



The Marine Fauna of New Zealand:

Echinodermata: Asteroidea (Sea-stars). 3.
Orders Velatida, Spinulosida, Forcipulatida, Brisingida
with addenda to Paxillosida, Valvatida

Donald G. McKnight

NIWA Biodiversity Memoir 120

COVER PHOTO:

Red form of *Henricia lukinsii* (Farquar) from 7 m depth, Awash Rock, Preservation Inlet, Fiordland.

Photo: Dr Ken Grange, NIWA

NATIONAL INSTITUTE OF
WATER AND ATMOSPHERIC RESEARCH (NIWA)

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NIWA Biodiversity Memoir 120

2006

Cataloguing in publication

McKNIGHT, D.G.

The marine fauna of New Zealand: Echinodermata: Asteroidea (sea-stars). 3.
Orders Velatida, Spinulosida, Forcipulatida, Brisingida, with addenda to Paxillosida, Valvatida /
by Donald G. McKnight – Wellington: NIWA (National Institute of Water and Atmospheric
Research, 2006

(NIWA Biodiversity memoir: ISSN 0083-7908; 120)

ISBN: 978-0-478-23274-5

ISBN: 0-478-23274-8

Supervising Editor: Dennis P. Gordon
Edited and typeset by: Geoff Gregory, Word Therapy, Paraparaumu
Printed and bound by: Graphic Press & Packaging Ltd, Levin

Received for publication 30 June 2005

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Frontispiece:

Top: Yellow form of *Henricia lukinsii* (Farquar), from 7 m depth, Awash Rock, Preservation Inlet, Fiordland. Photo: Dr Ken Grange, NIWA

Bottom: *Pteraster (Apterodon) bathamae* Fell from 35 m depth, Tricky Cove, Doubtful Sound, Fiordland. Photo: Dr Ken Grange, NIWA

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ABSTRACT

Sea-stars in the orders Velatida, Spinulosida, Forcipulatida and Brisngida are described for the New Zealand biogeographic region (latitudes 24° to 57° 30' S, 157° E to 167° W). The area includes the New Zealand Exclusive Economic Zone (EEZ), Lord Howe, Norfolk, and Macquarie Islands, the Kermadec Islands and associated ridges, and deeper basins and trenches. In all, 16 families, 39 genera and 83 species are represented. The order Velatida includes 5 families, 10 genera, and 23 species; Spinulosida includes 2 families, 4 genera, and 14 species; Forcipulatida 4 families, 17 genera, and 31 species; and Brisngida 5 families, 8 genera and 15 species. Families new to the fauna are Myxasteridae (Velatida), Leilasteridae (Spinulosida), and Pedicellasteridae (Forcipulatida). One new genus is described in the family Asteriidae (Forcipulatida). New species are described in the families Pterasteridae and Myxasteridae (Velatida), and Pedicellasteridae, Zoroasteridae, and Asteriidae (Forcipulatida). Species not formally recognised are present in the Pterasteridae, Zoroasteridae, and Hymenodiscidae.

The order Forcipulatida dominates the fauna in number of species and recorded occurrences, while the Spinulosida has least species and occurrences. The Velatida have the largest bathymetric range (0–6720 m), followed by the Forcipulatida (0–4405 m). The Spinulosida are decidedly shallower (0–1357 m), while the Brisngida (150–6160 m) are the only order not recorded from shallow water. At least 34 species are endemic, and only 8 are recorded from depths greater than 3000 m.

An addendum includes species in the orders Paxillosida (1), and Valvatida (17) not previously recorded locally. They include the genera *Patagiaster* (Astropectinidae, Paxillosida), *Astroceramus* and *Cladaster* (Goniasteridae), two new genera in the families Goniasteridae and Odontasteridae, and new species in the genera *Astroceramus*, *Cladaster*, *Ceramaster*, *Pillsburiaster* (Goniasteridae), *Marginaster* (Poraniidae) and *Podosphaeraster* (Podosphaerasteridae) in the order Valvatida. Also included are *Mediaster australiensis* H.L. Clark; *Pseudarchaster jordani* Fisher; and small specimens of *Ceramaster* which may be two distinct species and a species of *Marginaster*, though these last three are not formally named. Additional records are listed for *Anseropoda aotearoa* and *Tremaster mirabilis novaecaledoniae*. Two species of *Hippasteria* are included, though from outside the area; one is *H. falklandica* Fisher, the other is new.

Keywords: Solasteridae; Korethrasteridae; Pterasteridae; Echinasteridae; Leilasteridae; Zoroasteridae; Pedicellasteridae; Asteriidae; Brisngidae; Hymenodiscidae; Brisngasteridae; Novodiniidae; Freyellidae; Astropectinidae; Goniasteridae; Odontasteridae; Poraniidae; Podosphaerasteridae; Asterinidae; New Zealand; sea-stars; taxonomy; distribution: new species.

INTRODUCTION

This memoir on New Zealand sea-stars comprises the orders Velatida, Spinulosida, Forcipulatida, and Brisingida, and also additional species in the orders Paxillosida and Valvatida from material received after the completion of earlier studies. It completes the series of three memoirs, the previous ones being by Clark and McKnight (2000, 2001).

The area under study covers the latitudes 24°–57°30'S and longitudes 159°E–167°W. It includes Lord Howe, Norfolk, Macquarie, and the Kermadec Islands, their accompanying ridges, and the intervening basins and trenches.

The order Velatida includes the families Solasteridae, Caymanostellidae, Pterasteridae, Korethrasteridae, and Myxasteridae. The Solasteridae contains the genera *Lophaster* (1 species), *Paralophaster* (1 species), *Solaster* (2 species, one of which, *Solaster notophrynus* Downey, is not present in the collections examined), and *Crossaster* (2 species). Species are recorded from depths of 39–150 m, and three are not recorded from elsewhere. The Korethrasteridae has but one genus and species, *Peribolaster lictor* Fell, 129–1165 m. The Pterasteridae has 14 species, with 6 in *Pteraster*, 2 in *Diplopteraster*, and 6 in *Hymenaster*; three species are not named, as their identity remains in doubt. One species, *Hymenaster blevgadi* Madsen, from over 6000 m in the Kermadec Trench, is not included in the collections.

The Spinulosida includes only two families, the Echinasteridae and the Leilasteridae. The former contains three 3 genera and 13 species—2 in *Echinaster*, 9 in *Henricia* and 2 in *Odontohenricia*; 5 are endemic and they range from 0 to 1357 m. *Odontohenricia endeavouri* Rowe & Albertson is new to the fauna. The family Leilasteridae, with the species *Leilaster spinulosus*, is also new to the fauna.

The order Forcipulatida includes the families Zoroasteridae, Pedicellasteridae, Labidiasteridae, and Asteriidae, with 17 genera and 31 species, and is recorded in depths of 150–2162 m. The Zoroasteridae has 7 species, all referred to *Zoroaster*; 3 are described as new, and 1 is not named; 3 are endemic. The genus is present from 150 to 2162 m. The Pedicellasteridae has only 2 species, both in the genus *Hydrasterias*, both from depths just over 4000 m, and both described as new. The Asteriidae contains 14 genera and 21 species, of which 4 genera and 19 are endemic. It is present in depths of 0–1190 m. The Labidiasteridae contains 2 species in the genus *Coronaster*, with one, *C. reticulatus* (H.L. Clark) transferred from *Stylasterias* (family Asteriidae). The Asteriidae have the most records within the order, and occur between 0 and 1190 m. There are 14 genera and 21 species, of which 14 or

more are endemic. New species are described in the genera *Allostichaster* and *Psalidaster*, and one further genus allied to *Sclerasterias* is erected. Two species remain indefinite. They are "*Stolasterias edmondi*" Benham from shallow water at the Kermadec Islands and "*Asterias fragilis*" Studer in deeper water off north-eastern New Zealand.

All 5 families in the order Brisingida are represented; there are 8 genera and 15 species present in depths of 150–6160 m. The Brisingidae has 2 genera and 3 species, with 2 endemic; genera present are *Asterostephane* (1 species) and *Brisinga* (2 species). The Hymenodiscididae have 4 species, all in *Hymenodiscus*, though 3 are of uncertain affinity and are not named. The Brisingasteridae (*Brisingaster*) and Novodiniidae (*Novodinia*) are each represented by a single species, and the latter is endemic. The Freyellidae contains 3 genera and 5 species, of which 4 are endemic. New species are described in the genera *Freyella*, and *Freyastera*. Two species, *Freyastera mortenseni* (Madsen) (transferred from *Freyella*) and *Freyellaster polycnema* Sladen are not present in the collections, nor are brisingid arms referred to either *Astrolirus* or *Stegnobrisinga* by H.E.S. Clark (1970).

In the addenda, a further 17 species, obtained mainly from collections taken after the earlier manuscripts were completed, are included. In the order Paxillosida, family Astropectinidae, there is a new species of *Patagiaster*, the genus being new to the fauna. In the family Goniasteridae a new genus and species is described, as well as new species in the genera *Astroceramus*, *Cladaster*, *Ceramaster*, and *Pillsburia*. Further species are described though not named in *Calliaster*, *Ceramaster*, and *Mediaster*; described species new to the fauna are *Mediaster australiensis* H.L. Clark and *Pseudarchaster jordani* Fisher. Though outside the area, two species of *Hippasteria* are described, both from south of Tasmania. One is *H. falklandica* Fisher, while the other is described as a new species.

Additional records are given for *Sphaeriodiscus irritatus* H.E.S. Clark. A new genus and species is described in the family Odontasteridae, which like *Hoplaster* lacks the prominent recurved median oral spine present in other members of the family. In the Poraniidae, one new species is described in the genus *Marginaster*, while notes are given on a second, which may be undescribed. One notable addition is the family Podosphaerasteridae, with a new species in the sole genus *Podosphaeraster*, which is the most southerly Pacific Ocean record. Finally, new records are given for two species of the family Asterinidae, *Anseropoda aotearoa* McKnight and *Tremaster mirabilis novaecaledoniae* Jangoux.

CHECKLIST OF SPECIES

Order VELATIDA

Family SOLASTERIDAE

Lophaster suluensis Fisher
Paralophaster hyalinus H.E.S. Clark
Solaster torulatus Sladen
Solaster notophrynus Downey
Crossaster multispinus H.L. Clark
Crossaster campbellicus McKnight

Family KORETHRASTERIDAE

Peribolaster lictor Fell

Family PTERASTERIDAE

Pteraster (Pteraster) affinis Smith
Pteraster (Pteraster) robertsoni McKnight
Pteraster (Pteraster) sp. A
Pteraster (Apterodon) bathamae Fell
Pteraster (Apterodon) stellifer Sladen
Pteraster (Apterodon) obesus H.L. Clark
Pteraster (Retaster) sp. A
Pteraster (Retaster) sp. B
Diplopteraster hurleyi McKnight
Diplopteraster otagoensis n. sp.
Hymenaster blevgadi Madsen
Hymenaster carnosus Sladen
Hymenaster pullatus Sladen
Hymenaster estcourti McKnight
Hymenaster sp. A
Hymenaster sp. B

Family CAYMANOSTELLIDAE

Caymanostella phorcynis Rowe

Family MYXASTERIDAE

Asthenactis australis n. sp.

Order SPINULOSIDA

Family ECHINASTERIDAE

Echinaster colemani Rowe & Albertson
Echinaster farquhari Benham
Henricia aucklandiae Mortensen
Henricia compacta (Sladen)
Henricia kapalae Rowe & Albertson
Henricia lukinsii (Farquhar)
Henricia obesa (Sladen)
Henricia ralphae Fell
Henricia studeri Perrier
Henricia sufflata (Sladen)

Henricia tahia McKnight
Odontohenricia anarea O'Hara
Odontohenricia endeavouri Rowe & Albertson

Family LEILASTERIDAE

Leilaster spinulosus Aziz & Jangoux

Order FORCIPULATIDA

Family ZOROASTERIDAE

Zoroaster carinatus Alcock
Zoroaster spinulosus Fisher
Zoroaster planus Alcock
Zoroaster variacanthus n. sp.
Zoroaster singletoni n. sp.
Zoroaster alternicanthus n. sp.
Zoroaster sp.

Family PEDICELLASTERIDAE

Hydrasterias sacculata n. sp.
Hydrasterias tasmanica n. sp.

Family LABIDIASTERIDAE

Coronaster halicepus Fisher
Coronaster reticulatus (H.L. Clark)

Family ASTERIIDAE

Allostichaster insignis (Farquhar)
Allostichaster polyplax (Müller & Troschel)
Allostichaster farquhari n. sp.
Anasterias directa Koehler
Anasterias mawsoni (Koehler)
Anasterias laevigata (Hutton)
Anasterias suteri (de Loriol)
Astrostole rodolphi (Perrier)
Astrostole scabra (Hutton)
Coscinasterias muricata Verrill
Cosmasterias dyscrita H.L. Clark
Perissasterias monacantha McKnight
Psalidaster fisheri n. sp.
Pseudechinaster rubens H.E.S. Clark
Rumbleaster eructans n.gen. et sp.
Sclerasterias mollis (Hutton)
Smilasterias clarkailsa O'Loughlin & O'Hara
Smilasterias actinata n. sp.
Stichaster australis (Verrill)
Taranuiaster novaezealandiae McKnight
"Stolasterias edmondi" Benham
"Asterias fragilis" Studer

Order **BRISINGIDA**
Family **BRISINGIDAE**

Asterostephane moluccana Fisher
Brisinga chathamica (McKnight)
Brisinga tasmani H.E.S. Clark

Family **HYMENODISCIDIDAE**

Hymenodiscus aotearoa (McKnight)
Hymenodiscus sp. A
Hymenodiscus sp. B
Hymenodiscus sp. C
Stegnobrisinga/Astrolirus sp.

Family **BRISINGASTERIDAE**

Brisingaster robillardi de Loriol

Family **NOVODINIIDAE**

Novodinia novaezealandiae (H.E.S. Clark)

Family **FREYELLIDAE**

Freyastera mortenseni (Madsen)
Freyastera digitata n.sp
Freyella echinata Sladen
Freyella felleyra n. sp.
Freyellaster polycnema (Sladen)

ADDENDA

Order **PAXILLOSIDA**
Family **ASTROPECTINIDAE**

Patagiaster granulatus n. sp.

Order **VALVATIDA**
Family **GONIASTERIDAE**

Astroceramus denticulatus n.sp
Astropatricia marita n.gen. et sp.
Calliaster sp.
Ceramaster cognatus n. sp.
Ceramaster sp. A
Ceramaster sp. B
Cladaster latus n. sp.
Hippasteria falklandica Fisher
Hippasteria tasmanica n. sp.
Mediaster australiensis H.L. Clark
Mediaster sp.
Pillsburiaster indutilis n. sp.
Pillsburiaster maini McKnight
Pseudarchaster jordani Fisher
Sphaeriodiscus irritatus H.E.S. Clark

Family **ODONTASTERIDAE**

Diabocilla clarki n. gen. et sp.

Family **PODOSPHAERASTERIDAE**

Podosphaeraster somnambulator n. sp.

Family **PORANIIDAE**

Marginaster patriciae n. sp.
Marginaster sp.

Family **ASTERINIDAE**

Anseropoda aotearoa McKnight
Tremaster mirabilis novaecaledoniae Jangoux

SYSTEMATICS

Order VELATIDA Perrier, 1884

Arms five or more, and body thickened, disc large, flat and sub-pentagonal. Abactinal, marginal and actinal plates usually small, and sub-paxilliform, closely arranged or more widespread. Two or one series of marginals present, or sometimes marginal not distinguishable. Oral plates prominent, and the adambulacral furrow relatively broad. Adambulacral plates with a transverse series of spines, and in one family a longitudinal furrow series also. Tubefeet usually in two rows with distinct sucking-discs. Papulae widespread abactinally, or absent.

KEY TO FAMILIES

- 1 Adambulacral spines in 2 series—a longitudinal furrow series, and a transverse subambulacral series. Marginal plates distinct, in one or two series; abactinal plates more or less paxillate; 5 or more arms Solasteridae
- 1' Adambulacral spines, in one or 2 transverse series only 2
- 2 Very small deep-water forms, usually found on sunken wood, with abactinal plates completely covered by granules or spines. A distinct marginal fringe of inferomarginal spines; spines on actinal face of adambulacral plates in 2 alternating rows; 5 arms Caymanostellidae
- 2' Marginal plates not apparent. Abactinal plates bearing a paxillate or fasciculate bundle of long spines, with skin either uniting them in independent groups, or all united, to form a supradorsal membrane. Generally larger forms not associated with sunken wood 3
- 3 A complete supradorsal membrane present with central osculum; segmental pores and papillae; 5 arms Pterasteridae
- 3' No supradorsal membrane 4
- 4 Adambulacral spines not united by a web. No osculum; 5 arms Korethrasteridae
- 4' Adambulacral spines delicate-webbed, osculum present, 5 or more arms Myxasteridae

Family SOLASTERIDAE Perrier, 1884

Disc large, arms five or more, rounded in cross-section, tapering to a narrow tip. Abactinal plates more or less paxilliform, with or without a central column,

base lobate and imbricating to form an open irregular reticulum. Papulae in groups, on abactinal surface only. Marginal plates paxillate, in two series, though the superomarginals may be reduced. Actinal plates usually not extending far along the arm. Adambulacral plates with a longitudinal furrow comb of spines, and a transverse row of subambulacral spines. Pedicellariae absent.

KEY TO GENERA

- 1 Five arms 2
- 1' Seven or more arms 3
- 2 Superomarginal plates well-developed, larger and differentiated from adjacent paxillae *Lophaster*
- 2' Superomarginal plates scarcely larger than adjacent abactinal paxillae *Paralophaster*
- 3 Abactinal plates ovoid or weakly lobate, skeletal meshes small, each with 1–2 papulae *Solaster*
- 3' Abactinal plates lobate, often cruciform; skeletal meshes larger, with 10 or more papulae *Crossaster*

Lophaster Verrill, 1878

Arms five, both marginal series developed, more or less equal, or superomarginals smaller, but distinct from the neighbouring abactinal paxillae. Abactinal plates lobate forming a reticulate skeleton without secondary plates. Usually one series of actinal plates extending far along the ray. Papular pores multiple. No membranous septum separating the gonads of adjacent rays.

TYPE SPECIES:

Solaster furcifer Duben & Koren, 1884.

Lophaster suluensis Fisher, 1913 (Pl. 1)

Lophaster suluensis Fisher, 1913: 219; 1919: 449, pls 123 (2), 124 (3), 132 (8, 8a); McKnight 1975: 57; 1993a: 173; A.M. Clark 1995: 189.

MATERIAL EXAMINED:

NIWA Stns: U567 (1); Z2098 (1).

DISTRIBUTION: Recorded from the Three Kings Rise and the southern Norfolk Ridge, to north and west of

northern New Zealand, 841–1480 m. Also known from the Philippines, 930 m.

STUDY SPECIMEN: NIWA Stn U567, R 25 mm, r 7 mm, br. 7 mm.

DESCRIPTION: *Outline* stellate, five slowly tapering, blunt tipped arms; abactinal surface rounded, actinal surface flat; a well-marked ventrolateral angle. Skin covers most of abactinal and actinal plates masking outlines.

Abactinal plates lobate, usually cruciform, though some disc plates with 5 lobes. Plates irregularly arranged on disc and along centreline of arms, forming more regular longiseries towards superomarginals. Plates with a short pedicel, slightly expanded distally, only a little longer than wide.

Pedicel capped by a cluster of glassy spinelets longer than pedicel, tapering in distal third, and terminating in a sharp point.

Marginal plates relatively prominent, with superomarginals abruptly larger than abactinal pedicels over most of arm, though the first 2–3 may be only slightly enlarged. From about 1/2 R, superomarginals alternate with inferomarginals. Superomarginal spinelets sometimes have tip flattened and irregularly pointed; up to 15 spinelets on superomarginal pedicels. Inferomarginal plates larger and longer, each plate is longer than wide, with pedicel broadened distally. Up to 15 spinelets on inferomarginal pedicels. Spinelets longer than on superomarginals, and often widened distally, with 3–4 sharp points.

Actinal plates in 2 series in interradii, and one extending to about 1/2 R; from arm base distinctly spaced apart; plates have 3–4 small spinelets

Adambulacral plates separated by membranous intervals, longer than plates in distal part of arm, and extending to inferomarginals; 4–5 furrow spines, webbed on basal half, and 3–4 larger subambulacral spines, set in an oblique series.

Oral plates broad, with 10–12 furrow spines, united by a basal web, and 4–5 suboral spines, near median suture, on distal part of plate.

Anal aperture not evident.

Madreporite small, inconspicuous, placed at 1/2r from disc centre, outline ovoid, about 1.5 mm long and 0.5 mm wide, sculpture is coarse, with deep grooves. It is only slightly tumid.

Adambulacral furrows are relatively broad.

Tube feet biserial, with distinct sucking-discs.

COLOUR (preserved specimens): Dull uniform brown.

REMARKS: A small specimen from NIWA Stn X686, R/

r = 11/7 mm may be referable to this species. It has 4 furrow and 3 larger subambulacral spines, the oral plates have 6 furrow spines and 1 suboral. In each interradius there are 2–3 small naked actinal plates. The abactinal paxillae have 6–8 glassy spinelets, and the lowermost row is enlarged, with 10–12 spinelets. This species is distinguished by the long subambulacral spines (longer than those on the marginal paxillae) and the large oral plates.

It resembles *L. antarcticus* Koehler and *L. gaini* Koehler in its general form, but differs in the armature of the adambulacral and oral plates; *L. furcilliger* Fisher from the northern Pacific and *L. furcifer* (Duben & Koren) from the Atlantic, it differs similarly and has lower marginal paxillae.

Paralophaster Fisher, 1940

Arms five, superomarginal plates only slightly larger than abactinal paxillae, if at all. Actinal plates not extending far along ray. No membranous septum separating the gonads of adjacent rays. A specialised internal longitudinal muscle band extending from the end of arm to interbrachial angle, and continuing to the end of the adjacent ray.

TYPE SPECIES:

Solaster godefroyi Koehler, 1912.

Paralophaster hyalinus H.E.S. Clark, 1970 (Pl. 2)

Paralophaster hyalinus H.E.S. Clark, 1970a: 177, pl. 1 (A, B); A.M. Clark 1995: 190.

MATERIAL EXAMINED:

NIWA Stns: G307 (1); I705 (1); J34 (1); Q16 (3); T50 (4); Z10828 (1); TAN0307/82(1)

STUDY SPECIMEN: NIWA Stn Q16, R 51 mm, r 16 mm, br. 18 mm.

DISTRIBUTION: Recorded from Challenger Plateau, Chatham Rise and Bounty Platform, 39?–890 m.

DESCRIPTION: *Outline* substellate, disc relatively large, with 5 arms, broad at base, evenly tapering to a small tip; arms are rounded abactinally, flattened on actinal surface; disc a little inflated abactinally.

Abactinal plates strongly lobate, each with 4–5 lobes, forming an irregular network, with relatively small meshes. A thin skin overlying plates, which have a conspicuous central pedicel, slightly expanded distally, and longer than distal width.

Pedicel capped by up to 25 short, glassy spinelets, basally invested or webbed by skin, and terminating

in irregular points. On disc and central portion of arms, pedicels not regularly arranged, but near superomarginals, at sides of arms, a more distinct arrangement in longitudinal rows is evident.

Superomarginal plates are placed at ventrolateral margin of arm proximally, but are just abactinal from about 1/3R. They are subalternate with inferomarginals in proximal half of arm; distally they are placed above inferomarginals, with the bases in contact. Pedicels broader and taller than those on adjacent abactinal plates, and they have 15–20 spinelets.

Inferomarginal plates on actinal surface interradially, but forming margin from about 1/2 R, with a sturdy pedicel, with up to 25 spinelets.

Actinal plates in 2 series in interradii, and here closely spaced. One series extends to distal third of arm, but from arm base are increasingly spaced apart. Plates with 1–5 short spinelets in a group.

Adambulacral plates wider than long throughout arm, widest at curved furrow margin; 3–4 furrow spinelets in a curved series, with a distinct basal web of skin, 4, or rarely 5, subambulacral spinelets slightly larger, and form a curved transverse or oblique series.

Oral plates broad, prominent, have 6–8 furrow spines, all basally united in a web of skin, and 3–4 suboral spines, placed in a group, near distal end of plate.

Anal aperture small, rounded, without any encircling armature, and placed near disc centre. Madreporite placed at about 2/3 r from disc centre, rounded, diameter 3 mm, slightly tumid, though lower than neighbouring paxillae, and has fine, radiate sculpture.

Papulae 1–5 in skeletal meshes, extending to superomarginals, with a few placed between superomarginals at about 1/2 R.

Adambulacral furrow relatively broad.

Tube feet biserial, with distinct sucking discs.

COLOUR (dried specimen): Dull brown.

REMARKS: This is the only species of the genus known from north of the Antarctic Convergence, though one species is reported from Kerguelen Island. It differs from *P. antarcticus* (Koehler) in having fewer abactinal and suboral spines, from *P. godefroyi* (Koehler) in having multi-pointed inferomarginal spines and from *P. lorioli* (Koehler) in having thorns or points on both sides of the spines.

Solaster Forbes, 1839

Usually 7–17 arms. Abactinal plates cruciform or rounded, close-set, with a group of subequal spinelets at plate centre. A single series of distinct marginal

plates usually actinal in position. Papular pores usually single.

TYPE SPECIES:

Asterias endeca Linnaeus, 1771.

KEY TO SPECIES

- 1 Abactinal plates with 2–4 spines; 3–4 adambulacral furrow spines, 4–5 subambulacral spines; 6–8 suboral spines *Solaster torulatus* Sladen
- 1' Abactinal plates with 5–15 spines; 6–14 subambulacral spines, up to 25 suboral spines *Solaster notophrynus* Downey

Solaster notophrynus Downey, 1971

Solaster notophrynus Downey, 1971: 39; Clark & Downey 1992: 305, pl. 73 (e, f); O'Hara 1999: 181, pl. 1 (g, h); A.M. Clark 1995: 193.

*Solaster diana*e Stampanato & Jangoux in Branch *et al.*, 1993: 45.

*Solaster diane*i Stampanato & Jangoux, 1993: 183.

MATERIAL EXAMINED: Nil.

DISTRIBUTION: Recorded from Macquarie Island, 330–450 m. Other records are from Tasmania, Prince Edward and Marion Islands and the northwestern Atlantic, 335–1300 m.

DESCRIPTION: (from O'Hara 1999). R/r = 40/11 mm, 7 arms, wide at base, tapering rapidly beyond mid-length.

Abactinal plates imbricating, usually with 4 lobes and with a small paxilla, the pedicel low with 5–15 bluntly cylindrical spinelets, the tips thorny. Plates of disc and lateral arm surfaces in regular oblique rows, less regular on dorsal surface of arms, occasionally with 3 lobes.

Papulae widespread on abactinal surface, usually only 1 to each area, sometimes 2 on dorsal arm surface. No papulae on actinal surface.

Superomarginal plates only slightly larger than abactinal plates, with up to 12 spinelets. Proximal plates alternate with the much larger inferomarginals.

Inferomarginal plates closely spaced, separated by less than their height, pedicel laterally compressed, with up to 30 spinelets in 3–4 transverse rows.

Actinal plates in 5 rows on disc, only a single row extends beyond about 2/3 R. Actinal plates small, with 3–8 spinelets.

Adambulacral plates narrow and spaced apart with 3–5 furrow spines, long and tapering and joined in a web. Subambulacral spines in one or more transverse

row without web. First plate has 5 furrow spines, and 14 subambulacral spines in 3 transverse rows. At about 1/2R there are 3 furrow spines and 8 subambulacral, the latter in a single row.

Oral plates large, wide and tumid, with 10 furrow spines, largest proximally with a basal web and up to 25 suboral spines.

Ambulacral furrows broad, tubefeet biserial, with distinct sucking-discs.

COLOUR (preserved specimens): White.

REMARKS: This species differs from *S. torulatus* in having only 7 arms, but 6–14 subambulacral spines and up to 25 suboral spines. There are 3–5 adambulacral furrow spines and the abactinal paxillae have 5–15 low, blunt cylindrical spinelets. The other southern species—*S. subarcuatus* Sladen, *S. regularis* Sladen, and *S. longoi* Stampanato and Jangoux—have fewer spines and spinelets, larger paxillae, and more arms.

Solaster torulatus Sladen, 1889 (Pl. 3)

Solaster torulatus Sladen, 1889: 457, pls LXX (3,4); LXXII (3,4).
McKnight 1973a: 2; A.M. Clark 1995: 194.

MATERIAL EXAMINED:

NIWA Stns: D32 (1); G283A (1)*; G700 (2); G706 (1)*G889 (2)*; G925 (1)*; I697 (12); Q84 (1); S159 (1); U197 (2); Y26 (1); Z8371 (1); Z9419 (2); Z9420 (1)*; Z9422 (1); Z9453 (2); Z9454 (2); Z9466 (1); Z9468 (1); Z9486 (4); Z9493 (1); Z9576 (1); Z9583 (2); Z9611 (1); Z9622 (1); Z9811 (1); Z10596 (2); Z10600 (1); Z10606 (1); Z10822 (1); Z10823 (1); Z10830 (1); Z10907 (1); TAN9511/143 (1); TAN9713/29 (1); TAN 9801/30; Trip 1319/02 (1); 1371/82 (1).

DISTRIBUTION: Recorded from the Kermadec Islands in the north to the Campbell Plateau in the south, 308–1540 m.

STUDY SPECIMEN: NIWA Stn Z10600, R/r/br = 125/46/33 mm, 8 arms.

DESCRIPTION: *Outline* stellate, the 8 arms relatively wide at the base, rapidly tapering to an attenuate tip. Rounded arms plump at the base, and the large disc is inflated with slight interradiial furrows on the abactinal surface. The actinal surface almost flat, with actinosome a little sunken.

Abactinal plates vary from ovoid to slightly lobate, sometimes a little raised, closely placed, so that the skeletal meshes are small; plates, especially on the arms, align in regular longiseries, and often also in transverse or oblique rows. Abactinal paxillae with

2–6 short pointed spinelets; usually sheathed in a very thin skin and standing in an erect group. Paxillae extend to arm-tip and down sides of arms.

Superomarginal plates no larger than adjacent abactinal paxillae, inferomarginals prominent, regularly spaced apart, transversely widened, forming actinolateral margin of arm. Plates with a slight ridge bearing spinelets or short spines. In the interradii each plate has up to 30 small spinelets, in 2–3 transverse series, but from the arm base these become fewer and larger, so that at about 1/2R there are 10–12 short spines.

Actinal plates small, ovoid, slightly tumid; proximally about 4 longiseries of actinal plates, though only one extends beyond 1/3R; proximal plates have up to 12 pointed spinelets, while the more distal have only 1–2.

Adambulacral plates wider than long, regularly spaced apart; proximal plates have 5–6 sharply pointed furrow spines, though at 1/3R there are 4, and over much of the arm 3; a thin skin unites the bases of the spines; proximal plates with 4–5 longer subambulacral spines, and this number is more or less constant over most of the arm. Subambulacral spines form a transverse row across the plate. Again, bases of spines united by a web of thin skin.

Oral plates large, conspicuous, each with 9–10 furrow spines largest proximally, all linked by thin skin, and 6–8 similar suboral spines.

Papulae confined to abactinal surface, rarely more than 1 to each skeletal mesh; near the disc centre is a small slit-like structure, presumably the anus. The small madreporite lies just over 1/2r from the disc centre; it is rounded, diameter about 2 mm, with coarse sculpture.

Ambulacral furrows broad, tubefeet biserial, with distinct sucking-discs.

COLOUR (dried specimen): Uniform light brown.

REMARKS: Of 50 specimens examined, 41 had 8 arms, 6 had 9, and 2 had 7. Some variation is seen in the plumpness of the arm bases, the length of spinelets on the abactinal paxillae, and the number of subambulacral spines, which may be 6 over the proximal half of the arm.

This species has fewer abactinal spinelets and fewer adambulacral and suboral spines than the previous. Though the arm count is similar to the other southern species, they all differ in having larger paxillae and more prominent marginal plates. *S. tropicus* Fisher, from the Philippines, also has more prominent marginals, smaller actinal areas and slightly fewer abactinal paxillar spinelets.

Crossaster Müller & Troschel, 1840

Arms 8–15; abactinal skeleton reticulate, very open and popular pores multiple. Abactinal paxillae high and widely spaced, each with groups of spinelets in a cluster. A single series of conspicuous marginal plates visible from above. Actinal plates more or less confined to disc.

TYPE SPECIES:

Asterias papposa Linnaeus, 1767.

KEY TO SPECIES

- 1 Small ovoid superomarginal plates alternating with larger inferomarginals in a single series along arm. 6–9 adambulacral furrow spines, about 30 inferomarginal spines
..... *Crossaster multispinus* H.L. Clark
- 1' Superomarginals present, similar to abactinal paxillae and placed just above inferomarginals. 4–5 adambulacral furrow spines and 10–12 on inferomarginals
..... *Crossaster campbellicus* McKnight

Crossaster multispinus H.L. Clark, 1916 (Pl. 4)

Crossaster multispinus H.L. Clark, 1916: 66, pl. 18 (5, 6); Rowe & Gates 1995: 113; A.M. Clark 1966: 185; O'Hara 1999: 182, pl. 1(f).

Crossaster japonicus Fell, 1958: 17, pl. 2 (F); 1960: 64; McKnight 1993: 193 (*non* Fisher 1911).

MATERIAL EXAMINED

NIWA Stns: C605 (1); C693 (1); D32 (field note); D35 (field note); D137 (1); D173 (10); D175 (1); D224 (1); D230 (2); E72 (1); E80 (1); E404 (1); E407 (1); E435 (1); E713 (1); E744 (1); E749 (3); E757 (2); E781 (3); E783 (1); F82 (1); F100 (1); F102 (1); F120 (4); F124 (1); F749 (2); F755 (1); F757 (2); F763 (1); F911 (1); G32 (1); G259 (4); G271 (1); G273 (2); G276A (6); G279 (2); G283A (5); G290 (3); G292 (2); G688 (3); G700 (1); G886 (6); G891 (1); G899 (1); G938 (7); G939 (1); I663 (1); I666 (2); I668 (1); I679 (2); I683 (1); I686 (1); I690 (1); I698 (1); I699 (1); I705 (1); I707 (2); I711 (1); J481 (1); K831 (1); P926 (1); P927 (1); P928 (field note); Q12 (1); Q122B (1); Q338 (1); S14 (4); S49 (1); S119 (1); S120 (1); S124 (5); S140 (1); S142 (4); S147 (1); S164 (1); S167 (1); S168 (1); S171 (1); S182 (1); T28 (1); T88 (10); U227 (9); V371 (1); V374 (1); V387 (3); W252 (1); W747G (1); X511 (1); X523 (1); Y27 (1); Z6482 (1); Z8566 (1); Z8677 (8); Z8991 (2); Z9186 (1); Z9302 (1); Z9309 (1); Z9419 (2); Z9574 (1); Z9622 (2); Z9790 (1); Z9838 (1); Z9850 (2); Z10590 (1); Z10594 (3); Z10611 (1); Z10827 (1); Z10878 (1); Z10881 (1); Z10929 (8); Z10930 (1); Z10931 (3); Z10936 (1); Z10968 (1); Z10972 (4); TAN0001/05 (5);

TAN0001/06 (3); TAN0001/07(10); TAN0001/08 (3); TAN0001/09 (1); TAN0007/123 (2); TAN0219/97 (1); TAN0307/67 (3); KAH9914/01 (1); KAH9914/05 (1); KAH9916/02 (1); KAH0002/04 (1); KAH0005/04 (1); KAH0108/23 (3); 1288/17 (6); 1288/53 (1) .

DISTRIBUTION: Widespread in the New Zealand region, 29–52°S, from the Kermadec Islands to the Campbell Plateau, 39–1427 m. It is also recorded from south-eastern Australia, 90–1152 m.

STUDY SPECIMEN: NIWA Stn G276A R/r/br = 62/27/14 mm, 12 arms.

DESCRIPTION: *Outline* stellate, arms gently tapering from large disc; actinosome slightly sunken, disc a little inflated, arms slightly carinate along midline.

Abactinal plates variously lobate, centres raised into a distinct pedicel; skeletal meshes relatively large, irregular in outlines. Abactinal paxillae composed of delicate, sharply pointed spinelets, with up to about 30 in the larger paxillae; distal paxillae slightly smaller; all irregularly arranged on abactinal surface and sides of arms.

Superomarginal plates present, paxillate like the abactinal plates, slightly larger, and placed between and just above the inferomarginals.

Inferomarginal plates transversely widened, forming a conspicuous actinolateral margin to arm; regularly spaced apart, each with numerous fine spinelets in several rows across the surface.

Actinal plates small, spaced, and in a single short series, not extending beyond about 1/4R, each with a cluster of 5–15 short spinelets.

Adambulacral plates wider than long, slightly spaced apart; 7–8 furrow spines (5–6 distally) in a comb; these spines slender, pointed and up to 1.5 mm long, the median longest and bases united by skin; 6–9 slightly longer subambulacral spines, set across plate, their web independent of that of the furrow comb.

Oral plates large and prominent, each with 12–15 furrow spines, largest proximally, and 7–12 suboral spines.

Papulae inconspicuous, with often 2–3 to a skeletal mesh; papulae not extending to actinal surface.

Madreporite small, placed about 2/3r from disc centre, rounded, diameter 2 mm with faint sculpture.

Ambulacral furrows broad, tubefeet biserial with distinct sucking-discs.

COLOUR (dried specimen): Uniform light brown.

REMARKS: This species is similar to *C. japonicus* Fisher from the northern Pacific but differs slightly in the number of adambulacral and oral spines. One constant feature appears to be that the adambulacral furrow

spine and the subambulacral spines are not linked by a web. *C. penicillatus* Sladen has fewer spinelets on all plates.

Crossaster campbellicus McKnight, 1973 (Pl. 5)

Crossaster campbellicus McKnight, 1973: 2; A.M. Clark 1995: 185.

MATERIAL EXAMINED:

NIWA Stns: D210 (1); E407 (1); G890 (3); J485 (1); V361 (1); Z9210 (1).

DISTRIBUTION: This species is recorded from the Chatham Rise and the Campbell Plateau, 278–353 m.

STUDY SPECIMEN: NIWA Stn D210 R/r = 128/44 mm; there are 10 arms.

DESCRIPTION: *Disc* large, arms gently tapering to a blunt tip. *Disc* a little inflated, actinosome slightly sunken.

Abactinal plates commonly cruciform, either in contact or linked by smaller elongate plates; on disc forming a wide-meshed reticulum; on arms, where secondary plates are absent they are spaced slightly closer. Plates tend to form irregular oblique rows on the arms. Centres of abactinal plates usually with a small, distinct pedicel, slightly shorter than the 2–5 slender spinelets that comprise the paxillae crown. These spinelets are tapering, pointed, terminating in 3–4 minute thorns, with a covering of thin skin. On the arms paxillae sparse or absent from lateral sides in proximal part of arm, and also along the interradial line on the disc surface. The superomarginal plates are small, only slightly larger than the abactinal paxillae and have 3–5 spinelets; they are placed just above and between the larger inferomarginal plates.

Superomarginal plates are quite distinct proximally, where abactinal paxillae are absent, but are less so distally.

Inferomarginal plates transversely widened and have 8–12 spinelets in 2 rows across the plate, a single spinelet at each end.

Actinal plates small, ovoid or elliptical, in a single series, skin-covered, each with 2–4 webbed spinelets, or lacking armament; extending for about 1/3R

Adambulacral plates wider than long, furrow margin convex; 4–5 tapering furrow spines, the median longest; 3–4, rarely 5 larger tapering subambulacral spines, in a single row across the plate; both series have a basal web of skin.

Oral plates large and prominent, each has 7–10 furrow spines, largest proximally, with a basal skin web, and 3–6 suboral spines.

Papulae present only on abactinal surface and numerous, with usually about 10 to each mesh; up to 15 may occur in larger meshes.

Madreporite placed just over 1/2r from disc centre, low 3.5 mm, in greatest diameter, with dense, fine radiate sculpture.

Anus more or less central, ringed by 5 paxillate plates that are in contact.

Adambulacral furrows broad, *tubefeet* biserial with distinct sucking discs.

COLOUR: (preserved specimen). Dull brown, slightly lighter on the actinal surface.

REMARKS: The largest specimen (Stn. V361) has R/r = 142/40 mm.

This species is readily distinguished from *C. multispinus* H.L. Clark by the fewer spines on the abactinal, marginal adambulacral, and oral plates. *C. penicillatus* Sladen from the Southern Ocean has usually 10 spinelets to the abactinal paxillae.

Family KORETHRUSTERIDAE

Danielssen & Koren, 1884

Five arms, with no actinal plates. Abactinal skeleton of round to lobate plates, sometimes with slender secondary connecting ossicles. Larger plates with a tuft of spines, either independent, or those of each plate united by skin; adambulacral spines in a single transverse series continued on the inferomarginals. Oral plates large, conspicuous, marginal spines not united by a web of skin. Interbranchial septum not calcified, gonads interradial.

Peribolaster Sladen, 1889

Abactinal plates cruciform, with lobes connected by secondary ossicles, skeleton fairly regular, with large quadrate meshes. At centre of each larger abactinal plate is a small boss, bearing a fascicle of delicate subequal spinelets enveloped in skin. Superomarginal plates similar to abactinal, inferomarginals usually with a single acicular spine, prominent and forming a transverse series with those on adambulacral plates. No actinal plates; adambulacrals with a single transverse series of spines, each separately sheathed. Oral plates large, with a prominent median keel, marginal spines few, 0–2 suboral spines. Tubefeet in 2 or 4 rows, with a button-like terminal sucker; interradial septum membranous; gonads open dorsally; no pedicellariae. Ampullae double.

TYPE SPECIES:

Peribolaster folliculatus Sladen, 1889.

Peribolaster lictor Fell, 1958 (Pl. 6)

Peribolaster lictor Fell, 1958: 15, pl. 2 (A, B); 1960: 63, pl. 3; H.E.S. Clark 1970: 4; A.M. Clark 1995: 216.

MATERIAL EXAMINED:

NIWA Stns: A908 (1); A916 (11); A917 (21); D35 (field note); D149 (1); D170 (2); D171 (2); D175 (1 fragment); D176 (2); D906 (10); D907 (3); G181 (1); G307 (1); G883 (1); I666 (1); I700 (1); I708 (1); I712 (2); J60 (1); J485 (1); Q8 (1); Q16 (1); Q18 (1); S29 (1); T10 (field note); T23 (1); X485 (1); Z9506(1).

DISTRIBUTION: Southern and eastern New Zealand Plateau, Chatham Rise to Campbell Plateau, and Bounty Platform, depth range 129–1165 m.

STUDY SPECIMEN: NIWA I700, R 78 mm, r 32 mm.

DESCRIPTION: *Outline* pentagonal–stellate, interbranchial arcs angular, somewhat indented; 5 arms, regularly tapering to a blunt tip. Disc and arms inflated abactinally, margin rounded, actinal surface flat.

Abactinal skeleton composed of well-spaced lobate plates, overlying smaller elongate secondary ossicles, forming an open reticulate network. Major plates cruciform, or occasionally with 3 or 5 lobes. A thick membrane covers over abactinal plates and concealing outlines. Larger plates have a small central boss carrying 3–5 elongate spines, up to 5 mm long. Spines are almost transparent and ridged in distal half, with tip pointed or truncate. Membrane invests spines, continues beyond tip, and covers over space between tips. Spines tend to radiate apart, and with membrane, form a small ‘floret.’

Papulae small, inconspicuous, between ‘floreets’, with up to 10 in each skeletal mesh. Papulae extend to near arm tip, across interradial line, and laterally almost to inferomarginals.

Anus not apparent.

Madreporite a large, irregularly lobate plate, maximum diameter about 15 mm, placed just less than 1/2r from disc centre, with fine radiate sculpture. Plate is only slightly tumid, surface irregular, and between lobes are often abactinal ‘floreets’.

Inferomarginal plates not prominent, placed just outside adambulacrals, recognisable by spine placed at a slight distance from subambulacrals. Plates not aligned with adambulacrals and may be more numerous. Spine is elongate, grooved distally, tip pointed or truncate, rarely flattened, length up to 8 mm. Membrane invests spine and continues beyond tip, forming a distinct pad. Spines may form a marginal fringe. Superomarginal plates not distinct from abactinal ‘floreets.’ Terminal plates small, inconspicuous,

triangular in outline, covered by small spines and membrane.

Actinal plates absent.

Adambulacrals plates wider than long throughout arm, crowded; 4 spines in a single transverse row, increasing in size from furrow, innermost set down in furrow, and third is at edge, outermost is spaced from inferomarginal spines. All spines with thick investing membrane, extending beyond tip. Outermost spine about 6 mm long, innermost about 2 mm

Oral plates large, conspicuous, rising to a blunt, rounded point distally, and broadly carinate along median suture. Everted stomach conceals furrow spines; suboral spines 2, large and conspicuous, tapering to a blunt tip, and slightly flattened; investing membrane makes spine appear much more flattened.

Tubefeet with a small terminal button-like sucking disc, strongly 4-ranked to near arm tip.

In one interradius on abactinal surface are a few small pores, noticeable only by their slightly darker colour. These may be gonadal openings.

COLOUR (preserved specimen): Creamy-white, with the tubefeet light brown.

REMARKS: In dried specimens, the investing membrane is much less conspicuous, and the ‘floreets’ of the abactinal surface are not expanded, so that the spines form a simple fascicle.

A dried specimen (NIWA Stn D176, R 66 mm, r 32 mm) shows the nature of the spines, with a slightly bulbous base, sometimes flattened, from which the spine rapidly tapers, with the diameter more or less constant in distal 3/4 or more. The oral plates are exposed, with 4–5 subequal furrow spines, and 2 larger suboral, the proximal placed at the edge of the actinosome, almost furrow in position, but above the furrow series.

Tubefeet superficially appear 4-ranked, but after examination from abactinal side, they are seen to be crowded biserial, the ampullae double, the outer lobe much the larger, the 2 lobes well separated. A small specimen (NIWA Stn I666, R/r = 26/10 mm) has 3–4 adambulacrals furrow spines, and the tubefeet biserial throughout. Two other small korethrasterid specimens were collected at NIWA Stns: R439 and X652; both are in poor condition and have not been further identified. They indicate the presence of this family as far north as the Bay of Plenty.

This species is distinguished by the 4–5 oral furrow spines, 2 larger suboral spines, and 4 adambulacrals spines. *P. biserialis* Fisher, from the northern Pacific, lacks suboral spines, and *P. macleani* Koehler from the Antarctic also has 2 suboral spines, but only 1 is large; the other is like the furrow series

and is at the distal end of the oral plate. *P. folliculatus* Sladen has 5 adambulacral spines and the tubefeet are definitely quadriserial.

Family **PTERASTERIDAE** Perrier, 1875

Abactinal plates cruciform or lobed, bearing paxilliform groups of spinelets that support a supradorsal membrane or canopy, distinct from the abactinal wall. Between these two lies a nidamental cavity, opening centrally by a valved aperture, the osculum. Actinolateral spines, arising from the adambulacral plates, support an actinal web or are merged in the actinal floor. External to the adambulacral plates is a series of segmental apertures opening into the nidamental cavity and guarded by a specialised opercular spinelet or papillae. Actinal intermediate plates absent. Oral plates broad, ploughshare shaped. Interradial septum membranous.

KEY TO GENERA

- 1 Adambulacral spines united by a web of skin 2
- 1' Adambulacral spines free, not united in a transverse web of skin *Hymenaster*
- 2 Tubefeet quadriserial, adambulacral plates more or less alternating, the more prominent with one more spine than the non-prominent *Diplopteraster*
- 2' Tube feet biserial, adambulacral plates not alternating, all similar *Pteraster*

Pteraster Müller & Troschel, 1842

Adambulacral plates with a transverse series of webbed spines, all similar, not alternating; lateral spines forming a marginal fringe; supradorsal membrane with muscle bands, usually not regularly reticulated and also spiraculae.

TYPE SPECIES:

Asterias militaris O.F. Müller 1776.

REMARKS: Fisher (1940) divided species in this genus into the subgenera *Pteraster*, *Apterodon* and *Retaster*, but these were not recognised in Clark and Downey (1992). While eversion of the stomach may make examination of the oral region difficult, the extent of the webbing of the oral spines provides a convenient character for initial separation of the species. The considerable variation in the more extensively studied species of *Pteraster* suggests that some nominal species will be reduced to the synonymy of others. Since most species in NIWA collections are represented by only a few specimens and comparative material is lacking, I have not attempted an extended discussion of each species described.

KEY TO SUBGENERA AND SPECIES

- 1 Furrow spines of oral plates all free, none united in a web of skin (*Apterodon*) 2
- 1' Furrow spines of oral plates united in a web of skin, either continuous across jaw angle, or independent on each plate 4
- 2 Abactinal paxillae with 4–6 spines, no central spine; muscle bands radiate from centre of paxillar mesh to peripheral spines; spiraculae numerous; actinolateral spines not reaching margin *Pteraster* (*Apterodon*) *bathamae* Fell
- 2' Abactinal paxillae with 1–2 central spines 3
- 3 Central paxillar spine thick and blunt; spiraculae few, scattered; actinolateral spine 8–10, longest and first to reach margin *Pteraster* (*Apterodon*) *stellifer* Sladen
- 3' All paxillar spines similar; spiraculae numerous; no actinolateral spines reaching margin *Pteraster* (*Apterodon*) *obesus* H.L. Clark
- 4 Marginal spines of each oral plate united in an independent web (*Pteraster*) 5
- 4' Oral web continuous across the jaw angle, so that all the spines are united in the web. 5–6 adambulacral furrow spines; 15 paxillar spines with 3–5 central 8–12 spiraculae (*Retaster*) sp.
- 5 8–12 paxillar spines, 1–4 central are truncate, others taper; spiraculae 1–2; abactinal surface appears bristly; 5–6 adambulacral spines *Pteraster* (*Pteraster*) *robertsoni* McKnight
- 5' 4 (2–6) paxillar spines, all similar; 4 adambulacral spines *Pteraster* (*Pteraster*) *affinis* Smith

Subgenus *Pteraster* Müller & Troschel, 1842

Furrow spines of each oral plate united by a web of skin, but the web not continuous across the jaw angle.

TYPE SPECIES:

Pteraster militaris (O.F. Müller, 1776).

Pteraster (*Pteraster*) *robertsoni* McKnight, 1973

(Pl. 7)

Pteraster (*Pteraster*) *robertsoni* McKnight, 1973a: 4; A.M. Clark 1995: 212.

MATERIAL EXAMINED:

NIWA Stns: F127 (2); F878 (1); G701 (1); S151(4); Z9429 (1); Z9583 (1); Z10874 (1).

DISTRIBUTION: Recorded from off East Cape to the Campbell Plateau, 997–1400 m.

STUDY SPECIMEN: NIWA Stn F127, (holotype); R/r = 30/16 mm, specimen has been dried at some stage.

DESCRIPTION: *Outline* pentagonal–stellate, five tapering arms, interbrachial arcs rounded. Abactinal surface inflated, actinal more or less flat, actinolateral membrane more or less defines margin.

Abactinal plates lobate, with 3 or 4 lobes, each with a distinct central pedicel bearing 8–12 paxillar spines; pedicel 2 mm tall, 0.5 mm wide at distal end; spines 2–2.5 mm long, longitudinally striated. Central 1–4 spines slightly expanded and truncate distally, peripheral spines tapering; all are semi-transparent. Abactinal membrane appearing bristly, with numerous close-set protruding spines; muscle bands inconspicuous, spiraculae few, 1–2 in each area. Membrane with scattered small grains. Valves of osculum with 12 spines, longest centrally, and about twice length of paxillar spines. To one side of osculum madreporite is visible beneath abactinal membrane. It is rounded, diameter 2 mm, with deep, irregular corrugations. A paxilla stands on its outer margin.

Adambulacral plates short throughout arm, with 6 spines on proximal plates, 5 in distal 2/3 of arm. Spines taper, increasing in size from furrow, and are all united by a web of skin. Fifth actinolateral spine is longest, and is first to reach margin. Actinolateral membrane more or less extending to margin.

Oral plates conspicuous, short, with a median crest; 5 tapering furrow spines, longest proximally, all spaced, except for distal 2, which are close together. Furrow spines of each oral plate united by a web, but this does not continue across jaw angle. Suboral spine single, larger than furrow series, longitudinally ridged, triangular and glassy distally.

Ambulacral furrows broad; tubefeet in 2 rows, each with a distinct sucking disc.

COLOUR (preserved specimen): Greyish-white.

REMARKS: This species differs from *P. affinis* Smith in having more numerous abactinal paxillar spines, with the central group enlarged, and in having 5–6 adambulacral furrow spines. *P. militaroides militaroides* H.L. Clark with 6–12 paxillar spines has usually 7 adambulacral and 8 oral furrow spines.

Pteraster (Pteraster) affinis Smith, 1876

Pteraster affinis Smith, 1876: 108; Koehler 1917: 48, pl. 10 (1); Clark & Downey 1992: 326; O'Hara 1999: 182; A.M. Clark 1995: 206.

Pteraster affinis affinis A.M. Clark 1962: 63.

MATERIAL EXAMINED: Nil.

DISTRIBUTION: Recorded from Macquarie Island in 8 m.

DESCRIPTION: Taken from O'Hara 1998: R/r = 13/7 mm; 5 arms, short, triangular, bluntly tipped. Abactinal plates paxillate; 2–6, usually 4, subequal paxillar spinelets, thin, slightly flattened, slightly serrate, widened at tip, surface fenestrate, up to 1.0 mm long. Paxillar pedicel small, twice as high as wide. Thick, pulpy supradorsal membrane connecting spinelets at midheight. Actinolateral fringe of spines connected by continuous webbing along arm; spines flat, striated, tip truncate, up to 2.0 mm long. 4 webbed adambulacral spines in a transverse row near furrow. 5 webbed marginal spines on each oral plate, webbing not continuous over jaw apex. 1 large suboral spine, distally directed, largely covered by membrane, tricarinate near pointed tip. 2 rows of suckered tubefeet.

REMARKS: Other records are from the Antarctic and subantarctic, apparently circumpolar, 0–603 m.

Downey (in Clark & Downey 1992) noted that characters distinguishing the 3 subspecies proposed in this taxon overlapped, and that the species could be considered as a subspecies of the northern *P. militaris* (O.F. Müller).

Subgenus *Apterodon* Fisher, 1940

Oral spines free, not united by a web of skin.

TYPE SPECIES:

Pteraster stellifer Sladen, 1882.

Pteraster (Apterodon) bathamae Fell, 1958 (Pl. 8)

Pteraster bathamae Fell, 1958: 14–15, pl. 2 (G, I); H.E.S. Clark 1970: 4.

Pteraster bathami A.M. Clark 1995: 207.

MATERIAL EXAMINED:

NIWA Stns: B487 (1); B560 (1); D176 (1); E832 (3); G290 (1); G365 (1); G689 (1); G882 (1); G892 (1); G907 (1); G931 (3); G933 (1); G937 (1); I622 (1); S192 (2); S231 (2); S260 (1); W252 (1); Z10825 (1); TAN0307/41 (1); KAH9704/18 (1).

DISTRIBUTION: Southern New Zealand, from Chatham Rise to Campbell Plateau and Bounty Platform, 20–520 m, with the only records shallower than 100 m from Fiordland.

STUDY SPECIMEN: NIWA Stn B487 [southern New Zealand], R/r = 43/31 mm, measured on actinal surface, and includes curvature of armtip.

DESCRIPTION: Outline pentagonal, body thick, cushion-like, inflated abactinally, 5 arms scarcely produced, except at recurved tip; margins more or less rounded, without a distinct fringe.

Abactinal plates strongly cruciform, overlapping, central pedicel about 3 mm long, slightly widened distally, supporting 4–6 slightly shorter, non-tapering paxillar spines. No central paxillar spine, so that area of supradorsal membrane within paxillar spread has no central projection. Muscle bands of supradorsal membrane radiate from centre of paxillae, i.e. top of pedicel, to near tip of each spine, regular but not especially conspicuous. Abactinal paxillae become more crowded towards margin and continue to actinal surface where they are irregular. Spiraculae small, numerous, with up to 45 in larger meshes. Osculum central, conspicuous, each valve with 8 tapering, webbed spines, longest centrally, up to 4 mm long. Arm tips completely recurved, with distal end of ambulacra on abactinal surface, terminal plate obscured.

Adambulacral plates short and wide throughout; spines in a single webbed transverse series, with 6–7 spines over most of arm. Spines increase in length from furrow, with longest supporting actinolateral membrane. First few plates have an additional small spine, set down in furrow, and placed slightly distal to the rest. Actinolateral membrane does not extend to margin.

Oral plates conspicuous, each pair forming a median ridge, broadly rounded proximally, and bluntly pointed distally. Each plate with 5–6 acicular furrow spines, longest proximally, and one stronger suboral spine, hyaline, and triangular in section distally.

Ambulacral furrows broad, tubefeet biserial, with distinct sucking discs.

COLOUR (dried specimen): Uniform dull brown; other specimens in ethanol are white. Colour in life “deep cream, or pale warm yellow” (Fell 1958: 14).

REMARKS: The specimen from NIWA Stn S260, with R/r = 49/29 mm, has colour uniform whitish. Supradorsal membrane thickened around spines, muscle bands not evident, though spiraculae are. Osculum inconspicuous; adambulacral fans from opposite sides of furrow alternately project across furrow and conceal tubefeet.

P. bathamae differs from both *P. stellifer* Sladen and *P. obesus* H.L. Clark in lacking central paxillar spines. The former has grooved paxillar spines, and the latter is strictly pentagonal in outline. *P. tetracanthus* H.L. Clark from southern Australia has 4 adambulacral spines, 4 oral furrow spines, and 6 spines in the abactinal paxillae.

Pteraster (Apterodon) stellifer Sladen, 1882 (Pl. 9)

Pteraster stellifer Sladen, 1882: 193; 1889: 474, pls 74 (1,2), 77 (1,2).

Pteraster (Apterodon) stellifer stellifer: A.M. Clark: 1962: 67; McKnight 1984: 142; A.M. Clark 1995: 213.

Pteraster (Apterodon) stellifer: Clark & Downey 1992: 355.

MATERIAL EXAMINED: NIWA Stn C734 (1).

DISTRIBUTION: Recorded from near Macquarie Island in 360 m. It is also known from the Antarctic and Subantarctic, 79–2084 m.

STUDY SPECIMEN: NIWA Stn C734, R/r = 17/12 mm. Specimen has been dried at some stage, and has flattened in storage.

DESCRIPTION: *Outline* almost pentagonal, somewhat like *Patiriella*, with a distinct marginal fringe. Abactinal surface slightly inflated (probably has flattened in storage), actinal surface flat.

Abactinal plates small, variously lobate, commonly cruciform, with pedicel up to 1 mm long, slightly widened at tip; pedicels with 7–9 spines, distally truncate, finely fenestrate throughout length and with deep longitudinal grooves. Central spine up to 1.5 mm long, stout and non-tapering; peripheral spines about 0.75 mm long, tapering slightly. Muscle bands not evident; spiraculae scattered, few, up to 8 in larger meshes.

Adambulacral plates short with 4–6 delicate, tapering spines in a single transverse row. Spines increasing in size from furrow, row straight, not curving. Actinolateral spines extending to margin, and membrane forming outline to body. 8th to 10th actinolateral spine is first to reach margin, and is longest or nearly so.

Oral plates with a prominent median crest; 4–5 oral furrow spines, longest proximally; one larger, tapering, grooved suboral spine. Oral spines not linked by skin.

Ambulacral furrows broad; tubefeet biserially placed, with distinct though small sucking discs.

COLOUR (preserved specimen): Dull, uniform creamy-white, tubefeet darker.

REMARKS: This specimen was initially assigned to one of the two subspecies of *P. stellifer*, but these are no longer recognised (Clark & Downey 1992). *P. stellifer* differs from *P. bathamae* in having a few more paxillar spinelets that are grooved, and fewer adambulacral spines.

Pteraster (Apterodon) obesus H.L. Clark, 1908
(Pl. 10)

Pteraster obesus H.L. Clark, 1908: 283; Rowe & Gates 1995: 111.

Pteraster (Apterodon) obesus myonotus Fisher, 1916: 28; 1919: 458, pls 127(1), 128(3), 133(4); McKnight 1975: 57; 1989: 10; 1993a: 173, 185; A.M. Clark 1995: 211.

MATERIAL EXAMINED:

NIWA Stns: I94 (1); I97 (1); K826 (1); Q69 (2); Z2098 (1); Z9026 (1).

DISTRIBUTION: Recorded from the northern Tasman Sea and the Kermadec Islands 142–850 m. It is also known from Japan and the Philippines.

STUDY SPECIMEN: NIWA Stn Z2098, R/r = 13/10 mm. Specimen is dry, and outline is irregular.

DESCRIPTION: *Outline* irregular pentagonal, arms scarcely produced and tips recurved, body strongly inflated. Abactinal membrane bristling with small, blunt, close-set spines, protruding slightly; margin rounded, marginal, fringe not evident from above.

Abactinal plates lobate, with pedicel tall, usually slightly longer than the 5–7, blunt-tipped paxillar spines. Paxillae form more or less hexagonal areas, with 1–2 spines at centre; muscle bands at marginal paxillae, and also radiating from central spine. Spiraculæ evident, numerous, with up to 25 in larger areas. Osculum central, each valve with several close-set spines, longest centrally.

Adambulacral plates short throughout arm, with 4–5 spines, united by skin, in a single transverse row; spines increase in size from furrow, and row slightly curved; actinolateral spine short, the membrane not extending to margin, and not visible from above.

Oral plates conspicuous, each with 5–7 furrow spines, and one much larger suboral spine, which is triangular and glassy in distal part.

Ambulacral furrows relatively narrow, tubefeet biserial, with small sucking discs.

COLOUR (dried specimen): Uniform dull brown.

REMARKS: This is now known as a wide-ranging species in the Pacific Ocean, though a comparison of specimens from the recorded localities is desirable. *P. obesus* differs from the other 2 local species in this subgenus in its strictly pentagonal form and fewer adambulacral spines.

Subgenus *Retaster* Perrier, 1878

All the furrow spines of a pair of oral plates united by a web of skin.

TYPE SPECIES:

Pteraster capensis Gray, 1847.

Pteraster (Retaster) sp. (Pl. 11)

MATERIAL EXAMINED:

NIWA Stns: I32 (1); Z9000 (1).

DISTRIBUTION: Known only from northeastern New Zealand, 323–375 m.

STUDY SPECIMEN: NIWA Stn I32, R/r = 22/11 mm.

DESCRIPTION: *Outline* pentagonal–stellate, 5 tapering arms, tip slightly recurved; abactinal surface inflated, actinal more or less flat; a distinct marginal fringe formed by actinolateral membrane. Surface of supradorsal membrane with fairly regular meshes, formed by slightly raised lines (?muscle bands) between spines. Paxillar areas are rounded, oval or angular, and become smaller and less regular toward arm tips, and margin. Each mesh delimited by tips of about 15 spines, which project only slightly, appearing almost granuliform. Central area of mesh with 3–5 slightly lower, bluntly rounded projections, and muscle bands not evident here; 8–12 small spiraculæ in larger meshes, usually set around edges. Osculum surrounded by a ring of conspicuous erect spines, about 2 mm long. Individual valves not evident.

Adambulacral plates short and broad throughout, with spines in a single webbed transverse row. Five or six spines over most of arm, proximal plates have a small additional spine set distal to the rest. Other spines only slightly increase in size from furrow and webs on second adambulacral almost meeting behind oral plates. Webs extend partly across furrow but do not conceal tubefeet. Actinolateral membrane forms marginal fringe, with outer spine from 2nd to 4th the first to reach margin.

Oral plates somewhat sunken, short, each pair rising to a median peak distally. Each plate with 5 furrow spines, slightly longer proximally, all furrow spines of pair of plates united in a web of skin; also with a single pointed and tapering suboral spine, not linked by a web.

Ambulacral furrows broad, tubefeet biserial with distinct sucking discs.

COLOUR (preserved specimen): Light over disc area, with ridges of meshes whitish, elsewhere creamy-white.

REMARKS: Fisher (1940) has listed species referred to the subgenus *Retaster*, and two groups are apparent, those with a single central paxillar spines, e.g.

P. capensis, *P. corynetes*, and *P. temnochiton*; the second group has several central paxillar spinelets, e.g. *P. pulvillus*, *P. gibber*, and *P. tessellatus*, and includes the present specimens.

Diplopteraster Verrill, 1880

Adambulacral plates more or less alternating, prominent and non-prominent, the former sometimes with an additional spine; adambulacral spines united by a web of skin. Tubefeet usually in four rows, at least in adult specimens.

TYPE SPECIES:

Pteraster multipes Sars, 1866

KEY TO SPECIES

- 1 Pedicel clearly shorter than paxillar spines; adambulacral plates with 5 and 4 spines; 5–6 oral furrow spines *Diplopteraster hurleyi* McKnight
- 1' Pedicel clearly taller than paxillar spines, central spine clearly enlarged and projecting; adambulacral plates with 4 and 3 spines; 3–4 oral furrow spines 2
- 2 Pedicels of abactinal plates up to 1 mm long
..... *Diplopteraster* sp.
- 2' Pedicels of abactinal plates up to 6 mm long
..... *Diplopteraster otagoensis* McKnight

Diplopteraster hurleyi McKnight, 1973 (Pl. 12)

Diplopteraster hurleyi McKnight, 1973a: 6; A.M. Clark 1995: 198.

MATERIAL EXAMINED:

NIWA Stns: E406 (1); F911 (1); G702 (1); G703 (1); S152 (1); Z9468 (2); Z9798 (1); Z10824 (1).

DISTRIBUTION: Recorded from northern New Zealand to Otago, 959–1676 m.

STUDY SPECIMEN: NIWA Stn F911, holotype, R/r = 89/24 mm.

DESCRIPTION: *Outline* pentagonal–stellate, 5 tapering arms, abactinal surface inflated, actinal surface more or less flat; margin somewhat rounded, actinolateral membrane does not extend to margin in interradius. Abactinal membrane with quite widely spaced spines.

Abactinal plates have 4 or 5 lobes, pedicel up to 1 mm long, twice as high as wide, non-tapering and truncate distally. Pedicel with 2–4, commonly 2–3 elongate, slightly tapering spines. Spines solid, 1 or 2 up to 5.5 mm long, projecting through dorsal membrane; others slightly shorter and not projecting. Muscle bands scarcely evident, spiraculae large, conspicuous, irregularly scattered, with up to 6 in larger paxillar

meshes. Osculum small, maximum diameter 6 mm, conspicuous due to erect spines of oscular valves, each valve with 9 or 10 webbed spines, longest centrally, and clearly longer than any others visible above membrane. Papulae almost as long as pedicels, but more or less recumbent, with a greatly wrinkled surface.

Adambulacral plates all short, spines in a single, webbed transverse row; prominent plates with 4–5 spines, inner smallest and distal to rest, all at least twice as long. Alternation of plates not entirely regular, and non-prominent plates often with 5 spines. Actinolateral spine and membrane not quite reaching margin in interradius, but forming marginal fringe elsewhere.

Oral plates conspicuous, short, with distinct ridge or crest along median suture of a pair, forming a distal “beak”. Plates with 5 or 6 furrow spines, longest proximally, and one larger suboral spine. All spines are pointed, and all linked by skin.

Ambulacral furrows broad, tubefeet have distinct sucking discs, and are quadriserial.

COLOUR (preserved specimens): Dull light grey; one specimen was noted with purplish furrows.

REMARKS: This species appears distinct, having very few (2–4) abactinal paxillar spines. One other species with few paxillar spines, *D. peregrinator* (Sladen), has 5–10 paxillar spines and 7–8 or 5 adambulacral spines.

Diplopteraster otagoensis n.sp. (Pl. 13)

MATERIAL EXAMINED:

NIWA Stns: E399(1); W248 (1); Z9459 (1); Z9460 (1); Z9573 (1); Z9611 (2).

DISTRIBUTION: Recorded from off the east coast of central and southern New Zealand, 860–1222 m.

STUDY SPECIMEN: NIWA Stn E399, R/r = about 93/48 mm, specimen damaged.

DESCRIPTION: *Outline* pentagonal–stellate, 5 tapering arms, abactinal surface inflated, actinal surface more or less flat; actinolateral membrane and spines probably not reaching margin in interradius, but elsewhere forming lower margin to a rounded arm. Dorsal membrane thick and tough, with spaced, protruding spines.

Abactinal plates lobate, commonly cruciform, pedicel elongate, up to 6 mm long, slightly widened and truncate distally. Pedicel bearing one large, tapering central spine, almost as long as pedicel, and up to 10 much more slender, shorter peripheral spines. Central spine projects through membrane, others do not. Dorsal membrane thick and tough, muscle fibres closely reticulated. Peripheral spines may form a ra-

diating figure from pedicel, and be mistaken for muscle bands. Spiraculæ small, inconspicuous, with up to 10 in larger meshes. Osculum central, small, diameter about 10 mm, and inconspicuous; spines of valves are covered by membrane and difficult to distinguish.

Adambulacral plates all short, more or less alternating prominent and non-prominent. Prominent plates with 4 spines, non-prominent with 3; spines united by a web of skin, extending well beyond tips of spines in a bag-like structure. Actinolateral spine encased in thick membrane, appears to almost reach margin in interradius, and probably forms marginal fringe elsewhere.

Oral plates concealed by everted stomach, and each pair is separated along median suture. Plates with 3–4 elongate tapering furrow spines, and 1 similar though larger suboral spine.

Ambulacral furrows very broad; tubefeet quadrilateral and very crowded, sucking discs small, but distinct. Tubefeet sometimes placed close to non-prominent adambulacral plates and concealing them.

COLOUR (preserved specimen): Light creamy-white, with the tubefeet almost purplish and their tips light brown.

ETYMOLOGY: *otagoensis*—for the type locality.

HOLOTYPE: Deposited in the collections of NIWA, Wellington, No. H-850 (Stn E399).

PARATYPES: Deposited in the collections of NIWA, Wellington, Nos P-1406 (Stn Z9573); P1407 (Stn Z9611 (2)).

REMARKS: This specimen is quite distinct from the previous in having paxillae with an elongate pedicel, and in the armature of the oral and adambulacral plates. While the relationship of the previous species may be with the southern *D. semireticulatus* and *D. verrucosus*, this specimen appears related to the northern *D. multipes*. This species differs, however, in having 2 central paxillar spines and 5 or 6 adambulacral spines.

Hymenaster Wyville Thomson, 1873

Adambulacral spines independent, not united by a web of skin; spinelets of paxillae support but do not extend through dorsal membrane; nidadamental cavity spacious; suboral spines usually present; adambulacral plates not alternating; tubefeet biserial or quadrilateral in large specimens.

TYPE SPECIES:

Hymenaster pellucidus Wyville Thomson, 1873

REMARKS: Downey (*in* Clark & Downey 1992) has noted that several characters previously used to define spe-

cies are growth-dependent or they depend on preservation, and the tabular key to the Atlantic species (Clark & Downey 1992: 313) illustrates the overlap of several species. I have provisionally separated 6 species from the New Zealand region, but decline to formally name 2 of these.

KEY TO SPECIES

- 1 Adambulacral plates with 1–2 spines 2
- 1' Adambulacral plate with 3–4 spines 4
- 2 Adambulacral spines 2, forming a single longiseries; abactinal paxillae with a single spine. Large, fleshy, membrane opaque; tubefeet crowded, almost quadrilateral
..... *Hymenaster carnosus* Sladen
- 2' Adambulacral spines 1–2, if 2 then in a transverse series; smaller, delicate forms, membrane translucent; abactinal paxillae with 4–7 spines; tubefeet biserial 3
- 3 Proximal actinolateral spines straight; aperture papillae with tapering tip covered by membrane, and appears broad *Hymenaster blevgadi* Madsen
- 3' Proximal actinolateral spines bent or curved, appearing as circles around mouth; aperture papillae spiniform at tip, not concealed by membrane
..... *Hymenaster* sp. A (cf. *H. pergamentaceus*)
- 4 Adambulacral spines flattened, distal is deepest in furrow, so that series is oblique; abactinal paxillae absent interradially *Hymenaster pullatus* Sladen
- 4' Adambulacral spines acicular, series transverse; interradiabactinal paxillae present 5
- 5 Adambulacral furrow spines long, extending across furrow; aperture papillae spiniform
..... *Hymenaster estcourti* McKnight
- 5' Aperture papillae flat and broad distally, covered by membrane; adambulacral furrow spines short, not extending across furrow *Hymenaster* sp. B. (cf. *H. crucifer*, *porissimus*, *praeoquis*, *gracilis*)

Hymenaster blevgadi Madsen, 1956

Hymenaster blevgadi Madsen, 1956: 27, pl. 1 (1–3); A.M. Clark 1995: 200.

MATERIAL EXAMINED: Nil.

DISTRIBUTION: Known only from the Kermadec Trench, 6606–6720 m.

DESCRIPTION (from Madsen (1956)): Outline almost pentagonal, 5 pointed arms, slightly inflated on radial

areas. Dorsal membrane tough and fibrous, paxillar spines forming regularly spaced protuberances.

Abactinal plates lobate, pedicel short, with 4–7 (usually 5 or 6) spines. Larger spines 5–6 mm long, central spine lacking. Paxillae arranged in 4 radial rows. Valves of osculum with 10–15 spines up to 8 mm long, and 4 shorter spines in a second outer row. Spiraculae small, numerous and scattered.

Adambulacral plates with 1–2 (usually 2) spines, in an oblique transverse series, uppermost longest, both with skin extending beyond tip. Aperture papillae broadly oval at base, tapering to a pointed tip. Actinolateral spines 9–14 longest.

Oral plates broad and short, each pair forming a high median keel; each plate with 3 or 4 furrow spines, and 1–2 suboral; if two, usually one less in furrow series.

Ambulacral furrows broad; tubefeet in 2 series.

COLOUR: “traces of violet skin on oral surface” (Madsen 1956).

REMARKS: Madsen (1956) indicated some reluctance to name these specimens, but indicated that the paucity of radial rows of paxillae was unusual.

Hymenaster carnosus Sladen, 1882 (Pl. 14)

Hymenaster carnosus Sladen, 1882: 220; 1889: 504, pl. 88 (1–5); A.M. Clark 1995: 200.

MATERIAL EXAMINED:

NIWA Stns: G703 (2); P927 (1); P939 (1); P970 (2); S151 (6).

DISTRIBUTION: Recorded from off Hawke Bay, and both east and west coasts of the South Island, 1009–3391 m. Also known from off the west coast of South America, 2743 m.

STUDY SPECIMEN: NIWA Stn S151, R/r = 83/55 mm.

DESCRIPTION: *Outline* almost pentagonal, with slightly produced arms, interbrachial arc slightly indented. Actinal surface flat, abactinal surface raised along radial midline of arms; margin thin, but may have been much higher in life. Abactinal paxillae arranged to form a stellate outline, so that actinolateral membrane is relatively broad interradially, narrowing toward arm tips. Dorsal membrane thick, tough and fibrous.

Abactinal plates lobate, with a distinct pedicel, covered by membrane; pedicel up to 5 mm tall, with a single tapering spine up to 8 mm long. Pedicels and spines tend to form 5 longitudinal rows on each arm, with carinal or median spines smallest, and increasing to quite conspicuous outer row. Osculum conspicuous, rounded-pentagonal in outline, diameter

about 25 mm, each valve with up to 15 webbed spines, central up to 12 mm long. Spiraculae small, barely visible to naked eye, in groups or lines of 3–15, between spines.

Adambulacral plates with usually 2 spines at furrow margin, forming a single row along furrow. Occasionally proximal plates may have 1 or 3 spines, and spines on each plate may be slightly oblique. Aperture papilla large, conspicuous, membranous covering forming a flap extending beyond calcareous part. Actinolateral spine immersed in membrane, almost invisible, in proximal half of arm actinolateral spines not appearing to reach margin.

Oral plates short, rising to a distal peak; actinosomial margin of each pair broad; 3–4 furrow spaced furrow spines, and 1 suboral spine; membrane covering of suboral spine is thick and extend beyond tip, so that spine appears thickened distally.

Ambulacral furrows broad; tubefeet conspicuous, with small, distinct sucking discs, crowded, in 2 slightly alternating series.

COLOUR (preserved specimen): Creamy-white; in life often with a purplish tinge, which may be retained in preservative.

REMARKS: The largest specimen from Stn S151, R/r = 138/92 mm, has almost quadriserial tubefeet in 2 zigzag series. A smaller specimen, R/r 52/21 mm, has a few adambulacral plates with 3 spines; one oral plate has 2 suboral spines; tubefeet crowded, in 2 subalternate series.

In a key, Sladen (1882) placed this species next to *H. echinulatus* Sladen, differing in having the spiraculae in groups, not singly. In his remarks it was distinguished from *H. nobilis* Sladen by the form of the paxillae and the larger spiraculae.

Hymenaster pullatus Sladen, 1882 (Pl. 15)

Hymenaster pullatus Sladen, 1882: 235; 1889: 519, pls 92(1), 93(1–3); McKnight 1973a: 8; A.M. Clark 1995: 204.

MATERIAL EXAMINED:

NIWA Stns: F911 (9); G703 (9); G706 (2); P939 (several); P940 (6); S151 (6); U194 (8); U195 (4); U197 (1); U198 (12).

DISTRIBUTION: Lord Howe Rise, northern and southern New Zealand, 1186–2930 m.

STUDY SPECIMEN: NIWA Stn S152, R/r = 55/49 mm.

DESCRIPTION: *Outline* almost pentagonal, interbrachial arcs little indented, broadly concave; abactinal sur-

face raised at disc centre and along arm midline, actinal surface flat. Dorsal membrane thin and delicate, easily damaged.

Abactinal plates lobate, pedicel up to 3 mm tall, slightly thickened distally, with 3–4 spines up to 7 mm long; spines radiate apart, forming peaks in dorsal membrane. Paxillae arranged in 5 rows, marginal row with largest paxillae; central row lowest, but scarcely rudimentary. Paxillae form a stellate figure, actinolateral membrane extends to near osculum interradially. Dorsal membrane thin and delicate, easily ruptured. Muscle bands very narrow, evident when dried, forming reticulate pattern. Osculum damaged, valves with up to 20 spines, longest (8 mm) at centre of valve. Spiraculae not evident. Membrane lacks deposits. On actinal surface very fine muscle fibres apparent between some actinolateral spines.

Ambulacral plates with 3 flattened, pointed, subequal spines placed on side of furrow, most distal spine is that deepest in furrow; aperture papilla broad, more or less ovate, a little longer than furrow spines, with fleshy tip; 14th actinolateral spine longest, and first to reach margin.

Each pair of *oral plates* with a rounded median crest and broad actinosomal margin; 4 small furrow spines, placed close together near lateral angle of plate; 2 suboral spines, one placed proximally near actinosomal margin could be almost a furrow spine, other placed about midway along plate. All spines flattened, furrow spines pointed and resemble adambulacral furrow spines, suboral spines larger and blunter, especially the distal.

Ambulacral furrows broadest at about $1/2R$, tubefeet biserial, with small though distinct sucking discs.

COLOUR (preserved specimen): Dull light grey. Some other specimens have traces of pink orally, and elsewhere may be deep purplish. In fresh material, the purplish colour, especially on the actinal surface, distinguishes this species.

REMARKS: This is a fragile species, and usually partly fragmented when captured, which, with the purplish or pink colour, helps to distinguish it.

Fisher (1919) compared his new species *H. bartschi* with *H. pullatus* Sladen, noting that the differences might be less than specific. *H. bartschi* differs in having 7 rows of abactinal paxillae, but only 8–10 spines in each oscular valve.

Hymenaster estcourti McKnight, 1973 (Pl. 16)

Hymenaster estcourti McKnight, 1973a: 10; A.M. Clark 1995: 201.

MATERIAL EXAMINED:

NIWA Stns: E774 (1); E880 (1); F126 (1); S202 (17).

DISTRIBUTION: New Zealand, from off Northland to Pukaki Saddle in the south, 1029–2476 m.

STUDY SPECIMENS: NIWA Stn S202, 17 specimens. R/r = 16/9.5 mm, to 8/6.5 mm.

Description: *Outline* pentagonal, interradial arcs scarcely indented in smaller specimens, larger specimens with arms slightly produced, terminating in a narrow point. Abactinal surface inflated, highest at disc centre, actinal surface flat. Abactinal paxillae with 5–7 spinelets near disc centre, 4–5 towards arm tips. Paxillae closely spaced, interradially extending to near margin. Towards arm tip, paxillae are lower, becoming inconspicuous. Paxillae with pedicel or shaft about as long as spinelets. Osculum conspicuous, valves with 8–10 webbed spines, longest centrally. A circle of small spinelets surrounds osculum. Abactinal membrane translucent to opaque, muscle bands evident, spiraculae small, distinct, in groups of up to 12.

Adambulacral plates with 4 spines proximally, usually 3 in distal half of arm. Spines elongate, often reaching across furrow, acicular, finely rugose, and hyaline; distal spine is deepest in furrow, so that series is slightly oblique. Aperture papillae shorter and broader than furrow spines, immersed in membrane except for tip; 5th–7th actinolateral spine first to reach margin. All actinolateral spines straight.

Oral plates relatively short, and narrow, sloping steeply into actinosome; 2–3 marginal or furrow spines, and usually 3 larger suboral spines in a single series along plate. Proximal suboral spine is close to furrow series, but is larger.

Ambulacral furrows widest at about $1/2R$; tubefeet biserial, with small sucking discs.

COLOUR (preserved specimen): Dull uniform cream.

REMARKS: This species appears related to 2 southern species, *H. praecoquis* Sladen and *H. densus* Koehler. The first has 3–5 adambulacral spines, arranged in overlapping curves, while the second has the aperture papilla free, not immersed in the actinal surface.

Hymenaster sp. A (Pl. 17)

MATERIAL EXAMINED:

NIWA Stns: P120 (1); P667 (1); P942 (1); Q84 (1).

DISTRIBUTION: Tasman Sea; Lord Howe Rise to east of Lord Howe Island and off west coast of South Island, New Zealand, 830–1047 m.

STUDY SPECIMEN: NIWA Stn P667, R/r = 12/8 mm.

DESCRIPTION: Outline pentagonal, interradiar arcs scarcely indented, abactinal surface domed centrally, actinal surface convex; marginal fringe very narrow though distinct. Abactinal paxillae well spaced, with 4 or 5 spinelets, shorter than paxillar shaft. Abactinal membrane almost transparent; spiraculae small, distinct, numerous, occurring all over membrane. Muscle bands very fine, numerous. Osculum conspicuous, about 4 mm diameter, valves with about 10 spines, all broken. No peripheral ring of spines around osculum.

Adambulacral plates with 1 acicular furrow spine, aperture papillae also acicular, and lacks membrane in distal half, appearing like an outer furrow spine; 6th–8th actinolateral spine is first to reach margin; proximal actinolateral spines curved or bent, reaching to interradiar line and forming concentric circles around mouth. Distal spines forming a small, distinct marginal fringe.

