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Some Echinozoans from North of New Zealand

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Abstract

THE echinoids and holothurians collected by the *Tui* expedition of 1962 are described. The collection comprises 44 specimens and fragments representing 19 genera and 19 species. Two elaspod holothurian species are described as new, and *Amperima* nom. nov. is proposed to replace the preoccupied generic name *Periamma* Perrier, type species *P. roseum* Perrier. New records for the New Zealand region are *Stereocidaris sceptriferoides* (Doderlein), *Prionocidaris australis* (Ramsay), *Salenocidaris hastigera* (Agassiz), *Oligopodia epigonus* (v. Martens), *Coelopleurus* sp. and *Benthogone rosea* Koehler.

Benthogone rosea was previously known only from the north Atlantic Ocean, while the remainder of the species listed above are of Indo-west-Pacific distribution. It is evident that many of the northern New Zealand deep-water faunal elements are shared with Australia. An annotated list is given of all the echinoids known from immediately to the north of New Zealand.

INTRODUCTION

THE waters to the north of New Zealand are of the transitional warm temperate type, as described by Knox (1960), under the influence of the warm westward flowing trade wind drift. It follows then that the fauna of this region should reflect the attendant physical conditions, and be of a warm temperate type, paralleling the warm temperate faunas of nearby areas, and showing some differences from the fauna of the remainder of the New Zealand region, which is characterised by cold temperate mixed waters and subantarctic cold temperate water.

This northern area is of great interest zoogeographically, especially in view of the fact that several Australian echinoderm species are known from the northern part of the New Zealand mainland (Fell, 1953), and that the portal of entry of these species is probably from the north. Unfortunately, however, current knowledge of this important northern area is fragmentary, as very little biological sampling has been carried out there, apart from a small number of stations worked by such expeditions as the *Challenger*, *Terra Nova*, *Discovery II* and *Galathea*.

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Until very recently, no particular study has been made of the benthic fauna between northern New Zealand and the Kermadec Islands. During July 1962, a deepwater research cruise was undertaken by H.M.N.Z.F.A. *Tui*, north of New Zealand, in the area bounded by Auckland, Norfolk Island and the Kermadec Islands. This expedition was led by Dr J. B. Gilpin-Brown, of the University of Auckland. More than 125 biological stations were occupied, several of these yielding benthic samples, some from depths in excess of 1,500 fathoms (2,700 metres). As expected, the hauls of echinoderms were exceedingly rich. This paper is an account of the holothurians and echinoids collected during the course of the expedition.

I am particularly grateful to Dr J. B. Gilpin-Brown, of the Department of Zoology, University of Auckland, for access to the *Tui* specimens for study, and to Dr C. A. Fleming, New Zealand Geological Survey, for the loan of specimens of *Echinocyamus polyporus* Mortensen, collected by him at the Kermadec Islands. I am indebted to Professor H. B. Fell, of this department, for the loan of some comparative material, and for his valued advice, particularly on the status of the holothurian genus *Periama*.

MATERIAL EXAMINED

Echinoids and holothurians were collected at 14 stations, as follows:

- Station 3—34° 20' S., 175° 12' E., 990 fathoms (1782 metres).
Salenocidaris hastigera (Agassiz), 1 specimen.
Scotoplanes gilpinbrowni n.sp., 1 specimen.
- Station 9—34° 45' S., 173° 51' E., 294–298 fathoms (529–536 metres).
Goniocidaris magi Pawson, 1 primary radiole.
Echinocyamus polyporus Mortensen, 1 test.
- Station 11—30° 45' S., 175° 51' E., 294–370 fathoms (531–666 metres).
Stereocidaris sceptriferoides (Doderlein), 3 specimens.
- Station 12—30° 37.5' S., 173° 53.5' E., 1,380–1,520 fathoms (2,486–2,736 metres).
Brissopsis oldhami Alcock, fragments.
- Station 21—Steel's Point (Norfolk Island), 310–400 fathoms (558–720 metres).
Brissopsis oldhami Alcock, 1 specimen.
- Station 22—Steel's Point (Norfolk Island), 52–57 fathoms (94–104 metres).
Peronella hinemoae Mortensen, 4 tests.
Echinocyamus polyporus Mortensen, 1 test.
- Station 24—Steel's Point (Norfolk Island), 32 fathoms (58 metres).
Prionocidaris australis (Ramsay), 1 specimen.
- Station 26—Steel's Point (Norfolk Island), 30 fathoms (54 metres).
Heliocidaris tuberculata (Lamarck), 1 specimen (juv.).
Clypeaster australasiae (Gray), 1 specimen.
- Station 37—29° 20' S., 169° 09' E., 110 fathoms (198 metres).
Prionocidaris australis (Ramsay), fragment.
Oligopodia epigonus (v. Martens), 1 test.
- Station 53—ca. 33° 56' S., 172° E., 440–450 fathoms (792–810 metres).
Pseudechinus variegatus Mortensen, 2 tests.
Apatopygus ? recens (Milne-Edwards), 1 test.
- Station 56—33° 58' S., 172° 07' E., 140–190 fathoms (252–342 metres).
Coelopleurus sp., radioles.
- Station 98—30° 18' S., 180° E., ca. 650 fathoms (1,170 metres).
Amperima tui n.sp., 14 specimens.
Benthogone rosea Koehler, 2 specimens.
- Station 103—At anchor, Raoul Island (Kermadecs).
Leganum depressum var. *tonganense* (Quoy and Gaimard), 2 specimens.
- Station 107—West side of Meyer Island (Kermadecs), shore collection.
Heliocidaris tuberculata (Lamarck), 2 specimens.
Tripneustes gratilla (Linnaeus), 2 specimens.
Echinometra mathaei (Blainville), 2 specimens.
- Station 113—30° 30' S., 178° 33' W., (Curtis Island, Kermadecs).
Peronella hinemoae Mortensen, 1 test.

Class ECHINOIDEA

Order CIDAROIDA

Stereocidaris sceptriferoides (Doderlein), Pl. I

Cidaris (Stereocidaris) sceptriferoides Doderlein, 1887, p. 5, Pl. II, figs. 12–17, Pl. III, fig. 3 a–e.

Stereocidaris sceptriferoides Mortensen, 1903, pp. 23, 29; Doderlein, 1906, p. 102; Mortensen, 1928, p. 274, figs. 85–6, Pls. XXIX, figs. 5–7, LXVII, figs. 1–3, 13, LXXXI, figs. 1–4.

Cidaris japonica Yoshiwara, 1906, Pl. I, figs. 4–5; Agassiz and Clark, 1907, p. 112.

Phalaerocidaris japonica Lambert and Thiery, 1910, p. 150.

Stereocidaris grandis Clark, 1925, p. 26 (partim).

Material Examined: Station 11, 30° 45' S., 173° 51' E., 294–370 fathoms (531–666 metres), 3 specimens.

REMARKS. All specimens are dried, in perfect condition. Dimensions:

	1. (female)	2. (male)	3. (male)
	mm	mm	mm
Horizontal diameter	39.0	38.0	33.0
Height	22.0	26.0	20.0
Apical system	19.5	18.0	15.5
Peristome	11.0	12.0	8.0
Longest primary radiole	59.0	57.0	64.0

The large size of the longest primary radiole in the smallest specimen indicates that the lengths of the radioles can vary independently of the size of the specimens.

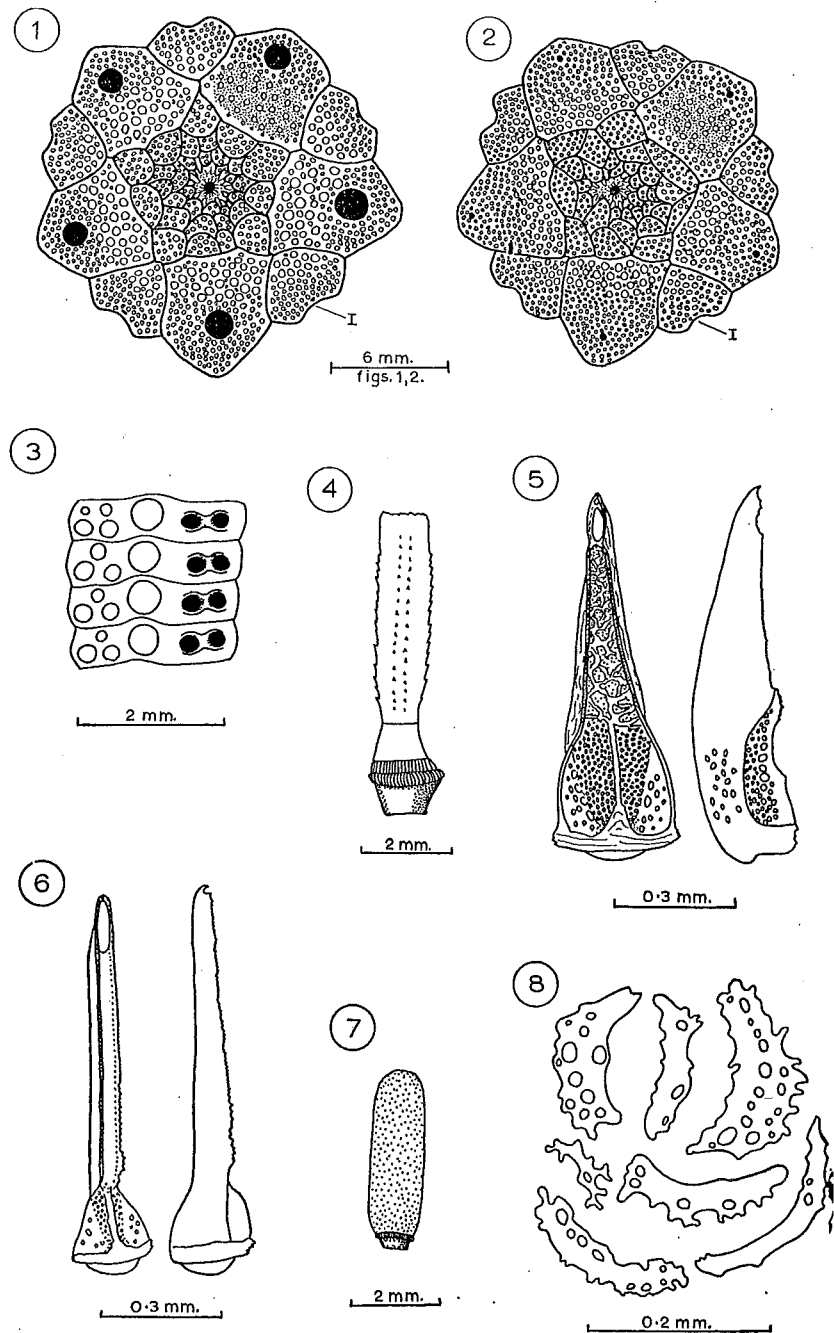
Test circular, flattened ventrally, sides strongly arched. Apical system flat in female specimen, slightly raised in males. Sutures between plates in interamb and apical system sunken, so that plates are sharply delimited.

