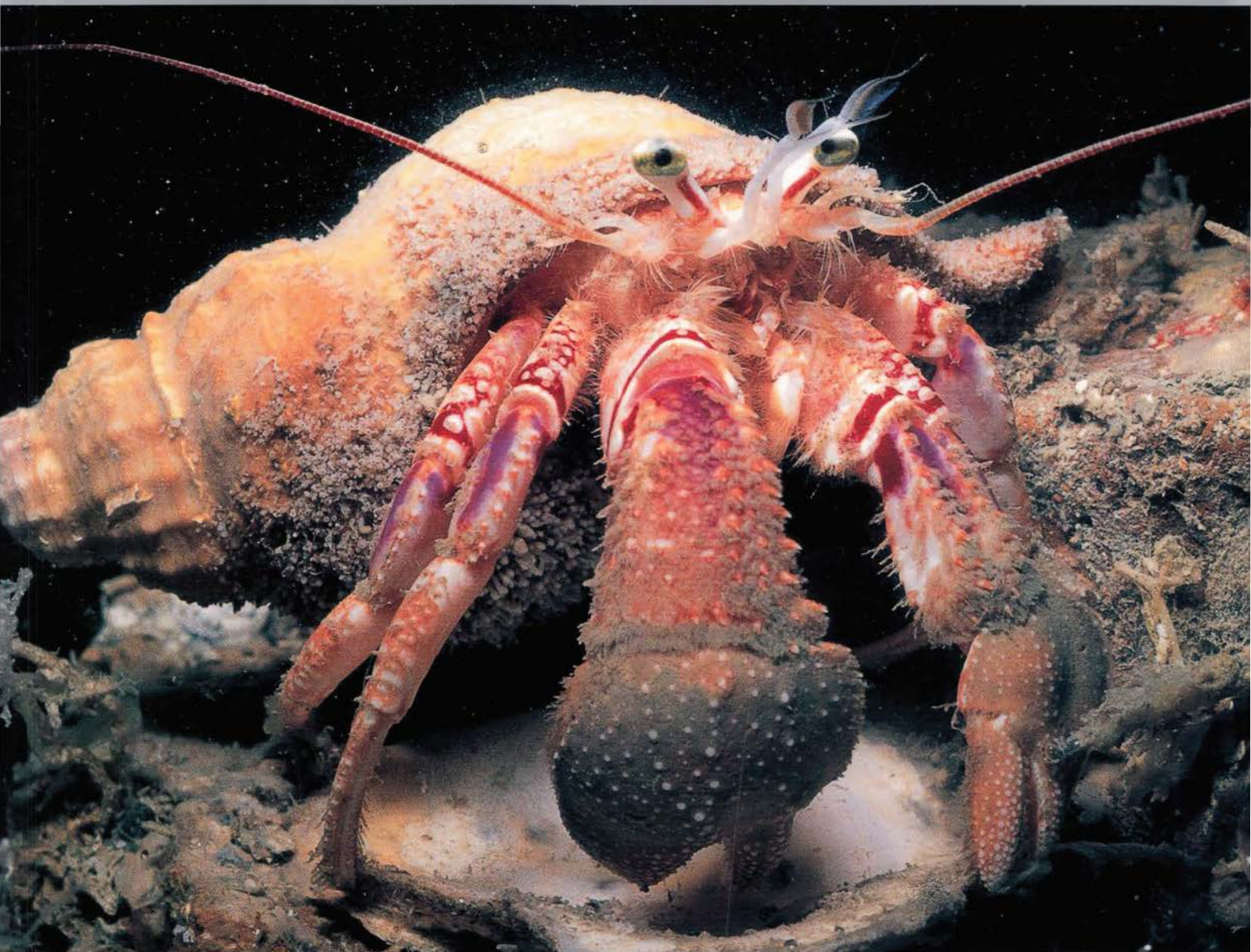


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The Marine Fauna of New Zealand:

# **Paguridea (Decapoda : Anomura) exclusive of the Lithodidae**

J. Forest, M. de S. Laurent, P.A. McLaughlin, R. Lemaitre

*NIWA Biodiversity Memoir 114*



**COVER PHOTO:** *Diacanthurus rubricatus* (Henderson) from NIWA Station U254 off Kaikoura, 80-100 m. (Photo: Ken Grange).



NATIONAL INSTITUTE OF  
WATER AND ATMOSPHERIC RESEARCH (NIWA)

**The Marine Fauna of New Zealand:  
Paguridea (Decapoda: Anomura)  
exclusive of the Lithodidae**

by

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# The Marine Fauna of New Zealand: Paguridea (Decapoda: Anomura) exclusive of the Lithodidae

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## ABSTRACT

A total of 18 genera and 52 species of hermit crabs are now recognised in the New Zealand fauna. The majority are found in the waters around the mainland, while five genera and 14 species appear only in the Kermadec Island fauna. Both anomuran superfamilies, the Coenobitoidea and Paguroidea, are represented in New Zealand waters, with only the semiterrestrial family Coenobitidae not reported. The Coenobitoidea includes two families and 18 species. The Pylochelidae comprises four species of the genus *Trizoecheles* including one new species described herein, and one each of the genera *Pylocheles* and *Cheiroplatea*. The quite recent recognition of members of this family in the New Zealand fauna undoubtedly reflects the poorly sampled specialised habitats of these hermit crabs (e.g., petricolous, spongiolous, etc., shelters) rather than recent introductions.

The family Diogenidae is represented by four genera and 11 species, four of which are common faunal representatives; however, it is only now that their specific identities can be defined with certainty. A Japanese taxon, for many years incorrectly identified as *Paguristes setosus* H. Milne Edwards, was found not to be conspecific with the New Zealand species of the same name, and was redescribed as *Paguristes miyakei* Forest & McLaughlin. All four New Zealand species of *Paguristes* are endemic whereas *Dardanus arrosor* (Herbst) has an extremely broad geographical distribution, New Zealand representing the maximum extension of the range of this species. A second species, *Dardanus hessii* (Miers) is found in the Kermadec Islands. The cryptic genus *Cancellus* is represented by two new species from the New Zealand mainland region, and two from the Kermadec Islands. The remaining genus, *Calcinus* with one species, is known only from the Kermadec Islands.

The paguroid fauna, at least the family Paguridae, is considerably more species-rich than the coenobitoid. In addition to the 13 species reported in the two subgenera of *Lophopagurus*, including one new species, five species of *Pagurus* are documented, of which *P. sinuatus* Henderson and one new species are restricted to the Kermadec Islands, while a second new species and two well-known species make up the mainland fauna; three species are recorded in the genus *Diacanthurus*. The genus *Porcellanopagurus* is represented in mainland waters by *P. edwardsi* Filhol and a new species, previously confounded with it, while *P. tridentatus* Whitelegge and a new species are reported from the Kermadec Islands. Included in the deep-water fauna are *Pagurodes inarmatus* Henderson, *Propagurus profundis* (Stebbing), and a species questionably assigned to *Michelopagurus*. In addition to *Bathypaguropsis yaldwyni* McLaughlin, a new species is described, and the genus *Pagurojacquesia* (nom. nov. pro *Jacquesia*) is recognised from the Kermadec Islands.



*Pagurus campbelli* (Filhol), at one time thought to be a junior synonym of *Pagurixus hectori* (Filhol), is regarded now as *incertae sedis*; a new species of this genus is reported from the Kermadec Islands. A new species of *Catapagurus*, restricted in its distribution to the Kermadec Islands, has been added to the New Zealand faunal list.

Revisions in the family Parapaguridae have resulted in changes in the nomenclature involving the New Zealand taxa. Ten genera are now recognised in the family, of which four, *Parapagurus*, *Sympagurus*, *Paragiopagurus*, and *Oncopagurus* have been found to have representatives in the New Zealand fauna. Previously, only four taxa had been reported from the New Zealand region: *Parapagurus latimanus* (Henderson), *P. bouvieri* Stebbing, *Paragiopagurus hirsutus* (de Saint Laurent), and *Sympagurus dimorphus* (Studer). Five additional parapagurids are reported from the region, of which one is represented by an incomplete specimen belonging to an undetermined species of *Oncopagurus*.

## INTRODUCTION

The Section Paguridea (cf. Forest 1987) is one of the most morphologically and ecologically diverse groups of reptant decapod crustaceans. Although one family, the Coenobitidae, composed of two genera, has adapted to semiterrestrial conditions, other families and genera are almost exclusively marine, and the majority have gastropod-shell-inhabiting species with soft, asymmetrical abdomens. However, there are numerous exceptions, some of which are found in New Zealand waters. Among these is the tropical/subtropical, and occasionally temperate family Pylochelidae, with five subfamilies and seven genera, whose members, for the most part, have well-developed, symmetrical abdomens with articulating somites, most of which are each provided with a pair of appendages. The vast majority of pylochelids are xylicolous, petricolous, or tusk-shell inhabitants. Representatives of the family Diogenidae occur predominantly in tropical and subtropical regions, although few are found in temperate waters; most occupy gastropod shells. A few species of the diogenid genus *Clibanarius* have adapted to estuarine conditions, and one species recently was described from a freshwater pool on Vanuatu (McLaughlin & Murray 1990). Members of the family Paguridae are most numerous, occurring in all of the world's oceans. Again, utilisation of gastropod shells to protect the soft abdomen is most common, but alternatives such as worm and bryozoan tubes, coral, wood, and sponges have been selected by various species. Associations of hermit crabs with anemones, hydroids, and bryozoans is quite common (cf. Taylor 1994). Members of the Parapaguridae all are residents of deep, often abyssal, waters.

Our study of New Zealand hermit crabs has included all known species and records of species from New Zealand political and territorial waters, which includes the Kermadec Islands and the subantarctic islands under New Zealand jurisdiction. Biogeographically speaking, the region includes subtropical, temperate and subantarctic waters. The marine fauna around the main islands is relatively homogeneous (Morton & Miller 1968), despite summer temperature fluctuations between 21°C in the far north and 9°C in the far south (Schuchert 1996). In contrast, the Kermadec Islands are more tropical, and this is reflected in their faunal composition. It must be noted, however, that while the hermit fauna of the Kermadec Islands appears relatively depauperate for a subtropical area, it is more probable that such a situation

reflects insufficient local sampling efforts rather than an actual paucity of species.

The New Zealand hermit crab fauna, although not sizable in terms of numbers of taxa, has long been recognised as a classic example of systematic ambiguity. For any accurate recognition of New Zealand hermit crab species, it would be necessary for a reviewer to have access to the type materials of Henri Milne Edwards and Henri Filhol, two of the principal early scientists to have described New Zealand species. As collections of both authors were housed in the Muséum national d'Histoire naturelle, Paris, this challenging task became that of the senior authors. In the mid-1960s virtually the entire hermit crab collections from the New Zealand Oceanographic Institute (now NIWA) and the Dominion Museum (now National Museum of New Zealand Te Papa Tongarewa) were sent to Paris. Work progressed slowly, as Forest and de Saint Laurent attempted, over a period of several years, to trace the numerous misidentifications to their original sources and describe the substantial number of new taxa encountered.

Their task was particularly complex because of a nomenclatorial matter that began with the initial separation of non-crab-like decapods from Linnaeus's (1758) genus *Cancer* by Fabricius (1775). This was a problem in pagurid systematics, not limited to the New Zealand fauna but universal, that arose from the use of the generic name *Pagurus* for species in both the Paguridae and the Diogenidae. As originally established by Fabricius (1775), the genus *Pagurus* contained a heterogeneous group for which he did not designate a type species. Subsequently, *Cancer bernhardus* Linnaeus, 1758, was selected by Latreille (1810).

Henri Milne Edwards, whose "Histoire naturelle des Crustacés" (1834–1840) was acknowledged as one of the most important and fundamental carcinological publications of the first half of the 19th century (Holthuis 1979), divided *Pagurus* into three subgroups, Pagures Ordinaires, Pagures Appendiculés, and Pagures Armés; *Pagurus bernhardus* was listed first in his subgroup Pagures Ordinaires. Later Milne Edwards (1848) further subdivided Pagures Ordinaires into sections Dextres, including *P. bernhardus*, *Senestres*, and *Aequimanes*.

Brandt (1851) assigned the name *Eupagurus* to section Dextres with the rank of subgenus; listed first in his subgenus was *P. bernhardus*. During that same year, Dana (1851) published a revision of Milne



Edwards' (1836, 1848) classification, and for Pagures Ordinaires section Dextres, Dana (1851) assigned the generic name *Bernhardus*, designating *P. bernhardus* as the type and renaming it *Bernhardus typicus*. Not subscribing to Milne Edwards' (1836) divisions, Senestres and Aequimanés, Dana (1851) used the terminal structure of the left chela to subdivide the species remaining in Pagures Ordinaires. For species with calcareous-tipped chelae the genus *Calcinus* was established, and those with corneous-tipped left chelae were assigned to *Pagurus*. Milne Edwards' (1836) Pagures Appendiculés became *Paguristes* and Pagures Armés became *Diogenes*. The following year, Dana (1852b) designated *Pagurus punctulatus* Olivier, 1811 as the type species of *Pagurus* (sensu Dana).

*Eupagurus* was raised to generic rank by Stimpson in a paper presented before the Boston Society of Natural History in 1856 (Stimpson 1859). Subsequently, Stimpson (1857) pointed out that *Eupagurus* and *Bernhardus* were synonymous and that *Eupagurus* had priority. *Cancer bernhardus* Linnaeus was formally designated as the type species of *Eupagurus* by Stimpson (1858) and applied to species with enlarged right chelipeds, while species with corneous-tipped, enlarged left chelipeds continued to be referred to *Pagurus* (sensu Dana). Paul'son (1875, 1961) erected the genus *Dardanus* for *Pagurus depressus* Heller, 1861, renaming it *Dardanus helleri* Paul'son. *Dardanus* was distinguished from *Pagurus* (sensu Dana) by the structure of the orbital region, a character shown to be invalid by Kossmann (1880). Thus *Dardanus* became a junior synonym of *Pagurus* (sensu Dana).

It was not until some twenty years later that Benedict (1896) realised *Pagurus* (sensu Dana) contained none of the species originally placed in the genus by Fabricius (1775), and Latreille's (1810) designation of *Cancer bernhardus* as the type species of *Pagurus* had priority over its assignment to either *Bernhardus* or *Eupagurus*. Benedict (1896) strongly recommended that *Pagurus* (sensu Fabricius) be "returned" to the taxon typified by *P. bernhardus*, but did not propose a replacement name at that time for *Pagurus* (sensu Dana). A few years later Rathbun (1903) pointed out that *Dardanus* Paul'son was an available replacement name for *Pagurus* (sensu Dana). Although some carcinologists at that point adopted *Pagurus* (sensu Fabricius) for their species with enlarged right chelipeds and *Dardanus* Paul'son for species with enlarged, corneous-tipped left chelipeds, most continued to refer their species to *Eupagurus* and *Pagurus* (sensu Dana). Only after a ruling by the International Commission on Zoological Nomenclature (cf. Forest & Holthuis 1955; Hemming 1957) was the matter resolved and *Pagurus* and *Dardanus* were validated. Tracing each reference to a *Pagurus* species for

a period of nearly a century became a monumental task.

However, by 1980 Forest and de Saint Laurent were able to provide a working list of the species in the collections for New Zealand carcinologists (e.g., Schembri & McLay 1983) and by 1982 had produced an initial manuscript (in French) of the coenobitoids. Although a translation was completed within the following two years, circumstances beyond their control interrupted the work and prevented them from acting quickly to review the translation. In the interim, Forest had become aware of the growing number of Pylochelidae in the New Zealand collections, and those had become the subject of a preliminary study during the 1970–1975 period. By that time two species, both undescribed, had been distinguished and attributed to the genus *Mixtopagurus* A. Milne-Edwards, 1880. However, in 1978, Forest, after having examined numerous Pylochelidae from various sources, realised that no serious study of this group could be achieved without a complete taxonomic review. That review (cf. Forest 1987) further delayed work on the other New Zealand taxa. The opportunity has now become available for us to review, revise, and completely update the original manuscript on the Coenobitoidea and supplement it with a review of the Paguroidea. The superfamily Paguroidea Latreille, 1802 contains the families Paguridae, Latreille, 1802, Parapaguridae Smith, 1882, and Lithodidae Samouelle, 1819. The Lithodidae, or crab-like paguroids, of New Zealand have been covered in a series of papers by Yaldwyn and Dawson (1970), Dawson (1979, 1982), Dawson and Yaldwyn (1970, 1971, in prep.), and Dawson and Webber (in prep.), and are excluded from the present work.

The paguroid fauna of New Zealand, at least the family Paguridae, is considerably more diverse than the coenobitoid, and has received more recent attention. Of the 11 species of the genera *Lophopagurus* McLaughlin, 1981 and *Australeremus* McLaughlin, 1981, which were reported by McLaughlin and Gunn (1992), one has been placed in synonymy, and one new species has been recognised; *Australeremus*, however, has now been reduced to subgeneric rank. *Pagurus hectori* (Filhol, 1883) was transferred to the genus *Pagurixus* Melin, 1939 by Schembri and McLay (1983) on the advice of one of the senior authors (MSL) and at the time was thought to be the senior synonym of *P. campbelli* (Filhol, 1885). The latter now must be considered *incertae sedis*, as discussed in the remarks of the former species. A second, and new species of *Pagurixus* has now been recognised in the Kermadec Islands. McLaughlin (1994) described a new genus, *Bathypaguropsis*, with a new species, *B. yaldwyni* McLaughlin, 1994, from New Zealand, and a second species described from

Australia. One additional New Zealand species is described herein. A new genus, suggested by Hyden and Forest (1980) for fossil "*Pagurus*" *clifdenensis* and two common Recent New Zealand species, *Pagurus rubricatus* (Henderson, 1888) and *P. spinulimanus* (Miers, 1876), has recently been established (McLaughlin & Forest 1997). One additional species has been found in New Zealand waters. Despite the transfer of *P. rubricatus* and *P. spinulimanus* to *Diacanthurus*, the genus *Pagurus* still has five New Zealand representatives, two of which are described here for the first time. *Porcellanopagurus* Filhol, 1885, was originally proposed for a very distinctive New Zealand species, *P. edwardsi* Filhol, 1885. A second species, formerly confounded with *P. edwardsi*, has now been recognised. Two additional species, *P. tridentatus* Whitelegge, 1900 and a new species formerly confounded with it (Chilton 1911b) are reported from the Kermadec Islands. The genus *Pagurodes* Henderson, 1888, is recognised in New Zealand waters, and a related genus, *Michelopagurus* McLaughlin, 1997, is questionably reported on the basis of two imperfect female specimens. With establishment of the new genus, *Propagurus* McLaughlin & de Saint Laurent, 1998, the total number of New Zealand pagurid genera reached nine; however, two additional genera, *Catapagurus* A. Milne-Edwards, 1880 and *Paguro-jacquesia* (nom. nov. pro *Jacquesia* de Saint Laurent & McLaughlin, 1998), have now been recorded from the Kermadec Islands.

When she reestablished the family Parapaguridae, de Saint Laurent (1972) reported two species as occurring in New Zealand waters, *Parapagurus pilosimanus latimanus* Henderson, 1888, and *P. dimorphus* (Studer, 1883) with *Sympagurus arcuatus johnstoni* Hale, 1941 and *S. a. mawsoni* Hale, 1941 questionably placed in synonymy with the latter. Lemaitre (1989) raised *Para-*

*pagurus pilosimanus latimanus* to full specific rank and transferred *P. dimorphus* to the reinstated genus *Sympagurus* Smith, 1883. Lemaitre and McLaughlin (1992) reported *P. latimanus*, *P. bouvieri* Stebbing, 1910, and *Sympagurus dimorphus* from New Zealand. Subsequently, Lemaitre (1993, 1996) and Osawa (1995, 1996) reevaluated the species and subspecies placed in *Parapagurus* and *Sympagurus*, and proposed three more genera for the family: *Tsunogaipagurus* Osawa, 1995, *Paragiopagurus* Lemaitre, 1996, and *Oncopagurus* Lemaitre, 1996. As a result, ten genera are now recognised in the Parapaguridae, four of which, *Parapagurus*, *Sympagurus*, *Paragiopagurus*, and *Oncopagurus* have been found in this study to have representatives in the New Zealand fauna. Lemaitre (1996) added to the New Zealand faunal list *Paragiopagurus hirsutus* (de Saint Laurent, 1972), formerly considered by de Saint Laurent (1972) to be a subspecies of *Parapagurus acutus* de Saint Laurent, 1972. More recently, in a review of the species of *Parapagurus* from the Indian and Pacific Oceans, Lemaitre (1999) recorded *P. abyssorum* (Filhol, 1885c) and *P. richeri* Lemaitre, 1999 from New Zealand waters or its vicinities. During this study, three additional parapagurids have been found in this region, *Sympagurus papposus* Lemaitre, 1996, *Paragiopagurus diogenes* (Whitelegge, 1900), and an undetermined species of *Oncopagurus*, reported as *Oncopagurus* sp., represented by a single incomplete specimen.

Keys to the families, subfamilies (Pylochelidae), genera, subgenera (*Lophopagurus*), and species are presented. Diagnoses for the taxa above the species level are also provided. For each species, a description, abbreviated for known taxa or complete for new species, is given and accompanied by pertinent synonymies and illustrations.

## NEW ZEALAND HERMIT CRAB RESEARCH 1838–1991

The first list of New Zealand Crustacea, including hermit crabs, appeared in a chapter of Dieffenbach's "Travels in New Zealand" by White and Doubleday (1843). The list was based on the material collected during early exploratory travels, and included the first known New Zealand pagurids, *Pagurus pilosus* H. Milne Edwards, 1836, and *P. cristatus* H. Milne Edwards, 1836, obtained from the New Zealand coast in early 1827 by the French naturalists J.R.E. Quoy and J.P. Gaimard on board the *Astrolabe* during the first cruise of Dumont d'Urville (1826–1829). Henri Milne Edwards, whose "Histoire naturelle des Crustacés" (1834–1840) was acknowledged as one of the most

important and fundamental carcinological publications of the first half of the 19th century (Holthuis 1979), was also the first to produce a comprehensive synopsis of the pagurids known at the time (H. Milne Edwards 1836). In a subsequent publication Milne Edwards (1848) described another New Zealand species, *Pagurus setosus* H. Milne Edwards, 1848, which he stated was closely related to *P. pilosus*. However, he inadvertently reported the type locality of *P. setosus* as New Guinea. In that same publication, Milne Edwards described *Clibanarius cruentatus* H. Milne Edwards, 1848 (also as *Pagurus*), citing its type locality as New Zealand. Milne Edwards *lapsus calami*



were the first in a series of errors and misidentifications that ultimately produced major confusion and uncertainty concerning the identities of the New Zealand hermit crab fauna.

At the British Museum, H. Milne Edwards' (1834, 1837) first two volumes of the "Histoire Naturelle des Crustacés" provided the foundation for curator Adam White's arrangement of their crustacean collections (Ingle 1991). White's contributions to New Zealand's hermit crab fauna included the correct identification of Milne Edwards' (1836) *Pagurus pilosus* from Dieffenbach's collection (White & Doubleday 1843), and his incorrect identification (White 1847) of specimens from the British Antarctic Expedition of 1839–1840 as Milne Edwards' (1836) *Pagurus cristatus*.

France was not the only country interested in world exploration of the seas. New Zealand was also visited by ships of the U.S. Exploring Expedition (1838–1842) and the Austrian frigate *Novara* (1857–1859), to mention just those whose collecting efforts included hermit crabs. Crustaceans from the U.S. expedition were documented in a series of papers by James Dana (1851, 1852a–c, 1855); those collected by the crew of the *Novara* were reported by Camil Heller (1865). From the U.S. material, Dana (1851) described the New Zealand hermit species *Bernhardus novizealandiae*, with a subsequent comparative note (Dana 1852c) on Milne Edwards' (1836) *Pagurus cristatus*. Dana, on occasion, felt the necessity to change specific names from those designated by the original authors, and such was the case for a species that he identified as *Pagurus aniculus* (Fabricius, 1787), assigning it to his genus *Aniculus* (Dana, 1852b) as *Aniculus typicus* Dana. While Dana (1852c) had reported *Aniculus typicus* only from several Pacific island localities, Heller (1865) recorded it, without comment, from Auckland (North Island), together with Dana's (1852b) *Eupagurus novizealandiae*. Heller (1865) also described a new species from Auckland as *Clibanarius barbatus* Heller. At this point, including H. Milne Edwards' (1836) *Pagurus pilosus*, which had, by then, been transferred to *Paguristes* by Dana (1852b), the known New Zealand hermit crab fauna presumably consisted of six species: one each in the diogenid genera *Aniculus* and *Paguristes*, two in *Clibanarius*, and two pagurids in the genus *Eupagurus*.

In 1872, Edward J. Miers took charge of the crustacean collections at the British Museum (Ingle 1991), and in four years had produced, among other contributions, his "Catalogue of the Stalk- and Sessile-eyed Crustacea of New Zealand" (Miers 1876b). Miers' inventory was based on the literature available at the time and a collection entrusted to him for the compilation of a catalogue of the species of podophthalmous and edriophthalmous Crustacea of New Zealand for

the New Zealand government (Miers 1876a). The collection included eight hermit crab species, three pagurids, his *Eupagurus spinulimanus* (Miers 1876a) being the additional pagurid, and five diogenids. Miers recognised White's (1847) error in the identification of *Pagurus cristatus*, and correctly assigned the species to Dana's (1851) "*Eupagurus novizealandiae*". Miers (1876b) repeated Heller's (1865) report of "*Aniculus typicus*", noting that specimens of this species were in the museum collection. Miers (1876b) then followed Dana's (1851) interpretation of *Pagurus* (= *Dardanus* Paul'son, 1875) and reported *Pagurus imbricatus* H. Milne Edwards, 1848 from "Ruffles Bay", citing Hombron and Jacquinot's expedition to the Strait of Magellan and the South Pole as the source of the material. Despite the conflict between Miers' (1876b) diagnosis of *Pagurus* sensu Dana and *Paguristes pilosus*, he included Milne Edwards' taxon in this genus. The final two diogenids were Heller's (1865) *Clibanarius barbatus* and Milne Edwards' *C. cruentatus*. Miers' (1876b) inclusion of the latter species was based solely on Milne Edwards (1848) citation of the type locality as New Zealand, as Miers indicated he had not seen the species. The stage was now set for a series of errors that persisted for more than a century.

Professor F.W. Hutton (1882), whose primary carcinological knowledge was of the Brachyura, was the first to evaluate Miers' (1876b) catalogue, and purge it of errors. He immediately recognised that *Pagurus imbricatus*, reported from Raffles Bay, was an Australian species rather than a component of the New Zealand fauna and recommended its exclusion. Hutton regarded three additional species as questionable, since they were not, to his knowledge, represented in any of the local collections. These were *Clibanarius cruentatus*, *C. barbatus*, and "*Eupagurus cristatus*".

In 1884, the French Académie des Sciences organised an expedition to Campbell Island for observations of an exceptional astronomical event, the passage of the planet Venus in front of the sun. Henri Filhol, who was primarily a vertebrate anatomist, was sent to New Zealand to join the scientific team as a naturalist. During his stay in New Zealand, Filhol collected many specimens of various Crustacea, primarily on the eastern coast of Stewart Island and in the surroundings of Cook Strait, by hand on the shore, and by dredging to approximately 25 m. Among these collections were ten species of hermit crabs. Preliminary descriptions of species he thought to be new were published in two notes (1883, 1885a). Two other papers also appeared in 1885, one dealing mainly with new or rare species collected during his trip (Filhol 1885b), complemented by a list of species

reported from the area, and a second (Filhol 1885d, e) as a full report of all Crustacea known from New Zealand, with a table of their known distribution and 16 plates in an Atlas. We have been unable to find which of these latter two descriptive publications appeared first, or even if the plates of the Atlas were all issued at the same time.

Filhol described several pagurids as new, i.e., *Eupagurus edwardsii* (= *E. spinulimanus* Miers, 1876), *E. thompsoni*, *E. cookii*, *E. kirkii*, *E. stewarti*, *E. hectori*, *E. campbelli* (*incertae sedis*), *E. traversi*, and one new genus, *Porcellanopagurus*. The other species previously attributed to the New Zealand fauna were included in a listing of the species "living" in New Zealand. Unfortunately, Filhol attributed authorship of all three previously reported pagurids to Miers, as well as *Clibanarius cruentatus*. These improprieties and mistakes led to considerable confusion regarding dates of publication and authorship as well as synonymies. Although Filhol apparently did actually describe his species, he designated no types. These appear subsequently to have been selected by Bouvier, as can be seen in Bouvier's handwritten labels. In the case of *Eupagurus campbelli*, it seems certain that Bouvier erred with his selection of a type, as the specimen so indicated in the collection of the Muséum national d'Histoire naturelle does not bear any real similarity to the species described, albeit quite briefly, and illustrated by Filhol (1885b: 32; 1885c: pl. 52, fig. 3). Rather, the specimen selected by Bouvier is clearly identifiable as *Eupagurus hectori* (Filhol, 1883).

Perhaps the most famous of late 19th century expeditions was that of the round-the-world voyage of H.M.S. *Challenger* (1873–1876). The Anomura of the expedition were reported by John R. Henderson after Jules Barrois was unable to undertake the task (Henderson 1888). The total number of pagurids reported was considerable, five of which, all new species, were added to the New Zealand fauna. These included *Eupagurus lacertosus* Henderson, *Eupagurus rubricatus* (Henderson), *Pagurodes inarmatus* Henderson, *Paguristes subpilosus* Henderson, and *Parapagurus latimanus* Henderson. Henderson repeated the occurrence of *Pagurus imbricatus* in New Zealand, but his report was not based on material collected from New Zealand by the crew of the *Challenger*.

In his revision of the Anomura of New Zealand, Thomson (1899) also pointed out that since Raffles Bay, where *Pagurus imbricatus* was collected, was in northern Australia, that species certainly should not be included in the New Zealand fauna. Thomson grouped together the pagurid genus *Eupagurus*, and the diogenid genera *Clibanarius*, *Aniculus*, and *Paguristes*, with his new genus *Stratiotes* Thomson. He retained both *Eupagurus cristatus* and *E. spinulimanus*

in the faunal list, although they had not been identified again. Descriptions of all of Filhol's (1883, 1885b) *Eupagurus* species were provided, most based on Thomson's personal examinations, as were those of Henderson's (1888). However, he redescribed *Eupagurus thompsoni* Filhol, 1885b as *Eupagurus thomsoni* Filhol, 1885d. Thomson (1899) reported that *Clibanarius cruentatus* had been collected in the northern part of New Zealand by Quoy and Gaimard, and that Filhol (1885d) provided a good representation of the species based on the original specimens. However, he noted that neither Filhol nor anyone else had seen it in New Zealand. Of *Clibanarius barbatus*, he remarked that it "occurs in the British Museum, apparently from Auckland, ...", but that it had not been collected since Heller's original material. Thomson's only knowledge of Dana's (1852b) *Aniculus typicus* came from a Polynesian specimen borrowed from the Australian Museum. He commented that the species seemed not to have been seen since Heller's (1865) account. Thomson (1899), correctly referred *Pagurus pilosus* to *Paguristes*, and included Henderson's *Paguristes subpilosus* in his account of the genus, together with Henderson's (1888) observation of its similarities with *Clibanarius barbatus*. However, for Filhol's *Pagurus setosus*, Thomson established the new genus, *Stratiotes*, an action that did little to ease the growing confusion concerning the identities of the few diogenid species actually occurring in New Zealand waters. Thomson (1899) had no personal knowledge of *Porcellanopagurus edwardsi* (Filhol, 1885b), but he considered the genus *Porcellanopagurus* Filhol *incertae sedis*, being unaware of Filhol's (1885a) generic diagnosis.

An additional species, *Eupagurus intermedius* Lenz, 1901 was added to the New Zealand faunal list by Lenz (1901) from the crustaceans collected during Schauinsland's Pacific voyage of 1896–1897. Lenz reported that *E. intermedius* appeared to be, as his name implied, intermediate between *Eupagurus novae-zealandiae* and *E. edwardsi*. Of the twelve hermit crab species in his collection, three previously described species were also from New Zealand, *E. "novae-zealandiae"*, *E. hectori*, and *E. traversi* Filhol, 1885.

Chilton's (1906, 1909, 1911a, b) contributions to the study of New Zealand hermit crabs corrected some of the previous errors and misinterpretations, while generating others. For example, he noted the similarities between *Eupagurus spinulimanus* and *E. edwardsi*, even remarking that it would not be surprising if they proved identical (Chilton 1906). He also provided additional information on the morphology and habitat of *Porcellanopagurus edwardsi* (Chilton 1909). In his account of the results of the 1907 Government Trawling Expedition, Chilton



(1911a) incorrectly placed *E. intermedius* Lenz, 1901 in synonymy with *E. rubricatus*, but correctly re-assigned *Clibanarius barbatus* to *Paguristes*, placing *P. subpilosus* in synonymy with it. However, he followed Thomson (1899) with the incorrect spelling “*thomsoni*” for Filhol’s (1885c) *E. thomsoni*, and for *E. edwardsi* Filhol, 1883 (correctly as *edwardsii*), he provided the replacement name *norae*, noting, as Alcock (1905b) had done, that *edwardsi* was preoccupied by *E. edwardsii* Dana, 1852c. For “*Aniculus typicus*”, he reinstated *Aniculus aniculus* Fabricius, but incorrectly cited the date of publication as 1793, rather than the actual date of 1787 (cf. Forest 1984). Chilton’s (1911b) account of the Crustacea of the Kermadec Islands included species identified as *Clibanarius striolatus* Dana 1852, *Calcinus imperialis* Whitelegge, 1901, *Porcellanopagurus tridentatus* Whitelegge, 1900, *Eupagurus sinuatus* Stimpson, 1864 [sic], *Eupagurus hectori* Filhol, 1885 [sic], and an unknown small hermit crab that “in general resembles *Eupagurus*, but has the abdomen straight, though soft, and the telson and uropoda symmetrical”. Although Chilton implied that a description of the unknown species would be forth coming at a later time, to our knowledge it never was. Not only was Chilton’s (1911b) identification of *C. striolatus* incorrect, his dates and/or sources of original publication for *Clibanarius striolatus*, *Eupagurus sinuatus*, and *E. hectori* were also incorrect.

The British *Terra Nova* Expedition (1910) also sampled in New Zealand waters; however, of the ten stations, most were plankton stations. Nonetheless, Borradaile (1916a) recorded five hermit crab species, including his new species *Eupagurus crenatus* Borradaile. He found disagreement with Thomson’s (1899) description of the length of the antennular peduncles of *E. kirki* [sic]. Although Borradaile (1916a) appeared to have followed Chilton (1911a) in reporting the occurrence of *E. norae*, he listed *Paguristes subpilosus*, apparently not agreeing with Chilton’s synonymy of Henderson’s (1888) species with Heller’s (1865). Borradaile (1916a) also found considerable differences in his single female specimen of *Porcellanopagurus edwardsi* and the male described and figured by Chilton (1909), and noted that the specimen would be the subject of a separate report. In that report, Borradaile (1916b) referred to the specimen as “*Porcellanopagurus*, presumably *edwardsi*”.

Thompson (1930), the last carcinologist to directly address hermit crab systematics for many years, added further to the enigmatic identifications that had accumulated by challenging Chilton’s (1911a) interpretations of Heller’s (1865) *Clibanarius barbatus* and Miers’ (1876b) “*Aniculus typicus*”. He reinstated Henderson’s (1888) *Paguristes subpilosus*, putting

“*Paguristes barbatus* (Heller) Chilton” in synonymy; and described a species as *Aniculus chiltoni* Thompson, 1930, presumably based on, but not stated as such, the specimen Chilton had called *Aniculus aniculus*. He considered Chilton’s (1911a) *Eupagurus norae* a synonym of Lenz’s (1901) *E. intermedius*, concluding, correctly, that the species described by Lenz was not conspecific with *E. rubricatus* Henderson, 1888.

Of the decapods collected during the joint British Australian and New Zealand Antarctic Research Expedition (BANZARE) 1929–1931 (Hale 1941), only *Lithodes murrayi* Henderson, 1888 was actually reported in the New Zealand fauna (Yaldwyn & Dawson 1970); however, *Eupagurus lacertosus nana* Henderson, 1888, recorded by Hale (1941) from off east Tasmania, has now (de Saint Laurent & McLaughlin, this volume) been questionably recorded in New Zealand waters. This taxon was elevated to full specific rank by McLaughlin and Gunn (1992).

There was no question in the minds of local biologists that regional hermit crab systematics in New Zealand were in great need of professional attention (e.g., Yaldwyn 1975). Unfortunately, the only local published systematic studies in the ensuing 50 years were devoted to the Lithodidae (Yaldwyn & Dawson 1970; Dawson & Yaldwyn 1970, 1971, 1979; Dawson 1979, 1982). However, as indicated in the introduction, work by the senior authors had begun in the Paris Museum in the 1960s to replace chaos with order through a meticulous examination of the early type materials and, by 1980, New Zealand carcinologists were presented with a preliminary key and list of species, as well as the description of a Miocene pagurid (Hyden & Forest 1980). In the interim, the United States had initiated its U.S. Antarctic Research Program (1962–1965), and identification of the hermit crabs collected during the program became the responsibility of one of the junior authors (PMcL). During several cruises of the USNS *Eltanin* hermit crabs were collected in New Zealand waters, and in a preliminary work on the heterogeneous genus *Pylopagurus* A. Milne-Edwards and Bouvier, 1891, McLaughlin (1981a) established two new genera, *Lophopagurus* and *Australeremus*, to accommodate certain New Zealand species, including three of Filhol’s, one of H. Milne Edwards’, two of Henderson’s, and Borradaile’s *Eupagurus crenatus*.

From the late 1960s through to the early 1980s, in New Zealand itself, hermit crab research turned from systematics to more applied avenues of study. Among the first was the description of the early larval and megalopal stages of the common intertidal hermit, *Pagurus novizealandiae* by Greenwood (1966). Greenwood (1972a, b) followed his larval studies with a detailed descriptive study of the mouthparts and feed-

ing behaviour of *Pagurus novizealandiae* and *Paguristes setosus*, which he identified as *Stratiotes setosus*, and a detailed examination of the male reproductive system and spermatophore development in the former species. Hand (1975), reporting on the association of New Zealand anemones and their hosts, referred to the associations of *Calliactis conchicola* Parry and *Paracalliactis rosea* Hand with *Paguristes subpilosus*.

Although the benthic community study of Batham (1969) reported only two species of pagurids, both identified by one of the authors (JF), it is apparent from species lists in subsequent studies (e.g., Probert *et al.* 1979, Rainer 1981, Probert & Wilson 1984) that the accessibility of more current systematic information, even if only of a preliminary nature, was allowing more attention to be given to this apparently rather significant group of decapods. Probert and Wilson (1984), for example, reported that the crustacean ele-

ment of one group of stations in their study of the shelf benthos off the Otago Peninsula was characterised by a preponderance of hermit crabs (60.1%).

With the availability of the preliminary species list and some identified materials, Schembri and McLay (1983) produced an annotated key to the hermit crabs of the Otago region, in which the authors also incorporated McLaughlin's (1981a) generic assignments. Locally restricted as it was, this annotated key allowed Schembri (1982a, b) to analyse functional morphology and feeding behaviours of a number of local species, and later a regional bathymetric distributional analysis. Particularly interesting were the reports and studies of the symbiotic association of several hermit crab species with bryozoans (e.g., Morton & Miller 1968; Taylor & Cook 1981; Taylor *et al.* 1989; Taylor 1991, 1994).

## MATERIALS AND METHODS

Materials for this study have come primarily from the collections of the New Zealand Oceanographic Institute (now part of the National Institute of Water and Atmospheric Research, NIWA) and the National Museum of New Zealand (now Museum of New Zealand Te Papa Tongarewa), with supplemental and/or comparative materials from the collections of the Australian Museum, Sydney; Bernice P. Bishop Museum, Honolulu, Hawaii; Canterbury Museum, and the University of Canterbury, Christchurch; Muséum national d'Histoire naturelle, Paris; Museum of Victoria, Melbourne; National Museum of Natural History, Smithsonian Institution (formerly the United States National Museum); New Zealand Department of Conservation; New Zealand Marine Department (subsequently incorporated into the collections of the Museum of New Zealand); Portobello Marine Biological Station, University of Otago, Dunedin; Scripps Institution of Oceanography; Swedish Museum of Natural History, Stockholm; The Natural History Museum [formerly British Museum (Natural History)], London; University of Auckland; Victoria University Collection, Wellington (subsequently incorporated into the collections of the Museum of New Zealand); Zoological Museum Berlin; Zoological Museum, University of Copenhagen; and Zoological Museum, University of Uppsala. Institutional abbreviations are given below.

Holotypes have been deposited with NIWA or Museum of New Zealand; paratypes have been deposited in these institutions and the Muséum national d'Histoire naturelle. Where sufficient num-

bers allowed, additional paratypes have been deposited in The Natural History Museum and the National Museum of Natural History, Smithsonian Institution. In some cases, type designations cited in Forest (1987) are incorrect. These have been corrected herein. Not all specimens collected with the holotypes have been designated as paratypes. With the exception of specimens belonging to the personal collection of one of the authors (PMcL), all specimens have been returned to their institutions of ownership, or deposited as indicated under Material Examined.

Carapace lengths (cl) and/or shield lengths (sl), are given in parentheses in the materials examined. Carapace lengths have been measured from the midpoint of the rostrum or rostral lobe to the midpoint of the posterior carapace margin. Length and/or proportions indicated for the shield have been determined by measuring from the tip of the rostrum or midpoint of the rostral lobe to the midpoint of the posterior margin of the shield, as delineated by the cervical groove. Both measurements provide an indication of animal size; however, while shield length is the more precise measurement, carapace length provides an illustrative notation of total size. Measurements of ocular peduncles refer exclusively to the length of the distal segment, and are measured from the peduncular base to the distal margin (or apex) of the cornea along the lateral face; corneal diameter represents the maximum width of the cornea. Proportions of segments of the ambulatory legs have been determined by measuring the length of the segment on a straight line on the dorsal surface



between segmental articulations. Proportions of the hand of the cheliped are represented by the ratio of the maximum breadth of the dorsal surface to its total length.

Although all stations at which paguroids have been collected have been benthic or shore stations, the letters BS preceding some station numbers specify the stations as a bottom sample; CC refers to shrimp trawl. Stations with abbreviations AM, CM, GQ, SM, and T are those of the fishing vessels (FV) *Akebono Maru*, *Chiyo Maru*, *Golden Quest*, *Shinkai Maru*, and *Triena* respectively; stations with abbreviations JC, Kah, K, Mu, O7, Tan, and Ty are of the research vessels (RV) *James Cook*, *Kaharoa*, *Kapala*, *Munida*, *Oyana 7*, *Tangaroa*, and *Trinity*, respectively; those with the abbreviation KA are from the University of Canterbury, and ET of the United States Antarctic Program's USNS *Eltanin*. However, when actual station numbers were not available, individual samples have been designated by letters in parentheses or quotations, e.g., (a) or "a".

## Abbreviations of Institutions and Campaigns

AM:	Australian Museum, Sydney, Australia
BPBM:	Bernice P. Bishop Museum, Honolulu, Hawaii, U.S.A.
MFD:	New Zealand Marine Fisheries Department
MCC:	Museum of Canterbury, Christchurch, New Zealand
MNHN:	Muséum national d'Histoire naturelle, Paris, France
MUSORSTOM:	Acronym for the joint expeditions by the Muséum national d'Histoire naturelle, Paris, and Office de la Recherche Scientifique et Technique d'Outre-Mer.

MVM:	Museum of Victoria, Melbourne, Australia
MZUS:	Musée de Zoologie, Université de Strasbourg, France
NHM:	The Natural History Museum, London, England
NIWA:	National Institute of Water and Atmospheric Research, Greta Point, Wellington, New Zealand
NMNZ:	National Museum of New Zealand, Wellington (now Museum of New Zealand Te Papa Tongarewa)
NTM:	Northern Territories Museum, Darwin, Australia
NZDC:	New Zealand Department of Conservation
NZMD:	New Zealand Marine Department
NZOI:	New Zealand Oceanographic Institute, Wellington (now part of NIWA)
PMBS:	Portobello Marine Biological Station, Otago, New Zealand
PMcL:	Personal collection of one of the authors
QM:	Queensland Museum, Brisbane, Australia
SAM:	South African Museum, Cape Town, South Africa
SIO:	Scripps Institute of Oceanography Invertebrate Collection, University of California, San Diego, U.S.A.
SMNH:	Swedish Museum of Natural History, Stockholm, Sweden
UO:	University of Otago, Dunedin, New Zealand (i.e., PMBS)
UA:	University of Auckland, Auckland, New Zealand
UC:	University of Canterbury, Christchurch, New Zealand
USNM:	National Museum of Natural History, Smithsonian Institution, Washington, D.C., U.S.A.
VUC:	Victoria University Collection, Wellington, New Zealand
ZMB:	Zoological Museum, Humboldt University, Berlin, Germany
ZMUC:	Zoological Museum University of Copenhagen, Denmark
ZMUU:	Zoological Museum, University of Uppsala, Sweden

# CHECKLIST OF PAGURIDEA

## Superfamily COENOBITOIDEA

### Family PYLOCHELIDAE

- Pylocheles* (*Pylocheles*) *mortensenii* Boas, 1926  
*Cheiroplatea pumicicola* Forest, 1987  
*Trizacheles brachyops* Forest & de Saint Laurent, 1987  
*Trizacheles perplexus* Forest, 1987  
*Trizacheles pilgrimi* sp. nov.  
*Trizacheles spinosus bathamae* Forest & de Saint Laurent, 1987  
*Trizacheles spinosus spinosus* (Henderson, 1888)

### Family DIOGENIDAE

- Calcinus imperialis* Whitelegge, 1901  
*Cancellus frontalis* sp. nov.  
*Cancellus laticoxa* sp. nov.  
*Cancellus rhynchogonus* sp. nov.  
*Cancellus sphaerogonus* sp. nov.  
*Dardanus arrosor* (Herbst, 1796)  
*Dardanus hessii* (Miers, 1884)  
*Paguristes barbatus* (Heller, 1862)  
*Paguristes pilosus* (H. Milne Edwards, 1836)  
*Paguristes setosus* (H. Milne Edwards, 1848)  
*Paguristes subpilosus* Henderson, 1888

## Superfamily PAGUROIDEA

### Family PAGURIDAE

- Bathypagiuropsis cruentus* sp. nov.  
*Bathypagiuropsis yaldwyni* McLaughlin, 1994  
*Catapagurus spinicarpus* sp. nov.  
*Diacanthurus ecphyma* McLaughlin & Forest, 1998  
*Diacanthurus rubricatus* (Henderson, 1888)  
*Diacanthurus spinulimanus* (Miers, 1876)  
*Lophopagurus (Australeremus) cookii* (Filhol, 1883)  
*Lophopagurus (Australeremus) cristatus* (Filhol, 1885)  
*Lophopagurus (Australeremus) eltaninae*  
 (McLaughlin & Gunn, 1992)  
*Lophopagurus (Australeremus) kirkii* (Filhol, 1883)

- Lophopagurus (Australeremus) laurentae*  
 (McLaughlin & Gunn, 1992)  
*Lophopagurus (Australeremus) stewarti* (Filhol, 1883)  
*Lophopagurus (Australeremus) triserratus* (Ortmann, 1892)  
*Lophopagurus (Lophopagurus) foresti* McLaughlin & Gunn, 1992  
*Lophopagurus (Lophopagurus) lacertosus* (Henderson, 1888)  
*Lophopagurus (Lophopagurus) ?nanius* (Henderson, 1888)  
*Lophopagurus (Lophopagurus) nodulosus* McLaughlin & Gunn, 1992  
*Lophopagurus (Lophopagurus) pumilus* sp. nov.  
*Lophopagurus (Lophopagurus) thompsoni* (Filhol, 1885)  
*? Michelopagurus* sp.  
*Pagurodes inarmatus* Henderson, 1888  
*Pagurojacksia polymorpha* (de Saint Laurent & McLaughlin, 1999)  
*Pagurixus hectori* (Filhol, 1883)  
*Pagurixus kermadecensis* sp. nov.  
*Pagurus albidianthus* sp. nov.  
*Pagurus iridocarpus* sp. nov.  
*Pagurus novizealandiae* (Dana, 1852)  
*Pagurus sinuatus* (Stimpson, 1858)  
*Pagurus traversi* (Filhol, 1885)  
*Porcellanopagurus chiltoni* sp. nov.  
*Porcellanopagurus edwardsi* Filhol, 1885  
*Porcellanopagurus filholi* sp. nov.  
*Porcellanopagurus tridentatus* Whitelegge, 1900  
*Propagurus deprofundis* (Stebbing, 1924)

### Family PARAPAGURIDAE

- Oncopagurus* sp.  
*Paragiopagurus diogenes* (Whitelegge, 1900)  
*Paragiopagurus hirsutus* (de Saint Laurent, 1972)  
*Parapagurus abyssorium* (Filhol, 1885)  
*Parapagurus bouvieri* Stebbing, 1910  
*Parapagurus latimanus* Henderson, 1888  
*Parapagurus richeri* Lemaitre, 1999  
*Sympagurus dimorphus* (Studer, 1883)  
*Sympagurus papposus* Lemaitre, 1996

# LIST OF STATIONS

## New Zealand Oceanographic Institute Stations

Stn No.	Date	Latitude (°S)	Longitude (°E unless noted)	Depth (m)	Stn No.	Date	Latitude (°S)	Longitude (°E unless noted)	Depth (m)
A115	10.5.55	37°41'	178°55'	256	B236	23.5.60	46°35'	168°02.5'	36
A444	5.10.58	41°14.3'	174°29.2'	192	B237	23.5.60	46°35'	168°11'	25
A447	6.10.58	41°01.9'	174°37.2'	201	B238	23.5.60	46°35.2'	168°14'	33
A489	13.10.59	41°27'	174°50.8'	101	B245	26.5.60	46°30'	167°48'	49
A696	1.3.62	54°37.7'	158°57'	433	B246	26.5.60	46°30'	167°55.4'	49
A701	3.11.62	47°41'	179°23'	159	B247	26.5.60	46°30'	168°02.5'	36
A702	3.11.62	47°41'	179°31'	168	B249	26.5.60	46°25'	167°54.5'	18
A703	4.11.62	47°42'	179°39'	183	B252	26.5.60	46°30.6'	168°11.6'	18
A704	4.11.62	47°42'	179°27'	154	B254	27.5.60	46°37'	168°32.2'	14
A705	4.11.62	47°41.6'	179°05.7'	48	B256	27.5.60	46°36.7'	168°45.3'	21
A714	5.11.62	47°43.5'	179°04'	165	B258	27.5.60	46°40'	168°38.3'	19
A717	5.11.62	47°55'	179°04'	120	B263	27.5.60	46°55'	168°24'	53
A718	5.11.62	48°02'	179°04'	256	B264	27.5.60	46°34.5'	168°07'	17
A738	9.11.62	49°41'	178°47.3'	62	B265	28.5.60	46°55.5'	168°55.5'	23
A740	9.11.62	49°41'	178°40.2'	315	B266	29.5.60	46°55'	168°31'	73
A746	15.11.62	47°30'	179°30'	159	B267	29.5.60	46°20'	168°40'	72
A835	23.8.63	47°05'	167°32.7'	95	B270	29.5.60	46°42'	168°00'	33
A849	27.8.63	47°20'	167°10'	157	B278	1.6.60	46°55'	168°38.5'	80
A852	28.8.63	47°16.5'	167°48.5'	135	B313	25.10.60	39°22.5'	171°37'	624
A854	28.8.63	47°15'	168°05'	101	B314	25.10.60	39°40'	171°50'	263
A859	28.8.63	47°14.1'	167°36.9'	11	B315	26.10.60	39°11'	172°01'	624
A886	31.8.63	45°18'	171°31'	454	B335	15.3.61	46°40.2'	168°27.7'	22
A887	31.8.63	45°15.5'	171°27.5'	135	B443	16.5.61	42°45'	177°00'	1175
A898	8.9.63	43°22'	177°17'	231	B482	5.6.61	46°08.8'	166°06'	91
A899	8.9.63	43°27.5'	177°11.3'	241	B488	7.6.61	46°28.7'	166°14.2'	164
A900	8.9.63	43°22'	177°03.5'	251	B489	7.6.61	46°39'	166°09.5'	198
A901	8.9.63	43°17'	177°03.5'	251	B505	22.3.61	46°43.1'	168°32.5'	24
A906	12.9.63	43°56'	179°40'W	329	B515	5.2.62	43°27'	175°03'	165
A908	13.9.63	43°22.3'	179°03'W	459	B524	13.2.62	42°24'	173°42'	45
A910	13.9.63	43°04'	178°39'W	550	B528	13.2.62	42°01.4'	174°06.4'	58
A911	13.9.63	42°45'	178°15'W	497	B542	4.10.62	42°40'	173°28.3'	20
A912	14.9.63	43°12.5'	178°11.5'W	430	B546	5.10.62	43°20'	173°14.6'	48
A913	14.9.63	43°37'	178°11.5'W	402	B549	5.10.62	43°20.5'	173°04.5'	130
A914	15.9.63	44°04'	178°11.5'W	455	B553	6.10.62	44°00'	172°35.5'	49
A916	15.9.63	43°58.5'	179°11'	274	B554	6.10.62	44°00'	172°58.2'	81
A917	15.9.63	43°56'	179°15'	203	B555	6.10.62	44°00.5'	173°35'	128
B10	26.8.58	39°13.5'	177°41.1'	55	B556	6.10.62	41°00'	173°47.5'	179
B173	8.10.59	48°33'	168°20'	697	B558	7.10.62	44°40'	171°39.2'	77
B196	18.10.59	46°20.6'	170°27'	135	B559	7.10.62	44°40.4'	172°10'	132
B202	2.11.59	41°24'	174°45'	91	B560	7.10.62	44°40'	172°24'	240
B219	21.5.60	46°45'	168°09.8'	36	B561	7.10.62	45°18.2'	171°28.5'	176
B220	21.5.60	46°40'	168°09.8'	37	B563	7.10.62	45°18.4'	171°15'	71
B221	21.5.60	46°40'	168°16.8'	31	B565	8.10.62	46°00'	170°18'	22
B223	21.5.60	46°45'	168°24.2'	26	B566	8.10.62	45°59.8'	170°59.2'	346
B224	21.5.60	46°45'	168°16.8'	32	B567	8.10.62	46°00'	170°55'	124
B225	21.5.60	46°50'	168°20'	31	B581	11.10.62	48°00'	168°06'	138
B226	21.5.60	46°55'	168°16.8'	49	B582	11.10.62	48°00'	167°38'	143
B230	22.5.60	46°40'	168°02.5'	26	B591	13.10.62	48°46'	167°05'	143
B235	23.5.60	46°35'	168°55'	49	B597	14.10.62	46°40.3'	167°32'	78



Stn No.	Date	Latitude (°S)	Longitude (°E unless noted)	Depth (m)	Stn No.	Date	Latitude (°S)	Longitude (°E unless noted)	Depth (m)
B605	17.10.62	46°23.5'	167°22'	73	C653	14.6.61	42°49.5'	173°31.3'	91
B608	17.10.62	46°05.4'	166°36.7'	17	C662	15.6.61	42°46.6'	173°27.7'	36
B616	18.10.62	45°20'	166°47'	134	C671	16.6.61	42°41'	173°30'	28
B619	19.10.62	44°42'	167°33.2'	95	C683	17.6.61	42°28.1'	173°40.7'	88
B620	19.10.62	44°17'	168°00'	42	C693	18.6.61	42°30.2'	173°40.4'	878
B626	20.10.62	43°20'	169°53.7'	70	C696	19.6.61	42°35.2'	173°33.3'	165
B628	20.10.62	42° 55.5'	170°27'	28	C699	19.6.61	42°35.1'	173°40.1'	274
B632	20.10.62	43°40.7'	170°43.5'	289	C703	19.6.61	42°42'	173°37.8'	184
B634	21.10.62	41°58.8'	171°10.1'	143	C706	20.6.61	42°26.3'	173°46.6'	75
B638	21.10.62	41°21.5'	171°32.5'	135	C732a	25.11.61	Buckles Bay, Macquarie Is		73
B646	22.10.62	40°00'	173°00'	117	C734	25.11.61	53°55'	158°55'	360
B647	22.10.62	40°00'	173°23.5'	97	C748	16.2.62	36°00'	173°32.2'	135
B651	22.10.62	40°00.5'	174°57'	24	C749	16.2.62	36°00'	173°31'	210
B654	23.10.62	39°20.5'	173°18'	128	C751	17.2.62	35°20'	173°02.2'	75
B658	24.10.62	38°39'	173°25'	143	C753	17.2.62	35°20.1'	172°52'	190
B660	24.10.62	38°40'	174°12'	71	C754	17.2.62	35°40'	172°51.3'	24
B661	24.10.62	38°40'	174°36'	22	C755	17.2.62	35°40.5'	172°34.8'	46
B662	25.10.62	38°06.1'	174°43.7'	15	C758	17.2.62	35°40'	172°14.5'	203
B663	25.10.62	38°01.2'	174°46.4'	22	C763	18.2.62	33°58'	172°17.6'	73
B664	25.10.62	38°01.8'	174°25.3'	75	C765	19.2.62	34°26.5'	172°49'	22
B666	25.10.62	38°02'	173°55.8'	170	C767	19.2.62	34°05.7'	172°49.5'	135
B665	25.10.62	38°01.8'	174°25.3'	75	C768	20.2.62	34°40'	173°02.8'	24
B667	25.10.62	37°18.7'	174°37.2'	17	C773	20.2.62	35°20'	173°46'	26
B668	25.10.62	37°18.7'	174°23'	75	C798	23.2.62	37°20.1'	176°19'	205
B669	25.10.62	37°18.7'	174°06.2'	130	C799	24.2.62	37°40'	176°15.3'	20
B670	25.10.62	37°18.7'	174°03.9'	170	C806	24.2.62	37°57.4'	177°11'	22
B671	26.10.62	36°40'	174°17'	22	C814	25.2.62	37°40'	178°56.4'	194
B672	26.10.62	36°40'	174°03.3'	75	C826	27.2.62	39°24.2'	177°23.8'	77
B673	26.10.62	36°40'	174°56.5'	124	C844	1.3.62	41°38.3'	175°11.2'	88
B675	26.10.62	36°40'	173°60'	384	C855	2.3.62	40°54.7'	173°53.7'	40
B686	28.10.62	40°16'	172°32.3'	126	C856	2.3.62	40°55.5'	173°50.7'	22
B687	28.10.62	40°33'	173°05.4'	59	C871	5.3.62	41°14.4'	174°09.1'	62
B689	29.10.62	40°40.2'	172°48.8'	29	C921	10.2.63	41°04.9'	173°57.3'	75
B690	29.10.62	41°00'	173°05.1'	26	C957	7.3.63	43°09'	175°15'	123
B691	29.10.62	41°00'	173°20.5'	42	C958	7.3.63	43°11'	175°27'	119
B805	18.3.63	39°10'	173°42.2'	29	C980	12.6.64	41°20'	174°56'	0
B851	111.7.63	41°15.9'	174°47.1'	11	D1	12.4.63	44°18'	176°10'	141
B852	18.7.63	41°15.9'	174°47.1'	10	D5	19.4.63	56°40.6'	158°45.5'	1280
B885	12.3.64	40°35'	177°16'	2025	D13	21.4.63	54°37'	158°55.7'	0
C176	5.9.59	39°40.2'	173°57'	0	D35	5.5.63	52°56.4'	169°33'	188
C182	5.9.59	39°50'	173°57'	55	D38	7.5.63	51°58'	165°58'	252
C183	5.9.59	39°50'	173°44'	95	D39	7.5.63	50°58'	165°54'	549
C261	22.10.59	38°20'	174°38.5'	37	D71	11.5.63	50°30.8'	166°21.1'	42
C342	26.10.59	37°41.8'	174°13.9'	155	D72	11.5.63	50°19.8'	166°24'	163
C344	26.10.59	37°58.6'	174°34.4'	55	D75	12.5.63	50°55.9'	166°01.5'	95
C380	28.10.59	38°54'	174°21.5'	37	D85	13.5.63	49°50'	170°13'	611
C442	7.5.60	40°00'	174°27.5'	55	D87	13.5.63	49°56'	171°50'	483
C486	11.5.60	41°27'	175°06'	27	D90	17.5.63	43°50'	179°00'W	399
C601	24.4.61	43°13.2'	176°40.3'	285	D101	27.9.63	49°20'	166°30'	686
C608	27.4.61	43°19'	179°00'	450	D104	29.9.63	50°49.2'	166°15.6'	95
C617	30.4.61	43°58.4'	175°22.9'W	300-286	D121	11.10.63	43°16.5'	177°10.5'	210
C619	2.5.61	43°52'	174°48'	802	D127	1.1.64	46°54'	168°17.3'	29
C633	27.5.61	39°16'	171°54'	340	D131	11.1.63	48°02'	167°03'	132
C640	28.5.61	39°17.00'	171°53.00' E	364	D134	13.1.64	48°16'	168°43.5'	677
C642	28.5.61	39°15.6'	171°52.5'	354	D136	12.1.64	48°33.5'	169°10'	390
C644	28.5.61	39°15.50'	172°00.0'	442	D137	12.1.64	48°50.5'	169°07'	668
C646	29.5.61	39°16'	172°03'	420	D138	13.1.64	48°32'	168°19.5'	668



Stn No.	Date	Latitude (°S)	Longitude (°E unless noted)	Depth (m)	Stn No.	Date	Latitude (°S)	Longitude (°E unless noted)	Depth (m)
D156	16.1.64	48°01.5'	166°35'	81	E267	7.4.65	34°30'	172°37.5'	37
D160	18.1.64	49°31.5'	166°15.5'	722	E268	7.4.65	35°30'	172°35'	44
D175	21.1.64	50°36.2'	167°41'	426	E365	14.4.65	34°30'	173°03'	35
D176	21.1.64	51°06'	167°48.5'	216	E400	7.10.65	46°00'	171°02'	622-586
D194	22.1.64	50°44'	166°21'	95	E401	7.10.65	46°00'	171°12'	914
D200	23.1.64	50°22'	167°28'	113	E404	9.10.65	47°20'	169°44'	716
D203	24.1.64	51°00'	169°28.5'	565	E405	9.10.65	47°20'	169°55'	1004
D205	24.1.64	50°57.5'	171°16'	529	E408	10.10.65	46°40'	170°11'	518
D207	25.1.64	50°40'	171°23'	510	E409	10.10.65	46°41'	170°21'	743
D210	26.1.64	49°21.5'	171°53'	353	E412	11.10.65	45°10'	171°41'	429
D211	26.1.64	48°53'	172°17.5'	519	E413	11.10.65	45°12'	171°44'	594
D220	26.9.64	39°32'	171°54'	344	E414	11.10.65	45°16'	171°49'	999
D225	27.9.64	40°27'	169°05'	940	E421	13.10.65	44°00'	175°00'	494
D228	28.9.64	39°08'	170°19'	662	E422	15.10.65	44°15'	175°00'	615
D230	29.9.64	38°10'	170°21'	861	E423	15.10.65	44°18'	174°31'	640
D231	29.9.64	37°53'	167°45'	774	E424	16.10.65	44°40'	172°38'	293
D232	29.9.64	38°30'	169°09'	505	E426	16.10.65	44°47'	172°48'	1130
D233	29.9.64	38°50'	169°20'	530	E428	17.10.65	44°16'	174°00'	646
D234	29.9.64	39°07'	168°32'	561	E429	17.10.65	44°00'	173°56'	523
D235	30.9.64	39°43'	163°56'	792	E433	18.10.65	43°43'	174°30'	571
D244	03.10.64	39°31'	171°00'	838	E436	18.10.65	42°15'	174°00'	695
D267	6.10.64	40°50'	173°43'	60	E439	22.10.65	41°40'	174°19'	22
D870	24.3.69	43°34.7'	178°40'W	440	E709	21.3.67	40°28'	177°43'	1642
D871	24.3.69	43°20'	178°40'W	420	E711	22.3.67	39°18.8'	178°13.8'	490-428
D873	25.3.69	43°34.5'	176°38'W	66	E712	22.3.67	39°20'	178°16.8'	772
D896	29.3.69	44°22'	175°50'W	106	E713	22.3.67	39°20.8'	178°17'	935
D899	29.3.69	44°23'	176°49'W	370	E714	22.3.67	39°19.6'	178°21.2'	1285-1250
E72	21.3.64	42°50'	176°22'	748	E717	23.3.67	38°42'	178°33.3'	828
E74	23.3.64	44°00'	176°40'	299	E719	23.4.67	38°46'	178°48'	913-750
E79	24.3.64	43°05'	178°00'	371	E720	24.3.67	37°33'	178°35'	256-253
E80	25.3.64	43°23'	179°32'W	459	E727	25.3.67	37°40'	177°12'	300-278
E106	11.10.64	43°55'	177°10'W	98	E728	25.3.67	37°37.5'	177°12.2'	688-432
E109	12.10.64	43°15'	177°00'W	300	E738	27.3.67	37°35'	179°03'	265-253
E111	12.10.64	43°00'	176°30'W	675	E744	28.3.67	38°01.5'	178°58.6'	772
E113	12.10.64	43°30'	176°30'W	117	E745	28.3.67	38°04'	179°06.5'	1441-1412
E114	13.10.64	43°35'	176°15'W	135	E746	29.3.67	40°41.6'	176°41.6'	267
E116	13.10.64	43°30'	176°44.5'W	77	E747	29.3.67	40°43.2'	176°48.4'	554-569
E117	13.10.64	43°30'	176°00'W	333	E749	29.3.67	40°47'	176°57'	913
E119	14.10.64	43°10'	176°00'W	638	E751	30.3.67	41°40'	175°15'	300
E120	14.10.64	42°59'	175°29'W	872	E752	30.3.67	41°40.7'	175°15.4'	619-597
E121	14.10.64	43°15'	175°40'	693	E755	30.3.67	42°00.5'	174°25.4'	247-276
E125	15.10.64	43°45'	175°54.5'W	150	E756	30.3.67	42°1.8'	174°26.5'	885
E134	16.10.64	44°10'	176°25'W	99	E759	31.3.67	42°45'	173°40'	1951-2134
E137	16.10.64	43°54.7'	176°20.7'W	40	E760	31.3.67	42°44.5'	173°43'	567-556
E139	16.10.64	44°00'	176°00'W	95	E766	1.4.67	41°17.7'	174°14.6'	intertidal
E144	17.10.64	44°25'	176°25'W	130	E770	14.10.67	42°00'	170°42'	262
E145	17.10.64	44°30'	176°30'W	293	E771	14.10.67	42°00'	170°30.5'	508
E146	17.10.64	44°30'	177°00'W	664	E772	14.10.67	42°00'	170°16'	748
E148	17.10.64	44°30'	177°45'W	880	E774	15.10.67	42°00'	169°15'	1168
E159	19.10.64	44°00.9'	176°59'W	165	E776	15.10.67	42°43'	169°45.5'	978
E160	19.10.64	43°59.5'	176°50'W	128	E777	16.10.67	42°43'	169°45'	731
E162	19.10.64	43°44.8'	177°20'W	172	E779	16.10.67	42°44'	170°07'	229
E164	20.10.64	43°15'	177°20'W	380	E780	16.10.67	43°23.5'	169°27'	252
E165	20.10.64	43°00'	177°20'W	591	E781	16.10.67	43°22.5'	169°17'	478
E167	20.10.64	43°15'	175°45'W	395	E783	16.10.67	43°23'	168°34.5'	966
E228	24.10.65	54°41'	158°55'	148	E785	17.10.67	44°00'	168°17.5'	282
E237a	27.2.65	54°51'	158°38'	155	E792	19.10.67	44°40'	167°34.5'	213

Stn No.	Date	Latitude (°S)	Longitude (°E unless noted)	Depth (m)	Stn No.	Date	Latitude (°S)	Longitude (°E unless noted)	Depth (m)
E796	20.10.67	45°20'	166°45.5'	251	F739	2.4.66	40°30'	173°30'	67
E797	20.10.67	45°20'	166°44.7'	471	F741	2.4.66	40°30'	174°30'	112
E801	21.10.67	45°53.5'	166°07'	994-895	F746	17.8.66	43°15'	175°30'	102
E803	21.10.67	45°57'	166°09'	534	F749	17.8.66	44°01'	175°26'	1427
E804	21.10.67	45°58.1'	166°18.5'	255	F750	17.8.66	44°15'	175°26'	594
E806	21.10.67	46°02.2'	166°35'	238-258	F760	20.8.66	4245'	176°30'	739
E817	23.10.67	46°38.5'	166°29.5'	235	F766	21.8.66	41°25.6'	176°00.4'	946
E819	23.10.67	46°29'	166°09'	416	G155	12.11.67	42°46'	173°39'	137
E820	23.10.67	46°35.5'	165°58'	152	G156	13.11.67	42°58'	173°30'	110
E821	23.10.67	46°43.5'	165°46.5'	286	G157	13.11.67	43°09'	173°40'	143
E822	23.10.67	46°50.6'	165°36'	682	G162	15.11.67	42°55'	173°33'	101
E826	24.10.67	46°37.5'	166°44.2'	823	G163	15.11.67	42°45'	173°38'	128
E827	24.10.67	46°35.5'	166°44.5'	530	G167	18.11.67	42°14'	173°56'	64
E828	24.10.67	46°30'	166°49'	220	G307	26.1.68	44°07'	179°13'W	402
E831	25.10.67	47°20.5'	167°03.8'	479	G935	15.1.71	50°32.5'	167°07'	110
E832	25.10.67	47°21'	167°21'	251	G938	17.1.71	49°33.9'	166°44.5'	490
E833	26.10.67	46°57'	168°08.9'	53	G942	27.5.73	39°56.4'	178°40.5'	3250
E845	16.3.68	34°07.5'	172°01'	277-179	G947	30.5.73	40°13.8-20.2'	177°20.0-24.6'	1491-1423
E846	16.3.68	34°07.5'	171°57.5'	417-343	G948	30.5.73	40°31.4'	177°46.6'	2080
E864	19.3.68	32°36'	167°36'	130	G949	31.5.73	41°10.0-14.3'	177°06.8-15.3'	2090
E876	19.3.68	33°19'	167°30'	1392-1430	H651	12.3.75	43°35.2'	179°30.3'	405
E879	22.3.68	35°19'	172°25'	768-786	I7	3.5.75	35°47.2'	175°50.2'	370
E907	28.3.68	38°39'	172°40'	322-323	I32	7.5.75	35°11.4'	174°50.3'	388-450
E908	28.3.68	38°38'	172°41'	256	I63	12.5.75	36°10.9-11.3'	176°23.6-13.6'	585-400
F79	14.1.65	49°04'	168°01'	679	I72	20.7.75	29°04.4'	168°01'	55
F80	14.1.65	49°00'	167°01'	631	I73	20.7.75	29°00.2'	168°00.8'	51
F90	16.1.65	49°30.5'	167°40'	586	I82	22.7.75	29°07.7'	168°00.3'	51
F91	16.1.65	49°00'	167°30'	688	I97	25.7.75	32°22.9'	167°28.2'	540-544
F92	16.1.65	47°59'	167°59'	137	I354	19.11.77	34°46.2'	174°04.6'	520
F94	17.1.65	48°31'	168°01'	604	I364	20.11.77	34°46.0'	174°05.8'	492-472
F95	17.1.65	48°53'	168°39'	646	I365	20.11.77	34°47.8'	174°06.4'	436
F99	18.1.65	48°32'	168°54.5'	705	I400	6.12.77	46°04.3'	166°38'	—
F100	18.1.65	49°02'	168°53.5'	734-747	I666	13.3.79	47°47.5-46°00'	178°59.5-179°00.8'W	1165
F101	18.1.65	49°08'	169°23'	598	I667	12.3.79	47°45.6'	179°17.0'W	648
F102	19.1.65	48°39'	169°51'	810	I669	12.3.79	47°49.0'	179°45.7'W	355
F104	20.1.65	48°40'	170°48.5'	814	I672	13.3.79	48°00.3-02.0	179°44.0-41.0'W	380
F105	20.1.65	49°34.5'	170°57'	500	I701	20.3.79	48°09.6'	179°15.9'	250
F107	20.1.65	48°45'	172°00'	659	I705	21.3.79	47°30'	178°45'	390
F109	21.1.65	49°11'	173°00'	501	I773	26.5.79	29°54.3'	159°02.3'	30-33
F112	22.1.65	48°08'	175°56'	1427	J55	17.5.70	44°05.5'	176°12'	198
F113	23.1.65	48°46'	177°02'	1372	J660	5.9.74	35°02'	179°15.8'	803-788
F114	23.1.65	48°58'	178°02'	107	J673	7.9.74	36°26.4'	175°45.6'	2-10
F120	25.1.65	48°18'	179°16'	494-512	J676	8.9.74	37°22.5'	177°11.7'	341-353
F122	26.1.65	48°06'	179°57'	255	J711	11.9.74	37°59.4'	176°03'	366-472
F135	30.1.65	50°58'	173°57'	832	K583	1.10.72	41°10.4'	173°10'	—
F136	30.1.65	51°20'	172°42'	547	K800	22.7.74	29°12.6'	177°50.3'	670-778
F138	31.1.65	52°03'	170°23'	353-342	K804	22.7.74	29°14.8'	177°49.6'W	590-490
F142	31.1.65	52°52'	169°49'	168	K805	22-23.7.74	29°10.7'	177°47.4'W	1142
F144	1.2.65	53°29'	178°56'	596					-1156
F145	1.2.65	53°14'	171°48'	436	K815	24.7.74	29°12.6'	177°54.9'W	320
F146	1.2.65	53°00'	175°45'	435	K819	24.7.74	29°13.24'	177°56.3'W	100-140
F147	1.2.65	52°21'	173°09'	611	K820	24.7.74	29°13.3'	177°59.8'W	95-122
F150	2.2.65	49°28'	174°35'	501	K824	25.7.74	29°18.1'	177°52.35'W	600-615
F151	3.2.65	48°32'	174°50'	814	K829	26.7.74	29°12.35'	177°52.8'W	590-565
F153	4.2.65	46°33'	175°33'	1829					
F185	21.3.65	40°30'	173°03'	59					
F493	9.5.65	21°23.2'	159°73.2'W	shore colln					

Stn No.	Date	Latitude (°S)	Longitude (°E unless noted)	Depth (m)
K830	26-7.8.74	29°11.5'	177°53'W	545-590
K840	28.7.74	30°17.6'	178°25.3'W	398-412
K848	30.7.74	30°32.9'	178°33.6'W	60-42
K857	30.7.74	30°33.8'	178°30.6'W	165-180
K863	31.7.74	30°32.5'	178°32.3'W	325
K928	22.1.75	41°30.38'	174°02.65'	-
P120	3.6.77	35°45.7'	165°04.1'	950
Q11	15.3.78	43°44.1'	179°31.6'W	300
Q24	22.3.78	44°29.7'	176°33.7'W	300
Q25	22.3.78	44°26.2'	176°38.4'W	360
Q47	24.5.78	33°06'	156°10.5'	138
Q118	13.11.78	41°11.8'	174°00'	0-15
R123	25.1.79	37°33.1'	177°33.8'	482-353
S17	16.9.78	50°30.2'	166°17'	0-10
S176	30.10.79	44°00.5'	173°38.6'	123
S180	31.10.79	43°30'	173°35'	100
S181	31.10.79	43°26.7'	173°30'	392-260
S208	4.11.79	42°45.2'	173°30.1'	79
T255	27.3.82	30°31.7'	178°34.8'W	275
U207	5.10.82	34°11.1'	151°26'	198
V418	6.9.92	42°34.7'	170.15'	450-403
V426	10.9.92	41°40'	170°30.8'	327-352
V464	11.11.93	40°54'	174°59'	intertidal
Y18	13.3.97	46°01.7'	165°58.7'	440
Z1800	21.9.62	72°30'	170°30'	intertidal
Z1833	21.9.62	53°40'	169°10'	intertidal
Z1840	21.4.63	53°40'	169°10'	5
Z1892	10.6.63	53°40'	169°10'	intertidal
Z2363	— . — .71	37°21'	176°26'	311-348
Z6080	28.11.47	52°30'	169°05'	prob. intertidal
Z8259	— .1.94	36°14.3'	176°12.1'	360
Z8270	— .1.94	37°31.6'	176°37'	330
Z8641	27.2.97	34°23.4'	172°51.8'	49
Z8662	27.2.97	34°21.4'	172°46.2'	54.5
Z8676	27.2.97	34°22.9'	172°54'	52
Z8792	17.4.97	43°59.1'	176°03.7'	378-405
Z9000	20.1.98	37°37.11'	177°13.94	445-467
Z9001	20.1.98	37°37.89'	177°09.1'	205-228
Z9003	20.1.98	37°32.61'	177°05.01'	323-327
Z9007	21.1.98	37°08.61'	176°19.64'	472-475
Z9009	22.1.98	37°40'	176°14.37'	224-264
Z9074	5.5.98	34°22.1'	172°46.4'	47
Z9076	5.5.98	34°21.3'	172°46.2'	56
Z9089	6.5.98	34°24.5'	174°47.5'	30
Z9096	5.5.98	34°22.2'	172°46.1'	44
Z9100	5.5.98	34°22.4'	172°46.6'	41
Z9104	6.5.98	34°23.2'	172°45.9'	36
Z9108	4.5.98	34°23.5'	172°51.1'	44
Z9244	24.11.97	43°04.1- 42°57.7'	176°55.8- 177°10.7'	368 -351

#### Museum of New Zealand Stations

A 01/37/87	26.6.87	39°24.5'	178°19.9'	921-981
A 01/41/87	26.6.87	39°38.5'	178°19.9'	906-924
AEX 2/11/89	20.11.89	48°31.6'	179°03.1'	660-675

Stn No.	Date	Latitude (°S)	Longitude (°E unless noted)	Depth (m)
AKM 81	2.3.88	48°27.4'	166°30.6'	150-141
AKM-T100	7.3.88	48°15.7'	166°42.6'	142-146
BS 163	30.8.51	40°52.6'	174°49.5'	137
BS 172	1.9.51	40°48.6'	174°06.6'	55
BS 173	10.8.51	40°52.2'	114°57.2'	59
BS 181	6.2.55	41°27'	175°03'	~183
BS 186	23.3.49	45°00'	167°20'	37
BS 189	14.8.55	45°28.5'	171°02'	220
BS 190	16.8.55	45°45.5'	171°05'	549
BS 197	11.1.57	41°03'	174°42'	220
BS 198	13.1.57	45°40'	167°51'	36
BS 207	27.2.57	37°19.5'	176°16.5'	110-183
BS 208	27.2.57	37°22.5'	176°22'	216-220
BS 216	15.2.68	41°26.3'	175°03'	82-64
BS 228	23.11.71	35°12.5'	174°12.9'	4
BS 233	23.11.71	32°12.4'	174°13.3'	2
BS 239	23.11.71	35°14'	174°15.3'	2-4
BS 240	24.11.71	35°13.3'	174°14.6'	2.6-7.2
BS 246	25.11.71	35°13.4'	174°12.1'	4-6
BS 247	25.11.71	35°13.9'	174°11.3'	2.6-5.5
BS 261	29.11.71	Oke Bay		4-6
BS 263	30.11.71	Shingle slip, Waewaetoria Passage		2
BS 264	1.12.71	38°8.8'	174°10.3'	75
BS 277	20.2.72	Betw. Shipbuilders' Cove/Narrow Passage		-
BS 278	20.2.72	Port Pegasus Passage, Stewart Is.		18-20
BS 279	21.2.72	~ 10 mi south Whale Passage		119
BS 281	22.2.72	North Arm Port Pegasus		36-42
BS 288	28.2.76	W of Easy Harbour, SW Stewart Island		93
BS 292	11.5.72	41°30.7'	174°58.4'	448-512
BS 296	24.8.72	Off Hutchison Bluff, Raoul I., Kermadec Islands		84-113
BS 300	6.9.72	8.3 km off Cape Turakirae		640-658
BS 310	4.4.73	29°12.6'	177°56.8'W	155-165
BS 313	5.4.73	29°13.0'S, 177°59.8'W		201-146
BS 321	6.12.73	35°12'	174°18'	33-46
BS 335	10.12.73	Betw. Hope Passage & Deepwater Cove		36-40
BS 340	13.12.73	Betw. & north of Black & Moturoa		31
BS 353	7.2.74	37°30'	179°22'	1134-1207
BS 358	10.2.74	36°25'	175°28'	51
BS 359	10.2.74	36°38'	175°08'	-
BS 360	3.2.74	36°08'	174°45'	48
BS 366	14.2.74	35°29'	175°02'	256-269
BS 374	15.2.74	35°17'	174°28'	121-117
BS 389	18.2.74	34°10'	172°08'	82
BS 392	18.2.74	34°08.5'	172°11'	102
BS 395	10.2.74	36°38'	175°08'	-
BS 396	12.1.74	34°13'	172°11'	256
BS 398	19.2.74	34°21'	172°37'	88
BS 401	20.2.74	34°22'	172°03'	121
BS 408	22.2.74	Off Kopumiti Pt, Whangaroa Harbour		9-15
BS 415	23.2.74	Bay in Stephenson's Island		22-24



Stn No.	Date	Latitude (°S)	Longitude (°E unless noted)	Depth (m)	Stn No.	Date	Latitude (°S)	Longitude (°E unless noted)	Depth (m)	
BS 419	24.2.74	34°47'	174°17'	417-483	BS 731	21.1.79	37°50.5'	176°40'	19-24	
BS 420	24.2.74	34°49'	174°17'	468-476	BS 732	21.1.79	37°46.5'	176°38.5'	39	
BS 424	11.12.74	41°30.2'	174°52'	380	BS 737	21.1.79	37°40.4'	176°24.3'	44	
BS 431	30.8.75	Orchard Bay, Marlborough Sound			29	BS 738	21.1.79	37°40.3'	176°22.7'	20
BS 432	30.8.75	Betw. Titi Is & Alligator Head			84-88	BS 741	22.1.79	37°20.6'	176°28'	482-550
BS 438	28.10.75	29°14.7'	177°49.4'	165-140	BS 742	22.1.79	37°22.0'	176°28.5'	448-388	
BS 443	28.10.75	Bearing 90°T, 0.3 nautical miles off Meyer Is., Boat Harbour, Raoul Is, Kermadec Islands			27-22	BS 750	22.1.79	37°11.5'	176°10'	198-273
BS 470	16.2.76	35°13.2'	174°17.4'	11-16	BS 760	24.1.79	36°57.3'	176°21.5'	803-846	
BS 480	29.2.76	40°26.5'	174°46.5'	106-99	BS 761	24.1.81	37°22'	176°37.2'	616-666	
BS 490	2.3.76	39°57'	174°34'	33-35	BS 768	21.2.79	43°25'	173°26'	329-183	
BS 500	3.3.76	40°57.5'	174°18'	139-144	BS 776	28.1.79	41°26.1'	174°15.9'	59-64	
BS 506	4.3.76	40°38.5'	174°12'	128	BS 771	26.1.79	39°15.4'	178°19.3'	413-453	
BS 508	4.3.76	40°24'	168°17'	110	BS 777	28.1.79	41°24'	174°24.1'	127-142	
BS 510	4.3.76	40°38.5'	174°01'	182-187	BS 781	15.2.79	45°51'	171°00'	348-220	
BS 517	5.3.76	41°00.5'	174°11'	15	BS 783	21.2.79	43°31'	173°30.5'	256-293	
BS 525	9.3.76	40°36'	172°43'	7	BS 785	21.2.79	43°25'	173°26'	485-476	
BS 526	9.3.76	40°37.0'	172°43.5'	13	BS 786	21.2.79	43°25'	176°26'	329-183	
BS 528	9.3.76	40°36.5'	173°00.5'	26-24	BS 796	10.1.81	34°50'	172°46.1'	90	
BS 530	10.3.76	40°54'	172°04'	55	BS 798	10.1.81	34°41.9'	172°33.5'	103	
BS 539	11.3.76	40°53.5'	173°03.5'	—	BS 805	11.1.81	37°33.1'	177°33.8'	776-836	
BS 540	11.3.76	40°53'	173°54'	22-24	BS 806	11.1.81	34°54'	172°12'	543-579	
BS 542	12.3.76	41°08'	174°33.5'	282-292	BS 812	11.1.81	35°37.6'	172°36.5'	657	
BS 543	12.3.76	41°13.5'	174°30.5'	314-292	BS 815	12.1.81	36°02'	173°35'	—	
BS 546	18.3.76	42°55'	173°43'	549-586	BS 819	12.1.81	37°06.6'	173°54.1'	925	
BS 548	19.3.76	45°10'	171°30'	293-256	BS 822	12.1.81	Betw. Manukau & Raglan Hbrs			231
BS 549	19.3.76	45°38.5'	171°05'	595-530	BS 824	13.1.81	37°48'	174°14.7'	103	
BS 556	27.9.76	43°52'	173°06'	44	BS 826	13.1.81	38°21.5'	174°17.8'	83	
BS 557	27.9.76	43°45'	173°14'	—	BS 829	13.1.81	38°55'	174°09.3'	48	
BS 559	27.9.76	43°14'	173°39'	1006-512	BS 830	21.1.79	39°52.8'	177°36.5'	785-882	
BS 560	28.9.76	42°35'	173°41'	640	BS 834	22.1.81	37°36.7'	178°51.6'	56-63	
BS 561	29.9.76	41°24'	174°33'	256-274	BS 836	22.1.81	37°34.6'	178°52.8'	35-37	
BS 562	1.9.76	46°12'	170°41.5'	150	BS 837	22.1.81	37°35'	178°52.8'	31-47	
BS 571	10.9.76	29°18.8'	177°54.2'W	274-219	BS 838	22.1.81	37°35.4'	178°52.9'	34-54	
BS 581	22.1.79	29°14'	177°52.8'W	567-530	BS 840	22.1.81	37°38.4'	178°51.7'	79-83	
BS 582	1.9.76	45°46'	171°03'	660	BS 842	23.1.81	37°17.4'	176°53.6'	337-292	
BS 589	7.1.79	45°17.2'	166°49.3'	146	BS 844	23.1.81	37°10.9'	176°38.7'	685-705	
BS 643	9.1.79	41°42'	175°15'	461	BS 846	23.1.81	37°04.3'	176°26.6'	807-872	
BS 647	11.1.79	42°28.6'	175°50.6'	1792	BS 847	23.1.81	37°02.5'	176°18.1'	521-516	
BS 648	11.1.79	42°29.2'	176°06.3'	1568	BS 860	26.1.81	34°59.7'	174°52.3'	650-660	
BS 649	11.1.79	42°33.2'	176°09'	1262	BS 862	26.1.81	35°00.35'	173°45.7'	25	
BS 650	11.12.79	42°38.2'	176°10.5'	999-984	BS 864	26.1.81	34°54'	173°42.6'	83	
BS 656	12.1.79	43°06.1'	175°20.5'	153	BS 870	27.1.81	34°48.4'	173°19.5'	—	
BS 657	12.1.79	43°13.3'	175°23.6'	94-99	BS 871	27.1.81	34°49.6'	173°05'	23	
BS 659	12.1.79	43°23'	175°06.8'	129-124	BS 877	27.1.81	34°25'	173°13.1'	327-257	
BS 660	13.1.79	42°41.7'	174°28'	1723-1549	BS 884	28.1.81	37°10.9'	176°40'	685-705	
BS 664	13.1.79	42°38.2'	173°36'	632	BS 886	29.1.81	32°35.3'	167°41.8'	437-422	
BS 668	14.1.79	41°55.9'	174°43.2'	—	BS 887	29.1.81	32°37.8'	167°42.4'	572-487	
BS 669	14.1.79	41°55.8'	174°40.7'	434-446	BS 888	29.1.81	32°40.2'	167°39'	487-357	
BS 672	15.1.79	41°31.4'	174°52.6'	533-225	BS 898	31.1.81	34°01.2'	171°44.4'	206-211	
BS 682	17.1.79	37°35'	178°42.9'	129	BS 910	2.2.81	34°18.8'	172°18.5'	93-88	
BS 685	17.1.79	37°32.4'	178°19.9'	90-102	BS 914	3.2.81	32°25.9'	172°49.6'	18	
BS 690	18.1.79	37°22.1'	178°26.9'	2027-1952	BS 915	3.2.81	34°25.6'	172°48.2'	23	
BS 723	20.1.79	37°35.9'	176°59.5'	139-179	BS 916	3.2.81	34°25'	172°46.6'	29	
BS 725	20.1.79	37°45.8'	177°00.8'	72-84	BS 940	13.4.85	43°26.9'	173°29.5'	505	
BS 729	21.1.79	37°49.5'	176°39'	29	BS 941	13.4.85	43°20.3'	173°31.4'	622	
					CM (a)	10.9.87	46°30'	166°14.4'	573-545	
					CM (b)	10.9.87	46°31.9'	165°44.4'	320-346	



Stn No.	Date	Latitude (°S)	Longitude (°E unless noted)	Depth (m)
CM (c)	10.9.87	46°47.2'	166°03.7'	494-574
CM (d)	11.9.87	46°12.3'	165°55.4'	454-388
CM (e)	13.9.87	47°05.7'	168°32.5'	396-406
CM (f)	13.9.87	47°30.5'	169°14.7'	506-529
CM (g)	13.9.87	48°05.7'	168°32.5'	396-406
CM (h)	15-19.9.87	43-44°29'	176°34'-179°25'W	—
CM (i)	15-19.9.87	43-44°29'	176°34'-179°25'W	—
CM 5	10.9.87	44°44.4'	165°43.8'	566-296
CM 145	10.9.87	46°35.6'	165°40.9'	532-544
CM 146	10.9.87	46°44.4'	165°43.8'	576-306
CM 147	10.9.87	46°31.9'	165°44.4'	320-346
CM 149	10.9.87	46°30'	165°14.4'	545-573
CM 154	13.9.87	48°05'	168°32.5'	396-406
CM 155	13.9.87	47°30.5'	169°14.7'	529-526
CM 156	13.9.87	47°02.8'	169°34.7'	309-331
CM 160	16.9.87	43°42.1'	177°26.4'W	307-271
CO 1/23/88	16.7.88	42°48.1'	176°47.7'	975-974
GQ "a"	22-23.10.87	45°49'	171°05'	128-179
JC (a)	3.11.79	37°34'	177°54'	0-27
JC (b)	14.4.81	Off Kaikokopu Beach, Mahia Peninsula		15
JC (c)	24.4.81	34°13.8'	173°02.9'	375-388
JC (d)	24.1.82	44°24.7'	171°31.3'	36-29
JC (e)	12.9.89	41°21.6'	176°10.3'	830-710
JC (f)	28.9.89	39°37.6'	177°59.8'	783-891
JC (g)	29.9.89	39°32.8'	178°16.5'	880-857
JC D4	24.11.70	41°24.8'	170°45'	371
JC 1/005/73	mid-Foveaux Strait			28
JC J01/022/77	23.1.77	48°01'	168°09'	700-706
JC J02/001/82	23.1.82	45°06.8'	171°44.6'	232-229
JC J03/10/72	20.2.72	51°00'	167°10'	457
JC J06/006/81	12.4.81	40°41.1'	176°53.1'	464-451
JC J06/008/81	15.4.81	39°29.8'	178°10.8'	529-568
JC J06/038/81	24.1.81	35°00.4'	174°34.6'	463-461
JC J06/048/81	22.4.81	34°13.8'	173°02.9'	375-388
JC J06/061/81	24.4.81	34°56.4'	172°14.7'	507-525
JC J1/12/77	19.1.77	51°20'	166°34'	646-670
JC J1/19/77	22.1.77	48°50'	167°08'	514-535
JC J1/22/77	23.1.77	48°12'	168°13'	700-706
JC J1/24/77	23.1.77	48°19'	167°55'	210-292
JC J1/001/82	21.1.82	45°06.8'	171°44.6'	232-229
JC J2/16/80	30.1.80	51°01.4'	166°19.2'	168-262
JC J2/11/81	24.1.81	38°53.6'	167°23.7'	841-847
JC J2/26/81	27.1.81	38°41.1'	168°23'	512-515
JC J2/27/82	25.1.82	44°26.4'	172°24.6'	90-104
JC-J2/52/80	9.2.80	46°56.4'	168°51'	87
JC J3/39/84	8.2.84	34°16'	172°11.4'	200-190
JC J6/3/81	12.4.81	40°49.8'	176°50.8'	752-688
JC J6/8/81	15.4.81	39°29.8'	178°10.8'	529-568
JC J6/12/81	16.4.81	37°46.3'	178°57.4'	829-928
JC J9/6/77	13.12.77	44°40.7'	172°35.5'	370-360
JC-J9/009/77	14.12.77	46°54.7'	169°52.2'	600-550
JC J09/15/77	18.12.77	43°13.1'	173°51'	610
JC J9/04/89	12.9.89	41°21.6'	176°10.3'	830-710
JC J9/4/89	28.9.89	39°37.6'	177°59.8'	783-891
JC J9/49/89	29.9.89	39°32.8'	178°16.5'	880-857

Stn No.	Date	Latitude (°S)	Longitude (°E unless noted)	Depth (m)
JC J10/60/86	—	38°32.4'	178°48.4'	630
JC J9/49/89	29.9.89	39°32.8'	178°16.5'	880-857
JC J10/60/86	—	38°32.4'	178°48.4'	630
JC J10/52/86	31.1.86	38°47.5'	178°48.7'	769
JC J12/006/78	10.12.78	42°33'	170°07'W	400-473
JC J15/15/76	25.9.76	41°25'	170°43'	212-332
JC J15/17/76	26.9.76	41°47'	170°29'	512-562
JC J16/6/84	17.9.84	37°51.1'	177°19.4'	48
JC J18/081/78	19.11.78	34°59.4'	172°35.5'	156-160
JC J19/006/78	10.12.78	42°33'	170°07'	400-473
JC J19/9/84	13.11.84	40°06.3'	167°57.9'	960-982
JC J19/011/84	13.11.84	40°03.2'	167°53.3'	912-940
JC J9/42/89	27.9.89	39°29.5'	178°18.9'	823-870
JC J9/49/89	29.9.89	39°32.8'	178°16.5'	880-857
JC J22/60/70	23.11.70	42°27'	170°36'	440-460
K 40/81	28.11.81	40°51.5'	176°57.9'	1125-1150
KA080	28.9.67	3 miles NE Kaikoura		62-73
Kah 10	9.4.96	36°55'	176°17'	348-352
Kah 26	13.4.96	37°05'	176°15'	395-399
Kah 55	22.4.96	36°54'	176°18'	442-445
Kah 9604	—	Bay of Plenty (no further data)		
Mun 5	10.5.90	45°43'	170°50.74'	39-40
Mun (a)	10.5.90	45°43'	170°50.7'	39-40
SM2/50	9.11.75	42°50.5'	177°42.5'	540-499
SM 77	15.11.75	42°47.5'	178°22'	939-920

#### R.V. *Trinity*, R. McGrath collector

"a"	27.10.87	North of Motiti Island	390-420
"b"	7.87	22 km East of Aldermen Is.	410-415
"c"	11.87	Bay of Plenty	380-420

#### Portobello Marine Biological Laboratory Stations

Mu 66-38	Shallow shelf off Otago Peninsula		
Mu 66-52	25.10.66	Canyon ESE of Taiaroa Heads	311-329
Mu 66-59	—	East of Taiaroa Heads	119
Mu 66-75	9.12.66	East of Taiaroa Heads	51-55
Mu 66-76	9.12.66	East of Taiaroa Heads	73
Mu 66-77			
Mu 67-7a	1.2.67	45°57' 170°57' (E. Saunders Canyon)	330-400
Mu 67-25	11.2.67	Port Pegasus, Stewart Is.	11-18
Mu 67-42			
Mu 67-61	22.5.67	Canyon D	375-345
Mu 67-142	30.11.67	Papanui Canyon	732
Mu 70-45		Papanui Canyon off Otago Peninsula	490-540
Mu 74-92		45°51' 171°01'	420-320
Mu 74-95			
Mu 74-139			
Mu 74-179		45°50.2' 170°48.4'	55
Mu 74-202			500
Mu 75-23		45°46' 170°49'	40
Mu 75-57		45°54.5' 170°55'	130
Mu 75-71			

Stn No.	Date	Latitude (°S)	Longitude (°E unless noted)	Depth (m)	Stn No.	Date	Latitude (°S)	Longitude (°E unless noted)	Depth (m)
<b>MISCELLANEOUS STATIONS</b>					168	8.7.1887	40°28'	177°43'	2012
<b>New Zealand Marine Department</b>					169	10.7.1874	37°34'	179°22'	1280
Haul 1	25.9.62	Between Aldermen & Red Mercury Is.		49	214	10.2.1875	04°33'N	126°06'	914.5
Haul 5	26.9.62	Between Aldermen & Red Mercury Is.		91.5	<b>Danish Expedition</b>				
Haul 14	30.9.62	14.8 miles E of White Is.		91-105	62	9.5.22	05°29.2'	132°50'	290
(a)	30.9.62	9.5 miles E of White Is.		100	<b>USNS <i>Eltanin</i></b>				
Haul 20	9.11.62	30 miles NNE ? Arid Is.		61	16/1431	23.2.65	45°37'	170°58'	51
Haul 21	11.11.62	30 miles ENE of Poor Knights Is.		24	32/2142	26.2.68	49°39'	178°55'	109
Haul 26	24.4.62	12 miles of SE Poor Knights Is.		165	33/2198	12.5.68	43°48'	174°24'W	909
Haul 27	20.11.62	18 miles N, 20 miles E of Poor Knights Is.		87-81	51/590	20.1.72	52°08.5'	169°43.7'	91-92
Haul 28	20.11.62	23 miles N of Poor Knights Is.		95-98	<b>Kapala</b>				
Haul 30	22.11.62	22 miles N of Cape Brett		732	K75-01-02	2.4.75	33°38-34'	151°57'-152°01'	786-804
Haul 31	22.11.62	17 miles NE Cavelli Is.		91	K80-07-02	10.6.80	36°45'	150°02'	64
Haul 90	14.11.62	Colville Channel		88	<b>HDMS <i>Galathea</i></b>				
(c)	— .12.62	NW Cooper's Is., Dusky Sound		30.5	554	5.12.51	37°28'	138°55'	1340-1320
"a"	11.1.64	Off Cuvier Is.		46-51	575	19.12.51	40°11'	163°35'	3710
"b"	11.1.69	35°07' 174°43'		402-439	626	20.1.52	42°10'	170°10'	610
Trawl 5	1.1.69	36°57' 176°17'		329-374	668	29.2.52	36°23'	177°41'	2640
Trawl 6	1.1.69	37°02' 176°13'		256-293	<b>Ob</b>				
Trawl 15	—	36°32' 176°14'		483-556	75	7.4.56	—	—	120
Trawl 16	2.1.69	36°24' 176°24'		308-304	342	11.3.58	37°40'	150°00'	110
Trawl 17	2.1.69	36°25' 176°08'		271-293	352	17.3.58	46°10'	166°01'	334
Trawl 31	10.1.69	35°27' 175°06'		—	353	17.3.58	46°12'	166°30'	156
Trawl 35a	10.1.69	35°08' 174°55'		—	<b>Pieter Faure</b>				
Trawl 35b	7-8.1.69	37°05' 176°12'		160-182	153	—	Buffalo River, NW 1/2 W, 19 mi		549
Trawl 36	10.1.69	35°05' 174°44'		457-481	<b>Talisman</b>				
Trawl 38	11.1.69	35°07' 174°43'		402-439	148	24.8.1883	42°23'N	21°15''W	4010
<b>HMS <i>Alert</i></b>					<b>Terra Nova</b>				
160	10.1881	Arafura Sea, NW Australia		58-66	90	25.7.11	From summit Gt King, Three Kings Is., S 14° W 8 miles		183
<b>BIOGÉOCAL (MUSORSTOM)</b>					<b>Thetis</b>				
272	20.4.87	21°00'	166°56.9'	1615-1710	35	10.3.1898	34°03.5'	151°12.5'	40-69
<b>Chalcal 1 (MUSORSTOM)</b>					48	18.3.1898	34°27'	151°04'	101-102
DC 61	26.7.84	21°42.4'	159°29'	50	57	— .3.1898	Off Wata Mooli, Australia		99-108
DC 68	27.7.84	22°34.2'	159°15.5'	296	<b>Washington</b>				
<b>HMS <i>Challenger</i></b>					41 (D5)	12.2.86	34°28.8'	178°52.3'	2500
68	24.6.1873	38°03'N	39°19'W	3915					
162	2.4.1874	30°10.5'	146°35'	69.5					
163A	4.4.1874	36°59'	150°20'	274					
166	23.6.1874	38°50'	169°20'	500					
167	24.6.1874	39°32'	171°48'	274					
167A	27.6.1874	41°04'	174°19'	?18					

Stn No.	Date	Latitude (°S)	Longitude (°E unless noted)	Depth (m)
<b>Musorstom 5</b>				
CP 293	11.10.86	23°09.4'	159°30.8'	280
CP 311	12.10.86	22°14'	159°23.9'	320
<b>Musorstom 8</b>				
CP 1084	5.10.94	15°50'	167°17'	207-280
<b>Taylor-Morrison Collection, Bay of Plenty, N.Z.</b>				
10	9.4.96	36°55.1'	176°16.4'	348-352
13	10.4.96	36°59.2'	176°14.4'	269-275
26	13.4.96	37°04.8'	176°14.8'	395-399
55	22.4.96	36°54'	176°17.9'	442-445
<b>Taylor Collection, Greater Omaha Bay, N.Z.</b>				
A 12	17.7.95	36°17.9'	174°49.1'	28
A 13	29.6.95	36°17.9'	174°48.8'	23

Stn No.	Date	Latitude (°S)	Longitude (°E unless noted)	Depth (m)
A 18	24.7.95	36°18.4'	174°48.9'	27
A 21	21.7.95	36°18.5'	174°48.7'	26
A 25	11.8.95	36°18.7'	174°48.6'	25
A 49	14.7.95	36°20.0'	174°49.0'	27
A 59	17.7.95	36°20.6'	174°49.4'	26
A 62	17.7.95	36°20.6'	174°49.7'	28
A 66	7.8.95	36°21.0'	174°49.3'	19
A 73	15.8.95	36°21.1'	174°50.3'	28
A 110	8.8.95	36°20.4'	174°48.7'	19
B 5	17.8.95	36°21.2'	174°51.7'	36
B 12a	21.8.95	36°16.9'	174°49.7'	30
B 12	15.12.95	36°16.9'	174°49.7'	30
B 13	15.12.95	36°17.2'	174°49.7'	29
B 19	22.8.95	36°20.8'	174°50.0'	31
C 22	19.5.95	36°19.0'	174°48.2'	17
C 27	22.5.95	36°19.4'	174°47.5'	8
C 37	1.6.95	36°21.4'	174°49.5'	11
C 44	9.6.95	36°19.4'	174°48.0'	14
C 53	15.6.95	36°19.4'	174°47.6'	9

## MORPHOLOGY AND TERMINOLOGY

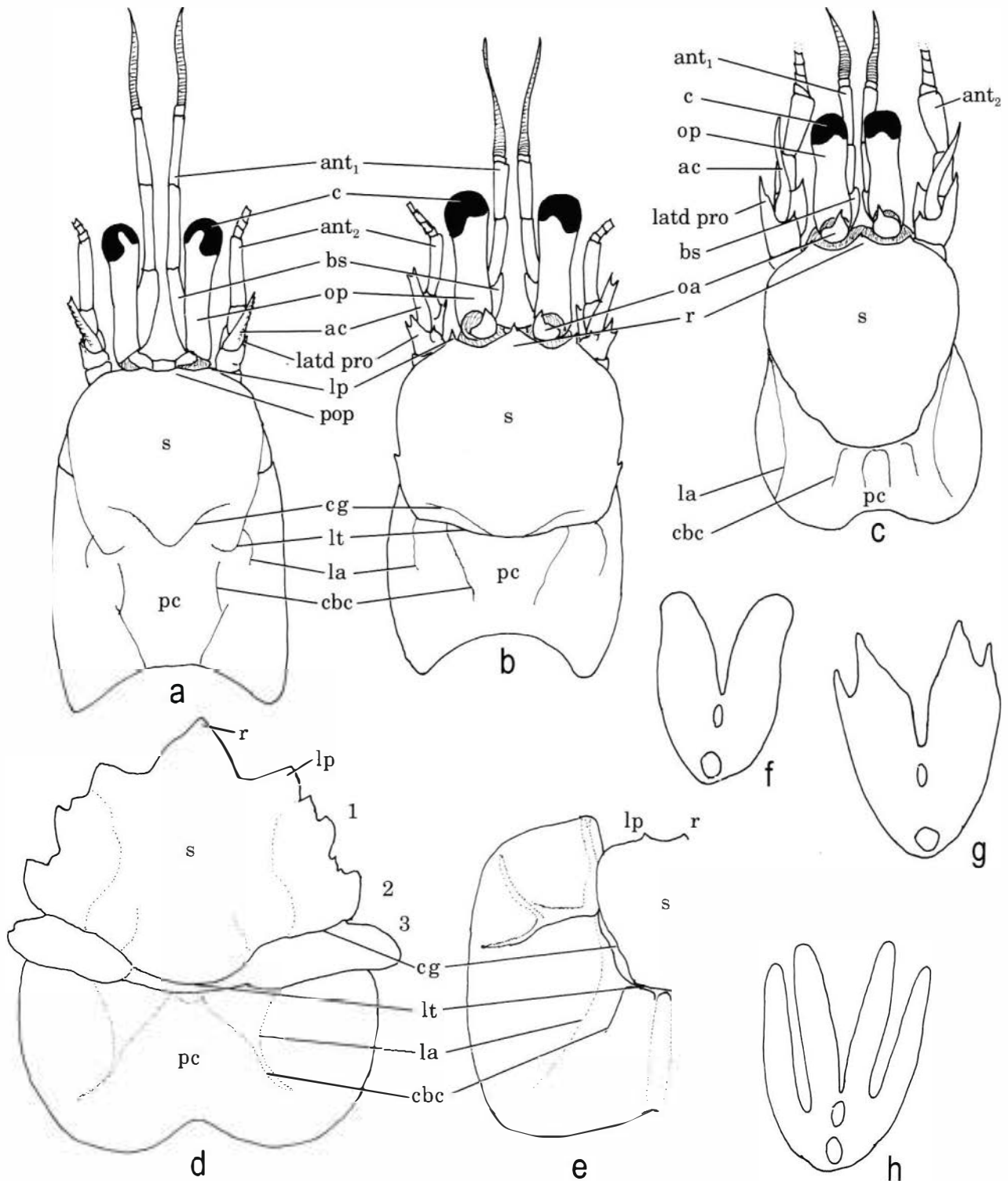
As in all malacostracans, the hermit crab body consists of 19 or 20 somites, depending upon whether the reader interprets the ocular peduncles as being appendages of a true segment or not (cf. Mayrat & de Saint Laurent 1996). The cephalic and thoracic segments collectively constitute the cephalothorax, the tergites of which are dorsally fused to form the carapace; ventrally the cephalothorax is represented by a series of sternal plates. The abdomen or pleon is composed of six somites and the telson, which is not considered to represent a true somite.

In the majority of shell-dwelling hermit crabs, calcification of the cephalothorax is minimal and only two principal regions are commonly described. The anterior gastric region or "shield" is relatively well calcified, whereas the posterior cardiac region is membranous. The shield (Fig. 1a-e) is delineated posteriorly and laterally by the cervical groove. The posterior cardiac region is separated from the shield by a narrow, uncalcified hinge, the *linea transversalis* (Pilgrim 1973). Linea and grooves, such as the *linea anomurica* and branchiocardiac grooves, provide pertinent systematic information in some genera. The lateral carapace is formed by the branchiostegites, which may be membranous or partially or completely calcified, and which provide a covering for the gills.

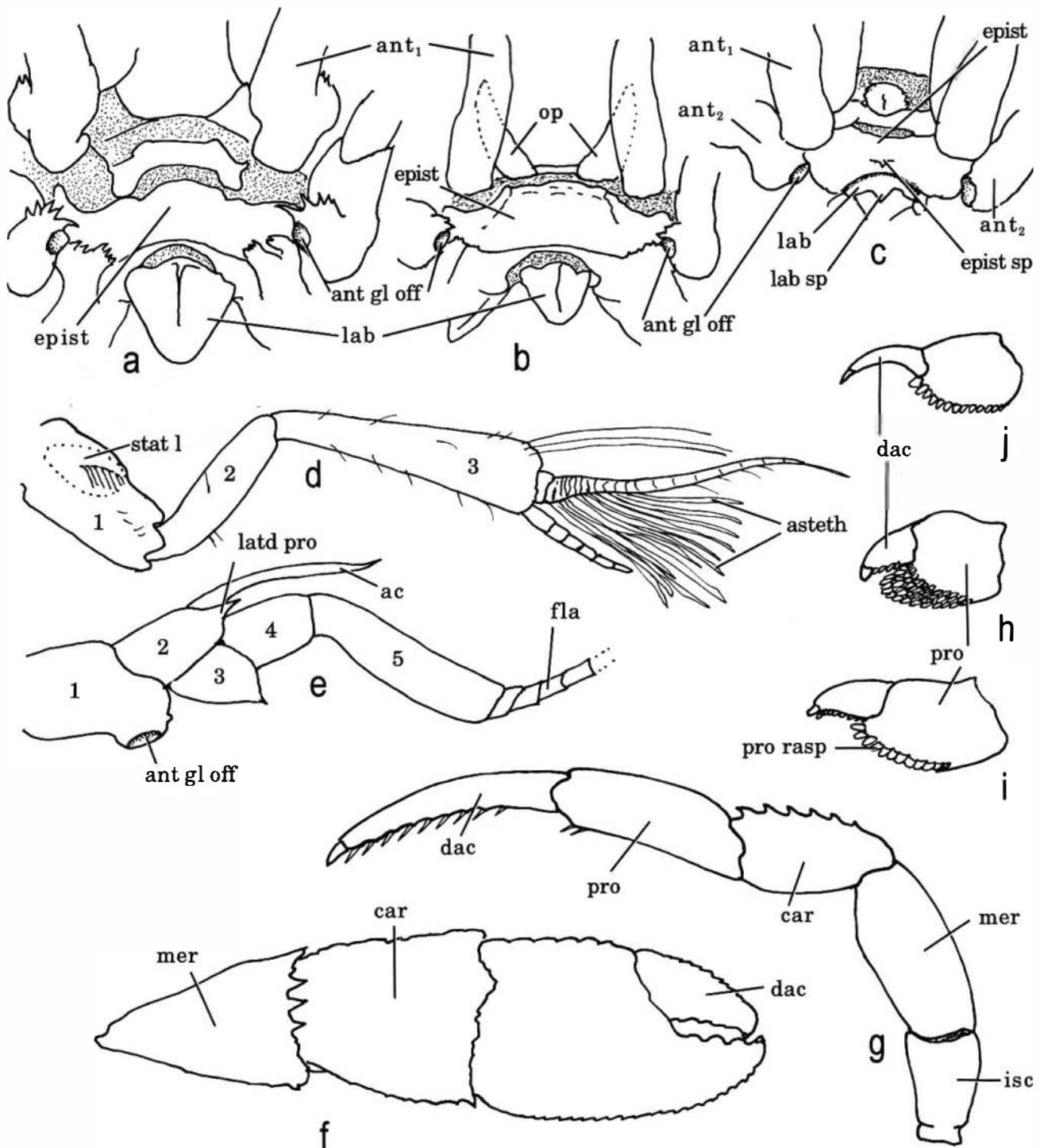
The six abdominal somites are clearly defined only in the Pylochelidae, where the articulating somites are, for the most part, provided with paired appendages. In the families Diogenidae, Paguridae, and Parapaguridae, the abdomens are almost entirely membranous and, as a consequence, segmentation has been obscured; recognition of individual somites is afforded primarily by the presence of appendages and also frequently by reduced or residual tergites.

As previously indicated, there is an ongoing debate concerning the validity of an ocular sternite; however, the peduncle itself is thought to be indistinguishably 2 or 3-segmented (Powar 1969) and provided basally with a small calcified plate referred to as an ocular acicle or, in some genera of the Pylochelidae, an ocular plate. In addition to the ocular peduncles, the cephalic appendages include the antennules (Fig. 2d), antennae (Fig. 2e), mandibles, maxillules (Fig. 3a, b) and maxillae. The ventral parts of the antennular and antennal somites form the epistome, which may or may not be fused into a single plate. The morphological structure of the epistome (Fig. 2a-c) is of particular importance in the families Pylochelidae and Parapaguridae. The peduncle of the antennule is 3-segmented, with the basal segment provided with a statocyst as in all reptants. The flagellum of the anten-

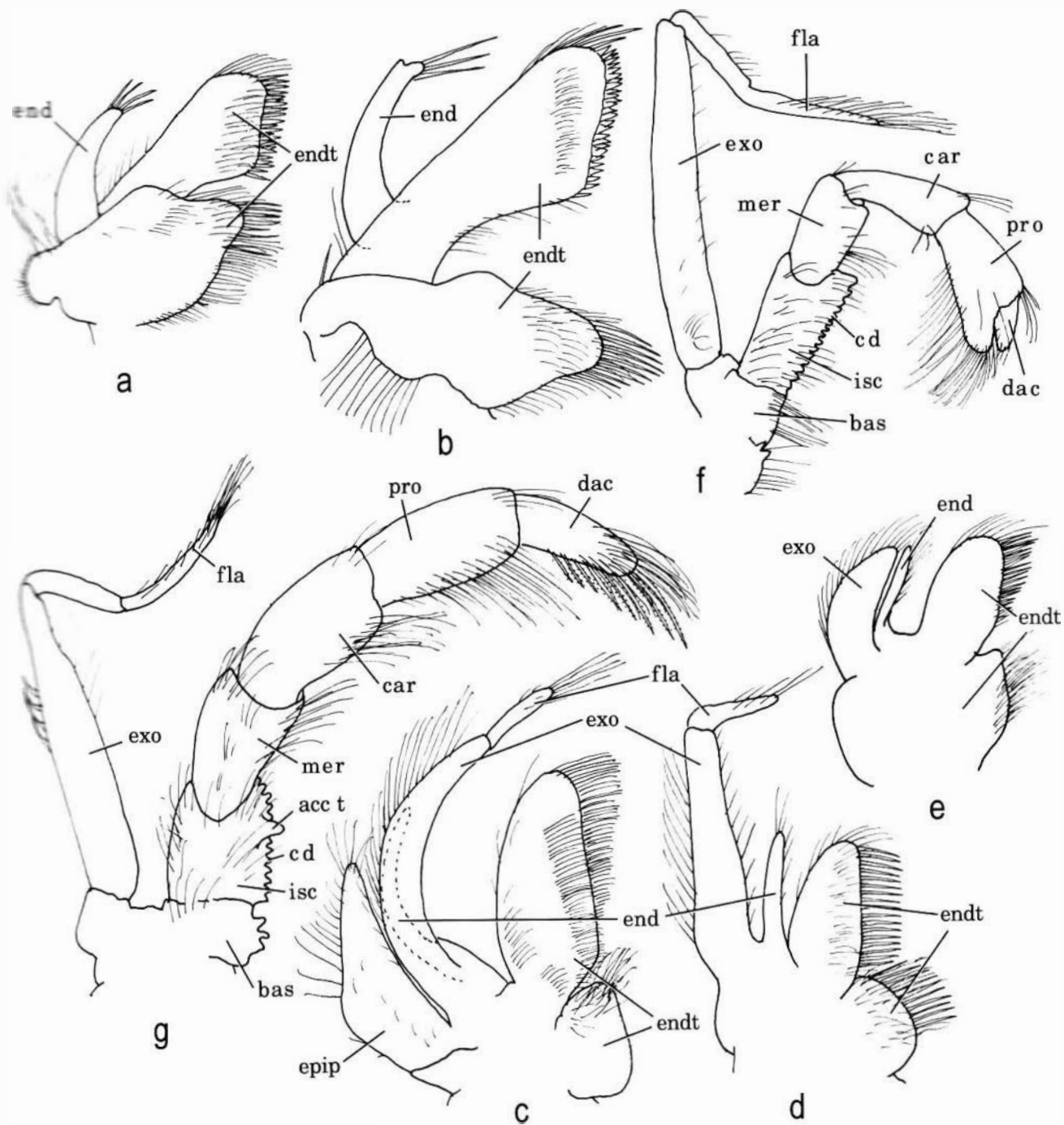




**Fig. 1. Paguridea morphology.** a-e, carapace morphology (a-c including cephalic appendages); f-h, gill lamellae: a, diagrammatic *Pylocheles* (after Forest 1987); b, diagrammatic *Trizocheles* (after Forest 1987); c, diagrammatic *Pagurus* (adapted from McLaughlin 1974); d, diagrammatic *Porcellanopagurus* (adapted from McLaughlin & Lemaitre 1997); e, diagrammatic left side of pagurid shield, branchiostegite, and left half of cephalothorax as seen in *Pagurus* (after Pilgrim 1973); f, biserial gill lamella; g, h, quadriserial gill lamellae. Abbreviations: *ac*, antennal acicle; *ant<sub>1</sub>*, antennule; *ant<sub>2</sub>*, antennal peduncle; *bs*, basal segment; *latd pro*, laterodistal projection; *lp*, lateral projection; *la*, linea anomurica; *lt*, linea transversalis; *c*, cornea; *cg*, cervical groove; *cbc*, cardiobranchial groove or ridge; *oa*, ocular acicle; *op*, ocular peduncle; *pc*, posterior carapace; *pop*, postocular projection; *r*, rostrum; *s*, shield. Numbers indicate lateral lobes of porcellanopagurid carapace. Not to scale.

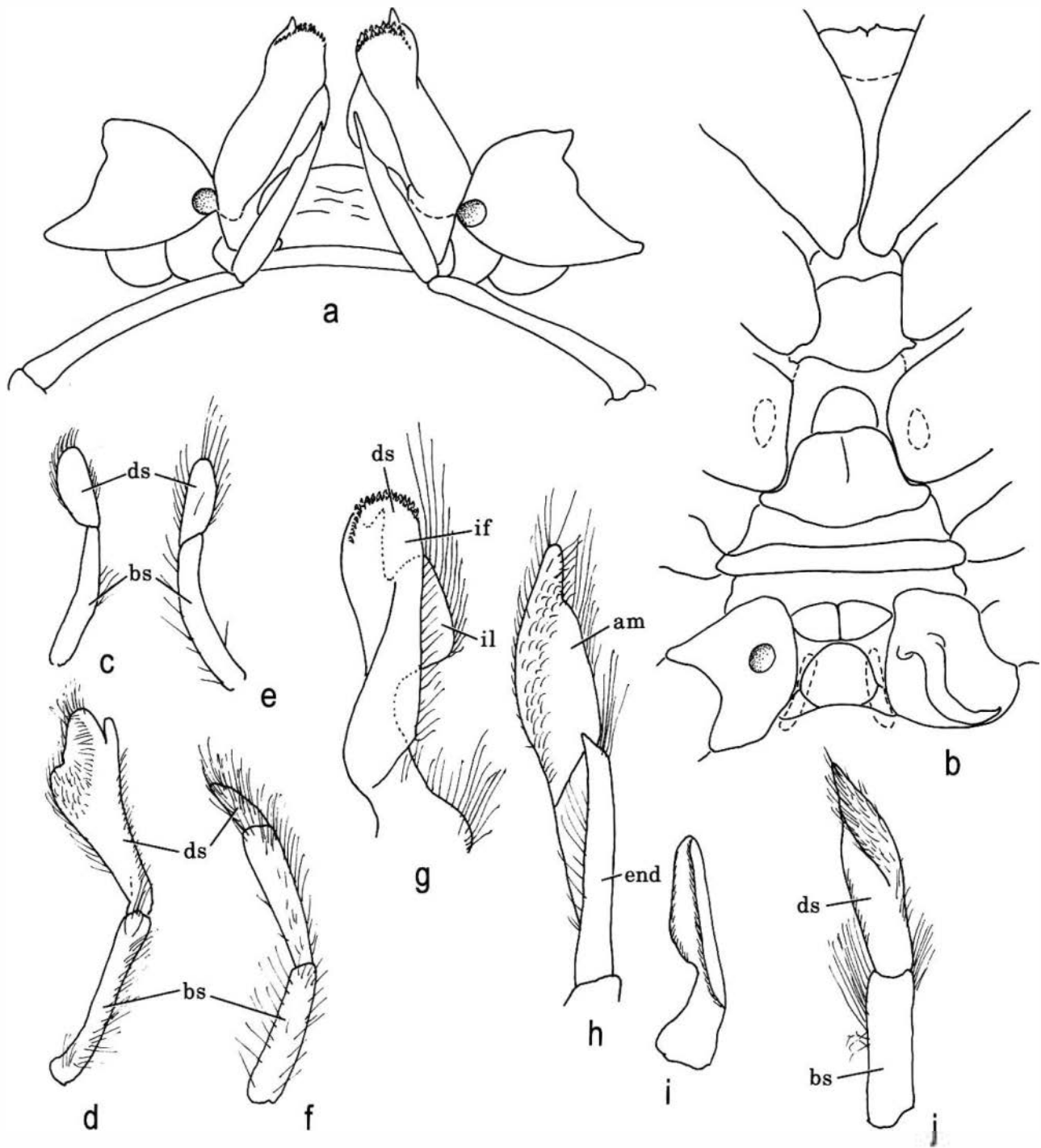


**Fig. 2. Diagrammatic buccal structures, cephalic and thoracic appendages:** a-c, epistomial structure; d, e, cephalic appendages; f, g, thoracic appendages; h-j, semichelate dactyls and propodi of fourth pereopods: a, *Pylocheles* (after Forest 1987); b, *Cheiroplatea* (after Forest 1987); c, *Parapagurus* (after Lemaitre 1989); d, antennule of *Pagurodes*; e, pagurid antennal peduncle and basal portion of flagellum (after Sandberg & McLaughlin 1998); f, pagurid right cheliped (after McLaughlin 1974); g, left third pereopod (after McLaughlin 1974); h, *Cheiroplatea* (after Forest 1987); i, *Pagurodes*; j, *Sympagurus* (after McLaughlin & Lemaitre 1997). Abbreviations: ac, antennal acicle; ant<sub>1</sub>, antennule; ant<sub>2</sub>, antenna; ant gl off, orifice of antennal gland; asteth, aesthetascs; car, carpus; dac, dactyl; epist, epistome; epist sp, epistomial spine; fla, flagellum; isc, ischium; lab, labrum; lab sp, labral spine; latd pro, laterodistal projection; mer, merus; op, ocular peduncle; pro, propodus; pro rasp, propodal rasp; stat l, statocyst lobe. Numbers indicate segments progressing distally. Not to scale.



**Fig. 3.** Selected representative mouthparts: **a, b**, maxillule; **c-e**, first maxilliped; **f, g**, third maxilliped: **a, c, f**, *Pylocheles* (after Forest 1987); **b, d**, *Pagurodes*; **e**, *Sympagurus* (after Lemaitre 1994). Abbreviations: **acc t**, accessory tooth; **bas**, basis; **car**, carpus; **dac**, dactyl; **cd**, crista dentata; **end**, endopod; **epip**, epipod; **exo**, exopod; **endit**, endites; **fla**, flagellum; **isc**, ischium; **mer**, merus; **pro**, propodus. Not to scale.





**Fig. 4. Thoracic and abdominal sternite and male gonopod morphology:** a, coxae and sternite of male fifth pereopods and anterior abdominal somites 1 and 2, showing position of gonopores and first and second pleopods (after Forest 1954); b, diagrammatic composite male and female sternites of posterior thoracic segments 3-8 and first abdominal somite, showing anterior lobe of sternite of third pereopods, coxae and sternite of fifth male pereopods with position of right gonopore and left sexual tube, superimposed female gonopores (dashes) and female first pleopods (dashes); c, d, male gonopods of *Pylocheles* (after Forest 1987); e, f, male gonopods of *Cheiroplatea* (after Forest 1987); g, h, male gonopods of *Paguristes* (after Forest 1954); i, j, male gonopods of *Parapagurus* (after Lemaitre 1989); c, e, g, i, first pleopods; d, f, h, j, second pleopods. Abbreviations: am, appendix masculina; bs, basal segment; ds, distal segment; end, endopod; if, inferior lamella; il, internal lobe. Not to scale.

nule is biramous; the upper ramus or endopod is provided with a series of chemoreceptive setae or aesthetascs (Snow 1973). The adult antenna has a 5-segmented peduncle; the antennal or green gland opens ventrodistally on the first or basal segment. The antennal acicle at the distolateral margin of the second peduncular segment represents the larval exopod or scaphocerite. The antennal flagellum, arising terminally from the fifth peduncular segment is uniramous, sometimes quite long, and frequently provided with long plumose setae.

The mandibles, maxillules and maxillae, together with the first three thoracic pairs of appendages collectively form the mouthparts of the crab; all but the mandibles and maxillules are biramous. Taxonomic significance is often attributed to the development of the maxillary endopod (Fig. 3a, b), development of the flagellum on the first maxilliped (Fig. 3c-e), and development of the crista dentata on the ischium of the third maxilliped that may or may not be provided with one or more accessory teeth (Fig. 3f, g). The remaining thoracic appendages are the pereopods, the first pair most commonly referred to as the chelipeds. All are uniramous and consist of coxa and basis (larval protopod), and 5-segmented endopod (ischium, merus, carpus, propodus, and dactyl) (Fig. 2f, g). However, coxa and basis are fused in all pereopods, as they usually are also at least partially, on the second and third maxillipeds. Most descriptions of the chela refer to the surfaces as dorsal, ventral, mesial and lateral; however, when propodal-carpal articulations are rotated from the perpendicular plane of the body, the more general terms upper, lower, inner, and outer, are more appropriate to avoid confusion. The second and third pereopods function as walking or "ambulatory" legs, or very rarely as swimming appendages (cf. García-Gómez 1983), whereas the fourth and fifth pairs are reduced. The fourth pereopods commonly are semichelate in structure (Fig. 2h-j); the dactyl may be provided with a presumably sensory, preungual process at the base of the claw, and the rasp on the lateral face of the propodus may be composed of one to several rows of scale-like setae. The fifth pereopods usually are chelate and both the dactyl and the propodus are provided with a rasp of corneous scale-like setae.

Female sexual ducts open through gonopores on the ventral or occasionally on the posterior surface of the coxae of the third pereopods (Fig. 4b); male gonopores are positioned on the ventral or occasionally posterior surface of the coxae of the fifth pereopods (Fig. 4b). In numerous genera, males are provided with "sexual tubes", which are extrusions of the vas deferens through the gonopore (Fig. 4b). Sexual tubes may be present on the right or left coxae

or both. Males and/or females in some genera are provided with structurally modified, paired first and/or second pleopods (Fig. 4a, c-)).

The gills are composed of a series of lamellar plates, which may be biserial (Fig. 1f) or quadriserial (Fig. 1g, h) in structure. Hermit crabs do not have podobranchs; they have usually a pair of arthrobranchs at the bases of thoracic appendages 3-7 (maxilliped 3 through pereopod 4), and one pleurobranch on the pleural wall of one or more thoracic somites: 5-8 ( $P_2$ - $P_5$ ) [Pylochelidae, some Diogenidae]; 5-7 ( $P_2$ - $P_4$ ) [some Diogenidae, some Paguridae]; 7-8 ( $P_4$ - $P_5$ ) [some Parapaguridae]; 7 ( $P_4$ ) [most Paguridae and Parapaguridae]; pleurobranchs are completely absent in some Paguridae and arthrobranch number is occasionally reduced in some Paguridae. Structure, number, and arrangement of gills are given important taxonomic value.

Only in the family Pylochelidae are all the abdominal tergal and sternal plates clearly distinguishable. In most hermit crabs the abdomen is primarily membranous, with rudiments of the plates appearing only as faint cuticular thickenings or transverse fibrils of connective tissue. The exception is in the sixth somite where the tergite is generally at least partially calcified. The digestive tract terminates in an anal opening usually on the ventral surface of the telson. Non-modified abdominal appendages basically consist of paired (Pylochelidae) or unpaired (other families) pleopods on somites 2-5 and paired uropods on somite 6. However, the pleopod number is frequently reduced in males of the Diogenidae, Paguridae, and Parapaguridae, or occasionally pleopods are totally lacking. In females, pleopods 2-4 are biramous and egg-bearing, whereas pleopod 5 may be reduced or occasionally absent. The terminal telson is usually weakly calcified, and may be entire, or incompletely divided into 2-4 lobes.

Terminology for morphology of the Pylochelidae follows that of Forest (1987); that of the gonopods of *Paguristes* follows that of Forest (1954). Terminology for morphology of the Paguridae and Parapaguridae follows that of McLaughlin (1974, 1997), Lemaitre (1989, 1999), McLaughlin and Forest (1997), and McLaughlin and de Saint Laurent (1998). Figures 1-4 identify and illustrate the majority of terms used in the text. However, certain more ambiguous terms are defined below.

- (a) spine (and spinule): a rectilinearly, thin, sharp-pointed process (spinule being smaller);
- (b) spiniform seta: movable spine (corneous spines of McLaughlin & Lemaitre 1997);
- (c) tooth (and denticle): variably shaped process, thick, sometimes curved, not especially sharp (denticle being smaller), usually located on margin;



- (d) tubercle: rounded knob or nodule of varying size, often located on a segmental surface;
- (e) postantennal projections, lateral projections, and laterofrontal processes have been used interchangeably for the process emanating on the anterior margin (or frontal border) of the shield;
- (f) inner, mesial, and internal surface or face are used interchangeably, as are upper and dorsal; lower and ventral; outer, external and lateral;
- (g) laterodistal projection of second segment of antennal peduncle is used in the Paguridae and Parapaguridae in preference to McLaughlin's (1974, 1997) and others' dorsolateral distal angle;
- (h) antennalexopod = antennal acicle = antennal scale = antennal spine = scaphocerite, depending upon which major decapod taxon is being reviewed. We have elected to use antennal acicle.
- (i) mushroom-shaped tubercles refer to flattened structures shaped much like a toad-stool or boletiform mushroom;
- (j) posterolateral lobes or plates of the carapace refer to those distinct lateral projections of the shield and posterior carapace seen in genera like *Porcellanopagurus*;
- (k) propodal terminations of the fourth pereopod follow those proposed by McLaughlin (1997), i.e., subchelate, in which the pereopod is developed as a prehensile structure by the folding back of the dactyl against the propodus; semichelate (fourth pereopods), where the ventral margin of the propodus is produced beneath the dactyl to such an extent that flexion of the dactyl becomes much more akin to the action of a dactyl against a fixed finger of a chelate appendage;
- (l) preungual process refers to a structure, often tubular, and presumably sensorial, that develops on the ventrodistal margin of the dactyl of the fourth pereopod at the base of the claw.

## INTRODUCTION TO SYSTEMATIC SECTIONS

There is no consensus yet on the hierarchical classification of the Decapoda (e.g., de Saint Laurent 1979; Bowman & Abele 1982; Schram 1986; Abele 1991; Scholtz & Richter 1995), nor even in the use of the terms *Anomura* or *Anomala* (e.g., de Saint Laurent 1979; Burkenroad 1981; McLaughlin 1983b; McLaughlin & Holthuis 1985; Squires 1990; Richter & Scholtz 1994). We have chosen to accept the use of the term *Anomura* (sensu McLaughlin & Holthuis 1985) and the Section Paguroidea (sensu Forest 1987).

The general classification of the Paguroidea adopted here recognises the two superfamilies Coenobitoidea Dana, 1851 and Paguroidea Latreille, 1802. This classification, proposed by MacDonald *et al.* (1957: 256) was based on larval characters. However, it corresponded to the major divisions "Eupagurinae" (= Paguroidea) and Pagurinae (= Coenobitoidea) proposed by Bouvier (1940: 112), which characterised the two major divisions on the basis of the position of the third maxillipeds, i.e., basally approximate in the first and widely separated in the second. The particular positioning of the bases of these appendages reflects the fundamental difference in the organisation of the endophragmal structure between

the two groups. After the exclusion of the Lomisidae (Lomidae) from the Coenobitoidea, and its elevation to superfamily rank (McLaughlin 1983a), the Coenobitoidea consists of the families Coenobitidae Dana 1851, Pylochelidae Bate, 1888 and Diogenidae Ortmann, 1892. The Paguroidea includes the families Paguridae Latreille, 1802, Parapaguridae Smith, 1879, and Lithodidae Samouelle, 1819. With the exception of the tropical and semiterrestrial Coenobitidae, all families are represented in the New Zealand fauna. Arrangement of taxa within the Coenobitoidea and families Paguridae and Parapaguridae follows the keys to the genera and species and does not imply phylogenetic relationships.

### KEY TO THE SUPERFAMILIES

- 1 Bases of third maxillipeds approximate or nearly so. Chelipeds with left generally larger; if equal or subequal, structurally similar ..... COENOBITOIDEA
- Bases of third maxillipeds widely separated by sternal plate. Chelipeds with right generally larger; if subequal, structurally dissimilar ..... PAGUROIDEA



# SUPERFAMILY COENOBITOIDEA

## Families Pylochelidae, Diogenidae

by

Jacques Forest and Patsy A. McLaughlin

### SYSTEMATICS

#### Superfamily COENOBITOIDEA

Anomura with generally cylindrical or dorso-ventrally compressed body; abdomen usually well developed, symmetrical or asymmetrical; occasionally with abdomen reduced; tergites calcified or membranous. Eyes usually well developed; antennal acicle usually moderately well developed. Third maxillipeds approximate basally or nearly so. First pereopods chelate, subequal, or left usually larger than right; second and third pereopods simple. Telson reduced, commonly with bilateral indentation; uropods symmetrical or asymmetrical, usually with well-developed rasps.

#### KEY TO THE NEW ZEALAND FAMILIES

- 1 Paired pleopods on abdominal somites 2-5 ..... PYLOCHELIDAE
- No paired pleopods on abdominal somites 4 and 5 ... DIÖGENIDAE

#### Family PYLOCHELIDAE Bate, 1888

"Paguriens" A. Milne-Edwards, 1880: 37 (in part).  
Pylochelidae Bate, 1888: 10 (in part); Alcock 1905b: 113;  
Forest 1954: 167; Dechancé 1963: 494; Pilgrim 1965: 549;  
Schembri & McLay 1983: 28; Forest 1987: 25.  
Parapaguridae: Henderson, 1888: 85 (in part).  
"Paguriens" or "Pagurides": A. Milne-Edwards & Bouvier  
1893: 17.  
Pomatochelidae Stebbing, 1914: 2; Balss 1924: 753; Miyake  
1978: 3; McLaughlin 1983b: 615; Baba 1986: 184.  
"Pomatocheliden": Balss 1924: 780.  
"Pylochelimen": Boas 1926: 3.

TYPE GENUS: *Pylocheles* A. Milne-Edwards, 1880.

Carapace pagurid-like, divided by complete or incomplete *linea transversalis* into strongly calcified shield and posterior carapace with calcification more or less extensive. Anterior margin with or without rostrum. Ocular peduncles normal or reduced, corneas

large, reduced, or absent. Antennular and antennal peduncles always very well developed, flagella and antennal acicle present.

Endopod of maxillule with external lobe developed or not. First maxilliped with well-developed epipod and usually with flagellated exopod. Second maxilliped with or without epipod. Third maxilliped approximate basally, endopod cheliform or not, rarely with rudiment of epipod; ischium with well-developed crista dentata, with or without accessory teeth. Fourteen pairs of gills.

Chelipeds nearly always symmetrical, carpus and palm modified or not to form operculum. Second and third pereopods ambulatory. Fourth and fifth pereopods more or less subcheliform, with propodal rasp consisting of modified setae (scales), except in Pylochelinae where fourth pereopods have single row of setae.

Abdomen macruran-like, symmetrical or not, with individual somites calcified dorsally and articulated. Abdominal somites each with pair of pleopods, first and second in males, and first in females modified as gonopods. Telson well developed, with or without transverse suture.

REMARKS: Until recently (Forest 1987) the family was known only from a small number of species often imperfectly described. As noted in the introduction, two species were initially distinguished in the New Zealand fauna, both undescribed, and attributed to the genus *Mixtopagurus* A. Milne-Edwards, 1880. That genus had been established originally for *M. paradoxus* A. Milne-Edwards, 1880, a species from the western Atlantic Antilles region. Indo-Pacific species were later included and the specimens from New Zealand clearly presented the same generic characters. One of the two species appeared closely related to *M. spinosus* (Henderson, 1888) from the Tasman Sea. During the course of a major review of the Pylochelidae by Forest (1987), it appeared that this family was markedly heterogeneous and reassembled lineages had to be separated into distinct subfamilies. Such subdivision, which led to the placement of formerly congeneric species in entirely different subfamilies, required the redefinition of known genera and the establishment of new genera.

The inclusion of Indo-west Pacific species in the genus *Mixtopagurus* was found inappropriate. In fact, *Mixtopagurus* proved to be a monotypic genus and the sole representative of a subfamily located in the western Atlantic. Consequently, Indo-Pacific (e.g., Indonesia, Australia, New Zealand) species were assigned to the new genus *Trizoches* Forest, 1987 and the new subfamily Trizochelinae (loc. cit.: 155), unified by the possession of a stridulatory device composed of two elements, i.e., a field of flattened tubercles on the produced anterolateral region of the carpus of the cheliped (*pars stridens*) and a set of tubercles or corneous striae on the mesial face of the carpus and of propodus of the second pereopods (plectrum). One of the two New Zealand species was described as *T. brachyops* by Forest and de Saint Laurent in Forest (1987). After the examination of additional specimens, the second species was found clearly to be related to what was, at that time, thought to be the exclusively Australian species *Trizoches spinosus* (Henderson, 1888), and was described in the same publication (Forest 1987) as a subspecies, *T. spinosus bathamae* Forest & de Saint Laurent, 1987. A third species was recognised in the New Zealand collection, but it was represented by a single damaged specimen. *Trizoches perplexus* Forest, 1987, presented the principal characteristics of the genus, but with certain details that indicated an aberrant form. More recent collections from NIWA have included additional representatives of *T. brachyops* and *T. spinosus bathamae*, a single specimen of *Trizoches spinosus spinosus*, five supplementary specimens of *T. perplexus*, and several specimens of a new species, *T. pilgrimi* sp. nov.

The subfamily Pylochelinae is represented in New Zealand by two species. *Pylocheles* (*Pylocheles*) *mortensenii* Boas, 1926, reported from Indonesia, Japan and the eastern coast of Australia, was found in two NZOI stations, the first in Tasman Bay, and the second more recently in the northern Kermadec Islands. In contrast, numerous specimens of an undescribed species of the genus *Cheiroplatea* were found in the Kermadec Islands. This species, *C. pumicicola* Forest, 1987, has been collected again in the Kermadec Islands and recently has been found in New Caledonia and the Loyalty Islands.

#### KEY TO PYLOCHELIDAE OF NEW ZEALAND INCLUDING THE KERMADEC ISLANDS

- 1 Shield incompletely separated from posterior part of carapace, *linea transversalis* interrupted medially. Telson composed of 2 articulated plates. Ocular acicles absent. Propodus of the fourth pereopods with row of spiniform or squamiform setae along ventral margin ..... 2  
..... Subfamily PYLOCHELINAE

- Shield completely separated from posterior part of the carapace by continuous *linea transversalis*. Telson composed of single plate. Ocular acicles acute, triangular. Propodus of fourth pereopods with numerous spiniform or squamiform setae, usually imbricated and forming generally broad rasp on lateral face .....  
..... subfamily Trizochelinae: *Trizoches*
- 2 Shield approximately as long as broad. Frontal margin with median concavity and reduced median denticle. Ocular peduncles well developed. Corneas large, hemispherical, pigmented ..... *Pylocheles mortensenii*
- Shield distinctly broader than long. Frontal margin with rounded rostral lobe. Ocular peduncles reduced, extremity conical. Corneas reduced, unpigmented .....  
..... *Cheiroplatea pumicicola*

#### *Pylocheles* A. Milne-Edwards, 1880

*Pylocheles* A. Milne-Edwards, 1880: 38; Ortmann 1892: 274; A. Milne-Edwards & Bouvier 1893: 17; Benedict 1901: 771; Alcock 1905b: 14; Boas 1926: 34, 40; Forest 1954: 167; 1987: 41.

*Mixtopagurus*: Yokoya 1933: 70 (in part).

TYPE SPECIES: By monotypy, *Pylocheles agassizii* A. Milne-Edwards, 1880. Gender masculine.

Carapace longer than broad; shield approximately square. Posterior margin incompletely calcified, branches arched from *linea transversalis* not rejoined across carapace. Cervical groove strongly marked, in form of broadly open "V", branches straight or concave. Anterior margin sinuous, with 1 pair of angular or rounded postocular protuberances, separated by concave sinus, straight or weakly convex, sometimes with rostral spinule or denticle. Lateral projections equally angular or rounded, spinulose or not. Endopod of maxillule elongate with 4 or 5 distal setae on rounded internal lobe and single median seta on mesial margin, no external lobe. Third maxilliped terminally chelate, propodus with produced digit, broader but same length or shorter than dactyl.

Chelipeds equal and symmetrical. Second and third pereopods similar. Fourth pereopods with extremities weakly semichelate.

First abdominal tergite trapezoidal, swollen, smooth. Tergites 2-5 with rectangular median region separated from pleural expansions by strong longitudinal depression. Pleurons rounded, entire. Sixth tergite longer and more slender than preceding, constricted posteriorly and with incision on each side extending obliquely onto dorsal surface. Telson divided into two sections by transverse articulation; posterior lobes rounded, separated by median cleft and by more or less defined membranous line or by thin furrow.



Male with first 2 pairs of pleopods modified as gonopods. Paired pleopods 3–5, often uniramous. Females with first pleopods slender, inserted side by side, distal flagelliform part separated or not from longer proximal part by articulation. Paired pleopods 2–5, biramous.

***Pylocheles (Pylocheles)* A. Milne-Edwards, 1880**

*Pylocheles (Pylocheles)*: Forest 1987: 48.

TYPE SPECIES: By monotypy, *Pylocheles agassizii* A. Milne-Edwards, 1880.

Anterior margin with postocular protuberances separated by weakly concave sinus or by produced, very obtuse rostral region with or without rostral spinule or denticle. Ocular peduncles overreaching antennal peduncles, but much shorter than antennular peduncles. Corneas dilated and pigmented; basal segment well developed, rounded. Third maxilliped with 1 seta on small epipodal lobule.

Chelipeds equal, symmetrical; anterodorsal facet of carpus broad; dorsal surface of palm lengthened and with carpus forming subcircular operculum.

Posterior lobes of telson rounded, completely separated by membranous longitudinal suture.

***Pylocheles (Pylocheles) mortensenii* Boas, 1926**  
(Fig. 5)

*Pylocheles Mortensenii* Boas, 1926: 40, figs 1, 5, 6, 10A, 11B, 13, 14, 18, 25A.