Oral plates with distal prominence and steeply sloping towards actinosome; 3–4 small distal furrow spines; 2 suboral spines, larger and stronger, surface finely rugose, one proximal, and a second at about middle of plate. Both spines curve slightly, and each pair of plates appears to have 2 sets of “bull’s horns.”

Ambulacral furrows broadest at about 1/2R; tubefeet biserial, small with small sucking discs.

COLOUR (preserved specimen): Whitish.

REMARKS: All specimens are small; that from Stn P667 is largest; that from Stn P942 sometimes has 2 adambulacral furrow spines; in all, the aperture papillae is free from membrane distally; but for this feature, the smaller size, and the widespread spiraculae, this suggests affinity with *Hymenaster pergamentaceus* Sladen, known from “Challenger” Stn 325, east of Buenos Aires, South America, 4850 m.

Hymenaster sp. B (Pl. 18)

MATERIAL EXAMINED:
NIWA Stn U200 (1).

DISTRIBUTION: Recorded from the western flank of Lord Howe Rise, 3180 m.

STUDY SPECIMEN: NIWA Stn U200, R/r = 43/26 mm.

DESCRIPTION: *Outline* almost pentagonal, interradiar arcs slightly indented, 5 arms, little produced, tips recurved; abactinal surface flat, actinal surface convex. Actinolateral spines slightly projecting. Abactinal paxillae regularly arranged, spaced apart, with one carinal row along midline of arms, flanked by a similar row; these paxillae usually with 4 spines; lateral to

these are 2 rows of paxillae usually with 5 spines. Paxillae extending almost to margin in interradius, with a narrow marginal fringe beyond. Shaft of paxilla shorter than terminal spines; spines project slightly; membrane within spread of paxillar spines is opaque, that between is translucent; spiraculae very small and inconspicuous; muscle bands narrow, tending to radiate from paxillar spines. Osculum conspicuous, about 10 mm diameter, each valve with 10–12 spines, longest at centre of valve; osculum margined by a circlet of small spines.

Adambulacral plates with 4 spines proximally, 3 over most of arm, distal spine is deepest in furrow, spines rounded, elongate, slightly tapering. Aperture papillae appear flat and broadened distally, but on close examination seen to be membrane covering, which is free, not part of actinal membrane; calcareous part is a simple small knob. Actinolateral spines straight, 9th or 10th first to reach margin.

Oral plates conspicuous, each pair forming a conspicuous elongate, swollen ridge. Furrow spines small, 3 or 4 spaced along lateral margin of plate; suboral spines 2, larger and stouter, one near proximal end of plate, other at centre; one plate has 2 spines at centre. Distal half of plate bare.

Ambulacral furrows widest at about 1/2R; tubefeet regularly biserial, sucking-discs small though distinct.

COLOUR (preserved specimen): Dull creamy-white.

REMARKS: *H. alcocki* Koehler, Bay of Bengal, 1177 m, has a wider marginal fringe, crowded paxillae and tubefeet, and lanceolate aperture papillae. *H. gracilis* Ludwig, off Panama, 2417–3241 m, and *H. praecoquis* Sladen, from between Marion and Crozet Islands, 2516–2928 m, both differ in aperture papillae.

Family CAYMANOSTELLIDAE Belyaev, 1974

Body small to minute, pentagonal to circular in outline; flat actinally, slightly convex abactinally: body covered with an epidermis, thin to very thick. Abactinal plates with distinct arrangement or not, variously imbricated, with spines or granules. Marginal plates usually distinct, inferomarginals defining outline, spines forming a marginal fringe; actinal plates absent; adambulacral plates with marginal straight furrow and few spines. First adambulacral short, second and third longest. Madreporite simple, papulae present or not; pedicellariae absent. Tube feet biserial, with sucking-discs; gonads 10, a pair in each interradius, may be visible through membranous area distal to oral plates, gonoducts notch or pierce first superomarginals.

Known only from sunken, waterlogged wood. (See Rowe (1989b) for extended diagnosis, and review of family and species.)

Caymanostella Belyaev, 1974

Hexagonal to fan-shaped lenticulate abactinal plates, a thin epidermis not obscuring skeletal plates in adult; abactinal plates with granules; ambital spinelets club-shaped. Gonopores notch or pierce first superomarginals; papulae absent; spicules absent from actinal membrane.

TYPE SPECIES:

Caymanostella spinimarginata Belyaev 1974.

Caymanostella phorcynis Rowe, 1989

Caymanostella phorcynis Rowe, 1989a: 301; A.M. Clark 1995: 218.

MATERIAL EXAMINED:

NIWA Stn K873 (several).

DISTRIBUTION: This species is known from eastern Australia and northern and central New Zealand, 736–1270 m, and also from Indonesia, 2053 m.

STUDY SPECIMENS: NIWA Stn K873, R 10.5 mm.

DESCRIPTION: *Abactinal surface* covered by imbricating plates; larger plates include primary interradials and adjacent distal plate; on arms carinal series present, with 5–8 fan-shaped plates, flanked by and alternating with 3–6 dorsolaterals; a second, smaller dorsolateral row present in larger specimens.

Abactinal and superomarginal plates with fine, even granulation, 9–12 granules per mm, granules slightly longer than broad, dome-shaped; 8–15 plates in each marginal row, plates wider than long, decreasing in size distally; inferomarginals with 2 spines on outer edge; actinal surface with spinelets like subambulacral spinelets, though smaller.

Adambulacral plates broader than long, extending to inferomarginals; first plate with 3–5 rugose, tapering spines, 2 at furrow edge; remaining plates with up to 10–12 similar spines, 2 at furrow edge, remainder in 2 alternating rows across plate; distal plates with 1 spine at furrow edge. Ambulacral plates dumb-bell shaped, possibly sub-petaloid in small specimens.

Oral plates with 3–4 furrow spines, or 5 on large specimens, and 2–3 suboral spines. Tubefeet paired, well-developed; 9–14 pairs in each ambulacral row.

Actinosome large, about 1/3 diameter of specimens.

Ambulacral furrows narrow; tubefeet paired, well developed; 9–14 pairs in each ambulacral row.

Gonads present on either side of interradial membrane, visible through a more or less triangular actinal membrane. This membrane delimited by oral plates, first 2 adambulacrals and inferomarginals. Gonopores pierce first superomarginal plates. Gonopore visible at centre of plate.

Anus subcentral, surrounded by 4–5 plates. Both gonopore and anus surrounded by 7–9 granules.

COLOUR (preserved specimen): Dull uniform cream.

REMARKS: In *C. spinimarginata* Belyaev & Litvinova the gonopore is in a notch in the most proximal marginal plate, while in *C. admiranda* Belyaev & Litvinova and the present species it pierces this plate. These latter 2 species differ in the arrangement and shape of the abactinal plates.

Family MYXASTERIDAE Perrier, 1885

5–11 long flexible arms, abactinal surface obscured by a thick supradorsal membrane with small delicate rounded or lobate, imbricate or non-imbricate plates bearing fascicles of delicate webbed or ensacculate spines; osculum in centre of disc surrounded by large primary radial plates bearing webbed spines; interradial sulcus extending from osculum to mouth plates; madreporite conspicuous, close to primary radial plates, in sulcus; a semi-circular or curved comb of webbed spines on adambulacral plates; mouth plates large, plowshare-shaped with a webbed series of oral spines.

This small family comprises 3 genera and 7 species; only 11 specimens have previously been recorded, all from the Northern Hemisphere.

Asthenactis Fisher, 1906

Primary radial plates encircle disc centre but do not form oscular valves; interradial sulci present; longitudinal actinolateral membrane present; arms 7–10.

TYPE SPECIES:

Asthenactis papyraceus Fisher, 1906.

Asthenactis australis n.sp. (Pl. 19)

MATERIAL EXAMINED:

NIWA Stns: Y31(1), Z10308(1).

DISTRIBUTION: Known only from off the southwest corner of South Island, New Zealand, and south of Tasmania, Australia, ?–1800 m.

STUDY SPECIMEN: NIWA Stn Y31. R 65 mm, r 23 mm, actinosome 22 mm diameter. 11 rays. Specimen has lost much of the spinulation in capture.

DESCRIPTION: *Disc* circular, relatively large, arms elongate, tapering to a narrow tip, rounded above, flat below. Abactinal surface of disc firm, that of arms more flexible.

Abactinal plates immersed in skin, becoming visible when dried; plates irregular in outline over much of disc, tending more lobate proximally on arms, more circular towards arm tips. Plates have a raised, conspicuous boss, more or less centrally placed, that carries 4–7 spines; these are short, up to 3 mm long, and united by thin skin into a distinct fascicle. Plates are slightly spaced apart, less so on rays where they form semi-regular oblique transverse series.

A distinct *sulcus* of flat immersed spineless plates extends from actinosome more or less to centre of disc abactinally, sulcus is broad distal to oral plates, becoming narrower on abactinal surface. At abactinal disc centre is a subcircular area with a slit-like anal opening in middle, surrounded by rounded flat, immersed plates; 10 primary radial plates encircle this anal area; these are the largest abactinal plates, and most are elongate-ovoid, much wider than long; the two just proximal to the madreporite are only slightly wider than long.

Madreporite lying just distal to primary radial plate circlet, angular in outline, maximum diameter about 3 mm and quite conspicuous, slightly higher than any other abactinal plate. The sculpture, partly concealed by skin, is relatively coarse and radiate.

Papulae few and scattered, visible as small dark circular objects just proximal to some abactinal plates; 4 of the primary radial plates near disc centre with similar papulae. Also irregular paler membranous spaces between some abactinal plates.

Oral plates large, the combined pair forming an isosceles triangle, with base facing the broad actinosome, and apex distal. Each oral plate with about 7 furrow spines, 4–5 on proximal margin and 2–3 at lateral angle. On the few intact spines there is only a basal web of skin. No suboral spines.

Adambulacral plates with 6–7 furrow spines in a curved transverse series, the few intact basally webbed; aperture spine present; remnants of longitudinal actinolateral web present in interradial and occasionally on arms. Actinolateral spine single.

Adambulacral furrows narrow: tubefeet biserial, crowded, elongate, large and conspicuous.

COLOUR (preserved specimen): Dull brown.

ETYMOLOGY: *australis*—for its presence in the Southern Hemisphere.

HOLOTYPE: Deposited in the collections of NIWA, Wellington, No. H-851 (Stn Y31).

PARATYPE: Deposited in the collections of NIWA, Wellington, No. P-1408 (Stn Z10308).

REMARKS: With 11 arms, this species is distinct from *A. papyraceus* Fisher (7 arms) and closer to *A. fisheri* Alton (10 arms); however, the primary abactinal plates are not crowded as in *A. fisheri*, but well spaced, as in *A. papyraceus*, which has very thin abactinal plates lacking a distinct boss. The oral and adambulacral armature is more or less similar in all three species.

Order SPINULOSIDA Perrier, 1884

Disc relatively small, usually with five elongate arms. Abactinal, marginal and actinal plates all similar, pseudopaxilliform, with small pedicels and stout bases, or flattened and rounded, but inferomarginals are pillar-like and project in Leilasteridae, which also has a distinct interradial channel. Plates generally closely arranged, in a regular or irregular network. Spines or spinelets small, often invested by skin. Marginals only slightly enlarged, except in Leilasteridae, separated proximally by a wedge of intermarginal plates, and proximal inferomarginals may be on actinal surface. Adambulacral furrows narrow, adambulacral plates short, with the furrow margin often angulated. Papulae widely distributed and often extending to the outer margins of the adambulacral plates. Tubefeet biserial, with distinct sucking-discs. Pedicellariae absent.

REMARKS: The Spinulosida has been successively reduced in content, so that it now contains the sole family, the Echinasteridae. Blake (1980) has placed the family Metrodiridae in the synonymy of the Echinasteridae. The comments by some notable asteroid workers apply to most taxa in this order. Fisher (1911): "all attempts at classification are to be regarded as provisional but in the case of *Henricia* especial emphasis should be directed to this fact"; Fisher (1940): "The name *Henricia* is applied to a rather considerable number of extremely unstable entities, for convenience called species"; H.L. Clark 1946: "the despair of any orderly-minded systematist." See also comments by A.M. Clark (in Clark & Downey 1992)

More recently Jangoux and Aziz (1988) have established the family Leilasteridae, order Spinulosida, to include *Leilaster* A.H. Clark and *Mirastrella* Fisher.

KEY TO FAMILIES

- 1 Inferomarginals not projecting, and no marginal fringe, no distinct interradial channel on abactinal surface; abactinal plates reticulate Echinasteridae
- 1' Inferomarginals projecting, pillar-like, with short spines in a marginal fringe. A distinct interradial channel extending from near the disc centre to the margin; 2–3 rows of midradial plates, flanked by 2 rows of larger adradials Leilasteridae

Family **ECHINASTERIDAE** Verrill, 1870

Disc relatively small, usually five elongate arms. Abactinal, marginal and actinal plates all similar, pseudopaxilliform, with small pedicels and stout bases, or flattened and rounded. Plates generally closely arranged, in a regular or irregular network. Spines or spinelets small, often invested by skin. Marginals only slightly enlarged, separated proximally by a wedge of intermarginal plates, and proximal inferomarginals may be on actinal surface. Adambulacral furrows narrow, adambulacral plates short, with the furrow margin often angulated. Papulae widely distributed and often extending to the outer margins of the adambulacral plates. Tubefeet biserial, with distinct sucking-discs. Pedicellariae absent.

KEY TO GENERA

- 1 A conspicuous recurved tooth at the apex of each pair of oral plates; spines short; skin thin, transparent *Odontohenricia*
- 1' No conspicuous recurved tooth at the apex of the oral plates 2
- 2 Abactinal spines usually less than 1 mm long, skin thin and transparent or translucent *Henricia*
- 2' Abactinal spines usually over 1 mm long, skin thick and tough often opaque, and extending to near tips of spines *Echinaster*

Echinaster Müller & Troschel, 1840

Echinasteridae with small disc and elongate arms, subcylindrical or sometimes flattened below. Abactinal skeleton open, reticulate, spines few to numerous to a plate; when few, they are spaced apart, not in groups or continuous series. Both series of marginal plates present, inferomarginals usually more prominent, both series with one or more spines. Actinal papulae absent. Adambulacral spines at the

edge of the furrow linked by skin, to form a longiseries. Relatively thick skin covers the abactinal plates and invests the spines, though the tips are usually free.

TYPE SPECIES:

Asterias seposita Retzius, 1783.

KEY TO SPECIES

- 1 1–2 oral furrow spines, 4–6 suboral, 2–3 spines on marginals and 1–4 (8) on abactinals *Echinaster colemani*
- 1' 2 oral furrow spines, 2 suboral, 1–7 on marginals and 3–5(8) on abactinals *Echinaster farquhari*

Echinaster colemani Rowe & Albertson, 1987 (Pl. 20)

Echinaster colemani Rowe & Albertson, 1987: 196; Rowe & Gates 1995: 59; A.M. Clark 1995: 223.

MATERIAL EXAMINED:

NIWA Stns: I77 (1); P51 (1).

DISTRIBUTION: *Echinaster colemani* is known from eastern Australia, ranging from Queensland to Bass Strait, and also to Norfolk Island. Depth range 17 to 40 m (possibly to 101 m).

STUDY SPECIMENS: NIWA Stns I77, R 130 mm, r 14 mm; P51, R 137 mm, r 18.5 mm. Both specimens dried and somewhat contorted. (Both identified by Dr F. W. E. Rowe.)

DESCRIPTION: *Outline* markedly stellate, disc small, and five rounded rays gradually tapering to a small, blunt tip. A thick skin covers body and invests spines, but does not extend to their tips.

Abactinal skeleton an open reticulum, enclosing more or less pentagonal papular areas. Larger, or primary plates are present at junctions of papular areas, while smaller or secondary plates, margin these areas.

Superomarginal plates irregular in shape, mostly with four lobes, forming an almost straight series along lower margin of arm. Inferomarginals similar, slightly larger.

Intermarginal plates, small, irregular, in a single series extending to about 1/4 R.

Primary abactinal plates have 2–4, rarely up to 8 small spinelets, up to about 2 mm long; secondary plates usually have a single spinelet. Marginal plates have 2–3 similar spinelets, some intermarginal have a single spinelet.

Actinal plates in a single series, extending to about 1/4 R; each with a single spinelet.

Adambulacral plates wider than long, separated by distinct, membranous spaces. A single small spine, in furrow; 2–3 subambulacral spines, if 3, middle spine, usually flattened and scoop-shaped distally, other 2 are usually rounded in section.

Oral plates small, with 1–2 furrow spines, and 4–6 suboral spines, in a single or double series along plate.

Anal aperture not apparent.

Madreporite relatively prominent, standing above abactinal surface, placed about 2/3 r from disc centre; rounded, diameter 4 mm, with coarse, radiate sculpture, and a few spinelets around margin.

Papulae not conspicuous. Abactinal papular areas are up to about 7 mm, in diameter, each with usually 6–8 (5–14); papulae are present to superomarginals, but not below. Between marginals, and actinally, skin is often puckered, resembling a papula, but a close examination shows they are not present.

Tubefeet are biserial, with a small, though distinct sucking-disc.

COLOUR (dried specimens): Dark, almost black. In life, it is recorded as velvet brown, with purple papulae.

REMARKS: This species appears closely related to two endemic Australian species, *E. arcystatus* H.L. Clark, and *E. glomeratus* H.L. Clark, recorded from western and southern Australia, and all 3 have clusters of spines on the primary abactinal plates. *E. glomeratus* has the abactinal spines in large groups of 5–60, with papulae extending to the inferomarginals; *E. arcystatus*, like *E. colemani*, has papulae extending only to the superomarginals, but has 11–40 or even up to 60 papulae to each area.

Echinaster farquhari Benham, 1909 (Pl. 21)

Echinaster farquhari Benham, 1909: 98, pl. 8 (1–4); Fell 1958: 13; 1960: 62, pl. 3: H.E.S.; Clark 1970: 4; A.M. Clark 1995: 224.

MATERIAL EXAMINED:

NIWA Stns: D132 (1); G307 (1); G684 (1); G940 (3); G886 (10); J55 (1); Q11 (1); Q20 (2); Q93A (1); S30 (1); S134 (1); S238 (1); S260 (1); T40 (1); T754 (1); T758 (1); T760 (2); (1 is 4-rayed).

DISTRIBUTION: This species was first recorded from off Otago Heads, 33–70 m. Fell (1960) mentions specimens from Cook Strait as well as the Chatham Rise; the depth range is given as 74–711 m in Clark (1970). The present records are from the Chatham Rise, Fiordland, Otago and southern New Zealand shelf, Snares Islands; Bounty Platform and off the Auckland Islands, 0–402 m.

STUDY SPECIMEN: NIWA Stn Q11, R 49 mm, r 11 mm; br 12 mm.

DESCRIPTION: *Outline* stellate, with five arms slowly and evenly tapering to a blunt tip. Arms rounded above, almost flat on ventral surface, ventrolateral angle rounded. Slight though obvious interradiial furrows present abactinally.

Abactinal plates narrow and elongate, shape variable, forming a reticulate skeleton, with relatively large meshes, each mesh with 1–3 papulae. Plates have 1–3 short blunt spinelets. A thick skin covers the plates and the spinelets to their tips, so that the groups often appear broad-based.

Marginal plates more conspicuous towards the arm-tip; superomarginals with 1–4 spinelets, clothed in skin, the spinelet groups often in a longitudinal series; inferomarginal plates broader and usually aligned transversely with 3–7 spinelets in a webbed series.

Intermarginal plates in a single series, extending to about 1/3R, the individual plates with 2–4 webbed spinelets.

Actinal plates in 2 series on disc, with one extending to about 3/4R, the plates are small, transversely aligned, each with 2–4 webbed spinelets.

Single papulae or glands are present from below the superomarginal plates to between the actinal plates. They are absent between actinals and adambulacrals.

Adambulacral plates short, wider than long; deep in furrow is a small compressed straight spinelet, and there are usually 4 subambulacral spines in a row, sometimes irregular, across the plate. These subambulacral spines are stubby, tapering only at the rounded tip; that at the furrow edge is probably the largest spine on the specimen; the skin invests only the bases of these spines.

Oral plates small, with 2 furrow spines and 2 suboral spines.

Adambulacral furrows narrow, tubefeet in two series.

Madreporite inconspicuous, placed almost midway to margin from disc centre, slightly raised, with a few spinelets and covered by thick skin.

COLOUR (preserved specimens): Dull uniform light brown.

REMARKS: The largest specimen examined, NIWA Stn S30, has R 92 mm, r 16 mm, br. 18 mm. Some lobate plates have up to 8 spines, but most have 3–5 usually arranged in a single series, individual series are slightly spaced. Even at arm tip, spines, which are usually single, remain distinctly spaced. Adambulacral plates are wider than long over most arm, and furrow margin has a small and narrow median carination.

Adambulacral plates with 4–6 spines, in a single transverse series across plate. Innermost spine small, only slightly flattened if at all, base is only slightly set down in furrow. Spine at furrow edge is largest, round, blunt-tipped, sturdy; outer spines similar, decreasing in size from furrow. Occasional spines at furrow edge flattened with broad face to furrow, tip may be bifid; occasional spines on actinal surface are paired. A transverse web of skin links all adambulacral spines.

Henricia Gray, 1840

Echinasteridae with the disc small and the arms elongate, and subcylindrical. Abactinal skeleton reticulate, with irregular meshes, the marginals usually more prominent and regular. Intermarginal plates usually present proximally. One or more series of actinal plates. Abactinal marginal and actinal plates with one or more small spines, in linear series or groups. Adambulacral plates with the spines in one or more transverse series, or clustered. Papulae usually present below the inferomarginals. Thin skin may invest the plates and spines, but does not link the adambulacral spines in a longiseries.

TYPE SPECIES:

Henricia oculata Pennant, 1777

REMARKS: I have not attempted an extended discussion of the affinities of local species with those known from elsewhere. Such discussion should be based on examination of specimens, especially the type material. In the species *H. aucklandiae*, *H. lukinsii*, and *H. ralphae*, occasional specimens may have an enlarged and erect median oral spine, but it is not hyaline or recurved, as in *Odontohenricia*.

KEY TO SPECIES

- 1 Subambulacral spines are clustered or in 2–3 rows 2
- 1' Subambulacral spines in a single row 7
- 2 Subambulacral spines in 2–3 rows, sometimes irregular 3
- 2' Subambulacral spines numerous and clustered . 4
- 3 Skeleton compact with numerous abactinal spinelets; inferomarginals adjoin actinal plates; usually 1 papula to skeletal meshes
..... *Henricia aucklandiae*
- 3' Skeleton open, abactinal plates with 1–6 spinelets; inferomarginals and actinals often joined by small narrow plates; 1–4 papulae to skeletal meshes
..... *Henricia obesa*

- 4 Abactinal spinelets clustered 5
- 4' Abactinal spinelets in linear series 6
- 5 3–4 larger spines at furrow edge in a fan-like arrangement; 20–35 spines on marginal plates; papulae occur between inferomarginals and actinals *Henricia compacta*
- 5' 1 larger spine at furrow edge; 15–20 spines on marginal plates; no papulae between inferomarginals and actinals *Henricia studeri*
- 6 Most skeletal plates with spines set on a ridge; oral plates conspicuous; actinal plates extend to about 1/4R, actinal papulae confined to disc
..... *Henricia kapalae*
- 6' Skeletal plates more or less smooth; oral plates inconspicuous; actinal plates extend to beyond 1/2R; actinal papulae extend beyond disc
..... *Henricia sufflata*
- 7 5 arms; marginal plates with 2–6 spines; actinals extend to about 1/2R; suboral spines present 8
- 7' 6 arms; marginal plates with 1 spine; 2–3 subambulacral spines; actinals extend to about 1/3R; no suboral spines *Henricia tahia*
- 8 Abactinal spines in clusters; 5–6 subambulacral spines *Henricia lukinsii*
- 8 1–3 Abactinal spines and often lacking; 3–4 subambulacral spines *Henricia ralphae*

Henricia aucklandiae Mortensen, 1925 (Pl. 22)

Henricia compacta var. *aucklandiae* Mortensen, 1925: 308.
Henricia aucklandiae Fell: 1960: 62; A.M. Clark 1962: 48; 1995: 232; H.E.S. Clark 1970: 4, 6; McKnight 1973a: 142; 1993a: 192, 198 (non *Henricia aucklandiae* McKnight, 1984 = *H. studeri*)

MATERIAL EXAMINED:

NIWA Stns: A721 (1); A734 (4); A738 (3); A748 (2); A750 (3); C601 (2); D42 (2); D50 (2); D80 (2); D109 (1); D143 (3)*; D208 (1); D209 (1)*; D595 (1); D877 (1); D882 (1); D896 (1); E161 (3); F122 (1)*; F149 (1); G156 (1); G159 (1); G163 (1); G259 (1); G290 (2); I661 (1); J55 (1); Q16 (1); S36 (4); S55 (7); S85 (1); S125 (1)*; T40 (2); T43 (5); T46 (1); T622 (1); W426 (1); Z6830 (2); TAN0307/41 (3); TAN0307/43 (4).

DISTRIBUTION: This species is recorded from the Marlborough Sounds, the Chatham Rise and Chatham Islands, Bounty and Antipodes Islands, the Snares, Auckland and Campbell Islands, and the southern New Zealand shelf and upper slope, 0–580 m.

STUDY SPECIMEN: NIWA Stn J55, R/r/br = 24/6/6 mm.

DESCRIPTION: *Outline* stellate, with 5 slowly and regularly tapering arms, disc inflated with slight interradial abactinal furrows. Arms rounded abactinally, margin of rays rounded. Actinal surface almost flat, a slight interradial furrow extends from behind oral plates to the margin.

Abactinal plates variously shaped, forming a relatively close-knit reticulum, the meshes small, each usually with a single papula. Plates covered by numerous small spines with angular tips.

Marginal plates inconspicuous, plates of both series with a double transverse row of spines, similar to those on abactinal plates.

Intermarginal plates few, confined to arm base, each with 2 rows of spines.

Actinal plates small, in a single series, extending to about 2/3R along the arm. Plates with 2 transverse rows of spines.

Adambulacral plates with a slight carination on furrow margin. A small spine relatively deep in the furrow, 8–10 subambulacral spines, in 2 transverse series; spines decreasing in size from the furrow margin; the first pair bluntly rounded at the tip, the others gradually becoming like those on the actinal plates.

Oral plates small and inconspicuous, each has 3–4 stubby furrow spines, largest proximally and 1–3 distal suboral spines.

Papulae single throughout, one series below inferomarginals extending to near arm tip.

COLOUR (dried specimen): Dull uniform very light brown. In life “bright orange, paler below” (Fell 1960: 63).

REMARKS: A larger specimen, NIWA Stn D877, R 38 mm, r 9 mm, br. 9 mm, has up to 12 subambulacral spines, arranged in 2 rows across plate, with occasional spines of a third row, and up to 35 spines on proximal marginal plates. The second actinal series of plates is restricted to arm base, and intermarginals do not extend beyond 1/3 R.

H. aucklandiae appears closely related to *H. obesa* (Sladen), a near circumpolar species. It differs in having a more compact skeleton, with a single papula to each mesh, more abactinal spinelets and lacks small supplementary plates connecting the inferomarginals and actinals.

Henricia compacta (Sladen, 1889) (Pl. 23)

Cribella compacta Sladen, 1889: 543, pls 96 (1, 2), 98 (3, 4).
Henricia compacta: Mortensen 1925: 307; Fisher 1940: 163, 164, 166; A.M. Clark 1995: 232; H.E.S. Clark 1970: 4; Rowe & Albertson 1987: 186; Rowe & Gates 1995: 61.

MATERIAL EXAMINED:

NIWA Stns: A751 (3); B173 (1); B683 (2); C620 (1); C703 (2); D137 (1); D159 (1); D176 (2); D178 (1); D203 (1); D204 (2); D207 (1); D211 (1); D221 (1); D224 (1); D226 (2)*; D230 (1); D231 (1); D232 (1)*; D244 (1); E75 (1); E121 (1); E409 (1); E411 (1); E423 (1); E748 (1); E772 (6); E774 (1); E820 (1); E840 (1); E879 (2); E880 (1); F91 (2); F95 (2); F99 (5); F100 (1); F107 (3); F108 (1); F120 (1); F127 (1); F135 (1); F151 (5); F874 (1); G663 (1); G688 (4); G700 (2); G824 (1); G825 (1)*; G886 (1) (6-rayed); G910 (3); G937 (1); G938 (1); I25 (1); I36 (3); I366 (2); I672 (3); I678 (1); I683 (8); I699 (3); J24 (2); J25 (1); J27 (1); J29 (1); J30 (2); J31 (6); J32 (2); J33 (3); J34 (2); J35 (2); J36 (4)*; P120 (1); P661 (1); P927 (2); Q17 (1); S14 (1); S65 (3); S68 (1); S140 (1); S142 (1); S166 (1); S174 (1); S378 (2); S568 (2)*; U197 (1); U227 (27); U582 (1)*; V361 (1); W427 (1); W430 (1); X503.(1); X505 (1); Z8371 (1); Z9001 (1 large, 6 rays); Z9008 (1); Z9017 (1); Z9304 (1); Z9376 (1); Z9582 (1); TAN0118/46 (1); TAN0306/06 (1); TAN0306/08(3); TAN0307/68 (3); TAN0307/83 (1); no label (1).

DISTRIBUTION: This species is recorded from north of New Zealand, and west of central New Zealand, to the Campbell Plateau in the south. It is by far the most common species of *Henricia* in the New Zealand area, 180–1357 m. It is also known from southern and south-eastern Australia, 146–1150 m.

STUDY SPECIMEN: NIWA Stn J32, R 28 mm., r 5 mm, br. 5.5 mm.

DESCRIPTION: The *outline* is stellate, the five sub-cylindrical arms tapering very slowly to a small, blunt tip; the disc is inflated, with very slight interradial furrows both abactinally and actinally.

Abactinal skeleton composed of small, close-set plates forming a close reticulum, with small meshes. Plates are ovoid to crescentic in outline, and have up to 25 short spines, the longest about 0.75 mm. The spines taper either at base or throughout length, and terminate in a fine sharp point, with 1–2 subterminal points also present; the distal half or more of spines is noticeably glassy, and fenestrate.

Marginal plates are ovoid to only slightly lobate, with the superomarginals longer than wide, and the

larger inferomarginals wider than long. The plates have small spines like those on the abactinal plates, with about 20 on the superomarginals, and up to 35 on the inferomarginals, where they tend to form longitudinal rows.

A single series of small *intermarginal plates*, which extends to about 1/5 R; these plates have spines similar to those on marginal and abactinal plates.

Actinal plates are in a single series extending to beyond 1/2 R, and usually to beyond 2/3 R. The plates are ovoid to squarish, and have up to 15 small spinelets.

Adambulacral plates with a small, narrow furrow carination, are slightly spaced apart, and are a little wider than long over most of arm. There is one small flattened spine deep in furrow, usually a second above it, out to about 1/2 R; 4–6 larger spines are set in more or less fan-like arrangement at the furrow edge. On the actinal surface are up to 20 smaller spines. Towards arm tip, furrow margin is more angular, with usually only 2–3 spines at the furrow edge.

Oral plates small and inconspicuous, each with up to 6 furrow spines, and a similar number of suboral spines.

Anal aperture small and circular, centrally placed, and surrounded by small spines.

Madreporite low, inconspicuous, placed at about 1/2 r from disc centre, rounded, diameter 1.5 mm; the sculpture consists of a few coarse grooves, and the intervening ridges have a covering of spines.

Papular areas small and have usually a single papular pore, almost completely filling the mesh. Sometimes in proximal half of arm there are 2–3 papulae in the abactinal meshes, with one always largest. On the actinal surface is a single series of papulae below the inferomarginals and none between actinals and adambulacrals.

Tubefeet biserial, with distinct sucking-discs.

COLOUR (preserved specimens): Uniform creamy-white.

REMARKS: Rowe and Albertson (1987) have described this species from a large number of specimens collected off eastern Australia. The size is larger, with R up to 85 mm, and these specimens have more spines on all plates, and on adambulacral plates there may be 3 spines in furrow, 2–3 at furrow edge, and up to 35 on rest of plate.

This species is distinguished among the local fauna by the numerous abactinal and subambulacral spines. Fisher (1940) referred *H. compacta* to a small group of species including *H. abyssalis* (Perrier), *H. praestans* (Sladen), and *H. studeri* Perrier. A.M. Clark (1962) separated *H. compacta* and *H. studeri* on geographic

grounds only. O'Hara (1998) has discussed differences between these species.

Henricia kapalae Rowe & Albertson, 1987 (Pl. 24)

Henricia kapalae Rowe & Albertson, 1987: 192.

MATERIAL EXAMINED:

NIWA Stn Z10170 (1).

DISTRIBUTION: This species is now recorded from off Mahia Peninsula, North Island, 865 m. It has previously been recorded from southeastern Australia, 170–1070 m.

DESCRIPTION: R/r = 81/16 mm. *Disc* and arms slightly inflated on abactinal surface, interradial arcs acute, arms very gently tapering.

Abactinal plates of disc roughly bar-like, those of arms becoming crescentic; plates with a median ridge bearing a single row of short spinelets up to 0.5 mm long. The spinelets taper to a sharp point, and are often beset with minute thorns; a web of skin connects the bases of the individual spinelets. Rarely the spinelets are arranged in a short double series. In each interradius there is a slight sulcus, composed of slightly enlarged and stronger plates, with fewer spines.

Marginal plates of both series distinct and regularly arranged, though not conspicuous. Superomarginals about as long as wide, the spiniform ridge almost transverse; inferomarginals much wider, about twice as wide as long, with a transverse spiniform ridge. Occasional plates with spinelets in a double row. Intermarginal plates similar to the superomarginals are present proximally, in 2 rows.

Actinal plates are present in 2–3 rows, the longest extends to beyond the mid-arm; the others are much shorter. The actinal plates are ridged like the abactinal plates, but the plate and ridge is straight and often the spinelets of actinal and marginal plates are aligned.

Adambulacral plates short, with 2–3 spinelets in the furrow in a vertical series; proximally there are usually 3 spines, beyond the arm base usually 2; the spines are usually stout but occasionally they are quite thin. At the edge of the furrow is a single prominent spine, with 2 similar spines immediately outside of it, and up to 22 more slender spines which grade into the actinal series.

Papular areas sunken, owing to the spiniform ridges on the plate, with 1–4 (usually 1) papulae to each area; papulae occur abactinally, intermarginally and on the actinal surface appear more or less confined to the disc.

Madreporite placed at about 1/3 r from the disc margin, it projects slightly, is rounded, diameter about 2 mm, and has spinelets over the exposed surface.

Adambulacral furrows narrow, tubefeet have distinct sucking-discs and are biserially arranged.

Oral plates large with several spines, each with 8–12 furrow spines in a series along the furrow margin and extending along the distal edge of the plate; on the actinal surface are usually 2 rows of suboral spines though not very regularly arranged. The distal oral spines and the first row of subambulacral spines lie close together and may be difficult to separate.

COLOUR (specimen frozen, then preserved): Very light brown, with the underlying plates cream, the larger abactinal plates of the sulcus almost white.

REMARKS: In the monoserial arrangement of spinelets on the abactinal plates, this species resembles *H. sufflata*, differing, however, from all local species in the large oral plates, with numerous spines.

Henricia lukinsii (Farquhar, 1898) (Pl. 25)

Cribella lukinsii Farquhar, 1898: 190.

Henricia lukinsii: Mortensen 1925: 304, pl. 13 (1, 2); Fell 1953: 90; 1960: 63; A.M.Clark 1962: 48; 1995: 236; H.E.S. Clark 1970: 4, 6; O'Hara 1999: 186; non McKnight 1984: 142 (*Henricia obesa*).

MATERIAL EXAMINED:

NIWA Stns: A735 (13); D52 (6); D53 (1)*; D183 (3)*; D193 (7); D186 (1); D595 (9); H680 (2); M797 (2); O866 (3); Q102 (3); S19 (2); S69 (2); Z1819 (4); Z1898 (1); Z1903 (1); Z1904 (1); Z8614 (1).

DISTRIBUTION: This species is recorded from Fiordland, the Chatham, Antipodes, Auckland, and Campbell Islands, 0–40 m.

STUDY SPECIMEN: NIWA Stn Z1903 R/r/br = 15/5/5.5 mm.

DESCRIPTION: *Outline* stellate, with 5 arms, plump basally and tapering to a blunt tip. Disc and arms inflated abactinally, with narrow abactinal interradiial furrows, margins rounded and actinal surface more or less flat, with a sunken interradiial area distal to the oral plates, but not extending to the margin. A thin skin covers both surfaces of the specimen and also the spines.

Abactinal skeleton composed of small lobate plates enclosing areas with 1–3, usually 2 papulae. The abactinal plates bear clusters of short spinelets, the

tips of which are finely denticulate, obvious under magnification when dried.

Marginal plates inconspicuous, but larger than the abactinal plates, regularly arranged. Superomarginals usually with 4 spines, inferomarginals with 5; the spines in a single transverse series.

Intermarginal plates lacking.

Actinal plates in a single row extending to about 1/2R, each with 1–2 spines.

Adambulacral plates wider than long and slightly separated, furrow margin slightly angulated. A small sabre-shaped spine deep in furrow, and 5–6 subambulacral spines in a single transverse series across plates. The spine at furrow margin is the largest and is blunt-tipped; the others are more sharply pointed and decrease in size from the furrow. The spines on the adambulacral, actinal and marginal plates form almost continuous transverse series.

Papulae single, in quite regular series between the marginals and inferomarginals and actinals; beyond about 1/2R they occur between the inferomarginals and adambulacrals to arm tip.

Oral plates small with 3 furrow spines, similar to the larger adambulacral spine, and largest proximally; one smaller suboral spine near distal margin of plate. Distal to each pair of oral plates the actinal surface is depressed, this area not extending to the margin; near its outer end are 2 apparent papular pores, which may be the openings of the gonads, since they do not appear to align with any of the rows of papulae.

Madreporite inconspicuous, placed about 1/2r from disc centre, rounded, slightly inflated, with coarse sculpture, more or less concealed by spinelets. Anus at disc more or less central, concealed by spinelets.

Ambulacral furrows narrow, tubefeet in 2 uncrowded rows with distinct sucking-discs.

COLOUR (preserved specimen): Uniform dull deep brown. In life, bright orange, paler on actinal surface (Fell 1953: 91).

REMARKS: As indicated, there have been misidentifications of this and other species of *Henricia* in the study area. Larger specimens than that described often have the spines on the actinal and marginal plates in 2 transverse series, and there may be a double row of spines on occasional adambulacral plates. In some specimens one or more of the pairs of oral plates have a slightly enlarged median spine, though this is not recurved or hyaline.

This species is closely related to *H. pagenstecheri* (Studer) from South Georgia and *H. simplex* (Sladen) from Tristan da Cunha. While Mortensen (1924) and Fisher (1940) noted differences between *H. pagenstecheri*

and *H. lukinsii*, A.M. Clark (1962) separated them only on geographic grounds.

Henricia obesa (Sladen, 1889) (Pl. 26)

Cribella obesa Sladen, 1889: 544, pls 96 (3, 4), 98 (5, 6).

Henricia obesa Fisher 1940: 164, pl. 11 (2); A.M. Clark 1962: 48; 1995: 237; McKnight 1984: 143; Rowe & Gates 1995: 61; O'Hara 1999: 183, pl. 2(a).

Henricia lukinsii: McKnight 1984: 143 (non *Cribella lukinsii* Farquhar, 1898).

MATERIAL EXAMINED:

NIWA Stns: A695 (1); A698 (1); B339 (3); C733 (3); E228 (17); E230 (1); E235 (2); E236 (6); E237 (7).

DISTRIBUTION: Within the New Zealand region this species is known only from Macquarie Island, 0–433 m, and is apparently circumpolar in subantarctic waters.

STUDY SPECIMEN: NIWA Stn B339, R 29 mm, r 7.5 mm, br. 8 mm.

DESCRIPTION: *Outline* stellate with the five arms tapering to a small, blunt tip; the arms are subcylindrical, plump at the base, and the disc is inflated, but lacks interradial furrows.

Abactinal skeleton forms a relatively open reticulate network, with large, conspicuous meshes. The abactinal plates are irregularly lobate, and connected by elongate secondary plates. Each has 1–4 short spines, arranged in a single series. In general appearance, skeletal meshes are more or less margined by a single row of spines.

Marginal plates inconspicuous proximally, and in this specimen difficult to trace. The superomarginals are longer than wide, and have 2–3 spines; the inferomarginals are wider than long and have 2–4 spines. One row of intermarginal plates is present, extending to about 1/2 R. At the arm base is a second, shorter intermarginal row. Most intermarginals have 1–2 spines, but some are without spines.

Actinal plates in a single series extending to near the arm tip, and a second series is present at arm base; these plates have 1–3 spines.

Adambulacral plates wider than long, are narrowly spaced apart, and have a small furrow carination. Each has a small spine deep in the furrow, and at the furrow edge is a larger spine, behind which are 3–4 spines across plate, decreasing in size outwards. Sometimes the spines on the actinal surface are not aligned with that at furrow edge, so that there appears to be 2 spines near or at edge.

Oral plates small, have 4 furrow spines, and 2–3 suboral spines.

Anal aperture rounded, more or less central, surrounded by small spines.

Madreporite very inconspicuous, placed at about 1/2 r from disc centre. It is rounded, diameter 1.5 mm, and has a few pits and spines on its surface.

Papulae 1–4 in abactinal skeletal meshes, which they do not fill, leaving noticeable areas covered by skin. On the actinal surface there are no papulae between adambulacrals and actinals, so that it is only near tip of arm that papulae are present next to adambulacrals.

Tube feet biserial, with distinct sucking-discs.

COLOUR (dried specimens): Uniform creamy-white to dull brown.

REMARKS: Larger specimens have subambulacral spines in 2 transverse rows, and small elongate plates linking inferomarginals and actinals.

H. obesa is very similar to *H. aucklandiae* Mortensen, and O'Hara (1998) suggested that the latter may be only a regional variant, also noting that other methods of discrimination besides morphology are needed to assist in species recognition.

Henricia ralphae Fell, 1952 (Pl. 27)

Henricia ralphae Fell, 1952: 8; H.E.S. Clark 1970: 4, 6; A.M. Clark 1995: 239.

MATERIAL EXAMINED:

NIWA Stns: B590 (1); B592 (2); D43 (1, 6 rays); D78 (1); D103 (3); D131 (2); D132 (11, 1 with 6 rays); D133 (7); D139 (3); D144 (2); D173 (3); D200(24); F78 (2); F93 (3); F97 (6); I711 (1); T40 (1); Z5357 (1); no label (1).

DISTRIBUTION: This species is recorded from off Oamaru southwards to the Auckland Islands, 71–159 m.

STUDY SPECIMEN: NIWA Stn Z5357, R 69 mm, r 14 mm, br. 15 mm (det. H.B. Fell).

Description: *Outline* stellate, with five arms relatively plump at the base, and gradually tapering to a blunt tip. The disc is inflated, with narrow interradial abactinal furrows; and the actinosome is slightly sunken, but there are no actinal interradial depressions. The arms are flattened, but in life were probably subcylindrical. Abactinal skeleton irregularly reticulate, with relatively large meshes. The larger plates have 1–3 simple, blunt-tipped spines, up to 1.5 mm long placed at their centres, and the groups of spines are relatively few and isolated, so that much of the abactinal surface is spineless.

Marginal plates of both series cruciform; the superomarginals form a sinuous line proximally, and

have 2–3 spines, like those on abactinal plates. The inferomarginals have 2–4 spines.

Intermarginal plates present out to about 1/2 R; they are also cruciform, and some of the proximal plates have a single spine. At the arm base, a short second series of intermarginals is present.

Actinal plates in a single series extending to about 1/2R; the plates are also cruciform, and have 1–3 spines. Adambulacral plates are wider than long throughout and separated by membranous interspaces, the furrow margin with a small narrow median carination. The adambulacral spines are in a single transverse series, with 1 one small sabre-like spine in furrow, and 4–5 five rounded, blunt-tipped subambulacral spines, decreasing in size from furrow, and with outermost spine placed at a slight distance from rest. The spines on the plates of the actinal and lateral surfaces are well-spaced from each other, with conspicuous bare areas between.

Oral plates small, with 3–4 furrow spines, and 1–2 suboral spines.

Anal aperture is almost central, small, and surrounded by small spines.

Madreporite placed at a little more than 1/2 r from the disc centre; it is rounded, diameter 2 mm, and is tumid, projecting well above abactinal surface. The sculpture consists of a few deep and narrow grooves, and there are some spines on surface.

Papulae 1–4 in skeletal meshes. On the abactinal surface they do not fill meshes, while below superomarginals they do. Papulae occur between adambulacrals and actinals, and distally between adambulacrals and inferomarginals.

Abactinal and actinal surfaces are covered by skin, which covers over the plates, extends over skeletal meshes, and also forms a basal web on spines.

Ambulacral furrow narrow, tubefeet biserial, with distinct terminal sucking-discs.

COLOUR (dried specimen): Uniform light brown.

REMARKS: This specimen agrees with the original description in the size, shape and sparse abactinal spinulation; it differs, however, in having fewer spine on the marginal plates. Most NIWA specimens recorded are much smaller.

A small specimen from NIWA Stn D132 has R/r/br = 19/5.5/6 mm. The abactinal skeleton is relatively open, with 1–4 papulae to each area. Abactinal spines are rare, while both series of marginal plates have 1–3 spines. There are a few intermarginals at the arm base; actinal plates, each with a single spine extending to about 1/3R. Adambulacral plates with 4 spines across the plate, and a smaller spine in the furrow; oral plates with 3–4 furrow spines, and 1 distal suboral spine.

H. ralphae differs from other local species in the sparse abactinal spinulation and it attains a much larger size. It appears most closely related to *H. lukinsii* (Farquhar) that has clustered rather than isolated abactinal spines, and usually 1 more subambulacral spine.

Henricia studeri Perrier, 1891 (Pl. 28)

Henricia studeri Perrier, 1891: 102, pl.9 (2); Fisher 1940: 183, pl. 11 (10); Clark & Downey 1992: 398; A.M. Clark 1995: 242; O'Hara 1999: 186, pl. 2b (3a–c).

Henricia aucklandiae: McKnight 1984: 143 (non *H. aucklandiae* Mortensen 1925).

MATERIAL EXAMINED:

NIWA Stns: C733 (1); C734 (1); E236A (1); E237 (8).

DISTRIBUTION: This species is recorded from Macquarie Island, 100–450 m, and is apparently circumpolar in the subantarctic, 74–527 m.

STUDY SPECIMEN: NIWA Stn E236A, R 41 mm, r 8 mm, br. 9 mm. (Specimen identified by T. O'Hara, flattened in storage.)

DESCRIPTION: *Outline* stellate with five arms gradually tapering to a small blunt tip.

Abactinal plates more or less elongate, straight or curved, and form a reticulate skeleton, with comparatively small meshes; most plates have 10–12 short spines; a few larger disc plates have up to 20, on the arms there are seldom more than 10. The spines stand in groups, which are usually slightly separated; they usually do not taper, and the tip may be a little expanded, ending in a few small prongs.

Marginal plates small, though distinct, both series are wider than long, with the inferomarginals the larger. The superomarginals have about 15 spines, the inferomarginals 20, and the intermarginals 12.

Intermarginals in a short series, which does not extend as far as 1/3 R, and at the arm base are a few plates of a second row.

Actinal plates in a single series extending to the distal third of the arm, and at the arm base are 2–3 plates of a second series. The plates are wider than long, and have up to 20 spines.

Adambulacral plates wider than long, slightly separated, and have a small furrow carination. There is a small spine deep in furrow, and one larger, blunt-tipped spine at furrow edge; standing just behind this spine are 2 slightly smaller spines, and the rest of actinal surface has 8–12 smaller spines, decreasing in size from furrow, and arranged in 2 irregular series.

Oral plates small and inconspicuous each with 5–6 furrow spines, and 6–8 suboral spines, the latter usually in 2 longitudinal rows.

Anal aperture is near central, quite conspicuous, and is encircled by a ring of slightly enlarged plates.

Madreporite is placed at just over 1/2 r from disc centre, has coarse sculpture, with the ridges beset with spines; is rounded, diameter 1.5 mm, and is inconspicuous.

Papulae 1–4 abactinally, which, if more than 2, are small, and do not fill the small skeletal meshes. Between the proximal marginals and below inferomarginals are often 2 papulae to each mesh, distally there is 1. There are no papulae between adambulacrals and actinals.

Adambulacral furrows are narrow, and the tubefeet are biserial with distinct sucking-discs.

COLOUR (preserved specimen): Dull cream to light brown.

REMARKS: *H. studeri* is related to *H. compacta* (Sladen), *H. abyssalis* (Perrier) and *H. praestans* (Studer), all with numerous spinelets on each plate. *H. compacta* differs in having a more compact skeleton and fewer superomarginals than inferomarginals. *H. praestans* has secondary abactinal plates and knob-like furrow spines, while *H. abyssalis* has actinal plates in 2 series, both extending to near the armpit.

Henricia sufflata (Sladen, 1889) (Pl. 29)

Cribella sufflata Sladen, 1889: 549, pls 96 (5, 6); 98 (1, 2).

Henricia sufflata: A.M. Clark 1962: 49; 1995: 242; McKnight 1973a: 14.

MATERIAL EXAMINED:

NIWA Stns: E849 (1); T262 (1); U197 (1).

DISTRIBUTION: This species is known from the Kermadec Islands and, to the north of New Zealand, Three Kings Rise and Lord Howe Rise, 216–1186 m.

STUDY SPECIMEN: NIWA Stn E849, R/r/br = 36/6/6.5 mm, specimen has been dried, and plates are distinct.

DESCRIPTION: *Outline* stellate, with five subcylindrical rays slowly tapering to a small blunt tip.

Abactinal skeleton forms a close-meshed reticulum, composed of mainly narrow elongate plates, or equally narrow lobate plates; almost all are of the same size, so that no secondary plates are evident. At the centres of the lobate plates or arranged in a single series along the others, are three to five small spines, up to

0.5 mm in length; these spines taper distally and terminate in a few sharp points, with that at the tip usually the longest. Groups of spines are semi-isolated, particularly those on lobate plates.

Marginal plates in two more or less regular series, the inferomarginals are about twice as broad as the superomarginals; both series are cruciform. The superomarginals have 5–7 spines, and the inferomarginals have 8–15, usually arranged in two rows across the plate; the intermarginals have 3–5 spines.

Intermarginals present, similar to marginals but smaller, in one series which does not extend beyond 1/4 R.

Actinal plates in one series extending to about 2/3 R; a short second series is present at the arm-base; the plates have 8–10 spines, usually arranged in two rows across plate, and sometimes almost continuous with inferomarginal spines.

Adambulacral plates wider than long, with a small narrow carination on furrow face, and are slightly separated by membranous intervals. They have a small flattened or sabre-like spine in furrow, one larger spine immediately above it, and two similar spines at the edge of the furrow, with 4–8 smaller spines, on the actinal surface, usually arranged in two transverse rows; sometimes the outermost spines form a longiseries of 3 spines.

Oral plates small and inconspicuous, each has 3–4 furrow and 2–3 suboral spines.

Anal aperture apparent as a small slit near disc centre.

Madreporite placed at just less than 1/2 r from the disc centre, is rounded, with a diameter of 1.5 mm, and has coarse sculpture, consisting of grooves and pits. It is only slightly tumid, and has spines over its exposed surface.

Papulae almost always one to a skeletal mesh, which they almost completely fill. Papulae are present between adambulacrals and actinals, but are small, and relatively inconspicuous.

Tubefeet biserial, with distinct sucking-discs.

COLOUR (dried specimen): Dull uniform brown.

REMARKS: The specimen from NIWA Stn U197 with R/r/br of 72/14/13 mm is almost as large as the holotype (80/12/13–14 mm). The abactinal skeleton is more open often with up to 3 papulae to each mesh. The spinelets on the abactinal plates are more numerous, and form almost continuous series. The marginal plates are less distinct, particularly the superomarginals, while the broad inferomarginals have up to 30 spines.

Fisher (1940) included *H. sufflata* in a species group with *H. obesa* (Sladen) and others. However, it appears more closely related to *H. kapalae* Rowe & Albertson.

This species differs in having distinct ridges on many of the plates and especially in the more prominent oral plates.

Henricia tahia McKnight, 1975 (Pl. 30)

Henricia tahia McKnight, 1975: 57; 1989: 10; 1993b: 185; A.M. Clark 1995: 243.

MATERIAL EXAMINED:

NIWA Stns: Q69 (9); Z2098 (1).

DISTRIBUTION: Known only from the Gifford Seamount and the Three Kings Rise, to the north of New Zealand, 354–841 m.

STUDY SPECIMEN: NIWA Stn Z2098, holotype, R 26 mm, r 6 mm, Br. 5 mm.

DESCRIPTION: *Outline* stellate with 6 equal rays tapering to a small blunt tip, disc slightly inflated, and with slight interradiial furrows abactinally. A relatively thick skin invests abactinal surface, and covers bases of spines. On actinal surface the skin is thinner.

Abactinal skeleton consists of small, irregularly lobate plates, and they form a delicate reticulum, the larger plates either in contact, or joined by smaller subrectangular secondary plates. Secondary plates are present to about 1/2 R, while distally all primary plates are in contact. The larger abactinal plates have 1–3 small spines, none longer than 0.5 mm; most have but a single spine, about 0.25 mm long.

The *marginal plates* are inconspicuous, forming 2 fairly regular series at ventrolateral margin of arm. The superomarginals are slightly lobate, while the slightly larger inferomarginals, which also have small lobes, overlap both superomarginals and actinals. The plates of both marginal series usually have a single spine. At arm base are 2 intermarginal series, one of which extends to about 1/4 R. These plates also have a single spine.

One series of *actinal plates* extends to about 1/3 R, and at arm base is another short series; all plates have a single spine.

The *adambulacral plates* are a little wider than long, and have a small, flattened spine deep in furrow and 2 larger, rounded spines on actinal surface. Occasional plates have an additional small spine near outer margin.

The *oral plates* are small and each has 2–3 furrow spines, larger than subambulacral spines. There are no suboral spines

The *anal aperture* is not apparent. The madreporite is placed at about 1/2r from disc centre. It is rounded-elliptical in outline, maximum diameter 1.5 mm, the

surface is damaged and sculpture abraded; the remaining intact surface is smooth, and there are no spines on it, or around margin.

Papulae are abundant on abactinal surface, with usually 1 to each of small skeletal meshes. Single papulae also occur between marginals, out to about 1/2 R. Below inferomarginals is a single series of papulae out to 1/3 R, and at arm base are a few papulae irregularly arranged in a further series.

Adambulacral furrows are narrow, and tubefeet are biserial, with distinct sucking-discs.

COLOUR (preserved specimen): Uniform brown to black.

REMARKS: This species is unusual for the genus in that all known specimens are 6-rayed; the very dark colour in the material at hand makes this species quite difficult to describe. It does not appear to have any relatives in the local fauna.

Odontohenricia Rowe & Albertson, 1988

Rays five, or rarely six; abactinal skeleton reticulate, with the plates raised at their centres, forming ridges which carry spinelets; both marginal series present and distinguishable, the inferomarginals the larger; papulae present on abactinal and actinal surfaces; adambulacral plates with 2–3 furrow spines in a vertical series; an enlarged recurved hyaline spine at tip of each pair of oral plates, clearly larger than the adjacent spines.

TYPE SPECIES:

Odontohenricia endeavouri Rowe & Albertson, 1988.

Odontohenricia anarea O'Hara, 1998 (Pl. 31)

Odontohenricia anarea O'Hara, 1998: 188, pl.2 (c-e).

Henricia lukinsii: McKnight 1984 (in part, non *Cribella lukinsii* Farquhar, 1898)

MATERIAL EXAMINED:

NIWA Stn C732A (1).

DISTRIBUTION: This species is as yet known only from Macquarie Island, 69–100 m.

STUDY SPECIMEN: NIWA Stn C732A R/r = 58/10 mm, br. 11 mm.

DESCRIPTION: *Outline* strongly stellate, arms gradually tapering, rounded above, lightly flattened below.

Abactinal plates form a reticulum, plates more or less crescentic, imbricating with 1–3 adjacent

plates. Each plate with a slightly raised ridge that bears 3–8 (1–12) short truncate spinelets, more or less enveloped in a thin skin.

Marginal plates relatively distinct in distal half of arm, the two series separated proximally by two rows of intermarginal plates one of which extends to about the mid-arm. Superomarginals plates with 8–10 spinelets, inferomarginals with 12–20, and intermarginals with up to 8 spinelets.

Actinal plates in two rows at arm base, only one extends along the arm, reaching to just beyond the mid-arm, each plate with up to 6 spinelets; adambulacral plates with a single small straight spine deep in furrow, usually 2 much larger blunt spines at furrow margin, with 4–8 smaller subambulacral spines outside of them, usually in 2 series. Spines on subambulacral, actinal, marginal, and intermarginal plates all form transverse series across the plates, though not always in and aligned series.

Oral plates inconspicuous, each with 3–4 short furrow spines and 1–3 suboral spines. At apex of combined plates is a much larger erect or recurved hyaline spine.

Individual *papular areas* on abactinal surface irregular in shape, each with 1–5 papulae, commonly 3–4; between marginal plates usually 3–4 papulae to each area, but usually single on actinal surface.

On *abactinal surface* in one interradius is a larger rounded, slightly elevated plate with numerous spinelets, assumed to be the hidden madreporite.

Anus not apparent.

Tubefeet biserial throughout with sucking-discs.

COLOUR (dried specimen): Dull medium brown.

REMARKS: This specimen has R about twice that of the type material, but save for more spinelets on some of the plates does not appear to differ significantly. *O. endeavouri* Rowe & Albertson has stellate abactinal plates that are arranged in a closer reticulum, and isolates groups of numerous spinelets. O'Hara (1998) regarded *O. clarkae* Rowe & Albertson from South Africa as the closest relative, with more numerous abactinal and subambulacral spinelets.

Odontohenricia endeavouri Rowe & Albertson, 1988
(Pl. 32)

Odontohenricia endeavouri Rowe & Albertson, 1988: 84; Rowe & Gates 1995: 62; A.M. Clark 1995:

MATERIAL EXAMINED:

NIWA Stn Z9000 (1); Z9223 (1).

DISTRIBUTION: Here recorded from the Bay of Plenty, 445–970 m; previously recorded from southeastern Australia, 128–457 m.

STUDY SPECIMEN: NIWA Z9000, dried and misshapen, R/r = 86/15 mm.

DESCRIPTION: *Outline* stellate, 5 tapering rays, inflated proximally.

Abactinal plates somewhat irregular in shape, varying from ovoid to stellate, raised along midline, and in a close-knit reticulum. Plates carry short spinelets usually in 2–3 irregular rows, though occasionally in clumps of 3–7. Spinelets are about 0.3 mm in length, taper distally to a sharp tip, and the groups are usually enclosed in a thin web of skin.

Skeletal meshes relatively small, with usually only 1 papula to each area. Papulae occur between the marginals and actinals. Lowermost row of papulae is between inferomarginals and adjacent actinals.

Madreporite is more or less covered by rounded clumps of spines.

Anal aperture concealed.

Marginal plates distinct and regularly arranged, not conspicuous, both series more or lobate, the inferomarginals the more distinct owing to their greater height, both series with transverse rows of spines. Two intermarginal series are present proximally, one extending to just over 1/2R, the other confined to the arm base.

Actinal plates in a single row, extending over almost all of arm length, and a second to just over 1/2R; actinal plates are similar to inferomarginals but not as wide, and have spinelets in an irregular double row

Adambulacral plates wider than long, slightly spaced apart. Within ambulacral furrow are 2–3 short, straight blunt spinelets, and across plate are 5–6 spinelets in 2 rows; those at edge of furrow are large and bluntly pointed, much larger than the furrow series; spines decrease in size from the furrow, the outermost almost as small as those on adjacent actinal plates.

Oral plates small, though quite distinct. A large hyaline spine, vertical or recurved at apex of each pair of plates; 5(4) smaller non-hyaline furrow spines and 3 suboral spines towards distal end of plate.

Tubefeet biserial.

COLOUR (dried specimen): Dull medium brown.

REMARKS: This species differs from *O. anarea* O'Hara in the more closely-knit abactinal skeleton, and in having more adambulacral furrow spines.

Family **LEILASTERIDAE** Jangoux & Aziz, 1988

With a distinct interradiial channel extending from near the disc centre to the margin; 2–3 rows of midradial plates, flanked by 2 rows of larger adradials; inferomarginals projecting, pillar-like or pseudo-tabulate, with short spines in a marginal fringe.

Leilaster A.H. Clark, 1938

Leilasteridae with 3 rows of midradial abactinal plates, and a subambulacral comb of spinelets present.

TYPE SPECIES:

Korethraster radians Perrier, 1881: 12

Leilaster spinulosus Aziz & Jangoux, 1985 (Pl. 33)

Leilaster radians spinulosus Aziz & Jangoux, 1985: 287, pls 6, 7.
Leilaster spinulosus: Jangoux & Aziz 1988: 645; A.M. Clark 1993: 355.

MATERIAL EXAMINED:

NIWA Stn Z10818 (1).

DISTRIBUTION: This species is now recorded from Rumble V seamount, offshore to the northeast of northern New Zealand. It is also known from the Philippines and Reunion Island.

DEPTH: 470–730 m.

STUDY SPECIMEN: NIWA Stn Z10818, R/r = 17/9 mm, 10–11 inferomarginals to the arm. The specimen is strongly arched.

DESCRIPTION: *Outline* stellate, with 5 short arms broad at the base, rapidly tapering to a blunt tip. Terminal plate small, naked, almost triangular in outline, with 2 spines on distal margin.

Abactinal plates separated by distinct grooves, more or less tabulate, surface often slightly tumid; plates with several short spinelets, with up to 30 on larger plates, these spinelets with distal third expanded into a distinct very finely rugose head. Abactinal plates form a regular pattern. Midradial region of arm with 3 rows of plates, the central row rounded, the outer a little larger, and round to ovoid, elongate longitudinally. On each side of the midradial region are 2 further rows of longer adradial plates. These rows extend over the length of the arm, or almost so. Below the adradial plates are shorter rows of plates that extend about halfway to the armtip.

Marginal plates distinct. Under adradials are near-vertical superomarginals that are nearly 3 times wider than long, each with 3 vertical rows of up to 25 spinelets. The inferomarginals flare almost horizontally and have about 20 spinelets on the abactinal surface; there are 2–3 short, stubby spines at the outer margin and up to about 10 shorter spines set at the margins of the actinal surface. These spines are finely thorny throughout their length. Extending down the interradius from close to the disc centre to the margin is a distinct though narrow channel, more or less overhung by spinelets on the adjacent plates.

Madrepore small, almost triangular, placed almost 1/4r from the disc centre. It has sparse, coarse sculpture. Papulae are single, distinct though not conspicuous, spaced over the abactinal surface, but not below the superomarginals.

Actinal plates in a single spaced series, those to about 1/2R with 6–8 thorny spines, the distal plates lack spines.

Adambulacral plates about as wide as long, with 4, occasionally 3 furrow spines in a subpalmate group, increasing in length from the proximal; subambulacral spines also 4, set in a slightly oblique row, the proximal longest. Both furrow and subambulacral spine groups basally webbed.

Oral plates relatively conspicuous, each with 7 furrow spines, slightly longer proximally, and united in a basal web. No suboral spines.

Ambulacral furrows narrow, tubefeet are biserial with distinct sucking-discs.

COLOUR: Uniform dull light brown, tubefeet slightly darker.

REMARKS: Specimens of *Leilaster* are rare in collections, and variation within species is not known. For many years the genus was recorded only from the Atlantic Ocean, but it has been recorded from the Philippines as a new subspecies (Aziz & Jangoux 1985) and subsequently from Reunion Island, elevating the Pacific and Indian Ocean form to specific status (Jangoux & Aziz 1988). In addition, these authors established the family Leilasteridae, order Spinulosida, to include *Leilaster* A.H. Clark and *Mirastrella* Fisher.

The present specimen differs from *L. radians* (Perrier) in having more spinelets on the abactinal plates and as such appears referable to *L. spinulosus* Aziz & Jangoux.

Order **FORCIPULATIDA** H.E.S. Clark, 1963

Skeleton variable, regular or not, strongly developed to almost abortive, not forming transverse arches; two series of marginal plates usually visible. Ambulacral plates strongly compressed, so that spines are usually in a single transverse series. Papulae present, sometimes conspicuous. Either only straight or both straight and crossed pedunculate pedicellariae present. Papulae always present.

KEY TO FAMILIES

- 1 Only straight pedicellariae present; disc small, with 5 slender tapering arms; abactinal skeleton composed of regular, closely spaced plates in definite longiseries; alternate adambulacral plates advanced into furrow Zoroasteridae
- 1' Both straight and crossed pedicellariae present; skeleton regular to very irregular, sometimes almost abortive 2
- 2 No marked adoral carina, the first pair of adambulacrals in contact at proximal ends or entirely separated; 5-6 arms; inferomarginals with 1 prominent spine; skeleton an open network; abactinal spinelets small; tubefeet in 2 rows, sometimes 4 rows proximally; abactinal crossed pedicellariae scattered over plates Pedicellasteridae
- 2' An adoral carina present; tubefeet usually in 4 rows at least in adults 3
- 3 No actinal plates; abactinal skeleton a very open network with squarish meshes or abortive; inferomarginal plates with a single spine; abactinal crossed pedicellariae in wreaths around the spines; 6-50 or more arms Labidiasteridae
- 3' Actinal plates often present; abactinal skeleton usually more compact, though variable; abactinal crossed pedicellariae in wreaths around spines or scattered. Arms 5 or more Asteroiidae

Family **ZOROASTERIDAE** Sladen, 1889

Disc small, with 5 long, rigid arms slowly tapering. Skeletal plates regularly and closely arranged in longitudinal and transverse series. Plates with a covering of spinelets, or skin, sometimes also with conspicuous spines. Usually alternate adambulacral plates advanced into furrow. Straight pedicellariae usually present, crossed pedicellariae absent. Tubefeet quadriserial at least proximally. Superambulacral plates may be present.

Zoroaster Wyville Thomson, 1873

Spinelets on abactinal and actinal plates; alternate adambulacral plates advanced into furrow. Rays slender, an adradial series of abactinal plates usually present. Marginal and actinal plates aligned in transverse as well as longitudinal series.

TYPE SPECIES:

Zoroaster fulgens Wyville Thomson, 1873.

KEY TO SPECIES

- 1 Proximal carinal plates with 1-3 spines 2
- 1' Carinal spines entirely absent; adradial series inconspicuous; 16-17 supermarginals to first 10 carinals; R = 6-8r *Zoroaster* sp.
- 2 Proximal carinal plates with 2-3 spines in a transverse row; papulae usually single; 15-16 supermarginals to first 10 carinals, R = 13r *Zoroaster variacanthus* n. sp.
- 2' Proximal carinal plates with 1 spine 3
- 3 Carinal spines fluted; all supermarginals with a spine; papulae usually single; 16 supermarginals to first 10 carinals; R = 16-17r *Zoroaster planus* Alcock
- 3' Carinal spines not fluted 4
- 4 All supermarginals with a spine 5
- 4' Alternate supermarginals with a spine; papulae usually 2 or more; 14 supermarginals to first 10 carinals; R = 7-8r *Zoroaster alternicanthus* n. sp.
- 5 All carinal plates with a spine 6
- 5' Carinal spines absent proximally; supermarginal spines absent; papulae usually single; 15 supermarginals to first 10 carinals; R = 11-15r... *Zoroaster carinatus* Alcock
- 6 Supermarginal spines absent proximally; 10-11 supermarginals to first 10 carinals; papulae usually 2 or more; R > 7r *Zoroaster singletoni* n. sp.
- 6' All supermarginals with a spine and 16-17 to first 10 carinals; papulae usually single; R = 10-15r *Zoroaster spinulosus* Fisher

Zoroaster variacanthus n. sp. (Pl. 34)

MATERIAL EXAMINED:

NIWA Stn P942 (1)

STUDY SPECIMEN: NIWA Stn P942, (holotype), R 171 mm, r 13 mm, br. 14 mm, R/r 13.2/1; 15 supermarginals to first 10 carinals.

DISTRIBUTION: Known only from the Challenger Plateau, western central New Zealand, 914 m.

DESCRIPTION: *Outline* stellate, disc small, domed abactinally; arms, arched on abactinal surface, with a slight carinal ridge, and slowly tapering. 15 superomarginals to first 10 carinals. At arm base, 4 series of actinal plates, 3 at 1/2 R.

Disc plates arranged in 2 circles, the outer includes basals and radials, and has larger plates. Centrodorsal and outer plates tumid.

Carinal plates wider than long over most of arm; adradial series narrow, slightly sunken, extending into distal third of arm. Plates form transverse series from superomarginals downward. Plates of disc and arms densely covered with elongate skin-covered spinelets tending to obscure plate outlines; spinelets are longer on actinal plates. On disc, larger plates have 1–4 short spines, only slightly longer than spinelets, and often partially masked by them. The centrodorsal has 4 spines, plates of the inner cirlet have 1, while the basals have 3–4. First 3–5 carinals (includes radials), have 3 spines in a transverse series, following 2–4 plates have 2. More distal plates, even near arm tip, have 1. No spines on adradial plates.

Marginal plates distinct, each superomarginal has a similar stubby spine. All inferomarginals have a slender spine, usually longer than plate, though it is inconspicuous on inferomarginals. Actinal plates of upper row of actinals also with inconspicuous spine. On lower 3 rows of actinals spine is relatively longer—as long as 2 plates—and is usually flattened.

Prominent *adambulacral plates* have 4 spines, innermost with a cluster of small pedicellariae near tip, and next spine with 1 larger pedicellaria, arising from near base, often extending beyond tip; third spine is at furrow margin and fourth on actinal surface. Neither has associated pedicellariae. Non-prominent plates have 3 spines, middle spine often with a larger pedicellaria attached near base.

Oral plates deeply sunken, each has 2 furrow spines with attached pedicellariae, and 2 suboral spines.

Pedicellariae lanceolate, common on some adambulacral spines, but rare on abactinal surface.

Papulae usually single, rarely 2 to an area, and are inconspicuous; on arms extend down to between lowermost 2 rows of actinal plates.

Tubefeet quadriseriate proximally, in zigzags from proximal third of arm, and biserial distally.

Madreporite small, inconspicuous, rounded, diameter 3 mm, and placed near margin; sculpture is coarse and radiate.

COLOUR (preserved specimen): Dull cream.

ETYMOLOGY: *variacanthus*—in reference to the number of carinal spines.

HOLOTYPE: Deposited in the collections of NIWA, Wellington No. H-852.

REMARKS: This species is distinguished by the dense covering of spinelets on the plates, the multiple spines on the proximal carinal plates, and the relatively low numbers of adambulacral spines.

Zoroaster carinatus Alcock, 1893 (Pl. 35)

Zoroaster carinatus Alcock, 1893: 107; Rowe & Gates 1995: 116.

Zoroaster carinatus philippinensis Fisher, 1916: 30; 1919: 477, pls 116(3), 135(3,3a), 137; Clark & Mah 2000: 233.

MATERIAL EXAMINED:

NIWA Stn J688 (1).

DISTRIBUTION: This species is recorded from Rangatira Knoll, Bay of Plenty, northeastern New Zealand, and the Philippines and the Bay of Bengal, 176–1106 m.

STUDY SPECIMEN: NIWA Stn J688 R 98 mm, r 11 mm, br. 12 mm, R/r 8.9/1. 15 superomarginals to first 10 carinals. At arm base 5 series of actinal plates, and at 1/2 R, 4.

DESCRIPTION: Disc small, *outline* stellate, five slender arms gradually tapering. Disc is domed centrally and arms have an evident carinal ridge.

All *disc plates* rounded, slightly tumid, arranged in 2 circles around centrodorsal, those of outer circle the larger, and radials larger than basals. On arms, most carinal plates wider than long; adradial series slightly sunken, extending almost to arm tip. From superomarginals downwards, plates arranged in transverse series. Plates of disc and arms relatively thickly covered with short spinelets, though plate outlines are visible; spinelets longer on actinal plates. Disc plates lack larger spines; carinals, apart from first 5–10, have a short stubby spine, less than half as long as plate. Adradials and superomarginals lack spines; first 2–3 inferomarginals lack spines, rest have a slender inconspicuous spine, a little longer than plate. Actinal plates have a stronger spine, as long as 2 or even 3 plates on lowermost plates; spine on 2 lower actinal series spine is distinctly flattened.

Prominent *adambulacral plates* with 4 furrow spines; 4–6 spines on actinal face, arranged in 2 transverse series. Innermost spine has 1–5 small pedicellariae in a cluster, near tip; next spine has 1 larger terminal, and sometimes 1–3 smaller subterminal pedicellariae. Other spines usually lack pedicellariae. On non-prominent plates, 2 furrow spines, and 3–4 spines on actinal face. Only innermost spine has a pedicellaria.

Oral plates deeply sunken, each has 3 spines. 2 are suboral, and sole furrow spine has a cluster of small pedicellariae, extending over most of length.

Pedicellariae are small, lanceolate; on abactinal surface are rare, standing at margins of papular areas, and are not conspicuous.

Papular pores inconspicuous, are single, and extend down sides of arms to between 2 lowermost rows of actinal plates.

Tubefeet quadriserial over most of arm.

COLOUR (preserved specimen): Dull cream with tubefeet darker.

REMARKS: This species is readily distinguished by the absence of superomarginal spines, the absence of proximal inferomarginal spines, and the relatively small pedicellariae.

Zoroaster singletoni n. sp. (Pl. 36)

MATERIAL EXAMINED:

NIWA Stns: E867 (1); J44 (1); J45 (2); J47 (1).

DISTRIBUTION: Known only from the New Caledonia Basin, 1392–2162 m.

STUDY SPECIMEN: NIWA Stn J45 R 130+ mm, r 17 mm, br. 14 mm, R/r 7.6+/1; 10–11 superomarginals to first 10 carinals. At arm base 4 series of actinal plates, near arm tip of broken arms, 2.

Description: *Outline* stellate, the five relatively broad arms tapering slowly. Disc domed, arms arched on abactinal surface, with a low carinal ridge.

Plates of disc arranged in 2 circles around centrodorsal, slightly raised centrally to form a rounded or irregular flat-topped area, margins are produced into short lobes. Plates of outer circle—basals and radials—are larger and conspicuous. On arms, plates in regular longiseries, also regular transverse series from carinals downwards. Carinals wider than long, with lateral margins produced, rounded, not scalloped by papular pores, as these lie between lateral lobes of plates. Adradial series almost aligned with carinals and superomarginals; narrow, not sunken, extending to about 2/3 R. Plates of disc and arms covered with small spinelets that do not obscure plate outlines. Disc plates lack larger spines, but most carinals have a short, stubby central spine, length less than that of plate

Marginal and actinal plates wider than long. Spinelets longer on plates below superomarginal series. Superomarginals, from about fifth, have a similar, stubby spine at centre of plate, but it is much less con-

spicuous. Inferomarginals and each actinals have a slender spine, longer than plate. On lowest actinal series this spine may be as long as 3 plates.

Prominent *adambulacral plates* have 4 furrow spines, inner 2 with 2–4 small pedicellariae and usually 1 larger. Outer 2 spines each have 2–4 small pedicellariae. Actinal face of plate has up to 6 small spines, in 2 transverse series or a cluster. Non-prominent plates have 1 spine at furrow margin, and usually 4 on actinal face, arranged in 2 transverse series. Spines on non-prominent plates usually lack pedicellariae.

Oral plates deeply sunken, inconspicuous, each has 4 spines; 2 are suboral, proximal often with a pedicellaria attached to base; 2 furrow spines are placed at proximal lateral angle of plate, and each has a cluster of small pedicellariae.

Madreporite small, rounded, diameter 4 mm, placed near margin, has coarse, radiate sculpture.

Anal aperture inconspicuous, lying interradially near centrodorsal.

On disc up to 5 *papulae* to each area, on arms, 2–3 above superomarginals, usually single below. They extend to between second and third row of actinal plates.

Pedicellariae lanceolate in form, though a few of larger sizes may tend to a duck-billed form. On abactinal surface they stand close to papular pores; are conspicuous, being larger than spinelets; conspicuous pedicellariae extend down to row of papulae between inferomarginals and first actinals

Tubefeet quadriserial over most of arm.

COLOUR (preserved specimen): Dull cream to light brown, tubefeet may be darker.

ETYMOLOGY: Named for Mr R. J. Singleton, NIWA staff, as a small appreciation of his contribution to New Zealand marine science.

HOLOTYPE: Deposited in the collection of NIWA, Wellington, No. H-853 (Stn J45).

PARATYPE: Deposited in the collection of NIWA, Wellington, No. P-1409 (Stn E867).

REMARKS: In having a double series of actinal spines on the adambulacral plates, this species resembles both *Z. alfredi* Alcock from the Indian Ocean, and also *Z. ophiactis* Fisher from the Philippines. It differs from the former in lacking grooved spinelets and large bunches of pedicellariae on some of the adambulacral spines, and from the latter in having larger pedicellariae at the papular pores, much stouter only slightly carinate arms.

Zoroaster spinulosus Fisher, 1906 (Pl. 37)

Zoroaster spinulosus Fisher, 1906: 1102, pls 24 (3); 41 (2); 42 (5, 6); 1919: 472; Fell 1958: 19, pl 3 (E); 1960: 65, pls 3, 5 (in part); McKnight 1967: 302; 1975: 59; 1993: 185 (in part); Clark & Mah 2000: 235.

MATERIAL EXAMINED:

NIWA Stns: E776 (1); G700 (11); G703 (1); J39 (1); J40 (1); J41 (1); J45 (2); J48 (2); S150 (2)*; S151 (10); S152 (12); U572 (1); V376 (1); W248 (1, fr.); W249 (6); W256 (1); Z9471 (4); Z9849 (1); TAN9511/182(1); TAN9713/30 (5); TAN0208/60 (1); unlabelled jar (4).

DISTRIBUTION: Widespread in the New Zealand region, 33–46°S, 97–2150 m, also known from off Hawaii, 600–1019 m.

STUDY SPECIMEN: NIWA Stn J48, R 175 mm, r 16 mm, br. 14 mm, R/r 10.9/1; 16–17 superomarginals to first 10 carinals. At arm base, 5 series of actinal plates; at 1/2 R, 4.

DESCRIPTION: *Outline* stellate, disc small, domed; 5 slender arms, tapering very gradually; a distinct though low carinal ridge on arms. Disc plates slightly raised into a broad, rounded central area, margins produced into short lobes joining with those of adjacent plates. On arm, carinal plates are longer than wide, lateral margins usually scalloped by a papular pore. Adradial series not sunken, extending to near arm tip. Plates arranged in transverse series from superomarginals to lowest actinal row. Plates of disc and arms with a covering of small spinelets, not obscuring plate outlines; spinelets become longer below marginal plates.

Disc plates lack larger spines, but most of proximal carinals have a stumpy pointed spine, not as long as plate; in distal third of arm, spines are present on alternate plates only. Adradial plates lack spines and superomarginals have a slender spine, about as long as plate. Inferomarginals and actinals have a slender spine, which may be as long as 2 or rarely 3 plates. On actinal plates spine is commonly flattened.

Prominent *adambulacral plates* have 5 spines in a single transverse series. Innermost spine has 5–10 small pedicellariae in a cluster near tip; next spine usually has a larger pedicellaria near tip, or in mid-length. Non-prominent plates have 4 spines, usually lacking pedicellariae.

Oral plates deeply sunken; each has 2 suboral spines and 2 furrow spines; furrow spines are placed at proximal lateral angle of plate, and each has a cluster of pedicellariae.

Madreporite near margin, rounded, diameter 4 mm, has coarse, radiate sculpture.

Anal aperture inconspicuous, placed interradially by centrodorsal, surrounded by small spinelets.

Papulae relatively conspicuous, single over most of disc and arms, occurring down to between 2 lowermost rows of actinal plates.

Pedicellariae vary in size; all are lanceolate. They occur on adambulacral and oral furrow spines, also on actinal surface, at margins of papular pores.

Tubefeet quadriserial over most of the ray.

COLOUR (preserved specimens): Dull cream to light brown, tubefeet often darker.

REMARKS: The slender rays and the slender spines or spinules on the marginal plates clearly distinguish this species from the others now known from the South-West Pacific Ocean.

Zoroaster alternicanthus n. sp. (Pl. 38)

? *Zoroaster spinulosus* Fell, 1958: 19, pl. 3 (E); 1960: 65, pls 3, 5. McKnight 1967: 302; 1975: 59; 1993: 185 (in part) (non *Zoroaster spinulosus* Fisher, 1906)

MATERIAL EXAMINED:

NIWA Stns: A908 (1); D85 (3); D138 (1); D147 (1); D180 (1); D205 (3); D206 (1); D207 (4); D211 (1); D234 (2); D868 (1); E79 (11); E413 (1); E714 (1); E757 (2); E776 (1); E783 (2); E784 (1); E867 (1); E901 (1); F80 (1); F109 (1); F147 (1); F148 (1); F749 (1); F754 (2); F869 (2); G259 (5); G294 (2); G329 (1); G335 (2); G663 (1); G895 (1); G898 (1)*; G910 (2)*; G912 (2)*; H636 (1); H923 (1); I721 (1); J36 (1); J544 (1); Q33 (1); Q339 (1); Q343 (1); S126 (1); S200 (1); S213 (1); S215 (2); S377 (2); T65 (2); U197 (9); U563 (1); W252 (1); W257 (1); W258 (1); Z1924 (1); Z8879 (2); Z8969 (2); Z8986 (1); Z8991 (1); Z9194 (2); Z9308 (1); Z9434 (1); Z9470 (1); Z9610 (1); Z9771 (1); Z9795 (1); Z9843 (3); Z9849 (1); Z9850 (1); Z10169 (4); Z10170 (1); Z10198 (1); Z10590 (3).

DISTRIBUTION: Widespread in the New Zealand region, 33–52°S, 150–1427 m.

STUDY SPECIMEN: NIWA Stn J36, R 137 mm, r 17 mm, br. 18 mm; 14 superomarginals to first 10 carinals. At arm base 4 series of actinal plates.

DESCRIPTION: *Outline* stellate, arms 5, gradually tapering. Disc domed towards centre, arms relatively broad, arched on abactinal surface with a distinct, low carinal ridge.

Disc plates arranged in 2 circles around centrodorsal, plates of outer circle, the basals and radials, are larger. Plates slightly raised and rounded toward centre, margins are produced into short lobes. On arms plates form regular longiseries, and transverse series from superomarginals downwards. A distinct, though low carinal ridge; on arms carinals and marginals are

wider than long over most of arm. Adradial series narrow, and not sunken; it extends to distal third of arm, but is absent distally. Plates of disc and arm have a covering of spaced, spinelets that do not obscure plate outlines, spinelets increasingly larger from superomarginals downwards. Disc plates have 1–4 spines, and carinals usually have 1 central spine, rarely 2. On occasional proximal plates spines may be lateral, rather than central; from beyond 1/2 R spine is usually present on alternate plates only. These spines up to 10 mm long, but usually 4–6 mm. Proximal adradials often with a central spine, though these usually do not extend beyond 1/2 R. A similar central spine is present on alternate superomarginal plates. Some proximal superomarginals may have a spine at upper and lower margins. All inferomarginal and actinal plates have a central spine, and on lower actinals spine is often flattened and usually accompanied by 1–3 more slender, elongate spinules. Spine on these lower plates may be as long as 3 plates, and elongate spinules about one-half that.