Amb strongly sinuate, 55–60 plates in each series. There are 17–19 plates to each ambital interamb plate. Pores in single series, not conjugate, of equal size, separated by a low wall. Pore pairs separated by a high ridge. Marginal tubercles not contiguous, alternating with the stalks of globiferous pedicellariae. Median area of amb flat, not sunken, internal tubercles numerous, tending to form series parallel to marginal tubercles (Pl. I, fig. 3).

Interamb broad (amb = 22% interamb), with 5–6 plates in each column. At ambitus, plates are high, as broad as long, tumid, with a dense coat of secondary tubercles outside areoles. Primary tubercles large, perforate, non-crenulate, arising smoothly from the floor of each areole. First aboral tubercle in each column rudimentary, lacking a radiole, or absent. Areoles not confluent, well separated, deep, circular at ambitus, transversely oval below it.

Apical system large (ca. 50% h.d.), component plates densely tuberculate, tubercles of the genital plates generally larger toward the periproctal margin (Pl. I, figs. 1, 2). Periproct slightly displaced into a postero-sinistral position; periproctal plates numerous, tuberculate. Genital pores subcentral, conspicuously larger in the female (Pl. I, fig. 1) than in the male (Pl. I, fig. 2). The smaller male specimen has a dicyclic apical system, with all oculars exsert. In the larger male and female specimens ocular I is narrowly exsert, oculars II, III and IV are broadly exsert, and ocular V is narrowly insert.

Primary radioles long (ca. twice h.d.), cylindrical, gently tapering. The complete radioles are bluntly pointed distally, or very slightly expanded. The shaft lacks lamellae, but carries numerous low inconspicuous ridges, beset with short, blunt spines. The milled ring is inconspicuous, collar short (1mm), neck long (3–4mm). Large primary radioles are carried at the ambitus and above it. Sub-ambital radioles are short (10–17mm long), slender.



Stereocidaris sceptriferoides (Doderlein). Fig. 1—Apical system of female. Fig. 2—Apical system of male. Fig. 3—Amb plates. Fig. 4—Adoral primary radiole. Fig. 5—Valves of globiferous pedicellariae. Fig. 6—Valves of narrow globiferous pedicellariae. Fig. 7—Scrobicular radiole. Fig. 8—Tubefoot deposits. Abbreviation: I, ocular I.

Adoral primaries are ca. 7 mm long, flattened, with edges serrate (Pl. I, fig. 4). The radioles are bluntly pointed or truncated. Generally one of the flat sides of each radiole carries a double row of spines; these are occasionally lacking.

Miliary radioles are slender, erect, not appressed to test. Scrobicular radioles form a sheathing ring around the base of each primary radiole. They are flat, spatulate, with a rounded distal extremity; some have a broad low ridge along the midline. Average length of these radioles is 4mm (Pl. I, fig. 7).

Colour when dried, test yellowish-white overall. Primary radioles greyish-yellow, tinged with pink; neck a bright shining pink, collar dull light brown. Subambital and adoral primaries white, with white collars. Secondary radioles yellowish-white, of a similar colour to the test.

Globiferous pedicellariae are particularly common. In general the valves are long and narrow (Pl. I, fig. 5), with a small single end tooth or with none. The terminal opening is narrow, while the edges of the blades are finely serrate. The stalk varies considerably in length, but it is longest on pedicellariae with extremely narrow blades (Pl. I, fig. 6). The stalk is never globular. No tridentate pedicellariae were found.

The tubefeet contain rods and perforated plates (Pl. I, fig. 8). The perforated plates lie near the terminal disc of each foot, while the rods lie nearer the middle of the foot, transverse to its longitudinal axis.

Epizoans are rare on the radioles, although two carry on their undersides the tubes of tubicolous annelids, composed of aggregations of foraminiferal skeletons and shells of minute gastropod molluscs.

As the female genital pores are very large (1.5mm diameter) it is probable that this species has large yolky eggs, and lacks a pelagic larval stage.

These specimens are undoubtedly representatives of the species *Stereocidaris sceptriferoides* Doderlein, agreeing in most respects with the description given by Mortensen (1928). However, in present material the midline of each amb is not sunken, while Mortensen (1928) notes that it is "more or less distinctly sunk". In the apical system some slight differences are found. Mortensen's material comprised five specimens, in which all but one specimen has a dicyclic apical system; the single variant has ocular I narrowly insert. The present material differs slightly in that the two larger specimens have ocular V narrowly insert. But this can probably be explained as a growth change, for Mortensen's largest specimen was of 33mm h.d., while present material exceeds that measurement by 5–6mm. These then are the largest known specimens of *S. sceptriferoides*. The typical form of this species characteristically has primary spines which are gently tapering, ". . . the point rather conspicuously flaring" (Mortensen, 1928, p. 276). Few of the radioles are complete in these specimens, but those that are show only a very weak distal expansion, while some taper to a blunt point. Adoral primaries, scrobicular radioles, pedicellariae and tubefoot deposits are more or less identical to those described by Mortensen (1928).

Fell (1954) has described *Stereocidaris hutchinsoni* Fell from Nukumaruan (Pliocene) beds in New Zealand, and *S. striata* (Hutton) from the Duntroonian (Lower Oligocene). Both these fossil species differ from *S. sceptriferoides* in having primary radioles with more conspicuous flutings and ridges. It is of great interest that the genus should be represented by an extant species near New Zealand. (Station 11 is approximately 230 miles NNE of North Cape). *S. sceptriferoides* occurs also off Japan, in 360–700 metres. The variety *lamellata* Mortensen of this species is known from the Philippines (1,040 metres) and the Kei

Islands (370–400 metres). The present record shows the species to be a wide-spread Indo-west-Pacific form and the depth (531–666 metres) from which material was taken near New Zealand is consistent with its known bathymetric range.

Goniocidaris magi Pawson

Goniocidaris magi Pawson, 1964, p. 67, Pl. I, figs. 1–4.

Material Examined: Station 9, 34° 45' S., 173° 51' E., 294–298 fathoms (529–536 metres), 1 primary radiole.

REMARKS. The radiole is 26mm long, light yellowish-brown in colour, with the distal extremity slightly widened to form a weakly developed crown, as is typical of this species.

The holotype and paratypes were taken from near Three Kings Islands at a depth of 135 metres. The present record (approximately 50 miles east of North Cape) indicates that the species is distributed about the warmer northern waters of New Zealand. Present known bathymetric range, 135–536 metres.

Prionocidaris australis (Ramsay) Pl. II, figs. 1–3

Prionocidaris australis Mortensen, 1928, p. 456, figs. 140 (2), 141, Pls. LII, LIII, fig. 12, LXXXIII, figs. 17–19, LXXXVII, figs. 6–8. (Complete synonymy.)

Material Examined: Station 24, off Steel's Point, Norfolk Island, 32 fathoms (58 metres), 1 specimen; Station 37, 20° 20' S, 169° 09' E., 110 fathoms (198 metres), fragment of radiole.

REMARKS. The single complete specimen is a juvenile of horizontal diameter 10mm, height 5mm.

Primary radioles at the ambitus and above it are elongate, slightly flattened. The shaft of each reaches its greatest width about $\frac{1}{3}$ of its length from base, then tapers gradually toward the distal extremity. In some radioles the distal extremity is very slightly expanded to form a very weak crown. The largest radiole is 16mm long, collar 2mm long. All are beset with regularly arranged spines, largest at the sharp edges of the flattened radioles. Milled ring not prominent; collar usually long (ca. 12% of total radiole length), carrying serially arranged conspicuous white spots, against a brownish-red background. These radioles are light red, with a greenish tinge (Pl. II, fig. 1).

Adoral radioles flattened, approximately 2.5mm long. The collar is long, almost the same length as it is on ambital primaries. Thus the cortex is restricted to the distal end of adoral radioles, forming a "cap". This cortex "cap" carries a small number of regularly arranged blunt spines (Pl. II, fig. 2).

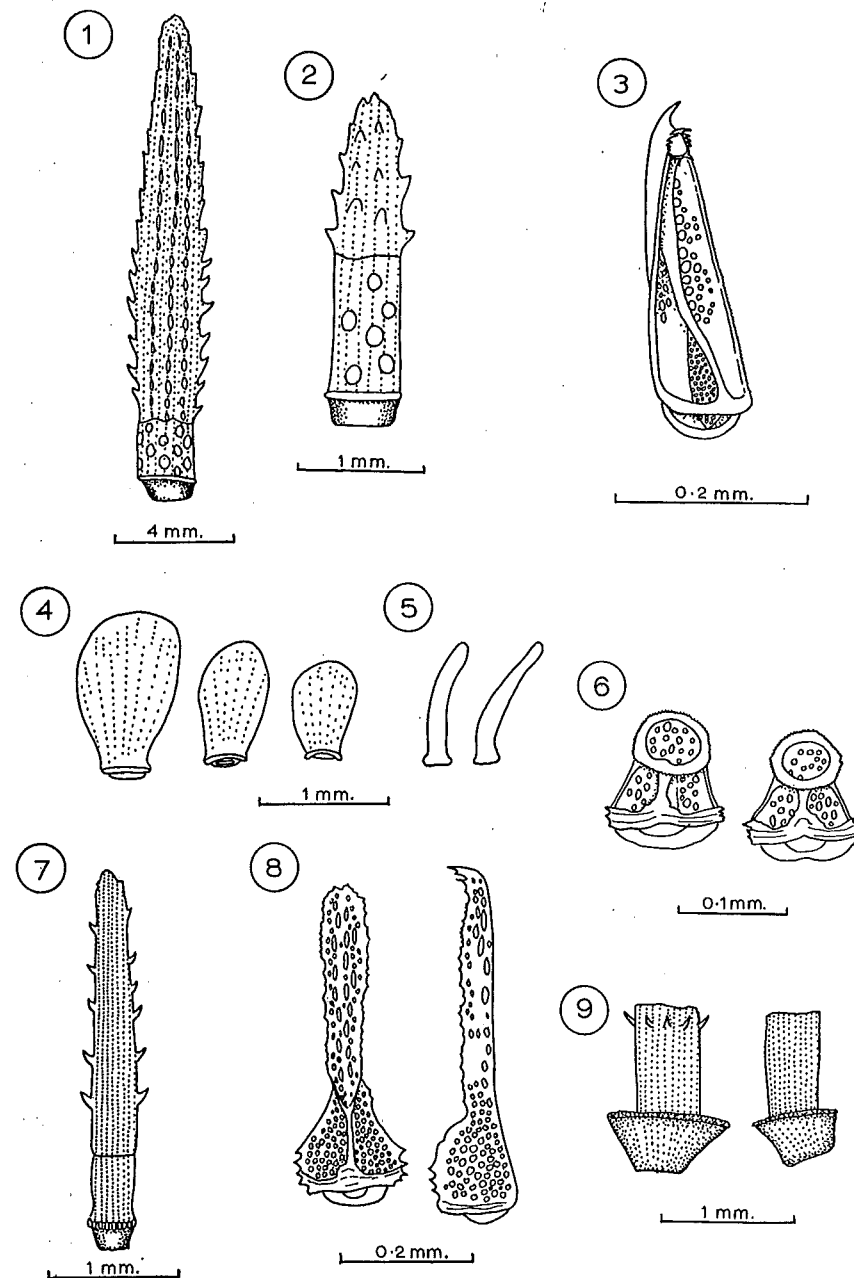
Secondary spines are flat, slightly curved, ca. 1.5mm long. They are bluntly pointed, the points being minutely serrate.

