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**NIWA**

*Taihoru Nukurangi*



The Marine Fauna of New Zealand:

**Basket-stars and Snake-stars  
(Echinodermata: Ophiuroidea: Euryalinida)**

D.G. McKnight

*NIWA Biodiversity Memor 115*

Cover photo: *Asteropora australiensis* H.L. Clark, on a plexaurid gorgonian,  
Three Kings Islands. Photo: Roger V. Grace.

NATIONAL INSTITUTE OF  
WATER AND ATMOSPHERIC RESEARCH (NIWA)

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NEW ZEALAND

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Frontispiece: *Astrobrachion constrictum* (Farquhar): two colour morphs on the black coral  
*Antipathes fiordensis*, Port Pegasus, Stewart Island. Photo: Roger V. Grace.

# The Marine Fauna of New Zealand:

## Basket-stars and Snake-stars

### (Echinodermata: Ophiuroidea: Euryalinida)

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#### ABSTRACT

The euryalinid fauna of the New Zealand region is now known to comprise some 33 species in 15 genera, with all families of the order represented. This review is based on collections held by the National Institute of Water and Atmospheric Research (NIWA) and the Museum of New Zealand (NMNZ), comprising over 1650 specimens. Four new species are added to the fauna (in the genera *Asteroschema*, *Ophiocreas*, and new genus *Astroniwa*), and two new records (*Astrotoma drachi* and *Astrodia tenuispina*).

Four species are restricted to the continental shelf (< 200 m) and a further seven occur on the continental slope. Most of the species (16) occur on the slope between 200 m and 2000 m. Only three species are known from depths below 2000 m.

Seven species are known from the far north of the region, while nine extend further south; two species are known only from the central New Zealand area, three are more southern in distribution, and eight are more or less widespread.

Nine species are endemic to the region. Five species form a distinct element, present elsewhere only in Australian seas; 12 species form a relatively widespread Indo-West Pacific element; one is more or less circumpolar in temperate waters, and three species are geographically widespread.

**Keywords:** Echinodermata, Ophiuroidea, Euryalinida, classification, distribution, new species, new genus, marine fauna, New Zealand.

## INTRODUCTION

Brittle-stars (Phylum Echinodermata, Class Ophiuroidea) are relatively common members of marine faunas, occurring from the intertidal zone to deep-sea trenches. They generally have a more or less circular disc, usually with five, but sometimes up to eight, arms. When captured the arms are often shed and become fragmented. In most species the arms do not branch, although a few have the arms repeatedly branching.

The first New Zealand ophiuroid was described in 1869 (*Ophiopsammus maculata* (Verrill)), and Mortensen (1921) summarised the history of the fauna. Of the 16 currently recognised families, all but one, Ophiocanopidae are represented locally. The present report details members of the order Euryalinida from the New Zealand region, defined by the boundaries 24° S to 57°30' S latitude, 157° E to 167° W longitude (CANZ 1997).

Members of this order have the arms coiling vertically. They commonly lack distinct plates or scales on the upper disc surface, the radial shields are usually elongate, bar-like, or sometimes composite; skin or granules cover the upper and lower disc surfaces, and may extend along the arms. The arm-spines are often transformed into hooklets, especially near the arm-tips. It is in this order that branching arms are present.

The first euryalinids described from the New Zealand region were two species of *Astroschema* (Lyman 1879, 1882). Two further euryalinids were added in the 1900s (Farquhar 1900; Benham 1909), and a further five species were recorded, with a comprehensive account of the known fauna, by Mortensen (1924). In later years, the species list slowly increased until Baker (1980) presented a major revision of the euryalinid fauna of the Southwest Pacific, describing 26 species from the New Zealand region, including six new species and one new genus. The present report summarises further collecting in the New Zealand region and adds seven more species, including four new species and one new genus.

### General Features

The class Ophiuroidea comprises generally stellate echinoderms with slender arms, usually simple but branching in a few genera. There are commonly five arms but in a few species seven or eight may occur.

The arms are of solid construction, with an internal row of vertebrae, each composed of two fused ambulacral ossicles. In contrast to the Asteroidea, ambulacral grooves are absent and the podia are reduced to small papillate organs which lack an ampulla. All species lack an intestine and anus, and all but one genus lack extensions of the digestive system into the arms. The gonads are restricted to the disc in most genera, and usually open ventrally at the sides of the arms bases. The Ophiuroidea are commonly known as brittle-stars, due to the brittle nature of the arms, or as snake-stars from the snake-like appearance of the arms. Ophiuroids are common members of marine faunal assemblages, although are sometimes overlooked because of their generally small size and cryptic habits.

Most ophiuroids lack the varied external appearance so evident in the Asteroidea. Most have a small flattened disc, rounded, pentagonal, or scalloped in outline, from which depend the five or more long slender, smooth or spiny arms.

The order Euryalinida is characterised by the presence of a skin covering the disc, below which there are generally no regularly arranged large plates; the arms usually roll into vertical coils and the arm-spines are placed at the ventrolateral margin of the arms and point downwards. This order contains all the genera with branching arms.

Five elongate pairs of areas are generally visible above the dorsal disc surface (aboral) in the Euryalinida. These are the radial shields, and may be entire or composed of several "soldered" ossicles. The radial shields may be skin-covered or variously ornamented with granules, tubercles, or short spikes; granules may be flattened or domed, in which case they may be regarded as small tubercles. Their surface is smooth, nodular, or beset with fine spines or thorns. The rest of the disc surface may also be variously covered with ornamentation, occasionally plated, or simply covered over by naked skin. Stronger marginal plates may be evident at the disc margin. The mouth lies on the ventral or oral surface.

The entire ventral surface may be naked or ornamented as the dorsal surface, or the ornamentation may be restricted to the area close to the mouth opening, the oral frame. Within the oral frame there are usually five plates; from the outer edge these are: the oral shield, an unpaired rounded to elongate single plate, lying in the mid-interradius; flanking the oral



shield or situated orally to it is a pair of adoral shields, inside of which are two oral plates (jaw plates, half jaws). These latter extend into the mouth field and almost always bear papillae along their sides (oral papillae) and, at the tip, tooth or dental papillae.

Below the tip of the jaw is a vertical row of pointed or flattened calcareous teeth. In addition, situated below the oral papillae are the first two podia, the oral tentacles or podia, arising from their respective oral tentacle-pores. Usually one of the oral shields is modified as a madreporite, although it may be scarcely distinguished; in some species there may be more than one such madreporite; also the madreporite may be placed at the outer edge of the oral frame or enclosed within it.

Outside the oral frame the ventral interradial areas may be naked or have a sparse to complete cover of granules or tubercles. Alongside the ventral surface of the arm is an elongate opening, the genital slit, whereby the gonads communicate with the exterior, and which also appear to assist in respiration. This genital slit is margined on each side by the genital plate, although that part adjacent to the arm may be hidden by skin or ornamentation.

As noted above, the arms are internally composed of united ambulacral ossicles, and for each arm segment so formed is a pair of podia (sometimes sheathed by skin) on either side of the ventral surface; close by the podia are the downwardly directed arm-spines. In the Euryalinida these never extend up the sides of arms. Arm-spines are usually absent from the first one or two arm segments; at first they are short, but from beyond the disc are longer, and those of each segment may differ in length; commonly they are beset with small spines, thorns, or prickles, especially near the tip, and they may be enveloped in a glandular bag of skin. Near the arm-tip the arm-spines usually become distally hooked, where they may have additional teeth below. Covering over the arm surface there may be thin calcareous plates, often irregular in outline, although more definite in some. These plates may extend down the sides of arms, and arm-spines generally arise from lateral arm-plates at the ventrolateral margin. The arm ventral surface may be irregularly paved with flat plates or there may be regular ventral arm-plates present, either separating the lateral arm-plates or situated distal to them, where they meet on the ventral midline.

Species with branching arms are restricted to the

families Gorgonocephalidae and Euryalidae. There are five arms from the oral frame in both families, but these divide near the disc margin or beyond; the branching can be equal or often unequal, with one branch longer than the other, or with more subdivisions.

The family Gorgonocephalidae also differs from others in that the arms have transverse bands of small hooks, each with a terminal tooth and sometimes with subsidiary teeth below. These girdle bands of girdle hooklets are arranged one or two to each arm segment, and more or less alternating with bands of granules.

### Habitat

Within the New Zealand region most five-armed species of the Euryalinida occur as epizooites on sponges, antipatharians, pennatulacea, gorgonians, and alcyonaceans and occasionally may be found on submerged logs or rocks. They are generally commoner beyond the continental shelf, although one species is relatively common on antipatharians in Fiordland. In contrast, most specimens with branching arms have been taken on level bottoms, often where the sediment is fine-grained. All species are thought to feed mainly on small planktonic organisms, for which the hooked distal arm-spines and girdle hooklets are obvious capture devices; apparently those species with branching arms have difficulty climbing or clinging to coelenterates and other benthic epifauna.

### Order Euryalinida

Ophiuroids with disc and arms covered by skin, with or without granules; arms coil vertically and vertebrae articulating by broad hourglass-shaped surfaces. Arms usually five at base, but may branch beyond base, a few species with more than five arms. Arm-spines point downwards.

Four families are currently recognised and all are present locally.

Species with unbranched arms are commonly found clinging to cnidarians and are often conspicuous because of colour or shape. Those with branching arms are commoner on softer seafloor sediments, and some are very large and conspicuous.

## CHECKLIST OF SPECIES

(\* new species and records described in this Memoir)

### Family ASTERONYCHIDAE

*Asteronyx loveni* Müller & Troschel  
\**Astrodia tenuispina* (Verrill)

### Family EURYALIDAE

*Astroceras elegans* (Bell)  
*Astroceras kermadecensis* Baker

### Family ASTEROSCHEMATIDAE

\**Asteroschema bidwillae* n.sp.  
*Asteroschema horridum* Lyman  
*Asteroschema igloo* Baker  
*Asteroschema migrator* Koehler  
*Asteroschema salix* Lyman  
*Asteroschema tubiferum* Matsumoto  
\**Asteroschema wrighti* n.sp.  
*Astrobrachion adhaerens* (Studer)  
*Astrobrachion constrictum* (Farquhar)  
*Ophiocreas japonicus* Koehler  
\**Ophiocreas mortensenii* Koehler  
*Ophiocreas oedipus* Lyman  
*Ophiocreas sibogae* Koehler  
*Ophiocreas willsi* n.sp.

### Family GORGONOCEPHALIDAE

*Asteroporpa australiensis* H.L. Clark  
*Asteroporpa reticulata* Baker  
*Astroboa granulatus* (H.L. Clark)  
*Astroboa* sp.  
*Astrocladus tonganus* Döderlein  
*Astrocladus elingamita* Baker  
\**Astroniwa nukurangi* n. gen. et sp.  
*Astrothorax waitei* (Benham)  
*Astrothrombus rugosus* H.L. Clark  
*Astrothrombus vecors* (Koehler)  
\**Astrotoma drachi* Guille  
*Gorgonocephalus chilensis* (Philippi)  
*Gorgonocephalus dolichodactylus* Döderlein  
*Gorgonocephalus pustulatum* H.L. Clark  
*Gorgonocephalus sundanus* Döderlein

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### Tabular Key to Families of the Order Euryalinida

	1	2	3	4	5	6	7
Asteronychidae	no	no	no	no	no	no	5
Asteroschematidae	no	yes	no	no	no	no	3-8
Euryalidae	no	yes	yes	yes	yes	yes	3-9
Gorgonocephalidae	yes	no	no	no	yes	no	5

- 1 Hooklets on dorsal sides of arms
  - 2 Gonads enter arms
  - 3 Vertebrae with ventral furrow closed
  - 4 Distal arm-spines with a serially perforated lamina
  - 5 Arms may branch
  - 6 Distal arm-joints long and slender
  - 7 No. of primary arms
-

## LIST OF STATIONS

Stn No	Date	Latitude (°S)	Longitude	Depth (m)	Stn No.	Date	Latitude (°S)	Longitude	Depth (m)
<b>NIWA (NZOI) Collections</b>					1667	13.3.79	47 45.60	179 16.98 W	648
A910	13.9.63	43 04.02	178 39.00 W	549	1674	14.3.79	48 00.42	179 10.50 W	750
B489	7.6.61	46 39.00	166 09.48 E	198	1689	17.3.79	48 51.48	178 41.52 E	808
C60	7.6.56	41 22.98	174 25.50 E	143	1691	17.3.79	48 50.10	179 44.22 E	827
C527	18.9.60	32 30.00	179 12.00 W	508	1693	18.3.79	49 05.58	178 52.98 E	778
C617	30.4.61	43 58.38	175 22.92 W	302	1705	21.3.79	47 30.00	178 45.00 E	739
C632	27.5.61	39 13.98	172 01.02 E	406	1721	26.3.79	44 07.38	175 46.20 E	540
C645	28.5.61	39 18.00	172 00.00 E	442	1732	11.5.79	25 10.50	159 38.52 E	61
C758	17.2.62	34 40.02	172 14.52 E	203	1733	11.5.79	25 01.02	159 37.50 E	66
C957	7.3.63	43 09.00	175 15.00 E	123	J55	17.5.60	44 05.52	176 12.00 E	198
D876	25.3.69	43 19.98	176 49.98 W	148	J58	20.5.60	43 31.02	179 09.48 E	512
D899	29.3.69	44 22.98	176 49.02 W	370	J59	20.5.60	43 51.00	179 25.02 E	309
E312	10.4.65	34 00.00	171 47.52 E	119	J676	8.9.74	37 22.50	177 11.70 E	341
E323	11.4.65	34 00.00	172 15.00 E	165	J683	8.9.74	37 20.70	177 06.78 E	388
E336	12.4.65	34 00.00	172 30.00 E	157	K800	22.7.74	29 11.88	177 50.82 W	555
E389	16.4.65	34 01.50	172 43.50 E	155	K806	23.7.74	28 30.72	177 49.32 W	1165
E399	6.10.65	46 00.00	171 33.00 E	1222	K812	24.7.74	29 16.98	177 54.00 W	10
E411	10.10.65	46 38.52	170 58.98 E	1275	K856	30.7.74	30 33.48	178 31.08 W	465-521
E636	10.10.66	37 28.50	177 13.02 E	190	P7	25.1.77	32 40.98	167 28.62 E	150
E716	22.3.67	38 40.08	178 31.98 E	551	P16	26.1.77	29 36.30	168 04.98 E	310
E756	30.3.67	42 01.80	174 26.52 E	885	P26	27.1.77	28 54.90	167 44.80 E	130-301
E774	15.10.67	42 00.00	169 15.00 E	1168	P39	29.1.77	29 10.38	167 51.72 E	77
E841	16.3.68	33 52.98	172 16.98 E	262	P41	29.1.77	29 10.20	167 47.28 E	669
E845	16.3.68	34 07.50	172 01.02 E	277	P46	30.1.77	28 42.30	167 56.70 E	475
E859	18.3.68	32 01.02	168 03.00 E	500	P62	6.2.77	34 10.02	172 07.80 E	25
E863	19.3.68	32 31.98	167 25.98 E	900	P98	30.5.77	31 45.78	159 10.20 E	60
E865	19.3.68	32 40.98	167 36.00 E	168	P103	30.5.77	31 37.62	159 04.02 E	41
E906	27.3.68	38 39.00	172 37.98 E	691	P108	31.5.77	31 32.10	159 01.20 E	30
F126	28.1.65	49 48.00	176 01.02 E	1256	P109	31.5.77	31 30.18	158 57.90 E	69
F132	29.1.65	49 58.98	177 31.98 E	1335	P939	22.4.80	41 20.40	166 54.78 E	1760
F149	2.2.65	50 31.02	174 19.02 E	1026	P946	31.5.80	25 59.10	179 18.10 W	660
F751	18.6.66	45 22.98	175 28.98 E	1277	P960	8.6.80	23 37.30	178 55.90 W	10-40
F752	18.8.66	45 25.02	174 30.00 E	1233	P970	17.6.80	39 30.00	178 49.98 E	3391
F779	5.9.66	37 27.00	178 58.02 E	161	Q24	22.3.78	44 29.70	176 33.72 W	320
F871	3.10.68	37 23.52	178 10.98 E	547	Q31	23.3.78	44 15.78	176 54.78 W	340
F874	3.10.68	37 18.00	178 10.98 E	1357	Q38	24.3.78	44 24.78	176 43.62 W	345
F881	4.10.68	37 07.50	177 13.98 E	1260	Q51	25.5.78	31 30.72	159 04.68 E	19
G169	20.11.67	42 04.02	174 19.98 E	146	Q72	3.6.78	24 52.92	159 37.32 E	65
G200	19.1.68	43 54.00	179 43.98 W	395	Q83	7.6.78	33 00.18	163 01.20 E	816
G355	3.2.68	44 00.48	178 37.98 W	439	Q99	7.11.78	46 04.80	166 37.62 E	6
G821	15.2.71	33 18.48	162 35.52 E	791	Q100	7.11.78	45 43.80	166 43.92 E	0
G822	15.2.71	33 20.40	162 49.20 E	875	Q104	9.11.78	45 01.62	167 15.42 E	0
G886	13.12.70	48 13.98	179 40.98 E	335	Q343	14.11.79	44 07.80	175 47.82 E	500
I45	9.5.75	35 00.12	174 59.88 E	596	Q749	16.7.82	44 54.00	167 26.20 E	40
I63	12.5.75	36 11.28	176 22.98 E	797	Q769	22.7.82	46 02.14	166 46.50 E	32
I85	22.7.75	29 07.90	168 15.00 E	280-290	R435	15.6.90	39 25.80	178 25.32 E	985
I90	23.7.75	29 25.02	168 05.58 E	71	R438	16.6.90	39 25.98	178 20.28 E	1010
I92	23.7.75	29 24.78	168 13.20 E	570	R439	16.6.90	39 26.82	178 19.98 E	1000
I94	23.7.75	29 20.22	168 10.80 E	308	S6	11.9.78	42 35.88	170 39.72 E	201
I622	22.2.79	45 56.10	166 58.90 E	0-20	S13	11.9.78	42 36.30	170 38.40 E	370
I627	22.2.79	46 02.52	166 46.92 E	0-25	S30	18.9.78	50 40.98	167 40.80 E	265
I666	13.3.79	47 47.52	178 59.52 W	1165	S66	26.9.78	48 03.78	179 40.32 E	466
					S70	26.9.78	47 45.60	178 30.78 E	353