Prominent *adambulacral plates* have 5 spines in a single transverse series the outermost is slender. Innermost has 3–5 small pedicellariae in a clump, near tip, and often there is one larger pedicellaria also. Next spine has 1 large conspicuous, duck-billed pedicellaria near tip. Outer spines may have a small pedicellaria near base. Non-prominent plates have 3 spines, innermost at furrow margin, often with a small pedicellaria at its base.

Oral plates deeply sunken, each has 2 suboral spines and 2–3 furrow spines placed at proximal lateral angle, and have a cluster of small pedicellariae.

Madreporite placed near margin, is rounded, diameter about 4 mm and has coarse, radiate sculpture.

Anal aperture lies interradially, close to centrodorsal, and is surrounded by spinelets.

Papular pores are relatively conspicuous. On disc and abactinal surface of arms 5 papulae to each area, between marginals 2–3, and below they are single. They extend to between the 2 lowest rows of actinals.

Tubefeet are quadriserial over most of the ray.

COLOUR (dried specimen): Dark cream to dull brown, with tubefeet a little darker.

HOLOTYPE: Deposited in the collection of NIWA, Wellington, No. H-854 (Stn E867).

PARATYPES: Deposited in the collection of NIWA, Wellington, Nos P-1411 (Stn E714); P1410 (Stn F109); P1412 (Stn G335A, 2 specimens).

REMARKS: Specimens from NIWA Stns: G898, G910, and G912, from south of New Zealand, are unusual in having the adradial series narrow and slightly sunken,

overlapped by the superomarginals and lacking spines.

This species is well characterised among the local taxa. The strong spines on the abactinal plates of the arms, and their distribution on the adradial and in particular the superomarginals, clearly separate this species from any others so far recorded. It has been previously listed as *Z. spinulosus* but a comparison of specimens shows it is quite distinct.

Zoroaster planus Alcock, 1893 (Pl. 39)

Zoroaster planus Alcock, 1893: 104; Fisher, 1919: 47; Clark & Mah 2000: 235.

MATERIAL EXAMINED: NIWA STN X675 (1).

DISTRIBUTION: This species is recorded from Rumble II Seamount to the northeast of the Bay of Plenty, 1680–1896 m.

STUDY SPECIMEN: NIWA Stn X675, R/r about 241/14 mm, (17/1), 1 arm is regenerating. 16 superomarginals to first 10 carinals. At arm base, 4 series of actinal plates.

DESCRIPTION: *Outline* strongly stellate, the five arms very gradually tapering; disc small, almost flat-topped, arms rounded, with the carinal ridge prominent; arms almost flat below, actinosome sunken.

Abactinal plates of disc with a dense covering of elongate spinelets that more or less obscure the plate outlines. The spinelets are up to 2 mm long, are bluntly tipped and invested by a very thin skin; sometimes this forms a web between several spines. On the arms the abactinal plates form definite longitudinal and transverse series; the plates have a covering of spinelets like those on the disc plates, but it is sparser, so that parts of the plate surface are visible. The carinal plates are about as wide as long and form a prominent ridge; beside the spinelets, most have a stout tapering spine, up to 5 mm long, beset with distinct ridges, this fluting, conspicuous under magnification, may not be apparent at first sight. One series of adradial plates extends over most of the arm, the plates with a sparse cover of spinelets only; their lateral margins are not overlapped by the carinals or superomarginals. The two series of marginal plates and also the 4 series of actinals have the cover of spinelets and also each plate has a single thin spine or spinule, equal to the carinal spines or longer but much thinner, some of these spinules, particularly those on the superomarginals may have faintly indicated longitudinal ridges. The spinules increase in diameter and also slightly in length towards the furrow, so that those on the lowest row of actinals are elongate spines.

Small straight *pedicellariae* are present abactinally, but are inconspicuous; there is often a single pedicellaria adjacent to each papular pore.

Adambulacral plates alternate, prominent plates very conspicuous owing to the extensive furrow carination, while non-prominent plates are easily overlooked. The prominent plates have 8–10 spines, one in the furrow and directed across it, the others standing erect along the lateral margins of the plates to form a V-shaped group. The inner spine is usually rounded, the others tend to be flattened. Small straight pedicellariae from a cluster of 6–8 on the inner spine in the furrow, and there is often a large lanceolate pedicellaria on this spine or that adjacent. Non-prominent plates with 4–6 spinelets, much thinner than those on the prominent plates.

Oral plates small, more or less vertical, each with 2 furrow spines and 1 distal suboral, all with attached small straight pedicellariae.

Madreporite concealed by slightly thicker and blunter spinelets than elsewhere.

Papular pores single, large and quite conspicuous on arms, inconspicuous on disc.

Ambulacral furrows narrow.

Tubefeet 4-ranked proximally, in 2 rows distally; dried tubefeet appear to have distinct sucking-discs.

COLOUR (dried specimen): Uniform light brown.

REMARKS: This species was originally described from the Laccadive Sea in 2196 m and does not appear to have been listed since, so its occurrence locally is surprising. The short, fluted carinal spines appear to be characteristic. *Z. alfredi* has grooved spinelets.

***Zoroaster* sp.** (Pl. 40)

MATERIAL EXAMINED:

NIWA Stns: Z11052 (1); Z11053 (1).

DISTRIBUTION: Recorded only from the Cavalli Seamount, to the east of northern New Zealand, 560–630 m.

DESCRIPTION: NIWA Stn Z11052, R/r = 72/9 mm, R = 8.0 r. 16 superomarginals to the first 10 carinals.

Outline markedly stellate, disc inflated on abactinal surface, actinosome sunken; arms narrow and elongate, slowly tapering, with a raised and rounded abactinal midline. Disc plates slightly tumid, the centrodorsal more tumid and larger than the 5 surrounding radials abutting against it; basal plates as large as centrodorsal and also more tumid, lying just outside the radials. All disc plates with a sparse cov-

ering of spinelets, not concealing their outlines. The spinelets are short, higher than wide, with the tip a little expanded, rounded and finely spinose. Anal aperture at side of centrodorsal, surrounded by larger spinelets. Madreporite situated just outside a basal plate, it is round, with the coarse sculpture more pronounced at the margins.

Arms with a rounded carinal ridge. Carinal plates wider than long, nearly rectangular, each with a sparse cover of short spinelets similar to those on the disc plates. Adradial plates small throughout, longer than wide, the series slightly sunken. Marginal and actinal plates wider than long, all slightly tumid, the superomarginals the widest. Four series of actinal plates at arm base. Carinal, marginal and actinal plates with short pointed spinelets, the carinals and superomarginals lacking larger spines or spinules; inferomarginals from about 1/2R, with an elongate spinule, longer than width of plate. Actinal plates of upper 2 rows with a similar spinule, lower plates with a stronger spinule or slender spine. Papulae single on disc and arms; carinal plates with a papular pore between each, and another at mid-length; those between adradials are only slightly spaced from the carinal series. Lowest row of papulae is at lower margin of upper row of actinals.

Adambulacral plates short, the prominent plates with 3–4 furrow spines, the lowest slender, the others more robust, with the uppermost at the furrow margin. The lowest spine has a cluster of 3–5 small straight pedicellariae in a cluster at the tip, the next has a larger pedicellaria, rarely with 1–2 smaller also; the upper 1–2 spines usually lack pedicellariae. Actinal surface of plate with 4–5 shorter spines in a double row. Non-prominent plates with 4 spines, the outer 2 in a double series. Pedicellariae are absent from these plates.

Larger *pedicellariae* with valves curved, more or less 'duck-billed'; small pedicellariae similar or with straight valves. Abactinal pedicellariae rare, with only 2–3 seen by adradial papular pores; they are smaller than any on the adambulacral spines, and have straight valves.

Oral plates small and deeply sunken, each with 1 furrow and one larger suboral spine, the furrow spines with a dense cluster of small pedicellariae.

Ambulacral furrows narrow, tubefeet 4-ranked, with distinct sucking-discs.

COLOUR (dried and wet specimens): Uniform cream.

REMARKS: The second specimen (Stn Z11053) has R/r 54/6 mm, 17 superomarginals to the first 10 carinals and 3 rows of actinal plates, with papulae only at the lower end of the uppermost row.

These two specimens are similar to *Z. carinatus* Alcock but lack any trace of carinal spines. Of the Indo-Pacific species lacking these spines, *Z. adami* Koehler has rounded to oval carinal plates and a conspicuous adradial series. Two further species have the adradial series inconspicuous. *Z. barathi* Alcock has a single transverse row of subambulacral spines and *Z. microporus* Fisher has the tubefeet biserial at R = 205 mm.

Family **PEDICELLASTERIDAE** Perrier, 1884

Forcipulatida with 5 or 6 arms; skeleton open, reticulate; plate small, cruciform or trilobate, carinal and marginal series in regular longitudinal rows; plates bearing small, usually single spinelet; inferomarginal plates bearing only single prominent spine; no adoral carina, the first adambulacral plate of each series wholly or partially separated from the neighbouring one interradially; crossed and straight pedicellariae present, scattered (never in clusters or circlets around spines); tubefeet primarily biserial, sometimes quadriserial proximally.

Hydrasterias Sladen, 1889

Five- to six-rayed, lacking actinal plates; with only one type of crossed pedicellariae, without enlarged terminal teeth. Abactinal skeleton either reticulate or regular, superomarginals and usually carinals cruciform; Adambulacral plates with 1–3 spines; first pair of adambulacral plates in contact proximally only, if at all. Crossed pedicellariae thickly scattered over abactinal surface; straight pedicellariae with enlarged terminal teeth, present along furrow margin, sometimes common on abactinal surface.

TYPE SPECIES:

Asterias (Hydrasterias) ophidion, Sladen, 1889

Two local species, both in a fragmentary state, are provisionally attributed to this genus.

KEY TO SPECIES

- 1 Six rays, abactinal spines enclosed in a thick sacculus of skin. Straight pedicellariae with terminal teeth slightly enlarged. Adambulacral plates with 1–2 spines, inferomarginals with 1
..... *Hydrasterias sacculata* n. sp.
- 1' Five rays, abactinal plates without a thick sacculus of skin. Straight pedicellariae with very distinct terminal teeth. Adambulacral plates with 1 spine, inferomarginals with 1–2
..... *Hydrasterias tasmanica* n. sp.

Hydrasterias sacculata n. sp. (Pl. 41)

MATERIAL EXAMINED:

NIWA Stn, P930 (1).

DISTRIBUTION: Known only from off the west coast, South Island, depth 4066 m.

STUDY SPECIMEN: NIWA Stn P-930, (holotype) R/r = 90/6.5 mm, arms detached, 6 oral plates.

DESCRIPTION: *Disc* small, detached rays coiled; disc flat-topped, margins more or less vertical; arms arched and rounded abactinally, about as high as wide or a little higher, tapering very gradually throughout length. Surface is covered by skin, which invests the small spines.

Disc plates small and irregularly arranged, in a close-knit reticulum. No enlarged disc plates. On arms abactinal plates similarly small, forming an open reticulum, only marginals are distinct. A denuded section of arm, towards tip, shows a series of cruciform carinal plates linked to superomarginals by small elongate plates, a single, longitudinal adradial series is present. Superomarginals cruciform, as long as wide, forming a regular longiseries along lower lateral margin of arm. Inferomarginals trilobate, with a small upper lobe, no lower lobe, a little longer than wide; they form ventrolateral margin of the ray.

Most *abactinal plates* have a single short spine, up to 2 mm long, which tapers to a blunt tip. Spines longitudinally striated, usually a few small projecting points at tip. Skin invests length of spine, often forms a conspicuous sheath, much wider than spine. Sheaths particularly apparent along centre-line of arms. Superomarginals and inferomarginals have a single central spine.

Actinal plates are absent.

Adambulacral plates slightly compressed, little wider than long; on actinal surface separated by a narrow membranous area. Plates fairly regularly diplacanthid proximally, both spines placed on actinal face of plate; monocanthid plates become more common distally; spines slightly shorter than adjacent inferomarginal spine. First pair of adambulacrals in contact on proximal margins only.

Oral plates not sunken; each has 3 spines, invested in skin.

Anal aperture not apparent.

Madreporite small, placed almost at margin, rounded, diameter 2 mm, has fine sculpture.

Papulae small, more or less concealed by the skin covering abactinal surface singly placed over most of abactinal surface, though up to 4 between the two series of marginal plates.

Crossed *pedicellariae* small, lacking enlarged terminal teeth; thickly scattered over abactinal surface. Slightly larger straight *pedicellariae* occur along furrow margin, 1, sometimes 2 to each plate; also present on oral plates. These *pedicellariae* are squatly lanceolate, jaws only slightly tapering if at all, with 1–2 relatively inconspicuous terminal teeth.

Tubefeet biserial throughout.

COLOUR (preserved specimen): Dull cream with tubefeet light brown.

ETYMOLOGY: *sacculata*—in reference to the skin sacculus on the abactinal spines.

HOLOTYPE: Deposited in the collections of NIWA, Wellington, No. H-855.

REMARKS: See below, under *Hydrasterias tasmanica*.

Hydrasterias tasmanica n. sp. (Pl. 42)

MATERIAL EXAMINED:

NIWA Stn P934 (1).

DISTRIBUTION: Known only from off the west coast, South Island, New Zealand at a depth of 4405 m.

STUDY SPECIMEN: NIWA Stn P934, (holotype), R/r = 66/5 mm, br. 8 mm, disc with 2 arms attached, 5 oral plates.

DESCRIPTION: *Disc* small, flat at centre, sloping at margin. Arms 5, slightly constricted at base, and slowly tapering, arched, rounded on abactinal surface, wider than high, though they may have flattened in storage. Actinal surface flat.

Disc plates small, lobate, close-set. On arms, plates similar, irregularly arranged. Low down on sides of arms is a series of cruciform superomarginals, and inferomarginals form ventrolateral margin. Inferomarginals tend to trilobate form, with no lower lobe. Thin skin covers abactinal surface and invests spines and does not form conspicuous pustules. Most disc plates and abactinal plates at arm-base with 1–3 short spines, up to 2 mm long. Spines slightly tapering with longitudinal striations and ending in 2–5 sharp points. Beyond arm base, spines more scattered, with only 1–2 on some plates, many lack spines. Superomarginal plates have 1 spine and inferomarginals have 1–2.

Actinal plates absent.

Adambulacral plates slightly wider than long and abut against each other on actinal surface. They have a single spine, as long as inferomarginal spine. First pair of adambulacrals completely separated.

Oral plates have 4–5 furrow spines and 2–3 suboral spines. Offset from disc centre is a small membranous area, with a perforation that may be anal aperture.

Madreporite placed about midway between margin and disc centre; is small, rounded, diameter 3 mm, with fine sculpture.

Papulae small, very inconspicuous, spaced apart, usually single. Slightly larger papulae present between the two series of marginals, also single. There are no actinal papulae.

Crossed *pedicellariae*, lacking enlarged terminal teeth, thickly scattered over abactinal surface, extending to inferomarginal plates, absent from actinal surface. Straight *pedicellariae* larger, often as long as spines, abundant on abactinal surface, also common on adambulacral and oral plates. On adambulacral plates, usually 1 *pedicellaria* on furrow margin, a second on actinal face, placed just outside of spine. *Pedicellariae* have blade slightly waisted, with tip about as wide as base, and height about three times width. Many abactinal *pedicellariae* have up to 5 enlarged terminal teeth, more or less felipedal in form. Some actinal *pedicellariae* similar, but most along furrow have 1–2 terminal teeth, often 1 tooth on one valve and 2 on other; teeth interdigitate, conspicuous; also a few simple lanceolate actinal *pedicellariae*.

Tubefeet biserial throughout.

COLOUR (preserved specimen): Dull cream, tubefeet dull brown.

ETYMOLOGY: *tasmanica*—in reference to the type locality in the Tasman Sea.

HOLOTYPE: Deposited in the collections of NIWA, Wellington, No. H-856.

REMARKS: This genus is poorly known. Fisher (1928) has limited the genus to two or three species—*H. ophidion* Sladen, *H. sexradiata* Perrier, which may be a form of *H. ophidion*, and *H. improvisa* Ludwig. All three species agree in having no actinal plates, only small crossed *pedicellariae* without enlarged terminal teeth, and an abactinal skeleton which is regular only at the marginal plates; a definite carinal series is present.

These two new deep-water species differ in having much smaller skeletal meshes and also having the adambulacrals all or partly monacanthid.

Family LABIDIASTERIDAE Verrill, 1914

A family of the Forcipulatida with 6 or more long slender arms; abactinal skeleton a very open delicate mesh, or reduced to scattered plates; inferomarginal plates armed with a single, prominent, sheathed spine bear-

ing a wreath of crossed pedicellariae; no actinal plates; gonopores lateral; tubefeet biserial to quadriserial.

Coronaster Perrier, 1884

Labidiasteridae with the crossed pedicellariae in wreaths around the abactinal and marginal spines; arms 6–11; abactinal skeleton an open network, meshes usually squarish; abactinal and marginal spines single, spaced, adambulacral plates with 1–3 spines; no actinal plates; tubefeet quadriserial or biserial; gonads open on side of arm.

TYPE SPECIES:

Coronaster brisingoides Perrier, 1884 (= *Coronaster parfaiti* Perrier, 1885)

KEY TO SPECIES

- 1 9–10 arms; crossed pedicellariae with 3 enlarged terminal teeth. R may exceed 200 mm
..... *Coronaster halicepus*
- 1' 6 arms; crossed pedicellariae with 2 enlarged terminal teeth. R usually less than 100 mm
..... *Coronaster reticulatus*

Coronaster halicepus Fisher, 1917 (Pl. 43)

Coronaster halicepus Fisher, 1917: 26; 1919: 497, pls 135 (5, 5a), 140, 151 (1, 1a–d); McKnight 1975: 60; 1993a: 186.

MATERIAL EXAMINED:

NIWA Stns: E859 (frag.); F868 (1); I359 (1); T214 (1); V480 (1); Z9420 (frag.).

DISTRIBUTION: Recorded from near the Kermadec Islands, the southern Norfolk Ridge, and off both east and west coasts of North Island, New Zealand. Other records are from the Philippines at depths of 260–898 m.

STUDY SPECIMEN: NIWA Stn I359, R/r = 215/25 mm, br. 12 mm at base, maximum is 22 mm. Specimen has been flattened slightly in storage.

DESCRIPTION: *Disc* relatively large, flat-topped, 10 rays tapering gradually.

Abactinal skeleton of disc composed of lobate plates, overlapping or connected by smaller elongate plates. Strongly cruciform plates connected by smaller elongate plates occur on arms. Major plates in definite longiseries, connecting plates form transverse series, skeletal meshes are large and squarish. Carinal and superomarginal plates strongly cruciform, and 1–3

connecting plates between carinals and superomarginals, 1–2 between marginal series. Most major plates have a single central spine, up to 3 mm, long; spines usually tapering, pointed, some have tip truncate. In proximal third of arm, a few similar spines on adradial connecting plates, so that an additional longiseries of spines is present. Thin skin covers plates and bases of spines.

Actinal plates absent.

Adambulacral plates small, with 2 spines, inner slightly shorter, outer placed slightly proximal. First pair of adambulacral plates just in contact.

Oral plates comparatively conspicuous and elongate; each with 1 distal suboral spine, 2 proximal furrow spines, one directed over actinosome and one across furrow.

Anal aperture not apparent.

Madreporite placed at margin, is rounded, diameter 4 mm, has fine radiate sculpture.

On disc, up to 10 *papulae* in skeletal meshes; on arms, each mesh has 2–3 groups of papulae, with up to 10 in each. No actinal papulae.

Crossed *pedicellariae* small, in conspicuous wreaths or clusters on abactinal and marginal spines; jaws have 2–3 enlarged terminal teeth, with smaller teeth between them. Straight pedicellariae occur along furrow margin, on oral plates, also scattered over abactinal and actinal surfaces. A cluster of small lanceolate straight pedicellariae occurs on furrow face of alternate adambulacral plates; occasionally these clusters include a larger lanceolate pedicellaria with tips of jaws crossed. Small lanceolate pedicellariae also occur at base of proximal spines on oral plates and sparsely in abactinal papular areas. Larger felipedal straight pedicellariae present on oral plates and on actinal face of inferomarginal plates. These pedicellariae have jaws tapering, widest distally, broadly rounded in outline, and with about 6 teeth, set around edge.

Tubefeet quadriserial to near arm tip. In smaller specimen they are zigzag proximally and biserial distally.

COLOUR (preserved specimens): Dull cream with the tubefeet light brown.

REMARKS: The specimen from Stn T214 is small, with R/r = about 11/2 mm. Two of the 9 arms remain attached. The adambulacrals are diplacanthid, the first pair separated proximally by the oral plates. Three spines on oral plates, a few lanceolate straight pedicellariae on proximal spines, also a few along furrow margin. On disc, a small lobate centrodorsal and a circle of roughly Y-shaped radials and basals. On arms, usually one elongate transverse connecting plate

between carinals and superomarginals, and between marginals. Most major plates have a short tapering spine wreathed in small crossed pedicellariae; 1–3 papulae to each skeletal mesh. A few lanceolate straight pedicellariae are present on the disc. A possible anal aperture is present; madreporite is at margin. The tubefeet are biserial.

Coronaster reticulatus (H.L. Clark, 1916) (n. comb.)
(Pl. 44)

Pedicellaster reticulatus H.L. Clark, 1916: 69, pl. 26 (3, 4); 1946: 155.

Stylasterias reticulata: A.M. Clark 1962: 99, pl. 6 (5, 6); H.E.S. Clark 1970: 5, 24, pl. 3 (c, d).

MATERIAL EXAMINED:

NIWA Stns: Z10767 (10); Z10768 (1); Z10769 (2); Z10770 (1); Z10771 (3); Z10772 (2 arms); Z10773 (3); 10775 (11); Z10776 (3); Z10779 (7); Z10797 (5); Z10799 (2); Z10802 (18); Z10804 (2); Z10805 (2); Z10810 (ca 50); Z10813 (1arm); Z10816 (2); Z10818 (1).

DISTRIBUTION: Known from off west coast, North Island, New Zealand, and quite abundant on the active volcanoes, Rumble III and Rumble V, offshore from the Bay of Plenty, northeastern New Zealand. It is also recorded from off Tasmania, depth range 167–1045 m.

STUDY SPECIMEN: This species is relatively fragile, with deciduous arms, and although many specimens were collected intact, few remain in that state. Description is taken from a specimen from NIWA Stn Z10804, R/r = 75/7 mm, 4 of the 6 arms remain intact.

DESCRIPTION: *Outline* strongly stellate, with 6 arms, tapering near bluntly rounded tip. Actinal surface more or less flat, abactinal surface of disc slightly tumid, that of arms is broadly rounded.

Abactinal skeleton of disc is very open and reticulate, composed of small narrow plates; on the arms, the plates form large near-square meshes; the carinals and superomarginals are cruciform, while the inferomarginals lack a lower lobe; small narrow plates connect the carinals and marginals in both longitudinal and transverse series; there is no adradial longiseries. On the disc, most of the plates have a single short sharp spine; since the plates are small, these spines form linear series across the disc. On the arms, the carinal and marginal plates each have a single, longer sharply pointed spine, and there is usually a similar single adradial spine on one of the smaller adradial plates.

Actinal plates are absent.

First pair of *adambulacral plates* in contact interradially; plates have 2 adambulacral spines, the inner slightly the shorter.

Oral plates small, each with 3 spines.

Madreporite placed close to disc margin; rounded, diameter about 2 mm, with coarse, radiate sculpture.

Papulae small and inconspicuous, 8–12 in the abactinal skeletal meshes, none present on actinal surface.

Anal aperture near central, slit-like, with a few surrounding granules.

Straight *pedicellariae* few, small and lanceolate, scattered along the furrow margin, tips cross in some. Crossed pedicellariae present on abactinal spines. Disc spines and those on proximal part of arm with 2–6 pedicellariae, but beyond on the arms these pedicellariae usually are numerous and form a conspicuous cluster either at the base of the spines or at about midlength. Crossed pedicellariae have the jaws slightly curved, the distal margin with fine teeth, and a distinctly larger lateral tooth on either side.

Tubefeet with a small, distinct terminal sucking-disc; in 2 rows, crowded from beyond disc to over 1/2R, otherwise in 2 uncrowded columns.

COLOUR: In life: Orange marked with yellow; madreporite white, tubefeet pale lemon yellow. Dried: White, the tubefeet brown or larger plates and spines whitish, skin covering skeletal meshes dark brown, sometimes almost black; papulae reddish-brown; actinal surface light brown with darker tubefeet. Other specimens vary from red-brown to almost white, and may be uniform in colour or not.

REMARKS: Some specimens from NIWA Stn Z10802 have larger felipedal straight pedicellariae, the jaws with 6–8 curving teeth sparsely strewn along the sides of the arms.

C. pauciporis Jangoux from New Caledonia is another relatively small representative of this genus, but lacks felipedal pedicellariae, the carinal plates do not extend to the arm tips, and there are spines only on the proximal part.

Family ASTERIIDAE Gray, 1840

Forcipulatida with five or more arms, usually merging into the disc, sometimes more sharply set off from it. Abactinal skeleton reticulate, with longitudinal and transverse series of plates, or reduced to isolated plates, in no apparent order. Skeleton extending to tip of rays, the plates armed with one or more spines or spinelets. Adambulacral plates short, with the spines in a single transverse series, usually one or two, but up to seven may be present. Tubefeet in two or four rows.

KEY TO GENERA

- 1 Crossed pedicellariae scattered over abactinal surface, not in conspicuous wreaths around the spines. In some species pedicellariae may be rare and present only at bases of inferomarginal spines; abactinal surface is then usually covered with pulpy skin 2
- 1' Crossed pedicellariae in wreaths around abactinal and superomarginal spines. Complete or partial wreaths are present on at least one series of inferomarginal spines 7
- 2 Actinal plates in 2 or more longiseries, ray rounded. Adambulacral spines usually more than 2 in a transverse series 3
- 2' Actinal plates in one series, sometimes the rudiment of a second, or absent; ray dominated by the inferomarginals that form a well-marked ventrolateral angle. Adambulacral plates with 1–2 spines 4
- 3 2–3 flattened inferomarginal spines; 2–3 adambulacral spines. Abactinal skeleton more or less regular, plates imbricating, each with several short spines; papular areas small. Large felipedal pedicellariae usually present *Cosmasterias*
- 3' One inferomarginal spine; 2–4 adambulacral spines; abactinal skeleton open, reticulate, plates elongate, narrow, longiseries not evident, irregular transverse series may be present; papular areas large; no large felipedal pedicellariae
..... *Pseudechinaster*
- 4 Adambulacral plates regularly diplacanthid 5
- 4' Adambulacral plates regularly monocanthid *Anasterias*
- 5 Dorsolateral area broad, plates in 3–5 longiseries, carinals and superomarginals very broad 11 arms; not fissiparous *Stichaster*
- 5' Dorsolateral plates in one straight or zigzag longiseries, 5–8 arms, sometimes fissiparous with 2 or more madreporites 6
- 6 Dorsolateral area narrow, abactinal skeleton close-knit. Inferomarginal plates with short spinelets; often fissiparous, 5–8 arms, often of 2 sizes and 2 or more madreporites *Allostichaster*
- 6' Dorsolateral area broader, skeleton open and irregular, though only one dorsolateral series. Inferomarginal plates with 2–5 flattened spines; 5 arms, not fissiparous *Smilasterias*
- 7 One inferomarginal spine; 7 arms; 1–2 large macrocephalous pedicellariae at base of abactinal and marginal spines; no actinal plates; 1(2) adambulacral furrow spine *Psolidaster*
- 7' 2 inferomarginal spines 8
- 8 3–4 adambulacral furrow spines with attached pedicellariae; 5 arms; 3 series of actinal plates ..
..... *Perissasterias*
- 8' 1–2 adambulacral furrow spines without attached pedicellariae 9
- 9 2 adambulacral furrow spines 10
- 9' 1 adambulacral furrow spine; 7–14 arms, often regenerating, and with multiple madreporites .
..... *Coscinasterias*
- 10 Only the outer inferomarginal spine with a cluster of pedicellariae 11
- 10' Both inferomarginal spines with a cluster of pedicellariae 13
- 11 7–8 arms; no web of skin linking outer inferomarginal spines *Astrostole*
- 11' 5 arms; a web of skin links the outer inferomarginal spines along arm 12
- 12 One adradial series of plates. Superomarginal plates with a “pebbled” area. Gonads open at base of ray just above superomarginal plate
..... *Sclerasterias*
- 12' 3 series of adradial plates. No pebbled area on superomarginal plates. Gonads open at base of ray close to dorsal surface on a specialised plate with several gonopores *Rumbleaster* n. gen.
- 13 7 arms; a spine on alternate carinals and every third superomarginal
..... *Distolasterias* /? *Stolasterias*
- 13' 5 arms; a spine on almost all superomarginal and abactinal plates; no actinal plates; large felipedal pedicellariae often present *Taranuiaster*

Allostichaster Verrill, 1914

Asteriidae with the abactinal crossed pedicellariae scattered, not in circumspinal wreaths; skeleton close-knit, plates in definite longiseries; carinals and superomarginals broader than other plates; adradial plates narrow, in a single straight or zigzag series; inferomarginals form edge to arm; one series of actinal plates. Adambulacral plates usually diplacanthid; cleaned superomarginal plates with beaded area; multiple madreporites, fissiparous, rays 6–8, often in 2 sizes.

TYPE SPECIES:

Asteracanthion polyplax Müller & Troschel, 1844

KEY TO SPECIES

- 1 Inferomarginal and adambulacral spines with capitate tips, elliptical in section. Usually more than 1 madreporite 2
- 1' Inferomarginal and adambulacral spines flat, with tip truncate. A single madreporite
..... *Allostichaster farquhari* n. sp.
- 2 5-6 arms. Adradials broader than carinals
..... *Allostichaster insignis* (Farquhar)
- 2' 8 arms. Adradials as wide as carinals or narrower
..... *Allostichaster polyplax* (Müller & Troschel)

Allostichaster polyplax (Müller & Troschel, 1844)
(Pl. 45)

Asteracanthion polyplax Müller & Troschel, 1844: 178.
Stichaster polyplax: Sladen 1889: 432; Farquhar 1909: 129;
Benham 1909: 15.
Tarsaster neozelanica Farquhar, 1895: 207, pl. 12.
Allostichaster polyplax: Verrill 1914: 363; H.L. Clark 1916: 70;
Fisher 1930: 220; H.E.S. Clark 1970: 4, 5; Clark & Mah
2000: 244.

MATERIAL EXAMINED:

NIWA Stns: D595 (1); C381A (3); E909 (1); G672 (9);
G679 (2); G680 (6); I617 (2); I646 (3); I651 (1); I652 (3);
S398 (2).

DISTRIBUTION: This species is said to occur throughout New Zealand and the Chatham Islands (Fell 1962; H.E.S. Clark 1970), but not the subantarctic islands. NIWA has no records from north of Cook Strait. It is also known from the Kermadec Islands and southern and eastern Australia, including Tasmania. Depth range 0–238 m.

STUDY SPECIMEN: NIWA Stn C381A R 35 mm, r 7 mm, br. 5 mm, 8 subequal arms.

DESCRIPTION: *Disc* small, slightly domed, 8 arms, well arched and rounded, tapering only slightly with a blunt tip. Interradial arcs acute, crowded.

Disc plates small, raised at centre, rounded, lobate or elongate. On arms, carinal series are slightly raised, forming a low ridge. Adradials in a zigzag series proximally, or all in a single series, as wide as carinals or a little less. Superomarginals all broader than long, wider than carinals or adradials. Inferomarginals form ventrolateral border to arm. Abactinal plates have from 1–5 short stubby spines, a little longer than wide.

The tip is slightly expanded. Most carinal plates have 2–4 spines, in no definite pattern. Adradials have 1–2, and superomarginals 2–4. Near arm base, superomarginals usually have 2 spines spaced apart, in upper third of plate; more distal plates have 3, rarely 4 spines spaced over entire width of plate. Inferomarginal plates have 2 longer and heavier spines, flattened and truncate at tip.

A single series of *actinal plates* extends to about middle of arm; plates often have a short spine like inferomarginal spines but a little shorter.

Adambulacral plates all compressed, 3 pairs of plates in adoral carina, next 3 pairs only slightly separated; 2 spines on each adambulacral plate, except for plates in adoral carina.

Oral plates small with 3 spines.

Papular areas small, with up to 3 papulae in each, though most, including those of arm, have 1; 2 series of papulae between carinals and superomarginals. No papulae on actinal surface.

Straight and crossed *pedicellariae* small, scattered over abactinal surface and a few along furrow margin. A single straight pedicellaria usually occurs on actinal surface between successive combs of inferomarginal and actinal spines.

Anal aperture barely visible, near disc centre.

Two *madreporites*, in opposite interradii, each rounded, with a diameter of about 1 mm, with coarse, radiate sculpture.

Tube feet quadriserial to distal third of arm.

COLOUR (dried specimens): Dull brown.

REMARKS: In comparison with *A. insignis*, this (besides the arm count) has narrower arms, a shorter actinal series, a narrower adradial series and one less row of adradial papulae, and the spinulation is less regular.

Allostichaster insignis (Farquhar, 1895) (Pl. 46)

Stichaster insignis Farquhar, 1895: 205, pl. 13 (1); Benham 1909: 15.

Allostichaster insignis: Koehler 1920: 85, pls 20 (2–7), 65 (2); Mortensen 1925: 316; Fisher 1930: 220; H.E.S. Clark 1970: 4, 6; Clark & Mah 2000: 244.

MATERIAL EXAMINED:

NIWA Stns: A444J (2); A701 (3); A714 (1); A738 (5); A746 (1); B175 (1); B220 (1); B237 (1); C222 (1); C224 (2); C672 (1); C703 (1); C870 (1); C921 (2); D148 (1); D208 (2); D384 (1); D876 (5); D877 (1); D882 (2); D894 (1); E909 (1); F890 (2); G156 (1); G671 (2); G674 (3); G694 (1); H680 (1); J122 (3); M579 (field notes); N911 (1); Q87 (2); Q100 (1); S39 (1); S55 (2); S69 (10); S180 (2); S398 (2); T43 (1); T478 (1); T488 (1); T559 (1); Z121 (1); Z4575 (2).

DISTRIBUTION: This species is widespread in New Zealand, though there are few records from north of Cook Strait, and the most northern is from the Bay of Plenty; to the south the species is known from the Auckland Islands, but not Campbell, the Bounty Islands, or Antipodes Island. Depth range 0–322 m.

STUDY SPECIMEN: NIWA Stn C672, R 38 mm, r 7 mm, br. 8 mm, 6 unequal arms.

DESCRIPTION: *Disc* small, domed toward centre; 6 unequal rays in 2 sizes; they taper slightly to a blunt tip. Three arms are 38–25 mm long; others are 10–12 mm. Arms well arched, with distinct ventrolateral edge; actinal surface flat, actinosome scarcely sunken.

Disc plates small and close-set, abactinal skeleton of arms also close-knit. Plates slightly raised, imbricate slightly. On arms, carinals form a slight though definite ridge; adradials are in a zigzag series over proximal 2/3 of arm, in a single series distally. Adradial area is broader than carinals. Superomarginals on sloping lateral margin and are broader than long; inferomarginals form a well-marked ventrolateral border. Abactinal plates have 1–4 short capitate spinelets, longer than wide, head slightly expanded. Most carinal plates have 3 spines in a transverse series. Central spine is usually placed a little proximal to others; adradial plates have 1, sometimes 2 spinelets; proximal superomarginals have 1, 2 for most of arm, 1 near tip. Superomarginal spines placed at upper border of plate. Rarely a third spine is present, lower down. Inferomarginal plates have 2 larger flattened spines, which form a distinct marginal fringe. A few proximal inferomarginals have 1 spine, often broadened in distal half.

One series of small *actinal plates*, extending to near armtip. Most have a single short spine.

Papular areas are small, though distinct, and form longiseries on arm. Papulae small, with up to 8 papulae to each area. Near arm base where adradials are in a zigzag series, there are 3 rows of papulae between carinals and superomarginals. No actinal papulae.

Adambulacral plates all compressed, 3 pairs of plates in adoral carina, next 3 pairs are only slightly separated; 2 short spines to each plate, except for first 3–4 which have 1; outer spine is slightly longer, slightly expanded distally.

Oral plates small with 3 spines.

Tubefeet quadriserial to near tip of larger arms; on smaller arms they are biserial.

Straight and crossed *pedicellariae* small, inconspicuous, scattered over abactinal surface; a few occur along furrow margin.

Anal aperture small, near disc centre, surrounded by a few small spines.

Two *madreporites*—the larger, placed in trio of larger arms, is rounded, diameter about 1 mm, has fine sculpture, and is surrounded by a circlet of small spines; the second, placed in trio of small arms, is very inconspicuous, and not apparent till specimen was dried. It has a diameter of less than 0.5 mm.

COLOUR (preserved specimen): Dull cream.

REMARKS: Most specimens differ from *A. polyplax* in the number of arms, but, as noted by Mortensen (1925), both species occasionally have 5- and 7-armed specimens that may be difficult to place.

Allostichaster farquhari n. sp. (Pl. 47)

MATERIAL EXAMINED:

NIWA Stns: Z8880 (1); Z9583 (1); Z10692 (1); Z10698 (14); Z10701 (1); Z10710 (1); Z10713 (2); Z10727 (2); Z10728 (3); Z10732 (1); Z10741 (1); Z10779 (1); Z10813 (1); Z10814 (1); Z10818 (1); TAN0306/06 (1).

DISTRIBUTION: This species is recorded from off the Bay of Plenty, on the Chatham Rise, and to the south of New Zealand. All occurrences are from small hills or seamounts. Depth range 243–1162 m.

DESCRIPTION: Holotype specimen, Stn Z10698, R/r/br = 25/9/8 mm. There are 6 unequal arms. Disc small, inflated on dorsal surface, the 6 arms gradually tapering to a blunt tip.

Disc plates close-knit, with only small skeletal intervals; on arms plates are spaced further apart. Over most of the arm there is a distinct though not conspicuous carinal series, a single adradial row and the two marginal rows. At the arm base, a short second adradial row is present. The carinal adradial and superomarginal plates are all wider than long, each with usually 4 short lobes; the adradials slightly narrower than the carinals, superomarginals much the widest plates on the arm, strongly cruciform and with a small beaded area visible before cleaning. The inferomarginals form the ventrolateral edge to the arm, are about as wide as long or longer, and lack a lower lobe. Both disc and arm plates, except the inferomarginals have 1 or more short capitate spinelets, 2–3 times higher than wide, usually with a slight waist or constriction near the base. The head is bluntly rounded and lighter in colour, sometimes appearing polished. Under magnification these spinelets are seen to be very finely dentate. The disc plates have 1–3 spinelets, the carinals 3–5 in a transverse row; the adradials have 1 or 2, while the superomarginals usually have 3 in a vertical series, the lowest near the lower margin of the plate and spaced from the other 2. Inferomarginals

with 3 spines, longer than any abactinal spinelets, set in an oblique series. At arm base uppermost spine is rounded in section, lower 2 are partly flattened, elliptical in section with a truncate tip. Beyond the arm base, all 3 spines are definitely flattened and truncate at the tip.

A single series of *actinal plates* is present; the plates are small, and more or less hidden beneath integument; sporadic plates in the basal half of the arm have a short flattened spine, usually placed just proximal to the lowest spine on the inferomarginal plate, inter-radial areas small and lacking spines.

Adambulacral plates short, regularly diplacanthid, the outer spine the longer, both flattened and truncate distally. First 2–3 adambulacral plates united on midline, and first 1–2 plates with a single furrow spine, usually enlarged.

Oral plates small, somewhat depressed into actinosome, each with a single furrow spine directed into actinosome, and a single suboral spine directed downward (in life). Armature varies, with 3 spines on the proximal margin of one pair of plates, 4 on another.

Papulae are small, inconspicuous, usually only 1 to skeletal meshes of disc and arm; except between the 2 marginal series, where 2–3 are present basally. No actinal papulae.

Madreporite very inconspicuous, single, rounded, diameter 1 mm, with fine sculpture and a single spine at centre.

A small subcentral depression is thought to represent the *anal aperture*.

Crossed *pedicellariae* small, with rounded tips to the blades, scattered over the dorsal surface, attached to the plates, not the spines; occasionally 1–2 are present on the inferomarginal plates distal to the spines; straight *pedicellariae* also small, though a little larger than the crossed. They are rare on the dorsal surface but are common along the furrow margin, and vary from simply lanceolate to near felipedal, with 2–3 teeth on the distal margin of the blade. In 4 interradial 1–2 larger straight *pedicellariae* are present, each with 2–3 small distal teeth.

Ambulacral furrows narrow, tubefeet in 2 zigzag series proximally, in 2 simple rows from about 1/2R. They have distinct sucking-discs.

COLOUR (preserved specimens): Dull uniform light brown, the tubefeet a little darker.

ETYMOLOGY: Named for H. Farquhar, in recognition of his studies on New Zealand echinoderms.

HOLOTYPE: Deposited in the collection of NIWA, Wellington, No. H-857 (Stn Z10698).

PARATYPES: Deposited in the collection of NIWA, Wellington No P-1413 (Stn Z10698, 13 specimens).

REMARKS: Of the 33 specimens examined, 10 had 5 arms, and 13 had 6; 7 had 8 arms and 2 had only 2 arms. From Stn Z10698, 4 specimens had indistinct furrows across the disc, suggesting that fission might be imminent. The small madreporite is difficult to see, but as far as I can tell is single in the specimens.

This species differs from the other two local forms in having the inferomarginal and adambulacral spines flattened and truncate distally, rather than capitate and elliptical in section, and in having a single madreporite. It thus appears closer to *A. hartii* (Rathbun) known from Brazil, 113–338 m, which apparently differs in having 6 subequal arms and the straight pedicellariae have slender valves constricted towards the base. A comparison of specimens is desirable.

Anasterias Perrier, 1875

Asteriidae with the crossed pedicellariae scattered abactinally, not forming circumspinal wreaths, sometimes rare and at bases of inferomarginal spines only; abactinal skeleton an open, irregular network, usually hidden by thick, pulpy skin, which may conceal the plates even when dried; both series of marginals well-developed, superomarginals more or less cruciform, often monacanthid, inferomarginals diplacanthid; one series of actinal plates, sporadically spiniferous; adambulacral plates monacanthid; adoral carina composed of about 3 pairs of plates, sometimes lacking spines; interbrachial septum strongly calcified; gonads open ventrally; paedophoric.

TYPE SPECIES:

Anasterias minuta Perrier, 1875

REMARKS: O'Hara (1999) has included *Calvasterias*, with two local species, as a synonym of *Anasterias*.

KEY TO SPECIES

- 1 6–8 arms *Anasterias mawsoni* (Koehler)
- 1' 5 arms 2
- 2 Superomarginals with a small 'beaded' area, i.e. embedded crystal bodies 3
- 2' No beaded area on superomarginal plates
..... *Anasterias directa* Koehler
- 3 Carinal plates with 0–2 granules, series often discontinuous *Anasterias laevigata* (Hutton)
- 3' Carinal plates with up to 8 granules in transverse arcs, series continuous *Anasterias suteri* (de Loriol)

Anasterias directa Koehler, 1920 (Pl. 48)

Parastichaster directus Koehler, 1920: 97, pls 20 (8-1), 21 (8-2), 23(1, 2), 62(2); Rowe & Pawson 1977: 342.

Sporasterias antarctica: Koehler 1920: 78, pls 18 (1-4) [non pl. 28 (1-4) = *Cryaster aurorae*] (non *A. antarctica* Lutken, 1857).

Sporasterias directa: Fisher 1930: 241.

Anasterias directa: A.M. Clark 1962: 97; McKnight 1984: 143; O'Hara 1999: 190, pl. 2 (f-h); Clark & Mah 2000: 245.

MATERIAL EXAMINED:

NIWA Stns: D15 (1); E232 (19); E233 (5); E235 (4).

DISTRIBUTION: This species is known only from Macquarie Island, depths 0–357 m.

STUDY SPECIMEN: NIWA Stn E235, R 21 mm, r 6 mm, br. 7 mm. A small dried specimen, which shows the skeleton. This is masked in the other wet specimens.

DESCRIPTION: *Outline* stellate, disc small, flat-topped, arms five, plump, tapering gradually, blunt-tipped, rounded on abactinal surface, with a well-marked ventrolateral angle.

Disc plates small, rounded to lobate, irregularly arranged. On arms, carinal plates are lobate, imbricating, in a sinuous series, not conspicuous. At arm base, 3 irregular adradial rows of lobate plates, beyond 2, arranged in irregular transverse series, so that skeleton is reticulate. Superomarginals are more or less cruciform and aligned with smaller inferomarginals. Abactinal plates of disc and rays have 1–3 short spines, slightly club-shaped, with fine longitudinal grooves. They are spaced apart, form a more or less continuous reticulate pattern. Superomarginals have 1–2 short spines, larger placed at centre of plate, first 3–5 plates have a smaller spine below it. Inferomarginal plates with 1–3 longer, rounded spines, marginal fringe not conspicuous. Most plates in proximal half of arm have 1 spine, most of distal have 3.

A single series of small, inconspicuous *actinal plates*, extending to about 1/3R; a few plates on arm have a small spine or tubercle; the 2–3 interradial plates are spineless.

Adambulacral plates have one spine, occasional spines tend to alternate, spine is slightly thickened near tip. Adoral carina composed of 2–3 pairs of plates, all have a spine.

Oral plates small each with 2 spines.

Anal aperture not apparent.

Madreporite small, with coarse radiate sculpture, diameter 1.5 mm, placed near margin.

Papular areas of disc and arms have 2–5 papulae, conspicuous when dried. Marginal papular areas do not differ. On actinal surface papulae are placed singly near base of inferomarginal spines.

Pedicellariae small and scarce. A few crossed pedicellariae present near base of inferomarginal spines on abactinal surface; a few straight pedicellariae along furrow margin.

Tubefeet quadriserial to near arm tip.

COLOUR (ex ethanol): Dull cream to light brown.

REMARKS: In discussing variation in this species, O'Hara (1999) has noted that there is little difference between this species, *A. rupicola* Verrill from Kerguelen and Marion Islands, and *A. laevigata* (Hutton) from the subantarctic islands of New Zealand.

Anasterias mawsoni (Koehler, 1920) (Pl. 49)

Stichaster suteri: Benham 1909: 32 (non *Calvasterias suteri* de Loriol, 1894)

Parastichaster mawsoni Koehler, 1920: 91, pls 19 (1-8), 20 (1), 21 (1-6), 23 (4), 24 (5), 30 (5), 63 (2).

Parastichaster sphaerulatus Koehler, 1920: 101, pls 21 (7), 23 (5-10), 24 (1-4), 63 (3), 64 (1, 2).

Sporasterias mawsoni: Fisher 1930: 241.

Sporasterias sphaerulata: Fisher 1930: 241.

Anasterias mawsoni: A.M. Clark 1962: 76, 96; McKnight 1984: 143; Clark & Mah 2000: 245.

Anasterias sphaerulata: A.M. Clark 1962: 96; McKnight 1984: 143 (part); Clark & Mah 2000: 246.

MATERIAL EXAMINED

NIWA Stns: C733 (1); D10 (2); E227 (1); E232 (1); E235 (1).

DISTRIBUTION: Recorded from Macquarie Island and also from Heard Island, depth range 0–357 m.

STUDY SPECIMEN: NIWA Stn C733, R 10 mm, r 3 mm, br. 2 mm. Specimen is dried.

DESCRIPTION: *Outline* stellate, arms 6, slowly tapering, tip blunt, rounded on abactinal surface, a marked ventrolateral angle; disc flat-topped.

Plates of disc and arms lobate, closely spaced; on arms carinal series is imbricate, slightly sinuous, plates are a little more prominent than adradials; over most of arm 2 fairly regular series of adradial plates. Superomarginal plates subtriangular, lower lobe narrowing towards inferomarginals. Inferomarginals aligned with superomarginals, as are adradials, so that abactinal skeleton is regular rather than reticulate. Abactinal plates have short, rounded spines, about twice as long as wide, closely spaced, with up to 5 on larger plates. Superomarginals have 2–3 spines in a transverse series. At arm base a single inferomarginal spine, usually 3.

Adambulacral plates have a single spine; 3 pairs of adambulacrals in adoral carina, all with a spine.

Actinal plates absent on arm, 2 small spineless plates in each interradius.

Anal aperture not apparent.

Madreporite small, rounded, diameter 1 mm, and placed at margin.

Disc *papulae* inconspicuous, 1–3 to each area. On arms, *papulae* are larger, usually 3 to each area. Intermarginal *papulae* single, large. No actinal *papulae*.

Small crossed *pedicellariae* common on abactinal surface, being at least as numerous as spines, are absent from inferomarginals and actinal surface. Straight *pedicellariae* uncommon, a few larger, lanceolate forms, present on inferomarginals and actinal interradial areas.

Tubefeet are quadriserial for 2/3 length of arm.

COLOUR (preserved specimen): Dull cream, with the *tubefeet* darker.

REMARKS: This species is distinguished by the relatively close and regular abactinal skeleton and the spines, which are clearly longer than wide.

Anasterias laevigata (Hutton, 1879) (Pl. 50)

Asterias rupicola var. *laevigata* Hutton, 1879: 353.

Calvaasterias laevigata: Fisher 1923: 600; Mortensen 1925: 311, pls 13 (12); 14 (3–10); H.E.S. Clark 1970: 4, 6; Fell 1953: 96; Clark & Mah 2000: 269.

Anasterias laevigata: O'Hara 1999: 190, 193.

MATERIAL EXAMINED:

NIWA Stns: A738 (1); A743 (1); B191 (4); D61 (2); D102 (4); D161 (1); D163 (2); D186 (2); D188 (2); D190 (3); F87 (13); F967 (1); S19 (3); S36 (11); S55 (13); S69 (7); T43 (3); T44 (3); Z1819 (9); Z1903 (12); Z6830 (2).

DISTRIBUTION: This species appears to be confined to the Subantarctic Islands—Campbell, Auckland, Bounty Is, and the Antipodes, depth range 0–80 m.

STUDY SPECIMEN: NIWA Stn B191, R/r/ br = 16 / 5 / 4 mm. R/r = 3.2 / 1

DESCRIPTION: *Outline* is stellate, with the disc small and inflated, and the five plump, rounded arms slowly tapering, with a distinct ventrolateral angle. The interbranchial arcs are acute.

On the disc there is a radiating series of small elongate plates. There are five of these “spokes”, and they extend to a ring of larger lobate plates—the basals and the radials. On the ray, the carinal series is distinct, though not raised. The carinal plates are cruciform

and imbricating. The adradial plates are small and are not lobate but elongate. They are arranged in irregular transverse series, and there is one longiseries of slightly lobate adradial plates placed slightly nearer the superomarginals than the carinals, and the entire adradial pattern is reticular. The superomarginal plates are the broadest of the abactinal plates and are arranged in an imbricating series. The plates are trilobate, with the distal margin evenly convex, and overlapped by the proximal margin of the succeeding plate. There is a broad upper lobe and a similar proximal lobe, in the upper third of the plate. The lower lateral lobe is elongate and attenuates towards the inferomarginals, so that the lower third or more of the plates is not overlapping. There is a small beaded area visible on the cleaned superomarginals. The inferomarginal plates are aligned with the superomarginals and form a distinct ventrolateral angle to the ray. None of the abactinal plates has spines or tubercles, though some—especially the lobate plates—have the central area slightly raised. The inferomarginal plates have two short spines with the tips slightly expanded.

Actinal plates spineless, inconspicuous, in a single series.

Adambulacral plates have one short stubby furrow spine only. The adoral carina is extensive, with three to four pairs of adambulacral plates being joined. The first pair lack spines, and on the second and third pair there is one spine only. Each of the small oral plates has two short stubby spines.

Papular areas are relatively conspicuous; on the disc are 3–5 *papulae* to each area, and on the arms 1–3. At base of ray there are two adradial series of *papulae*, and there are *papulae* between the lower ends of the superomarginals. There is a single series of actinal *papulae*, which extend to about 1/2 R.

Anal aperture not apparent.

Madreporite roughly elliptical in shape, with a length of 2 mm. It is placed near the margin, and has coarse irregular sculpture.

Crossed *pedicellariae* small, inconspicuous, rare, with a few on the abactinal surface, in the papular areas, and near bases of inferomarginal spines. Straight *pedicellariae* are also small, present on superomarginal papular areas and along furrow margin.

Tubefeet quadriserial to near the tip of the ray.

COLOUR (preserved specimen): Dull dark brown.

REMARKS: According to O'Hara (1999) this species is very similar to both *A. directa* Koehler and *A. rupicola* Verrill.

Anasterias suteri (de Loriol, 1894) (Pl. 51)

Asterias rupicola: Hutton 1872: 306.

Stichaster suteri de Loriol, 1894: 477, pl. 23.

Stichorella suteri: Koehler 1920: 87, pls 22 (1, 2, 4), 62 (3), 63 (1).

Calvaasterias suteri: Fisher 1922: 597; Mortensen 1925: 310; Fell 1953: 98; Clark & Mah 2000: 269.

Anasterias suteri: O'Hara 1999: 190, 193.

MATERIAL EXAMINED:

NIWA Stns: A735 (3); E115 (7); S55 (2); T43 (1); T44 (1); T753 (1); T755 (3); T762 (3); T764 (2); Z1904 (34).

DISTRIBUTION: This species is known from the subantarctic islands and also the South Island of New Zealand, depth range 0–60 m.

STUDY SPECIMEN: NIWA Stn A735 R/r/br = 49/11/14 mm. R/r = 4.5/1.

DESCRIPTION: *Outline* stellate, with the 5 plump rays gradually tapering. *Disc* inflated, though flat-topped at the centre. Arms are rounded on the abactinal surface, and there is a well-marked ventrolateral angle.

At the centre of the disc there is a central plate and radiating from it are five ribs of secondary plates that extend to the radials. The radials and basals form a circle on the disc, and touch each other. On the rays the plates are arranged in longiseries and less regular transverse series. Carinals are evident, and the plates are broader than long and imbricate. They are more or less rectangular, with a lateral lobe, this extending to the adradials. Over most of the ray there is a single series of adradial plates, slightly narrower than the carinals and nearly aligned with them. At the arm base the adradials are arranged in a zigzag series for a short distance. The adradials extend almost to the arm-tip. The superomarginals are much broader than the carinal or adradials. They imbricate and have the lower lobe attenuated. Each has a small beaded area on the lower lobe of the plate. The inferomarginals are smaller and form a well-marked ventrolateral angle to the ray. The two series of marginal plates are aligned, but the alignment of the superomarginals with the adradials and the latter with the carinals is not regular.

The *disc plates*, the carinals and the adradials all have short near-granuliform spines. These spines have an expanded head with fine radial grooves and are scarcely higher than wide. The centrodorsal, basals and radials have 6–15 such spines, with most on the radials. The carinal plates have 6–9 spines, arranged in 2 transverse series on the plate, the distal series with most spines and extending laterally beyond the proximal. Beyond about 2/3 R there is a single series of

spines on the carinal plates, and near the arm-tip there are only 2–3 spines. The adradial plates have a single spine except in the distal third of the ray, where they are spineless. The superomarginals are unarmed, while the inferomarginals have 2 stubby spines, which form a lateral fringe. All the abactinal plates are covered in puffy skin and this extends onto the outer face of the inferomarginal spines.

There is a single series of *actinal plates* extending to about 1/2 R. The plates in the interradian areas lack spines, but a few near the base of the ray have a single spine.

Adambulacral plates have a single spine, often alternating in position from the furrow margin. There are five pairs of adambulacral plates in the adoral carina. Almost all of these plates lack spines, though the distal pair may have a spine on one plate only. Beyond the adoral carina the spine is absent from 2 or 3 plates.

Each of the small *oral plates* has 2 spines.

The abactinal *papular areas* are distinct. On the disc there are up to 8 small papulae to each area. On the rays there are 2 adradial papular series, that between the carinals and the adradials has up to 5 small papulae, in each mesh, while that between the adradials and the superomarginals has up to 10 larger papulae. The areas between the superomarginals have up to 15 larger papulae. On the actinal surface the papulae are in a single series, with up to 3 papulae between successive actinal plates.

A circlet of small spines surrounds the inconspicuous *anal aperture*.

Madreporite placed on a basal plate, near the margin. It is rounded, with a diameter of about 2 mm, has fine, radiate sculpture and is surrounded by a circle of spines.

Pedicellariae are small. Crossed pedicellariae are present near the bases of the inferomarginal spines, on the abactinal surface, and rarely on the papular areas. There are also a few on the actinal surface. The straight pedicellariae are present along the furrow margin and on the actinal surface.

Tubefeet are quadriserial to near the arm-tip.

COLOUR (preserved specimens): Dull cream to brown.

REMARKS: The abactinal spinulation clearly distinguishes this species from the other 5-armed species above.

Astrostole Fisher, 1923

Five- to seven-rayed forms with diplacanthid adambulacral plates and pedicellariae only on the outer of the two inferomarginal spines; inferomarginal

web absent or rudimentary. One series of spiniferous actinal plates. Adradial spines present in one or two series. Alternate superomarginals spineless, the superomarginals with a conspicuous beaded area. Three to five pairs of adambulacral plates in the adoral carina. Straight pedicellariae smooth to denticulate.

TYPE SPECIES:

Margaraster scaber Hutton, 1872

REMARKS: The distribution of the genus is discussed in Town (1979).

KEY TO SPECIES

- 1 Colour blue-grey to brown and uniform. Large straight pedicellariae usually common on the abactinal surface. Alternate superomarginals regularly spiniferous *Astrostole scabra* (Hutton)
- 1' Colour varied and often mottled, red, yellow, brown, blue or even nearly black. Large straight pedicellariae uncommon on the abactinal surface. At about 1/2 R, every third superomarginal with a spine *Astrostole rodolphi* (Perrier)

Astrostole scabra (Hutton, 1872) (Pl. 52)

Margaraster(?) scaber Hutton, 1872: 5.

Asterias scabra: Farquhar 1895: 202, pl. 13 (3, 4); 1898: 315.

Astrostole scabra: Fisher 1923: 255; 1928: 94, 130, pls 42(8), 43(1); Mortensen 1925: 319, pl. 14 (11, 12); Rowe & Gates 1995: 27; Clark & Mah 2000: 267.

MATERIAL EXAMINED:

NIWA Stns: B584 (2); C978 (9); C980 (field notes); D140 (2); D595 (2); E105 (1); E836 (1); I362 (2); I378 (1); Q23 (1); Q42 (1); S261 (1); T760 (2); T762 (1); Z2318 (1).

DISTRIBUTION: This species is known from throughout New Zealand, including the Chatham Islands, but is not recorded from south of the Snares Islands. It is also known from eastern and southeastern Australia. Depth range: 0–73 m.

STUDY SPECIMEN: NIWA Stn C978, R 152 mm, r 16 mm, br. 15 mm.

DESCRIPTION: *Outline* stellate, interbrachial arcs acute, small; arms 7, slowly tapering, tip blunt. *Disc* almost flat-topped, arms arched, rounded abactinally. Actinal surface flat, actinosome not sunken.

Disc plates loosely arranged in several circles; 7 longiseries of abactinal plates at arm base, 5 from about

1/2 R. Carinals and superomarginals lobed or cruciform, superomarginals with a beaded area. 2 series of slightly lobed adradials {dorsolaterals} out to about 1/2R, then 1. Inferomarginals form ventrolateral margin of ray. Spinulation of carinals variable; proximally all plates may have a single pointed spine—rarely 2— or spine is absent; beyond proximal 1/4 of arm, alternate carinals usually without a spine; distally, spines are placed further and further apart. Most proximal adradials of upper row have a single spine, a few of lower row also with a spine; past proximal 1/3 of arm, adradial spines rare. Over most of arm every second superomarginal has a spine; inferomarginals regularly have 2, flattened, truncate spines.

A single series of *actinal plates* extends to about 1/2R; plates spaced apart, aligned with inferomarginals. Most actinals have a single spine, placed close to lower inferomarginal spine.

Adambulacral plates regularly diplacanthid, both spines flattened, truncate; inner tapers slightly, outer does not; 5 pairs of adambulacral plates form adoral carina.

Oral plates small; each has 3 spines, 2 proximal and 1 suboral.

Anal aperture small, near disc centre.

Madreporite placed near margin; rounded, diameter 5 mm, has fine radiate sculpture.

Papulae small, up to 7 in larger skeletal meshes. On actinal surface, a single series of papulae, 1 to each area.

Crossed *pedicellariae* small, in wreaths around abactinal and superomarginal spines, and on surface of plates; also present on outer face of outer inferomarginal spine, absent from inner spine, also actinal spines. Pedicellariae have a series of small terminal teeth, lateral teeth slightly enlarged. Straight pedicellariae vary in size, lanceolate to spatulate, with smooth tips. Small lanceolate pedicellariae present along furrow margin and on oral spines. Larger lanceolate or spatulate pedicellariae on actinal surface; spatulate forms of varying sizes scattered sparsely over abactinal surface.

COLOUR (dried specimen): Dull brown.

REMARKS: NIWA Stn E836, R/r = 117/17 mm, has short abactinal spines, carinal and adradial spines extending only to about 1/2R, superomarginals to near arm tip; crossed pedicellariae in large clusters abactinally, covering most of abactinal surface from 1/2R; straight pedicellariae spatulate, tips truncate, valve often widest distally, common, 2–5 in abactinal skeletal meshes, also intermarginally, and actinally, along furrow, intermingled with adambulacral spines, and near actinal

and inferomarginal spines; fairly conspicuous clumps of intermarginal papulae.

NIWA Stn Q23, large specimen, has abactinal and superomarginal spines at arm base only; over rest of arm there are just pads of pedicellariae.

NIWA Stn I329, 2 large specimens, one with slender arms, spaced carinal and superomarginal spines on every second or third plate. Other specimen has broader arms, most carinals and superomarginals with a spine. Both specimens have normal pedicellariae, but broad-rayed form also has abundant, small, long-stalked, lanceolate pedicellariae along furrow.

Arostole rodolphi (Perrier, 1875) (Pl. 53)

Asterias rodolphi Perrier, 1875: 305; 1876: 34; Farquhar 1897: 182; Benham 1909: 150.

Arostole rodolphi: Fisher 1923: 255; 1928: 130; McKnight 1968: 506, 515; H.E.S. Clark 1970: 5; Rowe 1989: 290; Rowe & Gates 1995: 27; Clark & Mah 2000: 267.

Arostole insularia H.L. Clark, 1938: 191, pl. 8(1); Clark & Mah 2000: 267.

Arostole multispina A.M. Clark, 1950: 808, pls 11, 12; Clark & Mah 2000: 267.

MATERIAL EXAMINED:

NIWA Stns: I77 (1); I78 (1); I95 (3); K798 (2); K801 (2); K810 (field notes); K833 (1); K864 (1); K865 (1); N895 (1); P20 (1); P21 (4); P22 (1); P23A (2); P38 (frags); P39 (1); P88 (10); P89 (1); P92 (2); P94 (2); P100 (1); P117 (3); P967 (3); Q51 (2); Q53 (1); Q82 (1); T220 (field notes); Z2054 (1).

DISTRIBUTION: This species is known from the Kermadec Islands, Norfolk Island, and Lord Howe Island. Rowe and Gates (1995) also mention northern New Zealand. Depth range 0–77 m.

STUDY SPECIMENS: NIWA Stn P21 4 specimens, R/r = 141–84/15–14 mm, br. 16–10 mm.

DESCRIPTION: *Disc* small, flat-topped: arms 7, in one case 5, tapering in distal half, tip blunt; arched, rounded abactinally; a distinct ventrolateral angle, actinal surface flat.

Disc plates lobate to cruciform, crowded; on arms, carinal series slightly raised, plates lobate, overlapping. Smallest specimen has a single long series of adradial plates, larger specimens have 2 adradial series, somewhat zigzagged, with smaller plates in irregular transverse series between carinals, adradials and superomarginals. Latter are cruciform, overlapping, lower lobe relatively long. Inferomarginals ovate, overlapping, forming ventrolateral margin. Most disc plates have 1–2 sharply pointed spines, up to 5 mm long.

Almost all *carinal plates* have a similar spine, except near arm tip, where a few alternate plates may be spineless. At arm base, in larger specimens, 2 series of adradial spines, one series from about 1/2 R. In smaller specimens, a single series of adradial spines zigzag proximally. Most proximal superomarginals have a spine, some have 2; second spine usually placed on lower lobe of plate, midway between upper spine and inferomarginal spines. From about 1/2R, a single superomarginal spine on alternate plates only. Inferomarginals have 2 spines, usually slightly flattened, tip either pointed or truncate; either spine may be longer. A single series of actinal plates; each has a single spine, like inferomarginal spines, placed close to inner of these, the three form an oblique comb. Actinal spines longer or shorter than marginals, generally more slender. Actinal spines extend to distal third of arm.

Adambulacral plates regularly diplacanthid, spines flattened, tip truncate; outer spine usually broader than inner; 3–5 pairs of adambulacral plates in adoral carina.

Oral plates small, each with three spines; one distal and suboral, other 2 at proximal face of plate; a short spine deep in actinosome, a longer spine above it.

When visible, *anal aperture* small, very inconspicuous.

Madreporite placed near margin, rounded, diameter 4 mm, has fine radiate sculpture.

Papulae relatively small, not conspicuous; up to 10 papulae in larger skeletal meshes, most have 3–5. A single series of actinal papulae, with 1–3 to each area.

Crossed *pedicellariae*, small, in wreaths at bases of abactinal and superomarginal spines, and outer inferomarginal spine. Straight pedicellariae lanceolate, present in oral area, scattered along furrow and over abactinal surface. On one specimen they are rare.

Tubefeet are quadriserial to near arm tip.

COLOUR (preserved specimen): Dull creamy brown, tubefeet a little darker.

REMARKS: NIWA Stn P117, Lord Howe Island. R/r = 88/11 mm. Most carinals with a spine; one series of adradial plates, adradial spines over most of arm. Superomarginals with a spine on every third plate—more or less—distally, every second. One series of actinal plates to over 1/2R, usually with a spine. Straight pedicellariae lanceolate, uncommon.

NIWA Stn P968, Raoul Island, Kermadec islands, R/r = 115/92 mm, one specimen with 8 arms. One series of adradial plates and spines to distal third of arm. Abactinal spines short. Actinal spines to at least 1/2 R. Straight pedicellariae lanceolate, occurrence variable, uncommon to common, often in a clump in interradius. Confirmation of its occurrence in northern New Zealand is desirable.

Coscinasterias Verrill, 1867

Asteriidae with monacanthid adambulacral plates, fissiparous, with 7 to 12 rays. Carinal plates alternately elliptical and lobed. Crossed pedicellariae on the abactinal and superomarginal spines, and on outer of the 2 inferomarginal spines. One series of spinous actinal plates (sometimes abortive). Crossed pedicellariae with an enlarged tooth on outer side of terminal lip, straight pedicellariae often with denticulate jaws.

TYPE SPECIES:

Coscinasterias muricata Verrill, 1867

Coscinasterias muricata Verrill, 1867 (Pl. 54)

Coscinasterias muricata Verrill, 1867: 249; Rowe 1989: 290; Rowe & Gates 1995: 28.

Coscinasterias calamaria: H.L.Clark 1909: 531; 1916: 244; 1946: 156; H.E.S. Clark 1970: 4, 5, 6; Clark & Mah 2000: 270.

? *Acanthaster* sp. juv. McKnight 1967: 324.

MATERIAL EXAMINED:

NIWA Stns: B220 (1); B237 (1); B249 (1); B251 (1); B254 (1); B267 (3); B493 (1); B660 (1); C380 (1); D564 (1); D595 (3); D882 (1); E86 (1); E808 (1); E833 (5); E909 (5); E965 (1); F890 (3); G671 (3); G835 (1); H917 (1); I362 (field notes); I617 (field notes); I622 (field notes); I623 (field notes); I624 (field notes); I625 (field notes); I626 (field notes); I627 (field notes); I645 (field notes); I651 (field notes); I652 (field notes); K100 (2); K109 (1); K985 (field notes); K988 (field notes); K994 (field notes); K995 (field notes); K996 (field notes); K997 (field notes); K998 (field notes); K999 (field notes); K1021 (field notes); M799 (1); O145 (1); O146 (3); O153 (3); O154 (1); O155 (1); O163 (1); O165 (1); O169 (2); O174 (1); O176 (1); O186 (3); O187 (1); P53 (2); P122 (2); P124 (1); Q56 (1); Q87 (1); Q97 (1); Q102 (1); Q103 (1); Q104 (1); Q105 (1); T539 (2); T599 (field notes); T602 (field notes); T605 (1); T612 (3); Z1909 (1); Z2322 (1); Z2781 (1); Z8473 (6); Z8479 (1); Z8586 (2); Z8587 (1); Z8588 (2); Z8642 (1); Z8843 (1); Z8918 (1); Z8922 (2); Z8924 (1); Z8925 (4); Z8936 (1); Z8940 (1); Z8941 (1); Z8942 (1); Z8943 (1); Z8951(1); Z8953(1); Z8954(2); Z10134(1); KAH 9615/96 (3); KAH 9615/101(1); KAH9704/128 (1); KAH9917/63 (1); KAH0004/60 (1); KAH0304/04 (1); BG9701/02 (1).

DISTRIBUTION: This species is known from throughout the New Zealand mainland and Australia in depths of 0–84 m.

STUDY SPECIMEN: NIWA Stn C380 R 195 mm, r 31 mm, br. 15 mm, at base, 27 mm maximum; one arm is regenerating, R 82 mm.

DESCRIPTION: *Disc* small, arms 11, gradually widening from a narrow base, tapering in distal two-thirds, tip blunt. *Disc* flat-topped, arms rounded-angular, carinal series forming a low, distinct ridge.

Disc plates lobate, roughly arranged in three circles around small centrodorsal; outermost circle with plates slightly larger, composed of basals and radials. On arms, carinals are ovate, wider than long, alternate plates produced laterally into distinct lobe. Two series of ovate dorsolateral plates. Superomarginals lobate, strongly imbricating, have a small “beaded” area. Inferomarginals ovate. Smaller oblong plates connect carinals and adradials proximally, also connect the two marginal series, near arm base. Lobate carinal plates have a single spine, tapering, pointed, up to 4 mm long; almost all proximal adradial plates have a similar spine, but from about 1/3R only alternate plates with spine. Row of spines adjacent to carinals continues to arm tip, or nearly so, lower series extends to about 1/2 R. Over most of ray, alternate superomarginals with a spine, though this may be irregular. Proximally all superomarginals may have a spine, or rarely 2. Usually the spine on alternate plates placed lower down. Inferomarginal plates have 2 slightly flattened spines, up to 5 mm long. Outer is slightly longer. Rarely plates have 3–4 spines. Spinous inferomarginal plates about twice as numerous as spinous superomarginals, at least distally.

A very inconspicuous series of spineless *actinal plates*, extending for 2/3 R along arm.

Adambulacral plates monacanthid throughout; adoral carina long, at least 8 pairs of plates joined on interradial midline.

Oral plates slightly sunken; each has 2 spines.

Crossed *pedicellariae* small, in wreaths around bases of abactinal and superomarginal spines, on outer side of outer inferomarginal spine. Straight pedicellariae lanceolate to spatulate, tip pointed, or as broad as base, usually with a few, small, subequal, terminal teeth.

Papular areas distinct, not conspicuous; up to 8 in larger meshes. On actinal surface, a single series of papulae, with 1–3 in each area.

Anal aperture not visible.

Madreporite single, placed at about 2/3 r from disc centre, is rounded, diameter 5 mm, has fine radiate sculpture.

Tubefeet quadriserial to near arm tip.

COLOUR (dried): Dull brown.

REMARKS: NIWA Stn E909, one specimen R/r = 111/15 mm, 10 arms and 2 madreporites, more or less opposite. Most carinal plates beyond arm base have 2–5 spines, usually 2–3, in a transverse series; a single series of actinals, most with a single spine, extending to

beyond 1/2 R. Adoral carina composed of 6 pairs of plates. Straight pedicellariae all spatulate. Smaller specimens from this station have 10 arms and 1–2 madreporites. One specimen with R/r = 45/5 mm, has 2 adjacent madreporites; the 4 arms opposite are much smaller.

This species was described by Verrill, but for many years was included in the synonymy of *Coscinasterias calamaria* Gray. Recently, Rowe (1989) has revived Verrill's original name, retaining Gray's name for the species that occurs in the Indian Ocean.

Cosmasterias Sladen, 1889

Asteriidae with crossed pedicellariae scattered over the abactinal surface, not forming wreaths around the spines; actinal plates in 2 or prominent longiseries forming actinolateral surface of ray, not overhung by inferomarginals; adambulacral plates diplacanthid, or with more spines; abactinal plates form regular longiseries; actinosome sunken; adoral carina of 3 or more pairs of adambulacral plates. Large felipedal straight pedicellariae often present. Gonads open dorsally.

TYPE SPECIES:

Asteracanthion luridum Philippi, 1858:

Cosmasterias dyscrita H. L. Clark, 1916 (Pl. 55)

Cosmasterias dyscrita H.L. Clark, 1916: 71, pl. 29 (1, 20); 1946: 158; Fell 1958: 20, pl. 2 (D, E, H); 1960: 66, pls 3, 6; H.E.S. Clark 1970: 4; McKnight 1967: 303; 1973a: 229; 1993a: 186; 1993b: 193, 198; Clark & Mah 2000: 272.

MATERIAL EXAMINED:

NIWA Stns: A910 (1); C645 (1); D876 (1); D899 (1); E840 (1); E885 (1); G259 (3); G273 (1); G307 (2); G880 (1); H945 (1); H947 (1); I97 (3); I672 (2); J485 (3); N85 (1); P66 (2); Q343 (2); R435 (1); R439 (1); S26 (12); S194 (1); U599 (1); V361 (1); Z2376 (frags.); Z8983 (1); Z9270 (1); Z9385 (frag.); Z9386 (1); Z9419 (1); Z9442 (frag.); Z9791 (frag.); Z9833 (1); Z9951 (2); Z10170 (1); Z10603 (1); Z10607 (1); Z10612 (1); Z10931 (1); Z11035 (frags.); Z11056 940; TAN0101/44 (3); TAN0201/14 (1); KAH9907/53 (2); KAH9909/51 (frags.); Trip 1288/51 (frags).

DISTRIBUTION: Widespread in New Zealand waters and also known from southern Australia. Depth 148–1190 m.

STUDY SPECIMEN: NIWA Stn D899, R 114 mm, r 11 mm, br. 14 mm, widest part of arm at about 1/3 R = 20 mm; 2 arms are detached.

DESCRIPTION: *Disc* small, slightly inflated, margins more or less vertical; actinosome deeply sunken. Arms five,

arched and rounded, no ventrolateral angle. Arms slightly narrowed at base, tapering gradually in distal two-thirds.

Plates of disc slightly inflated, rounded, subequal; arranged in about 3 circlets around centrodorsal. In outer circlet primary plates, i.e. radials and basals, are slightly enlarged. Plates with 2–7 short, blunt-tipped spinelets, up to 1 mm long; tip may be slightly expanded. On arms, skeletal plates form imbricating longiseries and also transverse series. At arm base, 1 adradial and 4 actinal series. Adradial series present almost to terminal plate; 1 actinal series is present to distal quarter of ray. All plates conspicuously wider than long, except 2 lower actinal series, which are longer than wide. Carinal, adradial and marginal series have 2–4 short, blunt spines in a transverse series across plate. In large specimens there may be 2 adradial series tending to a zigzag pattern along the ray. On actinal plates, spines are longer—up to 4 mm long, and flattened; on lower actinals, are arranged in oblique or longitudinal series.

Adambulacral plates short throughout, all wider than long. In proximal half of ray, 3 adambulacral spines in a transverse series, distally 2. Rarely a proximal plate may have 4 spines. First 3 pairs of adambulacral plates in contact behind oral plates.

Oral plates small, each has 4 spines in a linear series.

Small crossed *pedicellariae* are scattered over abactinal and actinal surfaces, and along furrow margin; 1–2 may occur at bases of actinal spines. Larger felipedal straight pedicellariae are also present on both surfaces.

Anal aperture inconspicuous.

Madreporite circular, diameter 3 mm, placed near margin, 3/4r from disc centre, with coarse, radial sculpture; madreporite surrounded by a circle of spinelets.

Papulae in groups of up to 15 between disc plates. Up to 5 papulae between rows of plates, but are absent from between 2 lowest rows of actinals.

Tube feet are four-ranked to near arm tip.

COLOUR (ex ethanol): Dull, uniform light brown.

REMARKS: The genus is restricted to the Southern Hemisphere, and five other species are known. Local material seems to differ from the other species in often having 3 furrow spines, and it differs similarly from the original description.

Perissasterias H.L. Clark, 1923

Five- to seven-rayed Asteriidae with small crossed pedicellariae in wreaths around the abactinal spines. Actinal area extensive, plates in 3–6 series. Abactinal

plates with 1–6 spines, marginals with 2–3, actinals with 2–5, adambulacrals with 2–7 spines, usually 4–5. Two or three pairs of adambulacrals in the adoral carina. Crossed pedicellariae small, not distinctive. Straight pedicellariae larger and lanceolate, scattered over body and occurring on the adambulacrals spines. Size large, gonads open dorsally.

TYPE SPECIES:

Perissasterias polyacantha H.L. Clark, 1923

REMARKS: One of the salient features is the presence of pedicellariae on the adambulacrals spines. This allies the genus to *Asterias*, *Leptasterias*, and *Evasterias* all from the Northern Hemisphere. It is thus a more or less isolated southern genus, known from South Africa, southern Australia, and southern New Zealand

Perissasterias monacantha McKnight, 1973 (Pl. 56)

Perissasterias monacantha McKnight, 1973a: 231.

MATERIAL EXAMINED:

NIWA Stns: D138 (2); S26 (1); Z8983 (1); Z9155 (1); Z9385 (frag.); Z9386 (frag.); Z9419(1).

DISTRIBUTION: This species is known from the Lord Howe Rise, northern New Zealand, and also from southern New Zealand, east of the Snares Island, and off the Auckland Islands. Depth range 200–982 m.

STUDY SPECIMEN: NIWA Stn S26, R/r = 157/22 mm, br. 22 mm.

DESCRIPTION: *Disc* small, inflated, 5 arms tapering gradually, attenuate distally, inflated and rounded.

Larger *abactinal plates* triradiate or cruciform, some imbricate, others connected by small, subrectangular secondary ossicles. On arms, carinals distinct, though not prominent, in a continuous series. Adradials distinguishable, and marginals relatively inconspicuous. Between carinals and superomarginals are several irregular rows of plates. Almost all larger plates and several of smaller have a single tapering spine, up to 4 mm long. Superomarginals have 1 similar spine, inferomarginals 2, sometimes flattened.

Actinal plates in 3 series at arm base, 1 series extends to beyond middle of arm; usually 2 flattened spines on actinal plates, some plates have only 1.

Adambulacrals plates all compressed with 3–4 non-tapering, slightly flattened spines; 2–3 pairs of adambulacrals plates in adoral carina.

Oral plates small, have 4 spines, 3 at apex and 1 suboral.

Anal aperture not visible.

Madreporite placed at margin of disc, is rounded to polygonal, diameter 5–7 mm., has fine radiate sculpture, and is enclosed by a circle of spines.

Papulae numerous, up to 15 in larger skeletal meshes.

Crossed *pedicellariae* small, not distinctive, occurring in small wreaths at bases of abactinal and marginal spines, absent from actinal spines. Straight pedicellariae larger (length up to 0.5 mm), abundant on abactinal surface, especially in papular areas, also between marginal and actinal spines, are numerous on adambulacrals spines, either at base, or particularly at tip, on innermost spine; general form is lanceolate, and some adambulacrals pedicellariae have 2 small terminal teeth.

Tubefeet quadriserial to near arm tip.

COLOUR: Dull cream to brown or light pink.

REMARKS: This specimen differs from the type material in having the abactinal straight pedicellariae much more numerous, and the spinal wreaths of crossed pedicellariae are relatively inconspicuous. The arms appear to become relatively longer with increasing size.

This species, though not common in the New Zealand region, is readily distinguished by the large size, and the presence of pedicellariae on the adambulacrals spines. It differs from the other two species with five arms in having elongate tapering abactinal spines and only one superomarginal spine. Comparison of these species is desirable.

Psalidaster Fisher, 1940

Asteriidae with large crossed pedicellariae at the bases of the abactinal and marginal spines; pedicellariae with a large base, jaws tapering to a narrow tip, with 2 enlarged terminal teeth. Abactinal skeleton reticulate, abactinal and marginal plates with a single spine, occasional superomarginals with 2; adambulacrals plates with 1 or 2 spines, occasional plates with 3; adoral carina variable, with 1–5 pairs of adambulacrals; no actinal plates; multibrachiate. Gonads open ventrally.

TYPE SPECIES:

Psalidaster mordax Fisher, 1940.

REMARKS: This genus was known from a single species from the Falkland Islands and the Ross Sea. A second species, from deep water south of New Zealand, is now added.

Psalidaster fisheri n. sp.

(Pl. 57)

MATERIAL EXAMINED:

NIWA Stn S100(3).

DISTRIBUTION: Known only from the southwestern margin of the Campbell Plateau, south of New Zealand. Depth 2370 m.

STUDY SPECIMENS: NIWA Stn S100 (3, type material); R 23 mm, r 7 mm, br. 5 mm; R 21 mm, r 6 mm, br. 5 mm; R 11 mm, r 3 mm, br. 3 mm.

DESCRIPTION: *Outline* stellate, interbrachial arcs small, acute; disc more or less flat-topped, sloping in interradii. Arms 7, slightly flattened abactinally, tapering in distal third to a small blunt tip. Actinal surface flat, actinosome slightly sunken.

Disc and abactinal surface of arms has a reticulum of small lobate plates, irregular in shape, with lobes touching or overlapping. Indistinct longiseries evident on arms, though none extends very far and irregular transverse series are more prominent. Skeleton is close-knit, no carinal series evident. Near arm base, 4–5 plates from centreline of arm to superomarginals. At sides of arm 2 series of marginal plates, little larger than abactinal plates, distinguished mainly by position. Abactinal plates with 1–2 short tapering spines, 1–1.5 mm long, base invested by skin; most plates, except at centre of disc, have large crossed macrocephalous pedicellariae. *Pedicellariae* often as long as spine, usually attached by a very short stalk, close to spine base; jaws have a large base and taper beyond proximal third to a narrow tip; at tip are 2 larger lateral teeth, a few much smaller teeth lie between these.

Superomarginal plates at side of arm, wider than long, more or less rectangular in shape; they connect to adradial plates, are distinctly spaced apart, with membranous intervals longer than plates. Most superomarginals have 1 spine and 2–3 pedicellariae, a few have 2 spines. Spine and associated pedicellariae are placed near upper margin of plate.