Globiferous pedicellariae of the large type are lacking. Small globiferous pedicellariae with a valve length of up to 0.4mm are especially common aborally. The valves are slender, and carry a single end tooth (Pl. II, fig. 3). The opening of the poison duct is also surrounded by a ring of teeth, of which two pairs, one at the top of the opening and one at the bottom, are the largest. Each edge of the valve is finely serrate for its entire length.

Tridentate pedicellariae have extremely long and narrow valves up to 2mm in length. The edges of the blade in each valve are irregularly serrated and thorny. The valves are of the same type as those figured by Mortensen (1928).

As this is the only specimen in the collection, no examination of the test has been made.

PLATE II



Prionocidaris australis (Ramsay). Fig. 1—Ambital primary radiole. Fig. 2—Adoral primary radiole. Fig. 3—Valve of globiferous pedicellaria.

Salenocidaris hastigera (Agassiz). Fig. 4—Secondary radioles, plan view. Fig. 5—Secondary radioles, profile view. Fig. 6—Valves of ophicephalous pedicellariae. Fig. 7—Adoral primary radiole. Fig. 8—Valves of tridentate pedicellariae. Fig. 9—Bases of primary radioles.

On the basis of the structure of the globiferous pedicellariae and the primary radioles, this specimen has been assigned to the species *Prionocidaris australis*. Juvenile cidarids are often extremely difficult to place, as the primary radioles, an important taxonomic character, change greatly with growth. However, the present specimen has primary radioles with a large collar, bearing white spots, also adoral radioles with a cortex "cap". Both these features are combined in *P. australis*, according to Mortensen (1928). The valve of a small globiferous pedicellaria of *P. australis* figured by Mortensen (1928, Pl. LXXXVII, fig. 6) agrees in all respects with that figured here (Pl. II, fig. 3). Also the colour of the juvenile radioles is exactly the same as that in adult specimens of *P. australis*.

The primary radioles in this species change with growth and become coarsely thorny. The largest known specimen of the species has a h.d. of 70mm, and the average size seems to be approximately 50mm h.d. In these full-grown specimens there is some variation in colour, Mortensen (1928) noting that "fully-formed primaries are light greenish, more or less distinctly banded with purplish". Clarke (1946) states that the primaries are deep brown.

The species was hitherto known only from the south-eastern coast of Australia, from Fraser Island, Queensland, to Bass Strait, and Lord Howe Island (Clark, 1946). Thus its presence at Norfolk Island in 58 metres and 198 metres is surprising. This species appears to have a bathymetric range of 10–85 metres, according to Mortensen (1928). The record here of a radiole fragment from 198 metres certainly does not prove that the species lives at that depth. *P. australis* probably has a pelagic larval stage (Mortensen, 1928), and may have achieved its distribution through larval drift in the plankton.

Order HEMICIDAROIDA

Salenocidaris hastigera (Agassiz). Plate II, figs. 4–9.

Salenia hastigera Agassiz, 1879, p. 198; Agassiz, 1881, p. 54, Pl. IV, figs. 3–17, Pl. XXXVIII, fig. 10; Agassiz, 1904, Pl. 20, fig. 8; De Meijere, 1904, p. 43 (partim); Doderlein, 1906, p. 177, Pl. XXI, fig. 1, Pl. XXII, fig. 1, Pl. XLV, fig. 3; Mortensen, 1935, p. 360, Pl. LXVI, figs. 1–2, Pl. LXXXV, figs. 5–7, Pl. LXXXVI, figs. 17–20.

Salenocidaris profundus Clark, 1925, p. 66 (partim).

Salenia hastigera var. *acuminata* Mortensen, 1934, p. 166.

Material Examined: Station 3, 34° 20' S., 175° 12' E., 990 fathoms (1,782 metres), 1 specimen.

REMARKS. The single specimen is complete, test circular, flattened adorally. Dimensions: horizontal diameter 10.5mm, height 6mm, peristome 4mm, apical system 6.5mm.

Aboral surface of test beset with numerous short and stout papillae, which are scattered, but may tend to be arranged in rows, radiating from the periproct. Between the papillae are large numbers of almost spherical ophicephalous pedicellariae.

Primary radioles cylindrical, long (longest radiole is 23mm, broken), slender, gently tapering towards the distal extremity, carrying whorls of small, sharp spines (the longest radiole has 38 such whorls). Ambital primaries slightly curved, with the convexity turning upwards. Collar short and inconspicuous, milled ring well developed, elegantly shaped (Pl. II, fig. 9). Adoral primaries flattened, resembling cidaroid adoral primaries, averaging 3mm in total length. The collar is long

(0.5mm), slightly narrower than the flattened shaft. The edges of the shaft each carry a single row of sharp spines (Pl. II, fig. 7). Milled ring prominent, but not as conspicuously developed as it is on the ambital primaries.

Secondary radioles short, spatulate (Pl. II, figs. 4, 5), slightly curved, approximately 1mm long.

When dried, the test is white adorally and at ambitus. The close-set papillae of the aboral surface are light violet. Primary radioles white, collar and milled ring with light violet striae. Secondary radioles with longitudinal violet striae, otherwise white.

Ophicephalous pedicellariae (Pl. II, fig. 6) have very short and broad valves, and are typical of those found elsewhere in the genus. Tridentate pedicellariae are uncommon, and have long and slender valves (Pl. II, fig. 8), up to 0.6mm in length. The edges of the blades are irregularly serrated.

Although the test has not been denuded, it can be clearly seen that the areoles are confluent, and that adoral interamb tubercles increase gradually in size towards the ambitus.

The species in the genus *Salenocidaris* are rather difficult to distinguish. Mortensen (1935) distinguishes the eight species which he recognises on the basis of such characters as position of ocular I, shape of secondary radioles, and relative length of valves of tridentate pedicellariae. For the purposes of specific identification, the important characters of the specimen in the *Tui* collection are as follows:

Areoles confluent, interamb tubercles increase gradually in size towards the ambitus. Secondary radioles broad, thin, slightly curved. Papillae of apical plates arranged in no definite order. Tridentate pedicellariae with long slender valves.

On the basis of these characters, the specimen falls closest to *S. hastigera* (Agassiz), but differs from that species in some minor respects. Some of the secondary radioles are slightly broader than they are in *S. hastigera*, and curved, while Mortensen does not indicate whether or not they are curved in *S. hastigera*. The presence of strongly curved secondary radioles is a key character of *S. pacifica* (Doderlein) from off Japan, but in that species the radioles are considerably thicker than they are in the present material. The conspicuous milled ring on the primary radioles is identical to that in *S. hastigera* (and *S. profundus* (Duncan) from the Atlantic Ocean). Valves of the tridentate pedicellariae of *S. hastigera* illustrated by Mortensen (1935) greatly resemble those figured here (Pl. II, fig. 8), but they do not show as many irregular serrations on the edges of the blade. These differences are considered slight, and the specimen has therefore been referred to *S. hastigera*. Further sampling in the area may produce more material and perhaps help to elucidate the systematic position of this southern Pacific form.

Salenocidaris is wide-ranging in the Atlantic and Pacific Oceans, and three of the eight species are recorded from the Indo-west-Pacific. One other species, *S. brachygnatha* Mortensen, is known from 28° 33' S., 177° 50' W., a short distance NE of the Kermadec Islands, in 1,080 metres. This specimen was collected by the "Challenger" and Agassiz (1881) referred it to his new species *S. hastigera*. Mortensen established a separate species for this specimen, which, as its name suggests, has tridentate pedicellariae with short valves, the blades of which are widened distally. In all other respects, the species of *S. brachygnatha* resembles *S. profundus* and *S. hastigera*, but in the shape of the tridentate pedicellariae a similarity is shown to *S. varispina* Agassiz from the Atlantic Ocean.

Thus there are now two species of *Salenocidaris* known from the vicinity of New Zealand; the present record (approximately 120 miles east of North Cape) establishes *S. hastigera* in the deep sea echinoderm fauna of New Zealand, and the known distribution of this species is extended to include the Malay archipelago, Indian Ocean and New Zealand, in 370–2,565 metres.

Order ARBACIOIDA

Coelopleurus sp.

Material Examined: Station 56, 33° 58' S., 172° 07' E., 140–190 fathoms (252–342 metres), five fragments of primary radioles.

REMARKS. The radiole fragments appear to belong to a representative of genus *Coelopleurus*. Members of this genus are characterised by possessing slender, slightly curved primary radioles, which are triangular in cross-section, with a median keel on the upper side. The shaft is smooth, shining, due to the presence of a well developed cortex layer. On some of the uppermost radioles the cortex is apparently never developed (Mortensen, 1935).

The largest radiole here is 145mm long, with a base triangular in cross-section, each side of the triangle being 4mm across. The radiole tapers gradually, and at its distal extremity (where it is broken) is approximately oval in cross-section. Two smaller fragments of length 110mm and 76mm are similar to that described, but the smallest fragments (70mm and 52mm) differ in that they appear to lack the smooth, shining cortex. Apparently these are the "uppermost radioles" to which Mortensen (1935) refers.

All but the smallest fragments are heavily encrusted in epizoans, including serpulid worms, bryozoans, and cirripedes. The radioles are white, those without a cortex layer yellowish-white.