*Mixtopagurus rigidus* Yokoya, 1933: 71, fig. 31.

*Pylocheles rigidus*: Miyake 1960: 94, pl. 47, fig. 6; 1965: 640, fig. 1064; 1978: 11, fig. 4; 1982: 95, pl. 32, fig. 3; Baba 1986: 185, 195, fig. 132; Miyake 1991: 95, pl. 32, fig. 3.

*Pylocheles mortensenii*: Pilgrim 1965: 556.

*Pylocheles (Pylocheles) mortensenii*: Forest 1987: 51, figs 2a, 3a, 5a,b, 7a, 8a-i, 9a-d, 10a,b, 12a-d, 41a, pl. 2C.

TYPES:

Lectotype by subsequent designation by Forest (1987): ovigerous female (cl = 13.5 mm), Danish Expedition, Stn 62, ZMUC.

Paralectotypes: 2 males, 2 females, Danish Expedition, Stn 62, ZMUC.

TYPE LOCALITY: Danish Expedition, Stn 62, Kai Islands, Indonesia, 05°29.25' S, 132°50' E, 290 m.

OTHER MATERIAL EXAMINED:

NZOI STNS: K583, 1 male (cl = 7 mm), 1 female (cl = 6.5 mm); K815, 1 male (cl = 6.7 mm), 1 female (cl = 5.7 mm).

DESCRIPTION: Shield (Fig. 5a) shorter than broad (ratio about 5 : 6) and clearly longer than posterior carapace. Anterior margin with pair of small acute teeth separated by weakly concave to weakly convex sinus, with or without median denticle. Lateral projections sharp, distinctly prominent. Gastric region delimited anteriorly by continuous arched furrow and laterally by 2 convergent depressions. Length of ocular peduncles approximately 0.83 shield length. Corneas dilated and pigmented; maximum diameter nearly double that of peduncles at midlength, 0.33–0.40 peduncular length. Antennular peduncles, when fully extended, reaching beyond distal margins of corneas by half to full length of last segment, second segment longer. Antennal peduncles reaching to base of corneas, or shorter; laterodistal projection of second segment strong, with 2 teeth posterior to terminal tooth, dorsal surface with strong transverse depression adapted with anterolateral angle of shield to permit peduncle to be raised vertically in relation to latter. Antennal acicle long, triangular in cross-section, reaching to or not quite to midlength of last segment, with 2 strong teeth on lateral margin and row of sharp denticles on mesial margin. Antennal flagellum 1.5 times length of shield.

Chelipeds equal, symmetrical; distal segments forming perfect operculum. When appendages extended, dorsal margins of meri appreciably perpendicular to opercular surface. Carpi each with anterodorsal crest of strong conical teeth delimiting distal triangular facet (operculate); transverse, pilose, more or less tuberculate striae proximal to crest; 1 row of several irregular teeth on proximal half of dorsal face. Propodus (Fig. 5b) with external margin convex, internal margin nearly rectilinear. Maximum breadth of palm included about twice (females) or 2.3 times (males) in length of opercular unit; “operculum” noticeably circular in females, somewhat longer than broad in males. Surface of palm and distal facet of carpus forming shallow basin covered with teeth or blunt to more or less sharp, conical tubercles, stronger and forming continuous row on margins. Piliosity consisting of quite dense setae of variable length, but not concealing underlying integument.

Second pereopods with meri and dactyls subequal, propodi 0.33 shorter. Dorsal margins each with denticles, less prominent on meri, row of sharp teeth on carpi and sharp denticles disposed on proximal 0.65 of propodi. Dactyls each with ventral row of fine corneous spines. Third pereopods (Fig. 5c) differing from preceding by relative proportions of segments: meri slightly shorter, dactyls slightly longer. Additionally, dorsal margins unarmed except for very small distal spine on carpus. Fourth pereopods (Fig. 5d) weakly semichelate. Propodi each with 7–10



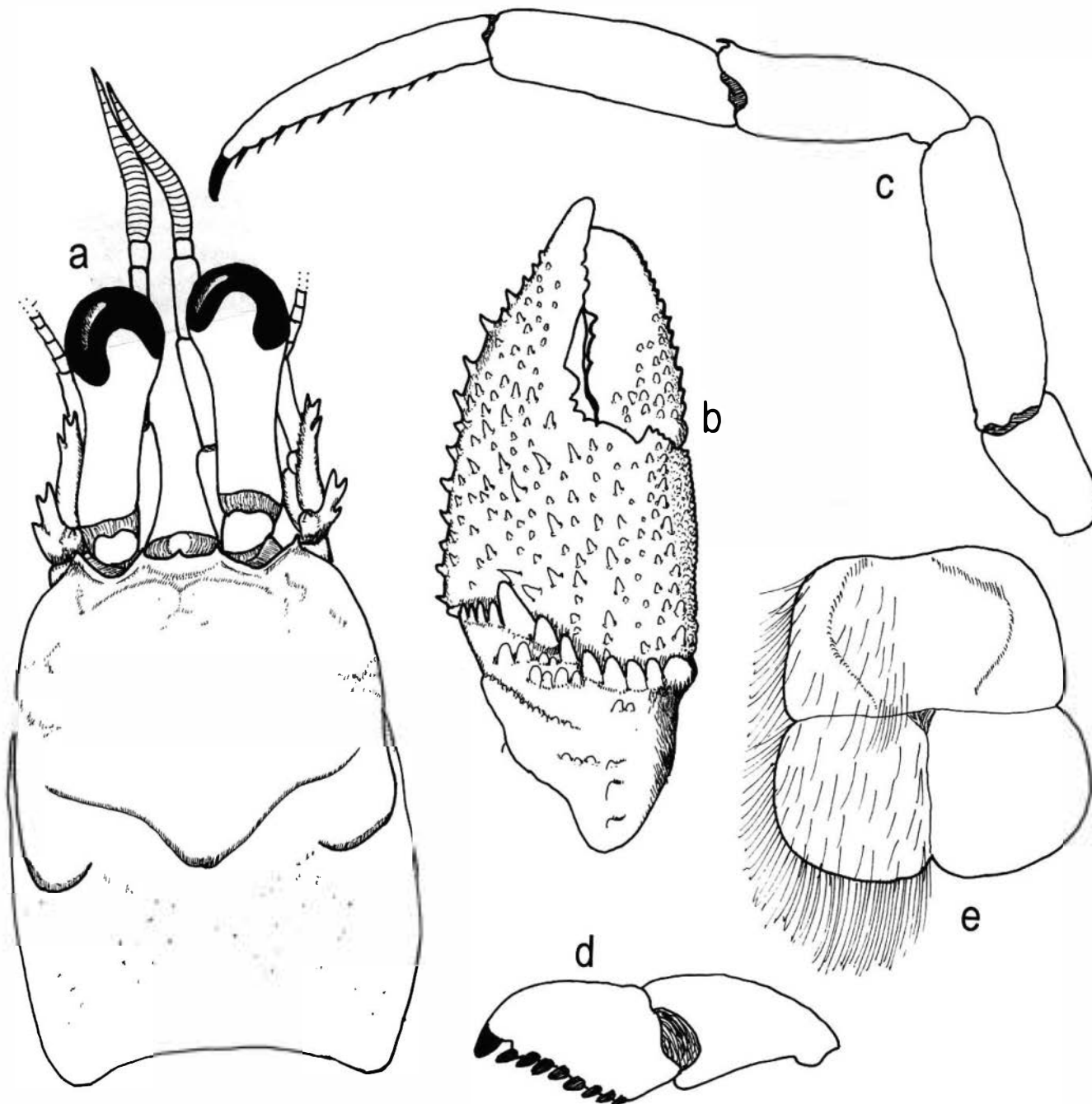


Fig. 5. *Pylocheles (Pylocheles) mortensenii* Boas, 1926, NZOI Stn K583, female (cl = 6.5 mm): a, cephalothorax and cephalic appendages (setation and aesthetascs omitted); b, carpus and chela of left cheliped (upper face, setation omitted); c, left third pereopod (lateral view, setation omitted); d, distal three segments of left fourth pereopod (lateral view, setation omitted); e, telson (setation shown on left side only). Magnifications equal 12x (a-c); 18x (d, e).

squamiform, corneous bristles on distal 0.75 of ventral margin. Fifth pereopods subchelate; anterodorsal region of propodi each projected, rounded, provided with modified bristles forming rasp. Dactyls bent back on truncate anterior margin of propodi.

Abdominal segments with well-calcified, symmetrical, articulated tergites. First segment trapezoidal, convex, smooth. Second to fifth tergites each with broad rectangular median region separated from marginally rounded pleural lobes by deep longitudinal depressions. Sixth segment distinctly shorter than broad, with concave lateral margins converging posteriorly; anterior to posterolateral angles, tergal margins marked by some shallow incisions extending onto dorsal surface as fine oblique grooves. Posterior margin divided by shallow incisions into 3 straight or very weakly convex lobes, lateral 2 forming with median very obtuse angles. Uropods symmetrical, exopod somewhat curved, endopod shorter, oval; both rami with broad rasp covering length of anterolateral margins on part of dorsal surface. Telson (Fig. 5e) subdivided by transverse articulation, generally slightly shorter than broad; posterior part divided into 2 circular lobes by membranous median notch; free margins with fringes of very fine setae, very long on posterior lobes.

First pleopods of male with slender basal segment and shorter, broadly foliaceous and slightly rolled distal segment. Second pleopods much larger, consisting of straight basal segment, longer endopod and very short exopod. Endopod lamelliform, with anterior surface hollowed and spooned, appearing trilobed, with distally rounded and semi-articulated lobe (articulation not visible on posterior surface), strong convex expansion on inner side and digitiform lobe with distal orientation on outer side. Following three pairs of pleopods consisting of 2 straight segments; distal segment slightly longer and narrower than proximal. Female with small first pleopods 2-segmented; proximal segment slender, arched; distal segment flagelliform, half as long. Four following pairs of pleopods much longer. Each appendage consisting of proximal straight protopod; terminally 2-segmented endopod, and exopod nearly twice as long and strongly arched.

Pilosity: Weak, except on opercular surfaces of chelipeds, which are covered with numerous setae; these may be long, more or less tangled, or much shorter, but intermingled with much longer setae.

COLOUR (in life): Body uniformly intense rose (Miyake 1978).

MEASUREMENTS: The largest specimens observed were a male (cl = 15.5 mm) from Japan and a female (cl = 13.5 mm) from the Kai Islands.

REPRODUCTION: Unknown for New Zealand, but ovigerous females have been collected from February to April in Tosa Bay, May in Kishu, and July in the Bungo Strait of Japan (Miyake 1978). Miyake reported that females carry 50–113 large eggs (1.8–2.0 mm diameter).

HABITAT: Not known for New Zealand specimens, but elsewhere found in excavations in sponge, dead coral, limestone and pumice, and on bottoms with silt or sand.

REMARKS: *Pylocheles mortensenii* was described from the Kai Islands by Boas in 1926, but has not since been reported under that name. In his revision of the Pylochelidae, Forest (1987) placed *P. rigidus* Yokoya, 1933, a species common in Japanese waters, in synonymy with Boas' (1926) species. The distribution of the species consequently has been considerably extended, as it is now also known from the Philippine Islands, Queensland, Australia, New Zealand, and (unpublished) Vanuatu. From New Zealand we have examined only four quite typical specimens, two males and two females. One pair was collected at a station in Tasman Bay, together with *Trizoecheles spinosus bathamae* Forest and de Saint Laurent, 1987 and *T. perplexus* Forest, 1987, and the second pair from the Kermadec Islands. We have no indication of *P. (P.) mortensenii*'s local habitat, but elsewhere the species has often been collected in fragments of volcanic rock (pumice).

*Pylocheles mortensenii* has been placed in the subgenus *Pylocheles*, and is very closely related to *P. (P.) agassizii* A. Milne-Edwards, 1880 from the western Atlantic Antilles (Forest 1987: 55).

RECORDS FROM NEW ZEALAND: Tasman Bay; depth unknown; northeastern Kermadec Islands at a depth of 320 m.

DISTRIBUTION: Indo-West Pacific, from Indonesia to Japan and the Philippine Islands, Vanuatu, Australia, and New Zealand at depths between 100 and 400 m.

### *Cheiroplatea* Bate, 1888

*Cheiroplatea* Bate, 1888: 11; Forest 1987: 87.

*Chiroplatea*: Ortmann 1892: 274 (misspelling).

*Cheiroplatea*: MacGilchrist 1905: 243 (misspelling).

TYPE SPECIES: By monotypy, *Cheiroplatea cenobita* Bate, 1888. Gender feminine.

Breadth of carapace equal to or slightly less than

length; cardiobranchial grooves, not detectable. Shield always clearly broader than long, lateral margins strongly convex; posterior limit incomplete; cervical groove and *linea transversalis* as in *Pylocheles*. Anterior margin generally with rounded rostral lobe, denticulate or not, reaching or not level of lateral projections; latter rounded, with 1 to several denticles. Ocular peduncles very short, distal region tapered, forming sharp or more or less rounded cone; corneas distinct or not, basal segments reduced, not visible in dorsal view, peduncles recessed in postocular sinus. Antennal peduncles reaching at most to proximal 0.25 of penultimate antennular peduncular segment. Extremity of third maxillipeds more subchelate than chelate with anterior protuberance of propodus broad and short; slight vestige of epipod in several species.

Chelipeds equal, symmetrical, operculate.

Abdominal tergites with broad, rounded pleura; posterior lobes of telson separated at most by weak notch on posterior margin. Pleopods sometimes with rudiment of endopod on non-sexual appendages of male.

*Cheiroplatea pumicicola* Forest, 1987 (Figs 6, 7)

*Cheiroplatea pumicicola* Forest, 1987: 108, figs 3b, 5e, 23a-e, 31a-f; pls 6E, F, 9.

Types:

Holotype: female (cl = 5.5 mm) from NZOI Stn K804, NIWA holotype H-706.

Paratypes: 3 males, 4 females from NZOI Stn K804, NIWA paratypes P-1157; 1 male, 3 females, MNHN Pg 3521; 1 male, 1 female, NHM 2000.887-888; 1 male, 1 female, USNM.

Type Locality:

NZOI Stn K804, Kermadec Islands, New Zealand, 29°14.8' S, 177°49.6' W, 590-490 m.

Other Material Examined:

NZOI Stns: K805, 1 female (sl = 2.4 mm); K824, 1 ovigerous female (sl = 3.5 mm); K829, 1 male (sl = 2.9 mm), 1 female (sl = 2.6 mm), 1 ovigerous female (sl = 3.3 mm); K830, 1 male (sl = 3.2 mm), 5 females (sl = 2.8-5.9 mm), 4 ovigerous females (sl = 3.9-5.6 mm).

NMNZ Stns: BS 442, 1 specimen not removed from pumice, Cr 9555; BS 581, 2 males (cl = 4.8, 5.1 mm), 1 female (cl = 5.4 mm), 5 ovigerous females (cl = 5.2-5.8 mm), 5 specimens not removed from pumice, Cr 9556.

DESCRIPTION: Shield (Fig. 6a) much shorter than broad (ratio of about 3 : 4). Posterior region of carapace more than twice as short as shield. Anterior margin with rounded rostral lobe, unarmed or with minute median

tooth, never exceeding lateral projections; latter each armed with 1-3 terminal spinules. Gastric region delimited laterally by 2 weak, setose depressions, and anteriorly by postrostral depression, formed with posterior point on median axis. Cervical groove very open, both branches arched. Anterolateral regions of carapace on either side of shield with numerous denticles. Ocular peduncles 2 to 3 times shorter than shield, strongly concave mesially; diameter in proximal region (not basal) 2 to 3 times length, tapering to terminal point; corneal region slightly translucent, clearly delimited. Antennular peduncles 0.20 longer than shield; overreaching ocular peduncles by 0.33-0.50 length of basal segment; latter strongly excavated dorsally, with lateral spine near midlength and similar spine ventrodistally; ultimate segment half length of penultimate segment. Antennal peduncles with fifth segment approximately 6 times longer than broad, reaching to base of penultimate antennular segment, overreaching ocular peduncles by half or slightly less than half own length; second segment with lateral distal projection long and quite slender. Antennal acicle reaching middle of last peduncular segment, armed with strong, acute teeth on lateral margin and more slender spinous teeth on mesial margin. Antennal flagellum twice length of shield.

Chelipeds equal, symmetrical, forming perfect subcircular operculum. Distal opercular facets of carpi each limited by crest of strong, acute, hooked teeth, recurved anteriorly; mesial margins with smaller and sharper teeth. Division of carpal crest into 2 lobes indicated only by slightly deeper interval between 2 teeth and by weak, sometimes obsolete, groove on posterior side. Propodi (Fig. 6b) each with convex lateral margin, mesial margin straight, in line with mesial crest of carpus and mesial margin of dactyl; maximum breadth of chela about half total length of opercular surface; dorsal surface level, slightly elevated towards margins; all surfaces, including opercular surface of carpus, covered with sharp spinous teeth, slightly shorter toward margins; marginal teeth strong, those of lateral margin sharp, erect.

Second (Fig. 6c) and third pereopods generally same length as chelipeds, slender. Dactyls noticeably shorter than meri and slightly longer than propodi; about 5 times longer than broad. Ventral margins of ischia and meri of second pereopods with irregularly placed denticles, sometimes very reduced; dorsal surfaces of meri each with distal spinule; carpi each with row of irregular spinous denticles on dorsal surface; propodieach with variable number of smaller denticles; ventral margins of dactyls with corneou spines posterior to claw. Third pereopods unarmed except for tiny distal spine on meri and microscopic



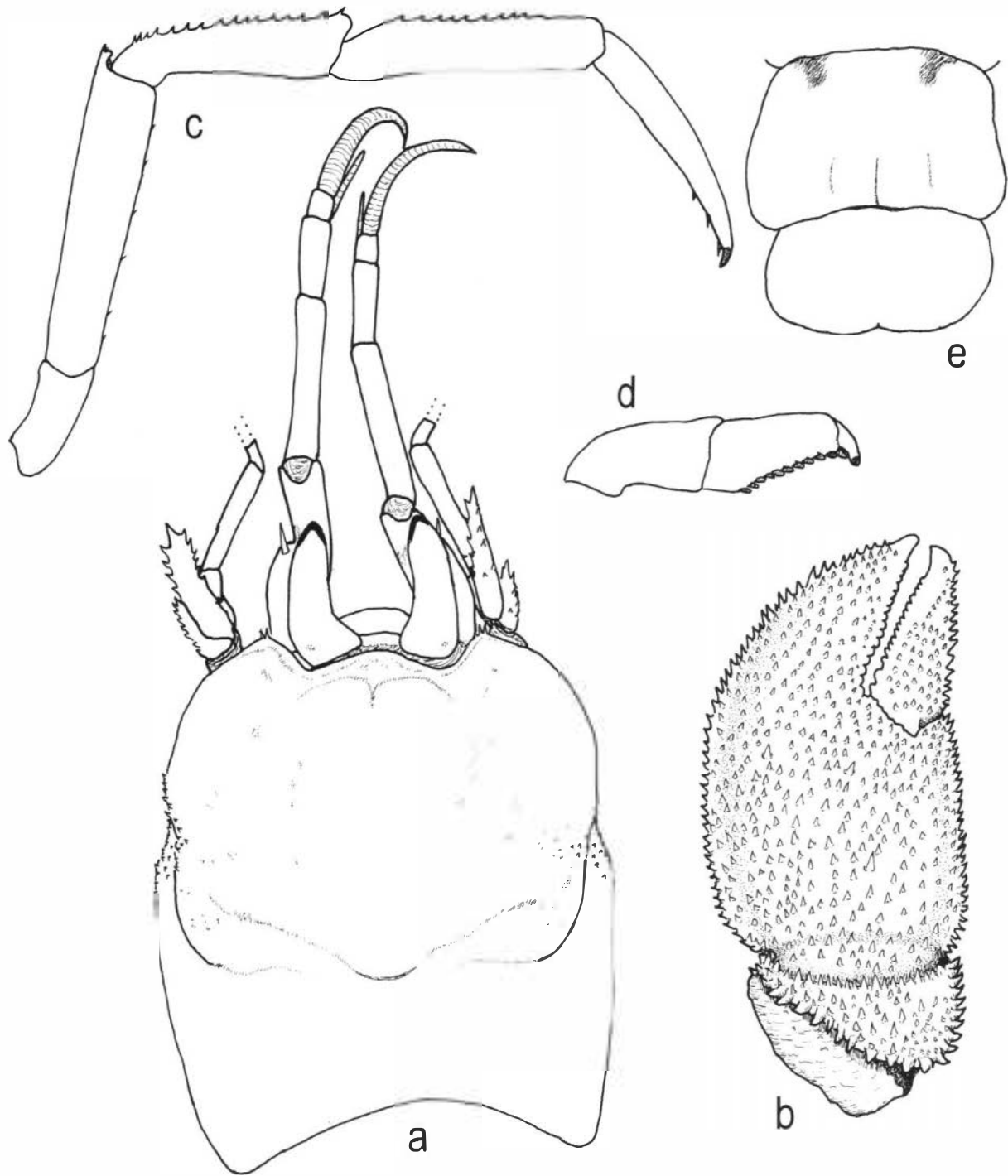
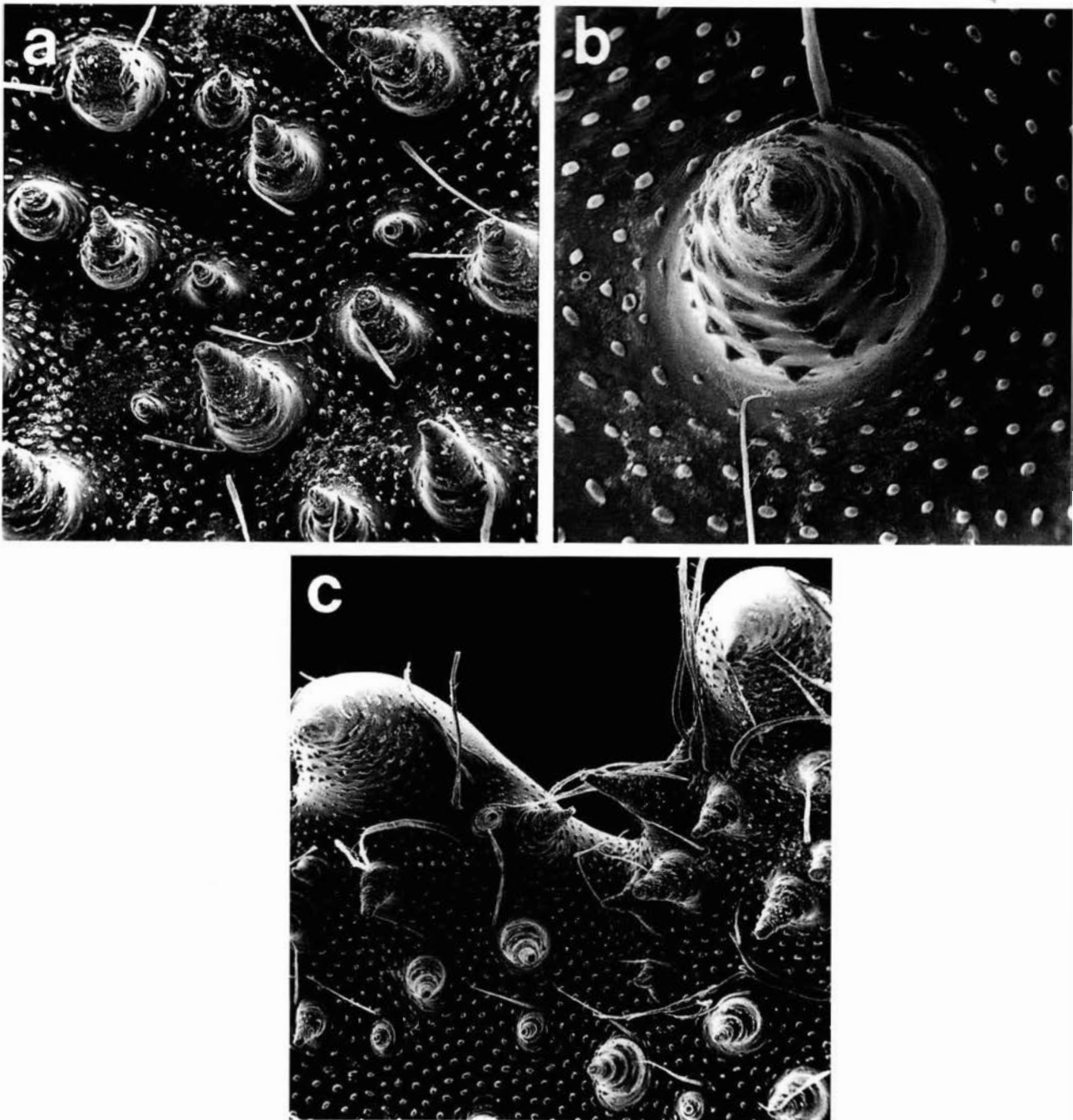


Fig. 6. *Cheiroplatea punnicicola* Forest, 1987. NZOI Stn K830, female (sl = 4.2 mm): a, cephalothorax and cephalic appendages (setation and aesthetascs omitted); b, chela and anterior opercular face of carpus of left cheliped (setation omitted); c, right second pereopod (lateral view, setation omitted); d, distal three segments of right fourth pereopod (lateral view, setation omitted); e, telson (setation omitted). Magnifications equal 12x (a-c), 18x (d, e).



**Fig. 7.** *Cheiroplatea pumicicola* Forest, 1987. NZOI Stn K804, male (cl = 5.2 mm): **a**, partial view of upper face of palm of left cheliped; **b**, one large tubercle with accompanying "trigones" and interspersed surface granules; **c**, partial view of posterior region of carpus of left cheliped. Marginal recurved tubercles are completely eroded on the external side, resulting from the excavating actions of the animal. (From Forest, 1987; SEM photographs by the Laboratoire d'Évolution des Êtres Organisés, Paris). Magnifications equal 180x (c), 250x (a), 600x (b).

spinules on dorsal surfaces of carpi. Maximum breadth of meri of fourth pereopods (Fig. 6d) about half length; ventral margins of propodi each with row of 10 corneous scales, smaller proximally. Fifth pereopods with meri 2.5–3.0 times longer than broad; propodi slightly less than twice as long as broad, lateral surfaces of propodi each with rasp limited posteriorly by line reaching from base of dactyl to proximal 0.35 of dorsal margin.

Sixth abdominal segment 0.60 as long as broad; posterior margin divided into 3 lobes by pair of very small incisions, extended dorsally by weak furrows, with margins forming very obtuse angles. Median lobe straight, slightly concave in posterodorsal view, armed with very short denticles; lateral lobes straight and unarmed. Telson (Fig. 6e) quite variable in proportions, but at least as long as broad; anterior portion trapezoidal, with posterior angles rounded, maximum breadth nearly equal to twice length; posterior portion clearly shorter and narrower (ratio of length to breadth varying from 2 : 3 to 1 : 2); lateral margins convex, posterior margin straight or slightly concave.

Pilosity: Overall weak. Opercular surfaces of chelipeds with some short setae, scarcely over-reaching spines covering surfaces.

COLOUR: Living colour unknown. In alcohol, greyish-white.

VARIATIONS: Certain specimens of *C. pumicicola* present notable variations with regard to the type figured by Forest (1987, fig. 31a). The rostral lobe may be slightly more prominent and carry an apical granule, but it never reaches beyond the level of the lateral projections, which usually are armed with 1–3 generally acute denticles but may sometimes be unarmed. The ocular peduncles can also be shorter, their total length being only 0.33 length of the shield, with a proximal diameter then about half their length. Another important variation is seen in the telson. The posterior portion commonly has proportions similar to those of the holotype (Forest 1987, fig. 31b), but it can also be a little narrower or broader, and at the same time longer, as in a second specimen figured (Forest 1987, fig. 31f), in which the posterior portion is almost as long and broad as the anterior portion, representing an extreme case. Although the posterior median cavity is generally weak, sometimes it can be accentuated, as seen in Figure 6a, or conversely may be entirely absent.

MEASUREMENTS: The 39 specimens removed from their lodgings consisted of 10 males measuring 3.6–5.9 mm in carapace length and 29 females measuring 4.8–6.5 mm, of which the 11 ovigerous females measured

between 5.2 and 5.9 mm.

REPRODUCTION: Ovigerous females were collected in August and September. The eggs were relatively large, measuring 1.1–1.3 mm in diameter at what appeared to be an early stage of development.

HABITAT: The specimens of *Cheiroplatea pumicicola* have all been found in more or less rounded pebbles in fragments of pumice. They have been lodged in perfect cylindrical cavities 5–8 mm in diameter, following the shape of the host, with the chelipeds forming a hermetic operculum, either at the entrance of the tube or in the interior, at a variable level.

REMARKS: The opercular surface of the left cheliped of this species was examined using scanning electron microscopy (cf. Forest 1987: 111, pl. 9). This examination has shown particularities of structure not detectable under optical microscopy. Each tooth or denticle appears as a conical tubercle bristling with small triangular plates (referred to as “trigones” (triangles) which seem to be implanted on an excrescence descending from the summit in a tight spiral. Between the tubercles, the surface is uniformly clothed in granules of a generally oval contour and pegged with pores. There are often one or two setae at the base of each tubercle (Fig. 7a–c). It is probable that these trigones, arranged like teeth on a rasp, are used for hollowing and enlarging the lodging occupied by the animal, as the wear of the trigones at the summit of the tubercles and on the marginal teeth will attest. One might suppose that cuticular differentiations on the chelipeds, probably with specific particularities, are present in the other species of *Cheiroplatea* and undoubtedly the petricolous *Pylocheles* as well, but the paucity of material available does not permit comparisons.

The genus *Cheiroplatea* was established by Bate (1888) for a new species, *C. cenobita*, from the Banda Sea. The genus grew with the successive additions of *C. scutata* Ortmann, 1892 from the Gulf of Mexico, *C. laticauda* Boas, 1926 from the Moluccas, *C. mitoi* Miyake, 1978 from Japan, and, in the revision of his Pylochelidae, *C. stenurus* Forest, 1987 from the Comores and the present species, *C. pumicicola* Forest, 1987, from the Kermadec Islands. A seventh and still undescribed species is present in the Loyalty Islands. All *Cheiroplatea* species are petricolous; they prepare their cylindrical lodgings especially in fragments of rock, most frequently pumice, or sponges, and bryozoans. Such is the case for the about 50 specimens of *C. pumicicola* collected, as indicated by the specific name given to this species.

*Cheiroplatea pumicicola* appears related to *C.*



*cenobita* (Forest 1987: 101, figs 29a-d) and *C. mitoi* (loc. cit.: 105, figs 30a-e), species that also have the extremities of the ocular peduncles tapered; however, the mesial side is less concave than is seen in *C. pumicicola*. A certain number of characters separate the latter from the other two species. For example, *C. cenobita* has a more triangular rostral lobe; the antennal peduncles are longer and the antennal acicles shorter; the tubercles are weakly visible, or microscopic on the opercular faces of the chelipeds; the second pereopods are armed with denticles only on the dorsal margins of the propodi; the telson has a subcircular posterior portion. As for *C. mitoi*, its rostral lobe is more prominent and the ornamentation of the opercular faces of the chelipeds is different. These surfaces are not, as in *C. pumicicola*, level and covered with denticles of the same size and consistently arranged, but instead have a longitudinal median swelling topped with a row of teeth that are much stronger than on the adjacent regions.

RECORDS FROM NEW ZEALAND: Kermadec Islands at depths of 590–490 to 1142–1156 m.

DISTRIBUTION: Kermadec Islands, New Zealand; Loyalty Islands, New Caledonia; (unpublished) at depths of 699–715 m.

### *Trizacheles* Forest, 1987

*Pylocheles* Henderson, 1888: 100 (in part).

*Mixtopagurus* A. Milne-Edwards & Bouvier, 1893: 23 (in part); Balss 1913: 34; Boas 1926: 34 (in part); Balss 1941: 174; Forest 1954: 167; Balss 1957: 1585 (in part).

*Pomatocheles* Stebbing, 1914: 3 (in part); Barnard 1950: 413 (in part); Balss 1957: 1548 (in part); Miyake 1978: 4 (in part).

*Trizacheles* Forest, 1987: 155.

TYPE SPECIES: By original designation, *Pylocheles spinosus* Henderson, 1888. Gender masculine.

Shield approximately square, or slightly broader than long; delimited posteriorly by *linea transversalis*. Cervical groove with median portion confounded with *linea transversalis*; branches more or less arched laterally nearly to posterior margin; deep transverse depression posterior to anterior margin of shield, delineating inverse “W” and also delimiting part of protogastric protuberances. Lateral margin with nearly median indentation extending onto dorsal surface as oblique somewhat arched groove. Rostrum broad, triangular, with depressed, tapering summit, usually over-reaching level of lateral projections;

sometimes slight rostral carina. Posterior carapace approximately half length of shield, surface generally calcified as wing-like rectangle, lateral and posterior margins membranous. Cardiac region delimited laterally by 2 generally distinct and complete lines, forming inverse trapezium. Ocular peduncles well developed, subcylindrical; corneas more or less swollen, pigmented; ocular acicles triangular in distal half, acute. Antennular peduncles over-reaching corneas by less than length of ultimate segment. Antennal peduncles quite slender, short, usually not overreaching distal margin of cornea. Maxillule with elongate endopod with rounded internal lobe armed with 5–7 quite long setae; external lobe present as only slight protuberance. First present maxilliped with 1 to several articles in flagellum. Third maxilliped with crista dentata moderately elongate, slightly sinuous; with 1 or 2 accessory teeth.

Chelipeds generally subequal and symmetrical, rarely one or other slightly stronger. Distal segments without adaptive modifications to habitat. Propodal-carpal articulation approximately 45° from sagittal plane. Hands lengthened, with fingers terminating in corneous claws; dorsal regions of palms and carpi with spinose teeth and generally strong setation; usually anterolateral surfaces of carpi each with triangular area of corneous, flattened tubercles forming stridulating structure together with tubercles of corneous plates on mesial faces of carpi and propodi of second pereopods. Fourth pereopods semichelate, propodal protrusion of ten reaching middle of dactyl; rasp of elongate modified almond-shaped imbricating setae.

Abdomen symmetrical, sometimes with some dextral torsion; tergites well calcified; dorsal surface of abdomen covered with dense, primarily long setae, particularly on sixth tergite. Telson forming single plate with sides nearly straight or weakly sinuous, parallel or slightly divergent posteriorly. Laterally, 1 pair of small notches or 1 set back indicating beginning of 2 rounded posterior lobes, separated by deep median suture.

Male with 2-segmented first pleopods. Second pleopods also 2-segmented. Female with first pleopods slender, distal region flagelliform.

### KEY TO THE NEW ZEALAND (INCLUDING KERMADEC ISLANDS) SPECIES OF *Trizacheles*

- 1 Telson distinctly shorter than broad. Dorsal margins of propodi of second pereopod unarmed. No stridulating apparatus ..... *Trizacheles perplexus*
- Telson notably longer than broad. Dorsal margins of propodi of second pereopods with at least strong distal spiniform tooth. Stridulating apparatus on lateral face

of chelipeds and on mesial faces of carpi and propodi of second pereopods ..... 2

- 2 Dorsal margins of propodi of third pereopods each with 3–6 acute teeth ..... 3
- Dorsal margins of propodi of third pereopods each with only 1 distal tooth ..... 4
- 3 Rostrum with apical denticle well developed. Peduncular length more than 3 times corneal diameter ..... *Trizacheles spinosus spinosus*
- Rostrum with apical denticle tiny or miniscule. Peduncular length less than 3 times corneal diameter ..... *Trizacheles spinosus bathamae*
- 4 Length of ocular peduncles distinctly less than half that of shield. Only 1 denticle behind distal tooth on dorsal margin of propodus of each second pereopod ..... *Trizacheles brachyops*
- Length of ocular peduncles distinctly more than half that of shield. Irregular double row of teeth behind distal tooth on dorsal margin of propodus of each second pereopod ..... *Trizacheles pilgrimi* sp. nov.

***Trizacheles perplexus* Forest, 1987** (Figs 8, 9)

*Trizacheles perplexus* Forest, 1987: 208, figs 47f, 59e, 66f.

TYPES:

Holotype: female (cl = 8 to 9 mm, mutilated; shield, cephalic appendages, left cheliped fourth and fifth pereopods missing) from NZOI Stn K583, NIWA holotype, H-707.

TYPE LOCALITY: New Zealand, Tasman Bay, NZOI Stn K583, 41°10.4'S, 173°10.0'E, depth unknown.

OTHER MATERIAL EXAMINED:

NZOI Stns: K830, 1 female (sl = 3.6 mm); K840, 2 males (sl = 3.6, 3.8 mm); K840, 1 male, (sl = 3.0 mm), 1 female (sl = 4.9 mm).

MNHN: Pg 5835.

DESCRIPTION: Shield (Fig. 8a) slightly longer than broad to broader than long, 3–5 times longer than posterior carapace. Rostrum subtriangular, margin curving inwardly, with sharp, apical tooth, clearly exceeding level of acuminate lateral projections.

Ocular peduncles subcylindrical, tapering slightly at midlength; ratio to shield 0.58 : 0.67. Corneas weakly dilated; diameter included 3.3–4.1 times in peduncular length. Ocular acicles small, very widely spaced, unidentate.

Antennular peduncles overreaching distal margins of corneas by 0.25 to nearly entire length of ultimate segment.

Antennal peduncles not reaching bases to extending slightly beyond bases of corneas. Second segment

with laterodistal projection bidentate, frequently with accessory tooth laterally, 1 tooth on inner side. Antennal acicle long and slender, reaching at least to distal 0.25 of fifth peduncular segment, lateral margin with 1 or 2 teeth posterior to simple or bifid tip.

Chelipeds subequal. Ischium with 1 or 2 widely spaced teeth on ventral margin. Merus with 1–3 widely spaced tiny denticles on ventromesial margin. Carpus (Fig. 8b) with 3 sharp corneous-tipped teeth on inner side and usually 1 tooth behind distal margin; strong protuberance near middle of segment and row of setae anteriorly; ventrolateral protuberance without stridulatory tubercles. Palm swollen, approximately as long as high, fingers same length or little shorter than palm; dorsal margin of palm with row of 6 corneous-tipped spines, slightly decreasing in size anteriorly, extending on dactyl as smaller and smaller denticles; remainder of hand practically unarmed, marked only by small depressions with tufts of setae. Claws very well developed, occupying slightly more or slightly less than 0.35 of cutting edges.

Second pereopods (Fig. 8c) long and slender. Dactyls shorter than or equal to propodal length, both slightly shorter than meri; propodal height 0.25 length; dorsal margins of segments unarmed except on carpi; left usually with 2 or 3 very short, widely spaced denticles, right with 2–4, anterior and posterior denticles often slightly sharper. No stridulatory tubercles on inner face. Third pereopods equally slender, distal margins unarmed except for tiny denticle on each carpus distally. Fourth pereopods (Fig. 8d) prominently semichelate.

Abdominal tergites and uropods with characters of genus, without any notable differences, but telson (Fig. 8e) atypical, being slightly to considerably broader than long, contour rounded with posterior margin forming continuous curve with lateral margins; median groove present.

In males, first pleopods (Fig. 9a) with moderately elongate, slightly arched subcylindrical basal segment and approximately equally long foliaceous, rolled distal segment. Second pleopods (Fig. 9b) with long basal segment; second segment broadening in distal half into depressed and rolled lobe with strongly convex mesial margin; posterior surface of second segment with thickening extending about as far as distal 0.8 and set apart from lobe by suture; short conical exopod with terminal setae. Third (Fig. 9c) to fifth pleopods with basal segment articulating with long exopod and shorter endopod. In females, first pleopods (Fig. 9d) set very close together, small, slender. Following pleopods (Fig. 9e) much stronger, consisting of proximally enlarged basal segment, with long arched exopod and distally inserted, 2-segmented endopod.

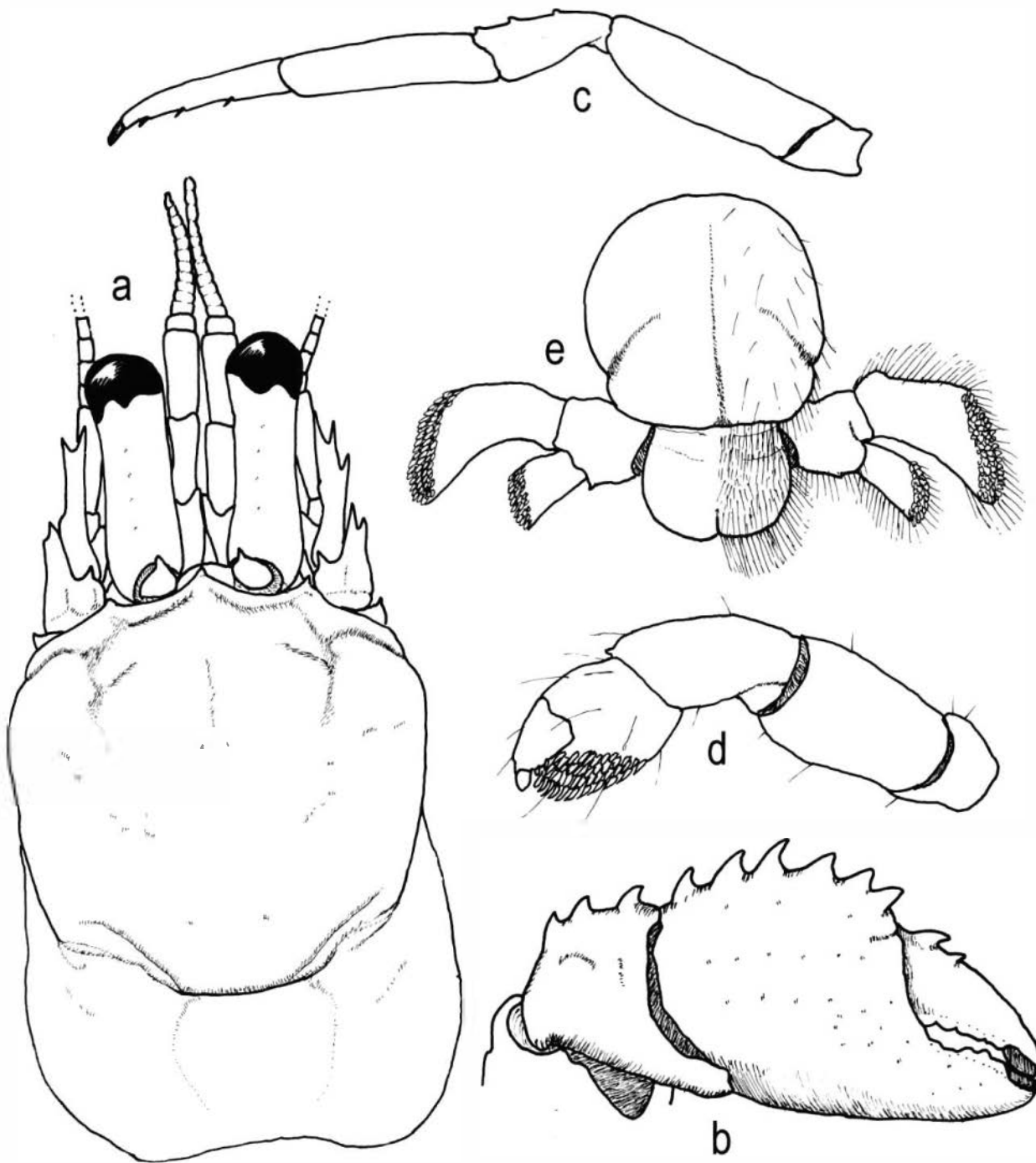


Fig. 8. *Trizacheles perplexus* Forest, 1987. NZOI Stn K830, female (sl = 3.6 mm): a, cephalothorax and cephalic appendages (setation and aesthetascs omitted); b, outer face of carpus and chela of right cheliped (setation omitted); c, left second pereopod (lateral view, setation omitted); d, left fourth pereopod (lateral view); e, sixth abdominal somite, uropods and telson (dorsal view, setation shown for right side only). Magnifications equal 18x (c), 25x (a, b), 37.5x (d, e).



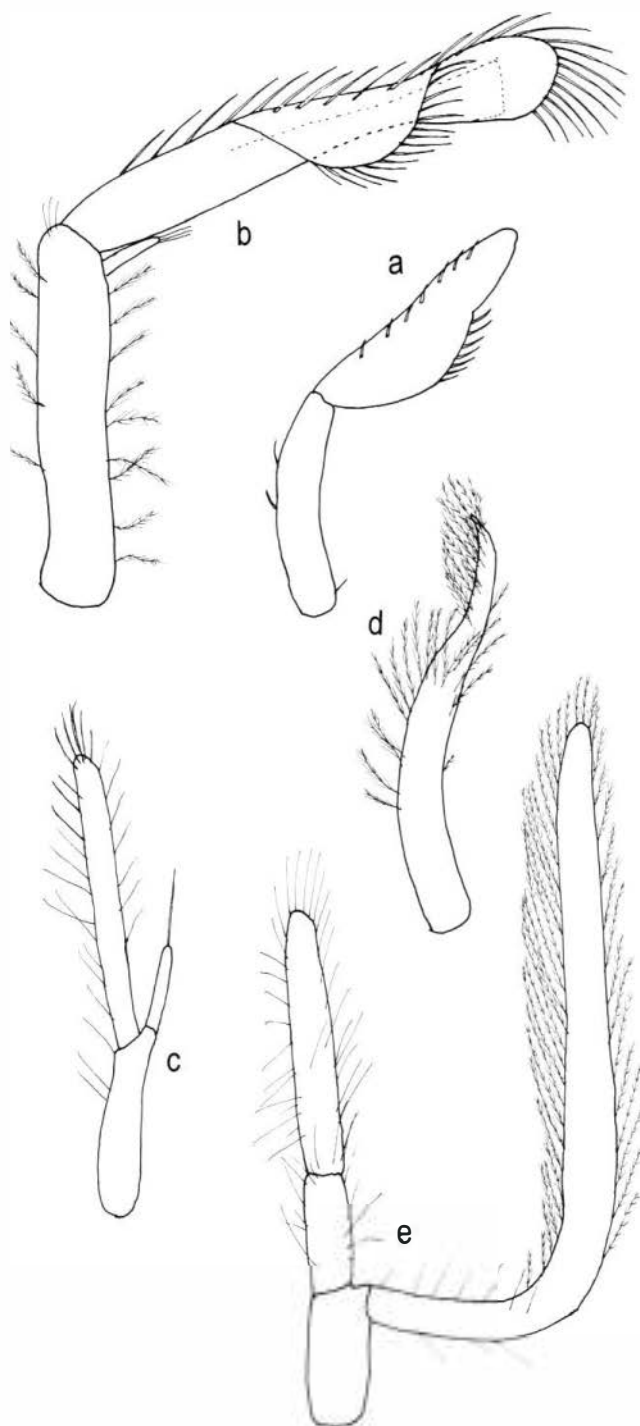


Fig. 9. *Trizacheles perplexus* Forest, 1987. NZOI Stn K840, a-c, male (sl = 3.6 mm), d, e, female (sl = 4.9 mm): a, male left first pleopod (external view); b, male left second pleopod (external view); c, male left third pleopod; d, female left first pleopod; e, female left second pleopod. Magnifications equal 40x (b, c, e), 50x (a, d).

**Pilosity:** Shield with very few extremely short setae in weak depressions. Ocular peduncles each with dorsal row of widely spaced, very short setae. Antennular and antennal peduncles with few moderately long setae. Dorsal surfaces of chelipeds and ambulatory legs sparsely set with irregular rows of pairs, or meagre tufts, of long setae. Surface of sixth abdominal tergite with slightly irregular, longitudinal rows of sparse, moderately short to long setae, posterior margin with fringe of slightly more numerous moderately long setae. Telson with covering of short setae and marginal fringe of longer setae.

**COLOUR:** Not known.

**MEASUREMENTS:** *Trizacheles perplexus* is a relatively small species. Although the carapace length of the damaged holotype was estimated at between 8 and 9 mm, no additional specimens larger than a total carapace length of 6.2 mm have been collected.

**REPRODUCTION:** Not known.

**HABITAT:** Not known.

**REMARKS:** *Trizacheles perplexus* was described by Forest (1987) from a mutilated and very incomplete specimen, lacking carapace and sensory cephalic appendages. However, the body parts remaining, i.e., one cheliped and the ambulatory legs, as well as the abdomen, permitted its recognition as a species of *Trizacheles*, although an aberrant one. The recent examination of six specimens not present among the materials upon which the revision of the Pylochelidae was based, has permitted us to provide a more complete description of this species. It should be noted that the original description and figures agree well with the recently collected specimens, particularly in the form, proportions and ornamentation of the cheliped and the ambulatory legs. The position and development of denticles are generally the same, although the number of denticles on the carpi of the second pereopods varies from 2 to 4. Similarly, the comparison between the original telson of the holotype which was a reconstruction of the deteriorated structure (Forest 1987: fig. 47f) and that of the complete specimen figured here (Fig. 8e) leaves no doubt about the identity of this specimen. Although the sixth abdominal tergite of *T. perplexus*, with a median longitudinal furrow and two posterolateral notches extended by an oblique groove, differs little from other *Trizacheles* (cf. Forest 1987, figs 47a-e), the morphology of the telson isolates the species within the genus. In all other species, the structure of the telson is relatively homogeneous, with a contour inscribing

an elongate rectangle, the posterolateral incisions more or less delimiting two rounded posterior lobes separated by a deep median notch; these lobes are separated from the anterior region by a suture that permits ventral flexing. The telson of *T. perplexus* appears quite different. It is clearly much broader than long, its contour is rounded, and there is no trace of a lateral incisions nor a line of flexion. Additional characters also aid in the separation of this species from other *Trizacheles*. For example, the shield frequently is slightly to considerably longer than broad; however, in at least one female the shield was clearly broader than long. In the other species of the genus it appears to always be distinctly broader than long. Moreover, in all other species the chelipeds and ambulatory legs are diversely armed, but always furnished with numerous strong teeth. It must also be noted that in *T. perplexus* no stridulatory apparatus is present on either the carpi of the chelipeds or on the propodi of the second pereopods. This absence of a stridulatory apparatus is found in only two other species of *Trizacheles*, *T. manningi* Forest, 1987, from the Philippines and *T. nutus* Forest, 1987, from the Java Sea. The male gonopores of *T. perplexus* show no significant difference from those of *T. brachyops*.

*Trizacheles perplexus* has now been reported from two widely separated areas. It is interesting to note that in the first, the type locality, NZOI Stn K583, in Tasman Bay at an unspecified depth, a very large female of *T. spinosus bathanae* was also collected. It is also at this station that two specimens were found confirming the presence of *Pylocheles* (*Pylocheles*) *mortensenii* in mainland New Zealand waters. The second area in which specimens of *T. perplexus* were collected are NZOI Stns K830 and K840 in the Kermadec Islands at depths of 398 to 545–590 m. The new species, *Trizacheles pilgrinii* sp. nov. was also found at Stn K830.

**RECORDS FROM NEW ZEALAND:** This species is known from only one locality in Tasman Bay at the north end of the South Island at a depth not precisely recorded. The remaining specimens all come from the Kermadec Islands at depths of 398 to 545–590 m.

**DISTRIBUTION:** Known only from these New Zealand localities.

***Trizacheles spinosus spinosus* (Henderson, 1888)**  
(Figs 10b, 11, 12f–h, 13j, k)

*Pylocheles spinosus* Henderson, 1888: 101, pl. 11, fig. 1;  
Ortmann 1892: 274; Stebbing 1893: 1, pl. 7.

*Mixtopagurus* (*Pylocheles*) *spinosus*: A. Milne-Edwards & Bouvier 1893: 23, 26.

*Mixtopagurus spinosus*: Ortmann 1899: pl. 118, fig. 8; Alcock 1905b: 153; Boas 1926: 39.

*Pematocheles spinosus*: Stebbing 1914: 2.

*Trizacheles spinosus spinosus*: Forest 1987: 202, figs 47d, 66g, 69c, 70.

#### TYPES:

Lectotype: male (cl = 6.5 mm), by subsequent selection by Forest (1987), *Challenger* Stn 163A, NHM 1888.33.7.

Paralectotypes: *Challenger* Stn 163A, 3 males, 3 ovigerous females, NHM 1888.33.7; 1 female (cl = 6.5 mm), MNHN Pg 3686.

**TYPE LOCALITY:** *Challenger* Stn 163A, Twofold Bay, southeastern Australia, 36°59'S, 150°20'E, 274 m.

#### OTHER MATERIAL EXAMINED:

NZOI Stn Z9001, 1 male (sl = 8.2 mm).

**DESCRIPTION** (based on New Zealand specimen): Shield (Figs 10b, 11a) broader than long (length/width ratio 0.93), approximately twice length of posterior carapace. Rostral lobe convex, with prominent apical denticle, reaching slightly beyond level of lateral projections; latter acuminate, each with small terminal denticle; lateral margins weakly convex, with deep notch behind middle and with 1 strong, sharp tooth. Ocular peduncles subcylindrical, approximately 0.70 length of shield. Corneal diameter 0.27 peduncular length. Ocular acicles broadly separated, narrowly and sharply triangular distally. Antennular peduncles over-reaching eyes by about half length of last segment, longer than penultimate segment. Antennal peduncles not reaching bases of corneas; first segment with lateral denticle; second segment with latero-distal projection robust, bidentate, and 1 strong, conical tooth behind distal margin; third segment with sharp ventrodistal tooth; fourth segment with long, slender dorsodistal tooth. Antennal acicle stout, depressed, tip forming bidentate blade reaching to middle of last peduncular segment; 1 denticle on outer margin distally, and 1 on inner margin proximally. Flagellum approximately 0.25 longer than carapace.

Chelipeds subequal. Inner surfaces of ischia each with longitudinal row of 5 short teeth ventrally. Meri each with very small denticles on inner and outer ventral margins; dorsal surfaces also with several short transverse rows of setae, distalmost with small denticle, and 1 strong spinous tooth distally. Carpi (Fig. 12f) each with strong, spinous teeth on dorsal surface, 3–4 decreasing in size proximally on inner face and 3 slightly smaller obliquely aligned; ventro-lateral projections each with patch of stridulatory tubercles with blunt corneous tips, anterior tubercles forming continuous row on distal margin. Hands

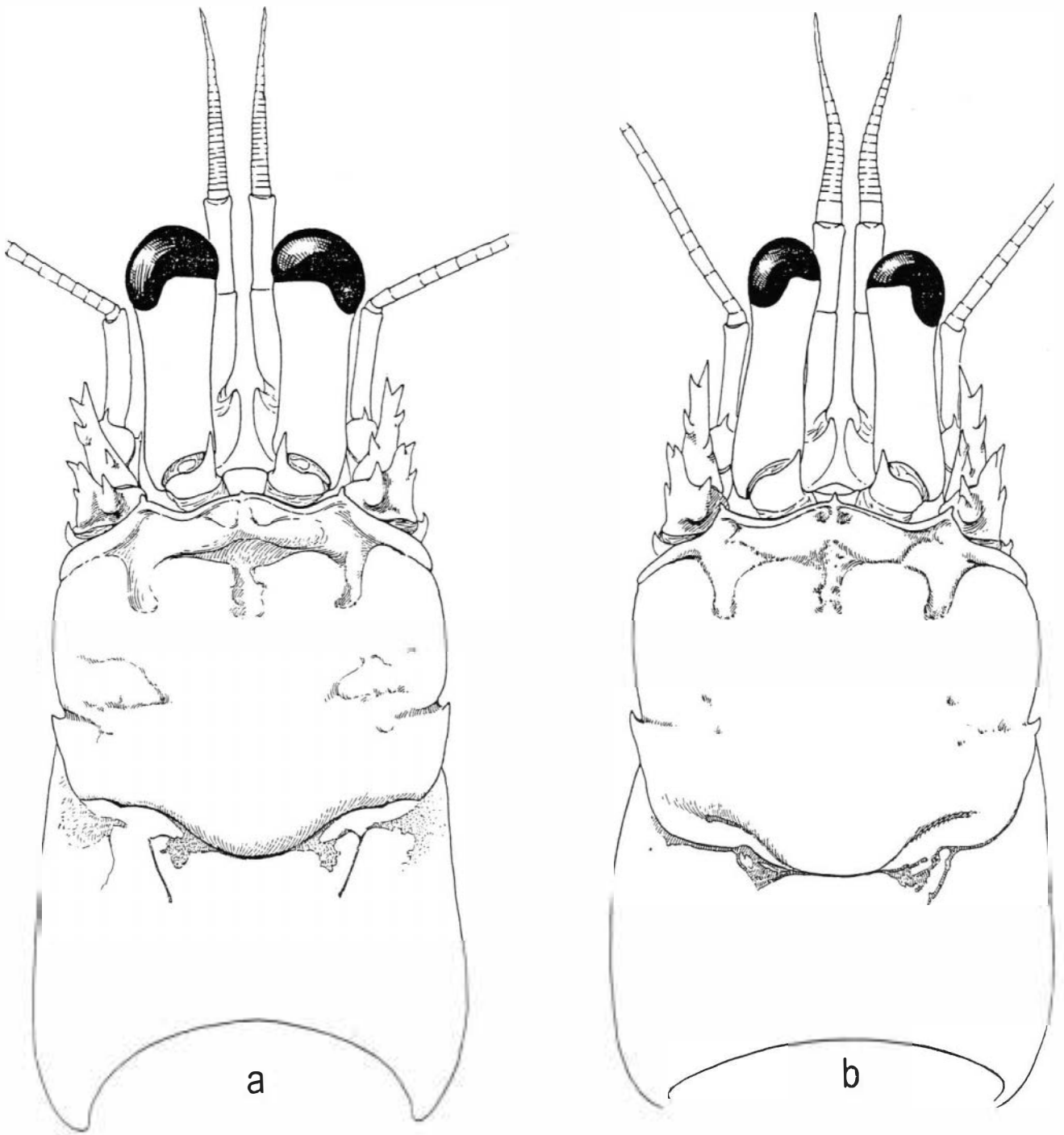


Fig. 10. a, *Trizoecheles spinosus bathamae* Forest & de Saint Laurent, 1987, PBMS, Canyon ESE of Taiaroa Head, ovigerous female (cl = 10.0 mm); b, *Trizoecheles spinosus spinosus* (Henderson, 1888), Challenger Stn 163A, ovigerous female paralectotype (cl = 8 mm): cephalothorax and cephalic appendages (setation and aesthetascs omitted). Magnifications equal 20x (a), 24x (b).



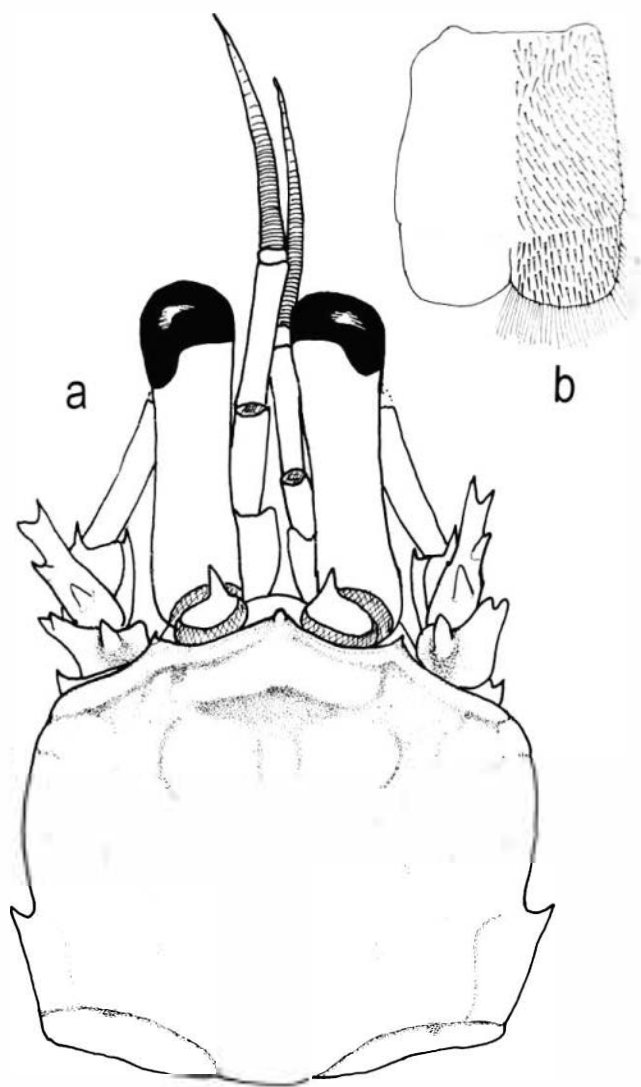


Fig. 11. *Trizoeles spinosus spinosus* (Henderson, 1888), NZOI Stn Z9001, male (sl = 8.2 mm): a, shield and cephalic appendages (setation and aesthetascs omitted); b, telson. Magnifications equal 6x (b), 9x (a).

approximately 0.38 longer than high, with palmar regions longer than fingers; dorsal margins each with row of 6 moderately long, pointed and corneous-tipped teeth, strongest proximally; upper half of outer surface with 2 additional rows of sharp but shorter teeth and numerous piliferous denticles or tubercles on lower half; dactyls with sharp teeth, strongest proximally. Cutting edges of fingers with large molar-like teeth, claws corneous.

Second pereopods with 2–4 denticles on ventral margins of ischia. Meri, each with 6 or 7 relatively small denticles on ventral margin, more closely spaced proximally; dorsal margins marked with very weak, setose indentations; maximum segmental

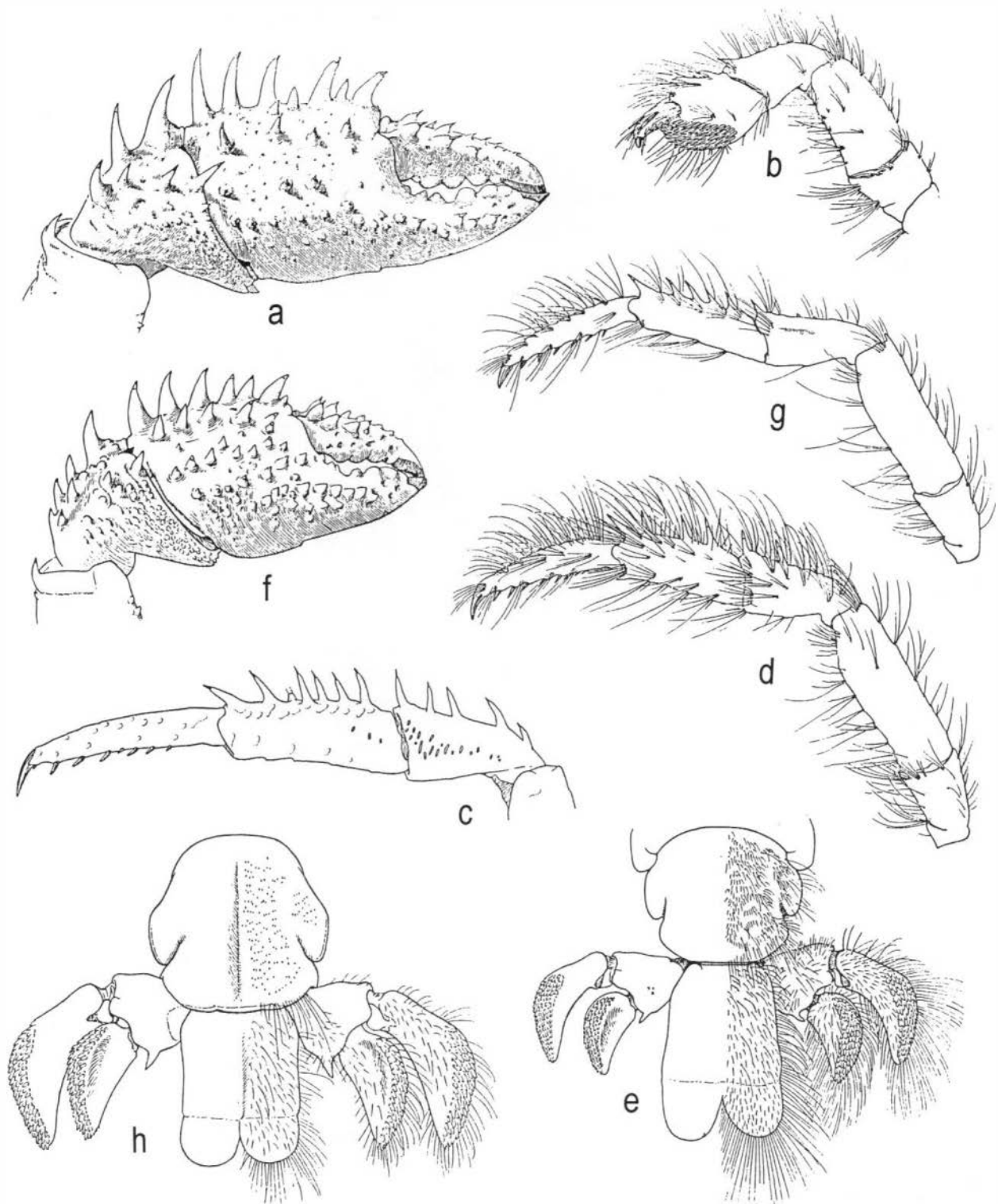
height approximately 0.35 length. Carpi each with 5 or 6 moderately long, acute spines dorsally; elongate triangle or oblique row of stridulatory tubercles present on nearly entire length of inner surface. Propodi each with 6 or 7 spines on dorsal margin; ventral margins each with some pilose indentations and 1 distal corneous spine; few stridulatory tubercles on proximal third of inner face; segmental height about 0.45 length. Dactyls equal to length of propodi, ventral margins each with 7 corneous spines, claws strongly curved. Third pereopods (Fig. 12g) differing from second by relative dimensions of segments: ischia, carpi and dactyls slightly longer, meri and propodi slightly shorter. Spines on dorsal regions of carpi and propodi weaker than on second; carpi each with 3, propodi each with 5. Fourth pereopods each with distal spine on carpus and propodus.

Abdominal tergites calcified as in *T. brachyops* (see p. 52). Sixth tergite (Fig. 12h) with rounded outline, broader than long, with narrow, glabrous median depression flanked laterally by curved depression bordering strongly marked notch on lateral margin. Uropods symmetrical; basal segments each with strong posterior spine, internal ramus clearly more than twice as long as broad. Telson (Fig. 12h) with lateral margins generally parallel, proximal width about 0.8 length; posterior region forming 2 equal lobes delimited by pair of weak lateral indentations and by narrow median notch, lateral margins straight, posterior margins rounded.

Males with first pleopods (Fig. 13j) consisting of moderately long, curved, subcylindrical basal segment and approximately equal foliaceous distal segment with outer margin more strongly convex than inner. Second pleopods (Fig. 13k) with moderately elongate basal segment, second segment straight proximally becoming broadened and depressed into rolled lobe with concave inner margin; suture separating thickened part of lobe from thinner distal part in distal 0.15 of segment. Short exopod with terminal setae. Third to fifth pleopods consisting of basal segment, less than half as long exopod, and 1-segmented shorter endopod.

Pilosity: Consisting of very short, transverse rows of long, moderately stiff setae, over-reaching, but not obscuring spination on dorsal regions of three distal segments of chelipeds and ambulatory legs. Dorsal surfaces of abdominal tergites and telson covered with short bristle-like setae, intermixed on sixth segment with long, simple setae, margins with long simple and plumose setae.

**COLOUR:** In preservative for four months, the specimen was generally a mottled orange and cream colour.



**Fig. 12.** a-e, *Trizacheles spinosus bathamae* Forest & de Saint Laurent, 1987, a-c, NZOI Stn A910, female (10.5 mm); d, male (cl = 8.0 mm); e, PBMS, Canyon ESE of Taiaroa head, ovigerous female (cl = 10.0 mm); f-h, *Trizacheles spinosus spinosus* (Henderson, 1888), f, h, Challenger Stn 163A, ovigerous female paralectotype (cl = 8 mm); g, male paralectotype (cl = 6.5 mm): a, f, outer face of carpus and chela of right cheliped; b, left fourth pereopod (lateral view); c, distal region of right second pereopod (mesial view, setation omitted); d, g, left third pereopod (lateral view); e, h, sixth abdominal somite, uropods and telson (setation shown for right side only, dorsal view). Magnifications equal 10x (e, h), 12.5x (b-d, g), 15x (a, f).



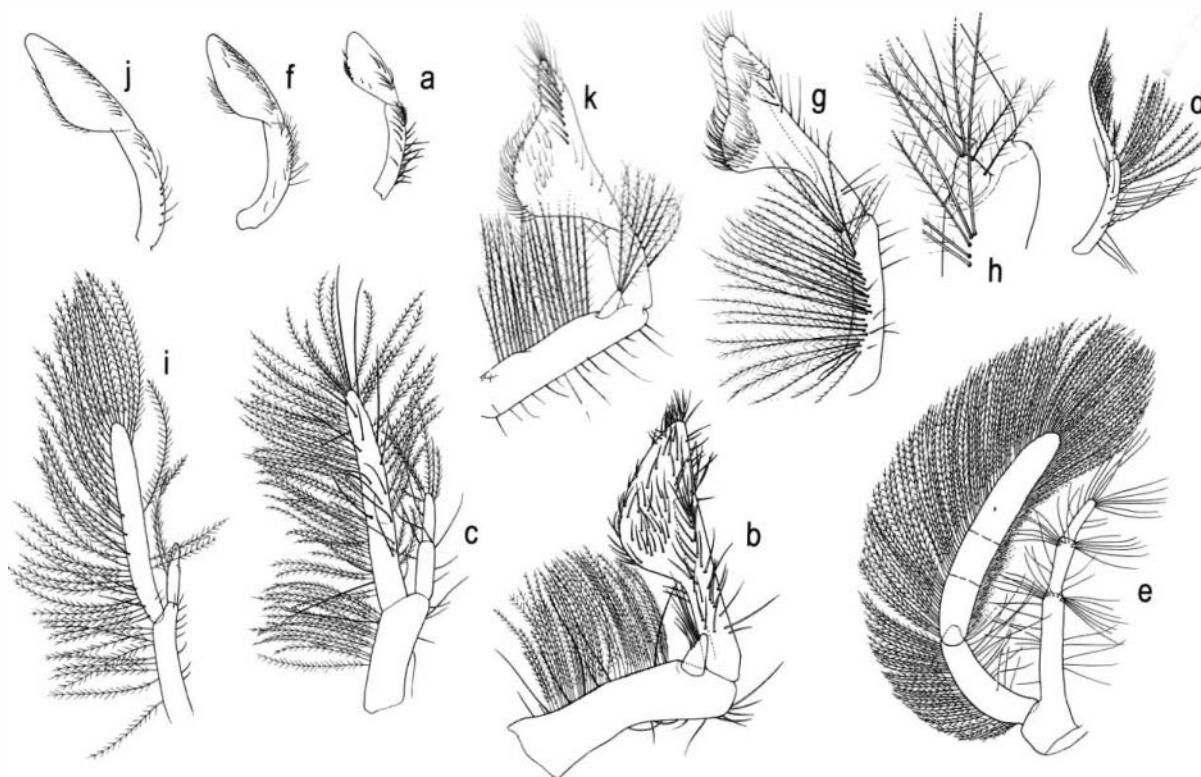


Fig. 13. a-e, *Trizacheles brachyops* Forest, 1987, NZOI Stn E719, a-c, male paratype (cl = 10.0 mm), d, e, female paratype (9 mm); f-i, *Trizacheles spinosus bathamae* Forest & de Saint Laurent, 1987, NZOI Stn A910, males (cl = 8.5 mm); j, k, *Trizacheles spinosus spinosus* (Henderson, 1888), Challenger Stn 163A, male paralectotype (cl = 6.0 mm): a, f, j, male right first pleopod; b, g, k, male right second pleopod; h, male right second pleopod, distal portion of basal segment; c, i, male right third pleopod; d, female right first pleopod; e, female right second pleopod. Magnifications equal 35x (g), 40x (a-f, i), 55x (k), 95x (h).

**MEASUREMENTS:** The New Zealand specimen is appreciably larger than any previously reported for *T. spinosus spinosus*, measuring 8.3 mm in shield and 12.4 mm in carapace length. The type series, and single additional specimen collected off Queensland all had carapace lengths measuring between 6.0 and 7.0 mm.

**REPRODUCTION:** Not known for New Zealand. Ovigerous females were collected in southeastern Australian waters during April and off Queensland in August.

**HABITAT:** The specimen collected off Queensland was lodged in a piece *Sigmattoxella* sponge. The New Zealand specimen was associated with pumice.

**REMARKS:** As previously indicated, *T. s. spinosus* is best distinguished from *T. s. bathamae* by its longer, sub-cylindrical ocular peduncles with small corneas and its more prominent rostral denticle. The New Zealand specimen (Fig. 11a) is a little more than twice the car-

pace length of the illustrated paralectotype (Figs 10b, 12f-h), but differs only slightly in overall morphology. Specifically, the carpi of chelipeds of the New Zealand specimen have only three large spines on the inner surface, whereas four somewhat smaller spines are present in the paralectotype. Although three spines are present on the dorsal margins of the carpi in both specimens, those of the New Zealand specimen are stronger. There is very good agreement in the structure of the male first and second pleopods (copulatory appendages) between the New Zealand specimen and those of the paralectotype illustrated (Fig. 13j, k), despite the overall size differences.

**RECORDS FROM NEW ZEALAND:** Known only from NZOI Stn Z9001, Bay of Plenty, 205–228 m.

**DISTRIBUTION:** Southeastern Australia from Twofold Bay, and Queensland; Bay of Plenty, New Zealand; 205–274 m.



*Trizacheles spinosus bathamae* Forest & de Saint  
Laurent, 1987 (Figs 10a, 12a-e, 13f-i, Pl.1, fig.1)

*Mixtopagurus* n. sp.: Batham 1970: 45, fig. 1, pl. 1; Schembri  
& McLay 1983: 28, fig. 3.

*Mixtopagurus spinosus*: Probert *et al.* 1979: 381 [not  
*Mixtopagurus spinosus* (Henderson, 1888)].

*Mixtopagurus* sp. nov.: Schembri 1982b: 863, figs 1, 2.

*Trizacheles spinosus bathamae* Forest & de Saint Laurent,  
1987: 205, figs 47e, 66i, 69d, 71a, b.

TYPES:

Holotype: ovigerous female (cl = 8.5 mm) from  
Stn Mu70-45, NMNZ Cr 9557.

Paratypes: 2 males, 1 ovigerous female from Stn  
Mu70-45, NIWA paratype P-0000; 1 male, 1 ovige-  
rous female from Stn Mu 70-45, MNHN Pg 3515.

TYPE LOCALITY: Papanui Canyon off Otago Peninsula,  
New Zealand, 490–540 m.

OTHER MATERIAL EXAMINED:

NZOI Stns: A910, 2 males (cl = 5.6, 8.0 mm), 1 female (cl  
= 10.5 mm), 1 ovigerous female (cl = 9.0 mm); B686, 1 female  
(cl = 4.0 mm); C633, 1 male (cl = 5.5 mm); C814, 1 female (cl  
= 8.0 mm); E738, 3 ovigerous females (cl = 11.5–12.0 mm);  
E821, 4 females (cl = 4.7–8.4 mm); I97, 2 females (cl = 5.9,  
8.2 mm); J55, 1 male (sl = 7.8 mm); J676, 2 males (cl = 10.5,  
12.5 mm), 1 female (cl = 6.5 mm); J711, 1 female (cl = 6.5 mm,  
abdomen missing); K583, 1 ovigerous female (cl = 12.0 mm),  
K804, 1 male (cl = 9.0 mm); Q24, 1 female (sl = 3.8 mm);  
V426, 1 male (cl = 4.0 mm), 4 females (cl = 2.9–4.9 mm), 1  
ovigerous female (cl = 5.4 mm); Y18, 1 ovigerous female (sl =  
5.8 mm).

NMNZ: Stn BS 190, 1 ovigerous female (cl = 11.5 mm)  
Cr 9558.

PMBS collections: Canyon ESE of Taiaroa Heads, 1.2.67,  
330–400 m, 3 ovigerous females (cl = 8.5–10.5 mm); Papanui  
Canyon, 27.8.68, 330–366 m, 1 female (cl = 5.5 mm); Stn Mu  
74–92, 3 males (cl = 5.0–6.0 mm), 2 females (cl = 2.8 mm).

DESCRIPTION: Shield (Fig. 10a) nearly as broad as long  
(approximately 9 : 10) and distinctly longer than  
posterior carapace. Rostral lobe convex, with or  
without apical denticle, reaching to or nearly to level  
of lateral projections; latter acuminate, lateral  
margins convex, with notch, sometimes deep, behind  
middle and with 1 more or less strong and sharp  
tooth. Ocular peduncles tapering in median region,  
length approximately 0.65 length of shield. Corneas  
moderately swollen, weakly notched posteriorly,  
diameter 0.50 (small individuals) to nearly 0.35  
peduncular length. Ocular acicles broadly separated,  
sharply triangular distally. Antennular peduncles  
overreaching eyes by about half length of last seg-  
ment, latter shorter than penultimate segment.  
Antennal peduncles reaching to or slightly over-

reaching bases of corneas; first segment with lateral  
denticle; second segment with laterodistal projection  
robust, bidentate, 1 sometimes obsolete small tooth  
in middle of outer margin and 1 strong, conical tooth  
behind distal margin; third segment with sharp  
ventrodistal tooth. Antennal acicle stout, depressed,  
tip forming bidentate blade not reaching or sometimes  
overreaching, middle of last peduncular segment; 1  
denticle on inner margin proximally; 1 on outer mar-  
gin distally. Flagellum same length as carapace.

Chelipeds subequal. Inner surfaces of ischia each  
with longitudinal row of 5 short teeth ventrally. Meri  
each with 6–8 generally blunt teeth, dorsal surfaces  
also with several denticles and 1 strong spinous tooth  
distally, lateral faces with some denticles in distal  
halves. Carpi each with strong spinous teeth on dorsal  
surface, 3 decreasing in size on inner face and 3  
smaller obliquely aligned; ventrolateral projections  
with patch of stridulatory tubercles with blunt cor-  
neous tips, anterior tubercles forming continuous row  
on distal margin. Hands (Fig. 12a) twice as long as  
high, with palmar regions slightly longer than fingers;  
dorsal margins each with row of 5 long, spinous,  
curved and pointed teeth, strongest proximally, with  
1 or 2 smaller teeth interspersed; upper half of outer  
surface with additional sharp but shorter teeth more  
or less in rows and numerous piliferous denticles or  
tubercles on lower half; dactyls with sharp teeth,  
strongest proximally. Cutting edges of fingers with  
large molar-like teeth, claws corneous, dactyl some-  
times longest.

Second pereopods (Fig. 12c) with 3 or more  
denticles on ventral margins of ischia. Meri with  
straight ventral margins, each with 6–8 generally  
well-developed denticles, more closely spaced  
proximally; dorsal margin similarly straight and  
nearly parallel with ventral margin, marked with very  
weak setose indentations; maximum segmental height  
slightly less than 0.33 length. Carpi each with 5 or 6  
(rarely 4 or 7) generally long, acute spines dorsally;  
elongate triangle of stridulatory tubercles present on  
nearly entire length of inner surface. Propodi each  
with 5 or 6 (rarely 7–9) spines on dorsal margin,  
longest and most acute like those of carpus, distally  
strongly bent forward; ventral margins each with  
some pilose indentations and 1 distal corneous spine;  
some stridulatory tubercles on proximal third of inner  
face; segmental height about 0.33 length. Dactyls  
equal to propodi, claws strongly curved, ventral mar-  
gins each with 7 or 8 corneous spines. Third pereopods  
(Fig. 12d) differing from second by relative dimen-  
sions of segments: ischia, carpi and dactyls slightly  
longer, meri and propodi slightly shorter. Spines on  
dorsal regions of carpi and propodi weaker than on  
second; carpi occasionally with 5, more frequently 3

or 4 spines, propodi each with 4 or 5, rarely 3 or 6. Fourth pereopods (Fig. 12b) each with distal spine on carpus; propodus with distal spine followed in some specimens by 1 or 2 additional spines.

Abdominal tergites calcified as in *T. brachyops* (see p. 52). Sixth tergite (Fig. 12e) with rounded outline, longer than broad, with glabrous median depression, flanked on each side by oblique depression bordering strongly marked notch on lateral margin. Uropods symmetrical; basal segment with strong posterior spine, internal ramus hardly more than twice as long as broad. Telson with lateral margins parallel or slightly divergent, proximal width about 0.60 length; posterior region forming 2 equal lobes delimited by pair of weak lateral indentations and by median notch, lateral margins straight, posterior margins convex, equal.

Males with first pleopods (Fig. 13f) consisting of elongate, curved subcylindrical basal segment and slightly shorter foliaceous distal segment with outer margin more strongly convex than inner; distal segment with maximum width in proximal third. Second pleopods (Figs 13g, h) with elongate basal segment, second segment straight proximally, becoming enlarged into depressed, rolled lobe with concave inner margin; suture separating thickened part of lobe from thinner distal part in distal quarter of segment. Exopod represented by more or less developed, conical protuberance on basal segment distally. Third (Fig. 13i) to fifth pleopods consisting of basal segment articulated with exopod 2 to 3 times as long as 1-segmented endopod. Female pleopod structure close to that of *T. brachyops*.

Pilosity: Pilosity consisting of unequal setae, appreciable on dorsal regions of three distal segments of chelipeds and ambulatory legs, some very long, stiff, translucent; entirety having hirsute appearance. Abdominal tergites and telson covered with short, bristle-like setae, intermixed with long simple setae, more numerous on sixth tergite and telson. Latter and uropods with marginal long setae.

COLOUR: "[*Trizacheles spinosus bathamae*] is predominantly orange. Chelas and walking legs are white and orange, irregularly mottled and barred. Their tips are dark brown. Eyestalks are light orange. Eyes are dark brown, with a bluish iridescence. Flagella of the first and second antennae are yellow-orange and translucent. Carapace is whitish with diffuse orange blotches, and carries some orange-red chromatophores anterolaterally. In some but not all specimens, the sides of the carapace are unpigmented and transparent. Abdomen is whitish, with a pair of orange spots at the anterior end of each well-calcified tergum. Uropods are pearly white; the telson ranges from

pearly white anteriorly to translucent at its posterior end. There are a few red chromatophores on all maxillipeds and anterolaterally on the carapace; and there are some white chromatophores at and under the sides of the carapace. For the rest, the pigment is not in chromatophores. The early eggs are red" (Batham 1970: 47).

MEASUREMENTS: Size extremes observed in the New Zealand material were 5.5 and 13.5 mm carapace length for males, 2.8 and 12.5 mm for females, whereas in New Caledonia, the males measured 3.5–7.0 mm and 3.5–8.5 for females. Shield lengths equal approximately 0.65 total carapace length.

REPRODUCTION: The New Zealand specimens examined consisted of 14 males and 31 females. Sixteen females were collected in February, March, April, and September. Several with carapace lengths of 7.0–12.5 mm carried 100 or more eggs, in varying stages of development and with diameters of 1.2–1.5 mm. In New Caledonia, the sex ratio was seven males to 13 females, but the smallest ovigerous female measured only 3.5 mm in carapace length.

REMARKS: Some Pylochelidae collected by the *Challenger* in southeastern Australia at a depth of 274 m were described by Henderson (1888: 101, pl. 11, fig. 1) as *Pylocheles spinosus*. The species subsequently was transferred to the genus *Mixtopagurus*, then more recently designated the type species of the genus *Trizacheles* by Forest (1987: 155). Forest and de Saint Laurent (in Forest 1987) reported, as the same species of *Trizacheles*, specimens from New Zealand, then others from New Caledonia, but placed them in a distinct subspecies because of consistent differences from the nominal species. This subspecies was dedicated to the memory of E.J. Batham, who, while director of the Portobello Marine Biological Station, provided the first specimens. Batham (1970) also published a note on the behaviour of this subspecies, identifying it according to the indications of the senior author at the time, as *Mixtopagurus* n. sp. It was then considered a species close to that described by Henderson (1888), but distinct. That opinion was subsequently modified following the examination of supplemental material, in which important variations in certain characters were found, and consequently the differences from the Australian taxon were determined to be of a subspecific nature.

*Trizacheles spinosus spinosus* was redescribed and illustrated by Forest (1987: 202: figs 47d, 66g, 69c, 70) from the type material and an ovigerous female collected off Queensland, Australia. More recently, a single specimen has been collected in New Zealand



waters. The subspecies *T. s. bathamae* is distinguished from the nominal subspecies primarily by reduction of its rostral tooth to a minute denticle, often becoming completely obsolete, thus leaving the rostral lobe perfectly rounded and smooth, and by its larger corneas, which have a ratio of corneal diameter to peduncular length of less than 3.0. This ratio is between 3.2 and 3.5 in *T. s. spinosus* in specimens of about 6–7 mm carapace length, and 3.6 in a male with carapace length of 12.4 mm. The pilosity in *T. s. bathamae* is stronger. On the dorsal regions of the chelipeds and ambulatory legs, the setae are dense and conceal the integument, whereas those of *T. s. spinosus* are less numerous leaving the underlying teeth visible. Additionally, the spinose teeth on the dorsal margins of the carpi and hands of the chelipeds generally are longer and more slender in *T. s. bathamae*, although this is variable. Similarly, the teeth on the dorsal surfaces of the carpi and propodi of the ambulatory legs are usually more slender and often less forwardly inclined in *T. s. bathamae*.

*Trizacheles spinosus bathamae* is also present in New Caledonia. Forest and de Saint Laurent (in Forest 1987) did not find morphological differences between specimens captured in this region and those of New Zealand. However, they did not exclude the possibility that the New Caledonian population might belong to another subspecies, which would be characterised by its small size. The largest of 20 individuals of that population that they examined measured 8.5 mm in carapace length and females of 3.5 mm were ovigerous. The maximum size we have observed in New Zealand is 13.5 mm; the smallest ovigerous female measures 5.4 mm carapace length.

It is equally possible that the populations of the two regions have different habitat preferences. In New Caledonia, the specimens have been found in Demospongiae (*Corallistes* sp.), or naked, but one of us (JF) has noted that these *Trizacheles* have a tendency to spontaneously leave their lodging immediately after capture. One might then presume that they all live in sponges, but that some have left during the raising of the trawl. In any case, none have been found in gastropod shells. With regard to the New Zealand specimens, all were sent to us naked, with no indication of the nature of their lodging. However, those whose behaviour Batham (1970: 45) studied were found in gastropod shells or, in one case, in a serpulid tube. Schembri (1982b) and Schembri and McLay (1983) have similarly mentioned shells and serpulid tubes as habitat, but without new observations, simply restating those of Batham (1970). Hers is the only available information on the habitat of *Trizacheles spinosus bathamae* and no association with sponges has been mentioned.

According to Batham (loc. cit.: 46): "The shells used are usually very eroded, and large as compared with the size of the hermit crab. This is probably related to the fact that the crab's abdomen does not closely fit the coiled gastropod shell, as does that of a typical hermit crab". Furthermore, the animal can move in all directions in the interior of its lodging, generally not dragging it because of its encumbrance. It leaves its habitat more easily than do asymmetrical pagurids and holds itself on the bottom with the abdomen folded under or will swim backwards, "by repeated flexing of its abdomen and flipping of its tailfan". Based on these observations, which show clearly the imperfect adaptation of these crustaceans to shells that they occupy, and on the association with sponges that is the rule in the New Caledonian population, one of us (Forest 1987: 208) proposed the hypothesis that the New Zealand individuals might possibly also be normally spongicoles, their habitation in shells being occasional. However, there are no actual data at the moment to support this hypothesis. It is then possible that in the absence of appropriate sponges, various types of shells are utilised. Additionally although the majority of *Trizacheles* are spongicoles, *T. sakaii* (Forest, 1987) from Japan, still has only been reported in shells of *Dentalium* or gastropods or in serpulid tubes. In any case, the problem of the normal habitat of *T. spinosus bathamae* in New Zealand remains unresolved.

The preceding remarks essentially concern the affinities and distributions of the two subspecies, *T. spinosus spinosus* and *T. spinosus bathamae*. In other respects, the species does not seem related to other *Trizacheles*. The genus is divided into several groups, principally on the basis of the presence and number, or the absence, of spinous teeth on the dorsal margins of the propodi of the second pereopods. *Trizacheles spinosus* is among those species in which the margin is armed along its entire length. It is close to *T. balssi* (Stebbing, 1914) from the southwest Indian Ocean, *T. pulcher* Forest, 1987 from New Caledonia, and *T. mutus* Forest, 1987 from Java. These three species differ from *T. spinosus* in several characters, in particular the propodi of the third pereopods which, instead of carrying 4 or 5 spinous teeth on the dorsal margin, are unarmed or have only a small distal tooth. As for the two other species that are also present in New Zealand, they are still more distant from *T. spinosus* as is indicated by the armament of the chelipeds and ambulatory legs. Both subspecies of *Trizacheles spinosus* are distinguished from *T. brachyops* by the latter's very short ocular peduncles (cf. Fig. 14a), from *T. perplexus* by the latter's atypical telson (Fig. 8e), and from *T. pilgrimi* by the latter's single distal spine on the propodi of the third pereopods.



RECORDS FROM NEW ZEALAND: Eastern New Zealand from East Cape, North Island to southwest Puysegur Point, South Island, and Chatham Islands, 127 to 550 m.

DISTRIBUTION: New Zealand, New Caledonia and Chesterfield Islands (recent collection); 127–550 m.

*Trizacheles brachyops* Forest & de Saint Laurent,  
1987 (Figs 13a–e, 14)

*Trizacheles brachyops* Forest & de Saint Laurent, 1987: 186,  
figs 47b, 61b, 62, 63a.

TYPES:

Holotype: ovigerous female (sl = 5.2, cl = 8.5 mm), from NZOI Stn E719, NIWA holotype H-708.

Paratypes: 1 male (sl = 5.5, cl = 9.0 mm), 1 female (sl = 6.0, cl = 8.0 mm), 1 ovigerous female (sl = 5.5, cl = 9.0 mm), from NZOI Stn E719, NIWA paratype P-1158; 1 female, from NZOI Stn E719, MNHN Pg 3522.

TYPE LOCALITY: NZOI Stn E719, southeast of Tuaheni Point, New Zealand, 38°46'S, 178°48'E.

OTHER MATERIAL EXAMINED:

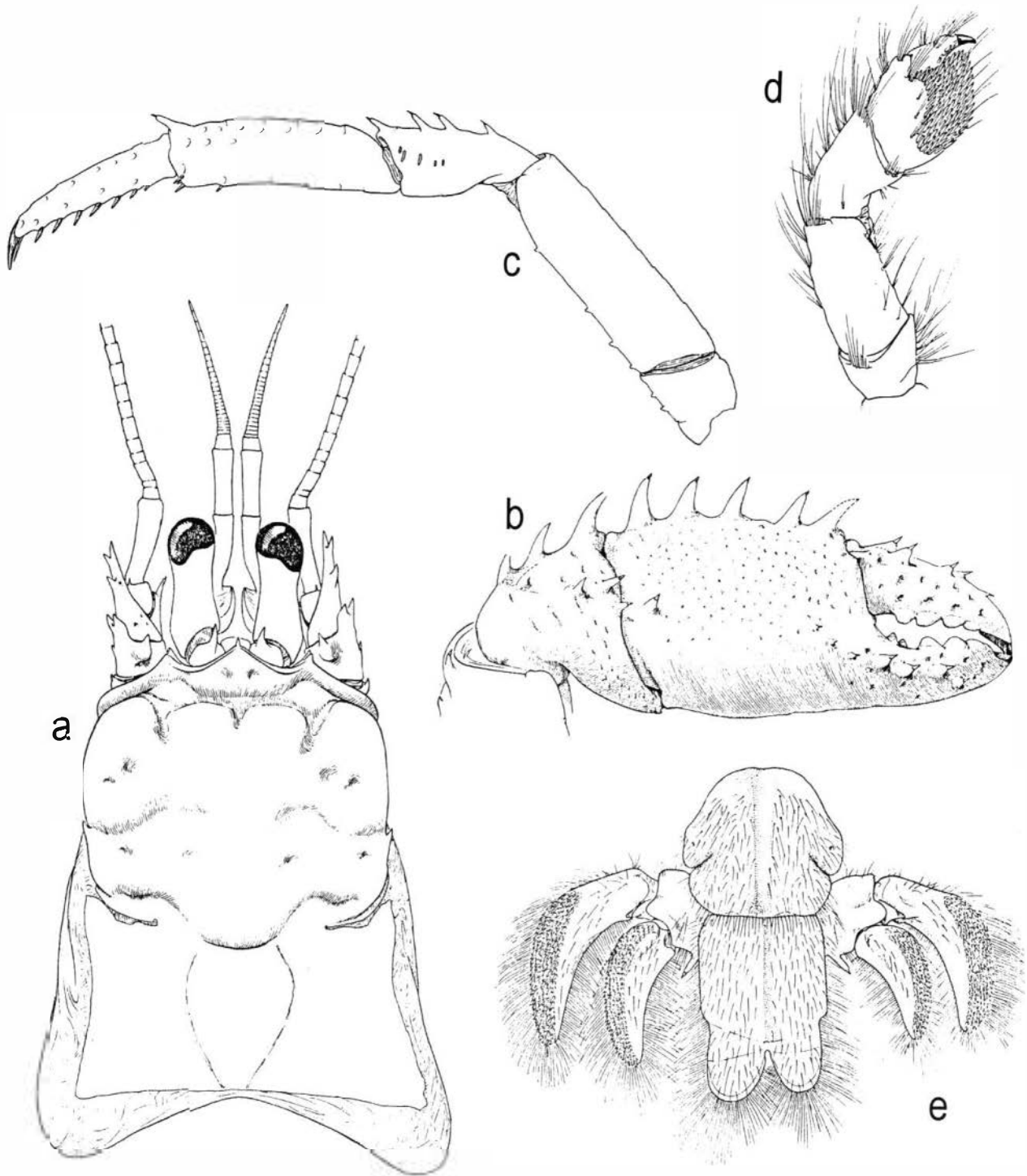
NZOI Stns: E719, 2 males, 2 female; 2 ovigerous females (type material), + 1 male (sl = 6.5, cl = 9.5 mm), 1 female, damaged (sl = 5.5, cl = 8.0 mm); K800, 2 ovigerous females (sl = 6.7, 7.2 mm); K928, 1 male (sl = 6.4 mm), 1 ovigerous female (sl = 5.3 mm); P120, 2 females (cl = 14, 15.7 mm).

DESCRIPTION: Shield (Fig. 14a) as long as broad. Posterior carapace less than half shield length. Rostrum prominent, triangular, slightly obtuse, with fine sharp, apical denticle, extensively overreaching lateral projections; latter angular, often with accessory tooth or tubercle behind tip. Lateral margins of shield convex, with notch and denticle, sometimes obsolete, at level of posterior third. Ocular peduncles short, tapering medially, less than half the length of shield. Corneas large and slightly notched posteriorly, diameter included 2.5–3 times in peduncular length; ocular acicles triangular distally, narrow, acute. Antennular peduncles overreaching corneas by entire length of last segment, penultimate segment slightly longer. Antennal peduncles slightly over-reaching corneas; laterodistal projection of second segment strong, terminally bidentate, with small sharp lateral tooth, 1 strong tooth dorsally. Antennal acicle long and strong, reaching or over-reaching middle of last segment, with 2–4 teeth laterally on external margin, more or less distinct tiny denticles proximally. Flagellum about 2.5 times longer than shield.

Chelipeds subequal. Ischia each with 5 short stout teeth on ventral margin, shorter proximally. Meri each with 4 or 5 smaller teeth, some less prominent denticles and 1 sharp corneous-tipped tooth, sometimes reduced on dorsal margin. Carpi (Fig. 14b) each with small number of spinose teeth dorsally, 3 stronger but decreasing in size; produced ventrolateral surface with region of stridulatory tubercles. Hands twice as long as high; dorsal margins each with row of 5 long, sharp-edged, recurved, spinose teeth, slightly stronger proximally, teeth much weaker on external surface, with 1 near proximal margin, 1 medially, few distally on palm extending in more or less regular row on fixed finger parallel to cutting edge. Teeth of dactyl similar to those of fixed finger, proximal-most strongest. Cutting edges of fingers with large tuberculate teeth; claws corneous.

Second pereopods (Fig. 14c) each with 2 denticles on ventral margin of ischium. Meri with maximum height slightly less than 0.35 total length, dorsal and ventral margins straight, parallel; dorsal margin with weak indentations and setae, ventral margin with 4 or 5 denticles, 1 distally, remainder in proximal half. Carpi about 0.33 as high as long; each with 4 long, generally regularly spaced, long, acute spines on dorsal surface, distal half of mesial surface with median transverse row of stridulatory tubercles. Propodi with setiferous indentations on dorsal and ventral margins, more closely spaced dorsally, and with strong distal spine, 2 subdistal corneous spines on ventral margin. Dactyls equal to propodi or slightly longer; claws strongly recurved; ventral margins straight, each armed with 5–7 corneous spines. Third pereopods generally of same length as second, but with ischia and carpi slightly longer and meri slightly shorter. Ischia and meri with ventral margins unarmed; dorsal margins of carpi each with spinous distal tooth smaller than on second, and 1 shorter tooth proximally; dorsal margins of propodi unarmed but 3 corneous spines on ventral margins distally. Dactyls each with 6 or 7 corneous spines on ventral margin. Fourth pereopods (Fig. 14d) with propodi oval, breadth about 0.70 length; large rasp of squamiform bristles covering dactyl and extending broadly on palmar region; dactyls over-reaching propodal extension by approximately 0.2 length. Fifth pereopods with propodi enlarged in distal half, obliquely truncate anteriorly, each with large rasp of squamiform bristles covering large part of propodus.

First and sixth abdominal tergites well calcified, tergites 2–5 calcified only in vicinity of lateral margins. Sixth tergite (Fig. 14e) as long as broad, with longitudinal glabrous median depression and oblique groove on each side bordering indentation of lateral margin. Left uropod slightly larger than right; basal



**Fig. 14.** *Trizacheles brachyops* Forest, 1987, NZOI Stn E719, male paratype (cl = 10.0 mm): a, cephalothorax and cephalic appendages (setation and aesthetascs omitted); b, right chela and carpus (outer view, setation omitted); c, second right pereopod (mesial view, setation omitted); d, fourth right pereopod (lateral view); e, sixth abdominal somite, uropods and telson (dorsal view). Magnifications equal 9x (e), 12x (c), 15x (a, b), 18x (d).



1 segment with strong posterior spine; inner ramus nearly 3 times as long as broad. Telson longer than broad (ratio of approximately 4 : 3); pair of lateral indentations and deep median incision cutting posterior part into 2 rounded lobes, left always slightly longer than right.

In males, first pleopods (Fig. 13a) with elongate arched subcylindrical basal segment and shorter foliaceous, notably rolled distal segment, with outer margin more convex than inner margin. Second pleopods (Fig. 13b) with long basal segment; second segment narrow proximally but broadening into depressed and rolled lobe with strongly convex mesial margin; posterior surface of second segment with thickening extending about as far as distal third and set apart from lobe by suture; 1 short, conical, somewhat developed, exopod present. Third (Fig. 13c) to fifth pleopods with basal segment articulating with long exopod and half as long endopod; latter, with 2 segments of quite variable relative lengths, about same length as basal segment. In females, first pleopods (Fig. 13d) set very close together, small slender, consisting of basal segment and shorter flagelliform distal segment. Following pleopods (Fig. 13e) much stronger, consisting of proximally enlarged basal segment, with long arched and more or less subdivided exopod and distally inserted, 2-segmented endopod.

Pilosity: Pilosity of anterior region of body not particularly dense and consisting principally of long, flexible, fine translucent setae not concealing integument. Dorsal regions of pereopods with setae more numerous. Abdominal tergites and telson with shorter setae, but margins of telson and uropods all with fringe of long setae.

COLOUR: Specimens preserved in alcohol no longer have any trace of colour. The calcified regions are yellowish-white with iridescence apparent in areas of little setation, notably on the shield and the first abdominal tergite.

MEASUREMENTS: Of the 15 specimens collected, carapace length varied from 8.5 to 15.7 mm.

REPRODUCTION: The five ovigerous females each carried between 15 and 20 eggs, measuring 1.2 to nearly 2 mm diameter. In four of the five, the embryos were in advanced stages of development with the eyes weakly to very visible.

HABITAT: The ovigerous females from NZOI Stn K800 in the Kermadec Islands were found in pumice. It is also possible that *T. brachyops* may live in hexactinellid sponges as does related *T. caledonicus* Forest, 1987.

REMARKS: *Trizacheles brachyops* does not have any particular affinities with the other three species of *Trizacheles* presently known from New Zealand. *Trizacheles brachyops* offers scarcely any resemblance to *T. spinosus bathanae* or *T. pilgrimi* sp. nov., and is immediately distinguished from the latter two species by its ocular peduncles that are less than half the length of the shield. *Trizacheles perplexus* differs at least in the proportions and ornamentation of the chelipeds and pereopods, and particularly in the absence of a stridulatory apparatus and in the form of the telson. In the length of its ocular peduncles, *T. brachyops* approaches two other species. The first, *T. laurentae* Forest, 1987 from the Philippines (Forest 1987: 184, figs 59a, 60, 61a), is otherwise considerably different, with a much stronger rostral tooth, more slender and weakly armed antennal acicles, longer ambulatory legs, unarmed propodi of the second pereopods, and a better developed stridulatory apparatus.

In contrast, the second species, *T. caledonicus* from New Caledonia (loc. cit.: 171, figs 53, 54f, 61c) is closely related to *T. brachyops*. It is distinguished by details of ornamentation, but especially by the second and third pereopods being more slender; the propodi of the second pereopods are four to five times longer than high, whereas in *T. brachyops* the ratio of this dimension is only 3 : 1. Furthermore, the distodorsal tooth on this segment, always present in *T. brachyops*, is missing in *T. caledonicus*. The two species appear to be among those in the genus *Trizacheles* that live at great depth. In fact, both species have been collected in depths between approximately 600 and 700 m.

RECORDS FROM NEW ZEALAND: Southeast of Lord Howe Rise, southeast coast of North Island, and west of the Kermadec Islands, at depths between 565 and 950 m.

DISTRIBUTION: At present known only from three widely-separated localities – in the northern Tasman Sea, off the southeast coast of North Island, and from just west of the Kermadec Islands.

*Trizacheles pilgrimi* sp. nov.

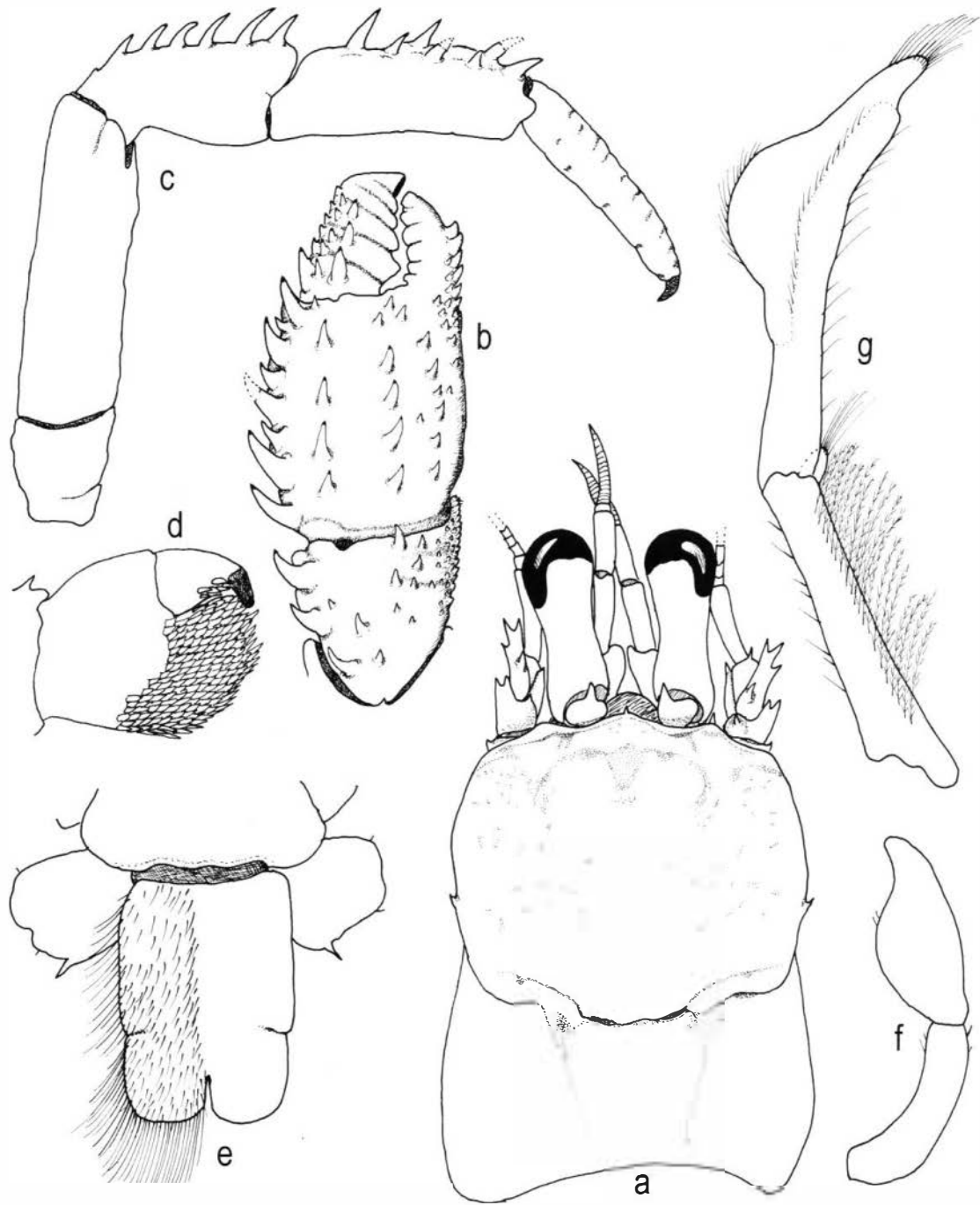
(Fig. 15)

TYPES:

Holotype male (sl = 7.4 mm, cl = 10.8 mm) from NZOI Stn K830, NIWA holotype H-709.

Paratypes: 2 males (cl = 6.4, 11.1 mm), 4 females (cl = 4.7–8.8 mm) from NZOI Stn K830, NIWA paratype P-1159; 1 male (cl = 13.1 mm), 2 females (cl = 7.4, 9.0 mm) from NZOI Stn K830, MNHN Pg 5837; 1 female (cl = 8.8 mm), MUSORSTOM 6, Stn CC 470, 21°04.4'S, 167°33.2'E, 560 m, MNHN Pg 5811.





**Fig. 15.** *Trizocleles pilgrimi* sp. nov., NZOI Stn K830, a-d, male holotype (sl = 7.4 mm), e, f, male paratype (sl = 7.5 mm): a, cephalothorax and cephalic appendages (setation and aesthetascs omitted); b, right chela and carpus (outer view, setation omitted); c, second left pereopod (mesial view, setation and stridulating tubercles omitted); d, dactyl and propodus of right fourth pereopod (lateral view); e, protopods of uropods and telson (dorsal view); f, male left first pleopod; g, male left second pleopod. Magnifications equal 9x (a-c, e), 12x (d), 18x (f, g).

TYPE LOCALITY: Kermadec Islands, NZOI Stn K830, 29°11.5'S, 177°53.05'W, 549–590 m.

DESCRIPTION: Shield (Fig. 15a) shorter than broad, ratio approximately 9 : 10, much longer than posterior carapace region. Rostrum obtusely triangular, with sharp apical tooth, overreaching similar teeth of lateral projections, lateral margins of latter convex, with small denticle posterior to weak submedian notch.

Ocular peduncles tapering in median region, distal region swollen and club-like; ratio of peduncular length to shield 0.60 : 0.65. Corneas dilated and noticeably extended basally on outer side; corneal diameter included 2.5–2.7 times in peduncular length. Ocular acicles widely separated, triangular, with long distal spine.

Antennular peduncles, when fully extended, overreaching anterior margins of corneas by 0.33–0.50 ultimate segment. Antennal peduncles usually reaching to or beyond distal corneal margin. Second segment with laterodistal projection bidentate, sometimes 1 tooth on inner side. Antennal acicle reaching approximately to middle of fifth peduncular segment, outer margin with 2 teeth posterior to distal tooth, 1 tooth on inner margin in proximal third.

Chelipeds subequal. Ischium with 5 or 6 short, conical teeth on ventral margin. Ventral margin of merus delimited by 2 rows of denticles or teeth, outer row very much smaller; dorsal margin with 1 small, sharp distal tooth. Carpus (Fig. 15b) with 3 teeth on inner margin of dorsal surface, proximal smallest; outer surface with several much shorter teeth; small conical stridulatory tubercles with rounded corneous summits covering ventrolateral projections. Palm approximately twice as long as high; dorsal margin with 7 or 8 subacute teeth: generally 5 strong teeth, decreasing in size distally and interspersed with 2 or 3 shorter teeth; outer face with conical teeth disposed principally in 3 irregular longitudinal rows. Dactyl with subacute conical teeth.

Second pereopods (Fig. 15c) with dactyls 0.25 shorter than meri and 0.33 longer than propodi. Ischia with smooth or weakly tuberculate ventral margins. Meri each with row of short conical teeth on ventral margin (not apparent in mesial view). Carpus with 6 long, sharp teeth dorsally, straight or slightly arched anteriorly, distal-most sometimes reduced. Propodi each with 7 or 8 unequally sized teeth on dorsal margin, 4 or 5 largest aligned along and slanted toward inner margin. Dactyls with dorsal regions unarmed, but marked with small pits and setiferous indentations; ventral margins each with 7 or 8 fine corneous spines not apparent in mesial view. Inner faces of carpi and propodi each with stridulatory

tubercles: 8 or 9 tubercles forming transverse parallel rows of variable length on carpus, proximal-most reduced and with tubercles rounded; longitudinal row of rounded tubercles on propodus. Smallest specimens with number of carpal tubercles reduced to 4 or 5, propodal tubercles missing.

Third pereopods differing from second in much shorter meri, practically same length as dactyls. Segments unarmed dorsally except for dorsodistal carpal and propodal spine; well-marked setiferous ridges on propodi, setiferous ridges or tubercles on dactyls; ventral margins of dactyls each with 7 or 8 corneous spines.

Morphology of fourth (Fig. 15d) and fifth pereopods, sixth abdominal tergite (Fig. 15e) and telson male (Fig. 15f, g) and female pleopods not appreciably different from those of *T. spinosus bathamae*.

Pilosity: Shield with long dense setae in depressions of anterior region, isolated and sparse setae on remaining surface; one fringe of fine setae under frontal margin between lateral projections. Pilosity weak on ocular, antennular and antennal peduncles. Dorsal surfaces of chelipeds and ambulatory legs covered with very long fine dense setae, partially concealing subadjacent spines. Surface of sixth abdominal tergite covered with short setae on anterior half, glabrous posteriorly, but with marginal fringe of long setae. Telson with surface covering of longer setae and fringe of long marginal setae.

COLOUR: Not known.

MEASUREMENTS: Of the 10 specimens known from the Kermadec Islands, carapace lengths of males ranged from 6.4 mm to 13.1 mm and of females from 6.4 to 12.8 mm; shield lengths equaled 0.67–0.68 of total carapace lengths. The single female collected in the Loyalty Islands had a carapace length of 8.8 mm.

REPRODUCTION: Not known.

ETYMOLOGY: This species is named for Dr R.L.C. Pilgrim in recognition of his contributions to New Zealand carcinology, both in his own research and in his tutelage of students.

REMARKS: *Trizacheles pilgrimi* sp. nov., a species that was not represented in the material from New Zealand and the Kermadec Islands initially studied by the first author (Forest 1987), has a certain resemblance to *T. spinosus bathamae* in the form and proportions of the shield, proportions of the ocular, antennular, and antennal peduncles, and strongly spinose chelipeds and second pereopods. It differs in certain points, particularly the presence of only a

single distal tooth on the propodus of each third pereopod. However, the new species is clearly much closer to *T. pulcher* Forest, 1987, described from New Caledonia (Forest 1987: 199, figs 50a, 66h, 68). Nonetheless it is distinguished from the latter species by several characters. Specifically, the rostrum of *T. pilgrimi* is longer, overreaching the level of the lateral projections; the ocular peduncles are shorter in relation to the shield, and the corneas extend further toward the bases of the peduncles on the outer side. However, the most notable differences are seen in the armament of the chelipeds and second pereopods. On the carpi of the chelipeds there are only 3 strong teeth near the outer margin instead of 4, and on dorsal margins of the propodi the teeth are more numerous. On the carpi of the second pereopods there are 6 dorsal teeth in *T. pilgrimi* in contrast to 4 or 5 in *T. pulcher*. On the propodi there are 7 or 8 teeth irregularly set in both cases; however, they are distinctly longer and sharper in the new species. Furthermore, in all the specimens of *T. pilgrimi*, the dorsal margin of each dactyl of the second pereopods is unarmed, whereas a row of denticles is present in *T. pulcher*. When the stridulatory apparatus is present on the propodus in *T. pilgrimi*, it is represented by a row of small rounded tubercles, which are missing in small specimens. In contrast, the stridulatory apparatus of *T. pulcher* is represented by parallel ridges which extend to the distal third of the segment.

*Trizacheles pilgrimi* has been collected off the Kermadec Islands at a depth between 545 and 590 m, but it is also represented in the Loyalty Islands by a specimen captured at 560 m. This depth is considerably greater than that of *T. pulcher*, which is known from six stations off New Caledonia between 345 and 445 m depth.

RECORDS FROM NEW ZEALAND: Kermadec Islands; 545–590 m.

DISTRIBUTION: Kermadec and Loyalty Islands; 545–590 m.

### Family DIOGENIDAE Ortmann, 1892

Diogenidinae Ortmann, 1892.

Dardaninae Schmitt, 1926.

Paguristinae Makarov, 1938.

TYPE GENUS: *Diogenes* Dana, 1851.

Fourteen or 13 pairs of quadriserial or biserial gills (cf. McLaughlin & de Saint Laurent 1998). Third maxillipeds approximate basally; ischium usually

with well-developed crista dentata, without accessory tooth or teeth.

Chelipeds equal, subequal or unequal, left often much larger.

Males usually with paired gonopores on coxae of fifth pereopods, occasionally only single gonopore, and infrequently also with indications of gonopores on coxae of third pereopods; vas deferens not produced and developed into sexual tube; sometimes with paired first, second or both first and second pleopods modified as gonopods; usually with four, occasionally without or with fewer, unpaired left pleopods. Females usually with paired gonopores, occasionally only with one; occasionally with paired first pleopods modified as gonopods; with four or three unpaired biramous and/or triramous pleopods, most frequently occurring on left side only, but occasionally present on either right or left side.

REMARKS: The early accounts of the New Zealand hermit crab fauna included the genera *Aniculus* Dana, 1852, and *Clibanarius* Dana, 1852. Both are incorrect. As we will demonstrate, the reports of *Aniculus* are referable to *Dardanus arrosor* (Herbst, 1796) (see pp. 82–84). *Clibanarius barbatus* Heller, 1862, is actually a species of *Paguristes* (see pp. 61–63). The reports of *Clibanarius cruentatus* H. Milne Edwards, 1848, by Miers (1876b), Filhol (1885d), and Thomson (1899) appear to have been based on H. Milne Edwards' (1848) citation of the type locality of this species as "Nouvelle Zélande". None of these authors saw a specimen referable to *Pagurus* (= *Clibanarius*) *cruentatus* and it has not been found in any of the collections we examined. It is very probable that, as with *Paguristes setosus* (H. Milne Edwards 1848), Milne Edwards erred in his citation of the type locality. In the case of *C. cruentatus* it should have been New Guinea.

### KEY TO THE NEW ZEALAND AND KERMADEC ISLANDS GENERA OF DIOGENIDAE

- 1 13 pairs of branchiae (no pleurobranch on last thoracic segment) ..... 2
- 14 pairs of branchiae (pleurobranch on last thoracic segment) ..... 3
- 2 Males with paired first and second pleopods modified as gonopods; females with paired first pleopods modified as gonopods ..... *Paguristes*
- Males without paired first and second pleopods modified as gonopods; females without paired first pleopods modified as gonopods ..... *Calcinus*
- 3 Chelipeds subequal or unequal, not operculate. Uropod of left generally larger than right. Four pleopods on left (2–5) well developed and biramous or rudimentary in males, first 3 triramous in females ..... *Dardanus*
- Chelipeds equal; with second pereopods adapted to form



operculum. Uropods equal or subequal. No pleopods in males; 4 unpaired biramous pleopods on left or on right in females ..... *Cancellus*

### *Paguristes* Dana, 1851

*Paguristes* Dana, 1851: 269.

*Stratiotes* Thomson, 1899: 185.

*Pagurites* Lörenthey & Beurlen, 1929: 71 (misspelling).

TYPE SPECIES: By subsequent selection by Stimpson (1858: 235), *Paguristes hirtus* Dana, 1851: 272. Gender masculine.

Thirteen pairs of gills (no pleurobranch on last thoracic segment), usually biserial, but occasionally quadriserial. Rostrum variable, sometimes very reduced, but always present. Ocular acicles well developed, more or less separated. Antennal acicles strong, spinulose or spinose. Antennal flagellum medium length or short. Endopod of maxillules with small external lobe recurved. Chelipeds usually similar in form and most often subequal, occasionally dissimilar and unequal; claws generally corneous, fingers usually opening in horizontal plane.

Males usually with paired gonopores; usually also with pair of pleopods modified as gonopods on first and second abdominal somites; unpaired, unequally biramous left pleopods on somites 3–5. Females usually with paired gonopores, occasionally only on coxa of left third pereopod, with or without pair of uniramous pleopods on first abdominal somite; following 3 somites with unpaired biramous left pleopods, both rami well developed; fifth pleopod as in males; often abdominal fold developed in front of fourth pleopod to form brood pouch.

REMARKS: When Dana (1851: 269) first erected the genus *Paguristes*, he included two species, *P. longirostris* Dana, 1851 and *P. hirtus* Dana, 1851, but designated no type species. In a later publication (Dana 1852b: 122), he proposed that either *Pagurus gonagrus* H. Milne Edwards, 1836 or *Pagurus pilosus* H. Milne Edwards, 1836 should be the type species. However, as neither species was included in the original description of the genus, Dana's subsequent type designation was not valid. Stimpson (1858) selected *Paguristes hirtus* as the type.

The genus *Paguristes* is very large, quite diverse, and probably heterogeneous; however, only four species are known from New Zealand. On the basis of two of these species, *Paguristes pilosus* and *P. setosus*, it might at one time have been thought possible to distinguish groupings of species on taxonomic and geographic criteria. Both species show peculiarities

that isolate them from most other species. However, it does not seem justifiable at present to exclude them from the genus *Paguristes*, which is currently defined principally by the absence of branchiae on the last thoracic segment, by the presence of two pairs of differentiated sexual pleopods in the male, and by the non-cheliform shape of the fourth pereopod. Recent redescriptions of known species (e.g., Haig & Ball 1988; McLaughlin & Clark 1997) and descriptions of several new taxa (e.g., Morgan 1987; Morgan & Forest 1991) clearly demonstrate the variability, at least in sexual characters, and the need for a thorough review of the genus before any formal subdivisions can be proposed.

Initially, we were of the opinion that only three species of *Paguristes* occurred in New Zealand waters, *P. "barbatus"*, *P. pilosus*, and *P. setosus*. *Paguristes subpilosus* Henderson, 1888, was thought to be a junior synonym of *P. barbatus*, as reflected in the reports of Schembri (1982b) and Schembri and McLay (1983). However, as discussed under the remarks pertaining to those species, both of the latter are now recognised as distinct taxa. Reports of the occurrence of *P. barbatus* in Australia and Japan have been proven erroneous, as also discussed under that species. *Paguristes barbatus* appears to be endemic to New Zealand, as is *P. subpilosus* with which it has frequently been confused. *Paguristes pilosus* has never been recorded outside New Zealand; *P. setosus* has been reported from New Guinea and from Japan, but, as discussed in the remarks for *P. setosus*, this is due to a *lapsus calami* in the first instance and to errors of identification in the second. Both of these species should also be considered endemic to New Zealand.

### KEY TO THE NEW ZEALAND SPECIES OF *Paguristes*

- 1 Chelipeds equal or only weakly subequal ..... 2
- Chelipeds unequal; left considerably larger ..... 3
- 2 Ocular peduncles approximately half length of shield.  
Length of dactyls of ambulatory legs subequal to length of propodi ..... *Paguristes barbatus*
- Ocular peduncles 0.60–0.75 length of shield. Length of dactyls of ambulatory legs 1.5 or more than length of propodi ..... *Paguristes subpilosus*
- 3 Ocular peduncles 0.75–0.80 length of shield; ocular acicles moderately broad, lateral margins subparallel. Mesial face of dactyl of right cheliped with longitudinal area of corneous-tipped spinules or tubercles ..... *Paguristes pilosus*
- Ocular peduncles approximately 0.85 length of shield; ocular acicles triangular with sharp distal tip, often with one accessory spinule. Mesial face of dactyl of right cheliped with longitudinal area smooth, without corneous-tipped spinules or tubercles, but flanked by single row of spinules or tubercles at least dorsally ... *Paguristes setosus*

***Paguristes barbatus* (Heller, 1862) (Figs 16, 17)**

*Clibanarius barbatus* Heller, 1862: 524; 1865: 90, pl. 7, fig. 5; Miers 1876b: 67; Filhol, 1885d: 425 (text), 496 (list); Thomson 1899: 172; McCulloch 1913: 340.

[Not *Paguristes barbatus*: Chilton 1911a: 300; Zarenkov, 1968: 194; Schembri 1982b: 865; Schembri & McLay 1983: 28, fig. 4; Schembri 1988: 95 = *Paguristes subpilosus* Henderson, 1888].

[Not *Paguristes barbatus*: Ortmann 1892: 279, pl. 12, figs 7, 7p; Doflein 1902: 645; Balss 1913: 39; Terao 1913: 373; Yokoya 1933: 74; 1939: 278, figs 10A, B; Miyake 1957: 86; 1960: 93, pl. 46, fig. 5; Miyake *et al.* 1962: 125; Kim 1963: 297, fig. 14; 1964: 8; 1970: 12; 1973: 210, 597, fig. 42, pl. 5, fig. 23 = *Paguristes ortmanni* Miyake, 1978]

[Not *Clibanarius barbatus*: Lucas 1886: 62 = *Paguristes sulcatus* Baker, 1905]]

[Not *Paguristes barbatus*: Stead 1898: 208; Whitelegge 1889: 232 = *Paguristes squamosus* McCulloch, 1913]

TYPE: Apparently no longer extant.

TYPE LOCALITY: Auckland, New Zealand.

MATERIAL EXAMINED:

NZOI Stn E267, 1 male (cl = 8.3 mm), 1 female (cl = 7.9 mm).

PMcL collection: Hinemoa Island, Princess Chain, Three Kings Islands, coll. C. Duffy, 3.2.93, 20 m, 1 male (sl = 8.9 mm), 1 female (sl = 6.4 mm), MNHN Pg 5815; Greater Omaha Bay, 36°16.9'S, 174°49.7'E, coll. R. Taylor & M. Morrison, 15.12.95, 30 m, 1 ovigerous female (sl = 7.6 mm).

DESCRIPTION: Shield (Fig. 16a) approximately 0.6–0.8 total carapace length; maximum shield width 0.7–0.8 length; surface with spiny tubercles laterally. Rostrum narrowly triangular, extending at least half own length beyond level of lateral projections, reaching to midlength of ocular acicles, apex subacute. Ocular peduncles with minimum diameter practically equal to corneal diameter and half length of shield. Ocular acicles terminally bifid or with long slender terminal spine and small lateral additional tooth.

Antennular peduncles reaching nearly to or slightly beyond distal margins of corneas. Ultimate and penultimate segments approximately equal in length. Basal segment with small acute tooth on dorsolateral margin of statocyst lobe.

Antennal peduncles reaching distal 0.8 of ocular peduncle, sometimes reaching to or nearly to base of corneas. First segment with 1 or 2 small teeth on lateral margin. Second segment with strongly produced laterodistal projection, reaching to base of last segment, and with 2 terminal teeth and 2 teeth on lateral margin; mesial margin with 1 or 2 dentiform tubercles, occasionally additional small tubercle on dorsal surface mesially. Third segment with strong

spur-like anteroventral angle. Fourth segment with small dorsodistal tooth. Antennal acicle long, reaching nearly to distal margin of fifth peduncular segment, distally bidentate and with 1 or 2 supplementary teeth on lateral margin; 1 strong tooth in proximal third of mesial margin. Antennal flagellum shorter than shield, articles usually with 1–4 short stiff setae.

Chelipeds subequal, similar. Left cheliped with spiny tubercles on ventromesial margin of ischium. Merus with small spinose tubercles on ventromesial and ventrolateral margins, ventrolateral margin sometimes also with 2 or 3 stronger teeth distally; lateral face sometimes with scattered, very low protuberances and somewhat concave ventral margin; dorsodistal margin with 1 strong corneous-tipped tooth. Carpus (Fig. 16b) with strong spinose, ventrolateral prolongation distally, providing support for one articulating point with hand. Dorsolateral margin of carpus with row of short setose, often corneous-tipped tubercles, dorsal surface with prominent median longitudinal groove, dorsodistal margin with 1 or 2 teeth, dorsomesial margin with row of 5 or 6 strong, conical, corneous-tipped teeth. Chela short, palm with lateral surface broadly rounded; dactyl nearly 1.5 length of palm. Dactyl with dorsal surface nearly level, few corneous-tipped teeth marginally and few piliferous tubercles on dorsal surface; mesial faces of both chelas flat, glabrous, and covered with tiny, regular, rounded, corneous tubercles, obviously forming stridulating apparatus when rubbed together. Corneous claws striated on outer surfaces.

Second and third (Fig. 16c) pereopods with dactyls subequal to propodi, lengths of upper margins in ratio of 0.88 : 1.1 dactyl to propodus. Second pereopods each with row of tiny denticles on dorsal margin of merus and double row of slightly larger denticles on ventral margin; setose protuberances dorsally on carpi and propodi, mesial and ventral surfaces with transverse protuberances; both segments with longitudinal dorsal row of corneous-tipped teeth. Mesial faces of dactyls with piliferous striations, each marginally armed with few corneous spinules and divided into 2 series by weak longitudinal groove; lateral faces each with few very low, setiferous protuberances; ventral margins each with 5 or 6 corneous spinules in distal half, often concealed by tufts of setae. Third pereopods lack dorsal row of sharp corneous-tipped teeth on carpi and propodi, but carpi each with strong dorsodistal tooth.

Paired first pleopods of male (Fig. 17a, b) each with inferior plate much longer than basal segment and enlarged, spatulate; distal margin armed with only few denticles; inner lobe rounded, weakly rolled, with long setae on the inner face and anterior margin; distal



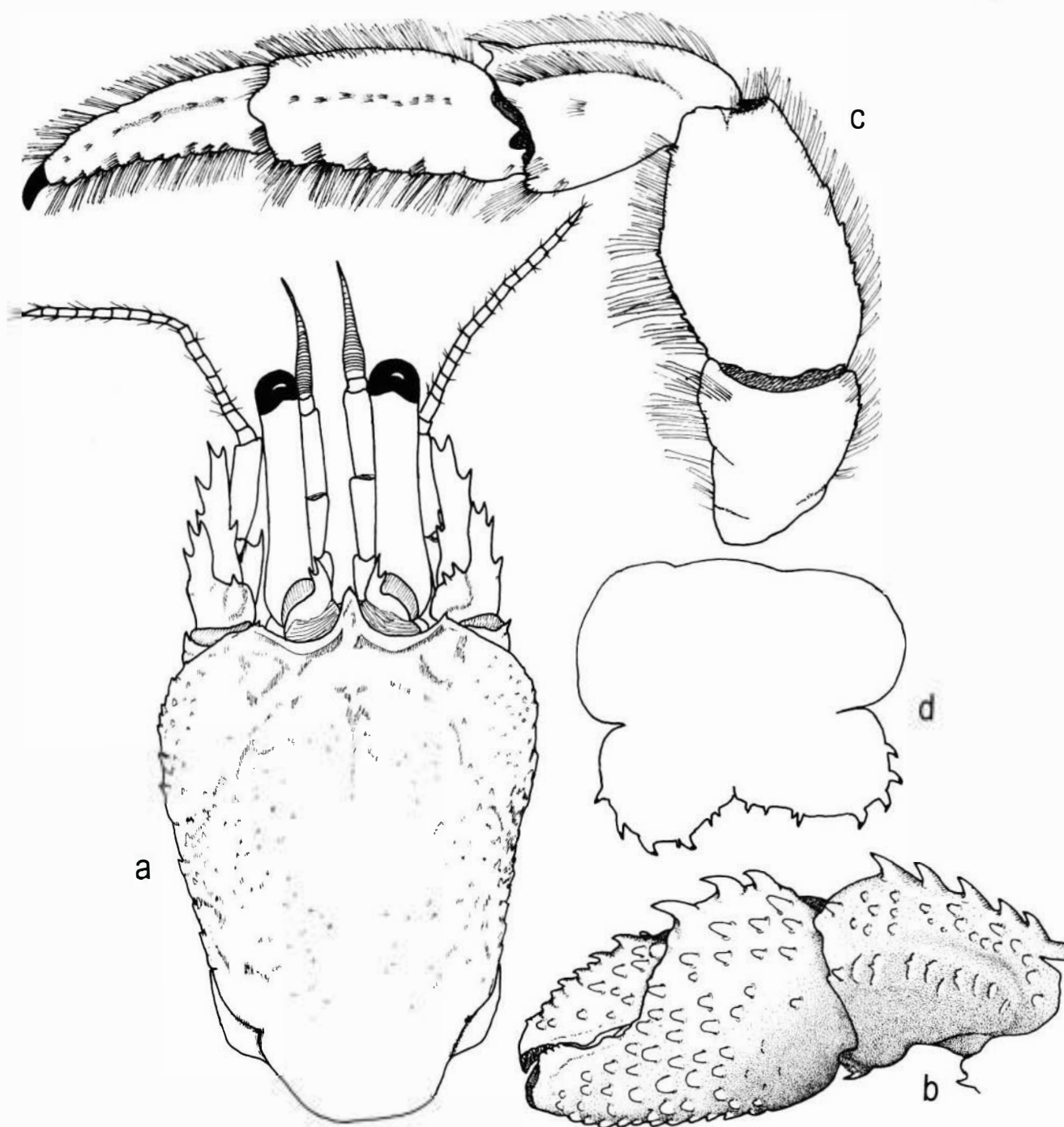


Fig. 16. *Paguristes barbatus* (Heller, 1862), Hinemoa Island, Three Kings Islands, male (sl = 8.9 mm): a, shield and cephalic appendages (aesthetascs omitted); b, carpus and chela of left cheliped (outer face, setation omitted); c, left third pereopod (lateral view); d, telson. Magnification equal 12× (a-c), 25× (d).



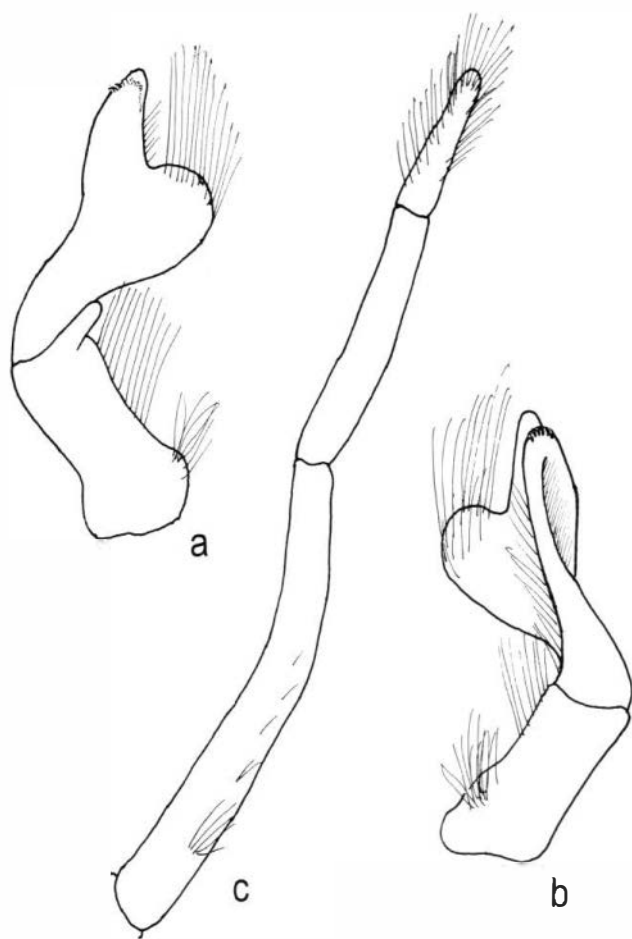


Fig. 17. *Paguristes barbatus* (Heller, 1862), Hinemoa Island, Three Kings Islands, male (sl = 8.9 mm): a, left first pleopod (anterior view); b, left first pleopod (posterior view); c, left second pleopod. Magnification equals 37.5x.

lobe slightly over-reaching inferior plate; free margin of inferior plate with fringe of shorter setae. Paired second pleopods (Fig. 17c) with short basal segment, elongate second segment and 2 partially fused distal segments, latter showing some torsion, with marginal and terminal setae; preceding segment without tuft of setae. Pleopods 3–5 with exopods short, endopods vestigial or absent. Paired first pleopods of female equal, 2-segmented; pleopods 2–4 biramous, pleopod 5 uniramous. Brood pouch formed by large fold of abdomen, very well developed and completely covering eggs attached to pleopods 2–4.

Telson (Fig. 16d) with posterior lobes broad, left lobe slightly larger, terminal margins each with 2 or 3 strong, recurved, corneous-tipped teeth, and few smaller teeth; 2 or 3 strong teeth on lateral margins.

Pilosity: Moderately dense covering of plumose, rather long setae on carpi and palms of chelipeds

arising in tufts from bases of tubercles, but not completely obscuring armature. Tufts of long dense, plumose setae on remaining thoracic legs form thick fringe on dorsal and ventral regions of segments; mesial faces of propodi with transverse piliferous striations.

**COLOUR:** In life, body and appendages brown; chelipeds and ambulatory legs tipped with black. Ocular peduncles, antennular, and antennal peduncles blue (C. Duffy, field notes).

In alcohol, ocular peduncles generally retain reddish-orange tinge; chelipeds and ambulatory legs mottled orange and cream.

**MEASUREMENTS:** *Paguristes barbatus* apparently is a small species. The present material consists of 2 males with carapace lengths of 8.3 and 11.2 mm (sl = 5.9 mm and 8.9 mm respectively), 2 females with carapace lengths of 7.9 mm and 8.5 mm (sl = 4.4 mm and 6.4 mm respectively), and an ovigerous female with carapace length of 13 mm (sl = 7.9 mm).

**HABITAT:** *Paguristes barbatus* appears to be an inhabitant of relatively shallow water, with 37 m the maximum depth recorded. Specimens from Three Kings Islands occupied shells of *Maurea* sp.

**REPRODUCTION:** Only one ovigerous female has been collected, during December in Greater Omaha Bay.

**REMARKS:** Heller (1862: 594; 1865: 90, pl. 7, figs 5, 5a) originally described this species as *Clibanarius barbatus* from a specimen collected by the crew of the frigate *Novara* off Auckland. Heller's specimen, deposited in the collection of The British Museum (Natural History), was subsequently redescribed under the same name by Miers (1876b), but not recognised again. A check of the current holdings of The Natural History Museum failed to locate this type specimen.

As Ortmann (1892: 280) remarked, the form of the rostrum, the carapace grooves, and the pilosity of Heller's (1862) specimen were not those of *Clibanarius*, but more probably of a *Paguristes*. Our specimens have the characters noted and figured by Heller (1862, 1865). These include an elongate shield and the form of the frontal margin, the relative lengths of the ocular and antennal peduncles, the laterodistal prolongation of the second segment of the long and strongly toothed antennal peduncle, the long antennal acicle, the sometimes bidentate ocular acicles (cf. Heller 1865: pl. 7, Fig. 5a), and the spinose tubercles on the chelipeds, with a setose covering of these and dorsal and ventral regions of the two following pairs of pereopods. The only point of slight disagreement between our speci-

mens and *Clibanarius barbatus* as described and figured by Heller are the antennules, which in Heller's figure (1865: pl. 7, fig. 5a) appear very much shorter than the ocular peduncles. The antennular peduncles of our specimens are relatively short, but occasionally do overreach the distal margins of the corneas; however, the antennules of Heller's specimen were probably not fully extended, as is typical of preserved pagurids.

Filhol (1855b: 51, 1885d: 496) listed both *Clibanarius barbatus* and *Clibanarius cruentatus* as occurring in the North Island region; however, he figured only *C. cruentatus* (Filhol 1885e: pl. 52, figs 4, 5). The type locality given by H. Milne Edwards (1848) for *C. cruentatus* was New Zealand but, as in the type locality error for *P. setosus*, it is more probable that the locality for *C. cruentatus* should have been New Guinea. Filhol's (1885e) rather poor illustration (pl. 52, fig. 4) certainly is recognisable as a species of *Clibanarius*, and the colour pattern of shield and legs described by Filhol agrees well with *C. cruentatus* (cf. De Man 1888: pl. 19, fig. 2). The type material, in the Muséum national d'Histoire naturelle, includes three males. The largest has a total body length of 20 mm, as noted by Filhol (1885e), and is certainly the one illustrated. Filhol's illustration includes the specific colour pattern (large white patches on the shield and white spots on

the ambulatory legs) that are quite recognisable. Moreover, on the faded type specimens in alcohol, some marks of the pattern are still visible.

In his description of *Paguristes subpilosus*, Henderson (1888) noted the similarities between his species and Heller's (1862) *Clibanarius barbatus*, but did not discuss the relationship of his species to the genus *Clibanarius*. He distinguished the two species by the differences in the lengths of the dactyls of the walking legs and their respective propodi, a character that we also have found diagnostically most reliable. There are, however, other distinct differences between the two species (see Table 1).

As mentioned above, it was Ortmann (1892) who first placed *Clibanarius barbatus* of Heller in the genus *Paguristes* and also recorded this species from Japan. He was of the opinion that the Japanese specimens corresponded exactly to Heller's (1862) description and that the few differences with Heller's (1865) figures were the result of inaccurate illustrations. We cannot accept his evaluation. First, comparisons between Heller's descriptions and Ortmann's are not conclusive since both are very succinct. Second, Ortmann's figures (1892: p1. 12, figs 7, 7p) show the second segment of the antennal peduncle as lacking the strong toothed process so characteristic of *P. barbatus*, and male first pleopods that do not agree with

Table 1. Principal distinctive characters observed in *Paguristes barbatus* and *P. subpilosus*.

	<i>Paguristes barbatus</i>	<i>Paguristes subpilosus</i>
Shield width/length *	0.70–0.80	0.80–0.85
Rostrum	narrowly triangular, reaching mid-length of ocular acicles	triangular, usually reaching only to base of ocular acicles
OP/S *	0.50	0.60–0.75
OP diameter	uniform	narrowing medially
Ocular acicles	narrowly bifid or with slender spine and additional small lateral tooth	simple or bifid
Antennal peduncles reach	0.80 length of OP	0.65–0.75 length of OP
Chelas	digital region broadly rounded	digital region triangular
Dactyl/propodus length of ambulatory legs *	0.8–1.1	1.4–1.8
Pilosity of chelas	moderately dense tufts not completely concealing spination	dense tufts concealing spination
* Ratios		
OP length	length of ocular peduncles	
S length	length of shield	
OP diameter	diameter of ocular peduncles	

those of *Paguristes barbatus* as described and illustrated herein (Fig. 17).

Thomson (1899) reported the collection of *Clibanarius barbatus* from Auckland by Heller, and remarked that it “occurs in the British Museum”, but that no one had seen it since Heller’s time. Chilton (1911a: 299) recorded two specimens, from Stns 5 and 26 of the New Zealand Government Expedition of 1907, as *Paguristes barbatus*, and placed Henderson’s (1888) *P. subpilosus* in synonymy with it. From his description of the lengths of the dactyls of the ambulatory legs, Chilton actually had Henderson’s species, not *P. barbatus*. Thompson (1930: 264) reported on the same two specimens collected by the *Nora Niven* of the New Zealand Exploring Expedition, 50 miles east of Stewart Island, between 65 and 183 fms (119 and 335 m) as *P. subpilosus*, rejecting, “at least temporarily” the synonymy of this species with *P. barbatus* proposed by Chilton (1911a).

Although he did not actually reexamine the specimens from Sagami Bay attributed by Ortmann (1892) to *Paguristes barbatus*, Miyake (1978) did review additional specimens of presumed *P. barbatus* from Sagami Bay. He compared them apparently with specimens of *P. subpilosus* from New Zealand, which at that time was considered synonymous with *P. barbatus*, and concluded that the New Zealand and Japanese species were distinct. Miyake (1978) named the Japanese species *Paguristes ortmanni*. He did not describe the length of the ambulatory dactyls of *P. ortmanni*, using instead, colour and characters of the ocular peduncles, antennal acicle, and telson to differentiate between the two taxa. Although the telson of *P. subpilosus* differs appreciably from that of *P. ortmanni*, the latter is generally quite similar to that of *P. barbatus*. However, the armature of the ocular acicle does distinguish Miyake’s species from both *P. barbatus* and *P. subpilosus*. Colouration among the three is also quite different. In *P. ortmanni*, Miyake (1978: 48) described the ocular peduncles as having a longitudinal broad white stripe both dorsally and ventrally; the antennular and antennal peduncles reportedly each had a dark reddish-brown stripe. The ocular, antennular, and antennal peduncles of *P. barbatus* and *P. subpilosus* all lack longitudinal striping. These appendages in *P. barbatus* are blue. In *P. subpilosus* the ocular peduncles and antennules are intense purple with a white border under the deep black corneas.

To date, *P. barbatus* is known from very few specimens, all from shallow depths. Nonetheless, as with the other New Zealand species of *Paguristes*, we consider it an endemic species. *Paguristes barbatus* is closely allied to *P. subpilosus* and to the Japanese *P. ortmanni*. Both *P. barbatus* and *P. subpilosus* are im-

mediately distinguished by their equal chelipeds from the other two New Zealand species, *P. setosus* and *P. pilosus*, which are strongly heterochelate. As previously indicated, the shorter ambulatory dactyls clearly set *P. barbatus* apart from the more common *P. subpilosus*.

RECORDS FROM NEW ZEALAND: Auckland, Greater Omaha Bay, North Island, and Three Kings Islands, at depths between 20 and 37 m.

DISTRIBUTION: Endemic to New Zealand.