Stn No.	Date	Latitude (°S)	Longitude	Depth (m)	Stn No.	Date	Latitude (°S)	Longitude	Depth (m)
S71	27.9.78	47 55.20	178 37.60 E	365	Z8883	6.7.97	37 25	176 53E	550
S121	20.10.79	43 30.60	175 58.08 E	335	Z8919	25.6.95	36 30	176 30.90 E	956-985
S194	1.11.79	43 09.42	173 47.52 E	1190	Z8968	4.8.96	42 46.69	177 33.06 W	941-
S233	15.2.80	46 01.80	166 46.20 E	9			42 45.08	177 32.96 W	1051
T23	11.3.81	47 59.70	179 07.80 W	830-890	Z8981	5.12.97	44 57.68	174 11.23 E	1041-
T29	12.3.81	48 20.30	179 30.70 W	768			44 56.76	174 09.56 E	1051
T36	13.3.81	48 43.68	179 27.12 E	775	Z8987	17.1.98	37 29.7	176 40.4E	460-493
T109	24.4.81	39 45.80	178 14.10 E	288-350	Z8988	17.1.98	37 27.8	176 39.7E	523-527
T220	20.3.82	29 14.52	177 52.20 W	0	Z8989	17.1.98	37 32.6	176 48.6E	550-577
T224	21.3.82	29 14.00	177 52.90 W	410	Z8990	18.1.98	37 31.7	176 47.0E	570-590
T226	22.3.82	28 33.00	177 49.98 W	800	Z8991	18.1.98	37 35.1	176 43.6E	440-495
T235	23.3.82	30 19.32	178 21.00 W	510	Z8992	18.1.98	37 34.0	176 39.2E	299-340
T237	23.3.82	30.17.00	178 30.00 W	1090	Z8996	19.1.98	37 23.2	176 32.9E	525-552
U582	5.2.88	31 52.00	172 26.50 E	1054-988	Z8997	19.1.98	37 25.2	176 36.5E	537-557
U594	7.2.88	30 20.10	172 59.60 E	406	Z8999	20.1.98	37 36.1	177 12.1E	460-467
U600	8.2.88	31 01.70	173 22.70 E	620	Z9000	20.1.98	37 37.1	177 13.9E	445-467
W426	19.2.95	43 31.17	175 37.62 E	320-419	Z9001	20.1.98	37 37.9	177 09.1E	205-228
W427	20.2.95	43 04.65	175 16.34 E	180-237	Z9007	21.1.98	37 08.6	176 19.6E	472-475
W430	20.2.95	43 02.47	175 09.00 E	310-330	Z9008	22.1.98	37 09.9	176 21.7E	518-536
X121	23.11.89	37 24.70	177 11.10 E	340	Z9018	24.1.98	36 55.7	176 15.0E	247-275
X152	28.11.89	36 09.74	176 48.38 E	940-820	Z9020	24.1.98	36 42.2	176 15.9E	520-527
X174	2.1.289	36 26.83	176 51.26 E	1800-1700	Z9021	24.1.98	36 40.9	176 14.8E	465-470
X369	13.2.92	36 04.60	178 01.70 E	505-611	Z9022	24.1.98	36 38.8	176 11.0E	288-298
X371	13.2.92	36 04.29	178 01.08 E	507-644	Z9026		31 58.8	174 15.87 E	700
X483	4.7.94	42 45.89	179 54.45 W	890	Z9041	5.4.98	32 10.9	179 04.2 W	128-260
X488	5.7.94	44 01.54	174 34.51 W	755-940	Z9042	6.4.98	32 12.0	179 05.0 W	202-292
X652	11.2.96	35 21.96	178 33.17 E	1496-1292	Z9043	5.4.98	32 10.5	179 04.9 W	224
X654	11.2.96	35 21.41	178 33.17 E	1365-1184	Z9044	6.4.98	32 11.7	179 05.5 W	122-307
X693	14.2.96	35 52.950	177 55.57 E	1664-1920	Z9157	19.5.98	36 32.18-	176 30.64	899-
X696	15.2.96	35 53.146	177 40.48 E	1680-1653			36 33.54	176 30.06 E	1026
X700	15.2.96	35 50.45	177 54.50 E	1760-1765	Z9159	25.5.98	36 10.13-	176 44.66	967-
Y18	13.3.97	46 01.68	165 58.66 E	440			36 10.68	176 44.61 E	1098
Z2371	15.4.71	41 23	170 47 E	366	Z9160	25.5.98	36 31.17-	176 29.79	912-
Z2374	16.4.71	42 09	170 36 E	366			36 30.96	176 28.51 E	1080
Z2375	16.4.71	42 30	170 36 E	348	Z9163	25.5.98	36 08.34-	176 43.64-	949-
Z2376	17.4.71	42 27	169 14 E	348			36 07.91	176 43.06 E	1060
Z2699	1.5.78	Off Mahia Peninsula		150	Z9173	5.7.98	37 02.3	176 41.9 E	1003-1108
Z6482	13.12.88	43 44.70	175 07.90 E	417-442	Z9181	-7.98	37 01.4	176 43.1 E	972-1207
Z8253	-12.94	36 52.30	176 16.37 E	380-385	Z9225	15.8.98	37 097.8	177 12.2 E	648
Z8255	-12.94	36 06.20	176 17.20 E	540	Z9227	17.8.98	37 05.8	176 41.6 E	985-1025
Z8422	13.1.95	40 36.50-	176 48.92	256-	Z9229	15.8.98	36 53.8	177 22.3 E	787
		40 33.91	176 51.93 E	268	Z9230	15.8.98	36 53.8	177 22.3 E	787
Z8425	17.1.95	39 44.29-	177 33.38-	311-	Z9566	16.10.98	44 42.8-	175 46.1-	673-
		39 45.59	177 29.74 E	354			44 44.1	176 45.5 W	823
Z8481	-4.96	37 54-	179 13-	1050-	Z9628	14.9.98	35 55.2-	165 36.1-	1118
		37 54	179 14 E	1100			35 54.4	165 36.2 E	
Z8483	29.4.96	35 57-	176 30-	700-	Z9271	19.9.98	34 03.9-	162 35.5-	694
		35 58	176 49 E	750			34 03.8	162 35.7 E	
Z8528	7.4.96	36 51.84-	176 18.04-	504-	Z9275	20.9.98	34.11.4-	162 39.4-	660
		36 54.84	176 19.15 E	518			34.12.0	162 39.8 E	
Z8566	7.10.96	43 04.00-	175 39.00-	460	Z9279	10.9.98	37 29.0-	167 43.3-	883
		43 12.00	175 53.00 E				37 28.8	167 43.7 E	
Z8691	14.2.92	4524.23	174 35.39 E	50?-316	Z9340	20.9.98	50 04.9	165 54.8 E	
Z8797	18.4.97	43 03.06	175 27.64 E	168-235	Z9343	29.9.98	48 59.6	175 35.9 E	
Z8879	3.8.97	43 04.94-	169 25.41-	678-	Z9412	26.3.97	43 12.85-	169 40.51-	261-
		43 05.92	169 27.78 E	729			43 10.17	169 44.24 E	270
Z8882	-8.98	37 01	176 43.10 E	976-11 29	Z9413	7.1.96	44 21.69	176 06.01 E	243-



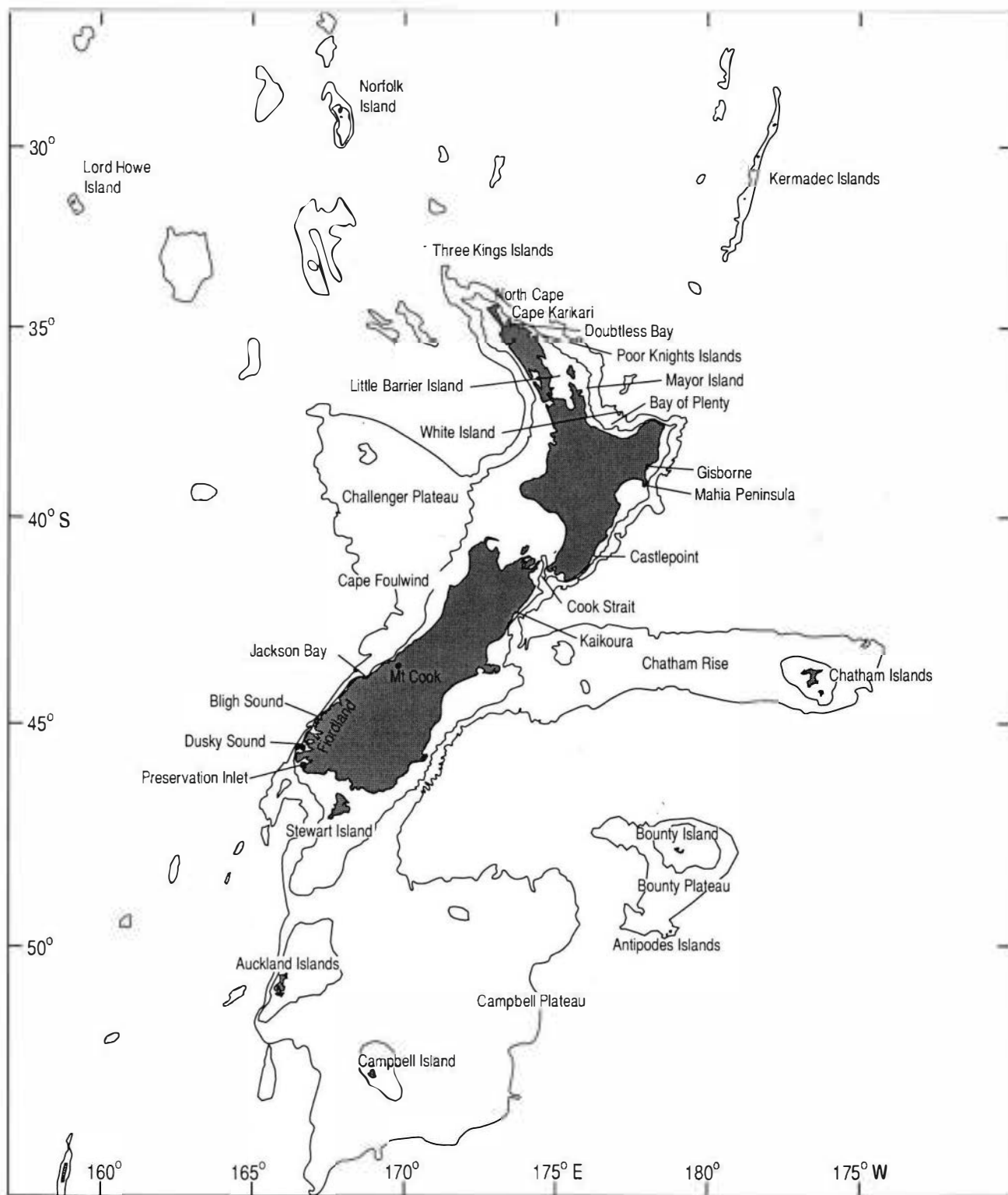


Fig. 1. Collection localities to accompany station data.

## SYSTEMATICS

Family ASTERONYCHIDAE Müller & Troschel, 1842

**Disc** and arms covered with naked skin; arms simple; gonads restricted to disc; distal arm spines hooklet-like, without perforated lamina; open ventral groove to vertebrae.

*Asteronyx* Müller & Troschel, 1842

**Disc** and arms covered dorsally with naked skin; more than three arm-spines, all, or most, modified as simple hooklets.

**TYPE SPECIES:** *Asteronyx loveni* Müller & Troschel, 1842

*Asteronyx loveni* Müller & Troschel, 1842

(Fig. 2, Pl. 1)

*Asteronyx loveni* Müller & Troschel, 1842: 119, pl. 10(3-5); Döderlein, 1927: 59, 97, pl. 7(7, 7a, 8); Baker 1980: 16 (*cum syn.*); Paterson 1985: 13.

### MATERIAL EXAMINED:

NIWA Stns: E399(1), E411(1), E774(1), F126(6), F132(1), F149(4), F751(1), F752(11), I666(1), I689(1), I691(3), P939(4), T36(1), Z9340(1).