These radioles cannot be assigned to a known species, but their great length serves as a guide for future investigations. The only species which has radioles approaching the size of the present fragments is *C. floridanus* Agassiz, in which the primary radioles may exceed 130mm in total length. This species is known from the West Indies north to Cape Hatteras on the American east coast. In the Indo-west-Pacific, no known species have primary radioles which exceed 100mm in length. Probably the present material represents a new species. While most species are centred about Japan and the East Indian region, one, *C. australis* Clark, is known from Australia. The present record, off Three Kings Islands, adds another northern genus to the known bathyal fauna of the New Zealand region.

Order TEMNOPLEUROIDA

Pseudechinus variegatus Mortensen. Plate V, fig. 1.

Pseudechinus variegatus Mortensen, 1921, p. 167, figs. 12, 14, 16, Pl. VI, figs. 21–21, Pl. VII, figs. 19–23; Lambert & Thiery, 1925, p. 672; Mortensen, 1943, p. 243, fig. 131.

Material Examined: Station 53, 33° 56' S., 172° E., 440–450 fathoms (792–810 metres), 2 naked tests.

REMARKS. The two tests are small, with aboral surfaces damaged, so that no details of the apical system can be given. Dimensions:

	Horizontal Diameter	Height	Peristome
	mm	mm	mm
1.	13.0	8.5	6.5
2.	8.0	5.0	5.0

Sides of test strongly arched, test scarcely sunken toward peristome. The tuberculation is as described by Mortensen (1921), coarse, with secondary tubercles of small size, with no regular arrangement. Primary tubercles form a regular singles series in each column; they are distinctly crenulate (Pl. V, fig. 1). The pores are, as usual, in slightly oblique arcs of three.

The rediscovery of this species is of considerable interest, but of special importance is the fact that there are distinct epistromal ridges in ambis and interambis. Mortensen (1921) made no mention of this, although the epistroma is rather conspicuous on an 8mm h.d. specimen, and Mortensen has material of the same size at his disposal. The larger specimen in the present collection is badly eroded, and no traces of epistroma can be found. Epistroma is best developed adorally, where it takes the form of ridges radiating from the primary tubercles toward the adjacent secondary tubercles (Pl. V, fig. 1), together with some ridges which run between the secondary tubercles. Small "tubercles" are also to be seen on the epistromal ridges.

Particularly in the interambis the areoles of the primary tubercles are separated by low ridges, such as are found adorally in *Pseudechinus novaezealandiae*. These ridges are not developed in the ambis. The test is light green, apart from the poriferous areas which are white. The tubercles are also light green. The species is aptly named, as in the smaller specimen the green varies considerably in shade, giving a mottled effect.

Only *P. albocinctus* (Hutton) and *P. variegatus* Mortensen have distinctly crenulate tubercles. Fell (1962) gives an account of the epistroma in *P. flemingi* Fell, *P. albocinctus* (Hutton) and *P. novaezealandiae* (Mortensen). Recent investigations by the writer (in press) show that epistroma is also present in the Magellanic species *P. magellanicus* (Philippi). Including the present species, five of the eleven species of *Pseudechinus* are known to have epistroma, at least in their young stages. It is expected that eventually all *Pseudechinus* species will be found to possess this important temnopleuroid character.

Mortensen (1921) stated that *P. variegatus* is most closely related to *P. albocinctus* on the basis of the crenulation of tubercles and similarities in their pedicellariae. Later, Mortensen (1943) contended that the species is related to *P. huttoni*, but differs in its more dense tuberculation, its size, and colour.

The type specimen of *P. variegatus* was collected from off Three Kings Islands, 65 fathoms (117 metres), and 10 miles NW of Cape Maria van Diemen, 50 fathoms (90 metres). A further two specimens were taken from west of Cuvier Island (near Auckland, New Zealand) in 35 fathoms (63 metres) (Mortensen, 1921). The present locality, approximately 20 miles north of Three Kings Is., does not affect the known distribution of the species. The depth of this station (792–810 metres) is very great compared with the depths from which the other material of the species is known, and it may be suggested that the dead tests were carried into deep water from the shelf. It is possible, however, that the species may live at that depth, as *Pseudechinus magellanicus* ranges from 0–820 metres, while *P. marionis* (Mortensen) occurs in 100–3,000 metres.

Tripneustes gratilla (Linnaeus)

Tripneustes gratilla Mortensen, 1943, p. 500, figs. 306–307, Pls. XXXIII, figs. 1–3, XXXIV, figs. 2–6, XXV, figs. 3–4, XXVII, figs. 1–2, 4–10, XXXVIII, figs. 1–4, LVI, fig. 11. (Complete synonymy.)

Material Examined: Station 107 (Raoul Island), west side of Meyer Island, shore collection, 2 specimens.

REMARKS. The two specimens have the following dimensions:

h.d.	Height	Peristome	Apical System
110mm	55mm	27mm	15mm
105mm	60mm	25mm	14mm

The largest specimen available to Mortensen (1943) was 106mm h.d. Clark (1946) notes that full-grown specimens are 140–145mm h.d.

The radioles are short as usual, greyish-white in colour. These contrast sharply with the black covering of the test. The cleaned test is strikingly coloured, the poriferous areas white, while the interambis and medium areas of the ambis are light violet. The colour of this species can vary quite remarkably, as has been pointed out by Mortensen (1943) and Clark (1946).

T. gratilla is widely distributed over the Indo-Pacific region from East Africa to the South Sea Islands, from Norfolk and the Kermadec Islands to the Marquesas and Hawaii, and from Australia to southern Japan (Mortensen, 1943). The species is as yet unknown from the northern coast of Australia (Clark, 1946), or from New Zealand. Bathymetric range 0–75 metres.

Order ECHINOIDA

Heliocidaris tuberculata (Lamarck)

Heliocidaris tuberculata Mortensen, 1943, p. 338, figs. 164–166, 167c, Pls. XXXVI, figs. 1–4, XXXVII, fig. 8, XXXVIII, fig. 8, LXIII, figs. 2–6, 9, 10. (Complete synonymy.)

Material Examined: Station 107 (Raoul Island), west side of Meyer Island, shore collection, 2 specimens; Station 26, off Steele's Point, Norfolk Island, 30 fathoms (54 metres), 1 specimen.

REMARKS. The two specimens from Station 107 have the following dimensions:

	h.d.	Height	Peristome	Apical System
	mm	mm	mm	mm
1.	90	45	21	12
2.	98	47	24	13

The largest size recorded for this species is 106mm h.d. (Clark, 1938), and thus it is probable that the present specimens are near their maximum size.

The freshly cleaned test is light green aborally, even lighter on the oral side. Adorally the poriferous areas are very light brown. Primary radioles dark brown generally, with a greenish tinge near the base. The tips of the radioles are brownish red. Adoral radioles often uniformly light green, with reddish brown tips. This colour description agrees with that of Benham (1911) and Mortensen (1943). Clark (1938) has noted that the colour in life is "bright brown, with a red tinge to test and pedicels, and greenish tips to the spines, very marked".

A small juvenile echinoid from Station 26 apparently also belongs to this species. The test is 8mm in horizontal diameter and 5mm in height. Colour when dried, light orange-brown, radioles light brown.

This species is known from the coasts of New South Wales and Victoria, although its occurrence there is apparently erratic (Clark, 1946). Also recorded from Lord Howe Island, where it is common, the Kermadec Islands and northern New Zealand (Mortensen, 1943). The Norfolk Island record of the juvenile specimen is new.

Echinometra mathaei (Blainville)

Echinometra mathaei Mortensen, 1943, p. 381, figs. 185–194, Pls. XLII, figs. 1–10, XLVII, figs. 1–4, LXV, figs. 16–26. (Complete synonymy.)

Material Examined: Station 107 (Raoul Is.), west side of Meyer Island, shore collection, 2 specimens.

REMARKS. The two specimens have the following dimensions:

h.d.	Height	Peristome	Apical System
41–32mm	20mm	17mm	9mm
61–51mm	33mm	22mm	11mm

As is usual in this species, the test is elongate, not sunken at the peristomal edge. Mortensen (1943) notes that circular specimens are rare, although very young stages are circular, and change shape with growth. The largest recorded specimen is one of 76mm greatest length (Agassiz, 1872).

The colour of the radioles is extremely variable, ranging from white to black (Mortensen, 1943). In present material they are faintly green basally, grey elsewhere. The test is almost white.

The species occurs all over the Indo-west-Pacific, and has elsewhere (Farquhar, 1897; Benham, 1911) been recorded from the Kermadec Islands, but is as yet unknown from New Zealand. Bathymetric range 0–139 metres.

Order CASSIDULOIDA

Apatopygus ? recens (Milne-Edwards) Pl. III, figs. 4–6

Apatopygus recens Mortensen, 1948, p. 181, figs. 158–163, Pl. 1, figs. 22–25, 31, 32, 34, 35. (Complete synonymy.)

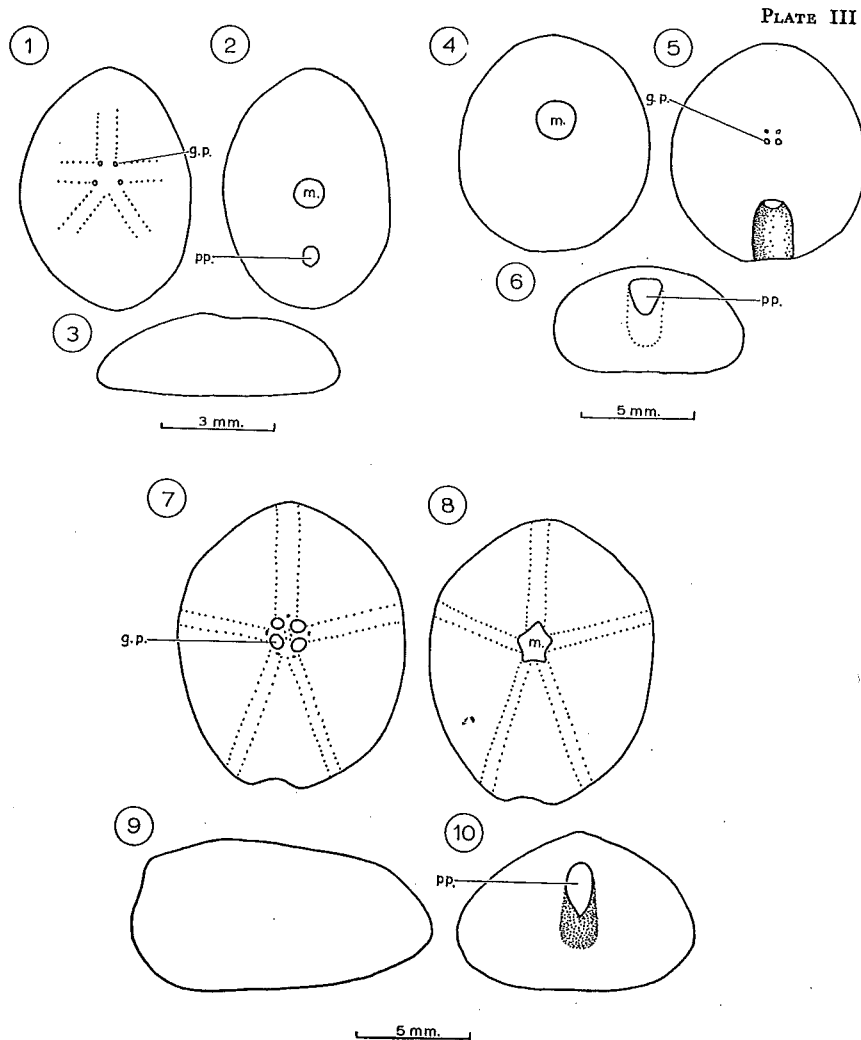
Material Examined: Station 53, approximately 33° 56' S., 172° E., 440–450 fathoms (792–810 metres), 1 naked test.