Inferomarginal plates with rounded or ovoid outline, forming ventrolateral margin; they have one spine—up to 2.5 mm long—and usually 3–4 pedicellariae.

Adoral carina composed of first pair of adambulacrals, second pair almost touching proximally. A single spine on almost all adambulacrals. This scarcely tapers and is as long as inferomarginal spine. Occasional plates beyond arm base may have 2 similar spines.

Small simple lanceolate straight *pedicellariae* sparsely scattered along furrow, more numerous proximally.

No *actinal plates*.

Oral plates small, elongate, each with 2 prominent spines, distal being longer than proximal adambulacrals spines.

Papulae inconspicuous, 1–3 in skeletal meshes, most intermarginal spaces with one.

Madreporite inconspicuous, placed near margin, is rounded, diameter 1.5 mm, and has coarse, irregular sculpture.

Anal aperture is not apparent, nor is opening of gonads.

Tubefeet quadriserial to near arm tip.

COLOUR (ex ethanol): Uniform dull brown.

ETYMOLOGY: *fisheri*—for W. K. Fisher, who described the genus.

HOLOTYPE: Deposited in the collection of NIWA, Wellington, No. H-858 (R/r = 23/7 mm, br. 5 mm).

PARATYPES: Deposited in the collection of NIWA, Wellington, No. P-1426 (R/r = 21/6 mm, br. 5 mm; R/r = 11/7 mm, br. 3 mm).

REMARKS: The only other species of *Psalidaster* is *P. mordax* Fisher, which has the superomarginals connected throughout the arm, more pedicellariae in the basal wreaths of abactinal spines, a longer adoral carina, and 8–11 arms. Two subspecies are recognised, *P. mordax mordax*, from the Falkland Islands, 351–367 m, and *P. mordax rigidus* from Antarctica, south of Kerguelen Island and the Ross Sea, 183–362 m.

Pseudechinaster H.E.S. Clark, 1962

Asteriidae with the crossed pedicellariae scattered over the abactinal surface, not in circumspinal wreaths; abactinal skeleton forms a close-knit reticulum, plates lobate, sometimes united by secondary ossicles; actinal plates in 2 or more rows, all plates with 1 or more spines. Adambulacrals plates with 2–4 spines; at least 2 pairs of adambulacrals plates in adoral carina; actinosome sunken; gonads open ventrally.

TYPE SPECIES:

Pseudechinaster rubens H.E.S. Clark, 1962

Pseudechinaster rubens H.E.S. Clark, 1962 (Pl. 58)

Pseudechinaster rubens H.E.S. Clark, 1962: 1970: 4; Clark & Mah 2000: 296.

MATERIAL EXAMINED:

NIWA Stns: D900 (1); D905 (1); E82 (1); E719 (1); G259 (1); G273 (1); G329 (1); T56 (1); V361 (1); V373 (1); V423 (1); Z2404 (1); Z9440 (1); Z9442 (1); Z9461 (frags.); Z9470 (1); Z9491 (frag.); Z9568 (1); Z9618 (frag.); Z9953

(1); Z10822 (2); Z10823 (1); Z10827 (1); Z10832 (2); Z10874 (1); TAN0012/60 (1); TAN0101/44 (4); TAN0201/108 (1); TAN0201/109 (1); KAH9704/17 (1); KAH0005/04 (1); KAH0108/24 (1).

DISTRIBUTION: Eastern central and southern New Zealand, from Cape Campbell to off Foveaux Strait, most records are from the Chatham Rise. Depth range 75–402 m.

STUDY SPECIMENS: NIWA Stn D900, R 173 mm, r 21 mm. V361, R 122 mm, r 21 mm, br. 20 mm.

DESCRIPTION: *Disc* small, slightly domed, margins more or less vertical. Actinosome sunken, arms arched, rounded, slightly constricted at base, and taper gradually distally.

Disc plates small, relatively numerous, irregularly shaped, usually elongate. On midline of arms, a definite carinal series of short broad, cruciform plates, at least 2 adradial plates in irregular transverse series, with occasional longitudinal connecting plates, all forming a reticular network. Marginal and actinal plates in definite transverse and longitudinal series. Plates of disc, carinal and superomarginal series usually have one pointed spine, up to 5 mm long; adradial plates usually spineless, the few adradial spines form no definite pattern. Marginal plates, especially superomarginals, are recognisable by the continuous longiseries of spines. At arm base, 2 series of actinal plates with rudiment of a third. In large specimens there are 4 actinal series. In distal third of arm, actinals absent, though adradials persist to arm tip, or nearly so. Proximal inferomarginals have 2 flattened spines, a little longer than superomarginal spines; from about 1/3 R there is only 1; actinals have 1–4 spines, usually flattened, with truncate tips.

Adambulacral plates short throughout; 2–4 flattened, truncate spines; proximal plates have 2, and 3 are common over most of arm; 3 pairs of plates in an adoral carina.

Oral plates sunken, small; 1 proximal furrow spine, 2 suboral spines.

Papulae common, up to 10 in larger skeletal meshes. Papular area extends to between two lowermost rows of actinal plates.

Small crossed *pedicellariae* occur on abactinal surface, scattered over plates, not associated with spines. On actinal surface they are not common, though a few occur along furrow margin. Large and small straight *pedicellariae* are also scattered over abactinal and actinal surfaces. They are all of the characteristic form as described. On inferomarginal and actinal plates a few may occur at bases of spines. These *pedicellariae* are also common along furrow margin. (Note: In the

large specimens from Stn D900, inferomarginal and actinal spines are often broadened in the distal third. Some are also curved into a scoop-shaped distal end.)

COLOUR (preserved specimen): Dull uniform brown.

REMARKS: This genus appears related to *Cosmasterias*, differing in the more open and reticulate skeleton; the species is not known outside of New Zealand.

Rumbleaster n. gen.

Asteriidae with 5 arms; abactinal skeleton with 3 regular longiseries of adradial plates. All or most carinal plates with a spine; only alternate superomarginals with a spine; inferomarginal with 2 spines, the outer united in a web of skin; a single series of actinal spines without attached *pedicellariae*; adambulacral plates with two spines. Straight *pedicellariae* small, slender, lanceolate, rare; only 3–4 seen at arm base; crossed *pedicellariae* small, no enlarged lateral teeth, relatively few in spinal sheaths, on the outer inferomarginal spine only. Gonads open dorsally at arm base, in a specialised area, with small perforated papilla-like structures. *Papulae* numerous to each area, in 6 longiseries on ray. No pebbled area on superomarginal plates. Colour dark brown with white spines and yellow madreporite.

TYPE SPECIES:

Rumbleaster eructans n. sp.

REMARKS: This genus is very similar to *Sclerasterias* Perrier but differs in having three, rather than a single adradial series of plates and spines, in having a specialised area to the opening of the gonads, and no pebbled area on the superomarginal plates. *Astrometis* Fisher differs in lacking the inferomarginal web and has two irregular adradial series.

The type and only known species is recorded only from Rumble 3 and Rumble 5, active submarine volcanoes, Bay of Plenty, New Zealand. Of 5 collecting sites, 3 also recorded the vent bivalve *Bathymodiolus* sp.

ETYMOLOGY: *Rumbleaster*—in reference to the type locality, Rumble III seamount.

Rumbleaster eructans n. sp. (Pl. 59)

MATERIAL EXAMINED:

NIWA Stns: Z10771 (1 juv.); Z10797 (3); Z10808 (1); Z10811 (1, frags); Z10818 (1).

DISTRIBUTION: Only known from active volcanoes, Rumble III and Rumble V, offshore from the Bay of Plenty,

North Island, New Zealand, in depths of 220–755 m.
DESCRIPTION: *Outline* stellate, 5 arms, tapering in distal half and with 5 sides, more or less flat on actinal surface, though abactinally with a distinct ridge along centre-line of arms; lateral face of arm between the 2 marginal series is short.

Disc small, abactinal surface lightly convex, with lobate plates in 2 more or less circular rings; adjacent plates with lobes touching, or united by small, narrow secondary plates; first plates of carinal series larger than others on the disc; the small anal aperture is central and is surrounded by very short spines. A thin skin covers the disc and arms and partially obscures the plate outlines. Spine of disc plates taper and have a sheath of skin extends from the base for at least 1/2 the length of the spine. 1–6 small crossed pedicellariae are present at the top of the sheath.

Oral plates small, slightly sunken into actinosome, each with 3 spines, the median usually the longest; behind each pair of oral plates the first 2 pairs of adambulacral plates are united interradially.

On arms, plates fairly regularly arranged; the carinal plates quadrilobate, the tips of the lobed broadly rounded and the plates imbricating, the proximal lobe over the distal lobe of the preceding plate; almost all carinal plates with a single spine, up to 7 mm long; lower half or more of spine with a sheath, the top of which has 4–10 crossed pedicellariae; area between carinals and superomarginals plates has transverse series of narrow elongate spineless connecting plates; on these rows are 3 series of larger plates with short variously developed lobes, these tending to form incomplete and slightly irregular longitudinal rows.

Superomarginal plates quadrilobate, imbricating like the carinals, every second plate with a tapering spine. Terminal plate widest at distal free margin, without spines except along distal margin. Inferomarginal plates form distinct edge to arm, each plate with 2 flattened spines with the tips truncate. Outer spine has a sheath and crossed pedicellariae on the outer or upper face only and these spines are united in a longitudinal web of skin; lower or inner spine lacks this web and pedicellariae, though both spines often have a broad groove towards the tip on the lower face.

A single series of *actinal plates* extends to within 1/4R of the arm tip; each plate has a single flattened spine, shorter than those on adjacent inferomarginals and not as compressed.

Adambulacral plates short, regularly with 2 spines; which vary in length; most proximal spines are round, and then become flattened, but occasional spines may be rounded.

Papulae are conspicuous in the abactinal meshes, with 4 rows between the carinals and superomarginals, and 15 papulae in each area. Between the marginal plates the areas are smaller and have up to

12 papulae. A single series of actinal papulae present, with 8–10 between the actinal plates reducing to a single papula distally.

Madreporite placed near disc margin, roughly rounded, diameter 3 mm, tumid, with coarse radiate sculpture. Skeletal meshes of disc contain up to 20 conspicuous papulae

Small lanceolate straight *pedicellariae* very occasionally present along the furrow margin.

Tubefeet quadriserial, with small, though distinct sucking-discs.

Gonads open dorsally at base of arm between the first and second adradial series of spinous plates; there is a small area with several small tubercles, most pierced by a single pore.

COLOUR: Spines and skeletal plates whitish, papular areas very dark brown and the conspicuous clusters of papulae almost black. Tubefeet light brown, in life madreporite yellow and conspicuous.

ETYMOLOGY: *eructans*—in reference to the volcanic environment at this locality.

HOLOTYPE: Deposited in the collection of NIWA, Wellington, No. H-859 (Stn Z10797).

PARATYPES: Deposited in the collection of NIWA, Wellington, Nos P-1415 (Stn Z10797); P-1414 (Stn 10808).

REMARKS: A small asteroid from NIWA Stn Z10771 (R/r = 13/2.5 mm) has been referred to this species. The abactinal surface is reddish brown, the actinal very light brown, tubefeet slightly darker; the spines are almost white. There are 5 equal arms and the tubefeet are biserial. The skeleton is composed of a carinal row, one adradial row extending spines to distal third of arm; then the two marginal series; actinal plates are absent. The plates have 1–2 short spinelets, with the tip truncate or bluntly rounded and is very finely rugose.

A single spinelet is present on the adradials and 1 or 2 on the carinals and superomarginals. All superomarginals have at least 1 spinelet and a small “pebbled” area. The whitish terminal plates are relatively large and conspicuous; it tapers to a distal point and has several small spinelets. Each of the inferomarginals has 2 flattened spines, like in the adult, though no longitudinal web of skin is present.

Only the first pair of adambulacral plates meet interradially, first 1–2 plates with a single spines, the remainder with 2, except near the arm tip, where only 1 is present. The oral plates have only 2 spines. The madreporite has little sculpture, only a few perforations. Papulae are single in the skeletal meshes of the abactinal surface, and are absent on the actinal surface.

A few small, lanceolate, straight pedicellariae scattered along the margin of the ambulacral furrow and a few larger bluntly tipped straight pedicellariae are present on the disc. Crossed pedicellariae small, scattered over plates on the abactinal surface, not associated with the spines. Genital pores not apparent.

A small specimen of *Sclerasterias mollis* (Hutton) (NIWA Stn D20, R/r = 4.2/1.5 mm) lacks adradial plates, but has single spines on the carinal and superomarginals and 2 on the inferomarginals. Crossed pedicellariae are present around the bases of all but the inner inferomarginal spine. The first adambulacrals are in contact and have a single spine, while the rest have 2; the oral plates also have 2 spines. Actinal plates, spines and papulae are absent. No inferomarginal web is present (dry specimen), and thick skin conceals the surface of the superomarginal plates. A smaller specimen from this station (R/r = 2.8/0.9 mm) has 1 arm longer than the others, only a few carinal spines, and none on the superomarginals, though the inferomarginals have 2. All but the first adambulacrals have 2 spines; actinal plates are absent, papulae are single, with none on the actinal surface. No inferomarginal web (dry specimen); skin conceals superomarginal plates. The madreporite is single and relatively conspicuous.

Sclerasterias Perrier, 1891

Asteriidae with pedicellariae on outer side of outer inferomarginal spine only, these spines linked by a longitudinal web of skin, sometimes retracted and inconspicuous. Adambulacrals diplacanthid. Five arms, pentagonal in section, usually one longiseries of adradial plates and spines. Alternate carinals and superomarginals usually spineless beyond base of arm, superomarginals with a beaded area. Crossed pedicellariae with the lateralmost of the terminal teeth slightly enlarged.

TYPE SPECIES:

Sclerasterias guerni Perrier, 1891.

REMARKS: This genus is unusual as three species are thought to be fissiparous, 6-armed when young, but 5-armed and non-fissiparous when adult. These young specimens may have more than one madreporite, and perhaps fission continues till there is only one madreporite. In addition, the crossed pedicellariae do not form circumspinal wreaths, but are scattered over the abactinal surface; the abactinal plates have 2–4 short uniform spinelets and the superomarginals 2–3.

Sclerasterias mollis (Hutton, 1872) (Pl. 60)

Asterias mollis Hutton, 1872: 4; Farquhar 1898: 316; Benham 1909: 19.

Eustolasterias mollis: Fisher 1923: 255.

Sclerasterias mollis: Fisher 1924: 4; 1928: 107; Mortensen 1925: 318, pl. 14 (13, 14); H.E.S. Clark 1970: 4, 6, 23; Clark & Mah 2000: 298.

MATERIAL EXAMINED:

NIWA Stns: A444C (1); A444G (1); A444J (1); A444K (1); A444N (1); A843 (2); A910 (8); B196 (6); B197 (6); B241 (1); B261 (1); B263 (1); B488 (1); B489 (2); B498 (1); B515 (3); B554 (14); B555 (3); B556 (frag.); B562 (1); B566 (1); B568 (1); B579 (1); B587 (1); B588 (1); B592 (4); B605 (1); B670 (1); C51 (1); C60 (1); C252 (1); C601 (1); C608 (2); C623 (1); C624 (3); C683 (2); C703 (3); C707 (1); C844 (6); C851 (1); C957 (2); D20 (2); D78 (4); D100 (2); D121 (2); D131 (77); D132 (13); D133 (68); D139 (8); D144 (37); D145 (1); D151 (20); D152 (36); D154 (12); D173 (12); D194 (2); D198 (1); D595 (2); D876 (1); E127 (1); E140 (1); E320 (1); E402 (1); E412 (1); E424 (1); E755 (3); E759 (2); E796 (1); E804 (1); E820 (5); E836 (field notes); E897 (2); F77 (13); F78 (42); F79 (1); F92 (2); F93 (8); F97 (44); F98 (2); G153 (1); G157 (2); G162 (1); G163 (1); G273 (1); G290 (1); G293 (1); G307 (1); G654 (3); G662 (1); G673 (1); G674 (1); G679 (60); G680 (8); G681 (5); G684 (1); G685 (4); G686 (8); G689 (9); G690 (11); G691 (1); G695 (3); G707 (4); G877 (frags); G878 (3); G882 (1); G885 (2); G899 (5); G940 (several); H950 (1); I19 (1); I622 (?); I623 (1); I624 (1); I625 (1); I626 (1); I711 (1); J32 (1); J34 (1); J55 (1); J59 (2); J676 (1); K795 (1); P 7 (1); P 10 (3); P61 (2); Q16 (5); Q24 (1); Q25 (3); Q85 (3); Q87 (1); Q97 (1); Q100 (1); Q104 (1); S23 (1); S69 (2); S80 (1); S134 (70); S155 (2); S157 (1); S176 (2); S177 (16); S179 (18); S184 (2); S190 (1); S201 (1); S216 (1); S217 (1); T55 (1); T501 (1); T760 (1); U591 (1); V373 (1); W435 (3); Y27 (1); Y39 (1); Z119 (1); Z2375 (1); Z5362 (1); Z8473(4); Z9000 (1); Z9210 (2); Z9244 (1); Z9512 (1); Z9825 (1); Z9826 (1); Z9828 (1); Z9829 (1); Z9831 (1); Z9836 (2); Z9823 (lots); Z9959 (1); Z9960 (1); Z9961 (1); Z9982 (1); Z9984 (3); Z9985 (1); Z10170 (1); Z10571 (1); Z10610 (1); Z10681 (1); Z10683 (1); Z10822 (1); Z10823 (1); TAN0219/84(1); TAN0219/85(1); TAN0219/91 (3); TAN0219/92 (1); KAH9604/14 (1); KAH9704/13 (1); KAH9704/16 (2); KAH9704/18 (1); KAH9704/23 (1); KAH9704/122 (frag.); KAH9809/70 (1); KAH9916/02 (1); KAH9914/01 (1); KAH9914/02 (1); KAH9914/03 (3); KAH9917/03 (1); KAH9914/06 (1); KAH0002/02 (3); KAH0005/05 (1); KAH0005/03 (2).

DISTRIBUTION: This species is widespread in the New Zealand region, from the Kermadec Islands to the Auckland Islands. The genus is widespread but surprisingly is not recorded from Australia. Depth range 0–660 m.

STUDY SPECIMEN: NIWA Stn D151, R/r = 107/15 mm, br. 14 mm.

DESCRIPTION: *Disc* small, flat-topped or inflated; arms 5, slightly constricted at base, slowly tapering in distal half, tip small, blunt. Arms arched, angular on abactinal surface. Carinal plates slightly raised, as are adradials, superomarginals often form a marked dorso-lateral edge to arm. Inferomarginals form a well-marked ventrolateral margin; actinal surface flat, actinosome slightly sunken or not.

Disc plates irregularly lobate, roughly arranged in 2 circles around small centrodorsal; plates of outer circle larger, with basals and radials. On arms, plates arranged in longiseries, less regular transverse series also evident. Carinal plates more or less cruciform, at least quadrilobate; 2 longiseries of adradial plates for proximal 1/3 of arm; series nearest to carinals extends to near arm tip. Adradials tend to a Y-shape, both series slightly zigzag; 1–3 small elongate supplementary plates link adradial series with each other, and carinals and superomarginals. Superomarginals lobate, strongly overlapping, with a small beaded area near centre of plate. Inferomarginals ovate, also overlapping. Near arm base a small elongate supplementary plate may link the 2 marginal series. Carinal plates have 1 pointed spine, usually on alternate plates, may be present on all plates proximally. Some specimens occasionally with 2 carinal spines, but this is not constant. Adradial spines present on plates of inner row to near arm-tip, outer series usually spineless. Superomarginals with a spine on alternate plates throughout arm; inferomarginals with 2 spines, sometimes flattened.

A single series of *actinal plates* extends to just beyond 1/2 R, plates with 1 spine, or in larger specimens sometimes 2.

Adambulacral plates regularly diplacanthid, 2 pairs of plates in adoral carina.

Each of the *oral plates* has 3 spines.

Anal aperture visible.

Madreporite prominent, placed near margin, rounded, diameter 5 mm, with fine, radiate sculpture.

Papular areas relatively conspicuous, larger skeletal meshes have up to 10 papulae. On actinal surface there is a single series of papulae, with 1–3 in each area.

Crossed *pedicellariae* small, in wreaths around abactinal and superomarginal spines, present as a pad on outer face of outer inferomarginal spine. These spines also linked by a longitudinal web of skin, sometimes retracted, particularly when dried. In others it is a conspicuous feature. No pedicellariae on inner inferomarginal spine or actinal spines. Straight pedicellariae larger, lanceolate, with jaws tapering and pointed. In this specimen they are uncommon, with a

few scattered over abactinal surface and a few also on actinal face of inferomarginal plates.

Tubefeet are quadriserial to near arm-tip.

COLOUR (dried specimen): Dull brown, with darker tubefeet.

REMARKS: NIWA Stn Z5362, Auckland Islands, R/r = 214/33 mm, br. 44 mm, the disc spines short, capitate, well-spaced; the centrodorsal has 3, the others usually 1. Madreporite large, rounded, diameter 7 mm, with fine, radiate sculpture, surrounded by a circle of spines. On the arms, the carinals have up to 5 short, pointed spines, variously arranged; there are a few short, pointed adradial spines, in a roughly linear series, but the spines are spaced, irregular, and not extending to 1/2R. Superomarginal spines are single, short, blunt. A low, inconspicuous longitudinal web of skin often links some superomarginal spines, but is not continuous. Intermarginal channel very broad. Inferomarginal spines 2, outer linked by skin, and sometimes inner also. A thinner web may link both inferomarginal spines and actinal. One series of actinal plates, extends to distal 1/3 of arm; usually 1 actinal spine though the proximal plates have 2–3. Lower inferomarginal and actinal spines flattened, sometimes with tip slightly scoop-shaped. Adambulacrals regularly diplacanthid, spines not tapering, tip slightly scoop-shaped. Three pairs of monacanthid adambulacrals comprise adoral carina. Spines on oral plates also scoop-shaped. Abactinal surface covered by a thin skin, and the papular areas are large, up to 30 papulae in each, and the areas tend to be confluent. On actinal surface, a single series of papular areas, with up to 10 papulae in each. The wreaths of crossed pedicellariae are very large and spread across most of the surface of plates. On some abactinal plates, particularly those with multiple spines, the pedicellariae are not on spines, but on plates. On marginal spines, wreaths are near tips, and large. Occasional inferomarginal plates have a few crossed pedicellariae on inner spine. Straight pedicellariae lanceolate, scattered over abactinal surface, on actinal side of inferomarginal spines and on the web of skin. No pedicellariae along furrow margin or on oral spines. Tubefeet are quadriserial to near arm-tip. Anal aperture not apparent.

NIWA Stn C608, central Chatham Rise, R/r = 152/14 mm, br. 17 mm; adambulacral plates with 2 spines over most of the arm, occasional plates in proximal 1/2 of arm have 3, a few have 4 spines. Occasional actinal plates with 2–3 flattened spines, most with 1; a short second spineless actinal series at arm base. Some inferomarginals with pedicellariae on both spines, and in some both spines are united in the web.

NIWA Stn A910, Chatham Rise, 7 small specimens with R 8–16 mm. All have five arms, a single

madreporite, and no visible anal aperture; crossed pedicellariae in small wreaths on abactinal and marginal spines; no longiseries of adradial plates, but 1–2 small adradials in transverse series, linking carinals and superomarginals; beyond about 1/3R, the carinals adjoin superomarginals. Alternate superomarginals with a single spine, all inferomarginals except those at arm-tip have 2. No trace of inferomarginal web. No actinal plates. Adambulacrals diplacanthid. A few very small lanceolate straight pedicellariae on abactinal surface and actinally. One specimen has several relatively large pedicellariae on oral plates. Tubefeet biserial.

NIWA Stn D20, R/r = 4.1/1.5 mm, and 2.8/0.9 mm; both with 5 arms, a single madreporite, single abactinal and superomarginal spines, and crossed pedicellariae around the bases of these spines, and on outer face of outer inferomarginal spine.

NIWA Stn E320; five unequal arms, and one missing, the only 6-rayed specimen examined; 2 larger arms, R 13 mm, have zigzagged, almost quadriserial tubefeet; the three smaller arms, R 7–10 mm, have biserial tubefeet; all 6 oral plates are the same size.

Smilasterias Sladen, 1889

Asteriidae with five rays and a compact, reticulate abactinal skeleton, the plates with small spinelets. Inferomarginals with an oblique comb of 3–4 flattened spines. Adambulacral plates with two or three spines. Adoral carina composed of the first pair of adambulacral plates. Crossed pedicellariae small, not distinctive, straight pedicellariae sometimes felipedal. Superomarginals may have a “beaded” area. One madreporite, not fissiparous. Gonads open dorsally.

REMARKS: This genus is related to *Allostichaster* but differs in having a wider and less regular adradial area, with the plates arranged mainly in transverse series. The longitudinal plates of the adradial area are small connectors and are one or two longiseries. The genus is more or less circumpolar, somewhat more southern than *Allostichaster*. Some species have a pebbled area on the superomarginal plates.

TYPE SPECIES:

Asterias (Smilasterias) scalprifera Sladen, 1889

KEY TO SPECIES

- 1 Superomarginal plates lobate and overlapping....
..... *Smilasterias clarkailsa* O’Loughlin & O’Hara
- 1’ Superomarginal plates not lobate or overlapping
..... *Smilasterias actinata* n. sp.

Smilasterias clarkailsa O’Loughlin & O’Hara, 1990
(Pl. 61)

Smilasterias cf. irregularis A.M. Clark 1962: 87.

Smilasterias irregularis: McKnight 1984: 143 (non *S. irregularis* H.L. Clark, 1928)

Smilasterias clarkailsa O’Loughlin & O’Hara, 1990: 316, pl. 1 (f, g); O’Hara 1999: 189; Clark & Mah 2000: 299.

MATERIAL EXAMINED:

NIWA Stns: A694 (1); A695 (4); A696 (1); A698 (1); B339 (1); C732A (2); D10 (2); E228 (14); E230 (1); E233 (1); E235 (2).

DISTRIBUTION: This species is recorded from Macquarie Island, 11–357 m, and south of Tasmania, 620–1650 m.

STUDY SPECIMEN: NIWA Stn D10, R/r/br = 31/5/6 mm, R/r = 6.2/1.

DESCRIPTION: *Disc* small and slightly domed, with 5 rays; 2 rays regenerating, the other 3 subequal in length, slightly constricted at base and tapering very gradually to a blunt tip. The actinosome slightly sunken. Rays rounded on the abactinal surface and almost flat actinally. A well-marked ventrolateral angle present.

On disc, *plates* are small, elongate, irregularly arranged. On rays, carinal plates are evident, but not raised, being cruciform and imbricate. Up to 4 small adradial plates in irregular transverse series, 1 series of longitudinal adradial connecting plates, about midway between the carinals and superomarginals. Superomarginals imbricate along ray, more or less cruciform. Inferomarginals correspond to superomarginals. Most proximal of superomarginals with a small beaded area, visible when cleaned. Plates of the disc and arms with 1–3 small spinelets, slightly expanded at tip, and when dried seen to have fine longitudinal striations. Tip capitate, 2–3 times longer than wide. Spines spaced apart. Proximal superomarginal plates have 3 spines—on lower lobe of plate, on upper lobe, and on distal lobe. Inferomarginal plates have 2–3 flattened spines, with tip widened; these form a distinct marginal fringe.

A single series of small *actinal plates* extends almost to 1/2 R along ray. Most proximal actinal plates with a small, inconspicuous spine; this absent beyond the first 4–5.

Adambulacral plates with 2, sometimes 3 spines; inner spine rounded and a little shorter than the more flattened outer spine. Where 3 spines are present the middle one resembles the outer. Adoral carina composed of first 2 pairs of adambulacral plates.

Each of the small *oral plates* has 2–3 spines.

Anal aperture inconspicuous, placed near disc centre, surrounded by cirlet of small spines.

Madreporite single, small, diameter about 1.5 mm, placed near margin. It has coarse, radiate sculpture and is surrounded by a cirlet of normal disc spines.

Papular areas not very conspicuous. On disc and arms there are up to 4 papulae in each area. The lowest row of papulae appears to be just above the superomarginal plates.

Crossed *pedicellariae* small, thickly scattered over abactinal surface, commoner than spines; rare on actinal surface. Straight pedicellariae mainly small and lanceolate. Occasional pedicellariae may have 2 curving spines on distal margin of blade. These small pedicellariae rare abactinally, but common along furrow margin. Larger straight pedicellariae lacking terminal teeth present between inferomarginal spines, on actinal surface.

COLOUR (preserved specimen): Dull brown or tan.

REMARKS: This species is well described by O'Loughlin and O'Hara (1990). The distinctive features are the relatively few actinal spines, and the abundant crossed pedicellariae on the abactinal surface. With 2–3 often flaring inferomarginal spines and actinal plates extending to about 1/2R, this species appears allied to both *S. scalpifera* (Sladen) and *S. triremis* (Sladen). It differs from the former in having fewer dorsolateral plates between the carinals and superomarginals and fewer inferomarginal spines; from the latter it differs in having spaced abactinal spinelets and fine beading on the superomarginal plates. Other species referred to this genus have a much shorter series of actinal plates.

Smilasterias actinata n. sp. (Pl. 62)

MATERIAL EXAMINED:

NIWA Stn S194 (1).

DISTRIBUTION: This species is known only from the Pegasus Canyon, east coast South Island. Depth: 1190 m.

STUDY SPECIMEN: NIWA Stn S194 (1), R 54 mm, r 8 mm, br. 7 mm, R/r = 6.8/1.

DESCRIPTION: *Disc* small and abactinal surface nearly flat. Small interradiar arcs rounded. The 5 rays arched, rounded on abactinal surface, tapering gradually to fine tip. Actinosome not sunken.

Disc plates irregularly arranged, though an indistinct circular pattern is present, in parts. Plates mainly elongate, much longer than wide. On the rays, a dis-

tinct carinal series, the plates strongly cruciform, their length and breadth about equal. The plates are not raised above the general abactinal surface. The adradial area broad, covers much of the abactinal surface. The plates are small and arranged in transverse series, each plate being transversely elongate, so that width is much longer than length. At the arm base there are 5–6 plates in each series and at 1/2R, there are 3. One series of adradials continues to near the arm-tip. One longiseries of adradial connector plates present at about two-thirds of distance between carinals and superomarginals. These connecting plates are of varying shape. Proximally they are often Y-shaped, sometimes inverted, so that the series is reticulate. From about the proximal third of the arm, most of the plates are elliptical or rectangular, with the longer axis along the arm. A second series of connecting plates is present at upper end of superomarginal plates, where one or two small plates join the superomarginals. Superomarginal plates elliptical, wider than long over most of ray, consecutive plates being separated by papular areas. There is no area of pebbling or beading on superomarginal plates. Inferomarginal plates form a well-marked ventrolateral angle to ray. Viewed from the side they are seen to be as long as wide or longer, and are overlapping. Abactinal plates of disc and rays have 1–5 small spinelets, finely denticulate and sometimes with fine grooves. Spinelets scarcely taper, except sometimes near tip. Superomarginal plates with 1–2 similar spinelets, one almost always present near upper margin of plate, the second, if present, placed slightly above centre of plate. Inferomarginal plates with 3 spines, longer than elsewhere and forming a distinct marginal fringe. The spines flattened and tip slightly wider than the base, the spine tapering evenly.

Actinal plates small and inconspicuous, placed by each inferomarginal. They extend to just beyond 1/2R along ray, and most have one flattened spine, a little shorter than the inferomarginal spines.

Adoral carina composed of first 2 pairs of adambulacral plates. The first pair meet throughout their length and the second touch proximally only. The first adambulacral plate has one spine, the second 1–2 spines, and the rest have 2 subequal and slightly flattened spines, the inner the more delicate.

Oral plates small, each has 2 spines.

Anal aperture not apparent.

Madreporite elliptical, length 2 mm, placed near margin. It has coarse radiate sculpture, and is surrounded by spines a little larger than elsewhere on the disc.

Papular areas large, especially on adradial areas of rays. On disc are up to 3 papulae in each area, and up to 8 on adradial areas of arms. Between supero-

marginals are usually two or three papulae; no papulae below superomarginals.

Tubefeet quadriserial over ray, except for distal third, where they are zigzagged or biserial.

Small crossed *pedicellariae* scattered over abactinal surface, and on the rays more abundant than spines. Straight *pedicellariae* vary in size, small ones common along furrow margin and under inner oral spines, with a few larger interspersed among them. These are all alike in form, simply elongate and lanceolate; 2–3 larger *pedicellariae* with jaws non-tapering and 2–3 curving terminal teeth present in each interradius on actinal surface.

COLOUR (preserved specimen): Dull creamy-light brown, with the tubefeet a little darker.

ETYMOLOGY: *actinata*—in view of the actinal plates extending beyond 1/2R.

HOLOTYPE: Deposited in the collection of NIWA, Wellington, No. H-860.

REMARKS: The genus has been reviewed by O'Loughlin and O'Hara (1990) and, from their key, this species is seen to be an intermediate form. It will run down to *S. clarkailsa*, but differs in having non-imbricating superomarginals. In this feature it is most like *S. multipara* O'Loughlin & O'Hara, known from shallow water in S.E. Australia. It differs, though, in the much more extensive actinal series, and from both in lacking any beading on the superomarginal plates.

Stichaster Müller & Troschel, 1840

Asteriidae with the abactinal crossed *pedicellariae* scattered, not in circumspinal wreaths; more than 5 arms. Carinal and superomarginal plates very short and broad, dorsolateral area broad, plates in 3–5 series on either side of carinals; superomarginals conspicuously broader than inferomarginals, which form well-marked ventrolateral angle to arm; actinal plates small, in a single series. Body covered with close-set, coarse granuliform spinelets; adambulacral plates with 2 spines; adoral carina present. Madreporite single. Gonads open dorsally; not fissiparous; interbranchial septa heavily calcified.

TYPE SPECIES:

Stichaster striatus Müller & Troschel, 1840

Stichaster australis (Verrill, 1871) (Pl. 63)

Coelasterias australis Verrill, 1871: 247; Hutton 1872: 5.
Stichaster australis: Sladen 1889: 431; Mortensen 1925: 313, pl. 14 (1, 2); Fisher 1930: 242; Clark & Mah 2000: 302.

MATERIAL EXAMINED:

NIWA Stns: A966 (2); C993 (2); E844 (1); E965 (1); J250 (1); J674 (1); P124 (1); Q107 (2).

DISTRIBUTION: Throughout New Zealand, North Cape to Snares Islands, and including Chatham Islands, depth range 0–10 m.

STUDY SPECIMEN: NIWA Stn R 83 mm, r 28 mm, br. 14 mm, 11 arms.

DESCRIPTION: Disc large, nearly flat-topped with sloping margins, arms 11, scarcely tapering until near bluntly pointed tip. Arms strongly arched above, have a well-marked ventrolateral angle and are flat below, actinosome not sunken.

Abactinal skeleton on disc not apparent, as the fairly close-set spinulation obscures plates. Disc plates have several elongate granules, as long as wide or wider, with tip expanded, and flattened. Granules are in groups of 3–7 or in rows. Madreporite appears to mark a boundary between plates of disc and arms; from here plates and accompanying granules fall in distinct longiseries. On arms, plates in both regular longitudinal and less regular transverse series. Individual series of plates not well-marked, owing to granular covering. Abactinal plates all relatively broad, carinals and superomarginals both much broader than long, adradials less so. Adradial plates in 3 series. All abactinal plates have an armament like disc plates. On carinals, arrangement is distinctive; a transverse row of 2–4 granules, followed by a second row, with up to 8 granules; second row extends laterally almost to granules on adradial plates. Adradials have granules in a single transverse series or a clump, on superomarginals they are in 2 transverse series, with a single granule at upper and lower margins. Inferomarginal plates project on to abactinal surface; on this face each has 1–2 granules. On actinal face are 2 short, dumpy spines, or elongate granules. Outer of these spines may be at ventrolateral angle.

One series of *actinal plates* extending to near arm tip; plates have a single spine, like those on inferomarginal plates.

Adambulacral plates compressed, each with 2 stubby spines. Adoral carina well-developed, with 10 pairs of adambulacral plates, next 5 are only slightly separated.

Oral plates small, each with 4 spines.

Papular areas are small, distinct; each has up to 10 small, crowded papulae. No actinal papulae.

Anal aperture not apparent.

Madreporite placed at about 1/2 r from disc centre, is rounded, diameter 5 mm, has relatively fine radi-

ate sculpture, the periphery margined by a continuous series of granules.

Small crossed *pedicellariae* are common on abactinal surface and on inferomarginal plates. They tend to form series around bases of spines, though these are not obvious wreaths. A few small straight pedicellariae present along furrow margin and on actinal surface.

Tubefeet quadriserial to near tip of ray.

COLOUR (preserved specimen): Dull cream to light brown

REMARKS: This species is a well marked form and easily recognised among the local near-shore fauna.

Taranuiaster McKnight, 1973

Asteriidae with five arms, abactinal skeleton a relatively open network, the carinal series not prominent. Carinal, adradial and superomarginal plates cruciform, connected by small secondary ossicles over most of arm. Abactinal and superomarginal plates with a single tapering spine, occasional spines on secondary plates. Inferomarginals with 2 flattened, truncate spines. No actinal plates. Crossed pedicellariae small, not distinctive, in wreaths on abactinal and superomarginal spines, and outer face of both inferomarginal spines. Large felipedal straight pedicellariae occur abactinally, intermarginally and actinally. Smaller lanceolate straight pedicellariae present along furrow margin. Papulae occur abactinally and in one actinal series.

TYPE SPECIES:

Taranuiaster novaezealandiae McKnight, 1973

Taranuiaster novaezealandiae McKnight, 1973
(Pl. 64)

Taranuiaster novaezealandiae McKnight, 1973a: 233; Clark & Mah 2000: 304.

MATERIAL EXAMINED:

NIWA Stns: F873 (1); G679 (1); J55 (2); J485 (1); S26 (1); S30 (1); S43 (1); S70 (1).

DISTRIBUTION: Central and southern New Zealand, from off East Cape, the Chatham Rise, off east Otago, the Bounty Platform and the Campbell Plateau, depth range 91–1050 m.

STUDY SPECIMEN: NIWA Stn F873 (holotype) R/r = 183/29 mm.

DESCRIPTION: *Outline* stellate, disc small, inflated, small and acute interradial arcs; arms five, gradually tapering, tip pointed, rounded on abactinal surface. Actinosome slightly sunken. Disc plates lobate, on arm, larger plates cruciform; carinal series not prominent. A single longiseries of adradial plates, which sometimes tend to a zigzag pattern. Superomarginals strongly cruciform, intermarginal channel broad; inferomarginals lack an upper lobe, more or less ovate. Small elongate plates connect larger plates over much of arm forming a reticular network. Plates may be in a single transverse series, or may link to 2 major plates to produce a Y-shaped pattern. Abactinal plates, including larger secondary plates, with a tapering spine, sometimes flattened.

No actinal plates.

Adambulacral plates compressed, with 2 spines, inner tapering, pointed; outer flattened, truncate. Two pairs of adambulacral plates in adoral carina.

Oral plates small and have 2 short spines.

Anal aperture not visible.

Madreporite placed near margin, is rounded, diameter 5 mm, has fine radiate sculpture.

Papular areas relatively large, up to 15 papulae in larger meshes. A single series of actinal papulae.

Crossed *pedicellariae* small, not distinctive. Lanceolate straight pedicellariae up to 0.5 mm long occur along furrow margin. Larger felipedal pedicellariae present abactinally, in intermarginal channel—here quite conspicuous—and between inferomarginal and adambulacral spines. These pedicellariae have tip scarcely expanded, with 3–6 distinct, terminal teeth, interlocking with those on opposite jaw.

COLOUR (preserved specimens): Creamy-white to dull yellow-brown or uniform brown.

REMARKS: This monotypic genus is restricted to local waters. It appears to have no close relatives. From examination of the new material it appears that the dorsolateral area expands when R is over about 100 mm; smaller specimens have a single adradial series and few secondary plates, most of which lack spines, while larger specimens have several spines between the carinals and the superomarginals and the area is relatively broad.

A specimen from NIWA Stn G679, R/r (estimated) = 180/27 mm, br. 29 mm, in poor condition, lacks felipedal pedicellariae and has modified spines on the abactinal and adambulacral plates. Most larger abactinal plates have a single spine, those remaining and intact, usually taper only slightly, and the tip is gouge-shaped; superomarginal have a similar spine with tip slightly expanded, while the inferomarginals

have 2 such spines, though the curved form is much more produced, often exceeding 180 degrees. On the adambulacral plates the inner spine is slightly the shorter, with tip a little narrower than base, often slightly grooved; and the outer spine is strongly grooved or gouge-shaped, like the inferomarginal spines.

INCERTAE SEDIS

Stolasterias edmondi (Benham, 1911)

Asterias (Stolasterias) edmondi Benham, 1911: 151.
Stolasterias edmondi: Clark & Mah 2000: 304.
Distolasterias edmondi: H.E.S. Clark 1970: 5.

DISTRIBUTION: Known only from the Kermadec Islands, depth range 0–30(?) m.

REMARKS: This species was described by Benham (1911) but was not mentioned by Fisher (1928) (under *Stolasterias*) or listed by Fisher (1930), though the reference is. It was referred to *Distolasterias* by H.E.S. Clark (1970).

Benham (1911) wrote: “it recalls *S. alexandri* Perrier (1905)”, also “is much more delicate in build than *A. rodolphi*” and “I have a very small specimen of *A. calamaria*—in which the disc-skeleton is already well developed”. The 2 specimens were small, R 33 and 26 mm, with 8 and 7 arms, respectively; have a regular abactinal skeleton, alternate carinals with a spine; every third superomarginal with a spine, 2 inferomarginal spines, and 2 adambulacral spines over most of the arm, which suggests *Sclerasterias* or *Astrostole*; the bright blue colour in life also occurs in *Astrostole rodolphi*.

“*Asterias fragilis*” Studer

“*Asterias fragilis*” Studer, 1884: 11–12, pl. 1 (2a–2d); Farquhar 1909: 126; Fisher 1930: 217.

DISTRIBUTION: Known only from east of the North Island, 1027 m.

REMARKS: The sole specimen is small, with R/r 16.5/4 mm; Studer placed it next to *Cosmasterias lurida* (Philippi); Farquhar (1909) gives an English translation of the original description, while Fisher (1930) listed the species but did not attempt any to place it in any other genus.

Order **BRISINGIDA** Downey, 1986

Deep-water Asteroidea with an ophiuroid form; disc small, distinctly set off from arms. Always more than five arms, covered with thin plates or skin, sometimes with spaced transverse bands of thickened plates—the costae. Proximal part of arm often inflated, to accommodate gonads—the genital inflation. Ambulacral and adambulacral plates elongate. One series of small spaced marginal plates, each with one or more elongate spines. Subambulacral spine or spines usually elongate. Spines including those on abactinal surface sheathed in skin that carries numerous minute crossed pedicellariae. Straight pedicellariae absent. The tubefeet are in two rows. Ampullae single, transverse ambulacral muscles poorly developed if at all.

Six families are now known (Mah 1998), and five are represented in the Southwest Pacific Ocean. The classification adopted here is provisional, awaiting a full revision of the order. The keys include all local species, except *Stegnobrisinga/Astrolirus* sp. H.E.S. Clark (1970).

KEY TO FAMILIES

- 1 Papulae present on disc and arms, transverse costae present; marginal and costal spines often forming vertical fans beyond genital inflation 2
- 1’ No papulae on arms, sometimes an inconspicuous pair on disc near arm base, transverse costae present or absent; beyond genital inflation, the marginal is usually the only elongate spine 3
- 2 Abactinal skeleton open, with up to 10 papulae in each; no adambulacral furrow spines proximally; costae irregular; first adambulacrals united by lateral face, 12 arms Brisingasteridae
- 2’ Abactinal skeleton close-knit, 1–3 papulae to each mesh; adambulacral furrow spine present proximally; costae regular; first 3–5 adambulacrals united by lateral faces; 15–19 arms Novodiniidae
- 3 Transverse costae present on arms 4
- 3’ No transverse costae on arms, but a mosaic of abutting plates Freyellidae
- 4 First pair of adambulacral united by lateral faces and also first pair of marginals. First and second adambulacral plates united by syzygy, also upper part of second and third ambulacrals, 1–2 elongate suboral spines project over actinosome; 13–17 arms. Brisingidae
- 4’ First pair of adambulacrals and first marginals not united; first and second adambulacrals not united; 7–10 arms Hymenodiscidae

Family **BRISINGIDAE** G.O. Sars, 1875

Interradial arcs acute. The madreporite large or moderate in size. There are no bare plates on the disc; the arms are constricted where they join the disc, and are usually deciduous. The abactinal arm plates form transverse costae and the first adambulacrals and marginals are united interradially.

KEY TO GENERA

- 1 Papulae absent. Subambulacral spines sometimes modified; gonads serial with several gonopores, 13–15 arms *Brisinga*
- 1' A pair of inconspicuous papulae on disc near arm base. Subambulacral spines unmodified; one enlarged suboral spine projects over actinosome, gonopores 2 to a ray; 14–17 arms *Asterostephane*

Asterostephane Fisher, 1917

Brisingidae with 2 gonads to each arm; first pair of adambulacral and marginal plates united interradially; suboral spines prominent, bent near base, extending across actinosome. A syzygy between first and second adambulacral plates and between upper part of second and third ambulacral plates. Costae thin, well-spaced, intercostal integument lacking spines. A single subambulacral spine.

TYPE SPECIES:

Brisinga moluccana Fisher, 1916

Asterostephane moluccana Fisher, 1916 (Pl. 65)

Brisinga moluccana Fisher, 1916: 32

Asterostephane moluccana: Fisher 1917: 421; 1919: 526, pls 147 (1, 2), 149 (3), 154 (2, 2a, c), 156 (2, 2a.); Baker & Clark 1970: 7; McKnight 1993: 174, 186; A.M. Clark & Mah 2000: 312.

Brisingenes delli Fell, 1958: 18, pl. 3 (D, F, H); 1963: 41.

MATERIAL EXAMINED:

NIWA Stns: E707 (1); I11 (1); I32 (4); I355 (1); I365 (1); J32 (1); K846 (1); P66 (1) U571 (1); Z1922 (1); Z2363 (frags); Z2365 (1); Z8990 (2); Z8992 (1); Z8995 (3); Z9008 (frags); Z10005 (frags); KAH0203/33 (frags).

DISTRIBUTION: Northeastern New Zealand, Bay of Plenty northwards; central-west New Zealand, Challenger Plateau; north of New Zealand, southern Norfolk Ridge, Kermadec Islands. Elsewhere: the Philippines. Depth range 210–1123 m.

STUDY SPECIMEN: NZOI Stn. I11, R/r = 164/11 mm, R broken, one detached ray is 211 mm long. 17 rays, 5

are small and regenerating, 10 are 22 mm long. Br. at base 4 mm, widest part of genital region is 8 mm. Genital region starts at 8 mm from disc and extends for about 50 mm.

DESCRIPTION: *Disc* small, flat-topped at centre, edges slightly sloping. Arms constricted at base, gently taper beyond genital inflation.

Disc covered with small *plates* and thin skin. Plates slightly spaced, each has a single short spine, the base invested by skin, which makes the base appear broad. Tip free of skin, sharply pointed. Arms covered by skin and lacking plates except for the transverse costae. Costal plates transversely elongate, much larger than disc plates and stand above general surface. Most costal plates have 1 short sharp spine. Costae in irregular transverse bands, some are convex or concave, others sinuous; beyond genital inflation, a few incomplete costae; distally, arm has a covering of skin only. Longest intact arm has 18 complete costae, and 3 incomplete.

Marginal plates relatively prominent proximally, first and second pairs are visible in abactinal and actinal views. First pair are short and united on interradial midline; first three pairs are contiguous, remainder are spaced apart and occur at lower ends of costae, at about every third adambulacral plate. Each marginal plate has a single, sharply pointed, elongate spine up to 12 mm long. Distally, where costae are absent, marginal spine persists, placed on a small plate on outer face of every second adambulacral

Adambulacral plates compressed proximally, a little wider than long, beyond genital inflation longer than wide. Furrow margin concave, more noticeable distally. First pair of adambulacral plates united behind oral plates. Two furrow spines, one at each end of plate; 2 furrow spines to near arm-tip; 2 subambulacral spines, inner the shorter, placed on proximal part of plate. Outer spine placed at about centre. Distally, inner spine disappears, and remaining spine becomes almost as long as marginal.

Oral plates small, though quite conspicuous; 2 divergent furrow spines placed at proximal lateral angle of plate; a much larger suboral spine, which projects over actinosome.

Anal aperture visible, more or less central, surrounded by a circle of slightly enlarged spinelets.

Madreporite near margin, rounded, diameter 3 mm, and has fine irregular sculpture. A circle of slightly enlarged spines surrounds madreporite. At or near base of most arms are 2 papulae, usually very inconspicuous, but sometimes large.

Small crossed *pedicellariae* present on marginal, adambulacral and oral spines, in a sheath of skin. Smaller pedicellariae occur at bases of disc spines. Pedicellariae also present as transverse bands on arms

between the costae. Proximally, 2–3 bands before first costa, then usually 1 between successive costae. Towards end of costal region, 3 between costae. These bands continue to near arm-tip but are incomplete distally, with section on midline of arm absent.

Tubefeet are biserial throughout the ray.

COLOUR (preserved specimen): Dull light brown, with the tubefeet darker.

REMARKS: The only other species in the genus, *A. acanthogenys* Fisher, also from the Philippines, has fewer arms and 2 large suboral spines.

Brisinga Asbjornsen, 1856

Brisingidae with a pair of inconspicuous papulae at the arm bases, or papulae absent; abactinal skeleton of rays as independent arches, the intervals lacking plates; proximal subambulacral spine or spines modified or not; first pair of adambulacrals united in interradius, also first marginals; a syzygy between first and second adambulacrals, and upper part of second and third ambulacrals. Gonads numerous, forming a series along proximal, swollen part of ray.

TYPE SPECIES:

Brisinga endecacnemos Asbjornsen, 1856

KEY TO SPECIES

- 1 2 subambulacral spines, the outer with tip truncate, expanded; 3 oral furrow spines, 2 suboral spines; 13 arms *Brisinga chathamica* (McKnight)
- 1' 1(2–3) subambulacral spines, tip pointed; 2 oral furrow spines, 1 suboral spine; 15 arms
..... *Brisinga tasmani* H.E.S. Clark

Brisinga chathamica (McKnight, 1973) (Pl. 66)

Craterobrisinga chathamica McKnight, 1973b: 238.
Brisinga chathamica: McKnight 1993a: 193, 198; A.M. Clark & Mah 2000: 313.

MATERIAL EXAMINED:

NIWA Stns: D90 (frags); D871 (2); E728 (frags); G364 (2); H923 (1); J58 (1); J59 (1); N868 (1); N869 (1); Q13 (2); Q40 (frags); S70 (frags) W257 (frags); X496 (frags); X499 (frags); X503 (frags); X504 (frags); X508 (frags); X509 (frags); X530 (frags); X532 (frags); X533 (frags); X534 (frags); X535 (frags); X536 (frags); X540 (frags); Z9422 (frags); Z9455 (frags); Z9459 (frags); Z9476 (frags); Z9493 (frags); Z9792 (1); Z9793 (1); Z9796 (1); Z10186 (4); Z10187 (frags); Z10189 (3); Z10385 (disc); Z10595 (frags); Z10612 (frags); Z10719 (frags); Z10731

(3); Z10957 (4); TAN9608/040 (1); TAN9713/024 (frags); TAN9908/14(frags); TAN9908/15 (frags); TAN9908/23 (frags); TAN0001/08 (frags); TAN0101/08 (frags); TAN0208/16 (frags); TAN0208/25 (frags); TAN0208/54 (frags); TAN0208/60 (frags); TAN0208/64 (frags); AEX9901/38 (1).

DISTRIBUTION: East coast of central and southern New Zealand, off East Cape and Chatham Rise, also off Bounty Islands, 309–1498 m.

STUDY SPECIMEN: NZOI Stn J59 (holotype) disc diameter 27 mm, and R about 140 mm, 13 rays.

DESCRIPTION: *Disc* small, with rounded margin, flat centrally.

Disc plates small, ovoid, each with a short tapering spine covered with thin skin; spines are pointed but may appear papillate owing to skin covering. Arms slightly constricted at base, proximally higher than wide. Genital region occupies basal third of arm; arm tapers very gradually distally. Abactinal surface covered in skin, and proximally has transverse costae present from arm base. First 3–5 inconspicuous, succeeding costae prominent and irregular. Costae composed of small elongate plates, raised above arm surface, and have occasional small skin-covered spines. Intercostal integument with a few small “prickles”. Distal part of arm has occasional costae only but towards tip costae are absent. Costae are spaced at every second or third adambulacral plate. Marginal spine sharply pointed, up to 6 mm long.

Adambulacral plates as wide as long proximally, with furrow margin nearly straight; 1 proximal and 1 distal furrow spine, 2 subambulacral spines, centrally placed, or just distal. Both spines longitudinally striated; inner is up to 5.5 mm long with tip sharply pointed; outer, up to 6.5 mm long has tip slightly expanded, with several terminal points. Distal adambulacral plates lack proximal furrow spine, and sometimes also inner subambulacral spine. First pair of adambulacral plates united for their entire length, behind oral plates, and have only 1 subambulacral spine.

Oral plates largely hidden by large suboral spines; the original account (McKnight 1973: 238) is misleading. Three furrow spines, all relatively short; one on proximal face of plate directed towards actinosome; second is at proximal lateral angle and extends across furrow; third is at distal margin, and also extends across furrow; 2 much larger suboral spines, distal is a little longer than proximal. Proximal pair, i.e. those of adjacent plates, often united by a membrane.

At base of the arms there is often a pair of inconspicuous *papulae*.

No *anal aperture* visible.

Madreporite placed at margin, subcircular, diameter 4 mm, has irregular coarse sculpture and is surrounded by slightly enlarged spines.

Crossed *pedicellariae* small, present in membranous sheaths which cover adambulacral, oral, and marginal spines; absent from disc, but present in transverse intercostal bands on arms, with usually 1 band between successive costae

Tubefeet biserial throughout arm, with distinct suckers.

COLOUR (preserved specimen): Brown to cream, with the tubefeet often darker. The gonads similar, or sometimes orange, and can be seen through the abactinal integument on the sides of the rays.

REMARKS: Of species with small "prickles" in the abactinal integument, *B. alberti* Fisher has 1 subambulacral spine, and an associated spinule; *B. eucoryne* Fisher and *B. analoga* (Fisher) have both subambulacral spines modified; *B. evermanni* Fisher has the subambulacral spines only slightly modified.

Brisinga tasmani H.E.S. Clark, 1970 (Pl. 67)

Brisinga tasmani H.E.S. Clark, 1970: 25, pl. 3(e, f); Clark & Mah 2000: 315.

MATERIAL EXAMINED:

NIWA Stns: E776 (1); P927 (8); S378 (1); S379 (1).

DISTRIBUTION: West coast of central and southern New Zealand, from 40° to 47°S latitude, 480–2470 m.

STUDY SPECIMEN: NIWA Stn P927, disc diameter 55 mm, 15 arms, over 300 mm long.

DESCRIPTION: *Disc* small, margin gently rounded, covered with small, ovoid, tumid plates, mostly spaced apart, but sometimes touching at disc centre, near margins and bases of arms. *Disc plates* have 2–8 short, tapering spines, usually finely toothed in distal quarter, and terminate in 2–3 distinct points. Bases of spines invested by thin skin. Genital region occupies proximal third of arm. On abactinal surface, arms covered by skin lacking embedded plates, and also have numerous transverse costae. Costal plates small, elongate, each with 1–2 (sometimes up to 5) short spines. Proximal costae more or less straight, distal sometimes sinuous and incomplete. A distinct tapering marginal spine, up to 13 mm in length, is present at lower end of each costa, which is at every second adambulacral plate. Marginal spines longer distally

Adambulacral plates a little longer than wide, furrow margin slightly concave. Armature of the plates variable. Usually a single distal furrow spine, project-

ing across furrow, and almost meeting fellow spine from opposite side; 2 subambulacral spines; inner short, pointed; outer much longer, tapering, with longitudinal ridges. Occasional plates may have 2 distal furrow spines, one above the other; a proximal furrow spine may also be present. Some plates may have 3 subambulacral spines in a transverse series. Distal plates usually have only the larger outer subambulacral spine present. First pair of adambulacral plates united throughout length.

Oral plates small, each with 1 large tapering suboral spine and 2 furrow spines on lateral margin of plate, one at proximal lateral angle, other at distal end. Both spines project across furrow. A very small spine sometimes present on proximal face, projecting across actinosome.

On abactinal surface, at arm bases, there may be a pair of small indistinct pits, possibly papular pores.

A small *anal aperture* present near disc centre, encircled by a more or less continuous series of plates.

Madreporite placed at margin, of irregular outline, and has deep, fine sculpture; surrounded by a strongly calcified area, devoid of spines. On inner side are tumid plates with spines and pedicellariae.

Crossed *pedicellariae* small, squat, with jaws toothed. They are scattered over disc, and as transverse bands on arms, between costae; present beyond complete costae on arms. Pedicellariae also occur in membranous sheaths that cover marginal, adambulacral and oral spines.

Tubefeet biserial throughout ray.

COLOUR: Orange on disc, with edges white, orange patches at arm bases; arms are orange-red, costae lighter; yellow-white gonads are visible through abactinal integument; actinosomal membrane dark red-brown, edges blue-grey. Tubefeet are pinkish brown; adambulacral plates white to pale orange. Between the arm bases are distinct white areas. In ethanol, the colour is dull pink to light brown.

REMARKS: This species is clearly distinct from the previous, and appears related to three Indo-Pacific forms, *B. andamanica* Wood-Mason and Alcock, *B. gunni* Wood-Mason and Alcock, both from the Indian Ocean, and also *B. trachydisca* Fisher from the Philippines. Arm numbers, numbers of costae, and differences in spinulation separate these species.

Family HYMENODISCIDIDAE Mah, 1996

Papulae absent, rarely a very inconspicuous pair present at one or more arm bases; arms usually very deciduous; adambulacral plates longer than wide with few furrow spines, a single unmodified subambulacral spine; a syzygy unites first and second adambulacrals

and dorsal part of second and third ambulacrals; first adambulacrals not united in interradius; first marginals united at proximal end only, distal end separated by interradiial plate; oral plates with small suboral spine; entrance of furrow into actinosome broad; one gonad on either side of arm.

A single genus.

REMARKS: Clark and Mah (2000) noted: "Many nominal species of *Hymenodiscus* are known only from type material, which in many cases is based on arm tips and other fragments. The widespread distributions of the better known taxa and the taxonomic implications of recognizing juvenile brisingidans dictate that all the species within this genus be seriously re-examined." In view of the limited material available, new species are not designated here.

Hymenodiscus Perrier, 1884

TYPE SPECIES: *Hymenodiscus agassizi* Perrier, 1884

KEY TO SPECIES

- 1 Adambulacral furrow spine near centre of plate; alternate costae lack marginal spine; 8 arms
..... *Hymenodiscus* sp. A
- 1' Adambulacral furrow spine placed at either or both ends of plate; all costae with marginal spine; 7–10 arms 2
- 2 Oral plates with truncate distal margin; 3 spines on proximal margin, suboral tubercles; 8 arms
..... *Hymenodiscus* sp. C
- 2' Oral plates taper to a distal point; 2 spines on proximal margin, suboral spine(s) present 3
- 3 1 suboral spine; 1 proximal adambulacral furrow spine, sometimes 1 distal; 8–10 arms
..... *Hymenodiscus aotearoa* (McKnight)
- 3' 2 suboral spines; 1 proximal adambulacral furrow spine, 2 distal *Hymenodiscus* sp. B

Hymenodiscus aotearoa (McKnight, 1973)

Brisingella aotearoa McKnight, 1973: 235.
Hymenodiscus aotearoa: Clark & Mah 200: 327.
Brisingid arms: H.E.S Clark 1970: 27, pl. 3 (g, h)

MATERIAL EXAMINED:

NIWA Stns: C605 (1); C640 (1); C642 (frag); D206 (3); D207 (frags); D208 (frags); D211 (1); E120 (frags); E433 (frags); E735 (frags); E750 (field note); E772 (2); E859 (frags); F115 (frags); F126 (1); F128 (frags); F137 (1); F138 (1); F755 (1); F911 (frags); G700 (1); G701 (3); G819

(frags); G820 (frags); I25 (1); I666 (3); P926 (frags); P942 (3); Q83 (1); Q84 (frags); S377 (1); W248 (frags); W460 (frags); Z8987 (frags); Z8988 (frags); Z8989 (1); Z8994 (2); Z8996 (frags); Z8997 (frags); Z9003 (frags); Z9005 (2); Z9006 (frags); Z9008 (frags); Z9014 (2); Z9016 (frags); Z9020 (frags); Z9022 (frags); Z9024 (frags); Z9217 (frags); Z10576 (1); Z10596 (frags); Z10741 (frags); Z10968 (frag.); TAN0307/32 (frags); KAH9604/006 (frags); KAH0203/38 (frags); 1054/49 (frags).

DISTRIBUTION: Widespread around New Zealand, Lord Howe Rise, east coast of both islands, west coast of South Island, Chatham Rise, Bounty Platform and Campbell Plateau, 150–1518 m. Only 1 record is from depths of less than 200 m and only 7? are from depths greater than 1000 m.

STUDY SPECIMEN: NIWA Stn D206 (holotype), R 138 mm, r 8 mm, with 8 rays.

DESCRIPTION: *Disc* small, flat-topped, margin slightly bevelled.

Abactinal surface of disc paved with small rounded to ovoid plates, each has a single short fluted spine, with tip slightly widened, terminating in 1–4 points. Arms slightly constricted at base, from genital inflation taper very gradually. Proximal part of arm about 5% of length, genital inflation about 25%. *Abactinal surface* covered with skin and has 18–21 transverse costae. Costal plates small and elongate, raised above surface. Occasional plates, or all have a small spine. Marginal spine up to 5 mm long, sharply pointed.

Adambulacral plates longer than wide over most of arm, furrow margin concave. Usually 1 small furrow spine, placed at proximal margin of plate. Occasional plates may also have a distal furrow spine; a single subambulacral spine, placed just distal to centre of plate. Marginal spine and costae are at every second adambulacral plate.

Oral plates distinctly pointed distally, separate first pair of adambulacral plates; 2 short oral furrow spines, on proximal margin of plate, often a further spine at lateral angle; 1 larger suboral spine.

Anal aperture subcentral, adjacent spines not enlarged. *Madreporite* placed at margin, rounded, diameter 1.5 mm, has coarse irregular sculpture and a few spinelets.

Crossed *pedicellariae* small, scattered over disc plates, and around bases of spines; 2–3 transverse bands of *pedicellariae* occur on arms between costae. Marginal, subambulacral and furrow spines invested in a sheath of skin, containing numerous *pedicellariae*; similar sheaths occur on oral spines.

Tubefeet biserial throughout arm.

COLOUR (preserved specimens): Pale yellow to cream or light brown, with the tubefeet darker. The light orange gonads may be visible through the intercostal integument.

REMARKS: This species is distinguished from *Hymenodiscus* sp. C by the smooth actinal surface on the oral and first adambulacral plates, and the presence usually of a single furrow spine at the proximal margin of the plate. Related species are *H. fragilis* (Fisher), with incomplete secondary costae, *H. pusilla* (Fisher), with 25–30 costae, both with a single distal adambulacral furrow spine, and also *H. pannychia* Fisher, with more than 19 costae and regular proximal and distal furrow spines; *H. distincta* (Sladen), from south of Australia has 3–4 furrow spines and only 2–3 proximal costae.

Hymenodiscus sp. A (Pl. 68)

MATERIAL EXAMINED:

NIWA Stn V376(1).

DISTRIBUTION: Known only from central eastern New Zealand, southern flank of Chatham Rise, 1239 m.

STUDY SPECIMEN: NIWA Stn V376, disc diameter 11 mm, 8 arms, all broken at base, longest detached ray is about 95 mm; br at base 5 mm, at widest part 7 mm.

DESCRIPTION: *Disc* small, subcircular; most of disc covering has been lost, remaining integument has a covering of slightly spaced, rounded to ovoid, slightly tumid plates, each with a single spine arising from a small tubercle. Spine ends in several sharp divergent points. Arms constricted at base, evenly widening to genital inflation, then gradually tapering to tip. Genital inflation not strongly marked; 14–15 costae extend to about proximal third of ray, but are absent from arm base. Gonads visible beneath abactinal integument, extending almost to end of costal region. Abactinal integument of arms lacks embedded plates, and beyond costal region forms all the abactinal covering. Costae more or less regular and straight, composed of small elongate plates, mostly with 1–2 low, blunt tubercles of 2 distinct types. At every second adambulacral plate are “primary” costae, with a distinct marginal spine at lower ends. At alternate plates are slightly lower costae that do not end in a marginal plate or spine. Distally there are 1–3 incomplete costae, and then occasional transverse bands of pedicellariae at about every second adambulacral plate.

Oral plates only slightly prolonged distally, but separate first pair of adambulacrals. A single proximal

oral furrow spine, placed at proximal lateral angle of plate. On one oral plate a second very small spine occurs alongside the major spine. Most plates also have a distal furrow spine, placed a little proximal to the distal lateral angle of plate; 1 larger suboral spine, equal to about 2/3 length of plate, placed just proximal to centre of plate.

Adambulacral plates longer than wide over most of ray, though first 2 are about as wide as long. Furrow margin is concave, and plates are thin towards distal end. First adambulacral plate has 1 distal subambulacral spine, and below it a small furrow spine. Proximal plates, beyond the first, have a single small furrow spine, placed just proximal to centre of plate, at edge of rounded furrow margin, not deep in furrow. A single tapering and pointed subambulacral spine, up to 5 mm long, placed at about centre of plate. The marginal spine is much larger and stronger. It also tapers, but all are broken, the longest stump being about 5 mm.

Madreporite rounded, diameter about 1.5 mm, with coarse radiate sculpture, placed at inner end of an interradial plate.

Pedicellariae absent from disc, adambulacral furrow spines and also all oral spines. They occur in membranous sheaths on subambulacral and marginal spines, and also as transverse belts, distal to costae. There may be a single belt between first 2 costae.

Loss of disc integument reveals presence of a “syzygy” between ambulacrals 2–3.

COLOUR (preserved specimens): Whitish with darker orange or brown gonads sometimes visible beneath the abactinal integument.

REMARKS: In having primary and secondary costae, this species is similar to *H. fragilis* Fisher, known from Hawaii and the Philippines, 468–758 m. It differs in having fewer oral furrow and suboral spines, and in having the adambulacral spines placed at about the middle of the plate. It differs from the other local members of the genus, by the reduced adambulacral and oral armature and the presence of two series of costae on the arms.

Hymenodiscus sp. B (Pl. 69)

MATERIAL EXAMINED:

NIWA Stn P970(1).

DISTRIBUTION: Known only from central eastern New Zealand, off Mahia Peninsula, 3391 m.

STUDY SPECIMEN: NIWA Stn P970, R estimated to be > 100 mm, r 9 mm, br at base 6 mm; 7 rays.

DESCRIPTION: *Disc* small, subcircular, margin gently sloping. Arms in same plane as disc, all are broken near base.

Disc covered with small, rounded *plates*, tumid centrally, each with a single short, tapering spine. Madreporite appears missing, but in one interradius are a few enlarged plates, which may have lain on distal side of madreporite. At arm bases are a few remnants of integument remaining and these have similar small plates. Abactinal surface of arms covered with a thin delicate membrane, lacking embedded plates. On 2 remaining arms are inconspicuous transverse costae, sinuous in form. The small elongate plates have 1–2 small spines, or lack spines entirely. On some arm fragments are a few similar costae, quite widely spaced, with bands of pedicellariae between them, these bands continue beyond the 3rd–4th costae.

Oral plates produced distally, and entirely separate the first adambulacral plates. On proximal face of oral plates, near lateral angle, are 2 short furrow spines, outer directed across furrow, and inner obliquely across actinosome. At distal lateral angle is a single furrow spine, directed across furrow. Just distal to centre of plate is a small suboral spine, and another spine is present between this spine and the distal furrow spine, forming an oblique trio.

First *adambulacral plates* wider than long, with furrow margin almost straight; remainder longer than wide, and have furrow margin concave. First adambulacral has 1 distal furrow spine, and one near-central subambulacral spine. Proximal plates have 1 proximal furrow spine, and 2 distal, placed one above the other, besides the central subambulacral spine. On more distal plates, only 1 distal furrow spine. A longer marginal spine occurs at about every 3 adambulacral plates.

Tubefeet biserial.

Some of disc covering is lost, also most of integument at bases of arms, so that “syzygies” are evident between first and second adambulacrals and also between second and third ambulacrals.

COLOUR (preserved specimens): Dull cream.

REMARKS: This specimen somewhat resembles *H. armillata* (Sladen), from Japan. It also has 7 arms, but the oral plates are not truncate distally, and have 1 more oral furrow spine, one more suboral spine, and fewer costae.

Hymenodiscus sp. C

(Pl. 70)

MATERIAL EXAMINED:

NIWA Stn U200 (1).

DISTRIBUTION: Known only from west of northern New Zealand on the Lord Howe Rise, 3180 m.

STUDY SPECIMEN: NIWA Stn U200, in poor condition and has lost most of central disc covering and that on abactinal surface of arms; r 8 mm, longest detached arm fragment is over 100 mm; 8 arms.

DESCRIPTION: *Disc* small, flat-topped, margin nearly vertical. Remaining peripheral disc plates small, rounded, with a short stubby spine. No pedicellariae on disc. All arms broken at joint between first and second adambulacral plates. Arm fragments also in poor condition, and have lost most of abactinal surface. Irregular costae present on some fragments, but no section of genital inflation is complete. Marginal spines all broken, longest being about 4 mm. These spines placed at every second adambulacral plate, and stand on a small tubercular prominence.

Oral plates about as wide as long, proximal margin almost straight, width about 1/2 length; a pronounced lateral angle, where plate adjoins first adambulacral, and distal margin of plate is truncate. On proximal margin are 3 furrow spines, just longer than proximal width of plate. Outermost spine at proximal lateral angle; 1 further shorter furrow spine at lateral angle; 1 suboral spine. Actinal surface of plate has 3–4 low tubercles scattered over surface. These do not appear to have carried spines, by comparison with scars left by furrow spines on proximal face.

First *adambulacrals* separated throughout length by oral plates. Above oral and first adambulacral plates are first marginals, united at their proximal ends. First adambulacrals have furrow margin concave and 2–3 short furrow spines, and one slightly longer subambulacral spine. Actinal surface, like that of oral plates, has low tubercles, with usually 3 in a transverse series. Other adambulacral plates longer than wide, furrow margin concave; 2 furrow spines, one at proximal margin, one at distal, so that successive pairs of *tubefeet* are separated by 2 spines. A single subambulacral spine, placed just distal to centre of plate. All are broken.

Madreporite may be represented by an ovoid area with enlarged plates, lying across margin, but the plates are damaged and broken.

COLOUR (preserved specimen): Uniform dull creamy-white.

REMARKS: In having 3 proximal furrow spines, this species is similar to *H. fragilis* (Fisher), from Hawaii and the Philippines. However, the distinctive and unique feature of the present specimen is the presence of tubercles on the oral and first adambulacral plates.

Stegnobrisinga/Astrolirus sp.

Stegnobrisinga/Astrolirus sp. H.E.S. Clark 1970: 28.

MATERIAL EXAMINED: Nil.

DISTRIBUTION: Known only from off southwestern Fiordland, southern New Zealand, 2104–2470 m.

DESCRIPTION: *Costae* conspicuous on genital inflation, distally inconspicuous, and present laterally only; costal plates tumid, rectangular, imbricating, sometimes overlapping; plates with 1, rarely up to 3 spines. Lateral plates with larger spines; spines short, fluted, round at tips. Primary costae at every third adambulacral plate, secondary incomplete costae present abactinally, plates small, flat, often with 1 small spine. Surface between costae paved with small, contiguous round, oval or rectangular plates, somewhat irregular laterally; these plates thin, porous and lack spines. Plates fewer and irregularly arranged beyond genital inflation.

Adambulacral plates separated by distinct, muscular spaces; one distal furrow spine projecting over furrow; a conspicuous, short, fluted subambulacral spine, occasionally a second, smaller spine present.

Pedicellariae occasionally present between costae, and on furrow spines.

Tube feet biserial, with distinct sucking discs, each pair separated by projecting furrow spines.

REMARKS: These arm fragments appear to represent an additional species in the fauna. Features of the plating and spinulation are not matched elsewhere in the material examined, but the absence of the disc precludes a definite assignment of this material.

Family **BRISINGASTERIDAE** Mah, 1999

Brisingida with papulae present on both disc and arms; abactinal skeleton open, with up to 10 papulae in each mesh, no proximal adambulacral furrow spines; costae irregular; first and second adambulacrals united by syzygy; arms more or less deciduous; disc plates form a close-knit cluster at disc centre; inverted Y-shaped plate at base of each arm; gonads serial.

A single genus.

Brisingaster de Loriol, 1883

Brisingasteridae with numerous papulae in the skeletal meshes of disc and genital inflation; disc plates form a close-knit cluster at disc centre; inverted Y-shaped plate at base of each arm; transverse costae

often irregular. First and second adambulacrals united by syzygy; gonads serial.

TYPE SPECIES:

Brisingaster robillardi de Loriol, 1883.

Brisingaster robillardi de Loriol, 1883

Brisingaster robillardi de Loriol, 1883: 55.

Novodinia helenae F.W.E. Rowe, 1989: 274–277, text-figs 10(a), b), 11(a–c).

Brisingaster robillardi: Mah 1999: 537.

MATERIAL EXAMINED: Nil.

DISTRIBUTION: Recorded from near Norfolk Island, northern Tasman Sea, 308 m, also known from Western Australia, New Caledonia, Japan, and Mauritius, 20–1220 m.

DESCRIPTION: (Taken from Rowe 1989.) Holotype of *Novodinia helenae*. R 75 mm, br at base 3.8 mm, 5.9 mm in widest part, 12 arms.

Disc small, circular, diameter 14 mm, covered by scale-like, overlapping, convex plates in an open reticulum; 1–3 small sharply pointed spines present on some plates. Thin skin covers disc surface and invests bases of spines.

Abactinal surface of arms covered by a thin membrane and has transverse costae composed of small elongate plates, usually with a single pointed spine. First 4–5 costae continuous across arm, remainder often incomplete. First 2 costae may be linked by small plates. At lower edge of costae is a pointed marginal spine, absent from first two. A marginal spine occurs at about every fourth adambulacral plate.

Adambulacral plates wider than long, with furrow margin nearly straight; no furrow spines, and only one subambulacral spine. On proximal plates, subambulacral spine flared at the tip, with 2–4 points, more distal spines sharply pointed. First pair of adambulacral plates united for their entire length. Beyond first 2 plates, adambulacrals are distinctly separated by soft tissue.

Oral plates small; 4–5 furrow spines set around free margin, that adjacent to median suture, on proximal face, small and inconspicuous, but second is largest spine on plate; other spines are small.

Madreporite small, convex, with coarse furrows, placed near margin. Anal aperture not apparent.

Papulae relatively common on disc and proximal part of arms. On disc up to 10 papulae present in groups between plates.

Crossed *pedicellariae* small, present in wreaths on disc spines, and in membranous sheaths on abactinals, marginal and subambulacral spines, also on inner 2

oral spines; as transverse bands linking incomplete costae across arms, and as patches between costae.

COLOUR: Overall red-orange; a bright orange ring around edge of disc and on the arms; preserved specimen white; dried specimens light cream to dark brown.

REMARKS: This species differs from the local species of *Novodinia* in lacking adambulacral furrow spines, and in having up to 10 papulae in the larger skeletal meshes.

Family NOVODINIIDAE Mah, 1998

Brisingida with papulae numerous, scattered over disc and proximal part of arms, arm with regularly arranged transverse combs of up to 7 conspicuous slender spines; region of genital inflation with immersed plates between costae; oral plates broad, almost fan-shaped towards actinosome, sometimes almost closing entrance to ambulacral furrow; adambulacral plates with a prominent subambulacral spines, often truncate and more or less spatulate on proximal plates; first 3–5 pairs of adambulacral plates united in interradii, the corresponding marginal similarly united. A syzygy between first and second adambulacrals, sometimes a partial syzygy between succeeding pairs; two gonads to each ray.

A single genus.

Novodinia Dartnall, Pawson, Pope & Smith, 1969

TYPE SPECIES:

Brisinga semicoronata Perrier, 1885

Novodinia novaezealandiae (H.E.S. Clark, 1962)
(Pl. 71)

Odinia novaezealandiae H.E.S. Clark, 1962: 6, pl. 2, text-figs 5–14.

Novodinia novaezealandiae: H.E.S. Clark 1970: 5; McKnight 1967: 304; Clark & Mah 2000: 311.

MATERIAL EXAMINED:

NIWA Stns: A910 (1); C618 (1); S194 (1); X482 (frags); X484 (frags); X485 (frags); X486 (frags); Z8986 (3); Z9181 (1); Z9583 (1); Z9792 (frags); Z9793 (2); Z9901 (frag.); Z10061 (1); Z10222 (disc); Z10690 (2); Z10714 (1); Z10720 (frags); Z10722 (5); Z10725 (frags); Z10920 (1); Z10929 (3); Z10931 (3); Z10966 (frag.); Z10972 (frags); Z11042 (1); TAN0307/46 (frags).

DISTRIBUTION: This species is recorded from 3 widely spaced localities: northeastern New Zealand, the Chatham Rise, and the Solander Trough to the south.

Almost all of the records are from commercial fishing operations, and the species appears restricted to the small "hills" where these activities occur.

STUDY SPECIMEN: NIWA Z10722, disc diameter 35 mm, 18 arms at least 200 mm long.

DESCRIPTION: *Disc* slightly sunken in central region, margin bevelled.

At centre of disc is a small non-calcified area; remainder of disc paved with small tumid plates, mostly ovoid or round, though sometimes lobate; plates near margin are noticeably more tumid than elsewhere. *Plates* have 1–5 spines, though usually only 1–2 are larger, up to 3 mm long. Almost all spines taper, though the tips vary, from pointed to truncate; many of these have multiple terminal points, and a few have small teeth throughout their length.

Madreporite ovoid, 5 x 3 mm, with coarse radiate sculpture, placed at disc margin and protuberant, conspicuous owing to size and orange colour, contrasting with the pale fawn of disc.

Papulae absent from centre of disc; elsewhere they occur singly between plates, but, near the margin, 2 are sometimes present in the interspaces. A thin skin covers most of the disc plates and may extend onto the spines; this skin thicker and more conspicuous near the disc margin.

Arms higher than wide to beyond genital inflation; pre-inflation section about 12 mm long; genital inflation 25–30 mm long, commencing rather abruptly; abactinal plating unites adjacent arms almost as far as genital inflation. At base, dorsal surface of arms with often isolated, ovoid, slightly tumid plates, like those on disc; size, shape of plates and their spacing varies from arm to arm; most plates with 1–3 spines, like those on the disc plates.

Sides of arms have 6 flattened *adambulacral plates* and above them 4–6 abutting subrectangular plates (?marginals). Over genital inflation, abactinal plates narrow and arranged in transverse rows over sides of arms, while on dorsal surface are usually lobate, generally cruciform, and arranged in both transverse and longitudinal rows. Plates of the costae noticeably longer and a little more tumid than the intercostal plates; 8–10 costae in region of genital inflation, the first 1–2 lacking spines, the remainder generally have about 6 plates on the side of the arm, each with a pointed spine up to 5 mm long; on the dorsal surface are 4–6 rows of the cruciform plates, with similar, though shorter spines. On the last 1–3 costae, the lowest plate, the marginal, has usually 2 elongate spines. 1–2 papulae present between plates on dorsal surface, but papulae absent low down on sides of arms, where the orange gonads visible through thin skin covering skeletal intervals. Beyond genital inflation, arm be-

comes lower, wider than high, papulae absent, intercostal plates become thinner and finally vanish, so that entire dorsal surface of distal arm segments is skin-covered, with transverse bands of minute pedicellariae. Costae, however, are more prominent, and form near-continuous bands across the dorsal surface; on each side of arm are 5–6 acicular spines, up to 15 mm long, shortest dorsally; at dorsal midline are 1–3 much shorter spines, up to about 8 mm. Sometimes a row of small, rounded “carinal plates”, each with a single short spine, unites successive costae along the arm.

Oral plates expanded laterally, so that ambulacral groove is usually sealed off from actinosome, except for a small “tunnel” beneath abutting lateral margins of oral plates. From 2 to 4 short, stubby spines on actinosomal margin of each oral plate; where oral plates do not quite meet across furrow, there are 1–2 similar though smaller spines, but these absent when furrow is closed.

First 5–7 pairs of *adambulacrals* more or less united in an adoral carina, the first 1–2 pairs very closely united; more distal plates wider than long and slightly spaced apart. Furrow armature variable; the more proximal plates often lack furrow spines, while most of the others have a single spine; distal to genital inflation, at least one spine usually present, and after about 1/2R are usually 2–4 small spines in an oblique series. Subambulacral spine usually single and prominent throughout arm; proximal spines with tip flattened and truncate, sometimes grooved and almost bifid; from about midway along genital inflation, spines have pointed tips. Usually 3–4 *adambulacrals* plates to each marginal spine.

Ambulacral furrows narrow.

Tubefeet with distinct sucking-discs, biserial throughout the arm.

Crossed *pedicellariae* very small, usually numerous, occurring in membranous sheaths on almost all spines, though only a few are present on oral and *adambulacrals* furrow spines.

REMARKS: Regional variation in specimens of *N. novaezealandiae* is:

	Northern	Central	Southern
No. of specimens	3	15	2
Modified subambulacral spines extend past genital inflation	yes	no	no
No. of spines in distal marginal fans	3	5–6	3
No. of spines on proximal margin of oral plate	2–4	2	2
No. of <i>adambulacrals</i> furrow spines distally	2–4	0	0
No. of arms	16	18	16

In addition, the disc spines vary from simple to having small multiple points or divergent terminal thorns.

Novodinia australis (H.L. Clark), recorded from southern Australia, has pointed disc spines, the subambulacral spine is chisel-like, and the *adambulacrals* plates are longer than wide. The presence of 4 madreporites is unlikely for this genus, however, so that re-description of *N. australis* is desirable.

This species can be distinguished from the next two by the dorsal plating on the genital inflation and the shape of the modified subambulacral spines and their restriction to the proximal part of the arm.

COLOUR (frozen specimen): Disc and arms light fawn above and below, madreporite and tubefeet bright orange; from beyond genital inflation, arms become lighter orange, marginal spines and tubefeet more brilliant orange.

Family FREYELLIDAE Downey, 1986

Interradial arcs rounded or gradually curved; madreporite is small, and there are bare plates on the abactinal surface of the disc. The abactinal surface of the arms is continuous with that of the disc, and the arms are less deciduous. The abactinal arm plates do not form costae on the proximal parts of the arm, but a mosaic of abutting plates. The proximal *adambulacrals* are united or not interradially.