**DESCRIPTION:** NIWA Stn F752, disc diameter 10 mm, arms at least 45 mm long, broken.

Disc inflated, outline pentagonal, interradii concave; disc margin rounded. Disc and arms, above and below, covered by smooth skin. Disc with radial shields conspicuous, elongate, extending to near disc centre where they more or less meet. Radial shields slightly curving, those of a pair widest apart at about one-quarter disc radius from margin; surface of shields smooth, areas between shields covered by smooth skin. Underside of disc skin-covered, plates of oral area relatively distinct. Only one small oral shield present, presumably the madreporite; proximal margin bluntly pointed, distal margin rounded. Adoral shields large, meeting broadly within. Distal margin of adoral shields form a wide, concave curve, that borders proximal side of a depressed area where genital slits lie; distal margin almost completely framed by genital scale, centrally without support. Genital slits short and separate within area. Oral

plates with 2 or 3 small pointed oral papillae along each side papillae along each side of jaw; tip of jaw with 2 or 3 similar, although slightly larger, apical papillae. Teeth also pointed, in a single vertical series.

Dorsal surface of arms covered with smooth skin, dorsal arm-plates absent; skin vertebrae clearly visible beneath. Lateral arm-plates meet on ventral midline, spines at ventrolateral margin extending onto ventral surface; a single spine at arm-base, increasing to about 5 from basal arm-segments; spines shorter than arm-segment, transformed into hooklets from arm-base. Uppermost spine a simple elongate hook, others with 3 or 4 hooks along shaft. Tentacle-pore placed just distal to lowest arm-spine; no tentacle-scale. Ventral arm-plates separated throughout arm, small, squarish to rectangular, with rounded corners.

**COLOUR** (ex ethanol): Dorsal surface of disc light brown, radial shields white; ventral interradial areas light brown; arms whitish above and below.

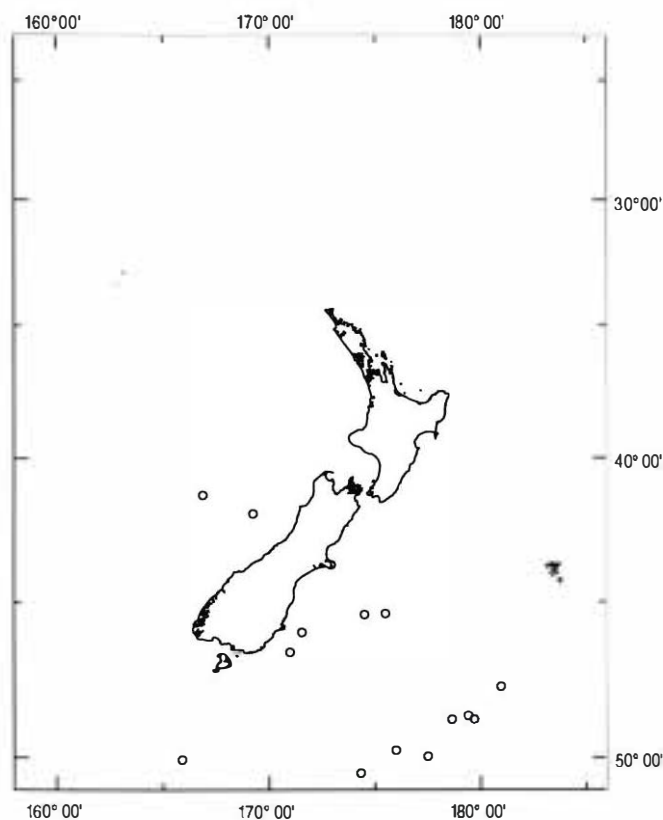


Fig. 2. New Zealand records of *Asteronyx loveni*.

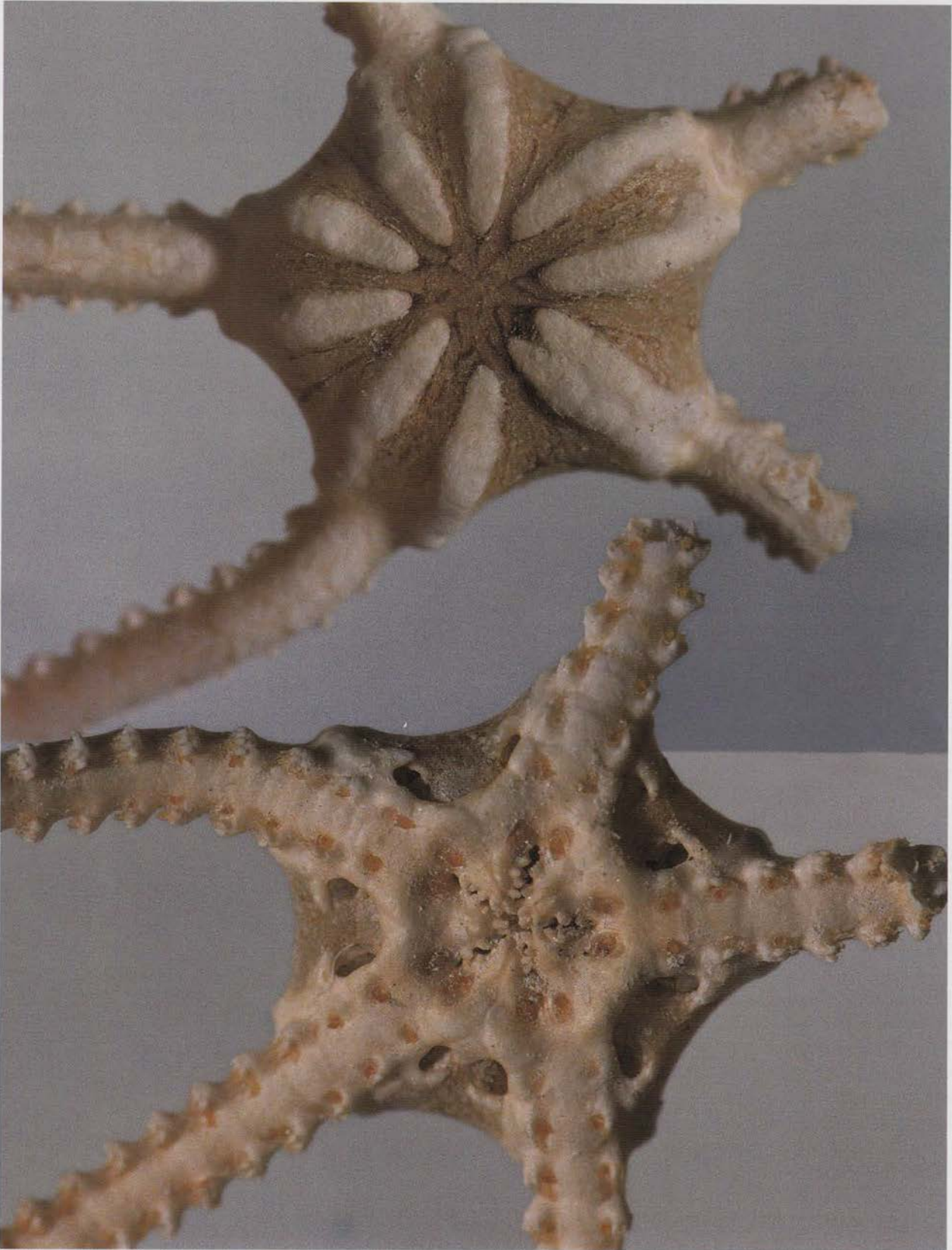


Plate 1. *Astronyx loveni* Müller & Troschel. NIWA Stn F752, disc diameter 10 mm, dorsal and ventral views.



**DISTRIBUTION:** Here recorded from central and southern New Zealand, 775–1760 m. Also known from Atlantic, Indian, and Pacific Oceans, 100–4721 m.

**REMARKS:** The sole specimen from NIWA Stn Z9340 has the gonads well developed, with the orange colour quite distinct beneath the skin covering the disc. Material cited by Baker (1980) as from NIWA Stn I49, is from Stn F149.

### *Astrodia* Verrill, 1899

**Disc** covered by skin and thin imbricating punctate scales; two or three slender arm-spines, never hooked.

**TYPE SPECIES:** *Asteronyx tenuispina* Verrill, 1884

*Astrodia tenuispina* (Verrill, 1984) (Fig. 3, Pl. 2)

*Asteronyx tenuispina* Verrill, 1884: 219.

*Astrodia tenuispina*: Verrill 1899: 371; Döderlein 1911: 116; 1927: 97; 1930: 388; Madsen 1951: 112; Baker 1980: 19 (with synonymy); Paterson 1985: 15.

*Astrodia bispinosa* Koehler, 1922: 11, pl. 76(12–15); Döderlein 1927: 59; 1930: 387, pl. 3(1–1c); Madsen 1967: 141

#### **MATERIAL EXAMINED:**

NIWA Stn P970 (2).

**DESCRIPTION:** Disc diameters 6 mm, and 5 mm, arms at least 40 mm long, broken.

Disc slightly inflated, outline near pentagonal, interradial arcs gently concave. Disc covered above by thin skin in which are thin, close-set scales. These cover most of disc, to near the margin where they are few. At margin and disc centre is a complete covering of scales. Radial shields visible, narrow, barely tapering, slightly converging towards disc centre. Ventral interradial areas with a thin skin cover, underlying plates visible when dried. Oral frame smooth, covered by thin skin. A distinct pointed tooth at jaw apex, sides of jaw with low confluent tubercles or 2 or 3 small spiniform oral papillae.

Arms rounded above, slightly flattened below, slowly tapering; the skin cover renders plate outlines indistinct, even when dry. One arm-spine from 2nd or 3rd segment, 2 from about 4th. Spines slender, slightly thorny in distal half, sometimes a little swollen towards tip. Inner spine longest. About equal to 1.5 segments; outer spine is much shorter. Towards arm-tip spines become short and nearly equal in length.

**COLOUR** (in ethanol): Creamy-white on both surfaces.

**DISTRIBUTION:** Here recorded from off the east coast of North Island, New Zealand, 3391 m; also known from the Indian and Pacific Oceans, 510–3720 m.

**REMARKS:** The presence of this widespread species locally was to be expected, since it has already been recorded from southern Australia.

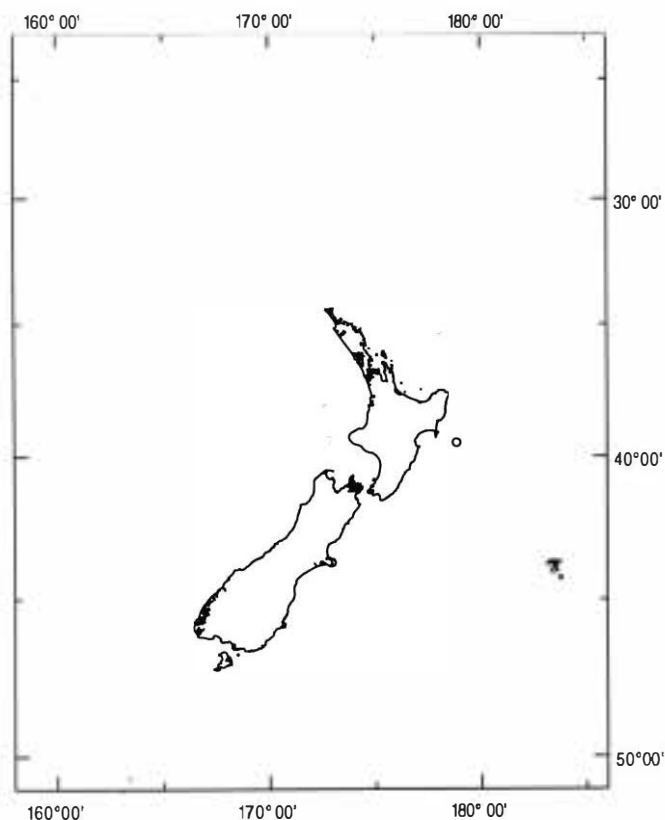
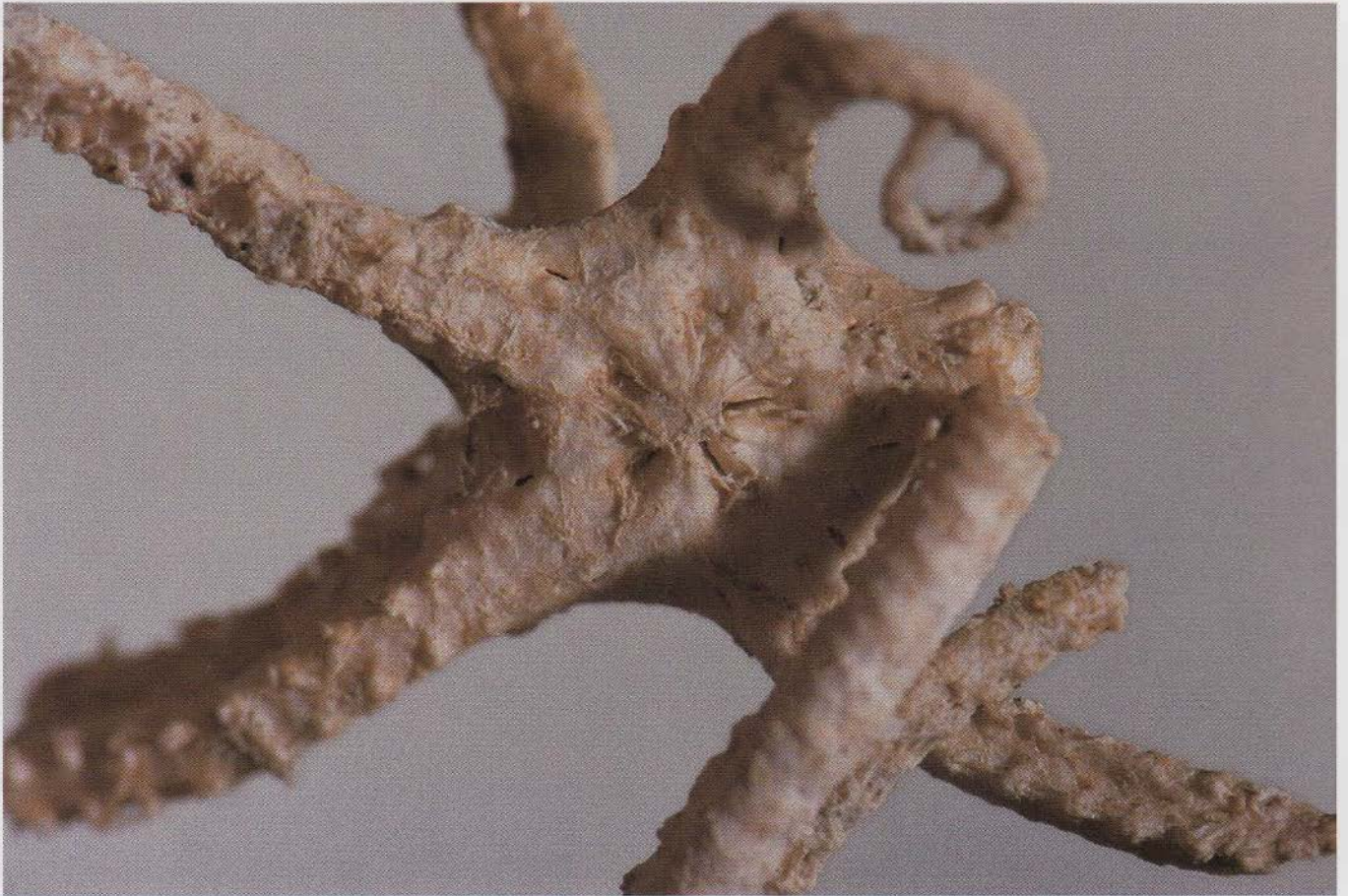
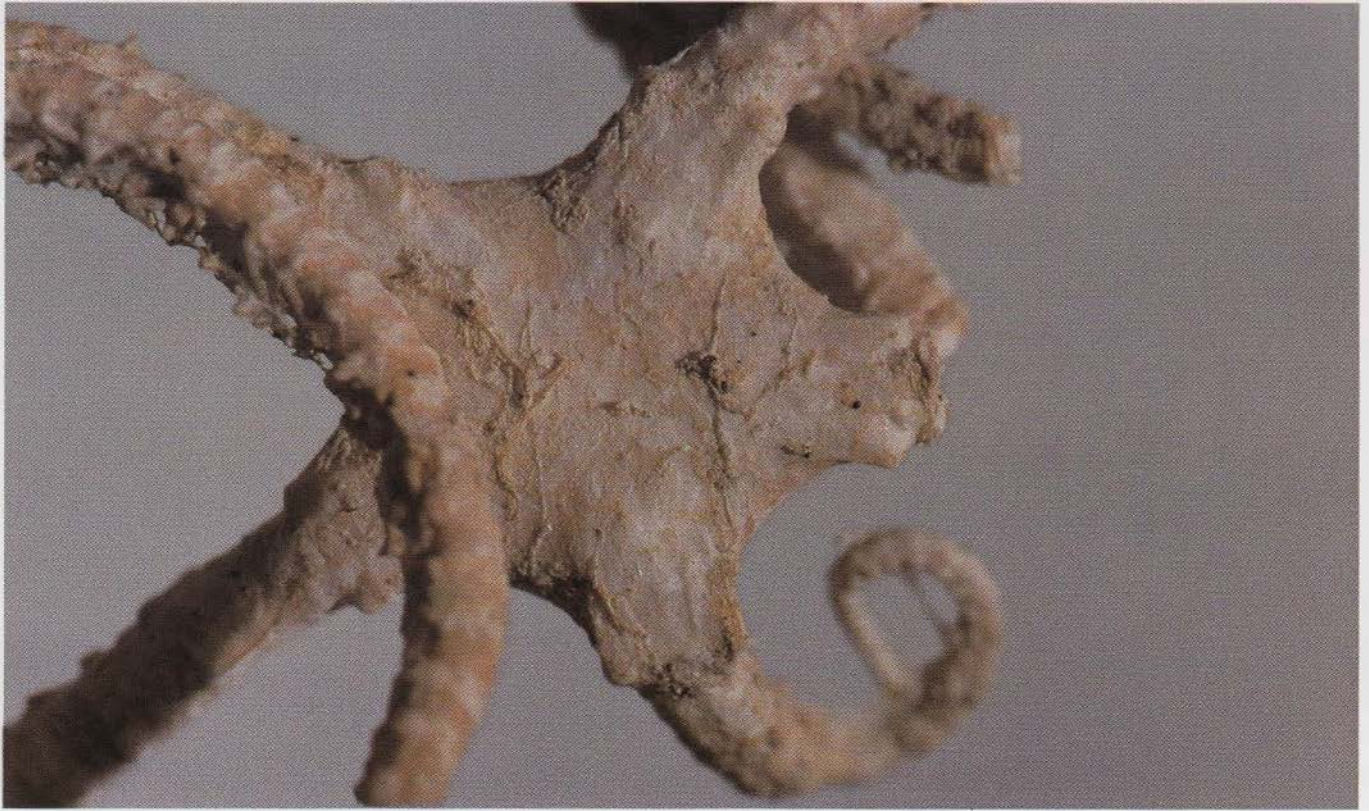