### *Paguristes subpilosus* Henderson, 1888

(Figs 18–20, Pl.1, fig. 2)

*Paguristes subpilosus* Henderson, 1888: 77, pl. 8, figs 2, 2a; Thomson 1899: 187; Alcock 1905b: 156 (list); Borradaile 1916a: 95; Thompson 1930: 264; Zarenkov 1968: 194 (list); Hand 1975: 510; Fenwick 1978: 206; Probert *et al.* 1979: 381 (list);

*Paguristes barbatus*: Chilton 1911a: 300; Zarenkov 1968: 194 (list); Schembri 1982b: 865; Schembri & McLay 1983: 28, fig. 4 [not *Paguristes barbatus* (Heller, 1862)].

#### TYPES:

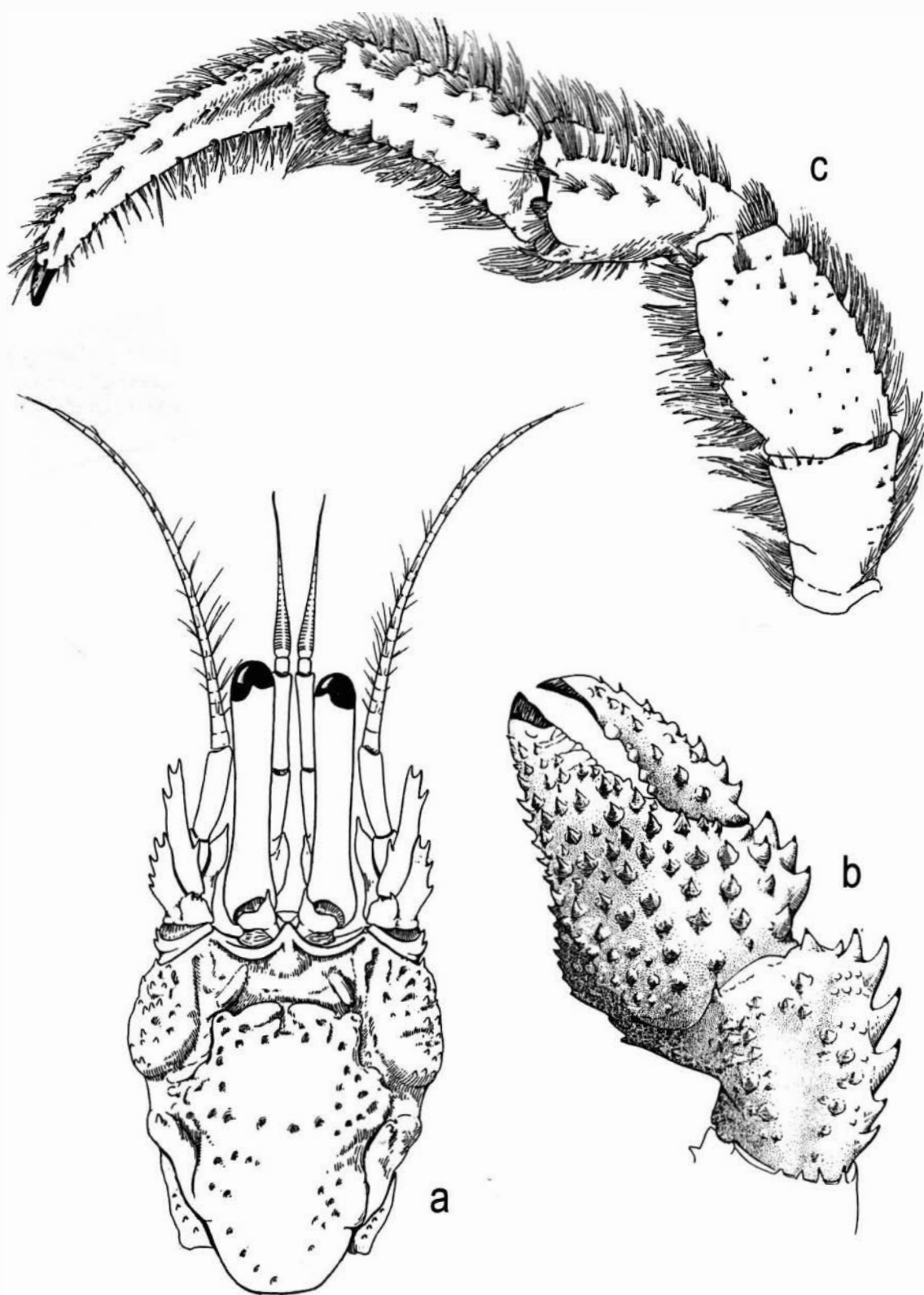
Syntypes: 1 male (sl = 5.4 mm), 1 female (sl = 8.0 mm), *Challenger* Stn 167, NHM 1888.33.2.

TYPE LOCALITY: *Challenger* Stn 167, west of New Zealand, 39°32’S, 171°48’E, 274 m.

#### OTHER MATERIAL EXAMINED:

NZOI Stns: B196, 1 male (cl = 7 mm); B314, 1 male (cl = 18 mm); B488, 1 male (cl = 18.5 mm); B489, 1 male (cl = 7 mm); B555, 1 male (cl = 20.5 mm); B559, 1 specimen parasitised; B616, 1 ovigerous female (cl = 12.5 mm); B666, 1 female (sl = 8.2 mm); B686, 3 males (sl = 10.4–10.9 mm), 1 female (sl = 6.3 mm), 2 juveniles (sl = 2.8, 2.9 mm); C642, 1 male (sl = 9.2 mm), 4 females (sl = 7.6–11.1 mm); C753, 2 males (sl = 4.4, 3.0 mm); C798, 1 ovigerous female (sl = 12.2 mm), MNHN Pg 5887; C814, 1 ovigerous female (sl = 7.2 mm); C844, 1 male (sl = 8.5 mm), 1 female (sl = 5.7 mm); C957, 9 males (sl = 8.9–14.9 mm), 14 females (sl = 8.3–11.6 mm), MNHN Pg 5888; D220, 1 female (cl = 6 mm); E106, 4 males (cl = 10–18.5 mm), 2 females (cl = 8.5–9 mm) 3 ovigerous females (cl = 16–17.5 mm); E113, 1 male (cl = 16 mm), 1 female (cl = 16 mm), 11 ovigerous females (cl = 11–17 mm); E114, 11 males (cl = 15.5–19.5 mm), 13 females (cl = 11.5–18.5 mm), 32 ovigerous females (cl = 14.5–18 mm); E720, 2 males (cl = 16–23 mm); E738, 3 males (cl = 14–18 mm), 1 female (cl = 14.5 mm); E759, 1 male (cl = 13 mm), parasitised; E779, 2 ovigerous females (cl = 14, 17.4 mm); E780, 2 males (cl = 15–23 mm), 2 females (cl = 13, 17.5 mm), 9 ovigerous females (cl = 17–19 mm); E792, 1 male (cl = 7 mm), 1 ovigerous female (cl = 20.2 mm); E796, 1 parasitised specimen; E804, 2 females (cl = 8.6, 12.1 mm), 2 ovige-





**Fig. 18.** *Paguristes subpilosus* Henderson, 1888, NZOI Stn E114, male (cl = 18 mm): a, shield and cephalic appendages (aesthetascs omitted); b, outer face of carpus and chela of left cheliped (setation omitted); c, left third pereopod (lateral view). Magnification equals 9x.

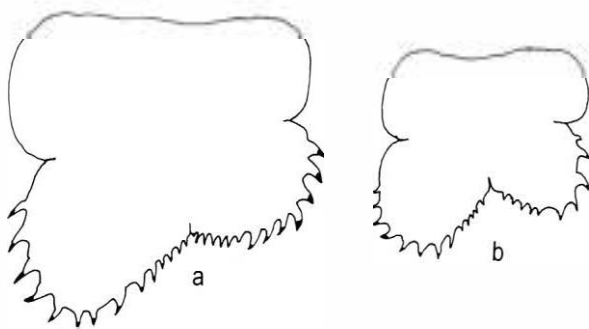


Fig. 19. *Paguristes subpilosus* Henderson, 1888. a, NZOI Stn E114, male (cl = 18 mm); b, NZOI Stn B686, juvenile (sl = 2.9 mm): telson. Magnifications equal 18x (a), 50x (b).

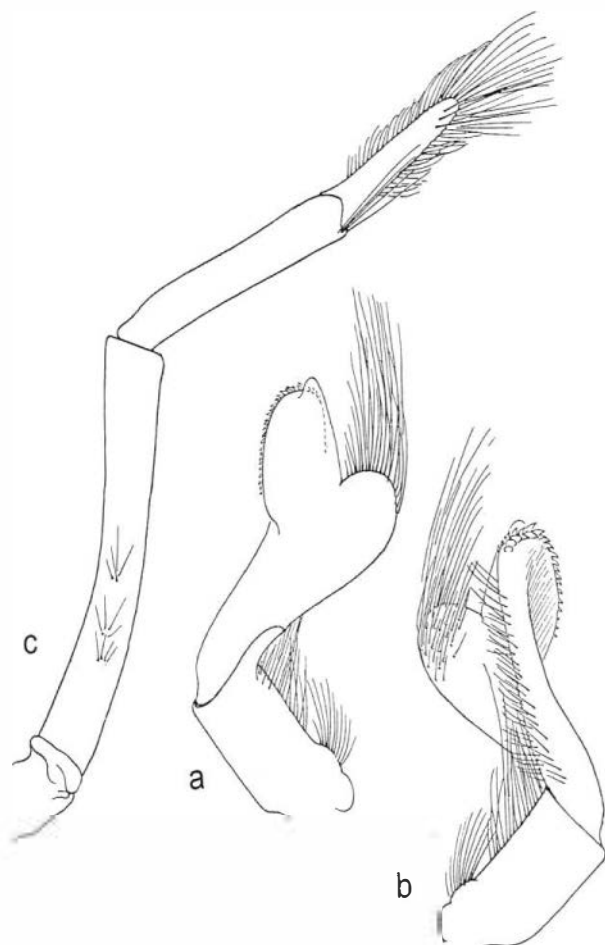


Fig. 20. *Paguristes subpilosus* Henderson, 1888. NZOI Stn E114, male (cl = 18 mm): a, left first pleopod (anterior view); b, left first pleopod (posterior view); c, left second pleopod. Magnification equals 25x.

ovigerous females (cl = 17.4–17.8 mm); Stn E817, 2 females (cl = 10, 13.4 mm); E820, 1 male (cl = 19.2 mm), 4 females (cl = 8–17 mm); E832, 4 males (cl = 3–6.8 mm), 3 females (cl = 5–8 mm); G163, 1 male (cl = 16 mm).

NMNZ collections: Off Great Barrier Island, 36°05'S, March 1962, 110–146 m, 3 males (cl = 11.3–17.2 mm), 1 female (13.5 mm), Cr 9559; Bay of Plenty, Aldermen and Slipper Islands, 5.8.61, 91–273m, 1 ovigerous female (cl = 22.5 mm), Cr 9560; off Kapiti Island, coll. F. Abernethy, December 1953, 18–27m, 1 male (cl = 27 mm), Cr 9561; Cook Strait, trawling grounds, 73 m, 1 female (cl = 14 mm), Cr 9562; Cook Strait, coll. M. Cataldo, 15.8.66, 1 male (cl = 17 mm), Cr 9563; off Palliser Bay, coll. F. Abernethy, 30.4.53, 18–46 m, 2 males (cl = 19.5 mm), Cr 9564; off Cape Campbell, Cook Strait, coll. F. Abernethy, June 1955, 73 m, 1 male (cl = 24 mm), Cr 9565; First Arm, Doubtful Sound, 45°19.4'S, 166°55.8'E, colls G.S. Hardy & P. Brotherstone, 27.2.85, 18 m, 1 male (sl = 13.4 mm), Cr 7408; Stn BS 163, 2 males (cl = 9.5–11 mm), Cr 9566; Stn BS 181, 2 males (cl = 9.8–17 mm), Cr 9567; Stn BS 189, 2 males (cl = 17–18 mm), 1 female (cl = 11.5 mm), Cr 9568; Stn BS 197, 2 ovigerous females (cl = 13, 16.5 mm), Cr 9569; Stn BS 208, 1 male (cl = 28 mm), Cr 9570; Stn GQ "a", 1 male (sl = 8.5 mm), Cr 9571.

NHM collections: *Terra Nova* Stn 90, 1 female (sl = 6.4 mm); Stn 96, 1 male (sl = 5.7 mm), 1 female (sl = 9.7 mm), NHM 1917.1.29.118–120.

NZMD collections: George Sound, 16.2.1962, 210 m, 1 female (cl = 11 mm), Cr 9572.

PMBS collections: Stn Mu 66–59, 1 female (cl = 12 mm); Stn Mu 66–75, 1 male (cl = 18 mm), in *Alcithoe* shell; Stn Mu 67–7, 4 males (sl = 6.5–8.4 mm), 1 female (sl = 9.4 mm); Stn MU 74–139, 1 male (sl = 7.2 mm); Stn Mu 75–23, 1 female (sl = 6.2 mm); Stn MU 75–71, 1 juvenile (sl = 2.7 mm).

PMcL collection: Bay of Plenty, 36°50'S, 176°17'E, coll. R. Taylor, 22.4.96, 387–392 m, 1 male (sl = 6.0 mm), 1 ovigerous female (sl = 11.0 mm), 1 juvenile (sl = 3.3 mm).

**DESCRIPTION:** Shield (Fig. 18a) approximately 0.60 total carapace length; maximum shield width 0.85 length; surface with spiny tubercles on lateral areas. Rostrum triangular, apex rounded, length somewhat variable, usually extending slightly beyond level of lateral projections, occasionally longer, reaching nearly to midlength of ocular acicles. Ocular peduncles slightly narrowed medially (relatively shorter and stouter in young individuals), minimum diameter 0.12–0.16 length, and 0.60–0.75 shield length. Ocular acicles somewhat variable, uni- or bidentate, outer margin convex behind distal point, usually with basal tubercle or sharp tooth. Antennular peduncles reaching to or slightly beyond distal margins of corneas. Antennal peduncles much shorter than ocular peduncles, generally reaching only to distal third or quarter. First segment with 2 or more spiny tubercles on lateral margin. Second segment with strongly produced laterodistal projection, reaching to or nearly to base of last segment, and with 3 or 4 teeth on lateral margin; mesial margin with 2 or more dentiform tubercles.



Third segment with strong spur-like anteroventral angle. Antennal acicle long, reaching distal 0.25 of fifth peduncular segment, distally bidentate and with 1–3 supplementary teeth on lateral margin; 1 strong tooth in proximal third of mesial margin. Antennal flagellum barely longer than shield, articles covered with stiff but not very dense setae.

Chelipeds subequal, similar. Left cheliped with poorly developed spiny tubercles on ventromesial and ventrolateral margins of merus, ventromesial margin also with 2 or 3 strong teeth distally; lateral face with some more or less flattened tubercles and concave ventral margin. Carpus (Fig. 18b) with strong ventrolateral prolongation distally, providing support for one articulating point with hand. [When cheliped is pressed down towards buccal region, prolongation fits into concave ventral part of merus, to which it is coadapted.] Dorsolateral surface of carpus with strong, short, setose, corneous-tipped tubercles, more numerous on lateral margin; dorsomesial margin with 3 distal teeth and row of 5 strong needle-like corneous-tipped teeth decreasing in size distally. Chela short, maximum width 0.65 length, digital region triangular and at least 0.65 total length of hand; dorsal surfaces of appendages in contact form weakly and regularly convex surface, armed with strong corneous-tipped tubercles, extending onto ventral surface of fixed finger and forming more or less regular longitudinal rows. Dactyls of chelipeds similar; mesial faces broadly triangular, flat, glabrous, and covered with regularly rounded corneous tubercles, obviously forming a stridulating apparatus when rubbed together. Corneous claws striated on outer surfaces.

Second and third (Fig. 18c) pereopods with dactyls much longer than propodi, lengths of upper margins in ratio of 5 : 3. Second pereopods with setose protuberances dorsally on carpi and propodi, mesial and ventral surfaces with transverse protuberances, both segments with longitudinal dorsal row of corneous teeth. Mesial faces of dactyls with piliferous striations divided into 2 series by longitudinal grooves with corneous spinules between striations; lateral faces proximal to claws with strong spinules of decreasing length. Third pereopods lack dorsal row of sharp corneous teeth on carpi and propodi.

Paired first pleopods of male (Fig. 20a, b) each with inferior plate much longer than basal segment and enlarged, spatulate; distal margin armed with recurved denticles; inner lobe broadly rounded, weakly rolled, with long setae on the inner face and anterior margin; distal lobe barely distinct, attached to inferior plate, incision absent or barely visible; free margin of inferior plate with fringe of shorter setae. Paired second pleopods (Fig. 20c) with short basal segment, elongate second segment and two partially fused seg-

ments, latter not showing particular torsion, terminal segment with marginal and terminal setae; preceding segment with tuft of setae at distal angle. Pleopods 3–5 unequal, exopods well developed; endopod of third and fourth rudimentary or absent, always absent from fifth. Paired first pleopods of female equal, 2-segmented; pleopods 2 to 4 biramous, pleopod 5 uniramous. Brood pouch, formed by large fold of abdomen, developed posterior to fourth pleopod.

Telson (Fig. 19a, b) with right posterior lobe semicircular, left lobe elliptical, very long; terminal margins each with strong, recurved, corneous teeth, smaller on margins of median incision; fairly strong teeth on lateral margins anteriorly.

Pilosity: Dense covering of plumose, greyish, rather long setae on carpi and hands of chelipeds, except for mesial faces of dactyls. Claws not covered. Similar setae on remaining thoracic legs form thick fringe on dorsal and ventral regions of segments; inner faces of propodi in particular, hidden by pilose covering, but transverse striations generally remain visible. Integument remains largely visible on lateral faces.

**COLOUR:** In life, the carapace and thoracic legs are light red-orange with some more intense red patches. Ocular peduncles and antennules are intense purple with a white border under the deep black corneas (Schembri & McLay 1983).

In alcohol, ocular peduncles remain quite strongly pigmented: violet-red in the middle, changing to salmon-red toward the extremities; the white border under the corneas generally remains visible. The red of the carapace and thoracic appendages persists on the dactyls and propodi of the second and third pereopods.

**MEASUREMENTS:** Sixty-nine males measured 3–27 mm in carapace length, 126 females 4.5–22.5 mm.

**HABITAT:** Henderson's (1888) syntypes were collected from a substratum of blue mud at a depth of 274 m, and inhabited shells of *Ancilla pyramidalis* Reeve. Although *Paguristes subpilosus* was found in a variety of habitats, from near-shore sand and muddy substrates to outer shelf areas of gravel and sand, it appeared to prefer the latter, at least in the Otago region (Schembri 1988).

**REPRODUCTION:** Ovigerous females have been taken from August to February carrying several hundred eggs about 1 mm in diameter. Samples from NZOI Stns E106, E113, and E114, taken in October, showed a clear preponderance of females: 62 females to only 16 males. The females were in full reproductive



condition, 46 (74%) carrying eggs.

REMARKS: Henderson (1888: 77, pl. 8, figs 2, 2a) described *Paguristes subpilosus* from two individuals, a male and a female collected at *Challenger* Stn 167 to the west of New Zealand at a depth of 274 m. Despite the much more detailed description that Henderson provided, we have also examined his syntypes to verify beyond doubt the conspecificity of our New Zealand material. As may be seen in Henderson's figure 2a, the most notable features of the cephalic region are the proportions of the ocular, antennular, and antennal peduncles; the second segment of the antennal peduncle that forms a long, strongly toothed process; and the antennal acicle that has a tooth on the proximal half of the inner margin and two subdistal teeth on the outer margin. As previously mentioned, Henderson noted great resemblance of his species to Heller's (1862) *Clibanarius barbatus*, differentiating *Paguristes subpilosus* by the relatively long and slender ambulatory dactyls (Henderson, 1888, fig. 2). Even among juvenile specimens (cl < 4.0 mm; sl < 3.0 mm), this character is diagnostic. However, equally diagnostic is the shape of the telson. The asymmetry seen in the posterior lobes in specimens of this species regardless of size (Fig. 19a, b) is appreciably greater than that observed in *P. barbatus*.

As mentioned under *P. barbatus*, Thomson (1899) rather cynically noted Heller's (1862, 1865) description of a *Clibanarius barbatus* in Auckland. He reported the occurrence of *P. subpilosus* only on the basis of Henderson's (1888) original account. Thomson (1899) himself had no personal knowledge of either species.

Although Chilton (1911a) made no reference to Ortmann's (1892) assignment of Heller's (1862) species to *Paguristes*, he reported *P. barbatus* from two stations of the *Nora Niven* Expedition. He considered that his specimens agreed closely with Heller's (1865) description and illustration of *C. barbatus*, and equally well with Henderson's (1888) *P. subpilosus*, particularly the relative proportions of the ambulatory dactyls and propodi. Consequently he placed Henderson's (1888) species in synonymy.

Borradaile (1916a: 95) identified as *P. subpilosus* specimens taken by the *Terra Nova* Expedition at Stns 90 and 96 north of New Zealand, in depths of 183 and 123 m, respectively. We have reexamined these specimens and found that Borradaile's identifications were correct. The male from Stn 96, at least now, lacks all of the ambulatory legs, but the telson clearly confirms its identity. The female from Stn 90 is now in poor condition; however, it too is unmistakably *P. subpilosus*.

Thompson (1930) reexamined the *Nora Niven* material. Believing, as Borradaile (1916) had, that the

long ambulatory dactyls were diagnostic of *P. subpilosus*, but not of *P. barbatus*, Thompson refuted Chilton's (1911a) proposed synonymy of the two species.

As previously indicated, we initially thought that only one homochelate species of *Paguristes* occurred in New Zealand waters. Consequently, in our initial prepublication list of species we cited the taxon as *Paguristes barbatus*, considering it the senior synonym of *P. subpilosus*. However, among recent collections, five specimens with generally equal chelipeds proved to differ appreciably from the common species, most notably in the proportions of the ambulatory dactyls and propodi, and configuration of the telson. Field colour notes accompanying one lot also indicated a different colouration. Comparisons of this material and the cosmopolitan New Zealand taxon have convinced us that there are two distinct homochelate taxa. The common species is correctly assigned to *Paguristes subpilosus*. By contrast, the occurrence of *Paguristes barbatus* is quite rare.

#### RECORDS FROM NEW ZEALAND:

North and South Islands including Stewart and Chatham Islands, 18–27 and 350–400 m.

#### DISTRIBUTION:

Endemic to New Zealand.

#### *Paguristes pilosus* (H. Milne Edwards, 1836)

(Figs 21, 22a, b, 23a, c, e, g, Pl. 2, figs 1, 2)

*Pagurus pilosus* H. Milne Edwards, 1836: 282, pl. 14, fig. 1; H. Milne Edwards 1837: 233; White & Doubleday 1843: 266; Filhol 1885b: 34.

*Paguristes pilosus*: Dana 1852b: 122; Stimpson 1858: 236; Miers 1876b: 66; Thomson 1899: 187; Alcock 1905b: 156 (list); Schembri 1982b: 865, fig. 3; Moore 1983: 55; Schembri & McLay 1983: 29, fig. 5.

*Stratiotes setosus*: Chilton 1906: 267 [not *Stratiotes setosus* Thomson, 1899].

[Not *Pagurus pilosus*: Filhol 1885d: 424 = *Paguristes setosus* (H. Milne Edwards, 1848)].

[Not *Paguristes pilosus*: Henderson 1888: 78 = *Paguristes setosus* (H. Milne Edwards, 1848)].

#### TYPES:

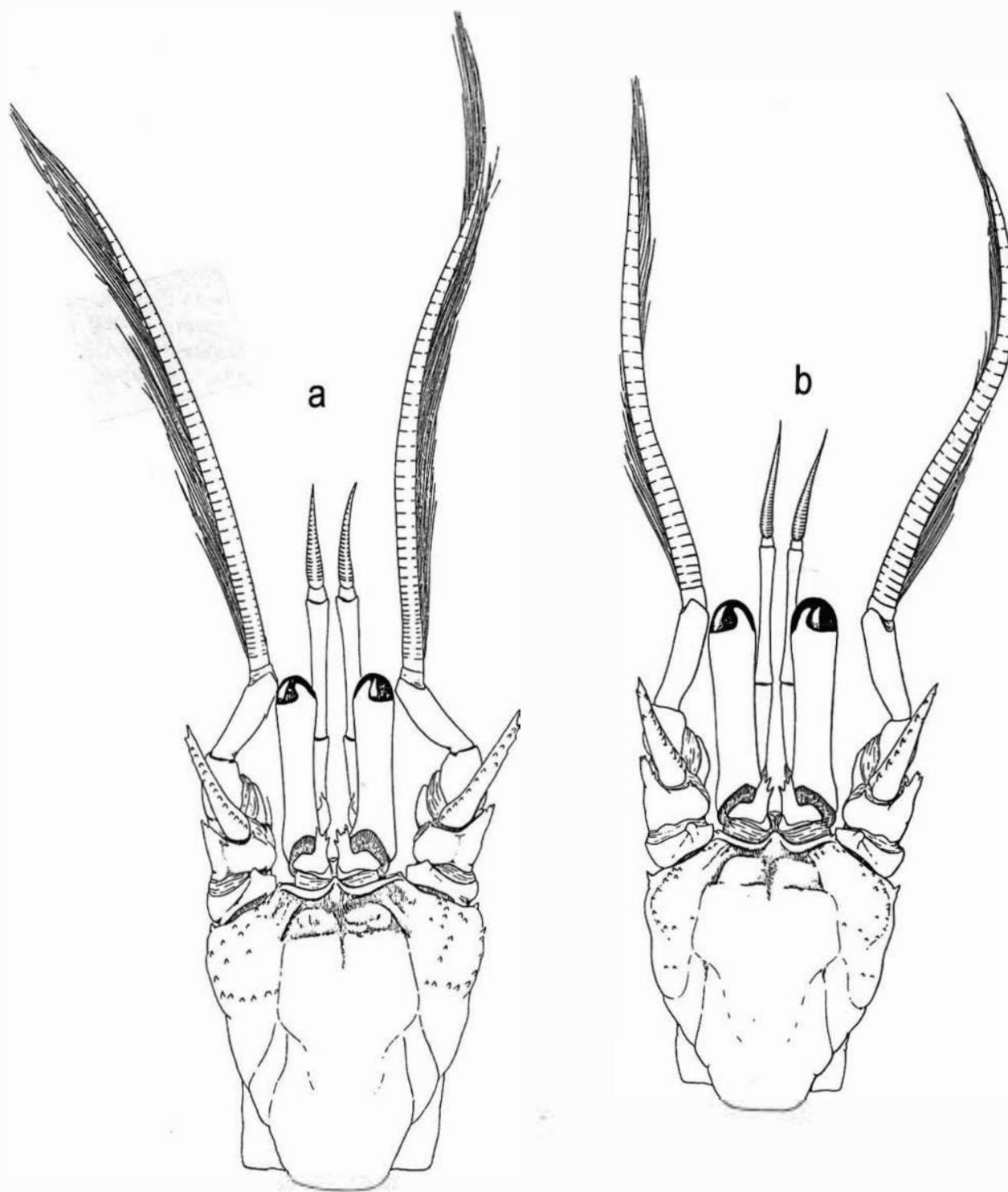
Lectotype, herein selected: male (cl = 19 mm) Quoy & Gaimard collection, MNHN Pg 5572.

Paralectotypes: 2 males (cl = 18.5, 20 mm), MNHN Pg 5573.

TYPE LOCALITY: New Zealand.

#### OTHER MATERIAL EXAMINED:

NZOI Stns: A447, 2 ovigerous females (cl = 15 mm); B10,



**Fig. 21.** *Paguristes pilosus* (H. Milne Edwards, 1836): a, Otago Stn Mu 66-38, male (cl = 23.5 mm); b, lectotype male (cl = 19 mm), MNHN Pg 5572: shield and cephalic appendages (aesthetascs omitted). Magnifications equal 8.5x (a), 10x (b).

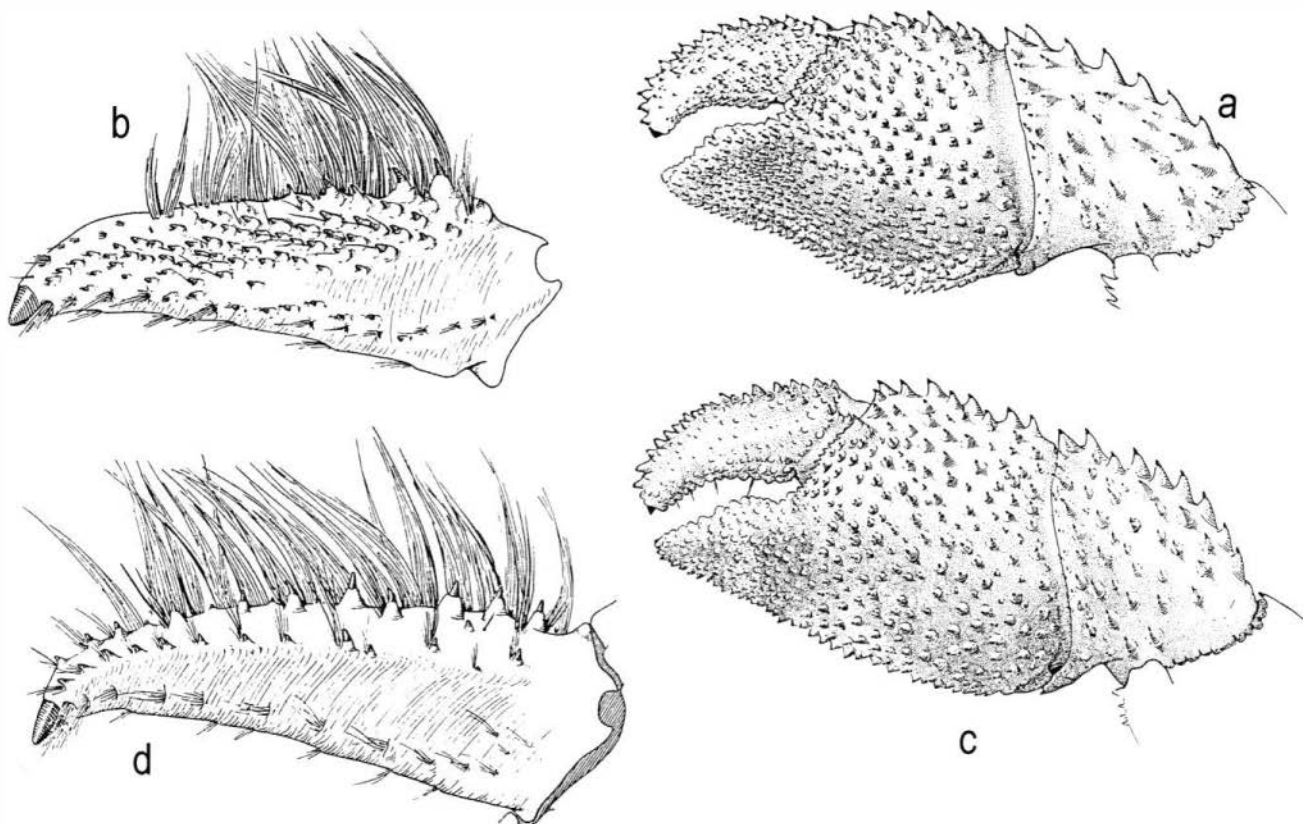


Fig. 22. a, b, *Paguristes pilosus* (H. Milne Edwards, 1836), Otago, male (cl = 23.5 mm); c, d, *Paguristes setosus* (H. Milne Edwards, 1848), NZOI Stn C765, male (cl = 19.5 mm): a, c, carpus and chela of left cheliped (outer face, setae omitted); b, d, dactyl of right cheliped (mesial face). Magnifications equal 6.6x (a, c), 22x (b); 25x (d).

1 female (cl = 15 mm); B528, 1 ovigerous female (cl = 15.5 mm); B542, 1 male (cl = 17 mm); B546, 2 females (cl = 14.5, 15 mm), 1 ovigerous female (cl = 13 mm); 553, 1 male (cl = 13 mm), 1 specimen in poor condition; B556, 3 males (cl = 16–17 mm); B668, 1 male (cl = 15 mm); B672, 7 males (cl = 8.5–17.5 mm), 3 females (cl = 6.5–11.3 mm), 1 ovigerous female (cl = 13.5 mm); B687, 4 males (cl = 9–15 mm), 1 ovigerous female (cl = 11 mm); B689, 1 male (cl = 11.5 mm), 1 female (cl = 12 mm); B690, 1 female (cl = 17 mm); B691, 1 specimen in poor condition; C182, 5 males (cl = 4.5–6 mm), 1 ovigerous female (cl = 13 mm); C261, 1 female (cl = 4.5 mm); C344, 13 males (cl = 8.5–14.3 mm), 6 females (cl = 7–13 mm), 9 ovigerous females (cl = 9.5–14.5 mm); C380, 6 males (cl = 6.9–12 mm), 1 female (cl = 8.5 mm), 2 ovigerous females (cl = 11 mm), + 34 specimens not removed from shells; C696, 1 male (cl = 7.5 mm); C755, 1 male (cl = 11.5 mm); C799, 9 specimens in poor condition; C806, 1 juvenile (cl = 2.9 mm) of uncertain identification; C826, 1 male (cl = 17 mm); C855, 2 females (cl = 15, 17 mm); E267, 1 male (cl = 10 mm); G167, 1 male (cl = 12.9 mm), 2 females (cl = 13.6–14 mm).

NMNZ collections: Te Anaputa, coll. B.L. Godfriaux, 11.6.70, 44 m, 9 males (sl = 2.4–7.9 mm), 11 females (sl = 2.5–7.1 mm), 1 juvenile (sl = 1.8 mm), Cr 8101; Motiti Island, coll. B.L. Godfriaux, 20.5.70, 46 m, 1 male (sl = 4.7 mm), Cr 8106; Tasman Bay, coll. M. Young, 11.3.4, 1 male (cl =

11 mm), 1 female (cl = 10.5 mm), 1 ovigerous female (cl = 13 mm), Cr 450; Tasman Bay, 5 mi E. Abel Head, 3.8.66, 44 m, 1 male (cl = 12.3 mm), Cr 9573; Cook Strait, trawling grounds 1956, 73 m, 3 males (cl = 10.5–19.5 mm), 1 female (cl = 8.5 mm), Cr 9574; Cook Strait, 41°31.5'S, 174°48'E, 19.1.56, 128–146 m, 1 male (cl = 21.3 mm), Cr 9575; South Bay, Kaikoura, 1–2.7.63, 55 m, 1 male (sl = 11.0 mm), Cr 7395; off Kaikoura, coll. F. Abernethy, –4.59, 7 males (cl = 14.5–22.5 mm), Cr 449; Blueskin Bay, 1.10.52, 18 m, 2 males (cl = 19.5, 21 mm), Cr 9576; Oamaru Harbour, coll. J. Graham, 1963, 4 males (sl = 7.3–9.9 mm), Cr 7391; Stn BS500, 1 female (sl = 6.5 mm), Cr 8207; Stn BS 505, 1 female (sl = 2.5 mm), Cr 7402; Stn BS 776, 1 female (sl = 5.9 mm), 1 ovigerous female (sl = 7.7 mm), Cr 8201.

MNHN collections: Cook Strait, H. Filhol coll. 1874, 4 females, MNHN Pg 5574.

NZMD collection: Haul 90, 1 female (cl = 10 mm), Cr 9577; Bay of Islands, north of Cape Brett, –9.1963, 18–165m, 1 male (cl = 15 mm), 2 females (cl = 5, 8.4 mm), 1 ovigerous female (cl = 9.6 mm), Cr 9578.

PMBS collections: Stn Mu 66–38, 2 males (cl = 16.4, 23.5 mm).

DESCRIPTION: Shield (Fig. 21a, b) barely shorter than posterior region of carapace, as broad or nearly as



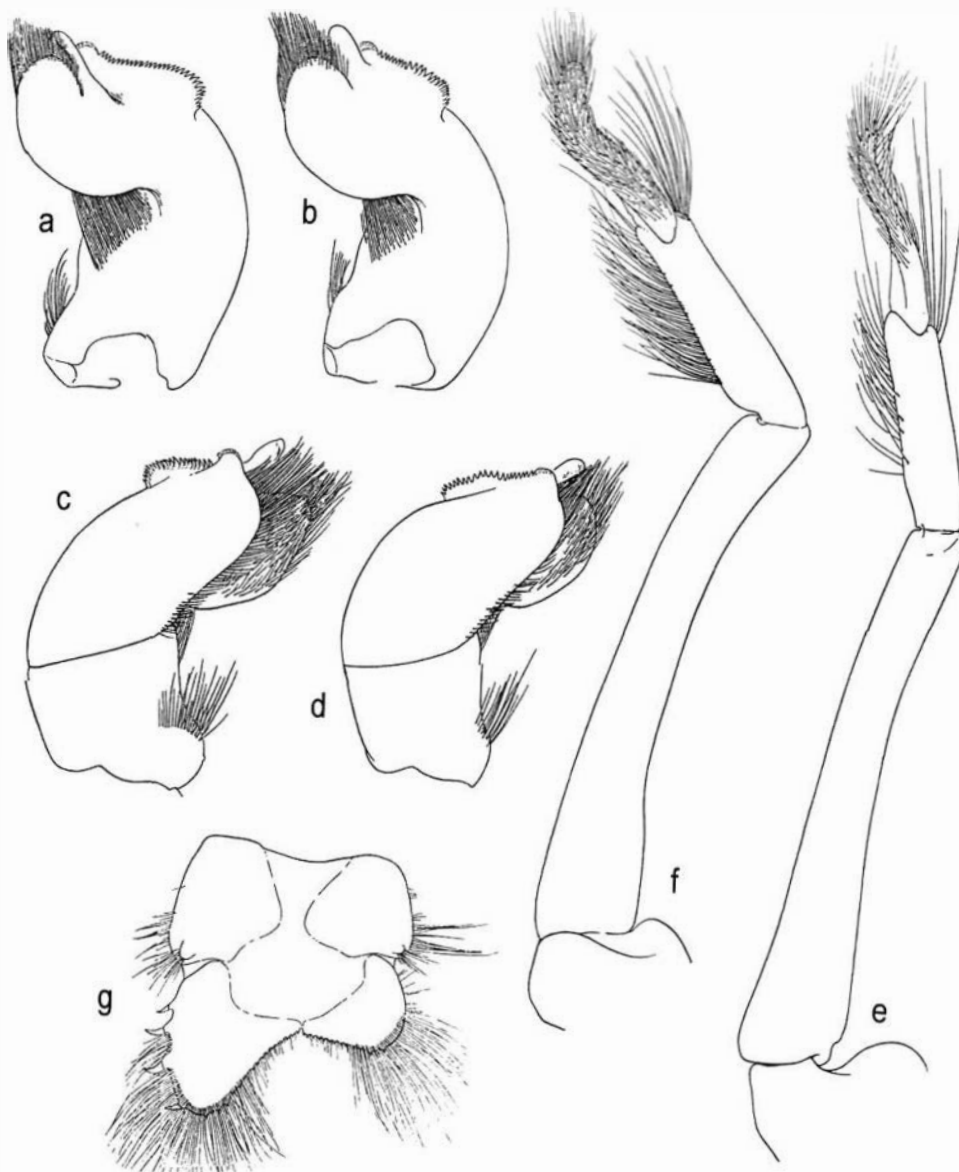


Fig. 23. a, c, e, g, *Paguristes pilosus* (H. Milne Edwards, 1836), Otago, male (cl = 23.5 mm); b, d, f, *Paguristes setosus* (H. Milne Edwards, 1848), b, d, f, NZOI Stn C765, male (cl = 19.5 mm): a, c, right first pleopod (anterior view); b, d, right first pleopod (posterior view); e, f, right second pleopod; g) telson. Magnifications equal 10x (g), 42x (b, d, f), 48x (a, c, e).

broad as long, with spiny tubercles anterolaterally. Rostrum triangular, rounded at apex, clearly reaching level of generally blunted lateral projections. Ocular peduncles slightly narrowed about midlength, minimum diameter 0.16–0.20 length; length 0.75–0.80 length of shield. Ocular acicles distally quite broad, with 1–3 teeth on inner margin in distal half. Antennular peduncles reaching beyond eyes by 0.35–0.50 length of ultimate segment. Antennal peduncles reaching to or slightly exceeding distal margins of corneas. Second segment with distomesial spinule, strongly developed laterodistal projection with 3–6 irregular, often blunted teeth. Antennal acicle strong, triangular, reaching proximal 0.25–0.33 of last segment, with 10–12 spiny denticles in row parallel to inner margin. Flagellum thick, with long setae ventrally, not quite twice length of shield.

Left cheliped much stronger than right. Merus tri-

hedral; inner face almost smooth, with transverse groove behind distal margin; ventral margin armed with corneous-tipped teeth; outer face with very depressed, setose tubercles, weakly protruded except triangular area of anteriorly directed, corneous-tipped tubercles near distal half of dorsal margin, and strong corneous-tipped spines near ventral margin. Carpus (Fig. 22a) with corneous-tipped tubercles covering outer face; some strong teeth on upper margin. Chela with outer face strongly sloping; maximum height of palmar region about 0.65 total length of the chela; lower margin lightly sinuous, feebly concave at base of fixed finger, then convex; outer face of palm swollen, that of fixed finger depressed. Dactyl with upper margin regularly convex, outer face faintly depressed. Entire chela covered with corneous-tipped tubercles, strongest on ventral and especially dorsal margins, smaller but denser on fixed finger, with some

smooth areas on dactyl.

Right cheliped shorter and much more slender than left. Carpus with row of 7–9 strong corneous teeth on inner margin of upper outer face and second parallel, but irregular row of spiny tubercles. Outer face of chela with sharp tubercles, much less dense than on left cheliped; 4 sharp teeth on dorsal margin of palm. Dactyl (Fig. 22b) with small, corneous tubercles over entire length of mesial face.

Ambulatory legs long and quite strong. Second pereopods with dactyls 1.50 times length of propodi. Carpi and propodi each with dorsal row of corneous teeth. Dactyls with corneous spinules on dorsal margins and distally on ventral margins. Right third pereopod like second in proportions and ornamentation, but dorsal teeth of carpus and propodus slightly weaker. Left third pereopod differing from right third and both second pereopods by variations in propodus and dactyl; each with enlarged outer face, faintly convex on propodus, concave on dactyl and both entirely covered by small corneous, spinulose tubercles, setation equally specific (see Pilosity).

Males with paired first pleopods (Fig. 23a, c) moderately short, massive. Distal segments strongly oblique in comparison with basal segments, thick, not laminar as in most *Paguristes*, but with homologous structures. In posterior view, “lame inférieure” (cf. Forest 1954: 164) with strongly convex surface, slightly longer than broad, bordered anteriorly by sinuous crest armed with comb of corneous teeth, fused distally into plate with convex free margin entire. Inner and distal lobes clearly visible when viewed from outer side and slightly from front; inner lobe relatively slender, broadly rounded and moderately curved to form large inner groove; digitiform distal lobe inserted between inner lobe and distal part of clearly shorter pectinate crest. Second male pleopods (Fig. 23e) as in other *Paguristes* species, with short basal segment, very elongated second segment, and two partially fused segments; distal segment with longitudinal torsion, partly covered with long setae; slightly longer preceding segment also with fringe of long setae on outer side and second transverse fringe behind partial articulation with distal segment. Following 3 unpaired left pleopods uniramous, rather strong. Females with paired, 2-segmented first pleopods; unpaired pleopods 2–4 each with 2 well-developed rami, fifth uniramous.

Posterior lobes of telson (Fig. 23g) triangular, with rounded apices, left produced much more than right; inner margins almost straight and forming very obtuse angle, armed with corneous spinules on inner halves, sometimes extending full length of margin and partially obscured by long setae; outer margin of left lobe usually with 4 strong corneous teeth.

**Pilosity:** General pilosity consists of plumose tufts not hiding ornamentation of integument except in certain regions where they are long and very dense. Setation also forms continuous covering on chelas, with only extremities of fingers visible. Only claw and narrow band of integument in distal region of dactyl visible between tufts of setae on swollen outer face of propodus and dactyl of left third pereopod.

**COLOUR:** In life, the ocular peduncles and antennules are whitish; antennal peduncles pale blue, flagella yellowish. The chelipeds are whitish at the base, pale orange at the extremity of the fingers. Ambulatory legs white, tinted with orange (Schembri & McLay 1983).

In alcohol, an overall creamy white or yellowish-white, with orange blotches on the shield and the base of the ocular and antennal peduncles, on the chelipeds and ambulatory legs.

**VARIATION:** Females are distinctly smaller than males; 62 males had carapace lengths measuring 5.5–23.5 mm, while 52 females measured 4.2–17 mm. The smallest female (sl = 2.5 mm, cl = 4.2 mm) was clearly immature. Although the gonopores were large and open, the paired first pleopods were represented only by developing rudiments; the unpaired second pleopod was biramous, but markedly smaller than any of the following three. Interestingly, this female also had a straight abdomen; however, the uropods were distinctly asymmetrical. Its protective covering is not known.

**REPRODUCTION:** Twenty-one ovigerous females were taken in September, October, and November, and one in January. The smallest had a carapace length of 9.5 mm. Eggs, numbering many hundreds, were small, approximately 400 µm in diameter.

**HABITAT:** *Paguristes pilosus* reportedly buries itself in the substratum, in the Otago region on the inner shelf, and mostly in very coarse sand (Schembri 1988).

**REMARKS:** As noted previously, *Paguristes pilosus* and closely allied *P. setosus* are distinct from most other species of the genus. A morphological comparison is presented in Table 2. Not only do the two species form a close morphological species pair, they share a generally common geographical distribution. Both species appear common around the North Island, both east and west coasts. In the South Island, both are found on the northeast coast, i.e., around Cook Strait. On the east coast *P. pilosus*, but not *P. setosus*, was present at many of the stations for which we had samples, as far south as Otago. Similarly, Schembri

**Table 2.** Principal distinctive characters observed in *Paguristes pilosus* and *P. setosus*.

	<i>Paguristes pilosus</i>	<i>Paguristes setosus</i>
OP/S length *	0.75–0.80	approximately 0.83
OP length /OP diameter*	5–6	6–7
Ocular acicles	somewhat broad, lateral margins subparallel, terminally multispinose, bifid in juveniles	triangular, with sharp distal point and often an accessory tooth, occasionally bifid
Distal segment of antennular peduncles overreach cornea by:	0.33–0.50 own length	0.25–0.33 own length
Antennal peduncles reach	at least to distal margin of corneas	to base of corneas
Laterodistal projection of 2nd peduncular segment	triangular, long, greatly surpassing dorsomesial spinule	more rounded, shorter, moderately surpassing dorsomesial spinule
Upper outer face of fingers of left chela	with some acute corneous-tipped tubercles	with some blunt, usually not corneous-tipped tubercles
Inner face of dactyl of right cheliped	with longitudinal area of corneous-tipped tubercles	with single row of tubercles parallel to upper margin
Pilosity of left chela	extending almost to tips of fingers	not covering fingers at least distally
<p>* Ratios</p> <p>OP length            length of ocular peduncles</p> <p>S length            length of shield</p> <p>OP diameter        diameter of ocular peduncles</p>		

Schembri and McLay (1983) recorded only *P. pilosus* from that region. However, Filhol (1885b) reported *P. setosus* from Stewart Island, (we have seen two specimens from his collection, for which the label mentions this locality). If these two specimens in fact, did come from Stewart Island, it is probable that the species will be found at other points in the southeast littoral of the South Island, because a discontinuity embodying the entire east coast of that island seems unlikely.

Despite their frequently common geographical range, the two species differ in their bathymetric distribution. *Paguristes setosus* has been collected occasionally in the intertidal zone but predominantly between 15 and 22 m. In contrast, *P. pilosus* has most often been collected between 20 m and 75 m, although some specimens have been found down to 200 m. There appears to be a very limited bathymetric zone, around 20 m, where they may coexist.

H. Milne Edwards' (1836) *Pagurus pilosus* was transferred to *Paguristes* by Dana (1852b). H. Filhol, in his "Catalogue of the Crustacea of New Zealand" (1885b: 424), identified as *Pagurus pilosus* a species

that he had encountered "from the north of New Zealand to the coasts of Stewart Island". This same author, in another paper dated 1885, probably edited after his initial writing of the Catalogue, returned to his identification with the following words: "J'avais d'abord à rapport, au *Pagurus pilosus* une espèce de Crustacé dont j'avais recueilli deux exemplaires dans le détroit de Cook. De nouvelles comparaisons m'ont montré que je m'étais trompé dans ce rapprochement et que la forme de Crustacé que j'avais trouvée était identique à un Pagure provenant également de Nouvelle Zélande et figurant sous le nom de *Pagurus setosus* dans les collections du Muséum de Paris." [I had first reported as *Pagurus pilosus* a species of Crustacea of which I collected two specimens in Cook Strait. New comparisons show me that I was deceiving myself in this identification and that the form of Crustacea that I found was identical to a pagurid also found in New Zealand and occurring under the name *Pagurus setosus* in the collections of the Paris Museum.] These same remarks, but with the insertion of his figure notation (Filhol 1885d: 490, pl. XLIX), appear under *Pagurus setosus* in an addendum to the



## Catalogue.

Henderson (1888: 77) recorded a specimen of *Paguristes pilosus* taken by the *Challenger* at Stn 167A in Queen Charlotte Sound at about 18 m depth. Henderson ignored the presence of a second New Zealand species closely related to *P. pilosus* and it might be presumed from the collection depth that his specimen was in fact *P. setosus*. This was confirmed by examination of the *Challenger* specimen in the Natural History Museum.

Chilton (1906: 267) identified several specimens from Channel Island, Hauraki Gulf, as *Stratiotes setosus*. These specimens, taken at a depth of 45 m, are very probably *Paguristes pilosus*, since *P. setosus* has never been collected with certainty in depths of more than 24 m.

**RECORDS FROM NEW ZEALAND:** North Island and north and east coasts of the South Island (from Cape Farewell to Otago). Depth range 15–201 m, with the great majority collected between 20 and 75 m.

**DISTRIBUTION:** Endemic to New Zealand.

### *Paguristes setosus* (H. Milne Edwards, 1848)

(Figs 22c, d, 23b, d, f, 24, Pl. 1, fig. 3)

*Pagurus setosus* H. Milne Edwards, 1848: 64; Filhol 1885b: 34; 1885d: 490; 1885e: pl. 49, figs 5–7.

*Paguristes setosus*: Stimpson, 1858: 236 (list) Alcock, 1905b: 156 (list).

*Pagurus pilosus*: Filhol 1885d: 424 [not *Pagurus pilosus* H. Milne Edwards, 1836].

*Stratiotes setosus* Thomson, 1899: 185, pl. 21, figs 4–6; Alcock 1905b: 167 (list); Thompson 1930: 267; Zarenkov 1964: 9; 1968: 194; Greenwood 1972a: 328.

*Paguristes pilosus*: Henderson 1888: 77 [not *Paguristes pilosus* (H. Milne Edwards, 1838)].

*Paguristes setosus*: Alcock, 1905b: 156 (list).

[Not *Paguristes setosus*: Ortmann 1892: 280, pl. 12, fig. 9; Yokoya 1933: 76; Makarov 1938: 167, fig. 67; 1962: 158, fig. 67; see Remarks].

[Not *Paguristes setosus*: Miyake 1978: 28, fig. 8 = *Paguristes miyakei* Forest & McLaughlin, 1998.]

#### TYPES:

Lectotype, herein selected, ovigerous female (cl = 10.5 mm), Quoy & Gaimard collection, MNHN Pg 5567.

Paralectotype: male (cl = 6.5 mm), MNHN Pg 5568.

**TYPE LOCALITY:** New Zealand.

#### OTHER MATERIAL EXAMINED:

NZOI Stns: B542, 1 male (cl = 17 mm), 1 specimen in poor condition; B651, 4 males (cl = 10.5–15 mm), 1 female

(cl = 9.5 mm), 8 ovigerous females (cl = 9–13 mm); B661, 5 males (cl = 6–18.5 mm), 4 females (cl = 6–8.5 mm), 3 ovigerous females (cl = 7.5–12 mm); B662, 8 males (cl = 7–18.5 mm), 8 females (cl = 6–10.5 mm), 1 ovigerous female (cl = 11 mm); B663, 8 males (cl = 7.5–17.5 mm), 5 females (cl = 8–10.5 mm); B667, 3 males (cl = 7–10 mm), 2 ovigerous females (cl = 5.5, 6.5 mm); B671, 1 female (cl = 6.6 mm) + 1 specimen in poor condition; C754, 1 female (cl = 4 mm); C765, 1 male (cl = 19.5 mm), + 10 males (cl = 10.5–18 mm); C768, 1 male (cl = 6 mm); C773, 1 male (cl = 10 mm).

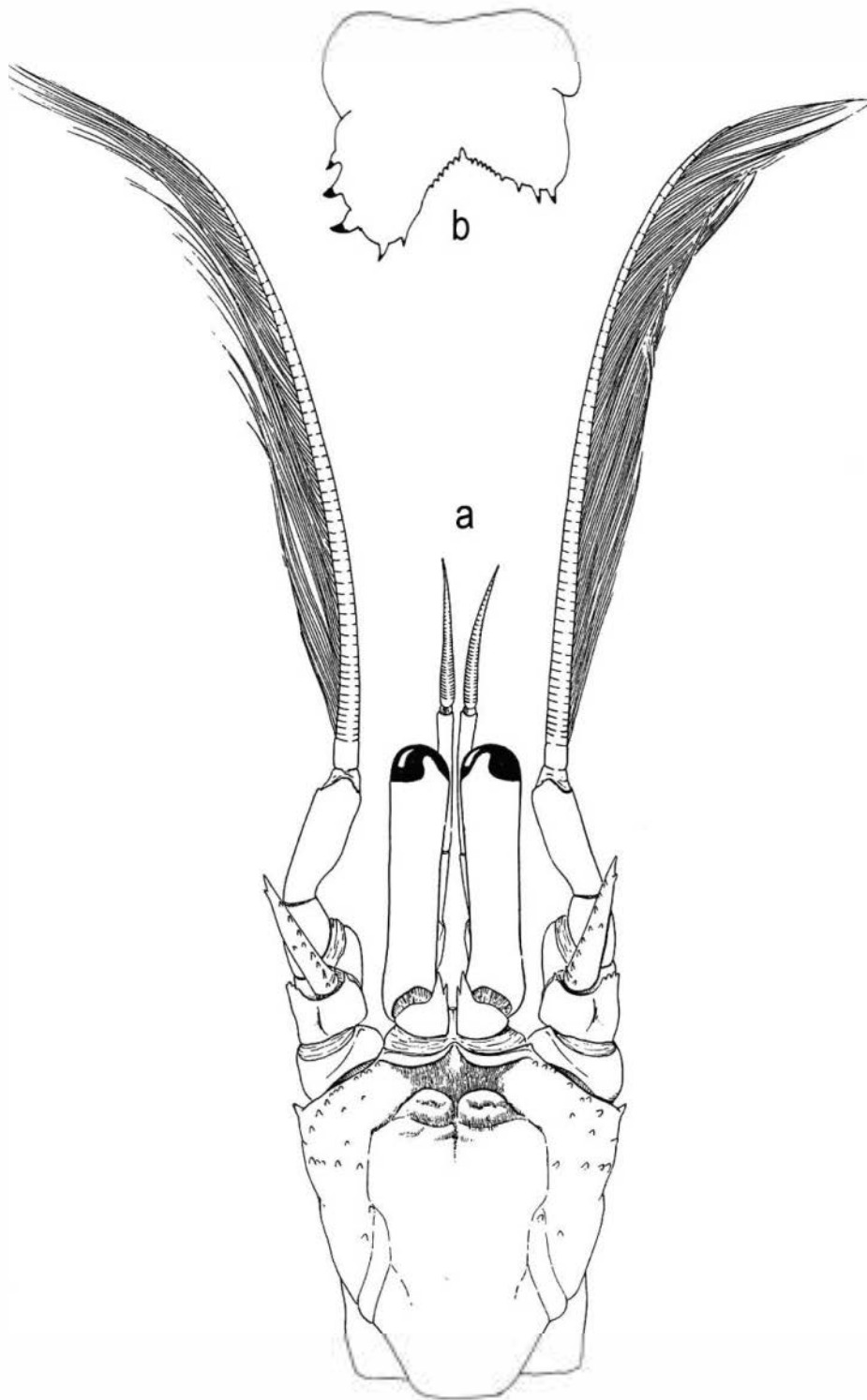
**NMNZ collections:** Doubtless Bay, Northland, coll. J.H. Chapman, 16.6.58, 16.5 m, 1 male (cl = 20 mm), Cr 9597; Tauranga, Mt. Maunganui, coll. W.R.B. Oliver, 24.8.20, from sandy beach, 1 male (cl = 19.5 mm), Cr 9580; Tasman Bay, coll. M. Young, 11.34, 2 males (cl = 11.5–20.5 mm), Cr 9791; off Days Bay, Wellington Harbour, 19.1.53, 3 m, 4 males (14.5–25 mm), 3 females (cl = 12–14.5 mm), Cr 447; Shelly Bay, Wellington Harbour, coll. J. Moreland, 28.6.53, shore net, 1 female (cl = 11 mm), Cr 9581; Wellington Harbour, trawled off Petone, coll. W.R.B. Oliver, 1.6.13, 2 males (cl = 22–25.5 mm), Cr 9582; Stn BS 408, 1 male (sl = 7.4 mm), Cr 7580; Stn BS 539, 1 ovigerous female (sl = 2.4 mm), Cr 8172; Stn BS 540, 5 males (sl = 5.0–6.7 mm), 1 female (sl = 5.1 mm), Cr 8171.

**MNHN collections:** Cook Strait, H. Filhol collection (identified as *P. pilosus* by Filhol), 1 ovigerous female (cl = 13 mm), MNHN Pg 5569; Cook Strait, Filhol collection, 23 males (cl = 9.9–24.4 mm); 16 females (cl = 10–18 mm) MNHN Pg 5570; Stewart Island, Filhol collection (identified as *P. pilosus* by Bouvier), 2 females (cl = 11.5, 15 mm), MNHN Pg 5571.

**NZDC collections:** Queen Charlotte Sound, coll. C. Duffy, 20.10.89, 15 m, 1 male (sl = 5.4 mm), Cr 54; Beatrix Bay, Marlborough Sound, coll. C. Duffy, 15.1.90, 1 male (sl = 7.6 mm), Cr 53.

**PMcL collection:** Greater Omaha Bay: Stn A59, 1 male, 8 juveniles (sl = 1.3–3.2 mm); Stn A66, 2 males, 1 female (sl = 7.9–11.0 mm); Stn A110, 1 male, 2 females, 3 juveniles (sl = 1.0–2.7 mm); Stn C22, 1 male, 2 females, 2 ovigerous, 1 juvenile (sl = 1.2–4.5 mm); Iwi-roa Point, Queen Charlotte Sound, coll. C. Duffy, 11.9.89, 11 m, 1 male (sl = 10.2 mm); Jag Rocks, Cook Strait, coll. C. Duffy, 3.3.90, 41 m, 1 male (sl = 8.2 mm).

**DESCRIPTION:** Shield (Fig. 24a) slightly shorter than posterior region of carapace: width 0.90 length; with spiny tubercles anterolaterally. Rostrum triangular, apex rounded; extending slightly beyond level of lateral projections. Ocular peduncles slightly narrowed at midlength; minimum diameter 0.12–0.14 length, total length 0.83 shield. Ocular acicles narrow distally, terminally uni- (most frequently small specimens) or bidentate, usually with accessory tooth on inner margin. Antennular peducles overreaching corneas by 0.25–0.33 length of ultimate segment. Antennal peducles reaching or almost reaching bases of corneas. Second segment with distomesial denticle or spinule, laterodistal projection armed with few, often blunted denticles. Antennal



**Fig. 24.** *Paguristes setosus* (H. Milne Edwards, 1848), NZOI Stn C765, male (cl = 19.5 mm); b, Off Days Bay, Wellington Harbour, male (cl = 23 mm): a, shield and cephalic appendages (aesthetascs omitted); b, telson (setae omitted). Magnifications equal 9x (b), 11x (a).

acicle strong, elongate, tapering, extending to proximal 0.25–0.33 of last segment; dorsal surface with about 10 denticles, most in row parallel with inner margin. Flagella thick, clearly twice as long as shield, furnished ventrally with long setae.

Chelipeds similar to those of *P. pilosus* in proportions and ornamentation. Left cheliped much stronger than right. Merus trihedral; inner face almost smooth, with transverse groove behind distal margin; ventral margin armed with corneous-tipped tubercles; outer face with few tubercles near upper margin and spinose distal margin, anteriorly directed, corneous tubercles or teeth on distal half of dorsal margin; ventral margins and surface with weak to strong corneous-tipped teeth or tubercles. Carpus (Fig. 22c) with corneous-tipped tubercles covering outer face; several stronger spines on upper margin. Chela with outer face convex; maximum height of palmar region 0.65–0.80 total length of chela; lower margin straight or somewhat convex, usually weakly to strongly concave at base of fixed finger, then straight or weakly convex; outer face of palm swollen, that of fixed finger weakly depressed. Dactyl with upper margin regularly convex, outer face rounded or faintly depressed. Entire chela covered with flattened or corneous-tipped tubercles, strongest on upper margins, those of palm frequently at least partially obscured by tufts of long setae.

Right cheliped shorter and much more slender than left. Carpus with row of 5–8 strong corneous-tipped teeth on inner margin of upper outer face and second parallel but irregular row of spinulose tubercles. Outer face of chela with sharp tubercles, much less dense than on left and completely obscured by long setae; 4 or 5 sharp spines on dorsal margin of the palm. Dactyl (Fig. 22d) with depressed mesial face, oriented towards sagittal plane of animal, with smooth, unarmed median longitudinal area flanked by row of corneous-tipped denticles above and row of tufts of setose processes below.

Ambulatory legs long and quite strong. Second pereopods with dactyls 1.30–1.50 times length of propodi. Carpi and propodi each with dorsal row of corneous teeth. Dactyls each with corneous spinules on dorsal and ventral margins.

Pleopods as in *P. pilosus*. Male first (Fig. 23b, d) and second (Fig. 23f) pairs without distinguishing characteristics.

Telson (Fig. 24b) as in *P. pilosus*, but usually with few strong spines on outer margin of left posterior lobe.

Pilosity: Pilosity similar to *P. pilosus*; however, that of left cheliped does not cover entire length of dactyl and fixed finger, and occasionally may be missing from considerable part of palm as well in largest

specimens.

**COLOUR:** In alcohol, like *P. pilosus*, the overall colour being creamy-white or yellowish-white with numerous red-orange patches. A longitudinal dorsal red stripe is frequently visible over most of the length of the ocular peduncles.

**VARIATIONS:** *Paguristes setosus* and *P. pilosus* share a number of primary characters. The form, proportions, and ornamentation of the various regions of the body and appendages differ little. Likewise, their pilosity is very similar, which undoubtedly has contributed to much confusion in the literature over their identities. It has only been through our examinations of the type specimens that we have been able to accurately define the two taxa. Despite their general similarities, and the considerable variation exhibited by certain characters, we have found others that permit more reliable and precise identification.

The main differentiating characters presented in Table 2 apply well to most specimens; however, length ratios are not as reliable among small individuals. Unquestionably, the differences in armature of the mesial faces of the dactyls of the right chelipeds provide the most dependable character for species recognition.

We have not been able to find any significant specific differences in the form of the chelipeds nor in the proportions of the segments, as there is considerable intraspecific variation, especially with respect to length. The largest individuals have more elongated left hands, the lower margins of which tend to be concave instead of straight or lightly convex. However, as may be seen in Table 2, the cheliped ornamentation provides relatively distinctive characteristics. The tubercles are a little stronger and sharper in *P. pilosus*, particularly on the upper outer face of the fingers of the left cheliped and on the inner median face of the dactyl of the right cheliped. On the left cheliped, the fixed finger is covered with sharp corneous-tipped tubercles in *P. pilosus*; in *P. setosus* the homologous tubercles are almost all blunt and lack corneous tips.

As previously noted, the right cheliped provides the most diagnostic character. *Paguristes pilosus* has numerous small corneous or corneous-tipped tubercles disposed in a large elongated area on the inner face of the dactyl; in *P. setosus* this face is centrally smooth, flanked by only a single row of well-spaced tubercles parallel to the upper margin and a row of tufts of setae parallel to the ventral margin. Another diagnostic character that can be used to separate the two taxa is pilosity. Although it is generally similar in the two species, the fingers of the chelipeds,



particularly the left, are completely covered in *P. pilosus*; in *P. setosus* at least the distal halves of the fingers are naked, and in some large specimens even the majority of the palm may similarly lack dense setae. This phenomenon appears related to the development of the tubercles: in *P. pilosus* setation extends as far as the claw and protects and, as a general rule, partly or completely hides the sharp corneous points of these characteristic tubercles. In *P. setosus*, the denuded part is that on which the tubercles are blunted and lack corneous tips.

Clearly, *Paguristes pilosus* and *P. setosus* are closely related and distinguished from most other species of the genus by the strong asymmetry of the chelipeds. There is also, probably in relation to heterochely, strong torsion of the chelas, with the fingers opening in a very oblique plane, not in the horizontal plane seen in *Paguristes* species with equal or only slightly subequal chelipeds. In addition, the left third pereopods show a differentiation comparable to that found in certain other Diogenidae, notably *Dardanus*, in which the left is usually much more developed than the right. Finally, the paired first pleopods of the male, while generally comparable to those of other *Paguristes* species, are distinguished by their shortness and their massive form.

It was the disposition of the chelas and the general appearance, reminiscent of certain *Diogenes* species that led Thomson (1899) to establish the genus *Stratiotes* for "*Pagurus setosus*" of Filhol (1885b). Thomson (1899) distinguished *Stratiotes* from Dana's genus by the absence of an unpaired, movable, interocular sclerite, but Thomson, like Filhol (1885b), had overlooked the presence of paired first and second pleopods in the male, and the form of the tip of the fourth pereopod, which is not semichelate. It is these characters that precisely separate *Paguristes* from other Diogenidae.

In view of the heterochely of the chelipeds, should we consider separating *P. setosus* and *P. pilosus* from other *Paguristes*, retaining for them the genus *Stratiotes* (in which case the diagnosis should be completed and corrected)? We do not think so, for although homochely is usual in *Paguristes*, it is not universal. In *Paguristes eremita* (Linnaeus, 1767) from the eastern Atlantic and *P. balanophilus* (Alcock, 1905b) from the Indian Ocean the right cheliped is clearly weaker than the left. *Paguristes frontalis* (H. Milne Edwards, 1836), *P. tuberculatus* Whitelegge, 1900, *P. purpureantennatus* Morgan, 1987, and *P. kimberleyensis* Morgan & Forest, 1991, all from Australia, exhibit even stronger asymmetry of the chela. However, if *P. eremita* and *P. balanophilus* are similar in this regard, these two species have numerous characters, very far removed from the *P. pilosus*-*P. setosus* pair and, apart from

heterochely, the Australian species have few points in common with either of these two groups.

**MEASUREMENTS:** The 86 males examined measured from 6 to 25.5 mm in carapace length and the 62 females from 4 to 18 mm. The difference in length between the two sexes is particularly marked in this species. For example, the sample from Cook Strait in Filhol's collection contains 23 males of which nine are 20 mm or greater, whereas the largest of the 16 females is 18 mm. Comparable differences are seen in the other samples we examined. The smallest specimens, all juveniles, had shield lengths of less than 2.5 mm. In this species, shield length is slightly less to slightly more than half the total carapace length. Although, like immature females of *P. pilosus*, paired first pleopods either had not begun to develop or were only rudimentary in *P. setosus* juveniles, the unpaired left second pleopod was appreciably better developed, in some cases nearly equaling the length of the following pleopods.

**REPRODUCTION:** Fourteen ovigerous females were taken in October, the smallest measuring 7.5 mm in carapace length. The eggs, numbering many hundreds, as in *P. pilosus*, are also small, about 400  $\mu$ m in diameter. One additional ovigerous female with shield length of 2.4 mm (cl = 4.1) was collected in January, and two slightly larger ovigerous females were collected in May.

**HABITAT:** *Paguristes setosus* has been reported from shelly sand and shell-gravel substrates. The similarities that are seen between Greenwood's (1972a) report of the mouthpart morphology and feeding in this species and that reported by Schembri (1982b) for *P. pilosus*, are indicative of the similar type of habitat of the two species.

**REMARKS:** *Paguristes setosus* and *P. pilosus*, both described by H. Milne Edwards (as *Pagurus*) would not have been the subject of such errors and confusion as are apparent from the synonymies, if the original description of one of them had not been compromised by an unfortunate *lapsus calami*. H. Milne Edwards (1836: 282, pl. 14, fig. 1) described *Pagurus pilosus*, from New Zealand, including it in the "subgenus" of appendiculate pagurids. Of the specimens seen by that author, including at least one female, only three males remain; the label which accompanies them specifies that it is type material and states, as provenance: "Nouvelle Zélande, Quoy et Gaimard". There are three males, one 18 mm and the other two 20 mm in carapace length. The lengths are clearly similar and correspond to the size (total body length) indicated

in the original description of 3 “pouces”. From these syntypes, all in good condition, we have chosen one of those measuring 20 mm as lectotype. Milne Edwards’s description is somewhat succinct but the illustrations are satisfactory and show the characteristic details.

The description was reproduced in H. Milne Edwards’ “Histoire Naturelle des Crustacés” (1837: 233). White and Doubleday, in Dieffenbach’s work on New Zealand (1843: 266), also cited *Pagurus pilosus*. In 1848 (p. 64) H. Milne Edwards described *Pagurus setosus* in the following terms: “Espèce très voisine de *P. pilosus* mais ayant les mains beaucoup moins velues et les pattes de la troisième pair plus grêles. Couleur jaune-rougeâtre. Longueur, environ 1 ponce. De la Nouvelle-Guinée, par MM. Quoy et Gaimard”. In the Paris Museum we found a sample, the original label of which is characteristic of H. Milne Edwards’ collection, and it reads “*Pagurus setosus*, Nelle-Zélande, Quoy et Gaimard”. There is every reason to believe that this label refers to the syntypes of the species. In fact, the largest, an ovigerous female with a carapace of 10.5 mm, which we have designated as lectotype, has a total body length corresponding to the “environ 1 ponce” given by H. Milne Edwards. Furthermore, the specimens clearly belong to *P. setosus* and are distinct from the closely related *P. pilosus*. The locality given on the label then is accurate; the locality given by H. Milne Edwards (1848: 64) is clearly a *lapsus calami*; it should have read, “New Zealand”, not “New Guinea”.

Stimpson (1858: 236) listed both of Milne Edwards’ (1836, 1848) species and, following Dana’s (1852b) transfer of *Pagurus pilosus* to *Paguristes*, also placed *P. setosus* in that genus. Miers, in his “Catalogue of the Crustacea of New Zealand” (1876b: 66), simply translated the original description of *P. pilosus*, noting that he had not seen this species. He retained the species in *Pagurus*, thus unwittingly placing it in the genus *Pagurus* (sensu Dana, i.e., = *Dardanus* Paul’son), although the description that he reproduced contradicted the generic diagnosis that preceded it.

As noted under *P. pilosus*, Filhol (1885b) originally identified two specimens from Cook Strait as that species. When he examined specimens in the Paris Museum identified as H. Milne Edwards’ *Pagurus setosus*, he was of the impression that the description of the species had never been published. Consequently, Filhol (1885b: 34; 1885d: 490) used the name *Pagurus setosus* in a brief description of the species and *Pagurus setosus* (H.F.) in the legend to the plates accompanying the Catalogue (1885e: 27, pl. 49, figs 5-7); however, in his list of species and their distributions (p. 496) he included both “*Pagurus pilosus* (H. M. Edw)” from the “Île du Nord”, “Île du Milieu” and “Île Stewart”, and

“*Pagurus setosus* (Filh)” from “Île du Milieu”. As a result, there was a *Pagurus setosus* H. Milne Edwards (1848) and a *Pagurus setosus* Filhol, which were at the same time homonyms and synonyms. It is the second of these species that has been referred to by authors who have subsequently published on the pagurids of New Zealand.

It should be noted that the specimens seen by Filhol are in the MNHM collections and identifiable as *Paguristes setosus* (H. Milne Edwards) but they are all labelled *Pagurus pilosus*, the name corresponding to their first identification. The figures of *Pagurus setosus* that Filhol published (loc. cit., pl. 49, figs 5-7) are all quite inaccurate; this is especially true of the left cheliped, even if account is taken of the fact that it is clearly inverted. Nothing in Filhol’s figures allows a useful comparison to be made with the much more accurate illustration accompanying the original description of *Pagurus pilosus* of H. Milne Edwards (1836: pl. 14, fig. 1).

Thomson (1899), in his revision of the Anomura of New Zealand, identified as *Pagurus setosus* Filhol, pagurids from Wellington, Lyttelton, and Cook Strait; he redescribed this species under the name *Stratiotes setosus* nov. sp., naming it as the type of his new genus *Stratiotes* (loc. cit., p. 185, pl. 21, figs 4-6). Thomson did not comment, any more than Filhol had, on the paired pleopods, nor did he associate the new genus with *Paguristes*, but rather with *Diogenes*. He did not establish any relationship between *Stratiotes setosus* (Filhol) and *Paguristes pilosus* which he also recorded on the authority of H. Milne Edwards, as cited by Miers (1876b) and Henderson (1888).

Thomson’s (1899) description, although more detailed than that of Filhol, is generally as applicable to *Paguristes pilosus* as to *P. setosus*. With respect to *P. setosus*, Thomson wrote “Peduncle of the antennae not reaching to the end of the ocular peduncles”. This is precisely one of the characters that distinguishes *setosus* from *pilosus*; but Thomson’s figure of the anterior region of the body (loc. cit., pl. 21, fig. 4) shows the antennal peduncles clearly extending beyond the eyes. We presume that this is a drawing error.

Alcock (1905b: 167) cast doubt on the position and validity of the genus *Stratiotes*, but from Thomson’s (1899) insufficient diagnosis, Alcock (1905b) envisaged a possible synonymy with *Troglopagurus* Henderson, 1893. Indeed, according to Thomson, the character distinguishing *Stratiotes* from *Diogenes* was the absence of the movable unpaired interocular sclerite; it is this absence upon which the distinction between *Troglopagurus* and *Diogenes* was founded.

As previously indicated, Chilton’s (1906: 267) identification of several specimens from Channel Island, Hauraki Gulf, as *Stratiotes setosus* probably are



*P. pilosus* since they were collected at a depth of 45 m.

Thompson (1930: 267) examined 120 specimens which he identified as *Stratiotes setosus* Thomson, although he noted that all of his specimens, while showing little variation, differed from Thomson's figures, particularly in the form of the left cheliped. While Thompson (1930) considered that the fingers in Thomson's (1899, fig. 6) figure were too long compared with the palmar region, Thompson (1930) believed that his identification was correct because of the several points of agreement between his specimens and Thomson's (1899) description. On the other hand, Thompson (1930) considered the identification of *Stratiotes setosus* by Thomson as *Pagurus setosus* of Filhol (1885b, d) "extremely doubtful", because Filhol's illustration differed "radically" from that of Thomson's (1899). Despite his doubts, Thompson (1930) concluded that if the identity of Filhol's *Pagurus setosus* proved to be synonymous with *Stratiotes setosus* Thomson, both might be, as Alcock (1905b) had suggested, synonymous with *Pagurus setosus* of H. Milne Edwards, although Alcock reported the taxon as *Paguristes setosus*. It should be noted, however, that both Thomson (1899) and Thompson (1930) ignored the fact that there was another species in New Zealand waters that was very close to *P. setosus*. Thomson properly cited *Paguristes pilosus*, following H. Milne Edwards (1836) and Henderson (1888), but did not establish any relationship between that species and *Stratiotes setosus*. Thompson (1930) did not mention *P. pilosus*. Consequently, it is possible that they had both confused the two species and identified at least some specimens of *P. pilosus* as *P. setosus*. Thompson (1930), in disagreeing with Alcock (1905b) on a possible synonymy between *Troglopagurus* and *Stratiotes*, and in noting the presence of paired pleopods, more correctly associated *Stratiotes* with *Paguristes*.

Certain authors, possibly influenced by the incorrect locality assigned to *Paguristes setosus* in the original description, have identified specimens from the Japanese region as H. Milne Edwards' (1848) taxon. As pointed out by Forest and McLaughlin (1998), Ortmann (1892) recorded *P. setosus* from Sagami Bay, Japan, indicating that he had chosen this species over *P. pilosus* because the chelipeds were less setose and the third pereopods more slender, as indicated by H. Milne Edwards (1848) in his original description. Ortmann's (1892: 28, pl. 12, fig. 9) description of a species having similar chelipeds clearly does not refer to *P. setosus*; his very diagrammatic figure illustrates only the shield and cephalic appendages. Yokoya (1933) reported *P. setosus* from several Japanese localities but provided only a reference to Ortmann's description and figure. Similarly Makarov

(1938, 1962) paraphrased Ortmann's description and reproduced his illustration (Makarov 1938: 167, fig. 67; 1962: 158, fig. 67), but indicated that he had no personal knowledge of the species.

Miyake (1978: 27, fig. 8) presented a relatively detailed description of a species he referred to as *Paguristes setosus* H. Milne Edwards, 1848 from New Guinea, and included the localities reported by Ortmann (1892) and Yokoya (1933). Forest and McLaughlin (1998) reexamined four of Miyake's (1978) specimens and found two species represented. Three of the four specimens generally agreed with Miyake's description of *P. setosus*, and these were described as *Paguristes miyakei* Forest & McLaughlin, 1998. These authors thought that Miyake's (1978, No. 84) fourth specimen, representing another species of *Paguristes*, conceivably might be Ortmann's *P. setosus*; however, without examining Ortmann's material, they were unable to conclusively identify the specimen.

**RECORDS FROM NEW ZEALAND:** North Island (west and northeast coasts), South Island (Cook Strait), Stewart Island (see remarks). Depth range from the intertidal zone to 24 m, but most specimens were collected between the very narrow bathymetric limits of 15–22 m.

**DISTRIBUTION:** Endemic to New Zealand.

### *Calcinus* Dana, 1851

*Cancer* Linnaeus, 1758: 625 (in part); Herbst, 1791: 1 (in part).  
*Pagurus* Fabricius, 1775: 410 (in part); H. Milne Edwards 1836: 236 (in part); 1837: 213 (in part); 1848: 59 (in part); Nicolet 1849: 186 (in part).  
*Calcinus* Dana, 1851: 268; 1852c: 456; Stimpson 1858: 234; 1907: 207; Haswell 1882: 158; Henderson 1888: 61; Chevreux & Bouvier 1892: 126; Ortmann 1892: 292; 1898: 1146; Borradaile, 1898: 460; Young 1900: 361; Alcock 1905b: 51; Nobili 1906: 117; Balss 1912: 93; Stebbing 1914: 278; Yap-Chiongco 1938: 204; Zariquiey Alvarez 1946: 112; Barnard 1950: 436; Fize & Serène 1955: 38; Zariquiey Alvarez 1968: 240; Miyake & Imafuku 1980: 4; Wooster 1984: 125; Morgan 1991b: 870; Asakura 1995: 355.

**TYPE SPECIES:** *Cancer tibicen* Herbst, 1791 by subsequent designation by Dana 1852b: 122. Genus masculine.

Thirteen pairs of biserial gills, arthrobranchs on third maxillipeds, chelipeds and pereopods 2–4; and pleurobranchs on thoracic somites 5–7 (above pereopods 2–4). Shield usually with lines of decalcification forming distinct "Y" posteriorly. Rostrum small. Ocular peduncles elongate; ocular acicles slender. Third maxillipeds with well-developed crista dentata; accessory tooth absent.



Left cheliped markedly larger than right; fingers moving obliquely, finger tips calcareous. Carpus of left cheliped with prominent tubercle on dorsolateral surface. Ambulatory legs with little spination; setation light.

Tergite of sixth abdominal segment usually well calcified and divided into anterior and posterior lobes by transverse suture. Telson with transverse indentation indicating anterior and posterior portions; posterior lobes separated by median cleft. Males and females both with 4 unpaired biramous left pleopods.

*Calcinus imperialis* Whitelegge, 1901 (Fig. 25)

*Calcinus imperialis* Whitelegge, 1901: 48, pl. 9; Grant & McCulloch 1907: 154; Chilton 1911b: 552; Morgan 1991b: 882, figs 21–23; Tudge 1995: 11, pl. 1, fig. F; Poupin 1996: 14; 1997: 697, figs 3F, 5C, 7D.

[Not *Calcinus imperialis*: Wooster, 1984: 130, = *Calcinus isabellae* Poupin, 1997.]

Types: Australian Museum (not seen).

Type Locality: Lord Howe Island.

MATERIAL EXAMINED:

MCC collections: Meyer Island, Kermadec Is., coll. W.R.B. Oliver, 1908, 5 males (sl = 4.9–10.3 mm), 1 female (sl = 7.3 mm), MCC, AQ 3196.

DESCRIPTION: Shield (Fig. 25a) longer than broad. Rostrum triangular, usually produced well beyond level of very weak lateral projections. Ocular peduncles slightly shorter to longer than shield, slender; acicles simple. Antennular peduncles reaching or nearly reaching to bases of corneas. Antennal peduncles reaching slightly to considerably beyond midlength of ocular peduncles. Antennal acicles short, reaching to or just beyond distal margin of fourth peduncular segment.

Outer face of palm of left cheliped (Fig. 25b) weakly granular or with distinct circular or ovate, flattened tubercles, and with 2 or 3 circular or subcircular depressions; acute, subacute or blunt tubercles, widely spaced in horizontal row proximally and sometimes near lower proximal angle; upper margin with 5 acute to very blunt teeth, lower margin of palm and fixed finger denticulate and somewhat carinate. Carpus with 2 or 3 acute or subacute teeth on upper margin, outer face and outer distal margin with several acute or blunt tubercles. Right cheliped with 5 corneous-tipped teeth on upper margin of palm, outer face with a row of widely spaced tubercles in upper half, lower half tuberculate. Ambulatory legs with setae of third

pereopods (Fig. 25c) distinctly stronger than on second. Dactyls of third 0.6–0.9 length of propodi; dactyls and distal margins of propodi each with tufts of long plumose setae forming dense brush, ventral margins with few corneous spines. Carpi each with dorsodistal spine, second pereopods usually with additional small spine on laterodistal margin dorsally.

Telson (Fig. 25d) with one spine on each terminal margin, sometimes absent on right.

COLOUR: Anterior region of carapace olive or olive-green, spotted and margined anteriorly with blue-violet or azure blue. Ocular peduncles olive-green. Antennular peduncles and flagella yellow or greenish-yellow. Antennal peduncles and flagella yellow or chlorine yellow. Palms of chelipeds brownish-grey or light olive, spines purplish-blue or blue-violet. Dactyl with two deep-red spots, one on each side near base; carpi and meri maroon-green, punctuated with blue-violet on tubercles and teeth particularly large tubercles and teeth of carpi. Ambulatory legs ringed with black or brown, olive-green and light yellow, with articulating margins orange. Dactyls white with median black or brown ring; propodi with proximal olive-green ring, median black or dark-brown ring, and distal ring of pale yellow or yellowish-white; carpi with broad proximal black or dark-brown ring and small, distal, pale yellow ring; meri of second pereopods with proximal olive-green ring and distal black ring; meri of third pereopods similar but with black ring interrupted on lateral face (after Whitelegge 1901; Poupin 1997).

HABITAT: Coral and coral rubble.

REMARKS: Despite having been in preservative for 90 years, some of the Kermadec specimens that Chilton (1911b) identified still show very clear colour patterns. *Calcinus imperialis* most closely resembles *C. isabellae* Poupin, 1997 in having simple ocular acicles, single spines on each terminal telsonal margin, and similar patterns of coloured rings on the ambulatory legs, although the actual colours differ somewhat. However, the two species are readily distinguished by the left chelas. Whereas the outer face of *C. imperialis* is marked by two or three circular or subcircular depressions, only a single longitudinal depression is present in *C. isabellae*.

RECORDS FROM NEW ZEALAND: Kermadec Islands; 7–30 m.

DISTRIBUTION: Cocos (Keeling) and Christmas Islands; Philippine Islands; Japan; southeastern Australia; Lord Howe and Norfolk Islands; Kermadec Islands;

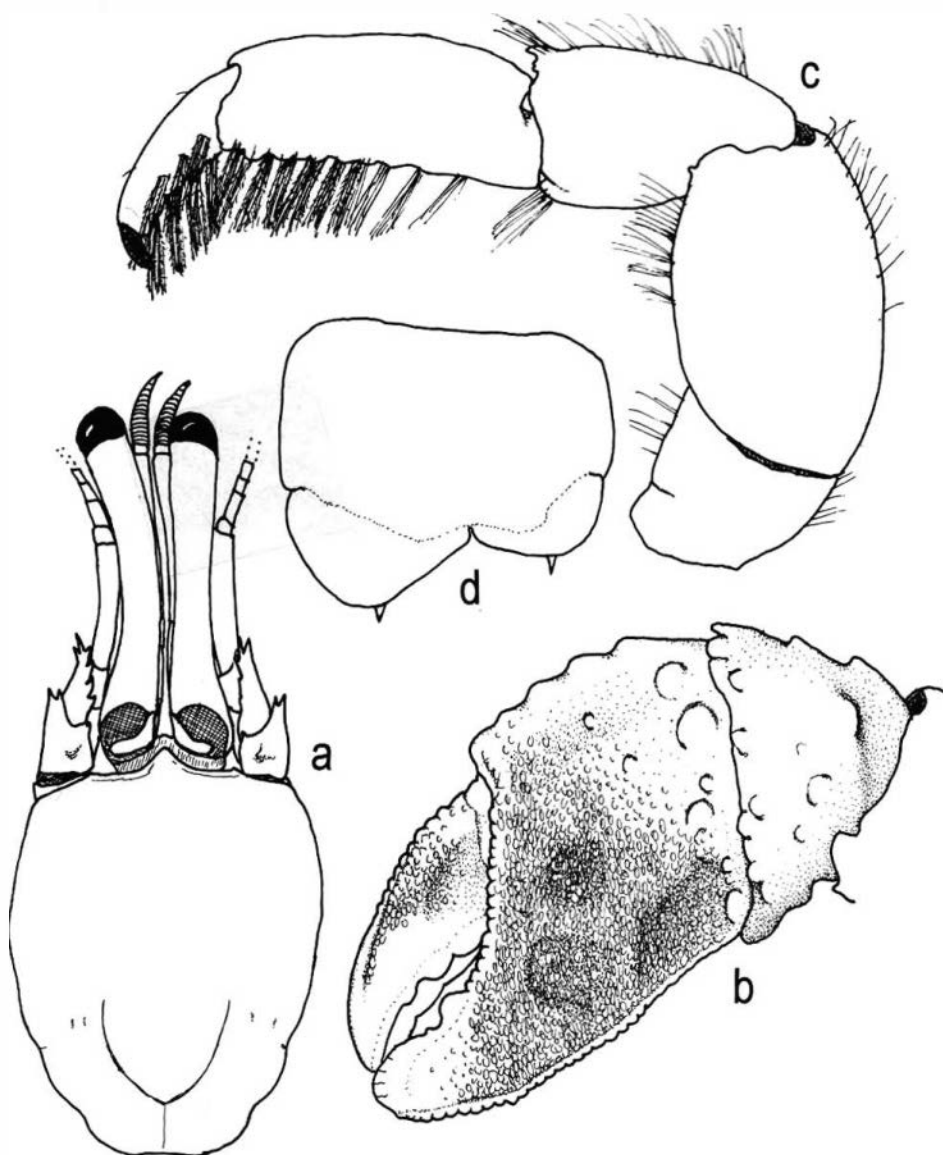


Fig. 25. *Calcinus imperialis* Whitelegge, 1901, Meyer Island, Kermadec Is., male (sl = 10.3 mm) AQ3196: a, shield and cephalic appendages (aesthetascs omitted); b, carpus and chela of left cheliped (dorsal surface, setation omitted); c, left third pereopod (lateral face); d, telson. Magnifications equal 6x (a-c), 12x (d).

New Caledonia; French Polynesia; Mariana and Hawaiian Islands.

#### *Dardanus* Paul'son, 1875

*Pagurus*: Dana, 1851: 268; 1852c: 449; de Haan 1849: 202; Stimpson 1858: 233; Heller 1863: 174; Miers 1876b: 65; Boas 1880: 190; Henderson 1886: 67; 1888: 55; A. Milne-Edwards & Bouvier 1893: 161; Alcock 1905b: 78; Fize & Serène 1955: 155 [Not *Pagurus* Fabricius, 1775].

*Dardanus* Paul'son, 1875: 90; 1961: 90; Rathbun 1903: 33; Schmitt 1921: 126; Makarov 1938: 167; 1962: 158; Provenzano 1959: 372; Williams 1965: 123; Forest & de Saint Laurent 1968: 90; Miyake 1978: 54; Tirmizi & Siddiqui 1982: 79; Asakura, 1995: 356.

*Pagurias* Benedict, 1901: 141.

*Neopagurus* Kamalaveni, 1950: 81.

TYPE SPECIES: *Dardanus hellerii* Paul'son, 1875; by monotypy. Gender masculine.

Fourteen pairs of biserial gills. Shield and cardiac portion of posterior carapace usually well calcified. Rostrum commonly obsolete; ophthalmic segment clearly visible. Ocular peduncles usually stout; ocular acicles large and widely separated. Antennal acicles well developed. Maxillule without external endopodal lobe developed. Exopods of all 3 maxillipeds with well-developed flagella; third maxillipeds basally approximate, ischium with well-developed crista dentata, no accessory tooth.

Chelipeds usually dissimilar and unequal, occasionally subequal, left largest; fingers opening in obliquely vertical plane. Ambulatory legs with left third often dissimilar.



Paired gonopores in both sexes, occasionally males also with indications of female gonopores. Abdomen well developed, tergites broadly separated. No paired pleopods in either sex. Males with 4 small uniramous pleopods (2-5). Females with second-fourth pleopods well developed, triramous, fifth reduced as in male. Uropods asymmetrical. Telson with bilateral indentation.

KEY TO THE SPECIES OF *Dardanus* FROM NEW ZEALAND (INCLUDING THE KERMADEC ISLANDS)

- 1 Left cheliped appreciably larger than right. Left chela and ambulatory legs covered with scutes or scute-like granular or tuberculate ridges ..... *D. arrosor*
- Chelipeds subequal. Left chela and ambulatory legs covered with strong corneous-tipped spines ..... *D. hessii*

*Dardanus arrosor* (Herbst, 1796) (Fig. 26, Pl. 2, fig. 3)

*Cancer arrosor* Herbst, 1796: 170, pl. 43, fig. 1.

*Pagurus strigosus* Bosc, 1802: 77, pl. 11, fig. 3.

*Pagurus striatus* Latreille, 1802: 163; Roux 1828-30: pl. 10; De Haan 1849: 204, pl. 49, fig. 1; Brocchi 1875: 34, pl. 19, figs 35-39; Whitelegge 1900: 166.

*Pagurus incisus* Olivier, 1811: 641; pl. 9, fig. 1; Latreille 1818: pl. 310.

*Pagurus Striatus*: Risso 1816: 54.

*Pagurus Strigosus*: Hope 1851: 12.

*Eupagurus striatus* Cuénot, 1892.

*Petrochirus arrosor*: Rathbun 1900: 302.

*Pagurus arrosor*: Pallary 1900: 221; Nobre 1931: 230, figs 128-130; Terao 1932: pl. 57, fig. 1; Bouvier 1940: 124, fig. 82; Zariquiey Alvarez 1946: 114, fig. 14; Barnard 1950: 423, fig. 79a; Zarenkov 1968: 183.

*Dardanus arrosor*: Gee 1925: 159; Schmitt 1926: 40, fig. 69; Hale 1927: 93, fig. 89; Makarov 1938: 168, pl. 1, fig. 1; Forest 1955: 90, fig. 19; Holthuis & Gottlieb 1958: 69, pl. 1, fig. 4; Makarov 1962: 159, pl. 1, fig. 1; Miyake 1965: 643, fig. 1077; Forest & de Saint Laurent 1968: 91, pl. 1, figs 1,3; Zariquiey Alvarez 1968: 241, fig. 90m; Holthuis & Sakai 1970: 96, pl. 7, fig. 1; Suzuki 1971: 96, pl. 33, fig. 2; Kim 1973: 200, 595, pl. 4, fig. 18; Minei 1973: 43 (key); Miyake 1975: 327, pl. 114, figs 1, 7; 1978: 58, fig. 20, pl. 1, fig. 5; Ross 1979: 1182, fig. 1A-F; Miyake 1982: 102, pl. 36, fig. 5; Baba 1986: 185, 295, fig. 133; Miyake 1991: 102, pl. 36, fig. 5; Asakura, 1995: 357, pl. 95, fig. 1; Sakai 1999: 11, pl. 4D.

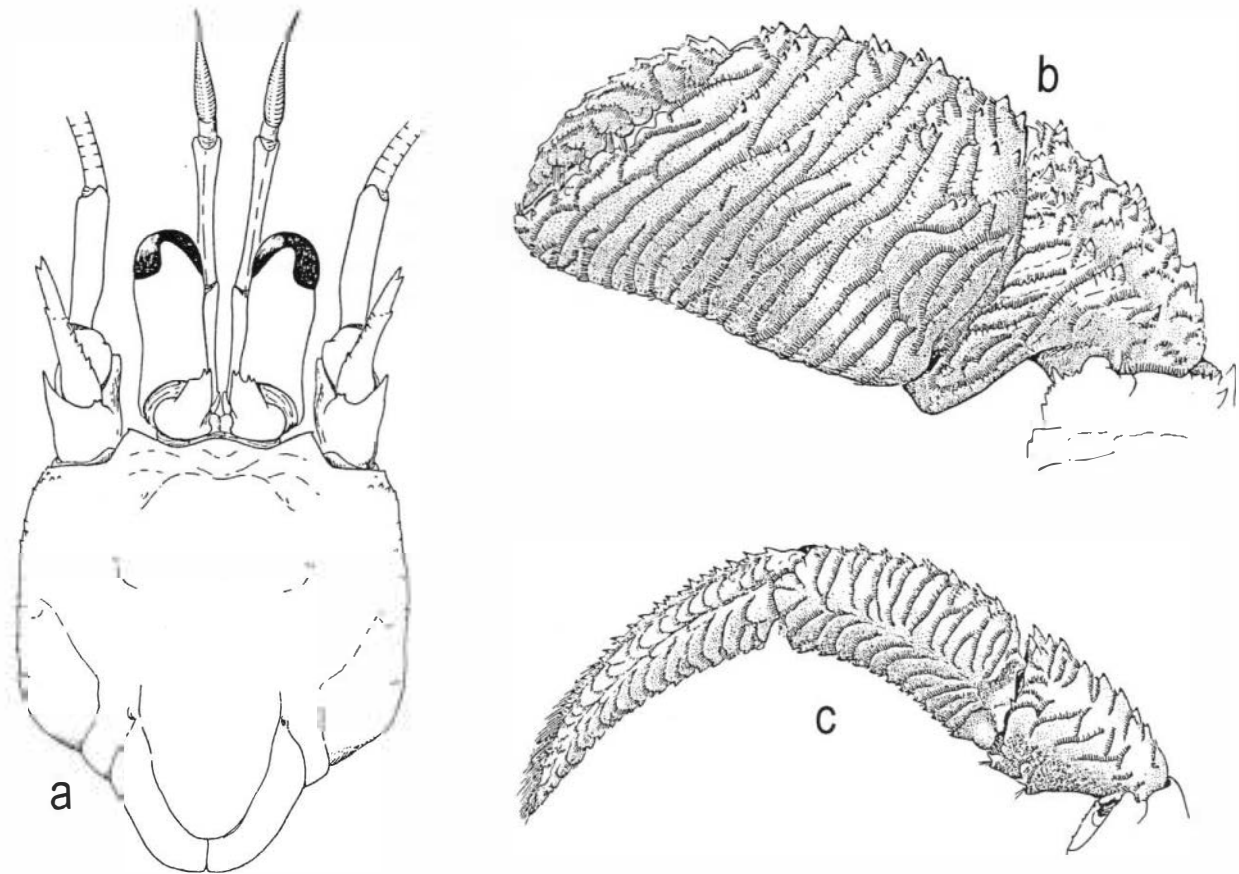


Fig. 26. *Dardanus arrosor* (Herbst, 1796), off Manukau Heads, male (cl = 58 mm) NMNZ Cr 872: a, shield and cephalic appendages (aesthetascs omitted); b, carpus and chela of left cheliped (outer face); c, dactyl, propodus and carpus of left third pereopod (lateral face). Magnifications equal 2x (c), 2.5x (b), 4x (a).



*Aniculus typicus*: Heller 1865: 90; Miers 1876b: 64; Filhol 1885d: 424; Thomson 1899: 184 [not *Aniculus typicus* Dana, 1852].

*Aniculus aniculus*: Chilton 1911a: 300 [not *Aniculus aniculus* (Fabricius, 1787)].

*Aniculus chiltoni* Thompson, 1930: 265, pl. 41, figs. a-e.

TYPE:

Lectotype: Dry specimen (cl = 17.5 mm), ZMB 2486.

TYPE LOCALITY: Unknown.

OTHER MATERIAL EXAMINED:

NZOI Stn: Z9009, 1 male (cl = 24 mm).

NMNZ collections: Between Kaipara Harbour at Cape Maria, coll. H.J. Chapman, 10.6.58, 90 m, 1 female (cl = 49 mm), Cr 9583; Auckland district, Inspector of Fisheries, 1 male (cl = 52.2 mm) Cr. 880; Off Manukau Heads, coll. H.J. Chapman, 18.3.57, 128 m, 1 male (cl = 58 mm) Cr. 872; Bay of Plenty, Alderman and Slipper Islands, 5-8.9.61, 92-274 m, 1 male (cl = 61 mm), Cr 9584; White Island, coll. R.T. Mildrum, 20.8.62, 15 m, 3 males (cl = 45-52 mm), Cr 9585.

NZMD collections: Haul 26, 1 ovigerous female (cl = 31 mm), Cr 9586; Fisheries Research Stn, between Little and Great Barrier Islands, 1 male (cl = 60 mm), Cr 9587; Fisheries Research Stn, off Cuvier Island, 11.11.64, 46-53 m, 1 male (cl = 75 mm), Cr 9588.

MCC collections: *Nora Niven* Expedition, Stn 5, 50 miles east of Stewart Island 120-130 m, 1 male (cl = 65 mm) [type of *Aniculus chiltoni* Thompson].

PMcL collection: Northwest of Great Mercury Island, coll. M. Morrison, 6.12.95, 15-20 m, 2 ovigerous females (sl = 19.8, 20.1 mm).

DESCRIPTION: Shield (Fig. 26a) 0.65 as long as posterior region of carapace, width about 0.90 length; rostrum obsolete, median part rounded, not reaching level of strong, angular lateral projections, each with terminal denticle. Ocular peduncles cylindrical or with corneas slightly dilated, diameter 0.33 length; in small individuals length may exceed 0.80 length of shield; in large specimens peduncles 0.50 length of shield. Ocular acicles moderately well separated, anterior margins obliquely truncate, with variable number of denticles. Lengths of antennular and antennal peduncles varying greatly in relation to ocular peduncles according to specimen size: in young specimens, antennular peduncles barely longer and antennal peduncles slightly shorter than ocular peduncles; in larger specimens, antennular and antennal peduncles over-reach corneas by approximately 0.50 length of last segment. Antennal acicles elongate, denticulate, reaching proximal third or middle of last peduncular segment.

Chelipeds asymmetrical, left (Fig. 26b) clearly stronger than right. Carpus and hand ornamented with sinuous, quite short, arched, and somewhat contiguous transverse striations, fringed towards

anterior with short setae, but not forming complete annulations, being interrupted on inner face and on upper external region, generally presenting more or less squamiform aspect; striations also armed with corneous spinules, some modified into strong granules or even into corneous-tipped tubercles along dorsal margins of segments.

Second and third pereopods with dactyls usually about 0.33 longer than propodi; both segments laterally compressed, right second and third moderately so, left third (Fig. 26c) more accentuated, with lateral face enlarged. Carpi, dactyls and propodi all with transverse setose striations, largely interrupted on inner faces; enlarged, regularly convex outer face of propodus of third left with 2 series of striations disposed 1 on each side of narrow, longitudinal, naked band; dactyl similarly with striations forming 2 series, separated by longitudinal groove. Carpi each with row of corneous-tipped teeth on dorsal margin, stronger on second than third. As on chelipeds, setose striations of pereopods similarly bordered with corneous spinules, in general not particularly obvious, with corneous denticles along dorsal and ventral margins.

Males with outer rami of pleopods 2-5 normal, inner rami reduced to buds. Females with pleopods 2-4 triramous, pleopod 5 as in male.

COLOUR: Carapace red-yellowish with vivid red and some whitish patches. Ocular peduncles pale pink with a proximal red ring, a pink ring at midlength, and another pink ring under the cornea. On the dorsal face these rings disappear quite rapidly in alcohol, but on the ventral face two transverse red bands persist, one proximally, the other subdistally. Chelipeds and ambulatory legs yellowish-red to violet-red with marks of an intense red persisting a long time in alcohol; in particular a transverse band on the inner face of the merus of the chelipeds just behind the distal margin and, on the outer face of the merus of the second legs, a transverse, very distinctive subdistal band. Setae are tinted yellow.

MEASUREMENTS: The 10 males measured 24-75 mm, the four females 31-49 mm in carapace length. The two ovigerous females from off Great Mercury Island had shield lengths of 19.8 and 20.1 mm, which is comparable to about half the carapace length.

REPRODUCTION: Of the four females examined from New Zealand, three were ovigerous. The smallest of the latter, cl = 31 mm, carried more than 30,000 eggs, of about 500  $\mu$ m diameter. New Zealand seems situated outside the area of successful reproduction (see Remarks).

**HABITAT:** The two ovigerous females collected off Great Mercury Island were found in shells of *Charonia* sp. and *Penion* sp. on a sandy-shell and gravel substrate.

**REMARKS:** *Dardanus arrosor* is one of the earliest named hermit crabs. It was described originally by Herbst in 1796 under the name *Cancer arrosor*, without indication of locality, then subsequently from the Mediterranean by Bosc (1802) as *Pagurus strigosus* and by Latreille (1802) as *Pagurus striatus*. It has since been recorded frequently from the Mediterranean under the name *P. striatus*. In the Atlantic the species has a precisely defined distribution (Forest 1955: 98; Forest & de Saint Laurent 1968: 92), from Portugal to South Africa.

In the Indo-Pacific, *D. arrosor* has been recorded from Japan (De Haan 1849: 206, pl.49, fig. 1); the Philippine Islands (Henderson 1888: 55); the east coast of South Africa (Stebbing 1908: 23); and New South Wales, Australia (Whitelegge 1900: 166, as *Pagurus striatus* Latreille, 1802). It was recorded from the Red Sea by Nobili (1906: 121) but, as it had not been found there since, Lewinsohn (1969: 37) doubted its presence in that sea. However, Nobili's specimen, a male found at Suez, is preserved at the Paris Museum and his identification is correct; thus *Dardanus arrosor* may occasionally be found in the Red Sea. We now can also record a new locality in the western Indian Ocean: a typical specimen, a female (cl = 38 mm), was collected by A. Crosnier at Tuléar, to the southwest of Madagascar, at a depth of 250–300 m. The presence of this species around New Zealand was established by one of us (Forest 1955: 98) through the recognition of its conspecificity with *Aniculus chiltoni* Thompson.

The particulars of the verification of this species are as follows. In his study of the Crustacea collected during the voyage of the *Novara* Heller (1865: 90) cited *Aniculus typicus* Dana [= *A. aniculus* (Fabricius)] with locality "Auckland". Miers (1876b: 64), Filhol (1885d: 424), then Thomson (1899: 184) followed Heller in listing this species from New Zealand. But in the interim, since it had never been found again and seemed to be a strictly tropical form, Hutton (1882: 264) thought that it should be excluded from the New Zealand fauna, its record by Heller probably being in error.

Chilton (1911a: 300) considered that he could invalidate Hutton's (1882) opinion by identifying, as *Aniculus aniculus*, a specimen of 55 mm carapace length collected during the *Nora Niven* Expedition, 80 km (50 miles) east of Stewart Island. In his commentary on this record, Chilton stated explicitly that he had compared the specimen with Alcock's (1905b) description and with a species of *Aniculus* found in Polynesia preserved at the Canterbury Museum, one-

third the size of the *Nora Niven* specimen. The latter, according to the characters noted by Chilton (1911a), differed in a number of points from Alcock's description. Notably the rostrum was "much less prominent, the front being merely produced a little in the middle so as to be slightly convex", by the ocular acicles having spinules on their anterior margins as well as the two well-marked distal spines, by the second pair of pereopods which were "only slightly longer than the chelipeds", and the third pair "somewhat longer than the second", and finally by the dactyls of both being "considerably longer than the propod". The Polynesian specimen, compared to the *Nora Niven* specimen, had a sharp rostrum, eyestalks rather more elongated, dactyls of the walking legs shorter, setose striations forming more regular annulations, and stronger setation in the anterior region of the carapace and on the thoracic legs. Chilton considered these differences insufficient to justify a specific distinction and, with regard to the Polynesian specimen, supposed that they resulted from the difference in size.

While revising the pagurids from the Canterbury Museum, Thompson (1930) reexamined the two specimens seen by Chilton as well as a third, with a carapace less than 40 mm in length, from the north of New Zealand. He concluded that: 1) the two New Zealand specimens belonged to the same species; and 2) they were completely distinct from the Polynesian specimen. Under the circumstances, Thompson described a new species, *Aniculus chiltoni*, taking as its type the specimen from the *Nora Niven*.

In the course of a study in which the new genus *Trizopagurus* was established, one of us (Forest 1952) was led to question the generic position of the aforementioned species attributed to *Aniculus*. The detailed description of *A. chiltoni* and the drawings which accompanied it did not correspond at all to *Aniculus*, but much more to *Dardanus*, close to *arrosor*. At his request, the Director of the Canterbury Museum kindly sent him the type of *Aniculus chiltoni* and he was able to establish that it was a large specimen of Herbst' (1796) species (Forest 1952: 35). The granulations on the setose striations of the thoracic appendages appear stronger than those found on the specimens from other regions, but he later noted a similar ornamentation on *Dardanus arrosor*, generally of large size, from diverse localities, especially from the African Atlantic.

The presence of *Dardanus arrosor* around New Zealand and the specific identity of specimens taken from distant and biogeographically distinct regions are fully established by the collections studied, which include 14 specimens of this species as well as the type of *Aniculus chiltoni*. We could find no character to distinguish *Dardanus arrosor* from New Zealand from



those from the Indo-Pacific or East Atlantic. At first glance, the hand of the left cheliped appears shorter and more massive in the New Zealand specimens, but similar proportions occur, though rarely, in large males from other regions. The granulations and spinose tubercles on the setose striations of the thoracic legs are also noticeably developed, in the type of *Aniculus chiltoni* especially, but here again a similar ornamentation is found in large males from the eastern Atlantic. These granulations are always weaker and less numerous than in the closely allied *Dardanus insignis* (de Saussure, 1858) of the western Atlantic, and upon which the rows of tubercles are found all along the length of the setose striations. In this respect it is useful to compare the figures of the left cheliped of a male (cl = 58 mm) specimen from New Zealand (Fig. 26b) with the photographs (Forest & de St Laurent 1968) of the corresponding appendages of a *Dardanus arrosor* male (cl = 65 mm) from off Morocco (loc. cit., pl.1, figs 1, 3) and a male (cl = 63 mm) of *Dardanus insignis* from Brazil (loc. cit., pl. 1, figs 2, 4).

While most New Zealand coenobitoids are endemic to the region, *Dardanus arrosor* appears to be a species principally found in the eastern tropical Atlantic, with New Zealand representing the maximum geographical extension of its range. The characteristics and conditions of the collection of the specimens reported here call for several comments. First, males are much more numerous than females and they are nearly all large or very large. Nine of the 10 males were large, measuring from 45 to 75 mm in carapace length; the four females measuring between 31 and 49 mm, three being ovigerous. The single relatively small but mature male measures only 24 mm in carapace length. With the exception of the type of *Aniculus chiltoni* taken to the east of Stewart Island, i.e., south of New Zealand, all were found on the west and east of North Island, north of Auckland on the west, and Bay of Plenty northward on the east. The depths varied considerably, from 15 to 165 m for all of the larger specimens, but at least 224 m for the smaller male. The maximum depths could have been even deeper since three trawls were taken on bottoms sloping to 264 m, 274 m, and 330 m respectively.

There are very few data on the specimens collected in the other Indo-Pacific regions. In contrast, the eastern Atlantic populations are much better known (Forest 1955; Forest & de Saint Laurent 1968: 92). In that area, the species is present between 20 and 300 m depth but only approaches the coast in cooler waters; in contrast, in the tropics it is hardly ever found in less than 50 m. In various parts of the eastern Atlantic area of distribution, males and females are found in approximately equal numbers at all stages from the

megalopa onwards. Females, ovigerous at variable periods depending on the hydrological conditions, are rarely more than 30 mm carapace length. Males reach a much greater size; the largest we have seen previously is a 65 mm specimen from Morocco. However, the carapace of the largest New Zealand specimen (from Cuvier Island) measured 75 mm.

Comparison between the composition of the populations of *Dardanus arrosor* in the eastern Atlantic and the representation of the species around New Zealand highlights the very incomplete nature of the latter population. In New Zealand, large and very large individual males predominate; females are not numerous, and individuals of small or medium size are completely missing from deep-water collections, whereas they are common in the eastern Atlantic. These data suggest that New Zealand may be outside the area of effective reproduction of the species; hydrological conditions may not permit the completion of the full life history and, particularly, the development of the larvae, but are sufficiently favourable, especially near the northern coasts, for individuals to be encountered migrating from tropical or subtropical regions. It is likely that the centre of dispersion of these mature individuals is situated in southern Australia, where the species is also present. Whitelegge (1900) reported 30 specimens from off New South Wales. A predominance of large males perhaps means that females are more fragile when external conditions for the species are critical.

The above remarks, as well as confirming the relatively frequent presence of *Dardanus arrosor* in New Zealand waters, resolve the controversy concerning the genus *Aniculus* in these same waters. It is probable that, like Chilton (1911a) and Thompson (1930), Heller (1865) had also identified, as *Aniculus*, a hermit crab with annulated legs that was in reality *Dardanus arrosor*. Such a comparison could quite naturally have been made with an Indo-Pacific species rather than a species which at that time was known principally from the Mediterranean. We consider therefore that, until the contrary is proven, the genus *Aniculus* does not belong to the New Zealand fauna.

RECORDS FROM NEW ZEALAND: North Island in the Auckland area on the west and from the Barrier Islands to the Bay of Plenty on the east; Foveaux Strait (as *Aniculus chiltoni*). Depth ranges in New Zealand waters extend from 15 to 165 m. The species could, however, have been taken at greater depths since two specimens were taken in the course of trawling, one between 92 and 274 m, the other between 120 and 330 m.



**DISTRIBUTION:** Typically tropical and warm temperate zones of the East Atlantic; South Africa, Madagascar, Red Sea, Japan, Philippines, New South Wales, Australia, New Zealand.

***Dardanus hessii* (Miers, 1884)** (Fig. 27)

*Pagurus hessii* Miers, 1884: 264, pl. 28, fig. 4; Alcock 1905a: 832; 1905b: 93, pl. 8, fig. 4.

*Pagurus similimanus* Henderson, 1888: 59, pl. 6, fig. 6.

*Clibanarius striolatus*: Chilton, 1911b: 552, [not *Clibanarius striolatus* Dana, 1851].

*Pagurus hessii*: Fize & Serène 1955: 158, 214, fig. 34, pl. 4.

*Dardanus hessii*: Gordan 1956: 314 (lit.); Minei 1973: 43 (key); Haig & Ball 1988: 165; Forest & Morgan 1991: 207.

*Pagurus semilimanus* Henderson: Estampador 1937: 503 (mis-spelling of *Pagurus similimanus* Henderson, 1888).

*Dardanus semilimanus*: Gordan 1956: 315.

**Types:** Syntypes: 2 females, NHM (dry, not measured).

**TYPE LOCALITY:** HMS *Alert* Stn 160, Arafura Sea, northwestern Australia, 58–66 m.

**OTHER MATERIAL EXAMINED:**

MCC collections: Raoul Island, Kermadec Is., coll. Roy Bell, 2 females (sl = 6.2, 9.1 mm), AQ 3394.

NMNZ collections: Stn BS 443, 1 male (sl = 6.5 mm), 1 juvenile female (sl = 3.2 mm), Cr 9589.

**DESCRIPTION:** Shield (Fig. 27a) longer than broad; Rostrum broadly rounded, produced only very slightly. Lateral projections subtriangular, terminally rounded but often with apical denticle, produced considerably beyond level of rostrum. Ocular peduncles approximately 0.65 length of shield, somewhat broadened distally, corneas not strongly dilated, occupying 0.3–0.4 peduncular length; ocular acicles subrectangular, usually with 3 terminal spines. Antennular peduncles overreaching distal margins of corneas by approximately 0.35 length of ultimate segment. Antennal peduncles reaching to bases of corneas or slightly beyond, but not overreaching distal corneal margins; laterodistal projections short, terminating in bifid tooth. Antennal acicle reaching beyond proximal margin of last peduncular segment, terminating in bifid tooth; mesial margin with 2 or 3 teeth, sometimes 1 additional tooth dorsolaterally.

Chelipeds equal or slightly subequal, similar, fingers opening somewhat obliquely, surfaces with sparse tufts of long stiff setae. Carpi each with row of strong spines on upper margin; outer surface with 2 or 3 longitudinal rows of corneous-tipped tubercles. Upper surfaces of palms (Fig. 27b) and dactyls each with double or incomplete triple row of strong corne-

ous-tipped teeth; outer surfaces of palm and fingers each with 3–6 very conspicuous longitudinal rows of corneous-tipped spines, decreasing in size in lower halves.

Ambulatory legs generally similar, but third left (Fig. 27c) dactyl and propodus more strongly armed. Carpi each with row of (second) or 2 or 3 distal (third) corneous-tipped teeth on dorsal surfaces. Propodi each with corneous-tipped tubercles or teeth on dorsal and lateral faces, strongest ventrally on lateral face of third left, and accompanied by sparse tufts of long stiff setae. Dactyls 1.25–1.35 length of propodi; each with longitudinal sulcus on lateral face; dorsal surfaces and lateral face of third left each with corneous-tipped teeth or tubercles and sparse tufts of stiff setae.

Telson divided by transverse suture into very unequal anterior and posterior portions. Posterior lobes separated by shallow median cleft, terminal margins each with few curved corneous spines.

**COLOUR:** Shield with general tint of deep grey-green mixed with violet and yellow-ochre. Antennular and antennal peduncles pale greyish-green; setae on acicle and first antennal segments bright carmine. Ocular peduncles with broad longitudinal stripe of green-grey dorsally outlined in white, with white continuing to outline base of cornea, laterally and mesially an additional stripe of violet-carmine. Chelipeds with meri pale grey-violet mixed with patches of yellow-ochre, one more or less transverse band of bright yellow-ochre distally, spines carmine distally, setae carmine and yellow, tips black. Ambulatory legs with meri marked proximally by transverse band of yellow much less developed medially and distally and separated by two transverse bands of violet-grey; carpi violet-grey mixed with yellow; propodi with yellow tint proximally and dorsally, violet mid-distally; dactyls grey. Spines of carpi and propodi grey-white, tips black; setae of all segments carmine except bright yellow band of dense setae on dorso-distal 0.75 of dactyl of left third pereopod (after Fize & Serène 1955).

**REPRODUCTION:** *Dardanus hessii* is known in the Kermadec Islands from only four specimens. None of the three females were ovigerous. There are no reports, to our knowledge, on reproduction in this species.

**HABITAT:** Collected at depths between 15 and 55 m.

**REMARKS:** Although Miers (1884) indicated that his description of *Dardanus hessii* (as *Pagurus*), was based principally on a large female from the Banksian collection in the British Museum (cf. Ingle 1991) that lacked an abdomen, Miers (1884, pl. 28, fig. A) illus-

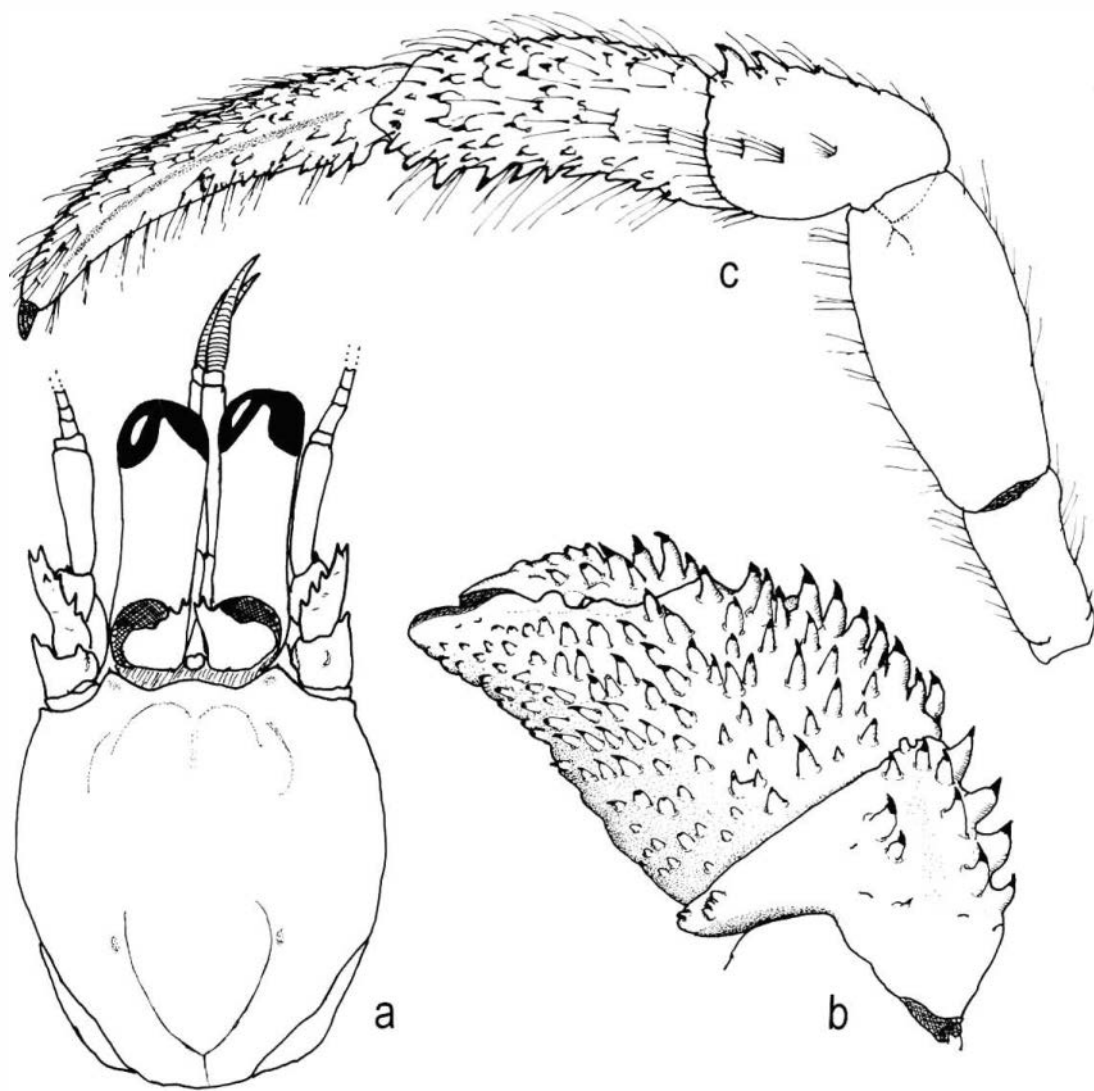


Fig. 27. *Dardanus hessii* (Miers, 1884), Raoul Island, Kermadec Is., female (sl = 9.1 mm), AQ 3394: a, shield and cephalic appendages (aesthetascs omitted); b, carpus and chela of left cheliped (outer face); c, left third pereopod (lateral face). Magnification equals 6x.

trated the smaller, intact female from the Arafura Sea. In his discussion of the species he remarked on the resemblance of this species to *Clibanarius* because of its nearly equal chelipeds.

Chilton (1911b) reported the presence of *Clibanarius striolatus* in the Kermadecs based on two specimens from Sunday (i.e., Raoul) Island, noting that this represented an extension of the southern range of the species to about 30° South latitude. Although Chilton found the chelipeds of his specimens to be more spinose and tuberculate than had been illustrated by Alcock (1905b: pl. 4, fig. 7) for *C. striolatus*, in that respect he thought that they agreed with Haswell's (1882: 159) specimens from Port Jackson, Australia.

We have now reexamined Chilton's specimens (MCC AQ 3394) and found them to represent *Dardanus hessii*. The abdomen of the larger of Chilton's specimens is missing; however, the triramous pleopods so characteristic of *Dardanus* species are present, although not fully developed on the smaller female. The ocular peduncles are not as broad, or the corneas as dilated in either of our specimens as those shown by Miers (1884: pl. 28, fig. A) and Fize and Serène (1955: fig. 34A) for their larger specimens from the Arafura Sea and Nhatrang. In this respect, as well as in the length of the dactyls of the ambulatory legs, our specimens agree better with the specimen illustrated by Alcock (1905b: pl. 4, fig. 7). Fize and



Serène (1955: fig. 34C) did not illustrate the strongly armed lateral face of the propodus of the left third pereopod that we have seen in our much smaller specimens (Fig. 27c), but neither did they illustrate the longitudinal sulci that they described (Fize & Serène 1955: 215).

Forest and Morgan (1991) discussed the similarities between *D. hessii* and *D. australis* Forest & Morgan, 1991 from southwestern Australia. Like *D. hessii*, *D. australis* is one of the atypical species of *Dardanus* with equal or subequal chelipeds. It too has very spinose chelipeds and ambulatory legs; however, it is immediately distinguished from *D. hessii* by its much longer antennular and antennal peduncles.

RECORDS FROM NEW ZEALAND: Known only from the Kermadec Islands.

DISTRIBUTION: Maldive Islands; Bay of Bengal; Gulf of Martaban; Indonesia; Gulf of Oman; Vietnam; Arafura Sea; Kermadec Islands, New Zealand.

### *Cancellus* H. Milne Edwards, 1836

*Cancellus* H. Milne Edwards, 1836: 262; Dana 1852a: 123; A. Milne-Edwards and Bouvier 1891: 66; Alcock 1905b: 76; Forest & de Saint Laurent 1968: 95; Mayo 1973: 6; Miyake 1978: 20.  
*Gryllopagurus* Zietz, 1888: 298.

TYPE SPECIES: By original designation, *Cancellus typus* H. Milne Edwards, 1836. Gender masculine.

Fourteen pairs of biserial gills. Shield generally broader than long; frontal margin with more or less roundly triangular, generally prominent rostrum, usually bordered by generally depressed ridge delineating "W". Dorsal surface of shield anteriorly with 1 median and 2 lateral groups of dorsally depressed protuberances; calcified portion of cardiac region inscribed as square or rectangle. Antennae with sparsely setose flagella, sometimes longer, often much shorter than shield. Second peduncular segment with broad, deep dorsal excavation, often recessing lateral part of anterior margin thus twisting segment into vertical position in relation to shield. Maxillule without external lobe on endopod. Ischium of third maxilliped with well-developed crista dentata; no accessory tooth.

Chelipeds equal, modified to form operculum with slightly concave surfaces of ambulatory legs. Anterior portions of carpi and palms of chelipeds presenting continuous depressed, generally concave dorsal surface; posterolateral margin of carpus cristiform,

divided into 4 sometimes only slightly distinct lobes; inner margin of propodus cut into 6 subrectangular or rounded lobes, separated by usually broad deep fissures; outer margin with tubercles or protuberances; dorsal surface rarely smooth, commonly covered with granules or tubercles sometimes arranged in transverse series; type of ornamentation specific. Ventral surface of propodus smooth, with region of transverse parallel striae often on side. Carpus, propodus and dactyl of second pereopods each with similarly depressed, operculate dorsal surface, exterior margins cut in lobes: carpus with 4–6, sometimes not very distinct, propodus with 5 always well separated; inner margin divided into simple or tuberculate lobules. Ornamentation of pereopodal surfaces consistent with adjacent similar ornamentation of chelipeds. Third pereopods laterally compressed, completing operculum with sometimes lobed and denticulate, cristiform margins of three distal segments. Fourth pereopods robust, strongly compressed laterally, semi-chelate; propodus broadly rounded, mostly covered with rasp of circular squamiform corneous bristles; dactyl much shorter than anteriorly produced propodus. Fifth pereopods chelate; propodus elongate, fingers of chela occupying only between 0.03 and 0.05 total length; rasp of squamiform bristles on dorsal half of outer face; similar bristles of variable number on dactyl, isolated, in rows or in elongate strip.

Males with strongly developed and differentiated coxae of fifth pereopods: sometimes globular but more often depressed; contour and position of gonopores constituting important specific character. No paired pleopods in either sex. Males without unpaired pleopods; four unpaired biramous pleopods ( $pl_2$ – $pl_5$ ) inserted on right or left in females.

Abdomen as spherical or ovoid sac, typically symmetrical. First 5 tergites weakly if at all calcified. Sixth tergite strongly calcified, with hexagonal contour divided by deep transverse depression. Anterior portion with 2 slightly rounded protuberances; sharp teeth or tubercles present or not on or near lateral margins. Posterior portion with posterior and posterolateral margins cut into more or less distinct lobes, more or less armed with tubercles or denticles unique to species. Uropods symmetrical. Exopods enlarged progressively from base distally to truncate (club-like) terminal region and with generally broad rasp of squamiform bristles. Endopods much shorter, elongate segment with parallel or convergent margins, tip rounded; distal part of dorsal surface also provided with rasp extending toward proximal region. Telson transversely ovate or more frequently trapezoidal, with convex or hollow concavity; posterior margin convex, straight or with median concavity.



REMARKS: *Cancellus* species, with the exception of *C. makrothrix* Stebbing, 1924, do not live in gastropod shells, but in mineral fragments: calcareous rocks or skeletons of colonial organisms in which they prepare a cylindrical shelter, as in certain Pylochelidae. They are sometimes associated with living organisms such as calcareous algae, bryozoans, and sponges.

The parallel striae on the ventrolateral part of the palms of the chelipeds have been interpreted by some (cf. Mayo 1973) as a stridulatory apparatus. However, if such is the case, this function has not been established. Notably, if this strip of striae can come in contact with the internal surfaces of the distal segments of the second pereopods, these segments lack a corresponding differentiation.

The genus *Cancellus* was established by H. Milne Edwards (1836) for one species, *C. typus* H. Milne Edwards, based on one specimen from an unknown locality but reported thereafter several times from southwestern and southeastern Australia. H. Milne Edwards also placed *Cancer canaliculatus* of Herbst (1804) in this genus. The latter species is known only from the incomplete type, with the only indication of locality the "East Indies". A third species, *C. parfaiti*, was described from the eastern tropical Atlantic by A. Milne-Edwards and Bouvier (1891). Subsequently, other species have been described from the Indian Ocean, the American Pacific and Atlantic and South Africa.

In 1973, Barbara Schuler Mayo published an excellent revision of the genus, redescribing and illustrated in detail all the valid species known, of which the number had by then risen to nine, in addition to the three mentioned above, *C. spongicola* Benedict, 1901, *C. ornatus* Benedict, 1901, and *C. viridis* Mayo, 1973 from the eastern Atlantic, *C. tanneri* Faxon, 1893 from the eastern Pacific, *C. investigatoris* Alcock, 1905b from the Indian Ocean and Japan, and *C. makrothrix* from South Africa. A tenth species was described in 1991, *C. quadraticoxa* Morgan & Forest, from southwestern Australia, and more recently, *C. mayoae* Forest & McLaughlin, 1998 was established for the *Cancellus* species from Japan mistakenly identified by previous workers as Alcock's (1905b) *C. investigatoris*.

Until now, no *Cancellus* species had been reported from the New Zealand region. However, the genus is clearly well represented here, since in the material studied, four species have been recognised. All are new to science; of which two have been collected in mainland New Zealand waters and two from the waters of the Kermadec Islands.

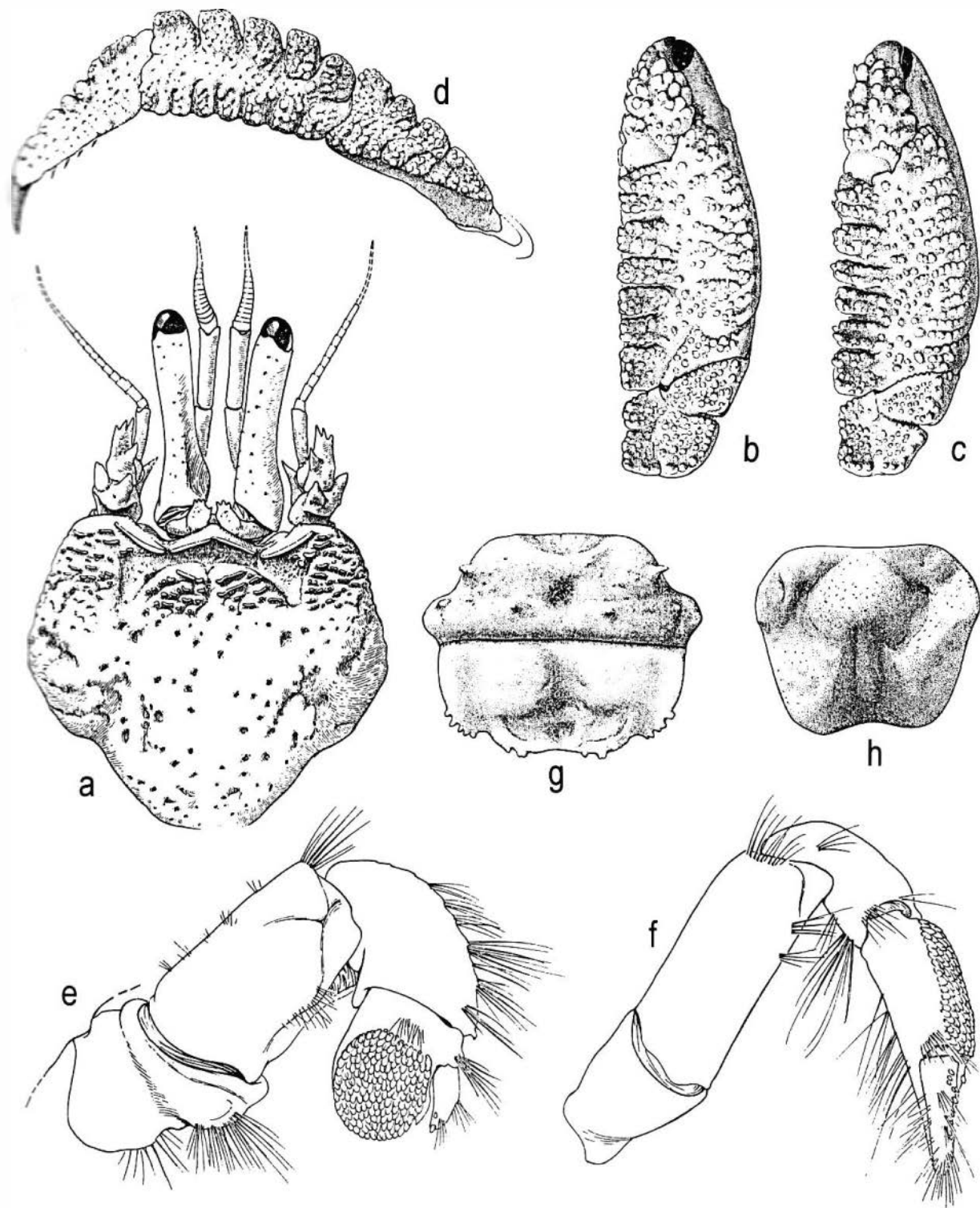
These four species belong to the group of *Cancellus* that inhabits the Indo-West Pacific and eastern tropical Atlantic and that, with the exception of *C. makrothrix*, the aberrant South African species, com-

monly shares the generally broad frontal rim of the shield that is fragmented in several sections. This group is set apart by this character from the eastern and western American species in which the frontal rim, when it exists, is continuous. The four New Zealand species do not show particular affinities among themselves and certain common characters that they may exhibit also occur in the other Indo-West Pacific species or in the single eastern Atlantic species. These will be addressed in detail in a discussion of the foursome, which follows their descriptions as will the similarities and differences that they exhibit among themselves and with other species.

The genus *Cancellus* now comprises fifteen valid species, but it is easy to anticipate that the number will increase, without doubt substantially when other geographic regions are intensively investigated. For example, in the material collected during recent French campaigns in the waters of New Caledonia, there are numerous *Cancellus* specimens, most appearing to belong to at least four undescribed species.

#### KEY TO THE SPECIES OF *Cancellus* FROM NEW ZEALAND AND THE KERMADEC ISLANDS

- 1 Ocular acicles approximate, with at least 3 distal teeth or spines ..... 2
- Ocular acicles broadly separated, unidentate, sometimes with 1 short accessory denticle on inner side ..... 3
- 2 Ocular peduncles elongate; corneal diameter included 5.5–6.5 times in peduncular length. Antennal acicle with 2 teeth laterally posterior to distal tooth. Lateral margins of telson each with well-marked posterior concavity. Coxae of fifth pereopods of male depressed, inner margins weakly convex; gonopores approximate on inner distal margins ..... *C. laticoxa* sp. nov.
- Ocular peduncles stout, corneal diameter included 4.2–4.5 times in peduncular length. Antennal acicle with 3–4 teeth laterally posterior to distal tooth. Lateral margins of telson each with very narrow posterior concavity. Coxae of fifth pereopods in males globulose; gonopores widely separated medianly on very oblique inner distal margins ..... *C. sphaerogonus* sp. nov.
- 3 Antennal peduncles slender, clearly reaching middle of ocular peduncles. Sixth abdominal tergite with 3–4 sharply spinose teeth on dorsal surface near anterolateral margins. Coxae of fifth pereopods of males depressed, inner margins concave in anterior half, each forming, with convex distal margin, short nib for gonopore .... *C. rhynchogonus* sp. nov.
- Antennal peduncles stout, reaching distal third of ocular peduncle. Sixth abdominal tergite with only slightly apparent low tubercles on dorsal surface near anterolateral margins. Coxae of fifth pereopods in males with convex inner and distal margins; gonopores open some distance from inner distal curvature ..... *C. frontalis* sp. nov.



**Fig. 28.** *Cancellus laticoxa* sp. nov. a, b, d-f, NZOI Stn C758, male holotype (cl = 11.8 mm); c, g, h, NZOI Stn C814, male (cl = 11.5 mm): a, shield and cephalic appendages (aesthetascs omitted); b, c, carpus and chela of left cheliped (dorsal view); d, right second pereopod (mesial face); e, right fourth pereopod (lateral view); f, right fifth pereopod (lateral view); g, sixth abdominal somite (dorsal view); h, telson. Magnifications equal 13x (a), 15x (b, d); 20x (c); 24x (e-h).



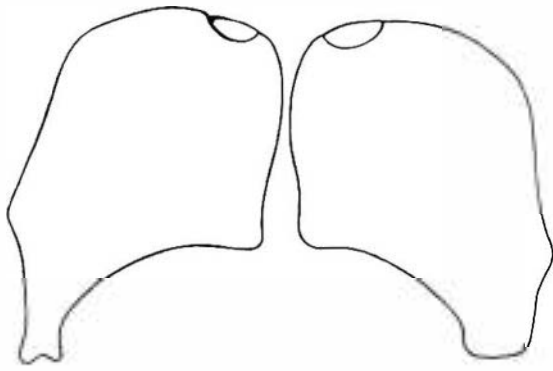


Fig. 29. *Cancellus laticoxa* sp. nov., NZOI Stn C758, male holotype (cl = 11.8 mm): coxae of fifth pereopods (ventral view). Magnification equals 17x.

*Cancellus laticoxa* sp. nov. (Figs 28, 29)

**TYPES:**

Holotype: male (cl = 13.0 mm), from NZOI Stn Z8641, NIWA holotype H-710.

Paratypes: NZOI Stn I87, 1 male (cl = 8.0 mm) NMNZ Cr 9590; NZOI Stn Z8676, 2 males (cl = 15.0, 6.6 mm), NIWA paratype P-1160; 1 male (cl = 11.8 mm), MNHN Pg 5812; NMNZ Stn BS 389, 1 female (cl = 6.3 mm), Cr 9591.

**TYPE LOCALITY:** Spirits Bay, NZOI Stn Z8641, 34°23.4'S, 172°51.8'E, 49 m.

**OTHER MATERIAL EXAMINED:**

NZOI Stn C814, 1 male (cl = about 11.5 mm), in poor condition, plus right cheliped, second and third pereopods of very small specimen.

**DESCRIPTION:** Shield (Fig. 28a) length equal to approximately 0.7 of carapace; ratio of length to breadth approximately 0.85. Rostrum triangular, terminally rounded, reaching to or slightly overreaching lateral projections. Frontal rim with flattened surface interrupted by fissure at inferior angles of "W". Shield with 2 large triangular depressions behind postocular indentations on anterior 0.25, connected by narrow transverse depression passing posterior to rostrum, externally surfaces strongly sculptured: lateral 2 symmetrical, median 1 semicircular, divided by longitudinal depression; sculpturing consisting of partially elongate transverse protuberances; surfaces flattened like frontal rim. Remainder of shield covered with occasional punctations, and with some irregular depressions laterally.

Ocular peduncles attenuated medially and very weakly at level of corneas; ratio of length to shield length varying from 0.70 to 0.81; corneal diameter

included 6.0–6.5 times in peduncular length. Ocular acicles rather widely spaced basally, distal regions broadened and armed with 3 or 4 generally sharp, and slightly divergent spines. Antennular peduncles reaching or nearly reaching bases of corneas; basal segment with 2 strong distoventral, spinose protuberances on either side of articulation with second segment, lateral protuberance with 5 spines, inner protuberance with 1 spine.

Antennal peduncles clearly reaching middle of ocular peduncles. First segment unarmed; second armed dorsally with 2 strong teeth, slightly swollen basally; lateral tooth plainly stronger than mesial; third segment with sharp ventrodiscal process. Antennal acicle twice as long as broad, reaching or over-reaching distal quarter of fifth segment, armed laterally with 2 sharp teeth posterior to distal tooth, sometimes third tooth in proximal region; one supero-internal tooth towards middle. Flagellum distinctly shorter than ocular peduncles.

Opercular faces of chelipeds (Figs. 28b, c) flat anteriorly, then progressively concave. Posterolateral margins of carpi each forming crest divided into 4 lobes, not very distinct except for deep fissure on outer side extending perpendicularly on lateral face, then prolonged in bifurcated furrow, one branch reaching outer articulation with merus, second extending past first on inner face and rejoining symmetrical articulation. Opercular faces of carpi covered with small, regularly rounded tubercles. Inner margins of hands each divided by deep fissures into 6 rectangular lobes covered with rounded tubercles, slightly larger than on carpus; remaining opercular faces with greater number of tubercles towards margins, arranged in transverse rows; lower ventrolateral face with large, regularly and strongly striated zone. Dorsal faces of dactyls with tubercles more elevated and sharper than those on propodi; median faces each with 2 longitudinal rows of corneous, flattened tubercles.

Opercular faces of carpi and propodi of the second pereopods (Fig. 28d) with weak but distinct concavity, ornamented with rounded tubercles, projecting more on lateral regions; pubescence of short but not very dense setae attenuating apparent relief of tubercles, as also seen on chelipeds. Outer margins of carpi each divided into 4 or 5 sections by more or less prominent indentations, prolonged by indistinct furrows across to inner margin as far as beginnings of lobulations. Propodi with outer margins each cut into 5 subrectangular lobes by deep furrows; inner margins also lobulated, with groups of tubercles separated by transverse grooves. Dactyls as long as propodi; opercular faces planar, with numerous setose punctations between tubercles or groups of tubercles; ventral



faces, proximal to claws, each with longitudinal row of 4–8 somewhat short corneous spines along distal 0.65. Third pereopods with inner and outer faces almost smooth apart from some punctations and setose depressions. Dorsal margins of carpi each with setose tubercles decreasing in length posteriorly. Dorsal margins of propodi each separated into 5 granular, setose lobes by distinct indentations; corresponding margins of dactyls with granular tubercles separated by clear indentations; ventral margins each with 5–7 somewhat short corneous spines posterior to claw. Fourth pereopods (Fig. 28e) prominently semichelate.

Fifth pereopods (Fig. 28f) of males with coxae (Fig. 29) depressed, convex anterior margins curving onto nearly straight outer margins. Inner margins weakly convex, each with rounded carina in anterior half. Coxae sometimes approximate at carinal level; gonopores opening on anterior margin or internal side and then in very close proximity.

Sixth abdominal tergite (Fig. 28g) with shorter than broad hexagonal contour; length : width approximately 3 : 4; with deep transverse furrow near midlength dividing tergite into anterior and posterior portions. Anterior margin strongly concave in advance of 2 rounded lateral protuberances; rugose surface of anterior portion with narrow elongate median depression extending to pair of lateral concavities; lateral concavities with 2 conical teeth and 4 weakly produced tubercles arranged in transverse row anterior to transverse furrow. Posterior portion of tergite with median longitudinal depression joining broad depression extending nearly full length of posterior margin; lateral margins weakly convex, entire; rounded posterolateral margins cut into 4 lobes separated by rounded notches; outer lobes with 5 or 6 irregular, relatively distinct tubercles, inner lobes with slightly stronger tubercles.

Telson (Fig. 28h) trapezoidal with rounded angles; shorter than sixth tergite (ratio 0.82), length equal to 0.82 width. Lateral and posterior margins generally concave. Dorsal surface with 3 depressions, 2 anteriorly, 1 posterior to midlength.

Pilosity: Shield with very short setae set in sparse punctations; two groups of longer setae in triangular postfrontal depressions. Ocular peduncles with longitudinal rows tufts of very short setae, proximal half of mesial face with quite long setae. Ocular acicles and antennal bases with sparse short fine setae. Dorsal regions of chelipeds and ambulatory legs with setae extensively overreaching summits of subjacent tubercles, blurring outlines but not concealing them completely; marginal lobes and tubercles with brushes of irregular setae, longest inserted on central parts of lobes and tubercles. Sixth abdominal tergite and telson

with some short setae as on opercular surfaces; sometimes setae of telson longer, with posterior lobes fringed with long setae.