Freyella Perrier, 1885

Freyellidae lacking marginal plates interradially, and first *adambulacrals* united interradially, or touching proximally only; no syzygy between first and second *adambulacrals*, or second and third *ambulacrals*; proximal subambulacral spines often with tip modified; gonads two to each ray.

TYPE SPECIES

Freyella spinosa Perrier, 1885

Freyella echinata Sladen, 1889 (Pl. 72)

Freyella echinata Sladen, 1889: 623, pl. 112 (1–5); McKnight 1975: 59; 1993: 186; Clark & Mah 2000: 320.

MATERIAL EXAMINED:

NIWA Stns: E869 (1); S150 (1); S151 (4); S152 (1) (juvenile); T54 (small); U194 (1); U198 (2) (1 is small); Z9793(1); Z10698 (1); Z10713 (2); Z10714 (1); Z10722 (1); Z10724 (7); Z10728 (1).

DISTRIBUTION: The species is known from near the Philippines and New Guinea, 1922–3935 m; locally,

records extending from 33° to 46°S in depths of 757–1815 m.

STUDY SPECIMEN: NIWA Stn S151, R 67+ mm, r 14 mm, br 6 mm, widest part of inflation is 9 mm; 11 arms, most are broken.

DESCRIPTION: *Disc* flattened on abactinal surface, margin rounded; at arm base, disc slightly higher than arms. Arms eleven, slightly constricted at base, becoming swollen in region of genital inflation. Distal arm portions missing. Disc covered with short, close-set, skin-covered spinelets, tapering to sharp pointed tip, often projecting beyond skin covering.

Disc plates small, flat, more or less hidden by spinelets. At disc margin between arm bases, spinelets fewer, but no plate completely bare.

Interradial arcs small, rounded; arms a little higher than wide throughout genital inflation. Abactinal surface arched, rounded, covered with small flat plates. Most plates with single sharp spinelet, length varies from elongate tubercle to spinelet 3–4 mm long. Spinelets sheathed in skin, small crossed pedicellariae immersed in skin. Spinulation may vary from sparse to dense in a single specimen. Occasional plates may have a few pedicellariae in a clump. On sides of arm are spaced marginal plates, with one marginal to every 2–3 adambulacral. Each marginal has a relatively conspicuous sheathed, acicular spine up to 5 mm long, with pedicellariae more conspicuous near tip. Adambulacral plates generally longer than wide, furrow margin evenly concave; a single small furrow spine, placed at distal end of plate and directed across furrow, tip with a cluster of pedicellariae; a single large subambulacral spine, placed at about centre of plate, sheathed in skin, with numerous pedicellariae. This spine longest on specimen—up to 7 mm long, acicular over most of arm, but proximally slightly flattened, tip truncate, slightly flaring. First adambulacrals of opposite sides of ray in contact along most of interradial margin.

Oral plates small, a little longer than wide, each with 1 suboral spine, similar to subambulacral spines, usually 2 short furrow spines, at proximal margin; outer spine usually directed across furrow, inner directed towards actinosome.

Madreporite small, rounded, diameter 3 mm, placed near margin. Slightly offset from centre of disc is a small raised area, which may be anal aperture; it is surrounded by slightly enlarged spinelets.

Tubefeet biserial, each pair separated by adambulacral furrow spines. They taper from a broad base to a distinct sucking-disc.

COLOUR (preserved specimen): Dull cream, with the tubefeet a little darker.

REMARKS: NIWA Stn T54, disc diameter 10 mm, has 3 oral furrow spines, and the first adambulacrals are separate throughout their length.

This species, described by Sladen from material collected by H.M.S. “Challenger”, appears distinct in having relatively large abactinal spines on the arms, 11–12 arms, 2 oral furrow spines, and a single adambulacral furrow spine. *Freyella pennata* Sladen has 3–4 oral furrow spines; *F. dimorpha* Sladen differs in its more delicate arms, shorter genital inflation, and has 12 arms. A comparison with the Atlantic species, *F. elegans* (Verrill), is desirable, since Downey (1986: 43) has included several species in its synonymy and suggests it may have a worldwide distribution.

Freyella felleyra n. sp. (Pl. 73)

MATERIAL EXAMINED:
NIWA Stn U200(1).

DISTRIBUTION: Known only from western flank of the Lord Howe Rise, 3180 m.

STUDY SPECIMEN: NZOI Stn U200, (holotype) r 10.5 mm, longest remaining arm broken at R 38 mm, br. 5 mm at base, 7 mm at widest part; 13 arms.

DESCRIPTION: *Disc* flat-topped over most of width, margin bevelled; interradial arcs are small, distinctly rounded.

Disc paved with small close-set ovoid *plates*, usually with a small, central tubercle. Disc plates have 1–3 short, pointed spines, up to 1.0 mm long, not invested by skin. From arm base, plates larger with irregular outlines; tubercles larger and sometimes conspicuous; almost all spines lost from arms, but tubercles more spaced; beyond genital inflation, arms covered by skin only. Marginal plates present as a small spine-bearing tubercle on about every second adambulacral plate. Almost all marginal spines absent; though a few broken stumps are present, these are tapering and unmodified. One broken distal spine is 6 mm long. No marginal plates on first 6 adambulacrals.

Adambulacral plates relatively short proximally, first 2 just wider than long, remainder are longer than wide. All have furrow margin concave; 1 furrow spine placed at distal margin; 1 subambulacral spine placed near centre of plate. Most subambulacral spines are broken, one proximal spine, 5 mm in length, is rounded, tapering and blunt-tipped, with fine longitudinal striations. First pair of adambulacral plates in contact proximally only, while soft tissue fills in space between distal ends.

Oral plates subtriangular in outline, with furrow margin concave, and each pair appears as a truncated triangle with base distal; 3 short oral furrow spines

on proximal margin, outer directed across furrow, inner 2 across actinosome; a fourth spine, placed at distal margin, directed across furrow; 1 slightly longer suboral spine—up to 5 mm long—placed close to distal margin of plate. Actinosomal membrane smooth.

Anal aperture distinct, almost centrally placed, adjacent spines not enlarged or modified. Madreporite placed at margin, ovoid, greatest diameter 4 mm; composed of 4 enlarged plates with a few irregular grooves.

Pedicellariae small, inconspicuous on disc, scattered at bases of spines. No pedicellariae left on abactinal surface of arms. Pedicellariae also in sheaths on oral spines, and on adambulacral furrow spines. Traces of the sheaths apparent at bases of subambulacral and marginal spines.

Tubefeet biserial throughout ray.

COLOUR (preserved specimen): Dull cream, with the tubefeet a little darker.

ETYMOLOGY: *felleyra*—an anagram of *Freyella*.

HOLOTYPE: Deposited in the collection of NIWA, Wellington, No. H-862.

REMARKS: This species differs from *F. echinata* Sladen in having a bevelled edge to the disc, much smaller abactinal spines, and more oral furrow spines. It also appears distinct from *F. pennata* Sladen in lacking an occasional second adambulacral furrow spine and has more oral spines. *F. dimorpha* Sladen has a similarly bevelled edge to the disc but fewer oral furrow spines. *F. fragilissima* Sladen has villiform appendages on the actinosomal membrane. *F. elegans* (Verrill) appears closely related but apparently lacks the tubercles on the abactinal plates.

Freyastera Downey, 1986

A genus of Freyellidae with normally 6 arms; disc flat, in same plane as arms, interradial arcs broadly rounded; arms not constricted at base; bare interradial plates present; proximal adambulacrals not united. No syzygy between first and second adambulacrals, or second and third ambulacrals; one pair of gonads to each ray.

TYPE SPECIES:

Freyella sexradiata Perrier, 1885

Freyastera mortenseni (Madsen, 1956) n. comb.

Freyella mortenseni Madsen, 1956: 29, pl. 1(4); Clark & Mah 2000: 322.

MATERIAL EXAMINED: Nil

DISTRIBUTION: Known only from north of New Zealand, the Kermadec Trench, 5850–6160 m.

DESCRIPTION: Taken from Madsen (1956). Disc diameter 11 mm, R at least 180 mm, there are 6 arms. Genital region of ray beginning 2–3 mm from the disc and 8–13 mm in length, 5 mm in width.

Disc small flat-topped, margin rounded; arms taper only gradually in distal part. Disc covered with small polygonal plates, irregularly arranged; similar plates present at base of arms and extend over genital inflation, where they are irregularly hexagonal, with 4–6 plates across abactinal surface. Beyond genital inflation, abactinal plates gradually become fewer, then absent, and ray covered by skin. Disc plates have 5–9 acicular spinelets, up to 1 mm long. On genital inflation, plates have up to 5 spinelets, and beyond they have up to 3. Spines absent distally. Marginal plates small, placed at about middle of adambulacral plates, absent from proximal 4–6. Each marginal plate has an elongate acicular spine up to 3 mm long; on proximal plates, tip slightly enlarged and truncate.

Adambulacral plates slightly wider than long proximally, beyond genital inflation becoming much more elongate. Furrow margin concave; proximally, 2 subambulacral spines, outer the more distal, 1 smaller proximal furrow spine. These spines usually have tip widened and truncate. Distally, only one pointed subambulacral spine, furrow spine absent. First pair of adambulacral plates separated by oral plates.

Oral plates with 3 spines, 2 on furrow margin, one at proximal lateral angle, other more distal; third spine suboral, placed at or near middle of plate.

Pedicellariae small, confined to membranous sheaths on abactinal and actinal spines, with 2 or more terminal teeth. Pedicellariae from oral spines have curving jaws, while those on subambulacral and abactinal spines have jaws more or less triangular in outline.

Madreporite not described.

Tubefeet biserial throughout ray.

REMARKS: With only six rays this species appears referable to *Freyastera*, rather than *Freyella*.

Freyastera digitata n. sp. (Pl. 74)

Freyastera benthophila: McKnight 1993: 173, 186, non Sladen 1889.

MATERIAL EXAMINED:

NIWA Stn U196(1).

STUDY SPECIMEN: NZOI Stn U196. Holotype: R 22+ mm, r 6 mm, br 4 mm, widest part of arm is 6 mm, 6 arms.

DISTRIBUTION: Known only from Fairway Trough, New Caledonia Basin, 3118–3120 m.

DESCRIPTION: *Disc* small, indented interradially, slightly inflated, margins nearly vertical. Arms constricted at base, gradually widen in region of genital inflation, tapering beyond. All broken, no distal arm fragments. Arms arched, rounded abactinally, interbrachial arcs small, rounded. Beyond genital inflation, arms slightly flattened.

Disc covered with thin, flat *plates* of varying shapes and sizes, irregularly imbricating. Some bare, probably owing to abrasion; others have covering of short, sharply tipped spinelets. In interradii, on sides of disc, plates more or less bare (these areas would not have been abraded in capture).

Arms constricted at base, genital inflation c. 10 mm long; beyond, arms taper rapidly at first, then slowly. Abactinal and lateral surfaces of arms covered with irregular, imbricating, thin, flat plates, most with several short, sharp spinelets. Abactinal plating continues beyond genital region. At outer margins of adambulacral plates, occasional abactinal plates have an enlarged tubercle bearing an elongate spine. Most spines missing, but one broken spine measured 3 mm in length. Marginal spines absent proximally. The first is at about adambulacral seven, which is towards distal end of genital inflation; present at every 2–3 adambulacrals beyond this point.

Adambulacral plates generally longer than wide, separated by distinct interspaces. Plates “spool-shaped”, with furrow margin concave, ends thicker than middle. First adambulacral plates widely separated by distal part of oral plates. Furrow relatively broad. A single subambulacral spine, stout, with longitudinal striations; most are broken, but some distal are blunt-tipped or truncate; those on 3 proximal plates are flattened in distal third and terminate in 2–3 “fingers” so that tip is much broader than base. No adambulacral furrow spines.

Oral plates relatively broad, with proximal margin flat; 1 blunt-tipped furrow spine, placed at proximal angle of plate, projecting across furrow or into actinosome. One suboral spine, modified like proximal subambulacral spines and placed just proximal of plate centre near lateral or furrow margin.

Anal aperture interradiial, offset from disc centre.

Presumed *madreporite* situated interradially, elliptical, longer than wide, with a few abruptly tumid or raised plates; one large and forms one side to area, other side has about 3 plates; they are separated in middle by a slit. No normal sculpture.

Small crossed *pedicellariae* in membranous sheaths on distal parts of oral and subambulacral spines, scattered over abactinal surface of disc and arms.

Tube feet conspicuous and biserially arranged.

COLOUR (ex ethanol): Dull cream.

HOLOTYPE: Deposited in the collection of NIWA, Wellington, No. H-861.

ETYMOLOGY: *digitata*—in reference to the modified proximal furrow spines.

REMARKS: The modified subambulacral and suboral spines invite comparison with *Freyella flabellispina* Korovchinsky & Galkin (1984) from the S.E. Pacific, 4160 m. It differs in having 1 adambulacral furrow spine, and 3 proximal furrow spines on the oral plates.

Freyellaster Fisher, 1918

A genus of Freyellidae with the first pair of adambulacrals more or less united throughout length, and above them the first marginals. A syzygy between first and second adambulacrals, and between upper part of second and third ambulacrals; rays usually more than 6; papulae absent; plates of genital region form a continuous cover, often spiniferous; numerous gonads along either side of inflated genital region of ray, each opening by a separate pore.

TYPE SPECIES

Freyella fecunda Fisher, 1905

Freyellaster polycnema (Sladen, 1889)

Freyella polycnema Sladen, 1889: 621, pl. 109 (12–17).

Freyellaster polycnemus: Fisher 1919: 538; 1928: 21.

Freyellaster polycnema: Clark & Mah 2000: 324.

MATERIAL EXAMINED: Nil.

DISTRIBUTION: North of Raoul Island, Kermadec Islands, 1098 m.

DESCRIPTION (taken from Sladen 1889): R?, r 5.8 mm, br. 1.8 mm.

Arms 17, delicate, with a median abactinal carination. Disc small, subcircular, margin bevelled.

Disc covered with membrane and beset with very small crowded plates, each with minute sharply pointed spines, which appear to be distinctly spaced. On arms skin thin, with small immersed plates, which have similar spines. Marginal spines up to 5 mm long, present at about every second adambulacral plate.

Adambulacral plates have furrow margin concave, proximal end widest. First 8 or more proximal plates with a small proximal furrow spine and a similarly small distal furrow spine; beyond, only distal spine present. A single subambulacral spine just distal to centre of plate.

Oral plates small and elongate; 3 spines, and 1 larger suboral spine.

Madreporite, placed near margin, inconspicuous, with little sculpture.

A few small *pedicellariae* on disc, also on abactinal surface of arms, but not in transverse bands. They occur in membranous sheaths on subambulacral, marginal and suboral spines. Larger *pedicellariae* present on oral furrow spines.

DISCUSSION

ABUNDANCE

Among the orders, the Forcipulatida is the commonest, followed by the Velatida, then Spinulosida, with the Brisingida least common.

At the family level, four families are dominant—Asteriidae, Echinasteridae, Solasteridae, and Zoroasteridae—all with more than 100 records. Three families are relatively common, with 55–74 records—Pterasteridae, Brisingidae, and Hymenodiscididae. A further four families have 15–29 records—Korethrasteridae, Labidiasteridae, Novodiniidae, and Freyellidae. The remaining five families—Caymanostellidae, Myxasteridae, Leilasteridae, Pedicellasteridae, and Brisingasteridae—have less than five records.

Six species comprise the commonest, each with at least 50 records:

Crossaster multispinus
Henricia compacta
Zoroaster alternicanthus
Coscinasterias muricata
Sclerasterias mollis
Hymenodiscus aotearoa

Eight species are relatively common, with 26–43 records:

Solaster torulatus
Peribolaster lictor
Henricia aucklandiae
Allostichaster insignis
Astrostole rodolphi
Cosmasterias dyscrita
Pseudechinaster rubens
Brisinga chathamica

Sixteen species are not common, with 10–24 records:

Pteraster (Pteraster) bathamae
Hymenaster pullatus
Echinaster farquhari
Henricia lukinsii
Henricia ralphae
Zoroaster spinulosus
Coronaster reticulatus

Allostichaster polyplax
Allostichaster farquhari
Anasterias laevigata
Anasterias suteri
Astrostole scabra
Smilasterias clarkailsa
Asterostephane moluccana
Novodinia novaezealandiae
Freyella echinata

The remaining 33 species have 10 or fewer records, and eight of these are not represented in the NIWA collections. The Addenda section (page 87) contains 21 species in the Paxillosida and Valvatida with 10 or fewer records.

BATHYMETRIC DISTRIBUTION

Two orders, the Velatida and Brisingida, have a vast bathymetric range, from less than 200 m to over 6000 m; the Forcipulatida also extend from shallow to relatively deep waters (4000 m); while the Spinulosida are recorded only down to 1357 m.

At the family level, the Pterasteridae and Freyellidae extend to over 6000 m, while the Hymenodiscididae range from 150 to 3391 m. A further nine families range from less than 500 m to over 1000 m—the Solasteridae, Korethrasteridae, Myxasteridae, Echinasteridae, Zoroasteridae, Labidiasteridae, Asteriidae, Brisingidae, and Novodiniidae. Four families, with few records, are restricted in range, the Pedicellasteridae at 4000 m, the Caymanostellidae at 1200 m, and the Leilasteridae and Brisingasteridae between 300 and 700 m.

Fourteen species are restricted to depths of less than 200 m:

Pteraster (Pteraster) affinis
Echinaster colemani
Henricia lukinsii
Henricia ralphae
Odontohenrica anarea
Allostichaster insignis
Allostichaster polyplax
Anasterias laevigata

Anasterias suteri
Astrostole rodolphi
Astrostole scabra
Coscinasterias muricata
Stichaster australis
"Stolasterias edmondi"

A further nine extend into deeper water:

Pteraster (Apterodon) bathamae
Echinaster farquhari
Henricia aucklandiae
Henricia obesa
Henricia studeri
Anasterias directa
Anasterias mawsoni
Pseudechinaster rubens
Smilasterias clarkailsa

Seventeen species occur only on the upper slope, above 1000 m:

Paralophaster hyalinus
Solaster notophrynus
Crossaster campbellicus
Pteraster (Apterodon) stellifer
Pteraster (Apterodon) obesus
Pteraster (Retaster) sp.
Henricia kapalae
Henricia tahia
Odontohenricia endeavouri
Leilaster spinulosus
Zoroaster carinatus
Zoroaster variacanthus
Coronaster halicepus
Perissasterias monacantha
Rumbleaster eructans
Sclerasterias mollis
Brisingaster robillardi

A further 22 species extend to over 1000 m:

Lophaster suluensis
Solaster torulatus
Crossaster multispinus
Peribolaster lictor
Pteraster (Pteraster) robertsoni
Diplopteraster hurleyi
Diplopteraster otagoensis n. sp.
Hymenaster sp. A
Asthenactis australis n. sp.
Henricia compacta
Henricia sufflata
Zoroaster alternicanthus
Coronaster reticulatus
Allostichaster farquhari
Cosmasterias dyscrita
Taranuiaster novaezealandiae
Asterostephane moluccana

Brisinga chathamica
Brisinga tasmani
Hymenodiscus aotearoa
Novodinia novaezealandiae
Freyella echinata

Twenty species occur only between 1000 and 4500 m:

Hymenaster carnosus
Hymenaster pullatus
Hymenaster estcourti
Hymenaster sp. B
Caymanostella phorcynis
Zoroaster spinulosus
Zoroaster planus
Zoroaster singletoni
Hydrasterias sacculata n. sp.
Hydrasterias tasmanica n. sp.
Psalidaster fisheri n. sp.
Smilasterias actinata n. sp.
Asterias fragilis
Hymenodiscus sp. A
Hymenodiscus sp. B
Hymenodiscus sp. C
Freyella felleyra n. sp.
Freyastera digitata n. sp.
Freyellaster polycnema
Stegnobrisinga/Astrolirus sp.

Two species are known only from depths over 6000 m.

Hymenaster blevgadi
Freyastera mortenseni

GEOGRAPHIC DISTRIBUTION

All four orders are present more or less throughout the entire range of latitudes; however, nine of the families are restricted in range. The Caymanostellidae, Brisingasteridae, and Leilasteridae are known only from north of New Zealand; the Pedicellasteridae only from central New Zealand; and the Myxasteridae only from off the southern South Island. The other four—Labidiasteridae, Brisingidae, Novodiniidae, and Freyellidae—range from the north only to southern New Zealand.

Eight species are present only to the north of New Zealand:

Hymenaster blevgadi
Echinaster colemani
Henricia tahia
"Stolasterias edmondi"
Brisingaster robillardi
Freyastera mortenseni
Freyastera digitata n. sp.
Freyellaster polycnema

Seven species range from north of to northern New Zealand:

Lophaster suluensis
Pteraster (Apterodon) obesus
Henricia sufflata
Zoroaster singletoni
Coronaster reticulatus
Astrostole rodolphi
Rumbleaster eructans

Eighteen species range from northern New Zealand or further north to about 48°S and southern New Zealand:

Paralophaster hyalinus
Pteraster (Pteraster) robertsoni
Diplopteraster hurleyi
Hymenaster pullatus
Hymenaster estcourti
Hymenaster sp. A
Zoroaster spinulosus
Coronaster halicepus
Allostichaster polyplax
Allostichaster farquhari
Astrostole scabra
Coscinasterias muricata
Pseudechinaster rubens
Stichaster australis
Asterostephane moluccana
Brisinga chathamica
Novodinia novaezealandiae
Freyella echinata

Twenty two species are recorded only from New Zealand, 35°–48°S:

Pteraster (Retaster) sp.
Hymenaster carnosus
Diplopteraster otagoensis n. sp.
Hymenaster sp. B
Caymanostella phorcynis
Asthenactis australis n. sp.
Henricia kapalae
Odontohenricia endeavouri
Leilaster spinulosus
Zoroaster carinatus
Zoroaster planus
Zoroaster variacanthus
Hydrasterias sacculata n. sp.
Hydrasterias tasmanica n. sp.
Smilasterias actinata n. sp.
"Asterias fragilis"
Brisinga tasmani
Hymenodiscus sp. A
Hymenodiscus sp. B
Hymenodiscus sp. C
Freyella felleyra n. sp.
Stegnobrisinga/Astrolirus sp.

Eleven species are recorded from central or southern New Zealand and to the south:

Crossaster campbellicus
Peribolaster lictor
Pteraster (Apterodon) bathamae
Echinaster farquhari
Henricia aucklandiae
Henricia lukinsii
Henricia ralphae
Allostichaster insignis
Anasterias suteri
Perissasterias monacantha
Taranuiaster novaezealandiae

Eleven species are recorded only in the south of the area:

Solaster notophrynus
Pteraster (Pteraster) affinis
Pteraster (Apterodon) stellifer
Henricia obesa
Henricia studeri
Odontohenricia anarea
Anasterias laevigata
Anasterias directa
Anasterias mawsoni
Psalidaster fisheri n. sp.
Smilasterias clarkailsa

Six species are widespread:

Solaster torulatus
Henricia compacta
Zoroaster alternicanthus
Cosmasterias dyscrita
Sclerasterias mollis
Hymenodiscus aotearoa

EXTERNAL RELATIONSHIPS

Forty seven species are endemic:

Paralophaster hyalinus
Solaster torulatus
Crossaster campbellicus
Peribolaster lictor
Pteraster (Pteraster) robertsoni
Pteraster (Apterodon) bathamae
Pteraster (Retaster) sp.
Diplopteraster hurleyi
Diplopteraster otagoensis n. sp.
Hymenaster blevgadi
Hymenaster estcourti
Echinaster farquhari
Henricia aucklandiae
Henricia lukinsii
Henricia ralphae
Henricia sufflata
Henricia tahia
Odontohenricia anarea

Zoroaster variacanthus
Zoroaster singletoni
Zoroaster alternicanthus
Hydrasterias sacculata n. sp.
Hydrasterias tasmanica n. sp.
Allostichaster insignis
Allostichaster farquhari
Anasterias directa
Anasterias laevigata
Anasterias suteri
Astrostole scabra
Perissasterias monacantha
Psalidaster fisheri n. sp.
Pseudechinaster rubens
Rumbleaster eructans
Sclerasterias mollis
Smilasterias actinata n. sp.
Stichaster australis
Taranuiaster novaezealandiae
"Stolasterias edmondi"
"Asterias fragilis"
Brisinga chathamica
Brisinga tasmani
Hymenodiscus aotearoa
Novodinia novaezealandiae
Freyella felleyra n. sp.
Freyastera mortenseni
Freyastera digitata n. sp.
Freyellaster polycnema

Eleven species are shared only with Australia:

Crossaster multispinus
Asthenactis australis n. sp.
Echinaster colemani
Henricia compacta
Henricia kapalae
Odontohenricia endeavouri
Coronaster reticulatus
Allostichaster polyplax

Astrostole rodolphi
Cosmasterias dyscrita
Smilasterias clarkailsa

Thirteen species are shared with the Indo–West Pacific region:

Lophaster suluensis
Pteraster (Apterodon) obesus
Hymenaster pullatus
Caymanostella phorcynis
Leilaster spinulosus
Zoroaster carinatus
Zoroaster spinulosus
Zoroaster planus
Coronaster halicepus
Coscinasterias muricata
Asterostephane moluccana
Brisingaster robillardii
Freyella echinata

Seven species compose a distinct southern element, possibly circumpolar in subantarctic latitudes:

Solaster notophrynus
Pteraster (Pteraster) affinis
Pteraster (Apterodon) stellifer
Hymenaster carnosus
Henricia obesa
Henricia studeri
Anasterias mawsoni

Six species are of uncertain affinity:

Hymenaster sp. A
Hymenaster sp. B
Hymenodiscus sp. A
Hymenodiscus sp. B
Hymenodiscus sp. C
Stegnobrisinga/Astrolirus sp.

ADDENDA

This section includes species and specimens not detailed in the previous memoirs on the orders Paxillosida and Valvatida:

- (1) The family Podosphaerasteridae is now recorded from New Zealand waters.
- (2) Genera new to the fauna are *Patagiaster*, *Astroceramus*, *Cladaster* and *Podosphaeraster*. A further two are described as new.
- (3) New species are described in these genera as well as in *Ceramaster*, *Hippasteria*, *Pillsburiaster*, and *Marginaster*. Described species new to the fauna are: *Hippasteria falklandica* Fisher, *Mediaster australiensis* H.L. Clark, and *Pseudarchaster jordani* Fisher. Unnamed and unusual specimens in the genera *Calliaster*, *Ceramaster*, *Mediaster*, and *Marginaster* are also described.

Significant new records are given for *Sphaeriodiscus irritatus* H.E.S. Clark, *Anseropoda aotearoa* McKnight, and *Tremaster mirabilis novaecaledoniae* Jangoux.

Order PAXILLOSIDA Perrier, 1884

Family ASTROPECTINIDAE Gray, 1840

Patagiaster Fisher, 1906

Abactinal surface covered with close-set uniform paxillae, the top rounded, slightly tumid or flat, covered with granuliform spinelets, the central larger. Marginal plates of both series conspicuous, inferomarginals extend beyond superomarginals either slightly or conspicuously and covered with granules; inferomarginals may carry an oblique row of enlarged spinules; deep narrow fascioles separate the marginal plates. Actinal plates present, with an odd interradian series present.

The adambulacral plates have 5–9 long furrow spines and several subambulacral spines. Madreporite concealed by paxillae.

TYPE SPECIES:

Patagiaster nuttingi Fisher, 1906.

REMARKS: This genus is related to *Dipsacaster* but differs in having the abactinal paxillae low, flat-topped or nearly so, with the internal granules larger than the marginal. The new species described below lacks adpressed spinules on the inferomarginal plates.

Patagiaster granulatus n. sp. (Pl. 75)

MATERIAL EXAMINED:

MONZ BS715 (1).

DISTRIBUTION: This species is recorded only from Rangatira Knoll in the Bay of Plenty, North Island, New Zealand.

DEPTH RANGE: 251–308 m.

DESCRIPTION: R/r 27/14 mm, 26 superomarginals to the interbrachial arc.

Outline stellate, marginal plates defining outline, inferomarginal plates slightly projecting interradianly, more so on arms.

Abactinal plates mostly rounded, top slightly convex, regularly arranged in longitudinal rows and also oblique–transverse rows from carinals to margins of area. Plates near margin are smaller than elsewhere and largest are those of carinal series out to 5th or 6th superomarginal, where only the carinal series is present. The following plates are lower, smaller and mainly longer than wide and continue to the terminal plate. All plates with a cover of slightly spaced spinelets or granules. Those at margin are thin and short, with truncate tips, while the central are like pointed granules, just higher than wide, and thicker than the marginal row; mid-radial carinal plates with 20–25 marginal spinelets and 10–15 central.

Papulae very inconspicuous, owing to marginal fringe on plates; papulae single with 5–7 around each plate. Papular area extensive, covering almost all of abactinal area, except near the armtips.

Anal aperture and *madreporite* both concealed by close-set paxillae; no specialised paxillae present on any interradian plate.

Marginal plates opposite throughout, both margins of body rounded. Inferomarginals project very slightly interradianly, and a little more so on arms. Marginal plates all narrow, separated by very narrow clefts, with a complete cover of short bluntly tipped spinelets, those at margin of fasciolar clefts thinner than elsewhere. Terminal plate small, conical, with a slight median notch for ambulacral groove, the sides with 1–2 spinelets.

Actinal plates in 5 chevrons, each with a single plate at proximal end, forming an unpaired interradian row; other plates form longitudinal rows and also rows extending from adambulacrals to inferomarginals. The inner row extends to 5th inferomarginal from

interradius, about $1/3R$ along arm. Plates are rectangular to ovoid, slightly raised and flat-topped. Each has 4–7 thicker central erect spinelets, and 8–12 thinner marginal, the latter radiating from the periphery, sometimes thickened at the tip.

Adambulacral plates with furrow margin slightly convex and projecting a little over furrow. Furrow spines 6 in proximal half of arm, then 5, and 4 distally. Spines are elongate, non-tapering and blunt-tipped. They do not meet those of opposite side of furrow. Subambulacral spines in 3–4 rows, 3–4 adjacent to furrow series, then 2–3 or 2; they decrease in length from the furrow spines.

Oral plates large, proximal end curving dorsally into actinosome. Furrow spines 8–9, outer slender, similar to adambulacral furrow spines, proximally they become longer and flattened; suboral spines in 2 series of 8–10, one parallels furrow series, other lies close to median suture; in both, the proximal spines are longest, and, with the proximal furrow spines, form a clump facing into actinosome.

Adambulacral furrows narrow, tubefeet biserial and with pointed tips.

COLOUR (dried specimen): Uniform creamy-white.

ETYMOLOGY: The specific name, *granulatus*, refers to the covering of the inferomarginal plates.

HOLOTYPE: Deposited in the collection of Te Papa, No. MNZ EC.8901.

REMARKS: The genus is known from Hawaii and the Philippines, 143–357 m, and both included species have enlarged spinules on the inferomarginal plates. The holotype of *P. nuttingi* is larger (R/r 42/14 mm), has 30–35 central granules on the abactinal paxillae, 7–9 adambulacral furrow spines, and actinal plates extend to almost $1/2R$. The holotype of *P. sphaerioplax* is similar in size to this new species (R/r 28/12 mm, with 28 superomarginals to the interbrachial arc), the abactinal paxillae have 30–40 internal granules, and the actinal plates extend to $1/2R$.

Order VALVATIDA Perrier, 1884

Family GONIASTERIDAE Forbes, 1841

Astroceramus Fisher, 1906

Outline pentagonal-stellate, superomarginal plates united on radial midline beyond disc. Abactinal plates more or less regular, each with a marginal series of granules, and internal granules may also be present. Marginal plates with a distinct series of marginal granules and also with scattered deciduous granules within

borders. Proximal superomarginal plates may increase in size from the mid-interradius to where they meet on the radial midline. Actinals covered with spaced granules. Adambulacral furrow spines relatively few, 1–3 swollen or enlarged subambulacral spines. Pedicellariae spatulate, the jaws usually denticulate.

TYPE SPECIES:

Astroceramus callimorphus Fisher, 1906.

Astroceramus denticulatus n. sp. (Pl. 76)

MATERIAL EXAMINED:

NIWA Stns: Z11198 (1); Z11229 (1).

DISTRIBUTION: Known only from the Kermadec Ridge, northeast of New Zealand.

DEPTH RANGE: 643–1086 m.

DESCRIPTION: NIWA Stn Z11229, R/r = 87/28 mm, 23 superomarginals to the arm, and the fifth pair widest, joining on radial midline.

Outline pentagonal-stellate, disc with concave margins evenly curving into the narrow arms. Disc flat above and below, margins vertical.

Abactinal plates flat, round to ovoid at disc centre, becoming rectangular interradially and squarish close to margin. Along radial midline, plates hexagonal, about as wide as long. Proximal plate in carinal series largest, more ovoid in shape; placed about $1/3r$ from the disc centre; in 4 interradii is also a slightly larger plate, at the same distance—these may be the primary radials and basals. The missing basal is in the madreporic interradius. The two distal abactinal plates distinctly longer than those near them. Abactinal plates with a marginal series of small slightly spaced granules, outer margin usually angular, inner rounded. Up to about 25 on larger plate; plates also with up to 12 inner hemispherical inner granules. These are deciduous, placed in slight depressions; tiny crystal bodies also present. Small pedicellariae present on several plates, either centrally or at the edge. The 2 jaws higher than wide and each slightly curved; they widen from the narrow base, and tips of jaws usually have fine teeth. Where they have been abraded, a slight depressed outline of blades is apparent, with a small slit or pore at the centre. Papulae widespread at disc centre and along midline of arms, absent interradially. Papulae set at angles of plates with 4–6 around each.

Madreporite placed about $1/3 r$ from disc centre, 5-sided, with deep, coarse radiate sculpture. The plate on its proximal margin not enlarged. Apparent anal aperture subcentral, concealed by 3 enlarged granules.

Marginal plates opposite throughout, forming conspicuous border. Superomarginals wider than long or dimensions equal interradially, becoming wider than long where they unite on radial midline. Plates slightly tumid at first, more so towards armtip. Plates have a marginal series of granules, like those at margins of abactinal plates, but larger; between plates these form 2 very closely opposed series. Free surface of plate with scattered deciduous granules, larger than on abactinal plates, deciduous, set in small depressions and commoner on lateral face. A few small pedicellariae scars also present, mainly interradially. Inferomarginal plates becoming slightly tumid distally, otherwise flat, with scattered internal granules like those on superomarginals, though slightly larger, and a few pedicellariae. Marginal granules squarish and larger than those on superomarginals, the rows between plates more widely separated.

Actinal plates in about 5 chevrons, regularly arranged adjacent to the adambulacrals, less so elsewhere. Row adjacent to adambulacrals extends to about the fifth inferomarginal. Plates rectangular to ovoid, with 8–16 closely spaced angular granules, the top broadly rounded or flat, the granules larger than on abactinal or marginal plates, internal granules the larger. Most plates have some granules replaced a conspicuous 2-jawed pedicellaria, larger than abactinally, the jaws usually wider than high, the teeth quite prominent.

Adambulacral plates wider than long, subrectangular, furrow margin straight, outer margin weakly rounded. Furrow spines 7 on proximal plates, then 6–7, sometimes 8–9 distally. On first 2–3 plates, spines flattened, almost square in section, with wide edge to furrow and series radiating slightly. Subsequent plates with spines in a straight comb, with narrow edge to furrow. Distally, beyond about 1/2R, spines distinctly smaller and closely crowded. Most plates with single distal subambulacral spine, tip distinctly swollen, bulbous or hastate, rarely a similar though smaller proximal spine present. A single large conspicuous pedicellaria fills most of space behind furrow spines; all are wider than high and have prominent teeth on outer margin. Where lost they leave a distinct elongate slit. A narrow though distinct gap is present between furrow spines and subambulacral spine and pedicellaria. Another gap present outside of these, where there are 2 angular short spines or enlarged tubercles, longer than wide with angular, swollen tips; 6–8 smaller angular granules margin the outer lateral and distal borders of plate.

Oral plates large and prominent, with 12 close-set furrow spines, flattened, often triangular in section, increasing in size proximally. Actinal surface of plate with 6–7 large squarish tubercles along median suture, and 3–5 paralleling the furrow, with single large

pedicellaria in middle of this series. 1–2 smaller granules are near distal end of plate.

Adambulacral furrows narrow, tubefeet biserial, with distinct sucking-discs.

COLOUR: Dull orange when captured, fading to dull light orange brown.

HOLOTYPE: Deposited in the collection of NIWA, Wellington No. H-863 (Stn Z11129).

PARATYPE: Deposited in the collection of NIWA, Wellington No. P-1416 (Stn Z11198).

ETYMOLOGY: The specific name, *denticulatus*, refers to the teeth on the jaws of the pedicellariae.

REMARKS: The specimen from Stn Z11198 has 2 isolated abactinal plates beyond the united superomarginals on 3 rays.

The genus is recorded from the Indian, Pacific and Atlantic Oceans and of the 6 species known, only *A. sphaerostictus* Fisher (R 73 mm) has internal granules on the abactinal plates. It differs from the present specimens in having these granules acorn-shaped, much larger than the marginal series, and with only 1–5 present on the larger plates. It also differs in having only 4–5 adambulacral furrow spines, and 8 oral furrow spines.

Astropatricia n. gen.

A genus of Goniasteridae with primary and secondary abactinal plates present, both with marginal granules only. Marginal plates with granule around edges and a few centrally. Adambulacral plates with 5–6 erect furrow spines in a curving comb. 1–2 subambulacral spines, the distal larger than furrow series, the proximal may be replaced by pedicellariae. One prominent subambulacral spine distally. Pedicellariae erect with 2 smooth jaws on actinal and adambulacral plates. Abactinal and marginal plates both with tiny shining inclusions, the surface minutely granulose.

TYPE SPECIES:

Astropatricia marita n. sp.

ETYMOLOGY: The genus and species are named for my wife.

REMARKS: This genus is near both *Plinthaster* and *Pillsburiaster*. It differs from *Plinthaster* in having secondary abactinal plates and from *Pillsburiaster* in lacking internal granules on these plates. A conspicuous difference from both genera is the presence of 1–2

subambulacral spines, the distal longer and thicker than those at the furrow margin.

Astropatricia marita n. sp. (Pl. 77)

MATERIAL EXAMINED:

NIWA Stn X700 (1).

DISTRIBUTION: Recorded only from east of northern New Zealand, near margin of Havre Trough.

DEPTH RANGE: 1760–1765 m.

DESCRIPTION: R/r 23/10 mm, 16–17 supermarginals to the interbrachial arc.

Outline stellate, with broad disc, relatively narrow upturned arms (R measured on actinal surface), and high margins. All abactinal and marginal plates with very small shining inclusions, which roughen surface of plates.

Abactinal plates close-set, very slightly raised, flat-topped, both larger and smaller plates present. Plates rounded to ovoid, with smaller interspersed between the larger; carinal series evident, with smaller plates between. Plates have a series of small granules set around the slightly depressed margin. Granules are slightly spaced apart; most are flattened, though occasionally rounded. Larger plates have 15–25 granules, fewer on smaller plates. A single longitudinal row of plates present at about 1/2R, at level of 3rd supermarginal from interradian line, but near armtip (last 2–3 supermarginals) 2 rows of smaller plates are present, continuing to terminal plate or almost so.

Papulae very inconspicuous, with about 4–6 papulae at plate margins. Papular area appears to cover almost all of disc but does not extend onto arms. *Anal aperture* not visible. *Madreporite* inconspicuous, placed just outside a larger interradian plate (? basal), slightly tumid, with 3 coarse ridges on exposed surface.

Interradian *supermarginal plates* slightly tumid, just wider than long, lateral margin weakly convex. Other plates more tumid, clearly wider than long and lateral margin more convex. Plates have single marginal series of small rounded granules, occasional plates with 1–3 similar granules along outer margin of abactinal surface. Inferomarginal plates correspond with supermarginals, the suture between the two series slightly depressed. Inferomarginals wider than long and tumid, lateral margin more convex than on supermarginals, and visible on distal plates from above. Plates with similar marginal granules to supermarginals, and also with a transverse row or group of larger granules or small tubercles across outer edge of plate. Terminal plates large and conical, lacking any tubercles on abactinal or lateral surfaces.

Actinal plates in 3 chevrons, inner extends to about half way along 2nd inferomarginal from interradian line, remainder to distal end of first marginal, and outer to half way along this plate. A single plate lies just distal to oral plates, and one further unpaired plate lies just proximal to median suture, between the first inferomarginals. Plates flat, subrectangular, with subtubercular granules around margins and spaced across surface. Occasional plates with small erect 2-jawed pedicellaria replacing some or all internal granules; jaws slightly curved, with outer margin smooth; as wide as high.

Adambulacral plates subrectangular, wider than long, furrow margin almost straight on first 2 plates, more convex beyond. Six furrow spines over most of arm, 5–6 on distal plates, where they form a curved series. Spines long, tapering near tip and standing erect, opposite spines almost touching across furrow. Length may vary in each set, and sometimes one is noticeably thicker. Actinal surface of plate with 2 subambulacral spines, the distal the larger, longer and thicker than furrow spines; the shorter proximal spine sometimes absent or replaced by an erect 2-jawed pedicellaria. Outer part of plate with 3–7 angular granules larger than those on adjacent actinal plates. Distal plates with single prominent subambulacral spine.

Oral plates large, with 8–9 pointed furrow spines, a little longer than those on adambulacral plate. Actinal surface with slightly spaced angular granules and a single suboral spine placed at distal outer end on plate.

COLOUR (preserved specimen): Uniform creamy-white.

ETYMOLOGY: *marita* = wife.

HOLOTYPE: Deposited in the collection of NIWA, Wellington, No. H-864.

Calliaster Gray, 1840

Calliaster sp. (Pl. 78)

MATERIAL EXAMINED:

NIWA Stn Z9843.

DISTRIBUTION: This specimen recorded from east of Coromandel Peninsula, northern Bay of Plenty.

DEPTH RANGE: 920–1053 m.

DESCRIPTION: R/r 15/7 mm, 15–16 supermarginals to the interbrachial arc.

Outline stellate, interbrachial arcs strongly curved.

Abactinal plates flat, irregularly rounded–ovoid, largest at disc centre, smallest at margins. Carinal series slightly larger than adjacent plates; most plates

smooth-topped though some carinals have a slight central swelling. Plates ringed by a single series of small granules, mostly in contact, though these have been lost from many plates. On each ray, third pair of superomarginals (from interradius) just meet and carinal series is interrupted. It continues beyond as narrow variously shaped plates to the terminal; no other abactinal plates are present.

Papulae barely visible, with only single pores placed beside some radial plates. *Anal aperture* not apparent.

Madreporite small, inconspicuous, angular, greatest diameter 1.7 mm, sculpture of a few smooth ridges only, placed almost 2/3r from disc centre.

Interradial *superomarginal plate* slightly tumid, longer than wide, the others wider than long and distinctly tumid, especially near armtip. Plates have smooth surface, with a few small granules scattered near margins; most also have a single blunt tubercle, higher than wide, at the rounded margin. Lateral face with a few small granules. Inferomarginal plates correspond with superomarginals, though all longer than wide. Plates have spaced granules along lateral and actinal margins, these becoming few on the arms; Interradial plates with 1–3 tubercles at edge, others with a single tubercle.

Terminal plate large, bulbous, slightly flattened, with 1–3 tubercles on outer edge.

Actinal areas small, plates in 2 chevrons, the inner extending to proximal end of second inferomarginal, the outer to near distal end of interradial inferomarginal. The plates with spaced tubercular granules and some plates of inner row with erect bivalved pedicellaria, jaws longer than high, slightly convex, outer margin weakly rounded, with a few fine teeth.

Adambulacral plates rectangular, wider than long, furrow margin slightly convex on proximal plates, more so on distal. Furrow spines 4, rarely 5, spines long, bluntly pointed, median pair longest, proximal and distal occasionally quite small. Spines relatively long, extending across furrow, those of opposite sides intermingling. Distal plates where margin is strongly convex have 4 short spines. Most plates with a large subambulacral spine, longer and thicker than furrow spines, the tip either pointed or blunt; much shorter tubercular granules also present, usually one proximal to spine, sometimes another distal, and usually 1–2, rarely 3, outside it. Occasional plates lack the spine, and have a small erect bivalved pedicellaria instead; these shorter and relatively higher than actinal ones, with blade smooth. Beyond actinal plates almost all adambulacrals have lost subambulacral armature.

Oral plates short and broad, with 8–9 long furrow spines, longer and more slender than adambulacral furrow spines, increasing in size proximally. One pointed suboral spine near distal end of plate with 2–4 shorter spines or tubercles proximal to it.

COLOUR (dried specimen): Uniform dull brown.

REMARKS: While this specimen appears distinct in lacking spines on the abactinal plates, it is clearly juvenile, and may well be the young form of *C. thompsonae* H.E.S. Clark, also thought to be from the Bay of Plenty.

Ceramaster Verrill, 1899

Ceramaster cognatus n. sp. (Pl. 79)

MATERIAL EXAMINED:

NIWA Stn Z9778 (1).

DISTRIBUTION: Known only from east of northern New Zealand.

DEPTH RANGE: 900 m.

DESCRIPTION: R/r = 46/33 mm, with 20–21 superomarginals to the interbrachial arc.

Outline near-pentagonal, interr radial arcs slightly arcuate; flat below, with a slight narrow interr radial furrow on abactinal surface; margin relatively high.

Abactinal plates low tabulate, closely spaced, secondary plates absent. Plates covered with granules. Marginal plates (10–12) subrectangular, inner end angular to bluntly rounded, clearly larger than internal (10–13), which are angular with 4–6 sides. Marginal granules flat-topped, most internal granules similar though some may be slightly convex. Plates generally hexagonal, carinal and adjacent plates wider than long, others with width about equal to length; they become a little smaller towards the margin, and those at margin vary from simply rectangular to having inner edge rounded.

Papulae often not apparent, owing to close-fitting abactinal plates, but are apparent towards armtips, where plates are slightly spaced apart, and papulae visible between successive plates, but not between the adjacent; here there are about 4 papulae between successive plates. Elsewhere occasional single papulae seen between some plates. Papulae occasionally visible over almost all of abactinal area.

Madreporite irregular in outline, 5-sided, about 2.0 mm in width, with coarse radiate sculpture. *Anal aperture* more or less central and inconspicuous, with 3 small stubby spinelets set around opening.

All *superomarginal plates* tumid and wider than long, the last 4 pairs in contact on radial midline. Plates have scattered embedded granules over much of abactinal surface, granulation in denser patches towards margins. A complete series of subrectangular marginal granules, internal granules slightly smaller and generally 5-sided. Lateral face with an almost complete cover of granules, the marginal series again distinct.

Inferomarginal plates more or less corresponding with superomarginals and completely covered with granules, the marginal series again distinct. Inferomarginals wider than long throughout, evenly curving onto actinal surface, with no distinct edge.

Terminal plate on all 5 rays small and flush with marginal plates.

Actinal plates numerous, in several series. Plates flat and densely covered with small angular, flat-topped granules, so that plate edges are indistinct; often granules have small though distinct pits.

Adambulacral plates wider than long, furrow margin slightly convex. Adambulacral armature crowded, with 5–6 furrow spines in overlapping combs. Spines short and stubby, flattened with either edge to furrow, the tip truncate, sometimes widened. Many spines pitted and rarely some are grooved. Subambulacral spines in several rows, the inner with usually 3 spines, almost as long as the furrow spines, followed by 3–4 irregular rows of shorter granules, with 3–5 in each row, the series decreasing in size from the inner row, so that the outer is similar to the adjacent actinal granules.

Granules vary in shape, from occasionally thin and flat to others with tip flat and widened, these often with small pits. On all arms the distal plates have lost all granules.

Oral plates large, 10–11 furrow spines, the outer angular to flattened, the innermost longest, flattened with the tip bluntly rounded. Actinal surface of plate with slightly spaced angular granules, largest proximally.

Pedicellariae rare, one abactinal pedicellaria erect, with elongate, narrow slightly curved blades, 3 possible scars also noted; pedicellariae absent from marginal and adambulacral plates; 3 found on actinal plates, with a few further scars; some of these actinal pedicellariae have the blade narrowed as in the abactinal while one has it spoon-shaped; probably the narrowed form has been damaged.

Adambulacral furrows almost completely concealed by adambulacral furrow spines; *tubefeet* hidden.

COLOUR (specimen was originally frozen, then dried after immersion in weak formalin): Dull uniform reddish brown.

ETYMOLOGY: *cognatus* – in reference to its similarity to *Ceramaster smithi* Fisher.

HOLOTYPE: Deposited in the collection of NIWA, Wellington, No. H-866.

REMARKS: This species is very close to *C. smithi* Fisher from the Philippines, and has very similar adambulacral and oral armature, particularly the pitted and sometimes grooved spinelets, overlapping ad-

ambulacral furrow combs, and inferomarginals not forming a raised edge to the actinal areas. *C. smithi* differs in having slightly fewer furrow spines on the adambulacral and oral plates, granulation of actinal plates more spaced so that plate outlines are distinct, superomarginals longer than wide except distally, and more attenuate arms (R1.5–1.9r).

A smaller specimen from NIWA Stn Z10978 (Aotea Seamount, 1090 m) with the same coloration may be referable to this species, but is described separately below, as well as another lot of small specimens from near the Chatham Rise. While the status of these two forms may be uncertain, they appear sufficiently distinct to describe.

Ceramaster sp. A (Pl. 80)

MATERIAL EXAMINED:

NIWA Stn Z10978 (1).

DISTRIBUTION: Known only from Aotea Seamount, west of North Island, New Zealand.

DEPTH: 1060 m.

DESCRIPTION: R/r 19/14 mm, R = 1.3r, 14 superomarginals to the interbrachial arc.

Outline pentagonal, flat above and below. Abactinal plates small and tabulate, regularly arranged on radial areas, less so at disc centre, interradially, and near margin. Plates of radial areas hexagonal, slightly wider than long. At and around disc centre, plates vary from hexagonal to rounded, rarely triangular. Interradial plates tend to be rounded or square, while those at margin are slightly smaller, rounded or square. All plates tabulate, most with pedicel taller than wide, the top slightly widened; those at margin only slightly lower. Plates with a marginal series of 4–10, commonly 8, angular granules, widest on outer face, and with 1–2, rarely 3, slightly larger internal granules. These usually angular, but do not taper; occasionally, internal granules, where only 1 is present, are rounded. A single larger plate at disc centre has 6 internal granules. Granules separated by narrow spaces, and most of the plate surface is covered. Where granules have been dislodged, a small depression usually evident. Small 2-jawed spatulate erect pedicellariae replace 1–2 granules on several plates; most centrally placed, but some at or near plate margin. Jaws higher than wide, slightly curved inwards, with tip broadly rounded. A small slit apparent where pedicellariae have been lost, and plate surface may have a slight depression, outlining the recumbent jaws.

Anal aperture concealed. *Madreporite* small and subrectangular, wider than long, placed just over 1/2r from the disc centre, with coarse radiate sculpture.

Papulae placed by angles of abactinal plates, with up to 6 around each plate. Papular area very extensive, extending almost to margin interradially, with small area at disc centre lacking papulae.

Marginal plates conspicuous, forming distinct margin, the 2 series opposite throughout. Superomarginal plates tumid and slightly raised above adjacent abactinal surface, the last 2 in contact on radial midline; all wider than long. Plates with marginal row of granules, mainly square, occasionally angular, with similar granules covering almost all of lateral face, Bare abactinal surface of almost all superomarginals except distal 2–3 with 1–2 small pedicellariae. These have more slender jaws than those on abactinal plates, and fit into a small, distinct depression, outlining the jaws.

Inferomarginal plates tumid, but less so than superomarginal series; they form a slightly raised border to the actinal area. Interradial plates have 2 (sometimes 3) series of marginal granules on actinal surface, but distal 3 plates have a single series. Near outer margin the entire surface is covered with granules that extend to the lateral face and cover it. The granules angular rather than square. A bare patch present on actinal surface of almost all plates, and several have 1–2 pedicellariae, like those on superomarginal plates.

Terminal plate, viewed from above, triangular, pointed proximally, lateral and distal margins convex; distal margin has a distinct notch at end of ambulacral groove, with small tubercles on it.

Actinal areas extensive, actinal plates in 6–7 chevrons, regular proximally and adjacent to the adambulacrals, less regular towards margin. The plates generally squarish, the 2 rows adjacent to the adambulacrals being longer than wide. Slightly spaced granules cover plates, with 9–12 on most; mainly angular, but 1–4 central granules may be rounded.

Adambulacral plates subrectangular, longer than wide, the furrow margin straight or only weakly curving. Furrow spines usually 5, rarely more, the spines flattened, with narrow edge to furrow, the tip broadly rounded. On the first 1–3 plates they are usually equal in length, but further out the proximal and distal are shorter. On a few plates, where up to 7 spines may be present, the furrow series may grade in length from the short first to the fourth or fifth. Sub-ambulacral armature in 3 series, the inner row with 3 thick short rounded spines, much thicker than furrow series and a little longer, the distal spine becoming enlarged near armtip. The outer 2 rows have 3–4 angular granules only slightly larger than those on actinal plates. The 4 rows on each plate set close together, with little space between. A few plates have small pedicellariae like those on marginal plates, and small perforations and jaw outlines present on others. On these plates there are only 1–2 outer granules.

Oral plates large, all somewhat damaged, with 9–10 furrow spines, only slightly larger proximally, and a little thicker than adambulacral furrow series. Actinal surface of plate has a row of 7–8 large angular granules paralleling furrow series and extending across the rounded distal margin of plate. A second row of 3–4 similar granules margins the suture.

Adambulacral furrows narrow, tubefoot biserial throughout, with distinct terminal discs.

COLOUR (dried specimen, ex formalin): Entire specimen dull brown.

REMARKS: With only 1–2 internal granules on the abactinal plates, and usually only 5 adambulacral furrow spines this sole specimen is clearly distinct from *C. patagonicus* and *C. glasbyi*, though it may be referable to the previous species. One other similar species is *C. clarki* Fisher, from the North Pacific, with high paxillae that have few internal granules. However, this present specimen differs in having high, tumid superomarginals, and the plates of both marginal series are wider than long with a distinct bare patch; actinal plates are regularly arranged with square granules, and the papular area is much more extensive that includes even the outer interradiial paxillae.

Ceramaster sp. B

(Pl. 81)

MATERIAL EXAMINED:

NIWA Stns: Z10698 (1); Z10721 (1); Z10722 (1); Z10724 (1); Z10732 (1); Z10743 (1); TAN0307/46 (1).

DISTRIBUTION: This species is here recorded from hills Diabolical, Graveyard, Gothic and Pyre, in the Graveyard area, near the Chatham Rise, and also near the Antipodes Islands.

DEPTH RANGE: 504–1076 m.

DESCRIPTION: Study specimen NIWA Stn Z10724, R/r = 16/10 mm. 14 superomarginals to the interbrachial arc, penultimate superomarginals in contact on radial midline, the outer small pair just separated by the terminal plate

Outline pentagonal, body flat above and below, and margins vertical. Abactinal area covered with small regular plates tabulate at disc centre and on radial areas, less so interradially, becoming non-tabulate towards margins. Radial plates regularly hexagonal, just wider than long to as wide as long, flanking plates tending to an ovoid outline, interradiial plates ovoid, with outlines indistinct. Tabulate plates almost as high as wide, other plates barely raised at all. All plates with cover of slightly spaced granules, marginal gran-

ules angular, usually narrower within, internal granules rounded, near-hemispherical, more deciduous than marginal. Radial plates with 6–9 or rarely 10 marginal granules, and 1–3, rarely 4 internal granules. A slightly enlarged plate near disc centre has 12 marginal and 5 internal granules. Interradial plates with 6 marginal and 1–2 internal granules. Close to margin, plates have only 2–5 granules, with marginal series sometimes rounded.

Papular area distinct, extending for just less than 1/2R; it covers 9 plates in length and 9 plates in width, with 4 rows on either side of carinal series; a small separate papular area present at disc centre. Papulae placed at angles of plates, with usually 6 around each plate. Lateral to papular area, and clearly separated from and near the interr radial line, is a small slit between 2 interr radial plates that may be a gonopore.

Madreporite conspicuous, placed just less than 1/3r from disc centre; it is rounded and distinctly tumid, almost hyaline, with fine sculpture confined to a small area near margin.

Superomarginal plates tumid on abactinal surface, less so on lateral surface. First 2 longer than wide, third as long as wide, distal 3 clearly wider than long. Plates with a small irregular naked area on abactinal surface, with granules scattered around it; lateral face generally covered with granules. These rounded and hemispherical, a little larger than those on abactinal plates; plates also with a series of close-set more angular granules at the margins.

Inferomarginal plates opposite superomarginals throughout, plates much less tumid; the first 1–2 longer than wide, the next about equal, and distal wider than long. They do not form a distinct edge to actinal area, but form a smooth even curve to lateral

face. Plates entirely covered with granules like those on superomarginals; the marginal row slightly smaller and lower.

Terminal plate longer than wide, triangular with slightly convex margins. The outer face has a series of small tubercles and the inner point separates the outer pair of small superomarginals.

Actinal plates regularly arranged in 6 chevrons, the outermost with only 1–3 plates. The plates rectangular near the adambulacrals, tending to lozenge-shaped interr radially, smaller and more rounded towards margin. Plates very slightly elevated, and carry up to 18 elongate granules, all as high as wide or higher, and often angular in section. The plates adjacent to the adambulacrals often with some internal granules absent, though none show any impressions or pores left by pedicellariae.

Adambulacral plates subrectangular, wider than long. First plate with 4–6 furrow spines set in slight arc, the others with 3–4. Spines subequal, flattened, the tip rounded, rectangular to angular in section; narrow edge usually faces furrow, though occasional spines more oblique. First row of subambulacral spines slightly spaced from furrow series, with 2–3 heavier angular spines, the distalmost becoming the larger beyond about 1/2R. Outside of these are 4–6 smaller, angular granules, just larger than those on the actinal plates, usually in 2 rows.

Oral plates large with 8 furrow spines, largest proximally, all angular in section, with bluntly rounded tips. Suboral armature of angular spines and granules, with 5–6 near furrow margin and towards distal margin, and 4–5 near median suture, 2–4 smaller granules near distal margin, between these 2 series.

Pedicellariae not seen.

Ambulacral furrows narrow, *tubefeet* biserial, with sucking-discs.

Some numerical characters of small specimens of *Ceramaster*.

Station	R/r, mm	Superomarginals to interbrachial arc	Marginal/internal granules on midradial abactinal plate	Adambulacral furrow spines/subambulacral granules	Oral furrow spines/suboral granules
<i>Ceramaster patagonicus</i>					
F107	19/12	18–19	13/10	3–4/3 + 3	6/12
F107	14/10	14	10/8	3/3 + 3	6/8
G702	15/9	13–14	11/8	3–4/3 + 3	6/8–9
<i>Ceramaster</i> sp. A					
Z10978	19/14	14	8/1–3	5/3 + 3–4 + 3–4	9–11/10–12
<i>Ceramaster</i> sp. B					
Z10698	16/10	12	9/1–3	3–5/2–3 + 3	6/10
Z10721	14/10	10	8/1	3–5/2–3 + 3	8/12
Z10722	12/9	8	8/1	3–4/2 + 3	6/9
Z10724	16/10	14	8–10/1–3	3–4/2–3, + 1–2 + 3–4	8/12
Z10732	11/8	10–11	7–8/1–2	3–4/3 + 3	7/9–10
Z10743	11/7	12	8–9/1	3–4/3 + 3	8/10–12
TAN0307/46	17/12	12–13	11/4	3–4/3 + 3	8–9/8–9

COLOUR (preserved specimens): Uniform creamy-white above and below.

REMARKS: These specimens with few internal granules on the abactinal paxillae suggest affinity with either *C. clarki* Fisher or *C. arcticus* (Verrill), both from the northern Pacific; *C. clarki* differs little in the oral and adambulacral armature but has much higher paxillae, lower and less tumid superomarginals, and a more extensive papular area. *C. arcticus* also has a more extensive papular area, but only 2–3 adambulacral furrow spines; the superomarginal plates have large flat granules and the abactinal paxillae have a strongly stellate base, and the top with large granules, resembling a toadstool.

KEY TO LOCAL SPECIES OF *Ceramaster*

- 1 Mid-radial abactinal paxillae with only 1–3 internal paxillae, and 8–10 peripheral; small species with R 20 mm, or less 2
- 1' Mid-radial paxillae with 8 or more internal and 10 or more peripheral granules, R may be over 30 mm 3
- 2 Paxillae higher than wide. Abactinal, marginal and actinal pedicellariae, with tip of blade slightly widened and smooth. Inferomarginals form raised border to actinal surface, with bare area present. Papular area extensive *Ceramaster* sp. A, Aotea Seamount, 1060 m
- 2' Paxillae lower than wide. Pedicellariae not seen. Inferomarginals do not form raised border to actinal surface, covered with granules. Papular area restricted *Ceramaster* sp. B, Graveyard Seamounts, near north Chatham Rise, 890–1076 m
- 3 R 2.1r. Abactinal paxillae with 15–18 peripheral and 10–19 internal granules. 7–8 adambulacral furrow spines, 3 subambulacral spines, and 3–4 outer rows of granules. Pedicellariae with crenulate margin to widened blade *Ceramaster glasbyi*, Three Kings Rise, north of New Zealand, 486 m
- 3' R 1.2–1.4r. Usually 4–5 adambulacral furrow spines, rarely up to 7. Pedicellariae with smooth margin to blade which is only slightly widened, if at all 4
- 4 Adambulacral furrow combs crowded and overlapping, furrow and subambulacral spines pitted, sometimes grooved. Abactinal plates with 10–12 marginal granules, clearly longer than wide, internal rounded, 10–13 *Ceramaster cognatus*, northeastern North Island
- 4' Adambulacral furrow combs not crowded, spines not pitted or grooved. Abactinal plates with 15–20 marginal granules about as wide as long, or only slightly longer *Ceramaster patagonicus* — 5
- 5 Abactinal paxillae with 15–20 peripheral and 10–20 internal granules. Subambulacral granules in 2–3 rows *Ceramaster patagonicus patagonicus* widespread in New Zealand region, Bay of Plenty southwards, and near Macquarie Island, 120–1400 m
- 5' Abactinal paxillae with 15–16 peripheral and 12–15 internal granules. One row of subambulacral spine, and 2 outer rows of granules *Ceramaster patagonicus australis* Macquarie Island and Macquarie Ridge, 148–415 m

Cladaster Verrill, 1899

Outline pentagonal–stellate; abactinal plates rounded to hexagonal with spaced granules, secondary abactinal plates absent. Marginal plates prominent, with a covering of spaced granules, but no prominent spines, 1 or more distal superomarginals of opposite sides of ray may be in contact. Actinal areas large, paved with spaced granules. Adambulacral plates with 2–3 prominent furrow spines, and 1–2 large erect subambulacral spines and granules; furrow spines usually interlocking with those on opposite side of furrow. Pedicellariae spatulate and erect, with 2, sometimes 3 valves, broad, distal margin often toothed. Papulae single, set at the rounded corners of the abactinal plates

TYPE SPECIES:

Cladaster rudis Verrill, 1899

Cladaster latus n. sp. (Pl. 82)

MATERIAL EXAMINED:

NIWA Stns: TAN0306/04 (2); TAN0306/05 (1); TAN0306/07 (1); TAN0307/45 (1).

DISTRIBUTION: This species is recorded from Christabel Seamount, west of the Auckland Islands and also from near the Antipodes Islands.

DEPTH RANGE: 270–1065 m.

DESCRIPTION: Holotype, NIWA Stn TAN0307/45, R/r = 44/19 mm, 22 superomarginals to interbrachial arc.

Outline pentagonal–stellate, interbrachial arcs arcuate. Abactinal plates ovoid to hexagonal; if the latter, corners are rounded; plates slightly elevated, and slightly tumid, with a marginal series of granules, and a few well-spaced internal granules; marginal granules mostly higher than wide with tip rounded and slightly widened, though some are pointed; internal granules deciduous, presence indicated by small round depressions on plate surface; internal granules

with rounded tip, a little larger than the marginal. Near margins, plates smaller, lower, with a nearly complete cover of granules, larger and smaller intermingled. Largest disc plate close to disc centre; carinal series and 1–2 flanking series a little larger than other plates, though a few smaller plates are also present; those adjoining superomarginals tend to rectangular. Near armtip, last 3–4 carinal plates occupy entire abactinal surface and are lower, flatter, and wider than almost all other plates of carinal series.

Occasional *abactinal plates* with a 2-jawed, spatulate pedicellaria, mostly just higher than wide, the jaws widened distally. Pedicellariae leave a small slit when lost, but have no depression to fit into when widely opened.

Madreporite placed just less than 1/2r from disc centre, 5-sided, angular, maximum length 4 mm, surface with numerous fine apertures. *Anal aperture* subcentral, inconspicuous, opening between 2 disc plates, and fringed with small, delicate spines.

Papulae single, with 4–6? around abactinal plates. Papular area extends almost to armtip, and about 2/3 distance to margin interradially.

Superomarginal plates form conspicuous edge to body; plates tumid, interradiial plates being longer than wide, but the rest wider than long. Plates have a complete series of granules around margins, granules slightly flattened, with tip blunt; larger granules with rounded tip are spaced over rest of plate; distal 3 superomarginals meet opposite numbers on centreline of arm.

Terminal plate rounded, rising to blunt tip; no tubercles present, but a few faint depressions are.

Inferomarginals all wider than long, with granules as on superomarginals, though internal are more closely spaced.

Adambulacral plates subrectangular, wider than long. Furrow spines 3 on first 2–5 plates, then usually 2, rarely 3; spines set at edge of furrow are elongate, flattened with narrow edge to furrow and project over it, often interdigitating with those of opposite side; proximally, where 3 spines occur, all are about the same length. Proximal furrow spines with tip widened, from about 1/3r, spines are bluntly pointed. Lateral and outer margin of plates with short angular granules, varying in size, with bluntly pointed tips, except for those on lateral margins, close to furrow series which are often slender, pointed delicate spines, about 1/3 length of the furrow series; from about 1/2R, granule at centre of outer margin of plate is larger and longer, with tip bulbous.

Subambulacral armature of a single erect major spine, erect and with rounded, bulbous tip, except for first 3–4 plates, where it resembles furrow series; behind this spine are 1–3 tubercles or enlarged granules, with tip bulbous. Distally, near armtip, the subambulacral

spine becomes more slender with straight sides. Occasional plates with pedicellaria of 2 types; some resemble abactinal pedicellariae, erect and spatulate, with jaws widened distally and occasional teeth; others usually 2 small pointed granules, with slender tips, standing close together.

Actinal plates extend to inferomarginal 7, over 1/2R; plates slightly raised and flat-topped, with complete cover of granules, bulbous-tipped; erect spatulate pedicellariae occasionally present, some having 1–2 associated small granules close to the ends.

Oral plates curve into actinosome, and armature partly hidden; furrow spines 5–6, as long as adambulacral furrow spines, outer 2–3 flattened with truncate tip, inner spines with tip pointed. Suboral spines 2, equally long and flattened, outer spine with truncate tip, inner with pointed tip.

COLOUR (preserved specimen): Uniform dull light brown, slightly lighter on actinal surface.

ETYMOLOGY: *latus* = broad, in reference to the distal abactinal plates.

HOLOTYPE: Deposited in the collection of NIWA, Wellington, No. H-865 (TAN0307/45). (R/r 44/19 mm, 22 superomarginals.)

PARATYPES: Deposited in the collection of NIWA, Wellington, No. P-1417 (TAN0306/04, 2); P1418 (TAN0306/05); P-1419 (TAN0306/07). (R/r 51–29/2–16 mm, 16–22 superomarginals.)

REMARKS: All specimens have oral plates curving down into the actinosome and are difficult to examine. The smallest specimen (Stn Z10727) has R/r = 9.5/6.0 mm. Abactinal plates at the disc centre are abraded, the others generally have marginal granules only, a few an erect 2-jawed bivalved pedicellaria; third carinal plate from the armtip is slightly widened; marginal plates with a few tubercles, taller than wide, on lateral face; interradiial inferomarginals with lateral margins covered by granules; last superomarginals just touch at distal corners.

Adambulacral plates with 3-furrow spine, the median usually the longest, a few plates with 2 subequal spines; 1–2 bluntly pointed subambulacral tubercles; actinal plates with short angular tubercles and occasional pedicellariae.

Four nominal species are known in this genus, separated by characters that may be ontogenetic rather than specific, but are kept apart owing to their wide geographic separation (A.M. Clark 1993: 251). The one distinct feature that separates this new material from previous descriptions and illustrations is the larger widened distal carinal plates.

Hippasteria Gray, 1840

Hippasteria falklandica Fisher, 1940 (Pl. 83)

Hippasteria falklandica Fisher, 1940: 127, pls 3 (2); 4 (4); Clark & Downey 1992: 246 (in key), 247.

MATERIAL EXAMINED:

NIWA Stn Z10308 (1).

DESCRIPTION: *Outline* stellate, arms strongly recurved, R/r about 133/35 mm and about 50 superomarginals to interbrachial arc.

Abactinal plates small, lobate, ovoid or irregular in outline, centre of plate raised, lobes immersed in membrane. Plates closer-spaced at disc centre. Raised area of plates with 1–5 granules, varying in size; if 1–2, these are usually large and hemispherical; small granules vary, are like the larger or may be flat. The larger granules are up to 1.5 mm in diameter. Large, long (3.0 mm), partly embedded bivalve *pedicellariae* are abundant, each with a narrow raised surround. The *pedicellariae* almost completely cover the plates and are surrounded by a narrow rim. *Pedicellariae* only on larger plates.

Papulae widespread, with 1–3 in each area between abactinal plates, absent near armtip. *Anal aperture* not apparent. *Madreporite* large, strongly tumid, sub-circular, diameter 5 mm, with irregular sculpture. It is placed about 1/2r from disc centre.

Marginal plates relatively small and not conspicuous owing to masking granules; both series more or less correspond, and are completely covered with granules, the smaller usually angular and flat-topped, the larger almost tubercular, diameter a little larger than those on abactinal plates. Most superomarginal plates longer than wide, the distal 9–10 slightly wider than long; inferomarginals wider than long throughout. Some distal marginal plates, especially the inferomarginals, with a single larger conical tubercle, almost twice as high as wide. Occasional plates also with a bivalved *pedicellaria*, shorter than those on abactinal plates, lacking the distinct surround, but with smaller granules closely packed around them. *Terminal plates* small and covered with granules.

Actinal plates numerous, extending well beyond 1/2R. Plates irregular in outline, covered by flat-topped granules, many with a bivalved *pedicellaria* at the centre. *Pedicellariae* adjacent to adambulacrals sometimes curved.

Adambulacrals plates narrow, wider than long. Furrow spines two, short and stubby, tip rounded, compressed with narrow edge to furrow, often unequal in size. Subambulacrals granules, 4–8 on each plate, unequal in size, often 1–2 tubercular. Distal plates with smaller granules and a single large tubercle. On 2 first adambulacrals plates, furrow series replaced by a

bivalved *pedicellaria*; most other plates lack a *pedicellaria*, though one is often on the adjacent actinal.

Oral plates large and prominent, with 5–6 flat furrow spines, these longer and thinner than adambulacrals furrow spines, tip rounded. Actinal surface covered with large angular and irregular granules.

Ambulacrals furrows narrow, tubefeet with distinct sucking discs, in two regular rows.

COLOUR (dried specimen, ex formalin, was originally frozen): Uniform creamy-white.

REMARKS: The only other recorded specimen of *Hippasteria falklandica* has slightly longer arms, with R/r = 139/43 mm, and 44 superomarginals to the interbrachial arc. It was recorded from near the Falkland Islands, 251–225 m.

Hippasteria tasmanica n. sp. (Pl. 84)

MATERIAL EXAMINED:

NIWA Stn Z10305 (1).

GEOGRAPHIC DISTRIBUTION: Recorded only from the South Tasman Rise, south of Tasmania, Australia.

DEPTH RANGE: 935–1058 m.

DESCRIPTION: R/r about 119/35 mm, 52 superomarginals to the interbrachial arc.

Outline stellate, with large disc, armtips recurved. Abactinal surface flat, actinal surface inflated, with a shallow furrow in each interradius. Arms upturned, and have abraded areas on abactinal surface.

Abactinal plates rounded to ovoid, larger plates widespread, smaller secondaries present at and around disc centre. Plates slightly tumid, slightly spaced apart except near margins and armtips, where they abut; these, especially near armtips (beyond about 2/3R) larger than those at disc centre and over papulate areas. Plates with a cover of granules, spaced apart, the marginal varying from round-topped to pointed, the inner usually larger, with rounded tops; almost all as high as wide or higher, with finely rugose tops; beyond 1/2R, occasional larger plates have a central granule enlarged into a short, pointed spine. Larger plates have up to 12 marginal granules and 4–5 central granules, the smaller with 6 marginal and 2–3 central. Several larger plates have small slits where *pedicellariae* were present. A single *pedicellaria* observed is erect, with 2 spoon-shaped jaws, higher than wide.

Papulae single, with 5–6 around margins of plates, absent near disc margin and near armtips, where plates meet.

Anal aperture visible as slit on near-central disc plate and fringed by small elongate granules.

Madreporite placed about 1/2r from disc centre, ovoid, maximum diameter 5.0 mm, and tumid with more or less radiate sculpture.

Marginal plates form definite edge to disc, though not always conspicuous owing to contortion of specimen; no pedicellariae on marginal plates.

Superomarginal plates slightly tumid, wider than long, not extending far onto abactinal surface; the lateral surface rises to a low cone, bearing 1–2 short stubby spines; rest of surface covered with spaced pointed granules, higher than wide; these also finely rugose. Distal superomarginals abraded.

Inferomarginal plates occasionally alternate with superomarginals, lateral and actinal in position, more tumid than superomarginals, with similar elongate spaced tubercular granules; interradiial plates with 2 short stubby spines, the others with one. Distal plates abraded.

Terminal plate large, rounded above and flat below, distal margin with lateral spine base on each side.

Actinal areas extensive, plates rectangular near adambulacrals, rounded to ovoid elsewhere. Plates in about 5 chevrons, the inner extending almost 3/4R along arm. Plates slightly tumid, with cover of slightly spaced tubercular granules, varying from flat-topped to bulbous, the surface finely thorny. Many plates with either a single spine or an erect 2-jawed pedicellaria, the jaws flat, higher than wide, widest distally, with 1–5 finger-like teeth along margin, interdigitating with those of other jaw. Almost all pedicellariae missing, though slits are present. They tend to be commoner proximally, while bases of spines are commoner distally.

Adambulacral plates wider than long, the outer margin rounded; lateral margins straight, proximal margin barely convex on first 2–3 plates, then convex, more so distally. Furrow spines 2 on first 2–3 plates, then 3, at about 1/2R 1–2 plates have up to 4, beyond 3 they vary, rarely 4. Many spines are broken; those remaining are blunt-tipped, ovoid to flat in section, with narrow edge to furrow, and extend across furrow to meet their opposite numbers. Proximal 3–4 plates with distal subambulacral spine, and a proximal pedicellaria; from about 1/2R, most plates with single spine with large base. Outer part of latter with 2–3 irregular rows of granules, varying in size, with finely thorny tips.

Oral plates large, with 6–7 flat furrow spines, longer than those on adambulacral plates and intermeshing across furrow; actinal surface with slightly spaced dumpy tubercles, wider than high, the top flat and thorny.

Adambulacral furrows narrow, *tubefeet* biserial throughout, with distinct sucking-discs.

COLOUR (dried specimen, ex formalin, was originally frozen): Uniform dull light brown.

ETYMOLOGY: *tasmanica*, in reference to the type locality.

HOLOTYPE: Deposited in the collection of NIWA, Wellington No. H-867.

REMARKS: This species resembles *H. falklandica* Fisher in having the marginals completely covered with granules, but differs in having abactinal and marginal spines. *H. caribaea* Verrill, also with granulose marginals, differs in having the primary abactinal plates concave, many of them with small bivalved pedicellariae and a row of marginal granules, but lacking any spines.

Mediaster Stimpson, 1857

Mediaster australiensis H.L. Clark, 1916 (Pl. 85)

Mediaster australiensis H.L. Clark, 1916: 39, pl. 9 (1-2); 1946: 83; A.M. Clark 1993: 262; Rowe & Gates 1995: 66.

MATERIAL EXAMINED:

NIWA Stns: Z10714 (1); Z10727 (1).

DISTRIBUTION: Only local records from Gothic and Zombie hills, near the Chatham Rise, central New Zealand. Also known from southeastern Australia and south of Tasmania, depth range 890–1076 m.

STUDY SPECIMEN: NIWA Stn Z10727 with R 174 mm, r 53 mm, R = 3.3r.

DESCRIPTION: *Outline* pentagonal–stellate, interbranchial arcs rounded, the 5 arms regularly tapering. Body more or less flat below; above, it is slightly inflated centrally and along midline of arms.

Abactinal plates small, with a rounded or ovoid base, spaced apart so that around disc centre and proximally on the arms, the narrow elongate connecting ossicles are visible, though on interradiial and distal arm areas these are not apparent. Base of most plates rounded, but along arms are 5 rows of plates clearly wider than long, the carinals and 2 flanking rows on either side, and all plates arranged in regular longitudinal and transverse rows. Plates adjacent to superomarginals only slightly tabulate or tumid, elsewhere all plates with a distinct tabulum, usually higher than wide and a little expanded distally to a flat top; plates near armtip are lower than those paced proximally. Tabulae with 9–15 peripheral and 1–6 usually larger inner granules; all are angular with truncate tips, the peripheral often with a few small spikes at the tip, while the inner granules are mostly smooth-tipped. Often there are intergrades between 2 elon-

gate granules and a distinct bivalved pedicellaria. Very rarely the pedicellariae have 3 valves. Typical bivalved pedicellariae are 2–4 times longer than high, with smooth jaws and, while most lie more or less centrally on the paxillae, they may extend to the margin and replace some of the peripheral granules. *Pedicellariae* present on both radial and interradial areas and to near the armtips.

Madreporite inconspicuous, placed about 1/4r from disc centre; it is roughly circular, greatest diameter 4 mm, with coarse sculpture; though tumid it is not as high as the adjacent paxillae.

Anal aperture central, flanked by 5 paxillae, spaced closer than elsewhere, and surrounded by small spines.

Papulae widespread, absent at margins near armtips only; on proximal parts there are up to 6 papulae in each mesh between connecting ossicles, so they are numerous about each plate; distally there are usually 6 single around each plate and interradially up to 4.

Marginal plates more or less opposite throughout arm; in interradius, superomarginals sloping, becoming vertical beyond, wider than long, becoming longer than wide and then wider distally; inferomarginals mostly wider than long, both series of plates tumid and all separated by distinct grooves. Plates with a complete cover of granules, squarish in section and with bluntly pointed tips, those at plate margins slightly the smaller, with tips often truncate and beset with a few small spikes; granules on inferomarginals a little taller than those on superomarginals. Plates of both series sometimes with a bivalved pedicellaria like those on abactinal plates.

Actinal areas extensive with plates in about 10 rows proximally, though only 2 extend beyond 1/2R and only 1 is present to near the armtip. Most plates wider than long and flat, each with up to 30 granules, squarish in section, with angular or truncate tips, sometimes with a few small spikes; elongate bivalved pedicellariae relatively common, variously placed on the plates, some almost as long as the plates are wide and generally noticeably longer than the abactinal or marginal pedicellariae.

Adambulacral plates a little wider than long, the furrow margin almost straight; 5–7 furrow spines, successive combs crowded and overlapping, the spines flattened, with narrow edge to furrow and the sides often with slight longitudinal grooves; subambulacral armature in 5 closely spaced, irregular rows of angular pointed granules, each row with 4–6 such granules and the granules decreasing in size outwards; those of inner row a little shorter than the furrow spines and slightly spaced from them. Occasional plates with some or all subambulacral granules replaced by a bivalved pedicellaria.

Oral plates large, median suture scarcely apparent; 16–19 furrow spines, angular distally, becoming increasingly compressed and slightly larger proximally; up to 36 short, blunt-tipped and compressed suboral spines in 1–2 rows.

Ambulacral furrows narrow, *tubefeet* biserial, distinctly suckered.

COLOUR (dried specimen): Uniform light brown above, uniform slightly lighter brown below.

REMARKS: The specimen from NIWA Stn Z10714 has R/r = 21/10 mm, outline pentagonal–stellate with short upward curved arms; 18 superomarginals to the interbrachial arc; 4–5 furrow spines, 3 in the inner subambulacral row; and 4–5 granules in the outer row, these being somewhat irregular. The furrow spines with bluntly rounded tips, laterally compressed; but less so than in the large specimen, furrow combs slightly overlap. There are 10–12 oral furrow spines; the abactinal paxillae usually have 1–2, rarely 3, inner granules; most marginal plates have a bare patch, the last superomarginals in contact on radial midline. A small centrodorsal plate is present; pedicellariae not seen.

A direct comparison of the large specimen with one from Australian waters has been made. Apart from the size, the only significant difference appears to be that, in the smaller, the actinal pedicellariae are similar to the abactinal, and on abraded plates leave a large rounded perforation. This smaller specimen (R/r = 81/26 mm) is from south of Tasmania (NIWA Stn Z9269).

Mediaster sp. (Pl. 86)

MATERIAL EXAMINED:

NIWA Stn Z10812 (1); Z11213 (1).

DISTRIBUTION: This species is recorded from 2 seamounts on the Kermadec Ridge, northeast of New Zealand, 1041–1272 m. One seamount, Rumble V, is an active volcano; the other is informally known as Cupcake and is probably inactive.

STUDY SPECIMEN: NIWA Stn Z10812, R/r = 77/21 mm, R = 3.7r.

DESCRIPTION: *Outline* stellate, the 5 elongate arms tapering to a small though blunt tip; interbrachial arcs somewhat acute. Disc more or less flat above and below, distal half of arms with a low broadly rounded ridge.

Abactinal plates at disc centre and radial portion of arm in proximal 2/3 with a stellate base and a dis-

tinct tabulum. Interradially and distally plates become lower and scarcely tabulate. Top of tabulae slightly convex, with several granules, the peripheral truncate, with straight-cut outer edge and angular within; inner granules larger and rounded, the top convex; a mid-radial paxilla has 17–20 peripheral and 10–14 inner granules; interr radial and distal paxillae and plates with fewer granules. At disc centre are 5 larger and more tumid plates, with up to 25 inner granules. Plates near midline of arm clearly wider than long, arranged in 7 longitudinal rows, 3 on either side of the carinal series, also aligned in less evident oblique–transverse rows. On each arm the carinal row is interrupted at about 2/3R and by encroaching adjacent plates, and beyond is somewhat irregular. Interradial and distal plates ovoid or round.

Papulae single, placed at corners of plates, with 6 about each plate, but are absent interr radially and near armtip; papular areas of 4 arms confluent centrally, but that of madreporic interradius is not.

Madreporite small, inconspicuous, placed about 1/3r from disc centre, 4-sided, greatest diameter 2 mm, with coarse sculpture.