Fig. 3. New Zealand records of *Astrodia tenuispina*.

### Family ASTEROSCHEMATIDAE

Verrill, 1899

Arms not branching, disc and arms covered with naked skin, or tuberculate; gonads extend to at least proximal half of arm; ventral groove of vertebrae open; distal arm-spines transformed into hooks, lacking a lamina or perforations.



**Plate 2.** *Astrodia tenuispina* (Verrill), NIWA Stn P970, disc diameter 6 mm, dorsal and ventral views.

TABULAR KEY TO GENERA OF ASTEROSCHEMATIDAE

	1	2	3	4	5
<i>Asteroschema</i>	no	yes	yes	a	no
<i>Ophiocreas</i>	no	yes/no	yes	b	no
<i>Astrobrachion</i>	yes	no	yes	b	no

- 1 Ventral arm-plates separate laterals
- 2 Granules on dorsal surface of disc and arms
- 3 Radial shields extend to disc centre or nearly so and meet
- 4 a - jaws flat, often separated distally; b - protuberant, firmly united
- 5 Primary plates visible

*Asteroschema* Oersted & Lütken, 1856

Disc covered by granulated skin, sometimes plated; radial shields mainly covered by granules, sometimes with a small naked area distally; lateral arm-plates meet on ventral midline.

TYPE SPECIES: *Asterias oligactes* Pallas, 1788

TABULAR KEY TO SPECIES OF *Asteroschema*

	1	2	3	4	5
<i>Asteroschema bidwillae</i>	n	s	3-8	T	S
<i>Asteroschema horridum</i>	y	3-6	5	S	Cc
<i>Asteroschema igloo</i>	y	8-10	5	S	Cd
<i>Asteroschema migrator</i>	n	6-8	5	S	C
<i>Asteroschema salix</i>	y	11-13	5	F	S
<i>Asteroschema tubiferum</i>	y	ca. 6	5	C	S
<i>Asteroschema wrighti</i>	n	6-8	6	T	S

- 1 Ventral surface of arms usually with dense granular cover  
Yes/no
- 2 Two arm-spines from segment no. ; s - sporadic
- 3 Number of arms
- 4 Inner arm-spine : S - sinuous, T - straight, C - club-shaped, F - becoming flattened.
- 5 Dorsal tubercles : S - small, uniform; C - coarse, tubercular; c - conical, finely thorny; d - domed, smooth.

REMARKS: The genus *Asteroschema* is widespread in depths greater than 200 m and has been reported from the Atlantic, Indian, and Pacific Oceans. It contains at least 25 species, and several are distinguished by comparatively minor differences in tuberculation and the number of arm-joints to the second arm-spine. The two new species described herein appear relatively distinct in having either six arms (*A. wrighti*) or undergoing transverse fission with 3-8 arms, often in two sizes (*A. bidwillae*).

*Asteroschema horridum* Lyman, 1879 (Fig. 4, Pl. 3)

*Asteroschema horridum* Lyman, 1879: 66, pl. 17 (458-461); 1882: 275, pl. 30 (1-4); Baker, 1980: 20.

MATERIAL EXAMINED:

NIWA Stn K806(2) (det. Dr A.N. Baker).

DESCRIPTION: NIWA Stn K806, disc diameter about 10 mm, arms about 160 mm long.

Disc deeply excavate interradially, arms slightly inflated at base; disc small, flat, interradiial margins vertical. Disc and arms covered with small, tumid plates of varying shapes, many plates with tall, conical tubercles, the tip finely thorny. Plates and tubercles smaller at and near disc centre and between each pair of radial shields. Radial shields convergent proximally, covered with tubercles, most with a small bare patch distally. Genital slits narrow, straight, not in a common depression; interradiial area between each pair of slits, adjacent arm-base with fewer and distinctly lower tubercles. Entire oral area covered with plates and tubercles, at margin tubercles are higher and thinner. Oral and adoral shields concealed. Jaws with tubercles on lower surface, on sides are lower near rectangular tubercles; teeth bluntly triangular.

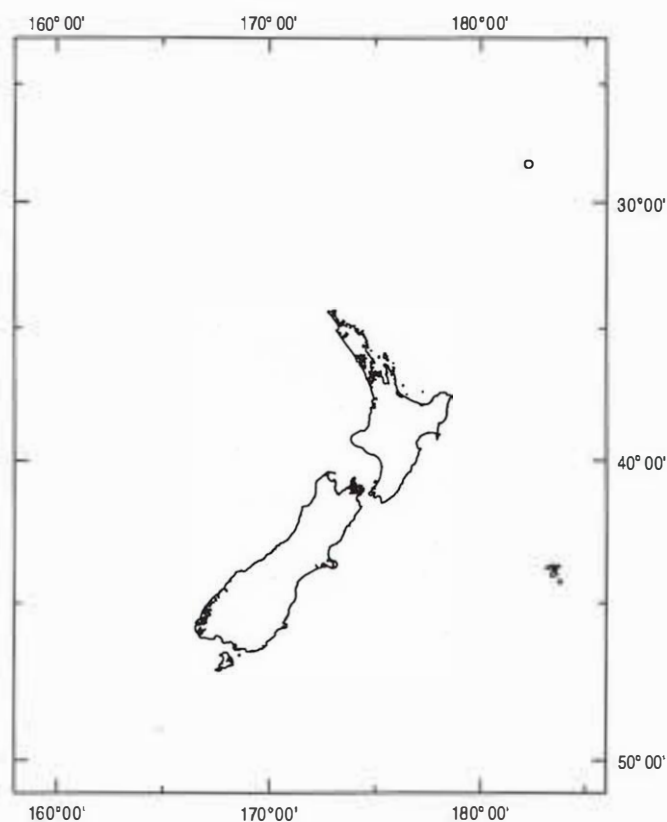


Fig. 4. New Zealand record of *Asteroschema horridum*.

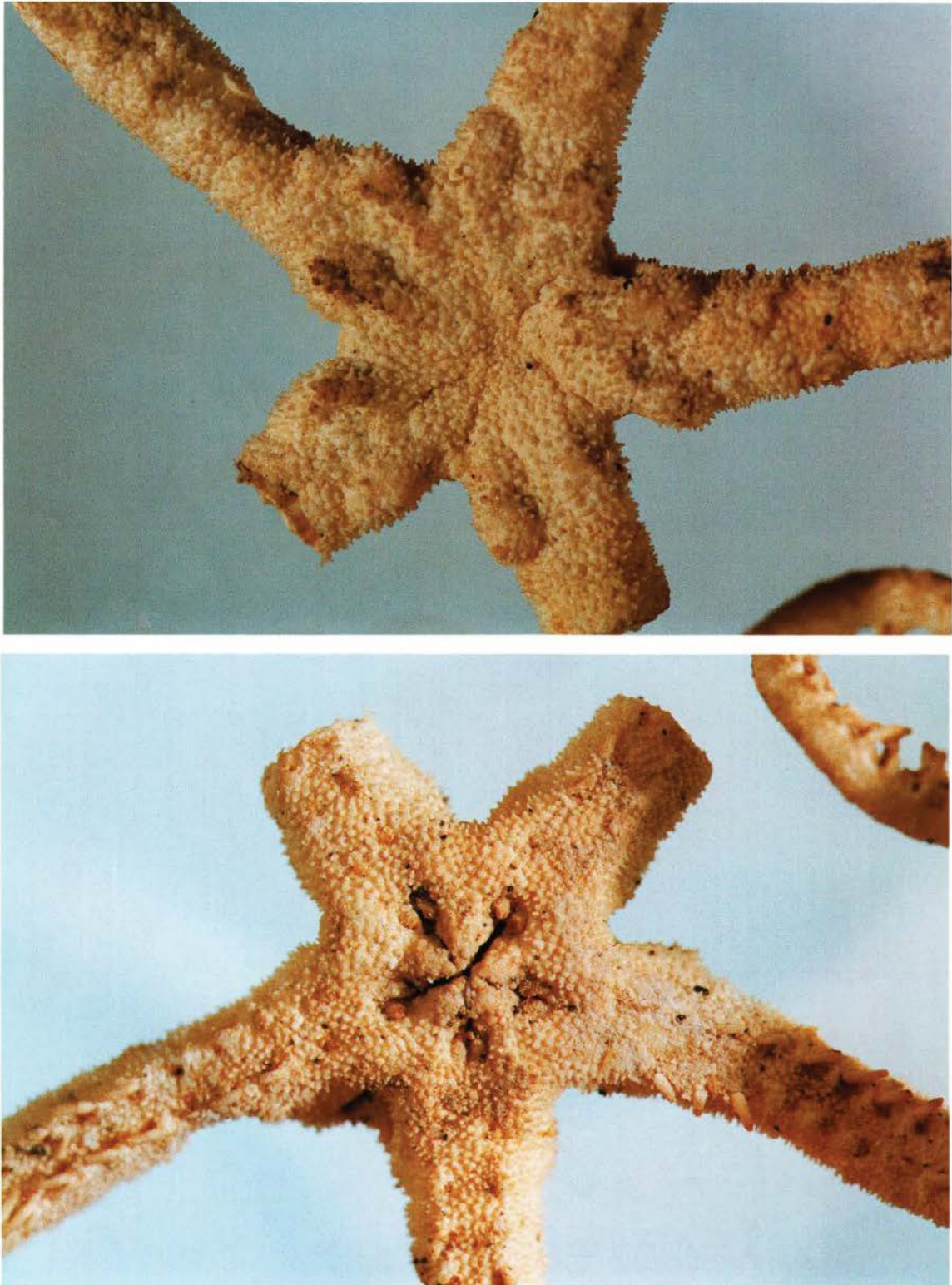


Plate 3. *Astroschema horridum* Lyman. NIWA Stn K806, disc diameter 10 mm, dorsal and ventral views.

Arms slightly swollen at base, out to about segments 5–7, plates of dorsal and lateral sides larger than those of disc; beyond plates are smaller; arms appear weakly annulated, owing to differences in size of tubercles. Ventral surface of arm-tubercles slightly lower and thinner. At arm-base, 1 arm-spine, occasionally 2, beyond segments 3–6 usually 2; spines cylindrical with tip thorny, inner spine slightly swollen, longer than arm width, outer spine half length of inner, not swollen. Distal spines shorter, more thorny.

COLOUR (ex ethanol): Pale reddish-brown and pink. Specimens now dried and uniform dull brown.

DISTRIBUTION: This species is recorded only from the Kermadec Islands, 1152–1185 m.

COLOUR (ex ethanol): White.

*Asteroschema igloo* Baker, 1980 (Fig. 5, Pl. 4)

*Asteroschema igloo* Baker, 1980: 24.

MATERIAL EXAMINED:

NIWA Stns K856(1); P41(1); P46(2) (all material det. Dr A.N. Baker); T226(1).

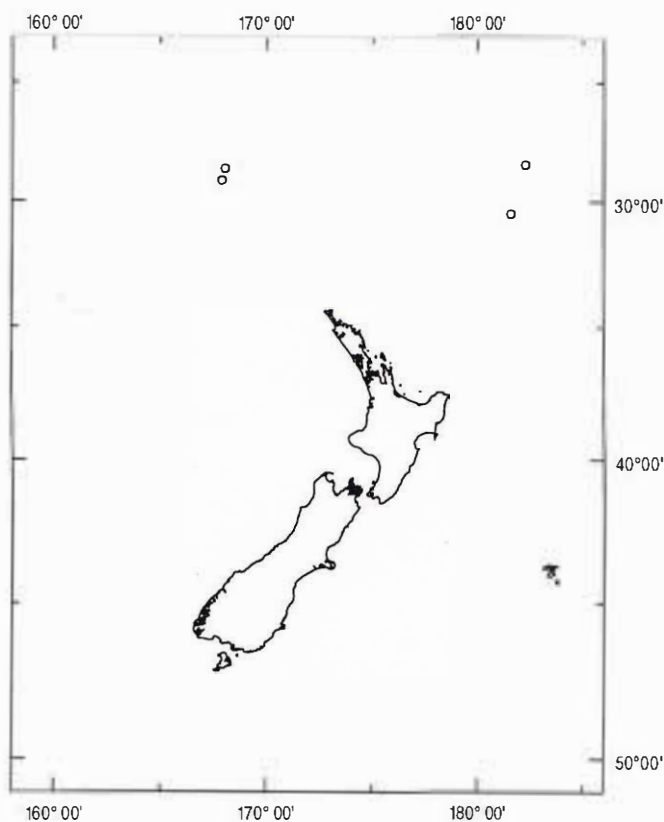


Fig. 5. New Zealand records of *Asteroschema igloo*.