REMARKS. The specimen has the following dimensions: length, 9.5mm, greatest breadth, 8mm, height 4.5mm. Test broadly oval in outline (Pl. III, figs. 4, 5), flat ventrally, but slightly sunken towards the peristome. Dorsal side arched, sides of the test smoothly rounded laterally. The periproct is placed on the postero-dorsal side of the test, in a deep groove (Pl. III, figs. 5, 6). Four genital pores are present, the posterior pair being the larger. Mouth ventral, in a slightly anterior position. There is no evidence of petals or pores.

There is little doubt that this specimen represents the genus *Apatopygus*, but its specific placement is rendered difficult because of the lack of pedicellariae and radioles. Mortensen (1921) has described some growth stages of *A. recens* (M.-Edwards), noting that the petals may begin to form rather early, at a size of 8–9mm. The lack of forming petals in present material seems slightly inconsistent with Mortensen's evidence, but may represent an individual variation. Unfortunately Mortensen (1921) does not refer to the shape of the peristome in young stages of *A. recens*, but in a later publication, Mortensen (1948) employs the shape of the peristome as a feature by which the two species *A. recens* and *A. occidentalis* Clark may be distinguished, for in the former species it is transversely elongate, while in the latter it is circular.

In the present specimen the peristome is definitely circular (Pl. III, fig. 4), and the posterior genital pores are distinctly larger than the anterior pores, as they are in *A. occidentalis*. In *A. recens* the pores are all of approximately equal size. However, as the specimen is a juvenile, these characters may not persist with growth.

A. occidentalis is known so far only from Western Australia in depths of 18–40 metres, while *A. recens* ranges the South Island of New Zealand and the southern islands in depths of 10–162 metres, but has not as yet been recorded from north of the Wellington area, where it is rare. The specimen described here may not with certainty be referred to the New Zealand species. For the present its true identity must remain in doubt, until better material from the same area becomes available.



Echinocyamus polyporus Mortensen. Fig. 1—Test, dorsal aspect. Fig. 2—Ventral aspect. Fig. 3—Lateral aspect.
Apatopygus ? recens (Milne-Edwards). Fig. 4—Test, ventral aspect. Fig. 5—Dorsal aspect. Fig. 6—Posterior aspect.
Oligopodia epigonus (v. Martens). Fig. 7—Test, dorsal aspect. Fig. 8—Ventral aspect. Fig. 9—Lateral aspect. Fig. 10—Posterior aspect.
 Abbreviations: g.p., genital pore; m., mouth; pp., periproct.

Oligopodia epigonus (v. Martens) Pl. III, figs. 7-10

Oligopodia epigonus Mortensen, 1948, p. 228, figs. 211–216, Pl. I, figs. 5–13, Pl. XII, figs. 13, 14, 17, 19, 24. (Complete synonymy.)

Material Examined: Station 37, 29° 20' S., 169° 09' E., 110 fathoms (198 metres), 1 naked test.

REMARKS. The single test is not in good condition, and the position and numbers of the ambulacral pores cannot be determined exactly. But the shape of the test provides enough evidence for the inclusion of this specimen in the genus *Oligopodia*.

Test ovoid (Pl. III, figs. 7, 8), moderately high and vaulted. Total length 12.5mm, greatest breadth (at level of apical system) 10mm, height 7mm. Posterior interamb slightly raised to form a very weak keel (Pl. III, fig. 9), which is almost flat, sunken toward peristome, which is pentagonal in shape. Periproct terminal, dorsally placed in the truncated posterior end of the test, at the upper end of a narrow groove, and deeply sunken (Pl. III, fig. 10). Apparently the ambes are petaloid dorsally, but their exact configuration is impossible to determine.

Both the apical system and the peristome are slightly anteriorly placed. There are four very large genital pores (Pl. III, fig. 7); apparently this is a female specimen. Only five hydropores were seen, scattered between genital pores. The ocular pores are barely visible. Colour of denuded test, white.

It is possible that this specimen represents a different species from the only recorded surviving species of this genus, *O. epigonus*. The specimen has a pentagonal peristome, while Mortensen (1948) notes that in *O. epigonus* the peristome is elongate oval. But because of the lack of better material, it is felt best to leave the specimen in this known species. *O. epigonus* is known to vary considerably in the shape of the test (Mortensen, 1948), although as yet no variation in the shape of the peristome has been described. The largest specimen recorded is 20mm in total length, and thus the present specimen is probably almost full-grown.

Mortensen (1948) suggests that the centre of distribution of this species is the Malay region, and records its occurrence at the Kei Islands, Jolo, off Natal, between depths of 35 and 141 metres. The "*Siboga*" took a specimen at a depth of 390 metres, but it is unknown whether this specimen was dead or alive. Clark (1925) described specimens from Lord Howe Island, but later (Clark, 1946) indicates that this record must be regarded with some doubt. The present record, off Norfolk Island, is new, and indicates that the species does in fact also occur at Lord Howe Island.

Order CLYPEASTEROIDA

Clypeaster australasiae (Gray)

Clypeaster australasiae Mortensen, 1948, p. 79, figs. 49–50, Pls. XIX, figs. 1–2, XX, figs. 1–3, XXI, figs. 1–7, LXV, figs. 3, 6, 10, 17–19. (Complete synonymy.)

Material Examined: Station 26, off Steele's Point, Norfolk Island, 30 fathoms (54 metres), 1 specimen.

REMARKS. The single large specimen is typical of this species. Its dimensions are as follows:

Total length 119mm, width 98mm, height 40mm, thickness of margin 10mm.

Test elongate oval in outline, with slight emarginations in posterolateral interambes. Posterior end of body smoothly rounded, while anterior end is slightly sharper. Petaloid region is elevated to form a broad convexity in middle of dorsal side. Ventral side concave, sloping gradually toward the peristome, which is deeply sunken. Mortensen (1948) has described the considerable variation in shape which may be found in this species.

Colour in formalin (with radioles attached) dark brown. Denuded petals also dark brown, with a narrow lighter brown band medially in each petal.

C. australasiae is distributed about the east and south coasts of Australia, Tasmania, Lord Howe Island, in depths of 0–220 metres, and Fell (1949) describes specimens taken from New Zealand (East Cape and Parengarenga) in 70–157 metres. The occurrence of the species at Norfolk Island is consistent with the hitherto known distribution, but constitutes a new record.

Echinocyamus polyporus Mortensen. Plate III, figs. 1–3

Fibularia australis Benham, 1911, p. 162.

Echinocyamus polyporus Mortensen, 1921, p. 176, Pl. VI, figs. 28–31; Mortensen, 1925, p. 390, fig. 67; Clark, 1925, p. 163; Mortensen, 1948, p. 200, fig. 115b.

Fibularia polypora Lambert & Thiery, 1925, p. 577.

Material Examined: Station 9, 34° 45' S., 173° 51' E., 294–298 fathoms (529–536 metres), 1 naked test; Station 22, off Steel's Point, 52–57 fathoms (94–99 metres), 1 naked test. Denham Bay, Kermadec Islands, shore collection, 3 naked tests, collected by G. A. Fleming.

REMARKS. All five specimens are typical of the species. The specimen from Station 9 is heavily encrusted with bryozoans. Largest specimen 12mm in total length, smallest 7mm in length. Test elongate oval (Pl. III, figs. 1, 2), broadest at the level of the peristome, low arched, slightly higher toward the posterior end (Pl. III, fig. 3). Apical system central, with four genital pores. Petals long but not reaching the ambitus. The anterior petal is exactly similar to that figured by Mortensen (1948, p. 198). Peristome distinctly, but not deeply, sunken, with periproct lying half-way between peristome and posterior edge of test. Colour of test, greyish-white.

E. polyporus has been previously recorded from Cook Strait at a depth of 40 metres (Mortensen, 1921), and the Kermadec Islands 9–18 metres (Benham, 1911, as *Fibularia australis*). At this latter locality the species is very common. The present Norfolk Island record is new, and the occurrence of the species approximately 50 miles east of North Cape is not unexpected. The bathymetric range may now be given as 9–536 metres. Whether or not the species actually lives at a depth of 536 metres cannot as yet be established; it may well be that the dead test taken from that depth was carried there by bottom currents. It is notable, however, that several species of this genus have a wide bathymetric range (e.g., *E. pusillus* (Muller) 0–1250 metres), and this may also be the case in *E. polyporus*.

Peronella hinemoae Mortensen

Laganum sp. Bell, 1917, p. 6.

Peronella hinemoae Mortensen, 1921, p. 177, Pls. VI, figs. 22, 23, VII, figs. 31–36; Clark, 1925, p. 159; Mortensen, 1948, p. 284.

Echinodiscus hinemoae Lambert & Thiery, 1925, p. 581.

Material Examined: Station 22, off Steele's Point, Norfolk Island, 52–57 fathoms (94–104 metres), 4 naked tests; Station 113, 30° 30' S., 178° 33' W. (Curtis Island), 1 naked test.

REMARKS. In his key to the species in the genus *Peronella*, Mortensen (1948) gives the following diagnosis for *P. hinemoae*:

Genital pores placed within the apical system. Periproct naked, central, round or transversely oval. Oral ambulacral furrows not at all distinct.