**COLOUR:** In preservative, shield irregularly tinted light red and whitish-yellow, punctuated by small round patches of white and red; red stripe on either side of median group of protuberances; surface depressed by these protuberances and frontal rim grey. Ocular peduncles yellow mixed with red. Thoracic appendages rose with smudges and punctations of red.

**MEASUREMENTS:** The five complete adult males and 1 female have carapace lengths ranging from 6.3 to 15.0 mm.

**REPRODUCTION:** Unknown.

**HABITAT:** Unknown.

**ETYMOLOGY:** The specific name, treated as a noun in apposition, is derived from the Latin *latus* meaning large, and *coxa* and refers to the broad coxae of males of this species.

**REMARKS:** The specimen, from NZOI Stn C814, was close to moulting, as adjudged by the condition of the integument, which had partially disappeared, particularly at the level of the shield where only calcified fragments could be seen. Some regions were, however, still covered with the old integument – antennular, antennal, and ocular peduncles, and thoracic appendages. These latter were detached and some segments were missing, but on the whole they still permitted comparison with the complete specimens; the posterior portion of the abdomen, i.e., tergite of the sixth segment, telson, and uropods, was quite intact.

While this specimen appears to us indisputably to belong to *C. laticoxa*, some slight differences have been observed. This specimen has slightly longer antennular peduncles than seen in the type series; its right antennal flagellum (the only one remaining) is a little thicker and longer. It is as long as the ocular peduncles, whereas it is distinctly shorter in the holotype and paratypes. The ornamentation on the ocular and antennal acicles does not differ significantly nor do the chelipeds and pereopods, notably the opercular faces of the second and third pereopods.

Whereas the abdomen usually forms a rounded sac, that of the premoulting specimen is long and subcylindrical, but it corresponds closely to the lodging which it occupied and in which it had been preserved. The tergite of the sixth abdominal segment of this specimen is distinguished by greater development of

the tubercles on its anterior portion and by the presence of more strongly developed and consequently more distinct tubercles on the outer lobes of the posterolateral border. The telson is clearly longer than in the holotype and paratypes (length : width ratio about 5 : 6) and its lateral margins are less deeply indented.

At NZOI Stn C814, the cheliped and first two right pereopods of a species of *Cancellus* clearly identifiable as *C. laticoxa* were also collected. These appendages are smaller than those of the other specimen from this station, the opercular face of the cheliped measuring 7 mm in length as opposed to 9.5 mm, but their ornamentation is extremely similar.

RECORDS FROM NEW ZEALAND: North and east coasts of North Island from off Cape Maria van Diemen and Spirits Bay to East Cape. Depth range for the specimens known is 49–200 m.

DISTRIBUTION: Known only from New Zealand.

*Cancellus sphaerogonus* sp. nov. (Fig. 30)

TYPES:

Holotype: male (cl = 8.4 mm), NPC, trawl I31, NMNZ Cr 9592.

Paratypes: NZOI Stn J676, 1 male (cl = 7.0 mm), NIWA P-1161; 1 female (cl = 7.0 mm), MNHN Pg 5814.

TYPE LOCALITY: East of North Island, NPS Trawl I31, 35°23'S, 175°06'W, 350–373 m.

DESCRIPTION: Shield (Fig. 30a) length approximately 0.72 length of carapace; length : width ratio approximately 0.82. Rostrum triangular, summit rounded, slightly overreaching level of lateral projections, latter each with 2 sharp denticles. Frontal rim with rounded section of "W" very flattened between lateral projections and interruptions at inferior angles of "W". Shield with anterior surface covered with flattened protuberances generally set transversely and divided into three parts: median area limited anteriorly by smooth groove and separated from lateral regions by 2 narrow longitudinal depressions; lateral regions with flattened protuberances just as on frontal rim, depressions hollowed posteriorly by strong irregular cavities.

Ocular peduncles attenuated medially, swollen basally, and very weakly narrowed at level of corneas; small blunt denticle internally in proximal region. Ratio of peduncular length to shield varying between 0.60 and 0.75. Corneal diameter included 4.5 times

peduncular length. Ocular acicles rather widely spaced basally, armed distally with 4 sharp, long spines.

Antennular peduncles reaching to or nearly to bases of corneas; basal segment with 2 strong distoventral, spinose projections on either side of articulation with second segment.

Antennal peduncles reaching slightly beyond mid-length of ocular peduncles. First segment unarmed, second armed dorsally with 2 strong teeth, lateral tooth clearly much stronger than inner; third segment with sharp distoventral process. Antennal acicle strong, twice as long as broad, reaching distal 0.33 of fifth segment, armed with sharp teeth: 3 or 4 behind distal tooth and 1 dorsomesially in proximal third.

Opercular face of chelipeds slightly concave; maximum breadth included approximately 3.2 times in length. Posterolateral margin of carpus divided into 3 lobes armed with marginal teeth; surface covered with small sharp tubercles, less developed in vicinity of posterolateral margin. Inner margin of propodus cut into 6 rectangular, denticulate lobes by deep fissures. Remainder of opercular surface covered with corneous-tipped tubercles, irregularly set but tending to form transverse rows on lateral half; parallel transverse striae armed with denticles increasing in size ventrally on ventrolateral face. Dorsal surface of dactyl covered with strong conical teeth.

Carpi and propodi of second pereopods with opercular faces strongly concave. Lateral margins of carpi each divided into 3 lobes by notches. On propodi deep fissures cut lateral margins into 5 lobes, anterior 3 rectangular, following 2 rounded. All lobes bordered by sharp teeth, dorsal surfaces tuberculate. Upper inner margin of both segments similarly armed with tubercles; tubercles on propodi each arranged in short transverse, parallel rows, tubercles of median region smaller and corneous, denser and sharper behind distal margin. Dactyls appreciably longer than propodi, dorsal surfaces depressed, each with strong, sharp, corneous-tipped tubercles. Beyond opercular surfaces integument of three segments smooth, punctuated by small cuticular depressions.

Three distal segments of third pereopods compressed, dorsal margins cristiform; margins of carpi each with small sharp, corneous teeth, stronger and more numerous on dactyls; margins of propodi each cut into 4 equally dentate lobes.

Fifth pereopods of male with massive rounded coxae (Fig. 30b), shorter than broad; ventral surfaces quite swollen; widely separated gonopores opening in middle of mesially oblique margins.

Sixth abdominal tergite (Fig. 30c) shorter than broad, with hexagonal contour; length : width approxi-

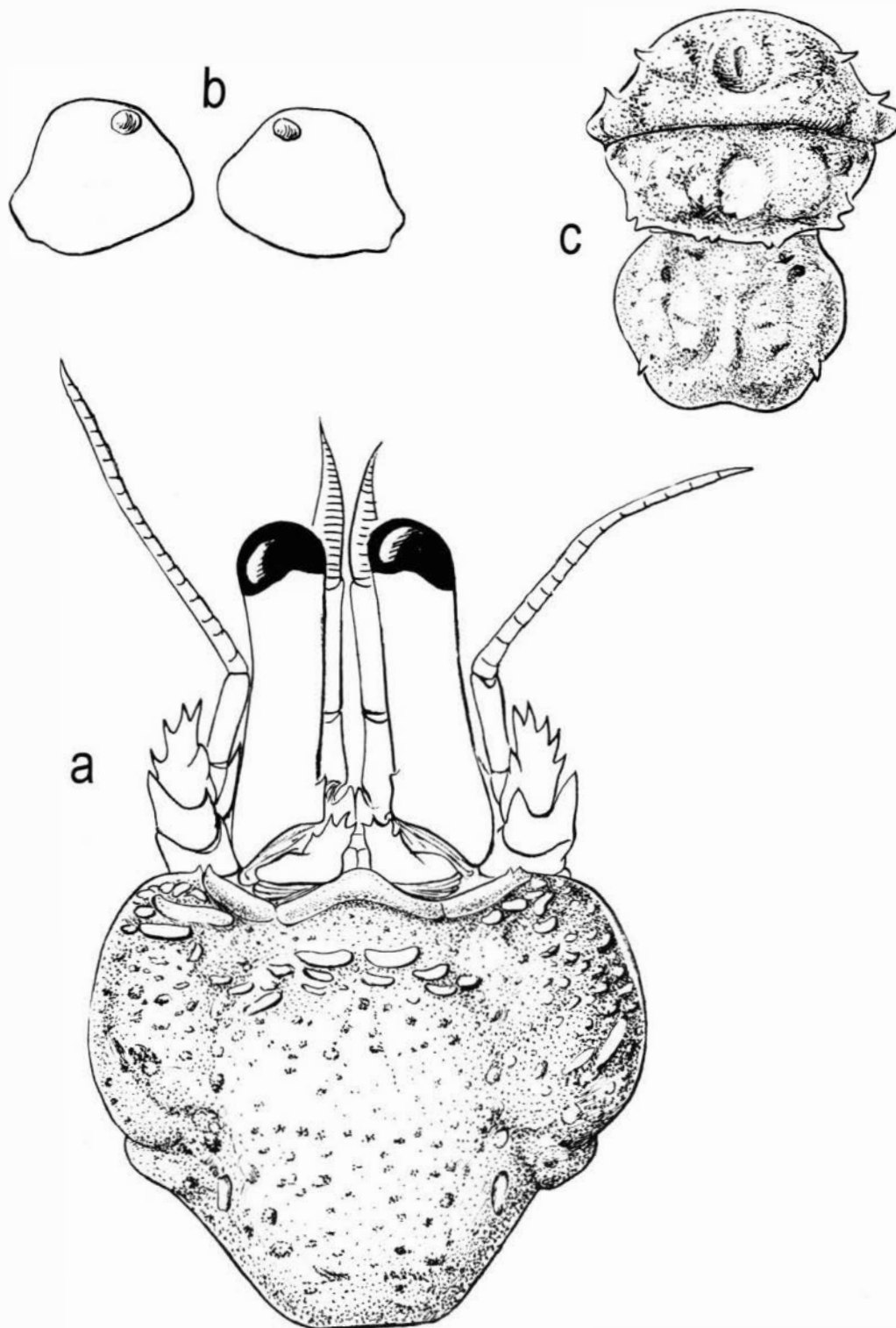


Fig. 30. *Cancellus sphaerogonus* sp. nov., NPC Trawl 31, male holotype (cl = 8.4 mm), NMNZ Cr 9592: a, shield and cephalic appendages (aesthetascs omitted); b, coxae of fifth pereopods (ventral view); c, tergite of sixth abdominal somite and telson (dorsal view). Magnification equals 12x.



mately 0.72; with deep, transverse depression near midlength; anterior portion with 2 rounded lateral protuberances separated from anterior margin by weak concavity; surface sunken by median depression; larger and deeper triangular depression centrally on posterior part; 2 or 3 strong spinose teeth near anterolateral margin; posterolateral margin cut into 3 weakly protuberant lobes, median lobe armed near extremity by 2 pairs of conical tubercles; 2 lateral lobes each with 1 or 2 tubercles.

Telson with subcircular contour, shorter than sixth tergite, ratio 0.80; length 0.80 width; lateral margins convex, with 1 very slight concavity and 1 sharp spine on posterior half; posterior margin weakly concave; dorsal surface with very slightly elevated central zone surrounded by depression.

Pilosity: Shield with very short setae set in sparse punctations; 2 groups of longer setae in postfrontal depressions. Fine long setae, less dense on ocular acicles and bases of antennae. Dorsal regions of chelipeds and ambulatory legs less pilose: mesial margins and especially lateral opercular faces with numerous fine long setae, very short setae on remaining faces not concealing ornamentation. Sixth abdominal tergite with isolated, long, straight setae on protuberances and at bases of tubercles. Telson with similar straight setae on dorsal surface, lateral and posterior margins with fringe of longer setae.

COLOUR: In alcohol, calcified integument yellow-rose; reddish tint on proximal regions of three distal segments of second and third pereopods.

REPRODUCTION: Not known.

HABITAT: Not known.

ETYMOLOGY: From the Greek *sphairōtos* meaning rounded and *gōnia*, a corner, referring to the rounded anteromesial "corner" of the coxae of the male fifth pereopods.

RECORDS FROM NEW ZEALAND: East of North Island; 341–373 m.

DISTRIBUTION: Known only from New Zealand.

*Cancellus rhynchogonus* sp. nov. (Fig. 31)

TYPES:

Holotype: male (cl = 10.4 mm), NMNZ Stn BS 296, NMNZ Cr 9593.

Paratypes: NZOI Stn K819, 3 males (sl = 3.8–6.0 mm) NIWA paratype P-1162; Stn K820, 1 male (sl

= 6.8 mm), 1 female (sl = 4.2 mm) NIWA paratype P-1163; Stn BS 296, 1 male (cl = 7.7 mm), MNHN Pg 5813.

TYPE LOCALITY: Off Hutchinson Bluff, Raoul Island, Kermadec Islands, 84–113 m.

OTHER MATERIAL EXAMINED:

NMNZ collections: Stn BS 313, 6 males (cl = 3.2–5.1 mm), Cr 9594.

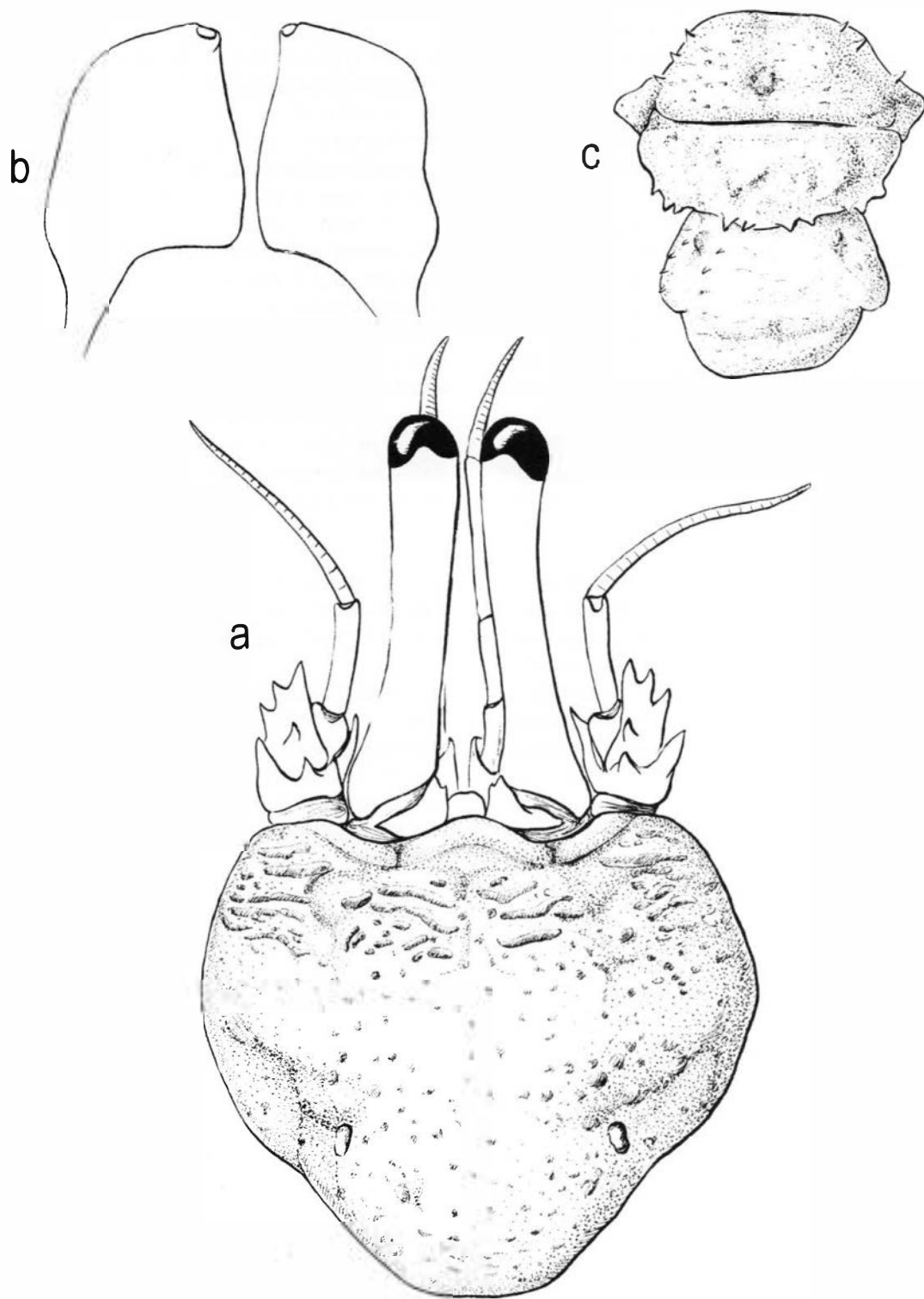
DESCRIPTION: Shield (Fig. 31a) length approximately 0.70 carapace; length : width ratio approximately 0.86. Rostrum very rounded, slightly over-reaching level of lateral projections; latter each with very small terminal denticle. Frontal rim with rounded section extending between lateral projections and interrupted by narrow decalcification at very rounded inferior angles of "W". Anterior 0.25 of shield covered with irregular flattened, prominent, usually transversely aligned protuberances; sculptured dorsal surface divided into median region and 2 lateral regions by triangular depressions behind post-ocular indentations, remainder with rounded depressions, broader posterolaterally.

Ocular peduncles subcylindrical, swollen basally, length 0.80 length of shield; corneas not dilated, diameter included 6.0–6.5 times in peduncular length. Ocular acicles triangular, with strong distal tooth, frequently also with 1 blunt denticle on inner side; broadly separated basally.

Antennular peduncles reaching to or nearly to bases of corneas; basal segment with spinose teeth on distal margin on either side of articulation with second segment.

Antennal peduncles only slightly over-reaching middle of ocular peduncles. First segment unarmed. Second armed dorsally with 2 teeth, outer clearly longer than inner. Third segment with sharp ventro-distal process. Antennal acicle strong, twice as long as broad, reaching proximal 0.33 of fifth segment, armed with robust teeth; 2 subacute lateral teeth behind simple or bifid distal point and 1 dorsal tooth proximally.

Opercular faces of chelipeds each with weak longitudinal depression extending length of internal margin; maximum width included approximately 3 times in total length. Posterolateral margin of carpus divided by 2 moderately shallow incisions into 3 lobes bordered by small blunt teeth; dorsal surface covered with small depressed tubercles. Inner margin of propodus cut into 6 angular or rounded, bluntly tuberculate lobes, separated by weakly developed notches. Remainder of opercular face covered with depressed tubercles similar to carpal tubercles, but tending to



**Fig. 31.** *Cancellus rhyngogonius* sp. nov., Stn BS 296, male holotype (cl = 10.4 mm), NMNZ Cr 9593: a, shield and cephalic appendages (aesthetascs omitted); b, coxae of fifth pereopods (ventral view); c) tergite of sixth abdominal somite and telson (dorsal view). Magnification equals 12x.

form irregular, transverse rows in vicinity of inner lobes. Internal surface with some nearly smooth, transversely parallel striae ventrally, 4 or 5 strong teeth on ventral margin. Dorsal surface of dactyl covered with roundly denticulate tubercles, stronger than on inner lobes of propodus.

Carpi and propodi of second pereopods with weakly concave opercular surfaces. Lateral margin of carpus divided into 4 lobes, proximal lobe triangularly protuberant, more distal lobes increasingly broader; inner margin with several groups of denticulate tubercles separated by weak incisions; dorsal surface with rounded tubercles. Propodus with deep fissures cutting lateral margin into 5 subrectangular lobes on approximately 0.33 surface width; lobes all bordered by weak denticles, dorsal surfaces with rounded tubercles, reaching median region of segment; upper inner margin cut into 7 smooth, rounded lobes, much less protuberant on lateral margin. Dactyl appreciably longer than propodus; dorsal surface depressed, armed with small conical tubercles, stronger and sharper on outer surface; beyond opercular surface, integument of all three segments smooth but punctuated by small circular depressions.

Three distal segments of third pereopods compressed. Dorsal margin of carpus with protuberances, distally increasing in size, 2 distalmost with summits irregularly denticulate. Propodus with 5 protuberances, proximal 4 each with terminal denticle, distalmost with single tooth. Dactyl with row of short conical teeth on dorsal margin.

Coxae (Fig. 31b) of fifth pereopods of male broadly depressed, subrectangular. Distal margins convex, each forming continuous curve with straight or slightly concave lateral margin; inner margin sinuous, convex proximally, then concave forming slightly protuberant angle with distal margin; gonopore opening on anterior margin in proximity of antero-inner angle.

Sixth abdominal tergite (Fig. 31c) distinctly hexagonal in contour, shorter than broad, length/breadth approximately 0.65; deep transverse depression slightly posterior to middle of tergite; anterior portion with 2 laterally rounded protuberances, separated from anterior margin by weak concavity; surface depressed by median concavity, with broader and deeper triangular depression in central region of posterior portion; 3 or 4 spinous teeth irregularly set on anterolateral margins; posterolateral margin cut into 4 slightly protuberant lobes, separated by weak concavities and armed with subacute tubercles, 2 on internal lobes, 2–4 on external lobes.

Telson (Fig. 31c) shorter than sixth tergite (ratio 0.77–0.80), length equal to 0.73–0.80 breadth; lateral margins slightly concave posterior to 2 rounded pro-

tuberances, posterior margin weakly concave; dorsal surface slightly swollen on anterior half between 2 depressions, and with minute spinules laterally.

Pilosity: Shield with pubescent setae in depressions of anterior region; remainder of surface with setiferous punctations only slightly apparent. Ocular peduncles glabrous except in proximal region and on internal surfaces at fine setal insertions. Ocular acicles and antennular and antennal peduncles with long fine, but not dense setae.

Opercular surfaces of chelipeds covered with short tomentum and randomly scattered setae inserted between and considerably over-reaching tubercles. Pilosity similar on second pereopods but with more widely spaced and longer setae on external lobes and inner margin. Dorsal region of third pereopods similar. Sixth abdominal tergite with slightly apparent, short setae and some longer setae near posterolateral margins. Dorsal surface of telson covered with irregular, sometimes spiniform setae; marginal setae longer and localised on either side of posterior margin.

COLOUR: In alcohol, a background of greyish-white yellow. Ocular peduncles light red-orange. Shield with more or less spread-out reddish patches. Pereopods irregularly spotted with red.

REPRODUCTION: Unknown.

HABITAT: Removed from pumice pebbles.

ETYMOLOGY: From the Greek *rhynchos* meaning beak, and *gōnia*, a corner, and referring to the beak-like anteromesial angles of the coxae of the male fifth pereopods.

REMARKS: The description presented is based upon the holotype (cl = 10.4 mm) and the male paratypes. In addition to the female paratype (sl = 4.2 mm), we were able to examine a nonparatypic lot. One group of smaller males (cl = 3.2–5.1 mm) was collected from NMNZ Stn BS 313. Considerable variation related to size was noted in the smaller males and female. For example, the ocular peduncles tended to be shorter, the ratio peduncular length to shield length reduced in some instances to just 0.69. Correspondingly the corneas were larger than in the holotype, their diameter being included a minimum of 4.7 times in the peduncular length in contrast to 6.5 times in the holotype. The denticle on the ocular acicle located behind the distal tooth was missing in most of these small specimens. On the coxae of the fifth pereopods the gonopores are always at the anteromesial angle, but this angle was less sharp on the mesial side than in larger specimens. The lateral lobes of the sixth



abdominal tergite instead of being rounded can form a strikingly sharp, almost dentiform angle. Finally, the telson can have a perfectly hexagonal contour, with straight posterolateral and posterior margins.

RECORDS FROM NEW ZEALAND: Kermadec Islands; 84–146, possibly to 201m.

DISTRIBUTION: Known only from the Kermadec Islands.

*Cancellus frontalis* sp. nov. (Fig. 32)

TYPES:

Holotype: female (sl = 10.0 mm) from NZOI Stn T255, NIWA holotype H-711.

Paratype: 1 female (sl = 6.4 mm) from NZOI Stn K840, NIWA paratype P-1164.

TYPE LOCALITY: Kermadec Islands, NZOI Stn T255, 30°31.7'S, 178°34.8'W, 275 m.

OTHER MATERIAL EXAMINED:

NZOI: Stn K863, 1 female (damaged).

NMNZ collections: Stn BS 441, 1 male (sl = 9.5 mm) (fragmented and incomplete), Cr 9595.

DESCRIPTION: Shield (Fig. 32a) approximately 0.7 length of carapace; shield ratio length : width approximately 0.87. Rostrum triangular with rounded summit, slightly over-reaching lateral projections; latter each armed with small denticle. Frontal rim with rounded section forming very flat "W", extending between lateral projections and broadly interrupted at inferior angles of "W". Shield with anterior and lateral areas covered dorsally with very irregular, flattened protuberances; gastric region posterior to smooth groove with some strong, transversely elongate protuberances; remainder of gastric region marked with prominent, round punctations.

Ocular peduncles attenuated in median region, swollen at base, and more weakly at level of corneas; ratio of length to shield length 0.80; diameter of corneas included 6 times in peduncular length. Ocular acicles triangular, with sharp, corneous distal tooth; broadly separated basally.

Antennular peduncles reaching nearly to bases of corneas; basal segment with 2 strong, spinose disto-ventral projections on both sides of articulation with second segment.

Antennal peduncles reaching distal 0.35 of ocular peduncles. First segment unarmed; second armed dorsally with 2 strong teeth, outer tooth much longer than inner; third segment with sharp ventrodistal process. Antennal acicles relatively narrow, 3 times

longer than broad, reaching middle of fifth segment, armed with robust sharp teeth: 2 lateral posterior to distal tooth and 1 supero-internal tooth proximally.

Opercular surfaces of chelipeds with breadth included 2.8 times in total length; nearly smooth, slightly concave at level of carpus. Outer posterior margin of carpus divided into 4 lobes by 3 incisions, inner, posterior, and deeper outer incision; free margins of lobes armed with small, erect, conical teeth each with dorsal surface covered by less-dense conical blunt tubercles. Internal margin of propodus divided into 6 broadly separated rectangular lobes, and occupying slightly less than third width of palm (ratio 0.30); margins of lobes with small teeth similar to carpal teeth. Remainder of opercular surfaces covered with conical tubercles with rounded summits, tending to form transverse rows; tubercles grouped on weakly developed protuberances toward outer margin; inner surface of ventral side with 5 to 6 broad parallel, smooth or weakly granular striae terminating in subacute ventral tooth. Dorsal surface of dactyl covered with tubercles slightly stronger than propodal tubercles.

Carpus and propodus of second pereopods with opercular surfaces slightly concave. Inner and outer margins of carpus divided respectively into 5 and 3 lobes by notches deeper on external side, margins with small, erect, blunt teeth, as on carpus and propodus of chelipeds; dorsal surfaces of segments each covered with rounded, widely spaced tubercles. Propodi each with deep fissures cutting outer margin into 5 rectangular lobes with somewhat rounded angles; inner margin also divided into 8 shorter and narrower lobes; segment with ornamentation of teeth and tubercles as on carpus. Dactyl appreciably longer than propodus, dorsal surface depressed, with margins also appearing as lobes with about 10 denticulate protuberances on outer side and similar number of rounded and smooth teeth on inner side, protuberances and teeth decreasing in size distally; dorsal surface tuberculate as on 2 preceding segments.

Three distal segments of third pereopods moderately compressed. Dorsal surface of carpus from proximal to distal, with 1 very low conical unarmed protuberance, followed successively by second stronger protuberance armed with 2 short corneous spinules, 1 small corneous tooth, 1 much larger tooth developed with sharply corneous-tipped summit and 1 short denticle on anterior margin, and finally 1 distal projection with 2–3 corneous spinules. Propodus cut into 5 lobes: proximal lobe triangular, following lobes rectangular, all denticulate. Dactyl armed with approximately a dozen robust but not very sharp teeth, size decreasing distally.

Coxa of right fifth pereopod (Fig. 32b) in males (left

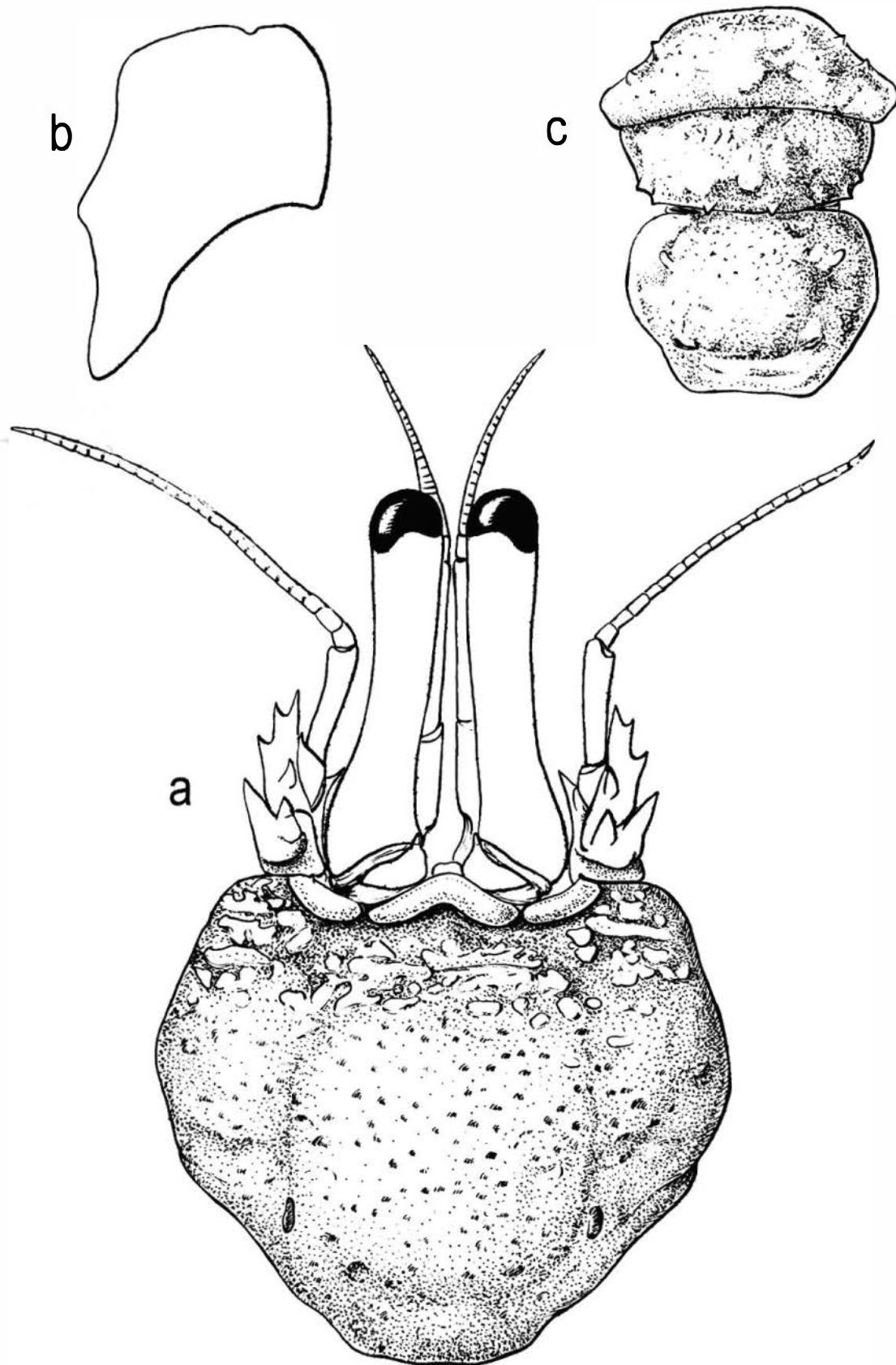


Fig. 32. *Cancellus frontalis* sp. nov. NZOI Stn T255, male holotype (cl = 10.0 mm), NZOI H-711: a, shield and cephalic appendages (aesthetascs omitted); b, coxa of right fifth pereopod (ventral view); c, tergite of sixth abdominal somite and telson (dorsal view). Magnification equals 12x.



missing in fragmented specimen) broad, depressed; inner margin regularly convex, curving to nearly straight anterior margin; gonopores opening on anterior margin some distance from internal curve.

Sixth abdominal tergite (Fig. 32c) shorter than broad, length/width ratio approximate 0.68; 2 strong externally oval projections with nearly straight anterior margins anterior to deep, transverse depression situated slightly behind middle of tergite; surface ribbed by irregular shallow depressions and with numerous conical, very low, setiferous tubercles; additional projecting tubercles near lateral margins; posterior portion marked by median longitudinal depression, pair of small, widely spaced, not very sharp nor apparent tubercles on posterior margin and second pair on each postero-external curvature.

Telson (Fig. 32c) shorter than sixth tergite, ratio 0.88, length equal to 0.82 width. Rounded antero-lateral lobes followed by regular curvature, cut sharply at posterior margin; dorsal surface with weakly defined, approximately square swelling, with rounded depression at each angle; anterolateral regions with tiny piliferous tubercles like those of sixth tergite but less numerous.

Pilosity: Shield with very short setae implanted in widely separated punctations; setae longer marginally. Fine long setae on ocular acicles, bases of antennae and proximal halves of ocular peduncles on inner sides. Opercular face of first two pairs of pereopods nearly glabrous except marginally and stiff irregularly sized setae on digits. Setae often in tufts on ventral parts of pereopods; setae long, erect, isolated or in tufts on sixth abdominal tergite and on dorsal surface of telson, which has marginal long fine setae.

**COLOUR:** In preservative, shield red-orange, with frontal rim and flattened summits of protuberances porcelain white. Ocular peduncles and acicles, antennular, and antennal peduncles red-orange. Spines of second segment and acicle of antenna white at tips. Outer faces of first three pereopods light red-orange with white smudges, summits of tubercles bleached; remainder of calcified integument yellowish-white to whitish-rose, with smudges of red.

**REPRODUCTION:** Unknown.

**HABITAT:** Unknown

**ETYMOLOGY:** The specific name calls attention to the prominent frontal rim of this species.

**RECORDS FROM NEW ZEALAND:** Kermadec Islands, 275–402 m.

**DISTRIBUTION:** Known only from the Kermadec Islands.

## DISCUSSION OF *CANCELLUS* IN NEW ZEALAND

The four species described here exhibit the general characters observed in other Indo-West Pacific and eastern Atlantic species of *Cancellus* in having a frontal rim and three areas of flattened protuberances on the anterior third of the shield, one median, two lateral. However, the New Zealand species are quite distinct and display no particular similarities with the others; if some closeness exists, it is seen in isolated characters and not in the sum of their morphology (Table 3). In the key to the species presented, the first character of importance is the ocular acicles. In the two species from mainland New Zealand waters the acicles are similarly approximate and carry 3 or 4 teeth, in contrast to those of the Kermadecs in which the triangular acicles are broadly separated and have a single sharp distal tooth with sometimes a small secondary denticle. *Cancellus sphaerogonus* sp. nov. is distinguished from the other local species, *C. laticoxa* sp. nov., by its ocular peduncles that are clearly shorter in ratio to the shield and especially more robust, with a corneal diameter included only 4.5 times in the peduncular length, instead of 6.0–6.5 times in *C. laticoxa*. Additionally, although both *C. sphaerogonus* and *C. laticoxa* have multiple teeth on the ocular acicles, these are longer and sharper in *C. sphaerogonus*. This latter species is also the only one in which the tubercles of the opercular faces of the chelipeds are provided with sharp corneous tips, and in which the telson is armed with a pair of posterolateral spines. Finally the coxae of the fifth pereopods of *C. sphaerogonus* males are not depressed, but globular, with the gonopores distant, being situated in the middle of the very oblique distomesial margins. In contrast, *C. laticoxa* has a shorter rostrum, the flattened post-frontal protuberances are more numerous, the lobes on the inner margins of the propodi of the chelipeds are bordered with rounded tubercles instead of sharp teeth, and on the anterior portion of the sixth abdominal tergite there are only two moderately well-developed tubercles, not two or three strong sharp teeth. Finally, the contour of the telson is trapezoidal rather than subcircular.

The two species from the Kermadec Islands have relatively long ocular peduncles, a little longer in *C. rhynchogonus* sp. nov., attenuated in the median region with the corneas slightly dilated. *Cancellus rhynchogonus* differs from *C. frontalis* sp. nov. in having a narrower frontal rim, but more importantly, the antennal peduncles are clearly shorter and the antennal acicles much broader. *Cancellus rhynchogonus* differs equally from the two mainland New Zealand species in the form and development of the



inner marginal lobes on the palms of the chelipeds. The lobes have some rounded rather than rectangularly produced tubercles that are separated by angular notches and not by deep fissures. In *C. rhynchogonus*, the sixth abdominal tergite is armed with three or four spines near the anterolateral margins and denticulate tubercles on the posterior margin, whereas in *C. frontalis* the anterior portion carries miniscule setiferous protuberances with some tubercles a little better produced, and on the posterior margin only four small, nearly equidistant tubercles.

In the males of *C. rhynchogonus* and *C. frontalis*, as in *C. laticoxa*, the coxae of the fifth pereopods have depressed ventral surfaces and similar, slightly excavated anterior halves, but their contours and the positions of the gonopores are specifically different. In *C. laticoxa*, the mesial margins are weakly convex; the convex distal margins pass onto the nearly straight lateral margins by continuous arching and the gonopores, placed in proximity to the distomesial curvature, are brought nearly together. In *C. frontalis* the coxae each have a convex mesial margin and a nearly straight distal margin, separated from the lateral margin by an accentuated arc; the gonopores are a little more approximate on the mesial margin than in *C. laticoxa*. The coxae in *C. rhynchogonus* are distinguished from the two preceding species by the more sinuous form of the mesial margins, being proximally convex and distally concave. These margins join the distolateral margins in continuous curves, each forming a produced angle with the summit on which the gonopore opens. The New Zealand species of *Cancellus* are not only separated from one another by an assemblage of distinctive characters, they are equally distinctive from all the other validly recognised species. These latter, for which the geographic distributions are closest, differ in numerous points. For example in *C. typus* H. Milne Edwards (cf. Mayo 1973: figs 18–20), known from southeastern and southwestern Australian waters, the hands of the chelipeds each have an inner margin divided into irregular projections, not into rectangular lobes. This arrangement is similar to that in *C. rhynchogonus*, but the opercular face is covered with much stronger tubercles of which the summits are garnished with

numerous long and stiff setae. Additionally, *C. typus* has a sharp rostrum, the ocular peduncles and antennular peduncles are short, the antennal peduncles much longer, and in the male the coxae of the fifth pereopods are formed very differently (Mayo loc. cit. fig. 18e). *Cancellus quadraticoxa*, another Australian species, but from the southwestern coast only, perhaps approaches *C. frontalis* in the rectangular form of the coxae of the last pereopods, but these are clearly longer than broad, whereas they are much broader than long in the species from the Kermadec Islands, and in other respects much different. *Cancellus canaliculatus* is known from only one incomplete specimen, for which Mayo (loc. cit., p. 50, figs 21a–f, 22a, b) described and figured the existing parts; its locality given as East Indies, is inexact, but refers perhaps to Indonesia. However, from its known characters it is distinct from all other species.

The fact that the *Cancellus* of New Zealand and the Kermadec Islands are so different from those of more distant regions becomes very clear when one compares the present descriptions and illustrations with those figured in the monograph by Mayo (1973). Examination of a collection from New Caledonia has yielded, as we have said previously, at least four additional species of *Cancellus*, all new to science. None among these is related to the species described in the present work either. The geographic distribution of the genus has been considerably broadened, and one can presume that intensive exploration of other oceanic regions will provide more extensions to this distribution. Furthermore, differences between the species represented in relatively small areas confirms the endemism of the majority of them. This is accompanied by relative stenobathy, as is the case with the New Zealand species. In effect, of the two species localised in the northern part of the North Island, *C. laticoxa* has been captured between 49 and 200 m, *C. sphaerogonus* sp. nov. between 350, 373, and ? m. The two species from the Kermadec Islands are equally distinct in bathymetric distribution, *C. rhynchogonus* having been collected between 84 and 113 m and *C. frontalis* between 275 and 402 m.

References: See pages 222–236.

**Table 3.** Morphological comparison of *Cancellus*.

	<i>C. laticoxa</i>	<i>C. sphaerogonus</i>	<i>C. rhynchogonus</i>	<i>C. frontalis</i>
<b>Cephalothorax and Appendages</b>				
<b>Region</b>	New Zealand	New Zealand	Kermadec Islands	Kermadec Islands
<b>Depth (m)</b>	49–299	350–373 ?	84–113 ?	275, 366–402
<b>Rostrum</b>	triangular	roundly triangular	very rounded	roundly triangular
<b>LOP : SL</b>	0.70–0.8	0.65–0.75	0.69–0.85	0.80
<b>LOP : cornea diameter</b>	6.0–6.5	4.5	4.7–6.5	6.0
<b>Ocular acicle with:</b>	4 short spines	4 long spines	1 distal tooth + 1 denticle	1 distal tooth
<b>Antennal peduncles</b>	reach 0.5 OP	reach slightly beyond 0.5 OP	reach slightly beyond 0.5 OP	reach distal 0.65 OP
<b>Antennal acicle</b>	reaches distal quarter of segment 5	reaches distal third of segment 5	reaches proximal third of segment 5	reaches half of segment 5
<b>Antennular margin</b>	2 teeth	3–4 teeth	2 teeth	2 teeth
<b>Propodus P1 6 inner margin lobes</b>	rectangular, closely spaced	rectangular	rounded or angular	rectangular, well separated
<b>Propodeal face</b>	small rounded tubercles	tubercles with corneous tips	depressed tubercles	conical blunt tubercles
<b>External propodeal margin</b>	5 subrectangular lobes	5 roundly rectangular lobes	5 rectangular lobes	5 rectangular lobes with rounded angles
<b>Coxae P5 males</b>	depressed, mesial margin nearly straight, distal margin convex, gonopores closely spaced	globular, gonopores widely separated	depressed, mesial margin sinuous, distolateral margin convex, gonopores on projection at distomesial angle	depressed, mesial margin convex, distal margin nearly straight, gonopores moderately well spaced
<b>5th abdominal tergite</b>				
<b>Anterior portion</b>	2 conical teeth near lateral margin 4 posterior tubercles	2–3 strong sharp teeth near lateral margin	3 sharp teeth near lateral margin	very small setiferous tubercles + stronger tubercles near margins
<b>Posterolateral margin of posterior portion</b>	4 lobes with irregular tubercles	with 4 groups of 2 denticles	with 4 groups of 2 denticles	4 denticles
<b>Telson</b>	unarmed	1 pair of postero-lateral spines	miniscule spinules on anterior half	unarmed



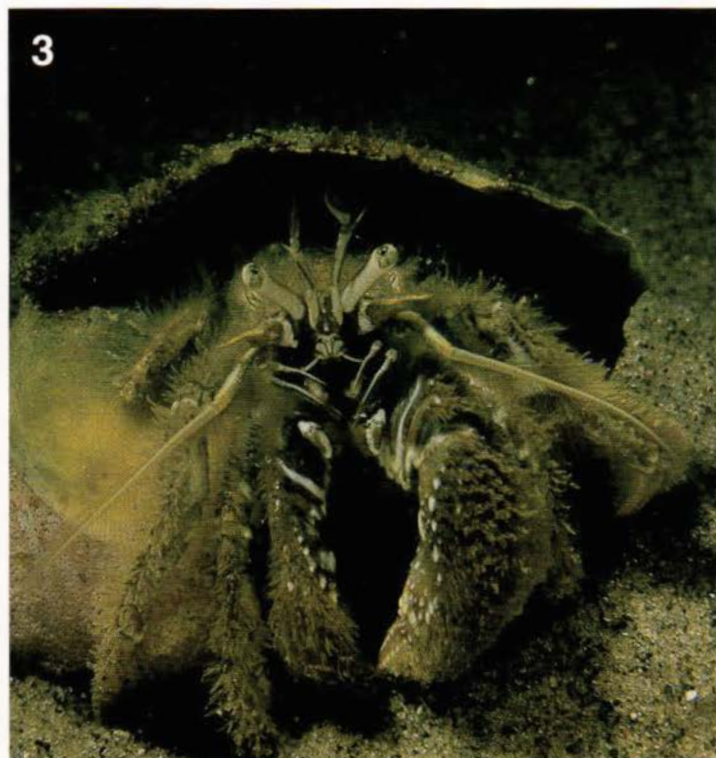


Plate 1. Fig. 1. *Trizoecheles spinosus bathanae* Forest & de Saint Laurent (Photo: Colin McLay. Fig. 2. *Paguristes subpilosus* Henderson (Photo: Colin McLay). Fig. 3. *Paguristes setosus* (H. Milne Edwards) (Photo: Len Doel).





Plate 2. Figs 1, 2. *Paguristes pilosus* (H. Milne Edwards) (Photos: Fig. 1, Colin McLay; Fig. 2, Ken Grange). Fig. 3. *Dardanus arrosor* (Herbst) (Photo: Roger Grace).



# SUPERFAMILY PAGUROIDEA

## Family Paguridae

by

Michèle de Saint Laurent and Patsy A. McLaughlin

### SYSTEMATICS

#### KEYS TO THE FAMILIES OF THE PAGUROIDEA (exclusive of Lithodidae)

- 1 First maxilliped with exopodal flagellum; antennal acicle usually without marginal teeth ..... PAGURIDAE
- First maxilliped without exopodal flagellum; antennal acicle usually with marginal teeth .... PARAPAGURIDAE

#### Family PAGURIDAE Latreille, 1802

Pagurii Latreille, 1802: 29 (invalid spelling).

Paguridae: Samouelle 1819: 91; Dana 1852c: 435 (in part); Stimpson 1858: 52; Stebbing 1893: 159 (in part); Ortmann 1892: 269 (in part); Alcock 1901: 21 (in part); Ortmann 1901: 1145 (in part); Alcock 1905b: 21 (in part); Makarov 1938: 156 (in part); Forest & Holthuis, 1955: 321; Makarov 1962: 147 (in part); Forest & de Saint Laurent 1968: 113; Miyake 1978: 76.

TYPE GENUS: *Pagurus* Fabricius, 1775.

Occasionally 13, usually 11, sometimes fewer, pairs of quadriserial or biserial gills. Third maxillipeds separated basally by broad sternal plate; ischium usually with well-developed crista dentata, occasionally reduced, with or without one or more accessory teeth.

Chelipeds unequal or subequal, right almost always larger.

Males usually with paired gonopores on coxae of fifth pereopods, vas deferens sometimes developing short to long sexual tube on one or both coxae; usually without, occasionally with, modified, paired first and/or second pleopods; 3 (third through fifth) or 4 (second through fifth) unpaired left pleopods, occasionally only with third and fourth, or without unpaired pleopods. Females usually with paired gonopores on coxae of third pereopods, occasionally with only the left; sometimes with first pleopods paired and structurally modified; usually with 4 unpaired left pleopods (second through fifth), occasionally only with 3 (second through fourth).

#### KEY TO THE NEW ZEALAND (INCLUDING THE KERMADEC ISLANDS) GENERA OF PAGURIDAE

- 1 Carapace crab-like (brachyuran), frontal region enlarged, covering proximal portion of ocular peduncles ..... *Porcellanopagurus*
- Carapace hermit crab-like (pagurid), frontal region not enlarged, not covering proximal portion of ocular peduncles ..... 2
- 2 Branchial formula includes 3 well-developed or at least rudimentary pleurobranchs, 1 each above pereopods 2, 3, 4 (i.e., thoracopods 5, 6, 7) ..... 3
- Branchial formula includes 1 well-developed pleurobranch, above pereopod 4 (i.e., thoracopod 7) .... 4
- 3 Right cheliped very much stronger than left, with massive chela; ocular acicles with flattened or slightly convex dorsal surfaces ..... *Bathypaguropsis*
- Right cheliped longer but not very much stronger than left, chela not massive; ocular acicles with concave or slightly concave dorsal surfaces ..... *Propagurus*
- 4 No accessory tooth on crista dentata of third maxilliped; females with modified, paired first pleopods ..... *Pagurojacksonia*
- Accessory tooth present on crista dentata of third maxilliped; females with or without modified, paired first pleopods ..... 5
- 5 Gills quadriserial ..... 6
- Gills biserial ..... 7
- 6 Males with well-developed sexual tube on coxa of right fifth pereopod. Females without modified, paired first pleopods ..... *Pagurodes*
- Males with short or very short sexual tube on coxa of right, left, or both fifth pereopods. Females with modified, paired first pleopods ..... *Michelopagurus*
- 7 Telson with posterior lobes "half-moon" shaped, with prominent pair of spines adjacent to median cleft ..... *Diacanthurus*
- Telson with posterior lobes not "half-moon" shaped, without prominent pair of spines adjacent to median cleft ..... 8
- 8 Males with vas deferens extended from coxae of right fifth pereopod to form sexual tube. Females without modified, paired pleopods ..... *Catapagurus*
- Males without vas deferens extended from coxa of right fifth pereopods to form sexual tube. Females with or without modified, paired first pleopods ..... 9

- 9 Females with modified, paired first pleopods ..... *Lophopagurus*  
 - Females without modified, paired first pleopods ... 10
- 10 Coxae of fifth pereopods asymmetrical; coxa of right fifth pereopod of male produced, gonopore masked by tuft of long stiff mesially directed setae ..... *Pagurixus*  
 - Coxae of fifth pereopods symmetrical; coxa of right fifth pereopod of males not produced, gonopore not masked by tuft of long stiff mesially directed setae ... *Pagurus*

### *Porcellanopagurus* Filhol, 1885

*Porcellanopagurus* Filhol, 1885a: 47; 1885b: 23; 1885d: 410; 1885e: pl. 49, figs 2-4; Borradaile 1916b: 111; Bennett 1932: 520; Forest, 1951a: 82; 1951b: 182; Wolff 1961: 28; Miyake 1978: 117; Türkay 1986: 140; McLaughlin 1997: 464.

TYPE SPECIES: *Porcellanopagurus edwardsi* Filhol, 1885, by monotypy. Gender masculine.

Eleven pairs of biserial gills. Anterior carapace vaulted and well calcified; lateral margins of shield developed into 2 pairs of blunt or spiniform, wing-like projections. Rostrum and lateral projections widely separated; anterior margin of shield enlarged and covering proximal portions of ocular peduncles. Ocular acicles obscured from dorsal view by broad rostrum. Posterior carapace well calcified anteriorly and usually drawn out into projecting lobes; remainder of posterior carapace membranous or with areas of slight calcification. Maxillule with external lobe of endopod slightly produced, not recurved. Ischium of third maxilliped with well-developed crista dentata and 1 accessory tooth, and in some species well-defined dense tuft of thick, distally tapered setae dorsolaterally.

Chelipeds unequal. Ambulatory legs generally similar. Fourth pereopods usually semichelate. Fifth pereopods chelate.

Males with coxae of fifth pereopods sometimes expanded posteroventrally, but usually without sexual tube developed, gonopores encircled by long setae; without paired or unpaired pleopods. Females with paired gonopores located posteriorly on coxae of third pereopods; no paired pleopods, unpaired left pleopods on somites 2-4. Abdomen reduced, usually globular, membranous, but with tergites at least faintly delineated. Sixth somite divided dorsally into 2 or 4 distinct lobes. Uropods symmetrical or slightly asymmetrical. Telson with weak lateral indentation suggesting delineation into anterior and posterior lobes; often carried ventrally.

### KEY TO THE SPECIES OF *PORCELLANOPAGURUS* FROM NEW ZEALAND (INCLUDING THE KERMADEC ISLANDS)

1. Rostrum broadly and subacutely trilobed ..... 2  
 - Rostrum evenly triangular ..... 3
2. Second lateral carapace lobe with 1 prominent distinct spine; sixth abdominal tergite with terminal margin of posterior lobes entire ..... *P. tridentatus*  
 - Second lateral carapace lobe without prominent distinct spine; sixth abdominal tergite with terminal margin divided into median triangular and lateral accessory portions ..... *P. chiltoni* sp. nov.
3. First lateral carapace lobe with 2 equal or subequal lobules; antennular peduncles overreaching distal margins of corneas by slightly less to slightly more than length of ultimate segment; lateral width of propodi of ambulatory legs 0.30-0.36 segmental length .....  
 ..... *P. edwardsi*  
 - First lateral carapace lobe with only posterior lobule prominent; antennular peduncles overreaching distal margins of corneas by 0.25-0.50 length of penultimate segment; lateral width of propodi of ambulatory legs less than 0.25 segmental length ... *P. filholi* sp. nov.

### *Porcellanopagurus tridentatus* Whitelegge, 1900

(Fig. 33)

*Porcellanopagurus tridentatus* Whitelegge, 1900: 181, figs 13-13b.

*Porcellanopagurus tridentatus*: Türkay 1986: 140; Zarenkov 1990: 239.

[Not *Porcellanopagurus tridentatus*: Chilton 1911b: 352; = *Porcellanopagurus chiltoni* sp. nov.]

#### TYPE:

Lectotype (herein selected): female (sl = 3.9 mm), *Thetis* Stn 57, AM G2384.

TYPE LOCALITY: *Thetis* Stn 57, Off Wata Mooli, Australia, 99-108 m.

#### OTHER MATERIAL EXAMINED:

NZOI Stn: Q47, 1 male (sl = 5.2 mm).

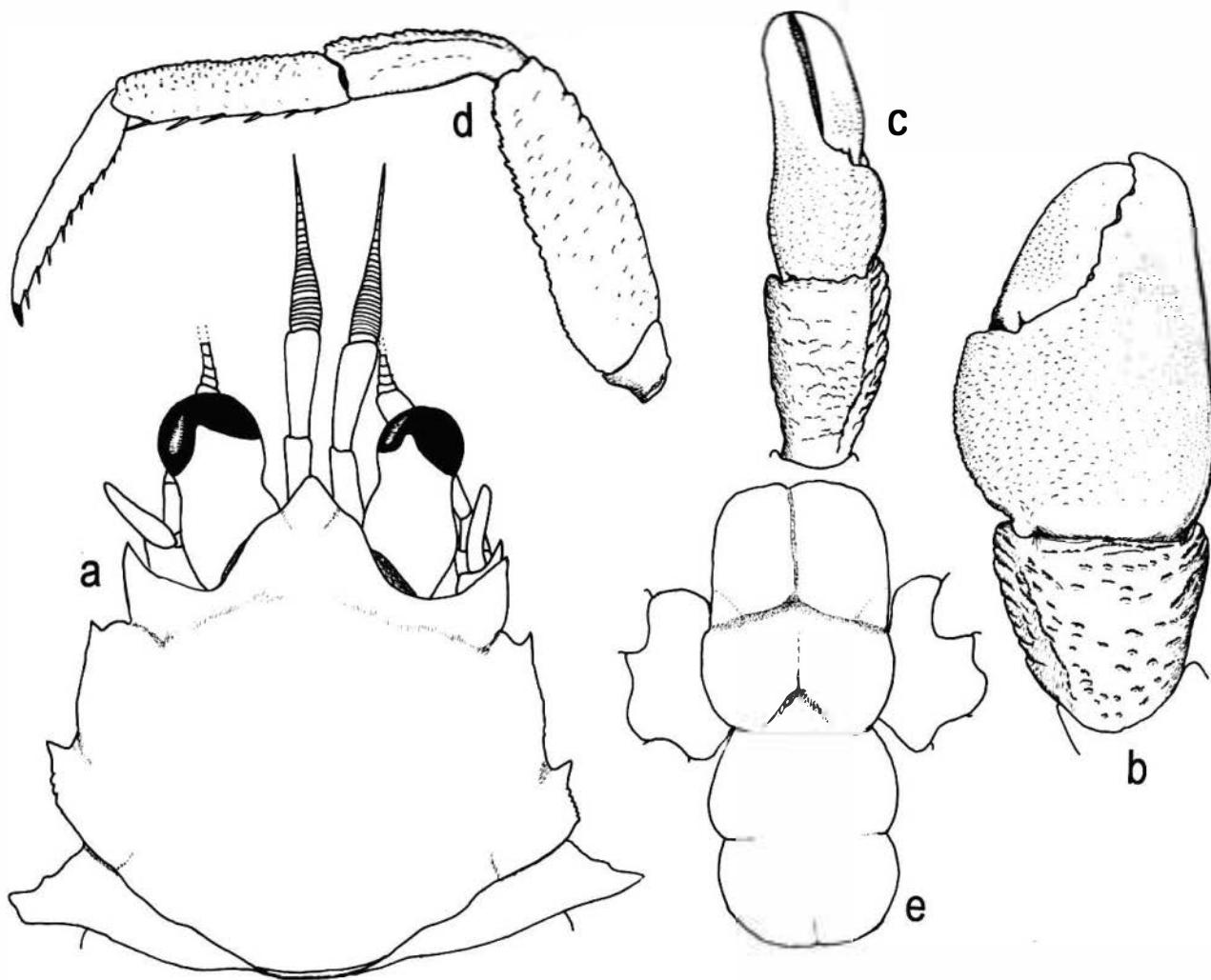
MNZ collections: Stn BS 438, 1 male (sl = 4.3 mm), Cr 9596.

AM collection: NZOI Stn U207, 2 males (sl = 2.4, 2.7 mm), plus one damaged male, AM 4045.

MNHN collections: *Nimbus* cruise, Stn 20, off Queensland, 1.1968, coll. A.J. Bruce, 1 male (sl = 4.8 mm), MNHN Pg 3682, 1 ovig. female (sl = 5.6 mm), MNHN Pg 3683.

DESCRIPTION: Cephalothorax (Fig. 33a) broad, smooth, with few scattered tufts of short setae; shield broader than long; lateral margins each with small, acute tooth on triangular first lateral lobe, slightly larger spine on short subtriangular prominence of second lateral





**Fig. 33.** *Porcellanopagurus tridentatus* Whitelegge, 1900, a-d, *Thetis* Stn 57, female lectotype (sl = 3.9 mm) AM, G2384; e, NZOI Stn Q47, male (sl = 5.2 mm): a, shield and cephalic appendages (setation and aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view, setation omitted); c, carpus and chela of left cheliped (dorsal view, setation omitted); d, left third pereopod (lateral view, setation omitted); e, tergite of sixth abdominal somite, protopods of uropods, telson (setation omitted). Magnifications equal 12x (a-d), 37.5x (e).

lobe, and strong subtriangular spinulose projection posterior to cervical groove; posterior carapace incompletely calcified. Rostrum triangular, reaching to or nearly to midlength of ocular peduncles, broad basally, narrowing abruptly in distal 0.33–0.25, terminating subacutely. Lateral projections very prominent, triangular, acute and forwardly directed. Ocular peduncles short, stout; with constriction adjacent to corneas. Corneal diameter included 1.25–1.5 times in peduncular length. Ocular acicles quite small, subtriangular, obscured from dorsal view. Antennular peduncles when fully extended overreach distal margins of corneas by full length of ultimate segment and occasionally half of penultimate segment. Antennal peduncles overreaching distal margin of cornea by 0.25–0.75 the length of fifth segment. Antennal acicle

unarmed, reaching to or slightly beyond proximal margin of fifth segment. Ischia of third maxillipeds without distinctive tuft of setae dorsolaterally.

Right cheliped (Fig. 33b) stout, considerably stronger than left. Dactyl articulating somewhat obliquely with palm; dorsal and mesial surfaces rounded, faintly granular. Palm with dorsomesial margin marked by low, flattened tubercles or granules, dorsal surface granular or minutely tuberculate, and slightly setose, dorsolateral margin rounded, but with low, granular ridge. Carpus trapezoidal, ventral face with prominent, somewhat concave articulating membranes, dorsomesial and dorsolateral margins and mesial and lateral faces dorsally with series of low transverse, protuberant ridges, strongest mesially. Merus without distinctive tuft of

setae on ventromesial margin.

Left cheliped (Fig. 33c) with slight granular ridge proximally on dorsomesial margin of dactyl. Palm with granular dorsal surface, dorsolateral margin with faint ridge. Carpus with mesial face marked by low transverse ridges and forming longitudinal ridge at dorsomesial margin; dorsal surface with short, transverse, low, sometimes denticulate ridges.

Ambulatory legs (Fig. 33d) generally similar. Dactyls equal to or slightly longer than propodi; each with 10 or 11 spiniform setae on ventral margin. Propodi with low protuberances on dorsal surfaces, lateral faces with short, transverse protuberances or ridges; ventral margins each with row of 5 or 6 long spiniform setae. Carpi each with 1 or 2 irregular rows of denticulate protuberances on dorsal surface, dorsodistal spine sometimes better developed; lateral faces each with prominent denticulate ridge in dorsal half and row of smaller ridges or low protuberances ventrally.

Coxae of fifth pereopods in male drawn out posteromedially and fringed with setae, but no membranous sexual tubes developed. Sixth abdominal tergite (Fig. 33e) with prominent transverse suture at midlength; anterior and posterior lobes each incompletely divided by longitudinal groove; posterior lobes without median indentation, terminal margin entire. Uropods with rasps of 6 and 5 rows of scales on exopods and endopods respectively. Telson (Fig. 33e) longer than broad, with slight transverse indentation; rounded terminal margins with minute median cleft.

**COLOUR:** Unknown.

**REPRODUCTION:** Not generally known, but an ovigerous female was found off Queensland, Australia that was 56 mm shield length.

**HABITAT:** In the Kermadec Islands, occurring at depths in excess of 100 m.

**REMARKS:** In his original description, Whitelegge (1900) indicated that he had examined two males. Türkay (1986) reexamined the syntypes and found them to be represented by a complete female and some additional appendages, but no body of a second specimen. Since Whitelegge (1900) described the coxae of the fifth pereopods in the male as each having "a tubular prolongation directed inwards and downwards ...", we must presume that the disassociated appendages belonged to a male, the body of which was subsequently lost. Türkay (1986) confirmed the elongation of the coxa in males of *P. tridentatus* from supplemental material that he was able to examine; however, McLaughlin (1997) incorrectly interpreted

Türkay's (1986) remarks, attributing them to Whitelegge's (1900) original male.

Whitelegge's description of *Porcellanopagurus tridentatus* was relatively detailed, but in some instances misleading and inaccurate. As noted by McLaughlin (1997: 465), Whitelegge (1900: 182) incorrectly described the segmentation of the antennal peduncle, considering both the second and third segments as representing the first of a three-segmented peduncle. Whitelegge's reference to the "inner" surface of the carpus of the right cheliped being "deeply excavated" actually applies to the concavity formed on the ventral surface of the segment by the articulating membrane. His report of four "denticulated ridges above" on the carpi of the ambulatory legs would suggest that the dorsal surfaces of the carpi each are provided with four ridges. In actuality, he was referring to the pair of ridges on the lateral face and the one or two irregular longitudinal rows of denticulate protuberances visible, in lateral view, on the dorsal surface.

Chilton (1911b) reported *P. tridentatus* from the intertidal area of the Kermadec Islands, and although he noted some differences between his specimens and Whitelegge's (1900) description, he felt confident that his specimens were unquestionably *P. tridentatus*. We have reexamined the female syntype of Whitelegge's species, and other specimens from the Australian regions, and compared them with Chilton's material. The two taxa are not conspecific. Since Whitelegge's (1900) syntypes now consist of one female and remnants of a second specimen, we have, in the interest of stability in nomenclature, designated the intact female specimen as the lectotype of *P. tridentatus*. Chilton's (1911b) specimens are described as *P. chiltoni*, sp. nov.

**RECORDS FROM NEW ZEALAND:** Kermadec Islands; 138–140 m, possibly 165 m.

**DISTRIBUTION:** Eastern Australia; Lord Howe, Norfolk and Kermadec Islands; New Caledonia (McLaughlin, in press a).

*Porcellanopagurus chiltoni* sp. nov. (Fig. 34)

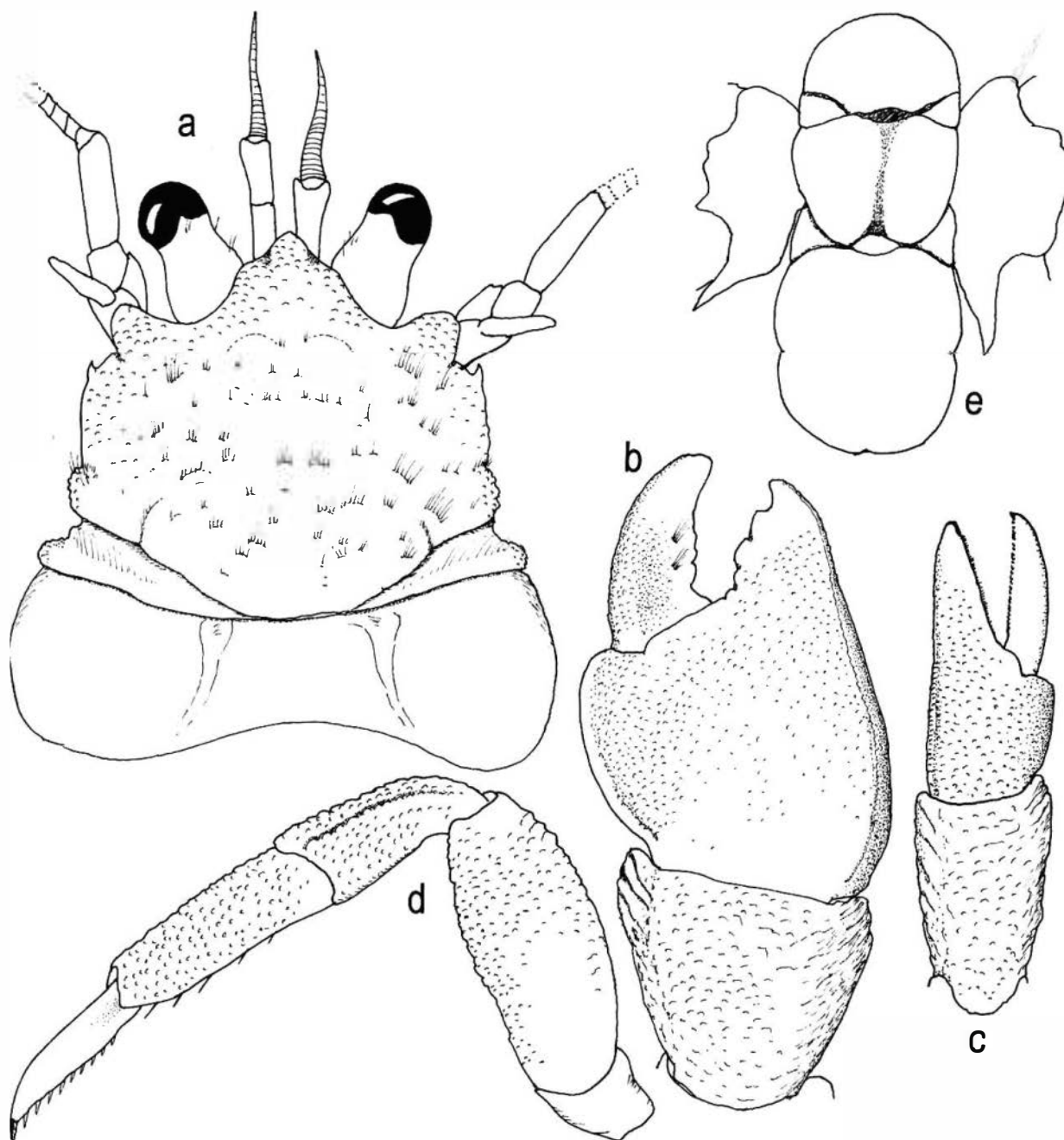
*Porcellanopagurus tridentatus*: Chilton 1911b: 352. [Not *Porcellanopagurus tridentatus* Whitelegge, 1900]  
*Porcellanopagurus* sp. 1 of de Saint & McLaughlin: McLaughlin in press a.

**TYPES:**

**Holotype:** female (sl = 4.5 mm), Kermadec Islands, C. Chilton collection, MCC.

**Paratypes:** 1 female (s = 3.8 mm), Kermadec Is-





**Fig. 34.** *Porcellanopagurus chiltoni* sp. nov., Kermadec Islands, female paratype (sl = 4.5 mm), MCC: a, shield and cephalic appendages (setation and aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view, setation omitted); c, carpus and chela of left cheliped (dorsal view, setation omitted); d, left third pereopod (lateral view, setation omitted); e, tergite of sixth abdominal somite, protopods of uropods, telson (setation omitted). Magnifications equal 18x (a-d), 30x (e).

lands, C. Chilton collection, MCC; 1 male (sl = 3.6 mm), Kermadec Islands, C. Chilton collection, NHM 1912.5.25.42

**TYPE LOCALITY:** Meyer Islands, Kermadec Islands, intertidal.

**DESCRIPTION:** Cephalothorax (Fig. 34a) broad, with numerous denticulate, scale-like protuberances, particularly laterally and on anterior part of shield and rostrum, also few scattered tufts of short setae; shield broader than long; lateral carapace margins each with small acute, subacute or blunt tooth on

weakly produced first lateral lobe, second lateral lobe also weakly produced, subtriangular, marginally denticulate, and stronger subtriangular subacute projection posterior to cervical groove; posterior carapace incompletely calcified. Rostrum triangular, broadly and subacutely or acutely trilobed, reaching beyond midlength of ocular peduncles. Lateral projections prominent, subtriangular, subacute and anterolaterally directed.

Ocular peduncles short, stout; with weak constriction adjacent to corneas. Corneal diameter included approximately 1.25 times in peduncular length. Ocular acicles reduced, small, plate-like, with little or no spinose projections, obscured from dorsal view.

Antennular peduncles when fully extended overreach distal margins of corneas by slightly less to slightly more than full length of ultimate segment. Ultimate segment with dorsodistal tufts of setae; penultimate segment with few scattered setae; basal segment with proximal and medial spine on dorsolateral margin.

Antennal peduncles overreaching distal margin of cornea by 0.25–0.75 the length of ultimate segment. Fifth and fourth segments with few scattered setae; third segment with tufts of setae at ventrodistal angle; second segment with distolateral projection moderately short, slender, terminally acute, dorsomesial distal margin with very small tooth; first segment with marginal and median row of small denticles or tubercles extending onto produced ventral lobe. Antennal acicle unarmed, terminally acute or subacute, reaching almost to or slightly beyond proximal margin of fifth segment. Ischia of third maxillipeds usually without distinctive tuft of setae dorso-laterally.

Right cheliped (Fig. 34b) stout, considerably stronger than left. Dactyl articulating somewhat obliquely with palm; approximately equal to or slightly longer than palm; dorsal and mesial surfaces rounded, granular or minutely tuberculate, dorsomesial margin sometimes defined by faint ridge; cutting edge with few strong calcareous teeth. Palm with dorsomesial margin marked by low, flattened tubercles or granules forming slightly elevated ridge, dorsal surface granular or tuberculate, sometimes with few scattered setae, dorsolateral margin with crenulate, granular, or minutely tuberculate ridge, mesial, lateral, and ventral surfaces tuberculate or granular; cutting edge of fixed finger with 3 or 4 strong calcareous teeth. Carpus trapezoidal, ventral face with prominent, somewhat concave articulating membranes, dorsomesial and dorsolateral margins and mesial and lateral faces dorsally with series of low, transverse, scale-like, denticulate protuberant ridges, strongest mesially. Merus subtriangular, with

transverse low, denticulate ridges extending mesially and laterally; dorsodistal margin with few small teeth; without distinctive tuft of setae on ventromesial margin; ventrolateral and ventromesial margins each with row of subacute teeth; ventral surface granular or minutely tuberculate.

Left cheliped (Fig. 34c) with dactyl 1.25–1.40 times the length of palm; dorsomesial margin with row of very small tubercles, dorsal midline with short longitudinal row of tiny tubercles, dorsal surface with low tubercles. Palm with covering of low tubercles or granules on dorsal surface not extending to distal half of fixed finger; dorsomesial and dorsolateral margins each with low denticulate or crenulate ridge; lateral and mesial faces each with low, obliquely transverse rows of granules or denticles. Carpus with transverse ridges forming longitudinal row on dorsomesial margin, dorsal surface with numerous scale-like denticulate, protuberant short ridges; mesial and lateral faces with low transverse ridges; ventral surface with few subacute tubercles. Merus subtriangular; dorsal margin with row of low, short transverse slightly scale-like protuberances; lateral face with numerous short, obliquely transverse denticulate ridges; mesial face with few short tuberculate ridges near ventral margin, ventromesial margin with row of subacute tubercles; ventrolateral margin with irregular double row of blunt or subacute tubercles, ventral surface with sparse covering of moderately large tubercles. Ischium with transverse rows of small tubercles on ventral half of lateral face, ventrolateral margin with row of tubercles; mesial faces with few tubercles ventrally, ventromesial margin also with row of small tubercles, ventral surface with scattered small tubercles.

Ambulatory legs (Fig. 39d) generally similar. Dactyls 0.75–0.85 length of propodi; dorsal surfaces with low protuberances and sparse setae; ventral margins each with 8–11 spiniform setae. Propodi approximately equal to length of carpi; both shorter than meri; dorsal surfaces with numerous low, sometimes denticulate, protuberances; lateral faces with short, transverse protuberances or ridges; mesial faces granular, at least in ventral halves; ventral margins each with row of 5 or 6 long spiniform setae, and usually additional pair at ventrodistal margin. Carpi each with 1 or 2 irregular rows of denticulate protuberances on dorsal surface, no distinct dorso-distal spine; lateral faces each with prominent denticulate ridge in dorsal half and row of smaller ridges or low protuberances ventrally. Meri with row of low protuberances and few setae on dorsal surfaces, lateral faces with short transverse scale-like ridges; ventromesial margins unarmed or granular; ventrolateral margins with 1 or 2 rows of teeth or



denticles; ventral surfaces granular or tuberculate proximally.

Coxae of fifth pereopods in male slightly drawn out posteromedially and fringed with setae, but no sexual tubes developed. Sixth abdominal tergite (Fig. 34e) with prominent, transverse suture at midlength; posterior, and usually anterior lobes each incompletely divided by longitudinal groove; posterior lobes with subtriangular terminal margins and adjacent, usually similarly well-calcified accessory plates. Uropods with rasps of 6 and 5 rows of scales on exopods and endopods respectively. Telson (Fig. 34e) longer than broad, often membranous, with slight transverse indentation; rounded terminal margins with very slight median indentation.

COLOUR: Unknown.

REPRODUCTION: Not known.

HABITAT: Reportedly living under stones between the tidemarks, and carrying half of a bivalve shell "or a vacant *Siphonaria* or limpet shell" (Chilton 1911b).

ETYMOLOGY: This species is dedicated to Charles Chilton, who first discovered it.

REMARKS: Chilton (1911b) reported *P. tridentatus* from the Kermadec Islands, commenting that while differences between Whitelegge's (1900) description and his specimens existed, he was confident that his specimens were correctly identified as *P. tridentatus*. After comparing Chilton's (1911b) specimens with the remaining intact syntype of *P. tridentatus*, we found several characters that clearly separate the two taxa. These include the shield, cephalic appendages, lateral carapace lobes, and sixth abdominal tergite. The ocular peduncles in Chilton's specimens are shorter and stouter than in *P. tridentatus*, and the corneas occupy considerably more of the segment. In contrast, the antennular and antennal peduncles are proportionately longer. The rostrum of *P. chiltoni* sp. nov. is terminally blunter; the lateral projections are less triangular and much more weakly produced than in *P. tridentatus*. Similarly the three lateral carapace lobes are less developed in the Kermadec species. Perhaps most importantly are the differences in the tergite of the sixth abdominal somite. In *P. chiltoni*, the posterior lobes of the tergite are terminally triangular, with a small plate adjacent laterally. In *P. tridentatus*, the posterior lobes of the tergite have an entire terminal margin, with only a slight indication of longitudinal division.

RECORDS FROM NEW ZEALAND: Kermadec Islands; intertidal.

DISTRIBUTION: Meyer and Raoul Islands, Kermadec Islands, intertidal; New Caledonia, 56–200 m (McLaughlin, in press a).

*Porcellanopagurus edwardsi* Filhol, 1885 (Fig. 35)

*Porcellanopagurus edwardsi* Filhol, 1885a: 47; 1885b: 23; 1885d: 410; 1885e: 27, pl. 49, figs 2–4.

*Porcellanopagurus edwardsi*: Thomson 1899: 187; Alcock 1905b: 191 (list); Chilton 1909: 610, fig. 1a–c; 1911b: 553; Balss 1930: 196 (in part); Bennett 1932: 470 (in part); Forest, 1951a: 83, figs 1–12; 1951b: 181; Gordan 1956: 339 (in part) (lit.); Roberts 1972: 383, figs 1–36; Fenwick, 1978: 206; Türkay 1986: 140; McLaughlin & Lemaitre 1997: 86, figs 5, 7; Suzuki & Takeda 1987: 23; Zarenkov 1990: 239 (in part); McLaughlin, in press b.

*Porcellanopagurus (Edwardsii)* Filhol ?): Stephensen 1927: 295. *Porcellanopagurus (edwardsi)* Filhol ?): Thompson 1930: 272.

[Not *Porcellanopagurus edwardsi* (sp. ?): Borradaile 1916a: 97 = *Porcellanopagurus filholi* sp. nov.].

[Not *Porcellanopagurus* sp., probably *P. edwardsi*: Borradaile 1916b: 111, figs 1–13 = *Porcellanopagurus filholi* sp. nov.].

TYPES:

Lectotype, herein selected: female (sl = 4.8 mm), Stewart Island, coll. H. Filhol, MNHN Pg 5839.

Paralectotypes: 1 female (sl = 3.8 mm), Stewart Island, Filhol collection, MNHN Pg 5840; 7 males (sl = 3.1–4.5 mm), 4 females (sl = 3.2–4.8 mm), Campbell Island, Filhol collection, MNHN Pg 5841.

TYPE LOCALITY: Stewart Island, New Zealand.

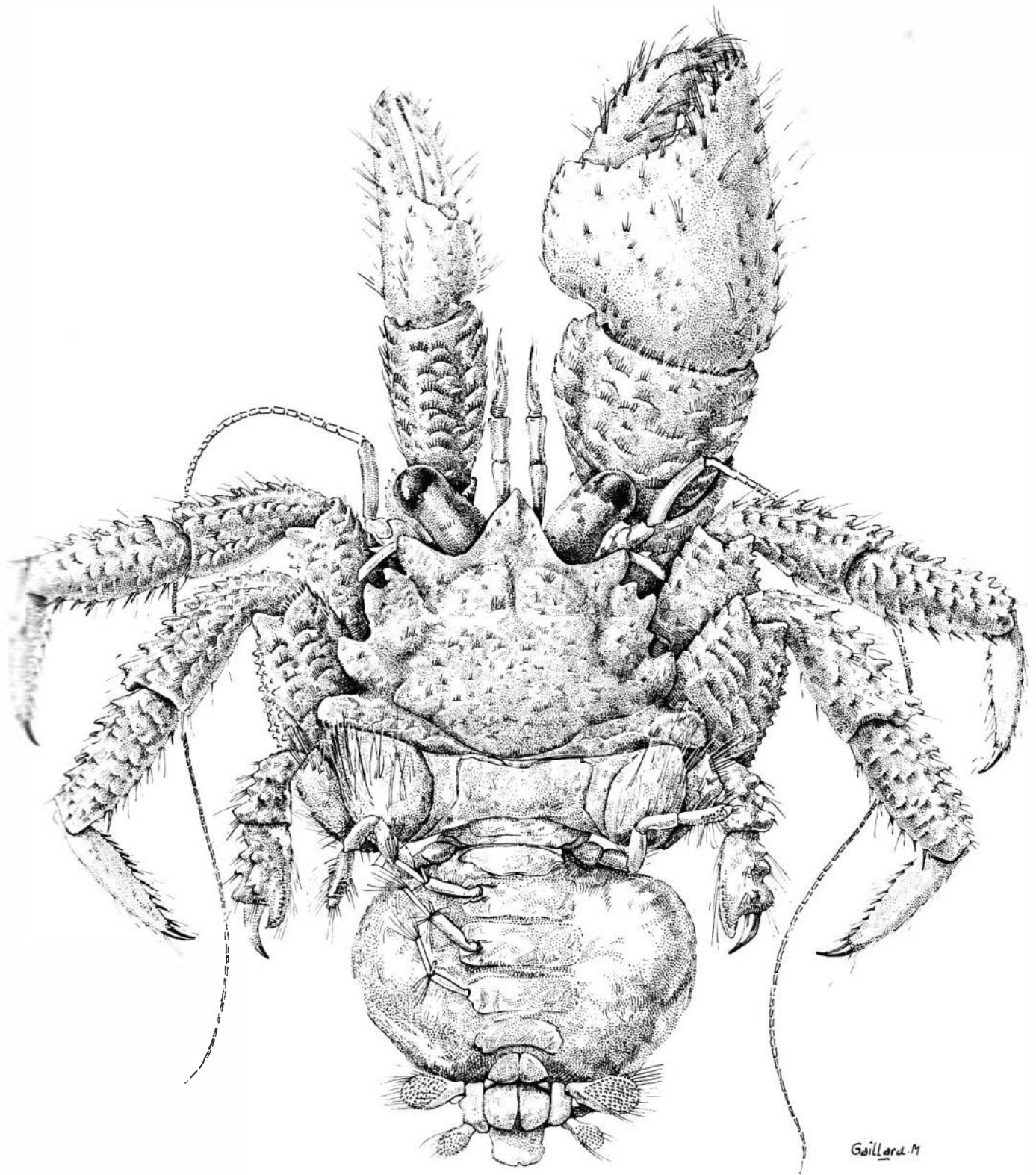
OTHER MATERIAL EXAMINED:

NZOI Stns: A738, 5 males (sl = 1.7–6.8 mm), 5 females (sl = 1.8–2.0 mm), 1 juvenile (sl = 1.7 mm); C442, 1 male (sl = 5.8 mm); D35, 1 male (sl = 2.6 mm); D873, 1 male (sl = 3.9 mm); D896, 1 female (sl = 7.0 mm); J55, 1 male (sl = 2.5 mm); S17, 1 male (sl = 11.5 mm); S180, 1 ovigerous female (sl = 7.2 mm); S181, 1 male (sl = 5.1 mm); Z6080, 1 male (sl = 10.1 mm).

NMNZ collections: Tucker Cove, Campbell Island, coll. R.L. Oliver, 21.7.44, 2 males (sl = 3.1, 5.6 mm), 4 females (sl = 3.3–7.5 mm), Cr 442; Tucker Point, Auckland Islands, coll. J. Yaldwyn, 1.63, 25–27 m, 1 female (sl = 3.3 mm), Cr 1288.

UC collections: Snares Island, coll. Capt. Bollons, -10.06, 110 m, male (sl = 9.5 mm).

DESCRIPTION: Anterior carapace (Fig. 35) strongly calcified; shield shorter than maximum breadth; lateral margins each with 3 lobular or wing-like processes: anterolateral lobe broad, divided into 2 distinct equal or subequal lobules by usually prominent, V or U-shaped indentation; subtriangular, broad, blunt or subacute lobe at midlength, sometimes preceded by small tooth; and slightly stronger, subrectangular, truncate or subacute simple or rarely bifid lobe



**Fig 35.** *Porcellanopagurus edwardsi* Filhol, 1885, female lectotype (sl = 4.5 mm), Campbell Island, MNHN Pg 5839. From Forest (1951a). Magnification equals 12x.



posterior to cervical groove; dorsal surface marked by weak but numerous transverse ridges fringed with short setae, giving slightly scale-like appearance. Rostrum broad, triangular, with dorsal keel at least distally, separated from subacute, not strongly produced, lateral projections, by nearly straight, or only very slightly concave anterior margin. Ocular peduncles short, stout, 0.35–0.40 length of shield; corneas dilated, corneal diameter included approximately twice in peduncular length. Ocular acicles small, triangular, hidden from dorsal view. Antennular peduncles over-reaching distal margins of corneas by slightly less to slightly more than length of ultimate segment. Antennal peduncles over-reaching distal margins of corneas by approximately half length of fifth segment.

Ischia of third maxillipeds each with moderately sparse tuft of basally thickened, distally tapered setae on dorsolateral surface.

Chelipeds (Fig. 35) very unequal, right much stronger. Dactyl of right cheliped with numerous tufts of setae. Palm noticeably swollen, dorsal surface smooth or finely granular, sparsely setose, dorsomesial margin slightly granular, dorsolateral margin rounded. Dorsal surface of carpus covered by weak, piliferous protrusions arranged in generally parallel rows, dorsomesial margin forming ridge in larger individuals. Merus with sparse to moderately dense tuft of basally thickened, distally tapering setae on ventral surface mesially; ventromesial and ventrolateral margins each with row of small teeth.

Left cheliped long, moderately slender; similar in structure and ornamentation to right. Dactyl with tufts of setae; dorsomesial margin of palm slightly concave. Carpus with short, transverse piliferous protrusions or ridges covering dorsal surface and giving scaly appearance. Merus lacking tuft of setae on ventral surface; ventromesial and ventrolateral margins denticulate.

Ambulatory legs generally similar, moderately short. Dactyls 0.70 to approximately equal length of propodi; laterally compressed, dorsal margins with sparse tufts of setae, ventral margins each with row of 8–11 spiniform setae. Propodi 0.30–0.36 as broad (lateral view) as long; each with row of distinct spinose teeth or scale-like tubercles on dorsal surface, strongest on second pereopods; lateral and mesial faces with scale-like, piliferous ridges; ventral margins each with 1 or 2 rows of 5 or 6 long spiniform setae. Carpi each with conical, often spinose teeth or tubercles on dorsal surface, lateral faces each with longitudinal ridge of spinous tubercles or protuberances at midlength and weaker row ventrally. Meri with denticulate ventral margins.

Males with coxae of fifth pereopods roundly sub-

quadrate, gonopores encircled by long setae. Abdomen globular, often expanded laterally. Tergite of sixth abdominal somite divided into anterior and posterior plates, each divided by longitudinal median furrow, pair of nodules laterally at junction of anterior and posterior plates. Telson with lateral indentations posterior lobes separated by small median cleft and normally folded under, terminal margin unarmed.

**COLOUR:** In preservative, overall reddish-orange.

**REPRODUCTION:** Roberts (1972) collected an ovigerous female of *P. edwardsi* from Perseverance Harbour, Campbell Island in April and, after examining several eggs near hatching, was able to describe the larval development of this species from local plankton samples similar to the prezoeae of his ovigerous female. McLaughlin (in press b) has now described the megalopa and first crab stages from material collected during one of the U.S. Antarctic Expedition cruises. The single ovigerous female in the present collection was carrying eggs in an early stage of development, with diameters measuring between 0.72 and 0.88 mm.

**HABITAT:** Collected at Perseverance Harbour from fronds of *Ulva* and *Corallina*-encrusted rock bottoms. Specimens have also been found utilising bivalve shells.

**REMARKS:** With the exception of Chilton's (1911b) record of *P. tridentatus* from the Kermadec Islands, virtually all other reports of *Porcellanopagurus* have been attributed to Filhol's (1885a) *P. edwardsi*. We have compared Filhol's syntypic material with specimens collected throughout New Zealand waters, and have found that two species have been confounded under the name *P. edwardsi*. In addition to specimens from Stewart, Auckland, and Campbell Islands and southwards, *P. edwardsi* has been collected as far north as Pegasus Bay, South Island. We did not examine Chilton's (1909) male specimen from the Snares Islands; however, another large specimen from there has confirmed the presence of *P. edwardsi* in this vicinity. Neither did we examine the specimens from Campbell Island reported by Stephensen (1927), Balss (1930), and Bennett (1932), and it is not possible, on the basis of the information and illustrations presented, to confirm the identifications of these authors. Nonetheless, given the subantarctic environment and the relatively shallow depths from which the specimens were collected, it is quite probable that these reports actually were of *P. edwardsi*. Specimens of a second species in the collections of the N.Z. Oceanographic Institute and Museum of New Zealand have been

referred to *Porcellanopagurus filholi* sp. nov.

Thomson's (1899) report of *P. edwardsi* was simply a verbatim translation of Filhol's (1885b) description. Thomson (1899) had no personal knowledge of Filhol's taxon. Alcock (1905b) included *P. edwardsi* in his list of pagurid species, but like Thomson, had no personal knowledge of the species. The difficulties that subsequent authors had in identifying their specimens was due in part to the very general and somewhat ambiguous nature of Filhol's (1885b: 23) description and in part to the discrepancies between it and his illustrations (Filhol 1885e: pl. 49, figs 2–4). Chilton (1909) reported that his male specimen agreed in general with Filhol's (1885b) description but emphasised the differences between the chelipeds of his specimen and those described and illustrated.

Borradaile (1916a) reported the capture of a specimen of *Porcellanopagurus* from *Terra Nova* Stn 96 off northern New Zealand, and questionably assigned it to *P. edwardsi*. In his brief remarks, Borradaile noted several differences between the right cheliped of his female specimen and the male illustrated by Chilton (1909), but commented that before a new species could be established for the *Terra Nova* specimen, a series of specimens would have to be examined. In a subsequent report, Borradaile (1916b) provided a much more detailed description and illustrations of his specimen. It is quite clear from his figure of the whole animal (Borradaile 1916b: fig. 1), that he actually did have the species we describe herein as *P. filholi* sp. nov.

Stephensen (1927) reported a male specimen questionably as *P. edwardsi* that was dredged in sand and algae from a depth of 18 m at Port Ross, Auckland Islands. Stephensen remarked that while the chelae were exactly as illustrated by Chilton (1909), the ocular peduncles were much thinner than either of those illustrated by Filhol (1885e: pl. 49, figs 2, 4) or Borradaile (1916b: fig. 1), and the processes on the "edge of the thorax" were smaller. We have been able to confirm the occurrence of *P. edwardsi* in the Auckland Islands (NMNZ Cr 1288; NZOI Stn S17); however, the ocular peduncles of the small female (sl = 3.3 mm; Cr 1288) were as stout as those illustrated by Filhol (1885e). Stephensen (1927) did not give any indication of the size of his male, but despite the indicated differences from most *P. edwardsi*, the collection habitat and depth lend support to the assumption that he indeed had a representative of Filhol's (1885b) species.

It is unclear whether Thompson (1930) actually reexamined Chilton's (1909) specimen of *P. edwardsi*, but he certainly considered Chilton's identification questionable. However, Thompson (1930) was basing his evaluation on Borradaile's (1916a) expressed

differences between the *Terra Nova* specimen and Chilton's (1909) description. As stated earlier, it was Borradaile's specimen that was incorrectly assigned to *P. edwardsi*. In contrast, Balss (1930) found general agreement between his specimen from Perseverance Harbour, Campbell Island and Borradaile's (1916a, 1916b) description of the *Terra Nova* specimen. However, Balss (1930) considered only the similarities of the right cheliped.

Bennett (1932) not only reexamined Chilton's (1909) specimen and an additional specimen from Campbell Island, but extensively reviewed all of the earlier reports of *P. edwardsi*, including Filhol's (1885b) original description and illustrations (Filhol 1885e: pl. 49, figs 2–4). His ultimate conclusion was that all specimens from New Zealand were conspecific.

It is apparent from the difficulties encountered by earlier carcinologists, that *P. edwardsi* and *P. filholi* sp. nov. are morphologically very similar species. Although Bennett (1932) considered the lateral carapace lobes to be variable, this is not truly accurate. A certain amount of variation does occur, as illustrated by Forest (1951a: fig. 2). Nonetheless, the most immediate diagnostic character is seen in the first of the lateral lobes of the shield. In *P. edwardsi* this lobe is distinctly divided into two equal or subequal lobules (Fig. 35). In contrast, this lobe in *P. filholi* is broad, level or nearly rounded anteriorly, and with a posterior spike or spinose protuberance (Fig. 36a). *Porcellanopagurus edwardsi* commonly does not appear to reach as large a size as *P. filholi*, but in specimens of similarly small size, the specific differences in the armature of the ambulatory legs are indisputable. The dorsal margins of the propodi, in particular, and the dorsal margins of the carpi, are armed in *P. edwardsi* with individually distinct spinose or spiniform teeth. In contrast, these margins in specimens of *P. filholi* have only irregular rows of denticulate protuberances. Differences are also seen in the length/width (lateral view) ratio of the propodi of the ambulatory legs in the two species. The width of the propodi in *P. edwardsi* is approximately 0.35 total length, whereas in *P. filholi* the width of the propodi is only 0.18–0.21. In the two large males of *P. edwardsi* that we examined, the scale-like, piliferous ridges on the propodi of the ambulatory legs were appreciably better developed than were seen in specimens of *P. filholi* of comparable size.

A specimen of *P. edwardsi* was collected at NZOI Stn S180 (100 m depth), and a second, in rather poor condition, from NZOI Stn S181 (260–392 m deep). This latter station also contained a specimen of *P. filholi* sp. nov. It is uncertain whether the two species do occasionally occur sympatrically, or if the specimen of *P. edwardsi* was actually collected at the previous station but not removed from the netting at



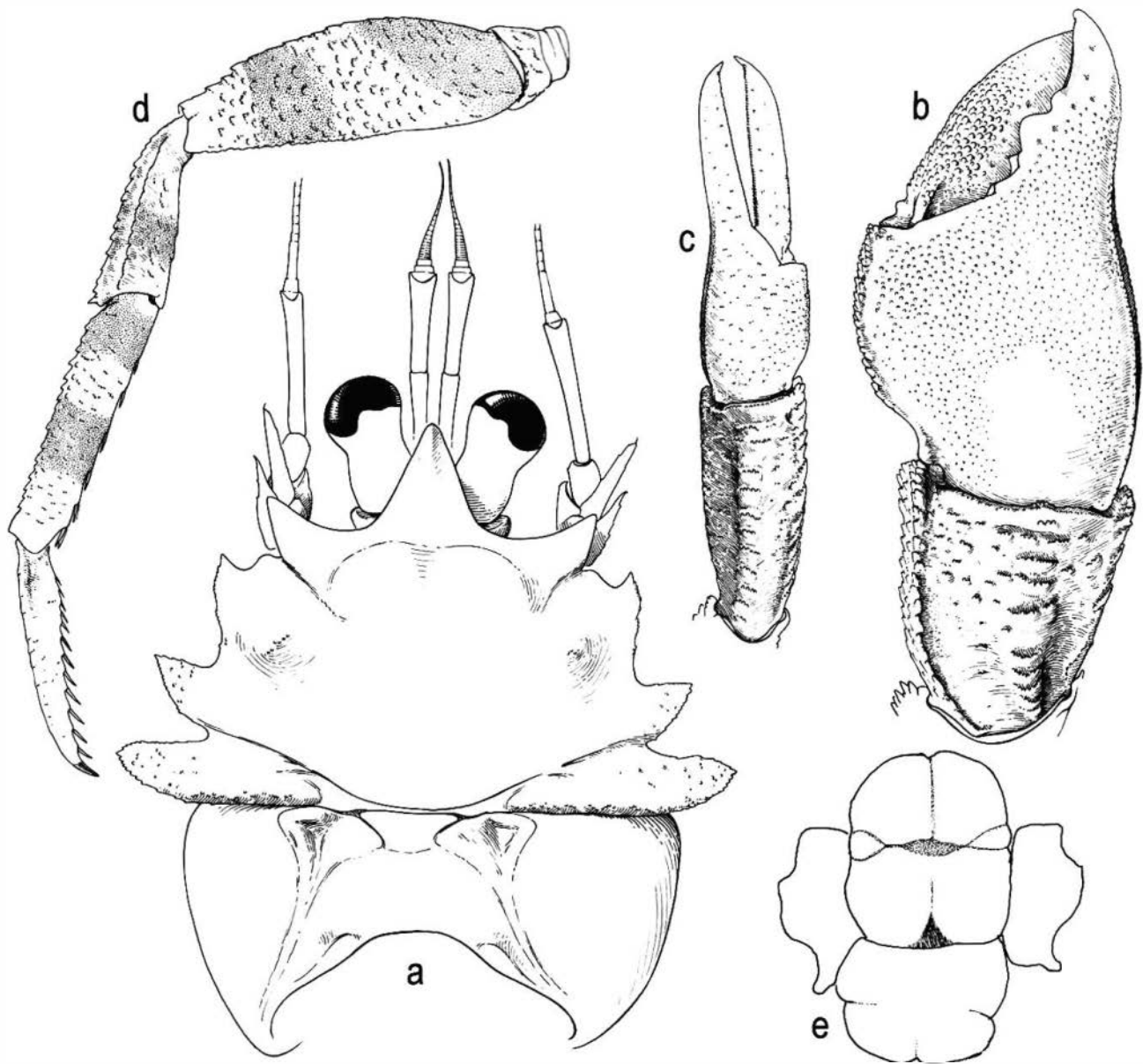


Fig. 36. *Porcellanopagurus filholi* sp. nov., NZOI Stn E751, male paratype (sl = 8.6 mm), P-1165: a, cephalothorax and cephalic appendages (setation and aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view, setation omitted); c, carpus and chela of left cheliped (dorsal view, setation omitted); d, left third pereopod (lateral view, setation omitted; stippled areas indicate bands of colour); e, tergite of sixth abdominal somite, protopods of uropods, telson (setation omitted). Magnifications equal 9x (b-d), 12x (a), 18x (e).

that time. The minimum depth of 260 m at Stn S181 is considerably greater than all other records for *P. edwardsi*.

RECORDS FROM NEW ZEALAND: Auckland, Campbell, Snares, and Stewart Islands northwards to Pegasus Bay, South Island, 1–198 m, possibly to 260 m.

DISTRIBUTION: Auckland, Campbell, Snares, and Stewart Islands of New Zealand.

*Porcellanopagurus filholi* sp. nov.

(Fig. 36, Pl. 3, fig. 3)

*Porcellanopagurus edwardsi* (sp. ?): Borradaile 1916a: 97. [not *Porcellanopagurus edwardsi* Filhol, 1883].

*Porcellanopagurus* sp., probably *P. edwardsi*: Borradaile 1916b: 111, figs 1–13.

*Porcellanopagurus edwardsi*: Balss 1930: 196 (in part); Bennett, 1932: 470 (in part); Gordan 1956: 339 (in part) (lit.); Zarenkov 1990: 239 (in part).

*Porcellanopagurus* sp. 2 of de Saint Laurent & McLaughlin: McLaughlin, in press a.

#### TYPES:

Holotype: female (sl = 11.0 mm), NZOI Stn Q25, NIWA holotype H-712.

Paratypes: 1 male (sl = 8.6 mm), NZOI Stn E751 NIWA paratype P-1165; 2 males (sl = 3.3, 7.1 mm), NZOI Stn Q11, NIWA paratype P-1166, 1 female (sl = 9.7 mm); NZOI Stn S181, NHM 1999.877; 2 females (sl = 3.2, 3.3 mm), 2 ovigerous females (sl = 5.3, 6.0 mm), Conway Rise, Kaikoura; NMNZ Cr 5904; 1 male (sl = 8.1 mm), NMNZ Stn BS 396, NMNZ Cr 8045; 1 male (sl = 7.3 mm), NMNZ Stn BS 669, NMNZ Cr 9597; 1 male (sl = 8.7 mm), 1 female (sl = 9.4 mm), NMNZ Stn BS 768, MNHN Pg 5849; 1 female (sl = 9.7 mm), NZOI Stn E908, NHM 1999.2612; 1 male (sl = 9.9 mm), NMNZ Stn BS 768, USNM 268575.

TYPE LOCALITY: Chatham Islands, NZOI Stn Q25, 44°26.2'S, 176°38.4'W, 360 m.

#### OTHER MATERIAL EXAMINED:

NZOI Stns: C683, 1 male (sl = 11.4 mm); E751, 1 male (sl = 8.6 mm); D899, 2 males (sl = 3.3, 6.8 mm); E845, 2 males (sl = 4.6, 13.4 mm), 3 females (sl = 2.8–9.5 mm); E876, 4 males (sl = 5.9–8.6 mm), 2 females (sl = 6.4, 7.2 mm); G307, 3 males (sl = 6.3–7.2 mm), 1 female (sl = 5.2 mm); H651, 1 female (sl = 10.8 mm); V464, 1 male (sl = 3.6 mm); Stn Z8792, 1 male (sl = 7.0 mm).

NMNZ collections: Stn BS 292, 3 females (sl = 4.9–5.4 mm), Cr 9598; Stn BS 649, 2 males (sl = 7.6, 9.2 mm), 7 females (sl = 5.8–7.8 mm), Cr 9599; Stn BS 783, 1 female (sl = 11.7 mm), Cr 9560; Stn BS 840, 1 male (sl = 3.5 mm), Cr 8149.

AM collections: Stn K80-07-02, 1 female (sl = 3.5 mm), AM P40395.

**DESCRIPTION:** Cephalothorax (Fig. 36a) strongly calcified; shield shorter than maximum breadth (excluding lateral processes); lateral carapace margins each with 3 distinct lobular or wing-like processes: anterolateral lobe moderately broad, anteriorly flat or rounded, with prominent spike-like or spiniform posterior projection; acute or subacute triangular lobe at mid-length; and considerably larger, subrectangular, roundly truncate or subacute lobe posterior to cervical groove; dorsal surface of shield and lateral processes marked by numerous short, transverse, low ridges fringed with setae (not illustrated). Rostrum moderately broad, triangular, with short dorsal keel distally, separated from subacute, moderately short, lateral projections, by straight or slightly concave anterior margin.

Ocular peduncles short, stout, 0.31–0.36 length of shield, with prominent constriction near base of cornea; dorsal and/or dorsomesial surfaces with few small granules or protuberances and setae; corneas dilated, corneal diameter included 1.5–1.7 times in peduncular length. Ocular acicles very small, subtriangular, hidden from dorsal view.

Antennular peduncles over-reaching distal margins of corneas by 0.25–0.50 the length of penultimate segment. Ultimate segment with cluster of several long setae at dorsodistal margin and few scattered setae on dorsal surface. Penultimate segment with few scattered setae. Basal segment with tiny spinulose tubercle on lateral face.

Antennal peduncles overreaching distal margins of corneas by 0.25–0.65 length of ultimate segment. Fifth and fourth segments with few scattered setae. Third segment with tiny denticle at ventrodistal margin. Second segment with laterodistal projection slender, with terminal, simple or bifid small tooth, lateral margin sometimes with 2 or 3 minute denticles; dorso-mesial distal margin with small tooth. First segment with longitudinal row of tiny granules on lateral surface, continuing onto lateral margin of produced ventral lobe and becoming stronger distally. Antennal acicle slender, terminally subacute, reaching at least to distal margin of fourth peduncular segment, often considerably beyond proximal margin of fifth in large specimens. Antennal flagellum long, articles naked or with occasional very short seta.

Ischia of third maxillipeds each with prominent ovate patch of dense, basally thickened and distally tapered setae dorsolaterally.

Chelipeds very unequal, right much stronger, although not appreciably longer. Dactyl and fixed fingers of both chelipeds arched ventrally. Dactyl of right (Fig. 36b) cheliped 0.20–0.35 longer than palm; dorsomesial margin with row of small granules or denticles in proximal 0.65; dorsal surface rounded, granular or minutely tuberculate, and with sparse tufts of moderate to long setae, with short, subacute ridge proximally; mesial face and ventromesial margin minutely granular; cutting edge with row of 5 or 6 calcareous teeth, and adjacent row of tufts of moderately short setae. Palm with convex dorsal surface minutely granular, particularly in mesial half and with numerous sparse tufts of moderately long setae, dorsomesial margin with low ridge of tiny tubercles or simply crenulations, dorsolateral margin curving inward on fixed finger and with distinct low ridge of crenulations or granules, becoming somewhat more prominent on fixed finger; ventral surfaces of both palm and fixed finger with scattered setae, longer on palm but more dense on fixed finger; cutting edge of fixed finger also with row of prominent calcareous teeth. Carpus somewhat roundly elevated in dorsal midline with several short, transverse, piliferous ridges or protrusions, dorsomesial and dorsolateral margins and mesial and lateral faces each with transverse, piliferous, crenulated low ridges; dorso-mesial and dorsolateral distal angles produced beyond levels of articulation with palm; ventral



surface with only narrow median bridge of calcified integument between prominently excavated articulating membranes. Merus subtriangular; dorsal margin with several short, transverse, piliferous ridges; ventromesial and ventrolateral margins each with row of moderately small teeth, ventral surface with very dense patch of basally thickened, distally tapering setae in mesial half, several spiniform tubercles laterally. Ischium with row of small blunt teeth on ventromesial margin.

Left cheliped long, appreciably more slender than right. Dactyl 0.35–0.50 longer than palm; surfaces unarmed but with sparse tufts of setae adjacent to cutting edge and ventrally; cutting edge with row of fine corneous teeth. Palm (Fig. 36c) with somewhat convex, minutely granular dorsal surface also provided with numerous scattered, sparse tufts of setae; dorsolateral margin only weakly delimited by very low granular ridge, not extending onto fixed finger; dorsomesial margin with granular ridge; cutting edge of fixed finger with row of very small calcareous teeth, interspersed with few fine corneous teeth. Carpus with several transverse, weakly raised piliferous ridges; dorsomesial and dorsolateral margins each with low, transverse, somewhat crenulated ridges and sparse tufts of longer setae; mesial, lateral and ventral surfaces also with scattered sparse tufts of moderately long setae. Merus with short transverse ridges and moderately short, sparse setae; ventromesial margin with row of small teeth in proximal 0.65; ventrolateral margin with row of smaller, more widely spaced teeth in proximal 0.65. Ischium with row of small, rather widely spaced teeth on ventromesial margin.

Ambulatory legs generally similar in armature, but differing slightly in segmental proportions. Dactyls of second pereopods 0.65–0.70 length of propodi; dactyls of third pereopods (Fig. 36d) 0.75–0.80 length of propodi; dorsal margins with sparse setae (second) or transverse rows of moderately long setae (third); ventral margins each with row of 8 or 9 (second) or 12 or 13 (third) spiniform setae. Propodi with width (lateral view) 0.18–0.21 of total length; with short, somewhat denticulate ridges forming irregular longitudinal rows on dorsal surface and lateral and mesial faces dorsally, ventral margin with single or double row of long spiniform setae and moderately long simple setae. Carpi each with dorsodistal spine, rows of denticulate protuberances on dorsal and mesial faces; lateral faces each with protuberances forming distinct ridge near midwidth and with few lower denticulate protuberances ventrally. Meri with similar but weaker denticulate ridges or protuberances and sparse setae; lateral surfaces somewhat granular or with granules forming short transverse rows, ventrolateral margins each with row of very

small teeth; mesial faces faintly granular, ventromesial margins minutely granular; ventral surfaces concave distally.

Males with coxae of fifth pereopods roundly subquadrate, gonopores each encircled by tuft of long setae. Abdomen globular; tergite (Fig. 36e) of sixth abdominal somite divided into anterior and posterior halves by prominent transverse furrow, with small area of calcification laterally. Anterior and posterior portions each divided by longitudinal median furrow. Anterior lobes calcified only in posterior halves. Telson (Fig. 36e) with faint lateral indentations; posterior lobes broader than long, separated by very minute median cleft, terminal margins rounded and with very fine setae.

**COLOUR:** In preservative, ambulatory legs each with median and proximal band of pigment on propodus and merus, single median band on carpus.

**REPRODUCTION:** Only two ovigerous females are represented in the present collections. These, collected in August, were each carrying between 50 and 100 moderately small eggs (diameter 0.53–0.73 mm) in early stages of development.

**HABITAT:** Commonly found utilising halves of bivalve shells, and in one instance a limpet with an expanded covering of a colonial hydrozoan. In several instances, the animals were found with the telson and endopods of the uropods securely lodged in the umbones of the shells.

**ETYMOLOGY:** This species is dedicated to Henri Filhol, who first recognised this distinctive genus.

**REMARKS:** As indicated in the remarks for *P. edwardsi*, the two species have been confounded for many years. A review of the literature pertaining to this confusion, including the fact that Borradaile (1916a, 1916b) was not entirely convinced that his specimen from the *Terra Nova* expedition actually represented Filhol's (1885b) *P. edwardsi*, was discussed under that species and need not be repeated here. Several authors have been listed as "in part" in the synonymy, because their references were to *P. edwardsi sensu lato*.

Balss (1930) and Bennett (1932) considered *Porcellanopagurus platei* Lenz, 1902, from Easter Island, very closely related to, if not synonymous with, *P. edwardsi*. Lenz (1902) had seen one of Filhol's (1855b) syntypes of *P. edwardsi*, and distinguished *P. platei* from Filhol's species by the shape of the lateral carapace lobes. Judging from Lenz's (1902: pl. 23, fig. 20) rather stylised figure, the similarity in carapace lobes is greater with *P. filholi*; however, the short, moderately

stout pereopods of the illustrated ambulatory legs do resemble *P. edwardsi* more closely. A second, recently described Eastern Pacific species of *Porcellanopagurus*, *P. foresti* Zarenkov, 1990, appears to resemble *P. tridentatus*, at least in the shape of the carapace lobes; however, in overall morphology, *P. foresti* is more closely allied to *P. filholi*. Specimens of *P. foresti* have not been available for detailed comparison.

*Porcellanopagurus filholi* sp. nov. is best distinguished from *P. edwardsi* by the configuration of the lateral carapace lobes, the length of antennular peduncles, and length and breadth of the propodi of the ambulatory dactyls. Quite frequently the distinctive tuft of setae on the ischium of the third maxilliped is denser in this species, but that has not proven to be specifically diagnostic, since occasionally a dense tuft of setae is also present in *P. edwardsi*. Although *P. filholi* is most commonly found at appreciably greater depths than *P. edwardsi*, there does appear to be a bathymetric overlap between 75 and 188 m. In geographical distribution, the present data suggest that *P. filholi* is the north-temperate representative of the genus, whereas *P. edwardsi* is the southern representative, with an overlap only in the area around Banks Peninsula.

RECORDS FROM NEW ZEALAND: From north of Three Kings Islands southwards on the east of both islands to the Canterbury Bight and the Chatham Islands, 79–1392 m, possibly as deep as 1430 m.

DISTRIBUTION: Eastern Australia, 64 m; New Zealand; New Caledonia (McLaughlin, in press a).

### *Bathypaguropsis* McLaughlin, 1994

*Bathypaguropsis* McLaughlin, 1994: 469; McLaughlin 1997: 539.

TYPE SPECIES: *Bathypaguropsis yaldwyni* McLaughlin, 1994. Gender feminine.

Thirteen pairs of quadriserial gills. Shield with central dorsal surface sometimes only weakly calcified. Rostrum well developed. Cardiac sulci extending more than half length of posterior carapace. Maxillule with 1 stiff bristle on internal endopodal lobe, external lobe articulated, not recurved. Third maxilliped with well developed crista dentata and 1 accessory tooth. Sternite of third maxillipeds unarmed.

Right cheliped massive; chela operculate or nearly so; dactyl articulating obliquely with palm. Left cheliped moderately elongate, slender; dactyl and fixed finger opening obliquely. Fourth pereopods very

weakly semichelate; propodal rasp consisting of 1 or more, sometimes incomplete, rows of scale-like bristles.

Males with paired gonopores, each partially masked by tuft of stiff setae; no paired pleopods or sexual tubes. Four unpaired pleopods on left, with exopods only moderately well developed, endopods markedly reduced. Females with paired gonopores. No paired pleopods; left second to fifth unpaired, second to fourth with both rami well developed and egg-carrying, fifth reduced as in males.

Tergite of first abdominal somite with chitinous or weakly calcified short rectangular plate; tergites of somites 2–5 indicated by transverse bands of fibrils; tergite of sixth somite divided by deep transverse furrow in posterior third. Uropods asymmetrical. Telson with transverse indentation suggesting division into anterior and posterior portions; posterior lobes subtriangular; terminal margins oblique, unarmed or denticulate.

REMARKS: *Bathypaguropsis* was established for two deep-water species, *B. yaldwyni* from New Zealand and *B. marionensis* McLaughlin, 1994, from the Marion Plateau off Queensland, Australia. A third species, *B. rayahuae* McLaughlin, 1997, was described from the Kai Islands of Indonesia. From personal examination (MSL), we have found that *Pagurus kuroshioensis* Miyake, 1978, should also be included in this genus. Consequently, the range of *Bathypaguropsis* is extended to Sagami Bay, Japan, while the minimum depth is decreased to 125 m. Nonetheless, all four species are known only from depths in excess of 100 m, thus it came as a surprise to find a second New Zealand species in much shallower water. Two specimens of *Bathypaguropsis cruentus* sp. nov. were collected in the Wellington area at depths of less than 100 m.

### KEY TO THE NEW ZEALAND SPECIES OF *Bathypaguropsis*

- Rostrum produced nearly to midlength of ocular acicles. Palm of right chela with dorsomesial distal angle produced into very prominent unarmed lobe. Dactyls of ambulatory legs each with 9 or 10 strong spiniform setae ..... *B. cruentus* sp. nov.
- Rostrum not so produced. Palm of right chela without dorsomesial distal angle produced into very prominent unarmed lobe. Dactyls of ambulatory legs each with 15–31 strong spiniform setae ..... *B. yaldwyni*

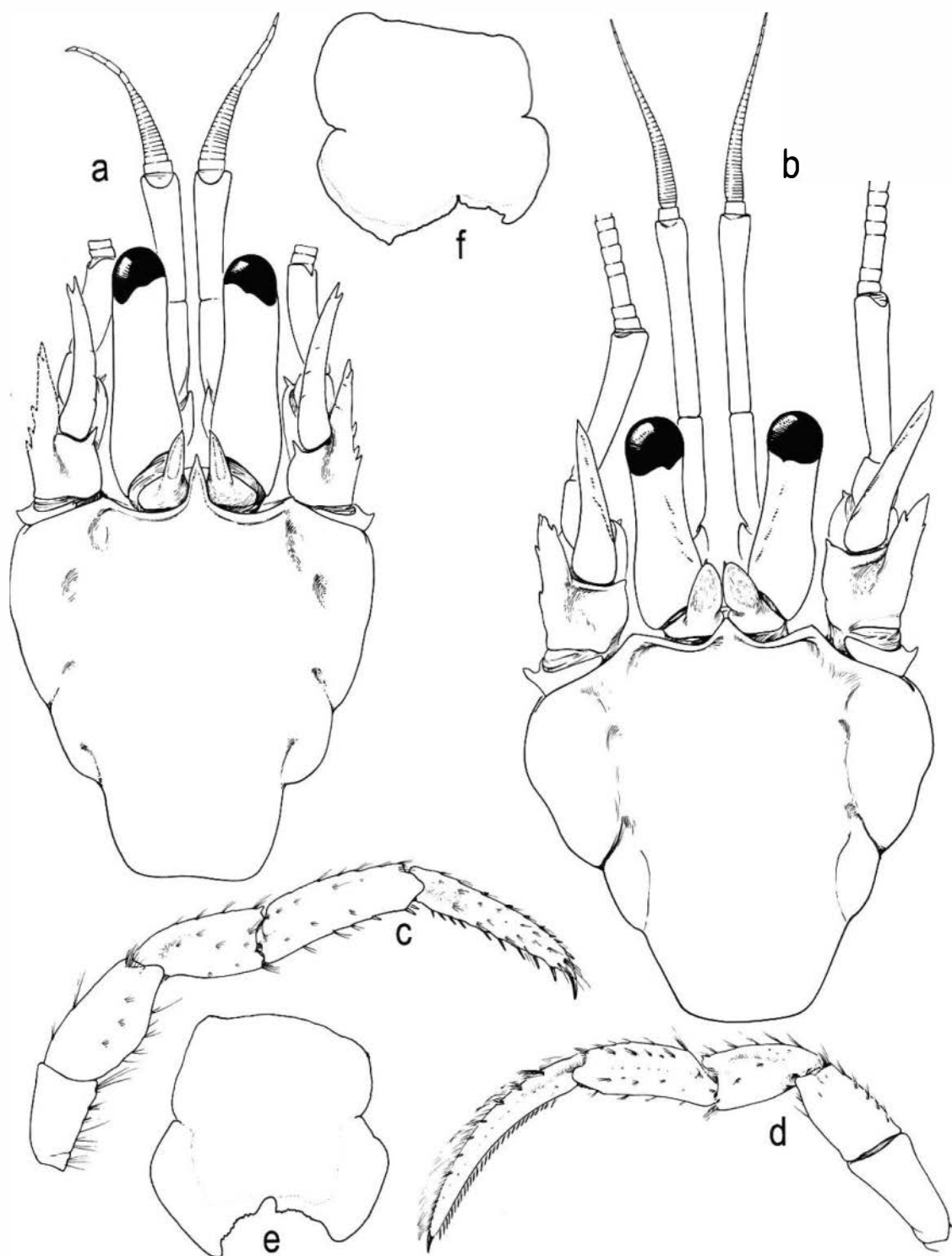
### *Bathypaguropsis cruentus* sp. nov.

(Figs 37a, c, e; 38a, c)

TYPES:

Holotype: female (sl = 5.2 mm) from NZOI Stn





**Fig. 37.** a, c, e, *Bathypaguopsis cruentus* sp. nov. NZOI Stn C844, female holotype (sl = 5.2 mm), NIWA H-713; b, d, f, *Bathypaguopsis yaldwyni* McLaughlin, 1994, Bay of Plenty, male (sl = 5.4 mm), Cr 9602: a, b, shield and cephalic appendages (setation and aesthetascs omitted); c) right third pereopod (lateral view); d, left third pereopod (lateral view); e, f, telson. Magnifications equal 6.5x (d), 15x (b, c), 18x (f), 27x (a), 37.5x (e).

C844, NIWA holotype H-713.

Paratype: 1 male (sl = 6.4 mm), off Kapiti Island, Wellington, coll. V. Hoggard, 5.5.73, 12 m, NMNZ Cr 2232.

TYPE LOCALITY: NZOI Stn C844, off Cape Palliser, 41°38'S, 175°11'E, 88 m.

**DESCRIPTION:** Shield (Fig. 37a) longer than broad; anterior margin between rostrum and lateral projections concave, anterolateral margins sloping; posterior margin truncate. Rostrum acutely triangular, reaching to midlength of ocular acicles, with tiny terminal denticle. Lateral projections obtusely triangular, with very tiny marginal denticle.

Ocular peduncles 0.65 shield length, dorsomesial surface with row of stiff setae; corneas not dilated, corneal diameter less than 0.25 peduncular length. Ocular acicles simple, narrowly triangular, with tiny marginal terminal denticle.

Antennular peduncles, when fully extended, overreaching ocular peduncles by approximately entire length of ultimate segment; basal segment with prominent spine on dorsolateral margin distally.

Antennal peduncles exceeding proximal margins of corneas but not distal margins. Fifth and fourth segments with few scattered setae. Third segment with prominent tooth at ventrodistal margin. Second segment with laterodistal projections triangular, elongate, reaching beyond distal margin of fourth peduncular segment, terminating in bifid tooth, mesial margin unarmed, lateral margin with 3 teeth in proximal 0.65, dorsomesial distal angle with large spine. First segment with small denticle at laterodistal margin, ventral margin with prominent tooth distolaterally. Antennal acicle reaching beyond midlength of ultimate peduncular segment, slightly arcuate, with row of tufts of stiff setae on mesial margin; terminating in bifid tooth. Antennal flagella missing.

Right cheliped (Fig. 38a) massive, operculate. Dactyl broad, approximately equal to dorsomesial margin of palm; articulation with chela almost horizontal; cutting edge with calcareous margin faintly cusped; dorsal surface slightly elevated in midline proximally, glabrous, dorsomesial margin rounded, unarmed, ventral surface slightly elevated in midline proximally, and with very low, flattened, corneous-capped, blister-like tubercles. Palm with maximum breadth 0.33 greater than length of dorsomesial margin, approximately equal to total length of chela (including fixed finger), dorsomesial distal angle very prominently produced into broad, terminally rounded lobe; dorsomesial margin with 4 very low, blunt tubercles in proximal third; dorsal surface convex,

faintly pitted, with 2 very low tubercles at proximal margin mesially and 2 similar tubercles forming short oblique row on proximal surface laterally; dorso-lateral margin slightly elevated, rounded and irregularly punctate; mesial face with numerous tiny pits and few very low flattened tubercles; ventral surface with 2 low but distinct swellings in mesial half, each with cluster of low, flattened, blister-like, corneous-capped tubercles; cutting edge of fixed finger with 2 broad, very weakly delineated calcareous teeth. Carpus approximately same length as merus, subtrapezoidal when viewed dorsally; dorsomesial distal angle depressed and with small lateral tooth, depressed dorsomesial surface and rounded margin weakly tuberculate and with 1 prominent subacute tooth distally, dorsal surface punctate, dorsodistal margin with 3 very low, flattened tubercles; dorsolateral margin not delimited, lateral face ventrally and ventrolateral margin proximally each with few low, flattened tubercles, some corneous-capped. Merus roundly subtriangular; dorsal margin with few low transverse ridges extending onto lateral face dorsally; ventrolateral margin with row of small denticles proximally; ventromesial margin minutely denticulate; ventral surface with numerous flattened, corneous-capped tubercles. Ischium with microscopically denticulate ventromesial margin.

Left cheliped (Fig. 38c) slender; rotation of propodal-carpal articulation approximately 45° counterclockwise from perpendicular. Dactyl 1.35 times the length of palm; surfaces unarmed but with scattered tufts of short setae; cutting edges of dactyl and fixed finger each with row of small corneous teeth in distal half; terminating in small corneous claws. Palm slightly more than 0.50 length of carpus; dorsomesial and dorsolateral margins unarmed but each with row of sparse tufts of short setae; all surfaces also unarmed. Carpus subtriangular, slightly shorter than merus; dorsal margin with irregular, single to double row of acute and subacute teeth, distalmost largest; laterodistal margin with prominent tooth, lateral face with numerous shallow pits and very short setae. Merus with unarmed dorsal margin; ventrolateral margin minutely denticulate; ventromesial margin with 1 tiny tubercle proximally. Ischium with row of tiny denticles on ventromesial margin in distal half.

Ambulatory legs (Fig. 37c) similar. Dactyls 1.10 times length of propodi; in dorsal view, straight; dorsal margins each with row of sparse tufts of short, simple setae, accompanied distally by short spiniform setae; lateral and mesial faces each with faint longitudinal sulcus, flanked dorsally and ventrally by row of sparse, widely spaced tufts of short setae; ventral



margins each with row of 9–11 spiniform setae. Propodi 0.25–0.35 longer than carpi, each with row of widely spaced sparse tufts of short setae on dorsal surface, lateral faces each with dorsal and ventral row of widely spaced sparse tufts of short setae; ventral surfaces each with row of widely spaced small spiniform setae. Carpi 0.65–0.80 length of meri; dorso-distal angles each with small spine, dorsal surfaces each with row of widely spaced spinulose protuberances, strongest on second pereopods, accompanied by few short setae. Meri and ischia with scattered setae on dorsal and ventral margins; ventral margins of meri of second pereopods with 2 tiny denticles laterally in distal half. Fourth pereopods with propodal rasp consisting of 2 rows of corneous, scale-like setae; dactyl with small terminal claw, no preungual process detected. Anterior lobe of sternite of third pereopods subsemicircular, with marginal fringe of long setae.

Telson (Fig. 37e) with posterior lobes slightly asymmetrical, marginally somewhat calcified, separated by moderate median cleft, terminal margins unarmed or minutely denticulate, outer angles produced, terminally subacute.

**COLOUR:** Distal three segments of ambulatory legs and left chela blood-red (Hoggard, field notes).

**REPRODUCTION:** Not known.

**HABITAT:** Silty boulder substrate; male found in *Struthiolaria* shell.

**ETYMOLOGY:** From the Latin *cruentus*, meaning blood-red, referring to the colouration of the left chela and distal segments of the ambulatory legs.

**REMARKS:** *Bathypaguropsis cruentus* is known from only a pair of specimens, one male and one female, but there is no question regarding their assignment to *Bathypaguropsis*, despite their shallow-water habitat (12–88 m). This new species is distinguished from the other New Zealand species of the genus, *B. yaldwyni*, by having a much more prominent rostrum, longer ocular peduncles and antennal acicles, right cheliped with very short dactyl and very prominently produced dorsomesial angle of the palm, considerably fewer spiniform setae on the ventral margins of the ambulatory dactyls, and its colouration.

**RECORDS FROM NEW ZEALAND:** Off Cape Palliser and Kapiti Island; 12–88 m.

**DISTRIBUTION:** Known only from New Zealand.

*Bathypaguropsis yaldwyni* McLaughlin, 1994

(Figs 37b, d, f; 38b, d)

Pagurid 'smooth apricot': Schembri 1982b: 871; Schembri & McLay 1983: 29, figs 7a, b.

*Bathypaguropsis yaldwyni* McLaughlin, 1994: 471, figs 1A, 2, 3; 1997: 541.

**TYPES:**

Holotype: female (sl = 10.4 mm), CM Stn 149, NMNZ Cr 8067.

Paratypes: 1 male, 2 females (sl = 5.2–5.9 mm), 22 km E Aldermen Islands, 410–415 m, 12.87, NMNZ Cr 7523; 1 female (sl = 3.4 mm), Stn BS 842, NMNZ Cr 8129; 1 male (sl = 8.3 mm), Stn BS 741, NMNZ Cr 8151; 1 male (sl = 11.2 mm), CM Stn (a), NMNZ Cr 7519; 1 female, 1 ovigerous female (sl = 9.5, 9.6 mm), CM Stn (b), NMNZ Cr 7517, Cr 7518; 1 ovigerous female (sl = 9.8 mm), CM Stn (c), NMNZ Cr 7514; 2 males (sl = 9.4, 10.6 mm); CM Stn (d), NMNZ Cr 7513, Cr 7515; 1 male, 1 ovigerous female (sl = 10.0, 9.0 mm), CM Stn 145 NMNZ Cr 8118; 1 ovigerous female (sl = 10.5 mm), CM Stn 149, NMNZ Cr 7516; 1 male (sl = 8.5 mm), JC Stn D4, NMNZ Cr 8105; 1 male (sl = 4.4 mm), JC Stn JO6/048/81, NMNZ Cr 8087; 2 males (sl = 5.4, 7.6 mm), NPC Stn T3, NMNZ Cr 8027; 1 male (sl = 5.8 mm), NPC Stn "a", NMNZ Cr 8080; 1 male (sl = 6.2 mm), NPC Stn "b", NMNZ Cr 8214; 1 male, 1 female (sl = 10.0, 8.2 mm), CM Stn 145, USNM 267573.

**TYPE LOCALITY:** Solander Trough, CM Stn 149, 46°30'S, 165°14.4'E, 545–573 m.

**OTHER MATERIAL EXAMINED:**

NZOI Stns: A910, 1 male (sl = 10.2 mm); B315, 1 male, 1 female (sl = 3.1, 3.5 mm); C646, 1 male (sl = 2.8 mm); D176, 2 males (sl = 11.1, 12.2 mm); D870, 1 male moult (sl = 12.3 mm); D871, 1 male (sl = 13.2 mm), 1 female (sl = 13.7 mm); E79, 1 ovigerous female (sl = 12.4 mm); E728, 1 male (sl = 6.0 mm); E803, 5 males, (sl = 4.0–6.8 mm) 2 females (sl = 8.2, 9.7 mm), 2 ovigerous females (sl = 8.4, 9.9 mm); E822, 3 ovigerous female (sl = 8.2–9.9 mm); E827, 1 female, 1 intersex (sl = 8.0, 9.5 mm); 1 male (sl = 8.2 mm); E907, 1 female (sl = 4.3 mm); G935, 1 male (sl = 9.6 mm); G938, 1 male (sl = 6.4 mm); I7, 2 males (sl = 6.0, 7.1 mm), 1 female (sl = 5.5 mm); I32, 1 male (sl = 6.8 mm), 1 female (sl = 6.1 mm); I364, 1 male (sl = 9.3 mm); I365, 1 ovigerous female (sl = 6.0 mm); V418, 1 male (sl = 8.4 mm); Z2363, 2 males (sl = 6.5, 8.1 mm), 1 female (5.7 mm), 1 ovigerous females (sl = 7.9 mm); Z8259, 2 ovigerous females (sl = 7.9, 9.2 mm); Z8270, 1 female (sl = 6.7 mm), NMHN Pg 5890; Z9000, 1 male (sl = 7.9 mm), 1 female (sl = 10.2 mm), 1 ovigerous female (sl = 6.8 mm); Z9003, 1 male (sl = 6.2 mm), 2 ovigerous females (sl = 5.8, 6.1 mm).

NMNZ collections: Bay of Plenty, coll. J. Costello, 13.6.62, 457 m, 1 male (sl = 5.4 mm), MNHN Pg 5889; Bay of Plenty, 1994, 457 m, 1 male (sl = 8.7 mm), Cr 9601; 1 male (sl = 5.4 mm) Cr 9602; Stn BS419, 1 male (sl = 8.6 mm), Cr 9603; BS 783, 1 male (sl = 6.9 mm), Cr 9604; CM Stn 146, 2 ovigerous females (sl = 8.4, 10.2 mm), Cr 9605; CM Stn 146,

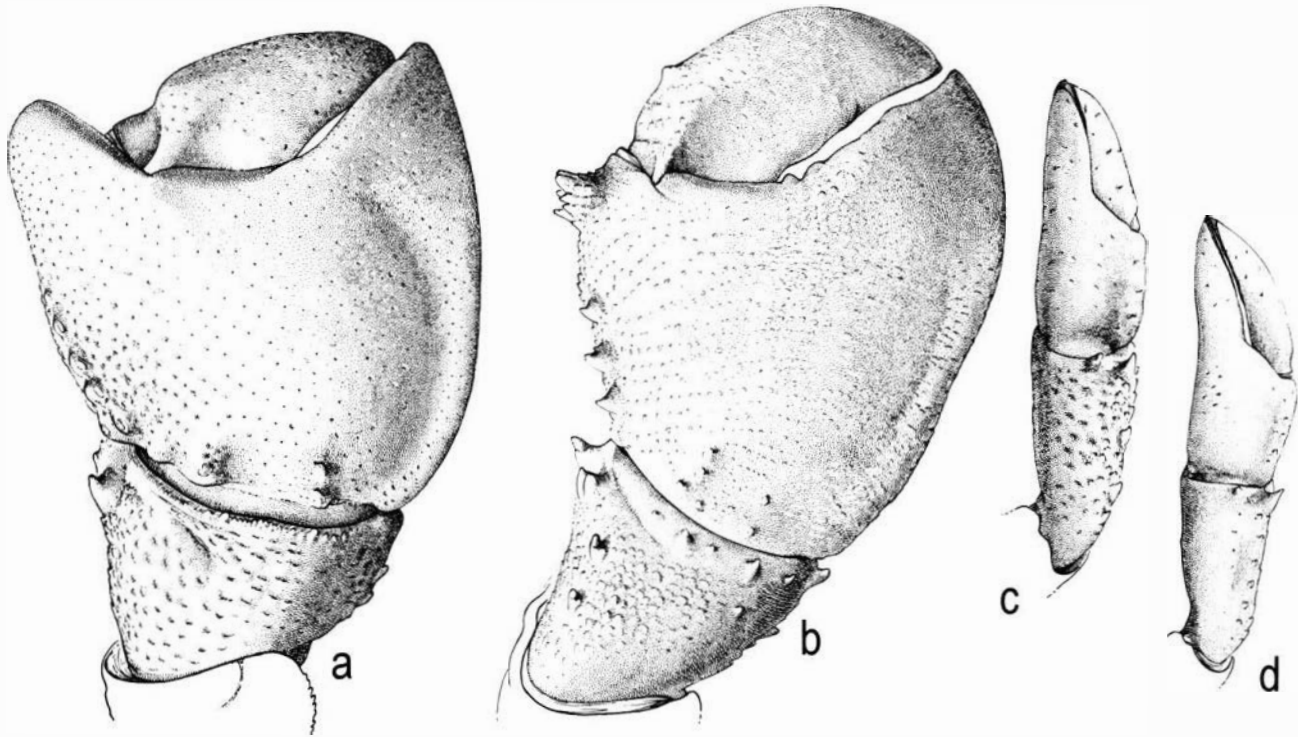


Fig. 38. a, c, *Bathypaguropsis cruentus* sp. nov. NZOI Stn C844, female holotype (sl = 5.2 mm), NZOI H-713; b, d *Bathypaguropsis yaldwyni* McLaughlin, 1994, Bay of Plenty, male (sl = 5.4 mm), NMHN Pg 5889; a, b, chela and carpus of right cheliped; c, d, chela and carpus of left cheliped. Magnifications equal 6x (b, d), 15x (a, c).

2 ovigerous females (sl = 8.4, 10.2 mm), Cr 7508; CM Stn 154, 2 males (sl = 9.4, 11.1 mm), Cr 7530; VUC "a", 1 female (sl = 4.6 mm), Cr 9606.

NZMD collections: Haul 5, 1 ovigerous female (sl = 5.0 mm), NMNZ Cr 9607; Haul 20, 1 female (sl = 4.6 mm), NMNZ Cr 9608; Haul 27, 1 male (sl = 7.4 mm), NMNZ Cr 9609; Haul 31, 1 female (sl = 8.6 mm), NMNZ Cr 9610.

PMBS collections: Stn Mu 67-61, 1 female (sl = 8.1 mm), 1 ovigerous female (sl = 8.5 mm); Stn Mu 74-95, 1 male (sl = 4.7 mm); Stn Mu 74-202, 7 males, 3 females (sl = 2.3-7.8 mm).

ZMUC collections: Mortensen's 1914 Expedition, 38°05.3' S, 150°04'E, 12.9.14, 200-260 m, 1 ovigerous female (sl = 10.4 mm).

**DESCRIPTION:** Shield (Fig. 37b) usually longer than broad. Rostrum triangular, often reaching beyond level of lateral projections, acute, usually with terminal denticle. Ocular peduncles stout, short, 0.50-0.65 shield length, dorsomesial surface with row of stiff setae; corneas not dilated, maximum width included 2.5-3 times in peduncular length. Ocular acicles roundly triangular, with distal half of dorsal surface corneous or only weakly calcified, usually with small marginal, terminal denticle; frequently approximate in distal half. Antennular peduncles over-reaching ocular peduncles by slightly less to more than entire length of ultimate segment. Antennal peduncles exceeding distal margins of corneas by 0.50-0.65 length of ultimate segment, but reaching

only to distal half of ultimate segment of antennular peduncle; second segment with laterodistal projection strongly produced into broad, triangular process, terminating in acute simple or rarely bifid tooth, mesial margin unarmed or with distal tooth, lateral margin with 1 or 2 often widely separated teeth or denticles. Antennal acicle usually reaching at least to middle of ultimate peduncular segment, stout, slightly arcuate, with row of tufts of stiff setae on mesial margin and terminating in small tooth.

Right cheliped (Fig. 38b) massive, operculate. Dactyl broad, slightly shorter to slightly longer than palm; dorsal surface slightly elevated in the midline proximally, smooth, slightly pitted, or with scattered low tubercles, granules or short transverse ridges, dorsomesial margin faintly or weakly crenulated and with 1 blunt tubercle proximally, mesial and ventral surfaces with very low, flattened, frequently corneous-capped, blister-like tubercles. Palm with maximum breadth usually greater than length, dorsomesial distal angle armed with prominent simple or multifid tooth; dorsomesial margin usually with irregular row of 4-6 (rarely 2 or 3) acute or blunt, tuberculate teeth, occasionally only row of small, spinose teeth; dorsal surface convex, smooth, faintly pitted, or covered with flattened granules and small tubercles, often with 1 or 2 prominent tubercles at proximal margin; dorsolateral margin not delimited, usually unarmed;



mesial and lateral faces with scattered low tubercles or granules; ventral surface usually with several large, flattened, blister-like tubercles, often with corneous surfaces. Carpus subquadrate when viewed dorsally; dorsomesial distal angle depressed and with small tooth, dorsomesial surface with 1 very strong, usually blunt tooth distally and frequently single or double row of much smaller teeth or tubercles proximally, dorsal surface with scattered, low, blunt or spinulose tubercles in mesial half, very short, transverse ridges in lateral half, distal margin with few to several blunt teeth; dorsolateral margin not delimited, lateral and mesial surfaces with scattered blunt or spinulose tubercles or granules, ventral surface with scattered low tubercles or granules, strongest in lateral half. Dorsomesial margin of merus unarmed or occasionally with 1 or 2 small teeth distally; ventrolateral margin with 1 or 2 strong acute spines at distal angle and few smaller teeth or tubercles proximally; ventromesial margin unarmed or with 1 or 2 smaller spines at distal angle; ventral surface with scattered granules or tubercles, 2 or 3 moderately large tubercles on somewhat produced lateral protuberance.

Left cheliped (Fig. 38d) not reaching to base of dactyl of right, slender; rotation of propodal carpal articulation approximately 45° from perpendicular. Dactyl with surfaces unarmed but with scattered tufts of short setae. Palm with 1–3 low protuberances on tubercles on dorsomesial margin; surfaces all unarmed, but with few scattered setae, particularly on fixed finger. Carpus with 1 strong, acute or blunt tooth on dorsomesial margin distally, and row of 3–5 small, blunt or subacute teeth or tubercles proximally; dorsolateral margin not delimited. Merus with unarmed dorsal margin; ventrolateral margin unarmed or with row of very small acute, simple or bifid denticles, ventral surface sometimes with 1 or 2 very small denticles and usually 1 moderately prominent tubercle proximally near mesial margin.

Ambulatory legs (Fig. 37d) similar. Dactyls 1.35 times to nearly twice length of propodi; in dorsal view, straight or very faintly twisted in distal third; dorsal margins each with row of tufts of long, stiff setae; mesial faces often somewhat concave, each with 2 or 3 sparse rows of tufts of short to moderately long setae, or short, stiff and spiniform bristles; lateral faces with few tufts of short setae; ventral margins each with row of 12–31 spiniform setae (number increasing with increased animal size). Propodi with few scattered setae on dorsal surfaces; ventrodistal angles each with 1 or 2 small spiniform setae, ventral surfaces frequently with row of widely spaced, small spiniform setae, at least on second. Carpi each with small tooth at dorsodistal angle, dorsal surface with sparse row

of setae. Meri with scattered setae on dorsal and ventral margins. Fourth pereopods with propodal rasp consisting of 1 long row and 1 or rarely 2 very short to moderately long rows of scale-like setae. Anterior lobe of sternite of third pereopods subrectangular, with central fringe of short setae. Sternite of fifth pereopods broadly rectangular, with 2 prominent tufts of setae.

Telson (Fig. 37f) with posterior lobes asymmetrical, left largest, separated by moderate median cleft, terminal margins each with row of very small denticles.

COLOUR: "Eyestalks, antennules, antennae, chelipeds, and walking legs a uniform light orange-brown ('apricot') colour" (Schembri & McLay 1983).

VARIATIONS: As is apparent from the description, *B. yaldwyni* exhibits considerable variability, particularly in chela morphology. In contrast to many pagurids where the strength of chela armature decreases with increasing animal size, tubercles and spines in *B. yaldwyni* increase in strength and number in large specimens of both sexes. Similarly, the number of spiniform setae on the ventral margins of the pereopodal dactyls increases from 12 to 18 in animals with shield lengths of < 3 to 6 mm to 25–31 in animals with shield length over 9.5 mm.

REPRODUCTION: Twenty of the 41 females examined were carrying eggs; the smallest had a shield length of 5.0 mm, the largest 12.4 mm. On each of the anterior three pleopods, these females usually carried a cluster of 20–30 relatively large eggs, with diameters varying from 1.2 to 1.6 mm. The majority of ovigerous females were collected in January, May, and September.

HABITAT: A variety of gastropod shells in the Otago region (Schembri & McLay 1983), but most commonly *Fusitriton* sp. and less frequently *Iredalina* sp. in the material examined.

REMARKS: Characters differentiating *B. yaldwyni* from *B. cruentus* were detailed under the latter species. McLaughlin (1994) noted that one specimen of *B. yaldwyni* (sl = 9.6 mm) parasitised by an unidentified rhizocephalan had female-appearing pleopods, but neither male nor female gonopores were present. A slightly smaller male specimen (sl = 8.0 mm) examined more recently showed a similar pleopod condition.

RECORDS FROM NEW ZEALAND: Eastern North Island and from North Cape to north of Mayor Island, and western South Island from Westport to the Solander

Trough including area off Otago Heads, and northern Campbell Plateau; 256–695 m.

DISTRIBUTION: New Zealand; southeastern Australia; Tasmania.

***Propagurus* McLaughlin & de Saint Laurent, 1998**

*Propagurus* McLaughlin & de Saint Laurent, 1998: 159; McLaughlin & Forest 1999: 333.

TYPE SPECIES: *Pagurus gaudichaudii* H. Milne Edwards, 1836. Gender masculine.

Thirteen pairs of generally quadriserial gills, with pleurobranch on fifth thoracic somite (above second pereopod) rudimentary or well developed, on sixth somite (above third pereopod) always rudimentary. Ocular acicles with slightly concave dorsal surfaces. Laterodistal projection of second segment of antennal peduncle with denticulate mesial margin. External lobe of maxillulary endopod varying from vestigial to well developed. Crista dentata of third maxilliped with strong accessory tooth.

Chelipeds unequal; right longer and stronger.

Fourth pereopods semichelate, with propodal rasp consisting of 2 to several rows of scale-like bristles.

Males with paired gonopores; no paired pleopods, usually 3 unpaired left pleopods (third through fifth), second occasionally rudimentary. Females with paired gonopores, no paired pleopods, 4 unpaired left pleopods.

REMARKS: Superficially, species of *Propagurus* appear indistinguishable from *Pagurus*, which has made the careful examination of both gill structure and number a critical element in the accurate generic placement of these species. It is not only the somewhat variable quadriserial structure of the gill filaments themselves that set species of *Propagurus* apart from *Pagurus* species, but more importantly the presence of rudimentary to moderately well-developed pleurobranches on the walls of the fifth and sixth thoracic somites. As pointed out by McLaughlin and de Saint Laurent (1998), morphological variation among species of *Propagurus* is not restricted just to gill development. These authors reported variation in development of the external lobe of the maxillule and in the number of male unpaired pleopods.

***Propagurus depofundis* (Stebbing, 1924) (Fig. 39)**

*Eupagurus depofundis* Stebbing, 1924: 243, pl. 70; Barnard 1950: 164; Forest 1955: 107.

*Pagurus depofundis*: Gordan 1956: 329 (lit).

*Pagurus depofundus*: Kensley 1981: 33 (list) (misspelling).

*Propagurus depofundis*: McLaughlin & de Saint Laurent 1998: 170, figs 2D, E, 4B, 7B, 8A–D, 9, 11C, D; McLaughlin & Forest 1999: 334, figs 7A–K.

TYPE:

Holotype: female (sl = 9.3 mm), NHM 1928.12.1.245.

TYPE LOCALITY: 13 miles northwest of Cape Morgan, South Africa, 32°42.6'S, 28°21.8'E, 457–585 m.

OTHER MATERIAL EXAMINED:

NZOI Stns: C619, 1 male (sl = 12.4 mm); D233, 1 male (sl = 14.7 mm); E711, 1 male (sl = 12.9 mm); E719, 5 males (sl = 9.0–11.8 mm), 1 ovigerous female (sl = 11.3 mm); E747, 1 female (sl = 11.8 mm); E797, 1 male (sl = 9.9 mm); E822, 1 female (sl = 7.8 mm); E827, 1 male, 1 female (sl = 14.4, 12.6 mm); E831, 1 ovigerous female (sl = 11.8 mm); E876, 1 female (sl = 10.0 mm); E879, 1 female (sl = 7.6 mm); J660, 1 male (sl = 8.0 mm); J711, 1 male (sl = 10.5 mm).