DESCRIPTION: NIWA Stn P41, disc diameter 8 mm, arms about 100 mm long.

Disc excavate interradially, slightly tumid, inter-radial margin subvertical. Disc covered with rounded or polygonal slightly domed plates; near disc centre are 5 slightly larger plates, more or less radial in position. Radial shields short, outlines partly distinct, extending inwards for about half disc radius. Vertical interradiial area plates similar to those of dorsal surface; genital clefts short and wide, slightly convergent ventrally, not in common depression. Oral area with domed plates, outlines of oral and adoral shields concealed. Ventral surface and lateral margins of jaw covered with plates. Teeth flattened, lowermost pointed, others blunt at tip.

Arms slightly widened at base, about as wide as high beyond, subcircular, flattened ventrally, with plating like that of disc. One arm-spine from segment 3, 2 from segments 8–10; inner spine longer than arm width, tip swollen and finely thorny, outer spine about half length of inner, pointed, tip almost smooth.

DISTRIBUTION: This species is known from Norfolk Island and the Kermadec Islands, 465–800 m.

*Asteroschema migrator* Koehler, 1904 (Fig. 6, Pl. 5)

*Asteroschema migrator* Koehler, 1904: 164, pls 24 (8), 30 (5–7), 35 (1); Döderlein 1911: 111; Baker 1980: 22.

MATERIAL EXAMINED:

NIWA Stn K800(1) (det. Dr A.N. Baker).

DESCRIPTION: NIWA Stn K800, disc diameter 11 mm, arms about 275 mm, long.

Disc indented interradially, margins near vertical in interradii, disc slightly inflated. Dorsal surface of disc covered with thin skin, and occasional small, domed tubercles, with finely thorny tips; tubercles sparsely scattered over much of disc, cover relatively dense on radial shields and at margin. Radial shields narrow, widest distally, converging proximally, extending inwards to near disc centre where they are slightly separated. Vertical interradiial margin smooth; genital slits large, opening into common depression. Oral area covered with smooth skin, outlines of plates obscured. Distal part of oral area with a few well-spaced very small tubercles or pustules. Oral shields apparently absent, adoral shields large; jaws with low rounded granules along margins. Teeth triangular, lowest tooth composed of several small pieces.

Arms narrow, higher than wide, closely paved with small, tumid granules; these smaller and spaced



Plate 4. *Astroschema igloo* Baker. NIWA Stn P41, disc diameter 8 mm, dorsal and ventral views.

towards lateroventral margin, ventral surface with skin, and a few granules or pustules. One arm-spine from segment 3, 2 from segments 6-8; inner spine longest, longer than arm width, tip sometimes swollen; outer spine half length of inner, tip pointed; both spines thorny at tip. Small, subrectangular ventral arm-plates may be visible in distal half of arm; proximally they are irregular, often absent.

COLOUR (ex ethanol): Pink and dark red on disc, dark pink on arms. Specimen now dried and brownish, darker on disc between radial shields.

DISTRIBUTION: This species is known from the Kermadec Islands and Indonesia, 670–1301 m.

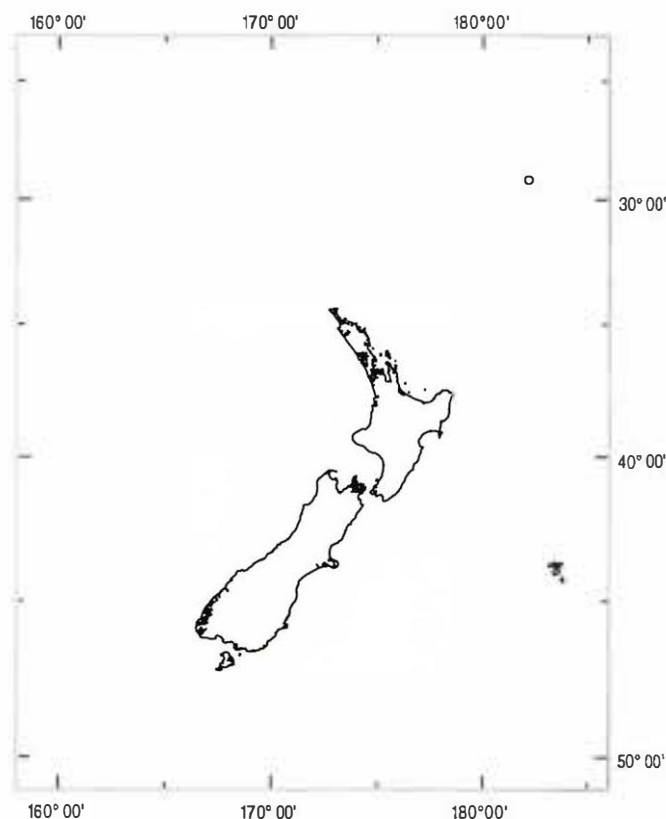


Fig. 6. New Zealand records of *Asteroschema migrator*.

*Asteroschema salix* Lyman, 1879 (Fig. 7, Pl. 6)

*Asteroschema salix* Lyman, 1879: 66, pl. 17 (466–469); 1882: 277, pl. 22 (13–15); Baker, 1980: 22.

MATERIAL EXAMINED:

NIWA Stns J676(1) (det. Dr A.N. Baker); T224(1); X174(1); X696(2); X700(1).

DESCRIPTION: NIWA Stn J676, disc diameter 5.5 mm, arms about 55 mm long.

Disc excavate interradially, somewhat inflated; interradially margins more or less vertical; both surfaces of disc and arms covered with very small, low, rounded granules. Radial shields raised, prominent, obscured by granules, outlines relatively distinct; shields narrow, elongate, parallel or slightly convergent proximally; shields extend inwards almost to disc centre and more or less touch. Ventral surface of disc in interradii with genital slits short, wide, in a common depression. Oral shields absent; adoral shields large, outer margin forms edge to inter-radial area; sides of jaws with low dome-like granules; teeth flattened, triangular.

Arms narrow, higher than wide, covering granules a little smaller than those of disc. Lateral arm-plates project slightly, and granulation continues to base of arm-spines; one arm-spine from 3rd segment, 2 from about segments 11–13. Spines short, less than arm width, inner spine longest; spines finely thorny near tip; distal spines (from about segment 20) become flattened with 4–5 teeth.

COLOUR (ex ethanol): Pink. Specimen is now dried and dull brown.

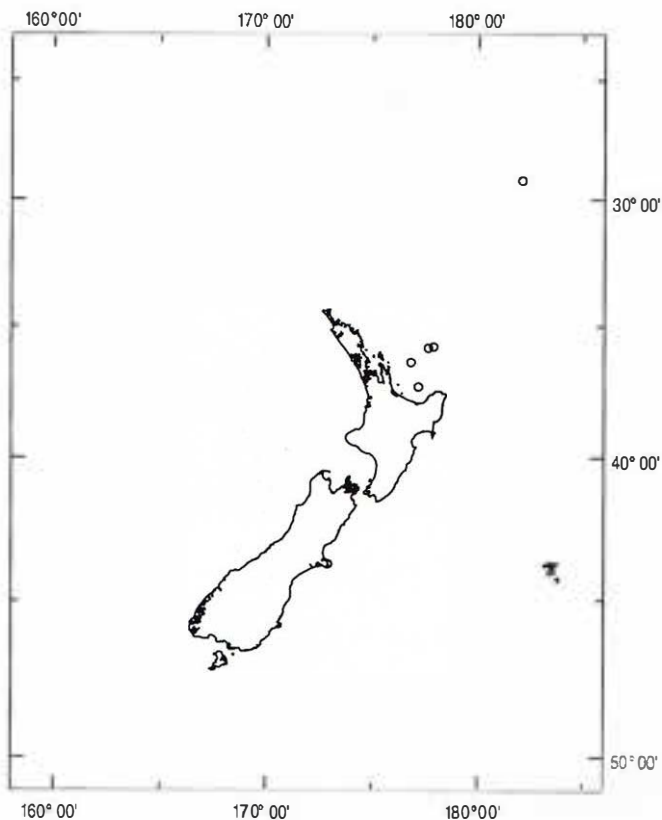


Fig. 7. New Zealand records of *Asteroschema salix*.

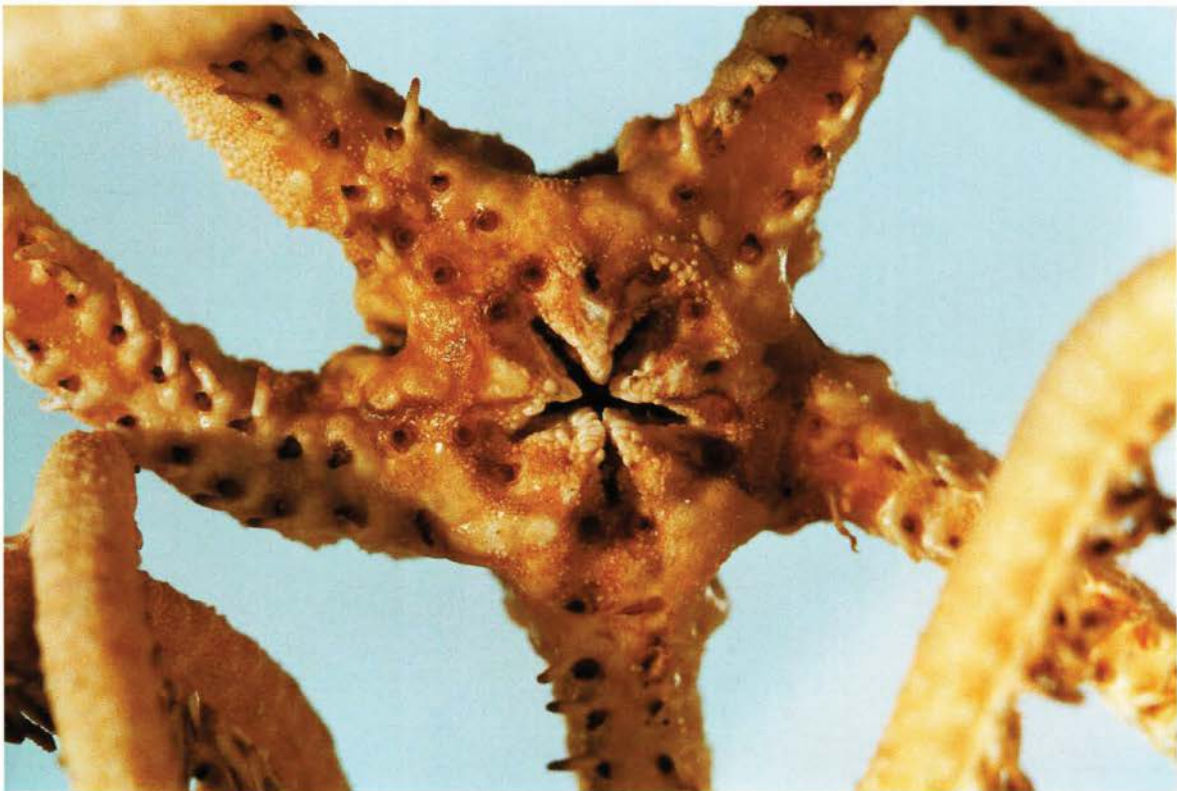
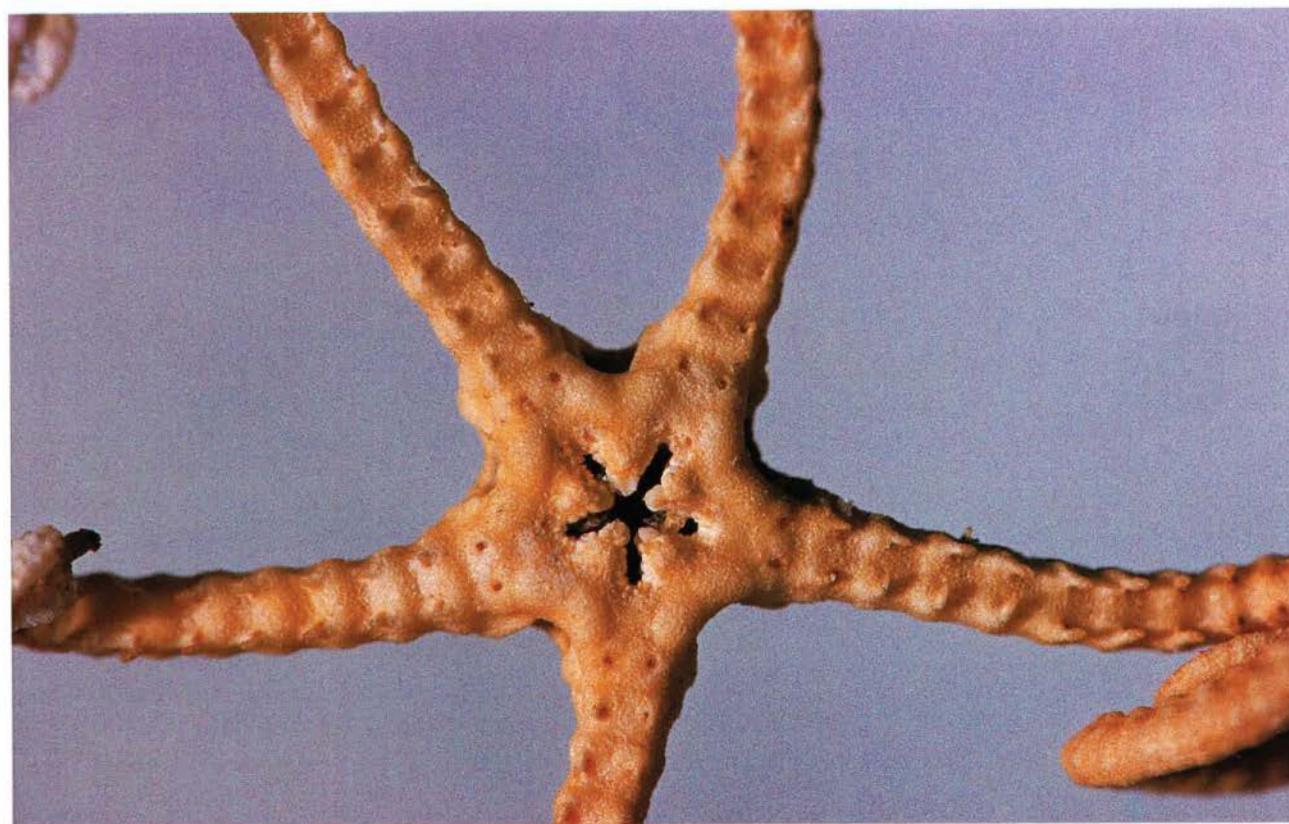
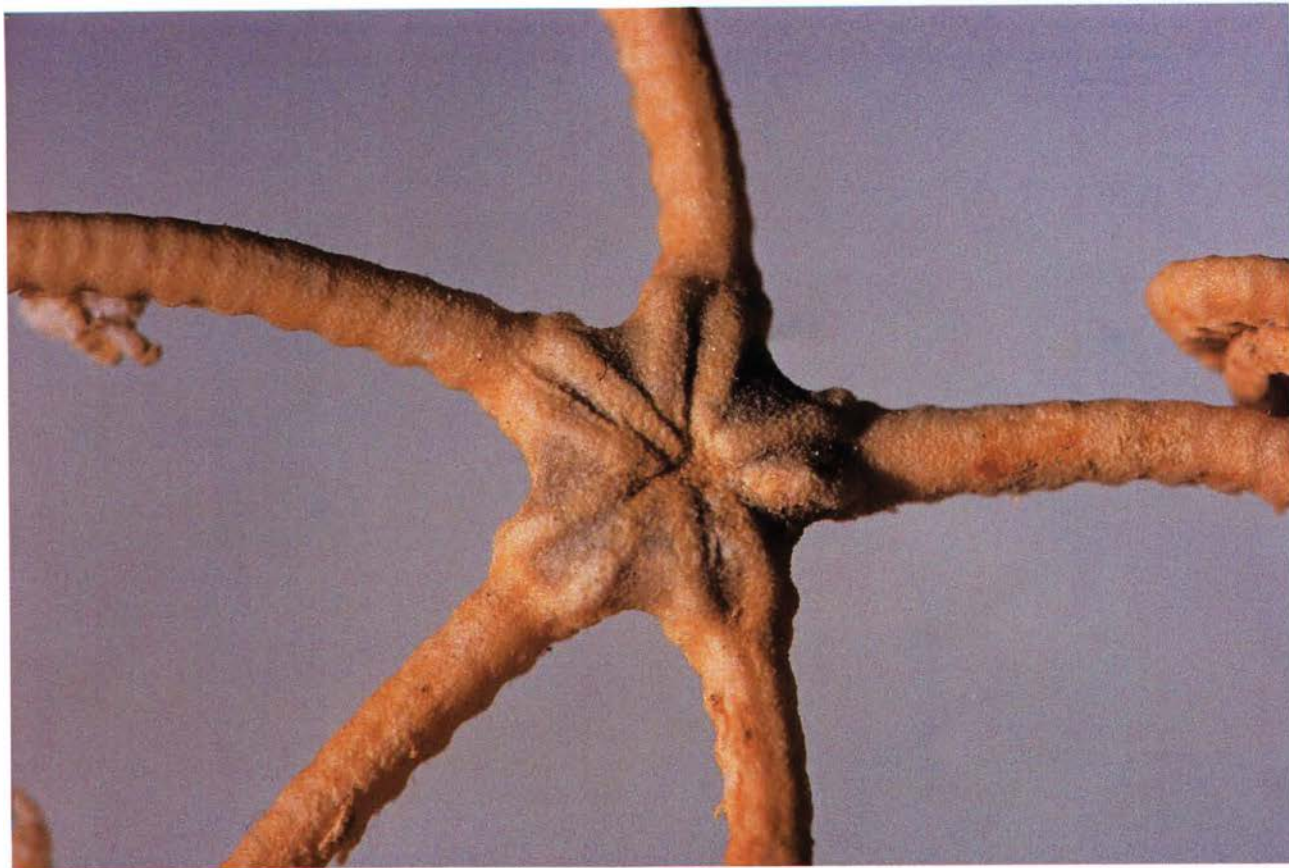