Small 2-jawed *pedicellariae* occasionally present on both radial and interr radial paxillae, replacing 2 of the peripheral granules; rarely they are centrally placed. Jaws higher than wide and often resemble a slightly curved granule; they vary from shorter to taller than adjacent granules. On some abraded plates is a small distinct orifice where a pedicellaria was present.

Marginal plates form a distinct edge to body; proximally the superomarginals are sloping, distally they are more or less vertical like the inferomarginals. The 2 series of plates more or less opposite throughout and fit closely together; they are covered with small angular truncate granules; those at plate margins are not differentiated. No pedicellariae were observed on marginal plates, though distal plates have lost almost all covering.

Actinal areas extensive, the plates in about 5 rows proximally though only 1 extends beyond 1/2R. Plates flat, with up to 20 small, angular and truncate granules, slightly spaced apart. Pedicellariae like those on abactinal paxillae are present on actinal plates; on some abraded plates a small, distinct orifice is apparent.

Adambulacral plates a little longer than wide, furrow margin slightly convex on first 1–2 plates and also beyond 3/4R; first plate with 6 furrow spines, succeeding with 7–8, at about 2/3R there are 9–11 spines, near armtip 8–10. The spines compressed, ovoid in section, often slightly thicker towards tip; those at each end of the plate are the shortest. Subambulacral armature in 2 slightly spaced rows; inner row of 4, occasionally 5 short, squarish spines with angular tips, outer row of 4–7 smaller angular granules, only a little larger than those on adjacent actinal plates.

Oral plates large, in shape of equilateral triangle, the long base interr radial; plates of a pair separated by a distinct membranous space. Furrow margin with 15 short bluntly rounded angular spines, only slightly larger proximally. Actinal face of plate with up to 30 small granules roughly arranged in 2 rows, with 1–2 of the proximal granules distinctly larger.

Anal aperture small and inconspicuous, centrally placed.

Ambulacral furrows narrow, *tubefeet* biserial, with distinct sucking-discs.

COLOUR (preserved specimen): Uniform very light brown above and below.

REMARKS: In the second specimen, R/r 52/12 mm, the carinal series is not interrupted, but is indistinct beyond about 2/3R; there are 6–8 adambulacral furrow spines, and 2 rows of subambulacral spines with 4–5 in each; the oral plates have 14–15 furrow spines, and about 20 suboral granules. These specimens quite closely resemble *Mediaster arcuatus* (Sladen) but differ in having much longer arms (R 3.7–4.3r) and more numerous suboral granules.

KEY TO LOCAL SPECIES OF *Mediaster*

- 1 5–7 crowded, sometimes overlapping adambulacral furrow spines, 4–6 subambulacral spines, outer granules close to furrow series; 16–19 oral furrow spines. Pedicellariae bivalved, jaws low and long. Outline stellate, R up to 3.3r *Mediaster australiensis*
- 1' Adambulacral furrow spines not crowded; subambulacral armature spaced from furrow series. Pedicellariae low or high with 2–3 jaws 2
- 2 Outline arcuate, with R about 2.0r or less; 7–8 adambulacral furrow spines, subambulacral granules in 2 rows. Pedicellariae higher than wide *Mediaster arcuatus*
- 2' Outline more stellate, with R usually more than 2.0r; one row of 4–7 subambulacral spines, then 1 row of granules 3
- 3 9–13 adambulacral furrow spines, oral plates with 14–18. Pedicellariae higher than wide, the jaws with fine teeth *Mediaster gartrelli*
- 3' 5–8 adambulacral furrow spines, jaws of pedicellariae smooth 4
- 4 5–6 adambulacral furrow spines and 9–10 oral; pedicellariae low and long conspicuous with 2 jaws or 3 jaws and triangular *Mediaster sladeni*
- 4' 6–8 adambulacral furrow spines and 15 oral. Pedicellariae small, higher than wide *Mediaster* sp.

Pillsburiaster Halpern, 1970

Pillsburiaster indutilis n. sp. (Pl. 87)

MATERIAL EXAMINED:

NIWA Stns: TAN0306/05 (1); TA0306/06 (1); TAN0306/08 (3); Z10714 (1).

DISTRIBUTION: This species is known from Christabel Seamount, to the south of New Zealand, and also on Gothic Seamount, northeast of the Chatham Islands

DEPTH RANGE: 968–1140 m.

DESCRIPTION: Holotype specimen (NIWA Stn TA0306/08) R/r = 33/21 mm. 14 superomarginals to the interbranchial arc, the distal 3 pairs united on radial midline.

Outline arcuate–pentagonal, arms short, rapidly tapering, body flat above and below, margins vertical.

Abactinal plates more or less regularly arranged, with a few smaller secondary plates near disc centre and flanking inner end of carinal row. Larger plates round or ovoid, though secondaries may be angular; carinal plates ovoid, wider than long, in a regular series extending to meeting of superomarginal plates. On either side of carinal row are 3 further regular series of rounded plates; interradial plates more variable in shape, decreasing in size towards margin. Abactinal plates slightly raised, each with a marginal series of small granules, slightly spaced apart, the top a little wider than the base, the outer margin almost straight. Top of plates with rounded deciduous granules, often very slightly flattened, also slightly spaced apart. Marginal granules more or less equal in size and usually just larger than the internal, which often vary in size. Many plates with some or all internal granules lost, leaving distinct depressions, and on these plates very small “crystal bodies” are apparent. Carinal plates with about 20 marginal granules and a similar number of internal granules.

Papulae single, with 5–6 around plates. Papular area covers disc centre, extends almost to end of abactinal plates on carinal row, and the 3 rows on either side of it. Small pedicellariae present on several abactinal plates and when absent leave a distinct slit, surrounded by a narrow shallow groove; they are erect and spatulate with 2 jaws, the jaws almost flat, widened at the tip, which is slightly curved.

Madreporite placed about 1/3r from disc centre; it is 4-sided, greatest width about 2 mm, with radiate sculpture. *Anal aperture* not apparent.

Superomarginal plates distinctly higher than inferomarginals in interradius, equal in height beyond. Superomarginals tumid on abactinal surface, wider than long throughout. Abactinal surface of plates with

scattered embedded hemispherical granules, interradial plates have lateral surface covered with these granules; distal plates almost completely naked on both abactinal and lateral surfaces. Margins of plates with a complete series of smaller partly flattened granules. Inferomarginal plates wider than long, except for last three, which are longer than wide. Plates with marginal and embedded deciduous granules, forming a dense cover on interradial plates, but becoming sparser distally, the last three with the marginal series only.

Terminal plate rounded and conical, one plate with a pointed tubercle present, others with a slight pit.

Actinal areas extensive, plates in about 6 chevrons, the innermost extending to proximal end of third inferomarginal from armtip. A single plate lies at distal end of combined oral plates. Plates flat, rectangular adjacent to adambulacrals, 4-sided to round interradially. They have a cover of hemispherical granules, often varying in size, with about 30 on larger plates. No pedicellariae seen on actinal plates.

Adambulacral plates subrectangular and wider than long throughout, furrow margin weakly convex on first three plates, then straight. Furrow spines 5 (rarely 6), the proximal and distal slightly the shorter; spines have a bluntly rounded tip, do not taper, and are ovoid in section. Subambulacral armature in 3 slightly spaced rows; inner with 3, sometimes 4, short blunt spines; if 4, proximal is smallest; middle row with 3–4 shorter spines; outer row at margin of plate and less regular, with 3–5 granules, a little larger than those on adjacent actinal plates. Rarely a plate has a pedicellaria like those on abactinal plates. Distal plates with one subambulacral spine enlarged, longer and thicker and quite conspicuous.

Oral plates large, flat and triangular; furrow spines 9–10, a little longer than adambulacral furrow spines, and somewhat angular in section, bluntly pointed, proximal spine being clearly longer than any other. Five or six shorter angular suboral spines parallel the furrow series with a further 3–4 short spines continuing along the margin adjoining the first adambulacral and proximal actinal plate; 7–8 large angular granules or short spines form a row along median suture; 3–4 others lie between this row and that next to the furrow series.

Ambulacral furrows narrow, *tubefeet* with distinct sucking-discs, in 2 rows.

COLOUR (preserved specimen): Uniform light brown.

ETYMOLOGY: The specific name, *indutilis*, refers to the united distal superomarginal plates.

HOLOTYPE: Deposited in the collection of NIWA, Wellington, No. H-868 (Stn TAN0306/08). (R/r 33/21 mm,

14 superomarginals to interbrachial arc, distal 3 pairs united.) Has a few orangey patches on abactinal side.

PARATYPES: Deposited in the collection of NIWA, Wellington, No. P-1420 (Stn TAN0306/08 (3)).

REMARKS: The smallest specimen (Z10714) has the abactinal area sunken, while the largest (TAN0306/08) is damaged with several oral and adambulacral plates lacking their armature.

This species, like small specimens of *Pillsburiaster aoteanus* McKnight, has very small hyaline bodies that are present on the abactinal plates. It differs from this species in having slightly fewer and higher superomarginal plates, with the distal united on the radial midline, and secondary plates confined to the disc centre. However, the principal difference between this new species and all others referred to the genus is the larger carinal plates with about 20 granules in the marginal and internal series.

Pillsburiaster maini McKnight, 1973

Pillsburiaster maini McKnight, 1973: 183, fig. 6; A.M. Clark 1993: 276; H.E.S. Clark 2001: 105, pl. 28.

MATERIAL EXAMINED:

NIWA Stn Z11213 (1).

REMARKS: This specimen has R/r 12/7 mm, 12 superomarginals to the interbrachial arc, the last 3 in contact. Adambulacral plates with 3, rarely 4 furrow spines, 6 subambulacral granules in 2 longitudinal rows; 9 oral furrow spines. Abactinal plates larger and smaller, larger usually with centre bare, smaller plates with slightly spaced uniform granulation. Papulae few, about 6–8 at about 1/2R in a zigzag line on either side of carinal plates.

KEY TO LOCAL SPECIES OF *Pillsburiaster*

- 1 Abactinal secondary plates more or less confined to disc centre; carinal plates with about 20 marginal and 20 internal granules *Pillsburiaster indutilis* n. sp.
- 1' Abactinal secondary plates present on disc and to near armtip. Carinal plates with usually 5 or fewer internal granules 2
- 2 R about 2.3r; 1–3 central granules on larger abactinal plates *Pillsburiaster maini* McKnight
- 2' R 2.0r or less 3
- 3 Outline arcuate–pentagonal to pentagonal with R 1.5–1.8r; central granules on abactinal plates about equal to marginal *Pillsburiaster aoteanus* McKnight
- 3' Outline more stellate, R2.0r, central granules on abactinal plates often enlarged *Pillsburiaster* sp. H.E.S. Clark

Pseudarchaster Sladen, 1889

Pseudarchaster jordani Fisher, 1906 (Pl. 88)

Pseudarchaster jordani Fisher, 1906: 1038, pl. 10 (7,7a), 19 (2,2a); Koehler 1909: 49; Jangoux 1981: 471; Clark 1993: 279.

MATERIAL EXAMINED:

NIWA Stns: Z10873 (1); Z11013 (1).

DISTRIBUTION: No data for either NIWA Stn though Z10873 is said to be Ritchie Bank. Here recorded from Ritchie Bank, east coast North Island, and northeastern Challenger Plateau.

P. jordani has been recorded from Hawaii, the Philippines, and the Indian Ocean in depths of 686–1986 m.

DEPTH RANGE: 393–1262 m.

STUDY SPECIMEN: NIWA Stn Z10873, R/r = 196/55 mm; has upturned arms, and oral area is damaged.

DESCRIPTION: *Outline* stellate, disc relatively large, the 5 arms gradually tapering, tip pointed. Margin bevelled, the superomarginal plates sloping over arm and more or less abactinal, except close to armtip. Abactinal surface of disc slightly inflated, of arms more so, forming a broad ridge. Actinal surface flat.

Abactinal plates regularly arranged on disc and arms. At centre of disc a small, abruptly tumid area, elsewhere on disc, interradian areas and lateral parts of arms plates closely packed. Along centreline of arms is a region of more widely spaced plates; several series of small plates extend almost to armtip. Plates have a lobate base and rise to a low though distinct and slightly expanded tabulum. Paxillae rounded along centreline of arms and on disc; interradianly they become 4-sided, and, close to the margin, narrow and more or less rectangular. Paxillae usually have 8–14 inner granules, often with 1 at centre; these are slightly higher than wide, expanding from base to a slightly tumid top, and they stand higher than the sometimes-hidden peripheral series; these almost as long, but much thinner, flattened and straight-sided.

Papular area covers at least 2/3 width of arm, with 4–6 papulae around each plate; on disc and in interradian, paxillae are tightly packed and papulae are not evident; in one interradian, however, paxillae are separated and no papulae are present at bases of tabulae.

Madreporite placed just less than 1/4r from disc centre; it is round, diameter 3 mm, slightly sunken and has coarse sculpture.

Anal aperture cannot be seen, presumably hidden by clustered paxillae at disc centre.

Superomarginal plates wider than long, flat-topped or slightly tumid near armtip, separated by narrow fasciolar grooves. Plates have a covering of regularly spaced granules, as large as those at centre of paxillae, but simply rounded. Granules largest along centre of plate, and close to outer border are 1–6 short spines, or larger, sometimes flattened, granules. At lateral margins of plates is a row of much finer small spinelets, lining the fasciolar grooves. Inferomarginal plates also wider than long, extending almost to abactinal surface; the plates with a close cover of semi-appressed flattened short spines, as well as granules near margins and fasciolar spinelets.

Actinal plates form oblique rows from adambulacrals to inferomarginals, shallow channels separating rows, so that longitudinal series are less evident; one row of plates nearly reaches armtip. Each plate has several round or partly flattened spines; at edges are well-spaced smaller and rounded spines.

Adambulacral plates wider than long; first two plates with straight furrow margin, rest have angular furrow margin; 6–8 furrow spines, the median longest, 1–4, commonly 2 enlarged subambulacral spines and up to 8 smaller spinules scattered over plate.

Oral plates damaged, with at least 10 furrow spines; on 2 oral pairs there appears to be a longer and stouter spine at the jaw apex, outside of which are a few small spinelets. Suboral spines in 2 rows, numerous.

Tubefeet biserial, with distinct sucking-discs.

COLOUR (frozen specimen, now dried): Reddish-brown above, almost cream below.

REMARKS: In having short spinelets on the superomarginal plates this specimen is distinct from *P. garricki* Fell.

Sphaeriodiscus Fisher, 1910

Sphaeriodiscus irritatus H.E.S. Clark, 2001

Sphaeriodiscus irritatus H.E.S. Clark, 2001: 133, pl. 37.

MATERIAL EXAMINED:

NIWA Stn Z10690 (2).

DISTRIBUTION: This species is now recorded from the Graveyard Hill, near the Chatham Rise, central New Zealand; depth range 900–993 m. The only other record is from the Three Kings Rise, north of New Zealand, in 530 m.

REMARKS: These 2 specimens are larger than the holotype, with R/r = 33/22 mm (12 superomarginals to the interbrachial arc) and R/r = 32/22 mm (10 superomarginals). Both specimens were dissected

upon collection for an examination of the gonads, and neither has an entire actinal surface. The gonads are in a single extensive tuft on either side of the interradial septum, and open dorsally in a slit-like pore at the extreme edge of the papular area, about 2/3R from the disc centre. One polian vesicle in each interradius. Ampulla of tube feet single.

Family ODONTASTERIDAE Verrill, 1899

Diabocilla n. gen.

Odontasteridae without prominent enlarged and recurved spines at the apex of the jaws, but with 1–2 larger erect spines and some smaller only. Abactinal plates very slightly elevated, with short, broad lobes, superomarginal plates wider than long, interradial inferomarginals wider than long, becoming longer than wide near armtip. Abactinal and marginal plates with elongate tubercles widest at the tip, and with embedded crystal bodies. Actinal plates with short spines.

TYPE SPECIES:

Diabocilla clarki n. sp.

ETYMOLOGY: The generic name *Diabocilla* is an anagram of Diabolical, the submarine hill from which the species was collected.

REMARKS: This is the second genus in the family that lacks the enlarged and recurved suboral spine, at the apex of each jaw, a conspicuous feature of *Odontaster*, *Diplodontias*, *Acodontaster*, and *Eurygonias*. From *Hoplaster* it differs in having abactinal plates barely elevated and both abactinal and marginal plates with a cover of tubercles rather than spines. In this respect it is more like *Acodontaster* but it lacks the large hyaline suboral spine.

Diabocilla clarki n. sp. (Pl. 89)

MATERIAL EXAMINED:

NIWA Stns: Z10697 (1); Z10727 (1); Z10728 (1).

DISTRIBUTION: This species is known only from near the Chatham Rise, central New Zealand, namely on the hills Diabolical and Zombie.

DEPTH RANGE: 890–970 m.

STUDY SPECIMEN: Holotype: NIWA Stn Z10728, R / r = 12.5/8.5 mm. 13 superomarginal plates to the interbrachial arc.

DESCRIPTION: *Outline* pentagonal–stellate, with 5 short rapidly tapering arms, interbrachial arcs curving. Body slightly inflated above, almost flat below, though actinosome sunken.

Abactinal plates slightly raised, flat-topped, irregular in shape at disc centre and interradially, and close-set; over radial areas plates smaller and spaced apart; plates generally with 5 short broad lobes, most distinct on radial papular areas. All plates with slightly spaced elongate tubercles. These up to 0.5 mm long, and c. 0.2 mm in diameter; the head the widest part, flat-topped or only slightly rounded. The larger central and interradiial plates have up to 25 such tubercles, while those on radial areas have up to 12. All plates also have embedded, slightly spaced crystal bodies.

Papulae single, the pores conspicuous, absent from disc centre and interradiial area; on arms are 6 rows of papulae, the lateral rows short. On the two central rows the most distal pore is placed at proximal border of the last abactinal plate. *Anal aperture* centrally placed, small, surrounded by tubercles.

Madreporite at almost $1/2r$ from disc centre, irregularly pentagonal in outline, diameter about 1.5 mm. The centre finely rugose, with radiate sculpture near margins. Marginal plates conspicuous with vertical margin to body; an unpaired interradiial plate in both series, these plates triangular and widest within; other marginal plates subrectangular.

Superomarginal plates wider than long, slightly wider near armtip. Penultimate superomarginals touch distally, the last plates much smaller and lie on either side of terminal plates. Inferomarginal plates wider than long interradially, becoming longer than wide near armtip. The marginals have a cover of tubercles like those on the abactinal plates, and are separated by distinct though shallow grooves. The terminal plate roughly teardrop-shaped, longer than wide, and covered by tubercles. All marginal plates and the terminal have embedded crystal bodies.

Actinal plates in about 5 rows parallel to ambulacral furrow; the plates flat, with 4–7 short spines up to 1.0 mm long; most of these thickest beyond base, the tip bluntly rounded, though occasional spines are thinner and taper throughout to a sharp tip.

Adambulacral plates almost rectangular, just wider than long. There are 3, rarely 2, spines at edge of furrow and 5–6 subambulacral spines, the latter more or less in pairs across plate. Furrow spines gently taper to blunt tip, while inner subambulacral spines are thicker and often widen beyond the base, and are like many of the spines on the actinal plates; outer subambulacral spines much shorter, though usually thickened.

Oral plates small, each pair with a slight median skin-covered furrow. There are 5–6 pointed furrow

spines, largest proximally, and 5–7 erect suboral spines, in longiseries along plate. The first is close to the proximal border, is longer and thicker than the furrow spines. The second longer and thicker again, the tip pointed, and on 3 oral angles is almost triangular in section, the distal 3–5 spines much thinner and shorter than the others or the furrow series.

Pedicellariae not observed, though rarely an actinal spine is thin and curved, like the valve of a fasciculate pedicellaria; none has a similar opposing spine, however.

Ambulacral furrows relatively narrow, tubefeet in 2 regular rows, each with a distinct terminal sucker.

COLOUR: Uniform dull very light brown.

ETYMOLOGY: This species is named for Dr Malcolm Clark, NIWA.

HOLOTYPE: Deposited in the collection of NIWA, Wellington, No. H-869. (Stn Z10728 R/r = 12.5/8.5 mm, 13 superomarginals to the interbrachial arc.)

PARATYPES: Deposited in the collection of NIWA, Wellington, Nos P-1421 (NIWA 3870). (Stn Z10697 R/r = 15.0/9.5 mm, 11 superomarginal plates to the interbrachial arc.) and P-1422 (NIWA 3871). (Stn Z10727 R/r = 11.0/7.5 mm, 11 superomarginals to the interbrachial arc.)

REMARKS: The specimen from Stn Z10697 has the proximal furrow spine flattened with the narrow side to the furrow and the 2 larger suboral spines are thickened at the tip. That from Z10727 has the suboral spines only slightly enlarged.

The specimen from Z10728 has very small distal superomarginal plates present on each arm, thus having a higher number than the other specimens. It has two larger, rounded or flattened suboral spines on each plate, and also 5 much smaller distal spines. The specimen from Z10727 has the suboral spines only slightly enlarged.

Family **PODOSPHAERASTERIDAE** Fujita & Rowe, 2002

A family of the Valvatida with the body almost spherical to high and cushion-shaped; skeleton of relatively thick plates firmly sutured together, plates usually 5- or 6-sided, and body resembles an echinoid test. Marginal plates not distinct, plates covered by thin skin, and bearing short spines, tubercles, or granules.

Podosphaeraster A.M. Clark, 1962

Body circular in outline, cushion-like to spherical in form, abactinal plates somewhat irregular, though

primary disc and some radial plates relatively distinct; dorsolateral plates present. Ambital plates usually in 2 series, probably representing the marginals; subambital plates present; all plates armed with short blunt spines or tubercles, longest below the ambitus. Adambulacral plates with a few short blunt furrow spines and slightly larger subambulacral spines. Papulae single, inconspicuous, placed at angles of plates; madreporic pore small, sited in a primary inter-radial plate, pedicellariae not known.

TYPE SPECIES:

Podosphaeraster polyplax A.M. Clark in Clark & Wright, 1962

Podosphaeraster somnambulator n. sp. (Pl. 90)

MATERIAL EXAMINED:

NIWA Stn Z10727 (1).

DISTRIBUTION: This species is known only from Zombie Hill, situated in the Graveyard region, near the Chatham Rise, central New Zealand, depth range 890–955 m.

STUDY SPECIMEN: NIWA Stn Z10727, R 6.5 mm, r 6.0 mm, diameter 15.0 mm, height 10.5 mm (horizontal/vertical diameters = 1.43).

DESCRIPTION: *Outline* pentagonal, interradial arcs almost straight; body highly inflated above and below ambitus.

Abactinal and actinal plates form a close-knit skeleton; abactinal plates slightly tumid, so that indistinct outlines become apparent when dried; centrodorsal plate 5-sided, surrounded by 5 interradial plates, and between the outer ends of these are inserted the inner pointed ends of 5 radial plates; a further 4 carinal plates extend to the terminal; interradially there are 4 plates between each pair of terminal plates and 6 in the next row actinally; 6 horizontal rows of interradial plates are present from terminals to orals. A shallow narrow furrow runs down each interradial midline to ambitus or just below; it arises from distal margin of larger interradial plates of second row.

Papulae small, very inconspicuous and sparsely scattered, placed at some angles of plates; they are rare on apical system and absent from lowest 3 rows of actinal plates.

Madreporite small, rounded, placed on second horizontal row of interradial plates from centrodorsal or terminals; it is more tumid than any other abactinal plates, and has fine sparse sculpture.

Anal aperture not evident.

Terminal plate with 8 spinelets in a double row across plate; plate not denuded, but perforation

thought to be absent, actinal surface of plate nearly straight, actinal channel only faintly indicated.

Almost all plates with short spinelets truncate or bluntly rounded at tip that may be slightly widened, and have fine sculpture of longitudinal ridges and grooves. This sculpture extends over tip. There are usually 5–8 spinelets on each plate, scattered around the margin; rarely are there any internal spinelets. Abactinal spinelets usually rounded and about 0.3 mm long, the actinal longer, up to 0.5 mm, and flattened.

Adambulacral plates distinct when dried; plates about as wide as long. They have 2–3 delicate rounded, tapering furrow spines (1 on first few plates) and a stouter flattened subambulacral spine, with a truncate tip. On the actinal surface sporadic plates may have 2 such spines; beyond about 1/2 length of ambulacrum are almost always 2 spines set transversely, the inner usually the longer, up to 0.7 mm long.

Oral plates small, with 3 furrow spines and a single suboral spine.

Adambulacral furrows almost closed; *tubefeet* not apparent.

COLOUR (preserved specimens): Uniform light brown.

ETYMOLOGY: *somnambulator* in reference to the type locality, Zombie Hill.

HOLOTYPE: Deposited in the collection of NIWA, Wellington, No. H-870.

REMARKS: Specimens of *Podosphaeraster* are rare in collections, with about 12 known specimens (Rowe 1985). Four species are recognised, but the differences between species are slight. Features that distinguish the present species are: the restriction of spinelets to the periphery of the plates; the lack of perforations or well-marked actinal channels in the terminal plates; 2–3 papulae on the apical system; and no papulae on the lowest 3 rows of actinals.

Rowe and Nichols (1980) and Rowe (1985) provide details of previously described species.

Of these, *P. thalassae* Cherbonnier, Atlantic Ocean, 500–520 m, has a nodular first carinal plate that in at least some radii is separated from others in the series; *P. gustavi* Rowe, Atlantic Ocean, 500–615 m, has, at HD 9.5 mm, a distinct perforation or channel in the terminal plates and also has a slightly more extensive actinal papular area; *P. polyplax* Clark & Wright, Pacific Ocean, 72–125 m, has a somewhat irregular apical system and HD/VD 1.1–1.3; *P. pulvinatus* Rowe & Nichols, Pacific Ocean, 244–324 m, is the only species with the ratio HD/VD greater than 1.8 and has the terminal plate more or less naked.

Family PORANIIDAE Perrier, 1894

Marginaster Perrier, 1881

Poraniidae with outline nearly pentagonal and small size, R usually < 20 mm. Plates skin-covered, obscuring plates until dried; interradii slightly sunken; abactinal plates with coarse abactinal spinelets; inferomarginals projecting to form edge of body, each with 2–5 spines forming a marginal fringe; actinal plates well-developed, with an enlarged interradiial plate; actinal spinelets spaced and few. Marginal and sometimes abactinal plates with embedded crystal bodies.

TYPE SPECIES:

Marginaster pectinatus Perrier, 1881

Marginaster patriciae n. sp. (Pl. 91)

MATERIAL EXAMINED:

NIWA Stns: Z10697 (1); Z10706 (1); Z10713 (1); Z10731 (1).

DISTRIBUTION: This species is recorded from near the Chatham Rise, central New Zealand, specifically from some hills in the Graveyard area, namely Diabolical, Gothic, and Ghoul.

DEPTH RANGE: 900–1130 m.

STUDY SPECIMEN: NIWA Stn Z10713. R 13 mm, r 8 mm, 9 inferomarginals to each arm.

DESCRIPTION: *Outline* stellate, with short arms tapering to a blunt upturned tip. Body flat below, inflated on disc and arms above.

Abactinal skeleton reticulate, around disc centre, plates are rounded, while along arms and towards margins they become elongate and arranged in transverse rows; in each interradius is a relatively conspicuous double row of elongate plates. *Terminal plate* short and broad, crescentic in outline. *Abactinal plates* tumid, usually with short spinelets, 0.2–0.4 mm long, the spinelets either tapering to a point or truncate distally, occasionally with a few terminal thorns, many though not all being glassy at tip. Most plates with 2–6 spinelets, though 5 larger rounded interradiial plates (basals?) have 10. Disc plates have spinelets scattered over surface, though most are peripheral; however, elsewhere spinelets tend to lie along centreline of plates or along an edge, so that in interradii the sulcus is clearly outlined by the marginal spinelets.

Superomarginal plates small in interradii, becoming larger and more conspicuous near armtip; plates have

c. 6 scattered spinelets, and on larger distal plates immersed crystal bodies are clearly apparent. At lower end of interradiial sulcus is a small unpaired plate, placed a little lower than flanking superomarginals, but similar in shape and spinulation.

Inferomarginal plates form outline of body. From abactinal side they appear wider than long, while from below they are wider than long interradially, but become longer than wide distally; crystal bodies apparent on most inferomarginals; they also have 2–4 abactinal spinelets placed near outer margin; along this edge are 3–5 flattened spines, much longer than the spinelets, usually pointed but sometimes truncated; these spines form a distinct marginal fringe. *Papulae* usually single, spaced apart, the skeletal meshes sunken, the individual papulae inconspicuous. *Anal aperture* small though distinct, central, fringed by spaced spinelets. *Madreporite* small, inconspicuous, rounded, with few grooves, placed just above inner end of an interradiial sulcus.

Actinal plates forming transverse rows from adambulacrals to inferomarginals, with 3 paired rows extending from oral plates almost to margin, terminating in a single plate. This lies between and proximal to the first inferomarginals. Actinal plates tumid, separated by narrow shallow grooves and each with 1–3 bluntly pointed spines.

Adambulacral plates wider than long, slightly spaced apart, with one spine directed across furrow, and 2, rarely 3, subambulacral spines in a transverse row; the first 2 adambulacral plates have 2 spines at edge of furrow in a longitudinal series, and also 2 subambulacral spines, transversely placed.

Oral plates relatively small, each with 5 furrow spines largest proximally, and 0–2 suboral spines.

Ambulacral furrows narrow, *tubefeet* in 2 rows, each with a distinct terminal sucker.

COLOUR (specimen formalin fixed): Uniform creamy-white above and below. Tubefeet light brown.

ETYMOLOGY: Named for an understanding partner in life.

HOLOTYPE: Deposited in the collection of NIWA, Wellington, No. H-871 (Stn Z10713).

PARATYPES: Deposited in the collection of NIWA, Wellington, Nos P-1423 (Stn Z 10697); P-1424 (Stn Z10706); P-1425 (Stn Z10731).

REMARKS: The smallest specimen, Stn Z10706 has R/r about 4/2.5 mm. Spines and spinelets are about as numerous and as long as on the holotype, so are more closely spaced, and the specimen appears more spinulose. All are beset with thorns, which are espe-

cially noticeable on the inferomarginal spines. There are 4–5 inferomarginal plates, and on the actinal surface only the interradiial plate has a single spine. The adambulacral plates are armed as in the holotype. The orals have 3 furrow spines and no suborals.

Three species groups are apparent in *Marginaster*:

1. With the subambulacral spines in a longitudinal series:
M. paucispinus Fisher, Hong Kong and Reunion Island, 183–227 m, and the unnamed specimens mentioned below.
2. With a single subambulacral spine, abactinal skeleton more compact with ovoid plates:
M. littoralis Dartnall, Tasmania, shallow water.
3. With the subambulacral spines in transverse series:
M. pectinatus Perrier, Atlantic, 166–230 m.
M. capreensis (Gasco), Mediterranean, 50–600 m.
M. patriceae n. sp., New Zealand, 518–554 m. This new species differs from both *M. pectinatus* and *M. capreensis* in having an unpaired median plate in the superomarginal series and also in the interradiial actinal series, in lacking enlarged primary basal plates, and in having the adambulacral furrow spines placed longitudinally on the first plate, transversely on the rest.

Marginaster cf. *paucispinus* Fisher, 1922 (Pl. 92)

MATERIAL EXAMINED:

NIWA Stn Z11045 (1).

DESCRIPTION: R/r = 3.8/3.4 mm, R = 1.1r. 8 inferomarginal plates to the interbrachial arc.

Outline pentagonal, body flat below, domed above, rising to a small flat apex. Abactinal surface with mainly elongate narrow plates leaving relatively large skin-covered areas, containing small, immersed plates, and rarely a minute rugose tubercle. Almost all abactinal and marginal plates with very small shiny inclusions.

At *disc* centre are a few small rounded plates, surrounded by a pentagon of elongate plates. Further elongate plates, in a roughly pentagonal figure, connect to the subrectangular basals. Distal to the basals, two series of elongate plates form a distinct interradiial sulcus, the narrow gap between the 2 series being partly calcified. Carinal plates 5, shorter than adjacent plates, decreasing in size distally. Terminal plate larger than distal carinals, subrectangular, and glassy in appearance. Superomarginal plates nearly vertical in position, small and subrectangular, opposite inferomarginals.

Disc plates generally with up to 8 spinelets, length 0.20–0.30 mm, and about twice as high as wide, some-

times slightly widened distally, tip either truncate or pointed and beset with distinct thorns. Terminal plate with up to 6 similar spinelets on abactinal surface, and 6–7 longer-tapering thorny spinelets on the distal margin. Skeletal meshes become smaller distally, absent near armtip. Small skin-covered areas present between the first two pairs of proximal superomarginals, but lack a distinct pore.

Papulae small and inconspicuous, generally one to each skeletal mesh.

Madreporite small and rounded, diameter about 0.30 mm, with a central dentate slit, otherwise smooth and shiny.

Anal aperture a short slit, guarded by 4 short rugose tapering spinelets that have a broad base.

Inferomarginal plates form the margin; they are flattened, longer than wide, with 0–2 very short spinelets on abactinal surface; up to 5 spinelets at outer abactinal margin, and arising from actinal surface a series of flattened, tapering thorny spinelets about twice length of abactinal series. Interradiial inferomarginals have 5 spinelets, the number decreasing, with only 2 on outer. The spines of each plate united for c. 1/2 length by a fine web of skin.

Actinal interradiial areas more or less smooth, though actinal plates very slightly tumid, as are inferomarginals, which are separated by slight grooves. One subrectangular plate lies just behind oral plates, and a second larger subrectangular plate extends to inner inferomarginals, while 2–4 much smaller plates lie adradial and between these 2 plates. Some interradiial plates have a single rugose spinelet. Partly calcified areas, variously shaped, may lie between and lateral to the 2 principal interradiial plates.

Adambulacral plates wider than long, the first 1–3 with 2 small furrow spines, the rest with 1; there are 2 tapering, rugose subambulacral spines on each plate, forming a longitudinal series along the furrow. These spines the longest on the specimen, sometimes those of each plate have a basal web of skin.

Oral plates small, with distinct furrow between distal ends of each pair. Individual plates have 5 furrow spines, longest proximally, and 1–2 suboral spinelets.

COLOUR (preserved specimen): Dull reddish brown above, the skeletal meshes darker, creamy white below.

REMARKS: Four specimens of *Marginaster* with subambulacral spines forming a longitudinal series along the furrow have been reported from the Pacific and Indian Oceans. They include *M. paucispinus* Fisher from Hong Kong and Réunion Island, 183–227 m, an unnamed specimen from off Tasmania, 155–174 m, another unnamed specimen from the Kermadec Islands, 179 m, and the present specimen from Cavalli

Seamount, off northern New Zealand, 518–554 m. All have very similar abactinal skeletons and differ mainly in the nature of the abactinal spinelets, subambulacral spines, and extent of actinal interradial areas. I suspect that only one species may be present.

Specimens of *Marginaster* with subambulacral spines in a longitudinal series.

R, mm	R/r	Abactinal spinelets	Subambulacral spines	Locality /depth
11	1.4	Clavate	Narrow, spatulate, truncate	Hong Kong, 183 m
9	1.4	Rugose tubercles or spinelets	Distally flat and expanded	Tasmania, 155–174 m
7	1.2	Granules	Narrow, spatulate, truncate or pointed	Réunion Is., 210–227 m
4	1.2	Granuliform spinelets	Blunt	Kermadec Is., 179 m
3.8	1.1	Thorny	Slightly flattened, tapering, rugose	northern New Zealand, 518–554 m

Family ASTERINIDAE Gray, 1840

Anseropoda aotearoa McKnight, 1973

Anseropoda aotearoa McKnight, 1973a: 12; 2001: 161, pl. 63; A.M. Clark 1993: 205.

MATERIAL EXAMINED:

NIWA Stns: Z10769 (1); Z10770 (2); Z10799 (1); Z10805 (2).

REMARKS: This species is now recorded from the Brothers and Rumble III seamounts, active submarine volcanoes offshore from the Bay of Plenty, northern New Zealand. The only previous record is from the Challenger Plateau, west of New Zealand in 366–500 m. These new specimens range from R/r = 13/7 mm to 29/15 mm, and are much smaller than the holotype, with R/r = 75/39. These smaller specimens have 10–15 spinelets on the abactinal plates and up to 25 on the inferomarginals. The proximal actinal plates have up to 15 spinelets, the distal 5–8. The adambulacral plates have 5–7 furrow spines, while the subambulacral are usually in a single fan of 4–6; rarely a second fan is present.

Tremaster mirabilis novaecaledoniae Jangoux, 1982

Tremaster mirabilis novaecaledoniae Jangoux, 1982: 152, pls 1, 2, 4(C, D); A.M. Clark 1993: 228; McKnight 2001: 163, pl. 65.

MATERIAL EXAMINED:

NIWA Stn Z10937 (1).

REMARKS: This specimen is distorted, with the papular areas strongly inflated. R is about 77 mm, much larger than that previously recorded from the New Zealand region. When received, the frozen specimen was bright orange in colour; now dried after fixing in formalin, it is light pinkish. No data exist for this station.

ACKNOWLEDGMENTS

Several NIWA staff have contributed to the completion of this monograph, particularly Dr Dennis Gordon for advice and encouragement and A. Blacklock for expertise with the colour plates. In particular, the valuable assistance of NIWA seagoing staff and crew on R.V. *Tangaroa* and previous research vessels is gratefully acknowledged.

This research was supported by Research Contracts CO1421 and COIX0026 with the Foundation for Research, Science and Technology.

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APPENDIX 1

LIST OF STATIONS

This complements the lists in Asteroid Memoirs 1 and 2 (Clark & McKnight 2000, 2001): Paxillosida, Notomyotida, and Valvatida.

The station list should contain these species, but I have changed those listed as new to sp. A, B, etc., as shown below. Unfortunately the 2003 Australia/New Zealand Norfolk Rise (NORFANZ) Cruise has outdated this list. Added to the list are Cavalli, Christabel (TAN0306), and TAN0307 (incl. Bollons Seamount), NORFANZ from database (very provisional), and Freezer Cleanout asteroid material left over from H. Rotman and H.B. Fell.

Station List—about 965 stations.

Stn No.	Date	Latitude (°)	Longitude (°)	Depth (m)	Species and number
A444C	04.10.58	41 20.80 S	174 31.60 E	232–258	<i>Sclerasterias mollis</i> (1)
A444G	04.10.58	41 16.50 S	174 29.70 E	256	<i>Sclerasterias mollis</i> (1)
A444J	06.10.58	41 19.20 S	174 29.50 E	201	<i>Allostichaster insignis</i> (2), <i>Sclerasterias mollis</i> (1)
A444K	06.10.58	41 20.00 S	174 29.67 E	192	<i>Sclerasterias mollis</i> (1)
A444N	06.10.58	41 19.20 S	174 30.90 E	238	<i>Sclerasterias mollis</i> (1)
A694	01.03.62	54 40.95 S	158 54.80 E	95	<i>Smilasterias clarkailsa</i> (1)
A695	01.03.62	54 36.40 S	158 57.00 E	91	<i>Henricia obesa</i> (1), <i>Smilasterias clarkailsa</i> (4)
A696	01.03.62	54 37.70 S	158 57.00 E	433	<i>Odontohenricia anarea</i> (1), <i>Smilasterias clarkailsa</i> (1)
A698	01.03.62	54 29.30 S	158 59.30 E	183	<i>Henricia obesa</i> (1), <i>Smilasterias clarkailsa</i> (1)
A735	07.11.62	49 42.40 S	178 44.30 E	0	<i>Henricia lukinsii</i> (13), <i>Anasterias suteri</i> (3)
A843	26.08.63	47 13.50 S	167 15.00 E	139	<i>Sclerasterias mollis</i> (2)
A908	13.09.63	43 27.30 S	179 03.00 W	459	<i>Peribolaster lictor</i> (1), <i>Zoroaster</i> sp. C (1)
A910	13.09.63	43 04.00 S	178 39.00 W	549	<i>Novodinia novaezealandiae</i> (1), <i>Cosmasterias dyscrita</i> (1)
					<i>Sclerasterias mollis</i> (8)
A916	15.09.63	43 58.50 S	179 11.00 W	274	<i>Peribolaster lictor</i> (11)
A917	15.09.63	43 56.00 S	179 15.00 W	203	<i>Peribolaster lictor</i> (21)
A966	? 03.68	40 54.00 S	176 14.00 E	0	<i>Stichaster australis</i> (2)
B173	08.10.59	48 33.00 S	168 20.00 E	697	<i>Henricia compacta</i> (1)
B175	08.10.59	50 26.50 S	166 37.50 E	95	<i>Allostichaster insignis</i> (1)
B191	15.10.59	52 36.00 S	169 12.00 E	0	<i>Anasterias laevigata</i> (4)
B196	18.10.59	46 20.60 S	170 27.60 E	135	<i>Sclerasterias mollis</i> (6)
B197	18.10.59	46 14.10 S	170 32.50 E	110	<i>Sclerasterias mollis</i> (6)
B220	21.05.60	46 40.00 S	168 09.80 E	37	<i>Allostichaster insignis</i> (1)
					<i>Coscinasterias muricata</i> (1)
B237	23.05.60	46 35.00 S	168 11.00 E	25	<i>Allostichaster insignis</i> (?)
					<i>Coscinasterias muricata</i> (1)
B241	24.05.60	47 00.00 S	168 16.80 E	53	<i>Sclerasterias mollis</i> (1)
B249	26.05.60	46 25.00 S	167 55.40 E	18	<i>Coscinasterias muricata</i> (1)
B251	26.05.60	46 25.00 S	168 10.00 E	15	<i>Coscinasterias muricata</i> (1)
B254	27.05.60	46 37.00 S	168 32.20 E	14	<i>Coscinasterias muricata</i> (1)
B261	27 05.60	46 50.00 S	168 28.30 E	53	<i>Sclerasterias mollis</i> (1)
B263	27.05.60	46 55.00 S	168 24.00 E	53	<i>Sclerasterias mollis</i> (?)
B267	29.05.60	46 50.00 S	168 45.80 E	72	<i>Coscinasterias muricata</i> (3)
B339	15.12.60	54 33.00 S	158 58.00 E	91	<i>Henricia obesa</i> (3)
					<i>Smilasterias clarkailsa</i> (1)
B487	06.06.61	46 16.00 S	166 03.00 E	196	<i>Pteraster bathamae</i> (1)
B488	07.06.61	46 28.70 S	166 14.30 E	164	<i>Sclerasterias mollis</i> (1)
B489	07.06.61	46 39.00 S	166 09.50 E	198	<i>Sclerasterias mollis</i> (2)
B493	08.06.61	45 34.40 S	166 39.10 E	84	<i>Coscinasterias muricata</i> (?)
B498	11.06.61	40 46.30 S	174 02.80 E	44	<i>Sclerasterias mollis</i> (1)
B515	05.02.62	43 27.00 S	175 03.00 E	165	<i>Sclerasterias mollis</i> (3)
B554	06.10.62	44 00.00 S	172 58.20 E	81	<i>Sclerasterias mollis</i> (14)
B555	06.10.62	44 00.50 S	173 35.00 E	128	<i>Sclerasterias mollis</i> (3)
B556	06.10.62	44 00.00 S	173 47.50 E	179	<i>Sclerasterias mollis</i> (frag.)
B560	07.10.62	44 40.00 S	172 24.00 E	240	<i>Pteraster bathamae</i> (1)
B562	07.10.62	45 18.20 S	171 27.50 E	128	<i>Sclerasterias mollis</i> (1)
B566	08.10.62	45 59.80 S	170 59.20 E	346	<i>Sclerasterias mollis</i> (?)
B568	08.10.62	46 00.00 S	170 43.20 E	75	<i>Sclerasterias mollis</i> (1)
B579	11.10.62	48 00.00 S	168 34.00 E	145	<i>Sclerasterias mollis</i> (1)

Stn No.	Date	Latitude (°)	Longitude (°)	Depth (m)	Species and number
B584	11.10.62	48 01.00 S	166 35.00 E	0	<i>Astrostole scabra</i> (2)
B587	12.10.62	48 00.20 S	166 39.00 E	155	<i>Sclerasterias mollis</i> (1)
B588	12.10.62	48 00.00 S	166 53.00 E	148	<i>Sclerasterias mollis</i> (1)
B590	13.10.62	48 46.00 S	166 49.00 E	159	<i>Henricia ralphae</i> (1)
B592	13.10.62	48 46.00 S	167 19.00 E	152	<i>Henricia ralphae</i> (2), <i>Sclerasterias mollis</i> (4)
B605	17.10.62	46 23.50 S	167 22.00 E	73	<i>Sclerasterias mollis</i> (1)
B660	24.10.62	38 40.00 S	174 12.00 E	71	<i>Coscinasterias muricata</i> (1)
B670	25.10.62	37 18.70 S	174 03.80 E	17	<i>Sclerasterias mollis</i> (1) <i>Odontohenricia</i> sp. C (1)
B683	28.10.62	40 00.00 S	171 15.00 E	693	<i>Henricia compacta</i> (2)
C51	07.06.56	41 15.70 S	174 26.20 E	238	<i>Sclerasterias mollis</i> (1)
C60	07.06.56	41 23.00 S	174 25.50 E	143	<i>Sclerasterias mollis</i> (1)
C222	14.09.59	41 18.00 S	174 24.00 E	88	<i>Allostichaster insignis</i> (?)
C224	14.09.59	41 22.40 S	174 24.00 E	146	<i>Allostichaster insignis</i> (2)
C252	09.10.59	41 39.70 S	174 17.00 E	64	<i>Sclerasterias mollis</i> (1)
C380	28.10.59	38 54.00 S	174 21.50 E	37	<i>Coscinasterias muricata</i> (1)
C381A	05.02.60	41 18.10 S	174 37.00 E	24	<i>Allostichaster polyplax</i> (3)
C601	24.04.61	44 18.00 S	176 16.00 E	144	<i>Henricia aucklandiae</i> (2), <i>Sclerasterias mollis</i> (1)
C605	26.04.61	43 40.00 S	179 30.00 E	441	<i>Crossaster multispinus</i> (1), <i>Hymenodiscus aotearoa</i> (1)
C608	27.04.61	43 19.00 S	179 00.00 W	450	<i>Sclerasterias mollis</i> (2)
C618	30.04.61	43 52.00 S	175 20.00 W	625–690	<i>Novodinia novaezealandiae</i> (1)
C620	02.05.61	43 40.00 S	174 47.00 W	752	<i>Henricia compacta</i> (1)
C623	07.05.61	44 26.50 S	175 16.00 W	398	<i>Sclerasterias mollis</i> (1)
C624	07.05.61	43 57.50 S	175 52.00 W	124	<i>Sclerasterias mollis</i> (3)
C640	28.05.61	39 17.00 S	171 53.00 E	364	<i>Hymenodiscus aotearoa</i> (1)
C642	29.05.61	39 15.50 S	171 52.50 E	354	<i>Hymenodiscus aotearoa</i> (frag)
C645	28.05.61	39 18.00 S	172 00.00 E	442	<i>Cosmasterias dyscrita</i> (1)
C672	16.06.61	42 43.60 S	173 30.60 E	64	<i>Allostichaster insignis</i> (1)
C683	17.06.61	42 28.10 S	173 40.70 E	88	<i>Sclerasterias mollis</i> (2)
C693	18.06.61	42 32.20 S	173 40.40 E	878	<i>Crossaster multispinus</i> (1)
C703	19.06.61	42 42.00 S	173 37.80 E	184	<i>Henricia compacta</i> (2), <i>Allostichaster insignis</i> (1), <i>Sclerasterias mollis</i> (3)
C707	21.06.61	42 50.00 S	173 27.70 E	64	<i>Sclerasterias mollis</i> (1)
C732A	25.11.61	54 29.50 S	158 58.50 E	77	<i>Odontohenricia anarea</i> (1), <i>Smilasterias clarkailsa</i> (2)
C733	25.11.61	54 25.00 S	159 02.00 E	104	<i>Henricia obesa</i> (3), <i>Henricia studeri</i> (1), <i>Anasterias mawsoni</i> (1)
C734	25.11.61	53 55.00 S	158 55.00 E	360	<i>Pteraster stellifer</i> (1), <i>Henricia studeri</i> (1)
C844	01.03.62	41 38.30 S	175 11.20 E	88	<i>Sclerasterias mollis</i> (6)
C851	02.03.62	40 40.40 S	174 43.60 E	128	<i>Sclerasterias mollis</i> (1)
C870	05.03.62	41 14.30 S	174 12.80 E	53	<i>Allostichaster insignis</i> (1)
C921	10.02.63	41 04.90 S	173 57.30 E	75	<i>Allostichaster insignis</i> (2)
C957	07.03.63	43 09.00 S	175 15.00 E	123	<i>Sclerasterias mollis</i> (2)
C978	14.05.61	41 20.00 S	174 48.00 E	0	<i>Astrostole scabra</i> (9)
C980	12.06.64	41 20.00 S	174 48.00 E	0	<i>Astrostole scabra</i> (notes)
C993	19.12.65	41 33.00 S	175 13.00 E	?	<i>Stichaster australis</i> (2)
D10	21.04.63	54 48.00 S	159 01.00 E	86	<i>Anasterias mawsoni</i> (2), <i>Smilasterias clarkailsa</i> (2)
D15	22.04.63	54 29.50 S	158 58.00 E	0	<i>Anasterias directa</i> (1)
D20	24.04.63	49 39.80 S	164 02.20 E	126	<i>Sclerasterias mollis</i> (2)
D32	03.05.63	52 08.00 S	168 50.00 E	188	<i>Crossaster multispinus</i> (note)
D35	05.05.63	52 56.40 S	169 33.00 E	188	<i>Crossaster multispinus</i> (note), <i>Peribolaster lictor</i> (note)
D42	08.05.63	50 46.70 S	166 03.20 E	49	<i>Henricia aucklandiae</i> (2)
D43	08.05.63	50 47.30 S	166 03.30 E	59	<i>Henricia ralphae</i> (1)
D50	08.05.63	50 44.00 S	166 09.60 E	35	<i>Henricia aucklandiae</i> (2)
D52	09.05.63	50 40.09 S	166 13.40 E	68	<i>Henricia lukinsii</i> (6)
D53	09.05.63	50 41.60 S	166 24.00 E	81	<i>Henricia lukinsii</i> (1)
D61	10.05.63	50 32.70 S	166 12.80 E	0	<i>Anasterias laevigata</i> (2)
D78	12.05.63	50 39.60 S	166 01.80 E	132	<i>Henricia ralphae</i> (1), <i>Sclerasterias mollis</i> (4)
D80	12.05.63	50 31.55 S	165 59.00 E	168	<i>Henricia aucklandiae</i> (2)
D85	13.05.63	49 50.00 S	170 13.00 E	611	<i>Zoroaster</i> sp. C (3)
D90	17.05.63	43 50.00 S	179 00.00 W	399	<i>Brisinga chathamica</i> (frags.)
D100	26.09.63	48 02.00 S	166 36.00 E	161	<i>Sclerasterias mollis</i> (2)
D102	28.09.63	50 32.50 S	166 13.50 E	0	<i>Anasterias laevigata</i> (4)
D103	29.09.63	50 40.00 S	166 19.50 E	71	<i>Henricia ralphae</i> (3)
D109	01.10.63	50 48.60 S	166 02.20 E	64	<i>Henricia aucklandiae</i> (1)
D121	11.10.63	43 16.50 S	177 10.50 E	210	<i>Sclerasterias mollis</i> (2)

Stn No.	Date	Latitude (°)	Longitude (°)	Depth (m)	Species and number
D131	11.01.64	48 02.00 S	167 03.00 E	132	<i>Henricia ralphae</i> (2), <i>Sclerasterias mollis</i> (77)
D132	12.01.64	48 06.00 S	167 36.50 E	134	<i>Echinaster farquhari</i> (1), <i>Henricia ralphae</i> (11), <i>Sclerasterias mollis</i> (13)
D133	12.01.64	48 11.50 S	168 21.00 E	141	<i>Henricia ralphae</i> (7), <i>Sclerasterias mollis</i> (68)
D137	12.01.64	48 50.50 S	169 07.00 E	668	<i>Crossaster multispinus</i> (1), <i>Henricia compacta</i> (1)
D138	13.01.64	48 32.00 S	168 19.50 E	668	<i>Zoroaster</i> sp. C (1), <i>Perissasterias monocantha</i> (2)
D139	13.01.64	48 20.50 S	167 46.50 E	150	<i>Henricia ralphae</i> (3), <i>Sclerasterias mollis</i> (8)
D140	13.01.64	48 01.00 S	166 34.50 E	0	<i>Astrostole scabra</i> (2)
D143	13.01.64	48 01.00 S	166 34.49 E	0	<i>Henricia aucklandiae</i> (3)
D144	13.01.64	48 31.00 S	167 17.00 E	132	<i>Henricia ralphae</i> (2), <i>Sclerasterias mollis</i> (37)
D145	14.01.64	48 42.00 S	167 27.00 E	366	<i>Sclerasterias mollis</i> (1)
D147	14.01.64	49 31.00 S	167 25.00 E	574	<i>Zoroaster</i> sp. C (1)
D148	14.01.64	49 48.00 S	167 02.50 E	146	<i>Allostichaster insignis</i> (1)
D149	14.01.64	49 10.50 S	166 51.00 E	454	<i>Peribolaster lictor</i> (1)
D151	15.01.64	48 12.00 S	166 38.00 E	152	<i>Sclerasterias mollis</i> (20)
D152	15.01.64	48 30.00 S	166 18.50 E	159	<i>Sclerasterias mollis</i> (36)
D154	16.01.64	48 09.00 S	166 23.00 E	159	<i>Sclerasterias mollis</i> (12)
D159	17.01.64	49 01.00 S	164 30.00 E	741	<i>Henricia compacta</i> (1)
D161	18.01.64	50 30.00 S	166 20.00 E	0	<i>Anasterias laevigata</i> (1)
D163	18.01.64	50 31.00 S	166 15.50 E	0	<i>Anasterias laevigata</i> (2)
D170	20.01.64	50 54.50 S	165 42.50 E	465	<i>Peribolaster lictor</i> (2)
D171	20.01.64	50 57.00 S	165 47.00 E	501	<i>Peribolaster lictor</i> (2)
D173	21.01.64	50 53.00 S	166 32.00 E	141	<i>Crossaster multispinus</i> (10), <i>Henricia ralphae</i> (3), <i>Odontohenricia</i> sp. C (1), <i>Sclerasterias mollis</i> (12)
D175	21.01.64	50 36.50 S	167 41.00 E	426	<i>Crossaster multispinus</i> (1), <i>Peribolaster lictor</i> (1, frag.)
D176	21.01.64	51 06.00 S	167 48.50 E	216	<i>Peribolaster lictor</i> (2), <i>Pteraster bathamae</i> (1), <i>Henricia compacta</i> (2)
D178	21.01.64	51 43.00 S	167 50.00 E	629	<i>Henricia compacta</i> (1)
D180	22.01.64	51 08.50 S	166 51.00 E	465	<i>Zoroaster</i> sp. C (1)
D183	22.01.64	50 50.00 S	166 05.00 E	57	<i>Henricia lukinsii</i> (3)
D186	22.01.64	50 50.50 S	166 01.00 E	0	<i>Henricia lukinsii</i> (1), <i>Anasterias laevigata</i> (2)
D188	22.01.64	50 45.80 S	166 02.00 E	0	<i>Anasterias laevigata</i> (2)
D190	22.01.64	50 50.00 S	166 05.00 E	0	<i>Anasterias laevigata</i> (3)
D193	22.01.64	50 40.50 S	166 21.50 E	73	<i>Henricia lukinsii</i> (7)*
D194	22.01.64	50 44.00 S	166 21.00 E	95	<i>Sclerasterias mollis</i> (2)
D198	23.01.64	50 24.00 S	166 14.00 E	141	<i>Sclerasterias mollis</i> (1)
D200	23.01.64	50 22.00 S	167 28.00 E	113	<i>Henricia ralphae</i> (24)
D203	24.01.64	51 00.00 S	169 29.50 E	565	<i>Henricia compacta</i> (1)
D204	24.01.64	50 58.50 S	170 16.00 E	565	<i>Henricia compacta</i> (2)
D205	24.01.64	50 57.50 S	171 16.00 E	529	<i>Zoroaster</i> sp. C (3)
D206	24.01.64	50 36.00 S	171 23.50 E	529	<i>Zoroaster</i> sp. C (1), <i>Hymenodiscus aotearoa</i> (3)
D207	25.01.64	50 04.00 S	171 23.00 E	510	<i>Henricia compacta</i> (1), <i>Zoroaster</i> sp. C (4), <i>Hymenodiscus aotearoa</i> (frags)
D208	25.01.64	49 18.00 S	171 46.50 E	150	<i>Henricia aucklandiae</i> (1), <i>Allostichaster insignis</i> (2), <i>Hymenodiscus aotearoa</i> (frags)
D209	26.01.64	49 19.00 S	171 45.70 E	81	<i>Henricia aucklandiae</i> (1)
D210	26.01.64	49 21.50 S	171 53.00 E	353	<i>Crossaster campbellicus</i> (1)
D211	26.01.64	48 53.00 S	172 17.50 E	519	<i>Henricia compacta</i> (1), <i>Zoroaster</i> sp. C (1), <i>Hymenodiscus aotearoa</i> (1)
D221	26.09.64	40 06.00 S	171 16.00 E	688	<i>Henricia compacta</i> (1)
D224	27.09.64	40 47.00 S	169 41.00 E	903	<i>Crossaster multispinus</i> (1), <i>Henricia compacta</i> (1)
D226	27.09.64	39 54.00 S	168 40.00 E	823	<i>Henricia compacta</i> (2)
D230	29.09.64	38 10.00 S	170 21.00 E	861	<i>Crossaster multispinus</i> (2), <i>Henricia compacta</i> (1)
D231	29.09.64	37 53.00 S	169 45.00 E	774	<i>Henricia compacta</i> (1)
D232	29.09.64	38 30.00 S	169 09.00 E	505	<i>Henricia compacta</i> (1)
D234	29.09.64	39 07.00 S	168 32.00 E	561	<i>Zoroaster</i> sp. C (2)
D244	03.10.64	39 31.00 S	171 00.00 E	838	<i>Henricia compacta</i> (1)
D384	21.11.64	41 18.60 S	174 50.50 E	12	<i>Allostichaster insignis</i> (1)
D564	20.02.66	29 07.80 S	167 59.00 E	24	<i>Coscinasterias muricata</i> (1)
D595	29.01.67	43 59.00 S	176 37.00 W	0	<i>Henricia aucklandiae</i> (1), <i>Henricia lukinsii</i> (9), <i>Allostichaster polyplax</i> (1), <i>Coscinasterias muricata</i> (3), <i>Astrostole scabra</i> (2), <i>Sclerasterias mollis</i> (2)
D868	24.03.69	43 54.00 S	179 43.99 W	420	<i>Zoroaster</i> sp. C (1)
D871	24.03.69	43 20.00 S	178 40.00 W	454	<i>Brisinga chathamica</i> (2)

Stn No.	Date	Latitude (°)	Longitude (°)	Depth (m)	Species and number
D876	25.03.69	43 20.00 S	176 50.00 W	148	<i>Cosmasterias dyscrita</i> (1), <i>Allostichaster insignis</i> (5), <i>Sclerasterias mollis</i> (?)
D877	25.03.69	43 20.00 S	176 48.00 W	148	<i>Henricia aucklandiae</i> (1), <i>Allostichaster insignis</i> (1)
D882	26.03.69	43 41.50 S	176 33.50 W	23	<i>Henricia aucklandiae</i> (1), <i>Allostichaster insignis</i> (2) <i>Coscinasterias muricata</i> (1)
D894	28.03.69	43 50.00 S	176 00.00 W	126	<i>Allostichaster insignis</i> (1)
D896	29.03.69	44 20.00 S	175 50.00 W	106	<i>Henricia aucklandiae</i> (1)
D899	29.03.69	44 23.00 S	176 49.00 W	370	<i>Cosmasterias dyscrita</i> (1)
D900	30.03.69	43 55.00 S	177 20.00 W	286	<i>Pseudechinaster rubens</i> (1)
D905	30.03.69	44 08.00 S	178 46.00 W	607	<i>Pseudechinaster rubens</i> (1)
D906	31.03.69	43 54.00 S	179 14.00 W	222	<i>Peribolaster lictor</i> (10)
D907	31.03.69	43 54.00 S	179 14.00 W	202	<i>Peribolaster lictor</i> (3)
E72	21.03.64	42 50.00 S	176 22.00 E	748	<i>Crossaster multispinus</i> (1)
E75	23.03.64	44 00.00 S	177 25.00 E	715	<i>Henricia compacta</i> (1)
E79	24.03.64	43 05.00 S	178 00.00 E	371	<i>Zoroaster</i> sp. C (11)
E80	25.03.64	43 22.99 S	179 31.99 W	489	<i>Crossaster multispinus</i> (1)
E82	26.03.64	43 22.00 S	179 30.00 E	402	<i>Pseudechinaster rubens</i> (1)
E86	31.03.64	41 03.08 S	173 55.20 E	29	<i>Coscinasterias muricata</i> (1)
E105	11.10.64	43 58.60 S	176 37.00 W	0	<i>Astrostole scabra</i> (1)
E115	13.10.64	43 34.00 S	176 49.00 W	0	<i>Anasterias suteri</i> (7)
E120	14.10.64	42 59.00 S	175 29.00 W	872	<i>Hymenodiscus aotearoa</i> (frags)
E121	14.10.64	43 15.00 S	175 40.00 W	693	<i>Henricia compacta</i> (1)
E127	15.10.64	43 55.00 S	175 50.00 W	128	<i>Sclerasterias mollis</i> (1)
E140	17.10.64	44 30.00 S	176 00.00 W	192	<i>Sclerasterias mollis</i> (1)
E161	19.10.64	43 57.10 S	176 33.20 W	0	<i>Henricia aucklandiae</i> (3)
E227	24.02.65	54 42.00 S	158 53.00 E	0	<i>Anasterias mawsoni</i> (1)
E228	24.02.65	54 41.00 S	158 55.00 E	148	<i>Henricia obesa</i> (17), <i>Smilasterias clarkailsa</i> (14)
E230	24.02.65	54 33.20 S	158 56.70 E	0	<i>Henricia obesa</i> (1), <i>Smilasterias clarkailsa</i> (1)
E232	26.02.65	54 29.00 S	158 58.20 E	0	<i>Anasterias directa</i> (19), <i>Anasterias mawsoni</i> (1)
E233	26.10.65	54 29.50 S	158 58.50 E	55	<i>Anasterias directa</i> (5), <i>Smilasterias clarkailsa</i> (2)
E235	27.02.65	55 01.00 S	158 42.50 E	357	<i>Henricia obesa</i> (2), <i>Anasterias directa</i> (4), <i>Anasterias mawsoni</i> (1), <i>Smilasterias clarkailsa</i> (2)
E236	27.02.65	54 59.70 S	158 36.40 E	155	<i>Henricia obesa</i> (6), <i>Henricia studeri</i> (1)
E237	27.02.65	54 51.00 S	158 38.00 E	155	<i>Henricia obesa</i> (7), <i>Henricia studeri</i> (8)
E320	11.04.65	35 56.50 S	172 15.00 E	70	<i>Sclerasterias mollis</i> (1)
E399	06.10.65	46 00.00 S	171 33.00 E	1222	<i>Diplopteraster</i> n. sp. (1)
E402	09.10.65	47 20.00 S	168 34.00 E	113	<i>Sclerasterias mollis</i> (1)
E404	09.10.65	47 20.00 S	169 44.00 E	716	<i>Crossaster multispinus</i> (1)
E406	09.10.65	47 20.00 S	170 17.00 E	1213	<i>Diplopteraster hurleyi</i> (1)
E407	10.10.65	46 40.00 S	170 08.00 E	278–305	<i>Crossaster campbellicus</i> (1)
E409	10.10.65	46 41.00 S	170 21.00 E	743	<i>Henricia compacta</i> (1)
E411	10.10.65	46 38.50 S	170 59.00 E	1275	<i>Henricia compacta</i> (1)
E412	11.10.65	45 10.00 S	171 41.00 E	249	<i>Sclerasterias mollis</i> (1)
E413	11.10.65	45 12.00 S	171 44.00 E	594	<i>Zoroaster</i> sp. C (1)
E423	15.10.65	44 18.00 S	174 31.00 E	640	<i>Henricia compacta</i> (1)
E424	16.10.65	44 40.00 S	172 38.00 E	293	<i>Sclerasterias mollis</i> (1)
E433	18.10.65	43 00.00 S	174 30.00 E	571	<i>Hymenodiscus aotearoa</i> (frags)
E435	18.10.65	43 15.00 S	174 29.00 E	574	<i>Crossaster multispinus</i> (1)
E707	21.03.67	40 10.30 S	177 18.30 E	951	<i>Asterostephane moluccana</i> (1)
E713	22.03.67	39 20.80 S	178 17.00 E	935	<i>Crossaster multispinus</i> (1)
E714	22.03.67	39 19.60 S	178 21.20 E	1284	<i>Zoroaster</i> sp. C (1)
E719	23.03.67	38 46.00 S	178 48.00 E	913	<i>Pseudechinaster rubens</i> (1)
E728	25.03.67	37 37.50 S	177 12.20 E	688	<i>Brisinga chathamica</i> (frags)
E735	26.03.67	37 28.00 S	176 47.00 E	680	<i>Hymenodiscus aotearoa</i> (frags)
E744	28.03.67	38 01.50 S	178 58.60 E	772	<i>Crossaster multispinus</i> (1)
E748	29.03.67	40 46.00 S	176 55.00 E	739	<i>Henricia compacta</i> (1)
E749	29.03.67	40 47.00 S	176 57.00 E	913	<i>Crossaster multispinus</i> (3)
E750	29.03.67	40 48.50 S	177 02.00 E	1358	<i>Hymenodiscus aotearoa</i> (note)
E755	30.03.67	42 00.50 S	174 25.40 E	247	<i>Sclerasterias mollis</i> (3)
E757	30.03.67	42 03.20 S	174 27.20 E	1081	<i>Crossaster multispinus</i> (2), <i>Zoroaster</i> sp. C (2)
E759	31.03.67	42 45.00 S	173 40.00 E	195	<i>Sclerasterias mollis</i> (2)
E772	14.10.67	42 00.00 S	170 16.00 E	748	<i>Henricia compacta</i> (6), <i>Hymenodiscus aotearoa</i> (2)
E774	15.10.67	42 00.00 S	169 15.00 E	1168	<i>Hymenaster estcourti</i> (1), <i>Henricia compacta</i> (1)

Stn No.	Date	Latitude (°)	Longitude (°)	Depth (m)	Species and number
E776	15.10.67	42 43.00 S	169 15.50 E	978	<i>Zoroaster</i> sp. C (1), <i>Zoroaster spinulosus</i> (1), <i>Brisinga tasmani</i> (1)
E781	16.10.67	43 22.50 S	169 17.00 E	478	<i>Crossaster multispinus</i> (3)
E783	16.10.67	43 23.00 S	168 36.50 E	966	<i>Crossaster multispinus</i> (1), <i>Zoroaster</i> sp. C (2)
E784	17.10.67	43 22.99 S	168 04.99 E	1221	<i>Zoroaster</i> sp. C (1)
E796	20.10.67	45 20.00 S	166 45.50 E	251	<i>Sclerasterias mollis</i> (1)
E804	21.10.67	45 58.50 S	166 18.50 E	183	<i>Sclerasterias mollis</i> (1)
E808	21.10.67	46 02.70 S	166 45.70 E	0	<i>Coscinasterias muricata</i> (1)
E820	23.10.67	46 35.00 S	165 58.00 E	220	<i>Henricia compacta</i> (1), <i>Sclerasterias mollis</i> (5)
E832	25.10.67	47 21.00 S	167 21.00 E	251	<i>Pteraster bathamae</i> (3)
E833	26.10.67	46 56.80 S	168 08.90 E	53	<i>Coscinasterias muricata</i> (5)
E836	28.10.67	41 48.80 S	174 17.60 E	73	<i>Astrostole scabra</i> (1), <i>Sclerasterias mollis</i> (note)
E840	16.03.68	33 52.00 S	172 16.00 E	757	<i>Henricia compacta</i> (1), <i>Cosmasterias dyscrita</i> (1)
E844	16.03.68	34 09.00 S	172 07.50 E	0	<i>Stichaster australis</i> (1)
E849	17.03.68	33 55.00 S	171 32.00 E	216	<i>Henricia sufflata</i> (1)
E859	18.03.68	32 01.00 S	168 03.00 E	500	<i>Coronaster halicepus</i> (frag.), <i>Hymenodiscus aotearoa</i> (frags)
E867	19.03.68	33 19.00 S	167 30.00 E	1392	<i>Zoroaster</i> sp. B (1), <i>Zoroaster</i> sp. C (1)
E869	19.03.68	33 58.00 S	167 45.00 E	1705	<i>Freyella echinata</i> (1)
E879	22.03.68	35 19.00 S	172 25.00 E	768	<i>Henricia compacta</i> (2)
E880	22.03.68	35 20.00 S	172 20.00 E	1029	<i>Hymenaster estcourti</i> (1), <i>Henricia compacta</i> (1)
E885	23.03.68	35 58.00 S	173 16.00 E	449	<i>Cosmasterias dyscrita</i> (1)
E897	25.03.68	37 59.00 S	173 58.00 E	253	<i>Sclerasterias mollis</i> (2)
E901	25.03.68	38 00.00 S	173 19.00 E	1247	<i>Zoroaster</i> sp. C (1)
E909	28.03.68	40 51.00 S	173 49.00 E	0	<i>Allostichaster polyplax</i> (1), <i>Allostichaster insignis</i> (1), <i>Coscinasterias muricata</i> (5)
E965	04.05.69	Pukerua Bay, Wellington		0	<i>Stichaster australis</i> (1), <i>Coscinasterias muricata</i> (1)
F77	12.01.65	47 00.00 S	169 30.00 E	117	<i>Sclerasterias mollis</i> (13)
F78	13.01.65	48 32.00 S	167 09.00 E	139	<i>Henricia ralphae</i> (2), <i>Sclerasterias mollis</i> (42)
F79	14.01.65	49 04.00 S	168 01.00 E	679	<i>Sclerasterias mollis</i> (1)
F80	14.01.65	49 00.00 S	167 01.00 E	631	<i>Zoroaster</i> sp. C (1)
F82	14.01.65	50 01.00 S	166 54.00 E	137	<i>Crossaster multispinus</i> (1)
F87	15.01.65	50 30.00 S	166 17.50 E	0	<i>Anasterias laevigata</i> (13)
F91	16.01.65	49 00.00 S	167 30.00 E	687	<i>Henricia compacta</i> (2)
F92	16.01.65	47 59.00 S	167 59.00 E	137	<i>Sclerasterias mollis</i> (2)
F93	17.01.65	48 31.00 S	167 30.00 E	141	<i>Henricia ralphae</i> (3), <i>Sclerasterias mollis</i> (8)
F95	17.01.65	48 53.00 S	168 39.00 E	646	<i>Henricia compacta</i> (2)
F97	17.01.65	48 00.00 S	168 32.00 E	134	<i>Henricia ralphae</i> (6), <i>Sclerasterias mollis</i> (44)
F98	17.01.65	48 01.00 S	168 55.00 E	660	<i>Sclerasterias mollis</i> (2)
F99	18.01.65	48 32.00 S	168 54.50 E	706	<i>Henricia compacta</i> (5)
F100	18.01.65	49 02.00 S	168 53.50 E	733	<i>Crossaster multispinus</i> (1), <i>Henricia compacta</i> (1)
F102	19.01.65	48 39.00 S	169 51.00 E	810	<i>Crossaster multispinus</i> (1)
F107	20.01.65	48 45.00 S	172 00.00 E	658	<i>Henricia compacta</i> (3)
F108	21.01.65	48 19.00 S	171 59.00 E	1108	<i>Henricia compacta</i> (1)
F109	21.01.65	49 11.00 S	173 00.00 E	501	<i>Zoroaster</i> sp. C (1)
F115	23.01.65	49 18.50 S	179 52.00 E	1518	<i>Hymenodiscus aotearoa</i> (frags)
F120	25.01.65	48 18.00 S	179 16.00 E	494	<i>Crossaster multispinus</i> (4), <i>Henricia compacta</i> (1)
F122	26.01.65	48 06.00 S	179 57.00 W	252	<i>Henricia aucklandiae</i> (1)
F124	27.01.65	47 34.00 S	179 56.00 W	476	<i>Crossaster multispinus</i> (1)
F126	28.01.65	49 48.00 S	176 01.00 E	1256	<i>Hymenaster estcourti</i> (1), <i>Hymenodiscus aotearoa</i> (1)
F127	28.01.65	49 22.00 S	176 16.00 E	1280	<i>Pteraster robertsoni</i> (2), <i>Henricia compacta</i> (1)
F128	28.01.65	49 09.00 S	177 18.00 E	978	<i>Hymenodiscus aotearoa</i> (frags)
F135	30.01.65	50 58.00 S	173 57.00 E	832	<i>Henricia compacta</i> (1)
F137	31.01.65	51 42.00 S	171 31.00 E	519	<i>Hymenodiscus aotearoa</i> (1)
F138	31.01.65	52 03.00 S	170 23.00 E	353	<i>Hymenodiscus aotearoa</i> (1)
F147	01.02.65	52 21.00 S	173 09.00 E	611	<i>Zoroaster</i> sp. C (1)
F148	02.02.65	51 43.00 S	173 32.00 E	677	<i>Zoroaster</i> sp. C (1)
F151	03.02.65	48 32.00 S	174 50.00 E	814	<i>Henricia compacta</i> (5)
F749	17.08.66	44 01.00 S	175 26.00 E	1427	<i>Crossaster multispinus</i> (2), <i>Zoroaster</i> sp. C (1)
F754	19.08.66	42 48.00 S	174 32.00 E	1324	<i>Zoroaster</i> sp. C (2)
F755	19.08.66	43 00.00 S	174 30.00 E	854	<i>Crossaster multispinus</i> (1), <i>Hymenodiscus aotearoa</i> (1)
F757	19.08.66	42 45.00 S	175 30.00 E	911	<i>Crossaster multispinus</i> (2)
F763	21.08.66	41 01.80 S	176 32.50 E	711	<i>Crossaster multispinus</i> (1)
F868	02.10.68	37 28.50 S	179 03.50 E	808	<i>Coronaster halicepus</i> (1)
F869	02.10.68	37 24.00 S	179 15.00 E	1284	<i>Zoroaster</i> sp. C (2)

Stn No.	Date	Latitude (°)	Longitude (°)	Depth (m)	Species and number
F873	03.10.68	37 19.50 S	178 11.00 E	1050	<i>Taranuiaster novaezealandiae</i> (1)
F874	03.10.68	37 18.0 S	178 11.00 E	1357	<i>Henricia compacta</i> (1)
F878	03.10.68	37 28.50 S	177 31.50 E	997	<i>Pteraster robertsoni</i> (1)
F890	05.10.68	36 58.00 S	176 06.00 E	0	<i>Allostichaster insignis</i> (2), <i>Coscinasterias muricata</i> (3)
F911	11.10.68	34 38.00 S	174 36.00 E	1295	<i>Crossaster multispinus</i> (1), <i>Diplopteraster hurleyi</i> (1), <i>Hymenaster pullatus</i> (9), <i>Hymenodiscus aotearoa</i> (frags)
F967	03.02.69	49 40.0 S	178 50.0 E	0	<i>Anasterias laevigata</i> (1)
G32	23.02.67	43 44.00 S	176 29.00 E	402	<i>Crossaster multispinus</i> (1)
G153	12.11.62	42 45.00 S	173 40.00 E	137	<i>Sclerasterias mollis</i> (1)
G156	13.11.67	42 58.00 S	173 30.00 E	110	<i>Henricia aucklandiae</i> (1), <i>Allostichaster insignis</i> (1)
G157	13.11.62	43 09.00 S	173 38.00 E	143	<i>Sclerasterias mollis</i> (2)
G159	13.11.67	43 02.00 S	173 38.00 E	146	<i>Henricia aucklandiae</i> (1)
G162	15.11.62	42 55.0 S	173 33.00 E	101	<i>Sclerasterias mollis</i> (1)
G163	15.11.67	42 45.00 S	173 38.00 E	128	<i>Henricia aucklandiae</i> (1), <i>Sclerasterias mollis</i> (1)
G181	17.01.68	43 58.00 S	179 27.00 W	289	<i>Peribolaster lictor</i> (1)
G259	23.01.68	43 33.00 S	179 22.00 E	419	<i>Crossaster multispinus</i> (4), <i>Henricia aucklandiae</i> (1), <i>Zoroaster</i> sp. C (5), <i>Pseudechinaster rubens</i> (1)
G271	24.01.68	43 27.00 S	179 15.00 E	435	<i>Crossaster multispinus</i> (1)
G273	24.01.68	43 30.00 S	179 15.00 E	410	<i>Crossaster multispinus</i> (2), <i>Cosmasterias dyscrita</i> (1), <i>Pseudechinaster rubens</i> (1), <i>Sclerasterias mollis</i> (1).
G276	24.01.68	43 36.0 S	179 15.00 E	410	<i>Crossaster multispinus</i> (6)
G279	24.01.68	43 39. 00 S	179 07.00 E	426	<i>Crossaster multispinus</i> (2)
G283	24.01.68	43 31. 00 S	179 07.00 E	413	<i>Solaster torulatus</i> (1), <i>Crossaster multispinus</i> (5)
G290	25.01.68	43 40.00 S	179 01.00 E	327	<i>Crossaster multispinus</i> (3), <i>Pteraster bathamae</i> (1), <i>Henricia aucklandiae</i> (2), <i>Sclerasterias mollis</i> (1)
G292	25.01.68	43 42.00 S	179 48.00 E	454	<i>Crossaster multispinus</i> (2)
G293	25.01.68	43 40,0 S	179 28.00 E	421	<i>Sclerasterias mollis</i> (1)
G294	25.01.68	43 34.00 S	179 20.00 W	417	<i>Zoroaster</i> sp. C (2)
G307	26.01.68	44 07.00 S	179 13.00 W	402	<i>Paralophaster hyalinus</i> (1), <i>Peribolaster lictor</i> (1), <i>Echinaster farquhari</i> (1), <i>Cosmasterias dyscrita</i> (2), <i>Sclerasterias mollis</i> (1)
G329	01.02.68	44 06.00 S	179 00.00 W	417	<i>Zoroaster</i> sp. C (1), <i>Pseudechinaster rubens</i> (1)
G335	02.02.68	43 39.00 S	178 56.00 W	399	<i>Zoroaster</i> sp. C (2)
G364	03.02.68	43 38.00 S	178 32.00 W	424	<i>Brisinga chathamica</i> (2)
G365	03.02.68	43 33.00 S	178 32.00 W	417	<i>Pteraster bathamae</i> (1)
G654	17.01.70	44 00.00 S	173 00.00 E	68	<i>Sclerasterias mollis</i> (3)
G662	18.01.70	44 24.50 S	173 00.20 E	153	<i>Sclerasterias mollis</i> (1)
G663	18.01.70	44 24.00 S	173 30.00 E	612	<i>Henricia compacta</i> (1), <i>Zoroaster</i> sp. C (1)
G671	19.01.70	45 10.00 S	171 04.00 E	23	<i>Allostichaster insignis</i> (2), <i>Coscinasterias muricata</i> (3)
G672	19.01.70	45 20.00 S	170 57.00 E	29	<i>Allostichaster polyplax</i> (9)
G673	19.01.70	45 27.00 S	171 01.00 E	48	<i>Sclerasterias mollis</i> (1)
G674	19.01.70	45 27.00 S	171 12.00 E	98	<i>Allostichaster insignis</i> (3), <i>Sclerasterias mollis</i> (1)
G679	20.01.70	45 43.00 S	171 05.00 E	148	<i>Allostichaster polyplax</i> (2), <i>Taranuiaster novaezealandiae</i> (1), <i>Sclerasterias mollis</i> (60)
G680	20.01.70	45 43.00 S	171 02.40 E	113	<i>Allostichaster polyplax</i> (6), <i>Sclerasterias mollis</i> (8)
G681	20.01.70	45 43.20 S	170 50.40 E	33	<i>Sclerasterias mollis</i> (5)
G684	20.01.70	45 48.00 S	170 57.00 E	108	<i>Echinaster farquhari</i> (1), <i>Sclerasterias mollis</i> (1)
G685	20.01.70	45 53.00 S	170 48.00 E	68	<i>Sclerasterias mollis</i> (4)
G686	20.01.70	45 53.00 S	170 54.00 E	108	<i>Sclerasterias mollis</i> (8)
G688	20.01.70	46 10.00 S	171 00.20 E	731	<i>Crossaster multispinus</i> (3), <i>Henricia compacta</i> (4)
G689	20.01.70	46 09.00 S	170 48.00 E	133	<i>Pteraster bathamae</i> (1), <i>Sclerasterias mollis</i> (9)
G690	21.01.70	46 09.00 S	170 36.00 E	78	<i>Sclerasterias mollis</i> (11)
G691	21.01.70	46 09.00 S	170 24.00 E	63	<i>Sclerasterias mollis</i> (?)
G694	21.01.70	46 20.00 S	169 52.00 E	19	<i>Allostichaster insignis</i> (1)
G695	21.01.70	46 19.70 S	170 11.80 E	73	<i>Sclerasterias mollis</i> (3)
G700	22.01.70	46 20.00 S	171 15.00 E	1116	<i>Solaster torulatus</i> (2), <i>Crossaster multispinus</i> (1), <i>Henricia compacta</i> (2), <i>Zoroaster spinulosus</i> (11), <i>Hymenodiscus aotearoa</i> (1)
G701	22.01.70	46 20.00 S	171 30.00 E	1400	<i>Pteraster robertsoni</i> (1),* <i>Hymenodiscus aotearoa</i> (3)
G702	22.01.70	46 20.00 S	171 45.00 E	1400	<i>Ceramaster patagonicus</i> (1), <i>Diplopteraster hurleyi</i> (1)
G703	23.01.70	46 20.00 S	172 04.00 E	1480	<i>Diplopteraster hurleyi</i> (1), <i>Hymenaster carnosus</i> (2), <i>Hymenaster pullatus</i> (9), <i>Zoroaster spinulosus</i> (1)
G706	23.01.70	45 49.00 S	172 30.00 E	1540	<i>Solaster torulatus</i> (1), <i>Hymenaster pullatus</i> (2)
G707	24.01.70	45 48.20 S	170 56.20 E	91	<i>Sclerasterias mollis</i> (4)