NMNZ collections: Off Westport, coll. K. Brody, 1 male (sl = 16.7 mm) Cr 7500; Stn BS 420, 1 male (12.0 mm), Cr 9611; Stn BS 742, 1 specimen, poor condition (sl = 10 mm), Cr 9612; Stn BS 844, 1 male, 1 female (sl = 15.2, 10.9 mm), Cr 7592, Cr 8211; Stn BS 847, 1 female (sl = 10.2 mm), Cr 8234; Stn BS 887, 2 males (sl = 11.2, 12.2 mm), 1 female (sl = 5.8 mm), Cr 7565; CM Stn 145, 1 male (sl = 14.0 mm), Cr 8063; CM Stn 148, 1 ovigerous female (sl = 11.9 mm), Cr 7503; CM Stn 149, 1 female, 2 ovigerous females (sl = 12.0–14.0 mm), Cr 8066; CM Stn 150, 1 male (sl = 12.6 mm), Cr 7502; JC Stn J2/26/81, 1 male, 1 female (sl = 13 mm, 12.4 mm), Cr 8104; JC Stn J06/006/81, 4 males (sl = 10.9–14.1 mm), 1 ovigerous female (sl = 10.7 mm), Cr 8196; JC Stn J06/008/81, 1 male (sl = 14.5 mm), Cr 8097, 1 female (sl = 10.5 mm), Cr 8070; JC Stn J9/04/89, 1 specimen in poor condition, Cr 7533; JC Stn J9/49/89, 1 male (sl = 9.4 mm), Cr 7534, 1 male (sl = 15.7 mm), Cr 7537; SM Stn 2/50, 1 male (sl = 17.0 mm), Cr 8099.

NZMD collections: Trawl 14, 1 female (sl = 9.7 mm), Cr 9613; Trawl 16, 2 females (sl = 9.4, 10 mm), Cr 8100; Trawl 35b, 1 male (sl = 12.7 mm), Cr 9805.

PMcL collection: Bay of Plenty, coll. R. Taylor, 4 males (sl = 12.6–14.9 mm).

DESCRIPTION: Shield (Fig. 39a) varying from slightly longer than broad to distinctly broader than long. Rostrum commonly triangular, usually produced beyond level of lateral projections; usually with prominent terminal spine. Ocular peduncles slightly less to slightly more than half shield length; moderately stout, dorsal or dorsomesial surface usually with short transverse rows of sparse tufts of setae; corneas slightly dilated. Ocular acicles ovately or acutely triangular, dorsal surfaces somewhat concave; with strong submarginal spine. Fully extended antennular peduncles overreach distal margins of corneas by 0.20 the length of ultimate segments to 0.25 length of penultimate segments. Antennal peduncles overreach



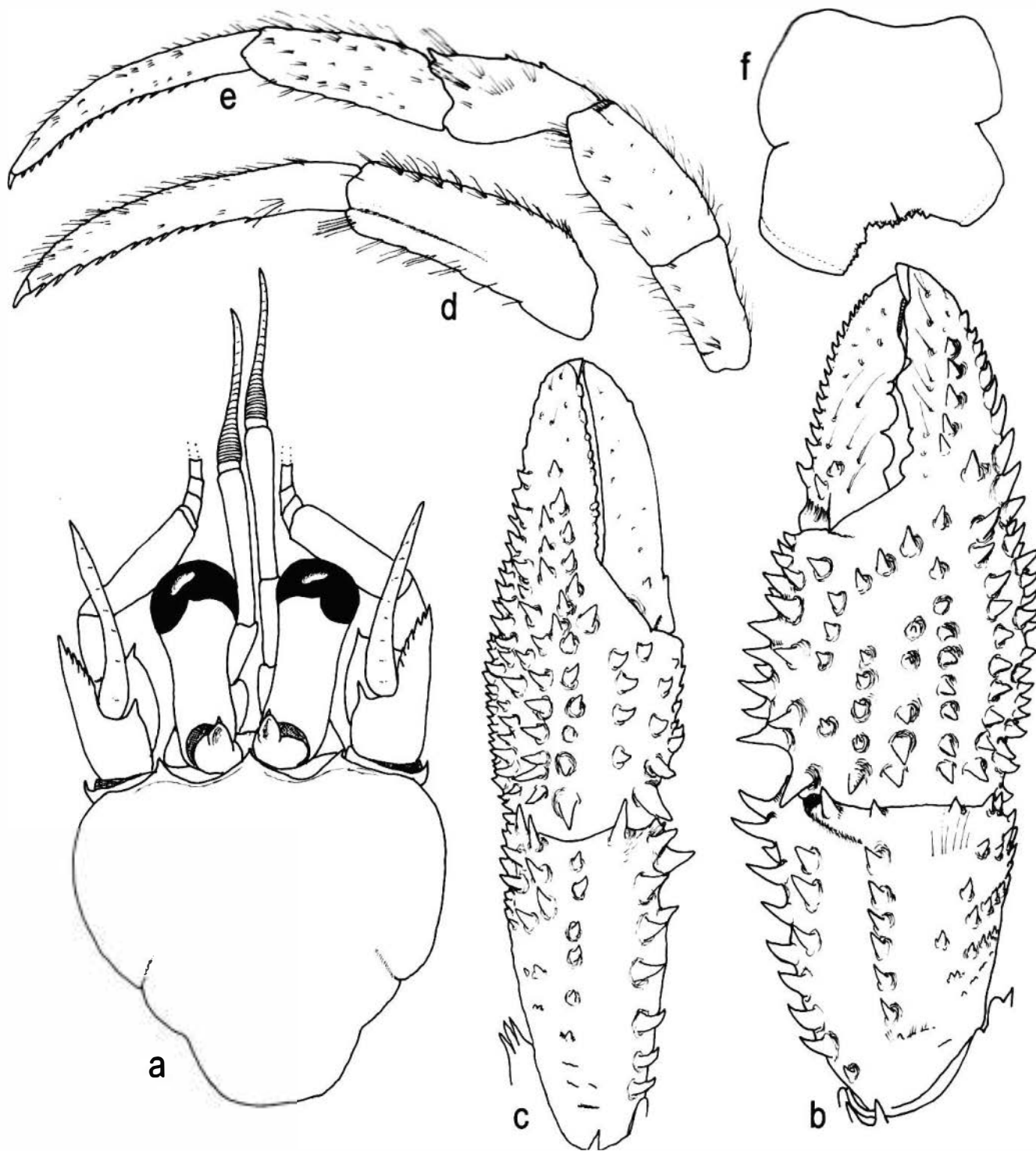


Fig. 39. *Propagurus deprofundis* (Stebbing, 1924), NZOI Stn E797, male (sl = 9.9 mm): a, shield and cephalic appendages (setation and aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view, setation omitted); c, carpus and chela of left cheliped (dorsal view, setation omitted); d, dactyl and propodus of right second pereopod (mesial view); e, left third pereopod (lateral view); f, telson (setation omitted). Magnifications equal 5x (d), 6x (e), 9x (a-c), 12x (e).

distal margins of corneas by 0.10–0.75 length of ultimate segments; second segment with laterodistal projection reaching at least to distal half of fourth peduncular segment, with simple or bifid terminal

tooth, mesial margin with 5–9 small teeth, lateral margin with tufts of long setae, dorsomesial distal angle with very strong spine; first segment with prominent tooth on distolateral margin dorsally;

ventrolateral margin with 1–3 teeth. Antennal acicle reaching at least to midlength of ultimate peduncular segment, usually considerably beyond, with strong terminal tooth and numerous tufts of long stiff setae on mesial face. External lobe of maxillulary endopod well developed, sometimes arched, but never strongly recurved.

Right cheliped (Fig. 39b) considerably stronger than left, but not always appreciable longer; sometimes with hiatus between dactyl and fixed finger. Palm varying from moderately slender to moderately broad, with irregular double row of teeth on dorso-mesial margin, convex dorsal surface sparsely covered with short setae, with 6 somewhat irregular rows of spinose tubercles, usually accompanied by long stiff setae; dorsolateral margin not distinctly delimited proximally, but with irregular row of teeth becoming marginal and extending nearly to tip of fixed finger; lateral face of palm with distinct rows of closely spaced subacute or acute tubercles particularly in ventral half. Carpus with irregular row of strong teeth on dorsomesial margin accompanied by adjacent, slightly irregular row of spinose tubercles on dorsal surface, separated by broad, nearly naked longitudinal band from median row of shorter tubercles, few scattered tubercles laterally; dorsolateral margin rounded but with row of small teeth, usually becoming double row distally; lateral face sometimes with forwardly directed teeth and denticles or tubercles, occasionally just low protuberances and long setae; ventral surface often with row of tubercles mesially and laterally. Merus with 0–3 spines on dorsodistal margin, dorsal margin with short transverse ridges; mesial face with scattered protuberances proximally; ventromesial margin usually with row of teeth or tubercles, strongest proximally; lateral face with transverse ridges sometimes spinulose at least in ventral half, ventrolateral margin with row of acute or subacute teeth; ventral surface often with few small and occasionally 2 large tubercles.

Left cheliped (Fig. 39c) frequently with hiatus between dactyl and fixed finger. Palm with median, single or double row of acute tubercles on convex dorsal surface, becoming less regular on proximal half of fixed finger; dorsomesial face usually with central row of tubercles and nearly double row of slightly smaller tubercles near margin; dorsolateral face with several irregular rows of small, closely spaced, blunt or acute tubercles or denticles, appreciably stronger dorsally, but not extending to tip of fixed finger. Carpus with 1 spine on dorsodistal margin, sometimes quite strong and occasionally with second spine directly beneath; dorsomesial margin with irregular row of moderate to strong teeth and tufts of long setae, dorsal surface unarmed, slightly depressed; rounded

dorsolateral margin with row of teeth; lateral surface with semiperpendicular rows of small, subacute tubercles decreasing in size proximally, ventrolateral margin with row of small, subacute teeth. Merus with 1–3 spines at dorsodistal margin, dorsal margin and mesial face each with transverse ridges and setae, sometimes becoming multidentulate ventrally on mesial face; ventromesial margin with row of teeth proximally and frequently also small spine distally; lateral face with short, transverse ridges becoming flattened, multifid tubercles ventrally, ventrolateral margin with row of teeth, sometimes becoming double row proximally.

Ambulatory legs (Fig. 39d, e) overreaching left cheliped by at least 0.75 the length of dactyls. Dactyls and propodi of left and right morphologically similar, but left with greater setation on lateral faces. Dactyls 1.10–1.85 times length of propodi; dorsal surfaces with transverse, low protuberances and long stiff setae; lateral surfaces each with faint longitudinal sulcus and row(s) of long or moderately long setae; ventral margins each with row of 8–21 prominent spiniform setae. Propodi each with transverse, low ridges and long stiff setae on dorsal and lateral surfaces; mesial faces of second pereopods each with longitudinal keel (Fig. 39d) in ventral third, extending from near distal margin to proximal half or third. Carpi of second pereopods with row of 3–8 teeth and transverse, setose ridges on dorsal surfaces; dorsal surfaces of third each with 0–5 smaller tubercles and transverse, setose ridges in addition to strong dorsodistal spine. Meri all with transverse, setose ridges dorsally, ventral margins of second each with ventral row of teeth, ventrolateral distal angles each sometimes with spine; ventral margins of third unarmed or rarely with denticle on ventrolateral margin and stronger denticle on ventromesial margin distally. Sternite of third pereopods with submarginal row of setae on subsemicircular to roundly subrectangular anterior lobe.

Mature females usually with dense setae on coxae of fifth pereopods. Telson (Fig. 39f) with asymmetrical posterior lobes separated by slender median cleft; terminal margins often considerably produced laterally, each with row of small calcareous teeth becoming stronger toward outer angles, largest teeth, particularly on left, somewhat hooked.

**COLOUR:** In alcohol, shield mottled white and orange. Ocular peduncles orange; ocular acicles orange basally, white distally. Antennular peduncles whitish with flagella orange. Antennal peduncles faintly orange, darkest on proximal segments. Chelipeds with orange tint, darkest on dactyls. Ambulatory legs each with orange band proximally and distally on



meri; carpi, propodi, and dactyls all faintly orange, darkest on distal halves of dactyls (McLaughlin & de Saint Laurent 1998).

**REPRODUCTION:** Females represented less than half the specimens of *P. deprofundis* captured in New Zealand waters, and of the 14 collected over a period of 25 years, only six were ovigerous. New Zealand data would suggest that the reproductive season begins in September and extends until March; however, ovigerous females have been reported in the Australian portion of the Tasman Sea as early as July (McLaughlin & de Saint Laurent 1998). Females were observed to carry a large number of small eggs. Egg size near time of hatching varied from 0.6 to 0.8 mm in diameter.

**HABITAT:** Found in a variety of gastropod shells, sometimes with an anemone attached.

**REMARKS:** As the description reflects, *P. deprofundis* exhibits considerable intraspecific morphological variation. These variations in the ratios of antennular and antennal peduncular lengths to ocular peduncular length, antennal acicle length, length-breadth ratio of the right chela, and particularly in the armature of the carpi of the ambulatory legs do not appear to be size or sex related. In their remarks on *Propagurus deprofundis*, McLaughlin & de Saint Laurent (1998) noted a number of apparent abnormalities in their material. Among these was the presence in a male of a female-appearing pleopod on the second abdominal somite, but no indication of a rhizocephalan infestation that might have produced a feminising effect. They found similar conditions in two male specimens of *Propagurus obtusifrons* Ortmann, 1892 (cf. Komai 1998) [as *Propagurus yokoyai* (Makarov, 1938)]. In the additional material of *P. deprofundis* that we have now examined, rudimentary female-like second pleopods have been observed in two additional males. Rhizocephalan infestations are not common among New Zealand hermit crabs, and none has been observed in *P. deprofundis*. Thus we are inclined to believe that, in *Propagurus*, the genetic blueprint for pleopod number in males is not firmly established. Although three male pleopods on the left third through fifth abdominal somites are usual, the presence of a fourth on the second somite may not properly be considered an abnormality.

**RECORDS FROM NEW ZEALAND:** Occurs sporadically along the west coast from the Norfolk Ridge to south of Stewart Island, and along the east coast to the Chatham Rise; 304 to 857–891 m.

**DISTRIBUTION:** Southeastern South Africa; Tasmania and southeastern Australia, Tasman Sea, western and eastern New Zealand to Chatham Rise; Philippine Islands; Hawaii; 200 to 857–913 m.

*Pagurojacksia* nom. nov.

*Jacksia* de Saint Laurent & McLaughlin, 1999: 79 [not *Jacksia* Mendes, 1944].

**TYPE SPECIES:** *Jacksia polymorpha* de Saint Laurent & McLaughlin, 1999. Gender feminine.

Eleven pairs of quadriserial gills. Rostrum rounded, usually produced only slightly beyond bases of ocular acicles. Lateral projections prominent. Ocular acicles narrowly triangular, terminating acutely. Antennular peduncles with elongate ultimate segment fringed with long setae near dorsodistal margin and longitudinal row of long setae dorsolaterally. Third maxilliped with well-developed crista dentata, without accessory tooth; merus with very long, slender spine on dorsodistal margin.

Chelipeds subequal in length, right stronger, but not always longer.

Ambulatory legs with elongate, slender dactyls; carpi (at least second) with row of teeth on dorsal margin but not at dorsodistal angle. Fourth pereopods subchelate or very weakly semichelate, with single row of scale-like setae in propodal rasp. Fifth pereopods subchelate.

Males with club-like, stout, very short to moderately long left sexual tube, provided with terminal tufts of very long setae and additional longitudinal row of long setae basally; coxa of right fifth pereopod with small gonopore; usually 3 unequally biramous left pleopods. Females with paired gonopores; coxae of fifth pereopods with fringe of moderate to dense long setae; modified paired first pleopods, unpaired left pleopods 2–5.

Uropods markedly asymmetrical. Telson with weak transverse indentation suggesting division into anterior and posterior portions; posterior lobes asymmetrical, left largest; terminal margins very oblique, each with well-developed teeth; posterolateral margins each with calcified plate.

**REMARKS:** *Jacksia* de Saint Laurent & McLaughlin, 1999 has proved to be a junior homonym of *Jacksia* Mendes, 1944, a molluscan genus (cf. Moore 1969), and as such must be replaced. The name *Jacksia* was chosen in recognition of the work of Jacques Forest. In proposing the replacement name *Pagurojacksia*, the dedication remains the same. This monotypic

genus is widely distributed in the tropical western Pacific Ocean, but in New Zealand waters is known only from the Kermadec Islands.

*Pagurojacksia polymorpha* (de Saint Laurent & McLaughlin, 1999) (Fig. 40)

*Jacksia polymorpha* de Saint Laurent & McLaughlin, 1999: 80, figs 1–4.

Types:

Holotype: male (sl = 5.0 mm), MUSORSTOM 8 Stn CP 1084, MNHN Pg 5655.

Paratypes: 1 male (sl = 3.6 mm), 2 females (sl = 2.6, 3.9 mm), Chalcal 1 Stn DC 61 MNHN Pg 5656; 1 male (sl = 4.9 mm), Chalcal 1 Stn DC 68, MNHN Pg 5657; 1 male (sl = 3.4 mm), 1 ovigerous female (sl = 4.7 mm), MUSORSTOM 5, Stn CP 311, USNM 261450; 1 male (sl = 4.0 mm), 1 female (sl = 3.9 mm), MUSORSTOM 5, Stn CP 293, NHM 1999.58–59.

TYPE LOCALITY: Vanuatu, MUSORSTOM 8 Stn CP 1084, 15°50'S, 167°17'E, 207–280 m.

OTHER MATERIAL EXAMINED:

NZOI Stn K857, 1 male (sl = 3.9 mm).

NMNZ collections: Stn BS 571, 1 male (sl = 4.4 mm), 1 female (sl = 4.6 mm), Cr 9614.

DESCRIPTION: Shield (Fig. 40a) usually as broad or broader than long, occasionally slightly longer than broad. Rostrum usually produced but not reaching beyond level of lateral projections; broadly rounded, occasionally nearly obsolete. Ocular peduncles 0.65 to nearly entire length of shield; corneas slightly dilated; ocular acicles each with prominent submarginal spine. Antennular peduncles over-reaching distal margins of corneas by half or more than half length of ultimate segment; ultimate segment with row of long setae adjacent to dorsodistal margin and longitudinal row of long setae on dorsolateral surface. Antennal peduncles overreaching distal margins of corneas by up to half length of ultimate segment. Antennal acicles usually reaching to or beyond distal margins of corneas.

Chelipeds both with dense covering of long and frequently also short setae on chelae and carpi, at least partially concealing armature. Right cheliped (Fig. 40b) with dactyl and fixed finger frequently roundly or acutely triangular in dorsal view. Palm with single or double row of short to long, slender to moderately stout teeth on both dorsomesial and dorsolateral margins, dorsal surface with several irregular, longitudinal rows of small, acute tubercles or granules, extending onto dorsolateral surface of fixed finger.

Carpus with row of teeth on dorsomesial and often nearly double row on dorsolateral margins; lateral face frequently with few small tubercles, particularly in ventral half. Merus with 2–5 acute spines on ventrolateral distal margin; blunt or subacute protuberance at ventromesial angle; ventral surface often with few small teeth or denticles.

Left cheliped (Fig. 40c) often equaling, sometimes exceeding, right in length but less robust; chela often narrowly to roundly triangular in dorsal view. Palm with row of slender, short to quite long, acute teeth on both dorsomesial and dorsolateral margins, dorsal surface with numerous irregular, longitudinal rows of small, acute tubercles and denticles extending at least onto proximal half of fixed finger. Carpus subtriangular; dorsomesial margin with row of moderate to long, acute teeth usually second short row of smaller teeth on sloping dorsolateral face; somewhat rounded ventrolateral margin with irregular, single or double row of spines, lateral face frequently with acute tubercles and several smaller tubercles in ventral half. Merus with 1 spine on dorsodistal margin; ventrolateral margin with 2–5 acute teeth in distal half, ventromesial margin with 1–3 subacute teeth near distal angle.

Ambulatory legs similarly armed from left to right, but segments proportionately dissimilar. Dorsal margins of dactyls each with row of long, bristle-like setae, mesial faces with covering of long, stiff setae and dorsally accompanied by row of pinnate, spiniform setae in proximal half, mesial faces ventrally and/or ventromesial margins each with 7–10 shorter spiniform setae. Carpi each with row of 5–12 spinose tubercles on dorsal surface, tubercles of third pereopods usually smaller and sometimes fewer in number. Meri of second pereopods each with 2–5 small teeth or denticles in distal half of ventral margin; third unarmed.

Coxae of left fifth pereopods in males (Fig. 40d) with thick, short to moderately long, setose sexual tube directed posteriorly toward exterior. Telson (Fig. 40e) with 1–3 prominent, curved or hooked teeth on each outer angle; terminal margins oblique, each with row of smaller acute teeth.

COLOUR: In alcohol, shield with splotches of orange, largest near posterior margin laterally. Ocular peduncles uniformly orange. Second segments of antennal peduncles opaque with orange distally. Chelipeds whitish, with orange band at midlength of both dactyls and fixed fingers; palms orange on mesial faces at dorsodistal angles and in longitudinal streak on dorsal midline; carpi each with patch of orange distomesially and distolaterally, and one large orange spot proximally on mesial and lateral face; meri each with patch of orange on mesial and lateral



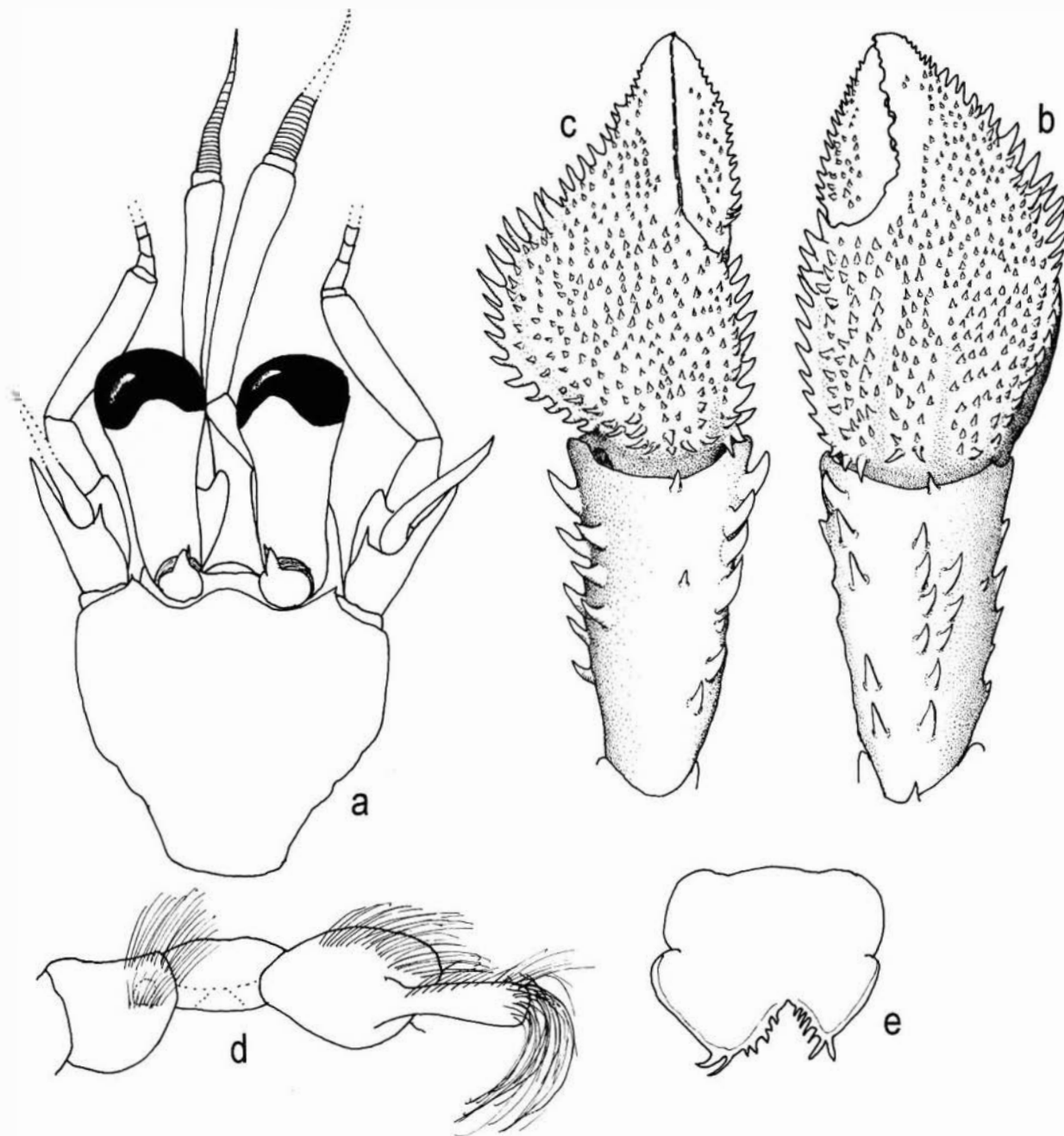


Fig. 40. *Paguroj Jacquesia polymorpha* (de Saint Laurent & McLaughlin, 1999), NZOI Stn K857, male (sl = 3.9 mm): a, shield and cephalic appendages (aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view, setation omitted); c, carpus and chela of left cheliped (dorsal view, setation omitted); d, coxae and sternite of male fifth pereopods; e, telson. Magnifications equal 18x (a-c), 25x (d), 37.5x (e).

faces at distal margins and one large orange spot on lateral face proximally.

Ambulatory legs whitish, each with three orange bands on dactyls, one distally, one in proximal half and one at proximal margin; propodi each with orange band at midlength and orange spot on lateral face proximally; carpi each with patch of orange on distal margin mesially and laterally, patch of orange

dorsally at midlength on mesial face and spot in proximal half of lateral face ventrally; meri each with orange patch dorsodistally, two widely separated orange spots on lateral face and additional orange spot on mesial faces of second pereopods. Ischia of third pereopods each with diffuse patch of orange laterally (based on residual colour of the holotype).

**REPRODUCTION:** Not known in New Zealand, but elsewhere females were ovigerous at shield lengths of 2.7–6.6 mm and carried numerous small eggs. The reproductive season reported is prolonged, with egg-bearing females collected from August to March. Non-eyed eggs measured from 0.62 to 0.82 mm in diameter.

**HABITAT:** Found occupying gastropod shells.

**REMARKS:** As reported by de Saint Laurent & McLaughlin (1999), *Pagurojacquesia polymorpha* is morphologically quite variable. Of the two quasi groups indicated by de Saint Laurent and McLaughlin, only one, that characterised by a broadly and roundly triangular left chela, and males with a relatively long sexual tube has been found in New Zealand waters, and then only rarely.

**RECORDS FROM NEW ZEALAND:** Kermadec Islands; 165 to 210–274 m.

**DISTRIBUTION:** Northwest of Mindoro, Philippine Islands, New Caledonia, Loyalty and Chesterfield Islands, Vanuatu, Kermadec Islands; reportedly 11 to 400–660 m, most commonly 250–400 m.

### *Pagurodes* Henderson, 1888

*Pagurodes* Henderson, 1888: 94 (in part); Alcock 1901: 224 (in part); 1905b: 106 (in part); de Saint Laurent 1969: 740.

[Not *Pagurodes*: Bouvier 1922: 22; Ingle 1993: 102; = *Michelpagurus* McLaughlin, 1997 (see remarks under *Michelpagurus*)].

**TYPE SPECIES:** *Pagurodes inarmatus* Henderson, 1888, by subsequent selection by de Saint Laurent (1969). Gender masculine.

Eleven pairs of quadriserial gills. Rostrum triangular. Ocular acicles triangular, moderately short. Maxillule with external lobe of endopod well developed, not recurved. Crista dentata of third maxilliped with accessory tooth.

Chelipeds elongate, subequal, right stouter. Fourth pereopods semichelate; with single row of corneous bristles in propodal rasp.

Coxae of fifth pereopods in males symmetrical, right with stout, relatively short sexual tube directed posteriorly, left sometimes with very short sexual tube; 3 unequally biramous unpaired left pleopods. Females with paired gonopores; without modified paired first pleopods, unpaired left pleopods on somites 2 to 5.

Telson with median transverse indentation sug-

gesting division into anterior and posterior portions; posterior lobes separated by distinct median cleft; terminal margins oblique or nearly perpendicular; lateral margins with corneous plate.

**REMARKS:** When Henderson (1888) established *Pagurodes*, he included three superficially very similar species. *Pagurodes* was defined as having males with a short right sexual tube and lacking paired first and second pleopods. Henderson had eight specimens of *P. inarmatus*, although he based his diagnosis on a single male from *Challenger* Stn 168 off New Zealand. *Pagurodes piliferus* Henderson, 1888 was represented by a single female, and a small male only questionably assigned to the species, and later found to represent *Pagurus compressipes* (Miers, 1884) (de Saint Laurent unpublished; McLaughlin 1997). *Pagurodes limatulus* Henderson, 1888, was known from a single male that, while lacking a right sexual tube, was damaged, causing Henderson (1888) to assume that the sexual tube had been broken off. As previously indicated, neither of the latter species corresponds to *Pagurodes*.

Alcock (1901) provided only a differential diagnosis of the genus, distinguishing it from *Parapagurus* by the development of the rostrum, shortness of the ocular peduncles, subequal chelipeds, male sexual tube, and absence of paired first and second male pleopods. In his key to the species, he gave general descriptions of specimens he referred to *P. inarmatus* and *P. limatulus*; however, in his accounts, both species were listed questionably. After comparing his specimens with Henderson's (1888) type materials, Alcock (1905b) concluded that his *P. limatulus* was indeed Henderson's species; however, the specimen that he (Alcock 1901) had cited as *Pagurodes* sp. ? *inarmatus* was neither *inarmatus* nor even *Pagurodes*. He reassigned this specimen to *Pagurus* sp. (as *Eupagurus*).

### *Pagurodes inarmatus* Henderson, 1888 (Fig. 41)

*Pagurodes inarmatus* Henderson, 1888: 94; pl. 10, fig. 5; Alcock 1905b: 108; Przibram 1905: 198 (footnote); Jordan 1956: 325 (lit.); de Saint Laurent 1969: 740; McLaughlin 1997: 482, figs 35b–e.

[Not *Pagurodes* sp. ? *inarmatus*: Alcock 1901: 225; = "*Eupagurus*" sp.: Alcock 1905b: 108, 133.]

**TYPES:**

Lectotype by subsequent designation by McLaughlin (1997), male (sl = 7.0 mm), *Challenger* Stn 168, NHM 88.33.5.

Paralectotypes: 3 males, 1 female, 1 ovigerous female (sl = 4.8–7.0) [3 additional specimens of the type series not seen], *Challenger* Stn 168, NHM 88.33.5.



TYPE LOCALITY: Off New Zealand, *Challenger* Stn 168, 40°28'S, 177°49'E, 2012 m.

OTHER MATERIAL EXAMINED:

NZOI Stns: G942, 1 ovigerous female (sl = 8.4 mm); G947, 1 male (sl = 3.8 mm); G948, 1 ovigerous female (sl = 6.1 mm), I666, 1 male (sl = 7.4 mm).

NMNZ collections: Stn BS 647, 1 female (sl = 6.2 mm), 1 ovigerous female (sl = 6.0 mm), Cr 9615; Stn BS 648, 3 males (sl = 3.1–5.4 mm), 2 females (sl = 3.4, 3.5 mm), 7 ovigerous females (sl = 3.1–3.9 mm), Cr 9616; Stn BS 660, 1 male (sl = 6.9 mm), 5 females (sl = 3.8–5.3 mm), 3 ovigerous females (sl = 4.4–5.4 mm), Cr 9617.

ZMUC collections: *Galathea* Stn 554, 1 male (sl = 5.5 mm).

DESCRIPTION: Shield (Fig. 41a) subquadrate, well calcified, slightly vaulted; cervical groove deep; posterior carapace adjacent to cervical groove well calcified. Rostrum triangular, usually reaching well beyond level of lateral projections, terminally blunt or acute, with or without terminal denticle, usually reaching beyond level of lateral projections. Ocular peduncles very short and moderately stout, basally bulbous; corneas large, occupying approximately 0.33 of peduncle; not dilated; ocular acicles narrowly triangular. Antennular peduncles when fully extended overreach distal margins of corneas by entire length of ultimate and penultimate peduncular segments; ultimate segment with row of 6–8 very long setae at dorsodistal margin. Antennal peduncles overreaching distal margins of corneas by at least 0.25 length of penultimate segment; second segment with latero-distal projection terminating in simple or bifid spine or tooth. Antennal acicle quite long, reaching beyond base, and frequently to or beyond distal margin of ultimate peduncular segment, terminating in acute spine, mesial margin with row of setae.

Chelipeds subequal; right appreciably stouter. Right cheliped (Fig. 41b) elongate, slender. Palm somewhat dorsoventrally compressed; midline of dorsal surface with slight tuberculate elevation proximally; dorsomesial margin not delimited, rounded surface minutely denticulate or granular, dorsal surface and dorsolateral margin also rounded, tuberculate, denticulate or granular and with not particularly dense covering of fine short setae. Carpus with double row of small or very small teeth or denticles on dorsomesial margin; dorsal surface with small, blunt or acute tubercles, dorsolateral margin not delimited, but lateral surface also with small tubercles or granules. Merus with transverse, somewhat tuberculate or granular ridges on dorsal surface and lateral face; ventromesial margin with at least partial row of teeth or spines, ventral surface with scattered small acute tubercles; ventrolateral margin with spine at distal angle and small teeth and/or

denticles proximally.

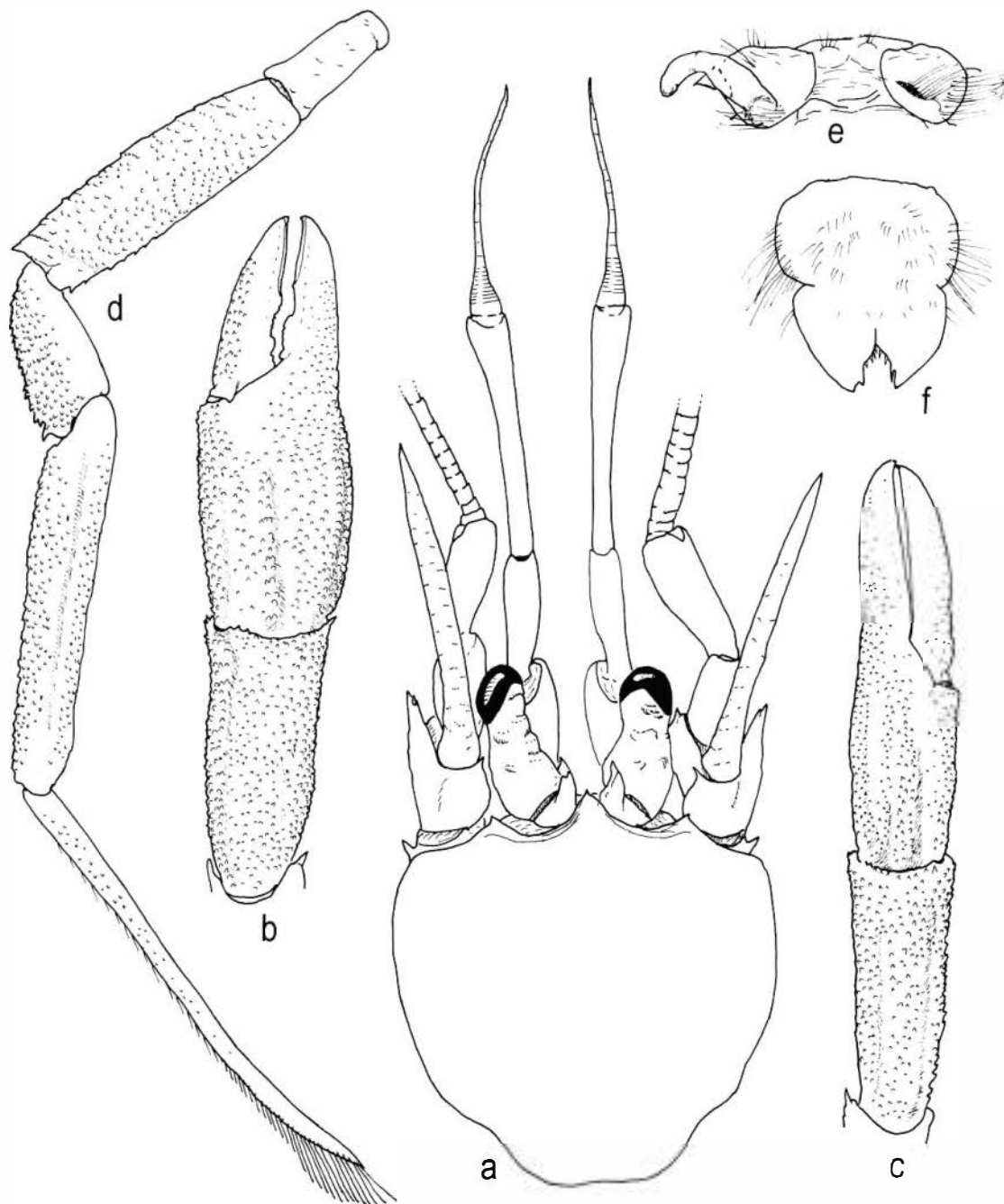
Left cheliped (Fig. 41c) with dactyl and fixed finger somewhat dorsoventrally compressed and deflected ventrally. Palm with longitudinal plateau in midline, not extending entire length of palm, with some more prominent tubercles than on remainder of dorsal surface. Carpus with minutely denticulate dorsomesial margin, dorsal surface tuberculate, dorsolateral margin rounded and denticulate; lateral and mesial faces tuberculate. Merus with transverse, tuberculate ridges and setae dorsally, mesially and laterally; ventral surface with scattered tubercles, ventrolateral margin not particularly delimited but 1 small tooth at distal angle; ventromesial margin with row of small teeth.

Ambulatory legs (Fig. 41d) very long, overreaching outstretched chelipeds by approximately half length of dactyls. Dactyls long, slender, curved, slightly twisted distally, 1.25–1.50 length of propodi; row of long setae on dorsal surface, faint longitudinal sulcus on both lateral and mesial faces, row of 8–12 widely spaced spiniform setae on ventral margin (not apparent in lateral view). Ventrolateral distal margins of propodi usually with spiniform setae; dorsal surfaces with transverse somewhat tuberculate ridges and setae; lateral face minutely tuberculate or granular in dorsal half. Carpi with irregular row of small, simple or multifid denticles or tubercles on dorsal surfaces, strongest distally and extending onto lateral faces as scattered very small tubercles. Meri with irregular, transverse rows of tuberculate protuberances and setae on dorsal surfaces; ventral margins of second pereopods each with row of small teeth or spinulose tubercles mesially, double row laterally; ventral margins of third often only minutely granular. Sternite of third pereopods broad; anterior lobe subrectangular and with 1 or 2 marginal denticles on either side.

Male with short right sexual tube moderately thick basally, curving posteriorly and externally. Left sometimes with very small protuberance of vas deferens. Abdominal somites 1–3 with tergal boundaries distinct, not calcified. Teison with marginal row of long setae on anterior lobes; posterior lobes rounded, with unarmed chitinous plate, median cleft usually quite deep, with margins oblique or nearly perpendicular, unarmed or with 1 or 2 small teeth and few setae, 1 more prominent tooth at outer angle.

COLOUR: Unknown.

REPRODUCTION: Of the 21 females collected, 13 were ovigerous and most were collected during January. Although all eggs were in an early stage of development, they were relatively large, measuring between 0.7 and 0.9 mm. While some eggs had been dislodged



**Fig. 41.** *Paguroides inarmatus* Henderson, 1888, *Galathea* Stn 554, male (sl = 5.5 mm): a, shield and cephalic appendages (setae and aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view); c, carpus and chela of left cheliped (dorsal view); d, left third pereopod (lateral view); e, coxae and sternite of male fifth pereopods, together with ventral view of first abdominal somite; f, telson. Magnifications equal 18x (b–d), 25x (a, e), 37.5x (f).

During the course of preservation and storage, most females carried in excess of 250 eggs.

**HABITAT:** Henderson's (1888) type specimens were all collected on a substratum of mud and *Globigerina* ooze at depths between 1549 and 2115 m whereas the present New Zealand specimens come from some-

what shallower to considerably greater depths. One New Zealand specimen inhabited a shell completely encompassed by an unidentified anemone, while others occupied shells lacking any epifauna.

**REMARKS:** While bearing a superficial resemblance to *Michelopagurus limatulus*, *Paguroides inarmatus* is



readily distinguishable. Not only do females of this species lack modified paired first pleopods and males have better developed right sexual tubes, but the ambulatory dactyls are appreciably longer and more slender, and the carpi of the chelipeds less strongly armed.

RECORDS FROM NEW ZEALAND: North Island southeast of Cape Kidnappers, South Island east of Kaikoura, and southwest of the Chatham Islands; 1165–3250 m.

DISTRIBUTION: Great Australian Bight; north and south-eastern New Zealand; Marion Island, western Indian Ocean.

### *Michelopagurus* McLaughlin, 1997

*Pagurodes* Henderson, 1888: 94 (in part); Alcock 1901: 224 (in part); Alcock 1905b: 106 (in part); Gordan 1956: 324 (in part); de Saint Laurent 1969: 740 (in part).

*Pagurodes*: Bouvier 1922: 22; Ingle 1993: 102. [Not *Pagurodes* Henderson, 1888.]

*Michelopagurus* McLaughlin, 1997: 481.

TYPE SPECIES: *Pagurodes limatulus* Henderson, 1888. Gender masculine.

Eleven pairs of quadriserial gills. Rostrum broadly rounded or obtusely and bluntly triangular. Ocular acicles simple. Maxillule with external lobe of endopod well developed, not recurved. Ischium of third maxilliped with accessory tooth on crista dentata.

Chelipeds elongate, subequal, right appreciably stouter. Fourth pereopods semichelate; with single row of scale-like bristles or rarely incomplete double row in propodal rasp; no distinctive preungual process.

Coxae of fifth pereopods in males symmetrical; right, left, or both with short sexual tube; 3 unequally biramous unpaired left pleopods. Females with paired gonopores; modified, paired first pleopods, unpaired, left pleopods on somites 2 to 5.

Telson with transverse indentation suggestive of division into anterior and posterior portions; posterior lobes separated by distinct median cleft; terminal margins rounded; lateral margins, at least left, with corneous plate.

REMARKS: De Saint Laurent (1969) expressed the belief that Henderson's (1888) species of *Pagurodes* actually represented three distinct genera. Females of *P. inarmatus* and *P. piliferus* lacked modified, paired first pleopods, and presumably Henderson assumed that females of *P. limatulus* would similarly lack these appendages. However, Alcock (1905b) pointed out in

his redescription of this species that females did possess paired first pleopods. Nonetheless, Alcock retained *P. limatulus* in *Pagurodes*, simply noting that at least in one species paired first pleopods were present. De Saint Laurent (1969) restricted *Pagurodes* to species typified by *P. inarmatus*; McLaughlin (1997) transferred *P. limatulus* to *Michelopagurus* and *P. piliferus* to *Pseudopagurodes* McLaughlin, 1997.

Bouvier (1922) assigned two new abyssal Atlantic species to *Pagurodes* sensu lato, remarking that since his species were both represented by only single specimens, he could not be sure that all characters of the genus were present. As previously indicated, de Saint Laurent (1969) pointed out neither *P. limatulus* nor *P. piliferus* should be included in *Pagurodes*. She commented that *P. limatulus* would be assigned to a new taxon, together with *Pagurodes richardi* Bouvier, 1922 and *Pagurodes atlanticus* Bouvier, 1922. However, in his comprehensive treatment of Atlantic pagurids, Ingle (1993) chose to retain *P. richardi* and *P. atlanticus* in *Pagurodes* (sensu Bouvier 1922), noting that confident placement of the Atlantic species would have to wait until *Pagurodes* could be reevaluated. McLaughlin (1997) provisionally reassigned Bouvier's (1922) species to *Michelopagurus*. We have now had an opportunity to reexamine both Atlantic species and have confirmed the accuracy of their assignment to *Michelopagurus*.

### ? *Michelopagurus* sp.

(Fig. 42)

#### MATERIAL EXAMINED:

NZOI Stn I63, 2 females (sl = 2.6, 2.8 mm).

DESCRIPTION: Shield (Fig. 42a) slightly broader than long. Rostrum broadly rounded, but produced at least to level of roundly triangular lateral projections. Ocular peduncles (including corneas) quite short and stout, approximately half length of shield; corneas approximately half length of peduncles, slightly dilated. Ocular acicles narrowly triangular. Antennular peduncles over-reaching distal margins of corneas by slightly less than entire length of ultimate segment; basal segment with very prominent spine on dorsolateral margin. Antennal peduncles over-reaching distal margins of corneas by 0.75 to full length of ultimate segment; second segment with laterodistal projection reaching to midlength of fourth peduncular segment, terminating in simple or bifid tooth or spine, dorsomesial distal angle with acute spine. Antennal acicle reaching at least to midlength of ultimate peduncular segment.

Right cheliped (Fig. 42b) moderately elongate. Dactyl with row of tubercles on dorsal midline. Palm

slender, somewhat compressed dorsoventrally; dorsomesial margin with row of small spines or teeth, convex dorsal surface with short, transverse, sometimes tuberculate ridge in proximal midline and scattered tufts of setae; dorsolateral margin with row of very small teeth, not extending to tip of fixed finger. Carpus with row of teeth on dorsomesial margin, dorsal surface with few short, transverse rows of spinulose tubercles, dorsolateral margin with irregular row of small teeth not extending to proximal or distal margins. Merus with irregular single or double row of teeth or spinulose protuberances on ventrolateral margin, most distal usually strongest; ventromesial margin with row of small teeth.

Left cheliped (Fig. 42c) with elongate, slender unarmed or weakly tuberculate dactyl and fixed finger, tending to curve ventrally. Palm with midline slightly elevated and armed with 1–2 double rows of small tubercles, dorsolateral surface minutely granular or tuberculate; dorsomesial margin with row of small tubercles. Carpus with row of teeth on both dorsolateral and dorsomesial margins; ventrolateral margin with weak protuberances. Merus with small teeth on distal half of ventromesial margin; 1–3 spines distally and transverse rows of denticles or tubercles in proximal 0.50–0.65 of ventrolateral margin.

Second and third pereopods similar from left to right. Dactyls 1.2–1.3 length of propodi; dorsal margins each usually with row of stiff setae, mesial and lateral faces each with weak longitudinal sulcus, flanked above on mesial faces by 1–2 rows of very short, spiniform setae; ventral margins each with row of 11–19 prominent spiniform setae. Propodi with low protuberances and tufts of setae on dorsal surfaces, 1–2 spiniform setae at ventrodistal margins. Carpi each with dorsodistal spine and row of low protuberances with tufts of setae on dorsal surface. Meri each with 1–3 teeth at ventrolateral distal angle, and row of denticles or tubercles, sometimes double, on ventral surface (second) or unarmed (third). Anterior lobe of sternite of third pereopods subrectangular, subdivided by median longitudinal groove into 2 sublobes, each with tuft of setae.

Telson (Fig. 42d) with prominent median cleft separating slightly asymmetrical posterior lobes; rounded terminal margins each with 3–8 prominent teeth often interspersed with smaller teeth.

COLOUR: Not known.

REPRODUCTION: Not known.

HABITAT: Not known.

REMARKS: In telson morphology, and in having quadri-

serial gills and modified, paired first pleopods, the two females collected at NZOI Stn I63 best fit the diagnosis of *Michelopagurus*; they differ appreciably, however, from most other species assigned to the genus in the shape of the corneas. Until additional specimens in better condition are known, particularly male, the generic placement must be considered tentative and the specific identity of the taxon uncertain.

RECORDS FROM NEW ZEALAND: Known only from NZOI Stn I63, 36°23.6–13.6'S, 176°23.6–13.6'E; 400 m, possibly to 585 m.

DISTRIBUTION: Uncertain.

### *Diacanthurus* McLaughlin & Forest, 1997

*Diacanthurus* McLaughlin & Forest, 1997: 237.

TYPE SPECIES: *Eupagurus spinulimanus* Miers, 1876a. Gender masculine.

Eleven pairs of biserial gills. Rostrum obsolete to broadly rounded. Ocular peduncles well developed, intersegmental articulating membrane prominent; ocular acicles widely separated, dorsal surfaces flattened or slightly convex, very broadly triangular, produced distally and with strong terminal, marginal or submarginal spine or spines. Maxillule with internal endopodal lobe well developed, external lobe obsolete. Third maxilliped with crista dentata well developed, 1 accessory tooth.

Chelipeds unequal, right appreciably larger. Left cheliped with some degree of clockwise rotation of propodal-carpal articulation; dorsolateral margin of chela weakly to strongly inflated proximally. Dactyls and propodi of second and third pereopods similar. Fourth pereopods semichelate; propodal rasp consisting of several rows of small scale-like bristles or setae.

Males with paired gonopores, almost completely masked by ventral fringe of long setae, no sexual tubes; no paired pleopods, 3 unpaired, uniramous or very unequally biramous left pleopods 3–5. Females with paired gonopores; no paired pleopods, 4 biramous left pleopods 2–5, first 3 egg-carrying, last as in males.

Abdomen with somites delimited by strong transverse fibrils. Tergite of sixth abdominal segment with deep median transverse groove. Uropods strongly asymmetrical. Telson with prominent lateral indentations indicating division into anterior and posterior portions; posterior lobes generally symmetrical, each with primarily "half-moon" contour, blade-like lateral margin and acute or subacute terminal angle,



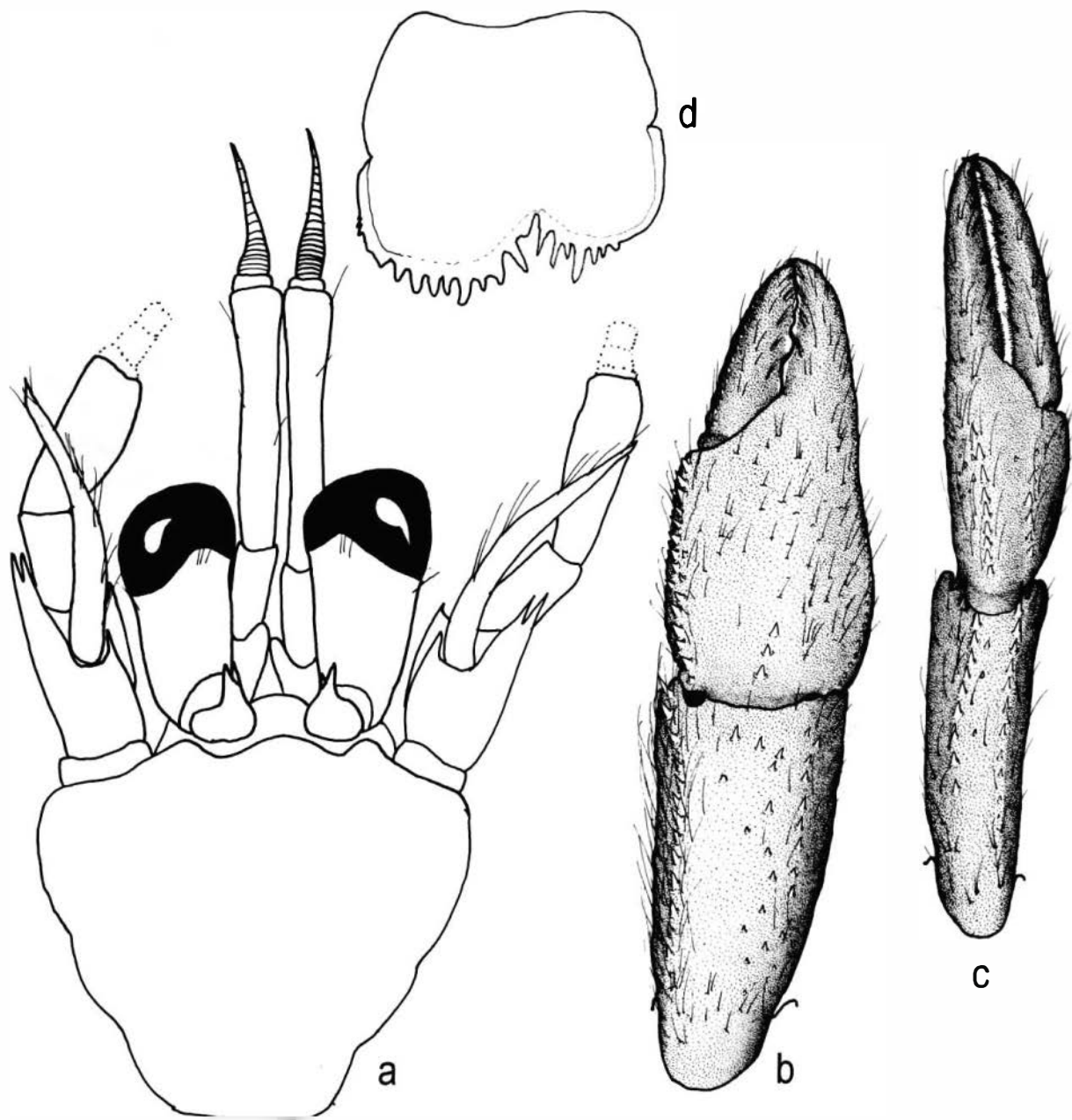


Fig. 42. ? *Michelopagurus* sp., NZOI Stn 163, female (sl = 2.8 mm): a, shield and cephalic appendages (aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view); c, carpus and chela of left cheliped (dorsal view); d, telson. Magnifications equal 18x (b, c), 25x (a), 50x (d).

usually broadly separated and with distinct median cleft; inner margins each with 1 prominent tooth in basal half.

REMARKS: Of the five Recent species of *Diacanthurus* currently recognised, three are represented in the New Zealand fauna. The most distinctive character of the genus is the unique structure of the telson (Figs 43e,

44e, 45e), which sets apart of this genus apart from other regional pagurids.

*Diacanthurus* is one of the few paguroid genera with a confidently documented fossil record. "*Pagurus*" *clifdenensis* Hyden & Forest, 1980 from the Altonian stage, Early Miocene, is one of two fossil hermit crabs reported from New Zealand (Feldman & Keys 1992).

Its relationship with *D. spinulimanus* was recognised by Hyden and Forest (1980); however, McLaughlin and Forest (1997) were of the opinion that it was more closely related to *D. ecphyra* McLaughlin & Forest, 1997, a species described from New Caledonia, but occurring rarely in New Zealand.

KEY TO THE NEW ZEALAND (INCLUDING KERMADEC ISLANDS)  
SPECIES OF *Diacanthurus*

- 1 Corneas slightly dilated. Ratio of peduncular length to corneal diameter approximately 4 : 1. Carpi of third pereopods each with 1 tooth on dorsal margin ..... *D. spinulimanus*
- Corneas moderately to strongly dilated. Ratio of peduncular length to corneal diameter less than 3 : 1. Carpi of third pereopods each with more than 1 tooth on dorsal margin ..... 2
- 2 Corneas strongly dilated. Ratio of peduncular length to corneal diameter less than 2 : 1. Maximum width of palm of right chela at least 1.25 (usually 1.5) times length of dorsomesial margin ..... *D. rubricatus*
- Corneas not strongly dilated. Ratio of peduncular length to corneal diameter approximately 2.5 : 1. Maximum width of palm of right chela only slightly greater than length of dorsomesial margin ..... *D. ecphyra*

*Diacanthurus spinulimanus* (Miers, 1876)  
(Fig. 43, Pl. 3, fig. 2)

*Eupagurus spinulimanus* Miers, 1876a: 222; 1876b: 63, pl. 1, fig. 6; Filhol 1885a: 25; 1885b: 412; Thomson, 1899: 169, 173 (key); Alcock 1905b: 176 (list).  
*Eupagurus Edwardsii* Filhol, 1883: 66 [not *Eupagurus edwardsii* (Dana, 1852c)].  
*Eupagurus Edwardsi* Filhol, 1885b: 25 (in part); 1885d: 412 (in part); 1885e: pl. 52, fig. 6 [not *Eupagurus edwardsii* (Dana, 1852c)].  
*Eupagurus edwardsii* Thomson 1899: 182, pl. 20, figs 6, 7; Chilton 1906: 266.  
*Eupagurus intermedius* Lenz, 1901: 446, pl. 32, figs 8-10; Thompson 1930: 271.  
*Eupagurus norae* Chilton, 1911a: 299; Borradaile 1916a: 95.  
*Eupagurus chiltoni* Thompson, 1930: 271.  
*Pagurus spinulimanus*: Gordan 1956: 335; Probert *et al.* 1979: 381 (list); Hyden & Forest 1980: 473, fig. 3b; Rainer 1981: 37 (list).  
*Pagurus norae*: Fenwick, 1978: 206.  
*'Pagurus' spinulimanus*: Schembri 1982b: 868; Schembri & McLay 1983: 34, figs 20, 25.  
*Diacanthurus spinulimanus*: McLaughlin & Forest 1997: 252, figs 1b-e, 2e, 7a-i.

TYPES:

*Eupagurus spinulimanus*: holotype male (sl = 12.7 mm; abdomen missing), New Zealand, NHM 1876.4.

*Eupagurus Edwardsii*: lectotype herein selected: female (sl = 9.1 mm); paralectotypes: 5 males (sl = 4.2-16.7 mm), females (sl = 7.7-13.9 mm), Cook Strait, MNHN Pg 5833.

TYPE LOCALITY: New Zealand.

OTHER MATERIAL EXAMINED:

NZOI Stns: A849, 1 female (sl = 5.1 mm); B225, 1 male, 1 female (sl = 12.4, 13.2 mm); B263, 1 female (sl = 10.0 mm); B605, 1 female (sl = 3.4 mm); B619, 1 female (sl = 6.5 mm); C765, 1 female (sl = 4.2 mm); C814, 1 male (sl = 5.4 mm); C844, 1 male, 1 female, 1 ovigerous female (sl = 4.2-11.5 mm); C957, 1 male (sl = 6.0 mm); D72, 1 female (sl = 9.7 mm); E139, 1 female (sl = 4.1 mm); E820, 1 ovigerous female (sl = 13.9 mm); Z8662, 1 male (sl = 14.0 mm); Z9089, 1 male (sl = 5.6 mm).

NMNZ collections: Spirits Bay, Terra Nova Stn 134, 31.8.11, 20-37 m, 5 specimens (as *E. intermedius*), Cr 446; Bay of Islands, collected by fisherman, 18.10.56, 1 specimen, Cr 9618; Henry Is., Whangaruru Harbour, Northland, coll. A. Baker, 5.12.71, 12 m, 1 male (sl = 4.9 mm), Cr 8122; off Great Barrier Island, -2.59, 36 m, 1 specimen, Cr 9619; Mercury Bay, coll. B. Godfriaux, 27.5.69, 33 m, 1 male (sl = 6.8 mm), Cr 8030; Mercury Bay, coll. B. Godfriaux, 6.4.70, 33 m, 1 male (sl = 9.0 mm), Cr 8061; Mercury Bay, coll. B. Godfriaux, 19.6.70, 40 m, 1 male, 2 females (sl = 3.4-8.7 mm), Cr 8069; off Canoe Rock, E of Kawau, coll. W.R.B. Oliver, 16.3.17, 1 specimen, Cr 9620; Aldermen Islands, Bay of Plenty, -11.81, 1 male, 1 female (sl = 6.0, 11.4 mm), Cr 8111; Slipper Island, coll. B. Godfriaux, 10.6.70, 33 m, 1 female (sl = 7.0 mm), Cr 8076; Motiti Is., coll. B. Godfriaux, 20.5.70, 46 m, 1 male (sl = 11.1 mm), 1 female (sl = 9.6 mm), Cr 9806; Hapuka Rock, Sugar Loaf, New Plymouth, coll. G. Hardy, 23.3.85, 27 m, 1 male (sl = 7.1 mm), Cr 8102; off Wanganui, coll. A. Baxter, 1.9.59, 36-55 m, 1 male (sl = 10.0 mm), Cr 9621; off Wanganui River, coll. A. Baxter, 1959, 37-55 m, 1 male (sl = 15.7 mm), Cr 9622; between Wanganui and Foxton, Admiral, ca. 91 m, 1 specimen, Cr 9623; Plimmer-ton, collected by fishermen, -.6.51, 1 specimen, Cr 444; Manuwakapakapa, D'Urville Is., coll. A. Stewart, 2.3.90, 6-12 m, 1 male (sl = 14.2 mm), Cr 7542; The Nugget, Patuki, D'Urville Is., coll. A. Stewart, 24.2.90, 6-12 m, 1 male (sl = 10.9 mm), Cr 7538; between Lucky & Woodman's Bays, D'Urville Is., coll. A. Stewart, 25.2.90, 9-15 m, 1 male (sl = 6.4 mm), Cr 9624; inside Te Kakaho Is., Chetwode Is., colls B. Young & B. Marshall, 13.4.88, 13 m, 1 male (sl = 9.0 mm), Cr 7599; north of Kapiti Is., coll. F. Abernethy, 5.9.56, 55 m, 1 specimen, Cr 9625; off Kapiti Is., coll. F. Abernethy, 12.53, 18-27 m, 1 specimen, Cr 9626; Kapiti Is., 12.12.76, 21 m, 1 male (15.3 mm), Cr 9627, 1 female, 1 ovigerous female (sl = 8.8, 11.9 mm), Cr 7604; Port Underwood, coll. G. Olsen, -.7.87, 12 m, 1 male (sl = 12.1 mm), Cr 7522; Cook Strait trawling grounds, 1956, 73 m, 1 specimen, Cr 9628; NE Rangitoto Is., Cook Strait, 18.12.64, 91-110 m, 1 female (sl = 2.9 mm), Cr 7594; Makara Beach, Wellington, crayfish pots, coll. R. Pike, 9-18 m, 3 specimens, Cr 9629; Days Bay, Wellington Harbour, fishing net, coll. R.K. Dell, 1.2.53, 1 specimen, Cr 448; Wellington Harbour, trawled off Petone, coll. W.R.B. Oliver, 1.6.13, 2



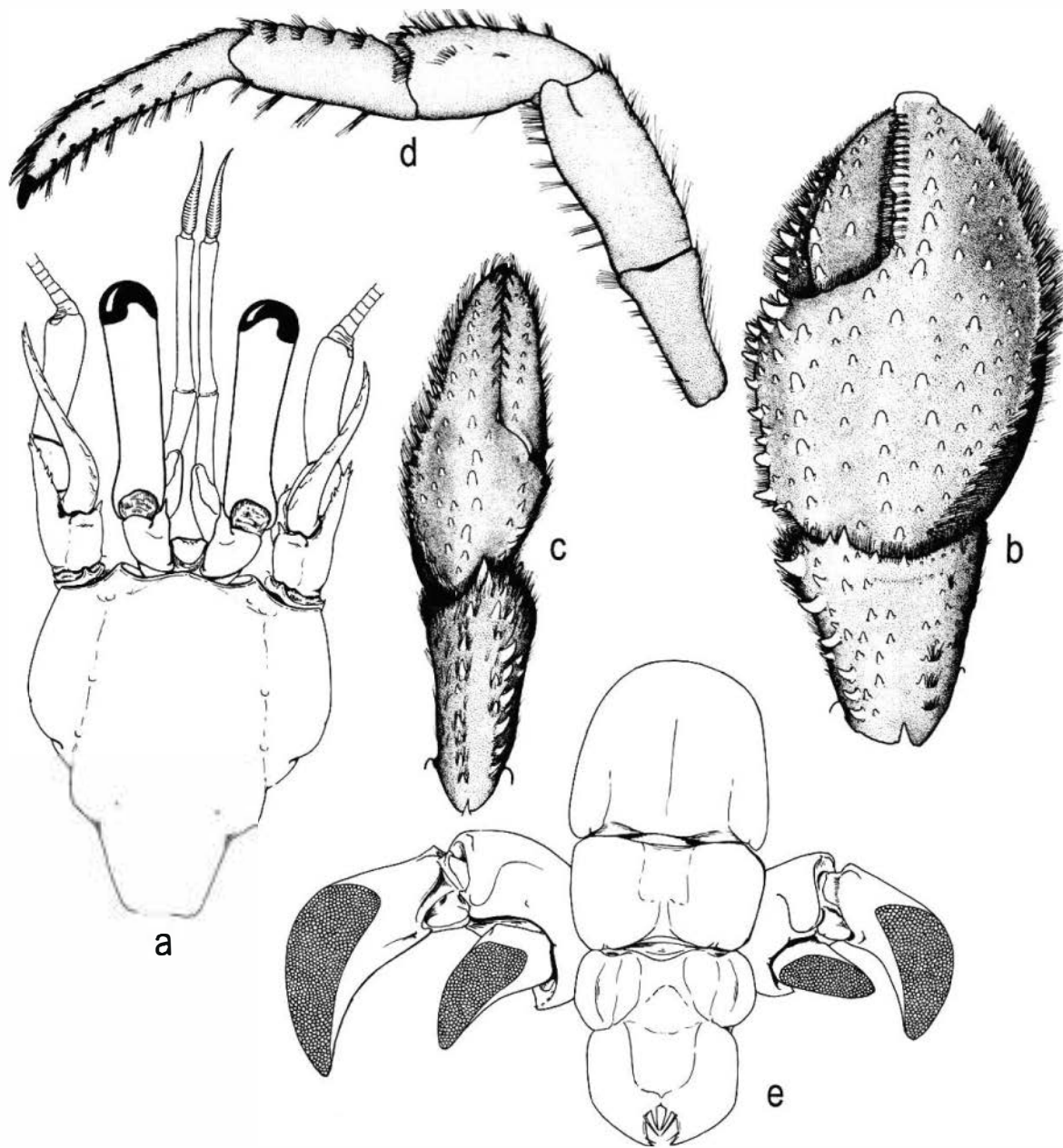


Fig. 43. *Diacanthiurus spinulimanus* (Miers, 1876), off Wanganui, a, e, male (sl = 10.0 mm), NMNZ Cr 9621; b-d, Pania Rock, Hawke Bay, female (sl = 12 mm), PMcL (from McLaughlin & Forest 1997): a, shield and cephalic appendages (setation and aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view); c, carpus and chela of left cheliped (dorsal view); d, left third pereopod (lateral view); e, tergite of sixth abdominal somite, protopods of uropods, telson (setation omitted). Magnifications equal 6x (a-d), 10x (e).

specimens, Cr 9630; approx. 3 miles off Kaikoura, coll. R. Pilgrim, 24.1.67, 27-55 m, 1 male (sl = 10.1 mm), Cr 4098; off Rhino Horn Pt., Kaikoura, coll. L. Bowring, 27.11.75, 80 m, 3 males (sl = 8.7-15.0 mm), Cr 8222; South Bay, Kaikoura, 1-2.7.62, 55 m, 1 female (sl = 13.2 mm), Cr. 7394; between Moeraki and Oamaru, coll. J. Moreland, 28.6.53, 73-110 m, 2 specimens, Cr 9631; North Otago, coll. J. Graham, 9 m, 1 male, 1 female (sl = 12.3, 18.3 mm), Cr 7390; North Otago, coll. J. Graham, 27-55 m, 1 female (sl = 12.4 mm),

Cr 8089; Foveaux Strait oyster grounds, coll. D. Stead, 1961, 4 males, 5 ovigerous females (sl = 9.8-17.9 mm), Cr 8081; Foveaux Strait oyster grounds, coll. P. Roberts, -2.66, 37 m, 1 ovigerous female (sl = 14.5 mm), Cr 9632; Paterson Inlet, Stewart Is., coll. J. Richards, 2-4 m, 1 male, 1 female (sl = 6.9, 7.5 mm), Cr 7411; west of Breaksea Is., Stewart Is., coll. G. Wilson, 27.8.73, 48 m, 2 males, 1 female (sl = 11.9-13.5 mm), Cr 8224; off east coast Stewart Is., crab pot, coll. O. Sansom, -11.54, 36-55 m, 1 specimen, Cr 9633.

specimens,

NMNZ Stns: BS 173, 1 female (juvenile) (sl = 2.1 mm), Cr 9634; BS 186, 1 female (sl = 8.9 mm), Cr 9635; BS 198, 1 male (sl = 3.2 mm), Cr 9636; BS 216, 2 juveniles (sl = 1.4, 1.5 mm), Cr 8193; BS 228, 1 juvenile (sl = 2.0 mm), Cr 9637; BS 277, 1 male, 3 females, 2 ovigerous females (sl = 13.0–16.7 mm), Cr 7539; BS 278, 4 males, 2 females (sl = 12.8–17.2 mm), Cr 7410; Stn BS 279, 1 male (sl = 15.3 mm), Cr 7550; BS 288, 2 females (sl = 10.9, 11.2 mm), Cr 8210; BS 358, 4 males, 3 females (sl = 10.4–13.7 mm), Cr 8212, Cr 8213; BS 359, 1 female (sl = 11.9 mm), 1 ovigerous female (sl = 8.8 mm), Cr 7609; BS 360, 1 male, 1 ovigerous female (sl = 5.1, 7.0 mm), Cr 9638; BS 392, 1 male (sl = 4.8 mm), Cr 9639; BS 408, 3 males (8.3–12.5 mm), Cr 7583; 1 male (17.2 mm), Cr 9799; BS 432, 1 female (6.7 mm), Cr 8115; 2 males, 1 ovigerous female (sl = 4.4–6.0 mm), Cr 8141; BS 488, 2 males, (sl = 5.5, 7.7 mm), Cr 8176; BS 489, 2 males, 5 females (sl = 3.8–8.9 mm), Cr 7577; BS 500, 1 male, 1 female (sl = 12.4, 12.6 mm), Cr 8208; BS 510, 1 female (sl = 9.8 mm), Cr 8165; BS 517, 1 male, 1 ovigerous female (sl = 11.0, 12.4 mm), Cr 7588; 1 female (sl = 10.0 mm), Cr 8238; BS 528, 1 female (sl = 11.6 mm), Cr 8237; BS 561, 4 males, 1 female (sl = 9.2–14.7 mm), Cr 7557; BS 562, 1 female (sl = 6.3 mm), Cr 8059; BS 485, 2 males, 5 females (sl = 3.4–6.3 mm), Cr 7574; BS 656, 1 female (sl = 9.8 mm), Cr 7582; BS 657, 3 males, 2 females, 3 ovigerous females (sl = 4.6–12.1 mm), Cr 8203; 2 males, 1 female, 1 ovigerous female (sl = 3.6–12.2 mm), Cr 8204; BS 732, 1 ? male (juvenile) (sl = 2.4 mm), Cr 9640; BS 737, 2 males, 2 females (sl = 6.3–10.9 mm), Cr 8206; BS 738, 1 male, 1 female (sl = 3.6, 6.7 mm), Cr 7579; BS 776, 2 males, 1 ovigerous female (sl = 8.4–14.0 mm), Cr 8202; BS 840, 1 female (sl = 15.2 mm), Cr 7576, 1 juvenile (sl = 1.8 mm), Cr 8147; BS 862, 1 male (sl = 2.7 mm), Cr 8162; BS 870, 1 female (sl = 2.7 mm), Cr 8158; BS 871, 2 males, 3 females (sl = 3.1–13.4 mm), Cr 7587; BS 910, 1 male, 2 females (sl = 7.8–10.1 mm), Cr 8233; BS 914, 1 male (sl = 5.4 mm), Cr 8124; BS 915, 6 males, 6 females, 1 juvenile (sl = 2.0–7.6 mm), Cr 7567; BS 916, 7 males, 4 females (sl = 2.4–8.7 mm), Cr 7584; AKM Stn T100, 1 male (sl = 13.2 mm), Cr 7555; CM Stn 171, 1 male (sl = 17.3 mm), Cr 7510; GQ Stn "a", 1 ovigerous female (sl = 11.7 mm), Cr 8065; 1 male, 2 females, 1 ovigerous female (sl = 9.2–14.7 mm), Cr 8085; Mu Stn 5, 3 males, 3 females (sl = 10.4–13.7 mm), Cr 7543; Stn KA080, 3 males, 1 female, 2 ovigerous females (sl = 12.1–17.2 mm), Cr 7551; Tan Stn "a", 1 male (sl = 5.1 mm), Cr 7590; VUC Stn H, 1 female (sl = 6.3 mm), Cr 9641; VUC Stn GUJ 166, 1 female (sl = 7.1 mm), Cr 9642.

MNHN collections: New Zealand, no specific locality, 1790–1795 m, coll. H. Filhol, as *Eupagurus Edwardsii* 1 male, 1 female (sl = 5.1, 5.8 mm), MNHN Pg 5833.

NZDC collections: Kaipakiriki Bay, Queen Charlotte Sound, 2 m, 28.9.89, 1 male, 1 female (sl = 14.0, 16.9 mm).

NZMD collection: Stn 90, 1 male, 2 females (sl = 3.4–5.7 mm); Stn (a), 1 ovigerous female (sl = 10.7 mm), Cr 9643.

PMcL collection: Great Omaha Bay: Stn A12, 1 female (sl = 2.6 mm); Stn A21, 1 male (sl = 2.3 mm), 1 female (sl = 2.2 mm); Stn A59, 1 male (sl = 9.1 mm); Stn B12, 1 female (sl = 6.2 mm); Pania Rock, Hawke Bay, 12 m, 29.7.1991, coll. C. Duffy, 4 males, 2 females, 2 ovigerous females (sl = 7.1–14.9 mm).

**DESCRIPTION:** Shield (Fig. 43a) longer than broad; 0.50–0.71 carapace length. Rostrum obsolete or broadly rounded, produced nearly to level of lateral projections. Ocular peduncles 0.75 to nearly as long as shield; corneas slightly dilated, ratio of peduncular length to corneal diameter 3.5 : 1 to greater than 4 : 1; ocular acicles very broad basally, terminally subtriangular to ovate, with strong marginal or submarginal tooth. Antennular peduncles reaching to distal margins of corneas or overreaching corneas by up to half length of ultimate segment. Antennal peduncles usually not reaching beyond basal margins of corneas, occasionally slightly longer, but not overreaching distal corneal margin; antennal acicles reaching nearly to distal margin of fifth peduncular segment, mesial margin with dense row of long setae.

Chelipeds with distal segments covered with dense, short setae; tubercles usually more acute in smaller specimens. Dactyl of right cheliped with dorsomesial row of blunt or subacute teeth and median row of large tubercles. Palm (Fig. 43b) with maximum breadth only slightly greater than length of dorsomesial margin; prominent teeth on dorsomesial and dorsolateral margins at least partially obscured by dense, long setae, dorsal surface with 1–2 longitudinal rows of widely spaced, tall, usually blunt tubercles, occasionally forming irregular inverted "V" medially, usually 1–2 more irregular rows of tubercles laterally and medially and scattered somewhat smaller tubercles on palm and fixed finger; tip of fixed finger usually heavily calcified, frequently flattened. Carpus with row of strong, slender teeth on dorsomesial margin, dorsal surface with scattered smaller, acute tubercles, often at least partially concealed by dense setae, and additional longitudinal row of acute tubercles laterad of midline; ventrodistal margin often with irregular row of small teeth. Merus with row of acute teeth distally on ventrolateral margin and transverse rows of tubercles extending onto ventral surface proximally; ventromesial margin also with row of acute teeth.

Left cheliped with palm (Fig. 43c) somewhat dorsoventrally flattened, propodal-carpal articulation rotated clockwise nearly 45°; dorsal surface of chela with mat of short dense setae. Dorsal surface of dactyl with row of spinulose or blunt tubercles in midline, dorsomesial margin unarmed but with dense tufts of long setae. Dorsal surface of palm with low, rounded median ridge armed with row of spinulose or blunt tubercles nearly obscured by dense setae; slightly elevated dorsolateral margin with row of prominent, acute tubercles, decreasing in size on fixed finger. Carpus with dorsomesial and dorsolateral row of teeth and few additional tubercles distally on dorsal surface, all at least partially obscured by dense



setae.

Second and third pereopods (Fig. 43d) with dactyls moderately stout, often somewhat blade-shaped, 1.35–1.75 times longer than propodi, dorsal margins with longitudinal rows of spiniform setae and stiff bristles or setae; mesial faces each with short, transverse, closely set rows of corneous, spiniform bristles dorsally and ventrally, and extending onto ventral margin distally. Propodi each with longitudinal row of transverse, low protuberances and setae dorsally; sparse row of tufts of setae ventrally. Carpi of second pereopods each with a row of teeth on dorsal surface, carpi of third with dorsodistal tooth, and frequently with additional denticle in proximal half, nearly obscured by tuft of setae. Sternite of third pereopods with small semicircular anterior lobe.

Telson (Fig. 43e) with posterior lobes laterally convex, mesially concave and drawn out into strong acute termination, 1 strong tooth basally on either side of deep median cleft, and occasionally 1–2 additional denticles on inner margin.

**COLOUR:** Ocular peduncles white with median light-orange band; antennules light orange; antennae reddish brown with white bars; chelipeds and ambulatory legs orange-brown ground colour and darker brown areas and distinctive purple and dark-red patches on regions of articulation of carpi and meri (Schembri & McLay 1983).

**REPRODUCTION:** Among the present material, females with shield lengths varying from 6.0 to 14.7 mm were found carrying eggs. Ovigerous females were present in practically all months from July to March, with the peak appearing in January and February.

**HABITAT:** *Dicathurus spinulimanus* occupies a variety of gastropod shells and may carry the anemone *Calliactis conchicola* Parry on the shell; on muddy sand substrata. Hurley and Jansen (1977) reported that often five or six specimens of the commensal isopod *Cassidina typa* H. Milne Edwards (family Sphaeromatidae) could be found within the gastropod shell occupied by *D. spinulimanus*. Although we did not note such occurrences in the material we examined, it does appear to be a quite common relationship (S. O'Shea, pers. comm.).

**REMARKS:** *Dicathurus spinulimanus* was first described by Miers (1876a) as *Eupagurus spinulimanus* from a single, large, damaged male. In a preliminary note on new species of New Zealand pagurids, Filhol (1883) described *Eupagurus Edwardsii* from Cook Strait and Stewart Island, remarking that "Elle devra être placée à côté de l'*Eupagurus spinulimanus* de M.

Miers." Filhol (1885b) again described his species as new, however, in this report using the spelling "*Eupagurus Edwardsii*". He repeated his observation that his species was closely related to *E. spinulimanus*, but commented that he did not think the two could be confounded, since Miers (1876a, b) had not mentioned or illustrated the rounded tubercles on the "external" surface of the carpus of the right cheliped, which Filhol (1885b) considered remarkable. Although an illustration of "*E. Edwardsii*" appeared in the atlas (Filhol 1885e), Filhol's (1885d) description and remarks were repeated verbatim from his previous account (Filhol 1885b). However, amongst Filhol's syntypes we found two small specimens of the superficially similar *Pagurus novizealandiae* (Dana, 1852c). The two taxa are immediately distinguishable by the marked differences in the telson, and by the ventral prolongation of the carpus of the right cheliped of Dana's species.

Thomson (1899) redescribed *E. edwardsii*, from specimens he examined. He noted that *E. spinulimanus* had not been reported since Miers' (1876a, b) description (Thomson, 1899: 169). Nonetheless, he included *E. spinulimanus* in his key to the species of *Eupagurus* (Thomson 1899: 173), distinguishing it from "*E. edwardsii*" by "two lines of spinules among short dense hair", as opposed to "six rows of round-topped tubercles buried in thick hair" on the right chela.

Lenz (1901), reporting on the crustaceans from the Schauinsland Pacific Expedition (1896–1897), described *Eupagurus intermedius* Lenz, 1901, as morphologically between *E. spinulimanus* and *E. "edwardsii"*. He reported that *E. intermedius* had rows of spines on the carpus of the right cheliped similar to those of *E. spinulimanus* [sic] Miers and *E. edwardsii*, and the shape of the right chela was like that of *E. edwardsii*. He also described two rows of spines on the chela of the former and six rows of tubercles for the latter, apparently following Thomson's (1899) key characters for *E. spinulimanus* and *E. edwardsii*. *Eupagurus intermedius* reportedly had more spine-like tubercles irregularly set between the rows, corresponding perfectly with those of *E. novae-zealandiae*. Chilton (1911a) subsequently considered Lenz's (1901) taxon synonymous with *D. rubricatus* (Henderson, 1888) (as *Eupagurus*).

Chilton (1906) recorded *Eupagurus edwardsii* from Channel Island, Hauraki Gulf, noting that Filhol's species showed a marked resemblance to *E. spinulimanus* and adding that he would not be surprised if the two proved to be identical. Following Alcock's (1905b) observation that Filhol's specific name was preoccupied by *E. edwardsii* Dana, 1852c, Chilton (1911a) subsequently proposed the replacement name *norae* for Filhol's *edwardsii*. Interestingly, Chilton used

the spelling *edwardsii*, while crediting its publication to Filhol (1885b) in which Filhol had spelled the name with a single "i".

After reexamining Chilton's (1911a) specimens, Thompson (1930) removed Lenz's (1901) "*E. intermedius*" from synonymy with *E. rubricatus*, placing it in synonymy with Chilton's (1911a) *E. norae*, as the senior synonym. With regard to Filhol's (1885b) *E. "edwardsi"*, Thompson (1930) was of the opinion that, should it prove to be distinct from *E. intermedius*, which he considered doubtful, he proposed that it should then be called *Eupagurus chiltoni*.

The conspecificity of *E. spinulimanus*, *E. edwardsii*, *E. intermedius*, and *E. norae* was recognised during the early stages of the senior authors' work on the New Zealand pagurids, and was so stated by Hyden and Forest (1980). In that same publication, those authors indicated that their fossil species, *Pagurus clifdenensis* Hyden & Forest, together with Recent *P. spinulimanus* and *P. rubricatus*, would be transferred to a new genus. Subsequent references by New Zealand authors therefore cited this species as "*Pagurus*" *spinulimanus*. For these species, and two additional species not recognised at the time, McLaughlin & Forest (1997) established the genus *Diacanthurus* McLaughlin & Forest.

Because of the superficial similarity of the tuberculate armature of the dorsal surfaces of the right chelipeds, specimens of *Pagurus novizealandiae* occasionally have been identified as *D. spinulimanus* (personal observations). However, the two species are readily differentiated by the structure of the telson of *D. spinulimanus*, and by the dense fringe of setae on the third left pereopod of *P. novizealandiae*.

*Diacanthurus spinulimanus* is immediately distinguished from all other species of the genus by the much longer and more slender ocular peduncles, and only slightly dilated corneas (peduncular length to corneal diameter 3.5 : 1 to greater than 4 : 1). Small specimens of *D. spinulimanus* tend to have slightly shorter and thicker ocular peduncles, and superficially resemble *D. ecphyma*, a species occurring rarely in New Zealand waters. The two species are immediately separated by the greater strength of the teeth on the dorsomesial margins of the dactyl and palm of the right cheliped in *D. ecphyma*, and by the armature of the carpi of the third pereopods. The carpi of the third pereopods in *D. ecphyma* each carry a row of teeth. In *D. spinulimanus*, these carpi are frequently armed only with a dorsodistal tooth. However, it is not uncommon, particularly on the right, to find a small denticle on the dorsal margin in the proximal half that is partially to entirely obscured by a tuft of setae. In contrast to the dimorphic development of the right cheliped in *D. rubricatus*, only three of the more than 80 male specimens of *D. spinulimanus* examined showed any noticeable elongation of the

chelae.

RECORDS FROM NEW ZEALAND: Three Kings Trough (32°25'S) southwards to Stewart Island and east to the Chatham Islands; 2–274 m.

DISTRIBUTION: Apparently endemic to New Zealand and Chatham Islands.

### *Diacanthurus rubricatus* (Henderson, 1888)

(Fig. 44, Pl. 3, fig. 4)

*Eupagurus rubricatus* Henderson, 1888: 69, pl. 7, fig. 4; Thompson 1899: 180; Alcock 1905b: 176 (list); Chilton 1911a: 297; Thompson 1930: 272.

*Eupagurus intermedius*: Chilton 1911a: 297 [not *Eupagurus intermedius* Lenz, 1901].

*Pagurus rubricatus*: Gordan, 1956: 335; Hand 1975: 510; Probert *et al.* 1979: 381 (list); Hyden & Forest 1980: 473; Schembri 1982a: 101, figs 1–12; Schuchert 1996: 48.

"*Pagurus*" *rubricatus*: Schembri 1982b: 868; Schembri & McLay 1983: 34, figs 21, 24; Schembri 1988: 93.

*Diacanthurus rubricatus*: McLaughlin & Forest 1997: 249, figs 2d, 6a–j.

#### TYPE:

Holotype, male (sl = 6.6 mm; abdomen missing), NHM 1888.33.1.

TYPE LOCALITY: New Zealand; *Challenger* Stn 169, 37°34'S, 179°22'E, 1280 m.

#### OTHER MATERIAL EXAMINED:

NZOI Stns: A901, 1 ovigerous female (sl = 11.9 mm); C753, 1 female (sl = 7.7 mm); D121, 1 male, 2 females, 2 ovigerous females (sl = 6.8–16.4 mm); D267, 1 male (3.9 mm); E106, 2 males, 5 females (7.6–15.5 mm); E114, 2 males, 2 females (sl = 3.3–7.3 mm); E727, 1 female (sl = 8.5 mm); E759, 1 female (sl = 5.0 mm); E785, 1 ovigerous female (sl = 11.9 mm); F739, 2 males (sl = 3.9, 5.2 mm); F741, 1 male, 1 female (sl = 5.2, 8.3 mm).

NMNZ collections: Cook Strait trawling grounds, 1956, 73 m, 1 specimen, Cr 9644; Plate Is., coll. B. Godfriaux, 7.10.69, 183 m, 1 male (sl = 15.7 mm), Cr 8220; Motiti Is., coll. B. Godfriaux, 20.5.70, 46 m, 2 males (sl = 5.3, 11.7 mm), Cr 9807; off Napier, coll. W.J. Phillipps, -11.23, 37 m, 1 male, 1 female (sl = 11.2, 14.9 mm), Cr 9645; Tasman Bay, 2.77, 1 male (sl = 12.8 mm), Cr 8228; off Westport (41°46'S, 170°29'E), coll. K. Brody, 21.7.87, 530 m, 1 male (sl = 10.7 mm), Cr 7501; Chatham Rise (no further data), 1 male (sl = 9.8 mm), Cr 7556; approx. 3 miles off Kaikoura, coll. R. Pilgrim, 24.1.67, 27–55 m, 2 males, 1 female (sl = 6.1–10.9 mm), Cr 9793; between Moeraki and Oamaru, coll. J. Moreland, 28.6.53, 73–110 m, 1 specimen, Cr 9646; Bushett's Shoal, coll. A. Baxter, 7.9.64, 4 males (sl = 9.7–11.0 mm), Cr 7393; 25.5.65, 91–110 m, 3 males (sl = 4.7–12.2 mm), Cr 7392; Anchor Bay, coll. B.L. Godfriaux, 24.7.69, 32 m, 1 male (sl = 7.2 mm), Cr 9647;

NMNZ Stns: BS 216, 1 male (sl = 8.2 mm), Cr 8195; BS 264, colls A. Baker, R. Dell & J. Moreland, 1 female (sl =



4.5 mm), Cr 7569; BS 366, 3 females (sl = 9.7–12.0 mm); Cr 7405; BS 374, 1 female (sl = 2.5 mm) Cr 8056; BS 401, 1 male (sl = 8.8 mm), Cr 8107; BS 492, 13 males, 10 females (sl = 2.3–4.3 mm), Cr 7406; BS 508, 1 male (sl = 6.0 mm), Cr 8103; BS 543, 1 female (poor condition), Cr 8209; BS 656, 1 male, 1 ovigerous female (sl = 10.9, 11.4 mm), Cr 7589; BS 685, 1 male (sl = 5.2 mm), Cr 7571; BS 723, 1 male (sl = 2.2 mm), Cr 7403; BS 725, 2 males, 1 ovigerous female (sl = 8.4–11.0 mm), Cr 7586; BS 750, 1 male (sl = 7.3 mm), Cr 7407; BS 796, 3 males, 2 females, 5 ovigerous females (sl = 6.7–10.5 mm), Cr 7561; 1 male (sl = 10.8 mm), Cr 7563; 4 males, 3 females (sl = 3.3–6.0 mm), Cr 7596; 1 ovigerous female (sl = 7.9 mm), Cr 8055; 5 males, 1 female (sl = 5.9–10.5 mm), Cr 8199; BS 798, 2 males, 2 females, 7 ovigerous females (sl = 6.3–8.5 mm), Cr 7593; BS 815, 2 ovigerous females (sl = 7.8, 8.6 mm), Cr 7404; BS 819, 1 male, 2 ovigerous females (6.1–9.3 mm), Cr 7585; BS 822, 1 male (7.5 mm), Cr 8033; BS 824, 1 female (sl = 5.4 mm) Cr 8135; BS 826, 4 males (sl = 5.5–10.3 mm), Cr 7578; A M Stn 81, 1 ovigerous female (sl = 16.4 mm), Cr 7603; CM Stn (h), 2 males, 1 female (sl = 10.3–14.1 mm), Cr 7505; CM Stn 146, 1 male (sl = 15.4 mm), Cr 7524; CM Stn 160, 1 male, 1 ovigerous female (sl = 9.2, 13.2 mm), Cr 7499; GQ Stn "a", 9 males, 1 female (sl = 10.4–13.4 mm), Cr 8064; 1 male, 1 ovigerous female (sl = 9.9, 12.7 mm), Cr 8068; 1 male, 1 female (sl = 9.3, 9.5 mm), Cr 8071; 3 males (sl = 12.3–13.2 mm), Cr 8090; JC Stn "a", 2 females (sl = 8.6, 9.8 mm), Cr 7529; JC Stn "b", 1 male, 1 female (sl = 8.4, 8.9 mm), Cr 9803; JC Stn J2/27/82, 1 ovigerous female sl = 12.1 mm, Cr 8088; JC Stn J2/52/80, 1 male, 1 ovigerous female (sl = 11.8, 14.9 mm), Cr 7605; JC Stn JO2/001/82, 1 male (sl = 13.2 mm), Cr 7549; 1 male (sl = 17.2 mm), Cr 8227; JC Stn JO6/061/81, 1 female (sl = 8.8 mm), Cr 8226; JC Stn J16/6/84, 1 specimen, very poor condition, Cr 8223; JC Stn J18/081/78, 1 female (sl = 7.0 mm), Cr 8079; 1 male (sl = 8.9 mm), 1 female (sl = 8.4 mm), 1 specimen not removed from shell, Cr 8062; Stn KA080, 3 males (sl = 12.0–14.8 mm), Cr 7602; Mu Stn "a", 6 males (sl = 8.7–14.9 mm), Cr 7606; O7 Stn "a", 2 males, 2 females (sl = 10.1–15.7 mm), Cr 7600; Stn "b", 1 female (sl = 11.7 mm), Cr 7521; O7 Tow 47, 1 male (sl = 12.9 mm), Cr 8091; Tow 49, 1 male (sl = 14.0 mm), Cr 7525; Tow 55, 1 male, 1 female (sl = 10.1, 10.8 mm), Cr 7531; Tir Stn a, 1 female (sl = 13.7 mm), Cr 8216; Ty Stn "a", 1 male (sl = 13.0 mm), Cr 7507; Stn "b", 2 males, 3 females (sl = 6.6–14.4 mm), Cr 7526; Stn "c" 1 male, 1 female, 1 ovigerous female (sl = 5.6–12.0), Cr 9648.

NZMD collections: Trawl "a", 1 female (sl = 12.1 mm), Cr 8109; Trawl 5, 1 female (sl = 11.5 mm), Cr 8219; Trawl 6, 2 females (sl = 5.7, 5.8 mm), Cr 8120; Trawl 17, 1 male (sl = 12.1 mm), Cr 8112; Trawl 31, 1 male (sl = 8.2 mm), Cr 8095; Trawl 38, 1 male (sl = 11.7 mm), Cr 8218.

PBMS collection: MU 66-75, 1 male (sl = 16.6 mm).

PMcL collection: Queen Charlotte Sound, coll. C. Duffy, 4.10.89, 15 m, 1 male (sl = 16.5 mm); Bay of Plenty: Stn 10, 1 male (sl = 10.0 mm); Stn 26, 1 female (sl = 9.7 mm); Stn 55, 1 male (sl = 9.9 mm).

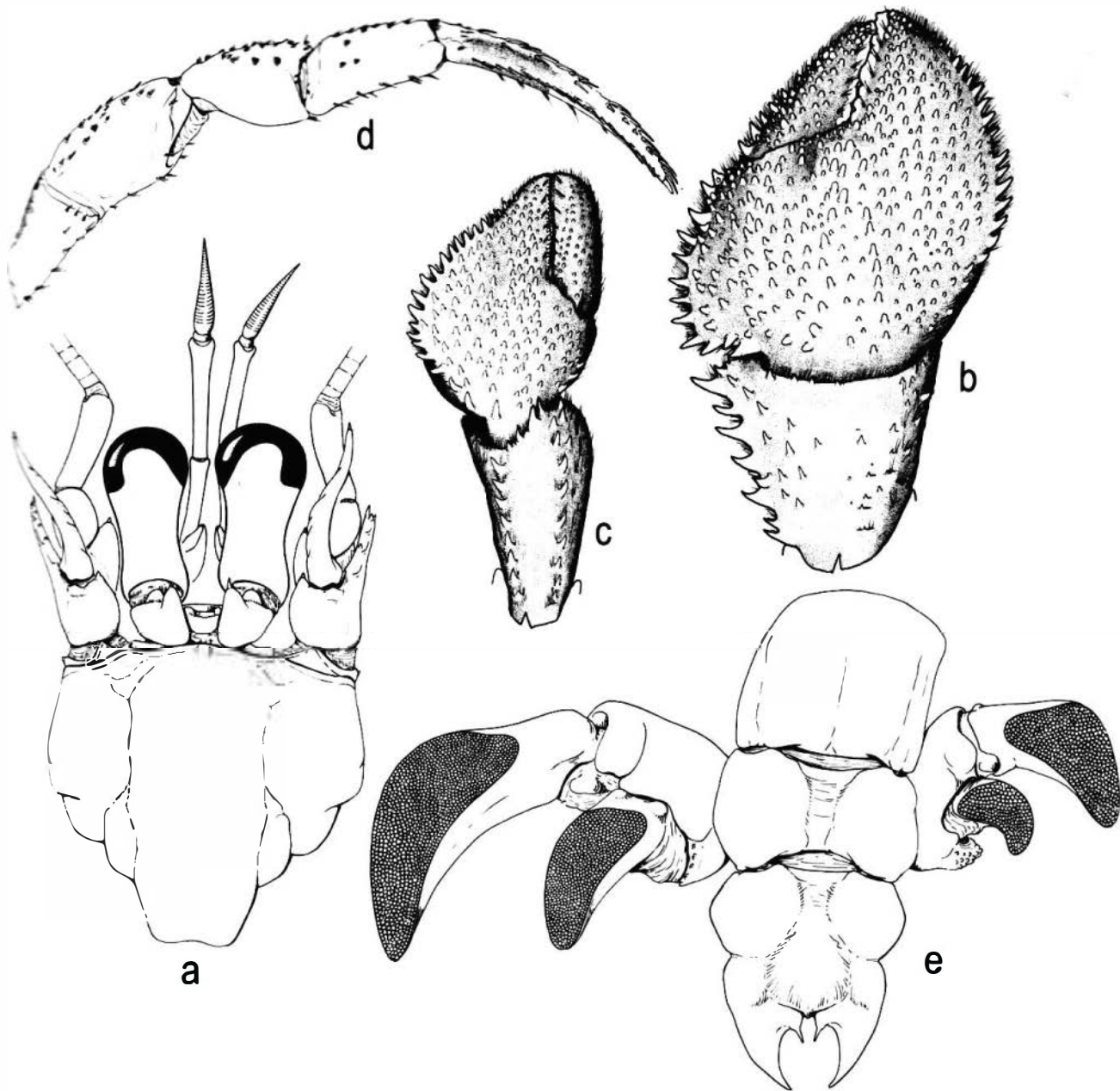
**DESCRIPTION:** Shield (Fig. 44a) subquadrate, slightly broader than long, 0.51–0.60 length of total carapace. Rostrum virtually obsolete to obtusely rounded, sometimes produced slightly beyond level of weakly developed lateral projections, large specimens

occasionally with small rostral protuberance. Ocular peduncles moderately stout, 0.50–0.75 length of shield (0.75–0.90 in small specimens); corneas dilated, corneal diameter included 1.25–1.80 in peduncular length; ocular acicles broad basally, slender and acuminate distally, with usually strong submarginal tooth. Antennular peduncles overreaching distal margin of corneas by 0.50–0.75 length of ultimate segment. Antennal peduncles equalling or slightly over-reaching corneas; second segment with latero-distal projection usually produced beyond proximal margin of last segment, with terminal tooth and small adjacent tooth, mesial margin with 1–3 denticles. Antennal acicle long, slender, reaching distal half or nearly to distal margin of fifth peduncular segment, mesial margin setose.

Chelipeds with distal segments usually covered with short matted setae; dactyl of right cheliped (Fig. 44b) with several rows of rounded tubercles on dorsal surface; palm with maximum breadth usually at least 1.5 times length of dorsomesial margin in females and moderately small specimens, in large males (sl = > 10 mm) frequently 1.25 times or less; dorsal surface elevated in midline, often more prominently produced distally, and with inverted, quasi V-shaped series of large, blunt tubercles, remainder of dorsal surface with rounded tubercles often partially obscured by setae, at least in small to moderately-sized individuals; dorsomesial and dorsolateral margins each with row of spines. Carpus with row of strong teeth on dorsomesial margin, dorsal surface with conical tubercles, strongest and most numerous mesiad of midline, usually partially obscured by setae, distal margin with 1 or 2 prominent teeth. Merus with strong tooth at dorsodistal margin; ventrolateral margin with row of small teeth or denticles and prominent, spinose protuberance proximally.

Left cheliped (Fig. 44c) with propodal-carpal articulation rotated clockwise 45–60° from horizontal plane. Dorsal surface of dactyl with dense mat of setae usually obscuring several irregular rows of small, spinulose tubercles; dorsolateral margin of palm expanded and strongly convex, somewhat elevated proximally and armed with blunt teeth, dorsal surface covered by short dense setae often completely obscuring irregular rows of small, spinulose tubercles. Dorsal surface of carpus with 2 rows of teeth. Merus with strong tooth on dorsodistal margin; ventromesial and ventrolateral margins each with row of slender teeth.

Second and third (Fig. 44d) pereopods usually slightly over-reaching tip of right cheliped; dactyls considerably longer than the propodi, slightly twisted; dorsal margins each with row of long, corneous, spiniform bristles, but only few additional setae;



**Fig. 44.** *Diacanthurus rubricatus* (Henderson, 1888), a, d, e, off Napier, male, (sl = 11.2), NMNZ Cr 9645; b, c, NZOI Stn D121, female (sl = 8.4 mm) (from McLaughlin & Forest 1997): a, shield and cephalic appendages (setation and aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view); c, carpus and chela of left cheliped (dorsal view); d, right third pereopod (lateral view); e, tergite of sixth abdominal somite, protopods of uropods, telson (setation omitted). Magnifications equal 3.5x (d), 6x (b, c), 7x (a), 10x (e).

ventral row of small spiniform setae; ventral margins each with row of prominent spiniform setae. Propodi with 5–7 short, transverse setose ridges dorsally and fewer similar ridges ventrally. Carpi of both second and third with toothed dorsal margins, teeth of third smaller and fewer in number. Meri of second each

with row of widely spaced low, sometimes spinulose protuberances or small teeth on ventral margins; third unarmed. Sternite of third pereopods with subquadrate to subrectangular anterior lobe.

Males with uniramous pleopods, or occasionally with vestigial endopod on pleopod 3. Telson (Fig.



mesial faces flat or concave, each with dorsal and 43e) with posterior lobes laterally convex or nearly straight, mesially concave and drawn out into strong terminally blunt or acute "half-moon"; 1 strong, but usually quite short tooth basally on either side of broad, often moderately deep median cleft, occasionally 1 or 2 denticles on inner margin.

**COLOUR:** Ocular peduncles white with red longitudinal stripe ventrally; antennules white; antennae uniformly reddish brown; chelipeds and ambulatory legs yellow-brown ground colour tending to white ventrally, with bright red bands on distal ends of meri and patch of same colour on mesial faces at proximal ends of carpi; carpi also with light purple longitudinal stripe on dorsal margins (Schembri & McLay 1983).

**REPRODUCTION:** Females with shield lengths between 7 and 16.4 mm were found carrying eggs. The reproductive season appears to be from September to March, with the peak in January.

**HABITAT:** Found occupying a variety of gastropod shells which are frequently covered with a hydrozoan, *Hydractinia rubricata* Schuchert. *Diacanthurus rubricatus* may also be associated with the anemones *Paracalliactis rosea* Hand and *Calliactis conchicola*.

**REMARKS:** As previously indicated, Chilton (1911a) incorrectly placed *Eupagurus intermedius* Lenz, 1901 in synonymy with Henderson's (1888) taxon. Lenz's (1901) species is a synonym of *Diacanthurus spinulimanus*. As with *D. spinulimanus*, the use of "*Pagurus*" for these species was explained by Schembri and McLay (1983) as their indication that these species would be removed from *Pagurus* to a distinct genus when the review of the New Zealand hermit crabs was completed.

*Diacanthurus rubricatus* is distinguished from other members of the genus by its short, stout ocular peduncles, broad, or in large males, extremely elongate right chela, and more sparsely setose ambulatory dactyls. In small specimens (shield lengths less than 4.0 mm), the ocular peduncles tend to be somewhat longer in relation to the length of the shield, but the relative proportions of corneal diameter to peduncular length remain constant. Similarly, in small specimens, the armature of the dorsal surfaces of the chelae consist of small, spinulose tubercles often almost completely masked by dense mats of short setae. With increasing animal size, these tubercles become blunted, and in large specimens (shield lengths in excess of 12 mm) are reduced to low, often flattened tubercles; the density of setation correspondingly diminishes.

The chelae of *D. rubricatus* are characteristically quite broad, although, as noted earlier, there is a tendency for the dactyl and fixed finger to become elongated in large males. The palm and carpus correspondingly become longer and proportionately narrower, giving the chela an almost triangular appearance in dorsal view. This trait was common among the large males examined, but not universal. In contrast, large females did not exhibit this phenomenon. Thus it would appear that in large males of *D. rubricatus* sexually dimorphic development of the right cheliped commonly occurs. It is accompanied by a very marked reduction in setation.

*Diacanthurus rubricatus* is a markedly eurybathyal species. Schembri and McLay (1983) gave a bathymetric range for *D. rubricatus* of 20–350 m, but reported it most commonly found between 40 and 220 m. Of the specimens we examined, the shallowest collection depth was 15 m, the deepest from between 1951 and 2134 m, with the majority of specimens collected at depths between 180 and 300 m.

**RECORDS FROM NEW ZEALAND:** North Island from vicinity of Three Kings Islands to the South Island and Stewart Island, east to Chatham Islands; 15–2134 m.

**DISTRIBUTION:** Apparently endemic to New Zealand.

*Diacanthurus ecphyma* McLaughlin & Forest, 1997 (Fig. 45)

*Diacanthurus ecphyma* McLaughlin & Forest, 1997: 238, figs 2a, 3.

**TYPE:**

Holotype: male (sl = 8.9 mm), MNHN Pg 5485.

**TYPE LOCALITY:** New Caledonia, Bathus 4, Stn DW 925, 18°54'S, 163°23'E, 370–405 m.

**OTHER MATERIAL EXAMINED:**

NMNZ Stns: BS310, 1 ovigerous female (sl = 7.3) Cr 9649; BS 313, 1 male, 2 females (SL = 3.0–4.4 mm), Cr 9650.

**DESCRIPTION:** Shield (Fig. 45a) width equal to length or slightly longer than broad. Rostrum obsolete, rostral region rarely produced beyond level of obtusely rounded and unarmed or weakly denticulate lateral projections. Ocular peduncles 0.80–0.95 length of shield, slightly broader at bases of corneas; maximum corneal width included twice to 2.5 times in peduncular length; tuft of stiff setae in dorsal, notched area of cornea, and usually longitudinal row of sparse tufts of setae on dorsal surface. Ocular acicles

triangular, terminating subacutely but with very strong submarginal tooth. Antennular peduncles overreaching distal margin of cornea by 0.15–0.50 length of ultimate segment. Antennal peduncle not reaching distal margin of cornea, but often reaching beyond corneal base. Antennal acicles long, slender, reaching nearly to distal margin of fifth peduncular segment, terminating in unequally bifid or simple tooth with 1 smaller accessory denticle.

Right cheliped (Fig. 45b) moderately long and slender; maximum width of palm only slightly longer than dorsomesial margin. Dactyl subtriangular in cross-section, dorsal surface roundly elevated in midline and covered with irregular rows of low, blunt, but very distinct tubercles, dorsomesial margin with row of rather widely spaced moderately small to large teeth. Palm equal to or shorter than carpus; dorsomesial margin with row of small to large, often slender, acute or subacute teeth, dorsomesial distal angle with cluster of low but distinct tubercles; dorsal surface of palm and fixed finger covered, but not densely, with small, conical, acute or subacute tubercles, usually not obscured by mat of very short fine setae, frequently 1 sparse row of slightly stronger conical tubercles in midline of palm, dorsoproximal margin sometimes with 1 or 2 moderate to very prominent teeth medially; dorsolateral margin with row of usually very much smaller teeth on palm becoming considerably stronger on fixed finger. Carpus with row of long, slender, very acute teeth on dorsomesial margin and adjacent second smaller and somewhat irregular row; dorsodistal margin with tooth mesially, surface also with mat of short, fine setae, midline with row of much smaller, acute tubercles and transverse rows of longer setae extending laterally, dorsolateral margin not delimited; ventrolateral margin with row of teeth; ventrodistal margin also with few teeth. Merus with 1 very prominent acute tooth on dorsodistal margin; ventrolateral margin with 3 to several slender teeth, occasionally fused to form broad single trifid tooth, ventral surface with transverse, irregular rows of moderately prominent tubercles, ventromesial margin with long stiff setae distally, strong teeth proximally.

Left cheliped (Fig. 45c) somewhat shorter than right, much less robust; propodal-carpal articulation rotated clockwise approximately 30° from horizontal plane. Dactyl with convex dorsal surface; single or irregularly double row of very small tubercles or granules in dorsal midline at least proximally. Palm with dorsal surface convex in midline; row of prominent acute tubercles, sometimes interspersed with smaller tubercles or granules, on elevated dorsolateral margin, decreasing in size on convex margin of fixed

finger; dorsal surface covered, but often not densely, with regularly placed, small, conical tubercles, usually lower and flatter on fixed finger; dorsomesial margin of palm frequently with 1 or 2 small teeth proximally, occasionally nearly complete row of widely spaced small teeth. Carpus with row of strong teeth on both dorsomesial and dorsolateral margins, prominent spinose projection on distal margin overlapping palm; ventrolateral margin with few teeth at least distally. Merus with strong tooth at dorsodistal margin; ventrolateral and ventromesial margins each with 1 or 2, sometimes complete row of prominent, slender, acute teeth; ventral surface usually spinulose or with several prominent teeth and tufts of long stiff setae.

Ambulatory legs (Fig. 45d) with dactyls 1.35 times to nearly twice length of propodi, with slight distal twist and ventral curve; dorsal surfaces each with nearly triple row of long spiniform bristles, extending slightly onto mesial faces dorsally; mesial faces with row of spiniform bristles ventrally (not visible in lateral view) and additional row on ventral surface; dorsal and ventral surfaces also with tufts of long stiff setae. Propodi approximately same length as carpi, with tufts of long stiff setae arising from low protuberances dorsally and ventrally. Carpi each with row of teeth on dorsal surface (smaller on third) and few tufts of setae. Meri of third pereopods unarmed or with 1 tooth on ventral margin; second pereopods each with single or double row of teeth on ventral margin. Sternite of third pereopods with anterior lobe sub-semicircular.

Male pleopods usually with endopod of third reduced or rudimentary, fourth vestigial, and fifth absent. Telson (Fig. 45e) with lateral angles of posterior lobes each produced as prominent spine; strongly concave inner margins each with 1 well-developed tooth on either side of moderately wide median cleft, 1 or 2 tufts of setae occasionally accompanied by small tooth or denticle in distal half.

**COLOUR:** In preservative, dactyl, fixed finger, and dorsomesial surface of palm of right cheliped reddish-orange. Dorsal surfaces of dactyl and fixed finger of left cheliped with white spots on reddish-orange background. Ambulatory dactyls with splotches of reddish-orange on white background, and median longitudinal reddish-orange stripe (McLaughlin & Forest 1997).

**REPRODUCTION:** Only seven ovigerous females have been collected, three from New Caledonia, two from the Chesterfield Islands, one from western Australia, and one from New Zealand. The New Caledonian females were carrying eggs in January and August, while those from the Chesterfield Islands were berried



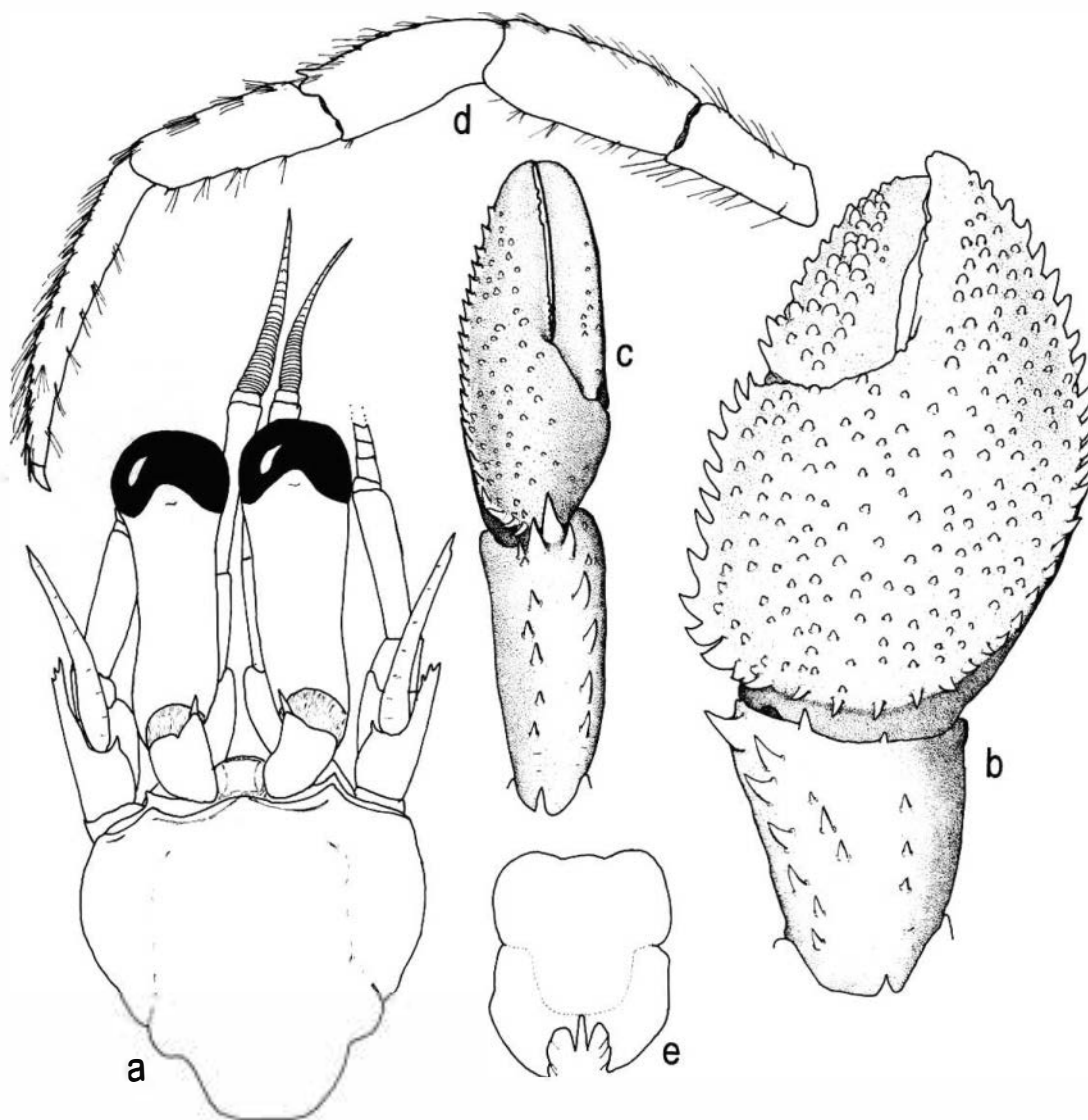


Fig. 45. *Diacanthurus ecphyma* McLaughlin & Forest, 1997, NMNZ Stn BS 313, male (sl = 4.4 mm), NMNZ Cr 9650: a, shield and cephalic appendages (setation and aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view, setation omitted); c, carpus and chela of left cheliped (dorsal view, setation omitted); d, left third pereopod (lateral view); e, telson. Magnifications equal 12x (d), 18x (a–c), 25x (e).

tralia was collected in March and the New Zealand specimen in April. Thus it would appear that *D. ecphyma* has an extended reproductive period.

HABITAT: Not known.

REMARKS: *Diacanthurus ecphyma* might at first glance be mistaken for *D. spinulimanus*. The ocular peduncles of *D. ecphyma* are shorter and the corneas slightly more dilated (approximately 1 : 2.5) than seen for the most part in *D. spinulimanus*; however, variation has been observed in the latter species. The species are

readily distinguished by the armature of the right cheliped and carpus of the third pereopods. In *D. ecphyma*, the teeth on the dorsomesial margins of the palm and fixed finger of the right chela are much stronger, whereas the dorsal surface of the palm is armed with smaller, more numerous and less regularly aligned tubercles on the dorsal surface. The marginal teeth of the right chela of *D. spinulimanus* are shorter and usually much more blunt; the tubercles of the dorsal surface of the palm usually are appreciably larger and are generally arranged in longitudinal rows. The carpi of the third pereopods of *D. ecphyma*

in October. The ovigerous female from western Australia each have a row of teeth, sometimes small, on the dorsal margin, while the dorsal margins of the carpi of *D. spinulimanus* have a dorsodistal tooth, often 1 spinule in the proximal half, particularly on the right third, or very rarely 2 denticles usually obscured by tufts of setae.

**RECORDS FROM NEW ZEALAND:** Kermadec Islands; 155–165, possibly to 205 m.

**DISTRIBUTION:** New Caledonia and Chesterfield Islands; Western Australia; Kermadec Islands of New Zealand; 155–560 m.

### *Catapagurus* A. Milne-Edwards, 1880

*Catapagurus* A. Milne-Edwards 1880: 46; Smith 1882: 14; Henderson 1888: 75 (in part); A. Milne-Edwards & Bouvier 1893: 125; Alcock 1905b: 114; Forest & de Saint Laurent 1968: 151; de Saint Laurent 1970: 1456; Miyake 1978: 141 (in part); McLaughlin 1997: 494.

*Hemipagurus* Smith, 1881: 422.

**TYPE SPECIES:** *Catapagurus sharreri* A. Milne-Edwards, 1880 by monotypy. Gender masculine.

Eleven pairs of biserial gills. Shield with rostrum weakly developed. Ocular acicles simple, slender, elongate. Maxillule with external lobe of endopod rudimentary. Ischium of third maxilliped with crista dentata more or less reduced, 1 accessory tooth.

Chelipeds long and slender; right stronger. Ambulatory legs with dactyls and propodi similar; dactyls long and slender or spatulate. Fourth pereopods semichelate, propodal rasp consisting of 1 row of scale-like setae; distinctive preungual process usually present.

Males with coxa of right fifth pereopod with vas deferens produced into elongate sexual tube orientated toward exterior then recurved over anterior part of abdomen, coxa of left with vas deferens occasionally very slightly produced; 2 (pl 3, 4) or 3 (pl 3–5) unpaired, usually uniramous pleopods. Females without paired pleopods, pl 2–4 biramous, fifth present or absent.

Telson with transverse indentation suggesting division into anterior and posterior portions; posterior lobes acutely or roundly subtriangular; terminal margins perpendicular or oblique.

**REMARKS:** Although A. Milne-Edwards (1880) made no comment on male pleopod number in his original description of *Catapagurus*, in subsequent and more detailed diagnosis, A. Milne-Edwards & Bouvier

(1893) described four (pl 2–5) reduced, uniramous left pleopods in the male; females were also provided with four, three (pl 2–4) unequally biramous, the last (pl 5) as in the male. Smith (1881) described *Hemipagurus* as having unpaired pleopods on abdominal somites 2–4, with the fifth absent in males and present or absent in females. The following year Smith (1882) placed *Hemipagurus* in synonymy with *Catapagurus*, but repeated his generic diagnosis verbatim.

Henderson (1888) made no mention of pleopods in his brief generic diagnosis of *Catapagurus*; however, he assigned his new species *Catapagurus australis* to the genus “with some uncertainty”, as the male right sexual tube was longer than described by Smith (1881, 1882). Henderson’s species was transferred to *Nematopagurus* by McLaughlin (1997). Alcock (1905b) reported four unpaired pleopods in both sexes of *Catapagurus*; his only representative of the genus was identified as *C. ensifer* Henderson, 1893; however, this species has recently been redescribed as *Catapagurus alcocki* McLaughlin, 1998 (cf. Hogarth, *et al.* 1998). Only one of Henderson’s (1893) syntypes of *C. ensifer* is a male, and it has only three unpaired pleopods (pl 3–5).

Forest and de Saint Laurent (1968) defined *Catapagurus* as having 2 or 3 unpaired pleopods (pl 3, 4) or (pl 3–5) in males and 3 or 4 in females (pl 2–4 or pl 2–5). These authors were also the first to describe the dentition of the crista dentata in *Catapagurus* species. Although the number of teeth was usually reduced, they found an accessory tooth always present. Miyake (1978), however, described the crista dentata as being well developed, with an accessory tooth present or absent. Apparently overlooking Lewinsohn’s (1969) expressed belief that *Catapagurus doederleini* Doflein, 1902, was incorrectly assigned to this genus, Miyake (1978) included both it and *C. japonicus* Yokoya, 1933, as *Catapagurus* species occurring in Sagami Bay. The crista dentata reportedly has an accessory tooth in the former species, but lacking in the latter. Additionally at the specific level, *Catapagurus misakiensis* Terao, 1914, was transferred, without comment, to *Cestopagurus* by Miyake (1978). Haig and Ball (1988) compared a presumably new, but unnamed, species from the Arafura Sea with *C. ensifer* and *C. granulatus* Edmondson, 1951, although Lewinsohn (1969) had expressed the belief that the latter two taxa would probably prove to be synonymous. The status of these taxa is currently under study by Dr A. Asakura, Natural History Museum & Institute, Chiba, Japan.

The presence of a distinctive preungual process on the dactyl of the fourth pereopod was cited by de Saint Laurent (1970) as a special character that set *Catapagurus* and *Solenopagurus* de Saint Laurent, 1970, apart from other genera of the Paguridae. A similar process has now been found in *Icelopagurus* McLaugh-



lin, 1997. The generic diagnosis presented here is based on an examination of representatives of the Atlantic species, *C. sharreri* and *C. gracilis* (Smith, 1881), *C. ensifer*, *C. oculocrassus* McLaughlin, 1997, *C. tanimbarensis* McLaughlin, 1997, *C. holthuisi* McLaughlin, 1997, and *C. alcocki*.

*Catapagurus spinicarpus* sp. nov. (Fig. 46)

TYPE:

Holotype: ovigerous female (sl = 2.7 mm), NMNZ Stn BS 438, NMNZ Cr 9651.

TYPE LOCALITY: NMNZ Stn B438, southeast of Nugent Island (2.2 nautical miles), Kermadec Islands (29°14.7'S, 177°49.4'W), 165–149 m.

DESCRIPTION: Shield (Fig. 46a) broader than long; anterior margin between rostrum and lateral projections concave; anterolateral margins sloping; posterior margin roundly truncate; surface with several tufts of setae. Rostrum broadly rounded, extending to (left) or not quite to (right) level of lateral projections. Lateral projections obtusely triangular, with terminal denticle (left) or broadly rounded and unarmed (right). Third maxillipeds with crista dentata each consisting of 4 large and 6 smaller teeth.

Ocular peduncles moderately short and terminally stout, slightly less than half length of shield, dorsal surfaces with 1 tuft of setae at corneal indentation; corneas dilated. Ocular acicles narrowly triangular, slender, reaching nearly to or slightly beyond midlength of peduncles; terminating acutely; very widely separated.

Antennular peduncles overreach distal margins of corneas by entire length of ultimate segment. Ultimate segment with several long setae at dorsolateral distal margin, row of widely spaced short setae on dorsal surface. Penultimate segment with few short setae. Basal segment with spine on produced ventromesial distal angle.

Antennal peduncles overreach distal margins of corneas by approximately half length of ultimate segment. Fifth and fourth segments with few scattered setae. Third segment with small denticle at ventrodistal angle. Second segment with laterodistal projection reaching midlength of fourth peduncular segment, terminating in acute tooth; dorsomesial distal angle with long spine, mesial margin with few setae. First segment with prominent tooth on laterodistal margin, ventral margin also with 1 prominent tooth distolaterally. Antennal acicles moderately long, reaching to midlength of fifth segment, and slightly over-reaching distal margin of corneas; with small

terminal denticle, mesial margin with few long setae. Antennal flagella missing.

Right cheliped (Fig. 46b) long, moderately slender, somewhat dorsoventrally compressed. Dactyl slightly shorter than palm; mesial half of dorsal surface minutely tuberculate in proximal 0.65 and with scattered setae; dorsomesial margin not delimited. Mesial face weakly tuberculate dorsally; cutting edge with 2 widely spaced calcareous teeth, interspersed with smaller, almost completely fused, calcareous denticles; tip broken but still slightly overlapped by fixed finger. Palm approximately 0.75 length of carpus; dorsomesial margin weakly delimited by double to triple row of very small denticles, dorsolateral margin not distinctly delimited, but with rows of tiny denticles, becoming tubercles on fixed finger and extending onto lateral face proximally; dorsal surface covered, but not densely, by weakly irregular rows of tiny granules except for smooth distal half of fixed finger; mesial and lateral surfaces minutely granular; fixed finger with moderately long setae distally; cutting edge with 3 low broad calcareous teeth and few smaller calcareous teeth distally, terminating in small corneous claw; ventral surfaces microscopically granular. Carpus approximately equal to merus in length; dorsomesial margin with row of slender teeth, dorsodistal margin unarmed, dorsal surface with small tubercles in lateral half forming 3 incomplete, irregular rows, dorsolateral margin with double row of denticles; lateral, mesial and ventral surfaces minutely granular. Merus subtriangular; dorsodistal margin with row of stiff bristles, dorsal surface 3 short transverse ridges, each with few moderately short stiff bristles, few setae posteriorly; mesial, lateral, and ventral surfaces granular; ventrolateral margin with 2 spines at distal angle and minute denticles or tubercles proximally; ventromesial margin rounded, minutely granular, ventromesial distal angle with blunt tubercle. Ischium unarmed.

Left cheliped (Fig. 46c) slender, as long as right; somewhat dorsoventrally compressed. Dactyl slightly longer than palm; terminating in corneous claw; dorsomesial margin only faintly delimited proximally and minutely denticulate, several moderately long setae marginally and on dorsal surface. Palm 0.75 length of carpus; rounded dorsomesial and dorsolateral margins denticulate; dorsal surface of palm and proximal 0.40 of fixed finger minutely granular; mesial and lateral faces and ventral surface microscopically granular; distal halves of dactyl and fixed finger with few long setae. Carpus slightly longer than merus; dorsomesial and dorsolateral margins each with row of prominent slender teeth; surfaces all minutely granular and with few short to mode-

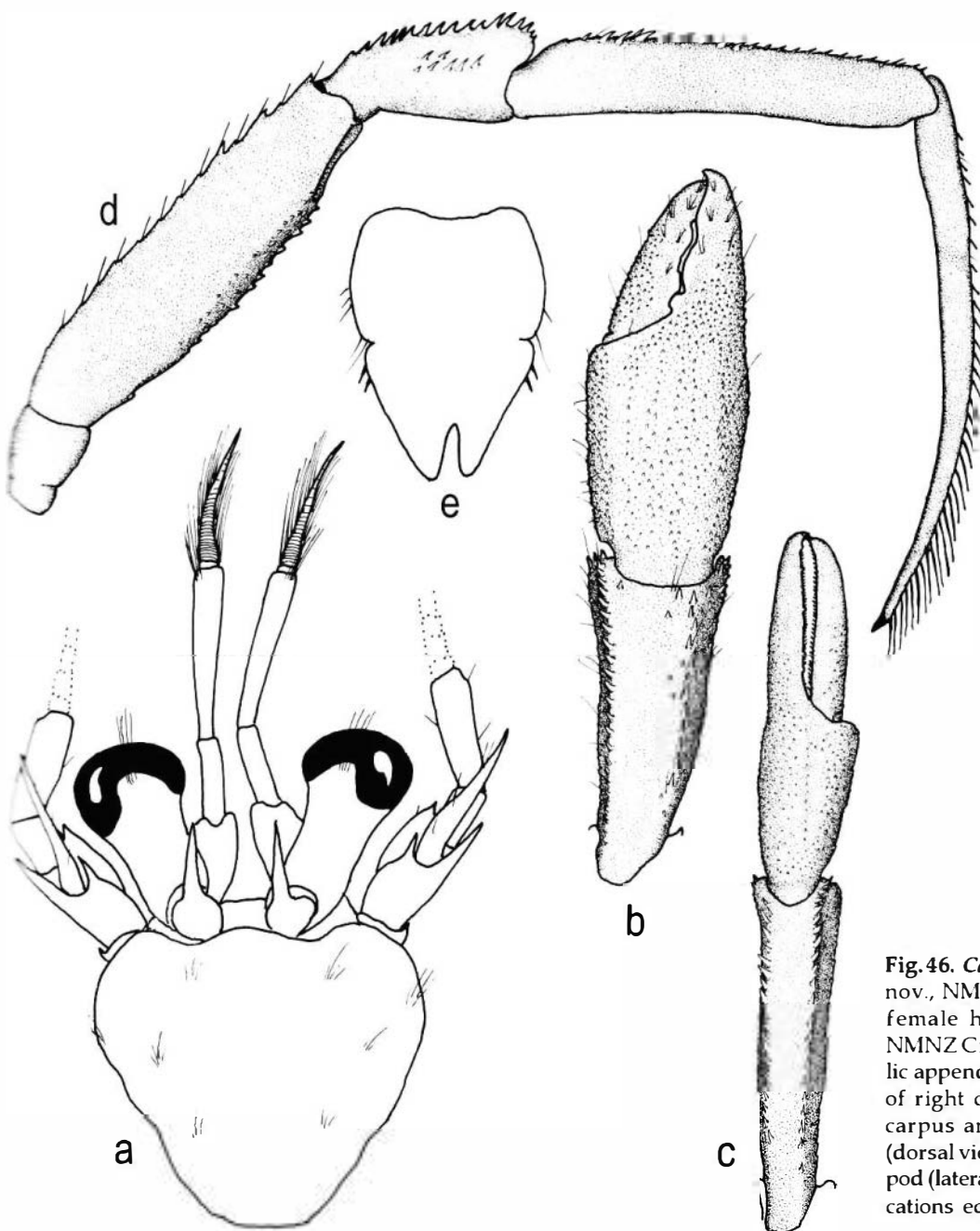


Fig. 46. *Catapagurus spinicarpus* sp. nov., NMNZ Stn BS 438, ovigerous female holotype (sl = 2.7 mm), NMNZ Cr 9651: a, shield and cephalic appendages; b, carpus and chela of right cheliped (dorsal view); c, carpus and chela of left cheliped (dorsal view); d, right second pereopod (lateral view); e, telson. Magnifications equal 18x (a-d), 37.5x (e).

rately long setae. Merus with short, transverse ridges and stiff setae; lateral and mesial with few short setae; ventral surface with scattered very small tubercles, ventromesial not delimited, but ventromesial distal angle with prominent, acute spine; ventrolateral margins only faintly delimited by row of widely spaced denticles, ventrolateral distal angle with blunt tooth. Ischium unarmed.

Ambulatory legs (Fig. 46d) (only right present) elongate. Dactyls not blade-shaped; in dorsal view, straight; in lateral view, curved ventrally in distal half; slightly longer than propodi, third longer than second;

dorsal margins each with row of spiniform setae, longer and more bristle-like distally; mesial faces each with ventral row of 20–24 spiniform setae; lateral faces with few setae; ventral margins glabrous. Propodi approximately twice length of carpi; dorsal surface with row of teeth (second) or with row of protuberances and short stiff bristles (third); mesial and lateral faces unarmed; ventromesial margins each with row of short spiniform bristles. Carpi short, 0.50–0.75 length of meri; dorsal surfaces each with sparse setae and row of teeth; lateral face of second pereopod with short irregular row of small tubercles;



mesial and ventral surfaces glabrous. Meri with 3 short transverse ridges dorsally, each with 1 small tubercle and 2 or 3 short bristles; ventrolateral distal angles each with very small denticle (minute on third), ventromesial and ventrolateral margins of second pereopod each with row of teeth, few additional tubercles on ventral surface; ventromesial and ventrolateral margins of third unarmed. Ischia unarmed. Sternite of third pereopods with narrowly subcircular anterior lobe. Fourth pereopods missing. Fifth pereopods chelate.

Male not known. Females with uniramous fifth pleopod.

Telson (Fig. 46e) with triangular posterior lobes separated by moderately deep V-shaped median cleft; terminating subacutely; oblique terminal margins unarmed; lateral margins each with narrow, chitinous, marginal plate and 2 short stiff bristles near transverse indentation.

COLOUR: Unknown.

REPRODUCTION: The holotype, captured in October, had relatively numerous small eggs (0.43–0.55 mm diameter), that were clearly in an early developmental stage.

HABITAT: Unknown.

ETYMOLOGY: From the Latin *spina* and *carpus*, in reference to the strong spine-like teeth of the carpal margins of the chelipeds in this species.

REMARKS: *Catapagurus spinicarpus* sp. nov. is most closely allied to *C. tanimbarensis* from the Kai and Tanimbar Islands of Indonesia. The similarities between the two species are seen particularly in the ratios of ocular peduncle length to corneal diameter (in females) and acicular length; length of antennular and antennal peduncles; armature of the dactyls of the ambulatory legs; and shape of the telson. However, *C. spinicarpus* is readily distinguished from *C. tanimbarensis* by the strong, spinose teeth on the dorso-mesial and dorsolateral margins of the carpi of the chelipeds in the former species. In *C. tanimbarensis*, these margins are armed with small teeth on the left cheliped and only denticles on the right. Although the telsons are similarly shaped, the perpendicular terminal margins of *C. tanimbarensis* are provided with 2 to several short bristles and occasionally with a small protuberance or denticle. There are no bristles, protuberances, or denticles on these margins in the holotype and only known specimen of *C. spinicarpus*.

RECORDS FROM NEW ZEALAND: Off Nugent Island, Ker-

madec Islands; 149–165 m.

DISTRIBUTION: Known only from the type locality.

### *Lophopagurus* McLaughlin, 1981

*Eupagurus* sensu lato: Melin 1939: 29 (in part).

*Pylopagurus*: Forest & de Saint Laurent 1968: 145 (in part) [not *Pylopagurus* A. Milne-Edwards & Bouvier, 1891]; Miyake 1978: 119 (in part); McLaughlin 1981a: 2 (in part).

*Lophopagurus* McLaughlin, 1981a: 3; McLaughlin & Gunn 1992: 45.

*Australeremus* McLaughlin, 1981a: 4; McLaughlin & Gunn 1992: 68 (reduced to subgeneric rank).

TYPE SPECIES: *Eupagurus thompsoni* Filhol, 1885. Gender masculine.

Eleven pairs of biserial gills. Maxillule with external lobe of endopod developed, not recurved. Third maxilliped with well-developed crista dentata and prominent accessory tooth.

Chelipeds subequal or unequal. Right cheliped with rotation of propodal-carpal articulation 0–15° from horizontal plane. Left cheliped with propodal-carpal articulation variable. Dactyls of ambulatory legs with lateral faces variable (rounded, flattened, marked by prominent longitudinal sulci, slightly or conspicuously concave). Sternite of third pereopods with anterior lobe narrowly ovate to subsemicircular or subrectangular. Fourth pereopods semichelate, with propodal rasp consisting of single row of scale-like setae.

Males without sexual tubes or paired pleopods, with 3 unpaired, unequally biramous left pleopods. Females with paired gonopores; modified first pleopods paired, and with 4 unpaired biramous left pleopods, second to fourth with both rami well developed, fifth with endopod reduced.

Abdomen flexed or straight. Uropods usually asymmetrical. Telson with transverse indentation suggesting division into anterior and posterior portions; posterior lobes symmetrical or slightly asymmetrical, terminal margins straight, oblique or rounded, armed with numerous small to moderately strong teeth, lateral margins often denticulate.

REMARKS: During the period that work on the New Zealand pagurids was continuing in Paris, one of us (PMcL) had begun revisionary work on a large complex of taxa assigned to the genera *Tomopagurus* and *Pylopagurus* (i.e., McLaughlin 1981a, 1981b, 1982). Although these genera were primarily represented in the Americas, several species appeared endemic to

New Zealand, and based on materials from the USNS *Etanin* Antarctic cruises, McLaughlin (1981a) established two genera represented, at that time, only in the waters of New Zealand and Australia. With supplemental collections from the area, McLaughlin and Gunn (1992) expanded the generic diagnoses of *Lophopagurus* McLaughlin and *Australeremus* McLaughlin, provided diagnoses of the recognised species, and described others that, while known to Forest and the senior author, had not been published. However, McLaughlin and Gunn's systematic work was restricted to species of these two genera, thus not fully addressing the overall paguroid faunal composition of New Zealand, and not having the benefit of the wealth of material collected over the years by New Zealand Oceanographic Institute.

The present review is based on the unpublished work of the senior author, as well as the published and unpublished work of the junior author, and has been enhanced by the extensive collections now available for study. As is so frequently the case, evaluations based on limited data often lead to honest, but erroneous conclusions. Such is the case with *Lophopagurus* and *Australeremus*. McLaughlin (1981a) and McLaughlin and Gunn (1992) provided what appeared to be a clear distinction between the two genera in the conformation and torsion of the left chela. However, it is now apparent that there is a specific link in *L. (A.) kirkii* (Filhol, 1883) between the morphological extremes in both taxa. Consequently, full generic rank for both is not justified, and *Australeremus* is reduced herein to a subgenus of *Lophopagurus*.

#### KEY TO THE SUBGENERA OF *Lophopagurus*

- 1 Left cheliped with rotation of propodal carpal articulation much less than 45° from horizontal plane. Palm and fixed finger of right chela not encircled by nearly continuous marginal row of teeth ..... *Lophopagurus* (*Lophopagurus*)
- Left cheliped with rotation of propodal carpal articulation greater than 45° from horizontal plane. Palm and fixed finger of right chela encircled by nearly continuous marginal row of teeth ..... *Lophopagurus* (*Australeremus*)

#### *Lophopagurus* (*Lophopagurus*) McLaughlin, 1981

*Pylopagurus*: Forest & de Saint Laurent 1968: 145 (in part) [not *Pylopagurus* A. Milne-Edwards & Bouvier, 1891].  
*Lophopagurus* McLaughlin, 1981a: 3; McLaughlin & Gunn 1992: 45.

TYPE SPECIES: *Eupagurus thompsoni* Filhol, 1885b, by original designation. Gender masculine.

Eleven pairs of biserial gills. Ocular acicles narrowly triangular. Maxillule with external lobe of endopod developed, not recurved. Third maxilliped with well-developed crista dentata and prominent accessory tooth. Sternite of third maxillipeds usually unarmed.

Right cheliped with chela longer than broad; with approximately 15° clockwise rotation of propodal-carpal articulation from horizontal plane. Dorsolateral margin of palm curved, dorsomesial margin depressed, dorsal surface with sloping or concave dorsomesial component, delineated by row(s) of acute or blunt teeth, remaining dorsal surface with 1 or 2 narrow to moderately broad, acute or blunt tuberculate ridges. Left cheliped with chela broadly triangular in cross-section and dorsal view; dorsolateral margin depressed, dorsal midline elevated into prominent acutely or bluntly tuberculate keel or crest; propodal-carpal articulation rotated 0–25° from horizontal plane. Dactyl of third left pereopod with lateral face variable (rounded, somewhat flattened, marked by prominent longitudinal sulci, slightly or conspicuously concave). Sternite of third pereopods with anterior projection subsemicircular to subrectangular, occasionally with 1 or 2 marginal teeth. Fourth pereopods semichelate, with propodal rasp consisting of single row of scale-like setae.

Males without sexual tubes or paired pleopods, with 3 unpaired, unequally biramous left pleopods. Females with paired gonopores and modified, paired first pleopods, with 4 unpaired biramous left pleopods, second to fourth with both rami well developed, fifth with endopod reduced.

Abdomen typically flexed. Uropods asymmetrical. Telson with lateral indentations suggestive of division into anterior and posterior portions; posterior lobes symmetrical or slightly asymmetrical, terminal margins straight, oblique or rounded, armed with numerous small to moderately well-developed teeth, lateral margins often denticulate.

#### KEY TO THE SPECIES OF *Lophopagurus* (*Lophopagurus*)

- 1 Ocular acicles each with single terminal tooth, rarely with 1 additional denticle on mesial margin ..... 2
- Ocular acicles each with terminal tooth and 2–4 additional teeth on mesial margin ... *L. (L.) pumilus* sp. nov.
- 2 Dactyls and propodi of left second and third pereopods distinctly different, in lateral view, segments of third appreciably shorter and broader (lateral face of dactyl conspicuously concave) ..... 4
- Dactyls and propodi of left second and third pereopods not distinctly different, in lateral view, segments of third not appreciably shorter ..... 3
- 3 Carpi of second and often also third pereopods each with row of distinct teeth or spinose tubercles posterior to tooth



- at dorsodistal angle on dorsal surface *L. (L.) lacertosus*
- Carpi of second and third pereopods unarmed or with few blunt or spinose protuberances on dorsal surface posterior to tooth at dorsodistal angle (second rarely with 1 additional tooth in posterior half) *L. (L.) ? nanus*
- 4 Carpi of second and often also third pereopods each with row of distinct teeth or spinose tubercles on dorsal surface posterior to tooth at dorsodistal angle *L. (L.) thompsoni*
- Carpi of second and third pereopods unarmed or with few low protuberances on dorsal surface posterior to tooth at dorsodistal angle *L. (L.) nodulosus*
- 5 Dorsal surface of palm of right chela with granules or small tubercles; dorsolateral surface of palm of left chela acutely or bluntly tuberculate *L. (L.) foresti*
- Dorsal surface of palm of right chela with large nodule-like tubercles; dorsolateral surface of palm of left chela unarmed *L. (L.) nodulosus*

***Lophopagurus (Lophopagurus) pumilus* sp. nov.**  
(Fig. 47, Pl. 3, fig. 1)

(?) *Pagurus* n. sp. (aff. *traversi*): Rainer 1981: 37.  
*Pagurus* sp. nov. B: Schembri 1982b: 866, figs 4, 5.  
*Pagurus* n. sp. B: Schembri & McLay 1983: 28, 34; Probert & Wilson 1984: 389; Schembri 1988: 93; Taylor *et al.* 1989: 1065.

**TYPES:**

Holotype: male (sl = 2.7 mm) from NZOI Stn E267, NIWA holotype H-714.

Paratypes: 1 ovigerous female (sl = 1.4 mm), NZOI Stn E267, NIWA paratype P-1167; 1 male (3.0 mm); NMNZ Stn BS 189, NMNZ Cr 9652; 1 female (sl = 2.4 mm), 1 ovigerous female (sl = 3.9 mm), Hawke Bay, coll. C. Duffy, 18.1.95, 4 m, MNHN Pg 5858; Great Omaha Bay, Stn A 18, 2 females (sl = 1.4, 2.4 mm), NHM 1999.878-879; 1 male (sl = 2.2 mm), Great Omaha Bay, Stn A59, USNM 268574.

**TYPE LOCALITY:** NZOI Stn E267, vicinity of Cape Maria van Diemen, 34°30' S, 172°37.5' E, 337 m.

**OTHER MATERIAL EXAMINED:**

NMNZ collections: Channel between Moturua and Motukiaia Is, 35°13.4'S, 174°12.1'E, 25.11.71, 3.6-5.5 m, 1 female (sl = 1.2 mm), Cr 9653; Kaikoura: St Kilda Rocks, coll. D.S. Horning, 2.12.73, 1 male (sl = 1.4 mm), Cr 8031; 27.1.74, 4 males (sl = 1.2-1.3 mm), 1 ovigerous female (sl = 1.4 mm), 1 juvenile (sl = 0.8 mm), Cr 8038; Seal Reef off First Bay, coll. D.S. Horning, 10.3.74, 1 ovigerous female (sl = 1.7 mm), Cr 8042; Ruby's Reef, coll. D.S. Horning, 9.3.74, 4-6 m, 1 male (sl = 2.0, 1 female (sl = 1.4 mm), 1 ovigerous female (sl = 1.7 mm), 2 juveniles (sl = 0.7, 0.9 mm), Cr 8052, Cr 8057; 9.3.74, 10-14 m, 1 male (sl = 2.3 mm), 1 female (sl = 1.1 mm), 1 ovigerous female (sl = 1.2 mm), 2 juveniles (sl = 0.7, 0.8 mm), Cr 8043, Cr 8058; 9.3.74, 12-14 m, 3 males (sl = 1.0-1.4 mm), Cr 8046; VUC Cr UT, no additional data, 2

males (sl = 2.1, 2.2 mm), Cr 9654; Dale Point, Milford Sound, coll. P.G. Moore, 1.9.81, 5 m, 1 male (sl = 2.0 mm), Cr 8040; Portobello, coll. C. McLay, 10.4.81, 60 m, 4 males (sl = 1.8-2.6 mm), Cr 4184; Stn BS 510, 1 male (sl = 2.8 mm), Cr 8163.

PMBS collection: East of Taiaroa Rocks, 19.7.76, 12 m, 1 male (sl = 2.9 mm); Mu Stn 74/179, 124 males (sl = 0.8-1.8 mm), 138 females (sl = 0.9-1.6 mm), 101 ovigerous females (sl = 1.0-1.5 mm).

PMcL collection: Greater Omaha Bay, Stn A 62, 1 male (sl = 2.2 mm); Stn B 12a, 2 males (sl = 2.3, 2.8 mm).