Plate 5. *Astrocheima migrator* Koehler. NIWA Stn K800, disc diameter 11 mm, dorsal and ventral views.





**Plate 6.** *Astroscinema salix* Lyman. NIWA Stn J676, disc diameter 5.5 mm, dorsal and ventral views.

DISTRIBUTION: This species is known from the Kermadec Islands and Bay of Plenty, North Island, New Zealand, 341–1800 m.

*Astroschema tubiferum* Matsumoto, 1915  
(Fig. 8, Pl. 7)

*Astroschema tubiferum* Matsumoto, 1915: 52; 1917: 44; Baker 1980: 22.

MATERIAL EXAMINED:  
NIWA Stns I92 (1) (det. Dr A.N. Baker); T237 (1).

DESCRIPTION: (taken from Baker (1980), NIWA Stn I92).

Disc diameter 14 mm, arms 300 mm long. Disc more or less pentagonal, excavate interradially. Dorsal and ventral surfaces of disc and arms covered with closely and evenly packed, small, rounded granules; on distal parts of ventral arm surfaces granules more widely spaced. Radial shields elongate, narrow, extending to near disc centre, convergent, but not meeting; shields constricted at about one-third length from outer end. Ventral surface of disc more or less vertical in interradii, densely granulated; genital clefts large; 4 madreporites present, each

situated at proximal end of interradiial area. Plates of oral region obscured by granules; oral papillae-like low tubercles, teeth triangular, 10 to each jaw, the lowest often in several small pieces.

Arms narrow, wider than high at base, slightly swollen over first 7 segments, gently tapering beyond. One arm-spine present from 2nd arm segment, 2 from about the 6th; proximal spines cylindrical, tapering to a blunt, prickly tip, from about 15th segment becoming distinctly club-shaped, with sharp prickles evenly set around the widened tip. Inner arm-spine longest, about twice length of outer spine. First 10–12 tentacle pores surrounded by a small sheath.

COLOUR (ex ethanol): Pink, with the arm-spines darker.

DISTRIBUTION: Recorded from Norfolk Island, Tasman Sea, and the Kermadec Islands 570–1090 m; also Bay of Plenty 1800–1700 m. Known also from Hawaii and Japan, 325–965 m

*Astroschema bidwillae* n.sp. (Fig. 9, Pl. 8)

MATERIAL EXAMINED:  
NIWA Stns Z8882 (numerous); Z9026 (several); Z9229 (numerous); Z9279 (numerous).

DESCRIPTION: Holotype specimen NIWA Stn Z8882. Disc diameter 5 mm; arms coiled estimated at about 50 mm long. One of the 6 arms is narrower than the others.

Disc indented in interradii; disc flat above and below, margins sloping. Dorsal surface of disc covered with fine granulation, granules small, domed and very finely rugose; dense at disc centre, on radial shields and interradially (8–10 in 1 mm), but slightly spaced beside each radial shield, where they are sometimes larger. Shields raised, extending almost to disc centre where they more or less meet. Both inner and outer ends of shields wider than elsewhere.

Ventral interradiial areas covered with small closely spaced granules. Genital clefts distinct, more or less conspicuous.

Oral area with well-spaced very small granules, except for jaw plates which are elongate, with a distinct separation distally. Along side of each jaw are 2–4 small granules. Lowermost tooth at tip of jaw is flattened and pointed, other visible teeth similar. Adoral shields large, oral shield small, lying on sloping interradius, 5 oral shields have 1 or 2 small tubercles on surface, while other is smooth and very small.

Arms slightly higher than wide at base, gently tapering throughout, becoming very attenuate distally. Dorsal surface of arms covered with granules, like those on disc, becoming slightly spaced distally, and

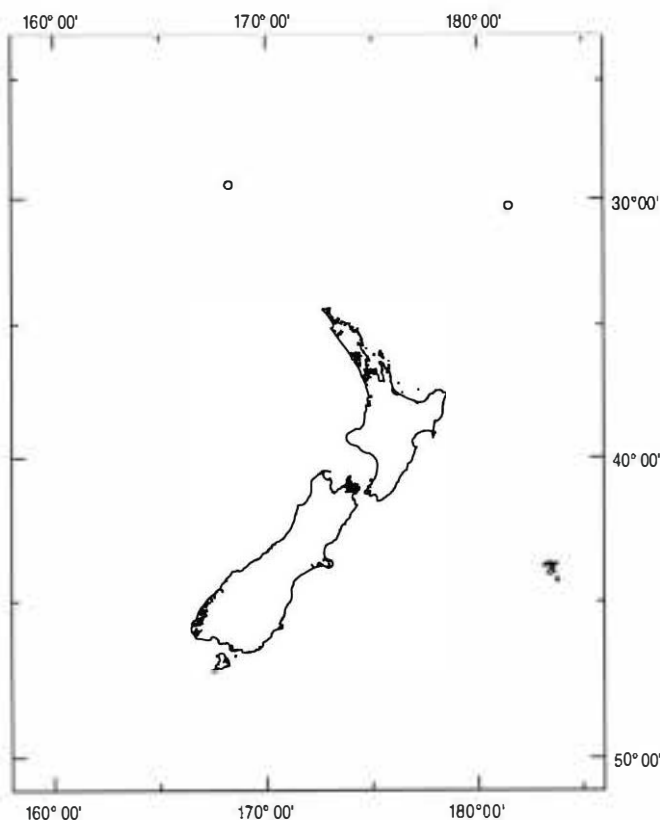


Fig. 8. New Zealand records of *Astroschema tubiferum*.



Plate 7. *Astroschema tubiferum* Matsumoto. NIWA Stn I92, disc diameter 14 mm, dorsal and ventral views.

almost absent near tip. Granulation extends down sides of arms but is almost always spaced. Underside of arm without granules. At arm-base irregular plates are present under granules, forming a complete cover. Lateral arm-plates more or less restricted to ventral surface of arm, and meet on ventral midline. Proximally they are only slightly raised, but from about midarm, the outer spine-bearing portion becomes a low tubercle with a broad base. Ventral arm-plate small, lying distal to lateral plates, becoming much smaller distally and absent in outer half of arm.

First pair of tubefeet with a sheath, others appear to be without.

No arm-spine on first arm segment, thereafter 1 or 2; inner spine initially short and flattened, about half arm segment in length, with rounded tip finely denticulate. The spine increases in relative and actual size, so that at one-third arm length it is equal to one segment in length, slightly flattened, denticulate over most of length, and with the proximal margin beset with small curved spines. Distally the spine slightly shorter than an arm segment, flattened and pointed. The surface denticulate, but major spines or hooks absent. Outer arm-spine small, inconspicuous, about one-third length of inner, present from 8th to 14th segment, sometimes absent along arm. Spine generally rounded and pointed, tip denticulate, hooks absent; beyond about half arm length where dorsal granulation becoming sparser, the distal "flare" of vertebrae increasingly conspicuous, as are the intervertebral muscular areas.

**COLOUR:** Dried specimens are uniform pale light brown on both dorsal and ventral surfaces.

**REMARKS:** This species is self-dividing and specimens with unequal arms are common. The commonest forms have either 3 arms and a half-disc, or 6 arms, 3 larger and 3 smaller. A few specimens had 8 arms, with 5 larger, 3 smaller. With this variation in arm count and size, there is considerable variation in shape, size, and disposition of the radial shields, and those of a pair may unite at midlength or one may be absent; on the small newly established arms they are often absent.

In many specimens the outer arm-spine is often present only occasionally along the arm, although usually present on a few consecutive segments in the midarm region. The intervertebral muscular areas are always prominent, and on some broken arms strands of muscle or ligament tissue are present. In comparison with most other species examined, this new species is quite robust, in that it can be disentangled from the gorgonian host without the basal part of the arm fracturing.

This species is thought to utilise both self-division and normal sexual reproduction to some advantage. With sexual reproduction and a pelagic larval form the distribution can be expanded, while once a suitable site is found, self-division enables population relatively quickly. In a specimen from Stn Z9026, the opened arm-base had a conspicuous gonad; a similar sized specimen from Stn Z8882 lacked a gonad.

**ETYMOLOGY:** This species is named for Ms Josie Bidwill, a friend of the collector, J. Wills, observer, Ministry of Fisheries.

**HOLOTYPE:** Deposited in the NIWA collections, Wellington, H-725.

**PARATYPES:** Deposited in the NIWA collections, Wellington, P-1189.

**TYPE LOCALITY:** NIWA Stn Z8882, 37°01' S, 176°43.1' E, Bay of Plenty, New Zealand, 976–1129 m.

**DISTRIBUTION:** Lord Howe Rise, seamount east of Three Kings Rise, and Bay of Plenty, New Zealand, 700–1129 m.

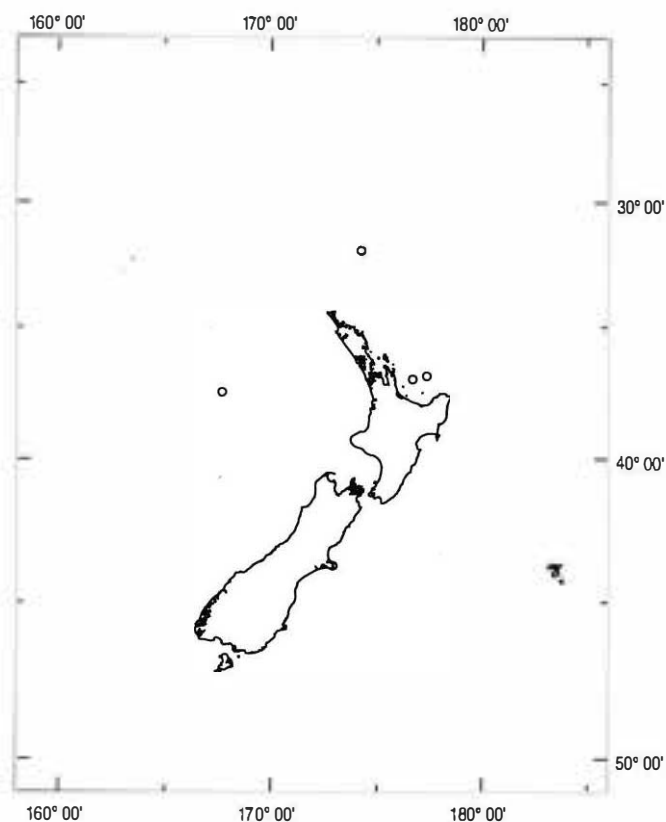


Fig. 9. New Zealand records of *Asteroschema bidwillae*.