Stn No.	Date	Latitude (°)	Longitude (°)	Depth (m)	Species and number
G819	14.2.71	32 57.60 S	162 35.30 E	782	<i>Hymenodiscus aotearoa</i> (frags)
G820	15.2.71	33 09.00 S	162 36.00 E	793	<i>Hymenodiscus aotearoa</i> (frags)
G824	15.02.71	33 10.40 S	162 59.20 E	811	<i>Henricia compacta</i> (1)
G825	15.02.71	33 20.90 S	162 59.50 E	829	<i>Henricia compacta</i> (1)
G835	23.02.71	40 47.60 S	174 09.60 E	62	<i>Coscinasterias muricata</i> (1)
G877	06.12.70	43 37.00 S	173 31.00 E	80	<i>Sclerasterias mollis</i> (frags)
G878	06.12.70	44 01.80 S	173 21.70 E	80	<i>Sclerasterias mollis</i> (3)
G880	01.12.70	43 36.90 S	175 31.20 E	270	<i>Cosmasterias dyscrita</i> (1)
G882	12.12.70	47 54.00 S	179 08.80 E	150	<i>Pteraster bathamae</i> (1), <i>Sclerasterias mollis</i> (1)
G883	12.12.70	47 54.00 S	179 09.00 E	180	<i>Peribolaster lictor</i> (1)
G885	13.12.70	47 54.25 S	179 53.10 E	240	<i>Sclerasterias mollis</i> (2)
G886	13.12.70	48 14.00 S	179 41.00 E	335	<i>Crossaster multispinus</i> (6), <i>Echinaster farquhari</i> (2), <i>Henricia compacta</i> (1)
G889	14.12.70	48 10.9 S	178 25.80 E	780	<i>Solaster torulatus</i> (2)
G890	15.12.70	47 59.40 S	178 51.10 E	250	<i>Crossaster campbellicus</i> (3)
G891	15.12.70	48 01.80 S	178 55.60 E	300	<i>Crossaster multispinus</i> (1)
G892	16.12.70	49 29.20 S	178 58.90 E	165	<i>Pteraster bathamae</i> (1)
G895	18.12.70	49 41.40 S	173 30.00 E	495	<i>Zoroaster</i> sp. C (1)
G898	19.12.70	49 12.70 S	171 40.40 E	150	<i>Zoroaster</i> sp. C (1)
G899	21.12.70	49 17.0 S	171 29.70 E	165	<i>Crossaster multispinus</i> (1), <i>Sclerasterias mollis</i> (5)
G907	23.12.70	49 50.00 S	171 49.60 E	460	<i>Pteraster bathamae</i> (1)
G910	24.12.70	49 48.20 S	173 44.10 E	505	<i>Henricia compacta</i> (3), <i>Zoroaster</i> sp. C (2)
G912	25.12.70	50 24.20 S	173 44.00 E	755	<i>Zoroaster</i> sp. C (2)
G925	12.01.71	53 28.90 S	170 32.90 E	520	<i>Solaster torulatus</i> (1)
G931	14.01.71	51 02.00 S	167 16.50 E	500	<i>Pteraster bathamae</i> (3)
G933	15.01.71	50 33.20 S	167 56.50 E	445	<i>Pteraster bathamae</i> (1)
G937	16.01.71	49 41.30 S	167 16.50 E	520	<i>Pteraster bathamae</i> (1), <i>Henricia compacta</i> (1)
G938	17.01.71	49 33.90 S	166 44.50 E	490	<i>Crossaster multispinus</i> (7), <i>Henricia compacta</i> (1)
G939	17.01.71	48 55.00 S	166 55.20 E	315	<i>Crossaster multispinus</i> (1), <i>Crossaster multispinus</i> (1)
G940	17.01.71	48 46.00 S	166 58.00 E	150	<i>Echinaster farquhari</i> (1), <i>Sclerasterias mollis</i> (several)
H636	10.03.75	43 26.40 S	179 34.90 E	395	<i>Zoroaster</i> sp. C (1)
H680	17.03.75	43 48.30 S	176 37.10 W	10	<i>Henricia lukinsii</i> (2), <i>Allostichaster insignis</i> (1)
H917	12.08.75	43 48.80 S	176 42.10 W	15	<i>Coscinasterias muricata</i> (1)
H923	13.08.75	43 29.00 S	179 32.20 E	395	<i>Zoroaster</i> sp. C (1), <i>Brisinga chathamica</i> (1)
H945	15.08.75	43 19.38 S	179 29.20 E	405	<i>Cosmasterias dyscrita</i> (1)
H947	15.08.75	43 21.60 S	179 30.35 E	394	<i>Cosmasterias dyscrita</i> (1)
H950	15.08.75	43 26.80 S	179 16.70 E	396	<i>Sclerasterias mollis</i> (1)
I11	04.05.75	35 36.00 S	175 13.60 E	308	<i>Asterostephane moluccana</i> (1)
I19	05.05.75	35 25.20 S	175 00.40 E	270	<i>Allostichaster</i> sp. (1)
I25	06.05.75	35 11.10 S	175 06.10 E	675	<i>Henricia compacta</i> (1), <i>Hymenodiscus aotearoa</i> (1)
I32	07.05.75	35 11.70 S	174 49.80 E	375	<i>Pteraster</i> (<i>Retaster</i>) sp. (1), <i>Asterostephane moluccana</i> (4)
I36	07.05.75	35 00.19 S	174 49.20 E	625	<i>Henricia compacta</i> (3)
I77	21.07.75	29 01.80 S	167 59.40 E	18	<i>Echinaster colemani</i> (1), <i>Astrostole rodolphi</i> (1)
I78	22.06.75	29 06.80 S	167 56.30 E	6	<i>Astrostole rodolphi</i> (1)
I94	24.07.75	29 20.20 S	168 10.80 E	308	<i>Pteraster obesus</i> (1), <i>Brisingaster robillardi</i> (1)
I95	24.07.75	29 04.10 S	167 55.50 E	15	<i>Astrostole rodolphi</i> (3)
I97	25.07.75	32 22.90 S	167 28.20 E	540	<i>Pteraster obesus</i> (1), <i>Cosmasterias dyscrita</i> (3)
I355	19.11.77	34 50.10 S	174 06.20 E	330	<i>Asterostephane moluccana</i> (1)
I359	20.11.77	35 17.30 S	174 50.50 E	260	<i>Coronaster halicepus</i> (1)
I362	20.11.77	34 58.90 S	173 57.80 E	0	<i>Coscinasterias muricata</i> (note), <i>Astrostole scabra</i> (2)
I365	20.11.77	34 47.80 S	174 06.40 E	436	<i>Asterostephane moluccana</i> (1)
I366	20.11.77	34 42.30 S	174 17.60 E	705	<i>Henricia compacta</i> (2)
I378	23.11.77	34 09.50 S	172 08.70 E	0	<i>Astrostole scabra</i> (1)
I617	20.02.79	46 56.75 S	168 03.05 E	0	<i>Allostichaster polyplax</i> (?), <i>Coscinasterias muricata</i> (note)
I622	22.02.79	45 56.10 S	166 55.90 E	0–20	<i>Pteraster bathamae</i> (1), <i>Coscinasterias muricata</i> (note), <i>Sclerasterias mollis</i> (1)
I623	22.02.79	45 57.90 S	166 53.50 E	0	<i>Coscinasterias muricata</i> (note), <i>Sclerasterias mollis</i> (notes)
I624	22.02.79	45 58.60 S	166 50.70 E	0	<i>Coscinasterias muricata</i> (note), <i>Sclerasterias mollis</i> (note)
I625	22.02.79	45 59.80 S	166 48.20 E	0	<i>Coscinasterias muricata</i> (note), <i>Sclerasterias mollis</i> (note)
I626	22.02.79	46 01.00 S	166 47.20 E	0	<i>Coscinasterias muricata</i> (note), <i>Sclerasterias mollis</i> (note)
I627	22.02.79	46 02.50 S	166 46.90 E	0	<i>Coscinasterias muricata</i> (note)
I645	27.02.79	46 56.66 S	168 05.89 E	25	<i>Coscinasterias muricata</i> (note)
I646	27.02.79	46 56.34 S	168 08.68 E	15	<i>Allostichaster polyplax</i> (note)
I651	28.02.79	46 56.47 S	168 06.78 E	24	<i>Allostichaster polyplax</i> (2), <i>Coscinasterias muricata</i> (note)

Stn No.	Date	Latitude (°)	Longitude (°)	Depth (m)	Species and number
I652	28.02.79	46 56.32 S	168 05.34 E	26	<i>Allostichaster polyplax</i> (3), <i>Coscinasterias muricata</i> (note)
I661	11.03.79	43 50.20 S	179 05.80 W	375	<i>Henricia aucklandiae</i> (1)
I663	11.03.79	43 51.60 S	179 44.50 W	394	<i>Crossaster multispinus</i> (1)
I666	13.03.79	47 47.50 S	178 59.50 W	1165	<i>Crossaster multispinus</i> (2), <i>Peribolaster lictor</i> (1), <i>Hymenodiscus aotearoa</i> (3)
I668	13.03.79	47 50.80 S	179 30.90 W	504	<i>Crossaster multispinus</i> (1)
I672	13.03.79	48 00.30 S	179 44.00 W	380	<i>Henricia compacta</i> (3), <i>Cosmasterias dyscrita</i> (2)
I678	14.03.79	48 10.00 S	179 45.00 W	457	<i>Henricia compacta</i> (1)
I679	15.03.79	48 10.00 S	180 00.00 E	327	<i>Crossaster multispinus</i> (2)
I680	15.03.79	48 09.50 S	179 47.00 E	220	<i>Crossaster multispinus</i> (note)
I683	15.03.79	48 18.50 S	179 56.80 W	516	<i>Crossaster multispinus</i> (1), <i>Henricia compacta</i> (8)
I686	16.03.79	48 30.50 S	179 45.00 W	710	<i>Crossaster multispinus</i> (1)
I690	17.03.79	48 51.00 S	179 15.00 E	700	<i>Crossaster multispinus</i> (1)
I697	19.03.79	48 29.10 S	178 16.60 E	917	<i>Solaster torulatus</i> (12)
I698	19.03.79	48 19.99 S	178 30.00 E	726	<i>Crossaster multispinus</i> (1)
I699	19.03.79	48 16.00 S	179 00.00 E	532	<i>Crossaster multispinus</i> (19), <i>Henricia compacta</i> (3)
I700	20.03.79	48 10.10 S	179 30.00 E	228	<i>Peribolaster lictor</i> (1)
I701	20.03.79	48 09.60 S	179 15.90 E	250	<i>Pteraster bathamae</i> (1), <i>Pteraster</i> sp. C (1) *
I705	21.03.79	47 30.00 S	178 45.00 E	39	<i>Crossaster multispinus</i> (1), <i>Paralophaster hyalinus</i> (1)
I707	22.03.79	47 20.00 S	179 30.00 E	552	<i>Crossaster multispinus</i> (2)
I708	22.03.79	44 40.00 S	179 50.00 E	155	<i>Peribolaster lictor</i> (1)
I711	22.03.79	47 50.00 S	179 15.00 E	139	<i>Crossaster multispinus</i> (1), <i>Henricia ralphae</i> (1), <i>Sclerasterias mollis</i> (1)
I712	22.03.79	48 00.10 S	179 30.10 E	129	<i>Peribolaster lictor</i> (2)
I721	26.03.79	44 07.40 S	175 46.20 E	540	<i>Zoroaster</i> sp. C (1)
J24	15.04.70	39 00.00 S	169 00.00 E	516	<i>Henricia compacta</i> (2)
J25	15.04.70	38 50.00 S	169 00.00 E	510	<i>Henricia compacta</i> (1)
J27	16.04.70	38 50.00 S	169 26.00 E	508	<i>Henricia compacta</i> (1)
J29	16.04.70	38 40.00 S	169 39.00 E	550	<i>Henricia compacta</i> (1)
J30	16.04.70	38 40.00 S	169 26.00 E	550	<i>Henricia compacta</i> (2)
J31	16.04.70	38 39.00 S	169 15.00 E	525	<i>Henricia compacta</i> (6)
J32	16.04.70	38 40.00 S	169 00.00 E	502	<i>Henricia compacta</i> (2), <i>Sclerasterias mollis</i> (1), <i>Asterostephane moluccana</i> (1)
J33	17.04.70	38 25.20 S	169 02.00 E	502	<i>Henricia compacta</i> (3)
J34	17.04.70	38 27.00 S	169 12.00 E	525	<i>Paralophaster hyalinus</i> (1), <i>Henricia compacta</i> (2), <i>Sclerasterias mollis</i> (1)
J35	17.04.70	38 30.00 S	169 26.00 E	546	<i>Henricia compacta</i> (2)
J36	17.04.70	38 30.00 S	169 39.00 E	560	<i>Henricia compacta</i> (4),* <i>Zoroaster</i> sp. C (1)
J39	18.04.70	37 00.00 S	170 00.00 E	2096	<i>Zoroaster spinulosus</i> (1)
J40	18.04.70	36 50.00 S	170 00.00 E	2113	<i>Zoroaster spinulosus</i> (1)
J41	19.04.70	36 50.00 S	170 13.00 E	2060	<i>Zoroaster spinulosus</i> (1)
J44	19.04.70	36 40.00 S	170 13.00 E	2112	<i>Zoroaster</i> sp. B (1)
J45	20.04.70	36 40.00 S	170 00.00 E	2146	<i>Zoroaster spinulosus</i> (2), <i>Zoroaster</i> sp. B (2)
J47	20.04.70	36 30.00 S	170 13.00 E	2162	<i>Zoroaster</i> sp. B (1)
J48	20.04.70	36 30.00 S	170 26.00 E	2150	<i>Zoroaster spinulosus</i> (2)
J55	17.05.70	44 05.50 S	176 12.00 E	198	<i>Echinaster farquhari</i> (1), <i>Henricia aucklandiae</i> (1), <i>Taranuiaster novaezealandiae</i> (2), <i>Sclerasterias mollis</i> (1)
J58	20.05.70	43 31.00 S	179 09.50 E	512	<i>Brisinga chathamica</i> (1)
J59	20.05.70	43 51.00 S	179 25.00 E	309	<i>Sclerasterias mollis</i> (2), <i>Brisinga chathamica</i> (1)
J60	21.05.70	43 31.50 S	179 37.00 E	411	<i>Peribolaster lictor</i> (1)
J122	16.04.71	46 08.00 S	166 16.50 E	322	<i>Allostichaster insignis</i> (3)
J250	25.11.72	39 02.99 S	174 00.00 E	10	<i>Stichaster australis</i> (1)
J481	06.12.73	49 00.80 S	170 24.60 E	730	<i>Crossaster multispinus</i> (1)
J485	07.12.73	50 38.00 S	167 38.00 E	320	<i>Crossaster campbellicus</i> (1), <i>Peribolaster lictor</i> (1)
J485	07.12.73	50 38.00 S	167 38.00 E	320	<i>Cosmasterias dyscrita</i> (3), <i>Taranuiaster novaezealandiae</i> (1)
J544	15.12.73	50 29.10 S	173 03.10 E	550	<i>Zoroaster</i> sp. C (1)
J688	08.09.74	37 16.60 S	176 50.10 E	330	<i>Zoroaster carinatus</i> (1)
J674	07.09.74	36 41.85 S	175 55.20 E	3	<i>Stichaster australis</i> (1)
J676	08.09.74	37 22.50 S	177 11.70 E	341	<i>Sclerasterias mollis</i> (1)
K100	01.03.71	41 10.10 S	173 09.75 E	14	<i>Coscinasterias muricata</i> (2)
K109	02.03.71	41 13.70 S	173 17.40 E	14	<i>Coscinasterias muricata</i> (1)
K795	18.06.74	33 02.60 S	179 34.60 W	350	<i>Sclerasterias mollis</i> (1)
K798	19.06.74	31 21.30 S	178 49.80 W	5	<i>Astrostole rodolphi</i> (2)
K801	22.06.74	29 14.70 S	177 51.70 W	18	<i>Astrostole rodolphi</i> (2)

Stn No.	Date	Latitude (°)	Longitude (°)	Depth (m)	Species and number
K810	23.06.74	29 17.10 S	177 54.20 W	1	<i>Astrostole rodolphi</i> (note)
K826	25.07.74	28 48.00 S	177 48.00 W	142	<i>Pteraster obesus</i> (1)
K831	27.07.74	29 51.70 S	178 10.90 W	965	<i>Crossaster multispinus</i> (1)
K833	28.06.74	30 14.00 S	178 25.10 W	18	<i>Astrostole rodolphi</i> (1)
K846	29.7.74	30 13.10 S	178 32.00 W	610	<i>Asterostephane moluccana</i> (1)
K864	31.06.74	30 31.60 S	178 34.00 W	20	<i>Astrostole rodolphi</i> (1)
K865	31.06.74	30 31.60 S	178 34.00 W	18	<i>Astrostole rodolphi</i> (1)
K873	03.08.74	37 34.00 S	179 22.00 E	1270	<i>Caymanostella phorcynis</i> (?)
K985	09.02.77	46 58.10 S	168 07.60 E	12	<i>Coscinasterias muricata</i> (note)
K988	09.02.77	46 56.30 S	168 09.50 E	5	<i>Coscinasterias muricata</i> (note)
K994	11.02.77	46 56.80 S	168 09.10 E	21	<i>Coscinasterias muricata</i> (note)
K995	11.02.77	46 56.80 S	168 08.60 E	22	<i>Coscinasterias muricata</i> (note)
K996	11.02.77	46 56.80 S	168 08.70 E	22	<i>Coscinasterias muricata</i> (note)
K997	11.02.77	46 56.80 S	168 08.60 E	23	<i>Coscinasterias muricata</i> (note)
K998	11.02.77	46 56.50 S	168 06.00 E	28	<i>Coscinasterias muricata</i> (note)
K999	11.02.77	46 55.60 S	168 06.00 E	26	<i>Coscinasterias muricata</i> (note)
K1021	14.02.77	46 56.50 S	168 06.00 E	30	<i>Coscinasterias muricata</i> (note)
M579	16.02.79	46 54.52 S	168 07.35 E	0	<i>Allostichaster insignis</i> (notes)
M797	09.04.81	44 37.10 S	167 51.53 E	30	<i>Henricia lukinsii</i> (2)
M799	09.04.81	44 36.83 S	167 52.58 E	42	<i>Coscinasterias muricata</i> (1)
N857	17.12.76	43 32.60 S	179 32.50 E	399	<i>Cosmasterias dyscrita</i> (1)
N868	18.12.76	43 33.00 S	179 48.00 E	395	<i>Brisinga chathamica</i> (1)
N869	18.12.76	43 34.00 S	179 50.40 E	395	<i>Brisinga chathamica</i> (1)
N895	22.02.77	31 21.50 S	178 49.90 W	10	<i>Astrostole rodolphi</i> (1)
N911	28.08.77	41 27.60 S	174 54.70 E	84	<i>Allostichaster insignis</i> (1)
O145	04.03.77	37 08.92 S	174 41.92 E	4	<i>Coscinasterias muricata</i> (1)
O146	04.03.77	37 08.57 S	174 41.03 E	10	<i>Coscinasterias muricata</i> (3)
O153	04 03.77	37 04.85 S	174 41.20 E	4	<i>Coscinasterias muricata</i> (3)
O154	05.03.77	37 04.71 S	174 41.90 E	1	<i>Coscinasterias muricata</i> (1)
O155	05.03.77	37 04.42 S	174 42.20 E	3	<i>Coscinasterias muricata</i> (1)
O163	08.03.77	37 01.20 S	174 40.11 E	2	<i>Coscinasterias muricata</i> (1)
O165	08.03.77	37 00.78 S	174 41.28 E	1	<i>Coscinasterias muricata</i> (1)
O169	08.03.77	36 59.96 S	174 40.37 E	15	<i>Coscinasterias muricata</i> (2)
O174	08.03.77	36 57.35 S	174 40.19 E	10	<i>Coscinasterias muricata</i> (1)
O176	08.03.77	37 02.30 S	174 43.60 E	16	<i>Coscinasterias muricata</i> (1)
O186	09.03.77	37 04.31 S	174 41.06 E	3	<i>Coscinasterias muricata</i> (3)
O187	09.03.77	37 04.36 S	174 42.58 E	10	<i>Coscinasterias muricata</i> (1)
O866	05.03.85	45 27.68 S	167 09.60 E	35	<i>Henricia lukinsii</i> (3)
P7	25.01.77	32 41.00 S	167 28.60 E	150	<i>Sclerasterias mollis</i> (1)
P10	25.01.77	32 40.00 S	167 28.40 E	378	<i>Sclerasterias mollis</i> (3)
P20	25.01.77	29 32.30 S	167 59.80 E	52	<i>Astrostole rodolphi</i> (1)
P21	26.01.77	29 31.80 S	167 59.20 E	52	<i>Astrostole rodolphi</i> (4)
P22	26.01.77	29 30.90 S	167 58.80 E	56	<i>Astrostole rodolphi</i> (1)
P23A	27.01.77	29 06.74 S	167 56.94 E	15-24	<i>Astrostole rodolphi</i> (2)
P38	29.01.77	29 10.40 S	167 55.80 E	64	<i>Astrostole rodolphi</i> (frags)
P39	29.01.77	29 10.40 S	167 51.70 E	77	<i>Astrostole rodolphi</i> (1)
P51	30.01.77	29 06.90 S	167 57.30 E	5	<i>Echinaster colemani</i> (1)
P53	01.02.77	29 03.73 S	167 57.70 E	2	<i>Coscinasterias muricata</i> (2)
P61	05.02.77	35 14.30 S	172 42.20 E	216	<i>Sclerasterias mollis</i> (2)
P66	07.02.77	35 03.80 S	172 22.60 E	435	<i>Cosmasterias dyscrita</i> (2), <i>Asterostephane moluccana</i> (1)
P88	28.05 77	31 33.20 S	159 02.20 E	0	<i>Astrostole rodolphi</i> (10)
P89	28.05.77	31 31.60 S	159 02.80 E	0	<i>Astrostole rodolphi</i> (1)
P92	29.05.77	31 31.59 S	159 04.96 E	0	<i>Astrostole rodolphi</i> (2)
P94	30.05.77	31 31.50 S	159 05.10 E	10	<i>Astrostole rodolphi</i> (2)
P100	30.05.77	31 43.40 S	159 12.30 E	0	<i>Astrostole rodolphi</i> (1)
P117	01.06.77	31 31.00 S	159 04.70 E	0	<i>Astrostole rodolphi</i> (3)
P120	03.06.77	35 45.70 S	165 04.10 E	950	<i>Hymenaster</i> sp. A (1), <i>Henricia compacta</i> (1)
P122	05.06 77	40 32.50 S	173 06.80 E	58	<i>Coscinasterias muricata</i> (2)
P124	06.06.77	41 02.60 S	173 38.20 E	0	<i>Stichaster australis</i> (1), <i>Coscinasterias muricata</i> (1)
P661	18.06.79	41 12.50 S	170 25.80 E	621	<i>Henricia compacta</i> (1)
P667	25.06.79	42 24.30 S	169 25.00 E	1047	<i>Hymenaster</i> sp. A (1)
P926	17.04.80	40 33.10 S	170 57.30 E	570	<i>Crossaster multispinus</i> (1), <i>Hymenodiscus aotearoa</i> (frags)
P927	18.04.80	40 50.10 S	168 14.80 E	1009	<i>Crossaster multispinus</i> (1), <i>Hymenaster carnosus</i> (1) <i>Henricia compacta</i> (2), <i>Brisinga tasmani</i> (8)

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P928	18.04.80	40 46.00 S	167 54.90 E	1029	<i>Crossaster multispinus</i> (note)
P930	19.04.80	41 15.50 S	166 35.60 E	4066	<i>Hydrasterias</i> n. sp. A (1)
P934	20.04.80	41 39.10 S	165 13.60 E	4405	<i>Hydrasterias</i> n. sp. B (1)
P939	22.04.80	41 20.40 S	166 54.80 E	1760	<i>Hymenaster carnosus</i> (1), <i>Hymenaster pullatus</i> (several)
P940	23.04.80	41 22.70 S	166 44.40 E	2092	<i>Hymenaster pullatus</i> (6)
P942	24.04.80	41 00.60 S	169 06.00 E	914	<i>Hymenaster</i> sp. A (1), <i>Zoroaster</i> sp. A (1), <i>Hymenodiscus aotearoa</i> (3)
P967	11.06.80	29 14.70 S	177 51.00 W	3	<i>Astrostole rodolphi</i> (3)
P970	17.06.80	39 30.00 S	178 50.00 E	3391	<i>Hymenaster carnosus</i> (2), <i>Hymenodiscus</i> sp. B (1)
Q8	15.03.78	44 02.20 S	179 20.30 W	305	<i>Peribolaster lictor</i> (1)
Q11	15.03.78	43 44.10 S	179 31.60 W	300	<i>Echinaster farquhari</i> (1)
Q12	15.03.78	43 51.50 S	179 51.40 W	410	<i>Crossaster multispinus</i> (1), <i>Peribolaster lictor</i> (1)
Q13	15.03.78	43 27.60 S	179 46.90 W	415	<i>Brisinga chathamica</i> (2)
Q16	16.03.78	43 59.40 S	179 15.60 W	215	<i>Henricia aucklandiae</i> (1), <i>Paralophaster hyalinus</i> (3), <i>Sclerasterias mollis</i> (5)
Q17	16.03.78	44 00.70 S	179 08.10 W	314	<i>Henricia compacta</i> (1)
Q18	16.03.78	43 57.50 S	179 18.20 W	204	<i>Peribolaster lictor</i> (1)
Q20	17.03.78	44 09.60 S	179 14.20 W	320	<i>Echinaster farquhari</i> (1)
Q23	22.03.78	44 16.50 S	176 15.00 W	10	<i>Astrostole scabra</i> (1)
Q24	22.03.78	44 29.70 S	176 33.70 W	320	<i>Sclerasterias mollis</i> (1)
Q25	22.03.78	44 26.20 S	176 38.40 W	360	<i>Sclerasterias mollis</i> (3)
Q33	23.03.78	44 13.50 S	177 04.70 W	403	<i>Zoroaster</i> sp. C (1)
Q40	24.03.78	44 29.50 S	176 32.50 W	345	<i>Brisinga chathamica</i> (frags)
Q42	25.03.78	43 44.40 S	176 39.80 W	0	<i>Astrostole scabra</i> (1)
Q51	25.03.78	31 30.70 S	159 04.70 E	19	<i>Astrostole rodolphi</i> (2)
Q53	26.03.78	31 30.30 S	159 05.00 E	10	<i>Astrostole rodolphi</i> (1)
Q56	27.03.78	31 36.00 S	159 03.70 E	25	<i>Coscinasterias muricata</i> (1)
Q69	02.06.78	27 00.00 S	159 18.30 E	354	<i>Pteraster obesus</i> (2), <i>Henricia tahia</i> (9)
Q82	06.06.78	31 31.70 S	159 02.80 E	0	<i>Astrostole rodolphi</i> (1)
Q83	07.06.78	33 00.20 S	163 01.20 E	816	<i>Hymenodiscus aotearoa</i> (1)
Q84	07.06.78	32 59.40 S	163 08.70 E	830	<i>Solaster torulatus</i> (1), <i>Hymenaster</i> sp. A (1), <i>Hymenodiscus aotearoa</i> (frag.)
Q85	02.11.78	41 13.40 S	174 28.50 E	340	<i>Sclerasterias mollis</i> (3)
Q87	03.11.78	40 45.00 S	173 58.80 E	37	<i>Allostichaster insignis</i> (2), <i>Coscinasterias muricata</i> (1), <i>Sclerasterias mollis</i> (1)
Q93A	06.11.78	46 03.2 S	166 47.3 E	5	<i>Echinaster farquhari</i> (1)
Q97	06.11.78	46 03.00 S	166 46.20 E	5	<i>Coscinasterias muricata</i> (1), <i>Sclerasterias mollis</i> (1)
Q100	07.11.78	45 43.80 S	160 43.90 E	0	<i>Allostichaster insignis</i> (1), <i>Sclerasterias mollis</i> (1)
Q102	08.11.78	45 38.80 S	166 53.30 E	0	<i>Henricia lukinsii</i> (3), <i>Coscinasterias muricata</i> (1)
Q103	08.11.78	45 05.00 S	166 59.80 E	0	<i>Coscinasterias muricata</i> (1)
Q104	09.11.78	45 01.60 S	167 15.40 E	0	<i>Coscinasterias muricata</i> (1), <i>Sclerasterias mollis</i> (1)
Q105	09.11.78	44 38.10 S	167 52.80 E	0	<i>Coscinasterias muricata</i> (1)
Q107	12.11.78	40 55.00 S	173 45.50 E	0	<i>Stichaster australis</i> (2)
Q122	14.11.78	40 58.00 S	174 08.99 E	88	<i>Crossaster multispinus</i> (1)
Q338	13.11.79	44 00.70 S	176 04.90 E	480	<i>Crossaster multispinus</i> (1)
Q339	13.11.79	44 05.60 S	176 11.40 E	455	<i>Zoroaster</i> sp. C (1)
Q343	14.11.79	44 07.80 S	175 47.80 E	500	<i>Zoroaster</i> sp. C (1), <i>Cosmasterias dyscrita</i> (2)
Q769	22.07.82	46 02.14 S	166 46.49 E	0-32	<i>Pteraster bathamae</i> (1)
R435	15.06.90	39 25.80 S	178 25.30 E	985	<i>Cosmasterias dyscrita</i> (1)
R439	16.06.90	39 26.80 S	178 20.00 E	1000	<i>Peribolaster lictor</i> (1), <i>Cosmasterias dyscrita</i> (1)
S14	13.09.78	48 17.30 S	168 42.10 E	607	<i>Crossaster multispinus</i> (4), <i>Henricia compacta</i> (1)
S19	14.09.78	50 32.60 S	166 13.00 E	0	<i>Henricia lukinsii</i> (2), <i>Anasterias laevigata</i> (3)
S23	17.09.78	50 28.70 S	167 34.50 E	156	<i>Sclerasterias mollis</i> (1)
S26	17.09.78	50 40.00 S	167 36.60 E	425	<i>Cosmasterias dyscrita</i> (12), <i>Taranuiaster novaezealandiae</i> (1) <i>Perissasterias monocantha</i> (1)
S29	18.09.78	50 40.70 S	167 41.10 E	300	<i>Peribolaster lictor</i> (1)
S30	18.09.78	50 41.00 S	167 40.80 E	265	<i>Echinaster farquhari</i> (1), <i>Taranuiaster novaezealandiae</i> (1)
S36	20.09.78	52 34.30 S	169 14.30 E	80	<i>Henricia aucklandiae</i> (4), <i>Anasterias laevigata</i> (11)
S39	20.09.78	41 26.40 S	171 07.70 E	179	<i>Allostichaster insignis</i> (1)
S43	21.09.78	53 29.10 S	170 04.20 E	693	<i>Taranuiaster novaezealandiae</i> (1)
S49	22.09.78	53 07.40 S	172 08.30 E	392	<i>Crossaster multispinus</i> (1)
S55	23.09.78	49 40.60 S	178 48.80 E	60	<i>Henricia aucklandiae</i> (7), <i>Allostichaster insignis</i> (2), <i>Anasterias laevigata</i> (13), <i>Anasterias suteri</i> (2)
S65	26.11.78	48 10.35 S	179 41.30 E	490	<i>Henricia compacta</i> (3)

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S68	26.11.78	48 14.05 S	179 59.40 E	440	<i>Henricia compacta</i> (1)
S69	26.11.78	47 45.06 S	179 01.30 E	0	<i>Henricia lukinsii</i> (2), <i>Allostichaster insignis</i> (10), <i>Anasterias laevigata</i> (7), <i>Sclerasterias mollis</i> (2)
S70	26.09.78	47 45.60 S	178 30.80 E	353	<i>Taranuiaster novaezealandiae</i> (1), <i>Brisinga chathamica</i> (frags)
S80	23.11.78	47 50.20 S	179 15.20 E	126	<i>Sclerasterias mollis</i> (1)
S85	24.11.78	49 39.19 S	178 50.20 E	70	<i>Henricia aucklandiae</i> (1)
S100	02.12.78	54 51.40 S	165 13.50 E	2370	<i>Psalidaster</i> n. sp. (3)
S119	20.10.79	43 31.99 S	175 59.40 E	368	<i>Crossaster multispinus</i> (1)
S120	20.10.79	43 33.00 S	175 58.80 E	365	<i>Crossaster multispinus</i> (1)
S124	21.10.79	43 30.70 S	175 59.90 E	363	<i>Crossaster multispinus</i> (5)
S125	20.10.79	43 32.10 S	175 58.50 E	365	<i>Henricia aucklandiae</i> (1)*
S126	20.10.79	43 33.40 S	175 58.60 E	322	<i>Zoroaster</i> sp. C (1)
S134	23.10.79	44 09.00 S	176 06.50 E	126	<i>Echinaster farquhari</i> (1), <i>Sclerasterias mollis</i> (70)
S140	24.10.79	44 33.90 S	174 51.20 E	750	<i>Crossaster multispinus</i> (1), <i>Henricia compacta</i> (1)
S142	24.10.79	44 30.90 S	174 52.50 E	715	<i>Crossaster multispinus</i> (4), <i>Henricia compacta</i> (1)
S147	25.10.79	44 30.10 S	174 18.80 E	760	<i>Crossaster multispinus</i> (1)
S150	26.10.79	45 46.00 S	174 24.50 E	1640	<i>Zoroaster spinulosus</i> (2), <i>Freyella echinata</i> (1)
S151	26.10.79	45 45.80 S	174 30.50 E	1586	<i>Pteraster roberstoni</i> (4), <i>Hymenaster carnosus</i> (6), <i>Hymenaster pullatus</i> (5), <i>Zoroaster spinulosus</i> (9), <i>Freyella echinata</i> (4)
S152	26.10.79	45 52.30 S	174 04.90 E	1676	<i>Diplopteraster hurleyi</i> (1), <i>Hymenaster pullatus</i> (3), <i>Zoroaster spinulosus</i> (12), <i>Freyella echinata</i> (1)
S155	28.10.79	44 05.30 S	173 11.40 E	85	<i>Sclerasterias mollis</i> (2)
S157	28.10.79	44 10.50 S	173 29.90 E	160	<i>Sclerasterias mollis</i> (1)
S159	28.10.79	44 19.30 S	173 35.50 E	525	<i>Solaster torulatus</i> (1)
S164	29.10.79	44 34.00 S	174 06.50 E	863	<i>Crossaster multispinus</i> (1)
S166	29.10.79	44 25.40 S	174 07.40 E	720	<i>Henricia compacta</i> (1)
S167	29.10.79	44 13.90 S	174 08.00 E	608	<i>Crossaster multispinus</i> (1)
S168	29.10.79	44 10.60 S	174 23.30 E	594	<i>Crossaster multispinus</i> (1)
S171	30.10.79	44 05.00 S	174 08.60 E	555	<i>Crossaster multispinus</i> (1)
S174	30.10.79	44 06.50 S	173 54.10 E	518	<i>Henricia compacta</i> (1)
S176	30.10.79	44 00.50 S	173 38.60 E	123	<i>Sclerasterias mollis</i> (2)
S177	30.10.79	43 53.40 S	173 54.20 E	400	<i>Sclerasterias mollis</i> (16)
S179	30.10.79	43 50.30 S	173 58.90 E	600	<i>Sclerasterias mollis</i> (18)
S180	31.10.79	43 30.00 S	173 35.00 E	100	<i>Allostichaster insignis</i> (2)
S182	31.10.79	43 24.70 S	173 28.20 E	460	<i>Crossaster multispinus</i> (1)
S184	31.10.79	43 22.40 S	173 21.90 E	75	<i>Sclerasterias mollis</i> (2)
S190	31.10.79	43 14.40 S	173 34.40 E	140	<i>Sclerasterias mollis</i> (1)
S192	31.10.79	43 15.00 S	173 49.70 E	?	<i>Pteraster bathamae</i> (2)
S194	01.11.79	43 09.40 S	173 47.50 E	1190	<i>Cosmasterias dyscrita</i> (1), <i>Smilasterias</i> n. sp. (1), <i>Novodinia novaezealandiae</i> (1)
S200	01.11.79	43 03.00 S	173 51.70 E	1400	<i>Zoroaster</i> sp. C (1)
S201	01.11.79	42 56.60 S	173 39.00 E	340	<i>Sclerasterias mollis</i> (1)
S202	02.11.79	42 14.70 S	175 08.60 E	2476	<i>Hymenaster estcourti</i> (17)
S213	04.11.79	42 45.20 S	173 44.80 E	805	<i>Zoroaster</i> sp. C (1)
S215	04.11.79	42 40.00 S	173 44.60 E	750	<i>Zoroaster</i> sp. C (2)
S216	04.11.79	42 40.90 S	173 39.20 E	200	<i>Sclerasterias mollis</i> (1)
S217	04.11.79	42 41.40 S	173 31.80 E	130	<i>Sclerasterias mollis</i> (1)
S231	14.12.80	45 59.80 S	166 46.70 E	22	<i>Pteraster bathamae</i> (2)
S238	16.02.80	45 54.40 S	166 41.20 E	28	<i>Echinaster farquhari</i> (1)
S260	22.02.80	45 29.45 S	167 05.10 E	33	<i>Pteraster bathamae</i> (1), <i>Echinaster farquhari</i> (1)
S261	22.02.80	45 21.10 S	166 59.30 E	32	<i>Astrostole scabra</i> (1)
S377	31.01.83	42 37.00 S	169 31.50 E	955	<i>Zoroaster</i> sp. C (2), <i>Hymenodiscus aotearoa</i> (1)
S378	31.01.83	41 37.30 S	169 56.30 E	900	<i>Henricia compacta</i> (2), <i>Brisinga tasmani</i> (1)
S379	01.02.83	41 58.20 S	170 28.90 E	480	<i>Brisinga tasmani</i> (1)
S398	10.02.83	40 52.40 S	171 32.90 E	175	<i>Allostichaster polyplax</i> (2), <i>Allostichaster insignis</i> (2)
S568	13.08.83	30 10.00 S	171 20.20 E	900	<i>Henricia compacta</i> (2)*
T10	08.03.81	43 57.20 S	179 41.20 E	400	<i>Peribolaster lictor</i> (note)
T23	11.03.81	47 59.70 S	179 07.80 W	830	<i>Peribolaster lictor</i> (1)
T28	12.03.81	48 15.00 S	179 45.40 W	494	<i>Crossaster multispinus</i> (1)
T40	14.03.81	49 40.10 S	178 50.10 E	95	<i>Echinaster farquhari</i> (1), <i>Henricia aucklandiae</i> (2), <i>Henricia ralphae</i> (1)
T43	14.03.81	49 40.50 S	178 49.60 E	0	<i>Henricia aucklandiae</i> (5), <i>Allostichaster insignis</i> (1), <i>Anasterias laevigata</i> (3), <i>Anasterias suteri</i> (1)

Stn No.	Date	Latitude (°)	Longitude (°)	Depth (m)	Species and number
T44	14.03.81	49 40.10 S	178 49.10 E	0	<i>Anasterias laevigata</i> (3), <i>Anasterias suteri</i> (1)
T46	14.03.81	49 41.50 S	178 35.00 E	580	<i>Henricia aucklandiae</i> (1)
T50	15.03.81	48 39.60 S	178 20.90 E	890	<i>Paralophaster hyalinus</i> (2)
T54	17.03.81	46 31.50 S	173 47.00 E	1670	<i>Freyella echinata</i> (1)
T55	20.03.81	48 49.60 S	168 30.20 E	47	<i>Sclerasterias mollis</i> (1)
T56	20.03.81	46 53.20 S	168 44.80 E	75	<i>Pseudechinaster rubens</i> (1)
T65	22.03.81	49 49.70 S	170 13.90 E	600	<i>Zoroaster</i> sp. C (2)
T88	31.03.81	44 02.00 S	174 46.60 E	500	<i>Crossaster multispinus</i> (10)
T214	18.03.82	30 40.90 S	178 25.50 W	565	<i>Coronaster halicepus</i> (1)
T220	20.03.82	29 14.50 S	177 52.20 W	0	<i>Astrostole rodolphi</i> (note)
T262	29.03.82	30 30.50 S	178 39.70 W	775	<i>Henricia sufflata</i> (1)
T478	07.12.83	41 03.20 S	174 21.50 E	93	<i>Allostichaster insignis</i> (1)
T488	08.12.83	41 07.80 S	174 17.50 E	37	<i>Allostichaster insignis</i> (1)
T501	10.12.83	41 15.95 S	174 02.50 E	14	<i>Sclerasterias mollis</i> (1)
T539	13.12.83	40 55.00 S	174 05.90 E	32	<i>Coscinasterias muricata</i> (2)
T559	15.12.83	41 03.50 S	173 57.40 E	65	<i>Allostichaster insignis</i> (1)
T599	21.12.83	40 55.15 S	173 53.20 E	47	<i>Coscinasterias muricata</i> (note)
T602	21.12.83	40 49.10 S	173 58.60 E	27	<i>Coscinasterias muricata</i> (note)
T605	21.12.83	40 44.80 S	173 58.50 E	27	<i>Coscinasterias muricata</i> (1)
T612	03.07.84	41 07.80 S	174 22.20 E	16	<i>Coscinasterias muricata</i> (3)
T622	28.09.84	41 16.60 S	173 59.90 E	15	<i>Henricia aucklandiae</i> (1)
T753	03.12.85	Snares Islands		0	<i>Anasterias suteri</i> (1)
T754	03.12.85	Snares Islands		20	<i>Echinaster farquhari</i> (1)
T755	04.12.85	48 01.28 S	166 36.60 E	20	<i>Anasterias suteri</i> (3)
T758	06.12.85	Snares Islands		0	<i>Echinaster farquhari</i> (1)
T760	07.12.85	48 01.45 S	166 36.63 E	20	<i>Echinaster farquhari</i> (2), <i>Astrostole scabra</i> (2), <i>Sclerasterias mollis</i> (1)
T762	09.12.85	48 01.69 S	166 36.76 E	0	<i>Anasterias suteri</i> (3), <i>Astrostole scabra</i> (1)
T764	10.12.85	48 01.51 S	166 36.60 E	0	<i>Anasterias suteri</i> (2)
U194	22.09.82	37 57.79 S	165 35.10 E	1815	<i>Hymenaster pullatus</i> (8), <i>Freyella echinata</i> (1)
U195	23.09.82	34 31.50 S	166 21.00 E	2930	<i>Hymenaster pullatus</i> (4)
U196	24.09.82	33 03.00 S	165 22.40 E	3120–311	<i>Freyastera</i> n. sp. (1)
U197	25.09.82	34 09.80 S	163 36.70 E	1186	<i>Solaster torulatus</i> (2), <i>Hymenaster pullatus</i> (1), <i>Henricia compacta</i> (1), <i>Henricia sufflata</i> (1), <i>Zoroaster</i> sp. C (9)
U198	26.09.82	34 59.30 S	162 11.21 E	1573	<i>Hymenaster pullatus</i> (12), <i>Freyella echinata</i> (2)
U200	27.09.82	35 35.10 S	160 57.10 E	3180	<i>Hymenaster</i> sp. B (1), <i>Hymenodiscus</i> sp. C (1), <i>Freyella</i> n.sp. (1)
U227	18.10.82	39 33.90 S	169 14.70 E	604	<i>Crossaster multispinus</i> (9), <i>Henricia compacta</i> (27)
U563	01.02.88	37 55.80 S	166 55.30 E	1308	<i>Zoroaster</i> sp. C (1)
U567	03.02.88	35 00.30 S	169 09.70 E	1480	<i>Lophaster suluensis</i> (1)
U571	03.02.88	34 44.10 S	169 25.00 E	1123	<i>Asterostephane moluccana</i> (1)
U572	03.02.88	33 36.70 S	170 02.00 E	1679	<i>Zoroaster spinulosus</i> (1)
U582	05.02.82	31 51.70 S	172 26.00 E	790	<i>Henricia compacta</i> (1)
U591	07.02.88	30 50 60 S	172 49.30 E	486	<i>Sclerasterias mollis</i> (1)
U599	08.02.88	30 43.00 S	173 16.90 E	640	<i>Cosmasterias dyscrita</i> (1)
V361	06.09.89	43 30.39 S	178 38.85 E	340–345	<i>Crossaster campbellicus</i> (1), <i>Henricia compacta</i> (1), <i>Cosmasterias dyscrita</i> (1), <i>Pseudechinaster rubens</i> (1)
V371	12.09.89	43 00.10 S	179 00.01 W	533	<i>Crossaster multispinus</i> (1)
V373	13.09.89	43 34.85 S	179 00.03 E	385	<i>Pseudechinaster rubens</i> (1), <i>Sclerasterias mollis</i> (1)
V374	13.09.89	43 51.65 S	178 59.12 E	470	<i>Crossaster multispinus</i> (1)
V376	13.09.89	44 20.29 S	179 00.08 E	1239	<i>Zoroaster spinulosus</i> (1), <i>Hymenodiscus</i> sp. A (1)
V387	16.09.89	43 49.62 S	176 59.83 E	237	<i>Crossaster multispinus</i> (3)
V423	09.09.92	42 33.55 S	170 25.79 E	522	<i>Pseudechinaster rubens</i> (1)
V480	07.06.94	41 17.55 S	176 33.01 E	725	<i>Coronaster halicepus</i> (1)
W248	14.09.93	44 36.00 S	178 58.00 E	1442	<i>Diplopteraster</i> n. sp. (1), <i>Zoroaster spinulosus</i> (1), <i>Hymenodiscus aotearoa</i> (frags)
W249	14.09.93	44 18.90 S	179 00.00 E	1200–1230	<i>Zoroaster spinulosus</i> (6)
W252	15.09.93	44 21.10 S	178 58.90 E		
W252	15.09.93	43 37.69 S	170 59.80 E	400–428	<i>Crossaster multispinus</i> (1), <i>Pteraster bathamae</i> (1), <i>Zoroaster</i> sp. C (1)
W252	15.09.93	43 38.50 S	170 58.45 E		
W256	18.09.93	44 41.10 S	179 01.20 E	1610–1688	<i>Zoroaster spinulosus</i> (1)
W256	18.09.93	44 43.20 S	179 00.40 E		

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W257	18.09.93	43 22.50 S	179 00.0 E	400–390	<i>Zoroaster</i> sp. C (1)
		43 22.50 S	178 58.90 E		<i>Brisinga chathamica</i> (frags)
W258	19.09.93	42 59.20 S	178 59.40 E	542–499	<i>Zoroaster</i> sp. C (1)
		43 00.70 S	178 59.10 E		
W426	19.02.95	43 31.17 S	175 37.62 E	320–419	<i>Henricia aucklandiae</i> (1)
W427	20.02.95	43 04.65 S	175 16.34 E	180–237	<i>Henricia compacta</i> (1)
W430	20.02.95	43 02.47 S	175 09.80 E	310–330	<i>Henricia compacta</i> (1)
W460	23.02.95	45 57.94 S	171 45.71 E	1400–1417	<i>Hymenodiscus aotearoa</i> (frags)
W747G					? <i>Crossaster multispinus</i> (1)
X482	03.07.94	42 45.70 S	179 58.30 W	742–702	<i>Novodinia novaezealandiae</i> (frags)
		42 45.49 S	179 58.37 W		
X484	04.07.94	42 45.84 S	179 54.38 W	899–1060	<i>Novodinia novaezealandiae</i> (frags)
		42 45.94 S	179 54.12 W		
X485	04.07.94	42 43.49 S	179 57.55 W	992–1156	<i>Peribolaster lictor</i> (1)
		42 43.75 S	179 56.98 W		<i>Novodinia novaezealandiae</i> (frags)
X486	04.07.94	42 46.62 S	179 54.83 W	910–921	<i>Novodinia novaezealandiae</i> (frags)
		42 46.99 S	179 54.33 W		
X496	07.07.94	43 58.37 S	174 20.69 W	1155–1157	<i>Brisinga chathamica</i> (frags)
		44 00.71 S	174 23.34 W		
X499	07.07.94	43 45.62 S	174 11.49 W	1136–1150	<i>Brisinga chathamica</i> (frags)
		43 48.35 S	174 13.21 W		
X503	08.07.94	43 16.09 S	174 04.74 W	1050–1058	<i>Brisinga chathamica</i> (frags)
		43 13.64 S	174 06.71 W		
X503	08.07.94	43 16.09 S	174 04.20 W	1050	<i>Henricia compacta</i> (1)
X504	08.07.94	43 08.56 S	174 02.89 W	1128–1139	<i>Brisinga chathamica</i> (frags)
		43 06.58 S	174 06.62 W		
X505	08.09.94	43 09.19 S	174 34.09 W	889	<i>Henricia compacta</i> (1)
X508	09.07.94	42 51.86 S	174 56.10 W	1163–1173	<i>Brisinga chathamica</i> (frags)
		42 57.67 S	174 52.13 W		
X509	09.07.94	42 53.71 S	174 34.92 W	1160–1190	<i>Brisinga chathamica</i> (frags)
		42 54.04 S	174 30.89 W		
X511	10.07.94	42 56.65 S	175 46.24 W	833–836	<i>Crossaster multispinus</i> (1)
		42 56.36 S	175 50.26 W		
X523	11.07.94	42 56.98 S	175 18.37 W	941–942	<i>Crossaster multispinus</i> (1)
		42 58.03 S	175 14.44 W		
X530	13.07.94	42 55.12 S	175 13.25 W	1019–1020	<i>Brisinga chathamica</i> (frags)
		42 54.13 S	175 17.15 W		
X532	13.07.94	42 51.06 S	175 17.71 W	1118–1127	<i>Brisinga chathamica</i> (frags)
		42 51.19 S	175 13.59 W		
X533	13.07.94	42 51.95 S	175 12.80 W	1108–1109	<i>Brisinga chathamica</i> (frags)
		42 51.35 S	175 16.87 W		
X534	13.07.94	42 51.24 S	175 24.66 W	1062–1064	<i>Brisinga chathamica</i> (frags)
		42 50.42 S	175 28.62 W		
X535	13.07.94	42 40.05 S	175 33.36 W	1097–1106	<i>Brisinga chathamica</i> (frags)
		42 49.27 S	175 32.49 W		
X536	14.07.94	42 46.47 S	175 13.31 W	1363–1365	<i>Brisinga chathamica</i> (frags)
		42 46.77 S	175 09.19 W		
X540	15.07.94	42 41.80 S	175 32.39 W	1482–1498	<i>Brisinga chathamica</i> (frags)
		42 41.31 S	175 34.93 W		
X652	11.02.96	35 21.96 S	178 32.16 E	1496–1292	Korethrasterid sp. (1)
		35 21.54 S	178 32.93 E		
X675	13.02.96	35 26.83 S	178 40.35 E	1896–1680	<i>Zoroaster planus</i> (1)
		35 26.20 S	178 40.50 E		
X686	14.02.96	36 00.16 S	178 03.92 E	1995–1815	? <i>Lophaster</i> sp. juv.(1)
		36 00.22 S	178 03.46 E		
X700	15.02.96	35 40.44 S	177 54.49 E	1760–1765	<i>Astropatricia marita</i> (1)
		35 40.90 S	177 54.64 E		
Y26	14.03.97	46 07.88 S	166 21.08 E	308	<i>Solaster torulatus</i> (1)
		46 07.54 S	166 20.77 E		
Y27	14.03.97	46 07.87 S	166 21.09 E	302	<i>Crossaster multispinus</i> (1)
		46 07.45 S	166 20.79 E		<i>Sclerasterias mollis</i> (1)
Y31	14.03.97	46 10.33 S	165 48.12 E	1800	<i>Asthenactis</i> n.sp. (1)
		46 09.85 S	165 47.22 E		Pterasterid sp. (1)*

Stn No.	Date	Latitude (°)	Longitude (°)	Depth (m)	Species and number
Y39	16.03.97	46 08.57 S 46 08.44 S	166 12.63 E 166 12.36 E	115	<i>Sclerasterias mollis</i> (1)
Z1191	18.08.59	Cook Strait		256	<i>Sclerasterias mollis</i> (1) (underwater photo)
Z1214	21.07.59	Cook Strait		177	<i>Allostichaster insignis</i> (1) (underwater photo)
Z1819	17.11.62	53 35.00 S	169 10.00 E	0	<i>Henricia lukinsii</i> (4), <i>Anasterias laevigata</i> (9)
Z1898	01.07.63	53 35.00 S	169 10.00 E	0	<i>Henricia lukinsii</i> (1)
Z1903	05.09.63	53 35.00 S	169 10.00 E	0	<i>Henricia lukinsii</i> (1), <i>Anasterias laevigata</i> (12)
Z1904	06.10.63	53 35.00 S	169 10.00 E	0	<i>Henricia lukinsii</i> (1), <i>Anasterias suteri</i> (34)
Z1909	?. ?. ?	41 09.00 S	173 28.00 E	?	<i>Coscinasterias muricata</i> (1)
Z1922	?. ?. ?	37 13.00 S	176 15.00 E	365	<i>Asterostephane moluccana</i> (1)
Z1924	30.09.62	37 32.00 S	177 16.00 E	630	<i>Zoroaster</i> sp. C (1)
Z2054	11.04.65	29 16.00 S	177 55.00 W	0	<i>Astrostole rodolphi</i> (1)
Z2098	04.09.67	28 39.50 S	173 01.00 E	850	<i>Lophaster suluensis</i> (1), <i>Pteraster obesus</i> (1), <i>Henricia tahia</i> (1)
Z2318	14.09.69	41 05.00 S	176 04.00 E	0	<i>Astrostole scabra</i> (1)
Z2322	19.05.70	41 16.30 S	174 54.49 E	0	<i>Coscinasterias muricata</i> (1)
Z2363	?. ?. 71	37 21.00 S	176 26.00 E	311	<i>Asterostephane moluccana</i> (frags)
Z2365	?. ?. 71	37 20.00 S	176 29.00 E	373	<i>Asterostephane moluccana</i> (1)
Z2375	16.04.71	42 30.00 S	170 36.00 E	348	<i>Sclerasterias mollis</i> (1)
Z2376	17.04.71	42 27.00 S	169 14.00 E	348	<i>Coscinasterias dyscrita</i> (frags.)
Z2404	21.04.64	41 43.00 S	174 17.00 E	102	<i>Pseudechinaster rubens</i> (1)
Z2781	01.06.81	46 05.50 S	170 38.99 E	0	<i>Coscinasterias muricata</i> (1)
Z4575	04.05.60	Shelly Bay, Wellington		0	<i>Allostichaster insignis</i> (2)
Z5357	15.09.61	Oamaru Heads		73	<i>Henricia ralphae</i> (1)
Z6482	13.12.88	43 44.70 S	175 07.90 E	422	<i>Crossaster multispinus</i> (1)
Z6830	28.5.86	Auckland Islands		0–3	<i>Henricia aucklandiae</i> (2), <i>Anasterias laevigata</i> (2)
Z7861	29.01.93	Wet Jacket Arm, Dusky Sound		1.5	<i>Stichaster australis</i> (1)
Z8371	10.08.95	39 50.00 S	177 39.00 E	1000–1100	<i>Solaster torulatus</i> (1), <i>Henricia compacta</i> (1)
Z8473	06.09.96	Milford Sound		0–20	<i>Coscinasterias muricata</i> (6), <i>Sclerasterias mollis</i> (4)
Z8479	04.07.96	40 45.90 S	172 58.70 E	24	<i>Coscinasterias muricata</i> (1)
Z8539	08.11.95	44 45.71 S 44 46.07 S	176 37.92 W 176 40.71 W	1220–1222	<i>Zoroaster spinulosus</i> (1)
Z8566	07.10.96	43 04.00 S 43 12.00 S	175 39.00 E 175 53.00 E	460	<i>Crossaster multispinus</i> (?)
Z8586	25.10.96	37 24.93 S 37 26.43 S	174 15.69 E 174 15.79 E	106–107	<i>Coscinasterias muricata</i> (2)
Z8587	30.10.96	38 42.04 S 38 40.67 S	174 30.16 E 174 30.94 E	41–40	<i>Coscinasterias muricata</i> (1)
Z8588	26.10.96	37 49.12 S 37 47.55 S	174 33.77 E 174 34.23 E	63–61	<i>Coscinasterias muricata</i> (2)
Z8614	09.02.97	43 48.12 S	176 42.49 W	0	<i>Henricia lukinsii</i> (1)
Z8642	24.02.97	36 00.80 S	174 36.00 E	27	<i>Coscinasterias muricata</i> (1)
Z8677	13.01.97	44 08.54 S 44 08.13 S	178 37.83 W 178 41.97 W	482–483	<i>Zoroaster</i> sp. C (1), <i>Crossaster multispinus</i> (8)
Z8840	08.04.96	37 01.21 S 37 04.10 S	176 19.59 E 176 20.51 E	567–571	<i>Hymenodiscus aotearoa</i> (frags)
Z8843	24.02.97	35 54.60 S	174 28.80 E	17	<i>Coscinasterias muricata</i> (1)
Z8877	22.01.97	43 14.77 S 43 16.88 S	178 24.85 E 178 27.78 E	372–386	<i>Zoroaster</i> sp. C (1)
Z8879	03.08.97	43 04.94 S 43 05.92 S	169 25.41 E 169 27.78 E	678–729	<i>Zoroaster</i> sp. C (2)
Z8880	29.07.97	30 00.10 S	177 20.10 E	678–729	<i>Allostichaster</i> ?sp. (1)
Z8918	24.10.96	36 58.93 S 37 00.43 S	174 23.44 E 174 23.34 E	38–42	<i>Coscinasterias muricata</i> (1)
Z8922	25.10.96	37 21.94 S 37 23.44 S	174 33.52 E 174 33.52 E	41–45	<i>Coscinasterias muricata</i> (2)
Z8924	27.10.96	38 02.10 S 38 03.42 S	174 46.19 E 174 45.29 E	14–18	<i>Coscinasterias muricata</i> (1)
Z8925	27.10.96	38 08.48 S 38 06.98 S	174 32.10 E 174 32.14 E	62–61	<i>Coscinasterias muricata</i> (4)
Z8936	26.10.96	37 36.50 S 37 35.20 S	174 39.01 E 174 38.06 E	39–40	<i>Coscinasterias muricata</i> (1)

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Z8940	27.10.96	37 53.33 S 37 54.82 S	174 44.91 E 174 45.18 E	21–24	<i>Coscinasterias muricata</i> (1)
Z8941	27.10.96	37 56.47 S 37 57.98 S	174 43.54 E 174 43.58 E	39–38	<i>Coscinasterias muricata</i> (1)
Z8942	31.10.96	38 50.97 S 38 49.74 S	174 29.07 E 174 30.38 E	22	<i>Coscinasterias muricata</i> (1)
Z8943	24.02.97	35 58.60 S	174 30.70 E	18	<i>Coscinasterias muricata</i> (1)
Z8946	26.10.95	44 32.56 S	175 45.94 W	822–840	<i>Solaster torulatus</i> (1)
Z8951	24.02.97	36 00.00 S	174 31.70 E	16	<i>Coscinasterias muricata</i> (1)
Z8953	24.02.97	35 56.30 S	174 32.80 E	29	<i>Coscinasterias muricata</i> (1)
Z8954	24.02.97	35 53.60 S	174 33.70 E	22	<i>Coscinasterias muricata</i> (2)
Z8968	04.08.96	42 46.59 S 42 45.09 S	177 33.06 W 177 32.96 W	941–1060	<i>Novodinia novaezealandiae</i> (3)
Z8969	24.11.97	43 04.10 S 42 57.70 S	176 55.80 E 177 10.70 E	368–351	<i>Zoroaster</i> sp. C (2)
Z8978	13.01.97	44 08.54 S 44 08.13 S	178 37.83 W 178 41.97 W	482–483	<i>Zoroaster</i> sp. C (1)
Z8983	? . 05.97	47 37.00 S	169 27.00 E	200–500	<i>Cosmasterias dyscrita</i> (1), <i>Perissasterias monocantha</i> (1)
Z8986	17.01.98	37 28.23 S 37 30.76 S	176 34.39 E 176 36.30 E	330–364	<i>Zoroaster</i> sp. C (1) <i>Hymenodiscus aotearoa</i> (frags)
Z8987	17.01.98	37 29.68 S 37 27.28 S	176 40.35 E 176 38.03 E	460–493	<i>Hymenodiscus aotearoa</i> (frags)
Z8988	17.01.98	37 27.76 S 37 29.22 S	176 39.66 E 176 42.96 E	523–527	<i>Hymenodiscus aotearoa</i> (frags)
Z8989	18.01.98	37 32.55 S 37 33.50 S	176 48.61 E 176 46.40 E	550–579	<i>Hymenodiscus aotearoa</i> (1)
Z8990	18.01.98	37 31.70 S 37 31.29 S	176 46.96 E 176 43.50 E	570–590	<i>Asterostephane moluccana</i> (2)
Z8991	18.01.98	37 35.09 S 37 34.03 S	176 43.62 E 176 40.08 E	440–495	<i>Crossaster multispinus</i> (2) <i>Zoroaster</i> sp. C (1)
Z8992	18.01.98	37 34.02 S 37 36.58 S	176 39.22 E 176 41.21 E	299–340	<i>Asterostephane moluccana</i> (1)
Z8994	19.01.98	37 20.19 S 37 21.54 S	176 22.04 E 176 24.15 E	297–310	<i>Hymenodiscus aotearoa</i> (2)
Z8995	19.01.98	37 21.69 S 37 23.38 S	176 24.37 E 176 26.71 E	303–336	<i>Asterostephane moluccana</i> (3)
Z8996	19.01.98	37 23.23 S 37 25.44 S	176 32.85 E 176 35.40 E	525–552	<i>Hymenodiscus aotearoa</i> (frags)
Z8997	19.01.98	37 35.20 S 37 27.47 S	176 36.49 E 176 38.98 E	537–557	<i>Hymenodiscus aotearoa</i> (frags)
Z9000	20.01.98	37 37.11 S	177 13.93 E	445–467	<i>Odontohenricia endeavouri</i> (1), <i>Pteraster</i> sp. A (1) <i>Sclerasterias mollis</i> (1)
Z9001	20.01.98	37 37.89 S	177 09.10 E	205	<i>Henricia compacta</i> (1)
Z9003	20.01.98	37 32.61 S 37 33.56 S	177 05.01 E 177 08.00 E	323–327	<i>Pteraster</i> sp. B (1) <i>Hymenodiscus aotearoa</i> (frags)
Z9005	21.01.98	37 37.00 S 37 37.04 S	176 48.50 E 176 44.73 E	360–367	<i>Hymenodiscus aotearoa</i> (2)
Z9006	21.01.98	37 13.63 S 37 10.86 S	176 19.35 E 176 17.76 E	358–376	<i>Hymenodiscus aotearoa</i> (frag)
Z9008	22.01.98	37 09.87 S 37 12.67 S	176 21.77 E 176 22.96 E	518	<i>Henricia compacta</i> (1) <i>Asterostephane moluccana</i> (frags)
Z9014	23.01.98	36 54.78 S 36 51.76 S	176 20.43 E 176 20.44 E	588–599	<i>Hymenodiscus aotearoa</i> (2)
Z9016	23.01.98	36 48.01 S 36 45.17 S	176 18.12 E 176 16.88 E	522–529	<i>Hymenodiscus aotearoa</i> (frs)
Z9017	23.01.98	36 46.53 S	176 16.56 E	465	<i>Henricia compacta</i> (1)
Z9020	24.01.98	36 42.17 S 36 39.23 S	176 15.89 E 176 15.11 E	520–527	<i>Hymenodiscus aotearoa</i> (frags)
Z9022	24.01.98	36 38.78 S 36 41.61 S	176 10.97 E 176 12.21 E	288–298	<i>Hymenodiscus aotearoa</i> (frags)
Z9024	25.01.98	37 00.77 S 37 03.47 S	176 12.66 E 176 11.05 E	202–206	<i>Hymenodiscus aotearoa</i> (frags)
Z9026	? . ? . ?	31 58.83 S	174 15.87 E	700	<i>Pteraster obesus</i> (1)

Stn No.	Date	Latitude (°)	Longitude (°)	Depth (m)	Species and number
Z9155	19 06.98	36 09.61 S 36 09.40 S	176 46.59 E 176 45.72 E	759–952	<i>Perissasterias monocantha</i> (1)
Z9181	20.07.98	37 01.39 S	176 43.09 E	972	<i>Novodinia novaezealandiae</i> (1)
Z9186	08.04.98	46 29.34 S 46 30.11 S	166 25.57 E 166 29.73 E	562–570	<i>Crossaster multispinus</i> (1)
Z9194	13.04.98	49 13.92 S 49 16.45 S	168 15.24 E 168 15.24 E	637–639	<i>Zoroaster</i> sp. C (2)
Z9210					<i>Crossaster campbellicus</i> (1)
Z9217	08.07.98	40 49.31 S	168 42.43 E	930	<i>Hymenodiscus aotearoa</i> (frags)
Z9223	07.08.98	37 06.04 S	176 34.05 E	970	<i>Odontohenricia endeavouri</i> (1)
Z9244	24.11.97	43 04.10 S 42 57.70 S	176 55.80 E 177 10.70 E	368–351	<i>Sclerasterias mollis</i> (2)1
Z9270	10.09.98	37 18.90 S 37 18.70 S	167 22.00 E 167 22.30 E	876	<i>Cosmasterias dyscrita</i> (1)
Z9272	10.09.98	37 18.00 S	167 15.00 E	800–900	<i>Perissasterias monocantha</i> (1)
Z9302	15.09.98	49 10.00 S	168 36.00 E	750	<i>Crossaster multispinus</i> (1)
Z9304	20.09.98	47 19.99 S	169 28.99 E	630	<i>Henricia compacta</i> (1)
Z9308	18.09.98	49 57.00 S	168 06.99 E	560	<i>Zoroaster</i> sp. C (1)
Z9309	20.09.98	47 28.00 S	169 30.00 E	510	<i>Crossaster multispinus</i> (1)
Z9376	15.10.98	43 52.03 S	178 51.00 E	500	<i>Henricia compacta</i> (1)
Z9385	27.10.98	44 03.58 S 44 03.86 S	179 22.00 E 179 23.68 E	673–688	<i>Cosmasterias dyscrita</i> (frag.) <i>Perissasterias monocantha</i> (frag.)
Z9386	30.09.98	44 05.50 S 44 06.33 S	178 32.04 E 178 32.10 E	952–982	<i>Cosmasterias dyscrita</i> (1) <i>Perissasterias monocantha</i> (frag.)
Z9419	25.10.98	44 28.85 S 44 28.90 S	178 30.97 W 178 30.98 W	940–956	<i>Solaster torulatus</i> (2)
Z9419	25.10.98	44 28.85 S 44 29.89 S	178 30.97 W 178 30.98 W	940–956	<i>Cosmasterias dyscrita</i> (1) <i>Perissasterias monocantha</i> (1)
Z9420	20.10.98	44 38.02 S 44 37.70 S	176 58.56 W 176 56.89 W	848–898	<i>Solaster torulatus</i> (1) <i>Coronaster halicepus</i> (frag.)
Z9422	20.10.98	44 41.22 S 44 42.72 S	176 58.92 W 176 58.88 W	1021–1071	<i>Solaster torulatus</i> (1)
Z9429	01.10.98	44 13.05 S 44 13.34 S	179 03.08 E 179 03.05 E	935–965	<i>Pteraster robertsoni</i> (1)
Z9434	25.10.98	44 32.76 S 44 34.32 S	178 31.03 W 178 31.01 W	1045–1100	<i>Zoroaster</i> sp. C (1)
Z9440	27.10.98	44 03.57 S 44 03.77 S	179 20.82 E 179 22.89 E	677–692	<i>Pseudechinaster rubens</i> (1)
Z9442	01.10.98	44 09.43 S 44 10.92 S	178 46.84 E 178 46.67 E	922–967	<i>Cosmasterias dyscrita</i> (frag.) <i>Pseudechinaster rubens</i> (1), <i>Brisinga chathamica</i> (frags)
Z9453	09.10.98	44 34.56 S 44 36.06 S	177 49.89 W 177 49.81 W	978–1038	<i>Solaster torulatus</i> (2)
Z9454	19.10.98	44 40.12 S 44 41.61 S	176 04.63 W 176 04.68 W	1003–1100	<i>Solaster torulatus</i> (3)
Z9455	20.10.98	44 38.32 S 44 37.66 S	176 58.87 W 176 58.94 W	938–1006	<i>Brisinga chathamica</i> (frags)
Z9459	01.10.98	44 09.85 S 44 09.14 S	178 50.46 E 178 50.47 E	957–977	<i>Diplopteraster</i> n. sp.(1) <i>Brisinga chathamica</i> (frags)
Z9460	20.10.98	44 43.05 S 44 44.28 S	176 37.20 W 176 37.21 W	1000–1048	<i>Diplopteraster</i> n. sp. (1)
Z9461	21.10.98	44 35.29 S 44 34.91 S	177 27.43 W 177 29.03 W	852–858	<i>Pseudechinaster rubens</i> (frag.)
Z9466	19.10.98	44 42.10 S 44 42.08 S	176 13.95 W 176 11.84 W	1046–1061	<i>Solaster torulatus</i> (1)
Z9468	02.10.98	44 12.40 S 44 12.99 S	179 03.55 E 179 05.47 E	959–961	<i>Solaster torulatus</i> (1) <i>Diplopteraster hurleyi</i> (1)
Z9470	05.10.98	44 15.69 S 44 15.49 S	179 53.68 E 179 54.38 E	912–920	<i>Zoroaster</i> sp. C (1) <i>Cosmasterias dyscrita</i> (frag.), <i>Pseudechinaster rubens</i> (1)
Z9471	29.09.98	44 13.68 S 44 14.70 S	178 22.41 E 178 22.35 E	1105–1117	<i>Zoroaster spinulosus</i> (4)
Z9476	29.09.98	44 04.68 S 44 05.76 S	178 15.27 W 178 15.20 W	935–960	<i>Brisinga chathamica</i> (frags)
Z9486	17.10.98	44 42.69 S 44 42.58 S	176 33.21 W 176 34.35 W	1016–1076	<i>Solaster torulatus</i> (4)

Stn No.	Date	Latitude (°)	Longitude (°)	Depth (m)	Species and number
Z9491	01.10.98	44 08.80 S 44 09.22 S	179 05.46 E 179 07.47 E	854–862	<i>Pseudechinaster rubens</i> (frag.)
Z9493	20.10.98	44 41.90 S 44 42.22 S	176 47.17 W 176 45.72 W	965–998	<i>Solaster torulatus</i> (1) <i>Brisinga chathamica</i> (frags)
Z9512	30.12.98	43 37.98 S 43 39.97 S	173 53.34 E 173 53.55 E	105–106	<i>Sclerasterias mollis</i> (1)
Z9568	11 01.98	43 42.39 S 43 42.37 S	178 43.53 W 178 47.67 W	424–445	<i>Pseudechinaster rubens</i> (1)
Z9573	14.12.98	40.01.00 S	178 07.00 E	860	<i>Diplopteraster n. sp.</i> (1)
Z9574	09.12.98	42 54.00 S	173 51.00 E	1010	<i>Crossaster multispinus</i> (1)
Z9576	10.12.98	42 43.00 S	177 34.00 E	946	<i>Solaster torulatus</i> (1)
Z9582	01.12.98	50 15.00 S	163 32.08 E	1033	<i>Henricia compacta</i> (1)
Z9583	25.11.98	48 02.10 S	166 06.10 E	935	<i>Solaster torulatus</i> (2), <i>Pteraster robertsoni</i> (1), <i>Allostichaster</i> ? sp. (1), <i>Novodinia novaezealandiae</i> (1)
Z9610	08.12.98	42 48.99 S	173 51.00 E	1105	<i>Zoroaster sp. C</i> (1)
Z9611	08.12.98	42 49.30 S	173 51.20 E	1087	<i>Solaster torulatus</i> (1), <i>Diplopteraster n.sp.</i> (2)
Z9618	04.01.99	43 21.96 S 43 21.12 S	178 55.09 E 178 59.21 E	393–397	<i>Cosmasterias dyscrita</i> (1) <i>Pseudechinaster rubens</i> (1)
Z9622	19.01.99	44 18.53 S 44 18.07 S	174 21.90 E 174 26.02 E	643–646	<i>Solaster torulatus</i> (1) <i>Crossaster multispinus</i> (2)
Z9771	28.05.99	52 08.90 S	171 28.80 E	524	<i>Zoroaster sp. C</i> (1)
Z9778	10.07.99	34 06.30 S 34 05.89 S	174 54.40 E 174 54.40 E	862–1050	<i>Ceramaster cognatus</i> (1)
Z9790	02.07.99	42 45.87 S 42 45.89 S	179 59.47 W 179 59.39 W	800–825	<i>Crossaster multispinus</i> (?)
Z9791	02.07.99	42 45.39 S 42 45.35 S	179 56.60 W 179 56.67 W	947–982	<i>Cosmasterias dyscrita</i> (frag.)
Z9792	26.06.99	42 45.98 S 44 09.14 S	179 54.34 W 178 50.47 W	940	<i>Novodinia novaezealandiae</i> (frags)
Z9793	04.07.99	42 43.52 S 42 43.99 S	179 55.23 W 179 55.46 W	1055–1110	<i>Novodinia novaezealandiae</i> (2)
Z9795	30.06.99	42 45.05 S 42 43.53 S	179 47.60 W 179 47.63 W	1043–1100	<i>Zoroaster sp. C</i> (1)
Z9798	23.06.99	42 36.55 S 42 36.19 S	179 55.72 W 179 55.48 W	1225–1430	<i>Diplopteraster hurleyi</i> (1)
Z9811	28.06.99	35 56.00 S	164 58.80 E	948	<i>Solaster torulatus</i> (1)
Z9822	02.12.97	44 57.67 S	174 56.62 E	949–997	<i>Solaster torulatus</i> (1)
Z9825	09.05.99	41 04.21 S 41 03.98 S	176 22.90 E 176 23.44 E	353–344	<i>Sclerasterias mollis</i> (1)
Z9826	09.05.99	41 04.55 S 41 04.80 S	176 23.15 E 176 22.22 E	401–411	<i>Sclerasterias mollis</i> (1)
Z9828	09.05.99	41 04.20 S 41 03.99 S	176 21.95 E 176 22.50 E	315–297	<i>Sclerasterias mollis</i> (1)
Z9829	08.05.99	41 04.57 S 41 03.98 S	176 22.94 E 176 24.67 E	404–406	<i>Sclerasterias mollis</i> (1)
Z9833	15.07.99	41 04.37 S 41 03.28 S	176 22.46 E 176 24.69 E	?	<i>Cosmasterias dyscrita</i> (1)
Z9836	15.07.99	41 04.59 S 41 04.02 S	176 22.76 E 176 24.55 E	400–422	<i>Sclerasterias mollis</i> (2)
Z9843	05.06.99	36 30.38 S	176 30.98 E	920–1053	<i>Zoroaster sp. C</i> (3), <i>Calliaster sp.</i> (1)
Z9849	01.09.99	42 18.05 S 42 15.13 S	170 08.43 E 170 08.78 E	796–820	<i>Zoroaster spinulosus</i> (1) <i>Zoroaster sp. C</i> (1)
Z9850	01.09.99	42 26.58 S 42 26.61 S	170 21.45 E 170 16.31 E	531–630	<i>Crossaster multispinus</i> (2) <i>Zoroaster sp. C</i> (1)
Z9853	20.07.99	42 26.00 S 42 26.00 S	170 20.00 E 170 03.00 E	585–780	<i>Allostichaster insignis</i> (1)
Z9901	01.07.99	36 30.00 S 36 28.00 S	176 30.00 E 176 31.00 E	914–1043	<i>Novodinia novaezealandiae</i> (frag.)
Z9951	05.01.00	43 23.75 S 43 24.36 S	179 18.06 W 179 14.02 W	458–464	<i>Cosmasterias dyscrita</i> (2)
Z9953	09.01.00	43 38.55 S 43 41.29 S	179 45.83 W 179 47.53 W	366–374	<i>Pseudechinaster rubens</i> (1)
Z9960	16.12.99	43 12.54 S 43 12.09 S	173 09.82 E 173 07.16 E	42–45	<i>Sclerasterias mollis</i> (1)

Stn No.	Date	Latitude (°)	Longitude (°)	Depth (m)	Species and number
Z9961	16.12.99	43 10.22 S	173 02.31 E	41–43	<i>Sclerasterias mollis</i> (1)
		43 11.73 S	173 00.51 E		
Z9984	01.01.00	45 26.79 S	171 09.72 E	69–75	<i>Sclerasterias mollis</i> (3)
		45 24.85 S	171 10.40 E		
Z9985	01.01.00	45 24.25 S	171 01.76 E	43–45	<i>Sclerasterias mollis</i> (1)
		45 22.24 S	171 02.58 E		
Z10005					<i>Asterostephane moluccana</i> (frags)
Z10014					<i>Henricia</i> sp. (1)
Z10015	18.02.00	36 12.97 S	176 12.72 E	340	<i>Henricia sufflata</i> (1)
Z10061	17.03.00	37 02.00 S	176 29.80 E	949	<i>Novodinia novaezealandiae</i> (1)
Z10136	08.01.98	43 14.47 S	177 02.55 W	310–327	<i>Solaster torulatus</i> (1)
Z10169	03.06.99	39 29.45 S	178 25.05 E	1000	<i>Zoroaster</i> sp. C (4)
Z10170	03.06.99	39 28.24 S	178 24.77 E	865	<i>Henricia kapalae</i> (1), <i>Zoroaster</i> sp. C (1)
					<i>Cosmasterias dyscrita</i> (1)
Z10171	03.06.99	39 27.53 S	178 25.33 E	796	<i>Cosmasterias dyscrita</i> (1)
Z10184	12.01.00	43 41.55 S	176 57.58 E	465	<i>Mediaster</i> sp. (1), <i>Crossaster multispinus</i> (1)
Z10189	21.06.99	42 44.17 S	179 52.51 W	978–1030	<i>Zoroaster</i> sp. (1)
		42 45.66 S	179 52.58 W		<i>Brisinga chathamica</i> (3)
Z10191	02.12.97	45 06.53 S	174 47.03 E	1065–1080	<i>Zoroaster spinulosus</i> (5)
		45 08.03 S	174 46.96 E		
Z10198	02.01.00	43 31.50 S	176 02.87 W	270–274	<i>Zoroaster</i> sp. C (1)
		43 30.09 S	176 06.61 W		
Z10222	18.11.99	50 11.80 S	165 49.30 E	1090–1172	<i>Novodinia</i> sp.(disc)
Z10305	02.08.00	47 09.00 S	148 43.90 E	935–1058	<i>Hippasteria tasmanica</i> (1)
		47 08.80 S	148 44.70 E		
Z10308	31.07.00	49 22.50 S	150 27.00 E	913–1148	<i>Asthenactis</i> sp. (1).
		49 22.30 S	150 27.50 E		<i>Hippasteria falklandica</i> (1)
Z10584	07.01.01	43 53.91 S	177 52.84 W	421	<i>Zoroaster</i> sp. C (4)
Z10590	31.12.00	43 09.40 S	179 33.22 E	470–481	<i>Crossaster multispinus</i> (1)
		42 98.89 S	179 37.27 E		<i>Zoroaster</i> sp. C (3)
Z10591	07.12.00	49 33.58 S	168 01.12 E	670	<i>Zoroaster</i> sp. C (1)
Z10594	06.12.00	49 28.78 E	167 23.41 E	644	<i>Zoroaster</i> sp. C (1)
Z10596	27.11.00	48 29.14 S	172 30.24 E	989	<i>Solaster torulatus</i> (2), <i>Zoroaster</i> sp. C (3)
					<i>Hymenodiscus aotearoa</i> (frags)
Z10600	01.12.00	53 28.39 S	171 04.09 E	545	<i>Solaster torulatus</i> (1)
Z10606	08.12.00	50 47.11 S	170 43.90 E	564	<i>Solaster torulatus</i> (1)
Z10609	02.12.00	53 31.56 S	167 15.87 E	995	<i>Diplopteraster</i> sp. (1)
Z10612	05.01.01	44 02.20S	179 03.66W	306–328	<i>Brisinga chathamica</i> (frags)
		44 02.16S	178 59.46W		
Z10681	10.02.00	43 25.38 S	173 18.05 E	53–57	<i>Sclerasterias mollis</i> (1)
Z10683	02.01.00	44 16.76 S	172 59.90 E	112–124	<i>Sclerasterias mollis</i> (1)
Z10690	15.09.01	42 45.93 S	179 59.34 W	875–757	<i>Sphaeriodiscus irritatus</i> (2), <i>Novodinia novaezealandiae</i> (2)
Z10692	16.04.01	42 45.53 S	179 59.61 W	1040–1035	<i>Allostichaster</i> ? sp. (1)
Z10697	16.04.01	42 47.57 S	179 58.86 W	950–900	<i>Diabocilla clarki</i> (1), <i>Marginaster</i> ? sp. (1)
Z10698	16.04.01	42 47.17 S	179 59.12 W	993–900	<i>Ceramaster</i> sp. B (1), <i>Allostichaster</i> ? sp. (14)
					<i>Freyella echinata</i> (1)
Z10701	17.04.01	42 43.10 S	179 57.81 W	1150–1000	<i>Allostichaster</i> ? sp. (1)
Z10706	17.04.01	42 48.24 S	179 59.27 E	1013–931	<i>Marginaster</i> ? sp. (1)
Z10710	18.04.01	42 43.02 S	179 57.60 W	1162–980	<i>Allostichaster</i> ? sp. (1)
Z10713	18.04.01	42 43.79 S	179 53.42 W	1130–1000	<i>Marginaster</i> ? sp. (1), <i>Allostichaster</i> ? sp. (2)
					<i>Freyella echinata</i> (2)
Z10714	18.04.01	42 43.95 S	179 53.91 W	1076–990	<i>Mediaster australiensis</i> (1), <i>Pillsburiaster indutilis</i> (1), <i>Freyella echinata</i> (1), <i>Novodinia novaezealandiae</i> (1)
Z10719	18.04.01	42 46.13 S	179 55.68 W	987–895	<i>Brisinga chathamica</i> (frags)
Z10720	19.04.01	42 45.92 S	179 55.62 W	1058–990	<i>Novodinia novaezealandiae</i> (frags)
Z10721	19.04.01	42 45.64 S	179 59.27 W	972–890	<i>Ceramaster</i> sp. B (1)
Z10722	19.04.01	42 45.89 S	179 59.16 W	800–757	<i>Ceramaster</i> sp. B (1), <i>Freyella echinata</i> (1), <i>Novodinia novaezealandiae</i> (5)
Z10724	20.04.01	42 43.10 S	179 54.57 W	1075–1008	<i>Ceramaster</i> sp. B (1), <i>Freyella echinata</i> (7)
Z10725	20.04.01	42 43.83 S	179 54.08 W	1038–990	<i>Novodinia novaezealandiae</i> (frags)
Z10727	20.04.01	42 46.07 S	179 55.31 W	955–890	<i>Mediaster australiensis</i> (1), <i>Diabocilla clarki</i> (1), <i>Podosphaeraster somnambulator</i> (1), <i>Allostichaster</i> ? sp. (2)
Z10728	20.04.01	42 46.00 S	179 55.36 W	970–900	<i>Dipsacaster magnificus</i> (1) ditched, <i>Diabocilla clarki</i> (1), <i>Allostichaster</i> ? sp. (3), <i>Freyella echinata</i> (1)