The present material is more or less in accord with this diagnosis, but differs in some small respects. The statement "periproct central" refers to the position of the periproct relative to the peristome and posterior margin of the test. Thus in this species the periproct lies midway between the peristome and the posterior margin.

The dimensions of the present specimens are as follows:

	A	B	C	D	E
	mm	mm	mm	mm	mm
Length	29.0	21	9	9.0	5.0
Breadth at peristome	28.0	19	8	8.0	4.5
Height	5.5	4	2	2.0	1.0
Peristome (distance from posterior margin)	14.0	11	5	4.5	2.5
Periproct (distance from posterior margin)	5.5	4	2	2.0	1.2

The above table shows that all specimens are almost circular in outline. Distance between periproct and posterior margin is approximately 20% less than that between the periproct and the peristome, showing that the periproct is slightly posteriorly placed, while it should be "central" if these specimens are in fact representatives of *P. hinemoae*. Professor H. B. Fell of this Department has kindly permitted my examination of his comparative material of *P. hinemoae*, and it was found that among eight specimens examined, three have the periproct in a position exactly midway between the peristome and the posterior margin, while in the remaining five specimens the periproct is slightly posterior to this midpoint. In view of such variation, although slight, and the otherwise complete resemblance of the *Tui* specimens to *P. hinemoae*, they have been assigned to that species.

In all cases the test is quite white, but the colour of the test in this species can vary from light green to light red or white.

The species has been recorded from the north and east of northern New Zealand from depths of 70–128 metres. Fell (1952) reports specimens from Fiordland in the southwest of New Zealand, 18–28 metres, and later (Fell, 1958) from the Bay of Plenty from depths up to ca. 225 metres. Within New Zealand the species appears to have a discontinuous distribution, the Fiordland record being some 700 miles south of its nearest northern locality, as pointed out by Fell (1952). The present records, Norfolk Island and Kermadec Islands, are new, and considerably extend the known range of the species. A very closely related species, *P. pellucida* Doderlein, is known from Japanese seas between 75 metres and 550 metres (Mortensen, 1948).

Laganum depressum tonganense (Quoy & Gaimard)

Laganum tonganense Agassiz, 1841, p. 114, Pl. 26, figs. 7–19. (Synonymy.)

Laganum depressum var. *tonganense* Mortensen, 1948, p. 323, Pl. LIV, figs. 1–4, 7–9. (Complete synonymy.)

Material Examined: Station 103, at anchor, Raoul Island, 2 specimens.

REMARKS. Mortensen (1948) regards *Laganum tonganense* as a variety of *L. depressum*, characterised by a slightly more anterior periproct and shorter oral ambulacral furrows. Also the typical form has more or less developed shallow emarginations of the ambitus in the posterior and posterolateral interambis, while *L. depressum tonganense* has none. It is also pointed out (Mortensen, 1948) that there is considerable variation in the outline of the test, and smaller specimens of the species may not with certainty be placed in any of the currently accepted subspecies.

The two specimens in the present collection are complete and in excellent condition. They have the following dimensions:

	Specimen A	Specimen B
Length	62mm	61mm
Greatest breadth	57mm	58mm
Height	11mm	10mm
Petaloid area	37mm	33mm
Oral furrows (anterior)	13mm	13mm
Oral furrows (posterior)	15mm	17mm
Peristome (distance from posterior end)	32mm	31mm
Periproct (distance from posterior end)	13mm	13mm

As can be seen from the above table the ambitus is almost circular in outline, and the specimens are low, height being approximately 18% of breadth. Periproct slightly posteriorly placed, distance from the periproct to posterior margin (13mm, 13mm) being less than that between periproct and peristome (19mm, 18mm). Peristome and apical system slightly anterior. Posterior oral furrows are longer than anterior furrows, and all furrows extend from the peristome to a point approximately halfway between peristome and ambitus. Test light yellowish-brown in colour when denuded. Primary and secondary radioles light yellow.

Thus in the above characters these specimens agree with the subspecies *tonganense* of *L. depressum*, rather than with the nominate subspecies.

In describing the echinoids of New Zealand, Mortensen (1921) records *L. depressum* from off the Hen and Chicken Islands (in the northern part of the North Island) at a depth of 55 metres, and the single test he describes has the characters of the specimens in the present collection. At that time Mortensen identified this specimen as *L. depressum*, with some hesitation. More recently Mortensen (1948) referred the specimen to the "variety" *tonganense*. The occurrence of the present specimens at the Kermadec Islands represents a new record for the species. Mortensen (1948) gives its distribution as "South Sea, from the Tonga, Gilbert and Fiji Islands, New Caledonia, Admiralty Islands, Queensland and New Zealand". A widespread southern Pacific species, with a bathymetric range of 0-40 metres.

Order SPATANGOIDA

Brissopsis oldhami Alcock

Brissopsis oldhami Mortensen, 1951, p. 409, fig. 198a, Pls. XXI, fig. 10, LVIII, figs. 1-3, 5-20 (complete synonymy); Fell, 1958, p. 38.

Brissopsis zealandiae Mortensen, 1921, p. 193, Pl. 6, figs. 33-34.

Material Examined: Station 21, off Steele's Point, Norfolk Island, 310-400 fathoms (558-720 metres), 1 specimen; Station 12, 30° 37' S., 173° 53' E., 1,380-1,520 fathoms (2,484-2,736 metres), fragments.

REMARKS. Fell (1958) has established the presence of *B. oldhami* in New Zealand, and has referred Mortensen's (1921) species *B. zealandiae* to *B. oldhami*. The present (fragmented) specimen appears to represent *B. oldhami*. The test is greyish-white, radioles very light green. Total length 20mm.

B. oldhami ranges the Indo-west-Pacific in depths of 1,040-2,140 metres. About New Zealand the species is known from the northern part of the North Island to the Chatham Rise in depths of 75-1,980 metres. Its occurrence near Norfolk Island and north of New Zealand is therefore not unexpected, but the bathymetric range of *B. oldhami* is now 75-2,736 metres.

This species appears to be closely related to *B. lyrifera* (Forbes) which is wide-ranging in the Atlantic Ocean.

Class HOLOTHUROIDEA

Order ELASIPODIDA

Family ELPIDIIDAE Theel, 1882

DIAGNOSIS. Tentacles ten, rarely eleven to twelve or twenty. Midventral radius naked. Lateral ventral radii each with a single row of pedicels, which may be distributed throughout the radius, or confined to the posterior half or posterior extremity. Dorsally, a smaller number of long or short to rudimentary processes, more common anteriorly, where they may form a branched or unbranched lobe-like appendage. Calcareous deposits most commonly include straight or slightly curved, C-shaped or horseshoe-shaped rods, three-armed spicules; rarely minute net-like plates, rosette-shaped or elliptical bodies. (After Theel, 1882.)

This is a large family embracing a dozen nominal genera. The family is cosmopolitan, more common in the northern hemisphere, with representatives in all depths below about 500 metres.

Two genera within this family are now known to be represented near New Zealand. They may be diagnosed as follows:

- 1 (2) Lateral ventral radii with pedicels distributed along their entire length *Scotoplanes* Theel
- 2 (1) Pedicels of the lateral ventral radii confined to the posterior half of each radius *Amperima* (nom. nov. for *Periamma* Perrier)

Amperima nom. nov.

Periamma Perrier, 1896, p. 901, type species *P. roseum* Perrier. (Preoccupied, Gistel 1848.)

DIAGNOSIS. Body slightly elongate or egg-shaped, at most two and a-half times as long as broad; tentacles 10. Dorsal side on its anterior part presenting a transversal row of 3-4 papillae sometimes distinct, sometimes adjoining, sometimes fused into a voluminous transverse four-lobed appendix. Immediately behind these papillae a small number of isolated very small papillae are found on the dorsal ambulacra. Ventral sides each with a lateral row of pedicels which are usually developed behind the middle part of the body. Deposits triradiate bodies, together with sigmas. (After Perrier, 1901, in Deichmann, 1931).

REMARKS. Neave (Nomenclator Zoologicus, 1940) notes that the generic name *Periamma* was first used in 1848 (Gistel, *Nat. Thierr.*, viii) for a beetle. Thus it is preoccupied. Deichmann (1931, p. 134) uses two spellings (*Periamma* and *Perriamma*) for this generic name, and it was first thought that because of this, the name *Perriamma*, differing by the required single letter from the original name, should automatically become the correct name for this genus.

But the fact that *Periamma* and *Perriamma* are used several times on the same page as alternatives, both names being attributed to R. Perrier, and both referring to the one genus with the one type species (*roseum* Perrier), shows clearly that Deichmann (through either a typographical error or *lapsus calami*) intended only the one spelling. Both the names *Periamma* and *Perriamma* refer to the one genus and are of the same origin and meaning. According to Article 33, subsection (b) of the *Code* (1961), the name *Perriamma* must be regarded as an "incorrect subsequent spelling", and thus has no status in nomenclature. Consequently it follows that neither *Periamma* Perrier nor *Perriamma* Deichmann is available for the type species *roseum* Perrier, and a new name is required for the genus of which *roseum* Perrier is the type. The new name given here is an anagram of *Periamma*.

This genus is cosmopolitan, containing seven species, of which five are known from the Pacific and Indian Oceans. Most species are found in depths exceeding 3,000 metres (Madsen, 1953), and recently specimens of "*Periamma*" *naresi* were taken from the Sunda Trench in depths of 7,130–7,160 metres. A new species is here described from north of New Zealand.

Amperima tui n.sp. Pl. IV, figs. 1-3

Material Examined: "*Tui*" Station 098-111, 14 specimens; Station 098-46, 2 specimens.

DESCRIPTION. Body elongate, approximately cylindrical, with a well-defined high anterior end, which is narrower than the rest of body (Pl. XII, figs. 2, 3). Total length ranges from 42mm to 70mm. Mouth ventral, surrounded by a ring of 10–12 tentacles with poorly defined terminal discs, anus subdorsal. Midventral radius naked. Anterior half of each ventrolateral radius naked, while posterior half carries short pedicels in a single row, six large pedicels (ca. 2mm diameter) followed by six small and very inconspicuous pedicels. Dorsally, there are four finger-like processes (Pl. IV, fig. 2) arranged in a transverse row approximately 15mm from anterior end of body. Slightly behind and lateral to this row of processes are two small pairs of papillae (Pl. IV, fig. 2), which are often difficult to see. These papillae lie in radii. In dorsal interradius, immediately behind the row of large processes, is a single small unpaired papilla (Pl. IV, fig. 2).