**DESCRIPTION:** Shield (Fig. 47a) as long or slightly longer than broad; anterior margin between rostrum and lateral projections concave. Rostrum acutely triangular, produced beyond bases of ocular acicles, terminating in small denticle. Lateral projections obtusely triangular, with submarginal denticle.

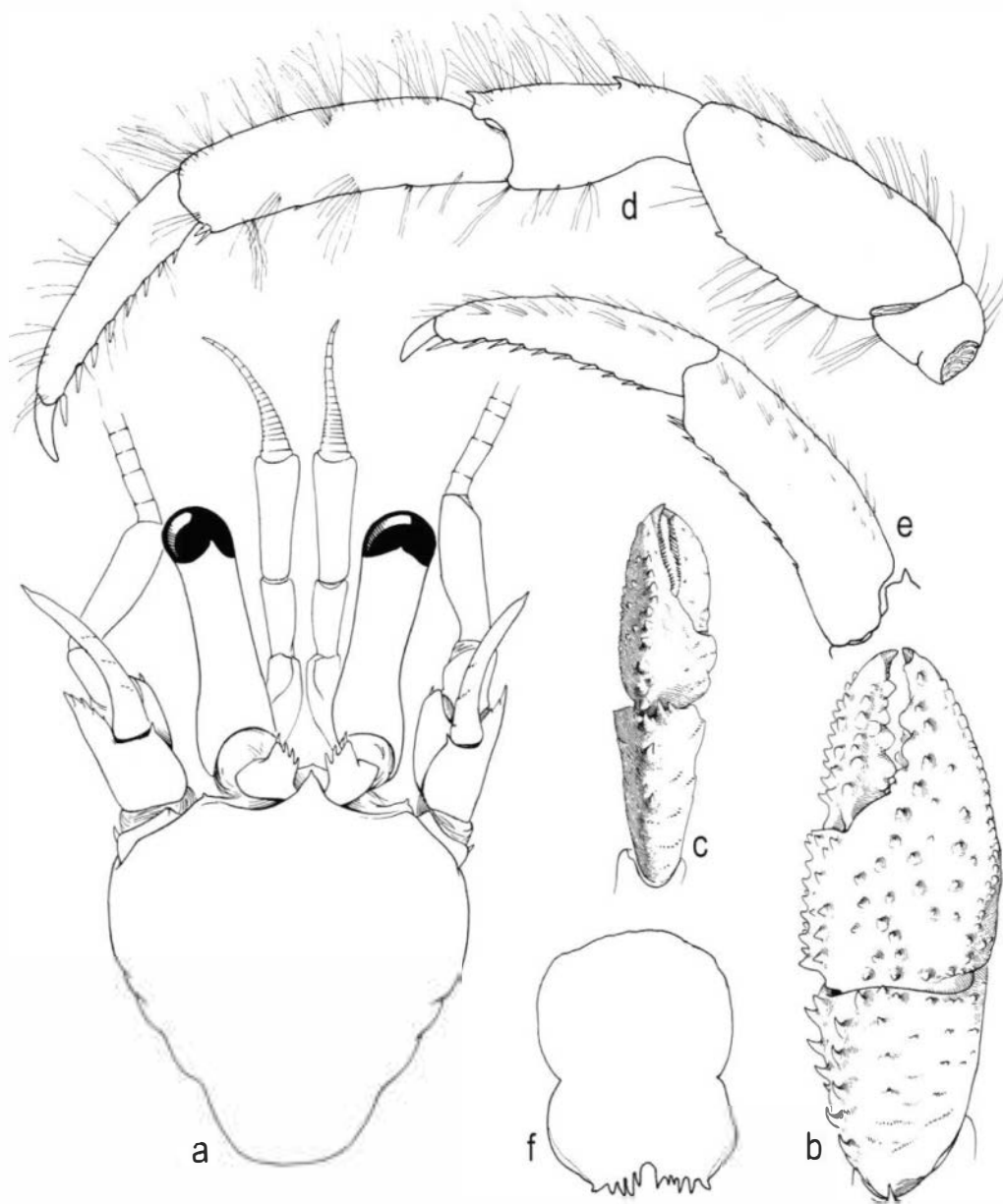
Ocular peduncles 0.50-0.75 length of shield, moderately slender, but basally noticeably swollen, with corneas slightly dilated, corneal diameter 0.25-0.28 peduncular length; dorsomesial surface sometimes with row of widely spaced, sparse tufts of setae. Ocular acicles acutely triangular, with strong submarginal terminal tooth and 2-5 additional teeth on mesial margin.

Antennular peduncles overreach ocular peduncles by 0.2-0.5 length of ultimate segment. Ultimate segment with 2 or 3 stiff setae at dorsodistal margin and scattered setae on dorsal surface. Basal segment with prominent, slender spine on dorsodistal margin of statocyst lobe.

Antennal peduncle length varying from reaching nearly to distal margins of corneas to overreaching corneas by half length of ultimate segment. Fifth and fourth segments with scattered tufts of setae. Third segment with small tooth at ventrodistal angle obscured by tuft of stiff setae. Second segment with laterodistal projection reaching to or beyond mid-length of fourth peduncular segment, terminating in prominent tooth, mesial margin with 1-4 small teeth, lateral margin with 0-2 small teeth distally; dorso-mesial distal angle with moderately prominent tooth. First segment with small tooth at laterodistal margin, and larger tooth on ventrolateral margin distally. Antennal acicle reaching to or beyond proximal half of ultimate peduncular segment. Antennal flagella short, not over-reaching right cheliped; 1-3 very short setae every 1 to several articles.

Right cheliped (Fig. 47b) with dactyl slightly shorter to slightly longer than palm. Dactyl slightly elevated in midline and armed with row of tubercles not extending to tip, dorsal surface mesiad of midline unarmed but with few tufts of setae, short longitudinal row of tubercles and tufts of setae laterad of midline; dorsomesial margin with row of teeth. Palm 0.65-0.95 length of carpus; dorsomesial margin

Fig. 47. *Lophopagurus (Lophopagurus) pumilus* sp. nov., NZOI Stn E267, male holotype (sl = 2.7 mm), NZOI H-714: a, shield and cephalic appendages (setation and aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view, setation omitted); c, carpus and chela of left cheliped (dorsal view, setation omitted); d, second right pereopod (mesial view); e) dactyl and propodus of left third pereopod (lateral view); f) telson (setation omitted). Magnifications equal 20x (b, c); 25x (d, e), 36x (a), 50x (f).



slightly depressed and armed with row of small teeth, dorsomesial component slightly convex, unarmed or with few subacute spinulose tubercles and weakly delimited dorsally by row of conical teeth or tubercles; dorsal surface with sparse covering of conical, acute or blunt tubercles; fixed finger with row of conical, blunt or spinulose tubercles adjacent to cutting edge; dorsolateral margin with row of closely spaced subacute or acute teeth, lateral surface convex, with few low protuberances and tufts of setae, particularly on fixed finger. Carpus slightly shorter to slightly longer than merus; dorsomesial margin with somewhat irregular row of moderately strong spines and second obliquely diverging row in distal half, dorsal surface with scattered small tubercles or short, trans-

verse frequently tuberculate, ridges and moderate to long setae. Merus with or without 1 strong spine at dorsodistal margin, dorsal surface with short, transverse row of moderately long setae distally; ventrolateral margin angular, with 2–7 slender acute or subacute teeth in distal half and few long setae, ventromesial margin with 2 small blunt or acute tubercles and few long setae in proximal half. Ischium with few long setae ventrally.

Left cheliped (Fig. 47c) with dactyl 1.25–1.35 times length of palm; dorsal, mesial, and ventral surfaces of dactyl each with row of widely spaced tufts of setae. Palm triangular in cross-section; strongly elevated dorsal midline armed with row of prominent, spinulose tubercles extending onto fixed finger but not to



or tip; ventrally placed dorsolateral margin with row of small teeth or denticles, usually strongest on fixed finger, but not extending to tip; dorsolateral and dorsomesial surfaces each with scattered, low protuberances or subacute tubercles and tufts of setae, dorsomesial margin not delimited. Carpus slightly shorter to slightly longer than merus; dorsolateral margin with row of 3 or 4 widely spaced teeth, 1 strong tooth on distal margin and sometimes second smaller tooth directly beneath, dorsomesial margin usually with short, transverse rows of long setae. Merus with row of setae on dorsodistal margin, dorsal surface with few short, transverse rows of sparse setae; ventrolateral margin with row of 3–6 acute teeth and long setae, ventromesial margin with row of long setae and 2 small denticles or tubercles proximally. Ischium with few setae on ventromesial margin.

Ambulatory legs (Fig. 47d, e) with dactyl and propodus of left third slightly deviant. Dactyls in dorsal view, straight; in lateral view, straight or slightly curved ventrally; dactyls of second pereopods and third right slightly shorter than propodi; dactyl of third left approximately equal to propodus; dorsal margins with irregular, short, transverse rows of setae, mesial faces each with dorsal row of spiniform setae and stiff setae, lateral faces of second pereopods and third right flattened, lateral face of third left slightly to markedly concave; ventral margins each with row of 7–11 spiniform setae. Propodi somewhat longer than carpi; dorsal surfaces with very low, transverse ridges and tufts of setae, ventral surfaces each with row of spiniform setae and short to long setae; lateral faces of second pereopods and third right convex, lateral face of third left slightly concave, with dorsolateral margin angular. Carpi slightly shorter than meri; dorsal surfaces with sparse, moderately long setae; dorsodistal margins each with tooth, second right usually, and second left occasionally, with additional tooth in proximal half. Meri with short, transverse ridges and tufts of setae on dorsal surfaces, ventral margins each with low protuberances and tufts of setae, ventral margins of second pereopods usually also with few small teeth or denticles distally. Ischia with tufts of setae on ventromesial margins. Anterior lobe of sternite of third pereopods semicircular to nearly subcircular, anterior margin with few long setae.

Telson (Fig. 47f) with posterior lobes separated by moderately broad median cleft; oblique terminal margins each with 3–6 strong teeth and few smaller teeth interspersed; lateral margins with chitinous plates.

**COLOUR:** In life, ocular peduncles white with maroon

and greenish, interrupted, irregular longitudinal stripes giving mottled effect; antennules yellow-orange; antenna articles maroon, interrupted with white. Chelipeds with chelas greenish and some white markings toward tips; remaining segments brownish ground colour with white band at meral-carpal articulation followed proximally by dark-green band. Ambulatory legs with alternating bands of green-brown, maroon, and yellow, green-brown bands and longitudinal maroon stripes. (after Schembri & McLay 1983). In preservative, ocular peduncles with reddish irregular, interrupted stripes giving mottled effect; acicles with mesial margins red. Chelipeds overall reddish-orange. Ambulatory legs with interrupted longitudinal stripes on each segment.

**REPRODUCTION:** A large number of ovigerous females were collected in the Otago region, at an unspecified date; however, most other captures of ovigerous females occurred between January and March. Eggs varied in stage of development from early to nearly ready to hatch. Early-stage eggs had diameters varying from 0.23 to 0.31 mm, whereas eggs in late development, i.e., with embryonic eyes visible, had diameters varying from 0.38 to 0.46 mm. Considering the sizes of the ovigerous females (sl = 1.0–1.5 mm), the eggs were of relatively large size and relatively few in number. The paratype ovigerous female was carrying 41 eggs in early development.

**HABITAT:** Schembri and McLay (1983) reported that this species occupied a variety of gastropod shells and occasionally bryozoan tubes. Taylor *et al.* (1989) found it primarily in tubes of the bryozoan species *Osthimosia monilifera* Taylor *et al.*, and *Crepidacantha zelanica* Canu & Bassler. In the Otago region it was abundant on the inner shelf between 20 and 40 m depth, on sand, and common to abundant in mid-shelf regions on gravel between 40 and 120 m depth (Schembri 1988). In Great Omaha Bay, *L. (L.) pumilus* sp. nov. was collected on sand and muddy sand.

**ETYMOLOGY:** The specific name is from the Latin *pumilus* meaning dwarf or pygmy, reflecting the small size of this species.

**REMARKS:** *Lophopagurus pumilus* sp. nov. is the smallest representative of the genus. In the Otago region, Schembri (1988) reported a mean shield length of 2.0 mm, with a standard deviation of 0.3 mm (n = 30). The holotype, one of largest specimens we have seen, has a shield length of 2.7 mm.

*Lophopagurus pumilus* sp. nov. is superficially quite similar to *Pagurus traversi*; however, in addition to the presence of paired first pleopods in the females,

this new species is distinguished from *P. traversi* by its shorter ocular peduncles, more weakly armed right chela, particularly the dorsolateral margin, and its longer ambulatory dactyls. *Lophopagurus pumilus* is immediately set apart from other species of the genus by its multidenticulate ocular acicles. Although these are uncommon among the pylopagurid-group genera, one species, *Aniopagurus pygmaeus* (Bouvier, 1918) (cf. McLaughlin 1981a, Lemaitre & McLaughlin 1996), is also characterised by them.

RECORDS FROM NEW ZEALAND: Discontinuous distribution in North Island, including vicinity of Cape Maria van Diemen, Channel between Moturua and Motukiakia Is, Great Omaha Bay, and Hawke Bay; eastern South Island from Kaikoura to Portobello; Cook Strait, north of Stephens Island; 4–187 m.

DISTRIBUTION: Apparently endemic to New Zealand.

***Lophopagurus (Lophopagurus) lacertosus* (Henderson, 1888)** (Fig. 48, Pl. 4, fig. 2)

*Eupagurus lacertosus* Henderson, 1888: 63, pl. 6, fig. 7.

*Pagurus lacertosus*: McCulloch 1913: 346; Gordan 1956: 331 (lit.).

*Eupagurus crenatus* Borradaile, 1916: 95, fig. 8.

*Pagurus crenatus*: Gordan 1956: 328 (lit.).

*Pylopagurus crenatus*: Forest & de Saint Laurent 1968: 145; McLaughlin 1981a: 3.

*Pylopagurus lacertosus*: Forest & de Saint Laurent 1968: 145; McLaughlin 1981a: 3.

*Lophopagurus lacertosus*: McLaughlin 1981a: 3 (by implication); McLaughlin & Gunn 1992: 61, fig. 6.

*Lophopagurus crenatus*: McLaughlin 1981a: 3 (by implication); McLaughlin & Gunn 1992: 58, fig. 5.

? *Pagurus* cf. *lacertosus*: Yaldwyn 1975: 361.

[Not *Eupagurus lacertosus*: Pope 1947: 131, unnumbered figs 3, 4; Dakin et al. 1948: 209, 219; 1952: 199, pl. 44, fig. 7; 1960: 199, pl. 44, fig. 7 = *Pagurixus jerviensis* McLaughlin & Haig, 1984.]

[Not *Pagurus lacertosus*: Griffin 1967: 306; Healy & Yaldwyn 1970: 72, fig. 35 = *Pagurixus jerviensis* McLaughlin & Haig, 1984.]

[? Not *Eupagurus lacertosus*: Zarenkov 1968: 182; = *Lophopagurus (Lophopagurus) nodulosus* McLaughlin & Gunn, 1992 (in part).]

[Not *Pagurus lacertosus*: Forest, 1961: 223 = *Lophopagurus thompsoni* (Filhol, 1885).]

[? Not *Pagurus lacertosus*: Liszka & Underwood, 1990: 47 ? = *Pagurixus jerviensis* McLaughlin & Haig, 1984.]

[Not *Pylopagurus crenatus*: Probert et al. 1979: 381 = *Lophopagurus (L.) nodulosus* McLaughlin & Gunn, 1992.]

TYPES:

Lectotype of *Eupagurus lacertosus*, by subsequent selection by McLaughlin and Gunn (1992): male (sl =

9.6 mm; total body length 33 mm), *Challenger* Stn 166, NHM 88.33.2 paralectotype: *Challenger* Stn 166, 1 juvenile, NHM 88.33.2.

Holotype of *Eupagurus crenatus*: male (sl = 5.8 mm), *Terra Nova* Stn 90, NHM 1917.129.134.

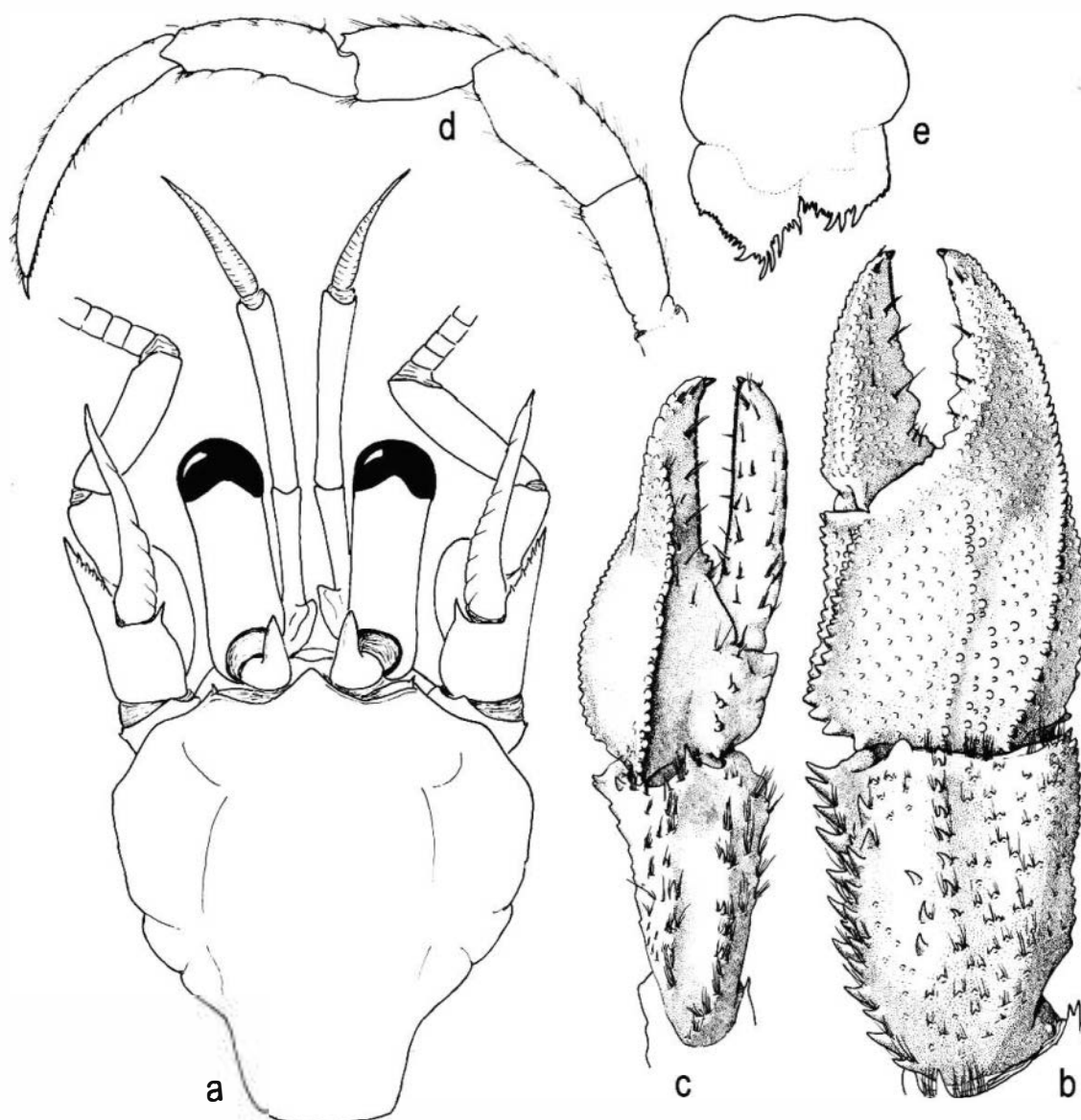
TYPE LOCALITIES: *Eupagurus lacertosus*: off New Zealand, *Challenger* Stn 166, 38°50'S, 169°20'E, 500 m; *Eupagurus crenatus*: *Terra Nova* Stn 90, from summit, Great King, Three Kings Islands, S 14°W, 8 miles, 183 m.

OTHER MATERIAL EXAMINED:

NZOI Stns: D39, 4 females (sl = 1.1–2.6 mm); D85, 8 males (cl = 10.0–16.0 mm), 8 females (cl = 11.0–14.0 mm), MNHN Pg 4418; D87, 1 female (cl = 14.0 mm); D136, 1 male (cl = 13.0 mm); D137, 3 males (cl = 11.0–13.5 mm), MNHN Pg 4415; D175, 1 female (cl = 12.5 mm); D203, 5 males (cl = 11.0–16.0 mm), 1 female (cl = 10.5 mm), MNHN Pg 4419; D205, 1 male (cl = 16.0 mm), MNHN Pg 4424; D207, 3 males (cl = 12.5–15.0 mm), MNHN Pg 4425; D210, 1 male (cl = 12.0 mm), MNHN Pg 4416; D211, 1 male (cl = 10.5 mm); D232, 2 males (cl = 16.0, 18.0 mm), 1 female (cl = 15.0 mm), 2 ovigerous females (cl = 13.0, 16.0 mm); D234, 1 ovigerous female (cl = 13.5 mm), MNHN Pg 4417; E144, 4 males (cl = 12.0–18.0 mm), MNHN Pg 4430; E146, 7 males, (cl = 8.0–13.0 mm), 1 ovigerous female (cl = 12.5 mm); E268, 1 male (sl = 2.9 mm); E400, 10 males (cl = 7.5–11.0 mm), 6 females (6.0–9.0 mm), MNHN Pg 4423, 1 male (sl = 4.6 mm); E408, 1 male (cl = 11.0 mm); E413, 3 males (cl = 11.0–13.0 mm), 1 female (cl = 11.0 mm); E424, 2 males (cl = 11.0, 13.0 mm); E752, 1 male (cl = 16.0 mm); E760, 1 male (cl = 6.5 mm), MNHN Pg 4422; E771, 1 female (cl = 12.5 mm); E803, 3 males (cl = 6.5–14.0 mm), 1 ovigerous female (cl = 7.5 mm); E806, 1 male (cl = 13.5 mm), MNHN Pg 4427; E819, 2 males (cl = 5.0, 8.0 mm), 1 female (cl = 9.0 mm), 1 ovigerous female (sl = 6.0 mm); E822, 1 female (sl = 4.7 mm); E827, 1 male, (cl = 13.0 mm), 1 female (cl = 13.0 mm), MNHN Pg 4429; E907, 1 female (sl = 2.8 mm); F79, 1 male (cl = 11.0 mm); F90, 1 male (cl = 13.5 mm), 1 female (cl = 7.0 mm), MNHN Pg 4421; F91, 2 males (cl = 12.0, 12.5 mm), 1 female (cl = 12.0 mm); F95, 1 female (cl = 10.0 mm); F99, 3 males (cl = 10.5–13.0 mm), 6 females (cl = 7.0–10.0 mm); F100, 1 male (cl = 10.0 mm); F101, 1 male (cl = 14.0 mm); F105, 2 males (cl = 10.55, 15.0 mm), 1 female (cl = 11.0 mm), MNHN Pg 4426; F107, 4 males (cl = 10.0–17.0 mm), 3 females, (cl = 7.0–11.0 mm); F109, 1 male (cl = 10.0 mm), 1 female (cl = 10.0 mm), MNHN Pg 4414; F120, 2 males (cl = 9.0, 11.0 mm); F122, 3 males (cl = 12.0–15.0 mm); F136, 4 females (cl = 12.0–16.0 mm); F138, 2 males (cl = 11.0, 18.0 mm); F145, 1 male (cl = 11 mm); F147, 4 males (cl = 7.0–11.0 mm), 1 female (cl = 11.0 mm); F150, 1 male (cl = 13.0 mm); I354, 1 male (sl = 8.2 mm); I667, 1 male (sl = 5.0 mm), with abdominal bopyrid; I669, 1 female (sl = 6.1 mm), with bopyrid; I672, 3 males (sl = 5.6–7.6 mm), 1 ovigerous female (sl = 5.2 mm); I701, 1 male, (sl = 5.1 mm); I705, 1 female (sl = 6.5 mm); Z9007, 1 male (sl = 10.2 mm); Z9076, 3 males (sl = 1.1–2.9 mm); Z9104, 2 males (sl = 1.3, 3.0 mm).

NMNZ collections: Taiaroa Trench, coll. A.J. Black, 11.8.74, 768–722 m, 1 badly damaged specimen, Cr 9655; BS 190, 1 ovigerous female (cl = 11.0 mm), MNHN Pg 4428;





**Fig. 48.** *Lophopagurus (Lophopagurus) lacertosus* (Henderson, 1888), a-d, NZOI Stn E752, male (cl = 16.0 mm); e, NZOI Stn D232, male (sl = 8.9 mm): a, shield and cephalic appendages (setation and aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view, setation omitted); c, carpus and chela of left cheliped (dorsal view, setation omitted); d, third left pereopod (lateral view); e, telson (setation omitted). Magnifications equal 7x (d), 10x (b, c), 14x (a), 18x (e).

Stn BS 424, 5 males (sl = 4.6–8.2 mm), 4 females (sl = 5.9–6.9 mm), Cr 7547, 2 specimens very poor condition, Cr 7528; Stn BS 548, 1 female (sl = 3.2 mm), Cr 9656; Stn BS 672, 3 males (sl = 5.7–8.3 mm), 3 females (sl = 5.7–8.1 mm), Cr 7575; Stn BS 781, 1 male (sl = 5.1 mm), Cr 8145; Stn BS 785, 1 male (sl = 5.9 mm), 5 females (sl = 3.7–7.8 mm), Cr 8139; Stn BS 806, 1 male (sl = 3.0 mm), Cr 8136; Stn BS 864, 1 female (sl = 2.3 mm), Cr 8128; Stn BS 877, 1 male (sl = 2.8 mm), Cr 8126; Stn BS 941, 1 female (sl = 4.2 mm), Cr 8123; Stn BS 940, 1 female (sl = 6.7 mm), Cr 8230; JC Stn J22/60/70, 5 males (sl = 5.0–11.8 mm), 2 females (sl = 7.6, 9.3 mm), Cr 4909; Stn J03/10/72, 1 female (sl = 7.9 mm), Cr 8113; Stn J1/12/77, 1

male (sl = 7.8 mm), Cr 2673; Stn J01/022/77, 1 male (sl = 10.0 mm), Cr 7548; Stn J06/038/81, 1 male (sl = 10.2 mm), Cr 8221.

NZMD collections: Haul 21, 1 female (cl = 14.5 mm), Cr 9814; Haul 28, 1 male (cl = 16.0 mm), Cr 9657.

PMBS collections: Canyon E, SE Taiaoroa Heads, 25.10.66, 311–329 m, 2 females (sl = 4.3, 6.1 mm). Stn Mu 67/25, 1 male (sl = 4.2 mm), 2 females (sl = 4.2, 4.3 mm); Stn Mu 67/142, 2 males (sl = 3.6, 4.0 mm), 2 females (sl = 2.7, 3.4 mm); Stn Mu 74/95, 4 males (sl = 3.4–6.5 mm), 12 females (sl = 2.3–6.2 mm); Stn Mu 74/202, 7 males (sl = 3.2–6.6 mm), 6 females (sl = 2.9–6.2 mm).

UMZC collections: *Galathea* Stn 626, 1 male (sl = 7.0 mm).

**DESCRIPTION:** Shield (Fig. 48a) slightly longer than broad to slightly broader than long. Rostrum obtusely triangular, acute or bluntly rounded. Ocular peduncles 0.43–0.75 length of shield; corneal diameter included 1.8–3.3 times in peduncular length. Ocular acicles narrowly and acutely triangular. Antennular peduncles overreaching distal margins of corneas by slightly less to slightly more than length of ultimate segment. Antennal peduncles overreaching distal margins of corneas by 0.25–0.65 length of ultimate segment; mesial margin of laterodistal projection with 2 to several teeth. Antennal acicle reaching well beyond proximal margin of fifth peduncular segment.

Right cheliped (Fig. 48b) with dactyl triangular and slightly elevated in midline, dorsal surface often covered with low, sometimes spinulose protuberances or tubercles; dorsomesial margin with row of closely spaced small tubercles. Palm with dorsomesial margin depressed and armed with single or double row of small teeth or tubercles, dorsomesial component weakly concave, armed with low, blunt or spinulose tubercles and delimited dorsally by moderately broad, spinulose or tuberculate ridge; dorsal surface often covered with low, blunt or spinulose tubercles, sometimes only granules, occasionally almost smooth, dorsal midline with single or double row of somewhat stronger spinulose or blunt tubercles; dorsolateral margin with row of blunt or acute teeth or tubercles. Carpus with double or triple row of prominent teeth on dorsomesial margin becoming widely divergent in distal half, dorsal midline with 1 or 2 rows of acute, smaller tubercles, dorsal surface laterad of midline with numerous small spinulose tubercles.

Left cheliped (Fig. 48c) with dorsomesial margin of dactyl unarmed or with row of small teeth or spinulose tubercles proximally. Palm strongly elevated in dorsal midline and armed with row of small tubercles extending onto fixed finger, dorsolateral margin with closely spaced, compressed teeth, dorsolateral surface unarmed or with minute to moderately well defined, blunt or spinulose tubercles, dorsomesial surface with scattered small tubercles, dorsomesial margin with row of broad, spinulose or blunt teeth. Carpus with row of teeth on dorsolateral margin, strongest at distal angle, dorsomesial margin usually with row of smaller teeth.

Ambulatory legs (Fig. 48d) generally similar from right to left, or dactyl of left third slightly stouter. Dactyls usually at least 0.8–1.9 times length of propodi; ventral margins each with row of 6–21 spiniform setae; lateral faces often with median longitudinal sulcus and sometimes dorsal row of low protuber-

ances, sometimes lateral face of third left slightly concave. Dorsal surfaces of carpi of second (rarely only right) and frequently also third each with row of prominent, distinct teeth, slightly smaller on third. Anterior lobe of sternite of third pereopods subsemicircular, sometimes 1 or 2 small denticles.

Telson (Fig. 48e) with posterior lobes oblique or rounded, terminal margins with few strong teeth and numerous smaller denticles extending onto lateral margins.

**COLOUR:** Chelipeds and ambulatory legs generally reddish-orange with darker reddish-orange teeth.

**REPRODUCTION:** Very few ovigerous females are represented in the collections. Of those we observed, eggs in early stages of development measured between 0.55 and 0.76 mm in diameter. McLaughlin and Gunn (1992) reported the time of collection of ovigerous females as July, September, November, and January.

**HABITAT:** Gastropod shells; broad depth range between 139 and 840 m.

**REMARKS:** *Lophopagurus* (*L.*) *lacertosus* is one of the commonest species of the genus and has a broad geographic and depth range. After a thorough examination of Borradaile's type specimen, and other specimens collected in the vicinity of Three Kings Islands, we concur with the suggestion of McLaughlin and Gunn (1992) that *L. lacertosus* might prove to be the senior synonym of *L. (L.) crenatus*. The carpi of the second pereopods, and often also the third are armed in *L. lacertosus* with a prominent row of distinct teeth (spines of McLaughlin & Gunn). Although Borradaile (1916) did not consider the spiniform protuberances on the right second pereopod of *L. (L.) crenatus* to be teeth, McLaughlin and Gunn (1992) did. We are of the opinion that the spines in Borradaile's specimen are actually worn down. However, even among confirmed specimens of *L. (L.) lacertosus*, variation in the strength of the spines, and even occasionally in their presence or absence, has been found. We have therefore formally placed *L. (L.) crenatus* in synonymy with *L. (L.) lacertosus*.

**RECORDS FROM NEW ZEALAND:** North of Three Kings Islands, west to the eastern slope of Wanganella Bank and the Challenger Plateau; off Greymouth; eastern side of New Zealand from Three Kings Islands to Otago Peninsula; Campbell and Auckland Islands; 36–790, possibly 840 m.

**DISTRIBUTION:** Endemic to New Zealand.



***Lophopagurus (Lophopagurus) ?nanus* (Henderson, 1888) (Fig. 49)**

*Eupagurus lacertosus* var. *nana* Henderson, 1888: 64, pl. 7, fig. 1; Ortmann 1892: 306; Whitelegge 1889: 231; 1900: 169; Alcock 1905b: 144 (list).

*Eupagurus lacertosus*, var. *Nana*: Grant (in Sayce) 1902: 155. *Pagurus lacertosus*: McCulloch 1913: 346; [not *Pagurus lacertosus* (Henderson, 1888)].

*Pagurus nana*: Hale, 1927: 94, fig. 90; Gordan 1956: 332 (lit.).

*Eupagurus lacertosus nana*: Hale, 1941: 279.

*Pagurus lacertosus* var. *nana*: Gordan, 1956: 331 (lit.).

*Pylopagurus nanus*: Forest & de Saint Laurent 1968: 145; McLaughlin 1981a: 3.

*Eupagurus lacertosus*: Zarenkov 1968: 182 (in part).

*Lophopagurus nanus*: McLaughlin 1981a: 3 (by implication); McLaughlin & Gunn 1992: 65, figs 1B, D, F, 7.

**TYPES:**

Lectotype, herein selected: male (sl = 3.5 mm) from Port Jackson, Australia, NHM 88.33.6.

Paralectotypes: 4 males (sl = 1.8–3.3 mm), 1 female (sl = 2.0 mm), 1 ovigerous female (sl = 1.7 mm), Challenger Stn 162; 5 males (sl = 1.8–2.9 mm), 3 females (sl = 1.8–2.0 mm), 2 ovigerous females (sl = 1.8, 2.0 mm), Port Moncoeur Island; 2 males (sl = 1.6, 1.8 mm), 2 females (1.6, 2.3 mm), Port Jackson, NHM 88.33.6.

**TYPE LOCALITY**, by lectotype selection: Port Jackson, Australia.

**OTHER MATERIAL EXAMINED:**

NZOI: Stn E845, 4 males (sl = 2.4–3.2 mm), 1 female (sl = 2.8 mm).

NMNZ: Stn BS 886, 2 males (sl = 6.3, 7.5 mm), Cr 7854, Cr 8143.

AM: Botany Bay, New South Wales, 1 female (sl = 0.8 mm), AM 617

MVM: 4 females (sl = 1.1–2.6 mm), 1 ovigerous female (1.5 mm), J17442.

**DESCRIPTION:** Shield (Fig. 49a) longer than broad. Rostrum triangular, reaching to or beyond bases of ocular acicles. Ocular peduncles 0.55–0.75 length of shield; corneal diameter included 0.24–0.32 times in peduncular length. Ocular acicles narrowly and acutely triangular. Antennular peduncles overreaching distal margins of corneas by 0.50–0.65 length of ultimate segment. Antennal peduncles reaching nearly to or slightly beyond distal corneal margins; mesial margin of distolateral projection of second segment with usually 1–3 teeth. Antennal acicles reaching distal half of fifth segment or slightly beyond.

Right cheliped (Fig. 49b) with row of small, sometimes spinulose denticles on dorsomesial margin of dactyl, dorsal surface often weakly tuberculate. Palm

with depressed dorsomesial margin armed with single or double row of small denticles, dorsomesial component often with weakly tuberculate surface, delimited above by single or double row of small denticles or spinulose tubercles, dorsal surface weakly tuberculate and with row of blunt or spinulose tubercles laterad of midline. Carpus with row of acute teeth on dorsomesial margin and adjacent second, oblique row of slightly smaller spinulose tubercles, dorsodistal margin with 1 or 2 small teeth, dorsal surface with additional 1 or 2 rows of tubercles laterad of midline.

Left cheliped (Fig. 49c) with unarmed dactyl. Palm with dorsal surface elevated in midline into prominent crest, armed with row of spinose tubercles, dorsolateral margin crenulate. Carpus with somewhat oblique row of acute teeth or tubercles extending from dorsolateral margin proximally to dorsomesial margin distally, dorsomesial margin also often with 2 or 3 smaller teeth or protuberances proximally, dorsodistal margin with 1 or 2 teeth.

Second (Fig. 49d) and third pereopods generally similar. Dactyls 1.1–1.5 times longer than propodi. Ventral margins each with row of 8–15 spiniform setae. Propodi each with row of spiniform setae on ventral surface; dorsal surface smooth or with low protuberances and tufts of setae. Carpi with 2 or 3 very low protuberances on dorsal surface, 1 or rarely 2 teeth at dorsodistal margins. Sternite of third pereopods with anterior lobe subsemicircular.

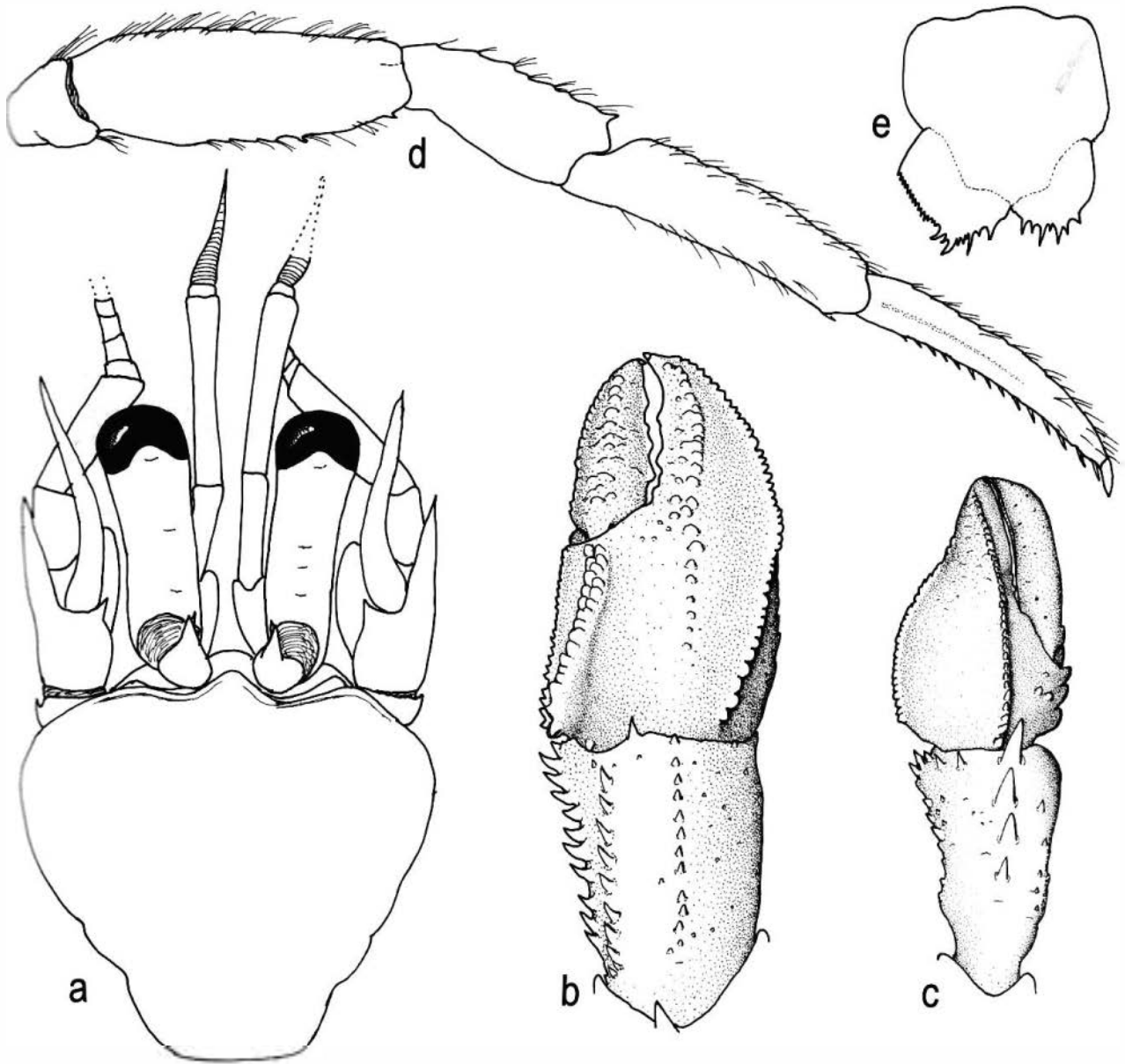
Telson (Fig. 49e) with posterior lobes generally asymmetrical; terminal margins oblique, each with 3 or 4 prominent teeth and smaller teeth or denticles extending onto lateral margins.

**COLOUR:** Unknown.

**REPRODUCTION:** Not known for New Zealand. In Australian waters, ovigerous females were collected in November (McLaughlin & Gunn 1992).

**HABITAT:** Not known, but collected over depth range of 14 to 422 m, perhaps to 437 m.

**REMARKS:** Henderson (1888) considered *L. (L.) nanus* a small variety of *L. (L.) lacertosus*, and all the specimens we have seen are appreciably smaller than average specimens of *L. (L.) lacertosus*. *Lophopagurus (L.) nanus* is a common representative of the pagurid fauna of southeastern Australia and Tasmania, thus it is with some degree of uncertainty that we have identified two lots of this species in New Zealand waters. The New Zealand specimens agree well with the type series and with other specimens from Australian waters. It is distinguished from *L. lacertosus* by its longer ocular peduncles and the absence of a row of



**Fig. 49.** *Lophopagurus (Lophopagurus) ?nanus* (Henderson, 1888), NMNZ Stn BS 886, male (sl = 6.3 mm), NMNZ Cr 8143: **a**, head and cephalic appendages (setation and aesthetascs omitted); **b**, carpus and chela of right cheliped (dorsal view, setation omitted); **c**, carpus and chela of left cheliped (dorsal view, setation omitted); **d**, second right pereopod (lateral view); **e**, telson (setation omitted). Magnifications equal 9x (b-d), 12x (a), 18x (e).

prominent teeth on the dorsal surfaces of the carpi of the second pereopods.

**RECORDS FROM NEW ZEALAND:** 32–34°S, 167–172°E  
NZOI Stn E845 and NMNZ Stn BS 886).

**DISTRIBUTION:** Southeastern Australia, Tasmania;  
northwest of North Island, New Zealand.

*Lophopagurus (Lophopagurus) thompsoni* (Filhol,  
1885) (Fig. 50, Pl. 4, fig. 1)

*Eupagurus thompsoni* Filhol, 1885b: 33 (in part); 1885d: 423 (in part); 1885e: pl. 51, ?not fig. 6, not fig. 7. [Not *Pagurus thompsoni* Bell, 1851: 372, unnumbered figure (= *Pagurus pubescens* Kröyer, 1838)].

*Eupagurus thomsoni*: Thomson 1899: 183 (in part); Chilton 1911a: 298.

?*Eupagurus thompsoni*: Thompson 1930: 270.

*Pagurus thompsoni*: Gordan 1956: 336 (in part); Forest in Pike 1961: 223; Fenwick, 1978: 206.

*Pagurus thomsoni*: Forest in Pike 1961: 223.

*Pagurus lacertosus*: Forest in Pike 1961: 223. [Not *Pagurus lacertosus* (Henderson, 1888)].

*Pylopagurus thompsoni*: Forest & de Saint Laurent 1968: 145



(in part); McLaughlin 1981a: 3 (in part).

*Lophopagurus thompsoni*: McLaughlin 1981a: 3 (by implication, in part); McLaughlin & Gunn 1992 (in part): 47, figs 2A-I.

TYPE: Holotype: female (cl = 14 mm), Filhol collection, MNHN Pg 435.

TYPE LOCALITY: Cook Strait, New Zealand.

#### OTHER MATERIAL EXAMINED:

NZOI Stns: A718, 2 specimens, badly damaged; A835, 1 male (cl = 15 mm); B202, 1 male (cl = 15 mm), 1 ovigerous female (cl = 14 mm); B524, 1 male (cl = 6 mm), 2 females (cl = 9.0 mm); B549, 1 male (cl = 16 mm), 2 females (cl = 8.0, 9.0 mm); B554, 8 males (cl = 6.5–18.0 mm), 6 females (cl = 7.0–13.0 mm), 8 ovigerous females (cl = 9.5–16.0 mm), MNHN Pg 4386I; B555, 7 males (cl = 7.0–17.5 mm), 5 females (cl = 6.5–13.5 mm), 1 ovigerous female (cl = 15.0 mm), MNHN Pg 4370; B556, 6 males (cl = 12.0–17.5 mm), 11 ovigerous females (cl = 11.5–13.0 mm), MNHN Pg 4368; B558, 1 male (cl = 16.5 mm), 2 ovigerous females (cl = 12.0, 13.0 mm), MNHN Pg 4383; B559, 4 males (cl = 13.0–20.0 mm), 1 female (cl = 12.5 mm), 3 ovigerous females (cl = 11.5–13.5 mm); B597, 1 male (cl = 4.0 mm); B605, 2 males (cl = 4.0, 6.5 mm), 1 ovigerous female (cl = 4.5 mm); B619, 1 female (cl = 6.0 mm); B646, 1 male (cl = 11.0 mm); B664, 1 male (cl = 6.0 mm); B669, 1 male (cl = 7.0 mm); B672, 1 male (cl = 14.5 mm), 1 female (cl = 9.0 mm); B673, 1 male (cl = 9.0 mm); C184, 1 male (sl = 3.2 mm); C342, 1 male (cl = 6.0 mm); C683, 1 male (cl = 19.0 mm); C706, 2 males (cl = 9.0 mm), 1 ovigerous female (cl = 10.0 mm); C748, 1 female (cl = 6.5 mm), MNHN Pg 4378; C751, 3 juveniles (cl = 2–4 mm); C767, 1 male (cl = 9.0 mm), 1 female (cl = 11.0 mm), MNHN Pg 4375; C957, 15 males (cl = 8.5–17.5 mm); D1, 2 males (cl = 4.0, 5.5 mm), 1 ovigerous female (cl = 7.0 mm), MNHN Pg 4376; D72, 1 ovigerous female (sl = 7.5 mm); E106, 4 males (cl = 16.0–19.5 mm), 2 females (cl = 8.0, 14.0 mm), 1 ovigerous female (cl = 14.0 mm), MNHN Pg 4371; E113, 2 males (cl = 10.5, 16.0 mm), 3 females (cl = 11.5–15.0 mm), 3 ovigerous females (cl = 14.0–15.0 mm); E114, 13 males (cl = 13.0–18.5 mm), 11 ovigerous females (cl = 9.5–15.0 mm); E125, 1 male (cl = 7.0 mm), MNHN Pg 4369; E134, 1 male (sl = 7.5 mm); E137, 1 male (cl = 9.5 mm), 1 ovigerous female (cl = 10.5 mm); E159, 3 males (cl = 11.5–18.0 mm); E160, 7 males (cl = 3.5–16.0 mm), 1 female (cl = 6.0 mm); E162, 1 ovigerous female (cl = 15.0 mm), MNHN Pg 4374; E412, 3 males (cl = 11.0–15.0 mm), 3 females (cl = 12.0–15.0 mm), 14 ovigerous females (cl = 12.0–16.0 mm), MNHN Pg 4380; E759, 1 female (cl = 12.0 mm), 1 ovigerous female (cl = 9.0 mm); E785, 1 male (cl = 12.5 mm); E817, 1 male (cl = 4.5 mm); E845, 4 males (cl = 4.0–6.0 mm), 1 ovigerous female (cl = 6.0 mm); F185, 1 ovigerous female (cl = 6.5 mm); G162, 1 male (cl = 14.5 mm); G167, 2 males (cl = 16.5, 19.0 mm), MNHN Pg 4373; S176, 1 male (sl = 8.6 mm), 1 female (sl = 5.1 mm); S208, 1 male (sl = 5.3 mm), 1 ovigerous female (sl = 6.2 mm);

NMNZ collections: North of Cape Brett, Bay of Islands, 19.9.63, 18–164 m, 1 ovigerous female (sl = 3.6 mm), Cr 9658; off Great Barrier Island, coll. Sandford, 3.62, 110–146 m, 3 males (cl = 6.0–15.0 mm), Cr 9659; Slipper Island, coll. B. Godfriaux, 10.6.70, 33 m, 1 male (sl = 4.8 mm), Cr 9802; Motiti Island, coll. B. Godfriaux, 20.5.70, 46 m, 3 males, (sl =

4.5–6.0 mm) 4 females (sl = 3.7–4.9 mm), Cr 8092; Cook Strait: trawling grounds, 1956, 73 m, 1 female (cl = 10.5 mm), Cr 9660; Cook Strait (41°31'S, 174°46'E), 19.1.56, 119–126 m, 4 males (sl = 8.5–9.4 mm), 1 female (sl = 6.3 mm), 1 ovigerous female (sl = 8.0 mm), Cr 9661; Cook Strait (41°31.3'S, 174°48'E), 128–146 m, 1 male (sl = 4.5 mm), Cr 9662; Cook Strait (41°36'S, 174°44'E), 29.8.70, 695 m, 1 female (sl = 7.2 mm), 2 ovigerous females (sl = 8.3, 9.4 mm), Cr 9663; Cook Strait, 29.8.57, 274 m, 22 males, several with rhizocephalans (sl = 4.2–11.7 mm), 15 females (sl = 6.0–10.6 mm), 4 ovigerous females (sl = 7.7–9.5 mm), Cr 9664; Kahu Rocks, Wairarapa coast, coll. G. Olsen, 29.9.86, 146 m, 1 male (sl = 7.6 mm), Cr 7546; Tasman Bay, 1963, 60 m, 1 male (sl = 4.5 mm), Cr 9665; NE Cape Campbell (~ 41°40.5'S, 174°30'E), coll. F. Abernethy, 4.65, 73 m, 2 males (cl = 11.5, 18.0 mm), 1 female (cl = 10.0 mm), 1 ovigerous female (cl = 14.0 mm), Cr 9666; Kaikoura, off Rhino Horn Point, coll. L.D. Bowring, 27.11.73, 80 m, 2 males (sl = 7.3, 9.0 mm), Cr 8215; North Otago, coll. J. Graham, 1963, 3 males (sl = 4.5–9.0 mm), 3 females (sl = 4.3–6.0 mm), 1 ovigerous female (sl = 5.6 mm), Cr 8073.

NMNZ Stns: BS 197, 2 males (sl = 4.3, 5.4 mm), 1 female (sl = 5.6 mm), Cr 9667; BS 216, 1 female (sl = 5.1 mm), Cr 8194; BS 424, 5 males, 4 females (sl = 6.0–8.7 mm), Cr 9797; BS 457, 1 ?female, poor condition (sl = 4.5 mm), Cr 7570; Stn BS 542, 7 males (sl = 3.6–9.1 mm), 5 females (sl = 3.5–6.3 mm), Cr 7413, 8048; BS 657, 4 males (sl = 3.9–8.2 mm), 1 ovigerous female (sl = 5.2 mm) Cr 8114, 9811; BS 659, 13 males (sl = 5.0–8.3 mm), 3 females (sl = 5.5–6.4 mm), 1 ovigerous female (sl = 5.3 mm) Cr 7560, 8175; BS 776, 8 males (sl = 6.4–9.5 mm), 3 females (sl = 3.5–7.0 mm), 2 ovigerous females (sl = 5.4, 7.3 mm), Cr 9810; BS 777, 3 males (sl = 4.5–6.9 mm), 1 female (sl = 7.1 mm), 1 ovigerous female (sl = 4.7 mm), Cr 8235; BS 783, 3 males (cl = 6.0–9.0 mm), Cr 9668; BS 786, 2 females (sl = 3.9, 5.4 mm), Cr 9669; BS 796, 95 males (sl = 2.0, 7.7 mm), 10 females (sl = 3.6–6.1 mm), 16 ovigerous females (sl = 2.5–6.2 mm), Cr 7544, 7562, 7564, 8138, 8198; BS 826, 15 males (sl = 3.9–7.5 mm), 4 females (sl = 3.2–4.9 mm), 4 ovigerous females (sl = 3.3–4.3 mm), Cr 7598; BS 910, 1 male (sl = 4.3 mm), 1 ovigerous female (sl = 5.2 mm), Cr 8231; CM Stn CM(i), 1 male (sl = 11.9 mm), Cr 7506; JC Stn J18/081/78, 7 males (sl = 5.4–8.8 mm), Cr 8072; Stn J19/006/78, 1 male (sl = 7.8 mm), Cr 8225.

NZMD collections: Trawl 15, 1 female (sl = 8.5 mm), Cr 8119; Trawl 36, 1 female (sl = 3.0 mm), Cr 8028.

DESCRIPTION: Shield (Fig. 50a) length equal to width or slightly longer than broad. Rostrum triangular, usually acute. Ocular peduncles 0.50–0.70 length of shield; corneal diameter 0.28–0.32 of peduncular length. Ocular acicles acutely and narrowly triangular. Antennular peduncles usually over-reaching distal margins of corneas by 0.35–0.75 length of ultimate segment. Antennal peduncles over-reaching distal margins of corneas by 0.30–0.60 length of fifth segment; laterodistal projection of second segment with 0–5 small teeth on mesial and/or lateral margins. Antennal acicle reaching nearly to or beyond mid-length of ultimate peduncular segment.

Right cheliped (Fig. 50b) with dactyl somewhat triangular in cross-section; dorsal surface with Dactyl

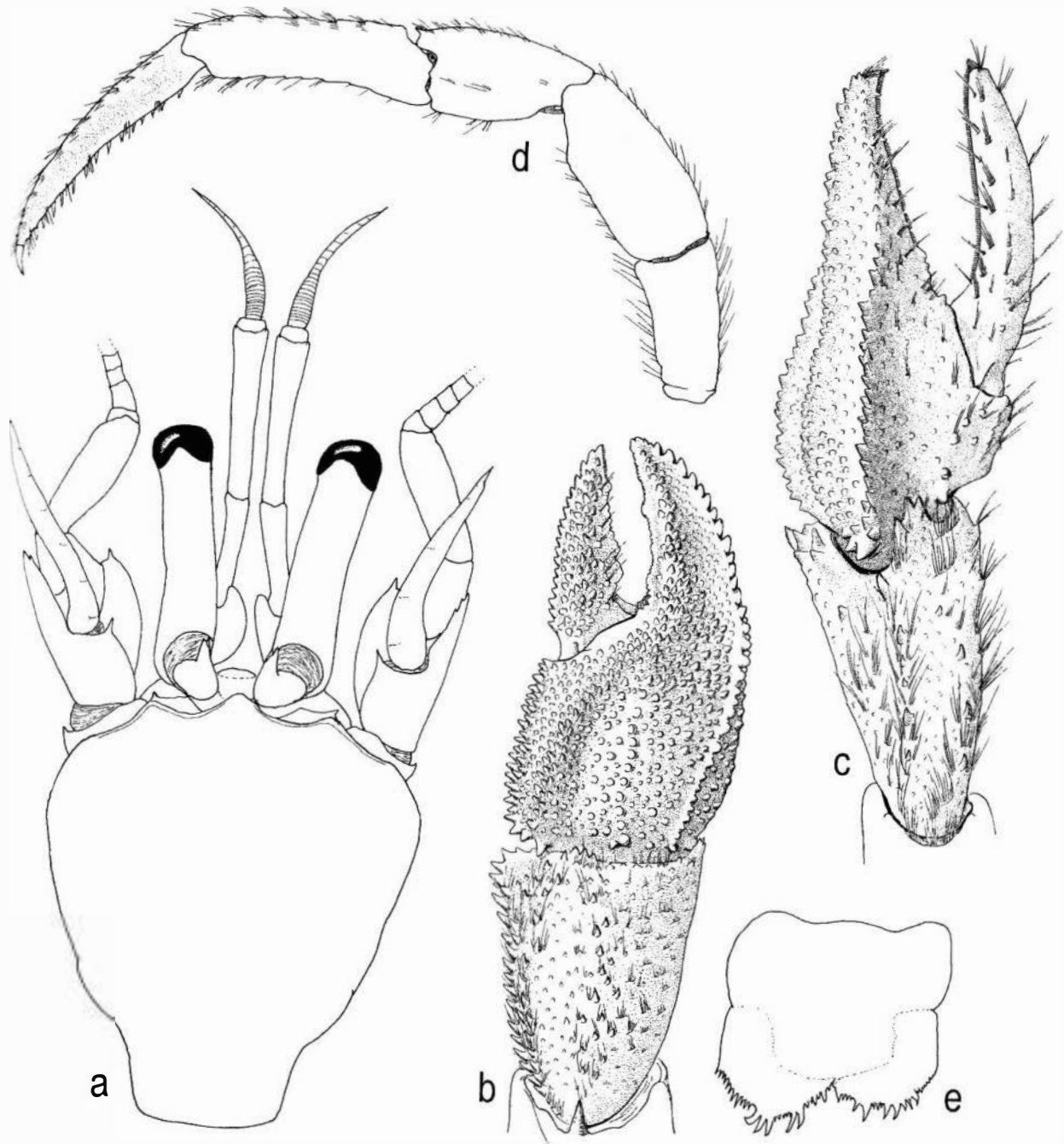


Fig. 50. *Lophopagurus (Lophopagurus) thompsoni* (Filhol, 1885), NZOI Stn E114, male (sl = 8.8 mm): a, shield and cephalic appendages (setation and aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view); c, carpus and chela of left cheliped (dorsal view); d, third left pereopod (lateral view); e, telson (setation omitted). Magnifications equal 5.5x (d), 10x (b, c), 13x (a), 18x (e).

regular rows of low tubercles, dorsomesial margin depressed ventrally and armed with row of tubercles; palm with depressed dorsomesial margin, dorsomesial component almost perpendicular, delineated above by tubercular or toothed ridge; dorsal surface with scattered blunt or acute tubercles and with row of stronger tubercles in midline, dorsolateral margin

with row of acute or blunt teeth on palm; dorsomesial margin of carpus with double row of acute teeth proximally, becoming single marginal and medially oblique row distally, dorsal surface with numerous small, acute or blunt tubercles.

Left cheliped (Fig. 50c) triangular in cross-section; propodal-carpal articulation usually horizontal.



Dactyl with row of small teeth in proximal half of dorsomesial margin. Palm markedly elevated in midline into prominent median crest armed with single row of very closely spaced tubercles, sometimes almost coalesced, dorsolateral margin crenulate or tuberculate, dorsomesial surface of palm with few tubercles, dorsomesial margin with row of blunt teeth, dorsolateral surface smooth or with only few small tubercles. Dorsolateral margin of carpus with row of moderately strong teeth, row of somewhat smaller teeth on dorsomesial margin.

Right and left second and right third pereopods similar. Dactyls slightly longer than propodi; ventral margins each with 13–21 spiniform setae. Carpi of second and frequently also third each with row of teeth on dorsal margin. Ventrolateral margins of meri each with row of teeth (second) or weak to moderately well-developed protuberances (third). Left third pereopod (Fig. 50d) with lateral face of dactyl markedly concave, unarmed, dorsal surface broad and flattened, dorsomesial and dorsolateral margins each with row of stiff bristles or thin, spiniform setae; ventral margin with 17–23 spiniform setae. Propodus broad, lateral face flattened or slightly concave, with dorsolateral margin forming distinct angle, at least in distal half; dorsal surface with transverse rows of short setae. Anterior lobe of sternite of third pereopods subrectangular to subsemicircular.

Telson (Fig. 50e) with posterior lobes slightly asymmetrical, terminal margins oblique, each with few strong teeth and numerous smaller teeth or denticles extending onto lateral margins.

**COLOUR:** Ocular peduncles orange-red proximally tending to pale blue distally, antennules pale blue or mauve; antennae strongly barred dark reddish-brown and white; chelipeds orange-red with longitudinal reddish stripes and white areas around the joint region, especially that between carpus and merus; walking legs orange-red with longitudinal reddish stripes and white areas around the joint regions (Schembri & McLay 1983).

**REPRODUCTION:** Females of *L. (L.) thompsoni* were found to be carrying eggs throughout the year, except in June and July; the peak reproductive period however, appears to be from October to January. Eggs were rarely found in an advanced stage of development, however, so the actual time of larval release is not known. Each female was found to carry a large number of quite small eggs, diameters varying between 0.46 and 0.61 mm.

**HABITAT:** Commonly found in gastropod shells on muddy bottoms.

**REMARKS:** Filhol's (1885b) description of *Eupagurus thompsoni* was very brief, and there was no indication of the number of specimens, or the sex, upon which the description was based. McLaughlin and Gunn (1992) were of the opinion that Filhol's (1885d) original material contained two closely allied species *L. (L.) thompsoni* and *L. (L.) foresti* McLaughlin & Gunn. This may not, in fact, be the case. It is possible that additional specimens in the Filhol collections at the Muséum national d'Histoire naturelle and subsequently identified by Bouvier as Filhol's (1885b) *thompsoni* were considered by him to represent syntypes. One of these presumed syntypes was subsequently donated by Bouvier to the National Museum of Natural History, Smithsonian Institution (Manning & Holthuis 1981). A second presumed syntype is in the collection of the Nationaal Natuurhistorisch Museum, Leiden. McLaughlin and Gunn (1992) designated as the lectotype of *L. (L.) thompsoni*, the single specimen, a female, remaining in the Filhol collections that J. Forest deemed to be an original syntype. It is probable that it is not the specimen illustrated by Filhol (1885e, pl. 51, fig. 6), which lacks pleopods. The specimens illustrated without pleopods in Filhol's figures usually were males; however, it is also apparent that Filhol did not always illustrate syntypic material. For example, his illustration of *L. (A.) kirkii* (Filhol 1885e, pl. 51, fig. 5) presumably represents a female, with pleopods illustrated on both sides of the abdomen. The type series of *L. (A.) kirkii*, is represented by males; only in his subsequent collections are females present.

Forest (in Pike 1961) considered *Eupagurus thompsoni* Filhol a homonym of *Eupagurus thompsoni* Bell, 1851 but, as pointed out by McLaughlin and Gunn (1992), secondary homonyms need not be rejected if they are no longer considered congeneric. Forest and de Saint Laurent (1968) transferred Filhol's *Eupagurus* (as *Pagurus*) *thompsoni* to *Pylopagurus*, and McLaughlin (1981a) reassigned it to *Lophopagurus*.

In their discussion of the affinities of *L. (L.) thompsoni*, McLaughlin and Gunn (1992) noted marked similarities between *L. thompsoni* and *L. foresti*, and between *L. thompsoni* and *L. lacertosus*. From the substantially larger samples of both of the latter species available for this review, we have found that the dactyl of third left pereopod is not as reliable a character as previously thought. While the dactyl is always concave and shorter in *L. thompsoni*, it is not always appreciably broader. Conversely, this segment, particularly in females of *L. lacertosus*, is frequently somewhat more concave and shorter than the dactyl of the second. A more reliable character that should be used to distinguish between the two taxa is the shape of the propodus of the left third pereopod. In *L. thompsoni*, the lateral and dorsal

surfaces of this segment meet to form a distinct dorsolateral angular margin, particularly in the distal half. The dorsal surface of the propodus in *L. lacertosus* sounds uniformly onto the lateral face.

**RECORDS FROM NEW ZEALAND:** Broadly distributed from northwest of Three Kings Islands, east and west of North and South Islands, to Foveaux Strait and Stewart Island; 40–1951, possibly to 2134 m.

**DISTRIBUTION:** Apparently endemic to New Zealand.

***Lophopagurus (Lophopagurus) foresti* McLaughlin & Gunn, 1992** (Fig. 51, Pl. 4, fig. 3)

*Eupagurus thompsoni* Filhol, 1885b: 33 (in part); 1885d: 423 (in part); 1885e, pl. 51, ?fig. 6, not fig. 7.

*Eupagurus kirkii*: Thomson, 1899: 175, pl. 20, figs 8–10. [Not *Eupagurus kirkii* Filhol, 1883.]

*Eupagurus thomsoni*: Thomson 1899: 183 (in part); Chilton 1911a: 298.

*Lophopagurus* sp. 'mauve antenna 1': Probert *et al.* 1979: 385.

*Lophopagurus thompsoni*: McLaughlin 1981a: 3 (in part).

*Pagurus* n. sp. (aff. *thomsoni*): Rainer 1981: 37.

*Lophopagurus 'thompsoni'*: Schembri 1982b: 870, fig. 9; Schembri & McLay 1983: 30 (in part), figs 8a, b; Probert & Wilson 1984: 389 (list); Schembri 1988: 93 (in part); Taylor *et al.* 1989: 1064 [not *Lophopagurus (Lophopagurus) thompsoni* (Filhol, 1855b)].

*Lophopagurus thompsoni*: McLaughlin & Gunn 1992: 47 (in part).

*Lophopagurus foresti* McLaughlin & Gunn, 1992: 52, figs 1A, C, E; 3A–G.

**TYPES:**

Holotype: male (sl = 5.3 mm), Cook Strait, USNM 22927.

Paratypes: 2 males (sl = 7.2, 7.8 mm), 2 females (sl = 5.4, 6.2 mm), Wellington Harbour, coll. M. Davidson, 7.5.80, 17 m, NMNZ Cr 4109; 9 males (sl = 3.4–6.0 mm), 6 females (sl = 4.8–5.4 mm), ET Stn 16/1431, USNM 244460.

**TYPE LOCALITY:** Cook Strait, New Zealand.

**OTHER MATERIAL EXAMINED:**

NZOI Stns: A444, 1 specimen in poor condition, MNHN Pg 4306; B219, 1 male (cl = 5.5 mm), 1 female (cl = 6.5 mm); B220, 2 males (cl = 5.0, 6.5 mm), 9 females (cl = 6.0–7.0 mm); B221, 4 males (cl = 5.5–7.5 mm), 2 females (sl = 5.0, 7.5 mm), MNHN Pg 4312, Pg 4313; B223, 1 female (cl = 7.0 mm); B224, 2 males (7.5, 9.0 mm), 3 females (cl = 5.5–6.5 mm); B225, 7 males (cl = 6.0–9.0 mm), 4 females (cl = 5.5–6.5 mm); B230, 3 males (cl = 6.0–7.5 mm), 1 female (cl = 6.5 mm), MNHN Pg 4315, Pg 4317, Pg 4318; B235, 2 males (cl = 7.0, 7.0 mm) MNHN Pg 4310, 1 female (sl = 1.9 mm); B236, 3 males (cl = 6.0–8.0 mm), 6 females (cl = 6.5–8.0 mm); B237, 3 males (cl =

5.5–7.0 mm), 1 female (cl = 5.0 mm); B246, 3 males (cl = 4.5–9.5 mm), 2 females (cl = 3.5, 7.7 mm), 1 ovigerous female (cl = 4.5 mm); B249, 2 males (cl = 12.0, 16.0 mm); B254, 1 male (cl = 6.5 mm); B264, 1 male (cl = 8.5 mm), 6 females (cl = 5.0–7.0 mm), MNHN Pg 4309; B524, 1 female (cl = 12.0 mm); B563, 1 male, (cl = 10.0 mm), 1 female (cl = 8.0 mm), MNHN Pg 4316; C653, 1 female (cl = 4.5 mm), MNHN Pg 4314; C662, 1 male (cl = 5.0 mm), MNHN Pg 4308; C763, 1 male (sl = 3.3 mm); C844, 1 female (cl = 11.0 mm); D127, 8 males (cl = 7.5–10.5 mm), 6 females (6.0–9.0 mm), 1 ovigerous female (cl = 7.0 mm); E833, 2 males (sl = 4.5, 6.7 mm), 1 female (sl = 6.2 mm), 1 ovigerous female (sl = 5.2 mm); S208, 1 male (sl = 5.7 mm).

NMNZ collections: Shelly Bay Wellington Harbour, coll. J. Moreland 28.4.53, 1 male (cl = 12.8 mm), MNHN Pg 4311. Wellington Harbour, Ward Island, -5.66, 3 males (sl = 3.8–6.3 mm), 1 female (cl = 3.8 mm), Cr 9670; Wellington Harbour, Mahanga Bay, coll. P.E. Roberts, -6.67, 6–8 m, 1 ovigerous female (sl = 4.5 mm), Cr 9671; Lyall Bay, Wellington, 30.8.55, 1 specimen, MNHN Pg 4319; Kaikoura, off Rhino Horn, 27.11.73, 80 m, 1 male (sl = 7.7 mm), 1 female (sl = 4.7 mm), Cr 9672; S. Kaikoura, Bushett Shoal, 7.9.65, 1 ovigerous female (sl = 6.5 mm), Cr 9673; North Otago, coll. J. Graham, 24 m, 1 male (sl = 4.7 mm), 1 ovigerous female (sl = 4.2 mm), Cr 9800; coll. J. Graham, -5.63, 55–80 m, 10 males (sl = 4.8–7.3 mm), Cr 8082; 1 specimen, very poor condition, Cr 8053; Foveaux Strait, off Ruapuke Is., coll. C.A. Fleming, 23 m, 10 males (cl = 9.0–10.0 mm), Cr 9674; Foveaux Strait oyster beds, -9.61, 1 male (cl = 7.0 mm), Cr 9675; Foveaux Strait oyster beds, coll. M. Stead, 1961, 17 males (cl = 5.5–11.0 mm), 5 females (cl = 5.0–7.0 mm), 2 ovigerous females (cl = 6.0, 7.0 mm), Cr 9676; Foveaux Strait oyster beds, coll. P.E. Roberts, -2.66, 36 m, 16 males (cl = 6.0–11.0 mm), 1 female (cl = 4.4 mm), Cr 9677;

NMNZ Stns: BS 557, 1 female (sl = 3.8 mm), Cr 9678; BS 561, 1 female (sl = 3.7 mm), Cr 7558; BS 729, 2 males (sl = 3.0, 3.3 mm), Cr 9679; BS 732, 3 males (sl = 4.3–5.1 mm), 1 female (sl = 4.3 mm), Cr 9680; BS 776, 4 males (sl = 5.7–7.1 mm), 2 females (sl = 4.8, 7.3 mm), 3 ovigerous females (sl = 5.5–8.2 mm), Cr 8205; BS 862, 1 specimen very poor condition, Cr 8159; Stn Mu 5, 5 males (sl = 5.5–6.5 mm), 1 female (sl = 5.1 mm), Cr 7545.

MNHN collections: Filhol collection, Cook Strait, (identified by E.L. Bouvier as *Eupagurus thompsoni* Filhol), 14 males (sl = 3.4–7.2 mm, 8 females (sl = 3.2–5.2 mm), MNHN Pg 433.

PMBS collections: Wellers Rocks, Otago Harbour, 20.8.63, low spring tide, 1 male (sl = 7.6 mm); Stn Mu 66/76, 12 males (sl = 2.9–6.5 mm), 3 females (sl = 3.6–4.9 mm); Stn Mu 75/23, 3 males (sl = 2.1–4.9 mm), 5 females (sl = 2.1–6.4 mm).

**DESCRIPTION:** Shield (Fig. 51a) longer than broad. Rostrum triangular, acute, frequently with terminal denticle. Ocular peduncles moderately slender, 0.65–0.80 length of shield; corneal diameter included more than 3 times in peduncular length. Ocular acicles slender, terminating acutely and with submarginal tooth. Antennular peduncles usually overreaching distal margins of corneas by 0.30–0.80 length of ultimate segment, occasionally shorter. Antennal



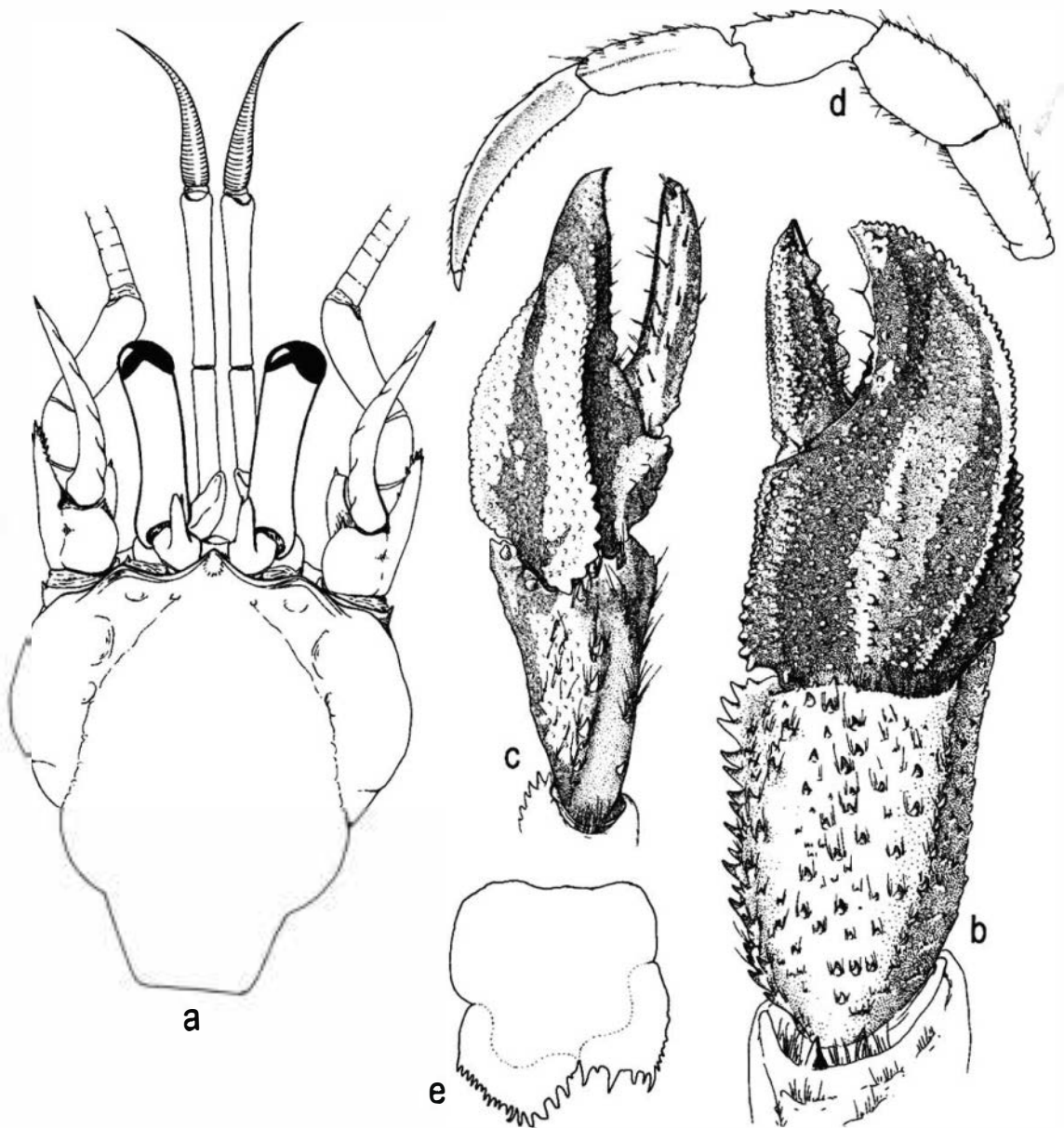


Fig. 51. *Lophopagurus (Lophopagurus) foresti* McLaughlin & Gunn, 1992, a-c, e, NZOI Stn B249, male (cl = 16.0 mm); d, same locality, male (cl = 12.0): a, shield and cephalic appendages (setation and aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view); c, carpus and chela of left cheliped (dorsal view); d, third left pereopod (lateral view); e, telson (setation omitted). Magnifications equal 6x (b), 7x (d), 10x (c), 12x (a), 18x (e).

peduncles reaching beyond bases of corneas, usually not exceeding distal corneal margins; laterodistal projection of second peduncular segment with 1 to several denticles on mesial and/or lateral margins. Antennal acicle usually reaching at least to midlength of fifth peduncular segment.

Right cheliped (Fig. 51b) with dorsal surface of dactyl elevated in midline and armed with irregular row of small to very prominent tubercles, dorsomesial margin with row of small to large acute or blunt teeth. Palm with single or double row of tuberculate teeth on dorsomesial margin, dorsomesial component flat

to strongly concave, weakly to strongly tuberculate, delineated dorsally by curved, tuberculate ridge extending to tip of fixed finger, dorsal surface covered with blunt or acute tubercles and with elevated ridge laterad of midline, dorsolateral margin with large, compressed, subacute or blunt teeth. Dorsomesial margin of carpus with irregular row of moderately prominent teeth, dorsal surface with single or double row of tubercles mesiad of midline.

Left cheliped (Fig. 51c) with propodal-carpal articulation horizontal. Dactyl with few blunt teeth on dorsomesial margin proximally. Palm with

prominent, median, elevated crest armed with single row of simple or corneous-tipped tubercles extending almost to tip of fixed finger, dorsolateral face tuberculate, dorsolateral margin with blunt teeth, dorsomesial margin with row of 2–4 small teeth. Carpus with single row of teeth on dorsolateral margin and 2 or 3 teeth on distal margin.

Ambulatory legs often overreaching right cheliped. Dactyls of second pereopods and third right longer than propodi; ventral margins each with 9–13 spiniform setae. Propodi with tufts of setae. Carpi each with strong dorsodistal spine and sometimes 1 additional spine in proximal half (second right, occasionally also second left). Third left pereopod (Fig. 51d) with lateral surface of dactyl concave, often conspicuously so; ventral surface broad, with outer margin frequently thickened and occasionally with small, calcareous nodules developed; row of 11–16 prominent, spiniform setae on inner margin, mesial face with double row of spiniform setae dorsally and additional single or double row ventrally. Propodus with lateral surface frequently somewhat flattened, but not forming distinct angle with dorsal surface. Carpus with single dorsodistal spine and frequently several low protuberances on dorsal surface. Anterior lobe of sternite of third pereopods subsemiovate to subsemicircular.

Telson (Fig. 51e) with numerous small teeth and few stronger teeth on terminal margins extending on to lateral margins.

**COLOUR:** In life, antennules mauve; dactyls and fixed fingers of chelae with longitudinal vermilion stripes. In preservative; antennal flagella alternately banded reddish-brown (4–7 articles) and translucent or white (2 or 3 articles). Right cheliped with two longitudinal orange stripes on dorsal surface of palm, one extending onto fixed finger and second at cutting edge, one additional at dorsodistal margin of dactyl. Left cheliped with longitudinal orange stripe on dorsolateral face of left chela. Ambulatory legs with four longitudinal orange stripes visible in lateral view on propodi, carpi, and meri and one to three on dactyls.

**REPRODUCTION:** Very few ovigerous females of *L. (L.) foresti* are represented in the collections. Those for which data are complete were collected in Foveaux Strait in January and May and south of Kaikoura in September. These females each carried several hundred small eggs, with diameters varying between 0.55 and 0.61 mm.

**HABITAT:** Found frequently on gravel or mud occupying a variety of gastropod shells, occasionally accompanied by an anemone.

**REMARKS:** Bouvier (unpublished) identified a number of specimens of *L. foresti* in the Filhol collection from Cook Strait, housed in the Muséum national d'Histoire naturelle, as *Eupagurus thompsoni*. It is thought that at least two of these specimens were presented as syntypic gifts to the museums in Leiden and Washington, D.C. McLaughlin and Gunn (1992) selected as the holotype of *L. foresti* the specimen in the Smithsonian National Museum of Natural History.

It is quite clear from Thomson's (1899: 175, pl. 20, figs 8–10) description and illustrations, the species he identified as *Eupagurus kirkii* actually was *L. (L.) foresti*.

As noted by McLaughlin and Gunn (1992), *L. (L.) foresti* is morphologically quite similar to *L. (L.) thompsoni*, and has frequently been confounded with it. McLaughlin and Gunn (1992) mistakenly included the literature citations of Probert *et al.* (1979), Rainer (1981), Schembri (1982b, 1988), Schembri and McLay (1983), Probert and Wilson (1984), and Taylor *et al.* (1989) in the synonymy of *L. (L.) thompsoni*. These latter authors were, for the most part, dealing with specimens of *L. (L.) foresti*. However, it is apparent from their distributional records that Schembri and McLay (1983) and Schembri (1988) were reporting on both species.

Both McLaughlin and Gunn (1992) and we have used the lack of a spine posterior to the dorsodistal spine on the carpi of the second pereopods (at least the right) to distinguish between *L. foresti* and *L. thompsoni*, and this is for the most part a reliable character. Occasionally, a small proximal tooth is present on this segment in *L. foresti*, and even more rarely a third tooth may be present proximally or at midlength. Additional characters that aid in distinguishing between the two species include the shorter antennal peduncles, more prominently armed dorsolateral surface of the left chela, and the absence of a distinct angular ridge on the dorsolateral margin of the propodus of the left third pereopod in *L. foresti*.

**RECORDS FROM NEW ZEALAND:** Three Kings Islands, off New Plymouth, Bay of Plenty, Tasman Bay, Cook Strait and Wellington Harbour, Kaikoura to Otago, Foveaux Strait; intertidal to 220, possibly 230 m.

**DISTRIBUTION.** Apparently endemic to New Zealand.

### *Lophopagurus (Lophopagurus) nodulosus*

McLaughlin & Gunn, 1992

(Fig. 52)

*Pylopagurus crenatus*: Probert *et al.* 1979: 381. [Not *Pylopagurus crenatus* Borradaile, 1916.]



*Lophopagurus* sp. nov.: Schembri 1982b: 870.

*Lophopagurus lacertosus*: Zarenkov, 1968: 182 (at least in part).

*Lophopagurus* n. sp.: Schembri & McLay 1983: 30, figs 9a, b.

*Lophopagurus nodulosus* McLaughlin & Gunn, 1992: 55, fig. 4A–H.

#### TYPES:

Holotype: male (sl = 6.4 mm), North side of Punui Bay, Snares Islands, NMNZ Cr 8347.

Paratypes: 9 males, 10 females, 2 ovigerous females (sl = 3.4–6.7 mm), Proclamation Island, Bounty Islands, 38 m, coll. D.S. Horning, 8.11.78, NMNZ Cr 8197.

TYPE LOCALITY: North side of Punui Bay, Snares Islands, 50 m.

#### OTHER MATERIAL EXAMINED:

NZOI Stns: A115, 1 male (sl = 1.2 mm); A852, 1 male (cl = 13.0 mm); A887, 1 ovigerous female (cl = 7 mm); Stn B230, 1 male (sl = 4.9 mm) plus moult fragments; B581, 3 males, 1 with rhizocephalan (sl = 2.7–4.2 mm), 2 females (sl = 2.7, 2.8 mm); B852, 1 male (sl = 6.7 mm); B591, 4 males (cl = 6–15 mm), 1 female (cl = 11 mm), MNHN Pg 4333; C601, 1 female (sl = 2.4 mm); C617, 1 female (sl = 4.1 mm); D1, 7 males (sl = 3.0–6.0 mm), 3 females (sl = 5.9–6.4 mm), 2 ovigerous females (sl = 3.3, 3.4 mm); D71, 1 ovigerous female (cl = 5 mm); D75, 1 male (cl = 6 mm), MNHN Pg 4431; D104, 2 males (cl = 8.0, 9.5 mm); D131, 1 specimen, MNHN Pg 4334; D156, 1 specimen, MNHN Pg 4335; D194, 1 male (cl = 6 mm); E820, 1 male (cl = 3.5 mm) MNHN Pg 4336; SA 3560, MNHN Pg 4332.

NMNZ collections: Campbell Island, off de la Vire, coll. P.A. Poppleton, 1.12.58, 16 m, 1 ovigerous female (cl = 10 mm), MNHN Pg 4337; Perpendicular Head, Auckland Islands, 16.2.85, 1 female (sl = 5.3 mm), Cr 9681.

MNHN collections: Ob Stn. 75, 1 female (sl = 2.8 mm), MNHN Pg 5836.

**DESCRIPTION:** Shield (Fig. 52a) longer than broad. Rostrum triangular, terminally subacute. Ocular peduncles 0.75–0.80 length of shield; ocular acicles narrowly triangular. Antennular peduncles over-reaching distal margins of corneas by 0.25–0.35 length of ultimate segment. Antennal peduncles usually reaching just beyond distal margins of corneas; laterodistal projection of second segment with 2–5 denticles on mesial margin, often 1 or 2 on lateral margin. Antennal acicles reaching at least to bases of corneas, sometimes over-reaching distal corneal margins.

Right cheliped (Fig. 52b) with dorsomesial margin of dactyl armed with closely set, blunt teeth proximally, dorsal surface with raised row of prominent tubercular nodules and few scattered, low tubercles. Palm with ridge of blunt or spinulose tubercles on dorsomesial margin, dorsomesial component con-

cave, surface with numerous tubercles, delimited above by elevated tuberculate ridge; dorsal surface of palm with very prominent ridge of tubercles or nodules in midline and similar row of tubercles extending length of fixed finger, remaining surface of palm with numerous large tubercles; dorsolateral margin with row of teeth; carpus with double row of teeth on dorsomesial margin and second adjacent oblique row, dorsal surface with 1 or 2 rows of acute tubercles in midline and scattered tubercles or granules particularly laterad of midline, dorsolateral margin delimited only by irregular row of transverse spinulose ridges.

Left cheliped (Fig. 52c) reaching to base of dactyl of right or slightly beyond; propodal-carpal articulation approximately horizontal. Dactyl with few low, acute or blunt denticles on dorsomesial margin proximally. Palm with midline very strongly elevated into crest composed of fused tubercles presenting scalloped appearance; dorsolateral margin crenulate proximally, becoming row of weak teeth distally, dorsomesial margin with 3 or 4 spinulose lobes. Carpus with row of prominent teeth on dorsolateral margin, dorsomesial margin sometimes with 1 or 2 teeth proximally, 1 acute tooth on dorsodistal margin.

Second pereopods and third right similar. Dactyls slightly longer than propodi; dorsal surfaces slightly flattened; ventral margins each with 10–12 spiniform setae. Carpi each with single dorsodistal tooth, rarely with second dorsal tooth in proximal half (second). Third left pereopod (Fig. 52d) with dactyl 0.20–0.25 longer than propodus; dorsolateral margin often broadly scalloped, lateral face markedly concave; ventral margin often tuberculate, with row of 12–15 spiniform setae. Sternite of third pereopods with anterior lobe subsemicircular.

Posterior lobes of telson (Fig. 52e) with terminal margins level to oblique, armed with several prominent teeth interspersed with smaller teeth, lateral margins often denticulate.

**COLOUR.** Ocular peduncles reddish; antennules uniform pale reddish-orange; antennae reddish with narrow white bands; chelipeds and walking legs, reddish-orange ground colour with darker bands (Schembri & McLay 1983). In preservative, chelipeds generally with red-orange tint; tubercles and crests white dorsally. Ambulatory legs with longitudinal bands of orange and white.

**REPRODUCTION:** Only five ovigerous females were present in the material examined, and these were collected in April and August in mainland New Zealand waters and November in the Bounty Islands. McLaughlin and Gunn (1992) reported one only cited

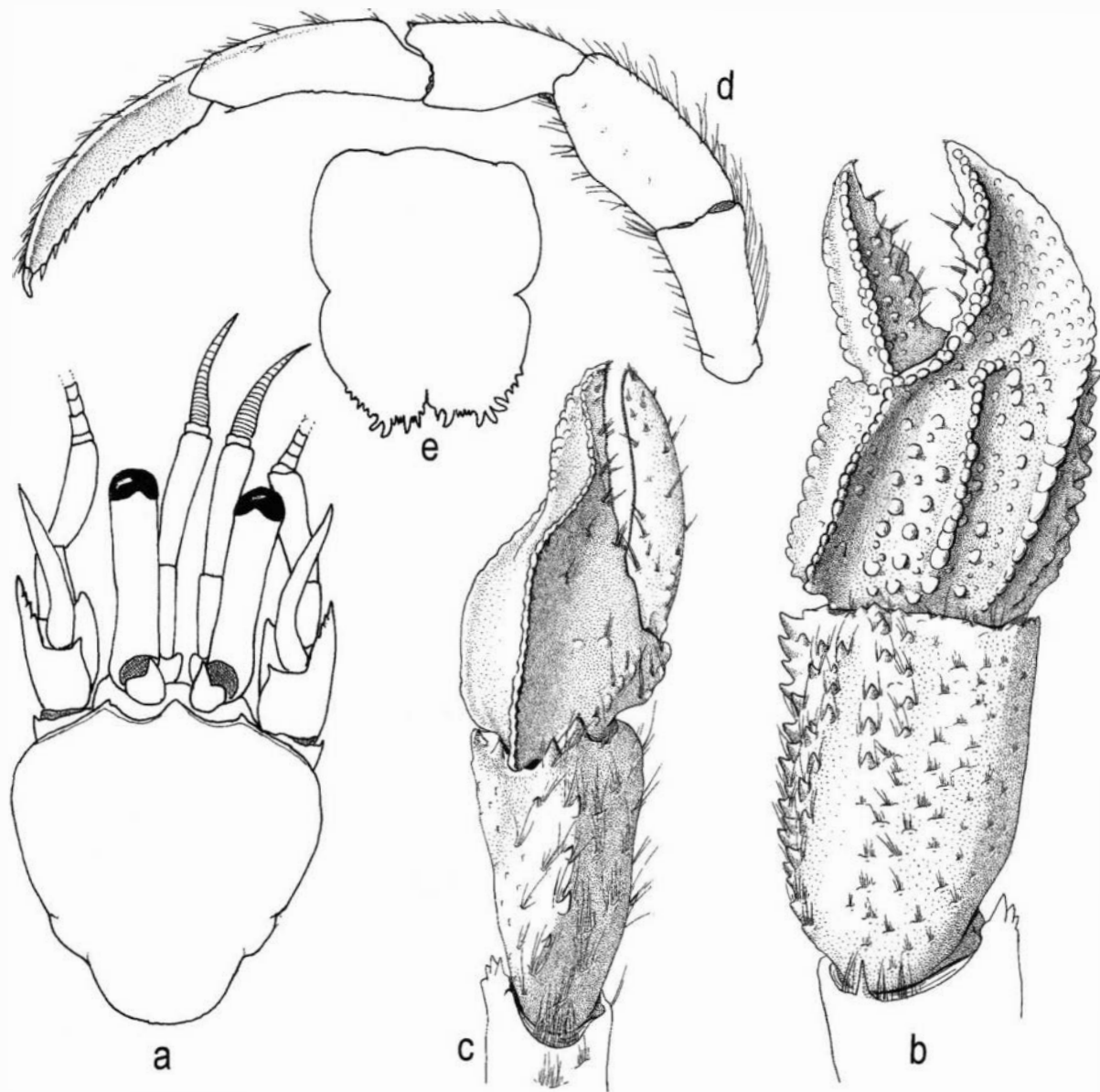


Fig. 52. *Lophopagurus (Lophopagurus) nodulosus* McLaughlin & Gunn, 1992, NZOI Stn B591, male (sl = 7.2 mm): a, shield and cephalic appendages (setation and aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view); c, carpus and chela of left cheliped (dorsal view); d, third left pereopod (lateral view); e, telson (setation omitted). Magnifications equal 7x (d), 9x (a), 10x (b, c), 18x (e).

ovigerous female collected at Campbell Island in February, in addition to the two from the Bounty Islands. Judging from the conditions of the females we examined, it is probable that all had lost many of the eggs that would normally have been carried. Egg diameter ranged from 0.46 to 0.61 mm.

**HABITAT:** Reported from the continental shelf and upper continental slope off the Otago region.

**REMARKS:** In having the dactyl of the left third pereopod distinctly concave, *L. (L.) nodulosus* is most closely allied to *L. (L.) foresti* and *L. (L.) thompsoni*, but is readily separated from both of the latter species by the distinctive armature of the chelae.

A specimen from the Soviet Antarctic Expeditions that was donated to the Muséum national d'Histoire naturelle (MNHN Pg 1846) [collected from the Auckland Islands, Ob Stn 356, March 19, 1958] has proved to be *L. (L.) nodulosus*. McLaughlin and Gunn (1992) Zarenkov's (1968) report of *L. (L.) lacertosus* from New Zealand and *L. (L.) nanus* from Australia without

pod distinctly concave, *L. (L.) nodulosus* is most closely allied to *L. (L.) foresti* and *L. (L.) thompsoni*, but is readily separated from both of the latter species by the distinctive armature of the chelae.



having seen Zarenkov's specimens. Both *L. (L.) lacer-tosus* and *L. (L.) nodulosus* are known from the Auckland Islands, and Zarenkov's report of the former species from Ob Stns 342, 352 and 353 falls within the distribution and depth ranges of both. From Zarenkov's (1967) comments on the shortness of the antennal acicles of his specimens, it is possible that his other specimens should also be assigned to *L. (L.) nodulosus*; however, two specimens of *L. (A.) eltaninae*, still in bryozoan tubes, accompanied the specimen sent to Paris.

RECORDS FROM NEW ZEALAND: Southeast South Island, Auckland, Bounty, and Campbell Islands; 11–400 m.

DISTRIBUTION: Southeastern New Zealand, Auckland, Campbell and Bounty Islands.

### *Lophopagurus (Australeremus)* McLaughlin, 1981

*Eupagurus sensu lato*: Melin, 1939: 29 (in part).

*Pylopagurus*: Forest & de Saint Laurent 1968: 145 (in part); Miyake 1978: 119 (in part); McLaughlin 1981a: 2 (in part). [Not *Pylopagurus* A. Milne-Edwards & Bouvier, 1891].

*Australeremus* McLaughlin, 1981a: 4; McLaughlin & Gunn 1992: 68.

TYPE SPECIES: *Eupagurus cookii* Filhol, 1883. Gender masculine.

Eleven pairs of biserial gills. Maxillule with external lobe of endopod well developed, internal lobe with 1 or 2 terminal bristles. Third maxilliped with well-developed crista dentata and very strong accessory tooth.

Right cheliped often not appreciably longer than left, but larger. Right chela subrectangular to subtriangular; dorsal surface of palm usually circumscribed by row of dorsomesial, dorsoproximal, and dorsolateral marginal spines; with approximately 15° of clockwise rotation of propodal-carpal articulation from horizontal plane. Left chela with dactyl elongated and considerably narrower than fixed finger; dorsolateral margin of chela elevated, at least proximally, and frequently expanded; propodal-carpal rotation variable. Sternite of third pereopods with subsemicircular, subovate or slender rod-like anterior lobe.

Abdomen frequently straight or only weakly flexed. Uropods symmetrical or asymmetrical. Telson with lateral indentations indicating division into anterior and posterior portions; posterior lobes symmetrical or subequal, terminal margins straight, oblique or rounded, armed with 1–4 strong, often

blunt spines and few smaller spines or spinules.

### KEY TO THE NEW ZEALAND (INCLUDING THE KERMADEC ISLANDS) SPECIES OF *Lophopagurus* (*Australeremus*)

- 1 Dorsal surface of chelae covered with closely spaced, flattened, mushroom-shaped tubercles ..... 2
  - Dorsal surfaces of chelae with spinulose or blunt tubercles ..... 3
- 2 Ventrolateral margin of carpus of right cheliped armed with row of teeth or denticles; left chela with sinuous dorsal surface; ventral margins of meri of second pereopods each with several teeth; thoracic sternites without capsulate setae ..... *L. (A.) cookii*
  - Ventrolateral margin of carpus of right cheliped unarmed; left chela with regularly sloping dorsal surface; ventral margins of meri of second pereopods unarmed; Thoracic sternites with capsulate setae ..... *L. (A.) laurentae*
- 3 Dorsal margins of propodi of third pereopods each with row of teeth ..... *L. (A.) cristatus*
  - Dorsal margins of propodi of third pereopods without row of teeth ..... 4
- 4 Dorsal margins of carpi of second pereopods each with row of spines (dactyls with 13–17 spiniform setae on ventral margins) ..... *L. (A.) kirkii*
  - Dorsal margins of carpi of second pereopods only with tooth at dorsodistal angle and occasionally 1 tooth in proximal half ..... 5
- 5 Dorsal margins of dactyls of second pereopods unarmed ..... *L. (A.) triserratus*
  - Dorsal margins of dactyls of second pereopods with teeth or protuberances ..... 6
- 6 Right cheliped (dorsal view) with chela rectangular, carpus width < 0.50 length; dactyls of second and third pereopods with markedly dissimilar dorsal margins ..... *L. (A.) stewarti*
  - Right cheliped (dorsal view) with chela subtriangular, carpus width > 0.55 length; dactyls of second and third pereopods with not markedly dissimilar dorsal margins ..... *L. (A.) eltaninae*

### *Lophopagurus (Australeremus) cookii* (Filhol, 1883) (Fig. 53, Pl. 4, fig. 4)

*Eupagurus Cookii* Filhol, 1883: 67; 1885b: 28; 1885d: 417; 1885e: pl. 51, fig. 2; Alcock 1905b: 176 (list); Chilton 1911a: 299; Thompson 1930: 270 (? in part).

*Eupagurus cookii*: Thomson 1899: 176 (? in part), ? pl. 20, figs 11–13.

*Pylopagurus cookii*: Forest & de Saint Laurent 1968: 145; McLaughlin 1981a: 4.

? "a hermit crab": Morton & Miller 1968: 577, fig. 215 (2).

? *Pylopagurus cookii*: Batham 1969: 79; Probert *et al.* 1979: 381, 388 (list).

? *Pagurus cookii*: Rainer 1981: 37.

*Australeremus cooki*: McLaughlin 1981a: 4 (by implication); Schembri & McLay 1983: 31 (in part), figs 10a, b, 11; McLaughlin & Gunn 1992: 70, fig. 9.  
 ?*Australeremus cooki*: Schembri 1982b: 865, figs 6, 7; Probert & Wilson 1984: 389 (list); Schembri 1988: 93 (list); Taylor *et al.* 1989.

#### TYPE:

Holotype: by monotypy, male (sl = 6.0 mm, cl = 11 mm) "Massacre" = Golden Bay, Cook Strait, Filhol collection, 1884, MNHN Pg 5847.

TYPE LOCALITY: Golden Bay, Cook Strait, New Zealand.

#### OTHER MATERIAL EXAMINED:

NZOI Stns: A444, 2 females (sl = 3.7, 3.8 mm); A859, 1 male (cl = 5 mm); B220, 3 males (sl = 7 mm); B221, 3 males (cl = 5–8 mm), MNHN Pg 4324; B223, 1 male (cl = 6 mm); B224, 1 male, 5 females (cl = 5–6 mm); B226, 1 male (sl = 2.4 mm); Stn B230, 1 male (cl = 7 mm), MNHN Pg 4322; B235, 2 males, 1 female (cl = 5–8 mm), MNHN Pg 4320; B236, 1 male, 2 females (cl = 5 mm), MNHN Pg 4325; B237, 1 female (cl = 5.5 mm), MNHN Pg 4327; B238, 2 males, 9 females (cl = 3–4.5 mm); B245, 3 males, 1 ovigerous female (cl = 4.5–6 mm); B246, 1 male (cl = 7.5 mm) plus 2 specimens not removed from shells, MNHN Pg 4323; B247, 1 male (cl = 7.5 mm); B252, 1 male (cl = 6 mm); B254, 1 female (cl = 6 mm), MNHN Pg 4326; B256, 3 males (cl = 6.5–10 mm); B658, 1 ovigerous female (sl = 2.4 mm); B263, 1 male (cl = 9 mm); B265, 2 males (cl = 9 mm), MNHN Pg 4321; B266, 1 male (cl = 4 mm); B267, 2 males (sl = 3.7, 4.1 mm), 1 female (sl = 1.9 mm); B278, 1 male, 1 female (cl = 6.5, 7 mm); B555, 1 female (cl = 10 mm); B561, 1 male (cl = 6 mm); B605, 1 male (cl = 6.5); B654, 2 males (cl = 9.5, 11 mm); B686, 1 male, 1 female (cl = 5.5, 4.5 mm); C871, 1 male, 1 female (cl = 5, 4.5 mm); D127, 3 males, 1 female (cl = 5.5–7 mm); E106, 2 males (sl = 2.5, 6.0 mm), 2 females (sl = 1.7, 2.6), 1 ovigerous female (sl = 3.5 mm); E113, 1 female (sl = 3.4 mm); E114, 1 male (sl = 6.9 mm); E160, 2 males (sl = 2.3, 3.9 mm); E412, 2 males (sl = 4.2, 4.4 mm); E759, 3 males, 1 female (cl = 6–9 mm); F746, 1 ovigerous female (cl = 6 mm).

NMNZ collections: 9–12 mi E Cape Brett, Bay of Islands, 1963, 163–168 m, 1 male (sl = 3.1 mm), Cr 9682; off Kaho Rocks, 37–45 m, 1 male, 1 female (cl = 2.5, 3.5 mm), Cr 9683; off Kapiti ls., ~12.1953, 18–27 m, coll. F. Abernethy, 1 juvenile, Cr 9684; Wellington, 1 male (sl = 2.8 mm), Cr 9685; Cook Strait, ~11.1956, 73 m, 2 males (cl = 3.5, 4 mm), Cr 9686; Open Bay Islands, 52.76, 7–11 m, 1 female (sl = 3.1 mm), Cr 4197; Foveaux Strait, off Ruapuke ls., coll. C.A. Fleming, 24 m, 6 males (cl = 6–9 mm), Cr 9687; Foveaux Strait, oyster beds, coll. M. Stead, 1961, 4 males, 2 females, 3 ovigerous females (cl = 5–6 mm), Cr 9688; Foveaux Strait, coll. P.E. Roberts, ~2.66, 36 m, 1 male (sl = 2.9 mm), Cr 9689; West end of Tory Channel, coll. J. Moreland, 11.11.61, 15 m, 11 males, 7 females (cl = 5–12 mm), Cr 9690; Henson Bay, Chatham ls., 27.1.54, 27 m, 1 ovigerous female (sl = 1.6 mm), Cr 4199.

NMNZ Stns: BS 172, 1 ovigerous female (sl = 4.4 mm), Cr 9691; BS 181, 1 female (sl = 1.8 mm), Cr 9692; BS 189, 6 males (sl = 2.9–6.1 mm), 5 ovigerous females (sl = 2.4–4.7 mm),

Cr 9693; BS 281, 2 males (sl = 3.0, 3.4 mm), Cr 8184; BS 431, 1 female (sl = 5.9 mm), Cr 8179; BS 432, 3 males (sl 3.7–3.9 mm, 2 females (sl = 4.0, 4.1 mm), 3 ovigerous females 2.7–4.0 mm), Cr 8093; BS 505, 4 males, 2 females (sl = 2.2–5.0 mm), Cr 9794, 8348; BS 506, 1 female (sl = 2.6 mm), Cr 8173; BS 561, 1 male (sl = 2.2 mm), Cr 9798; BS 589, 2 males (sl = 2.8, 3.6 mm), 1 female (sl = 2.3 mm), 1 ovigerous female (sl = 3.0 mm), Cr 8168, Cr 8169; BS 649, 1 male (sl = 2.3 mm), Cr 8167; BS 657, 1 male (sl = 3.0 mm), Cr 8155; BS 672, 1 male (sl = 2.8), Cr 9795; BS 723, 2 males (sl = 1.7, 3.4 mm), Cr 9796; BS 786, 3 males (sl = 2.8–5.2 mm), Cr 9694; BS 796, 2 males (sl = 3.9, 4.5 mm), 2 ovigerous females (sl = 3.7, 4.0 mm), Cr 7553, 7595, 8137; BS 910, 1 male (sl = 4.0 mm), Cr 8232.

AM collections: Dunedin, G.M. Thomson, 2 males, 2 females (sl = 3.9–4.7 mm), G2127.

PMBS collections: Mid-shelf off Otago Peninsula, coll. P.J. Schembri, 13 males, 9 females (sl = 1.9–5.0 mm); Stn Mu 66–76, 1 male (cl = 6 mm); Stn Mu 67–25, 2 ovigerous females (cl = 11 mm); Stn Mu 74–179, 3 small specimens; Stn Mu 75–23, 2 males (sl = 2.6, 2.9 mm), 2 females (sl = 1.8, 2.0 mm).

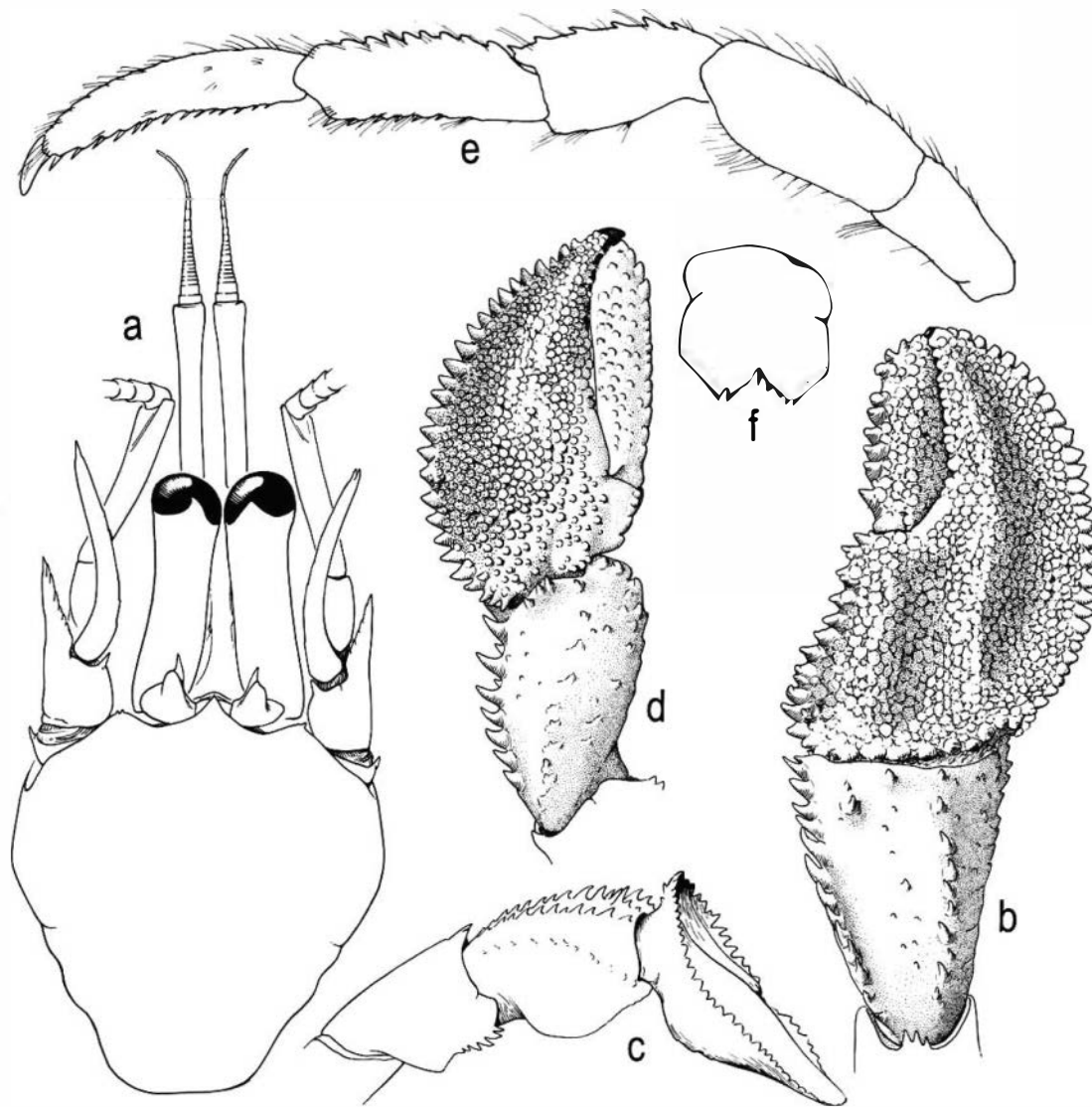
USNM collections: ET Stn 16/1431, 3 males, 2 females (sl = 2.8–3.7 mm), USNM 44441; ET Stn 23/1709, 1 male (sl = 3.1 mm), USNM 244440; ET Stn 23/1716, 1 female (sl = 3.8 mm), USNM 244442.

DESCRIPTION: Shield (Fig. 53a) as long or longer than broad. Rostrum broadly triangular, terminating acutely. Ocular peduncles 0.75–0.80 length of shield, 4.2–4.5 times longer than broad. Ocular acicles narrowly triangular, terminally subacute and with prominent submarginal tooth. Antennular peduncles over-reaching distal margin of corneas by more than 0.50–0.75 length of ultimate segment. Antennal peduncles over-reaching distal margins of corneas by 0.25–0.50 length of ultimate segment; laterodistal projection of second segment with acute terminal tooth and 2–5 denticles on mesial margin. Antennal acicles shorter or just reaching distal margin of corneas.

Right cheliped (Fig. 53b) with dorsal surface of dactyl covered almost completely with flattened tubercles, dorsomesial margin with row of compressed, blunt teeth; dorsomesial, dorsoproximal, and dorsolateral margins of palm each with row of compressed, blunt or acute teeth, joined to completely circumscribe palm and fixed finger, dorsal surfaces covered with flattened, mushroom-like, contiguous tubercles, midline slightly elevated to form low broad ridge, dorsomesial face of palm marked by deep, rectangular depressed area. Carpus with row of acute teeth on dorsomesial margin, dorsal surface flattened and with few scattered denticles and spinulose ridges; ventrolateral margin with row of small, often blunt teeth or denticles.

Left cheliped (Fig. 53c) somewhat shorter than right, but nearly as massive; propodal-carpal angle





**Fig. 53.** *Lophopagurus (Australeremus) cookii* (Filhol, 1883), Golden Bay, Greater Cook Strait, Filhol collection, male holotype (sl = 6.0 mm), MNHN Pg 5847: a, shield and cephalic appendages (setation and aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view, setation omitted); c, right cheliped (lateral view, setation omitted); d, carpus and chela of left cheliped (dorsal view, setation omitted); e, third left pereopod (lateral view); f, telson (setation omitted). Magnifications equal 9x (c), 15x (b, d, e), 18 (e), 22 (a).

of articulation 80–90° from horizontal plane. Dorsal surface of dactyl frequently with double row of granules near cutting edge and row of small denticles or teeth on dorsomesial margin. Palm with dorso-lateral margin expanded, strongly elevated proximally but becoming ventral in position distally on fixed finger, armed with row of strong, compressed, somewhat blunted teeth, dorsolateral surface covered with low, flattened, mushroom-like, contiguous tubercles, dorsomesial margin with few low, spinulose protuberances or blunt teeth. Carpus with row of acute tubercles on dorsal surface laterally.

Ambulatory legs (Fig. 53d) generally similar from

right to left. Dactyls slightly shorter to slightly longer than propodi, moderately slender, with row of low protuberances on dorsal margins, sometimes developed into distinct teeth, ventral margins each with row of 9–15 spiniform setae. Propodi each with row of protuberances or spinulose tubercles on dorsal surface, ventral margins each with row of small spiniform setae. Carpi of second with row of teeth on dorsal margin, occasionally reduced or lacking on left; third with dorsodistal tooth, less frequently 1 or 2 additional teeth in proximal half, occasionally complete row of teeth. Sternite of third pereopods with subovate or subquadrate anterior lobe.

Telson (Fig. 53e) with terminal margins armed with few small and few larger teeth toward external angles.

**COLOUR:** In life, ocular peduncles warm yellow, maxillipeds deep blue, anterior portion of thorax, chelipeds, and ambulatory legs dull reddish-grey, with a small patch of bright red on the propodi of the chelae, posterior part of thorax brilliant red, abdomen reddish-orange (Batham pers. comm., 1968).

Schembri and McLay (1983) reported a somewhat different colouration for living animals: ocular peduncles and antennules white with some brownish markings; antennae red with narrow white bands; second and third maxillipeds vivid deep blue; chelipeds pale to dark brown with a red spot on the propodi; walking legs pale to dark brown (Schembri & McLay 1983).

**REPRODUCTION:** Of the 81 females examined, 21 were ovigerous, and varied in size from shield lengths of 1.9–4.0 mm. Collection data are incomplete for several of these females; however, it would appear that the reproductive season is rather broad, extending at least from October through May. Females appear to carry several hundred small eggs of diameters ranging from 0.38 to 0.61 mm.

**HABITAT:** Often inhabiting bryozoan tubes and tusk shells; 51–553 m.

**REMARKS:** McLaughlin and Gunn (1992) pointed out several inaccuracies in Filhol's (1885b) illustration of *L. (A.) cookii*. These authors also discussed at length the actual and possible confusion of *L. (A.) cookii* with *L. (A.) cristatus* and *L. (A.) kirkii* by several earlier authors. Without direct examination, neither they, nor we, have been able to determine with confidence what taxa actually have been reported under the specific name *cookii*, and this uncertainty is reflected by the question marks preceding several entries in the synonymy. Suffice it to say, the spot of colour present on the dorsal surface of the chelae of all three of these species has been a major source of such confusion. The flattened, mushroom-like tubercles that cover the dorsal surfaces of both chelae of *L. (A.) cookii* will serve to distinguish this species from both *L. (A.) cristatus* and *L. (A.) kirkii*, where the chelae are armed with spinose tubercles or conical granules. However, a second species, *L. (A.) laurentae* McLaughlin & Gunn, 1992, shares with *L. (A.) cookii* the characteristic flattened, mushroom-like tubercles. Nevertheless, the chelae of *L. (A.) laurentae* lack the distinctive patches of red. In the absence of colour, the shorter dactyls, and more weakly armed carpi of the ambulatory legs

of *L. (A.) laurentae* help facilitate recognition.

While the majority of specimens were collected in depths of less than 100 m, a number were found between 100 and 267 m. One specimen was collected at NMNZ Stn BS 672 where the maximum depth recorded was 533 m, and two specimens at NZOI Stn E759 where the recorded depth ranged from 1924 to 2134 m. At least the latter depths may be a recording error.

**RECORDS FROM NEW ZEALAND:** *Lophopagurus (A.) cookii* can be reported with confidence from the Bay of Islands to Stewart Island, 11–267 m, possibly as deep as 533 and 1924–2134. It is more commonly found on the eastern sides of both Islands, but does occur at least on the west coast of South Island.

**DISTRIBUTION:** Endemic to New Zealand

*Lophopagurus (Australeremus) laurentae* (McLaughlin & Gunn, 1992) (Fig. 54, Pl. 5, fig. 3)

*Pylopagurus* 'mauve antenna 1': Probert *et al.* 1979: 386.  
*Pylopagurus* sp. nov.: Schembri 1982b: 869, fig. 8.  
*Pylopagurus* n. sp.: Schembri & McLay 1983: 31, fig. 13; Probert & Wilson 1984: 389; Schembri 1988: 93; Taylor *et al.* 1989: 1062.  
*Australeremus laurentae* McLaughlin & Gunn, 1992: 74, figs 8A, C, E; 10A–H.

**TYPES:**

Holotype: male (sl = 3.0 mm), NMNZ Stn BS 490, NMNZ Cr 8241.

Paratypes: 4 males, 5 females (sl = 1.6–3.8 mm), NMNZ Stn BS 500, NMNZ Cr 4913.

**TYPE LOCALITY:**

NMNZ Stn BS 490, approximately 10 miles SW of Waitotara River, 39°57'S, 174°34'E, 33–35 m.

**OTHER MATERIAL EXAMINED:**

NZOI Stns: B219, 2 males (cl = 4.0, 6.0 mm), 3 females (cl = 3.0–5.0 mm); B 220, 3 males (cl = 3.0–8.5 mm); B223, 1 female (cl = 3.5 mm); B224, 2 males (cl = 6.0, 7.0 mm), 4 females (cl = 5.0–9.0 mm) + 1 specimen not removed from shell; SB230, 1 female (cl = 5.0 mm); B236, 3 females (cl = 5.5–6.0 mm); B237, 1 female (cl = 4.0 mm); B247, 1 female (cl = 5.0 mm); B264, 1 male (cl = 7.0 mm); B270, 2 females (cl = 2.5, 3.5 mm); B565, 1 male (cl = 5.0 mm); B605, 2 males (1 with rhizocephalan) (cl = 4.0, 5.0 mm); C176, 2 females (cl = 4.0, 4.0 mm), 1 ovigerous female (cl = 5.0 mm); C442, 1 ovigerous female (cl = 4.0 mm); C844, 1 male (cl = 7.0 mm); C921, 1 male (cl = 6.0 mm), 1 female (cl = 2.5 mm), 1 ovigerous female (cl = 5.0 mm); D127, 2 males (cl = 5.0, 7.0 mm); E116, 1 female (cl = 4.5 mm); Z9108, 1 female (sl = 3.3 mm).

NMNZ collections: Off Wanganui, coll. A. Baxter, 1.9.59,



36–55 m, 2 females (cl = 5.0, 8.0 mm), Cr 9695; Wellington Harbour, coll. R.D. Cooper, 6.67, 1 female (sl = 3.3 mm), Cr 9696; NE Rangitoto Is., Cook Strait, 19.12.56, 73 m, 6 males (sl = 1.5–3.3 mm), 1 female (sl = 1.5 mm), 4 ovigerous females (sl = 1.9–2.7 mm), Cr 9697; Portobello region of Otago Harbour, -11.52, 3 males (cl = 7.0–8.0 mm), 2 ovigerous females (cl = 8.0, 8.5 mm), Cr 9698; Foveaux Strait, oyster beds, 1961, coll. M. Stead, 2 males (cl = 7.0, 7.5 mm), 7 females (cl = 6.5–8.8 mm), 1 ovigerous female (sl = 2.9 mm), Cr 9699; Foveaux Strait oyster grounds, -9.61, 3 males (cl = 5.0–8.0 mm), Cr 9700; Foveaux Strait oyster beds, coll. P.E. Roberts, -2.66, 10 males (cl = 4.5–7.5 mm), 2 females (cl = 4.0, 5.5 mm), Cr 9701; Port Hutt, Chatham Is., coll. F. Abernethy, 18.9.50, 1 female (cl = 7.0 mm), Cr 9702.

NMNZ Stns: BS 173, 1 male (cl = 7.0 mm), Cr 9703; BS 197, 1 female (cl = 4.5 mm), Cr 9704; BS 233, 1 female (sl = 1.2 mm), Cr 8041; BS 246, 1 male (sl = 1.5 mm), 1 juvenile (sl = 0.9 mm), Cr 8188; BS 432, 4 males (sl = 3.3–4.2 mm), Cr 9705; BS 480, 1 female (sl = 2.6 mm), Cr 8177; BS 510, 1 female (sl = 2.3 mm), Cr 8116, 1 male (sl = 3.8 mm), Cr 8164; BS 862, 2 males (sl = 2.5, 2.9 mm), 3 females (sl = 1.5–2.6 mm), Cr 8160; BS 870, 2 males (sl 1.9, 2.5 mm), 1 female (sl = 1.5 mm), Cr 8157.

NZMD collection: Colville Channel, 14.11.62, 48 m, 2 males (cl = 3.0, 9.0 mm), 3 ovigerous females (cl = 3.5–6.0 mm), Cr 9706.

PMBS collection: East of Taiaroa Heads, -11.68, 1 female (sl = 3.3 mm), Stn Mu 66-76, 1 male (cl = 7 mm); Stn Mu 66-77, 5 males, (cl = 4.0–7.0 mm); Stn Mu 75-23, 3 females (sl = 1.5–1.8 mm), 2 juveniles; Stn MU 75-57, 1 male (cl = 5.0 mm).

PMcL collection: Greater Omaha Bay, Stn B12a, 1 male, 3 ovigerous females (sl = 1.2–2.7 mm); Stn B12b, 2 male, 1 female, 3 ovigerous females (sl = 1.4–4.9 mm); Stn B13, 1 ovigerous female (sl = 2.9 mm); Stn B19, 1 male (sl = 3.4 mm).

**DESCRIPTION:** Shield (Fig. 54a) as long or longer than broad. Rostrum triangular, usually with terminal denticle. Ocular peduncles 0.75–0.85 length of shield; corneal diameter approximately 0.25 peduncular length. Ocular acicles triangular, terminating subacutely, with prominent submarginal tooth. Antennular peduncles overreach distal margins of corneas by 0.50–0.75 length of ultimate segment. Antennal peduncles overreach distal margins of corneas by 0.25–0.75 length of fifth segment; second segment with laterodistal projection terminating in simple or bifid tooth, mesial margin often with 2 or 3 denticles. Antennal acicles usually reaching to bases of corneas.

Right cheliped (Fig. 54b) with chela subrectangular in dorsal view; dorsal surface of dactyl with flattened tubercles, often covering entire surface, dorsomesial margin with row of closely spaced teeth; palm with dorsomesial, dorsoproximal and dorsolateral margins each with row of closely spaced, blunt or acute teeth joined to completely circumscribe palm and fixed finger, dorsal surfaces generally level, covered with flattened, mushroom-like, contiguous tubercles, occasionally those of midline developed into low, tear drop-shaped tubercles. Carpus with row of acute

teeth on dorsomesial margin, dorsal surface flattened, with 1 or 2 spinose tubercles near distal margin and row of spiniform tubercles laterad of midline; ventrolateral margin smooth, but adjacent lateral face often with low crenulate ridge.

Left cheliped (Fig. 54c) somewhat shorter than right; propodal-carpal angle of articulation 80–90° from horizontal plane. Dorsal surface of dactyl with 2 or 3 irregular rows of small granules or tubercles, dorsomesial margin with row of small teeth. Palm with dorsolateral margin strongly elevated proximally and armed with row of strong, compressed teeth, dorsal surface covered with usually low, flattened, mushroom-like, contiguous tubercles laterally. Carpus with row of very prominent, acute tubercles in dorsal midline.

Ambulatory legs (Fig. 54d) generally similar from right to left. Dactyls with dorsal margins each armed with somewhat spinulose protuberances or small teeth (second) or low protuberances (third), ventral margins each with row of 8–12 spiniform setae. Propodi with low protuberances and tufts of setae on dorsal surfaces. Carpi each with spine at dorsodistal margin, second (at least right) also with 1 spine in proximal half of dorsal margin. Sternite of third pereopods with subovate or subsemicircular anterior lobe. Sternites of fourth and fifth pereopods often with capsulate setae.

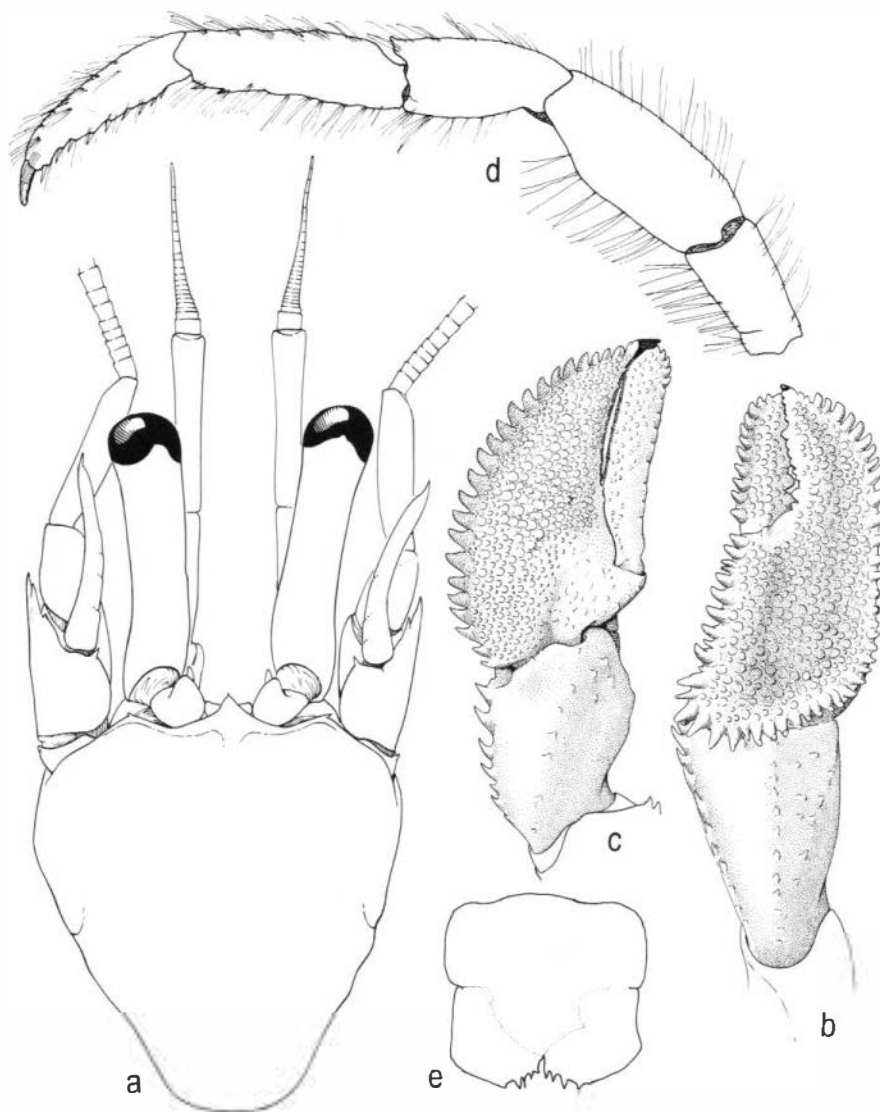
Uropods most frequently symmetrical. Telson (Fig. 43e) with terminal margins armed with few, small to moderately large teeth near median cleft.

**COLOUR:** In life, ocular peduncles and antennules uniform pale brown; antennae purple-brown with narrow white bars. Chelipeds and walking legs purple-brown ground colour with irregular white mottling (Schembri & McLay 1983). In preservative, chelas with dorsal surfaces uniformly orange or mottled orange and white. Dactyls of ambulatory legs white proximally, medially and distally separated by bands of colour, and with one coloured longitudinal striped on lateral and mesial face; propodi and meri each with median band of colour, wider in former; propodi also with coloured median longitudinal stripe on mesial and lateral faces; carpi with median band of colour and two or three longitudinal stripes of colour on lateral faces.

**REPRODUCTION:** Slightly more than 25% of the females in the collections were carrying eggs, and these were collected from May through December. Egg size is small (0.43–0.49 mm diameter), and the females often carry 200–300 eggs.

**HABITAT:** Frequently found occupying bryozoan tubes;

Fig. 54. *Lophopagurus (Australeremus) laurentae* (McLaughlin & Gunn, 1992), NZOI Stn D127, male (cl = 7.0 mm): a, shield and cephalic appendages (setation and aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view, setation omitted); c, carpus and chela of left cheliped (dorsal view, setation omitted); d, third left pereopod (lateral view); e, telson (setation omitted). Magnifications equal 18x (b-d), 28x (a), 37.5x (e).



however, the specimen collected from the Chatham Islands reportedly was "dug from burrows in sand". Although the depth range for *L. (A.) laurentae* is 7 to 139–144 m, it has been found most commonly at depths between 25 and 60 m.

REMARKS: As previously indicated, *L. (A.) laurentae* is most closely allied to *L. (A.) cookii*, sharing with that species the distinctive ornamentation of mushroom-shaped, flatten tubercles on the dorsal surfaces of the chelas. However, the surface of the right chela in *L. (A.) laurentae* is relatively level, whereas that of *L. (A.) cookii* is marked by a deep dorsomesial rectangular depression. Additionally, the carpi of the second pereopods, particularly the right, are armed only with a dorsodistal tooth and a second acute tubercle on the dorsal surface proximally in *L. (A.) laurentae*. This surface is armed with four or five teeth or acute tubercles in *L. (A.) cookii*. The occurrence of capsulate

setae on the sternites of the fourth and fifth pereopods appears to be restricted to *L. (A.) laurentae*. *Lophopagurus (A.) laurentae* is set apart, not only from *L. (A.) cookii*, but also *L. (A.) cristatus* and *L. (A.) kirkii*, by the absence of a red patch of colour at the articulation of the dactyls and fixed fingers that is found in all three latter species.

RECORDS FROM NEW ZEALAND: Western and eastern New Zealand and Chatham Islands; 7 to 139–144 m.

DISTRIBUTION: Endemic to New Zealand.

*Lophopagurus (Australeremus) cristatus* (H. Milne Edwards, 1836) (Fig. 55)

*Pagurus cristatus* H. Milne Edwards, 1836: 269; 1837: 218; 1848: 60; Dana 1852c: 441; Gordan 1956: 329 (lit.).



*Eupagurus cristatus*: Miers 1876b: 62 (? in part); Hutton 1882: 264 (list); Filhol 1885d: 412 Alcock 1905b: 176 (list); Thomson 1899: 184.  
*Eupagurus Krikii* Filhol, 1883: 66 (in part) (misspelling).  
*Eupagurus Kirkii*: Filhol 1885b: 27 (in part).  
*Eupagurus Kirkii*: Filhol 1885d: 416 (in part).  
*?Eupagurus cookii*: Thompson 1930: 270 (in part).  
*Pylopagurus cristatus*: Forest & de Saint Laurent 1968: 145; McLaughlin 1981a: 3.  
*?Lophopagurus cristatus*: McLaughlin 1981a: 3.  
*Australeremus cristatus*: McLaughlin & Gunn 1992: 77, fig. 11.  
 [Not *Pagurus cristatus*: White & Doubleday 1843: 266; White 1847: 59 = *Pagurus novizealandiae* (Dana)].

#### TYPES:

Lectotype: male (cl = 11 mm), Quoy & Gaimard collection, MNHN Pg 5693.

Paralectotype: male (cl = 16 mm) mutilated, Quoy & Gaimard collection, MNHN Pg 5694.

TYPE LOCALITY: New Zealand.

#### OTHER MATERIAL EXAMINED:

NZOI Stns: B555, 1 female (cl = 15 mm); B620, 1 male (cl = 13.5 mm); B626, 6 males (cl = 8–16 mm), 8 females (cl = 10–14 mm), 5 ovigerous females (cl = 10.5–12 mm); B654, 3 males (cl = 8–11 mm), 1 ovigerous female (cl = 10.5 mm); C182, 1 small specimen, MNHN Pg 4346; C380, several specimens, various sizes, MNHN Pg 4363; SC486, 1 female (sl = 1.7 mm).

NMNZ collections: Off Kapiti Island, coll. F. Abernethy, Dec. 1953, 2 specimens, MNHN Pg 4366; Fitzroy Bay, Wellington, coll. P.E. Roberts, 2.7.66, 1 male (sl = 2.2 mm), Cr 9707; Motiti Island, 1 specimen, very poor condition, Cr 9804; approx. 3 mi off Kaikoura, coll. R. Pilgrim, 24.1.67, 30–60 m, 5 males, 4 females (sl = 5.7–7.4 mm), Cr 3965; Cook Strait (41°31.5'S, 174°48'E), 19.1.56, 128–146 m, 1 male (cl = 14 mm), 1 female (cl = 12.5 mm), Cr 9708; 22.2.56, 2 males (cl = 5.5, 7.5 mm), Cr 9709; Cook Strait (41°33'S, 174°50'E), 29.8.57, 247 m, 9 males (cl = 6.0–14.0 mm), 8 females (cl = 4.5–10 mm), Cr 9710; 1 specimen, MNHN Pg 4364; 1 male (sl = 3.0 mm), 1 female (sl = 2.5 mm), Cr 9711; Cook Strait (41°31'S, 174°46'E), 120–128 m, 1 male (cl = 17), Cr 9712; 1 male (cl = 18.5 mm) MNHN Pg 4362; Off Canterbury Bight (44°24.7'S, 171°31.3'E), 24.1.82, 36–29 m, 1 male (sl = 2.4 mm), Cr 8054.

NMNZ Stns: BS 530, 2 females (sl = 3.0, 3.8 mm), Cr 7552; BS 556, 43 males (sl = 4.2–9.8 mm), 5 females (sl = 5.5–6.7 mm), 12 ovigerous females (sl = 4.9–8.6 mm), Cr 7568, 9713; BS 731, 2 males (sl = 2.9, 5.1 mm), Cr 7573; BS 776, 2 males (sl = 4.0, 7.9 mm), 1 ovigerous female (sl = 8.0 mm), Cr 8200; BS 829, 1 male (sl = 2.4 mm), Cr 8134.

MNHN collections: Cook Strait, Filhol collection, 3 males (sl = 3.3–5.7 mm), MNHN Pg 5844.

NZMD collection: Cook Strait, 9.5.62, 146 m, 2 females (sl = 2.4, 3.8 mm), Cr 9714.

MCC collections: Off Parapuko River, coll. R. Mannering, January 1965, 51 m, 1 male (cl = 14.0 mm), 1 female (cl = 13.0 mm).

ZMUC collections: Between Albatross Point and Gannet Island, coll. Th. Mortensen, 11.1.15, 37 m, 2 females (sl = 1.0, 1.6 mm), 2 ovigerous females (sl = 1.6, 1.6 mm).

DESCRIPTION: Shield (Fig. 55a) approximately as broad as long. Rostrum triangular, acute. Ocular peduncles 0.50–0.65 length of shield; approximately 3.5 times as long as broad, with corneas weakly dilated; ocular acicles narrowly triangular. Antennular peduncles over-reaching distal margins of corneas by nearly entire length of ultimate segment. Antennal peduncles over-reaching distal margins of corneas by 0.50–0.65 length of fifth segment; second segment with latero-distal projection reaching bases of corneas, armed with 6–10 small teeth mesially. Antennal acicle over-reaching distal margins of corneas by 0.25–0.33 own length.

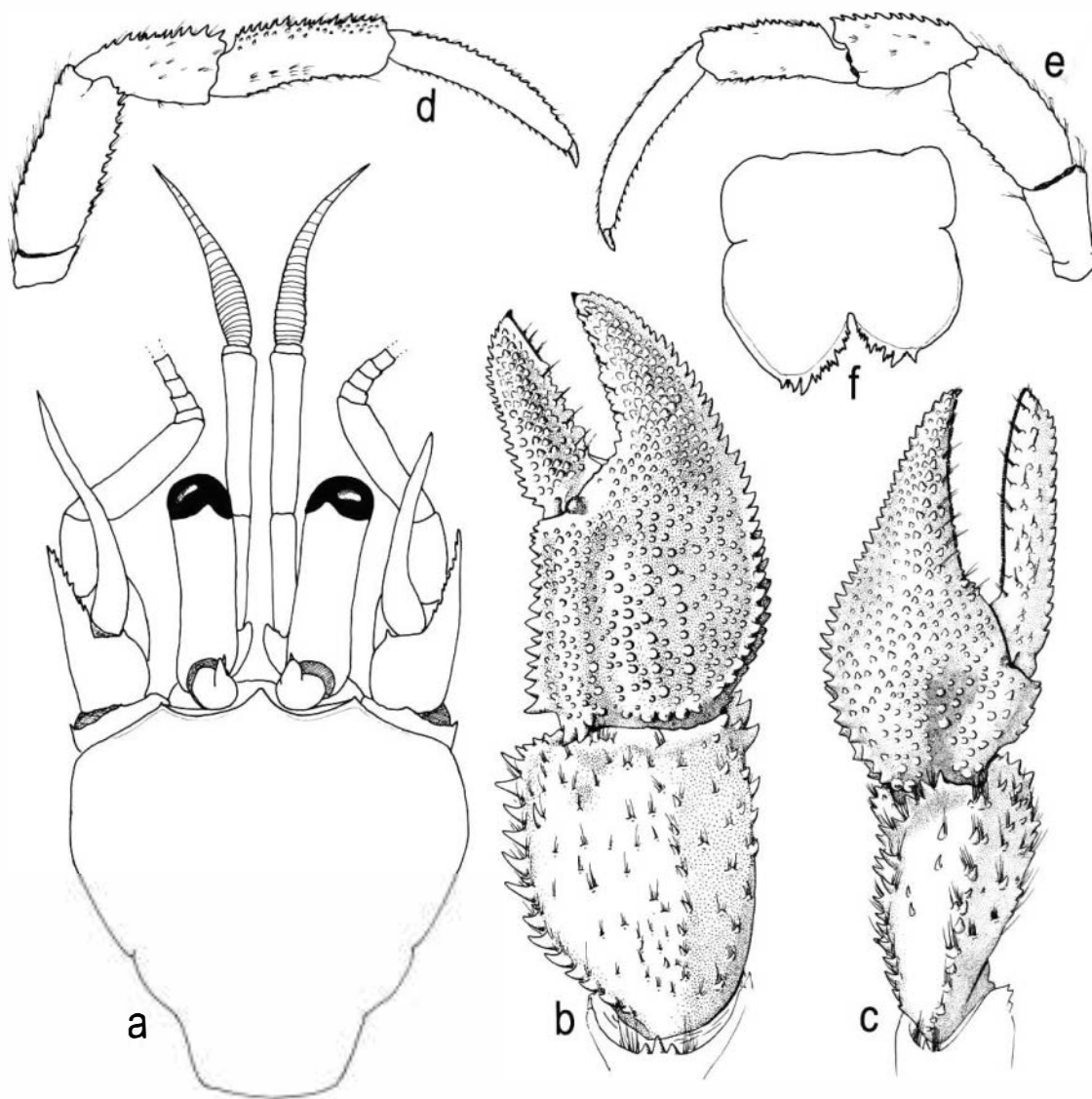
Right cheliped (Fig. 55b) with external margin of hand regularly convex, mesial margin nearly straight. Palm with row of acute teeth on dorsomesial margin. Dorsal surface covered with closely spaced, spinulose, tubercles or conical granules, midline with broad, low, longitudinal ridge separated from similar mesial ridge by longitudinal depression, 1 or 2 prominent teeth near dorsomesial margin proximally. Carpus with expanded or flared dorsomesial margin armed with row of closely spaced teeth, dorsal surface with few tubercles distally, irregular row of small spinose tubercles lateral to midline, dorsolateral margin with single or double row of small teeth.

Left cheliped (Fig. 55c) often with prominent hiatus between dactyl and fixed finger. Palm broadly expanded laterally, propodal-carpal angle of articulation approximately 80° from horizontal plane, dorsal surface somewhat convex, covered with small, acute tubercles or conical spinose granules, dorsolateral margin with row of closely spaced, acute or blunt teeth. Carpus with oblique row of strong spinose tubercles in dorsal midline and 1 or 2 irregular rows of smaller tubercles mesially and laterally.

Ambulatory legs (Fig. 55d, e) similar, slightly overreaching tip of right cheliped. Dactyls each with row of small calcareous tubercles on dorsal surface, at least on second; ventral margins each with row of 16–25 spiniform setae. Propodi each with row of denticles or tubercles and spinose setae on dorsal surface, ventral surfaces each with row of low protuberances and spiniform setae. Carpi each with row of prominent teeth on dorsal margin. Sternite of third pereopods with anterior lobe subsemiovalate, often with 1 or 2 denticles near anterior margin.

Telson (Fig. 55f) with posterior lobes slightly asymmetrical; terminal margins oblique, armed with 1–3 prominent and several short teeth.

COLOUR: In preservative, red-orange patch is present at the articulation of the dactyls and fixed fingers of both chelas.



**Fig. 55.** *Lophopagurus (Australeremus) cristatus* (Filhol, 1885), NZOI Stn B620, male (cl = 13.5 mm): a, shield and cephalic appendages (setation and aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view); c, carpus and chela of left cheliped (dorsal view); d, second right pereopod (lateral view); e, third left pereopod (lateral view); f, telson (setation omitted). Magnifications equal 6x (d, e), 10x (b, c), 18x (a), 25x (f).

**REPRODUCTION:** Ovigerous females were collected in September, October, January, and March. All females carried a considerable number of small eggs, diameters of which varied between 0.46 and 0.55 mm.

**HABITAT:** Gastropod shells.

**REMARKS:** H. Milne Edwards (1836) described *L. (A.) cristatus* (as *Pagurus*) from specimens collected in New Zealand by J.R.E. Quoy and J.P. Gaimard during the cruise of the *Astrolabe* (1826–1829). Considerably later, Filhol (1883) presented preliminary descriptions of four new species of pagurids that he collected during

a voyage to New Zealand, including “*Eupagurus Krikii*” [sic]. We have reexamined Filhol’s (1883) type series of *L. (A.) kirkii* and found that it contained representatives of both Filhol’s species and *L. (A.) cristatus*. *Lophopagurus (A.) kirkii* is defined by its lectotype, herein selected; Filhol’s (1883, 1885b, 1885d) specimens of *L. (A.) cristatus* are reported as material from the “Filhol collection”. McLaughlin and Gunn (1992) presented a detailed review of Miers (1876b) confusion about the identity of H. Milne Edwards’ species, as well as the probable confounding of *L. (A.) cristatus* and *L. (A.) cookii* by Thompson (1930) that need not be repeated here.



McLaughlin and Gunn (1992) also reported four male specimens of *L. (A.) cristatus* that had female paired first pleopods. Only one of these specimens exhibited any indication of rhizocephalan infestation. Among the specimens we have examined, we did not find additional males with paired first pleopods; however, one male (sl = 7.7 mm) from NMNZ Stn BS 556 did have the four unpaired left pleopods characteristic of females.

In chela morphology, *L. (A.) cristatus* most closely resembles *L. (A.) cookii* and *L. (A.) kirkii*. All three species exhibit a longitudinal depression on the dorsal surface of the palm mesiad of the midline. In life, these same species are characterised by a patch of red colour on the chela at the articulation of the dactyl and fixed finger. This colouration often persists for some time in preservative. The armature of the chelas in *L. (A.) cristatus* and *L. (A.) kirkii* differs from that of *L. (A.) cookii* in being a covering of spinose tubercles or conical granules. In the latter species the chelas are covered by flattened, mushroom-shaped tubercles. *Lophopagurus (A.) cristatus* is most readily distinguished from *L. (A.) kirkii* by the armature of the ambulatory legs. The dactyls, propodi and carpi of *L. (A.) cristatus*, all are armed on the dorsal surfaces with teeth or acute tubercles, whereas in *L. (A.) kirkii* only the carpi of the second pereopods have teeth or tubercles on the dorsal surfaces.

RECORDS FROM NEW ZEALAND: Eastern New Zealand; 30–274 m.

DISTRIBUTION: Endemic to New Zealand.

***Lophopagurus (Australeremus) kirkii*** (Filhol, 1883)  
(Fig. 56, Pl. 5, fig. 4)

*Eupagurus Krikii* Filhol, 1883: 66 (in part) (misspelling).  
*Eupagurus Kirki*: Filhol 1885b: 27 (in part); 1886: pl. 51, fig. 5.  
*Eupagurus Kirkii*: Filhol 1885d: 416 (in part).  
? *Eupagurus kirki*: Borradaile 1916: 95.  
? *Eupagurus kirkii*: Thompson 1930: 269.  
*Pylopagurus kirkii*: Forest & de Saint Laurent 1968: 145.  
*Pylopagurus kirki*: McLaughlin 1981a: 3.  
*Australeremus kirkii*: McLaughlin & Gunn 1992: 80, fig. 12.  
[Not *Eupagurus kirkii* Miers, 1884: 267, pl. 28, fig. C =  
*Eupagurus hedleyi* Grant & McCulloch, 1906].  
[Not *Eupagurus kirkii*: Thomson 1899: 175, pl. 20, figs 8–10  
= *Lophopagurus (L.) foresti* McLaughlin & Gunn, 1992].

TYPES:

Lectotype (herein selected): male (sl = 5.2 mm), Filhol collection, MNHN Pg 5845.

Paralectotypes: 2 males (sl = 5.8, 6.2 mm), Filhol collection, MNHN Pg 5846.

TYPE LOCALITY: Cook Strait, New Zealand.

OTHER MATERIAL EXAMINED:

NZOI Stns: B498, 1 male (sl = 4.0 mm); B805, 1 specimen, MNHN Pg 4406; E137, 1 specimen (fragmented); E365, 1 specimen, MNHN Pg 4306.