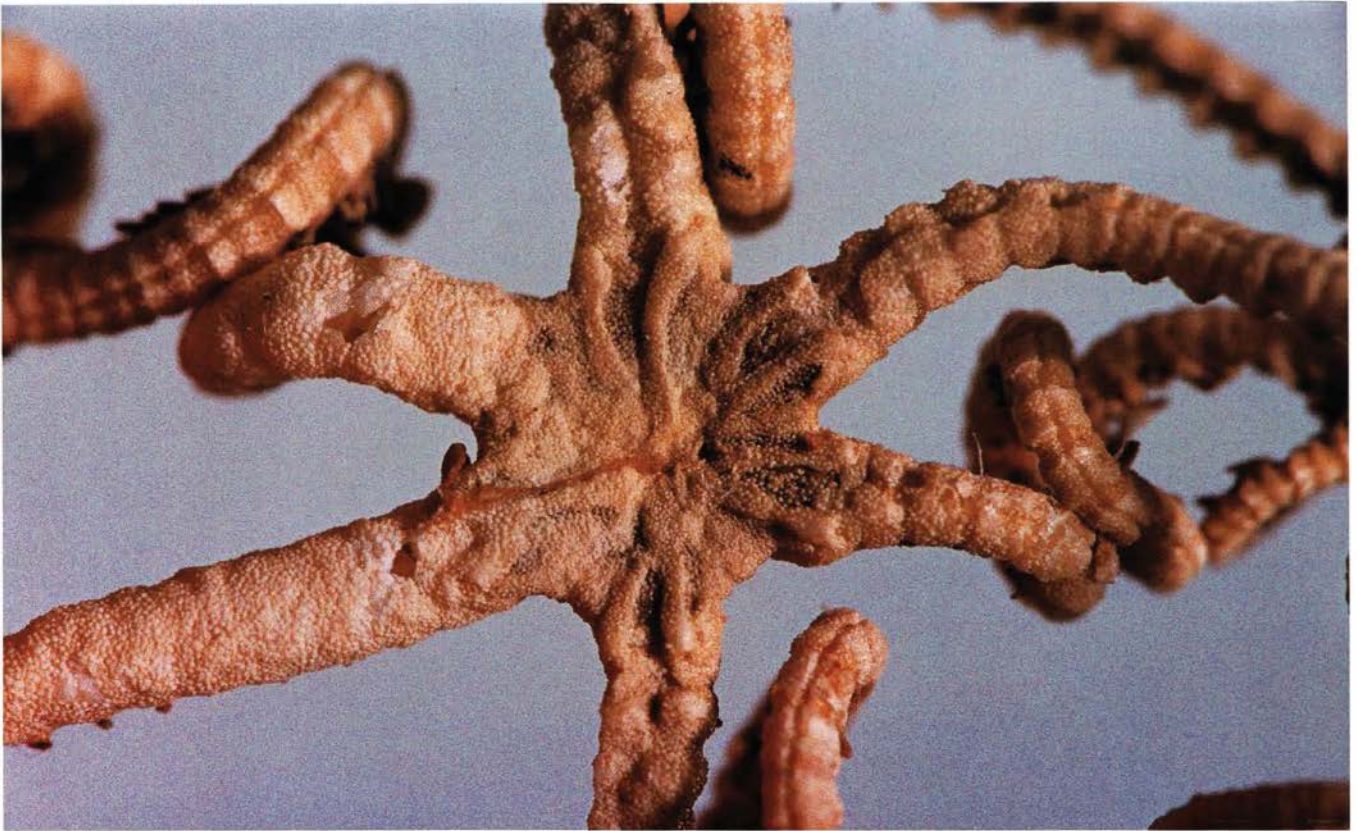


Plate 8. *Astroschema bidwillae* n.sp. NIWA Stn Z8882, holotype, disc diameter 6.5 mm, dorsal and ventral views.

*Astroschema wrighti* n. sp. (Fig. 10, Pl. 9)

MATERIAL EXAMINED:  
NIWA Stn X152 (4).

DESCRIPTION: Holotype specimen. Disc diameter 6.5 mm; arms at least 6 times disc diameter;

Disc excavate interradially, slightly raised along radial shields; arms about as wide as high at base, slightly higher beyond arm-base, broadly rounded on upper surface, flat below; upper side of disc and arms completely covered by fine uniform granulation (8 or 9 in 1 mm); granulation extends down sides of arms, granules becoming more spaced, not extending as far as arm-spines. Radial shields elongate, those of a pair converging inwards, extending to near disc centre, where they meet; shields scarcely visible when dried, relatively conspicuous when wet. In wet state shields seen to be slightly raised, quite conspicuous; a few small plates present at disc centre, inside radial shields. In 5 interradia a line of small elongate plates extending from margin towards disc centre, usually at least half way to centre. In the other interradius a larger plate at the margin, with what must be a radial shield extending inwards from it; thus the arms on either side have but 1 shield, so that there are 11 in all. Granulation is slightly more spaced between each pair of shields and interradially.

Arm granules tend to form indistinct, transverse series. Granulation becomes scattered distally on arms.

Oral frame and arms covered with thin smooth skin, and also with occasional small grains, enclosed in the skin.

Ventral interradial areas small, dorsal granulation extends to outer edge of genital slits, becoming more scattered here. Genital slits in a more or less common depression, the division between each pair usually narrow and inset, so that the external appearance is of a large ovoid space. Jaw elongate, side of jaw with 1–3 low tubercles; at tip of jaw a larger blunt or pointed tooth.

First tentacle-pore of arm with or without a single arm-spine; a single arm-spine for next 4 or 5 pores, thereafter usually 2; inner arm-spine the longer, in midarm about equal to 2 arm segments; straight, expanded from base, slightly club-shaped, finely thorny, with small teeth or hooks on inner margin. Outer arm-spine about one-third to half length of inner, and is relatively smooth;

One arm has lost some of the granulation from beyond arm-base; underlying granules are relatively large irregular plates.

COLOUR (in preservative): Generally whitish above and below; areas on disc between radial shields light

brown (radially and interradially – except where the interradial plates occur); brown colour ends at arm base, where presumably the dorsal arm plating starts.

REMARKS: The other specimens are smaller, all with 6 arms; the smallest specimen, with disc diameter about 2 mm, has genital slits distinct. The next largest after the type, with disc diameter 5.5 mm, has 12 radial shields but one is clearly narrower than others and is not raised. The holotype has three arms apparently regenerating at the tip, where the distal 5–10 mm is abruptly narrower and lower and lacks granulation.

HOLOTYPE: Deposited in the NIWA collections, Wellington, H-726.

PARATYPES: Three, deposited in the NIWA collections, Wellington, P-1190.

ETYMOLOGY: Named for Dr Ian Wright, NIWA Wellington, who collected these specimens.

TYPE LOCALITY: NIWA Stn X152, 36°09.74' S, 176°48.38' E, 820–940 m.

DISTRIBUTION: Known only from the Colville Knolls, northern Bay of Plenty, New Zealand, 820–940 m.

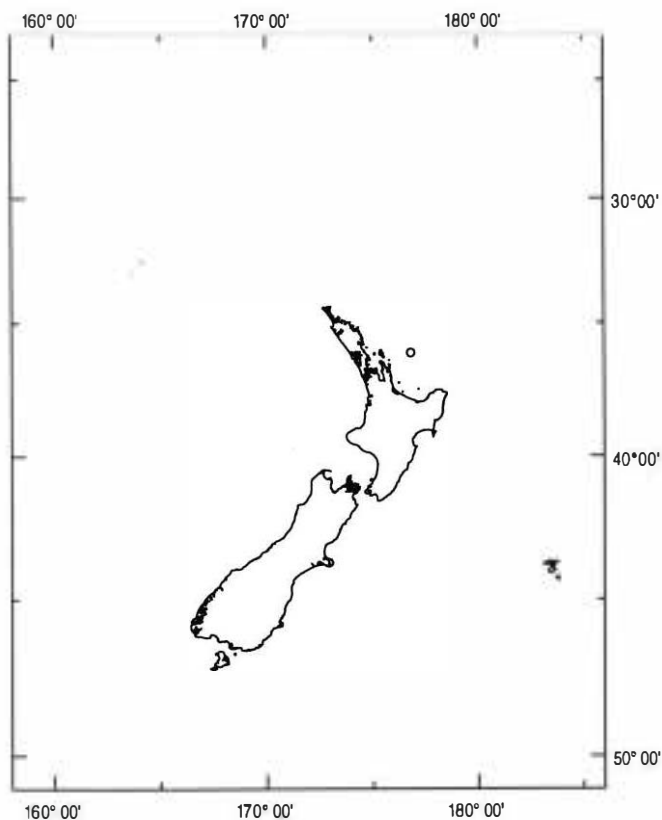


Fig. 10. New Zealand records of *Astroschema wrighti*.

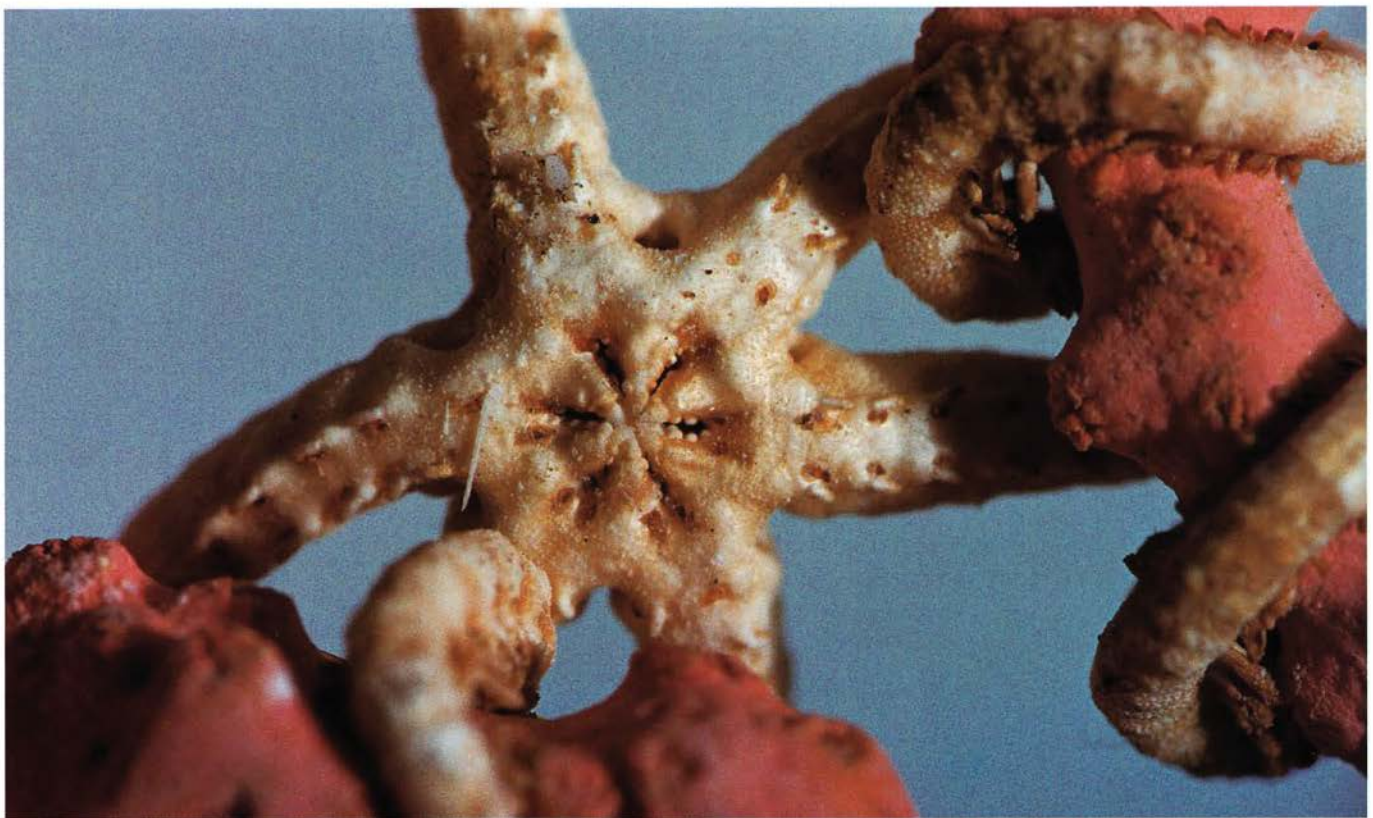
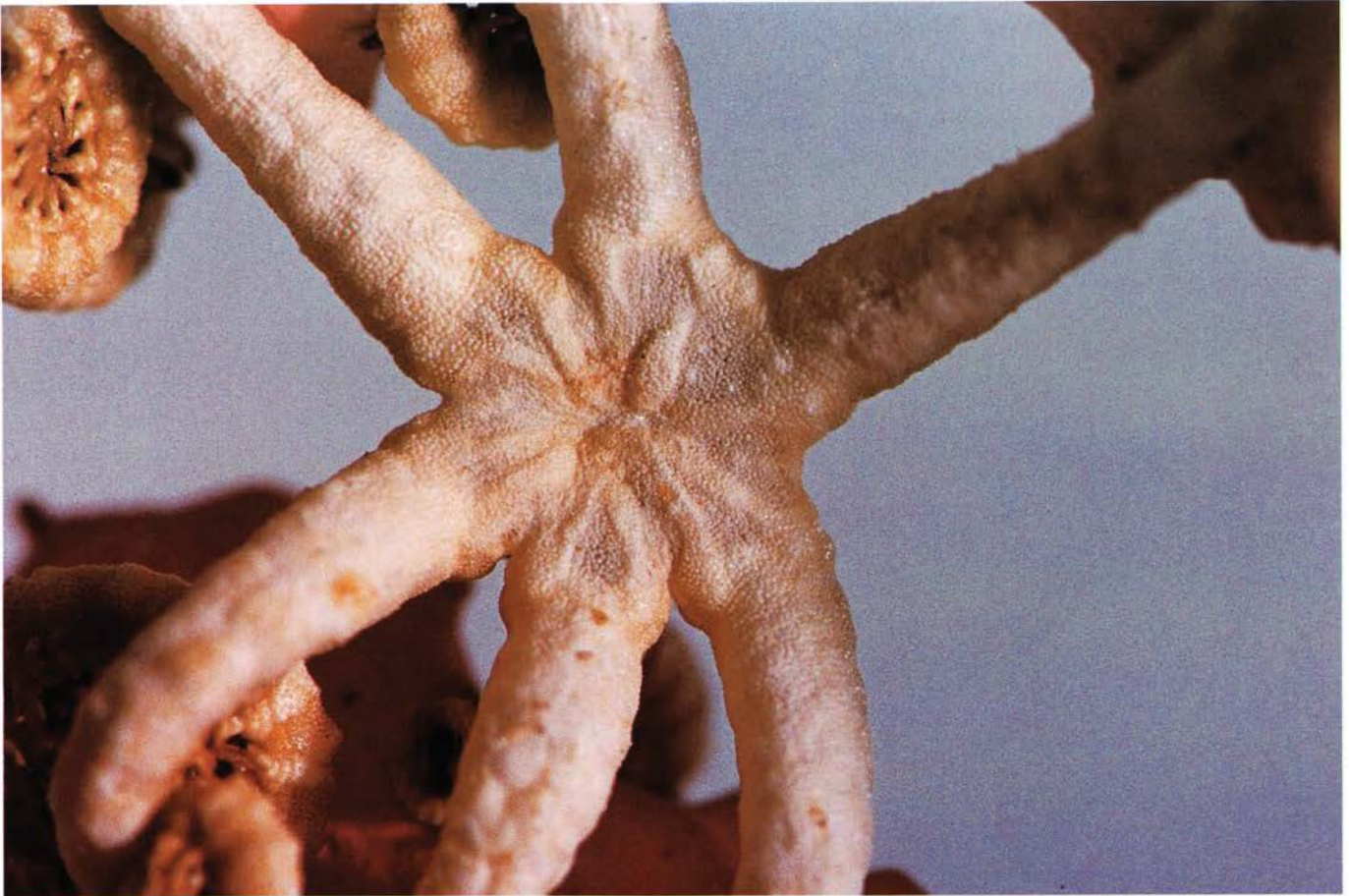


Plate 9. *Astroscema wrighti* n.sp. NIWA Stn X152, disc diameter 11 mm, dorsal and ventral views.

*Ophiocreas* Lyman, 1879

Disc covered by naked skin, sometimes with minute, closely set grains; lateral arm-plates meet on ventral midline, not separated by ventral arm-plates.

TYPE SPECIES: *Ophiocreas lumbricus* Lyman, 1879

TABULAR KEY TO SPECIES OF *Ophiocreas*

	1	2	3	4	5	6	7
<i>O. japonicus</i>	yes	L	no	c	no	no	yes
<i>O. mortenseni</i>	yes	L	no/yes	b	no?	no	yes
<i>O. oedipus</i>	no	S	no	a	no	yes	rare
<i>O. sibogae</i>	no	A	no	a	no	no	no
<i>O. willsi</i>	yes	L	yes	a	yes	no	no

- 1 Skin thick, often wrinkled
- 2 Dorsal furrow: A - absent, S - short, L - long
- 3 Disc granulated
- 4 Tentacle-pore: a - behind spines, b - almost beside, c - with blind pore behind
- 5 Lateral plates widened on ventral midline
- 6 Ventral arm-plates divided
- 7 Partial webbed arm-spines

*Ophiocreas japonicus* Koehler, 1907 (Fig. 11, Pl. 10)

*Ophiocreas japonicus* Koehler, 1907: 346, pl. 14 (54).