Bodywall thick and firm, colour in alcohol light yellow to light greyish-brown. Ventrolateral pedicels sometimes darker than the rest of the body.

Calcareous ring a fragile network. The single polian vesicle is long, tubular (Pl. IV, fig. 1) and semi-transparent. Intestine broad, describing a large loop in the posterior half of the body. This loop is supported by mesenteries which are reduced to strong narrow bands attached in lateral interradii. Rectum supported by numerous muscle fibres, which attach in the left lateral interradius and the right ventral interradius.

The gonad comprises a single elongate, flattened tube, which broadens in the distal half of its length (Pl. IV, fig. 1), and gives rise to isolated tufts of short, branching genital caeca. Genital duct opens to exterior immediately anterior to large dorsal processes. A short stome canal also opens to exterior adjacent to the genital duct.

Radial muscles well developed as broad straps, light orange in colour. Transverse muscles are feebly developed.

No calcareous deposits were found anywhere in the body.

HOLOTYPE. The holotype (55mm total length) and four paratypes are lodged in the Dominion Museum, Wellington (Ech. 930, 931).

REMARKS. This species closely resembles *Amperima robustum* (Theel) in the character of its dorsal papillae, but in *A. robustum* there is generally only a single pair of smaller papillae posterior to the large processes. However, such small structures may easily be overlooked in poorly preserved material. The complete lack of calcareous deposits in the bodywall is a feature which immediately distinguishes *A. tui* from the other species in the genus, and because of this lack of deposits and the arrangement of the dorsal appendages the New Zealand material has been assigned to a new species.

Species completely lacking calcareous deposits are not common in the Elasiopoda (apart from the Pelagothuriidae, whose members characteristically lack deposits), and thus the question arises as to whether the present specimens have lost their deposits as a result of the method of their preservation. This is very doubtful, as other holothurians taken during the *Tui* cruise still retain their calcareous deposits in excellent condition. Moreover, past experience has shown that in material which has lost deposits due to preservation, for example, in acid formalin, traces of the deposits can generally still be detected.

Scotoplanes Theel, 1882

Syn. *Ellipinion* Herouard, 1923.

DIAGNOSIS. Elpidids with body elongate to ovate. Tentacles ten. Dorsal surface of the body with a small number of processes, which may be restricted to the anterior end of the body, or located anteriorly and posteriorly. Ventrolateral pedicels present in small numbers throughout the radii. Midventral radius naked. Deposits include C-shaped spicules, unbranched rods, and three-armed spicules, of which the last two types may be spinous.

TYPE SPECIES. *Scotoplanes globosa* Theel.

REMARKS. *Scotoplanes* contains seven species and ranges the Atlantic and Pacific oceans, to depths of approximately 10,000 metres. Herouard (1923) erected the genus *Ellipinion* (type species *Scotoplanes delagei* Herouard) to accommodate those *Scotoplanes* species which have the dorsal processes restricted to the anterior end of the body. Hansen (1956) regarded *Ellipinion* as a synonym of *Scotoplanes*, for on the basis of their calcareous deposits, the two genera are indistinguishable.

Scotoplanes gilpinbrowni n.sp. Pl. IV, figs. 4-6

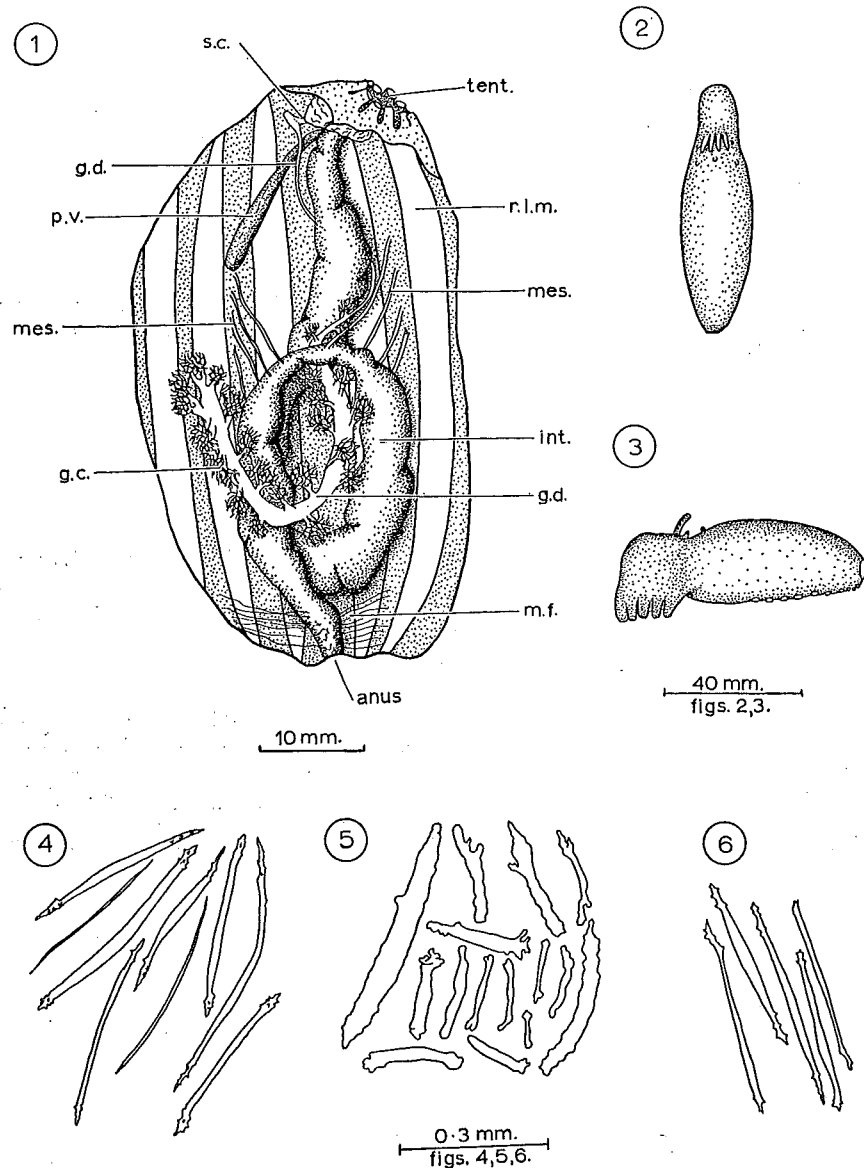
Material Examined: "*Tui*" Station 003-02, 1 specimen.

DESCRIPTION. Single specimen damaged anteriorly, so that tentacles are completely lacking. Total length 47mm, width at the widest part, 16mm. Body rounded posteriorly. Midventral radius naked, ventrolateral radii each with 11 short pedicels, which are regularly spaced anteriorly, slightly more crowded posteriorly. Dorsal surface of body apparently naked. Skin thin, but firm and leathery. Colour in life "greyish with irregular orange markings" in alcohol grey overall, pedicels light yellow.

Intestine large, describing a large loop. Gonad comprises a bunch of small light yellow branching caeca.

Calcareous deposits consist exclusively of spinous rods. In dorsal bodywall rods are long and narrow, sometimes slightly curved and very occasionally C-shaped, with spinous extremities (Pl. IV, fig. 4). Average length of these rods is 0.38mm. They are present in great numbers, with no regularity of arrangement. Ventrally, the deposits are somewhat similar (Pl. IV, fig. 6), but they are even more numerous, and tend to lie transverse to the longitudinal axis of the body. Ventral rods are of the same order of size as dorsal rods, although some individual rods are considerably longer.

PLATE IV



Amperima tui n. sp. Fig. 1—Internal anatomy. Fig. 2—Dorsal aspect of entire animal. Fig. 3—Left lateral aspect.

Scotoplanes gilpinbrowni n. sp. Fig. 4—Rods from the dorsal body wall. Fig. 5—Rods from the ventrolateral pedicels. Fig. 6—Rods from the ventral body wall.

Abbreviations: g.c., genital caeca; g.d., genital duct; int., intestine; mes., mesentery; m.f., muscle fibres; p.v., polian vesicle; r.l.m., radial longitudinal muscle; s.c., stone canal; tent., tentacle.

Tentacles are lacking, so their deposits remain unknown.

Ventrolateral pedicels carry at their distal extremities a large number of knobbed to spinous rods of variable shape and size (Pl. IV, fig. 5). Length of these rods varies from 0.07mm to 0.5mm.

HOLOTYPE. The holotype is lodged in the Dominion Museum, Wellington (Ech. 927).

REMARKS. The character of the calcareous deposits in this specimen is unique. The simple rods, straight or curved, with weakly spinous extremities, although found in many elasipod genera, are usually present in association with deposits of other types. After a thorough search of the bodywall in the present specimen, no other deposit types were found.

Three genera in the Family Elpidiidae have deposits in the form of simple rods. Some species of *Scotoplanes* Theel have simple rods, but these are usually associated with C-shaped deposits or triradiate spicules. *Kolga* Danielssen and Koren and *Irpa* Danielssen and Koren have rods usually associated with minute horseshoe-shaped spicules. On the basis of the calcareous deposits alone, the present specimen cannot be placed in any of these three genera.

It is most unfortunate that the anterior end of the body is missing from the specimen, as this region is of prime taxonomic importance. Because of this lack of certain important anatomical details, it is considered unwise to erect a new genus to accommodate this specimen, although the deposits seem to warrant such a course. There is very little doubt that the specimen should be placed in a new species. The number and disposition of the lateral pedicels, and the leathery character of the bodywall, recall certain species of the genus *Scotoplanes* Theel. Therefore, until more and better material becomes available, it seems the best course to refer this species to genus *Scotoplanes*, noting that the species may eventually be transferred to another genus or, as is more probable, be given the status of a new genus.

Family LAETMOGONIDAE Ekman, 1925

Benthogone rosea Koehler. Pl. V, figs. 2-5

Benthogone rosea Koehler, 1896, p. 114; Perrier, 1902, p. 399, Pl. XIX, figs. 8-14; Mortensen, 1927, p. 363, fig. 215; Deichmann, 1931, p. 121; Hedging, 1940, p. 369.