NMNZ collections: Slipper Island, 33 m, coll. B.L. Godfriaux, 10.6.70, 2 males (sl = 2.7, 3.6 mm), Cr 9715; Shelly Bay, Wellington, coll. J. Moreland, 28.6.53, 1 male (sl = 27 mm), Cr 9716; West of Tory channel, coll. J. Moreland, 8.11.61, 16 m, 1 male (sl = 2.3 mm), Cr 9717.

NMNZ Stns: BS 239, 1 ovigerous female (sl = 1.8 mm), 1 juvenile (sl = 1.2 mm), Cr 8192; BS 321, 2 males (sl = 2.1, 2.4 mm), Cr 9718; BS 335, 1 female (sl = 2.0 mm), 1 ovigerous female (sl = 1.7 mm), Cr 8183; BS 340, 1 male (sl = 1.7 mm), Cr 8182; BS 415, 1 male (sl = 2.4 mm), Cr 8180; BS 432, 3 males (2 with rhizocephalans) (sl = 2.4–5.2 mm), Cr 8140; BS 470, 1 male (sl = 2.6 mm), Cr 8178; BS 515, 1 specimen, MNHN Pg BS 525, 3 males (sl = 2.3–2.9 mm), Cr 9719; BS 526, 2 males (sl = 3.6, 3.9 mm), Cr 9720; BS 539, 24 males (sl = 1.7–4.3 mm), 15 females (sl = 1.3–2.3 mm), 1 ovigerous female (sl = 2.4 mm), 1 juvenile (sl = 1.2 mm), Cr 9809; BS 732, 1 specimen, MNHN Pg 4408; BS 776, 1 ovigerous female (sl = 7.0 mm), Cr 9721; BS 862, 1 male (sl = 2.6 mm), Cr 8161; BS 870, 1 male (sl = 2.3 mm), 2 females (sl = 1.7, 1.8 mm), Cr 8156; BS 871, 2 males (sl = 2.4, 3.0 mm), 1 female (sl = 2.3 mm), Cr 7591; BS 915, 11 males (sl = 2.0–4.4 mm), 2 females (sl = 1.5, 2.1 mm), 1 juvenile (sl = 1.1 mm), Cr 7566; BS 916, 1 male (sl = 1.5 mm), Cr 9722.

MNHN collections: Cook Strait, 1884–1886, 1891, Filhol collection, 18 males (cl = 6–9 mm), 4 females (cl = 4–8 mm), MNHN.

NZMD collection: Pakiri Beach, Hauraki Gulf, 9.12.65, 50 m, 3 males (2.0–2.4 mm), 1 female (sl = 2.0 mm), Cr 9723.

PMcL collection: Great Omaha Bay, Taylor Stn A13, 2 males, 1 ovigerous female (sl = 1.7–2.3 mm); A25, 1 male, 2 ovigerous females (sl = 2.0–2.4 mm); A49, 1 male, 1 female (sl = 1.3, 3.0 mm); A73, 3 males, 1 ovigerous female (sl = 1.0–2.4 mm); B5, 1 male (with rhizocephalan) (sl = 1.8 mm); C27, 4 males, 1 female (sl = 1.8–3.3 mm), NZOI.

DESCRIPTION: Shield (Fig. 56a) longer than broad; posterior carapace with tufts of setae adjacent to cervical groove. Rostrum triangular, acute. Ocular peduncles moderately long and slender, 0.75–0.80 length of shield, 4.2–4.4 times as long as broad; corneas slightly dilated. Antennular peduncles overreaching distal margins of corneas by 0.50–0.65 length of ultimate segment. Antennal peduncles overreaching distal margins of corneas by 0.20–0.50 the length of fifth segment; laterodistal projection of second segment with 1–5 denticles on mesial margin, 1 or 2 on lateral margin. Antennal acicles reaching nearly to or sometimes surpassing distal margins of corneas.

Right cheliped (Fig. 56b) elongate, with dorso-mesial margin nearly straight, dorsolateral margin weakly convex; dorsal surface of palm entirely, but

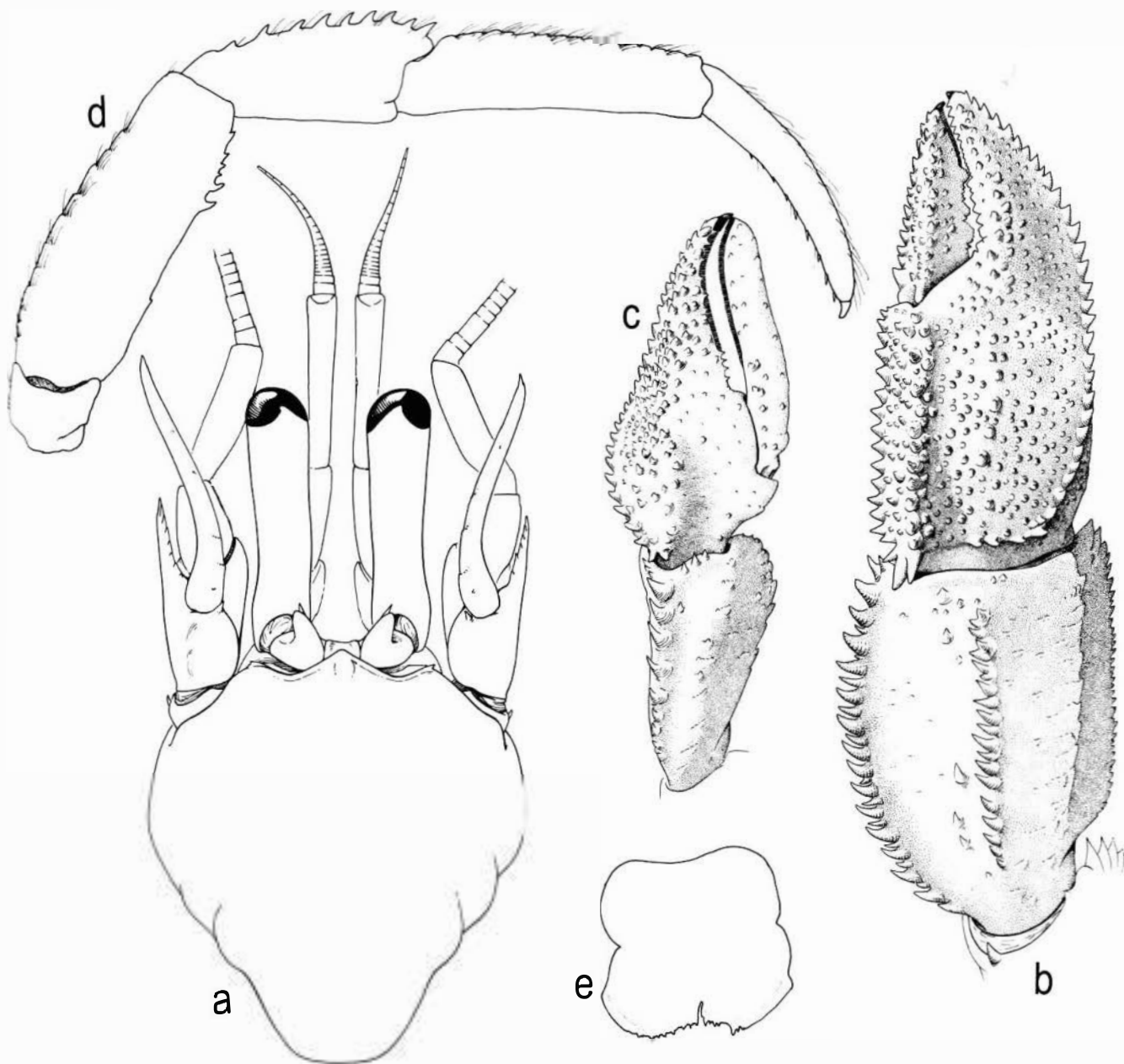


Fig. 56. *Lophopagurus (Australeremus) kirkii* (Filhol, 1883), a, b, d, e, Filhol collection, male paralectotype (sl = 6.2 mm), c, male paralectotype (sl = 5.8 mm), MNHN Pg 5846: a, shield and cephalic appendages (setation and aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view); c, carpus and chela of left cheliped (dorsal view, setation omitted); d, second right pereopod (lateral view); e, telson (setation omitted). Magnifications equal 12x (c, d), 18x (b), 20x (a), 25x (e).

sometimes weakly granulose or tuberculate, depressed dorsomesial margin armed with row of moderately small teeth, 1 prominent tooth at proximal angle, dorsolateral and dorsoproximal margins each with row of teeth, dorsal surface of palm slightly elevated in midline and near dorsomesial margin and armed with irregular single or double row of small acute tubercles. Carpus with row of teeth on dorso-

mesial margin, dorsal surface with row of often widely spaced tubercles mesiad of midline and row of closely spaced, spinose tubercles laterad of midline.

Left cheliped (Fig. 56c) with propodal-carpal angle of articulation 50–60° from horizontal plane. Palm with convex dorsal surface bearing numerous spinulose tubercles or granules, usually with median low, rounded, longitudinal ridge, frequently armed with



more prominent acute tubercles, dorsolateral margin with row of small teeth. Carpus with row of strong, acute teeth on dorsolateral margin, dorsomesial margin sloping distally and with row of small tubercles or transverse ridges.

Second and third pereopods (Fig. 56d) similar from left to right. Dactyls each with dorsal and ventral row of small spiniform setae on mesial faces, ventral margins each with row of 9–16 larger spiniform setae. Propodi each with low protuberances dorsally. Carpi each with row of 4–9 teeth and tufts of setae on dorsal margin (second) or low protuberances and single dorsodistal tooth (third), rarely third also with 1 or 2 additional small teeth. Sternite of third pereopods with anterior lobe subsemicircular to subsemiovalate, anterior margin sometimes with 1 or 2 calcareous teeth.

Telson (Fig. 56e) with terminal margins subcircular to oblique and armed with several calcareous teeth, strongest toward outer angles.

**COLOUR:** "In recently preserved material, shield mottled red-orange. Ocular peduncles white, acicles with faint red-orange hue. Antennular peduncles opaque with orange at distal margins of ultimate and penultimate segments. Antennal peduncles orange; flagella in proximal half red-orange dorsally and ventrally, white laterally and mesially, with every fourth or fifth article completely white; distal half uniformly red-orange interrupted by white every 4–6 articles. Chelas red-orange with tips of dactyls and fixed fingers white or light orange and with red patches on palms dorsally and ventrally at point of articulation with dactyls and ventrally at articulation with carpi, spines red. Carpi uniformly red-orange, darkest at proximal margins. Meri red-orange with band of white at distal margins. Ambulatory legs with uniformly orange dactyls; propodi and carpi light orange or white with longitudinal orange or red-orange stripes; meri orange, but with color fading unevenly." (McLaughlin & Gunn 1992).

**REPRODUCTION:** Males outnumber females in the present collection by more than 2:1, and a similar disparity appears in the material reported on by McLaughlin and Gunn (1992). Of the 31 females we examined, only eight were ovigerous, and half of those were collected in Great Omaha Bay during May–August. The collection sites of the remaining four females were widely dispersed from the Bay of Islands to western Tasman Bay during November to March. Each of the ovigerous females was carrying several hundred small eggs, diameters ranging from 0.38 to 0.49 mm. The smallest ovigerous female measured only 1.1 mm in shield length, while the largest had a shield length of 7 mm.

**HABITAT:** Collected on shell substrates in associations with Bryozoa.

**REMARKS:** In his original brief description of this species, Filhol (1883) misspelled the specific epithet as *Krikii*. Filhol (1885b) provided a more substantial description of the taxon, indicating once again "Nov. spec.", but corrected the spelling from Krik to Kirk. However, in this description and in his listing of taxa (Filhol 1885b: 27, 51) the species is cited as "*Kirki*", with the single "i" ending. This publication was followed by his more familiar report, "Passage de Vénus sur le soleil. Mission de l'Île Campbell", in which the species is cited as *Eupagurus Kirkii* (Filhol 1885d: 416). However, in the accompanying Atlas (Filhol, 1885e: 28, pl. 51, fig. 5), the spelling is again "*Kirki*". Since only obvious typing errors, or *lapsus calami* must be corrected in original spelling of species names, Filhol's (1885b) correction of his specific name from Krik to Kirk represents a correction of an original incorrect spelling (Art. 32.5, International Code of Zoological Nomenclature 2000). Therefore, his and other authors' subsequent spellings, "*Kirki*" or *kirki* are incorrect (Art. 33.4, ICZN).

Miers (1884) described a new species from the Arafura Sea as *Eupagurus kirkii*, apparently unaware that it was homonymous with *Eupagurus kirkii* Filhol, 1883. The replacement name, *Eupagurus hedleyi* was proposed by Grant and McCulloch (1906).

Thomson (1899) reported *Eupagurus kirkii* Filhol from Dunedin and Stewart Island. Although his illustrations (Thomson, 1899: pl. 20, figs 8–10) are not particularly informative, his description, including colour notes, leaves little doubt that he was not describing *Lophopagurus* (A.) *kirkii*, but rather the species subsequently described as *L. (L.) foresti* McLaughlin & Gunn, 1992.

Borradaile (1916) remarked that his specimens of *Eupagurus kirki* differed from the description given by Thomson (1899) in the length of the antennular peduncles. As noted above, Thomson incorrectly attributed specimens to Filhol's species, thus it is quite possible that Borradaile actually did have *L. (A.) kirkii*. However, as he gave no further information, we can only consider his report to be questionable. As previously discussed by McLaughlin and Gunn (1992), Thompson (1930) referred some of his specimens tentatively to *E. kirki*. We have not reexamined his material.

*Lophopagurus* (A.) *kirkii* shares with the other members of the subgenus *Australeremus* the circumscription of the right chela by a row of prominent, closely spaced teeth, and is superficially quite similar in chela conformation to *L. (A.) cristatus*. However, *L. (A.) kirkii* provides a morphological link to the nom-

inal subgenus in the development of the left cheliped. The propodal-carpal torsion is much less pronounced in *L. (A.) kirkii*; the dorsal midline of the palm has a tendency to develop a distinct, albeit low and generally rounded ridge; and the carpus is much more trapezoidal than in the majority of the other species of the subgenus *Australeremus*. *Lophopagurus (A.) kirkii* is a small species, with females capable of reproduction at a very small shield length. It is most readily distinguished from the larger *L. (A.) cristatus* by the absence of teeth on the dorsal surfaces of the dactyls and propodi of the ambulatory legs, and by the stronger and more regular row of spiniform tubercles on the dorsolateral surface of the carpus of the right cheliped.

**RECORDS FROM NEW ZEALAND:** Eastern North Island, western Tasman Bay, Cook Strait, eastern South Island to the Otago Peninsula; 2–88 m.

**DISTRIBUTION:** Endemic to New Zealand.

***Lophopagurus (Australeremus) triserratus* (Ortmann, 1892) (Fig. 57)**

*Eupagurus triserratus* Ortmann, 1892: 308, pl. 12, fig. 15.

*Eupagurus tricarinatus*: Balss 1913: 58 [? not *Eupagurus tricarinatus* Stimpson, 1858].

*Eupagurus triserratus*(?): Shiino 1936: 184.

*Eupagurus (Eupagurus) triserratus*: Melin 1939: 29, figs 9, 10.

*Pagurus triserratus*: Kim 1964: 5, pl. 1, fig. 6; 970: 8; 1973: 225, 599, fig. 50, pl. 65, fig. 30.

*Pylopagurus serpulophilus* Miyake, 1978: 120, pl. 4, fig. 4; 1982: 120, pl. 40, fig. 5; McLaughlin 1981a: 3.

*Pagurus tricarinatus*: Miyake 1982: 197 [not *Pagurus tricarinatus* (Stimpson, 1858)].

*Australeremus triserratus*: McLaughlin & Gunn 1992: 87, fig. 14, pl. 1; McLaughlin 1997: 521, fig 24 a, c, g.

#### Types:

Lectotype: male (sl = 3.6 mm), MZUS.

Paralectotype: male (sl = 3.3 mm), MZUS.

**TYPE LOCALITY:** Sagami Bay, Japan, 100 m.

#### Other Material Examined:

NZOI: Stn E864, 1 male (sl = 0.6 mm), 3 females (sl = 1.0–1.2 mm), 1 ovigerous female (sl = 1.0 mm).

NMNZ: Stn BS 207, 1 male (sl = 1.2 mm), Cr 9724.

AM: NZOI Stn U207, 3 males (sl = 1.3–1.7 mm), 5 females (sl = 1.3–1.7 mm), 1 ovigerous female (sl = 1.2 mm), AM 40416.

**DESCRIPTION:** Shield (Fig. 57a) slightly to considerably longer than broad. Rostrum acutely triangular. Ocular peduncles 0.65–0.95 length of shield, slightly shorter

than fully extended antennular peduncles; ocular acicles narrowly triangular. Antennal peduncles over-reaching distal margins of corneas by 0.25–0.50 length of ultimate segment; second segment with well-developed laterodistal projection reaching beyond proximal margin of fourth peduncular segment. Antennal acicle usually reaching beyond proximal margin of fifth peduncular segment, but not to distal margin of cornea, with small terminal tooth.

Right cheliped (Fig. 57b) with row of teeth on dorsomesial margin of dactyl, dorsal surface with scattered, blunt or spinulose tubercles. Dorsomesial, dorsoproximal, and dorsolateral margins of palm each with row of acute teeth entirely circumscribing palm and fixed finger, dorsal surface slightly convex and with numerous blunt or spinulose tubercles, midline with single row of larger spinose tubercles decreasing in size and often becoming obsolete on fixed finger. Carpus often with appreciably concave mesial face, dorsomesial margin with row of teeth, dorsal surface laterad of midline with row of spinose tubercles.

Left cheliped (Fig. 57c) with propodal-carpal articulation 75–80° from horizontal plane. Dactyl dorsoventrally flattened; palm and fixed finger with row of strong teeth on dorsolateral margin, dorsal surfaces generally flattened, armed with scattered tubercles, sometimes set in 2 irregular rows. Carpus with row of acute teeth on dorsal margin, often 1 distinctly larger.

Ambulatory legs (Fig. 57d) generally similar and with moderate abundance of long setae, particularly dorsally and ventrally on all segments. Dactyls with 6–11 spiniform setae on ventral margins; dorsal margins unarmed. Propodi with low protuberances on dorsal surfaces. Carpi each with 1 tooth at dorso-distal angle, second occasionally also with 1 additional tooth on dorsal surface proximally. Meri unarmed. Sternite of third pereopods with subsemioval anterior lobe.

Uropods symmetrical. Telson (Fig. 57e) with terminal margins of posterior lobes straight or slightly oblique, armed with 2–4 strong spines and occasionally 1 or 2 small spines.

**COLOUR:** In preservative, ground colour of body and legs light reddish-brown. Carapace with a pair of dark reddish-brown spots before and after cervical groove.

Antennal flagellum with light and dark reddish-brown segments alternating. Chela and carpus dark reddish-brown; merus light reddish-brown with three dark cross-bands. Ambulatory legs light reddish-brown; meri and dactyls each with two dark cross-bands; carpus and propodus each with two dark cross-bands (Miyake 1978).



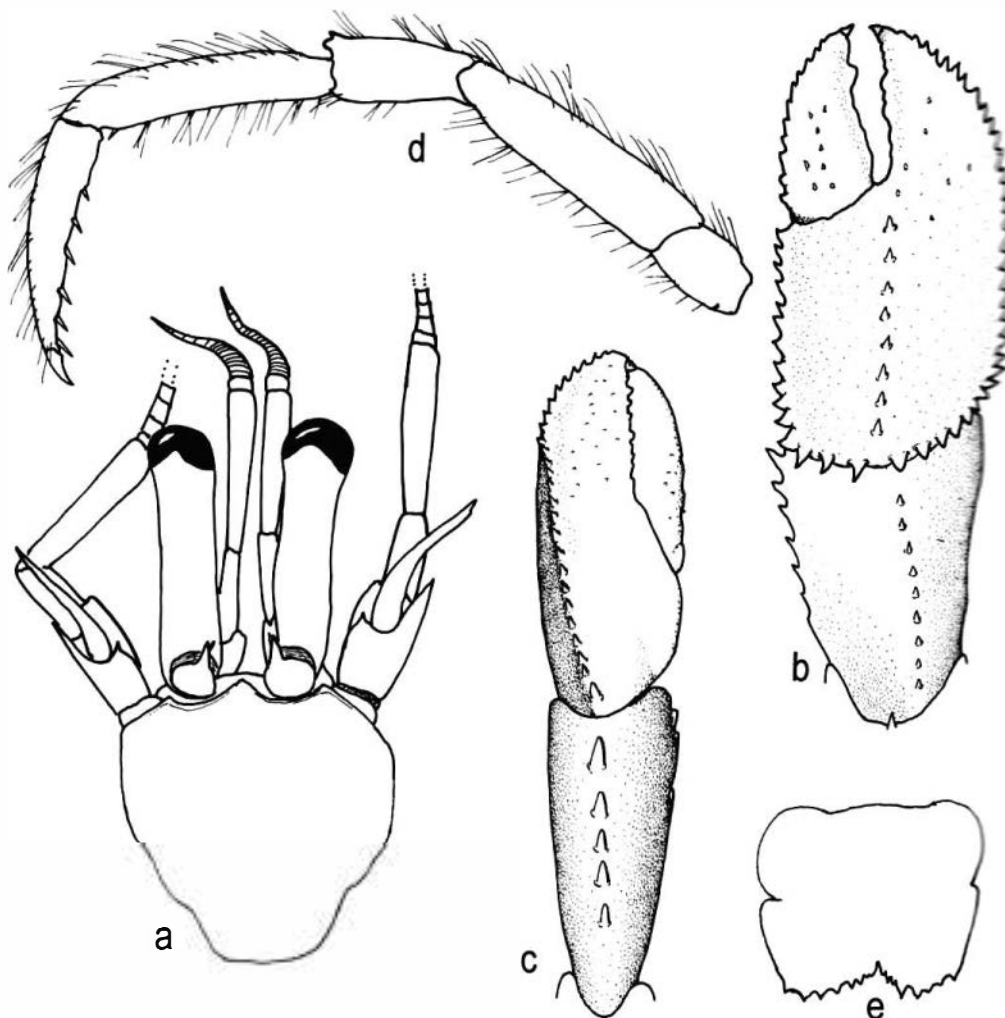


Fig. 57. *Lophopagurus* (*Australeremus*) *triserratus* (Ortmann, 1892), NZOI Stn E864, female (sl = 1.1 mm): a, shield and cephalic appendages (setation and aesthetascs omitted); b, carpus and chela of rightcheliped (dorsal view, setation omitted); c, carpus and chela of left cheliped (dorsal view, setation omitted); d) left second pereopod (lateral view); e, telson (setation omitted). Magnifications equal 25x (a-d), 50x (e).

**REPRODUCTION:** Only two very small ovigerous females have been collected from New Zealand waters, and both were carrying a relatively few number of eggs. Egg diameter ranged from 0.40 to 0.49 mm.

**HABITAT:** Often in serpulid worm tubes; 60–400 m.

**REMARKS:** In their review of *Australeremus*, McLaughlin and Gunn (1992) discussed the confusion apparent in some of the earlier literature (e.g., Balss 1913; Miyake 1978, 1982) over the identities of *Eupagurus tricarinatus* Stimpson, 1858 and *Eupagurus triserratus*. After examining Ortmann's type material, McLaughlin and Gunn (1992) transferred his species to *Australeremus*. They concluded that Stimpson's (1858) unique specimen of *E. tricarinatus* apparently was no longer extant. However, specimens seeming to agree with Stimpson's description were subsequently found

and transferred first to the genus *Ceratopagurus* (cf. McLaughlin 1992), and later to *Nematopagurus* (cf. McLaughlin & Sandberg 1995).

As a corollary of their study of the New Zealand Coenobitoidea, Forest and McLaughlin (1998) have shown that two diogenid species, *Cancellus investigatoris* Alcock, 1905 and *Paguristes setosus* (H. Milne Edwards, 1848), long considered part of the Japanese fauna, actually represent distinct taxa. Quite the contrary is true in certain pagurid species, particularly *L.(A.) triserratus*. In their review of *Australeremus*, McLaughlin and Gunn (1992) reported the southern limit of this Japanese species as the South China Sea, southwest of Kaohsiuhg, Taiwan. Its southern range was extended when McLaughlin (1997) reported a single specimen from the Tanimbar Islands of Indonesia. Its discovery in New Zealand increases the southern boundary farther again.

As may be seen in Figures 57b, c, the dorsal surfaces of the chelas in the New Zealand specimens are very weakly armed, with only the marginal teeth and median row of longitudinal, spinose tubercles well developed. This variation from the general description provided for the species is undoubtedly attributable to the very small sizes (sl = 0.6–1.2 mm) of the specimens, as well as the considerable decalcification of all appendages.

RECORDS FROM NEW ZEALAND: Bay of Plenty, 110–183 m.

DISTRIBUTION: Sagami Bay, Sea of Sagami, Tanabe Bay, Amakusa, Bonin Islands, Japan; East and South China Seas; Indonesia; southeastern Australia; New Zealand.

*Lophopagurus (Australeremus) stewarti* (Filhol, 1883)  
(Fig. 58, Pl. 5, figs 1, 2)

*Eupagurus Stewarti* Filhol, 1883: 67; 1885: 418, pl. 51, fig. 3.

*Eupagurus stewarti*: Thomson 1899: 180.

*Pylopagurus stewarti*: Forest & de Saint Laurent 1968: 145;

Schembri & McLay 1983: 30, figs 12a, b, 14.

*Pagurus stewarti*: Fenwick, 1978: 206.

*Australeremus stewarti*: McLaughlin & Gunn 1992: 83, figs 8B, D, F; fig. 14.

TYPES:

Lectotype, herein selected: male (sl = 4.1 mm, cl = 7.0 mm), MNHN Pg 431.

Paralectotype, male (sl = 2.2 mm, cl = 4.0 mm), MNHN Pg 432.

TYPE LOCALITY: East coast of Stewart Island.

OTHER MATERIAL EXAMINED:

NZOI Stns: A701, 2 males (cl = 2.0, 5.0 mm), 2 females (cl = 3.5, 5.0 mm); A702, 1 male (cl = 4.0 mm), 1 female (cl = 2.0 mm), MNHN Pg 4353; A703, 2 females (cl = 3.0, 4.0 mm); A704, 8 males (cl = 4.0–6.0 mm), 13 females (cl = 3.5–7.0 mm); A705, 2 males (cl = 3.5, 4.0 mm), MNHN Pg 4355; A714, 8 males (cl = 4.0–6.0 mm), 4 females (cl = 3.5–4.0 mm); A717, 1 male (cl = 6.0 mm), MNHN Pg 4357; A746, 2 males (cl = 3.5, 5.0 mm), 1 female (sl = 2.8 mm); A854, 1 male (cl = 7.0 mm), 1 female (cl = 5.0 mm), MNHN Pg 4341; A898, 2 males (cl = 3.5, 6.0 mm), 3 ovigerous females (cl = 4.0–6.0 mm); A899, 2 males (sl = 2.1, 2.9 mm), 1 female (sl = 2.6 mm); A900, 1 ovigerous female (cl = 4.0 mm); A916, 12 males (sl = 1.2–2.7 mm), 8 females (sl = 1.8–2.9 mm), 9 ovigerous females (sl = 1.4–2.7 mm), plus 3 specimens in very poor condition; A917, 23 males (cl = 2.0–6.0 mm), 1 female (cl = 3.5 mm), 6 ovigerous females (cl = 2.5–5 mm), MNHN Pg 4339; B196, 1 mutilated specimen; B219, 1 male (sl = 3.2 mm), 2 females (sl = 2.0, 2.4 mm); B488, 1 male (cl = 5.0 mm); B489, 2 females (sl = 1.2, 2.7 mm); B560, 1 male (cl = 7.0 mm); B567, 1 male (cl = 5.0 mm); B581, 2 males (cl =

4.0 mm), 1 female (cl = 5.0 mm); B582, 1 female (cl = 4.5 mm); B591, 1 male (sl = 2.3 mm); C617, 1 male (cl = 6.0 mm), MNHN Pg 4342; D1, 3 males (cl = 3.0–3.5 mm), 5 females (cl = 2.5–3.5 mm); SD5, 1 female (cl = 2.5 mm), MNHN Pg 4358; D35, 5 males (sl = 1.3–1.9 mm), 2 females (sl = 1.5, 1.8 mm) plus 1 specimen in poor condition; D38, 1 female (cl = 3.0 mm); D127, 6 males (cl = 5.0–6.5 mm), 8 females (cl = 3.0–5.0 mm), MNHN Pg 4356; D131, 57 males (sl = 1.1–3.0 mm), 32 females (sl = 1.1–2.5 mm), 16 ovigerous females (sl = 1.2–1.8 mm), 7 juveniles (sl = 0.8–1.0 mm, plus 14 not removed from various shelters; D200, 1 male (cl = 4.5 mm); D220, 1 male (cl = 3 mm) plus 1 specimen not removed from shell, MNHN Pg 4360; D228, 1 ovigerous female (cl = 2.5 mm); D228, 1 ovigerous female (cl = 2.5 mm); E79, 1 male (sl = 5.5 mm); E820, 3 males (cl = 4.5–5.5 mm), 1 female (cl = 3.5 mm); E821, 1 male (cl = 6 mm), plus 2 dam-aged specimens; E828, 5 females (sl = 2.1–3.2 mm), 2 ovigerous females (sl = 1.5, 1.9 mm); E832, 9 males (cl = 4.5–6.0 mm), 11 females (cl = 3.5–6.0 mm); F92, 3 males (sl = 1.7–2.1), 5 females (sl = 1.7–2.3 mm); F122, 1 female (cl = 4.0 mm), MNHN Pg 4359; F142, 1 male (cl = 4.0 mm), 4 females (cl = 3.5–4.0 mm), MNHN Pg 4354

NMNZ collections: Otago Harbour, 9.12.52, 73–110 m, 1 female (cl = 4.5 mm), Cr 9792; Foveaux Strait, oyster grounds, -9.61, 6 specimens, Cr 9725; no further data, 1 male (sl = 2.4 mm), Cr 9726; Stn BS 783, 1 male (sl = 3.0 mm), Cr 9727; JC 100573, 1 male (sl = 2.5 mm), Cr 3903.

NZMD collection: Tasman Bay, 60 m, 1963, 1 partial specimen, Cr 9728.

PMBS collection: Mu 66-52, 10 males (sl = 1.5–2.4 mm), 21 females (sl = 1.5–3.0 mm); Mu 74-202, 1 female (sl = 2.3 mm).

DESCRIPTION: Shield (Fig. 58a) considerably longer than broad. Rostrum acutely or subacutely triangular, reaching at least to bases of ocular acicles. Ocular peduncles 0.65–0.75 length of shield, moderately stout basally; ocular acicles triangular, terminating subacutely, but with prominent submarginal tooth. Antennular and antennal peduncles both over-reaching distal margins of corneas by 0.50–0.75 length of ultimate segments. Second segment of antennal peduncles with laterodistal projection reaching nearly to distal margin of fourth peduncular segment, mesial margin with 0–2 denticles. Antennal acicles not reaching to considerably over-reaching distal margins of corneas.

Right cheliped (Fig. 58b) usually with subrectangular, elongate carpus and chela. Dactyl with row of strong, blunted teeth on dorsomesial margin. Dorsomesial, dorsoproximal, and dorsolateral margins palm each with row of closely spaced, somewhat blunted teeth entirely circumscribing palm and fixed finger, dorsal surface covered with small to prominent, frequently irregular or teardrop-shaped tubercles, occasionally becoming heavily calcified nodules. Carpus subrectangular, usually much longer than broad; with row of teeth on dorsomesial margin and row of spinulose teeth or tubercles on dorsolateral



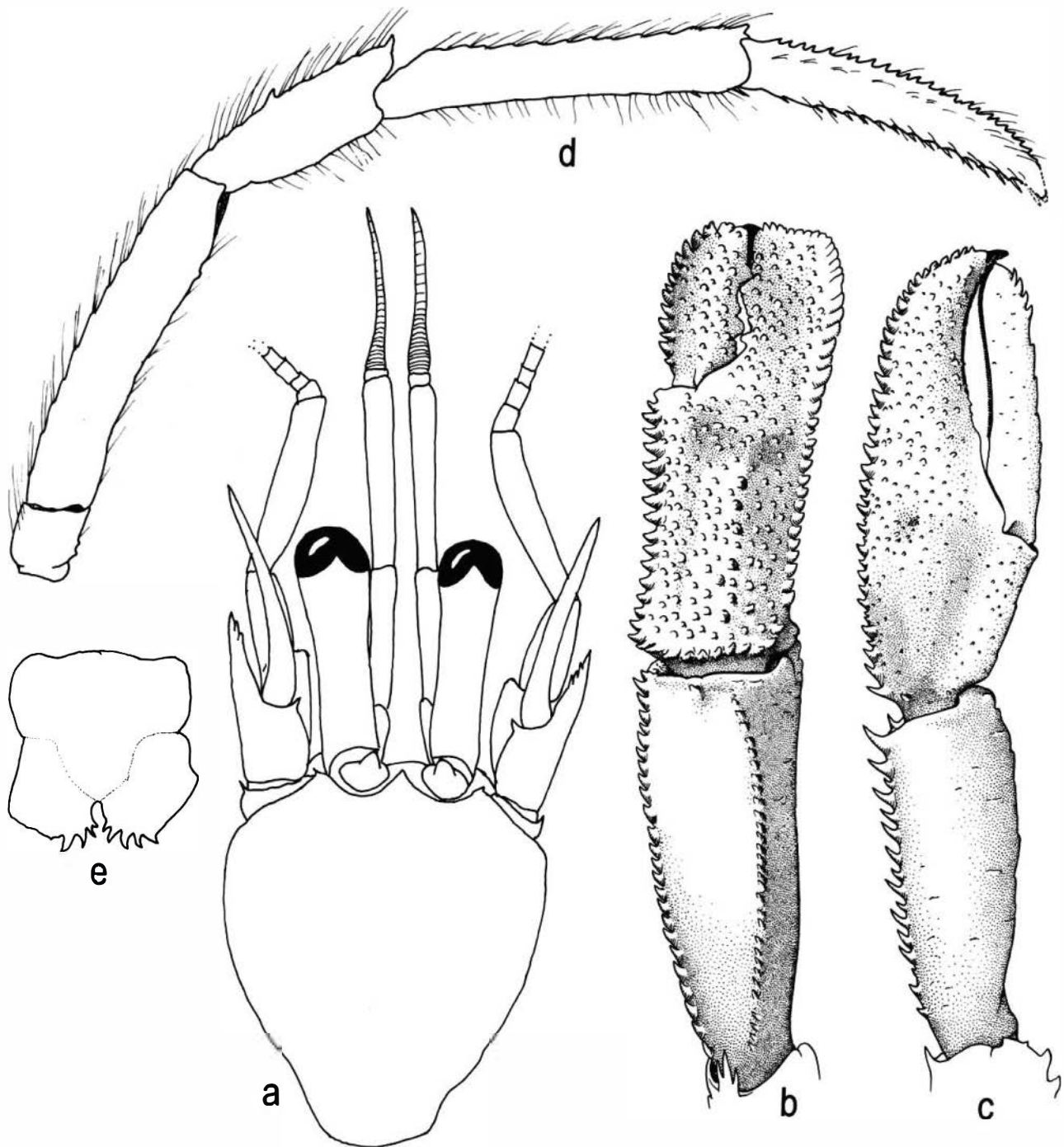


Fig. 58. *Lophopagurus (Australeremus) stewarti* (Filhol, 1883), male (sl = 5.5 mm), NZOI Stn E79: a, shield and cephalic appendages (setation and aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view, setation omitted); c, carpus and chela of left cheliped (dorsal view, setation omitted); d, right second pereopod (lateral view); e, telson (setation omitted). Magnifications equal 9x (b-d), 15x (a), 18x (e).

margin proximally, row curving mesially onto dorsal surface in distal half.

Left cheliped (Fig. 58b) with propodal-carpal articulation 85–90° from horizontal plane. Palm with row of prominent teeth on dorsolateral margin, dorsal

surface flattened, tuberculate. Carpus acutely triangular in cross-section, usually at least twice as broad as long in dorsal view, with row of sharp teeth on dorsal margin.

Ambulatory legs dissimilar. Second pereopods

(Fig. 58d) each with row of tooth-like protuberances or prominent teeth on dorsal margins of dactyls, ventral margins each with 8–14 spiniform setae; propodi with low protuberances or small tubercles on dorsal surfaces; carpi each with 1 tooth at dorsodistal margin, usually 1 additional tooth on dorsal surface proximally. Third pereopods with narrower, dorsally unarmed dactyls; propodi unarmed; carpi with only dorsodistal tooth. Sternite of third pereopods with narrowly triangular or rod-like anterior lobe.

Uropods symmetrical. Telson (Fig. 58e) with terminal margins of posterior lobes straight, slightly oblique, or slightly rounded, armed with 2–4 strong teeth and occasionally 1 or 2 small teeth.

**COLOUR:** Ocular peduncles pale orange; antennules uniform pale yellow; antennae reddish with narrow white bands; chelipeds reddish-pink to orange with some darker markings and a purple band at the distal end of the inner surface of the meri; walking legs orange ground colour with white bands towards the tips (Schembri & McLay 1983).

**REPRODUCTION:** Females appear to mature at very small size and may be ovigerous with shield lengths of only 1.2 mm (cl = 2.0 mm). Clusters of 20–40 moderately small eggs (diameter 0.31–0.55 mm) are typically attached to pleopods 2–4. Ovigerous females were collected from September to February.

**HABITAT:** Specimens have most frequently been found to occupy bryozoan and polychaete tubes, as well as scaphopod shells, but occasionally may also be found in gastropod shells. This species has a broad bathymetric range but is most commonly found between 135 and 275 m.

**REMARKS:** McLaughlin and Gunn (1992) have discussed the errors in Filhol's (1886) illustration of *L. (A.) stewarti*, as well as the confusion in its identification by Chilton (1911a). Although *L. (A.) stewarti* has possibly been confounded with *L. (A.) cookii*, it is most closely allied to *L. (A.) eltaninae*. McLaughlin and Gunn (1992) reported that in addition to the length/width ratio of the carpus of the right cheliped, the rectangular shape of the cheliped readily sets *L. (A.) stewarti* apart, and for the most part this is true. However, a single male specimen from NZOI Stn B591 has the triangularly shaped right chela of *L. (A.) eltaninae*, and might easily be mistaken for that species if only chela shape were considered. Additionally this specimen has the ventral margin of the merus of the right cheliped armed with strong spinose teeth, a character commonly found in *L. (A.) eltaninae*, but only seen occasionally in specimens of *L. (A.) stewarti*. Despite these similarities, the length/width ratios of

the carpi of both chelipeds and the very obvious dissimilarity of the second and third pereopods clearly confirm its identity as *L. (A.) stewarti*. Its collection site, southwest of Stewart Island also supports our conclusion. *Lophopagurus (A.) eltaninae* is not known from the South Island.

**RECORDS FROM NEW ZEALAND:** Western North Island southeast of New Plymouth and Tasman Bay; eastern South Island from Pegasus Bay to Stewart Island southwards; 28–1280 m.

**DISTRIBUTION:** New Zealand; Chatham Islands; Tasman Sea.

*Lophopagurus (Australeremus) eltaninae* (McLaughlin & Gunn, 1992) (Fig. 59)

*Australeremus eltaninae* McLaughlin & Gunn, 1992: 92, fig. 15.

**TYPES:**

Holotype: male (sl = 3.6 mm), from ET Stn 23/1716, USNM 244463.

Paratypes: 1 male, 1 female (sl = 1.8, 2.8 mm), NMNZ Stn BS 834, Cr 8133, 8060; 3 males (sl = 1.8–3.4 mm), NMNZ Stn BS 837, Cr 8131; 2 females (sl = 1.98, 2.0 mm), NMNZ Stn BS 838, Cr 8130; 4 males, 1 female (sl = 1.9–3.2 mm), NMNZ Stn BS 840, Cr 8132, 8148, 8150.

**TYPE LOCALITY:** ET Stn 23/1716, southeast of Mahia Peninsula, 39°35'S, 178°46'E, 128–146 m.

**OTHER MATERIAL EXAMINED:**

NZOI Stns: C814, 2 males (sl = 2.3, 2.9 mm), 3 females (sl = 2.0–2.4 mm), 2 ovigerous females (sl = 1.8, 2.0 mm), tentative identification based on cheliped ratios as all other appendages missing; Z9074, 1 male (sl = 2.0 mm); Stn Z9076, 2 females (sl = 1.0, 2.1 mm); Stn Z9096, 1 male (sl = 2.4 mm), MNHN; Stn Z9100, 1 male (sl = 1.1 mm), 1 female with rhizocephalan (sl = 1.3 mm); Stn Z9104, 2 ovigerous females (sl = 1.4, 2.1 mm).

NMNZ Stns: BS 392, 1 male (sl = 2.4 mm), Cr 7572; BS 682, 1 female (sl = 2.1 mm), Cr 8153.

MNHN collections: Ob Stn 75, 2 females (sl = 1.5, 2.2 mm), MNHN Pg 5696; Ob Stn 356, 3 females (sl = 2.3–3.3 mm), MNHN Pg 1846.

**DESCRIPTION:** Shield (Fig. 59a) as long or longer than broad. Rostrum triangular. Ocular peduncles 0.75–0.80 acutely triangular. Antennular peduncles when fully extended over-reaching distal margins of corneas by 0.25–0.50 length of ultimate segment. Antennal peduncles extending beyond distal margins of corneas by 0.25–0.35 length of fifth segment. Laterodistal



projection of second segment with 0–4 denticles on mesial and/or lateral margins. Antennal acicles reaching beyond bases of corneas.

Right cheliped (Fig. 59b) with lateral margin of chela convex, mesial margin somewhat concave; palm with prominent, basally broadened, acute or blunt teeth on dorsomesial, dorsoproximal, and dorso-lateral margins circumscribing palm and extending complete length of fixed finger, dorsal surface with row of large, teardrop-shaped or irregularly pillar-like, acute or blunt tubercles adjacent to dorsomesial margin, separated from similar, but more prominent median row by slight longitudinal depression, remaining surface of palm and fixed finger with teardrop-shaped, acute or blunt tubercles, frequently interspersed with mushroom-shaped tubercles. Carpus trapezoidal in dorsal view, with width more than half length; dorsomesial margin armed with row of prominent, acute teeth, dorsal surface with only longitudinal row of small spinulose tubercles or low ridges laterad of midline and rarely 1 small tooth at dorsodistal margin.

Left cheliped (Fig. 59c) with propodal-carpal articulation 60–80° from horizontal plane. Palm with row of prominent teeth on dorsolateral margin, lateral half of dorsal surface covered with moderate to large, often teardrop-shaped tubercles, sometimes interspersed with mushroom-shaped tubercles. Carpus with width more than half total length, dorsal surface armed with row of prominent, acute tubercles.

Ambulatory legs (Fig. 59d) generally similar. Dactyls somewhat blade-shaped, dorsal margins with low protuberances, sometimes developed into spinose processes, and row of long spiniform setae; ventral margins each with row of 7–11 spiniform setae. Carpi frequently with 1 tooth or spiniform process in proximal half of dorsal surface and 1 or 2 teeth at distal margin (second) or single tooth at dorsodistal margin and occasionally 1 tooth in proximal half (third). Sternite of third pereopods with anterior lobe small, semioval to subsemicircular.

Uropods generally symmetrical. Telson (Fig. 59e) with terminal margins rounded, few teeth medially, plate-like laterally.

**COLOUR:** After five months in preservative, shield with few patches of reddish-orange marginally. Ocular peduncles mottled reddish-orange. Antennal acicle with reddish-orange band subdistally. Palms of both chelipeds overall reddish-orange, marginal teeth frequently darker; carpi with reddish-orange distal margin, teeth and tubercles of dorsal surface tinged with reddish-orange. Ambulatory legs each with median reddish-orange band on meri; carpi each with dark reddish-orange patch medially on dorsal surface,

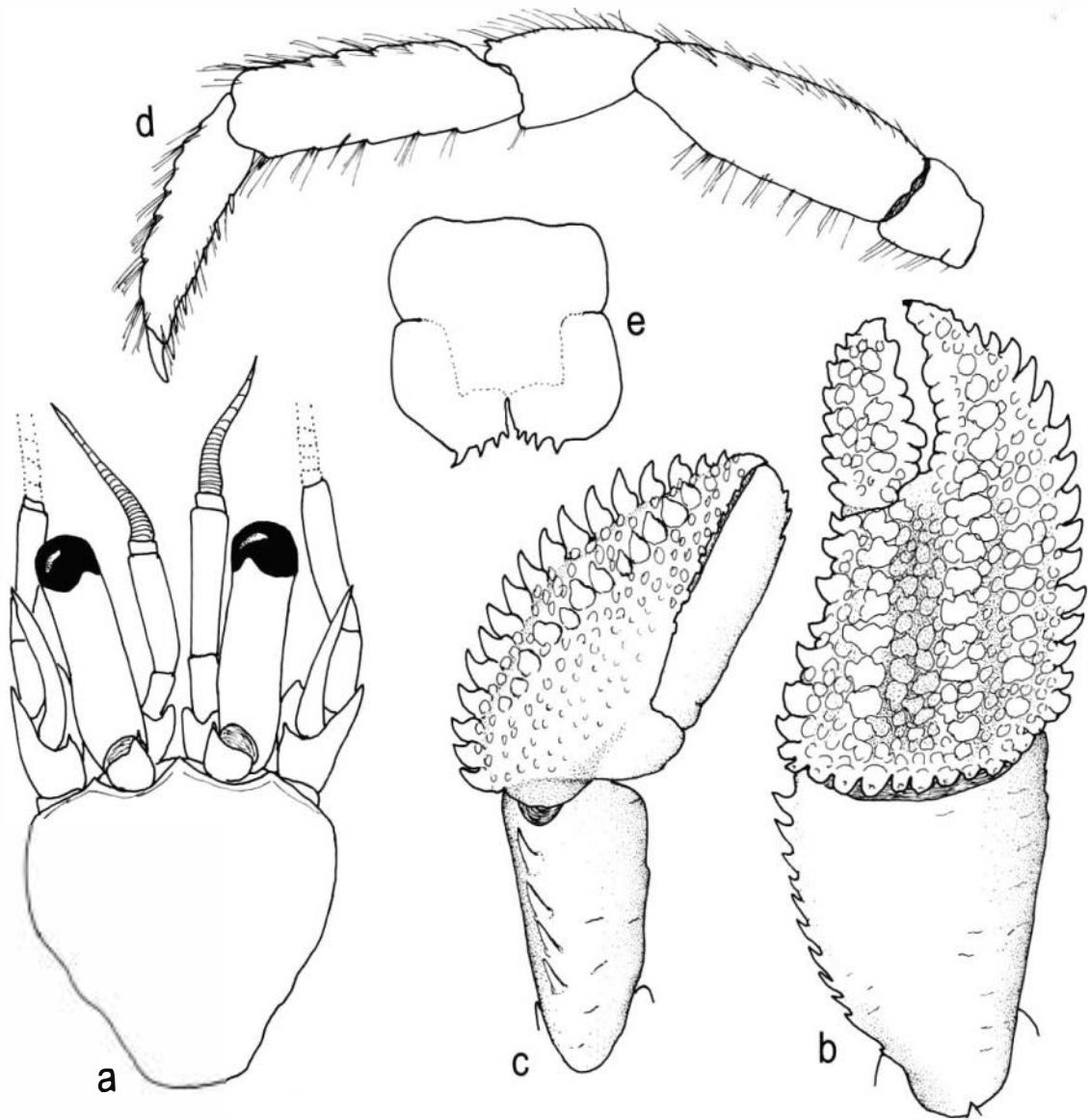
two longitudinal stripes of reddish-orange on lateral face; propodi each with one median band of reddish-orange, and dactyls each median and subdistal bands. Both segments also with longitudinal reddish-orange stripe in lateral midline.

**REPRODUCTION:** Two ovigerous females collected from Spirits Bay in May carried between 15 and 30 eggs, with diameters varying from 0.59 to 0.64 mm. The eggs of one of the females were very close to hatching. Two additional ovigerous females tentatively identified as *L. (A.) eltaninae*, were collected during February. The latter specimens were in very poor condition and the eggs could not be measured with accuracy.

**HABITAT:** All specimens collected at Spirits Bay inhabited bryozoan tubes. The male from NMNZ Stn BS 392 was accompanied by a sponge.

**REMARKS:** McLaughlin and Gunn (1992) noted in their original description that *L. (A.) eltaninae* is most closely allied to *L. (A.) stewarti*, but is distinguished by the shape of the right chela and the length/width ratio of its carpus. The length/width ratios of the carpi of both chelipeds provide reliable diagnostic characters in large specimens; however, in small specimens (sl = 1.2–2.0 mm) these ratios are reduced. After comparing the available specimens of *L. (A.) eltaninae* with numerous small specimens of *L. (A.) stewarti*, the one character that immediately sets the latter apart is the dissimilarity of the dactyls of the ambulatory legs. The dorsal margins of the dactyls of the second pereopods in all specimens of *L. (A.) stewarti* are armed with a row of prominent teeth, giving the margin a “saw-tooth” appearance, whereas the dorsal margins of the dactyls of the third are virtually smooth. In *L. (A.) eltaninae*, the dorsal margins of the dactyls of the second pereopods become more denticulate or tuberculate with increasing size, as do those of the third pereopods, but to a lesser degree.

Although the holotype and paratypes of *L. (A.) eltaninae*, and the specimens from Spirits Bay are characterised as having prominent, often teardrop-shaped, tubercles on the chelae, the tubercles of a specimen from the Three Kings Islands are more irregular and pillar-like, quite similar to those seen in many specimens of *L. (A.) stewarti*. However, the right chela of this specimen is more triangular than is usually seen in *L. (A.) stewarti*, the carpi of both chelipeds are broader and much shorter, and the dactyls of the second and third pereopods lack the marked dissimilarity seen in *L. (A.) stewarti*. The Three Kings specimen was accompanied by a small sponge, with a distinct indentation on one surface that easily could have accommodated the specimen’s



**Fig. 59.** *Lophopagurus (Australeremus) eltaninae* (McLaughlin & Gunn, 1992), NZOI Stn Z9074, male (sl = 2.0 mm): a, shield and cephalic appendages (setation and aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view, setation omitted); c, carpus and chela of left cheliped (dorsal view, setation omitted); d, left second pereopod (lateral view); e, telson (setation omitted). Magnifications equal 25x (a-d), 50x (e).

somewhat reduced abdomen, thus providing a covering somewhat like those used by dromiids.

**RECORDS FROM NEW ZEALAND:** Discontinuous distribution: North Island off Three Kings Islands, Spirits Bay, Ranfurly Bank, and Mahia Peninsula; 31–146 or possibly 194 m. Similar distributional patterns are

seen in certain molluscan and bryozoan taxa (S. O'Shea, pers. comm.).

**DISTRIBUTION:** Apparently endemic to New Zealand.



*Pagurixus* Melin, 1939

*Pagurixus* Melin, 1939: 37; McLaughlin & Haig, 1984: 122; Gunn & Morgan 1992: 40; Komai & Asakura 1995: 353.

TYPE SPECIES: *Eupagurus (Pagurixus) boninensis* Melin, 1939. Gender masculine.

Eleven pairs of biserial gills. Rostrum triangular, usually well developed and extending beyond bases of ocular acicles. Ocular acicles triangular or subtriangular. Ultimate segment of antennular peduncle with one to several long setae near dorsodistal margin laterally and often with ventral row(s) of short setae. Third maxilliped with crista dentata moderately well developed and provided with accessory tooth. Maxillule with external lobe of endopod produced, not recurved.

Right cheliped exhibiting considerable sexual dimorphism; dorsal surface of chela smooth, granular, or tuberculate; palm often greatly swollen or extremely elongate in large males. Left cheliped with chela subtriangular in cross-section, usually armed with tubercles or teeth. Sternite of third pereopods with anterior lobe subrectangular or subquadrate. Sternite of fifth pereopods produced into 2 prominent circular or ovate components. Fourth pereopods semichelate, propodal rasp consisting of single row of scale-like setae. Males with coxae of fifth pereopods often slightly asymmetrical; gonopore of right obscured by tuft of moderate to long stiff setae directed toward left; left gonopore often with encircling short to moderately long setae; with 3 unpaired, biramous pleopods. Females with paired gonopores or single gonopore on coxa of left third pereopod; 4 unpaired, biramous pleopods.

Uropods asymmetrical. Telson with lateral indentations indicative of division into anterior and posterior portions; posterior lobes generally symmetrical or nearly so, terminal margins straight, rounded or oblique, armed with teeth or denticles.

KEY TO THE NEW ZEALAND (INCLUDING THE KERMADEC ISLANDS) SPECIES OF *Pagurixus*

- 1 Carpus of right cheliped with prominent row of tubercles on dorsomesial margin ..... *P. hectori*
- Carpus of right cheliped without prominent row of tubercles on dorsomesial margin ..... *P. kermadecensis* sp. nov.

*Pagurixus hectori* (Filhol, 1883) (Fig. 60, Pl. 6, fig. 4)

*Eupagurus Hectori* Filhol, 1883: 67; 1885b: 30; 1885d: 419; 1885e: pl. 51, fig. 1.

?*Eupagurus Campbelli* Filhol, 1885b: 32; 1885d: 421; 1885e: pl. 52, fig. 3; Thompson 1930: 263.

*Eupagurus hectori*: Thomson 1899: 177; Lenz 1901: 447; Alcock 1905b: 176 (list); Chilton 1911b: 553 (in part).

?*Eupagurus campbelli*: Thomson 1899: 183; Alcock 1905b: 176 (list); Chilton 1909: 612.

?*Eupagurus (Campbelli Filhol)?*: Stephensen 1927: 294;

?*Pagurus campbelli*: Gordan 1956: 327 (lit.); Roberts 1971: 187, figs 1-34.

*Pagurus hectori*: Gordan 1956: 330 (lit.).

*Pagurixus hectori*: Schembri & McLay 1983: 34, fig. 26a, b; McLaughlin & Haig 1984: 144; Gunn & Morgan, 1992: 41; Morgan 1993: 180; Komai & Asakura 1995: 353.

TYPES:

Lectotype, herein selected: female (sl = 5.4 mm), Stewart Island, 1874-75, coll. H. Filhol, MNHN Pg 2680;

Paralectotype: female (sl = 5.0 mm), MNHN Pg 5850.

TYPE LOCALITY: Stewart Island, New Zealand.

OTHER MATERIAL EXAMINED:

NZOI Stns: Q118, 1 male (sl = 3.6 mm); Z1800, 8 males (sl = 4.3-5.1 mm), 1 female (sl = 4.0 mm), 2 ovigerous females (sl = 3.9, 4.0 mm); Z1833, 1 female (sl = 4.0 mm); Z1840, 2 males (sl = 4.8, 5.2 mm), MNHN Pg 0000; Z1892, 2 males (sl = 2.6, 5.2 mm), 12 ovigerous females (sl = 2.7-5.1 mm).

NMNZ collections: Three Kings Islands: NE Bay of Great Island, coll. G. Hardy, A. Stewart, 25.11.83, 13-15 m, 1 male (sl = 4.1 mm), Cr 8051; west end Great Island, coll. G. Hardy, A. Stewart, 28.11.83, 2-7 m, 1 male (sl = 2.9 mm), Cr 8032; Te Hapua, Parengarenga Harbour, coll. R.K. Dell, 14.11.63, 1 female (sl = 1.2 mm), Cr 9729; Henry Island, Whangaruru Harbour, coll. A.N. Baker, 5.12.71, 12 m, 1 male (sl = 2.3 mm), Cr 8122; Bay of Islands, Kokinga point, Parakura Bay, coll. R.K. Dell, 11.71, intertidal, 3 males (sl = 1.7-1.8 mm), 1 ovigerous female (sl = 2.0 mm), Cr 7541; Oke Bay, coll. R.K. Dell, 29.11.71, intertidal, 2 males (sl = 1.4, 1.6 mm), 1 ovigerous female (sl = 1.4 mm), Cr 8047; Kapiti Is., coll. V. Hoggard, 15.2.71, 1 female (sl = 3.5 mm), Cr 8117; Lyall Bay, Wellington, coll. A.N. Baker, 30.8.65, 3 males (sl = 1.5-4.0 mm), 1 female (sl = 2.6 mm), Cr 9730, 9731; Arapawa Is., Queen Charlotte Sound, coll. M. Crozier, 21.9.63, 1 male (sl = 2.6 mm), 1 ovigerous female (sl = 3.6 mm), Cr 9732; Kahn Rocks, Glenburn, Wairarapa, 24.9.72, 18 m, 1 female (sl = 4.7 mm), Cr 8121; Kaikoura, coll. C. McLay, 25.9.76, intertidal, 1 male (sl = 2.2 mm), Cr 4168; Open Bay Islands, NE side of main island, coll. G.D. Fenwick, 5.2.76, 7-10 m, 1 male (sl = 2.6 mm), Cr 8078; Dusky Sound, 15.2.85, 9 m, 1 ovigerous female (sl = 2.1 mm), Cr 8049; Antipodes Is.: Clio Bay, coll. D.S. Horning, 29.11.78, 12-15 m, 1 male (sl = 5.9 mm), Cr 8083; north side Crater Bay, 23.11.78, 3 males (sl = 2.4-6.0 mm), 4 females (sl = 2.3-5.1 mm), 6 ovigerous females (sl = 3.2-5.0 mm), Cr 8096; Ring Dove Bay, coll. R.K. Dell, 5.11.50, 2 males (sl = 2.4, 2.4 mm), Cr 9733; Auckland Is., coll. R.L.C. Pilgrim, -.9.80, 1 male (sl = 2.6 mm), 3 females (sl = 2.0-2.4 mm), Cr 4185; Crozier Point, 9.8.43, 4 males (sl = 2.3-4.8 mm), 14 females (sl = 2.7-6.1 mm), 3 ovigerous females (sl = 2.6-5.3 mm), Cr 9734; Ocean Is., coll. W.H.

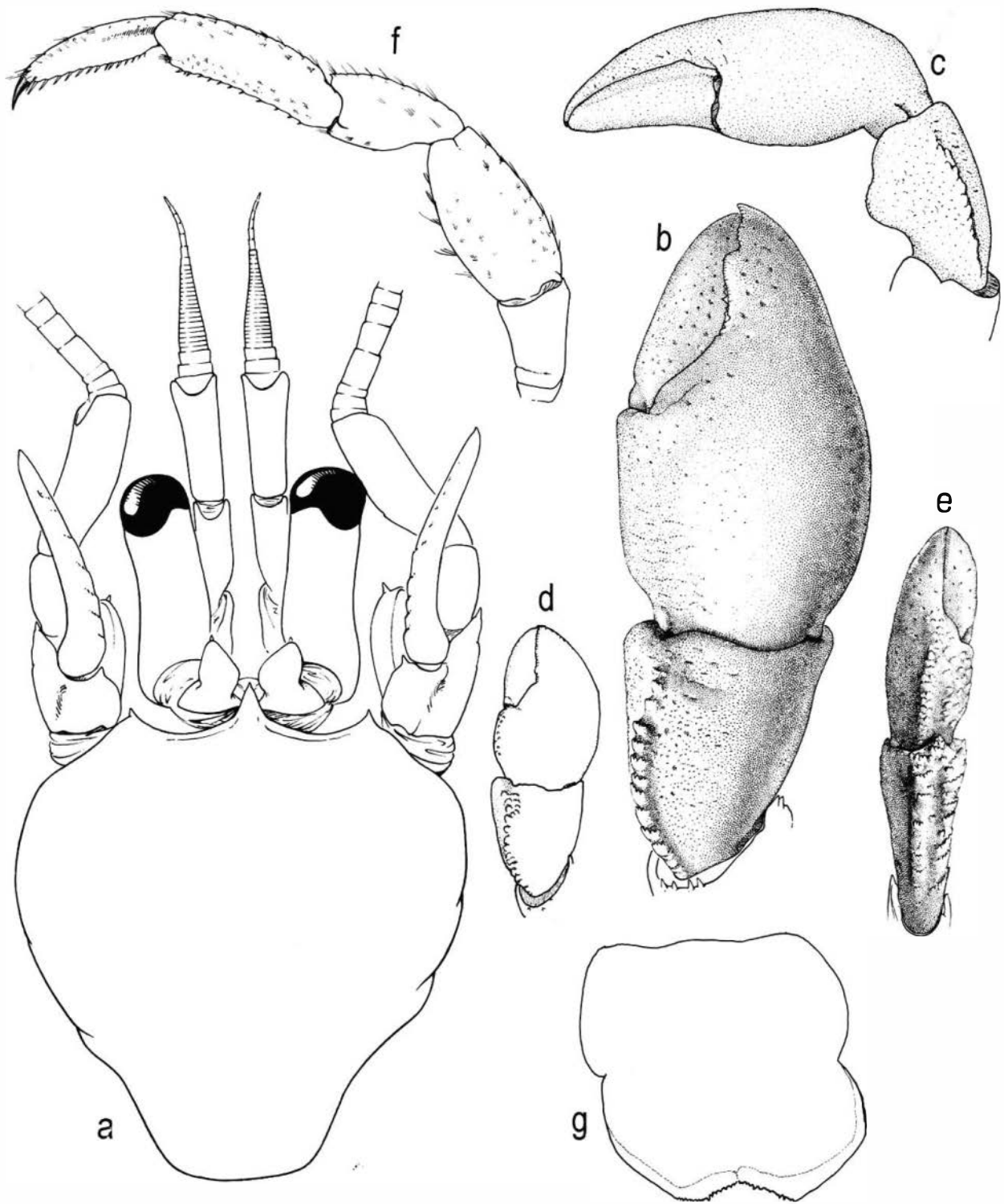


Fig. 60. *Pagurixus hectori* (Filhol, 1885), a-c, e-g, Erebus Cove, Port Ross, Auckland Islands, male (sl = 6.2 mm), MNHN Pg 5850; d, Barney Harbour, Auckland Islands, female (sl = 5.1 mm) NMNZ Cr 9737: a, shield and cephalic appendages (setation and aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view, setation omitted); c, carpus and chela of right cheliped (mesial view, setation omitted); d, carpus and chela of left cheliped (dorsal view, setation omitted); e, carpus and chela of left cheliped (mesial view, setation omitted); f, left third pereopod (lateral view); g, telson (setation omitted). Magnifications equal 9x (b-f), 22x (a), 37.5x (g).



Dawbin, 16.2.43, intertidal, 1 female (sl = 4.4 mm), Cr 524; off Passage Island, 24.8.43, intertidal, 2 males (sl = 5.5, 6.7 mm), Cr 9735; Perpendicular Head, 16.2.85, 2 males (sl = 3.3, 5.8 mm), Cr 4868; Port Ross, G. Jones, 1 specimen, poor condition, Cr 9736; Port Ross, Barney Harbour, 9.7.43, 4 males (sl = 3.3–4.2 mm), 1 female (sl = 5.1 mm), Cr 9737; Port Ross, Erebus Cove, 1963, 1 male (sl = 6.2 mm), Cr 1238; Port Ross, Ocean Is., coll. G.A. Knox, -12.62, 1 male (sl = 6.5 mm), Cr 1282; Ranui Cove, coll. G.A. Knox, 1.63, intertidal, 6 males (sl = 3.9–5.6 mm), 27 females (sl = 3.6–4.7 mm), Cr 1237; Campbell Is., De la Vire Point, coll. R.J. Street, 16.1.58, 5 males (sl = 4.2–4.8 mm), 1 female (sl = 2.6 mm), Cr 9738; Northwest Bay, coll. J.H. Sorensen, 2 males (sl = 5.8, 6.2 mm), 2 females (sl = 3.6, 4.2 mm), MNHN; Perseverance Harbour, Mortensen Expedition, 10.12.14, intertidal, 2 males (sl = 3.9, 4.0 mm), 1 female (sl = 3.4 mm), 2 ovigerous females (sl = 3.5, 4.2 mm), Cr 9739; Perseverance Harbour, coll. H.H. Sorensen, 23.11.47, 7 males (sl = 2.7–5.2 mm), 2 females (sl = 3.0, 3.1 mm), 2 ovigerous females (sl = 3.2, 3.6 mm), Cr 9740; Perseverance Harbour, coll. D. Nightingale, 25.1.66, 1 male (sl = 6.0 mm), Cr 9741; Perseverance Harbour, coll. K. Westerskov, 12.2.85, 11 m, 2 males (sl = 4.9, 5.5 mm), 3 females (sl = 4.3–5.0 mm), Cr 4868; Smoothwater Bay, coll. J.H. Sorensen, 2.11.47, 1 ovigerous female (sl = 3.5 mm), Cr 458; South East Harbour, coll. R.J. Street, 14.2.58, 1 female (sl = 4.3 mm), Cr 9742; Tucker Cover, 5.12.66, 10 males (sl = 3.0–5.8 mm), 5 females (sl = 2.9–3.5 mm), 2 ovigerous females (4.0, 4.4 mm), Cr 9743; Stn BS 240, 2 males (sl = 2.9, 4.0 mm), Cr 8189.

**DESCRIPTION:** Shield (Fig. 60a) longer than broad. Rostrum acutely triangular, well developed, often with terminal denticle. Ocular peduncles moderately short and stout in small individuals, increasing in length with increased size; corneal diameter included 2.5–3.0 times in peduncular length. Ocular acicles subovate to subtriangular with submarginal tooth. Antennular peduncles overreaching distal margins of corneas by 0.35–0.60 length of ultimate segment, with 1 to several long setae at dorsolateral distal angle of ultimate segment, ventral margins naked or with 1 or 2 short setae. Antennal peduncles over-reaching distal margins of corneas by a 0.25–0.50 length of ultimate segment; laterodistal projection of second segment often with 2–4 denticles on mesial margin.

Right cheliped in large males (Fig. 60b, c) becoming extremely elongate; palm with convex dorsal surface smooth, dorsomesial and dorsolateral margins unarmed; dorsomesial margin of carpus with irregular row of spinulose or blunt tubercles, sometimes almost low, short, transverse ridges, dorsal surface with few low granules, dorsolateral margin often indistinct. Meral-carpal articulation developing pronounced clockwise rotation. Right cheliped of females (Fig. 60d) and small males with surfaces of palm granular or faintly tuberculate, with stronger granules or denticles on dorsomesial and dorsolateral margins; carpus with irregular, almost double, row of small,

spinulose tubercles on dorsomesial margin, smallest near distal margin, all surfaces granular or tuberculate.

Left cheliped (Fig. 60e) with dactyl and fixed finger spoon-shaped. Dorsomesial margin of palm with numerous very small tubercles or granules, dorsal surface elevated in midline and armed with irregular, double row of small, blunt or acute tubercles, extending onto fixed finger proximally; dorsolateral surface strongly sloping. Dorsomesial and dorsolateral margins of carpus each with row of small teeth or short transverse denticulate ridges.

Ambulatory legs (Fig. 60f) with short and moderately stout dactyls, ventral margins each with 7–14 spiniform setae. Ventral margins of propodi each with row of spiniform setae. Carpi each with small tooth at dorsodistal margin. Sternite of third pereopods with anterior lobe subrectangular.

Females with paired gonopores. Telson (Fig. 60g) with terminal margins straight, slightly rounded, and usually with slight concavity mesially, each with 5–10 small, slender teeth or denticles.

**COLOUR:** Ocular peduncles with pale blue, orange, and white bands towards the bases; antennules orange with a pale blue basal band; antennae dark reddish-brown with narrow white bands. Chelipeds dark brown, with a narrow blue band at base of carpus, dactyls and fixed fingers pale blue; ambulatory legs with pale blue, dark brown, and pale orange bands distally on each segment (after Schembri & McLay 1983).

**REPRODUCTION:** Ovigerous females have been collected in August, September, November, and February. Several females collected in November in the Antipodes Islands were carrying eggs nearly ready to hatch. Diameters of these eggs varied from 0.61 to 0.92 mm; whereas more immature eggs had diameters ranging from 0.40 to 0.61 mm.

**HABITAT:** A variety of gastropod shells.

**REMARKS:** In his original diagnosis of *Eupagurus hectori*, Filhol (1883) made no reference to a type locality, saying only "Cette espèce est assez abondante sur toute la côte et de l'île du Milieu et de l'île Stewart". In his subsequent, and more expanded description (Filhol 1885b), he referred to *E. hectori* as being rare but distributed along all the New Zealand coasts, but particularly more abundant in the south, and relatively more common at Stewart Island. In contrast, the type locality for *Eupagurus campbelli* was specifically given as Perseverance Harbour, Campbell Island (Filhol 1885b: 32). Bouvier (unpublished)

apparently re-examined Filhol's material, housed in the Muséum national d'Histoire naturelle. On a label identifying two specimens as "type" of *E. hectori*, Bouvier referenced Filhol's 1885d publication and 1885e atlas figure, and with an accompanying note that "L'*E. hectori* ne un paraît differer se rien de l'*E. campbelli*". Although Filhol (1883, 1885b) gave no indication of the number of specimens he examined for his description of either species, he provided the total length and carapace length of a male of *E. hectori*, and illustrated presumably a female specimen at twice its natural size. The two specimens indicated by Bouvier as types of *E. hectori* are both females. Although a specimen indicated by Bouvier as the type of *E. campbelli* is also present in the collection, it does not agree well with Filhol's (1885b) description or (1885e) figure of *E. campbelli*. Clearly there was some confusion in the labelling of types of the two species, and consequently these are now presumed types of both, which are conspecific. Although we have examined a substantial number of specimens subsequently collected from Perseverance Harbour, and found none that differed from our interpretation of *E. hectori*, based on the purported syntypes and the sexual dimorphism common to this taxon, the possibility cannot be ruled out that a second, morphologically quite distinct, species did exist at one time that was identifiable with *E. campbelli* as originally described and illustrated by Filhol.

**RECORDS FROM NEW ZEALAND:** Infrequently found at Three Kings Islands, North and South Islands, Antipodes, Campbell, and Auckland Islands; intertidal to 18 m.

**DISTRIBUTION:** Apparently endemic to New Zealand.

***Pagurixus kermadecensis* sp. nov.** (Fig. 61)

*Eupagurus hectori*: Chilton, 1911b: 353 (in part). [not *Eupagurus hectori* Filhol, 1883]

**Types:**

Holotype male (sl = 2.9 mm), MCC, AQ 3200.

Paratypes: 3 males (sl = 2.0–3.3 mm), 2 females (sl = 1.6–1.9 mm), 1 ovig. female (sl = 2.4 mm), MCC.

**TYPE LOCALITY:** Meyer or Raoul Island, Kermadec Islands.

**OTHER MATERIAL EXAMINED:**

MCC collections: Meyer Island and Coral Bay, Raoul Island, Kermadec Islands; 12 males (sl = 1.8–2.6 mm), 19 females (sl = 1.3–2.4 mm), 5 ovigerous females (sl = 1.8–2.6 mm), 1 juvenile (sl = 1.0 mm), 6 specimens in poor condition, 1908, coll. R.B. Oliver.

**DESCRIPTION:** Shield (Fig. 61a) longer than broad; anterior margin between rostrum and lateral projections straight to somewhat concave; anterolateral margins sloping; posterior margin truncate; dorsal surface glabrous. Lateral projections broadly triangular, weakly produced, unarmed or with tiny denticle. Rostrum triangular, moderately slender, with terminal denticle.

Ocular peduncles moderately short and stout in small individuals, increasing in length with increased size; corneal diameter included 2.5–3.0 times in peduncular length. Ocular acicles subovate to subtriangular, with submarginal denticle; separated basally by approximately basal width of 1 acicle.

Antennular peduncles overreaching distal margins of corneas by 0.30–0.50 length of ultimate segment, with tuft of several long setae at dorsolateral distal angle of ultimate segment, ventral margins naked or with 1 or 2 short setae. Penultimate segment with few scattered setae. Basal segment unarmed.

Antennal peduncles over-reaching distal margins of corneas by 0.10–0.20 length of ultimate segment. Fifth and fourth segments with few scattered short setae. Third segment with small spinule on ventrodistal margin. Laterodistal projection of second segment somewhat produced, with simple or bifid terminal spinule. First segment with or without laterodistal denticle; ventrally produced lobe of antennal gland sometimes with minute terminal spinule.

Right cheliped in large males (Fig. 61b, c) becoming much more massive, and sometimes somewhat more elongate. Dactyl 1.1–1.25 times length of palm; dorsomesial margin delimited by faint crenulate or denticulate ridge in small males and females, rounded and granular in larger males. Palm 0.60–0.75 length of carpus in females and small males, only slightly shorter than carpus in large males; convex dorsal surface smooth or minutely granular, dorsomesial and dorsolateral margins not delimited. Dorsomesial margin of carpus only faintly indicated by few, or occasionally row of small, spinulose or blunt tubercles; all surfaces minutely granular, dorsolateral margin not delimited. Meral-carpal articulation lacking any pronounced clockwise rotation; dorsal margin of merus with few transverse ridges and very short bristles or setae; ventromesial margin granular, but not distinctly delimited; ventrolateral margin with row of small teeth, most acute distally; ventral surface granular or minutely tuberculate. Ischium unarmed. Right cheliped of females (Fig. 61d) and small males with surfaces of palm granular or faintly tuberculate, dorsomesial margin rounded, but separated from dorsal surface by very shallow longitudinal depression, dorsolateral margin with very faint crenulate ridge. Carpus with dorsomesial and small



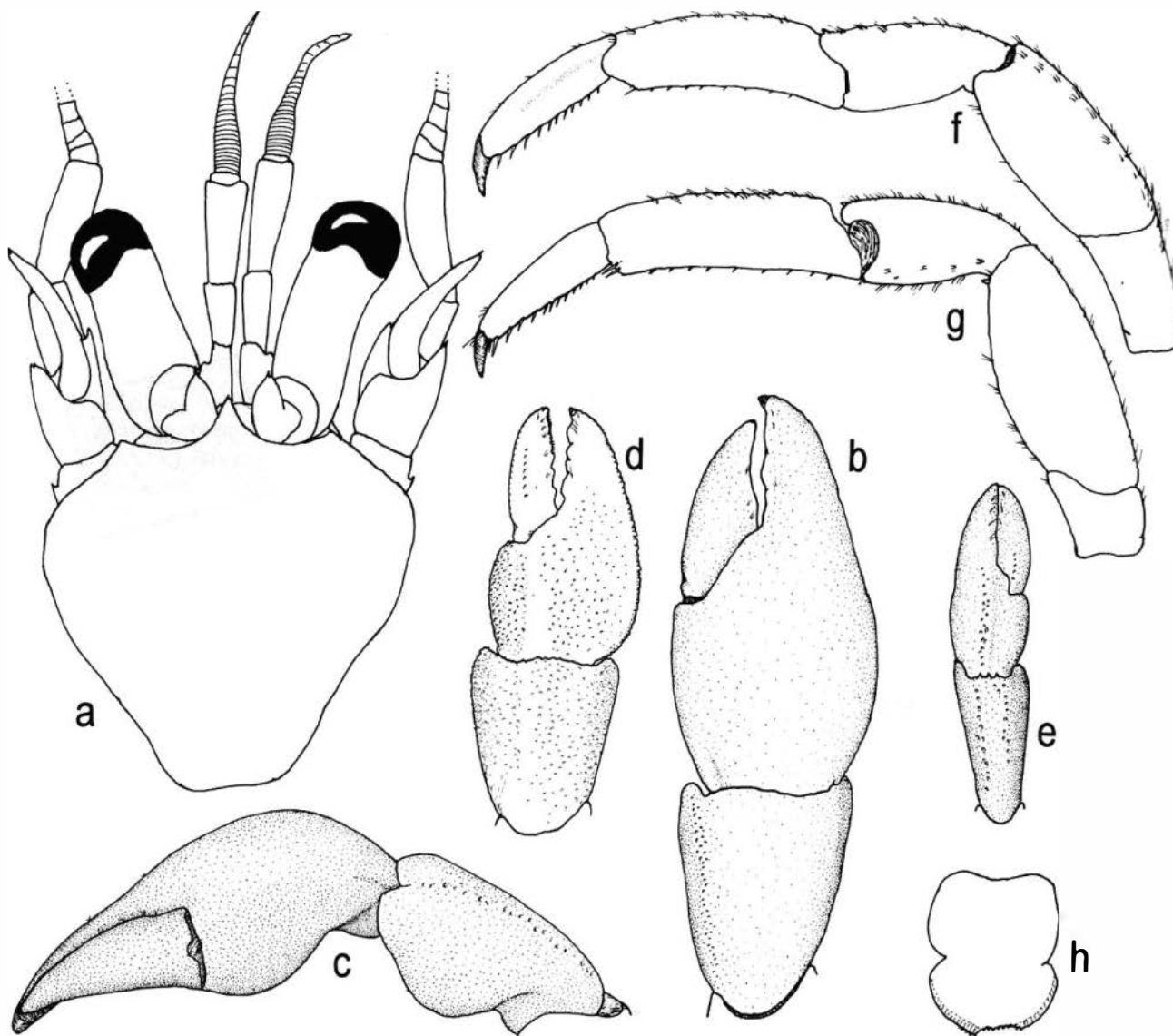


Fig. 61. *Pagurixus kermadecensis* sp. nov., a-c, e-h, Kermadec Islands, male holotype (sl = 2.9 mm), MCC, AQ 3200; d, female (sl = 2.3 mm), MCC: a, shield and cephalic appendages (setation and aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view, setation omitted); c, carpus and chela of right cheliped (mesial view, setation omitted); d, carpus and chela of right cheliped (dorsal view, setation omitted); e, carpus and chela of left cheliped (dorsal view, setation omitted); f, left third pereopod (lateral view); h, telson (setation omitted); g, second right pereopod (mesial view). Magnifications equal 18x (b-g); 37.5x (a, h).

dorsolateral margins not delimited, surfaces granular or with faint covering of very small tubercles, strongest dorsally; distal margins crenulate or minutely serrate. Merus with few short bristles or stiff setae on distal and dorsal margins; ventromesial margin and ventral surface granular; ventrolateral margin with row of small teeth. Ischium unarmed.

Left cheliped (Fig. 61e) with dactyl and fixed finger somewhat spoon-shaped. Dactyl 1.25–1.65 times length of palm, with numerous tufts of short, stiff setae distally and ventrally, surfaces unarmed; dorso-

mesial margin with row of minute teeth in small specimens, rounded and unarmed in larger individuals. Palm 0.60–0.75 length of carpus; dorsal surface elevated in midline and armed with irregular single or double row of tiny spinulose tubercles, usually not extending onto fixed finger; sloping dorsolateral and dorsomesial surfaces minutely granular; dorsomesial margin not delimited; ventrally depressed dorso-lateral margin with row of very small, subacute or acute teeth. Dorsomesial and dorsolateral margins of carpus each with row of small teeth, 3 or 4 additional

teeth on dorsodistal margin; mesial face generally with few scattered short setae; lateral face minutely granular; ventrolateral margin with row of tiny, acute or subacute teeth, ventral surface granular. Merus with few stiff setae on dorsodistal margin, dorsal surface sometimes with few low protuberances and short setae, commonly in larger specimens; ventrolateral margin with row of small, acute teeth and long setae; ventromesial margin minutely denticulate, ventral surface minutely granular. Ischium with few long setae on ventromesial margin.

Ambulatory legs (Fig. 61f, g) similar from right to left, moderately short and stout. Dactyls 0.65–0.85 length of propodi; dorsal surfaces with few scattered short setae; ventral margins each with 9–12 spiniform setae. Propodi 1.10–1.25 times length of carpi; dorsal surfaces each with row of low protuberances and short setae; ventral margins each with row of spiniform setae, often paired at distal margin. Carpi dorsal margins smooth or with very minute protuberances and setae, dorsodistal margins each with very tiny denticle. Meri with sparse tufts of setae on dorsal and ventral margins; ventrolateral margins of second pereopods each with 1 or 2 acute teeth near distal angle, third unarmed. Sternite of third pereopods with anterior lobe roundly subrectangular.

Males with moderately short tuft of stiff setae directed toward midline and masking right gonopore; left gonopore encircled with stiff setae. Females with paired gonopores.

Telson (Fig. 61h) with terminal margins slightly oblique or rounded, with weak concavity mesially, 5 or 6 tiny teeth on either side of very faintly delimited median cleft.

**COLOUR:** In preservative, the chelipeds and the greater part of the ambulatory legs are red (Chilton 1911b).

**REPRODUCTION:** Although six ovigerous females were among the numerous specimens available for study, Chilton (1911b) gave no data indicating the time of year of the collection. These eggs were relatively uniform in size, with diameters of approximately 0.4 mm.

**ETYMOLOGY:** This species is named for its general type locality, the Kermadec Islands.

**HABITAT:** Variety of gastropod shells.

**REMARKS:** Clearly, Chilton (1911b) was of the opinion that he was dealing with *Pagurixus hectori* when he reported on the numerous specimens that he had collected from Meyer and Raoul Islands, as he included in his discussion a remark about a specimen of Filhol's (1883) species that he had received from

the Chatham Islands. We have now had an opportunity to reexamine Chilton's (1911b) Kermadec material and compare it with Filhol's (1883) material, as well as numerous additional lots collected from various localities around the South Island. *Pagurixus kermadecensis* is superficially quite similar to *P. hectori*, but can be distinguished from it most readily by the absence of the series of blunt or spinulose tubercles that often form transverse ridges on the dorsomesial margin of the carpus of the right cheliped in *P. hectori*. Additionally, the lateral projections of the shield of *P. kermadecensis* sp. nov. are much less prominent than in *P. hectori*.

In a footnote to his report of "*Eupagurus hectori*", Chilton (1911b) mentioned having several specimens of a small hermit crab, that generally resembled "*Eupagurus*", but had a straight abdomen and symmetrical telson and uropods. His implied subsequent publication on this taxon was never published, and we have not been able to locate the specimens.

**RECORDS FROM NEW ZEALAND:** Kermadec Islands; intertidal.

**DISTRIBUTION:** Known only from the Kermadec Islands, New Zealand.

### *Pagurus* Fabricius, 1775

*Cancer* Linnaeus, 1758: 625 (in part).

*Pagurus* Fabricius, 1775: 410 (in part).

*Eupagurus* Brandt, 1851: 105 (in part).

*Bernhardus* Dana, 1851: 267 (in part).

[Not *Pagurus* Berthold, 1827: 255 (nomen nudum)].

[Not *Pagurus* Fabricius sensu Dana, 1851: 267 (= *Dardanus* Paul'son, 1875)].

**TYPE SPECIES:** *Cancer bernhardus* Linnaeus, 1758 (as defined by lectotype selection by Forest & Holthuis, 1955: 312: specimen figured by Swammerdam, 1737, pl. 2, fig. 1). Gender masculine.

Eleven pairs of biserial gills. Rostrum variable. Ocular acicles simple, bifid or multifid. Crista dentata well developed, with 1 or more accessory teeth. Sternite of third maxillipeds unarmed or armed. Chelipeds generally very unequal, right usually appreciably larger. Dactyls of ambulatory legs commonly with spiniform setae on ventral margins. Sternite of third pereopods with variably shaped anterior lobe. Fourth pereopods usually semichelate, with 1 to several rows of scales in propodal rasp. Sternite of fifth pereopods variable.

Coxae of fifth pereopods generally symmetrical in both sexes. Males with paired gonopores; no paired



pleopods, usually with 3 or 4 unpaired left pleopods, rarely without unpaired pleopods. Females usually with paired gonopores; no paired pleopods, usually 4 unpaired left pleopods, rarely only 3.

Abdomen usually spirally twisted, rarely straight. Uropods most commonly asymmetrical, occasionally symmetrical. Telson typically with lateral indentation suggesting division into anterior and posterior portions; posterior lobes frequently separated by well developed median cleft; terminal margins rounded, straight or oblique.

#### KEY TO THE SPECIES OF *Pagurus* FROM NEW ZEALAND (INCLUDING THE KERMADEC ISLANDS)

- 1 Ocular acicles with single terminal spine ..... 2
- Ocular acicles with 2 or more terminal spines ..... 3
- 2 Dorsal surface of right chela with dense covering of short plumose setae; tubercles of dorsal surface each with elongate corneous capsule; dactyls of ambulatory legs approximately equal to length of propodi, ventral margins each with row of 6 or 7 strong spiniform setae ..... *P. sinuatus*
- Dorsal surface of right chela without dense covering of short plumose setae; tubercles of dorsal surface without elongate capsules; dactyls of ambulatory legs appreciably longer than propodi, ventral margins each with row of 11–17 small spiniform setae ... *P. iridocarpus* sp. nov.
- 3 Third pereopods each with dense dorsal and ventral fringe of long plumose setae. Right cheliped with prominent tubercles set in inverted "V" on dorsal surface of chela; carpus strongly produced ventrally to form distinct triangular lobe ..... *P. novizealandiae*
- Third pereopods without dense dorsal and ventral fringe of long plumose setae; right cheliped without prominent tubercles set in inverted "V" on dorsal surface of chela; carpus not strongly produced ventrally to form distinct triangular lobe ..... 4
- 4 Ocular peduncles moderately short and stout; dorsal surface of right chela covered with low granules or tubercles; ambulatory dactyls longer than propodi, each with longitudinal sulcus on mesial and lateral face ..... *P. albidianthus* sp. nov.
- Ocular peduncles moderately long and slender. Dorsal surface of right chela with 6 or fewer regular or irregular rows of acute tubercles; ambulatory dactyls shorter than propodi, each without longitudinal sulcus on mesial and lateral face ..... *P. traversi*

***Pagurus sinuatus* (Stimpson, 1858) (Fig. 62)**

*Eupagurus sinuatus* Stimpson, 1858: 250; 1907: 228, pl. 26, fig. 1; Haswell 1882: 153; Whitelegge 1889: 231 Chilton, 1911b: 553; Pope 1947: 131, fig. 2; Dakin *et al.* 1953: 199, pl. 44, figs 3, 5.

*Pagurus sinuatus*: Gordan 1956: 335 (lit.); Griffin 1967: 306,

fig. 4; Lewinsohn 1969: 63; Healy & Yaldwyn 1970: 72 pl. 33; Morgan 1989: 412; Morgan & Jones 1991: 488; Morgan 1991a: 567; Jones & Morgan 1994: 121.  
[Not *Pagurus sinuatus*: Coleman 1977: 136, unnumbered colour fig. (see Remarks)]

TYPE: No longer extant.

TYPE LOCALITY: Port Jackson, Australia.

#### OTHER MATERIAL EXAMINED:

MCC collections: Kermadec Islands, coll. W.R.B. Oliver, 1908, 1 male (sl = 3.8 mm), 1 female (sl = 4.1 mm), 1 ovigerous female (sl = 5.3 mm), AQ 3379.

DESCRIPTION: Shield (Fig. 62a) slightly longer than broad. Rostrum acutely triangular, prominent, over-reaching level of lateral projections. Ocular peduncles stout, 0.55–0.70 length of shield; corneal diameter 0.38–0.45 peduncular length; ocular acicles subtriangular, slender, dorsal surfaces concave, with strong submarginal spine. Antennular peduncles over-reaching distal margins of corneas by 0.35–0.50 times length of ultimate segment. Antennal peduncles reaching slightly beyond distal margins of corneas; laterodistal projection reaching beyond proximal margin of fourth peduncular segment, terminating in bifid spine. Antennal acicles reaching to midlength of fifth peduncular segment or slightly beyond, mesial margin with dense plumose setae.

Distal segments of both chelipeds covered dorsally with moderately dense, short setae partially obscuring armature. Dactyl of right cheliped with dorsomesial row of subacute spines and median row of large conical, subacute tubercles. Palm (Fig. 62b) with moderately strong conical spines on dorsomesial margin, spines of dorsolateral margin much smaller and almost entirely obscured by moderately long, plumose setae; dorsal surface covered, but not extremely densely, with flattened tubercles, each with central, slender, elongate, corneous capsule, dorsal midline with a longitudinal row of distinct spines decreasing in size on fixed finger. Carpus subtriangular, dorsomesial margin with row of moderately small spines, dorsal surface with scattered capsulate tubercles, smooth patch medially and row of small, acute spines laterad of midline, all at least partially obscured by moderate to long plumose setae. Merus with row of slender acute spines and long setae on ventrolateral margin, ventromesial margin with long setae.

Left cheliped subtriangular; dorsal surface of palm and fixed finger with covering of capsulate tubercles partially obscured by short to moderately long, plumose setae, dorsal midline with row of conical tubercles. Carpus with row of moderately strong

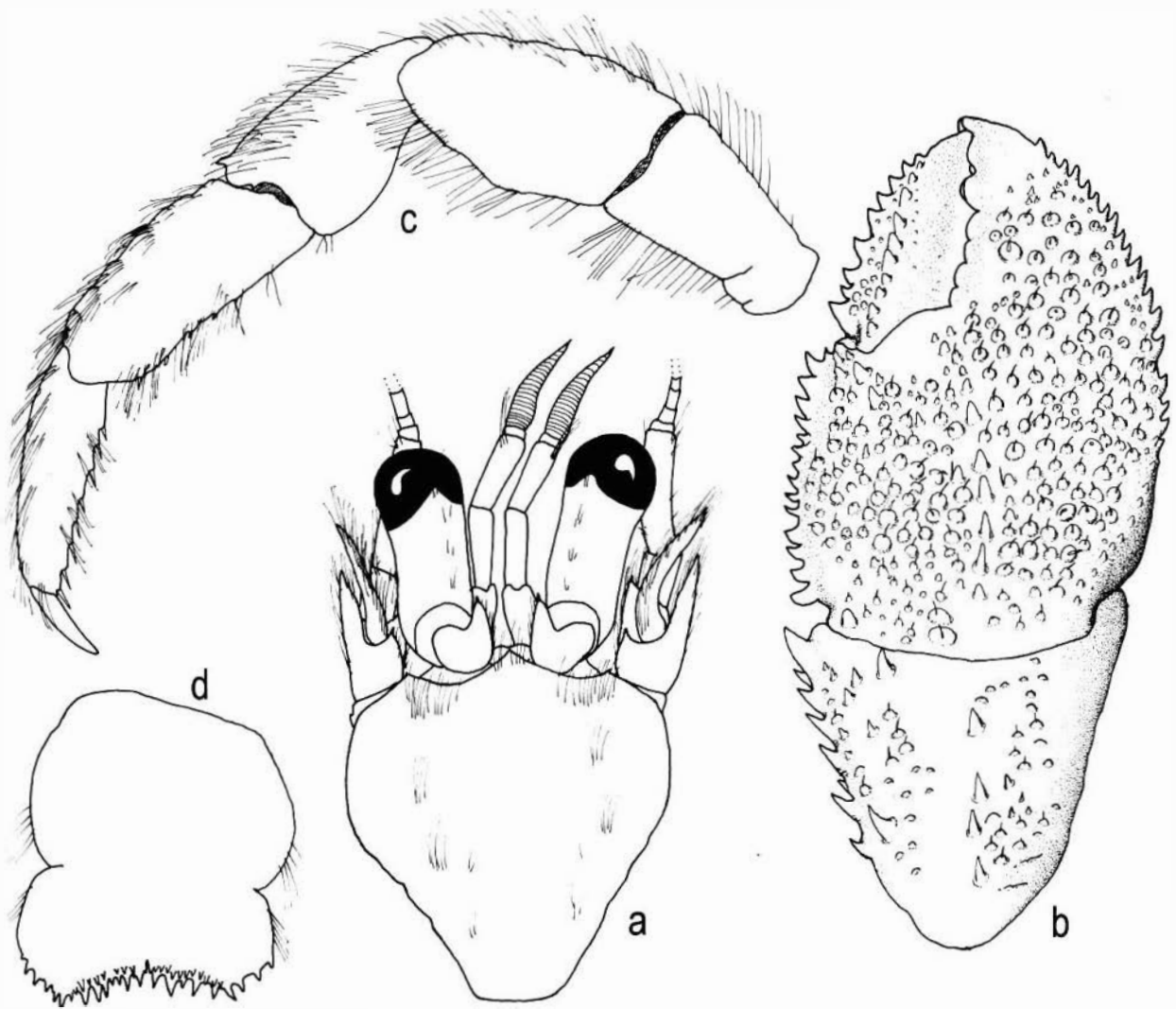


Fig. 62. *Pagurus sinuatus* (Stimpson, 1858), Kermadec Islands, male (sl = 3.8 mm), MCC, AQ 3379: a, shield and cephalic appendages (aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view, setation omitted); c, left third pereopod (lateral view); d, telson. Magnifications equal) 18x (a-c), 37.5x (d).

spines on dorsomesial margin, dorsolateral margin with row of much smaller teeth, dorsal surface between margins slightly concave and with only few spinose tubercles practically obscured by long setae; lateral surface covered with low, flattened protuberances with marginal long setae, ventrolateral margin with row of strong teeth. Merus with row of strong spines and long setae on ventrolateral margin, ventromesial margin with long setae.

Ambulatory legs (Fig. 62c) with moderately long, dense plumose setae dorsally on all segments and ventrally on meri. Dactyls each with row of small spiniform setae on mesial faces dorsally and row of 6 or 7 strong spiniform setae on each ventral margin. Propodi approximately equal to length of carpi, moderately broad. Carpi each with dorsodistal spine

and longitudinal row of setae medially on lateral face. Fourth pereopods semichelate; propodal rasp consisting of several rows of corneous bristles; dactyl with prominent preungual process at base of claw.

Males with 4 unequally biramous pleopods. Telson (Fig. 62d) with posterior lobes slightly asymmetrical, median cleft very slight; terminal margins each with few strong calcareous teeth and smaller teeth interspersed and on adjacent dorsal surface.

**COLOUR:** In life, "shield pale orange and red with darker red-violet mottling and patches. Ocular peduncles pale pink or cream, with band of orange at midlength and thinner areas of orange at distal and proximal margins; acicles pale orange or pink. Antennular peduncles with orange band on proximal half



penultimate segment and broader proximal orange or red band on ultimate segment; flagella orange. Antennal peduncles cream and orange; flagella orange. Chelipeds with dactyl orange or orange-violet, finger tip cream or cream-violet; carpus and merus orange or orange-red, sometimes almost burgundy. Spines and tubercles on chelipeds paler, often cream, especially pale on carpus and merus. Pereopods 2 and 3 distinctly banded; dactyl violet distally especially mesially and laterally, dorsal and ventral edges more strongly orange; propodus and carpus with red or maroon band at midlength; pale violet distal and proximal to this and orange near articulations; band more diffuse on merus, generally mottled orange, red and violet. Setae orange and red." (Morgan 1989).

**REPRODUCTION:** Morgan (1989) recorded ovigerous females in western Australia from October through April. The reproductive period for *P. sinuatus* in the Kermadec Islands is not known, as the single collection we have seen was not accompanied by specific collection data. However, the eggs of the one ovigerous female were relatively large, measuring 0.73–0.76 mm in diameter.

**HABITAT:** Unknown for New Zealand, but in western Australia *P. sinuatus* is reported to prefer rocky areas where wave and surge action is quite strong (Morgan, 1989). Pope (1947) found *P. sinuatus* to be a prevalent inhabitant of rocky reefs near Sydney, where it commonly occupied turban shells.

**REMARKS:** Lewinsohn (1969) and Morgan (1989) discussed the similarities between *P. sinuatus* and *P. hirtimanus* (Miers, 1880). We have compared Chilton's Kermadec Islands specimens with a specimen of *P. sinuatus* (male, sl = 7.4 mm) from the type locality, Port Jackson (BPBM S2477), and with a specimen of *P. hirtimanus* (male, sl = 6.0 mm) from the Snellius Expedition (USNM 122050), and concur that the two species are very closely related and morphologically very similar. Chilton (1911b) was correct in his identification of the Kermadec specimens as *P. sinuatus*. In addition to the shared characters noted by Lewinsohn (1969) and Morgan (1989), we have found that in both species the tubercles on the dorsal surfaces of the chelae are provided with long slender capsules similar to those reported by McLaughlin (1997) for *Pagurus capsularis* McLaughlin, 1997. Additionally, males of both species have four unpaired, unequally biramous, left pleopods. *Pagurus sinuatus* is readily distinguished from *P. hirtimanus*, as Lewinsohn (1969) and Morgan (1989) have observed by the much more strongly dilated corneas and shorter ambulatory dactyls of the latter. Morgan also observed that the

setation on the chelae of *P. sinuatus* was plumose whereas it was simple in *P. hirtimanus*. We found that to be true in the specimens we examined as well.

Coleman (1977: 136) reported and illustrated a species that he identified as *Pagurus sinuatus*, using the common name "Hairy red hermit crab". His photograph does depict a very red hermit crab, which is entirely contradictory to the colour pattern described by Morgan for this species. Unless Coleman's photograph was inadvertently reversed, it appears that the left cheliped is vastly larger than the right, suggesting possibly a species of *Dardanus*. Colour differences notwithstanding, it is clear from the long and moderately slender ocular peduncles of Coleman's photographed specimen that it is not *P. sinuatus*. Coleman may have been misled by Stimpson's (1858) notation that *P. sinuatus* had an overall reddish colour in preservative, or by the remark of Healy and Yaldwyn (1970: 72) that *P. sinuatus* was red and favoured turban shells. Their photograph (1970: pl. 33), however, shows a somewhat mottled red-maroon/whitish hermit crab, whose general colour agrees with that described by Morgan (1989).

**RECORDS FROM NEW ZEALAND:** Kermadec Islands.

**DISTRIBUTION:** Southern Australia from Sydney and vicinity westward to Western Australia as far north as Shark Bay. With the confirmation of the species in the Kermadec Islands, it can no longer be considered endemic to southern Australian.

*Pagurus iridocarpus* sp. nov. (Fig. 63)

**TYPES:**

Holotype: male (sl = 5.3 mm), NMNZ Stn BS 443, Cr 9744.

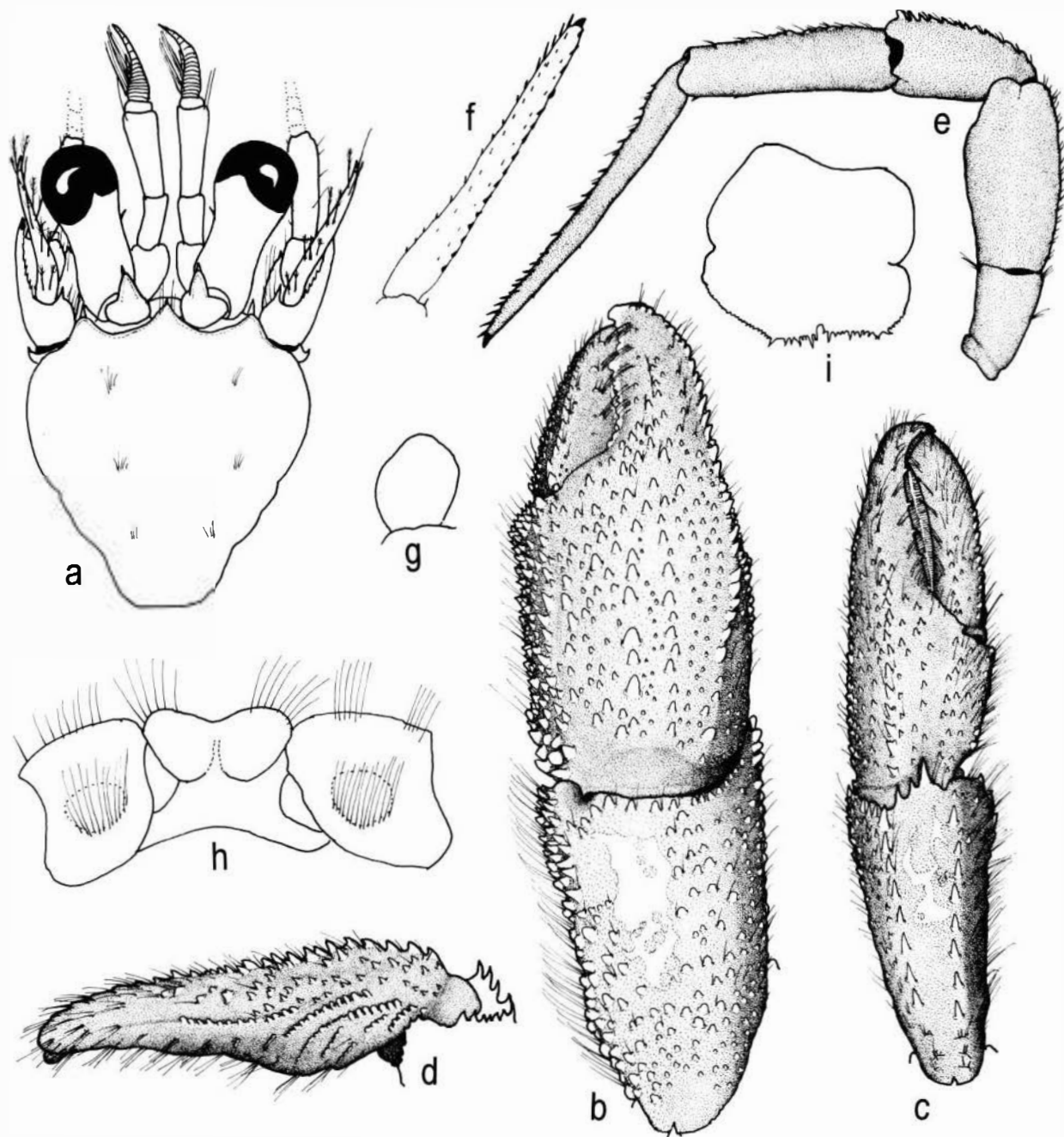
Paratypes: 1 male (sl = 1.3 mm), NMNZ Stn BS 296, Cr 9745; 2 males (sl = 2.4, 2.7 mm), NZOI Stn I82, MNHN Pg 5857; NZOI Stn K848, 2 males, (sl = 2.9, 4.9 mm), NZOI, P-1186.

**TYPE LOCALITY:** NMNZ Stn BS 443, 29°14.7'S, 177°52.7'W, Boat Harbour, Raoul Island, Kermadec Islands, 27–22 m.

**OTHER MATERIAL EXAMINED:**

NMNZ collections: Stn BS 443, 17 males (sl = 1.5–2.8 mm), 3 ovigerous females (sl = 2.1–2.5 mm), Cr 9746.

**DESCRIPTION:** Shield (Fig. 63a) slightly longer than broad; dorsal surface with few sparse tufts of setae; anterior margin between rostrum and lateral projections concave; lateral projections triangular, very



**Fig. 63.** *Pagurus iridocarpus* sp. nov., NMNZ Stn BS 443, male holotype (sl = 5.3 mm), NMNZ Cr 9744: a, shield and cephalic appendages; b, carpus and chela of right cheliped (dorsal view; iridescent area indicated by lack of stippling); c, carpus and chela of left cheliped (dorsal view; iridescent area indicated by lack of stippling); d, left chela (lateral view); e, left third pereopod (lateral view); f, dactyl of left third pereopod (mesial view); g, anterior lobe of sternite of third pereopods (setation omitted); h, coxae and sternite of fifth pereopods; i) telson. Magnifications equal 9x (e, f), 12x (a-d), 25x (g-i).

prominently developed, with strong submarginal spine; anterolateral margins terraced; posterior margin truncate. Rostrum acutely triangular, produced to level of lateral projections, with terminal spinule or spine.

Ocular peduncles moderately short, slightly more than half shield length, moderately swollen at bases

of corneas, tapered proximally; corneas large but not dilated, corneal diameter slightly less than half peduncular length. Ocular acicles triangular, with moderately strong submarginal spine.

Antennular peduncles overreach ocular peduncles by 0.50–0.75 length of ultimate segment. Ultimate segment with 1 or 2 long setae at dorsolateral distal



margin. Penultimate segment nearly glabrous. Basal segment with slender spine on statocyst lobe distolaterally.

Antennal peduncles over-reaching distal margins of corneas by 0.50–0.75 length of ultimate segment. Fifth and fourth segments with some scattered short setae. Third segment with strong spine at ventrodistal margin. Second segment with laterodistal projection reaching beyond proximal margin of fourth peduncular segment, terminating in strong spine, with 4–7 spinules on mesial margin; dorsomesial distal angle with prominent spine. First segment with spine on laterodistal margin and strong spine on ventrolateral margin distally. Antennal acicle reaching beyond midlength of ultimate peduncular segment, with double or triple irregular row of short to moderately long, stiff, distally plumose bristles.

Third maxillipeds each with strong spine on crista dentata; merus and carpus unarmed. Sternite of third maxillipeds also unarmed

Right cheliped (Fig. 63b) appreciably stronger than left, but not appreciably longer; chela and carpus moderately short and broad in small specimens, rather long and slender in large specimens. Dactyl approximately equal to length of palm, single or irregular double row of small spines or tubercles on poorly delimited dorsomesial margin; dorsal surface elevated in midline and armed with row of stronger spines extending to tip; cutting edge with 2 prominent calcareous teeth separated by small calcareous teeth from more distal large calcareous tooth, few small corneous teeth distally; terminating in very small corneous claw and slightly overlapped by fixed finger. Palm approximately equal to length of carpus; convex dorsal surface covered with regular or irregular rows of moderately closely spaced small spines or subacute tubercles sparsely accompanied by moderately short setae, median pair and rows adjacent to poorly defined dorsomesial and dorsolateral margins largest, spines or tubercles on dorsal surface of fixed finger fewer in number and not extending to tip, but dorsolateral margin clearly delimited by row of small, subacute teeth or spines, becoming blunt tubercles distally; cutting edge of fixed finger with several small calcareous teeth and 1 median strong calcareous tooth; terminating in strong calcareous tooth; mesial and lateral faces and ventral surface tuberculate. Carpus with single or double row of strong spines on dorsomesial margin, row of spines or tubercles on or adjacent to dorsodistal margin and extending nearly entire length of laterodistal margin; dorsal surface with large area of iridescent, at least partially uncalcified, integument, flanked mesially by regular or irregular longitudinal row of spines or spinulose tubercles, proximally by small spines or low tubercles

and laterally by numerous spines or blunt to subacute tubercles; dorsolateral margin not delimited, spines or tubercles of dorsolateral face continued onto lateral face, ventrolateral margin with single or double row of small spines or tubercles; mesial face with several spines or spinulose tubercles dorsally and distally, remainder of surface with short, transverse, sometimes spinulose ridges and long setae; ventral surface with scattered low tubercles. Merus approximately same length as carpus; dorsodistal margin with 1 strong spine, dorsal surface with few short, transverse ridges and short setae; ventrolateral margin with row of acute spines distally, becoming single or double row of subacute or blunt tubercles proximally; ventral surface with numerous short, transverse spinulose ridges, or sometimes only simple or bifid tubercles, ventromesial margin with row of small spines or tubercles. Ischium usually with row of small acute or blunt tubercles on ventromesial margin, occasionally unarmed.

Left cheliped (Fig. 63c, d) long, slender. Dactyl approximately 1.35–1.75 length of palm; dorsomesial margin with row of small spinules or tubercles, each accompanied by tuft of moderately long setae; dorsal surface with row of tubercles or spinules and tufts of setae on elevated midline in proximal 0.50–0.65, distal 0.50–0.35 with few low protuberances and tufts of setae; cutting edge with row of small corneous teeth, slightly overlapped by fixed finger. Palm approximately 0.50 length of carpus; subtriangular in cross-section; midline elevated and armed with single or double row of moderately small spines, extending onto proximal 0.50–0.75 of fixed finger; dorsolateral margin delimited by row of small, subacute or acute tubercles in small specimens, dorsolateral surface with 3 or 4 irregular rows of spines on palm dorsally, but only few small tubercles in proximal half of fixed finger; larger specimens (Fig. 63c) with marginal tubercles replaced in proximal half of palm by transverse rows of closely spaced acute or subacute tubercles extending onto ventral surface; dorsomesial face of palm with 1–4 regular or irregular rows of rather widely-spaced small spines or spinules, dorsomesial margin with row of small spinules or tubercles; cutting edge of fixed finger with row of widely spaced small calcareous teeth interspersed with small corneous teeth; ventral surfaces all with tufts of long setae. Carpus about same length as merus; dorsomesial and dorsolateral margins each with row of acute spines, 1–4 strong spines on dorsodistal margin, dorsal surface, at least in distal half, usually with integument weakly calcified and iridescent; laterodistal and mesiodistal margins each with row of spines; lateral and mesial faces each with few spines and/or transverse ridges and setae, ventrolateral and ventromesial margins

each with row of spines or tubercles; ventral surface with transverse, tuberculate ridges and tufts of long setae. Merus with dorsodistal spine, dorsal surface with few transverse ridges and setae; ventromesial margin with irregular row of rather blunt spines or tubercles; ventrolateral margin with row of strong acute spines in distal third, becoming smaller and decreasing in size proximally; ventral surface with transverse, tuberculate ridges. Ischium with row of subacute or blunt tubercles on ventromesial margin.

Ambulatory legs (Fig. 63e, f) with dactyls generally similar from left to right, although third slightly longer. Dactyls becoming longer and more slender with increasing size; 1.2–1.4 times longer than propodi; each with row of spinulose bristles on dorsal margin; mesial faces each often with weak longitudinal sulcus proximally, 1 row of spiniform setae dorsally, and occasionally also row ventrally; ventral margins each with row of 11–17 spiniform setae; lateral faces each with weak, longitudinal sulcus proximally. Propodi each with single or double row of small spines or sometimes only spinulose protuberances (third) accompanied by few stiff bristles on dorsal surface, 0–2 spiniform setae on ventrodiscal margin; row of 4–6 widely spaced spiniform setae on ventral surface. Carpi each with row of spines on dorsal surface, strongest on second. Meri with widely spaced setae on dorsal surfaces, ventral surfaces of second pereopods each with a row of very small spines; third unarmed. Fourth pereopods semichelate, with single row of corneous scales in propodal rasp; preungual process well developed at base of claw. Sternite of third pereopods with subcircular anterior lobe (Fig. 63g). Sternite of fifth pereopods (Fig. 63h) produced into 2 subovate lobes.

Male with 3 unpaired left pleopods, unequally biramous; exopods 0.35–0.50 length of endopods. Telson (Fig. 63i) with roundly rectangular posterior lobes separated by median cleft; terminal margins almost straight, with row of slender, small spines interspersed with few somewhat larger spines, extending onto lateral margins.

COLOUR: Not known.

VARIATIONS: Only one specimen was preserved with its appendages still attached. All other specimens had the chelipeds and most, if not all, other pereopods disarticulated, and only in a few instances was it possible to determine with assurance which appendages belonged to a specific animal. Nonetheless, it could easily be seen that *Pagurus iridocarpus* sp. nov. exhibits considerable variation in the shape and armature of the chelipeds that appears to be a function of size. The right cheliped is moderately short and the

palm nearly as broad as long in small specimens. In large specimens, such as the holotype (sl = 5.3 mm) the chela is appreciably more elongate and slender. The armature of the chelas is much more precisely defined in small specimens, i.e., distinct and regular rows of small spines and spinules, both on the dorsal surfaces and dorsolateral margins. With increased size the spines of the dorsal surfaces are more irregularly aligned and usually less acute. The ventrally displaced, distinct row of spines on the dorsolateral margin of the left chela is replaced proximally by several transverse rows of low, closely-spaced tubercles. Since the holotype (the largest specimen) is a male, it is possible that the observed variations are actually examples of sexual dimorphism, but until large females can be observed, we attribute these variations to size differences. The dactyls of the ambulatory legs also exhibit variation that appears size-related. In small specimens (sl = 1.3–1.8 mm) the dactyl is relatively deeper (ratio of lateral depth to length > 1 : 5), whereas, with increasing size (e.g., sl = 2.8 mm), the ratio increases. In the holotype (sl = 5.3 mm) it is < 1 : 12, and more stick-shaped.

REPRODUCTION: Only three ovigerous females are presently known, all small, with shield lengths measuring between 2.1 and 2.5 mm. These specimens, collected in October were each carrying > 50 relatively small eggs with diameters between 0.55 and 0.61 mm. None of the eggs appeared near hatching.

HABITAT: Each of the two specimens still remaining in very worn gastropod shells was accompanied by a small anemone on the shell aperture directly beneath the crab.

ETYMOLOGY: From the Greek, *iris*, the root of iridescent, and *karpus*, i.e., carpus, referring to the iridescent integument on the dorsal surface of the carpus of the right cheliped, and sometimes also the left.

REMARKS: *Pagurus iridocarpus* sp. nov. most closely resembles *P. tristanensis* (Henderson, 1888) from Tristan da Cunha in the south Atlantic, and *P. spinulentus* (Henderson, 1888) from the Philippine Islands. Neither of the latter species has been reported since its original description; however, we have been able to base our comparisons on the type specimens borrowed from The Natural History Museum, London. Although Henderson's (1888) descriptions were relatively detailed, they did not provide sufficient diagnostic characters to permit specific recognition, as demonstrated by Stebbing's (1910, 1924) misinterpretation of a South African species, first as *P. tristanensis* (as *Eupagurus*) (Stebbing 1910) and subse-



quently as *P. spinulentus* (also as *Eupagurus*) (Stebbing 1924). As suspected by Forest (1955) and recently confirmed, Stebbing's (1910, 1924) taxon is actually referable to *Pagurus prideaux* Leach, 1815 (cf. McLaughlin & Forest 1998). All three species are characterised by moderately short ocular peduncles; spinose right chelae, a medially elevated palm of the left chela, and spines on the dorsal surfaces of both the propodi and carpi of at least the second pereopods. However, it is not only the distinctive iridescence of the carpi of the chelipeds that may distinguish *P. iridocarpus* from both of Henderson's (1888) taxa but a number of additional characters, particularly the well developed rostrum and the shape of the anterior lobe of the sternite of the third pereopods.

RECORDS FROM NEW ZEALAND: Kermadec Islands; 84 m, possibly to 113 m.

DISTRIBUTION: At present known only from the Kermadec Islands.

*Pagurus novizealandiae* (Dana, 1852)  
(Fig. 64, Pl. 6, fig. 2)

*Pagurus cristatus*: White & Doubleday 1843: 266; White 1847: 59. [Not *Pagurus cristatus* H. Milne Edwards, 1836.]  
*Bernhardus novi-zealandiae* Dana, 1852c: 440; 1855, pl. 27, fig. 27.

*Eupagurus novi-zealandiae*: Stimpson 1858: 251; Thompson 1930: 268.

*Eupagurus novae-zealandiae*: Miers 1876b: 63; Thomson 1899: 173, pl. 20, figs 3-5; Lenz 1901: 445.

*Eupagurus Edwardsi* Filhol, 1883: 66 (in part).

*Eupagurus Novae Zealandiae*: Filhol 1885b: 51; 1885d: 496,

*Pagurus novae-zealandiae*: Greenwood 1966: 545, figs 1-3; 1972a: 325, 330, fig. 1; 1972b: 562, figs 1-10.

*Pagurus novaezealandiae*: Schembri 1982b: 868

*Pagurus novizealandiae*: Schembri & McLay 1983: 31, fig. 17; Schembri 1988: 93.

TYPE: Apparently no longer extant. Syntypes of *Eupagurus Edwardsi* Filhol, 1883, 2 males (sl = 5.6, 6.0 mm), 2 females (sl = 2.5, 3.6 mm) Cook Strait, 1874-1875, coll. H. Filhol, MNHN Pg 5843.

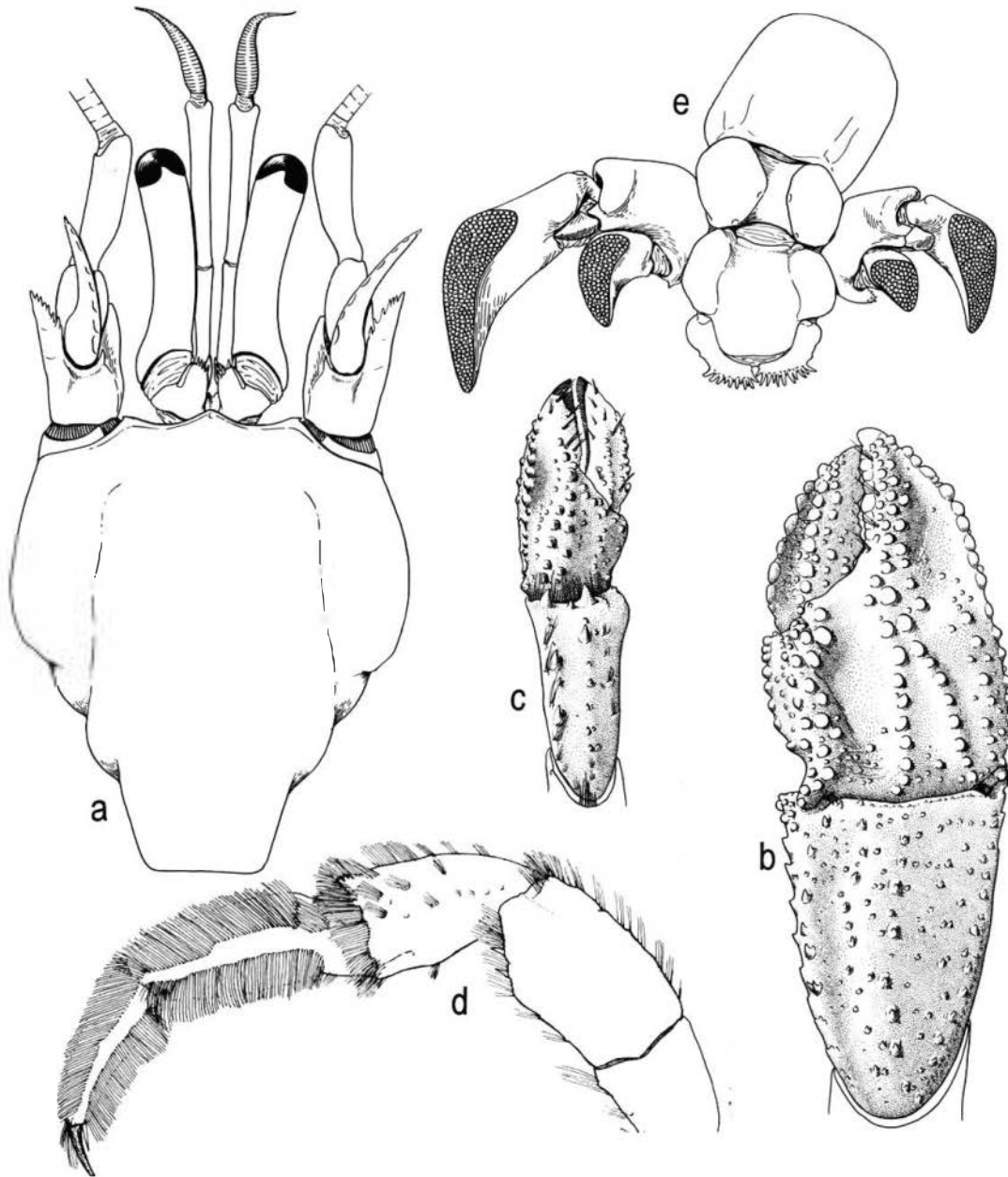
TYPE LOCALITY: New Zealand.

OTHER MATERIAL EXAMINED:

NZOI Stns: C765, 1 male (sl = 6.2 mm); C980, 3 males (8.4-13.7 mm); Makara, 16.12.59, 1 male (sl = 4.6 mm), 1 female (sl = 3.9 mm);

NMNZ collections: *Eupagurus intermedius* Lenz = *Eupagurus novae* Chilton, 1 female (sl = 9.8 mm), Cr 454; Off west coast, 27.6.68, 3 males (sl = 5.5-6.5 mm), Cr 8094; Kenepuru

Sound, 4.10.89, below mean low tide, 5 males (sl = 4.9-7.2 mm), 3 ovigerous females (sl = 4.0-6.7 mm), Cr 9747; Te Hapua, Parengarenga, coll. R.K. Dell, 14.11.63, 2 males (sl = 4.2, 7.4 mm), 1 female (sl = 2.5 mm), 1 ovigerous female (sl = 3.9 mm), Cr 9748; Reef Point, Ahipara, 24.4.67, 1 male (sl = 9.9 mm), 1 female (sl = 4.6 mm), Cr 8098; Bay of Islands: intertidal, -12.56, 1 male (sl = 1.7 mm), 1 female (sl = 5.4 mm), Cr 9749; Kohinga Wharf, Parekura Bay, coll. R.K. Dell, 1.8 m, -11.90, 1 male (sl = 5.3 mm), Cr 8037; Great Barrier Is., Onewhero, Katherine Bay, 17.4.68, 1 intersex (sl = 13.4 mm), 1 female (sl = 9.4 mm), Cr 7532; Kawa Katherine Bay, coll. J.A. Ragg, 24.8.52, 1 male (sl = 5.8 mm), 1 female (sl = 4.2 mm), Cr 7535; Kaipara Harbour, coll. W.R. Oliver, 1 male (sl = 8.7 mm), Cr 9750; Auckland: Muriwai, coll. R.K. Dell, 17.1.62, intertidal, 1 female (sl = 3.4 mm), Cr 9751; Waiheke Isl., coll. G. Chamberlain, 12.8 m, 5 males (sl = 3.9-8.0 mm), 2 females (sl = 4.5, 12.0 mm), 2 ovigerous females (sl = 8.4, 8.5 mm), Cr 443; Southeast Bay, Mayor Is., coll. A.N. Baker, 27.10.69, intertidal, 1 male (sl = 10.2 mm), 1 ovigerous female (sl = 5.2 mm), Cr 5709; Matakaoa Point, 28.6.88, 16.6 m, 1 female (sl = 6.4 mm), Cr 7512; New Plymouth, coll. M.A. Crozier, 30.3.64, 14 males (sl = 4.0-10.8 mm), 11 females (sl = 4.0-9.9 mm), 8 juveniles (sl = 1.7-2.7 mm), Cr 9752; off New Plymouth, coll. G. Hardy, -4.85, 1 male (sl = 4.9 mm), Cr 8035; off Kaikokopu Beach. Mahia Peninsula, 14.4.81, 15 m, 1 female (sl = 10.9 mm), Cr 8077; Hawera, Waiki Beach, coll. M.A. Crozier, 23.8.64, 1 specimen, Cr 9753; Paekakariki, coll. R.K. Dell, washed ashore, 1.4.48, 1 specimen, Cr 9754; Mangaoa, Tauranga Bay, coll. R.K. Dell, 11.11.63, 1 male (sl = 7.4 mm), Cr 9755; Castlepoint, 40°55'S, 176°10.5'E, coll. R.B. Pike, 28.3.64, 2 males (sl = 5.3, 7.7 mm), 2 females (sl = 4.6, 5.9 mm), Cr 9756; Mt Maunganui, coll. R.D. Cooper, 28.10.68, intertidal, 3 males (sl = 1.8-2.9 mm), Cr 8086; Houhora Harbour: coll. R.K. Dell, 18.11.63, 3 males (sl = 5.9-9.8 mm), 2 ovigerous females (sl = 3.1, 3.7 mm), Cr 9757; Lyall Bay, coll. R.K. Dell, 27.12.47, 1 male (sl = 6.0 mm), Cr 453; Wellington (no other data), 1 male (sl = 5.4 mm), Cr 9758; Wellington Harbour, Evans Bay, coll. P.E. Roberts, -8.65, intertidal, 1 male (sl = 3.8 mm), 1 female (4.3 mm), Cr 9759; Worser Bay, 24.8.52, 1 male (sl = 12.1 mm), 1 female (sl = 9.6 mm), Cr 451; Pukerua Bay, coll. W.F. Ponder, 9.2.66, 1 male (sl = 11.0 mm), 1 female (sl = 10.3 mm), Cr 8110; Cook Strait, 1 male, (sl = 10.9 mm), Cr 9760; NE Cape Campbell, approximately 41°40'S, 174°30'E, coll. F. Abernethy, -12.53, 3-4.6 m, 1 male (sl = 4.5 mm), Cr 9761; Kaikoura, coll. C. McLay, 25.11.76, intertidal, 5 males (sl = 7.2-13.1 mm), 2 females (sl = 5.2, 6.5 mm), 2 ovigerous females (sl = 10.4, 11.2 mm), Cr 4032; Totaranui, Nelson, coll. R.K. Dell, 5.63, 1 male (sl = 9.4 mm), Cr 9762; Manukau Harbour, -1956, 1 male (sl = 5.4 mm), Cr 9763; North Otago, coll. J. Graham, 1970-71, 2 males (sl = 3.5, 15.8 mm), 1 female (sl = 11.4 mm), Cr 7389; All Day Bay, coll. J. Graham, -12.71, 5 males (sl = 6.7-15.7 mm), 1 female (sl = 6.3 mm), Cr 7388; Cape Rock pools and Gees Pt., coll. J. Graham, 1963-64, 2 males (sl = 4.3 mm, 5.2 mm), 1 female (sl = 6.5 mm), Cr 8074, -8.64, 1 male (sl = 7.5 mm), Cr 9764; Otago Harbour, -11.62, 1 specimen, Cr 9765; Otago Harbour, Portobello Marine Station, coll. R.K. Dell, 15.8.55, 3 males (sl = 5.0-7.4 mm), 1 female (sl = 7.4 mm), Cr 9766; Portobello, Crib Beach, 27.8.51, low tide, 1 specimen, Cr 9767; Auckland Island, Ranui Cove, coll. G.A. Knox, 1.63, intertidal, 1 speci-



**Fig. 64.** *Pagurus novizealandiae* (Dana, 1852). NZOI Stn C980, male (sl = 13.7 mm): a, shield and cephalic appendages (setation and aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view, setation omitted); c, carpus and chela of left cheliped (dorsal view setation omitted); d, left third pereopod (lateral view); e, tergite of sixth abdominal somite, uropods, telson (setation omitted). Magnifications equal 6x (b, c), 9x (a), 12x (e), 16x (d).

men, Cr 9768; Stn BS 240, coll. A.N. Baker, 2 males (sl = 5.2, 9.2 mm), 2 ovigerous females (sl = 5.2, 5.9 mm), Cr 8191; Stn BS 247, 1 male (sl = 3.9 mm), Cr 8187.

PMBS collections: Little Papanui, Otago Peninsula, coll. J. Jillett, -2.67, low tide, 2 males (sl = 4.3, 5.1 mm), 4 females (sl = 4.2–6.0 mm).

PMcL collection: Great Omaha Bay, Stn C44, 1 female (sl = 4.2 mm); Stn C53, 1 ovigerous female (sl = 6.0 mm); Queen Charlotte Sound: Head of Tahuahua Bay, coll. C.

Duffy, 2.10.89, 1 males (sl = 2.6 mm), 1 female (sl = 2.4 mm); Kahikutea Bay, coll. C. Duffy, 3 m, 1 male (sl = 12.2 mm).

**DESCRIPTION:** Shield (Fig. 64a) broader than long to considerably longer than broad. Rostrum acute, produced to level of lateral projections. Ocular peduncles moderately slender; corneas not dilated; ocular acicles with 2–5 marginal spines but spination



frequently obscured by tufts of setae. Antennular peduncles reaching or considerably over-reaching distal margin of corneas. Antennal peduncles usually reaching slightly beyond bases of corneas, sometimes over-reaching distal margins; acicle reaching beyond proximal margin of fifth peduncular segment. Third maxilliped usually with 2 accessory teeth on crista dentata. Sternite of third maxillipeds unarmed.

Right cheliped (Fig. 64b) with ovate chela. Dorsomesial margin of dactyl with row of broad, blunt teeth; dorsal surface of dactyl, palm, and fixed finger with numerous large tubercles, on palm forming inverted "V"; dorsomesial and dorsolateral margins each with row of large, tuberculate spines. Carpus with irregular rows of subacute, moderately small spines on dorsal surface, strongest on dorsomesial margin and partially obscured by tufts of short setae, ventrolateral face and ventral surface strongly produced into subtriangular lobe. Merus with denticulate ventromesial and ventrolateral margins.

Left cheliped (Fig. 64c) with palm elevated in midline, but not as prominent crest, dorsal surface with 2 irregular rows of tubercles partially obscured by tufts of setae, dorsolateral margin with row of tubercles. Carpus with row of widely spaced strong, spines on dorsomesial margin, surface with dense tufts of setae. Merus with row of very small denticles on ventromesial margin and row of larger spines on ventrolateral margin.

Ambulatory legs with rows of tufts of short setae, forming dense fringe dorsally and ventrally on dactyls and propodi of third pereopods (Fig. 64d); ventral margins of dactyls each with 3 or 4 (second) or 9–11 (third) small, spiniform setae. Carpi each with row of spines on dorsal margin, at least on second pereopods. Fourth pereopods semichelate; with single row of corneous scales in propodal rasp. Anterior lobe of sternite of third pereopods usually very narrowly subrectangular, rarely subtriangular or subsemicircular, with median row of long setae.

Second somite of abdomen of both sexes with 2 protuberant fleshy lobes ventrally. Males with 3 unpaired left pleopods. Telson (Fig. 64e) with posterior lobes separated by moderately broad median cleft, terminal margins slightly rounded, each with several strong, acute or subacute spines interspersed with smaller spines.

**COLOUR:** Ocular peduncles pale bluish-green proximally, tending to white distally; antennules pale bluish-green with some yellow markings; antennae yellow with black stripes; chelipeds and ambulatory legs bluish-green ground colour with bright blue transverse bands at carpal-meral articulation and tufts of golden setae (Schembri & McLay 1983).

Juveniles in the Otago region were reported to have white chelipeds and white-banded ambulatory legs by Schembri and McLay; whereas juveniles and very small adults (sl < 2.6 mm) from the North Island were noted as having white chelipeds and ambulatory legs, the latter banded with blue or tan (C. Duffy, field notes).

**VARIATION:** Small specimens of *P. novizealandiae* (sl < 2.7 mm) have tufts of setae present only on the dactyls and propodi of the third pereopods, but the density is insufficient for the characteristic setal fringe. Additionally, these specimens have much stronger spines on the dorsolateral margin of the carpus of the left cheliped. The prominent ventral protuberance of the carpus of the right cheliped is well developed.

**HABITAT:** Occupying a variety of gastropod shells intertidally under rocks and on sand.

**REPRODUCTION:** Ovigerous females in our collections had shield lengths varying from 3.1 to 11.2 mm. A female (sl = 5.1 mm) from Mayor Island was carrying about 150 eggs about to hatch and with a few prezoeae present. The eggs varied from 0.65 to 0.70 mm in diameter. Two smaller females (sl = 3.1, 3.7 mm) from Houhora Harbour were carrying eggs still in early development. Eggs of these females measured between 0.43 and 0.52 mm in diameter, apparently the average size of developing eggs for females of all sizes. Both of the Houhora Harbour females were carrying a relatively small number of eggs (35–45), but some may have been lost during capture and preservation, so this number cannot be considered indicative of a normal brood. The relatively few ovigerous females in our samples were collected during October and November.

**REMARKS:** *Pagurus novizealandiae* is common and very distinctive. Among New Zealand pagurids it is most closely allied to *Pagurus traversi*, but bears a superficial resemblance to *Diacanthurus spinulimanus* in the armature of the right cheliped and occasionally has been confused with it. Nonetheless, the prominent ventrally produced carpus of the right cheliped and the shape of the posterior lobes of the telson will immediately distinguish *P. novizealandiae* from *D. spinulimanus*.

**RECORDS FROM NEW ZEALAND:** North and South Islands to Auckland Islands; intertidal to 28 m.

**DISTRIBUTION:** Known only from New Zealand.

*Pagurus albidianthus* sp. nov. (Fig. 65, Pl. 6, fig. 3)

(?) *Pagurus* n. sp. 1: Rainer 1981: 37.

*Pagurus* sp. 'pink and white': Probert *et al.* 1979: 381.

*Pagurus* n. sp. A: Schembri & McLay 1983: 28, 32, fig. 19;  
Schembri 1988: 93, 99.

#### TYPES:

Holotype: male (sl = 7.5 mm) from NZOI Stn B628, NIWA holotype H-715.

Paratypes: 1 male (sl = 7.7 mm) from NZOI Stn B628, NIWA paratype P-1168; 1 male (sl = 10.2 mm), 2 females (sl = 6.5, 6.7 mm), Cloudy Bay, coll. G. Olsen, 1987, 2–7 m, NMNZ Cr 8217; 1 female, 1 ovigerous female (sl = 2.4, 3.9 mm), Hawke Bay, coll. C. Duffy, 19.1.95, 4 m, MNHN Pg 5851; 1 male, 1 female (sl = 2.3, 4 mm), off Waitarere, 40°23.2'S, 175°13.3'E, coll. T. Willis, 6.5.94, 4.1 m, USNM 268573; 40°27.1'S, 175°12.4'E, coll. T. Willis, 10.4.94, 5.5 m, 1 male, 2 females (sl = 2.9–3.6 mm) NHM 1999.874–876.

TYPE LOCALITY: NZOI Stn B628, off Hokitika, 42°55.5'S, 170°27'E, 28 m.

#### OTHER MATERIAL EXAMINED:

NZOI Stns: B628, 8 males (sl = 3.6–7.2 mm), 6 females (sl = 3.8–4.2 mm), 1 ovigerous female (sl = 4.2 mm); B661, 2 females (sl = 3.6, 4.0 mm); B662, 1 male (sl = 4.8 mm); B671, appendages only.

NMNZ collections: Off Waitarere, 40°21.8'S, 175°13.4'E, coll. T. Willis, 6.5.94, 3.8 m, 2 males, 3 females (sl = 1.6–3.7 mm), Cr 9769; 40°24'S, 175°13.1'E, coll. T. Willis, 11.4.94, 5.2 m, 1 male (sl = 3.7 mm), Cr 9770.

PMBS collections: MU 67–68, Blueskin Bay, 29.5.67, 4.6–6.1 m, 2 males (3.7, 4.0 mm), 1 ovigerous female (3.7 mm).

PMcL collection: Great Omaha Bay, Stn C37, 1 female (sl = 3.4 mm); Off Waitarere, 40°25'S, 175°12.8'E, coll. T. Willis, 11.4.94, 6.1 m, 1 male (sl = 4.3 mm); 40°27.8'S, 175°11.9'E, coll. T. Willis, 10.4.94, 9.8 m, 1 male (sl = 2.6 mm), 1 ovigerous female (sl = 3.7 mm).

**DESCRIPTION:** Shield (Fig. 65a) slightly broader than long to slightly longer than broad; anterior margin between rostrum and lateral projections concave; anterolateral margins sloping or slightly terraced; posterior margin truncate or rounded; dorsal surface sometimes with few scattered setae. Rostrum usually roundly to subacutely triangular, without terminal spine, but occasionally with median tubercle and tuft of setae posteriorly. Lateral projections obtusely triangular or rounded, with or without small marginal or submarginal spinule.

Ocular peduncles moderately short, approximately 0.55–0.75 length of shield, corneal diameter 0.27–0.35 peduncular length. Ocular acicles roundly subrectangular, with 2–6 spines on terminal margin.

Antennular peduncles over-reaching corneas by

0.25–0.75 length of ultimate segment. Ultimate segment with few shorter setae on dorsal surface (not illustrated).

Antennal peduncles reaching nearly to or slightly beyond distal margin of corneas. Fifth and fourth segments with few scattered setae. Third segment usually with small spine at ventrodistal angle. Second segment with laterodistal projection broad, reaching beyond proximal margin of fourth segment, with simple or bifid terminal spine, mesial margin with 5–7 small teeth; dorsomesial distal angle with prominent tooth. First segment with 1 prominent tooth on ventrolateral margin. Antennal acicle reaching to proximal half of ultimate peduncular segment, slightly arcuate, terminating in acute tooth, mesial margin with sparse row of setae. Antennal flagellum much shorter than outstretched right cheliped, with 1 or 2 short and 1–3 slightly longer setae every article.

Maxillule with external lobe of endopod moderately well developed, not recurved. Ischium of third maxilliped with 1 or 2 accessory teeth on crista dentata. Sternite of third maxillipeds unarmed and without median concavity.

Chelipeds grossly unequal. Right cheliped (Fig. 65b) with dactyl approximately equalling length of palm; cutting edge with row of calcareous, distinct or nearly obsolete teeth, terminating in small corneous or calcareous claw; dorsal surface with scattered small tubercles and few setae, with row (more distinct in small specimens) of small, subacute tubercles in midline proximally but curving laterad of midline and extending nearly to tip; dorsomesial margin with regular or irregular row of low, broad, flattened teeth; ventral surface with few setae. Palm 0.65–0.75 length of carpus; dorsomesial margin with irregular row of small, often flattened denticles, angular dorsomesial face with numerous small tubercles, delimited from weakly convex dorsal surface by row of slightly stronger, subacute to acute tubercles appearing as continuation of median row of dactylar tubercles and in large specimens by longitudinal weak depression; dorsal surface covered, but not densely, with very small tubercles or granules; dorsolateral margin with row of small denticles, becoming distinct teeth (in small specimens) on fixed finger and extending almost to tip; mesial, lateral and ventral surfaces minutely to prominently tuberculate or granular, tubercles strongest on mesial face; cutting edge of fixed finger with row of small, sometimes nearly obsolete, calcareous teeth and 1 or 2 more prominent teeth medially, terminating in small corneous claw. Carpus approximately as long as merus; dorsomesial margin with irregular single or double row of very small denticles or teeth, sometimes separated from remainder of dorsal surface by weak longitudinal



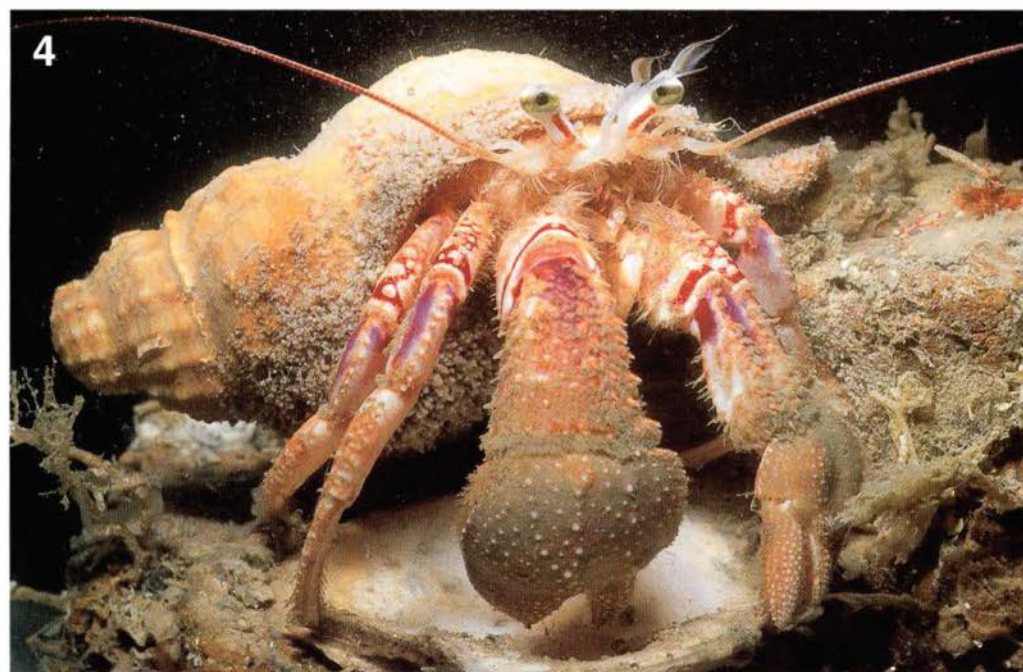
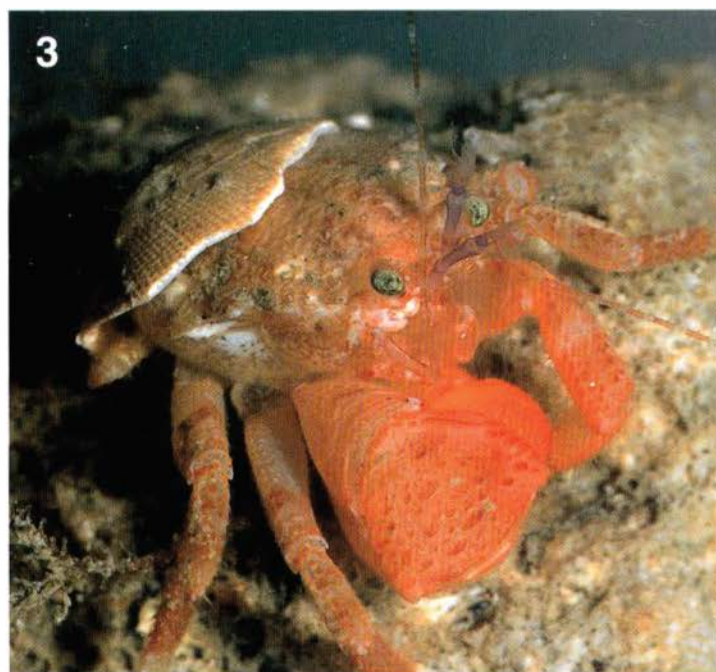


Plate 3. Fig. 1. *Lophopagurus* (*Lophopagurus*) *pumilus* sp. nov. (Photo: Colin McLay). Fig. 2. *Diacanthurus spinulimanus* (Miers) (Photo: Karen Gowlett-Holmes). Fig. 3. *Porcellanopagurus filholi* sp. nov. (Photo: Ken Grange). Fig. 4. *Diacanthurus rubricatus* (Henderson) (Photo: Ken Grange).





Plate 4. Fig. 1. *Lophopagurus* (*Lophopagurus*) *thompsonii* (Filhol). Fig. 2. *Lophopagurus* (*Lophopagurus*) *lacertosus* (Henderson). Fig. 3. *Lophopagurus* (*Lophopagurus*) *foresti* McLaughlin & Gunn. Fig. 4. *Lophopagurus* (*Australaremus*) *cookii* (Filhol) (Photos: Colin McLay).