Stn No.	Date	Latitude (°)	Longitude (°)	Depth (m)	Species and number
Z10731	20.04.01	42 43.57 S	179 53.91 W	1100–1000	<i>Marginaster</i> ? sp. (1), <i>Brisinga chathamica</i> (3)
Z10732	21.04.01	42 43.71 S	179 53.56 W	1070–990	<i>Ceramaster</i> sp. B (1), <i>Allostichaster</i> ? sp. (1)
Z10741	21.04.01	42 42.98 S	179 54.69 W	1050–1000	<i>Allostichaster</i> ? sp. (1), <i>Hymenodiscus aotearoa</i> (frags)
Z10743	21.04.01	42 43.10 S	179 57.63 W	1012–890	<i>Ceramaster</i> sp. B (1).
Z10767	19.05.01	35 44.51 S	178 30.29 E	470–260	<i>Coronaster reticulatus</i> (10)
		35 44.35 S	178 29.75 E		
Z10768	19.05.01	35 44.38 S	178 29.84 E	387–207	<i>Coronaster reticulatus</i> (1)
		35 44.30 S	178 29.30 E		
Z10769	19.05.01	35 44.10 S	178 29.86 E	416–220	<i>Anseropoda aotearoa</i> (1)
		35 44.12 S	178 29.60 E		<i>Coronaster reticulatus</i> (2)
Z10770	19.05.01	35 44.49 S	178 29.84 E	426–270	<i>Anseropoda aotearoa</i> (2)
		35 44.52 S	178 29.40 E		<i>Coronaster reticulatus</i> (1, frags)
Z10771	19.05.01	35 44.38 S	178 29.85 E	420–330	<i>Rumbleaster eructans</i> (1 juv.?)
		35 44.35 S	178 29.44 E		<i>Coronaster reticulatus</i> (3, frags)
Z10772	19.05.01	35 44.39 S	178 29.92 E	196–403	<i>Coronaster reticulatus</i> (frags)
		35 44.46 S	178 30.44 E		
Z10773	19.05.01	35 44.40 S	178 29.85 E	196–415	<i>Coronaster reticulatus</i> (3)
		35 44.71 S	178 30.02 E		
Z10775	20.05.01	35 44.28 S	178 29.89 E	340–300	<i>Coronaster reticulatus</i> (11)
		35 43.98 S	178 30.03 E		
Z10776	20.05.01	35 44.31 S	178 29.79 E	939–280	<i>Coronaster reticulatus</i> (3)
		35 43.95 S	178 29.38 E		
Z10779	20.05.01	35 44.40 S	178 30.28 E	641–243	<i>Allostichaster</i> ? sp. (1)
		35 44.30 S	178 29.75 E		<i>Coronaster reticulatus</i> (7)
Z10781	20.05.01	35 46.03 S	178 32.52 E	2120–1722	Asteriid sp. indet. (frags)
		35 45.62 S	178 31.70 E		
Z10783	21.05.01	35 44.50 S	178 30.25 E	393–1100	<i>Pseudarchaster jordani</i> (1)
		35 44.26 S	178 30.09 E		
Z10797	23.05.01	35 44.38 S	178 29.76 E	420–230	<i>Rumbleaster eructans</i> (3)
		35 44.34 S	178 29.46 E		<i>Coronaster reticulatus</i> (5)
Z10799	23.05.01	35 44.25 S	178 29.78 E	365–202	<i>Anseropoda aotearoa</i> (1), <i>Coronaster reticulatus</i> (2)
Z10801	23.05.01	35 43.34 S	178 33.52 E	2000–1935	Asteriid sp. indet. (frags)
		35 43.52 S	178 33.33 E		
Z10802	23.05.01	35 44.46 S	178 29.78 E	365–202	<i>Coronaster reticulatus</i> (18)
		35 43.98 S	178 29.70 E		
Z10804	23.05.01	35 44.27 S	178 30.48 E	1045–500	<i>Coronaster reticulatus</i> (2)
		35 44.37 S	178 29.71 E		
Z10805	23.05.01	35 44.35 S	178 29.74 E	200–500	<i>Anseropoda aotearoa</i> (2)
		35 44.24 S	178 29.53 E		<i>Coronaster reticulatus</i> (2)
Z10808	23.05.01	36 08.38 S	178 11.77 E	603–365	<i>Rumbleaster eructans</i> (1)
		36 08.26 S	178 11.43 E		
Z10810	24.05.1	36 08.73 S	178 11.98 E	750–670	<i>Coronaster reticulatus</i> (50)
		36 08.37 S	178 11.76 E		
Z10811	24.05.01	36 08.48 S	178 11.70 E	755–360	<i>Rumbleaster eructans</i> (1, frags)
		36 08.79 S	178 11.58 E		
Z10812	24.05.01	36 08.37 S	178 12.92 E	1210–1040	<i>Mediaster</i> sp. (1)
		36 08.40 S	178 12.55 E		
Z10813	24.05.01	36 08.73 S	178 11.98 E	750–570	<i>Allostichaster</i> ? sp. (1)
		36 08.37 S	178 11.76 E		<i>Coronaster reticulatus</i> (frag.)
Z10814	24.05.01	36 08.35 S	178 11.74 E	520–467	<i>Allostichaster</i> ? sp. (1)
		36 08.70 S	178 11.58 E		
Z10816	24.05.01	36 08.36 S	178 11.76 E	674–367	<i>Coronaster reticulatus</i> (2)
		36 08.08 S	178 11.96 E		
Z10818	24.05.01	36 08.29 S	178 11.75 E	730–470	<i>Leilaster spinulosus</i> (1), <i>Allostichaster</i> ? sp. (1),
		36 08.67 S	178 11.72 E		<i>Rumbleaster eructans</i> (1), <i>Coronaster reticulatus</i> (1)
?Z10819	24.05.01	36 08.27 S	178 11.74 E	485–415	<i>Brisinga chathamica</i> (3)
		36 07.96 S	178 11.70 E		
Z10822	15.01.01	43 43.70 S	176 34.56 E	438–430	<i>Solaster torulatus</i> (1), <i>Sclerasterias mollis</i> (1),
		43 44.38 S	176 30.52 E		<i>Pseudechinaster rubens</i> (1)
Z10823	17.01.01	44 01.81 S	175 25.05 E	490–514	<i>Solaster torulatus</i> (1), <i>Pseudechinaster rubens</i> (1),
		44 03.87 S	175 28.08 E		<i>Sclerasterias mollis</i> (1)
Z10824	20.01.01	44 34.96 S	172 57.17 E	527–479	<i>Diplopteraster hurleyi</i> (1)
		44 38.76 S	173 01.03 E		

Stn No.	Date	Latitude (°)	Longitude (°)	Depth (m)	Species and number
Z10825	18.01.01	43 50.61 S	175 35.78 E	419–430	<i>Pteraster bathamae</i> (1)
		43 52.26 S	175 32.31 E		
Z10827	14.01.01	43 33.78 S	176 25.57 E	386–394	<i>Crossaster multispinus</i> (1)
		43 34.73 S	176 29.49 E		<i>Pseudechinaster rubens</i> (1)
Z10828	16.01.01	44 21.35 S	176 09.29 E	241–217	<i>Paralophaster hyalinus</i> (3)
		44 19.90 S	176 09.96 E		
Z10829	30.12.00	43 15.65 S	178 25.51 E	374–392	<i>Zoroaster spinulosus</i> (3)
		43 16.12 S	178 29.59 E		
Z10830	20.01.01	43 47.53 S	174 15.28 E	500–524	<i>Solaster torulatus</i> (1)
		43 45.78 S	174 18.66 E		
Z10832	01.01.01	42 51.54 S	177 23.52 W	757–752	<i>Pseudechinaster rubens</i> (1)
		42 51.83 S	177 19.44 W		
Z10873	04.07.01	39 46.59 S	178 09.28 E	1225	<i>Pseudarchaster jordani</i> (1)
Z10874	04.07.01	39 43.57 S	178 13.21 E	960	<i>Pteraster robertsoni</i> (1), <i>Pseudechinaster rubens</i> (1)
Z10878	30.12.99	42 56.44 S	179 13.00 W	559	<i>Crossaster multispinus</i> (1)
Z10881	30.12.99	42 50.98 S	179 15.72 W	694	<i>Crossaster multispinus</i> (1)
Z10888	04.07.00	41 13.36 S	170 30.10 E	630	<i>Zoroaster</i> sp. C (1)
Z10937	17.10.01	44 27.90 S	179 30.49 W	1040	<i>Tremaster mirabilis novaecaledoniae</i> (1)
Z10978	24.04.00	37 30.31 S	172 13.68 E	1060	<i>Ceramaster</i> sp. A (1)
Z11013	22.02.02	37 17.80 S	168 13.00 E	1074–1262	<i>Pseudarchaster jordani</i> (1), Pterasterid sp. (1) ditched
Z11043	13.04.02	34 57.81 S	175 12.64 E	614–612	<i>Cheiraster ludwigi</i> (1)
Z11045	13.04.02	34 57.63 S	175 10.44 E	554–518	<i>Dipsacaster magnificus</i> (1), <i>Marginaster</i> sp. (1)
Z11047	14.04.02	34 06.91 S	174 08.70 E	625	? <i>Cosmasterias dyscrita</i> (1)
Z11051	15.04.02	34 05.98 S	174 06.83 E	480–470	<i>Pteraster obesus</i> (1)
Z11052	15.04.02	34 04.46 S	174 04.21 E	622–590	<i>Astropecten ?dubiosus</i> (1), <i>Zoroaster</i> sp. (1)
Z11053	16.04.02	34 04.32 S	174 04.08 E	630–560	<i>Astropecten ?dubiosus</i> (1), <i>Zoroaster</i> sp. (1)
Z11056	16.04.02	34 05.77 S	174 06.88 E	490–515	? <i>Cosmasterias dyscrita</i> (5)
Z11063	18.04.02	34 09.85 S	173 57.84 E	805–820	<i>Cheiraster ludwigi</i> (1)
Z11066	19.04.02	34 02.55 S	174 49.02 E	792–880	<i>Astropecten ?dubiosus</i> (1), <i>Henricia compacta</i> (1)
Z11138					? <i>Diplopteraster</i> sp. (1)
Z11198	16.04.02	33 10.246 S	179 58.208 W	999–643	<i>Astroceramus denticulatus</i> (1)
		33 09.763 S	179 57.738 W		
Z11213	20.04.02	31 05.917 S	179 06.379 W	1272–1248	<i>Mediaster</i> sp. (1)
		31 05.924 S	179 05.848 W		
Z11229	23.04.02	30 01.891 S	178 48.061 W	872–1086	<i>Astroceramus denticulatus</i> (1)
		30 02.371 S	178 48.484 W		
Z11193	15.04.02	33 09.389 S	179 57.172 W	613–667	<i>Leilaster spinulosus</i> (1)
		33 09.458 S	179 57.769 W		
MONZ					
BS715	20.02.79	37 17.00 S	176 51.00 E	251–308	<i>Patagiaster granulatus</i> (1)
MONZ J2/13/80		50 59.84 S	165 55.73 E	249	<i>Psilaster acuminatus</i> (1)

Stn No.	Date	Latitude (°)	Longitude (°)	Depth (m)	Species and number
TAN0306/04	14.04.03	50 56.32 S	164 33.17 E	1053–998	<i>Psilaster acuminatus</i> (1), <i>Cladaster latus</i> (2), <i>Henricia compacta</i> (3)
TAN0306/05	14.04.03	51 03.22 S	164 36.44 E	990–973	? <i>Dipsacaster magnificus</i> (1 juv.), <i>Pillsburiaster indutilis</i> (1), <i>Plinthaster?dentatus</i> (1), <i>Cladaster latus</i> (1)
TAN0306/06	14.04.03	50 56.57 S	164 36.86 E	1140–1105	<i>Dipsacaster magnificus</i> (1), <i>Pillsburiaster indutilis</i> (1), <i>Henricia compacta</i> (1), <i>Allostichaster</i> n. sp. (1)
TAN0306/07	14.04.03	51 04.34 S	164 36.37 E	1065–1030	<i>Cladaster latus</i> (1)
TAN0306/08	14.04.03	51 03.89 S	164 35.29 E	968–973	<i>Astropectinid</i> sp. (1), <i>Pillsburiaster indutilis</i> (2), <i>Henricia compacta</i> (3)
TAN0307/13	19.04.03	49 22.12 S 49 21.95 S	171 32.17 E 171 32.43 E	237–230	<i>Odontaster aucklandensis</i> (1)
TAN0307/32	21.04.03	49 19.38 S 49 19.31 S	176 36.11 E 176 35.69 E	1433–1449	<i>Hymenodiscus</i> sp. (frags) <i>Mediaster arcuatus</i> (1), <i>Psilaster acuminatus</i> (6)
TAN0307/41	22.04.03	49 38.02 S 49 38.06 S	178 48.11 E 178 47.72 E	127–123	<i>Pteraster bathamae</i> (1) <i>Henricia aucklandiae</i> (3)
TAN0307/42	22.04.03	49 38.04 S 49 38.05 S	178 50.54 E 178 50.26 E	114–121	
TAN0307/43	22.4.03	49 38.10 S 49 38.04 S	178 47.51 E 178 47.26 E	103–108	<i>Henricia aucklandiae</i> (4)
TAN0307/44	22.04.03	49 36.80 S 49 36.70 S	178 46.67 E 178 46.48 E	287–350	
TAN0307/45	23.04.03	49 39.71 S 49 39.95 S	178 52.55 E 178 52.53 E	270–296	<i>Astromesites primigenius</i> (1) <i>Benthopecten munidae</i> (1), <i>Cladaster latus</i> (1)
TAN0307/46	23.04.03	49 39.91 S 49 40.14 S	178 54.41 E 178 54.22 E	524–504	<i>Ceramaster</i> sp. B (1) <i>Novodinia</i> sp. (frag.)
TAN0307/47	23.04.03	49 35.81 S 49 36.22 S	178 50.95 E 178 50.09 E	725–731	<i>Psilaster acuminatus</i> (4) <i>Cheiraster otagoensis</i> (1), <i>Mediaster arcuatus</i> (3), <i>Brisingenid</i> sp. (frags)
TAN0307/55	28.04.03	49 40.14 S 49 40.68 S	179 55.52 E 179 55.29 E	2648–2650	<i>Hymenaster</i> sp. (6)
TAN0307/59	29.04.03	49 18.64 S 49 18.07 S	179 47.88 E 179 48.33 E	1506–1476	
TAN0307/64	29.04.03	48 40.41 S 48 40.38 S	179 37.35 E 179 36.58 E	757–764	<i>Psilaster acuminatus</i> (5) <i>Cheiraster otagoensis</i> (2), <i>Mediaster arcuatus</i> (2), <i>Solaster torulatus</i> (1), <i>Pterasterid</i> sp. (3)
TAN0307/67	30.04.03	48 14.84 S 48 14.76 S	179 29.29 E 179 29.65 E	282–283	
TAN0307/68	30.04.03	48 21.08 S	179 36.08 E	445	<i>Henricia compacta</i> (3)
TAN0307/79	02.05.03	49 48.63 S	176 40.70 W	908–887	<i>Astropectinid</i> sp. (1)
TAN0307/81	02.05.03	49 47.95 S 49 48.24 S	176 41.64 W 176 40.63 W	1180–881	
TAN0307/82	02.05.03	49 49.16 S	176 44.65 W	12180–1210	<i>Paralophaster</i> sp. (1)
TAN0307/83	02.05.03	49 46.10 S 49 46.44 S	176 45.45 W 176 44.87 W	1278–1261	<i>Cheiraster otagoensis</i> (1) <i>Pterasterid</i> sp. (1), <i>Henricia compacta</i> (1)
TAN0307/99	06.05.03	44 59.36 S 44 59.36 S	177 25.46 E 177 24.83 E	1890–1825	<i>Porcellanaster ceruleus</i> (1)

Stn No.	Species and number
TAN0308/06	<i>Zoroaster</i> sp. (1)
TAN0308/09	<i>Mediaster</i> sp. (1), <i>Rosaster</i> sp. (1)
TAN0308/16	Brisingidae sp.(1)
TAN0308/20	Paxillosida (lots?), <i>Henricia</i> sp. (1), Brisingidae sp. (1), small seastar (long arm) (1)
TAN0308/24	<i>Luidia</i> sp. (1), Ophidiasterid sp. (1)
TAN0308/29	<i>Mediaster</i> sp. (1), Asteroid #2 (1)
TAN0308/32	<i>Astroceramus</i> n. sp. (1), <i>Solasteridae</i> sp. (1)
TAN0308/40	<i>Dytaster</i> sp. (1), <i>Henricia</i> sp. (1)
TAN0308/43	<i>Astromesites</i> sp. (1), <i>Dytaster</i> sp. (12), <i>Pectinaster</i> sp. (1), <i>Zoroaster</i> sp. (1)
TAN0308/49	<i>Henricia</i> sp. (3)
TAN0308/51	<i>Dytaster</i> sp. (2), <i>Pteraster</i> sp. (1), <i>Henricia</i> sp. (1), unidentified starfish (1)
TAN0308/52	<i>Cheiraster</i> sp. 1 (1), Solasterid sp. (1)
TAN0308/55	Goniasteridae sp. B (1)
TAN0308/56	<i>Tarachaster</i> sp. 1 (2), <i>Zoroaster</i> sp. (2)
TAN0308/57	Asteroid sp. (1)
TAN0308/58	Asteroid sp. 4 (1)
TAN0308/60	Asteroid sp. (1)
TAN0308/64	<i>Mediaster</i> sp. (2)
TAN0308/66	<i>Mediaster</i> sp. (3)
TAN0308/68	<i>Luidia</i> sp. 2 (1), sea-star sp. 6, orange mottled (4), sea-star sp. 7, thin mottled (1)
TAN0308/69	Seastar sp. 7, thin mottled (1)
TAN0308/71	<i>Dytaster</i> sp. (4), <i>Pectinaster</i> sp. (10), <i>Pteraster</i> sp. 2 (3), <i>Hymenaster</i> sp. 1 (3), <i>Asthenactis</i> sp. 1 (1)
TAN0308/72	<i>Plutonaster</i> sp. (1), <i>Asthenactis</i> sp. 1 (1)
TAN0308/73	<i>Benthopecten</i> sp. 1, <i>Pseudarchaster</i> sp. 1? (1)
TAN0308/77	<i>Psilaster</i> sp. 1 (1), <i>Plutonaster</i> sp. (1), <i>Cheiraster</i> sp. 1 (1), Pterasterid sp. (1)
TAN0308/78	<i>Dytaster</i> sp. 1 (14), <i>Pillsburiaster</i> sp. 1 (1), Goniasterid sp. (1), Brisingid sp. (1)
TAN0308/80	<i>Astropecten</i> sp. 1 (1), <i>Dytaster</i> sp. (1), <i>Pectinaster</i> sp. (2), Echinasterid sp. 1 (1), Brisingid sp. (1)
TAN0308/82	<i>Psilaster</i> sp. 2 (1), <i>Pectinaster</i> sp. (2), <i>Henricia</i> sp. 3 (25)
TAN0308/85	Brisingid sp. (1)
TAN0308/86	<i>Dipsacaster</i> sp. (1), <i>Sclerasterias</i> sp. 1 (2), Brisingid sp. (1), Asteroid sp. (2)
TAN0208/89	<i>Persephonaster</i> sp. 1 (3), <i>Cheiraster</i> sp. 2 (1), Brisingid sp. (1)
TAN0308/91	<i>Dytaster</i> sp. (1), <i>Plutonaster</i> sp. (1), <i>Mediaster</i> sp. (5), <i>Pillsburiaster</i> sp. 1 (2), <i>Rosaster</i> sp. 1 (1), <i>Pteraster</i> sp. (6), <i>Pteraster</i> sp. 2 (1), <i>Pteraster</i> sp. 3 (4)
TAN0308/94	<i>Astropecten</i> sp. 1 (1), Brisingid sp. (1)
TAN0308/95	Brisingid sp. (1)
TAN0308/96	Brisingid sp. (1)
TAN0308/97	<i>Henricia</i> sp. 3 (3), <i>Coronaster</i> sp. 1 (1), <i>Cosmasterias</i> sp. (1), <i>Sclerasterias</i> sp. 1 (1), Brisingid sp. (1)
TAN0308/100	<i>Coronaster</i> sp. 1 (1), <i>Cosmasterias</i> sp. (1), <i>Sclerasterias</i> sp. (3), sea-star sp. 7, thin mottled (1)
TAN0308/101	<i>Benthopecten</i> sp. 2 (1), <i>Zoroaster</i> sp. (1), <i>Zoroaster</i> sp. 2 (1)
TAN0308/102	<i>Benthopecten</i> sp. 2 (1), <i>Pillsburiaster</i> sp. 1 (3), <i>Rosaster</i> sp. 1 (1), <i>Pseudarchaster maddougalli</i> (1), Solasterid sp. (4), <i>Hymenaster</i> sp. 1 (1), <i>Zoroaster</i> sp. (20), <i>Zoroaster</i> sp. 2 (10), Asteroid sp. (12)
TAN0308/106	<i>Astropecten polyacanthus</i> (1), <i>Anseropoda</i> sp. (1), <i>Asterodiscides truncatus</i> (2)
TAN0308/107	<i>Persephonaster</i> sp. 1 (1), <i>Tosia</i> sp. (1), <i>Henricia</i> sp. 3 (1), <i>Zoroaster</i> sp. (1)
TAN0308/120	<i>Zoroaster</i> sp. (2), Brisingenid sp. (1)
TAN0308/126	<i>Mediaster</i> sp. (3), <i>Tamaria</i> sp. (3), <i>Cosmasterias</i> sp. (1)
TAN0308/133	<i>Nepanthia</i> sp. 1 (1)
TAN0308/136	<i>Benthopecten</i> sp. 2 (1), <i>Mediaster</i> sp. (4), <i>Pteraster</i> sp. (1)
TAN0308/138	<i>Dipsacaster magnificus</i> (1)
TAN0308/139	<i>Cheiraster</i> sp. 3 (1)
TAN0308/141	<i>Persephonaster</i> sp. 1 (1), <i>Mediaster</i> sp. (1), Asterinid sp. (2), <i>Zoroaster</i> sp. 2 (2)
TAN0308/142	<i>Zoroaster</i> sp. 2 (1)
TAN0308/145	<i>Plutonaster</i> sp. (1), <i>Zoroaster</i> sp. (1)
TAN0308/146	<i>Gilbertaster</i> sp. (1)
TAN0308/147	Solasterid sp. (1)
TAN0308/150	<i>Psilaster acuminatus</i> (1), <i>Pillsburiaster</i> sp. 1 (1)
TAN0308/154	? <i>Tosia</i> sp. (1), Goniasterid sp. B (1), <i>Nepanthia</i> sp. 1 (2), <i>Podosphaeraster</i> sp. 1 (1), Solasterid sp. (1), <i>Leilaster</i> sp. (1), <i>Coronaster</i> sp. 1 (1), <i>Cosmasterias</i> sp. (1), <i>Sclerasterias</i> sp. 1 (2)
TAN0308/158	<i>Psilaster</i> sp. 2 (1), <i>Mediaster</i> sp. (1), <i>Zoroaster</i> sp. (1)
TAN0308/159	<i>Psilaster</i> sp. 2 (1), <i>Ceramaster</i> sp. 1 (1)
TAN0308/160	<i>Rosaster</i> sp. 1 (1), <i>Zoroaster</i> sp. 2 (1), Brisingid sp. (1)
TAN0308/164	<i>Ceramaster</i> sp. 1 (1)
TAN0308/167	<i>Benthopecten</i> sp. (1), <i>Hymenaster</i> sp. 1 (2)

Freezer cleanout (Positions in Mfish database)

Stn No.	Species and number
TAN9511/182	<i>Zoroaster spinulosus</i> (1)
TAN9713/30	<i>Zoroaster spinulosus</i> (5)
TAN9908/13	<i>Plutonaster</i> sp. (6) ditched
TAN9908/14	Brisingid sp. (arms) ditched
TAN9908/15	<i>Cheiraster</i> sp. (1) 1 jar. <i>Brisinga</i> sp. (6 discs, arms)
TAN9908/23	<i>Pillsburiaster aoteanus</i> (1) ditched, <i>Pterasterid</i> sp. (1) ditched, <i>Zoroaster</i> sp. (1) ditched, <i>Brisinga</i> sp. (frags) ditched
TAN9908/38	<i>Pillsburiaster aoteanus</i> (1) ditched, <i>Brisinga</i> sp. (frags)
TAN0001/05	<i>Plutonaster knoxi</i> (11) ditched, <i>Crossaster multispinus</i> (5) ditched, <i>Zoroaster</i> sp. C (1) ditched
TAN0001/06	<i>Crossaster multispinus</i> (3) ditched
TAN0001/07	<i>Dipsacaster magnificus</i> (1) ditched; R 172 mm. <i>Plutonaster knoxi</i> (2) ditched, <i>Crossaster multispinus</i> (10) ditched
TAN0001/08	<i>Crossaster multispinus</i> (3) ditched, <i>Dipsacaster magnificus</i> (2) ditched, <i>Plutonaster knoxi</i> (2) ditched
TAN0001/09	<i>Dipsacaster magnificus</i> (1) ditched, <i>Plutonaster knoxi</i> (4) ditched, <i>Crossaster multispinus</i> (1) ditched
TAN0101/08	<i>Dipsacaster magnificus</i> (1) ditched, <i>Pillsburiaster aoteanus</i> (2) ditched, <i>Hippasteria phrygiana</i> (2) ditched, <i>Pterasterid</i> sp. (1) ditched, <i>Zoroaster spinulosus</i> (8) ditched, <i>Brisinga</i> sp. arms ditched
TAN0201/001	<i>Pillsburiaster aoteanus</i> (3) ditched
TAN0201/14	<i>Cosmasterias dyscrita</i> (1) ditched
TAN0201/20	<i>Mediaster sladeni</i> (1) ditched
TAN0208/16	<i>Brisinga</i> sp. (1 disc, arms)
TAN0208/25	<i>Brisinga</i> sp. (2 discs, arms) ditched
TAN0208/29	<i>Pillsburiaster aoteanus</i> (1) ditched
TAN0208/54	<i>Brisinga</i> sp. (arms) ditched
TAN0208/60	<i>Zoroaster spinulosus</i> (1) ditched, <i>Brisinga</i> sp. (1) ditched
TAN0208/62	<i>Plutonaster</i> sp. (1) 1 jar
TAN0208/64	<i>Brisinga</i> sp. (arms) ditched
TAN0208/117	<i>Mediaster arcuatus</i> (1) ditched
TAN0219/07	<i>Pseudechinaster rubens</i> (1); R about 200 mm
TAN0219/69	? <i>Pteraster</i> sp. (1)
TAN0219/75	<i>Henricia</i> sp. (1)
TAN0219/84	<i>Sclerasterias mollis</i> (1) ditched
TAN0219/85	<i>Sclerasterias mollis</i> (1) ditched
TAN0219/91	<i>Sclerasterias mollis</i> (3) ditched
TAN0219/92	<i>Dipsacaster magnificus</i> (1) ditched, <i>Sclerasterias mollis</i> (1) ditched
TAN0219/97	<i>Crossaster multispinus</i> (1) ditched
TAN0219/103	<i>Ceramaster</i> sp. (1)
TAN0219/104	<i>Mediaster</i> sp. (1)
KAH9704/18	<i>Pteraster bathamae</i> (1)
KAH9809/70	<i>Sclerasterias mollis</i> (1) ditched
KAH0203/33	<i>Asterostephane moluccana</i> (1)
KAH0004/49	<i>Psilaster acuminatus</i> (1) ditched
KAH0004/50	<i>Psilaster acuminatus</i> (2) ditched, <i>Mediaster sladeni</i> (1) ditched
KAH0304/04	<i>Coscinasterias muricata</i> (1)
KAH0304/31	<i>Psilaster acuminatus</i> (2)
?KAH94/08	<i>Henricia compacta</i> (1)
?KAH9701/54 or 59	<i>Henricia compacta</i> (2)
AEX9901/48	<i>Plutonaster fragilis</i> (2) ditched, <i>Pillsburiaster aoteanus</i> (1) ditched
AEX9901/52	<i>Benthopecten munitidae</i> (1) ditched
AEX9901/35	<i>Plutonaster</i> sp. (3) 1 jar
Trip1288/13	<i>Dipsacaster magnificus</i> (1) ditched. <i>Hippasteria phrygiana</i> (4) large R about 165 mm.
Trip1288/17	<i>Crossaster multispinus</i> (6) ditched
1288/31	Asteroid defunct ditched
1288/53	<i>Crossaster multispinus</i> (1) ditched
1288/54	<i>Cosmasterias dyscrita</i> (1) ditched
1319/02	<i>Solaster torulatus</i> (1) ditched
1319/08	
1042	<i>Dipsacaster magnificus</i> (1) ditched (coll. D.P. Fairfax)
Trip1371/82 (13.02.03)	44 38.3 S, 177 21.7 W, 905–1064 m: <i>Plutonaster knoxi</i> (2) ditched, <i>Solaster torulatus</i> (1) ditched
1693/29 (14.10.02)	<i>Ceramaster</i> sp. (1) dry
TAN9908?? (no label)	<i>Brisinga</i> sp. few ditched

Additional data from H.E.S. Clark

Stn No.	Species and number
G323	<i>Pseudarchaster garricki</i> (1)
G937	<i>Dipsacaster magnificus</i> (1)
I32	<i>Proserpinaster neozelanicus</i> (1)
I33	<i>Psilaster acuminatus</i> (1), <i>Crossaster multispinus</i> (1), <i>Pectinaster mimicus</i> (1), <i>Pseudarchaster garricki</i> (4)
I690	<i>Mediaster arcuatus</i> (1)
I693	<i>Odontaster benhami</i> (1)
J482	<i>Pseudarchaster garricki</i> (1)
S151	<i>Porcellanaster ceruleus</i> (1) small, <i>Hymenaster pullatus</i> (1) small, <i>Zoroaster spinulosus</i> (1) small
T50	<i>Paralophaster hyalinus</i> (2)
U591	<i>Sclerasterias mollis</i> (1) small
V423	<i>Dipacaster magnificus</i> (1), <i>Psilaster acuminatus</i> (1)
W249	<i>Hippasteria phrygiana</i> (1)
Z8254	<i>Anthenoides granulosis</i> (1)
Z8539	<i>Pseudarchaster garricki</i> (1) (Position 52° 10.55 S, 172° 05.97 E, 577–582 m)
Z8540	<i>Mediaster sladeni</i> (1)
Z8552	<i>Pseudarchaster garricki</i> (1)
Z8559	<i>Pseudarchaster garricki</i> (1)
Z8614	<i>Henricia lukinsii</i> (1)
Z8969	<i>Anthenoides granulosis</i> (1)
Z8985	<i>Pseudarchaster garricki</i> (1)
Z9209	<i>Dipsacaster magnificus</i> (1)
Z9237	<i>Gilbertaster anacanthus</i> (1)
Z9403	<i>Gilbertaster anacanthus</i> (1)
Z9599	<i>Gilbertaster anacanthus</i> (1)
Z9748	<i>Astromesites compactus</i> (1)
Z9792	<i>Hippasteria phrygiana</i> (1)
Z9844	<i>Gilbertaster anacanthus</i> (1)
Z10176	<i>Hippasteria phrygiana</i> (1)
Z11084	<i>Dipsacaster magnificus</i> (1)
Unresolved, all juveniles:	
C344	<i>Astropecten</i> sp. juv. (1)
E127	<i>Notasterias</i> sp. juv. (1)
E403	? <i>Psilaster tiny</i> (3)
G309	tiny (1)
G385	tiny (1)
I685	<i>Astropectinid</i> sp. (10 small)
P65	tiny (1)
Q3B	<i>Pseudarchaster</i> sp. juv. (1)
Q4	? <i>Pseudarchaster</i> 3 small
S151	1 jar to sort and determine
S894	? <i>Psilaster tiny</i> (1)
T39	<i>Astropectinid</i> sp. (1)
U195	<i>Benthopecten</i> sp. (1) rotting
U200	? <i>Dytaster</i> sp. (1)
U571	? <i>Plutonaster</i> sp. (1)
U572	? <i>Astropectinid</i> sp. (2)
V362	<i>Plutonaster</i> sp. (1)
V372	tiny (2)
V381	DAB, juveniles (2)
Z2707	? <i>Astropecten</i> sp. (1) small

Material ex Smithsonian, H.B. Fell collection

Stn No.	Species and number
A701	<i>Psilaster acuminatus</i> (20) small
A702	<i>Astromesites primigenius</i> (1)
A706	<i>Astromesites primigenius</i> (1)
A714	<i>Astromesites primigenius</i> (4), <i>Sclerasterias mollis</i> (1), <i>Allostichaster insignis</i> (1)
A715	<i>Astromesites primigenius</i> (2)
A716	<i>Astromesites primigenius</i> (5)
A717	<i>Psilaster acuminatus</i> (5)
A721	<i>Henricia aucklandiae</i> (1)
A734	<i>Henricia aucklandiae</i> (4)
A738	<i>Henricia aucklandiae</i> (3), <i>Allostichaster insignis</i> (3), <i>Anasterias laevigata</i> (1)
A743	<i>Anasterias laevigata</i> (3)
A746	<i>Astromesites primigenius</i> (5), <i>Odontaster</i> sp. juveniles (5), <i>Allostichaster insignis</i> (1)
A748	<i>Henricia aucklandiae</i> (1)
A748	<i>Henricia aucklandiae</i> (1)
A750	<i>Henricia aucklandiae</i> (3), <i>Odontaster</i> sp. juveniles (3)
A751	<i>Sclerasterias mollis</i> (9), <i>Crossaster multispinus</i> (1), <i>Henricia compacta</i> (3), <i>Ceramaster patagonicus patagonicus</i> (2)
A753	<i>Astromesites primigenius</i> (1)
A759	<i>Pseudarchaster garricki</i> (1), <i>Psilaster acuminatus</i> (3)
A760	<i>Psilaster acuminatus</i> (2)
C618	<i>Novodinia novaezealandiae</i> (frag.) arm of Holotype
D32	<i>Solaster torulatus</i> (1)
D85	<i>Ceramaster patagonicus patagonicus</i> (6), <i>Lithosoma novaezealandiae</i> (1)
D85	<i>Pillsburiaster aoteanus</i> (1)

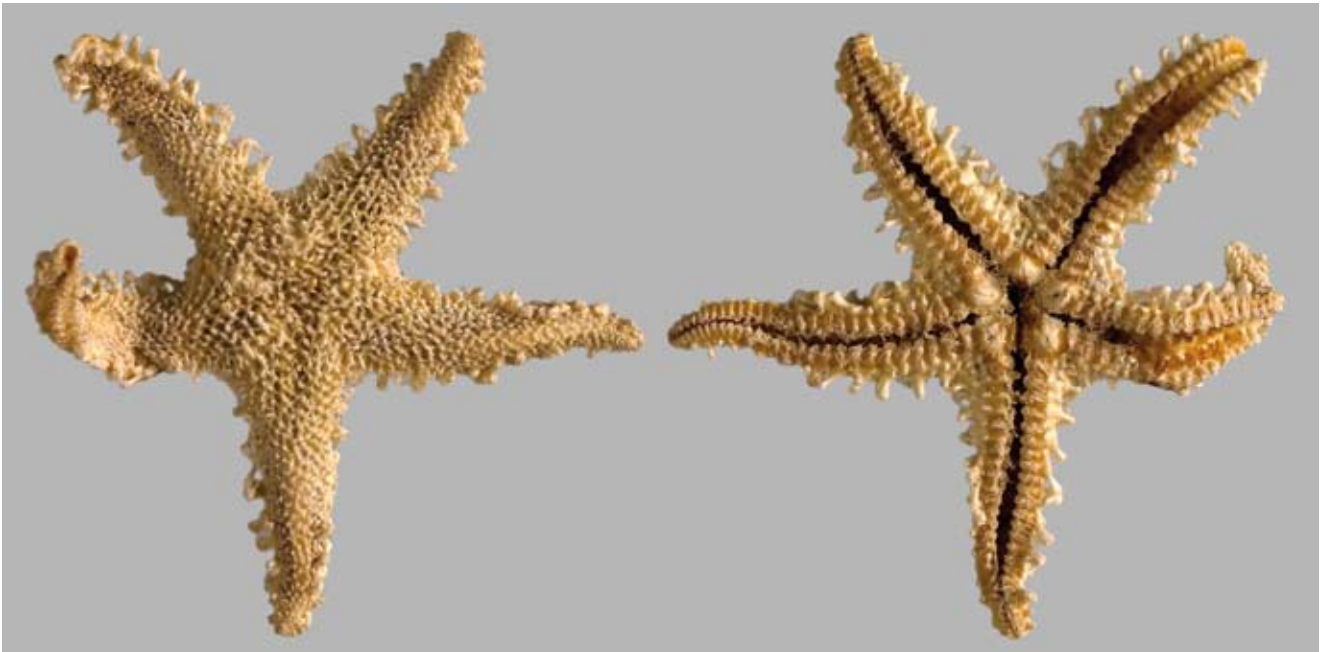


Plate 1. *Lophaster suluensis* Fisher. NIWA Station U567, R/r = 25/7 mm.



Plate 2. *Paralophaster hyalinus* H.E.S. Clark. NIWA Station Q16, R/r = 51/16 mm.



Plate 3. *Solaster torulatus* Sladen NIWA Station Z10600, R/r =125/46 mm.



Plate 4. *Crossaster multispinus* H.L. Clark. NIWA Station G276A, R/r = 62/27 mm.

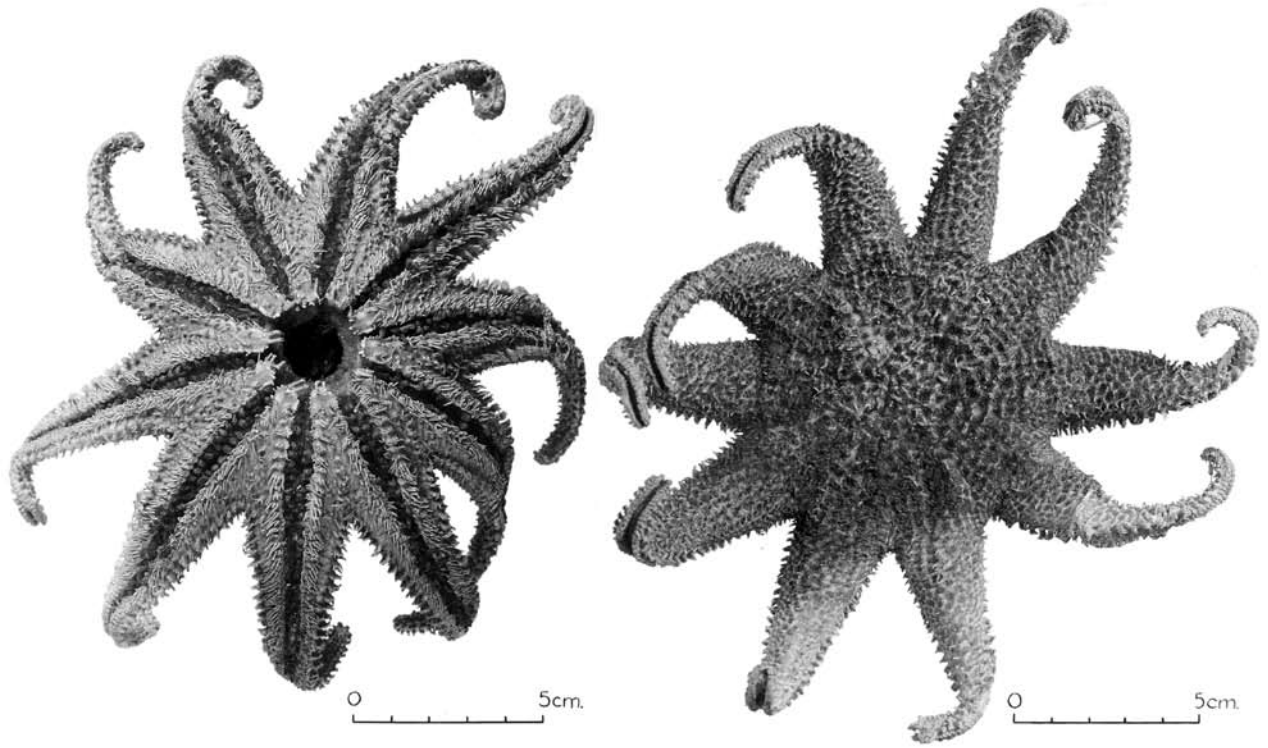


Plate 5. *Crossaster campbellicus* McKnight. NIWA Station D210? R/r = 128/44mm.



Plate 6. *Peribolaster lictor* Fell. NIWA Station I700, R/r = 78/32mm.



Plate 7. *Pteraster (Pteraster) robertsoni* McKnight. NIWA Station F127. R/r = 30/16 mm.



Plate 8. *Pteraster (Apterodon) bathamae* Fell. NIWA Station B487, R/r = 43/31 mm.



Plate 9. *Pteraster (Apterodon) stellifer* Sladen. NIWA Station D213, R/r = 17/12 mm.



Plate 10. *Pteraster (Apterodon) obesus* H.L. Clark. NIWA Station Z2098, R/r = 13/10 mm.



Plate 11. *Pteraster (Retaster)* sp. NIWA Station I32, R/r = 22/11 mm.

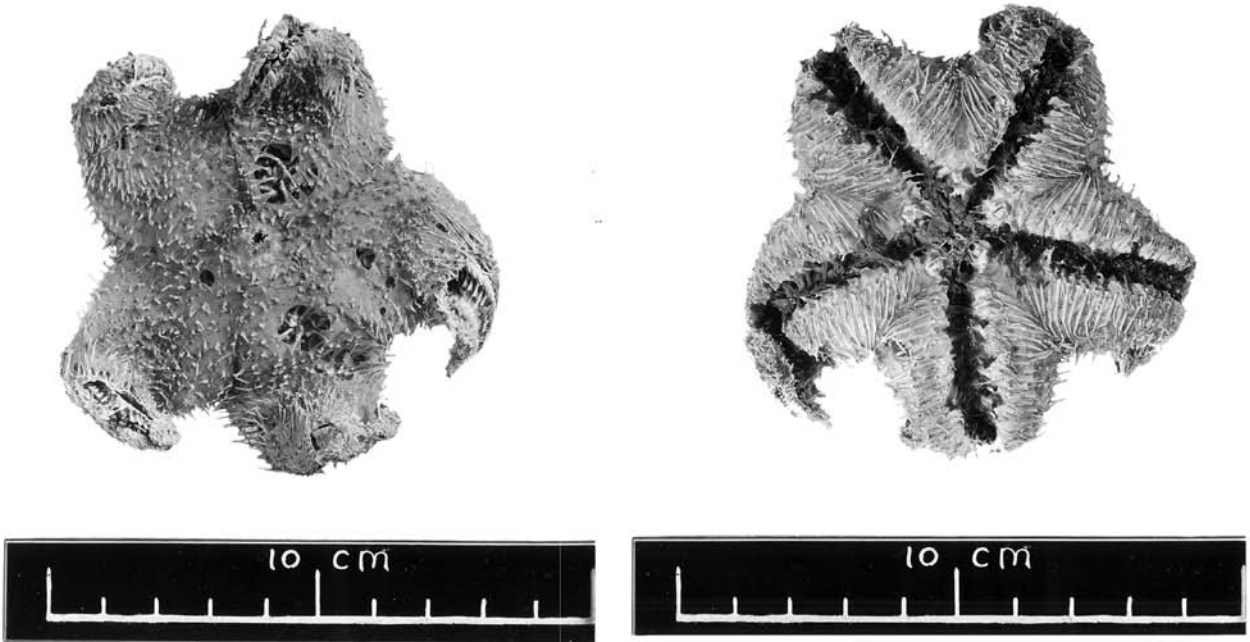


Plate 12. *Diplopteraster hurleyi* McKnight. NIWA Station F911, R/r = 89/24 mm.



Plate 13. *Diplopteraster otagoensis* n. sp. NIWA Station E399, R/r =93/48 mm. Abactinal and actinal surfaces.



Plate 14. *Hymenaster carnosus* Sladen. NIWA Station S151, R/r = 83/55 mm.



Plate 15. *Hymenaster pullatus* Sladen. NIWA Station S152, R/r =55/49 mm.



Plate 16. *Hymenaster estcourti* McKnight. NIWA Station S202, R/r = 16/9.5 mm.



Plate 17. *Hymenaster* sp. A. NIWA Station P667, R/r = 12/8 mm.



Plate 18. *Hymenaster* sp. B. NIWA Station U200, R/r = 43/26 mm.

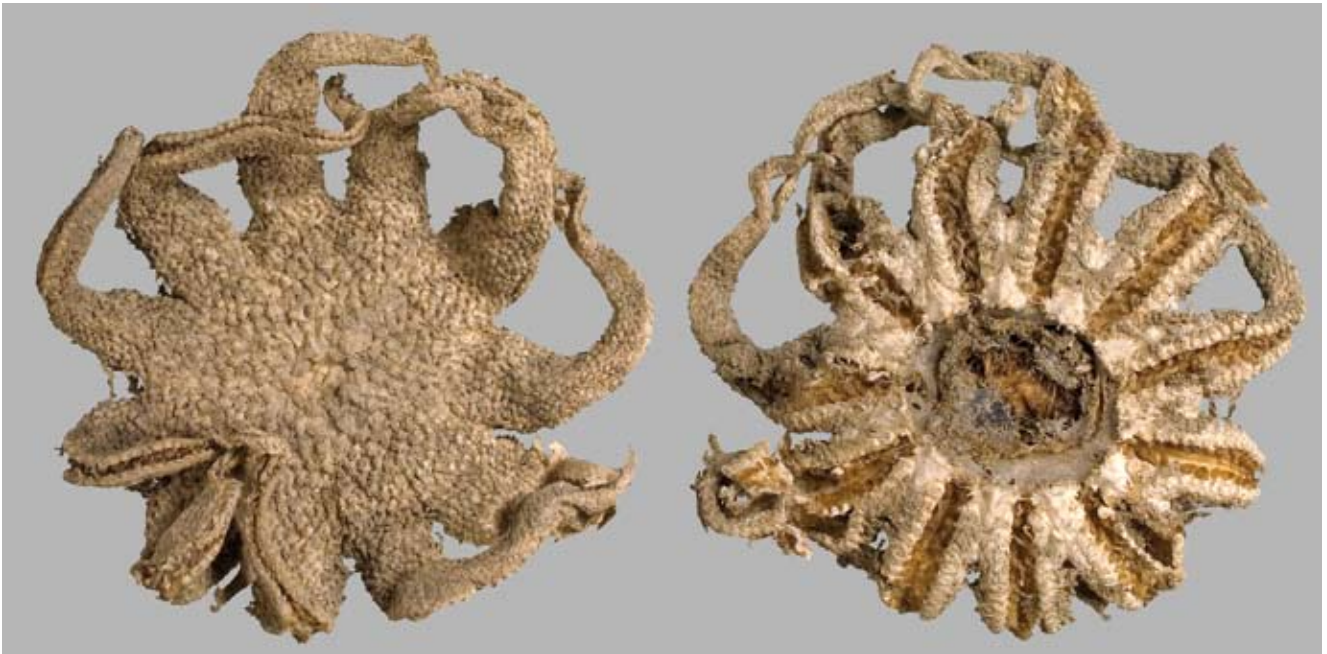


Plate 19. *Asthenactis australis* n. sp. NIWA Station Y31, R/r = 65/23 mm.



Plate 20. *Echinaster colemani* Rowe & Albertson. NIWA Station 177, R/r = 130/14 mm.



Plate 21. *Echinaster farquhari* Benham. NIWA Station Q11, R/r = 49/11 mm.



Plate 22. *Henricia aucklandiae* Mortensen. NIWA Station J55, R/r = 24/6 mm.



Plate 23. *Henricia compacta* (Sladen). NIWA Station J29, R/r = 28/5 mm.



Plate 24. *Henricia kapalae* Rowe & Albertson. NIWA Station Z10170, R/r = 81/16 mm.



Plate 25. *Henricia lukinsii* (Farquhar). NIWA Station Z1903, R/r =15/5 mm.

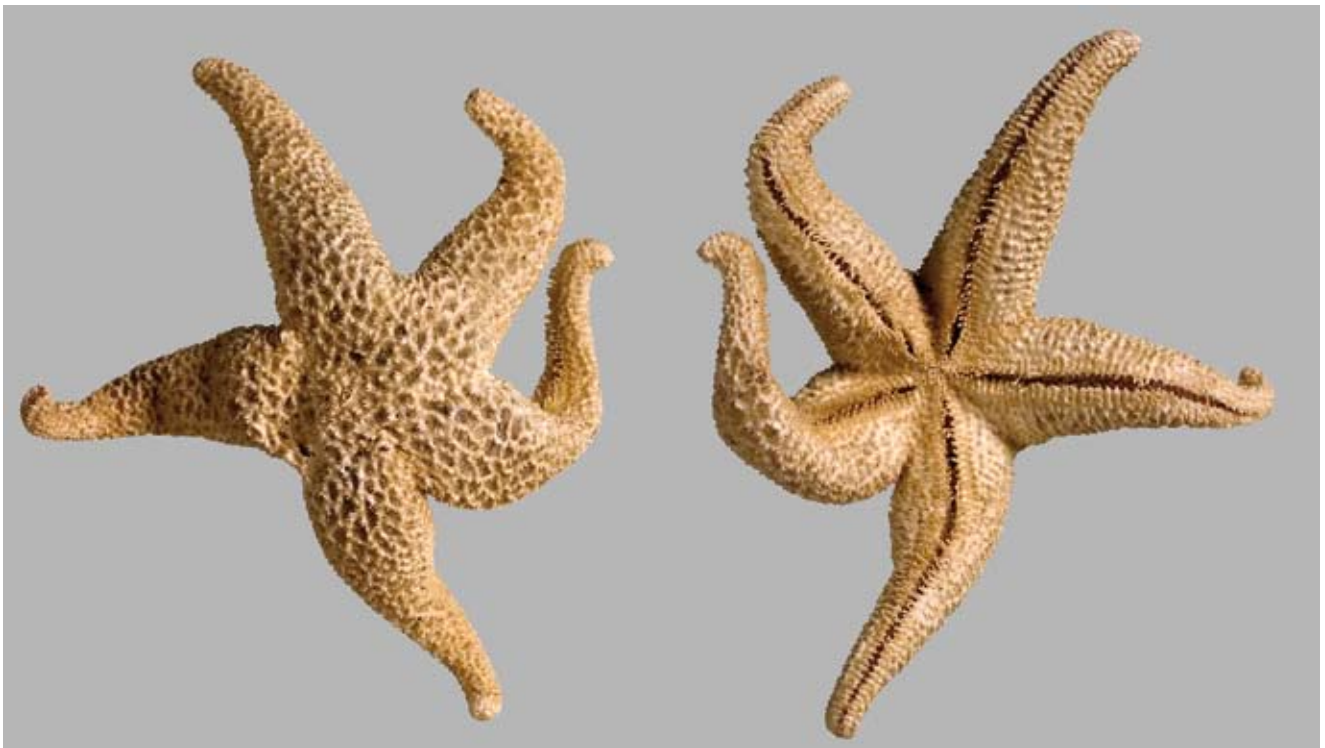


Plate 26. *Henricia obesa* (Sladen). NIWA Station B339, R/r = 29/7.5 mm.



Plate 27. *Henricia ralphae* Fell. NIWA Station Z5357, R/r = 69/14 mm.



Plate 28. *Henricia studeri* Perrier. NIWA Station E236A, R/r = 41/8 mm.



Plate 29. *Henricia sufflata* (Sladen). NIWA Station U197, R/r = 64/10.56 mm.

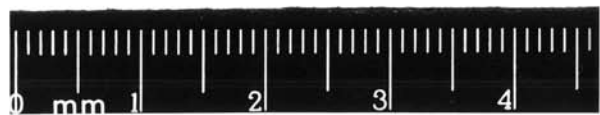
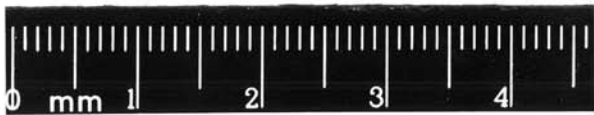
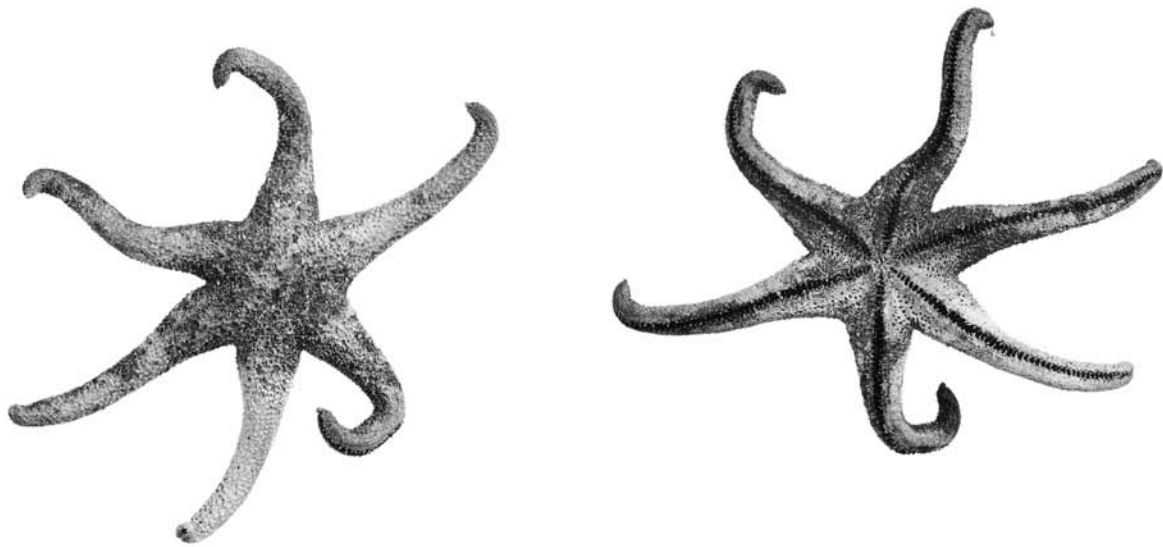


Plate 30. *Henricia tahia* McKnight. NIWA Station Z2098, R/r = 26/6 mm.



Plate 31. *Odontohenricia anarea* O'Hara. NIWA Station C732A, R/r = 58/10mm.



Plate 32. *Odontohenricia endeavouri* Rowe & Albertson. NIWA Station Z9000, R/r = 86/15mm.



Plate 33. *Leilaster spinulosus* Aziz & Jangoux. NIWA Station Z10818, R/r = 17/9 mm.



Plate 34. *Zoroaster variacanthus* n. sp.
NIWA Station P942,
R/r = 171/13 mm.



Plate 35. *Zoroaster carinatus* Alcock. NIWA Station J688, R/r = 98/11 mm.



Plate 36. *Zoroaster singletoni*
n. sp. NIWA Station J45, R/r =
130+/17 mm.



Plate 37. *Zoroaster spinulosus* Fisher. NIWA Station J48, R/r =175/16 mm.



Plate 38. *Zoroaster alternicanthus* n. sp. NIWA Station E867, R/r = 131/18 mm.



Plate 39. *Zoroaster planus* Alcock. NIWA Station X675, R/r = 241/14 mm.

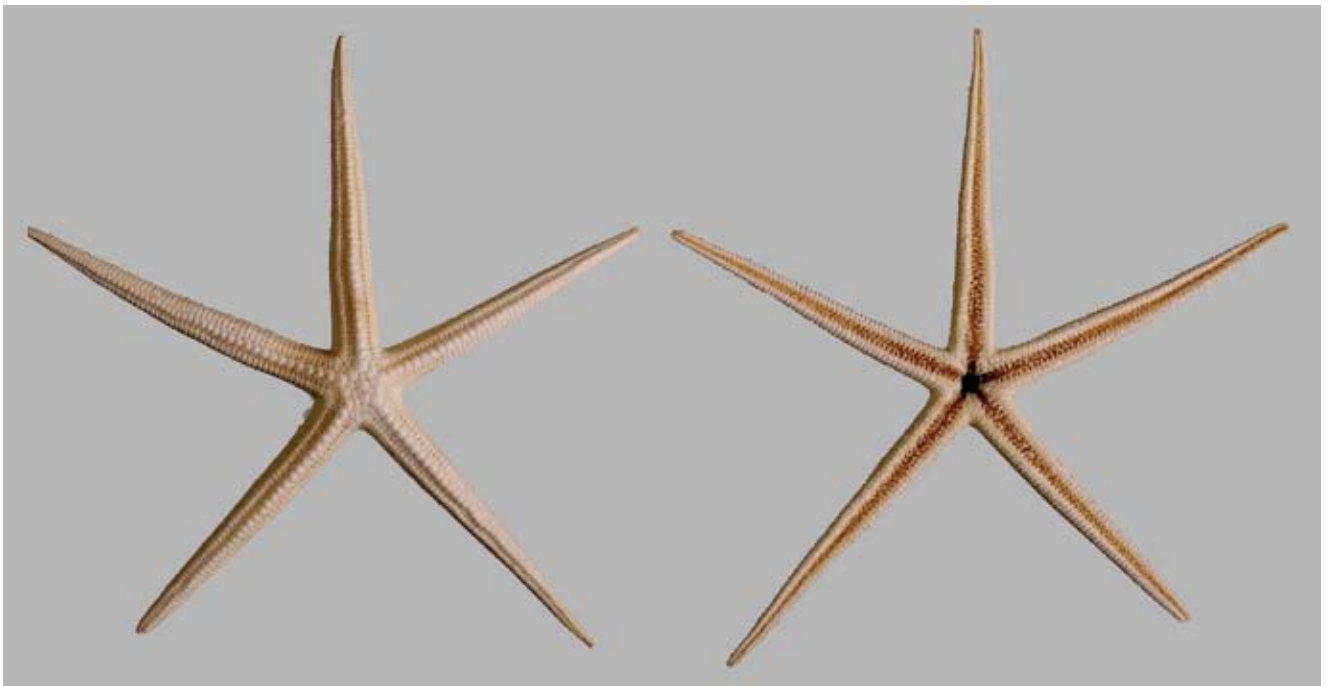


Plate 40. *Zoroaster* sp. NIWA Station Z11052, R/r = 72/9 mm.



Plate 41. *Hydrasterias sacculata* n. sp. NIWA Station P930, R/r=90/6.5 mm.



Plate 42. *Hydrasterias tasmanica* n. sp. NIWA Station P934, R/r=66/5 mm.



Plate 43. *Coronaster halicepus* Fisher. NIWA Station I359, R/r = 215/25 mm.



Plate 44. *Coronaster reticulatus* (H.L. Clark). NIWA Station Z10804, R/r = 75/7 mm.



Plate 45. *Allostichaster polyplax* (Müller & Troschel). NIWA Station C381A, R/r = 35/7 mm.



Plate 46. *Allostichaster insignis* (Farquhar). NIWA Station C672, R/r = 38/7 mm.



Plate 47. *Allostichaster farquhari* n. sp. NIWA Station Z10698, R/r = 25/9 mm.



Plate 48. *Anasterias directa* Koehler. NIWA Station E235 R/r = 21/6 mm.



Plate 49. *Anasterias mawsoni* (Koehler). NIWA Station E235, R/r = 10/3 mm.



Plate 50. *Anasterias laevigata* (Hutton). NIWA Station B191, R/r = 16/5 mm.



Plate 51. *Anasterias suteri* (de Loriol). NIWA Station A735, R/r = 49/11 mm.

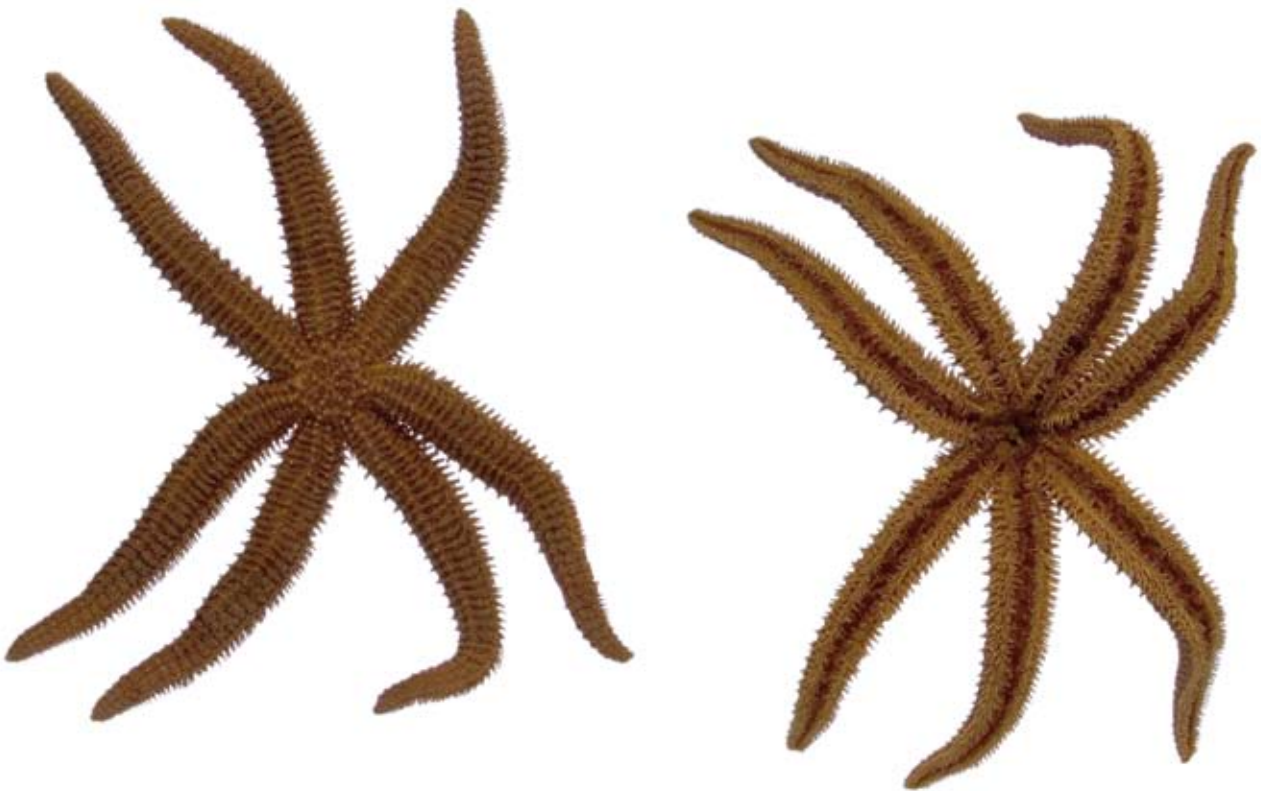


Plate 52. *Astrostole scabra* (Hutton). NIWA Station C978, R/r = 152/16 mm.



Plate 53. *Astrostole rodolphi* (Perrier). NIWA Station K833, R/r = 169/22 mm.



Plate 54. *Coscinasterias muricata* Verrill. NIWA Station C380, R/r = 195/31 mm.



Plate 55. *Cosmasterias dyscrita* H.L. Clark. NIWA Station D899, R/r = 114/11 mm.

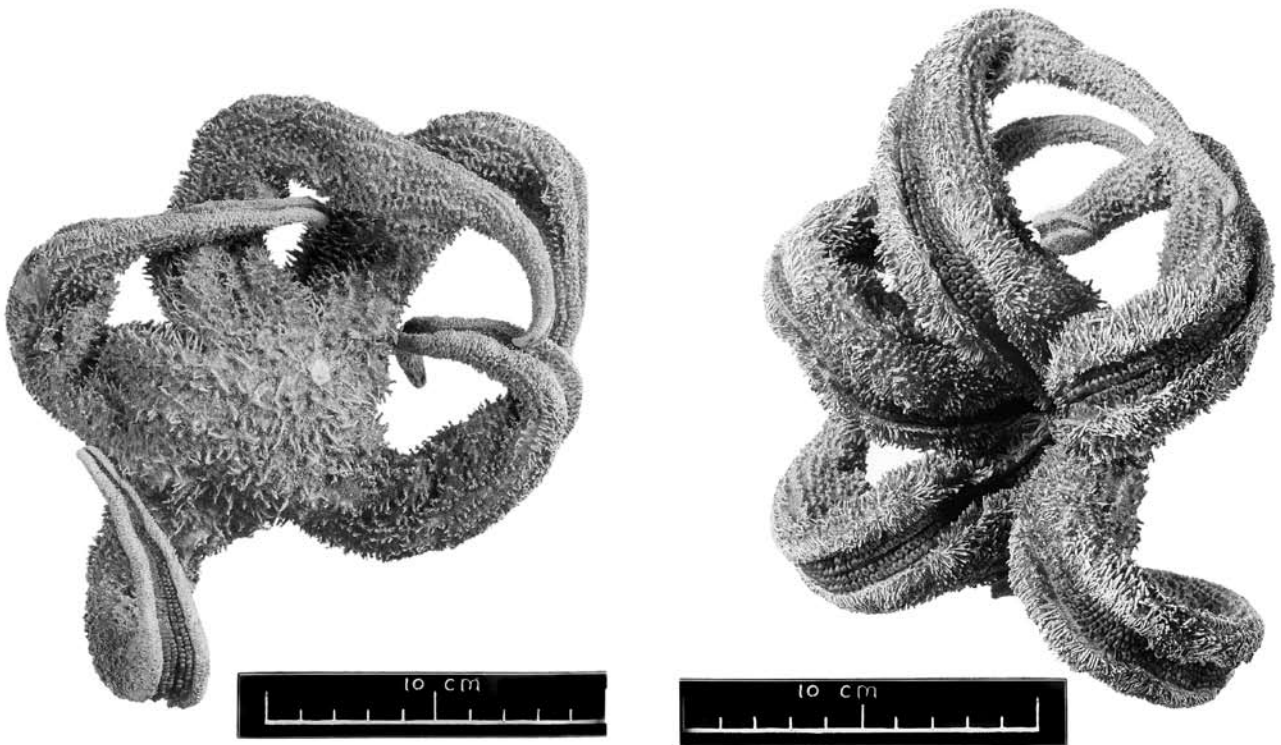


Plate 56. *Perissasterias monacantha* McKnight. NIWA Station S26, R/r = 157/22 mm.



Plate 57. *Psalidaster fisheri* n. sp. NIWA Station S100, R/r = 23/7 mm.



Plate 58. *Pseudechinaster rubens* H.E.S. Clark. NIWA Station D900, R/r = 173/21 mm.

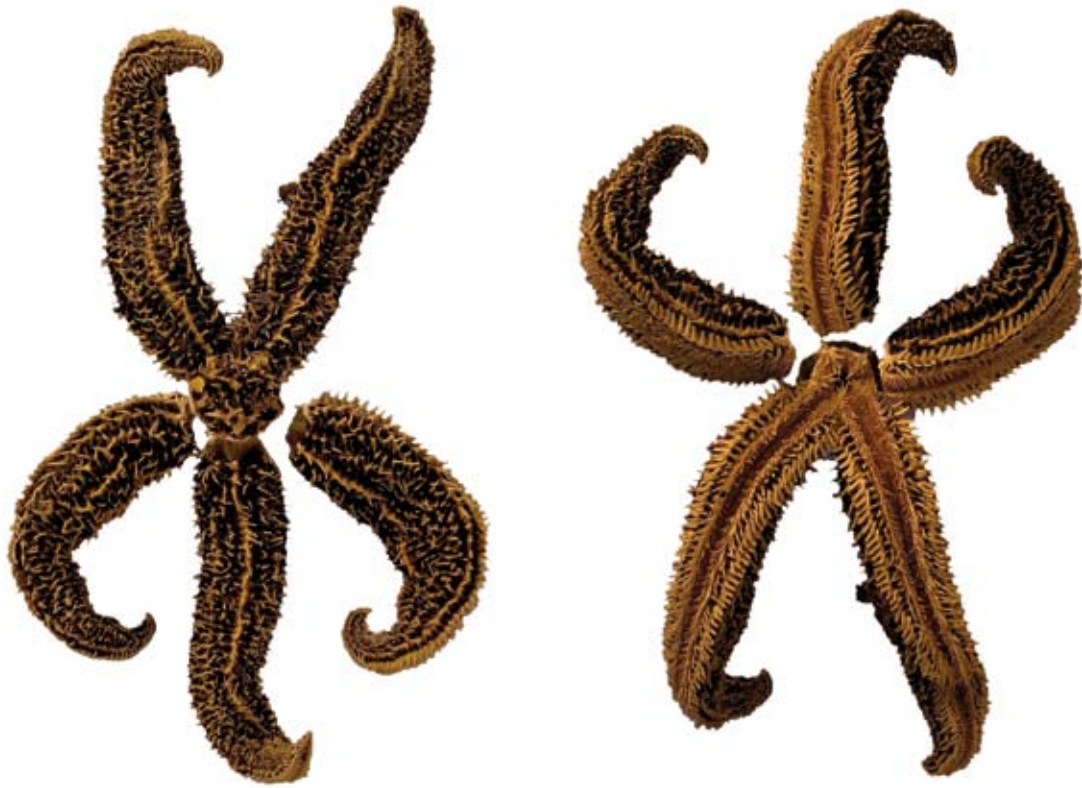


Plate 59. *Rumbleaster eructans* n. gen. et n. sp. NIWA Station Z10797, R/r = 137/11 mm.



Plate 60. *Sclerasterias mollis* (Hutton). NIWA Station D151, R/r = 107/16 mm.



Plate 61. *Smilasterias clarkailsa* O'Loughlin & O'Hara. NIWA Station D10, R/r = 31/5 mm.



Plate 62. *Smilasterias actinata* n. sp. NIWA Station S194, R/r = 54/8 mm.



Plate 63. *Stichaster australis* (Verrill). NIWA Station C993, R/r = 83/28 mm.

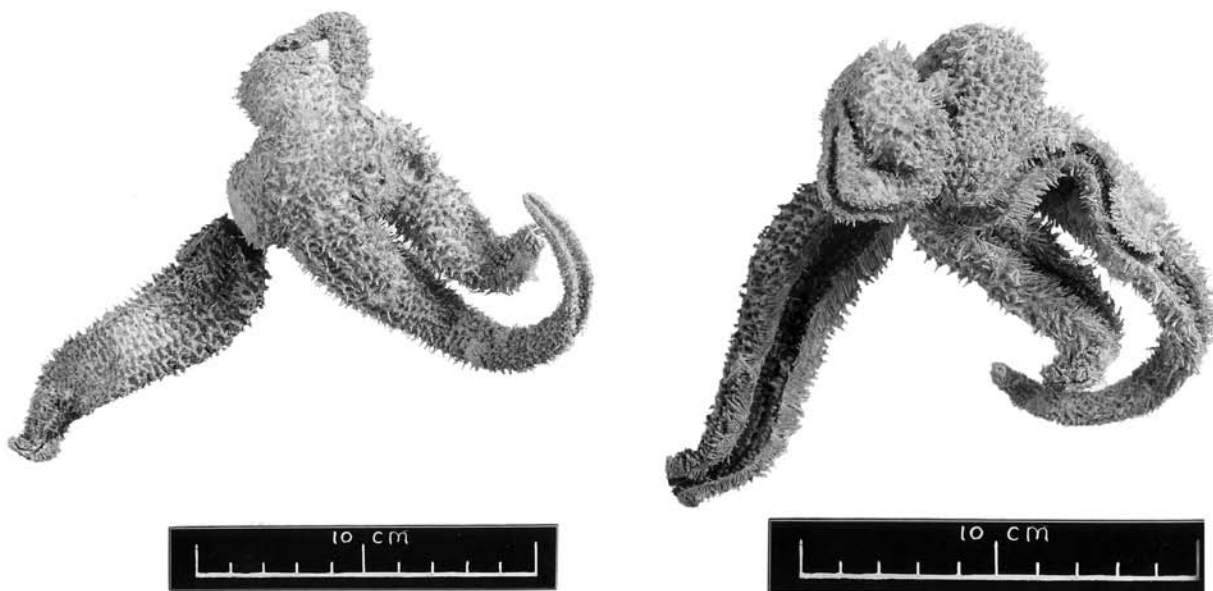


Plate 64. *Taranuiaster novaezealandiae* McKnight. NIWA Station F873, R/r = 183/29 mm.



Plate 65. *Asterostephane moluccana* Fisher NIWA Station I11, R/r = 164/11 mm.



Plate 66. *Brisinga chathamica* (McKnight). NIWA Station J59, R/r = 140+/14 mm (Z10937 is also photographed.)



Plate 67. *Brisinga tasmani* H.E.S. Clark. NIWA Station P927, R/r = 300+/27 mm.



Plate 68. *Hymenodiscus* sp. A. NIWA Station V376, R/r 95+/5.5 mm.



Plate 69. *Hymenodiscus* sp. B. NIWA Station P970, R/r 100+/9mm.



Plate 70. *Hymenodiscus* sp. C. NIWA Station U200, R/r 100+/8mm.



Plate 71. *Novodinia novaezealandiae* (H.E.S. Clark). NIWA Station Z10722, R/r200+/17 mm.



Plate 72. *Freyella echinata* Sladen. NIWA Station S151, R/r = 67+/14 mm.



Plate 73. *Freyella felleyra* n. sp. NIWA Station U200, R/r = 38+/10.5 mm.



Plate 74. *Freyastera digitata* n. sp. NIWA Station U196, R/r = 22+/6 mm.



Plate 75. *Patagiaster granulatus* n. sp. MONZ BS715, R/r = 27/14 mm.



Plate 76. *Astroceramus denticulatus* n. sp. NIWA Station Z11229, R/r = 87/28 mm.



Plate 77. *Astropatricia marita* n. gen et n. sp. NIWA Station X700, R/r = 23/10 mm.



Plate 78. *Calliaster* sp. NIWA Station Z9843, R/r = 15/7 mm.



Plate 79. *Ceramaster cognatus* n. sp. NIWA Station Z9778, R/r = 46/33 mm.



Plate 80. *Ceramaster* sp. A. NIWA Station Z10978, R/r = 19/14 mm.



Plate 81. *Ceramaster* sp. B. NIWA Station Z10724, R/r = 16/10mm.



Plate 82. *Cladaster latus* n. sp. NIWA Station TAN0307/45, R/r = 44/19mm.



Plate 83. *Hippasteria falklandica* Fisher. NIWA Station Z10308, R/r = 133/35 mm.

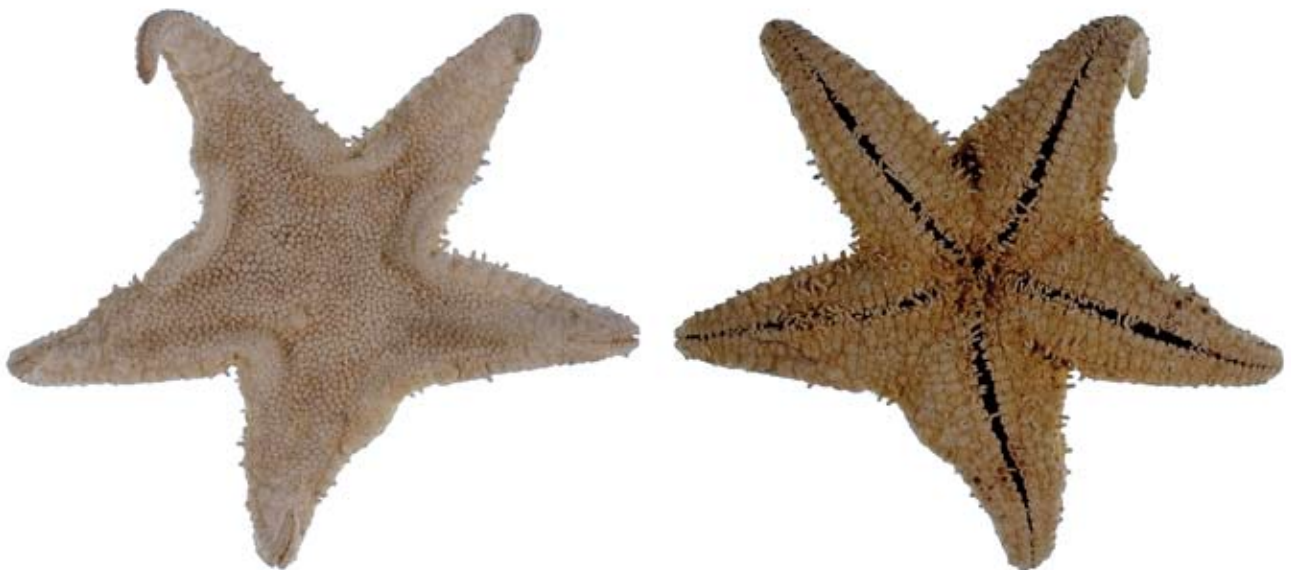


Plate 84. *Hippasteria tasmanica* n. sp. NIWA Station Z10305, R/r = 119/35 mm.



Plate 85. *Mediaster australiensis* H.L. Clark. NIWA Station Z10727, R/r = 174/53 mm.



Plate 86. *Mediaster* sp. NIWA Station Z10812, R/r = 77/21 mm.

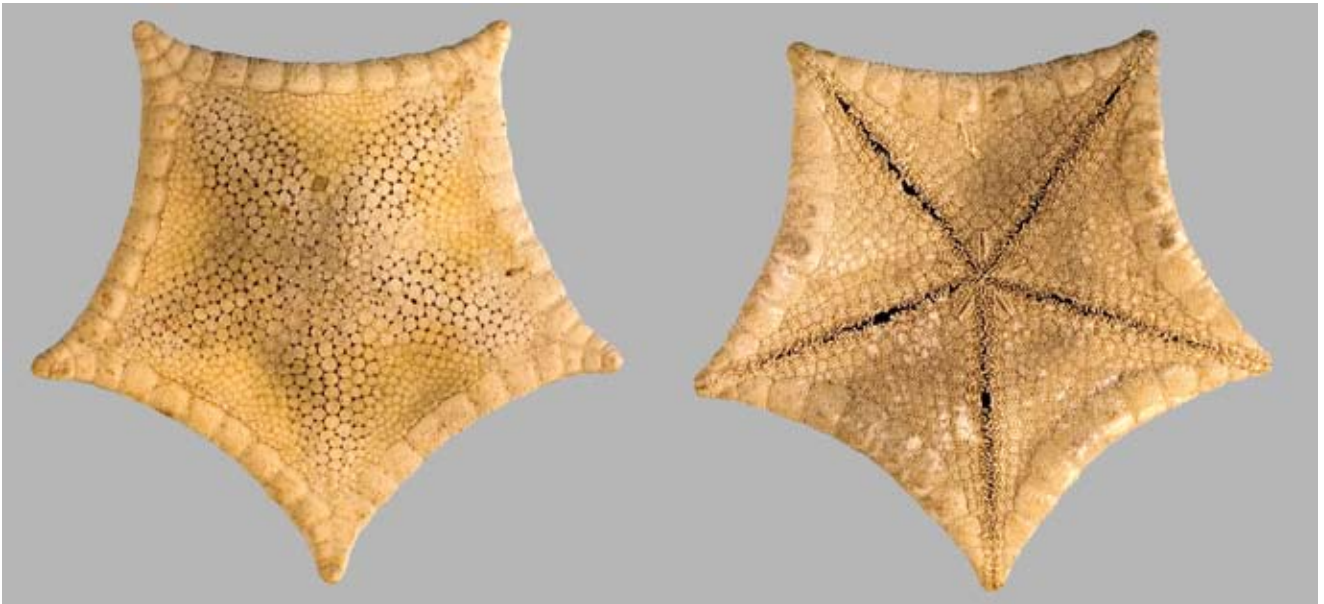


Plate 87. *Pillsburiaster indutilis* n. sp. NIWA Station TAN0306/08, R/r = 33/21 mm.



Plate 88. *Pseudarchaster jordani* Fisher. NIWA Station Z10873, R/r = 196/55 mm.

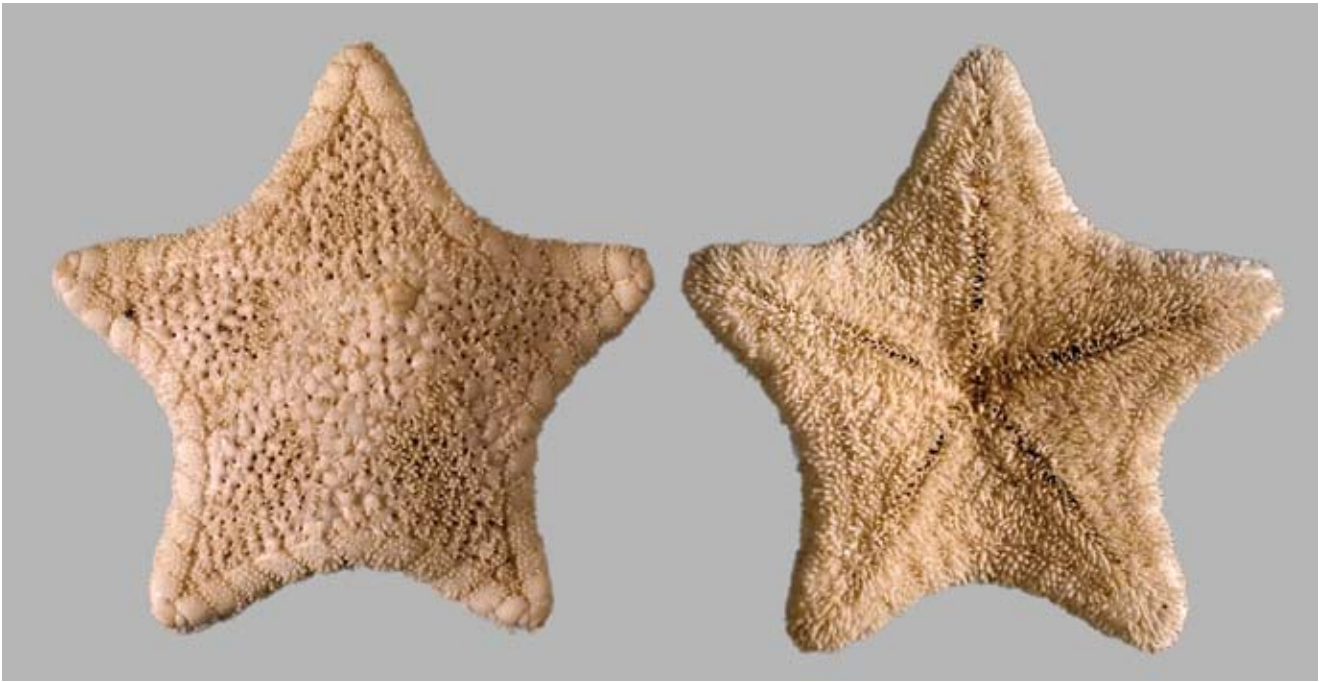


Plate 89. *Diabocilla clarki* n. gen. et n. sp. NIWA Station Z10728, R/r = 12.5/8.5 mm.



Plate 90. *Podosphaeraster somnambulator* n. sp. NIWA Station Z10727, R/r = ??/6.0 mm.



Plate 91. *Marginaster patriciae* n. sp. NIWA Station Z10713, R/r = 13/8 mm.



Plate 92. *Marginaster* cf. *paucispinus*. NIWA Station Z11045, R/r = 3.8/3.4 mm.

TAXONOMIC INDEX

This index has been compiled from the text. It does not include species names in Appendix 1 (List of Stations).
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