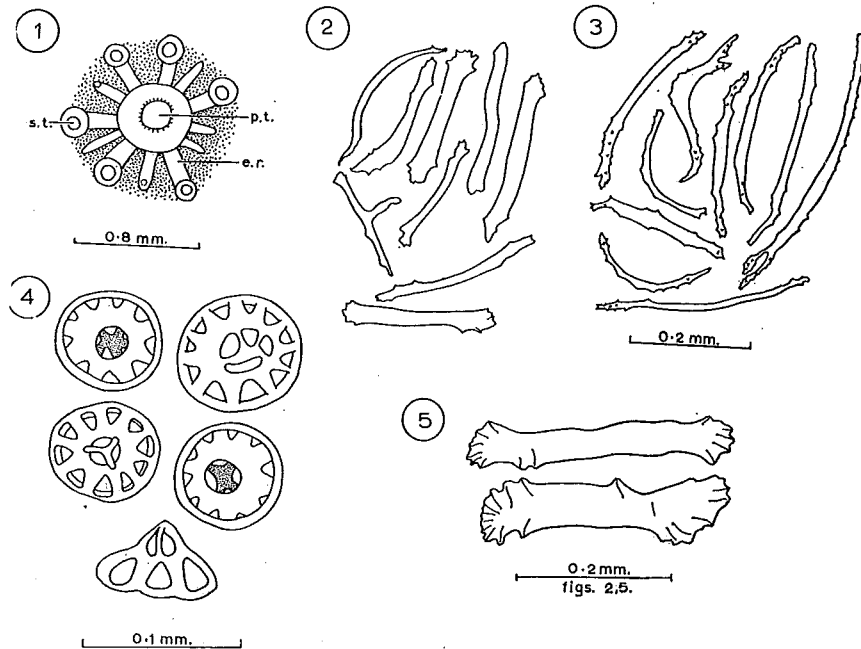
Benthogone rosea var. *cylindrica* Perrier, 1902, p. 400.

Benthogone rosea var. *quadrilineata* Perrier, 1902, p. 401.

Benthogone quadrilineata Hedging, 1940, p. 369; Hedging, 1942, p. 15.

Material Examined: "Tui" Stn. 098-17, 2 specimens.

DESCRIPTION. Both specimens are extensively damaged and autoeviscerated. Total length 103 and 105mm. Average breadth, 23mm. Body flattened dorsoventrally, elongate. Mouth subterminal, ventrally placed; anus subdorsal. Tentacles 15, with leathery terminal discs. Bodywall thick, firm. Ventrolateral radii each carry approximately 13 retractile pedicels; midventral radius naked. Each dorsal radius has ca. 40 short, retractile processes arranged in a single, sometimes double, row. Colour in alcohol greyish-white to light mottled violet dorsally, darker mottled violet ventrally. Tentacles light brown.



Pseudoechinus variegatus Mortensen. Fig. 1—Primary tubercle, showing radiating epistromal ridges extending towards secondary tubercles.

Benthogone rosea Koehler. Fig. 2—Small rods from ventral pedicels. Fig. 3—Tentacle deposits. Fig. 4—Wheels. Fig. 5—Large rods from ventral pedicels.

Abbreviations: e.r., epistromal ridge; p.t., primary tubercle; s.t., secondary tubercle.

Oesophagus and rectum light purple, radial muscles narrow light yellow bands. The single Polian vesicle is elongate, tubular, white in colour.

The bodywall contains wheels of only one type (Pl. V, fig. 4). The wheels have 7–13 spokes (40% have 11, 20% have 12), and are strongly vaulted. Diameter ranges from 0.064mm to 0.11mm, with an average diameter of 0.078mm. There is no correlation between wheel size and spoke numbers. Dorsally, wheels are scattered in small numbers, but they are rather more numerous ventrally.

Ventral pedicels contain, beside numerous wheels, small numbers of large (Pl. V, fig. 5) and small (Pl. V, fig. 2) rods, usually straight or slightly curved, with weakly spinous ends. The smaller rods have an average length of 0.18mm, while the larger type average 0.32mm in length.

Stems and terminal discs of tentacles contain spinous rods (Pl. V, fig. 3), many of which are curved. Curved rods are most commonly found in the tentacle discs; they have an average length of 0.3mm.

REMARKS. These are typical specimens of *Benthogone rosea*, differing little from those described by Koehler (1896) and Perrier (1902). The varieties *cylindrica* and *quadrilineata* originally described by Perrier (1902) were, according to Mortensen (1927) and Deichmann (1931), based on specimens in various

stages of contraction, and thus neither of those authors was in favour of maintaining these doubtful varieties. Heding (1940, 1942), however, regarded the var. *quadrilineata* as worthy of specific rank, and elevated it to that level. His evidence for doing so seems unconvincing to the writer, and it is felt best that *B. quadrilineata* should be reduced to complete synonymy with *B. rosea*.

DISTRIBUTION. Mortensen (1927) notes that this species is known from off south-west Ireland from 1,200–1,765 metres, the Bay of Biscay, off the Azores, and the African coast to the Cape Verde Islands in 1,000–2,320 metres. Heding (1940) records *B. quadrilineata* from near the Cape Verde Islands in depths of 2,480 metres ("Valdivia" Stn. 33) and 1,694 metres, and *B. rosea* from "Valdivia" Stn. 33. Later, Heding (1942) reported *B. quadrilineata* from west of Ireland at a depth of 1,330–1,440 metres. Its occurrence north of New Zealand is therefore unexpected, but the depth tolerance of the species would facilitate its wide distribution, and it is likely that *B. rosea* is widespread in the Pacific Ocean as well as in the Atlantic.

DISCUSSION

The distribution of each species has been considered in detail in the systematic section, but some general remarks about the fauna of the area sampled may be made. Stations 3, 9, 53 and 56 were occupied close to the New Zealand mainland, yielding seven species, of which three, *Salenocidaris hastigera*, *Coelopleurus* sp. and *Scotoplanes gilpinbrowni* are new additions to the known New Zealand fauna. As these species were collected from relatively deep water (252–1,782 metres), they are expected to occur further south at similar depths.

New records for the broad area bounded by New Zealand, Norfolk Island and the Kermadec Islands are as follows:

Prionocidaris australis
Stereocidaris sceptriferoides
Salenocidaris hastigera
Coelopleurus sp.
Oligopodia epigonus
Scotoplanes gilpinbrowni
Benthogone rosea
Amperima tui

Benthogone rosea was hitherto known only from the north Atlantic Ocean, while *Amperima tui* and *Scotoplanes gilpinbrowni* are described as new species. The remainder of the species listed above are widely distributed in the Indo-west-Pacific, and *Coleopleurus* is a genus well represented in the Indo-west-Pacific.

Fell (1953) analysed the generic content of the Tertiary and Recent echinoderm faunas of Australia and New Zealand, concluding that New Zealand and Australia have apparently derived many faunal elements from the northern Indo-Pacific region, and consequently have many elements in common at the generic level.

Previously, Fell (1949) had recorded the occurrence of Australian echinoids in New Zealand waters, and in view of the additional knowledge afforded by the present collections, it must be supposed that a substantial number of Australian or Indo-west-Pacific echinoids and holothurians are yet to be discovered north of New Zealand. There may in fact be a continuity between the deep-water faunas of Australia and New Zealand, such a continuity being established and maintained by trans-Tasman drift of larval stages and benthic migration across the Lord Howe Rise and the Norfolk Island Ridge.

Oligopodia epigonus, *Salenocidaris hastigera*, and *Stereocidaris sceptriferoides* are now known from several localities in the Indo-west-Pacific and from north of New Zealand; they are as yet unknown from Australia, but undoubtedly they occur there. Owing to the very small amount of sampling which has been carried out in Australian waters, the deepwater fauna of that region is very poorly known, and its content must be deduced on the basis of knowledge of the faunas of nearby areas (New Zealand and the Indonesian region).

ECHINOIDS KNOWN FROM NORTH OF NEW ZEALAND

The following list is intended to include all echinoids so far known from the area bounded by the Kermadec Islands, Norfolk Island and northern New Zealand (at latitude approximately 35° S.), with information on their distribution and bathymetric ranges. With regard to their distribution, special attention is paid to the presence of species in Australia, New Zealand and northern islands.

Bathymetric ranges (in brackets) are given in metres.

Abbreviations: A., Australia; I.P., Indo-west-Pacific; K., Kermadecs; L. H., Lord Howe Island; N., Norfolk Island; N.Z., New Zealand (including Three Kings Islands).

Order CIDAROIDA

- Prionocidaris australis* (Ramsay) A., N., L.H. (10-85).
Goniocidaris magi Pawson N.Z. (135).
Stereocidaris sceptriferoides (Doderlein) Japan, near N.Z. (360-700).
Phyllacanthus parvispinus Tenison-Woods A., K. (0-28).

Order LEPIDOCENTROIDA

- Araeosoma thetidis* (Clark) A., N.Z. (ca. 125-360).

Order HEMICIDAROIDA

- Salenocidaris hastigera* (Agassiz) N.Z., I.P. (370-2565).
Salenocidaris brachygnatha Mortensen K. (1080).

Order ARBACIOIDA

- Coelopleurus* sp. (chiefly an I.P. genus).

Order DIADEMATOIDA

- Centrostephanus rogersii* (Agassiz) A., K., L.H., N.Z. (0).
Aspidodiadema tonsum Agassiz K., I.P. (180-1135).

Order TEMNOPLEUROIDA

- Holopneustes inflatus* Lutken A., N., N.Z. (11-27).
Pseudechinus variegatus Mortensen N.Z. (65-120).
Pseudechinus grossularia (Studer) N.Z. (179).
Orechinus monolini (Agassiz) K., I.P. (ca. 450-2300).
Tripneustes gratilla (Linnaeus) A., N., K., I.P. (0-75).

Order ECHINOIDA

- Echinus multidentatus* Clark K. (1135).
Evechinus chloroticus (Valenciennes) K., N.Z. (0-20).
Heliocidaris tuberculata (Lamarck) A., K., L.H., N., N.Z. (0-54).
Echinometra mathaei (Blainville) A., K., L.H., I.P. (0-139).

Order HOLECTYPOIDA

- Echinoneus cyclostomus* Leske A., K., L.H. (0-120).

Order CASSIDULOIDA

- (*Apatopygus recens* (Milne-Edwards) N.Z. (10-162).)
Oligopodia epigonus (v. Martens) L.H., N., I.P. (35-141).

Order CLYPEASTEROIDA

- Clypeaster australasiae* (Gray) A., K., L.H., N., N.Z. (0-220).
Echinocyamus polyporus Mortensen K., N., N.Z. (9-536).
Peronella hinemoae Mortensen K., N., N.Z. (70-ca. 225).
Laganum depressum var. *tonganense* (Quoy & Gaimard) A., K., N.Z. (0-40).

Order SPATANGOIDA

- Brissopsis oldhami* Alcock N.Z., I.P. (75-2736).
Brissus latecarinatus (Leske) A., K., L.H., I.P. (O-ca. 45).
Brissus gigas Fell N.Z. (ca. 20).

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