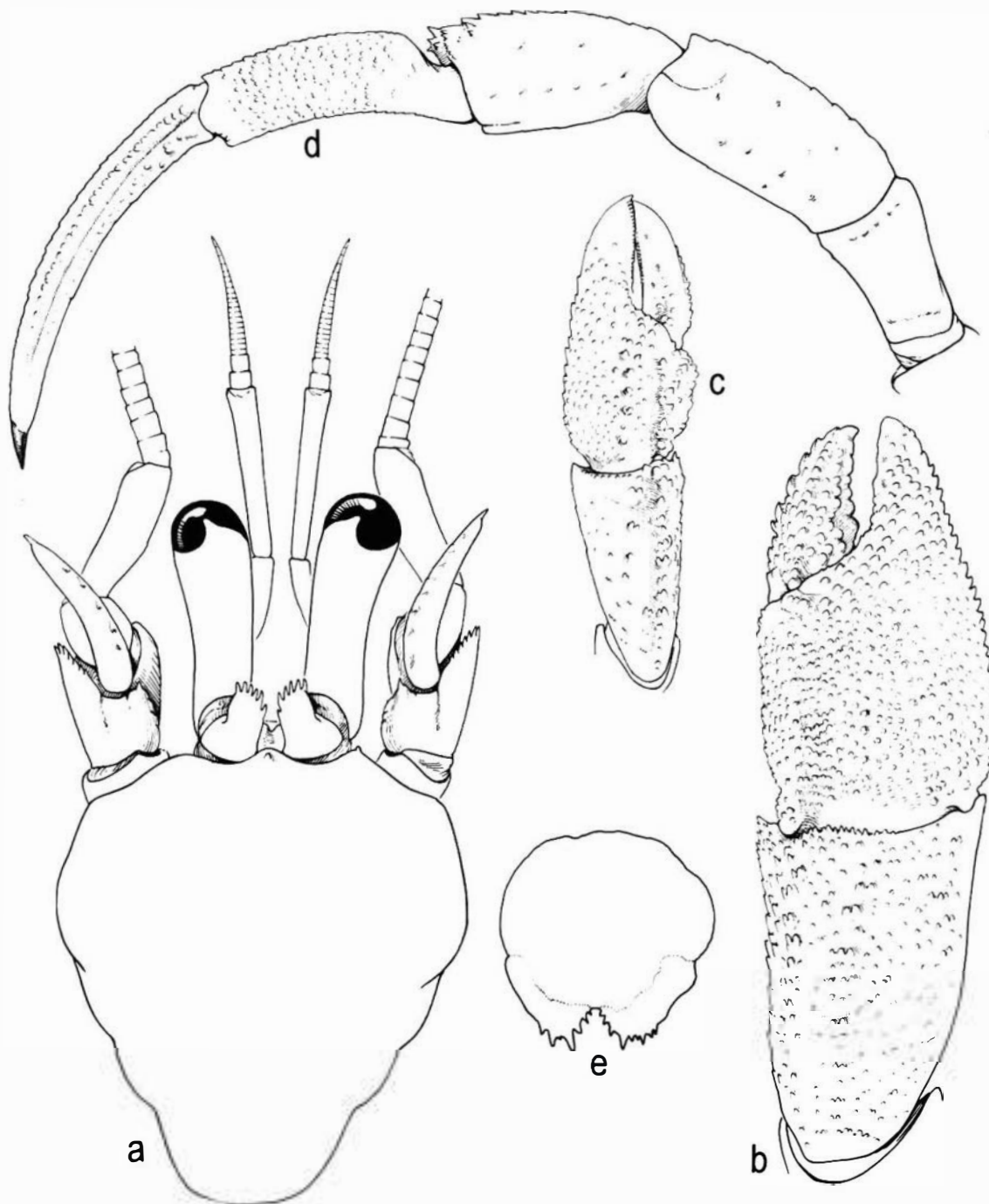


Fig. 65. *Pagurus albidianthus* sp. nov. NZOI Stn B628, a-d, male paratype (sl = 7.7 mm) NIWA P-1168; e, male holotype (sl = 7.5 mm), NIWA H-715: a, shield and cephalic appendages (setation and aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view, setation omitted); c, carpus and chela of left cheliped (dorsal view, setation omitted); d, left third pereopod (lateral view, setation omitted); e, telson (setation omitted). Magnifications equal 9x (b-d), 15x (a), 18x (e).

depression; dorsal midline with slightly stronger, longitudinal single or double row of spines or tubercles, dorsolateral margin not delimited, dorso-lateral surface with numerous subacute or acute tubercles and granules; dorsodistal, distomesial and distolateral margins each often with row of very small denticles or tubercles; mesial, lateral and ventral surfaces minutely tuberculate. Merus triangular; few

setae on dorsodistal margin, dorsal surface with 3 or 4 short, transverse ridges and moderately short setae; ventromesial and ventrolateral margins each with row of tiny denticles or tubercles; ventral surface granular or tuberculate. Ischium unarmed but with few moderately long setae on ventral margin.

Left cheliped (Fig. 65c) with dactyl exceeding length of palm by 0.25–0.45 own length; cutting edge

with row of very fine corneous teeth, terminating in small corneous claw; sometimes with hiatus between dactyl and fixed finger; dorsomesial margin of dactyl unarmed or with row of denticles at least in proximal half, dorsal midline usually slightly elevated and often with 1 or 2 short rows of acute tubercles in proximal half; dorsal, mesial, and ventral surfaces with scattered moderately long setae. Palm 0.50–0.65 length of carpus; usually subtriangular in cross-section, sometimes only angularly convex, dorsal surface commonly slightly elevated in midline, not forming distinct ridge or crest, dorsal surface covered with acute and subacute tubercles or spinules, extending onto proximal half of fixed finger, dorsolateral margin with row of small or very small, subacute or blunt denticles, usually not extending to tip of fixed finger, dorsomesial margin not delimited or with irregular row of protuberances or small teeth. Carpus approximately as long to slightly longer than merus; dorsolateral margin with short row of very small spines or teeth, dorsodistal margin unarmed, tuberculate, or with strong tooth, sometimes double, dorsomesial margin with single or double row of small teeth; ventral, mesial, and lateral faces with low, sometimes tuberculate ridges and setae; ventromesial margin with row of small to very small denticles or spinulose protuberances, ventrodistal margin with row of very small tubercles, at least laterally. Merus with short, transverse rows of setae on dorsal margin; ventromesial margin with row of small or very small denticles, ventrolateral margin unarmed or with few tiny denticles; ventral surface with tiny, blunt or acute tubercles and scattered setae. Ischium sometimes with few small or minute tubercles on ventromesial margin.

Ambulatory legs (Fig. 65d) similar from left to right. Dactyls 1.10–1.50 as long as propodi, in dorsal view straight, in lateral view slightly arched; terminating in strong corneous claws; dorsal margins each with row of low protuberances and stiff bristles, increasing in length distally; lateral and mesial faces each with longitudinal sulcus, often quite prominent, at least in proximal 0.65, lateral faces often also with dorsal and ventral row of widely spaced fine setae, mesial faces with row of short setae dorsally and few setae ventrally; mesioventral or ventral surfaces each with 18–21 small, closely spaced spiniform setae, increasing in length distally. Propodi 1.10–1.15 longer than carpi; dorsal surfaces each with 1 to several irregular rows of spinulose protuberances or tubercles (strongest on second pereopods), frequently accompanied by moderately short, spiniform bristles; lateral faces often tuberculate, in smaller specimens often only minutely so; ventrodistal margins each usually with 1 or 2 tubercles, ventral surface with row of blunt

or spinulose protuberances and short bristles. Carpi 0.75–0.95 length of meri; each with row of small teeth or spinulose tubercles on dorsal surface, becoming strongest at distal angles and accompanied by very short, spiniform bristles and sparse short setae, but much less developed in small specimens (e.g., sl < 3.4 mm); lateral faces sometimes with few small, spinulose tubercles at or near distal margin and median longitudinal row of tufts of setae. Meri each with series of transverse rows of short to moderately long setae on dorsal surfaces; ventromesial and ventrolateral margins each with low, sometimes spinulose protuberances and short setae, or with row of distinct, small spines particularly on second pereopods. Ischia with few setae dorsally and ventrally. Fourth pereopods semichelate; propodal rasp with single row of corneous scales; dactyl with preungual process as base of claw, developed in larger specimens (sl > 4.0 mm). Sternite of third pereopods with few long marginal setae on roundly subrectangular anterior lobe.

Sternite of fifth pereopods developed anteriorly as 2 laterally subovate lobes separated by broad, shallow, median depression, anterior margins each with row of moderately long setae. Second abdominal segment in both sexes with 2 ventral prominent protuberant fleshy lobes, left largest. Males with paired gonopores; 3 unequally biramous unpaired pleopods, pleopods 3 and 4 with exopods moderately well developed, endopods rudimentary, pleopod 5 with exopod moderately well developed, endopod vestigial or absent. Females with paired gonopores, 4 unpaired pleopods, pleopods 2 to 4 with both rami well developed, pleopod 5 with exopod well developed, endopod markedly reduced.

Uropods asymmetrical; exopods and endopods both with well-developed rasps. Telson with posterior lobes slightly asymmetrical, separated by moderately broad median cleft; terminal margins rounded, with several large, calcareous teeth interspersed with smaller teeth, extending onto chitinous or weakly calcareous lateral margins.

**COLOUR:** Ocular peduncles and antennules light brown; antennae light brown with faint white bands. Chelipeds and ambulatory legs with pink ground colour tending to white and marked with darker pink longitudinal stripes (modified from Schembri & McLay 1983). Small specimens almost uniformly white (C. Duffy, field notes).

**VARIATIONS:** Although our sample size was quite small, variations in armature that appeared to be size related were observed. In small specimens (sl < 3.5 mm), the armature of chelipeds and ambulatory



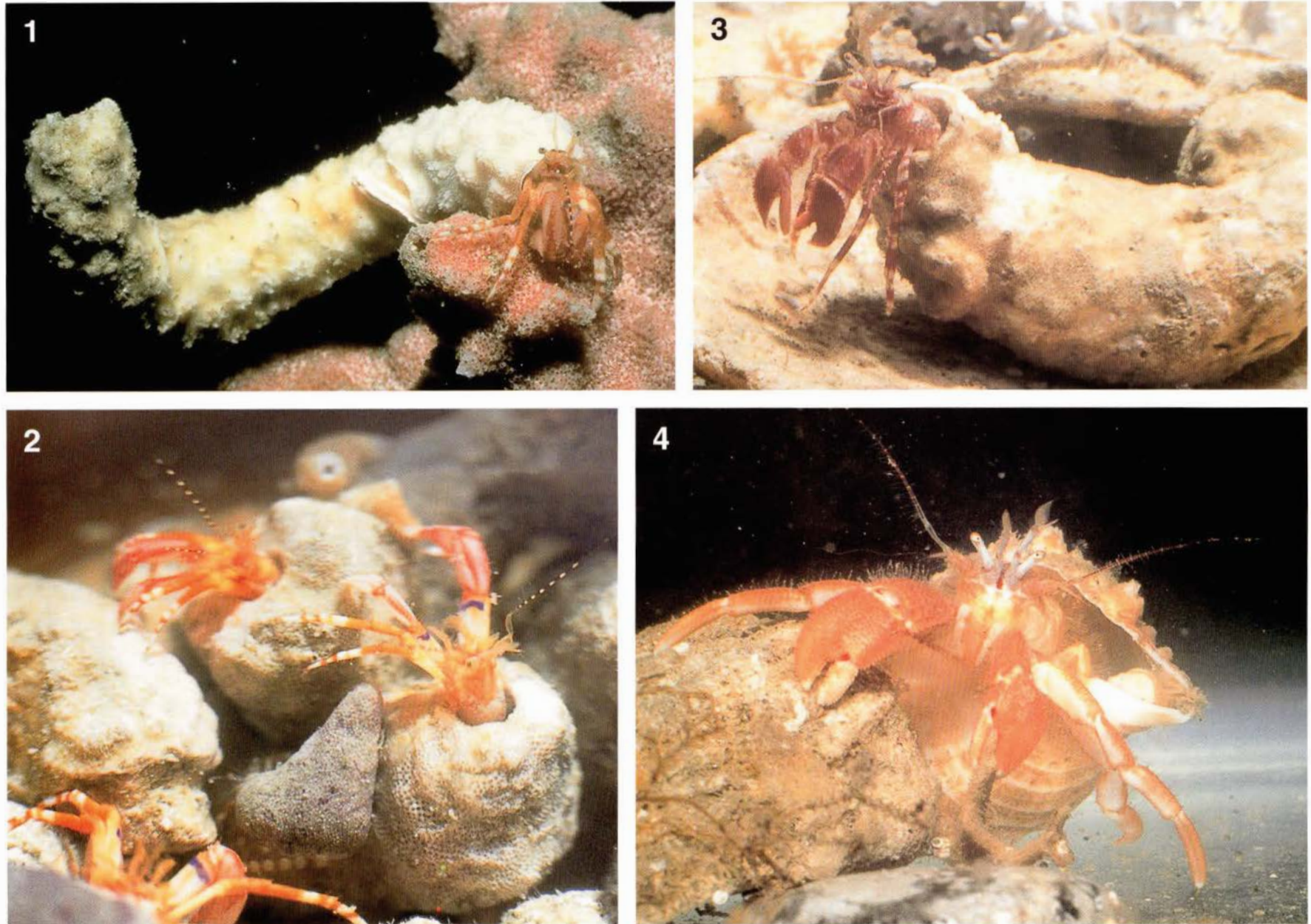


Plate 5. Fig. 1, 2. *Loplopagurus* (*Australaremus*) *stewarti* (Filhol) in tubes formed by the bryozoans *Disporella gordonii* (cream) and *Akatopora circumsaepia* (purple) (Photos: Fig. 1, Karen Gowlett-Holmes; Fig. 2, Colin McLay). Fig. 3. *Loplopagurus* (*Australaremus*) *laurentae* (McLaughlin & Gunn) (Photo: Colin McLay). Fig. 4. *Loplopagurus* (*Australaremus*) *kirkii* (Filhol) (Photo: Colin McLay).





Plate 6. Fig. 1. *Pagurus traversi* (Filhol) (Photo: Colin McLay). Fig. 2. *Pagurus novizealandiae* (Dana) (Photo: Steve Cook). Fig. 3. *Pagurus albidiautlius* sp. nov. (Photo: Colin McLay). Fig. 4. *Pagurixus hectori* (Filhol) (Photo: Colin McLay).



legs is appreciably weaker than depicted in the illustrated paratype (sl = 7.7 mm) and seen in the holotype and other larger specimens. Particularly noteworthy is the strength of tubercles on the mesial face of the palm of the right cheliped, and the multiple rows of tubercles on the dorsal and lateral faces of the propodi of the second and third pereopods. Also, in large specimens the sulci on the lateral faces of the pereopodal dactyls are flanked by small tubercles, not seen in small specimens. Two variations that do not appear to be related to size are the armature of the terminal margins of the ocular acicles, and the shape of the rostrum. While small specimens frequently have from two to four teeth on the terminal margins of the ocular acicles and larger specimens a greater number, the holotype (sl = 7.5 mm) also only two teeth on one acicle and three on the other. Although usually broadly triangular, in at least one specimen the rostrum is broadly rounded. The slight protuberance posterior to the rostral tip, as depicted in the illustrated paratype (Fig. 65a), is seen to a lesser extent in the holotype, and is more frequently represented by a tuft of setae.

**REPRODUCTION:** Ovigerous females were represented in our collection by only three individuals actually still carrying eggs, and one whose eggs had just been released. These egg-bearing females, all with shield lengths measuring between 3.1 and 3.7 mm, were collected in January, April, and May from the east coast of North and South Islands; however, the female (sl = 4.2 mm) from NZOI Stn 628 on the west coast of South Island had just released its eggs at the time of capture in October. It is premature to speculate as to whether reproductive periods for this species vary from west to east. The female from Hawke Bay, the largest of the ovigerous females, was also carrying the largest number of eggs, in excess of 200. These eggs, which were in an early stage of development, measured 0.40–0.46 mm in diameter.

**HABITAT:** In the Otago region, this species was found on the inner shelf, mainly on sand, and frequently occupied shells of *Umbonium*. Schembri (1988) reported it to be exclusively a nearshore inhabitant.

**ETYMOLOGY:** From the Latin *albus*, meaning white, and *dianthus* meaning pink, and referring to the colour of this species.

**REMARKS:** Although *P. albidianthus* has multifid ocular acicles as in some other shallow-water New Zealand species of *Pagurus*, it is readily distinguished from them by the armature of its chelipeds and ambulatory legs. The chelipeds of *P. albidianthus* are provided only

with small tubercles or granules whereas *P. traversi* and *P. novizealandiae* have chelipeds armed with prominent teeth or tubercles. The ambulatory legs however, provide the most diagnostic characters. In *P. albidianthus* the dactyls are longer than the propodi and each has a longitudinal sulcus, usually quite prominent, on the mesial and lateral face; the propodi are armed with spinulose protuberances dorsally and often laterally. In *P. novizealandiae* the dactyls are approximately equal to the length of the propodi and ornamented dorsally and ventrally with tufts of long setae, those of the third pereopods forming a very dense fringe. The dactyls of *P. traversi* are shorter than the propodi and lack the longitudinal sulci on the mesial and lateral faces.

*Pagurus albidianthus* is morphologically most similar to *Pagurus kaiensis* McLaughlin, 1997 from the Kai Islands of Indonesia, sharing the general morphology of the chelipeds and ambulatory legs. The New Zealand species is immediately distinguished from the Indonesian species by its multifid ocular acicles. The antennular and antennal peduncles are also shorter in *P. albidianthus* than in *P. kaiensis*, and there are more spiniform bristles on the ventral margins of the ambulatory dactyls in the former species.

**RECORDS FROM NEW ZEALAND:** On the west coast north of Auckland to southwest of Hokitika; eastern North Island from Great Omaha Bay to Otago; 3–28 m.

**DISTRIBUTION:** Known only from New Zealand.

***Pagurus traversi* (Filhol, 1885)** (Fig. 66, Pl. 6, fig. 1)

*Eupagurus Traversi* Filhol, 1885b: 32; 1885d: 422; 1885e, pl. 1, figs 5, 6.

*Eupagurus traversi*: Thomson 1899: 179; Lenz 1901: 445.

*Pagurus traversi*: Schembri 1982b: 867; Schembri & McLay 1983: 34, fig. 23; Schembri 1988: 99.

**TYPES:**

Lectotype, herein selected: male (sl = 6.0 mm), MNHN Pg 5842.

Paralectotypes: 3 males (sl = 6.4–7.2 mm), MNHN Pg 367.

**TYPE LOCALITY:** Stewart Island.

**OTHER MATERIAL EXAMINED:**

NZOI Stns: E439, 1 male (sl = 5.9 mm); J673, 1 male (sl = 4.4 mm); Wellington Harbour, Kau Point, coll. J.G. Gibb, low tide, 7.4.61, 1 female (sl = 4.4 mm).

NMNZ collections: Whangaroa: Taruanga Bay, coll. R.K. Dell, 11.11.63, 2 m, 6 males (sl = 3.4–5.6 mm), 4 ovigerous females (3.7–5.6 mm), Cr 9771, Cr 9772; Oke Bay, Bay of

Islands, 29.11.71, 1.0–5.5 m, 4 males (sl = 2.7–6.4 mm), Cr 8186; Onewhero Bay, Great Barrier Island, 17.4.65, 1 male (sl = 4.5 mm), Cr 7536; North side of East Cape, coll. W.F. Ponder, 16.9.66, 2 males (sl = 3.2, 4.6 mm), 1 ovigerous female (sl = 3.9 mm), 1 damaged specimen, Cr 7409; Castlepoint, 40°55'S, 176°10'E, low water spring tide, 5 males (sl = 2.2–5.1 mm), 26 ovigerous females (2.7–5.0 mm), Cr 9773; 2 miles off Mataikona, 1 male (sl = 5.6 mm), 1 ovigerous female (sl = 3.7 mm), Cr 9774; Houhora Harbour, coll. R.K. Dell, 18.11.63, 2 males (3.3, 3.9 mm), 1 female (sl = 3.8 mm), Cr 9775; Between Lucky and Woodman's Bays, D'Urville I., coll. A. Stewart, 25.2.90, 9–15 m, 2 males (sl = 3.4, 4.9 mm), 7 females (2.1–4.4 mm), 4 ovigerous females (sl = 4.4–5.3 mm), Cr 7559; Wellington Harbour, coll. P.E. Roberts, –7.66, 1 male (sl = 6.9 mm), 1 ovigerous female (sl = 6.0 mm), Cr 9776; Wellington Harbour; Off Hope Shoal Light, 41°18.5'S, 174°51.4'E, 23.9.57, 11 m, 1 male (sl = 4.9 mm), Cr 9777; Kau Point, coll. R.K. Dell, 10.13.54, 1 male (sl = 3.7 mm), Cr 9778; Shelly Bay, coll. J. Moreland, 28.6.53, 1 male (sl = 5.8 mm), 1 ovigerous female (sl = 4.5 mm), Cr 9779; west end of Tory Channel, coll. J. Moreland, 11.11.61, 1 ovigerous female (sl = 4.9 mm), Cr 9780; Kaikoura, coll. C. McLay, 25.11.76, intertidal, 22 males (sl = 3.3–14.2 mm), 19 females (sl = 3.7–6.9 mm), Cr 4097; 9–12 m, 11.2.87, 7 males (sl = 6.6–8.3 mm), 2 females (sl = 5.1, 5.2 mm), Cr 3956; St Kilda Rocks, coll. D. Horning, 27.1.74, 1 male (sl = 1.6 mm), Cr 9800; North Otago, coll. J. Graham, –6.72, 24 m, 1 male (sl = 4.4 mm), Cr 8034; Cape Rock pools and Gees Point, coll. J. Graham, 8.64, 2 males (sl = 4.7, 8.1 mm), 2 ovigerous females (sl = 3.2, 3.5 mm), Cr 8075; Foveaux Strait oyster beds, coll. M. Stead, 1961, 2 males (sl = 2.9, 3.2 mm), Cr 9781, Cr 9782; Stewart Island, Thule, Paterson Inlet, coll. R.K. Dell, 29.10.48, 3 males (sl = 3.8–5.1 mm), Cr 455; Westmere, Hayman's Bay, low tide, 7.1.51, 2 males (sl = 5.6, 6.1 mm), 1 female (sl = 3.5 mm), 2 ovigerous females (sl = 4.4, 5.7 mm), Cr 9783; outside Pegasus, coll. R.A. Falla, 12.7.48, 2 males (sl = 4.5, 5.7 mm), Cr 456.

PMBS collections: Otago Harbour: Portobello region, –11.52, 1 male (sl = 5.3 mm); Weller's Rock, coll. R. Crump, –2.67, 3 females (3.5–4.8 mm), 1 ovigerous female (4.9 mm); Aquarium Point, 29.6.53, low tide, 1 male (sl = 7.1 mm); Aquarium Point, 23.9.53, 0.3–1 m, 1 female (5.9 mm).

PMcL collection: Great Omaha Bay, Stn B12, 1 male (sl = 3.7 mm); Tahuahua Bay, Queen Charlotte Sound, coll. C. Duffy, 3.10.89, 15.5 m, 1 male (sl = 6.4 mm); Gannet Point Port Cove, Marlborough Sounds, coll. C. Duffy, 26.1.90, 1 ovigerous female (sl = 2.8 mm).

**DESCRIPTION:** Shield (Fig. 66a) slightly to considerably longer than broad. Rostrum triangular, usually terminating acutely, occasionally subacutely or terminally rounded. Ocular peduncles moderately long and slender, 0.50–0.65 length of shield; corneas only slightly, if at all, dilated, corneal diameter approximately 0.15 peduncular length. Ocular acicles subrectangular, with 2–5 terminal spines. Antennular peduncles reaching to or slightly overreaching distal margins of corneas. Antennal peduncles overreaching distal margins of corneas by 0.16–0.25 times length of ultimate segment; laterodistal projection of second segment reaching slightly beyond proximal margin

of fourth segment, terminating in small spinule, mesial margin denticulate. Antennal acicles arcuate, not reaching to distal corneal margins, mesial margins with tufts of setae.

Chelipeds grossly unequal. Dactyl of right cheliped (Fig. 66b) with row of blunt tuberculate teeth on dorsomesial margin, dorsal midline with row of large tubercles. Palm with row of strong teeth on dorsomesial margin, dorsolateral margin with row of well-separated subacute or acute spines or teeth, increasing in size on fixed finger and reaching nearly to tip, dorsal surface with 4–6 rows of regular or somewhat irregular conical, spines or spinulose tubercles, with only single row extending onto fixed finger, all partially obscured by long setae. Carpus with row of strong spines on dorsomesial margin and second adjacent, equally strong oblique row; dorsal surface with few scattered, low, blunt or acute tubercles, also partially obscured by long setae. Merus with row of slender spines on ventrolateral margin; ventromesial margin with 2 teeth medially.

Left cheliped (Fig. 66c) much shorter than right, narrow. Dactyl with few low protuberances or tubercles and tufts of setae. Palm elevated in midline, and armed with double row of moderately strong spines or spinulose tubercles partially obscured by long setae; dorsolateral margin with row of low tubercles. Carpus with short row of strong spines on dorsolateral margin and short row of shorter spines on dorsomesial margin, both partially obscured by long setae, dorsodistal margin with strong spine. Merus with row of small spines on ventrolateral margin, ventromesial margin with 2 tubercles proximally.

Ambulatory legs (Fig. 66d) with tufts of moderately stiff setae on all segments. Dactyls shorter than propodi, moderately deep dorsoventrally; ventral margins each with 5–7 strong spiniform setae. Propodi with transverse rows of setae on dorsal surfaces; ventral margins each with row of short spiniform setae. Carpi each with dorsodistal spine. Meri of second pereopods each with spine at ventrolateral distal angle; third unarmed. Anterior lobe of sternite of third pereopods usually subquadrate, occasionally subtriangular or subsemicircular. Fourth pereopods semichelate; single row of scales in propodal rasp; dactyl with well-developed preungual process at base of claw.

Second abdominal somite with 2 ventral fleshy lobes in both sexes. Males with 3 unequally biramous, unpaired pleopods; females with 4. Telson (Fig. 66e) with slightly asymmetrical posterior lobes separated by indentation suggesting division into anterior and posterior portions; slightly asymmetrical posterior lobes separated by moderately narrow



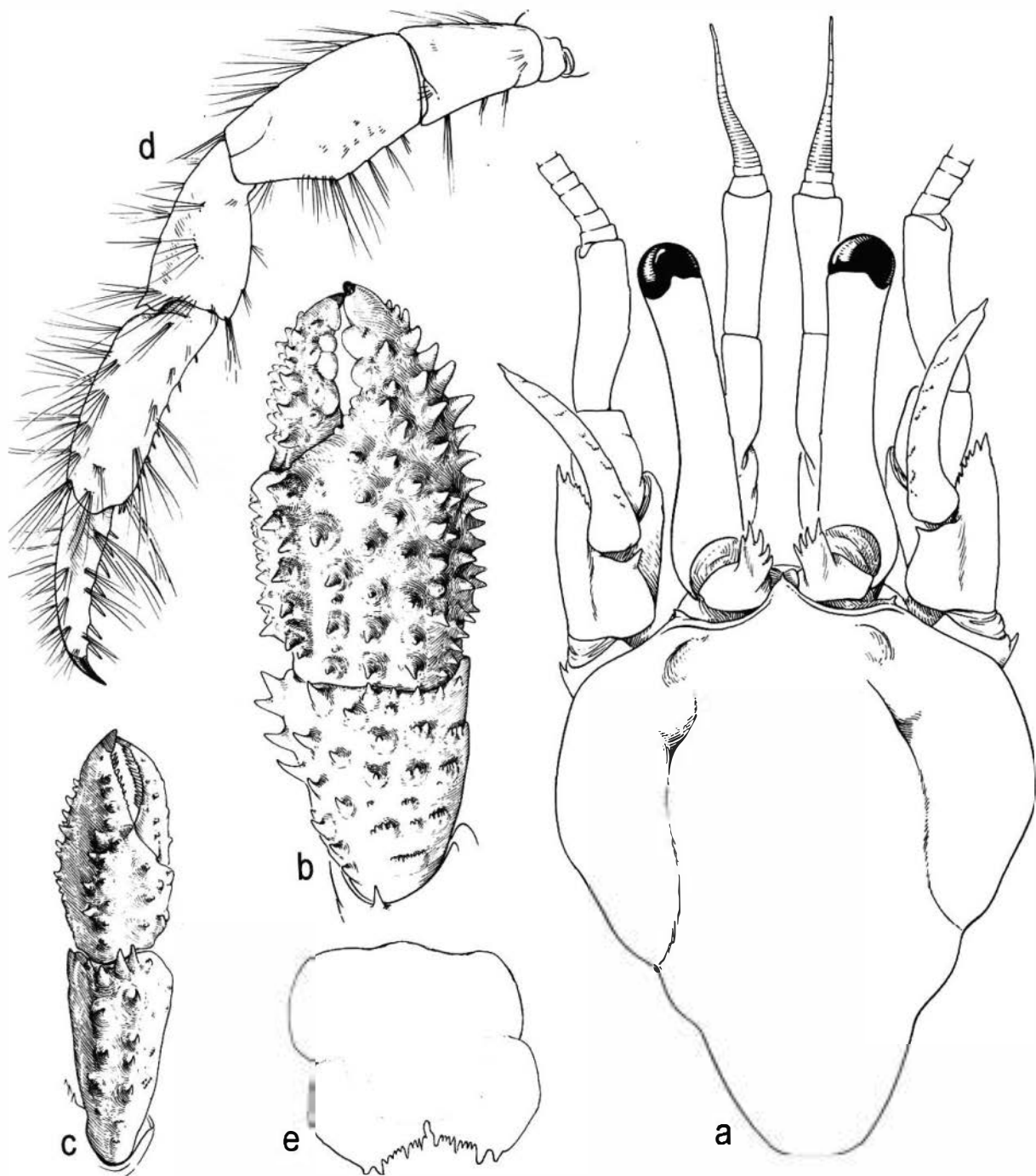


Fig. 66. *Pagurus traversi* (Filhol, 1885), Wellington Harbour, male (sl = 6.9 mm), NMNZ Cr 9776: a, shield and cephalic appendages (setation and aesthetascs omitted); b, carpus and chela of right cheliped (dorsal view, setation omitted); c, carpus and chela of left cheliped (dorsal view, setation omitted); d, left third pereopod (lateral view); e, telson (setation omitted). Magnifications equal 11x (b-d), 22x (a), 25x (e).

median cleft; terminal margins angular or oblique, each armed with several small spinules or denticles.

**COLOUR:** Ocular peduncles green-blue with lighter markings; antennules reddish-orange; antennae dark red with narrow white bars; chelipeds and ambu-

latory legs dark blue-green ground colour with small pale blue spots and pale blue patches in carpal-meral joint regions (Schembri & McLay 1983).

**REPRODUCTION:** Females appear to be ovigerous primarily in late spring and early summer (October and

November). In our relatively small sample, egg-bearing females varied in size from shield lengths of 2.7–5.0 mm, and each carried between 150 and 200+ eggs, most of which were in early stages of development, with diameters of 0.36–0.52 mm.

**HABITAT.** Found occupying a variety of gastropod shells; primarily intertidal, usually on *Corallina* patches and under rocks; intertidal to 15 m.

**REMARKS:** As has previously been indicated, there is considerable morphological similarity between *Lophopagurus* (L.) *pumilus* and *Pagurus traversi*. However, only with reexamination of individual specimens can the extent of any such confusion be determined. The presence of paired first pleopods in females of *L. (L.) pumilus* will immediately identify this species, which is usually smaller than average adult *P. traversi*. Nonetheless, when only males are available, identification becomes much more difficult. There are differences in the length of the ocular peduncles and ambulatory dactyls of the two species, as well as in the armature of the palm of the left chela and of the telsons, but there is a certain amount of variation in all of these characters. Only the armature of the dorsomesial margin of the right chela has proved to be a completely reliable diagnostic character. Filhol's (1885b) description of *P. traversi* is relatively general, and his use of the term "tubercles" in defining the marginal armature of the right chela certainly may have contributed to subsequent mis-

identifications. In *P. traversi* this margin is armed, not with a row of small tubercles as indicated in Filhol's (1885b) description, but with a row of clearly separated, acute or subacute teeth or spines (Fig. 66b). In contrast, this margin in *L. (L.) pumilus* is armed with a row of low, nearly contiguous, blunt tubercles (Fig. 47b).

Filhol (1885b) did not actually describe the ocular acicles of *P. traversi*, saying only "L'anneau ophthalmiques est presque complètement caché sous le bord antérieur de la carapace." Thomson (1899) considered Filhol's statement inaccurate and irrelevant but, in his redescription of *P. traversi*, introduced a major error regarding the ocular acicles. He described them as "rather slightly developed, produced on the inner side into a small ciliated spine". In fact, as may be seen in Figure 66a, the ocular acicles are rather large and subrectangular and provided on the terminal margin with two to several distinct spines. Thomson's reference to six rows of spinose tubercles on the dorsal surface of the right cheliped was exactly as stated by Filhol (1885b); however, this number is variable, and definitive rows may not be present at all.

**RECORDS FROM NEW ZEALAND:** Eastern North and South Islands from Bay of Islands to Foveaux Strait and Stewart Island; intertidal to 15 m.

**DISTRIBUTION:** Known only from New Zealand.

**References:** See pages 222–236.



# SUPERFAMILY PAGUROIDEA

## Family Parapaguridae

by

Rafael Lemaitre

### SYSTEMATICS

#### Family PARAPAGURIDAE Smith, 1882

Parapaguridae Smith, 1882: 20; de Saint Laurent 1972: 99.

TYPE GENUS: *Parapagurus* Smith, 1879

Eleven pairs of quadriserial or biserial phyllobranchiate gills, sometimes with twelfth pair of vestigial pleurobranchs on last thoracic somite. Shield broadly rounded posteriorly; dorsal surface frequently weakly calcified medially. Posterior carapace membranous or sometimes calcified.

Epistome armed with straight or curved median spine (epistomial spine), or unarmed. Labrum extended anteriorly, forming short beak-like spine (labral spine). Exopod of first maxilliped lacking flagellum. Ischium of third maxilliped with crista dentata lacking accessory tooth.

Chelipeds unequal (usually strongly so), right largest and frequently operculate.

Ambulatory legs (second and third pereopods) very long, slender.

Abdomen with tergites entire; membranous except for moderately calcified first and second tergites, sometimes all tergites well calcified. Telson with or without lateral indentations.

Males with paired first and second pleopods modified as gonopods, occasionally lacking first. Females with unpaired left gonopore; with paired second (right reduced), and unpaired or paired third to fifth (right reduced); pleopod rami crossed.

KEY TO THE NEW ZEALAND (INCLUDING THE KERMADEC ISLANDS) SPECIES OF PARAPAGURIDAE

- 1 Vestigial pleurobranch absent on last thoracic somite ..... 3
- Vestigial pleurobranch present on each side of last thoracic somite (*Sympagurus*) ..... 2
- 2 Propodal rasp of fourth pereopod with conical scales (in 2 or 3 rows); carpi of ambulatory legs unarmed dorsally, except for dorsodistal spine; fourth antennal segment unarmed; gills quadriserial, elements weakly divided distally ..... *Sympagurus papposus*

- Propodal rasp of fourth pereopod with ovate scales (in 2-5 rows); carpi of ambulatory legs armed dorsally with row of spines; fourth antennal segment armed with small dorsodistal spine; gills quadriserial, element deeply divided distally ..... *Sympagurus dimorphus*
- 3 Epistomial spine straight, or absent ..... 4
- Epistomial spine strongly curved upward (*Oncopagurus*) ..... *Oncopagurus* sp.
- 4 Gills biserial, or quadriserial with elements weakly divided distally; fourth segment of antennal peduncle armed with dorsodistal spine (*Paragiopagurus*) ... 5
- Gills quadriserial, with elements deeply divided distally; fourth segment of antennal peduncle unarmed (*Parapagurus*) ..... 6
- 5 Ocular acicles simple; males with paired first gonopods. .... *Paragiopagurus diogenes*
- Ocular acicles multifid; males lacking first gonopods ... *Paragiopagurus hirsutus*
- 6 Lateral faces of meri, carpi, and propodi of ambulatory legs with spines; anterodistal margin of branchiostegite armed with small spines .... *Parapagurus abyssorum*
- Lateral faces of meri, carpi, and propodi of ambulatory legs lacking spines; anterodistal margin of branchiostegite unarmed ..... 7
- 7 Length of ocular peduncles (including corneas) distinctly more than half length of shield; lateral faces of meri of ambulatory legs weakly calcified medially (lack of calcification usually indicated by dark brown colour) ..... *Parapagurus bouvieri*
- Length of ocular peduncles (including corneas) half or less length of shield; lateral faces of meri of ambulatory legs well calcified ..... 8
- 8 Propodal rasp of fourth pereopod with 1 row (at least distally) of ovate scales ..... *Parapagurus richeri*
- Propodal rasp of fourth pereopod with 2 or 3 rows of conical or lanceolate scales ... *Parapagurus latimanus*

#### *Sympagurus* Smith, 1883

*Sympagurus* Smith, 1883: 37; Lemaitre 1989: 36; 1996: 169.  
*Parapagurus*: de Saint Laurent 1972: 101 (in part).

TYPE SPECIES: *Sympagurus pictus* Smith, 1883, by monotypy. Gender masculine.

Twelve pairs of gills: 11 quadriserial, and 1 pair of vestigial pleurobranchiae on last thoracic somite. Shield about as broad as long, or slightly broader than long; dorsal surface usually with irregularly shaped, weakly calcified areas. Corneas weakly to moderately dilated.

Fourth segment of antennal peduncle unarmed, or with small dorsodistal spine.

Epistomial spine straight or absent.

Right chela with rounded dorsomesial and dorso-lateral margins, or sometimes operculate with well-delimited dorsomesial and dorsolateral margins.

Left cheliped usually well calcified.

Ambulatory legs with dactyls evenly curved.

Fourth pereopod with propodal rasp consisting of 1 or more rows of corneous scales or spines.

Second abdominal somite with left pleuron terminating ventrally in small subtriangular lobe.

Males with moderately to well-developed, paired first and second pleopods.

REMARKS: In addition to the two *Sympagurus* species known from the New Zealand region, 12 others are also included in this genus: *S. acinops* Lemaitre, 1989, *S. affinis* (Henderson, 1888), *S. andersoni* (Henderson, 1896), *S. brevipes* (de Saint Laurent, 1972), *S. dofleini* (Balss, 1912), *S. pictus* Smith, 1883, *S. planimanus* (de Saint Laurent, 1972), *S. poupini* Lemaitre, 1994, *S. rectichela* (Zarenkov, 1990), *S. soela* Lemaitre, 1996, *S. trispinosus* (Balss, 1911), and *S. villosus* Lemaitre, 1996.

***Sympagurus papposus* Lemaitre, 1996 (Fig. 67)**

*Sympagurus papposus* Lemaitre, 1996: 180, figs 3c,d, 5b, 8–10.

TYPE:

Holotype: ovigerous female (sl = 14.3 mm), *Kapala*, Stn K75-01-02, AM P44482.

TYPE LOCALITY: East of Broken Bay, Australia, *Kapala*, Stn K75-01-02, 33°38–34'S, 151°57'E.

OTHER MATERIAL EXAMINED:

NMNZ collections: Kah 9604, Stn 12, 2 males (sl = 15.2, 16.3 mm), Cr 9784.

DESCRIPTION: First 11 pairs of gills quadriserial with elements undivided or weakly divided distally. Shield as broad as long; dorsal surface frequently weakly calcified medially; rostrum broadly triangular, with short middorsal ridge; anterior margins weakly concave; lateral projections broadly rounded, often nearly obsolete; ventrolateral margin unarmed. Ocular peduncles about half length of shield; corneas

slightly dilated. Ocular acicles (Fig. 67b) subtriangular, terminating in strong spine (occasionally bifid or trifid). Antennular peduncle (Fig. 67c) long, slender, exceeding distal margin of corneas by half length of penultimate segment. Antennal peduncle exceeding distal margin of cornea by approximately half length of fifth segment. Fourth segment unarmed. Second segment with laterodistal projection produced, terminating in strong, multifid spine. First segment with small tubercle on lateral face; ventromesial angle produced, with 3–7 small spines laterally. Antennal acicles nearly straight (in dorsal view), exceeding distal margin of corneas by about 0.25 length of acicle, terminating in strong spine; mesial margin armed with 7–13 well-spaced spines, setose. Flagellum long, exceeding extended right cheliped and ambulatory legs.

Epistome with short, straight spine (often blunt), or unarmed. Sternite of third maxillipeds with small spine on each side of midline.

Right cheliped (Fig. 67d) with dense plumose setae; fingers straight. Dactyl set at weakly oblique angle to longitudinal axis of palm; mesial face rounded, with irregular rows of small spines. Palm about as long as broad; lateral and mesial faces rounded, with irregular rows of well-spaced, small spines; dorsal and ventral surfaces smooth or at most with scattered tubercles.

Left cheliped (Fig. 67e) well calcified, with dense plumose setae. Palm unarmed or occasionally with dorsomesial row of small tubercles or spines; ventral surface smooth or with scattered small tubercles. Carpus with dorsal surface usually unarmed, or occasionally with row of small tubercles or spines on dorsal margin.

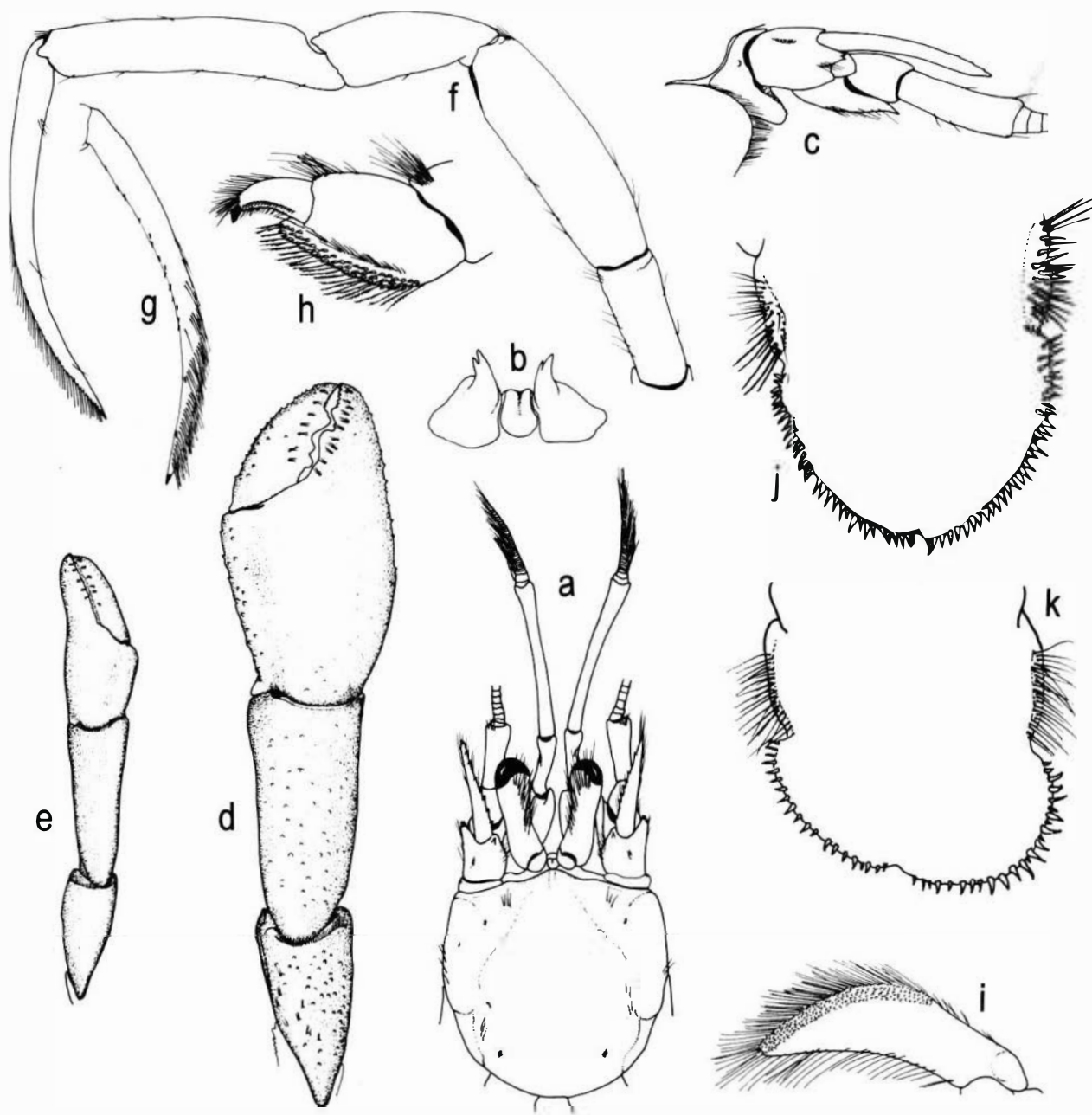
Ambulatory legs (Fig. 67f, g) reaching to extended right cheliped; ischium, merus, carpus, and propodus with scattered short setae. Dactyl about 1.4 times as long as propodus; with dorsomesial row of long setae, and ventromesial row of about 17–30 small corneous spines. Carpus with small dorsodistal spine (often blunt). Merus of second pereopods usually with row of small spines on ventral margin. Anterior lobe of sternite of third pereopods with strong marginal spine (sometimes bifid).

Fourth pereopod with dactyl (Fig. 67h) subtriangular, terminating in sharp corneous claw. Propodal rasp consisting of 2 or 3 rows of conical scales.

Fifth pereopod semichelate. Propodal rasp extending to midlength of segment.

Uropods (Fig. 67i) and telson (Fig. 67j, k) markedly asymmetrical; telson asymmetry sometimes less marked in fully grown females (Fig. 67j) than in males. Telson with lateral indentations separating anterior and posterior lobes; posterior lobes divided by rounded (U-shaped) or angled (V-shaped) cleft, termi-





**Fig. 67.** *Sympagurus papposus* Lemaitre, 1996, a, c-i, k, Western Australia, male paratype (sl = 12.1 mm) NTM Cr 006863; b, New South Wales, Australia, female paratype (sl = 14.5 mm) AM P21008; j, Queensland, Australia, female paratype (sl = 11.0 mm), QM 14338: a, shield and cephalic appendages; b, ocular acicles (dorsal view); c) right antennal peduncle (lateral view); d, right cheliped (dorsal view, setation omitted); e, left cheliped (dorsal view, setation omitted); f, left second pereopod (lateral view); g, dactyl of same (mesial view); h, propodus and dactyl of left fourth pereopod (lateral view); i, left exopod of uropods (dorsal view); j, k, telson (ventral view). After Lemaitre (1996). Magnifications equal 2x (d, e), 4x (a, f, g), 6x (c, i), 12x (b, h), 17x (k, j).

nal margin of lobes armed with corneous spines; female with ventrolateral margin of left anterior lobe (sometimes also right lobe) with cluster of corneous spines mixed with long bristle-like setae; male with ventrolateral margins of anterior lobes with long setae or rarely corneous spines.

Males with paired first and second gonopods well developed. First gonopods each with ovate, weakly concave distal lobe. Second gonopods each occasionally with rudimentary exopod on one side; distal segment nearly flat, setose on distomesial face, with row of short setae on lateral margin; basal segment



Plate 7. *Sympagurus dimorphus* (Studer) (Photo: Coliin McLay).



with long setae on posterior face. Females rarely with rudimentary paired first pleopods, and vestigial second right pleopod.

COLOUR: Not known.

REPRODUCTION: Ovigerous females have been found during January, March, April, May, November, and December; they range in shield length from 9.5 to 14.5 mm (Lemaitre 1996).

HABITAT AND SYMBIOTIC ASSOCIATIONS: Found living in zoanthids (probably *Epizoanthus* sp.).

RECORDS FROM NEW ZEALAND: Bay of Plenty; depth not known.

DISTRIBUTION: Madagascar; Indonesia; Australia; New Zealand; 205–960 m.

*Sympagurus dimorphus* (Studer, 1883)  
(Fig. 68, Pl. 7)

*Eupagurus dimorphus* Studer, 1883: 24, figs 11, 12

*Parapagurus brevinianus* Balss, 1911: 4, fig. 5; 1912: 100, fig. 9;  
Forest & de Saint Laurent 1968: 116; de Saint Laurent 1973: 791.

*Sympagurus arcuatus johnstoni* Hale, 1941: 279, fig. 13a-d;  
Gordan 1956: 341; Forest & de Saint Laurent 1968: 116.

*Sympagurus arcuatus mawsoni* Hale, 1941: 280, fig. 14a-c;  
Gordan 1956: 341; Forest & de Saint Laurent 1968: 116.

*Parapagurus dimorphus*: de Saint Laurent 1972: 108; Probert  
et al. 1979: 381; Schembri 1982b: 860; 1988: 93.

*Sympagurus dimorphus*: Lemaitre 1989: 71, figs 36–38, 40E–H; 1990: 229; Lemaitre & McLaughlin 1992: 747, figs 1–5, tpls 1, 2; Lemaitre 1994: 412.

TYPES:

Syntypes (not seen): Museum für Naturkunde der Humboldt Universität zu Berlin.

TYPE LOCALITY: Off Cape of Good Hope, South Africa, S.M.S Gazelle, 34°13.6'S, 15°00.7'W, 211 m.

MATERIAL EXAMINED:

NZOI Stns: A696, 1 male (cl = 14.0 mm), 2 females (cl = 12.5, 15.5 mm); A740, 1 male (cl = 9.5 mm), 1 female (cl = 11.5 mm); A886, 1 male (cl = 11.5 mm), 1 female (cl = 12.0 mm); A906, 1 male (cl = 7 mm); A908, 1 male (cl = 18.0 mm), 1 female (cl = 13.0 mm), 1 spec. poor condition; A910, 5 males (cl = 9.5–23.0 mm), 4 females (cl = 6.0–14.0 mm), 2 specs. poor condition; A911, 3 males (cl = 8.0–13.5 mm), 2 females (cl = 7.5, 8.5 mm); A912, chelipeds only; A913, 1 female (cl = 17.5 mm), 1 ovigerous female (cl = 17.5 mm); A914, 2 males (cl = 9.0–11.5 mm), 3 females (cl = 5.5–10.0 mm); B173, 1 female (cl = 14.0 mm); B313, 1 juv. (cl = 4.0 mm), 1 female (not

measured); B315, 1 female (cl = 13.5 mm); B549, 2 females (cl = 12.0, 12.5 mm), 1 ovigerous female (cl = 14.0 mm); B555, 14 females (cl = 14.0–18.0 mm); B632, 4 males (cl = 7.5–16.0 mm), 3 females (cl = 12.0–14.0 mm); B608, 5 males (cl = 7.5–14.5 mm), 5 females (cl = 7.5–13.0 mm), 3 ovigerous females (cl = 10.5–16.5 mm); C619, 1 male (sl = 13.0 mm); C640, 1 ovigerous female (cl = 12.0 mm); C642, 2 males (8.0, 8.0 mm); C644, 1 female (cl = 12.5 mm); C683, 1 male (cl = 17.5 mm); C693, 1 spec. poor condition; C732a, 3 males (cl = 9.0–15.5 mm), 3 females (cl = 10.5–14 mm), 4 ovigerous females (cl = 12–16 mm); C734, 3 males (cl = 5.0–6.0 mm), 3 females (cl = 6.0–7.5 mm); D39, 3 males (cl = 10.0–12.5 mm), 2 females (cl = 7.0–9.5 mm); D85, 3 males (cl = 12.5–16.0 mm), 1 ovigerous female (cl = 14.5 mm); D90, 1 female (cl = 12.5 mm), 1 ovigerous female (not measured); D101, 1 male (cl = 13.0 mm); D121, 2 males (cl = 15.0–17.5 mm), 1 female (cl = 13.5 mm), 1 ovigerous female (cl = 13.5 mm); D134, 3 males (cl = 13.0–17.5 mm), 1 ovigerous female (poor condition); D137, 1 female (cl = 11.0 mm); D138, 9 males (cl = 13.5–22.0 mm), 7 females (cl = 11.0–19.5 mm), 5 ovigerous females (cl = 11.0–22.0 mm); D160, 1 male (cl = 13.0 mm), 8 females (cl = 9.5–11.0 mm); D207, 1 female (cl = 13 mm); D211, 7 males (cl = 10.0–13.0 mm), 1 female (cl = 19.5 mm); 2 ovigerous females (cl = 12.0, 13.5 mm); D225, 1 male (cl = 13.0 mm); D228, 1 female (cl = 12.5 mm); D230, 1 male (cl = 16.5 mm), 1 ovigerous female (cl = 13.0 mm); D231, 1 male (cl = 15 mm), 1 ovigerous female (cl = 13.0 mm); D235, 1 male (cl = 13.5 mm); D244, 1 female (cl = 10.5 mm); E72, 2 male (cl = 13.5, 15.0 mm), 1 ovigerous female (cl = 11.5 mm); E74, 1 female (cl = 13.5 mm); E79, 1 male (cl = 18.0 mm), 3 females (cl = 12.0–15.5 mm), 1 ovigerous female (cl = 14.5 mm); E80, 1 female (cl = 22.0 mm); E109, 1 male (cl = 12.5 mm); E111, 1 female (cl = 14.5 mm); E119, 1 female (cl = 16.5 mm); E120, 1 male (cl = 17.5 mm), 1 ovigerous female (cl = 13.5 mm); E121, 1 ovigerous female (cl = 20.0 mm); E145, 1 female (cl = 18.0 mm), 2 ovigerous females (cl = 17.0, 15.0 mm); E146, 1 ovigerous female (cl = 22.5 mm); E148, 1 ovigerous female (cl = 12.0 mm); E164, 2 ovigerous females (cl = 7.5, 13.5 mm); E165, 1 female (cl = 14 mm); E167, 4 males (cl = 9.5–24.0 mm), 4 females (cl = 9.5–18.5 mm); E228, 1 male (cl = 14.5 mm), 1 female (cl = 14.0 mm), 5 ovigerous females (cl = 14.5–15 mm); E237a, 1 female (cl = 11.0 mm); E400, 12 males (cl = 11.5–18.5 mm), 4 females (cl = 9.5–13 mm), 8 ovigerous females (cl = 10.5–12.0 mm); E401, 14 males (cl = 10.5–22.0 mm), 5 females (cl = 10.5–14.5 mm), 1 ovigerous female (cl = 13.0 mm); E404, 7 males (cl = 11.0–20.0 mm), 1 female (cl = 9.0 mm); E405, 1 male (cl = 16.0 mm); E408, 2 males (cl = 13.0 mm); E409, 1 ovigerous female (cl = 13.0 mm); E412, 6 males (cl = 7.0–18.0 mm), 1 female (cl = 11.0 mm); E413, 3 males (cl = 15.5–20.0 mm); E414, 6 males (cl = 8.5–18.0 mm); E421, 4 males (cl = 9.0–10.5 mm), 3 females (cl = 10.0–10.5 mm); E422, 1 male (cl = 8.5 mm); E423, 1 male (cl = 10.5 mm), 1 ovigerous female (cl = 13.5 mm); E426, 2 males (cl = 18.0, 20.5 mm); E428, 1 female (cl = 15.5 mm); E429, chelipeds; E433, 2 males (cl = 11.5, 12.0 mm), 1 female (cl = 9.0 mm); E436, 1 male (cl = 27.0 mm), 1 female (cl = 19 mm); E712, 1 female (cl = 14.0 mm); E713, 1 male (cl = 9.0 mm); E717, 11 males (cl = 11.0–18.0 mm), 15 females (cl = 9.0–15.0 mm); E719, 36 males (cl = 10.0–21.5, 9.5 mm), 16 females (cl = 9.5–16.5 mm), 12 ovigerous females (cl = 11.5–15.0 mm); E744, 1 female (cl = 11.5 mm); E749, 6 males (cl = 9.0–16.0 mm), 2 females (cl = 11.0, 12.5 mm); E752, 4 males

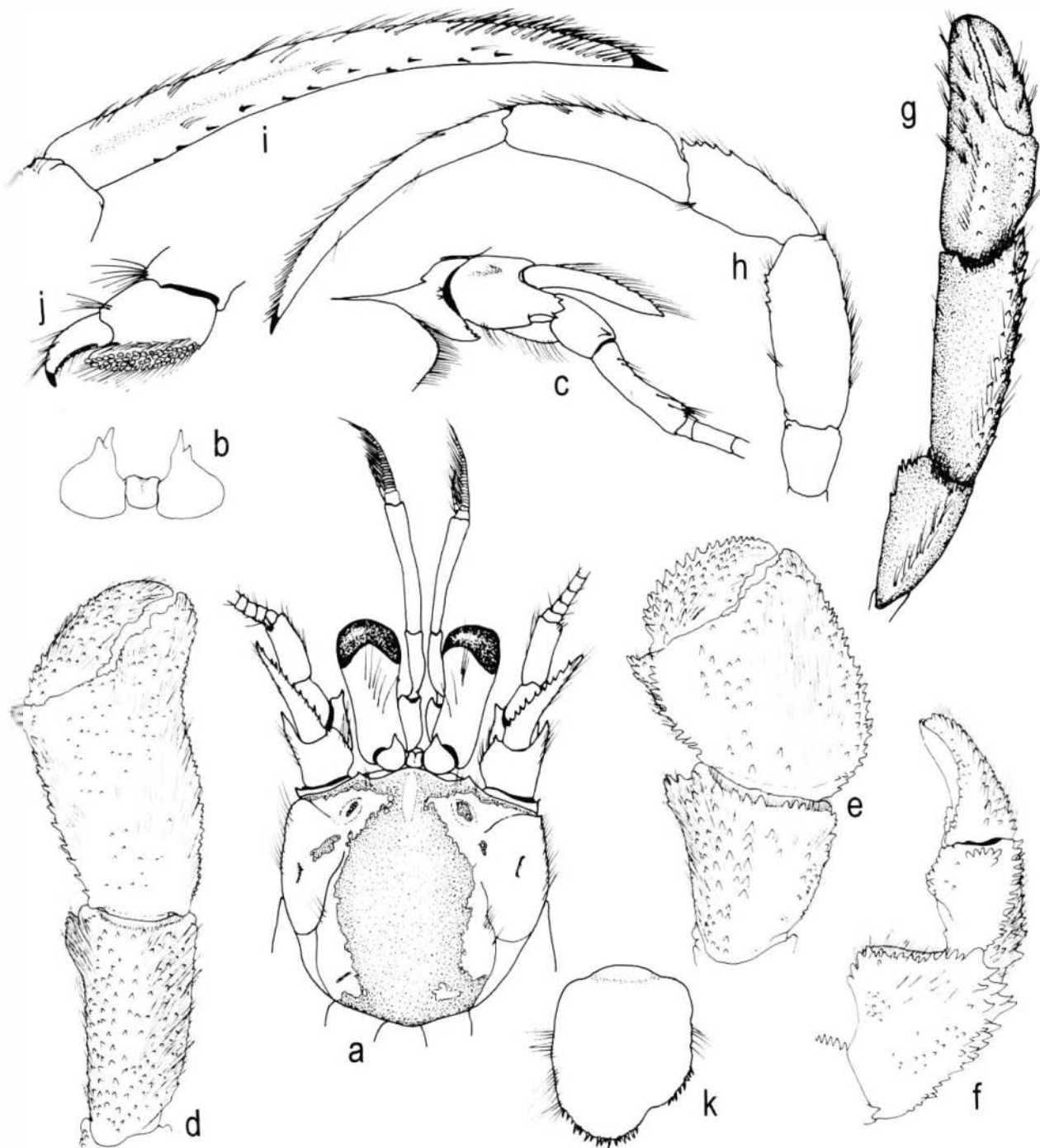


Fig. 68. *Sympagurus dimorphus* (Studer, 1883), New Zealand, a, c, g-k, SE Foveaux Strait, male (sl = 8.2 mm), NMNZ Stn J15/15/76, b, e, f, female (sl = 8.1 mm) USNM 267635, d, male (sl = 9.2 mm) USNM 267634: a, shield and cephalic appendages; b, ocular acicles (dorsal view); c, right antennular peduncle (lateral view); d, right cheliped (dorsal view); e, right cheliped (dorsal view); f, same (mesial view); g, left cheliped (dorsal view); h, left second pereopod (lateral view); i, dactyl of same (mesial view); j, propodus and dactyl of left fourth pereopod (lateral view); k, telson (dorsal view); b, d-f, after Lemaitre (1996). Magnifications equal 3.5x (d), 6x (e, f, h), 7x (a, g), 12x (c, i-k), 14x (b).

(cl = 8.0–11.0 mm), 26 females (cl = 9.0–16.0 mm), 16 ovigerous females (cl = 10.5–16.5 mm); E755, 33 males (cl = 10.0–24.5 mm), 21 females (cl = 10.0–18.5 mm), 12 ovigerous females (cl = 10.5–17.5 mm); E756, 4 males (cl = 10.0–25.0 mm),

5 females (cl = 11.5–12 mm), 6 ovigerous females (cl = 11.5–12.5 mm); E759, 15 males (cl = 9.0–19.5 mm), 28 females (cl = 18.0 mm), 23 ovigerous females (cl = 12.5–17.5 mm); E770, 1 female (cl = 11.5 mm); E771, 2 females (cl = 12.0, 13.5 mm);



E772, 4 males (cl = 13.0–26.5 mm), 2 females (cl = 11.5, 12.0 mm), 4 ovigerous females (cl = 13.0–15.5 mm); E777, 3 males (cl = 16.5–24.5 mm), 1 female (cl = 12.0 mm); E779, 9 males (cl = 9.5–17.5 mm), 4 females (cl = 10.0–16.5 mm), 2 ovigerous females (cl = 11.0, 13.0 mm); E781, 1 female (cl = 15.5 mm); E796, 1 female (cl = 13.5 mm), 1 ovigerous female (cl = 14 mm); E797, 1 female (cl = 5.5 mm); E803, 8 males (cl = 8.5–14.5 mm), 13 females (cl = 8.0–14.0 mm), 7 ovigerous females (cl = 12.5–14.5 mm); E822, male (cl = 14 mm); E826, 10 males (cl = 10.0–23.0 mm), 12 females (cl = 8.0–15.5 mm), 7 ovigerous females (cl = 12.0–20.0 mm); E827, 3 males (cl = 14.5–20.0 mm), 3 ovigerous females (cl = 15.0–15.5 mm), 1 spec. bad condition; E831, 2 females (cl = 11.5 mm); E879, 1 ovigerous female (sl = 6.6 mm); F80, 6 males (cl = 11.0–18.5 mm), 4 females (cl = 10.0–12.5 mm); F90, 5 males (cl = 9.5–20.0 mm), 5 females (cl = 8.0–10.0 mm), 5 15.0 mm, 1 ovigerous female (cl = 11.5 mm); ovigerous females (cl = 10.5–11.5 mm); F94, 2 males (cl = 19.5, 25.0 mm), 3 females (cl = 12.5–18.0 mm), 3 ovigerous females (cl = 14.0–16.5 mm); F95, 1 ovigerous female (cl = 11.5 mm); F100, 1 ovigerous female (cl = 11.5 mm); F101, 1 male (cl = 11.5 mm), 1 female (cl = 10.5 mm), 1 ovigerous female (cl = 12.5 mm); F102, 6 males (cl = 11.0–20.0 mm), 1 female (cl = 11.0 mm), 1 ovigerous female (cl = 12.0 mm); F104, 13 males (cl = 9.5–23.5 mm), 13 females (cl = 10.5–15.0 mm), 1 ovigerous female (cl = 11.5 mm); F105, 1 male (cl = 10.5 mm); F107, 61 males (cl = 8.0–25.0 mm), 51 females (cl = 7.5–10.0 mm), 44 ovigerous females (cl = 9.0–13.0 mm), 10 specs. poor condition; F112, 1 male (cl = 17.0 mm); F120, 1 male (cl = 12.5 mm), 1 female (cl = 11.0 mm); F122, 3 males (cl = 10.0–17.0 mm); F135, 2 males (cl = 14.0–19.0 mm), 2 ovigerous females (cl = 12.0–15.5 mm); F144, 5 males (cl = 14.0–29.5 mm), 1 female (cl = 12.0 mm), 4 ovigerous females (cl = 11.5–29.5 mm); F146, 10 males (cl = 12.0–27.0 mm), 13 females (cl = 9.0–13.0 mm), 5 ovigerous females (cl = 11.0–14.0 mm), 3 specs. bad condition; F147, 3 males (cl = 18.0–22.0 mm), 3 females (cl = 10.0–16.5 mm); F150, chelipeds; F151, 6 males (cl = 14.5–24 mm), 2 females (cl = 11.5–13.5 mm), 2 ovigerous females (cl = 11.5, 12.5 mm); F153, 1 female (cl = 15.5 mm); F749, 5 males (cl = 5.0–10.0 mm), 4 females (cl = 9.0–10.5 mm), 2 ovigerous females (cl = 9.5, 10.5 mm); F750, 2 males (cl = 11.5, 12.5 mm), 1 female (cl = 12.0 mm), 3 ovigerous females (cl = 13.5–15.5 mm); F760, 1 male (cl = 14.0 mm); G155, 1 male (cl = 15.5 mm); G156, 1 male (cl = 19.5 mm), 1 female (cl = 17.5 mm).

NMNZ collections: NW of Chatham Is., 42°49.8'S, 177°37.5'W, 13.8.89, 815 m, 1 ovigerous female (sl = 11.9 mm), Cr 8455; Turakirae Trench, 2.5 mi (4.6 km) off Cape Turakirae, 6.9.72, 640–658 m, 1 male (sl = 7.8 mm), 3 females (sl = 5.5–8.1 mm), 23 females (sl = 6.1–8.5 mm), Cr 8445; Canterbury Bight, 44°44'S, 172°41'E, 13.11.70, 402 m, 3 males (sl = 8.5–10.5 mm), 2 ovigerous females (sl = 8.5, 9.6 mm), Cr 8440; Taiaroa Trench off Otago Peninsula, 10 males (sl = 4.2–6.4 mm), 2 females (sl = 3.9, 4.8 mm), coll. A.J. Black, 11.8.74, 768–722 m, Cr 8474.

NMNZ Stns: BS 300, 5 males (sl = 8.3–11.2 mm), 1 female (sl = 7.1 mm), 22 ovigerous females (sl = 5.9–8.4 mm), Cr 8439; BS 546, 10 males (sl = 3.6–10.2 mm), 2 females (sl = 4.0, 5.2 mm), Cr 8469; BS 559, 7 males (sl = 3.1–6.2 mm), 7 females (sl = 3.9–6.4 mm), 29 ovigerous females (sl = 4.6–5.9 mm), 1 juv. sex indet. (sl = 2.2 mm), Cr 8450, 8463; BS 560, 1 male (sl

= 6.3 mm), Cr 8481; BS 643, 10 males (sl = 10.4–14.8 mm), 3 females (sl = 7.5–10.5 mm), Cr 8486, USNM 267636; BS 650, 3 males (sl = 4.2–6.0 mm), 2 females (sl = 4.8, 4.9 mm), Cr 8465, 8482; BS 664, 1 male (sl = 4.8 mm), Cr 8480; BS 668, 1 male (sl = 12.9 mm), 1 ovigerous female (sl = 10.9 mm), Cr 8446; BS 669, 4 males (sl = 9.3–12.2 mm), 4 females (sl = 3.4–6.4 mm), 2 ovigerous females (sl = 6.3–7.6 mm), Cr 8479; BS 672, 7 males (sl = 6.9–10.6 mm), 6 females (sl = 6.1–8.1 mm), 1 ovigerous female (sl = 8.1 mm), Cr 8458, 8471, 8483; BS 761, 1 female (sl = 4.3 mm), 1 ovigerous female (sl = 9.2 mm), Cr 8475; BS 805, 1 male (sl = 9.7 mm), Cr 8464; BS 812, 1 male (sl = 6.8 mm), Cr 8466; BS 830, 5 males (sl = 3.3–9.3 mm), 1 female (sl = 3.9 mm), Cr 8468; 844, 3 males (sl = 6.9–7.6 mm), 2 females (sl = 2.7, 5.3 mm), Cr 8467; BS 846, 2 ovigerous females (sl = 6.5, 6.6 mm), Cr 8460; CM Stn (h), 3 males (sl = 10.3–12.2 mm), 5 ovigerous females (sl = 9.2–10.5 mm), Cr 8436; CM haul 146, 1 male (sl = 12.1 mm), Cr 8449; CM haul 147, 2 males (sl = 12.8, 14.4 mm), 1 ovigerous female (sl = 13.1 mm), Cr 8428, 8434, 8435; CM haul 149, 2 males (sl = 12.2, 12.9 mm), 1 female (sl = 10.8 mm), Cr 8442; CM haul 155, 7 males (sl = 8.6–14.2 mm), 4 females (sl = 5.9–12.4 mm), Cr 8437, 8443, 8444; CM haul 156, 1 female (sl = 12.0 mm), Cr 8427; JC Stns: J1/19/77, 1 male (sl = 10.2 mm), Cr 8478; J2/16/80, 1 male (sl = 12.1 mm), Cr 8430; J1/22/77, 9 males (sl = 8.1–12.2 mm), 5 females (sl = 8.7–11.8 mm), 1 ovigerous female (sl = 10.4 mm), Cr 8457; J1/24/77, 1 male (sl = 9.7 mm), Cr 8432; J2/11/81, 1 male (sl = 12.8 mm), Cr 8441; J6/3/81, 1 male (sl = 9.2 mm), Cr 8456; J9/04/89, 7 males (sl = 6.2–10.5 mm), 1 female (sl = 7.8 mm), 3 ovigerous females (sl = 6.1–8.0 mm), Cr 8451; J9/6/77, 2 males (sl = 9.0, 12.5 mm), 1 female (sl = 6.9 mm), 4 ovigerous females (sl = 7.2–8.1 mm), Cr 8476; J9/009/77, 1 male (sl = 8.2 mm), Cr 7540; J09/15/77, 1 male (sl = 12.2 mm), Cr 3203; J10/52/86, 1 male (sl = 9.0 mm), Cr 8438; J10/60/86, 1 juvenile, sex not determined (sl = 2.5 mm), Cr 8426; J12/006/78, 5 males (sl = 7.8–14.8 mm), 5 females (sl = 5.2–8.9 mm), 2 ovigerous females (sl = 8.5, 8.6 mm), Cr 8448; J15/15/76, 3 males (sl = 6.8–9.2 mm), 5 females (sl = 6.2–7.7 mm), 8 ovigerous females (sl = 5.6–7.3 mm), USNM 267634, 267635; J15/17/76, 1 male (sl = 11.0 mm), Cr 8473; J19/9/84, 1 female (sl = 4.1 mm), Cr 8454. NZOI Stn R123, 1 male (sl = 5.0 mm), Cr 8461; Ty Stn "c", 1 female (sl = 8.5 mm), Cr 8433.

NZMD collections: Stn (a), 1 female (cl = 21.5 mm); Haul 30, 1 male (cl = 29.0 mm); Cook Strait, 28.8.1957, 41°31'S, 175°55'E, 695 m, 1 male (cl = 22.0 mm); 29.8.1957, 41°38'S, 174°53.5'E, 1006 m, 1 female (cl = 17.0 mm); 41°39'30"S, 175°17'E, no depth, 9 males (cl = 7.0–23.0 mm), 11 females (cl = 7.5–16.0 mm); Dusky Sound, NW Cooper Is., 1-2.1962, 183 m, 1 male (cl = 21.5 mm). VUC Stn Cr V.I., 1 male (cl = 6.5 mm); Portobello Marine Biological Laboratory Stn, Otago Heads, 2 males (cl = 6.5, 12.0 mm), 3 females (cl = 4.0–6.5 mm).

PMBS collection: Canyon A, NE Otago Heads, 475.5 m, 28.3.54; Stn Mu 67-7a, 1 male (sl = 8.1 mm); Stn Mu 74-95, 1 female (sl = 6.3 mm).

DESCRIPTION: First 11 pairs of gills quadriserial with elements deeply divided. Shield (Fig. 68a) usually as broad as long; dorsal surface often weakly calcified medially; rostrum rounded with broad low dorsal ridge; anterior margins concave; lateral projections

subtriangular, with small terminal spine; ventrolateral margin unarmed. Ocular peduncles more than half length of shield; ocular acicles (Fig. 68b) subtriangular, terminating in strong simple or bifid spine; corneas slightly dilated. Antennular peduncle (Fig. 68c) exceeding distal margin of corneas by nearly full length of ultimate segment. Antennal peduncle at most slightly exceeding distal margin of corneas; fourth segment with small dorsolateral distal spine; second segment with laterodistal projection produced, terminating in strong multifid spine; acicles sinuous in dorsal view, usually not exceeding distal margin of corneas, mesial margin armed with 13–19 strong spines; flagellum distinctly overreaching right cheliped.

Epistomial spine short and straight, often absent. Sternite of third maxilliped with spine on each side of midline.

Chelipeds markedly dissimilar, covered with moderately dense, simple and plumose setae. Right cheliped (Fig. 68d–f) massive, chela usually operculate; proportions and armature strongly affected by size and sexual dimorphism (see Lemaitre 1989, 1996); fingers strongly curved ventromesially, dactyl with ventromesial face concave; dorsal surface of palm with numerous, small tubercles or spines; dorsomesial and dorsolateral margins of palm well delimited by row of spines, dorsolateral margin often strongly curved.

Left cheliped (Fig. 68g) well calcified; palm with dorsomesial, dorsolateral, and often dorsomedian rows of small tubercles or spines; carpus with dorsal row of spines.

Ambulatory legs (Fig. 68h, i) usually overreaching extended right cheliped by about 0.25 the length of dactyl, armature on meri, carpi, and propodi frequently more developed on right than on left; dactyl longer than propodus, with ventromesial row of 11–20 strong spinules, dorsal row of long setae, and dorsomesial row of setae distally; carpus with dorsal row of spines. Anterior lobe of sternite of third pereopods with 1–3 small subterminal spines, setose.

Fourth pereopod with dactyl (Fig. 68j) terminating in sharp corneous claw; propodal rasp with 2–5 irregular rows of ovate scales.

Telson and uropods markedly asymmetrical. Telson (Fig. 68k) with weak lateral indentations; terminal margin divided into 2 rounded projections by wide, shallow, rounded (U-shaped) cleft; rounded projections armed distally with short, corneous spines.

Male first gonopods each with moderately concave distal lobe; second gonopods each with distal segment spatulate, basal segment occasionally with short exopod. Females lacking first pleopods, or occasionally with rudimentary paired or unpaired first pleopods; with vestigial right second pleopod.

COLOUR: Overall colour of body cream.

REPRODUCTION: Ovigerous females have been found during all months of the year except April and July; however, they have been found most frequently during September and October. Ovigerous females range in shield length from 3.9 to 13.1 mm.

HABITAT: Specimens have been found living in gastropod shells, usually with an actinian or zoanthid polyp attached to the shell; or in colonies of *Epizoanthus*.

REMARKS: This is the most abundant parapagurid in New Zealand waters.

RECORDS FROM NEW ZEALAND: Challenger Plateau west of South Island; WSW of Cape Maria van Diemen southward on east side of North and South Islands to Northern Campbell Plateau; Chatham Rise; 210–984 m, perhaps to 1006 m.

DISTRIBUTION: Southern hemisphere from 22°S to 57°S; in the Atlantic possibly as far north as Ascension Island; 91–1995 m.

### *Oncopagurus* Lemaitre, 1996

*Sympagurus*: Lemaitre 1989: 36 (in part).

*Oncopagurus* Lemaitre, 1996: 194.

TYPE SPECIES: *Eupagurus bicristatus* A. Milne-Edwards, 1880. Gender masculine.

Eleven pairs of biserial gills. Shield about as broad as long; dorsal surface usually weakly calcified medially. Corneas weakly to moderately dilated. Fourth segment of antennal peduncle armed with dorsodistal spine. Epistomial spine strongly curved upward.

Right chela operculate, with well-delimited dorsomesial and dorsolateral margins. Left cheliped with carpus and palm frequently with weakly calcified areas dorsally.

Ambulatory legs with dactyls curved.

Fourth pereopod with propodal rasp consisting of 1 row, at least distally, of corneous scales.

Second abdominal somite with left pleuron terminating ventrally in small subtriangular lobe.

Males with poorly to moderately developed paired first and second gonopods; first sometimes absent, or if present each with weakly concave distal lobe; second gonopods each with flat distal segment.



REMARKS: This genus includes the following 13 species: *O. africanus* (de Saint Laurent, 1972), *O. bicristatus* (A. Milne-Edwards, 1880), *O. cidaris* Lemaitre, 1996, *O. gracilis* (Henderson, 1888), *O. haigae* (de Saint Laurent, 1972), *O. indicus* (Alcock, 1905b), *O. minutus* (Henderson, 1896), *O. mironovi* Zhadan, 1997, *O. monstrosus* (Alcock, 1894), *O. oimos* Lemaitre, 1998, *O. orientalis* (de Saint Laurent, 1972), *O. stockmani* Zhadan, 1997, and *O. tuamotu* (Lemaitre, 1994.)

Zhadan (1997) remarked that one of the diagnostic characters used by Lemaitre (1996) for *Oncopagurus*, i.e., presence of one row of scales on the propodal rasp of the fourth pereopod, is not shared by all species in the genus. Zhadan (1997) observed that some species, such as *O. stockmani*, have two rows of scales proximally, and one row distally on the rasp. It is the number of rows of scales distally that is of diagnostic importance; thus, a clarification is made here in the diagnosis of this genus.

*Oncopagurus* sp. (Fig. 69)

MATERIAL EXAMINED:

NZOI Stn K815, 1 male (sl = 2.2 mm).

DESCRIPTION: Shield (Fig. 69a) about as long as broad, dorsal surface weakly calcified medially; rostrum broadly rounded, with low dorsal ridge; anterior margins concave; lateral projections subtriangular, terminating in small spine; ventrolateral margin with small spine. Ocular peduncles more than half length of shield; ocular acicles subtriangular, terminating in strong spine; corneas slightly dilated. Sternite of third maxillipeds with small spine on each side of midline. Antennular peduncle exceeding distal margin of corneas by nearly full length of ultimate segment. Antennal peduncle (Fig. 69b) reaching almost to distal margin of cornea; second segment with laterodistal projection produced, terminating in strong simple spine; acicles (Fig. 69c) not reaching distal margin of corneas, mesial margin with 6 strong spines; flagellum missing in specimen.

Right cheliped missing.

Left cheliped (Fig. 69d) evenly calcified; palm with dorsomesial row of small spines; carpus with strong, slender dorsodistal spine, dorsal row of 4 spines, and strong spine on laterodistal margin; merus with ventromesial and ventrolateral row of spines distally.

Ambulatory legs (Fig. 69e, f) with dactyl armed with 3 (first leg) or 4 (second leg) small corneous spines on ventromesial margin, and dorsal and dorsomesial rows of long setae; carpus with small dorsodistal spine; merus of first leg with 2 small subdistal spines on ventrolateral margin, merus of second leg un-

armed; ischium of first leg with 1 small subdistal spine on ventrolateral margin, ischium of second leg unarmed. Anterior lobe of sternite of third pereopods setose, armed with subterminal spine.

Fourth pereopod with propodal rasp (Fig. 69g) consisting of one row of ovate scales.

Uropods (Fig. 69h, i) and telson (Fig. 69j) markedly asymmetrical. Telson lacking lateral indentations; terminal margin divided into two rounded projections by shallow, rounded (U-shaped) median cleft; terminal margin armed with curved corneous spines (much stronger on left side).

Male lacking first gonopods; second gonopods 2-segmented, slightly asymmetrical (right largest), each gonopod with distal segment nearly flat.

COLOUR: Unknown.

REPRODUCTION: Unknown

HABITAT: Gastropod shell.

REMARKS: The single specimen belongs to a species of *Oncopagurus* in which the male lacks first gonopods, and the second pair of gonopods are two-segmented. Of the five described species in this genus (see Lemaitre 1998), only two exhibit the condition seen in the specimen from the Kermadecs: *O. tuamotu* and *O. cidaris*. The Kermadec specimen, however, differs significantly from both of these species in at least the greater development of the corneas and stronger terminal spine of each ocular acicle; and in having much stronger spines on the mesial margin of the antennal acicles. Unfortunately, given the incompleteness of the Kermadec specimen (right cheliped, and antennal flagella missing), it is not possible to determine with certainty its identity, or whether it might represent an undescribed species.

RECORDS FROM NEW ZEALAND: Kermadec Islands, 320 m.

DISTRIBUTION: Known from only one specimen collected in the Kermadec Islands.

*Paragiopagurus* Lemaitre, 1996

*Sympagurus*: Lemaitre 1989: 36 (in part).

*Paragiopagurus* Lemaitre, 1996: 207.

TYPE SPECIES: *Sympagurus diogenes* Whitelegge, 1900. Gender masculine.

Eleven pairs of biserial or quadriserial gills. Shield about as broad as long; dorsal surface often with

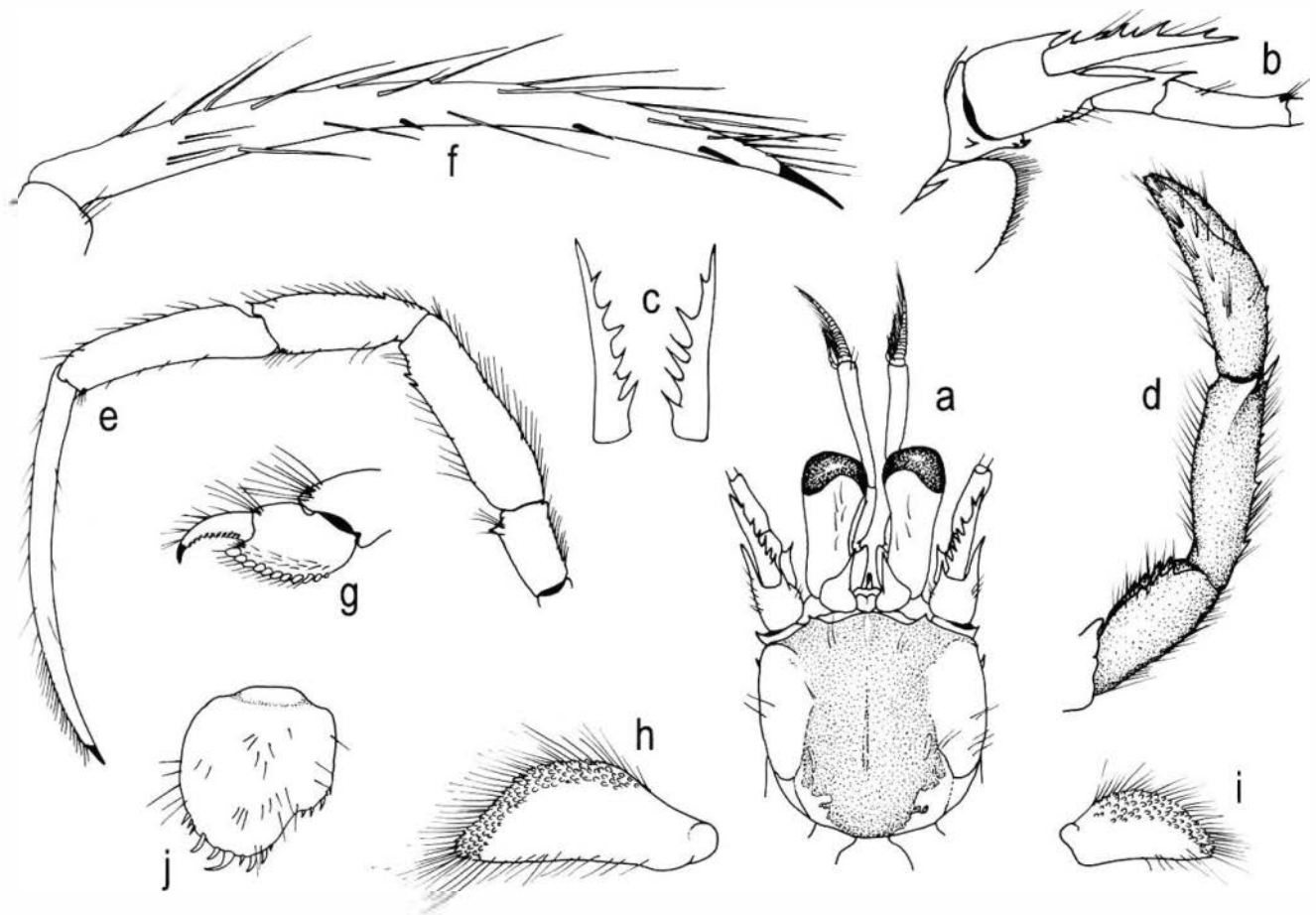


Fig. 69. *Oncopagurus* sp., NZOI Stn K815, male (sl = 2.2 mm). a, shield and cephalic appendages; b, right antennal peduncle (lateral view); c, antennal acicles (dorsal view); d, left cheliped (dorsolateral view); e, left second pereopod (lateral view); f, dactyl of same (mesial view); g, propodus and dactyl of left fourth pereopod (lateral view); h, left exopod of uropods (dorsal view); i, right exopod of uropods (dorsal view); j, telson (dorsal view). Magnification equals 25x (a, d, e), 50x (b, c, f-i).

irregularly shaped, weakly calcified areas medially. Corneas weakly to moderately dilated.

Fourth segment of antennal peduncle armed with dorsodistal spine. Epistomial spine straight, or absent.

Right chela usually with well-delimited dorso-mesial and dorsolateral margins; often operculate.

Left cheliped well calcified, or sometimes weakly calcified on merus and carpus.

Ambulatory legs with dactyls evenly curved. Fourth pereopod with propodal rasp consisting of 1 or more rows of ovate corneous scales.

Second abdominal somite with left pleuron terminating in small subtriangular lobe.

Males usually with weakly to moderately developed paired first and second gonopods; first gonopods sometimes absent; rarely with second unpaired left pleopod.

**REMARKS:** In addition to the two *Paragiopagurus* species known from the New Zealand region, 14 others are

included in this genus: *P. acutus* (de Saint Laurent, 1972), *P. bicarinatus* (de Saint Laurent, 1972), *P. boletifer* (de Saint Laurent, 1972), *P. bougainvillei* (Lemaitre, 1994), *P. curvispina* (de Saint Laurent, 1974), *P. hobbiti* (Macpherson, 1983), *P. macrocerus* (Forest, 1955), *P. pacificus* (Edmondson, 1925), *P. pilimanus* (A. Milne-Edwards, 1880), *P. rugosus* (de Saint Laurent, 1972), *P. ruticheles* (A. Milne-Edwards, 1891), *P. spinimanus* (Balss, 1911), *P. tuberculosus* (de Saint Laurent, 1972), and *P. wallisi* (Lemaitre, 1994).

#### *Paragiopagurus diogenes* (Whitelegge, 1900)

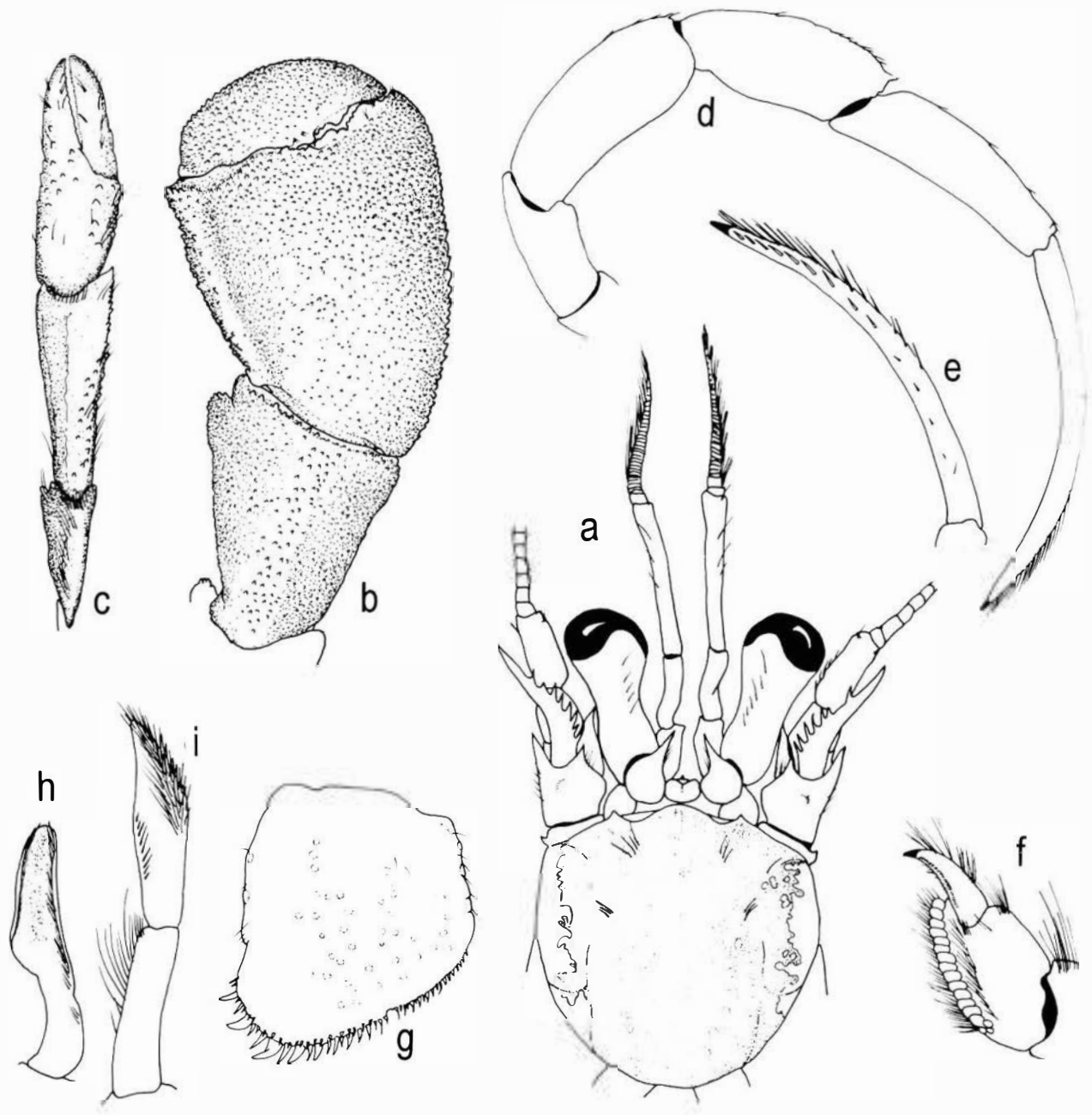
(Fig. 70)

*Sympagurus diogenes* Whitelegge, 1900: 172, pl. 34, fig. 3; Lemaitre 1994: 412, fig. 27g.

*Parapagurus diogenes*: de Saint Laurent 1972: 108.

*Paragiopagurus diogenes*: Lemaitre 1996: 208, figs 14d, e, 24. [Not *Sympagurus arcuatus diogenes* Hale, 1941: 279] (see Remarks)





**Fig. 70.** *Paragiopagurus diogenes* (Whitelegge, 1900), a, c-i, New South Wales, Australia, male (sl = 8.1 mm) AM P39441; b, NMNZ Stn BS 571, male (sl = 10.1 mm), NMNZ Cr 9785: a, shield and cephalic appendages; b, right cheliped (dorsal view); c, left cheliped (dorsal view); d, left third pereopod (lateral view); e, dactyl of same (mesial view); f, propodus and dactyl of left fourth pereopod (lateral view); g, telson (dorsal view); h, left first gonopod (mesial view); i, left second gonopod (anterior view). a, c-i, after Lemaitre (1996). Magnifications equal 4x (c-e), 4.2x (b), 7x (a), 14x (f-i).

**TYPES:**

Lectotype by subsequent designation by Lemaitre (1996), female (sl = 7.9 mm), *Thetis* Expedition, Stn 35, AM G2379.

Paralectotypes: 2 males (sl = 3.9, 4.4 mm), *Thetis* Stn 48, 18.3.1898, AM G2380.

**TYPE LOCALITY:** *Thetis* Expedition, Stn 35, 3 km E of Port Hacking, New South Wales, Australia.

**OTHER MATERIAL EXAMINED:**

NMNZ Stn BS 571, 1 male (sl = 10.1 mm), Cr 9785.

**DESCRIPTION:** Gills with elements weakly divided distally. Shield (Fig. 70a) as broad as long; dorsal surface weakly calcified medially, with low blister-like tubercles; rostrum broadly rounded, with short mid-dorsal ridge; anterior margins weakly concave; lateral projections subtriangular, with terminal spine; posterior margin broadly rounded. Ocular peduncles more than half length of shield, with dorsal longitudinal row of setae. Corneas slightly dilated. Ocular acicles subtriangular, terminating in strong spine usually directed anteromesially. Antennular peduncle long, slender, exceeding distal margin of corneas by nearly entire length of ultimate segment. Antennal peduncle exceeding distal margin of cornea by at most 0.20 length of fifth segment; third segment with strong ventromesial distal spine. Antennal acicles curved outward (in dorsal view), not exceeding distal margin of corneas, and armed mesially with 4–7 strong spines. Antennal flagellum long, reaching to or slightly exceeding extended right cheliped, articles with very short setae interspersed with long setae every 5–15 articles.

Epistome with strong, straight spine. Sternite of third maxillipeds with small spine on each side of midline.

Chelipeds markedly dissimilar, glabrous or at most with scattered short setae, carpi and chelae usually iridescent dorsally. Right cheliped (Fig. 70b) with small tubercles or spines on dorsal surfaces of carpus and chela (tubercles or spines decreasing in size and number with increased size of individuals); fingers curved ventromesially; palm with dorsolateral margin well delimited by row of blunt to sharp spines, dorsomesial margin with row of small, blunt spines, mesial face rounded.

Left cheliped (Fig. 70c) with dorsolateral face of carpus frequently weakly calcified; chela with dorsomesial row of few small spines; carpus with irregular row of small spines dorsally.

Ambulatory legs (Fig. 70d, e) reaching to tip of right cheliped, unarmed except for dorsodistal spine on carpus; dactyls approximately 1.8 times as long as propodi, each with ventromesial row of about 8–14 corneous spines. Anterior lobe of sternite of third pereopods unarmed, or rarely with small blunt marginal spine.

Fourth pereopod with dactyl (Fig. 70f) terminating in sharp corneous claw (longer and more slender in females than in males); propodal rasp consisting of 1 row of rounded scales.

Uropods and telson markedly asymmetrical; telson (Fig. 70g) with weak lateral indentations; dorsal surface usually with low, blister-like tubercles; terminal margin divided into rounded projections by narrow rounded, U-shaped cleft, terminal margin

armed with numerous corneous spines (often strongly curved on left side).

Male first gonopods (Fig. 70h) each with concave distal lobe; second gonopods (Fig. 70i) each with distal segment setose on distomesial face, and row of short bristle-like setae on lateral margin. Females occasionally with paired first pleopods; with vestigial second right pleopod.

**COLOUR:** "In fresh specimens, general color orange or reddish (in preservative, colour fades to cream white except on chelipeds where patterns remain for considerable time). Chelipeds with fingers cream white; dorsal surface of carpus and chela orange or reddish, iridescent, fading to white laterally. Walking legs orange or reddish, fading to cream-white towards the dactyls. Carpi of chelipeds and walking legs each with dark red band proximally. Merus of right cheliped with dark red stripe dorsomesially. Carapace and chelae with small, scattered red spots" (Lemaitre 1996: 211).

**REPRODUCTION:** Ovigerous females range in shield length from 3.2 to 8.2 mm, and have been found during all months except April, May, July, and September.

**HABITAT:** Inhabits gastropod shells.

**REMARKS:** Among parapagurids, this species occurs at the shallowest depths. Hale (1941) considered Whitelegge's (1900) *Sympagurus diogenes* as a subspecies of *S. arcuatus*; however, as pointed out by Lemaitre (1996), it is clear from Hale's (1941) description and illustrations his specimens do not represent Whitelegge's taxon but instead another undetermined species.

**RECORDS FROM NEW ZEALAND:** Kermadec Islands, 219–274 m.

**DISTRIBUTION:** Western Pacific: Japan; China Sea; Australia; and New Zealand, 40–695 m.

*Paragiopagurus hirsutus* (de Saint Laurent, 1972)  
(Fig. 71)

*Parapagurus acutus hirsutus* de Saint Laurent, 1972: 113, fig. 19.

*Sympagurus acutus hirsutus*: Lemaitre 1989: 37; 1994: 412.

*Paragiopagurus hirsutus*: Lemaitre 1996: 217, fig. 28.

**TYPES:**

Holotype male (not seen), Tosa Bay, Japan, November 1963, coll. K. Sakai, MNHN-Pg 2225.



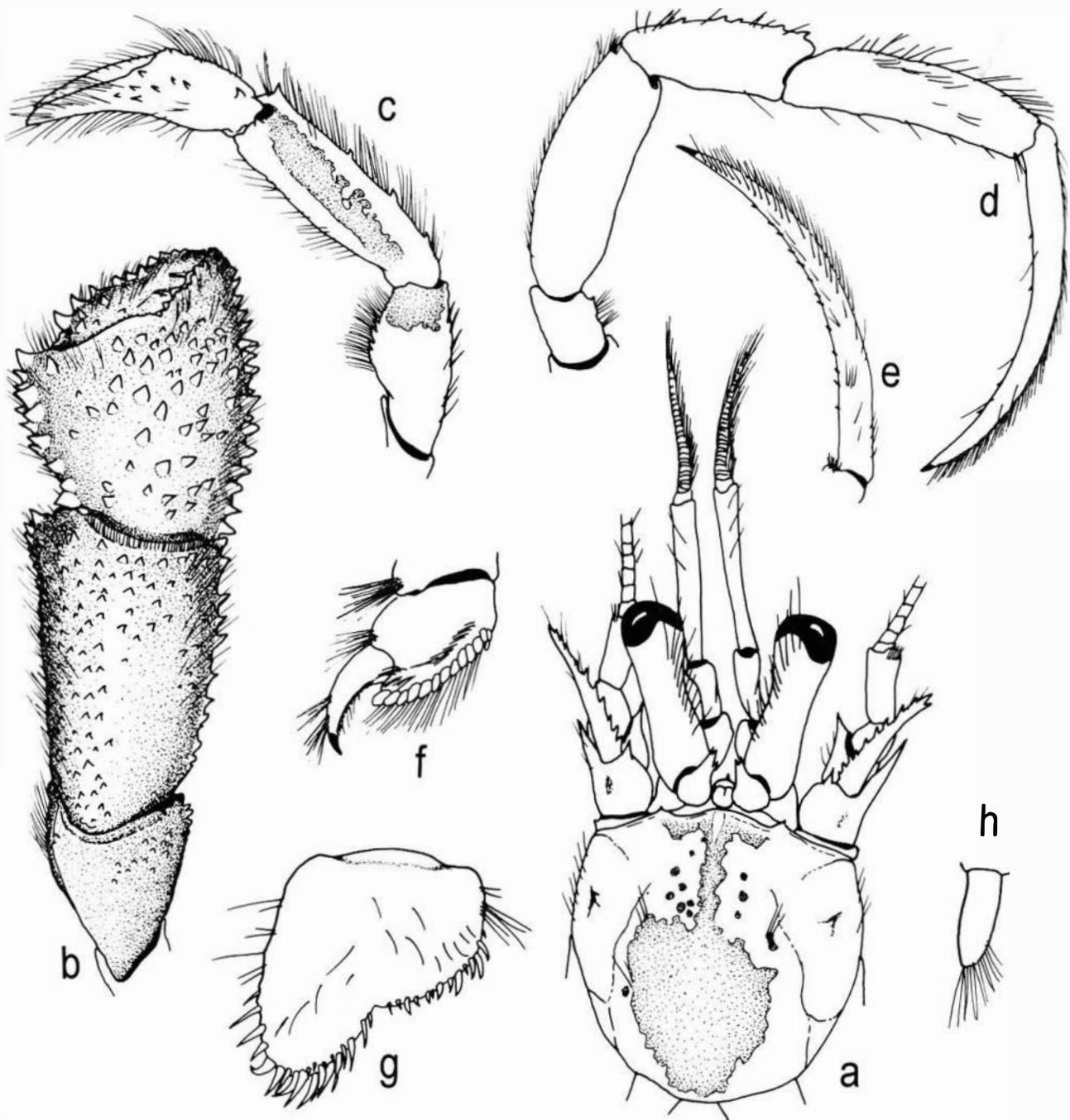


Fig. 71. *Paragiopagurus hirsutus* (de Saint Laurent, 1972), off Tully, Queensland, Australia, male (sl = 6.1 mm), QM W20595: a, shield and cephalic appendages; b, right cheliped (dorsal view); c, left cheliped (dorsolateral view); d, right second pereopod (lateral view); e, dactyl of same (mesial view); f, propodus and dactyl of left fourth pereopod (lateral view); g, telson (dorsal view); h, left second pleopod (lateral view). After Lemaitre (1996). Magnifications equal 7x (b-e), 8x (a), 18x (f-h).

TYPE LOCALITY: Tosa Bay, Japan.

OTHER MATERIAL EXAMINED:

NMNZ Stn BS888, 1 ovigerous female (sl = 8.8 mm), Cr 8459.

DESCRIPTION: Biserial gills. Shield (Fig. 71a) as long as

broad; dorsal surface weakly calcified medially; rostrum broadly rounded, with low dorsal ridge; anterior margins weakly concave; lateral projections subtriangular, terminating in small spine; ventro-lateral margin with spine (not always visible in dorsal view); posterior margin broadly rounded. Ocular

peduncles more than half length of shield; ocular acicles subtriangular, terminating in strong multifid spine (rarely simple on one side); corneas slightly dilated. Antennular peduncle exceeding distal margin of corneas by about 0.75 length of ultimate segment. Antennal peduncle reaching distal margins of cornea; second segment with laterodistal projection produced, terminating in strong simple spine reaching to mid-point of antennal acicle. Antennal acicles reaching distal margin of corneas, mesial margin with 8–13 spines. Antennal flagellum with long setae, 3 or 4 flagellar articles in length.

Epistomial spine straight, frequently bifid. Maxillule with internal lobe of endopod bearing 3 or 4 long setae. Sternite of third maxillipeds with small spine on each side of midline.

Chelipeds markedly dissimilar, surfaces with moderately dense setae interspersed with numerous long, stiff setae. Right cheliped (Fig. 71b) with palm broader than long, fingers curved ventromesially, dactyl with longitudinal row of blunt spines on ventral face; dorsal face of palm with strong spines (at least proximomedially), ventral face with numerous tubercles; palm with dorsolateral and dorsomesial margins each well delimited by row of strong spines, and ventromesial face rounded; carpus with numerous small tubercles or spines on dorsal surface.

Left cheliped (Fig. 71c) with lateral face of carpus usually weakly calcified; with dorsal row of 2–6 small, well-spaced spines, and strong dorsodistal spine on carpus.

Ambulatory legs (Fig. 71d, e) with dactyls having ventromesial row of 8–13 corneous spines, and dorsal and dorsomesial rows of long setae; carpi each with small dorsodistal spine; carpi of second pereopods each with dorsal margin armed with 1–4 small spines. Anterior lobe of sternite of third pereopods setose, armed with one or 2 marginal spines.

Fourth pereopod (Fig. 71f) with propodal rasp consisting of one row of ovate scales.

Uropods and telson markedly asymmetrical; telson (Fig. 71g) lacking lateral indentations; terminal margin divided into rounded projections (left elongated) by rounded, U-shaped median cleft, margin armed with often long, curved corneous spines. Males lacking first gonopods, with unpaired, uniramous second left pleopod. Females with vestigial right second pleopod.

COLOUR: Unknown.

REPRODUCTION: Very few ovigerous females have been found. These were taken during January and May; they range in shield length from 3.6 to 8.8 mm.

HABITAT: Inhabits gastropod shells.

RECORDS FROM NEW ZEALAND: Eastern slope of Norfolk Ridge; 357 to perhaps 487 m.

DISTRIBUTION: Indo-Pacific: China Sea; Philippines; Australia; New Zealand; questionably from off Durban, South Africa (see Lemaitre 1996: 218); 223–505 m.

### *Parapagurus* Smith, 1879

*Parapagurus* Smith, 1889: 50; de Saint Laurent 1972: 101 (in part); Lemaitre 1989: 11, fig. 2A–C, L, M; 1999: 308, figs 1, 2.

TYPE SPECIES: *Parapagurus pilosimanus* Smith, 1879: 51, by monotypy. Gender masculine.

Eleven pairs of quadriserial gills, lacking vestigial pleurobranchiae on last thoracic somite; gills each consisting of series of 4 long filamentous or flattened branches arranged along axis. Shield usually well calcified. Ocular peduncles (including corneas) typically half, or less than half, length of shield; corneas at most weakly dilated. Antennal peduncles and acicles distinctly over-reaching ocular peduncles. Fourth segment of antennal peduncle unarmed.

Epistomial spine, when present, short and straight.

Right cheliped elongate; palm rounded mesially and laterally. Left cheliped well calcified.

Ambulatory legs long, dactyls usually exceeding extended right cheliped by entire length of dactyl.

Fourth pereopod with propodal height usually subequal or greater than length of margin occupied by propodal rasp.

Second abdominal somite with left pleuron terminating ventrally in small subtriangular lobe.

Males with well-developed paired first and second gonopods; distal lobe of first gonopod subconical or subtubular; distal segment of second gonopod slightly twisted distally, anterior face with numerous setae distally and row of short stiff setae on lateral margin. Females with rudimentary right second pleopod.

REMARKS: This genus was revised and restricted by Lemaitre (1989). More recently, Lemaitre (1999) reviewed all species known from the Indian and Pacific Oceans. In addition to the four *Parapagurus* species now known to occur in the New Zealand region, 13 others are also included in this genus. Of these, ten are distributed in the Indo-Pacific or eastern Pacific: *P. andreui* Macpherson, 1984, *P. benedicti* de



Saint Laurent, 1972, *P. foraminosus* Lemaitre, 1999, *P. furici* Lemaitre, 1999, *P. holthuisi* Lemaitre, 1989, *P. janetae* Lemaitre, 1999, *P. microps* de Saint Laurent, 1972, *P. saintlaurentae* Lemaitre, 1999, *P. stenorhinus* Lemaitre, 1999, *P. wolffi* Lemaitre, 1999; and three are known exclusively from the Atlantic, *P. pilosimanus* Smith, 1879, *P. alaminos* Lemaitre, 1986, and *P. nudus* (A. Milne-Edwards, 1891).

***Parapagurus abyssorum* (Filhol, 1885c) (Fig. 72)**

*Pagurus abyssorum* Filhol, 1885c: 152, fig. 1; 1885f: 131, fig. 41.

*Parapagurus abyssorum* var. *scabra* Henderson, 1888: 89, pl. 9, fig. 3.

*Parapagurus pilosimanus scaber*: de Saint Laurent 1972: 102, pl. 1, fig. 3.

*Parapagurus scaber*: Lemaitre 1986: 533, figs 1G,H, 3F-J, 4I,J, 5G,H, 6A-C,K,L, 7D,H,I, 8F,G, 9C.

*Parapagurus abyssorum*: Lemaitre 1989: 30, figs 5D,E, 12-14; 1990: 220; 1999: 313, figs 4-6, 47, 49, 50.

**TYPES:**

Holotype of *Parapagurus abyssorum*: female figured by Filhol (1885c: 152, fig. 1), deposition unknown.

**TYPE LOCALITY:** North Atlantic, *Talisman* Stn 148, 42°23'N, 21°15'W. Holotype of *Parapagurus abyssorum* var. *scabra* Henderson, 1888: female (sl = 11.2 mm), NHM 1888: 33.

**TYPE LOCALITY:** *Challenger* Stn 68.

**OTHER MATERIAL EXAMINED:**

ZMUC Collections: *Galathea* Stn 575, 1 male with damaged cephalic appendages (sl = 17.7 mm).

**DESCRIPTION:** Shield (Fig. 72a) about as broad as long, dorsal surface well calcified; lateral projections broadly rounded. Rostrum broadly subtriangular, rounded distally and with low middorsal ridge. Ocular peduncles (including corneas) less than half length of shield, inflated basally; width of cornea about same as distal width of ocular peduncle. Ocular acicles subtriangular, terminating in strong simple spine. Antennular peduncle when fully extended exceeding distal margin of cornea by nearly entire length of penultimate segment; lateral face of basal segment with statocyst lobe having subrectangular distal lobe armed with 1 or more small spines, and 1 spine proximally. Antennal peduncle exceeding distal margins of cornea by nearly entire length of fifth segment. Antennal acicle nearly straight in dorsal view, exceeding distal margins of cornea by half or more than half length of acicle, mesial and dorso-

mesial distal margins armed with 5-25 small spines. Antennal flagellum with few setae, about 1 flagellar article in length or less.

Epistomial spine usually absent. Sternite of third maxillipeds with strong spine on each side of midline.

Chelipeds markedly dissimilar, each with dorsal surfaces of carpus and chela usually covered with dense, simple and plumose setae. Right cheliped (Fig. 72b) with proportions of carpus and chela influenced by size and sexual dimorphism. Palm and carpus each with numerous small spines and tubercles on dorsal surface, spines usually stronger on dorsomesial and dorsolateral margins.

Left cheliped (Fig. 72c) well calcified, with moderately dense setation; carpus with tubercles or spines on lateral and dorsal faces.

Ambulatory legs (Fig. 72d) very spinose; dactyls each with dorsal row of small spines; meri, carpi, and propodi each armed on mesial, lateral, dorsal, and ventral faces with numerous small spines (less numerous in small specimens, sl < 7.0 mm); meri each about 4.1 (first leg) or 3.5 (second leg) as long as high. Anterior lobe of sternite of second ambulatory legs (Fig. 72e) subsemicircular, setose, armed with 1-5 small subterminal spines.

Fourth pereopod with propodal rasp (Fig. 72f) consisting of 2 or 3 irregular rows of lanceolate scales. Fifth pereopod with propodal rasp less than half length of propodus.

Telson (Fig. 72h) and uropods asymmetrical. Terminal margin of telson divided into 2 rounded projections by shallow, rounded (U-shaped) cleft; rounded projections armed distally with short corneous spines. Left exopod of uropod (Fig. 72g) elongate, 2.2-2.8 as long as broad; with broad rasp.

**COLOUR:** Unknown.

**REPRODUCTION:** Ovigerous females have been found in March, June, August, and September, and range in shield length from 8.0 to 13.8 mm.

**HABITAT:** Usually found living in shelters formed by *Epizoanthus* species, or occasionally actinians.

**REMARKS:** The distribution of *P. abyssorum* is the broadest so far known for species of the genus, and includes both sides of the Pacific and Atlantic Oceans (Lemaitre 1999).

**RECORDS FROM NEW ZEALAND:** Eastern Tasman Sea; 3710 m.

**DISTRIBUTION:** Western and southeastern Pacific: Tasman Sea; about 1930 km west of Chile. North lobe

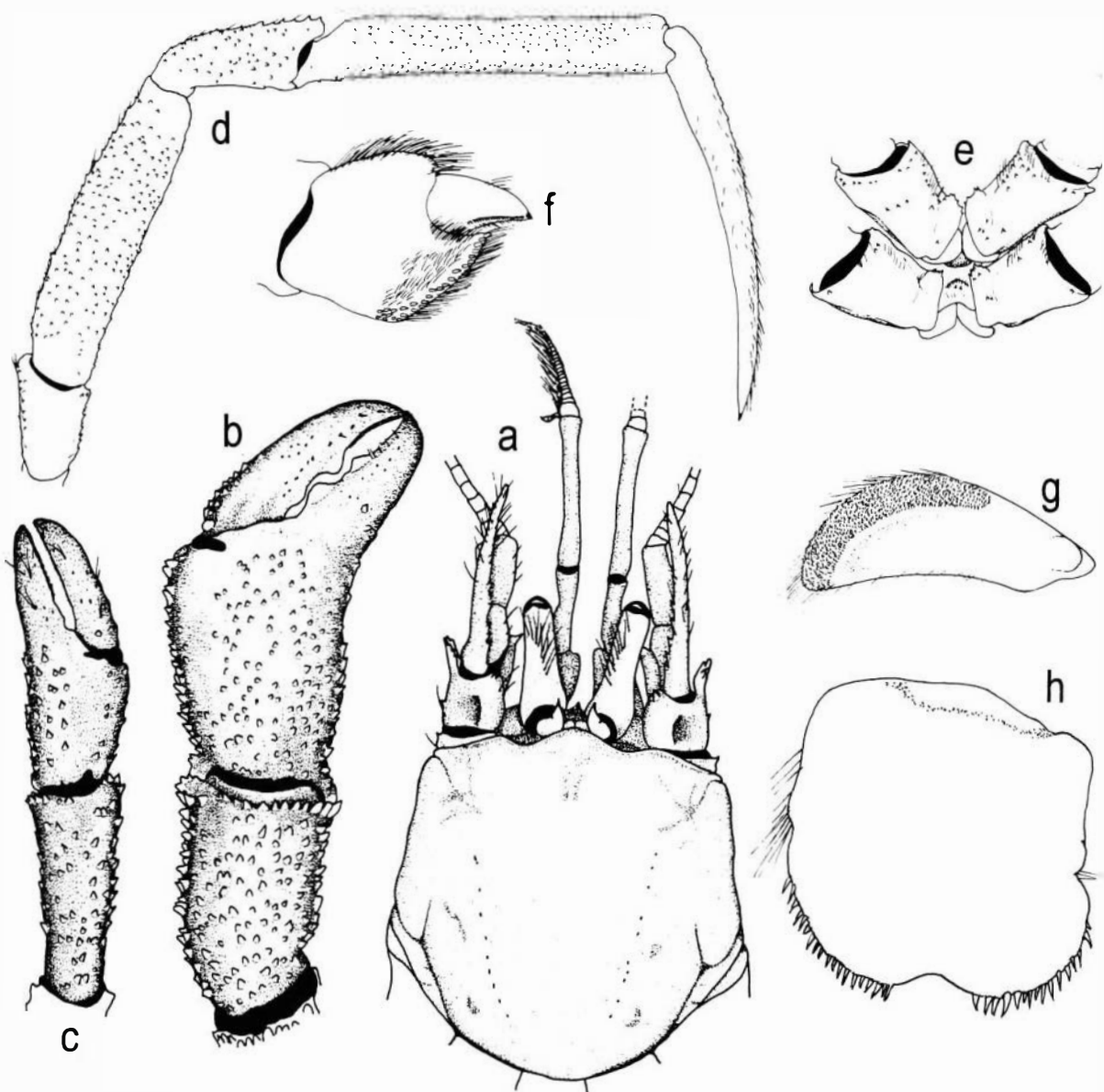


Fig. 72. *Parapagurus abyssorum* (Filhol, 1885), a-c, h, North Atlantic, *Challenger* Stn 68, female holotype of *Parapagurus abyssorum* var. *scabra* (sl = 11.2 mm), NHM 1888:33; d, e, g, Tasman Sea, *Galathea* Stn 575, male (sl = 17.7 mm) ZMK; f, SE Pacific, *Eltanin* Stn 233, male (sl = 6.6 mm) USNM 155046 : a, shield and cephalic appendages; b, chela and carpus of right cheliped (dorsal view); c, chela and carpus of left cheliped (dorsal view); d, right second pereopod (lateral view); e, coxae and sternites of second and third pereopods (ventral view); f, propodus and dactyl of right fourth pereopod (lateral view); g, left exopod of uropods (dorsal view); h, telson (dorsal view). a-c, h, after Lemaitre (1989); d-g, after Lemaitre (1999). Magnifications equal 1.5x (d), 2x (e), 4x (a-c), 6x (f), 8x (g), 12x (h).

Atlantic: northeastern United States; Azores to Cape Verde Islands; 2500–4360 m.

*Parapagurus bouvieri* Stebbing, 1910 (Fig. 73)

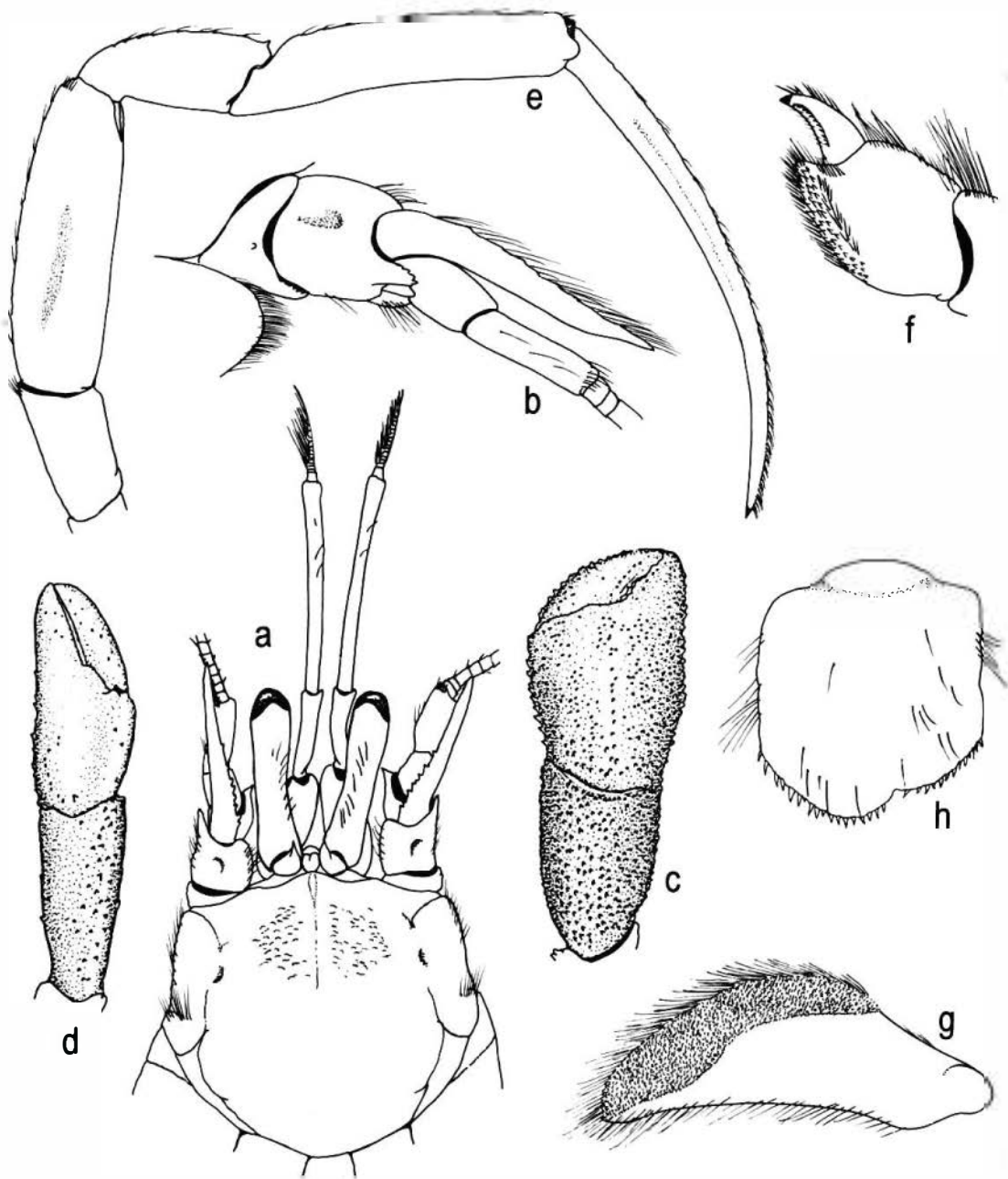
*Parapagurus bouvieri* Stebbing, 1910: 357, pl. 17 (Crustacea pl. 43); Lemaitre 1990: 223, fig. 2; 1999: 317, figs 7, 47, 49.

*Parapagurus pilosimanus*: Barnard 1950: 450, fig. 83a-b. [Not *Parapagurus pilosimanus* Smith, 1879.]

*Parapagurus pilosimanus bouvieri*: de Saint Laurent 1972: 102, pl. 1, fig. 4.

TYPE: Lectotype by subsequent designation by Lemaitre (1990: 223), ovigerous female (sl = 6.3 mm), SAM A1524.





**Fig. 73.** *Parapagurus bouvieri* Stebbing, 1910, a, b, e-h, NMNZ Stn Kah 9604, male (sl = 14.9 mm) NMNZ Cr 9786; c, d, SE Atlantic, male (sl = 8.2 mm), USNM 240185: a, shield and cephalic appendages; b, right antennal peduncle (lateral view); c, carpus and chela of right cheliped (dorsal view, setation omitted); d, carpus and chela of left cheliped (dorsal view, setation omitted); e, right second pereopod (lateral view); f, propodus and dactyl of left fourth pereopod (lateral view); g, left exopod of uropods (dorsal view); h, telson (dorsal view). c, d, after Lemaitre (1990). Magnifications equal 3x (c), 4x (a), 6x (d), 9x (b, g), 12x (f, h), 36x (e).

**TYPE LOCALITY:** Buffalo River, NW 1/2W 19 miles, South Africa.

**OTHER MATERIAL EXAMINED:**

NMNZ collections: Kah9604, Stn 12, 1 male with damaged chelipeds (sl = 14.9 mm), Cr 9786.

**DESCRIPTION:** Shield (Fig. 73a) about as broad as long, dorsal surface well calcified or weakly calcified medially; lateral projections broadly rounded. Rostrum broadly subtriangular, rounded distally; with short middorsal ridge. Ocular peduncles more than half length of shield, weakly inflated basally; width of

cornea about same or slightly more than distal width of ocular peduncle. Ocular acicles subtriangular, terminating in strong simple spine (rarely bifid). Antennular peduncle when fully extended exceeding distal margin of cornea by half length of penultimate segment; lateral face of basal segment with statocyst lobe having subrectangular distal lobe armed with 1 or 2 spines, and 1 spine proximally. Antennal peduncle (Fig. 73b) exceeding distal margin of cornea by at most half length of fifth segment. Antennal acicle weakly curved in dorsal view, exceeding distal margin of cornea by at most half length of acicle, mesial margin armed with 5–10 small spines. Antennal flagellum with setae 1 or 2 flagellar articles in length.

Epistomial spine usually present. Sternite of third maxillipeds with strong spine on each side of midline.

Chelipeds markedly dissimilar, each with dorsal surfaces of carpus and chela usually covered with dense, simple and plumose setae. Right cheliped (Fig. 73c) with proportions of carpus and chela influenced by size and sexual dimorphism. Palm and carpus each with numerous small spines and tubercles on dorsal surface.

Left cheliped (Fig. 73d) well calcified, densely setose; carpus with irregular rows of small spines on dorsal margin.

Ambulatory legs (Fig. 73e) with meri, carpi, and propodi unarmed except for small dorsodistal spine on each carpus; meri each about 3.5 (first leg) or 2.9 (second leg) as long as high, with lateral and mesial faces weakly calcified medially (weak calcification more pronounced on second leg). Anterior lobe of sternite of second ambulatory legs subsemicircular, setose, armed with small subterminal spine.

Fourth pereopod with propodal rasp (Fig. 73f) consisting of 2 or 3 rows of conical scales. Fifth pereopod with propodal rasp less than half length of propodus.

Telson (Fig. 73h) and uropods asymmetrical. Terminal margin of telson divided into 2 rounded projections by shallow, rounded (U-shaped) cleft; rounded projections armed distally with alternating short and long corneous spines (approximately 15–20 left, 10–17 right). Left exopod of uropod (Fig. 73g) elongate, about 3.0 times as long as broad; with broad rasp.

**COLOUR** (from Barnard 1950: 451, as *Parapagurus pilosimanus*): "Body pinkish, basal joints of chelipeds with reddish patches, 2nd and 3rd legs red, with a conspicuous white band along the upper and lower margins, cornea dark crimson, antenna 1 pink with white band along upper margin of last peduncular joint, antenna 2 pink."

**REPRODUCTION:** Ovigerous females were found during January, April, May, and October, and range in shield length from 6.3 to 12.2 mm.

**HABITAT:** Usually found living in shelters formed by zoanthid species, probably *Epizoanthus* species.

**RECORDS FROM NEW ZEALAND:** NMNZ Stn Kah9604, Bay of Plenty, depth unknown.

**DISTRIBUTION:** Southeastern Atlantic and southwestern Indian Ocean: off Angolan to South Africa shelf, northeastwards to KwaZulu-Natal shelf. Western Pacific: Australia; New Zealand; 247–990 m.

**REMARKS:** This species can be distinguished from all others in the genus by the weak calcification (usually marked by a dark, brown area) present on the lateral and mesial faces of the meri of the ambulatory legs, and the greater development of the ocular peduncles. In *P. bouvieri*, the length of the ocular peduncles (including corneas) is distinctly more than half the length of the shield, whereas in all other species of *Parapagurus* the ocular peduncles are half, or less than half, the length of the shield. The New Zealand specimen agrees in every respect with *P. bouvieri*, except for the lack of clearly marked, weakly calcified areas on the meri of the ambulatory legs.

*Parapagurus richeri* Lemaitre, 1999 (Fig. 74)

*Parapagurus richeri* Lemaitre, 1999: 334, figs 19–23, 47, 48.

**TYPE:**

Holotype: male (sl = 4.9 mm), BIOGEOCAL Stn 272, MNHN Pg 5614.

**TYPE LOCALITY:** BIOGEOCAL Stn 272, New Caledonia, 21°00.4'S, 166°56.9'E.

**OTHER MATERIAL EXAMINED:**

ZMUC collection: *Galathea* Stn 668, 2 males (sl = 3.1, 4.3 mm), 1 ovigerous female (sl = 4.3 mm), CRU-3389.

**DESCRIPTION:** Shield (Fig. 74a) about as long as broad; dorsal surface usually well calcified; lateral projections broadly rounded. Rostrum broadly subtriangular, rounded distally, with low middorsal ridge. Anterolateral margin of branchiostegite rounded, unarmed, setose. Ocular peduncles (including corneas) about half length of shield, each with dorsal longitudinal row of setae; peduncles inflated basally; width of cornea subequal to distal width of ocular peduncle. Ocular acicles subtriangular, termi-



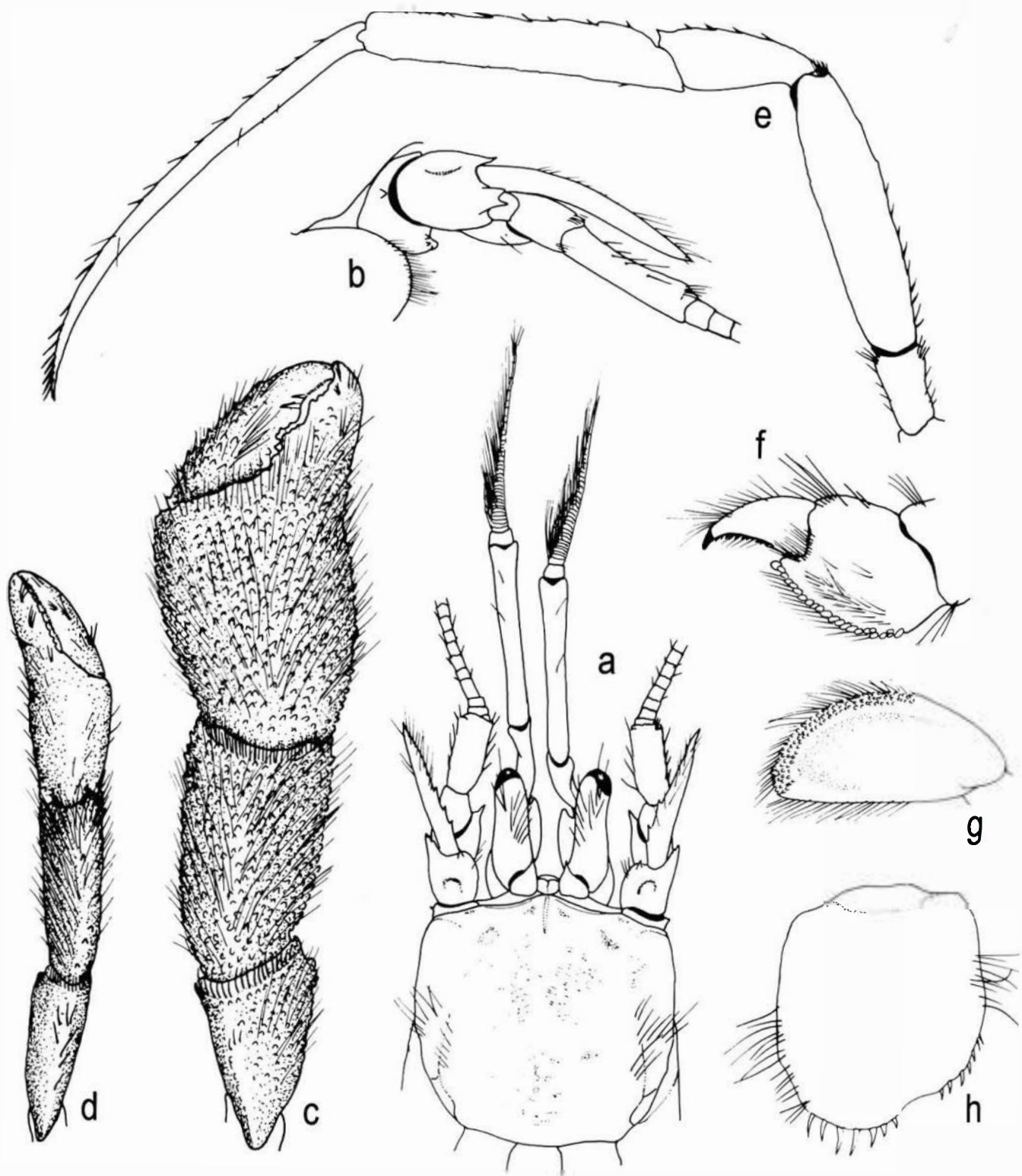


Fig. 74. *Parapagurus richeri* Lemaitre, 1999, New Caledonia, male holotype (sl = 4.9 mm) MNHN Pg 5614: a, shield and cephalic appendages; b, right antennal peduncle (lateral view); c, right cheliped (dorsal view, setation omitted); d, left cheliped (dorsal view, setation omitted); e, left second pereopod (lateral view); f, propodus and dactyl of left fourth pereopod (lateral view); g, left exopod of uropods (dorsal view); h, telson (dorsal view). After Lemaitre (1999). Magnifications equal 9x (e), 10x (c, d), 12x (a), 20x (g), 24x (b), 34x (f, h).

inating in strong spine (rarely bifid). Antennular peduncles long, exceeding distal margins of corneas by at least 0.25 length of penultimate segments; lateral face of basal segment with statocyst lobe armed with 2 small spines, and 1 spine proximally. Antennal peduncles (Fig. 74b) exceeding distal margins of corneas by about half length of fifth segments. Antennal flagellum with setae less than 1 to 2 flagellar articles in length. Antennal acicle nearly straight in dorsal view, setose, exceeding distal margin of cornea by 0.2 or more length of acicle, mesial margin usually armed on proximal half with 1–3 (occasionally up to 8) spines.

Epistomial spine usually present. Sternite of third maxilliped with spine on each side of midline.

Chelipeds markedly dissimilar, each with dorsal surfaces of carpus and chela covered with moderately dense, simple and plumose setae. Right cheliped (Fig. 74c) with proportions of carpus and chela influenced by size and sexual dimorphism. Palm and carpus each with numerous small spines and tubercles on dorsal surface.

Left cheliped (Fig. 74d) well calcified, with moderately dense setation; carpus armed with irregular row or rows of small spines or tubercles dorsally.

Ambulatory (Fig. 74e) legs with meri, carpi, and propodi unarmed except for small dorsodistal spine on each carpus; propodi 3.4–5.4 (first leg) and 3.1–5.3 (second leg) as long as high; meri 3.4–3.9 (first leg) and 2.8–3.3 (second leg) as long as high. Anterior lobe of sternite of second legs setose, armed with simple subterminal spine.

Fourth pereopod with propodal rasp (Fig. 74f) consisting of a row of ovate scales at least distally. Fifth pereopod with propodal rasp forming subtriangular area less than half length of propodus.

Telson and uropods asymmetrical (rarely weakly asymmetrical in specimens living in scaphopod shells). Telson (Fig. 74h) with terminal margin divided into 2 rounded projections by wide, shallow unarmed rounded (U-shaped) cleft; rounded projections each armed distally with few (usually 7 or 8) moderately long, well-spaced corneous spines. Left exopod (Fig. 74g) short, about 2–2.3 times as long as broad (often paddle-shaped), with moderately broad rasp.

COLOUR: Unknown.

REPRODUCTION: Ovigerous females have been found throughout the year except during June, July, and December; they range in shield length from 3.1 to 11.0 mm.

HABITAT: Gastropod shells (often with anthozoan polyp); occasionally scaphopod shells.

RECORDS FROM NEW ZEALAND: Kermadec Trench; 2640 m.

DISTRIBUTION: Central and western Pacific; South China Sea; southwestern Indian Ocean; 311–4470 m.

*Parapagurus latimanus* Henderson, 1888 (Fig. 75)

*Parapagurus latimanus* Henderson, 1888: 91, pl. 9, fig. 2; Lemaitre & McLaughlin 1992: 762, fig. 9; Lemaitre 1999: 310, figs 3, 47, 48.

*Parapagurus pilosimanus latimanus*: de Saint Laurent 1972: 103, pl. 1, fig. 5.

TYPE:

Holotype: male (sl = 6.6 mm), *Challenger* Stn 167A, NHM 1888:33.1.

TYPE LOCALITY: *Challenger* Stn 167A, New Zealand, 41°04'S, 174°19'E.

OTHER MATERIAL EXAMINED:

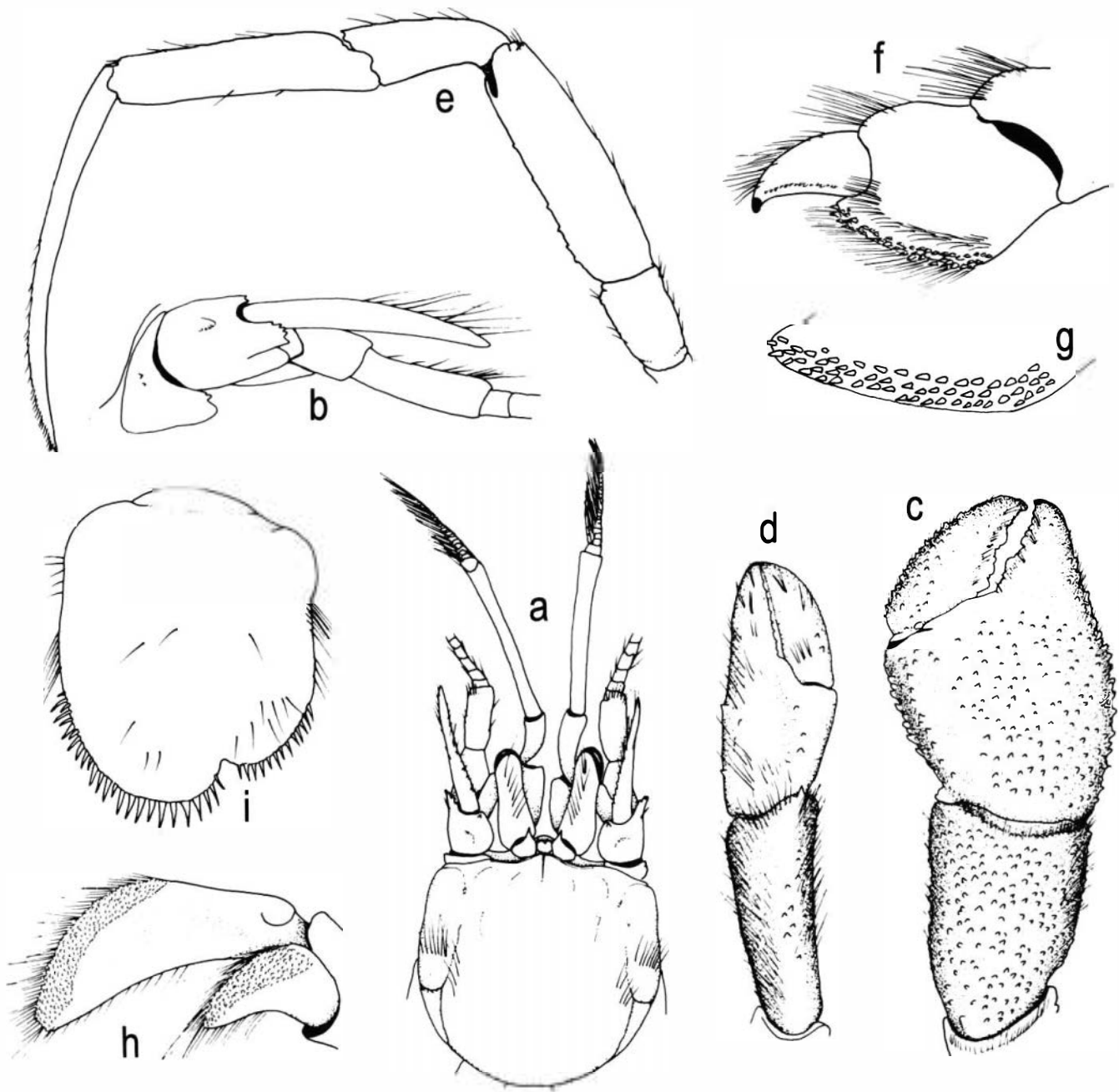
NZOI Stns: E72, 1 male (sl = 9.6 mm); E709, 1 male (sl = 6.7 mm); E714, 2 males (sl = 8.9, 9.0 mm); E745, 1 male (sl = 7.6 mm); E766, 1 female (sl = 7.2 mm); E774, 2 females (sl = 8.0, 8.5 mm); E776, 2 males (sl = 4.5, 11.3 mm), 3 females (sl = 5.4–8.6 mm); SE783, 1 male (sl = 6.4 mm); E801, 1 female (sl = 6.7 mm).

NMNZ collections: A Stn 01/37/87, 1 ovigerous female (sl = 10.9 mm), NMNZ Cr 4819; A Stn 01/41/87, 1 male (sl = 13.0 mm), NMNZ Cr 4820; AEX Stn 2/11/89, 1 male (sl = 16.0 mm), NMNZ Cr 8425; Stn BS 353, 1 male (sl = 15.9 mm), NMNZ Cr 3202, 1 female (sl = 7.6 mm), NMNZ Cr 8431, 1 male (sl = 9.6 mm), 1 female (sl = 9.1 mm), 1 ovigerous female (sl = 12.2 mm), NMNZ Cr 8477; BS 690, 1 male (sl = 8.9 mm), NMNZ Cr 3200; BS 760, 2 ovigerous females (sl = 11.5, 12.2 mm), NMNZ Cr 3199; BS 771, 1 ovigerous female (sl = 11.0 mm), NMNZ Cr 3201; CO Stn 01/23/88, 2 ovigerous females (sl = 11.0, 11.1 mm), NMNZ Cr 6052; JC Stn J6/12/81, 1 male (sl = 11.6 mm), NMNZ Cr 8484; JC Stn J9/49/89, 1 male (sl = 10.6 mm), NMNZ Cr 8453; JC Stn J19/9/84, 1 male (sl = 8.2 mm), 1 ovigerous female (sl = 8.3 mm), NMNZ Cr 8452; JC Stn J19/011/84, 2 males (sl = 10.3, 13.4 mm), NMNZ Cr 8447; JC Stn J9/42/89, 1 male (sl = 15.8 mm), NMNZ Cr 8485; K Stn 40/81, 2 males (sl = 8.5, 10.0 mm), NMNZ Cr 8429; SM Stn 77, 1 male (sl = 8.9 mm), NMNZ Cr 3198.

SIO collections: Stn 41(D5), 1 ovigerous female (sl = 12.2 mm), SIO C9546.

DESCRIPTION: Shield (Fig. 75a) about as broad as long, dorsal surface well calcified; lateral projections broadly rounded. Rostrum broadly rounded, with short dorsal ridge. Ocular peduncles (including corneas) less than half length of shield, inflated basally; width of cornea about same as distal width of ocular peduncle. Ocular acicles subtriangular, terminating





**Fig. 75.** *Parapagurus latimanus* Henderson, 1888, **a-d, h, i**, SE Pacific, "Eltanin" Stn 2198, male (sl = 7.5 mm), USNM 256845; **e-g**, NZOI Stn E776, male (sl = 11.3 mm): **a**, shield and cephalic appendages; **b**, right antennal peduncle, (lateral view); **c**, carpus and chela of right cheliped (dorsal view); **d**, carpus and chela of left cheliped (dorsal view); **e**, right second pereopod (lateral view); **f**, propodus and dactyl of left fourth pereopod (lateral view); **g**, propodal rasp of same (lateroventral view, setation omitted); **h**, left exopod and endopod of uropods (dorsal view); **i**, telson (dorsal view). **a-d, h, i**, after Lemaitre and McLaughlin (1992). Magnifications equal 4x (**e**), 6x (**a, c, d, h**), 12x (**b, f**), 15x (**i**), 25x (**g**).

in simple strong spine (rarely bifid on one or both sides). Antennular peduncle when fully extended exceeding eyes by nearly entire length of penultimate segment; lateral face of basal segment with statocyst lobe having subrectangular distal lobe armed with 2 spines, and 1 spine proximally. Antennal peduncle

(Fig. 75b) exceeding eyes by nearly entire length of fifth antennal segment. Antennal acicle straight or weakly curved in dorsal view, exceeding distal margin of cornea by half length of acicle, with proximal half of mesial margin armed with 1-6 small blunt to sharp spines or tubercles (acicle rarely unarmed). Antennal

flagellum with numerous setae 1–4 flagellar articles in length.

Epistomial spine usually absent. Sternite of third maxillipeds with strong spine on each side of midline.

Chelipeds markedly dissimilar, each with dorsal surfaces of carpus and chela covered with moderately dense, simple and plumose setae. Right cheliped (Fig. 75c) with proportions of carpus and chela influenced by size and sexual dimorphism. Palm and carpus each with numerous small spines and tubercles on dorsal surface.

Left cheliped (Fig. 75d) well calcified, densely setose; carpus with irregular row of small spines or tubercles on dorsal margin.

Ambulatory legs (Fig. 75e) with meri, carpi, and propodi unarmed except for small dorsodistal spine on each carpus; meri each about 3.3 (first leg) or 2.9 (second leg) as long as high. Anterior lobe of sternite of second ambulatory legs subsemicircular, setose, armed with small subterminal tubercle or spine.

Fourth pereopod with propodal rasp (Fig. 75f, g) consisting of 2 (rarely 3) often irregular rows of lanceolate or conical scales. Fifth pereopod with propodal rasp less than half length of propodus.

Telson and uropods asymmetrical. Terminal margin of telson (Fig. 75i) divided into 2 rounded projections by angled, V-shaped cleft; rounded projections armed distally with moderately long, evenly spaced corneous spines (approximately 15–26 left, 8–13 right); spines on left side frequently extending anteriorly nearly to midlength of lateral

margin of telson. Left exopod of uropod (Fig. 75h) elongate, about 2.8–3.0 as long as broad; with broad rasp.

COLOUR: Unknown.

REPRODUCTION: Ovigerous females have been found during January, February, June, and November; they range in shield length from 4.0 to 13.3 mm.

HABITAT: Usually found living in shelters formed by zoanthids, probably species of *Epizoanthus*, e.g., *E. paguriphilus* Verrill, *E. incrustatus* (Duben & Koren).

REMARKS: As noted by Lemaitre and McLaughlin (1992), the type locality for *P. latimanus* was given as *Challenger Stn 167A*, but the depth recorded for the specimen, only 18 m, seemed to be in error. Lemaitre and McLaughlin suggested that Henderson's (1888) specimen might actually have been collected from *Stn 167*, at a depth of 270 m.

RECORDS FROM NEW ZEALAND: Challenger Plateau; east of Aldermen Islands, North Island, southwards to Antipodes Island; Chatham Island and Chatham Rise; 413–2500 m.

DISTRIBUTION: Indo-Pacific: Japan; Indonesia; New Caledonia region; southern Australia; New Zealand. Western Indian Ocean: off Kenya. Confirmed depth 400–2500 m, but possibly as shallow as 270 m.

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This is compiled from Type localities, Records from New Zealand, and comments in Remarks sections.  
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