*Ophiocreas papillatus* H.L. Clark, 1908: 298.

*Asteroschema (Ophiocreas) japonicus*: Döderlein 1911: 59, pls 6 (5, 5a); 7(9).

*Asteroschema (Ophiocreas) monacanthum* Döderlein, 1911: 59, pl. 6 (9, 9b).

*Asteroschema (Ophiocreas) enoshimanum* Döderlein, 1911: 60, pl. 6 (8, 8a).

MATERIAL EXAMINED:

NIWA Stn Z9592(7).

DESCRIPTION: Disc diameter 16 mm, arm at least 210 mm long. Relatively thick skin covers disc and arms, and features become visible when dried.

Disc slightly indented in interradii, swollen, depressed at centre. Radial shields prominent, raised, extending to disc centre where they meet; each shield widest at disc margin, more or less tapering evenly to the pointed inner end. Radial shields and interradii areas with a few scattered fine grains. At disc margin upper end of genital plate extends across interradius. Genital plates slightly converge ventrally, genital slits in a common depression, entire ventral surface of disc with a few scattered grains. Oral plates convex, slightly protuberant, margin of jaw with a few small, low tubercles; teeth pointed, in a single vertical series.

Adoral plates large, slightly convex; oral shield smaller at disc margin, more or less triangular; none is apparent as the niadreporite.

Arms almost square in section at base, width 5 mm, height the same; dorsal furrow extends for at least one-fifth arm length. Arms taper abruptly beyond dorsal furrow. Dorsal arm-plates form prominent transverse bands over most of arm. Over proximal part of arm they are in a single series, generally rectangular; from about the end of the dorsal furrow they are in 2 series, on the side of the arm converging to the lateral plate. First tentacle-pore of arm lacks a spine, and tubefoot has a few small grains on surface; second tentacle-pore sometimes lacks a spine on 1 side; 1 spine to about pore 10 or 11, then 2. At about midarm outer spine is slightly longer than arm-segment, outer half to three-quarters length of inner; both spines slightly flattened, tip blunt, distal part with black glandular covering. When dried, both spines are seen to have several teeth on distal third of proximal margin. Distal spines small and hooked, with 1 or 2 teeth below the terminal. A web of skin links bases of spines along the arm, sometimes extending to near the tips, and often skin also forms a transverse web linking the 2 spines on each side of an arm-segment. Tentacles small, placed very close to base of

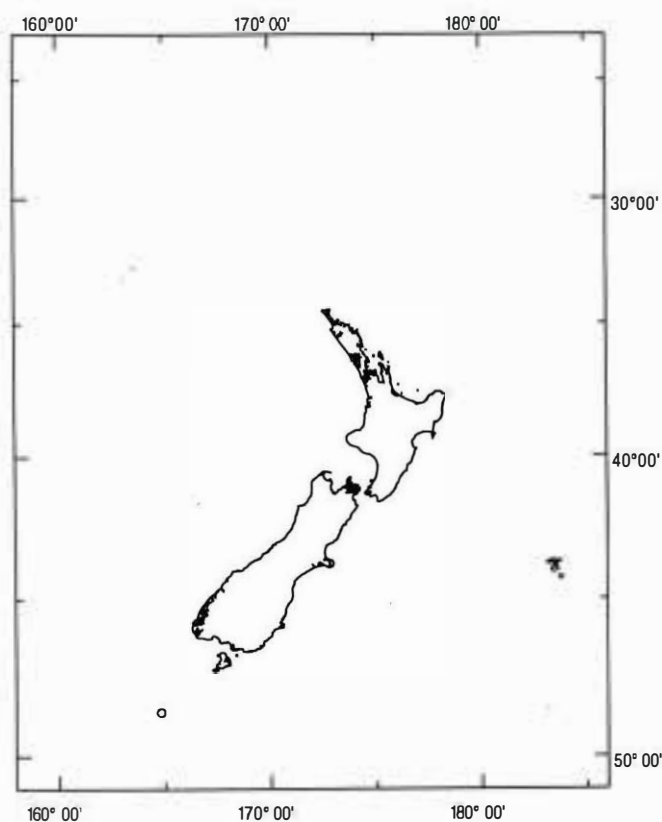


Fig. 11. New Zealand record of *Ophiocreas japonicus*.



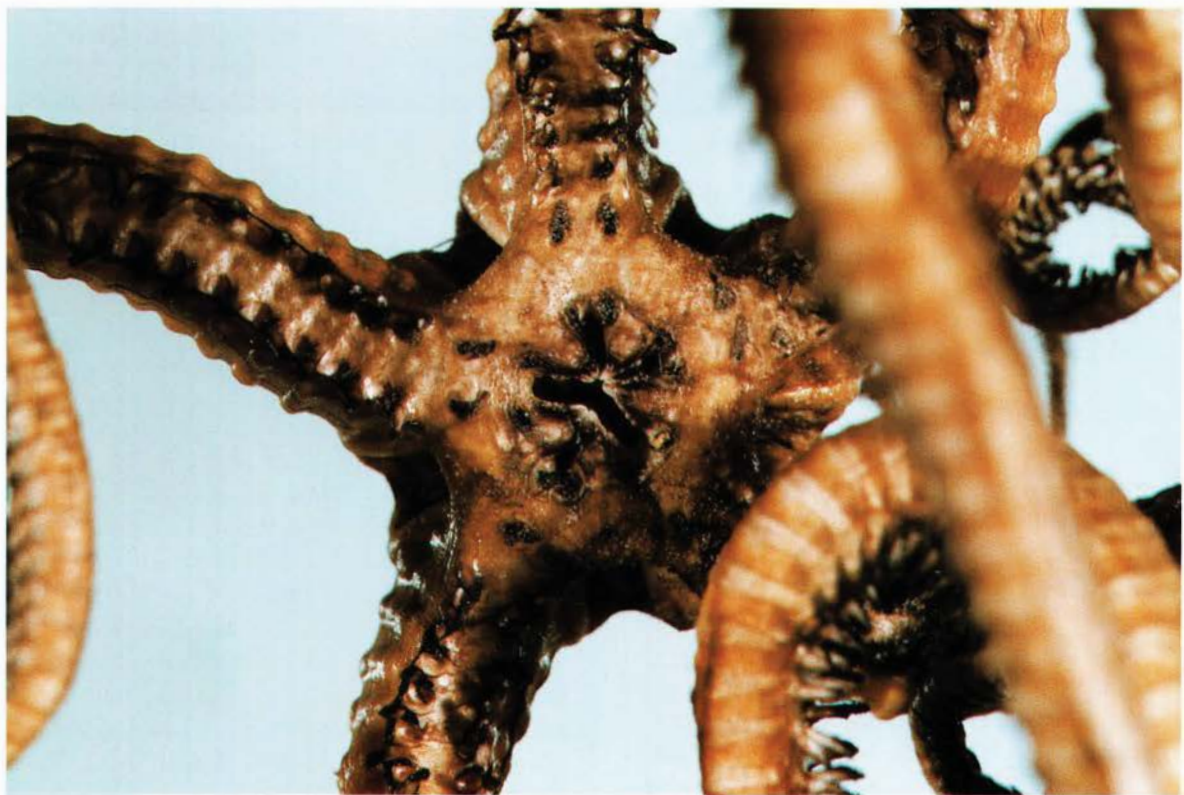


Plate 10. *Ophiocreas japonicus* Koehler. NIWA Stn Z9592, disc diameter 16 mm, dorsal and ventral views.

inner spine, and immediately behind them is a relatively conspicuous blind circular pore, separate from tentacle-pore. Lateral arm-plates meet on ventral midline of arm, inner ends not expanded. Ventral arm-plates small, triangular, placed just distal to laterals. Ventral surface of arm sometimes with a few scattered grains on skin.

COLOUR: (frozen specimens): Dull reddish-brown.

REMARKS: The specimens have a disc diameter of 14–17 mm and three specimens have 1 or 2 regenerating arms. Other specimens examined lack any grains on the disc or arms.

The blind pore distal to the tentacle-pore, present in all specimens, extends over almost all the arm and, following Matsumoto (1917), appears to be a distinctive feature of this species.

DISTRIBUTION: Here recorded from west of the Snares Islands, south of New Zealand, 940–1180 m. It is also known from Japan, 531–604 m.

*Ophiocreas mortensei* Koehler, 1930  
(Fig. 12, Pl. 11)

*Ophiocreas mortensei* Koehler, 1930: 38, pl. 3 (1–7).

MATERIAL EXAMINED:

NIWA Stns X700(1), Z8981(15), Z9271(1), Z9275(1), Z941(4), Z9566(9), Z9583(1), Z9585(6), Z9592(12), Z9595(1), Z9596(95), Z9597(1), Z9602(1).

DESCRIPTION: NIWA Stn Z8981, disc diameter 21 mm, longest arm 222 mm, tip missing.

Arm-base 7 mm wide and 6 mm high, lower surface flat, broadly U-shaped or flattened above. Arms scarcely taper until beyond about half length, then taper abruptly over about 10 segments to attenuated tip. This tapered section usually at different distances on each arm.

Disc and arm covered by skin, this thicker on arms, where it often forms longitudinal wrinkles or folds, with almost always one adjacent to arm-spines. Usually on part of at least 1 arm, skin forms a longitudinal web linking successive pairs of arm-spines. Disc excavate interradially, margin near vertical, centre of disc depressed. Radial shields extend to edge of depressed central area of disc, length almost half disc diameter. Shields of a pair convergent proximally, inner end pointed, generally widest at about mid-length. Skin smooth over radial shields and between those of a pair, finely wrinkled interradially. At disc margin upper end on genital plate extends slightly

into interradius. In 2 interradii, small supplementary plates form a continuous bridging series. Genital clefts in a common subrectangular depression, with the central division skin, lacking any plates.

Oral area skin covered, plates become visible when dried. Oral plates separated at outer ends, inner ends protrude, margins smooth, although a few small rounded granules are present well within oral slit. 1–3 small pointed tooth papillae at tip of jaw. Teeth triangular, in a single vertical series. Adoral plates large, also slightly protuberant, meeting proximally, separated distally. Oral shields not visible (in a smaller specimen, NIWA Stn Z9556, disc diameter 12 mm, there are 5 small triangular oral plates at outer edge of oral frame, almost at margin). One of these, slightly enlarged with a roughened surface, is presumed madreporite.

Arms scarcely taper in proximal quarter to third, with a narrow depressed area along dorsal midline. This extends for a variable distance, never less than one-third arm length, often more. Dorsal arm-plates project slightly, clearly visible when dried. At arm base, plates form a single series of overlapping plates down sides of arm, plates longer than wide, the lower 3 or 4, where skin is thicker, become abruptly smaller. From about one-quarter arm length, plates arranged in 2 or 3 series, smaller and varying in shape. Further out they separate into 2 distinct series which converge to 1 or 2 single plates just above the arm-spines. Near the arm-tips, the dorsal plating is absent.

Skin generally thickens near arm-spines, and occasionally forms a web linking successive pairs of spines along part of arm. First tentacle-pore lacks spines, tubefoot with a distinct sheath; second pore rarely similar, usually with a single spine; 2 arm-spines form pore 4–7. Spines short near arm-base; longest at about midarm where the inner is almost as wide as arm width, reaching to base of opposite inner spine, outer spine half to two-thirds length of inner. Inner spine slightly flattened, smooth in lower half, distally with several curved teeth on proximal side, darker glandular tissue surrounds distal half; outer spine similar but with fewer teeth, usually lacks glandular tissue. Distally, near arm-tip spines shorter and flat, with 3 or 4 curved teeth. Tentacle-pores more or less aligned with the arm-spines, i.e., inside rather than distal to them. Proximally, lateral arm-plates more or less flat, not projecting ventrally; distally they assume a nodular shape. Lateral arm-plates meet on ventral midline throughout arm. Ventral arm-plate subtriangular, widest distally, placed just behind lateral plates.

COLOUR: (ex ethanol): All specimens are a uniform dull reddish-brown.



Plate 11. *Ophiocreas mortenseni* Koehler. NIWA Stn Z8981, disc diameter 21 mm, dorsal and ventral views.

**DISTRIBUTION:** This species is known from Lord Howe Rise, Bay of Plenty and Chatham Rise, 660-1765 m. The only other record is from Kei Island, Indonesia, 385 m.

**REMARKS:** Initially this was thought to be a variant of *O. sibogae*, with the reddish colouration coinciding with that of the soft-coral host *Paragorgia arborea* (L.) However, closer examination shows consistent differences: position of the tentacle-pores; separation of arm-plates along dorsal midline of arms; rather abrupt taper towards arm-tips; much thicker and wrinkled skin; and occasionally webbed arm-spines, although these are also present on part of one arm of a specimen of *O. sibogae* (NIWA Stn C645, det. Dr A.N. Baker). These specimens of *O. mortenseni* differ from the holotype in having the arm-taper less pronounced.

**Variation:** The smallest specimen (NIWA Stn Z9595, disc diameter 7.5 mm, arms at least 110 mm long) has flattened granules over most of the dorsal surface of the disc, although some of the radial shields are bare, apparently because of abrasion in capture. The radial shields do not extend to the disc centre, which is slightly depressed. Granulation extends for

most of the arm length on the dorsal and lateral surfaces, becoming finer and more spaced distally. The oral surface of the disc and arm-base has a few small, well-spaced granules.

One of the larger specimens (NIWA Stn Z9271, disc diameter 25 mm, arm length 400+ mm) has scattered tubercles on the disc and a few along the dorsal sides of the arms. The tubercles are rounded in section and vary from higher than wide to squat, with the tip bluntly pointed to almost flat.

One specimen (disc diameter 17 mm) from NIWA Stn Z9566 has the pale orange gonads visible on a broken arm, extending to at least segment 12; on two further specimens from this station (disc diameters 14 mm and 17 mm) with the skin missing from the arm-base out to about segment 12 and underlain by spongy tissue, dissection revealed no trace of the gonads. Spongy tissue extends to where the arm tapers abruptly.

*Ophiocreas oedipus* Lyman, 1879 (Fig. 13, Pl. 12)

*Ophiocreas oedipus* Lyman, 1879: 65, pl. 16 (443-446); 1882: 282, pls 31 (5-8), 46 (1); Koehler 1909: 206, pl.7 (2); H.L. Clark 1915: 178; Baker 1980: 28; McKnight 1993: 174.

**MATERIAL EXAMINED:**

NIWA Stns F881(1, det. Dr A.N. Baker); U582(1), Z8481 (5), Z8483(4), Z9157(1), Z9159(1), Z9160(1), Z9163(1), Z9173 (3), Z9181(1), Z9227(3), Z9230(1), Z9150(1), Z9718(1).  
NMNZ: NE of Raoul Island, 1225 m (1).

**DESCRIPTION:** NIWA Stn F881 (det. Dr A.N. Baker), disc diameter 5 mm, arms coiled, estimated at about 100 mm long.

Disc inflated, depressed at centre, interradially slightly concave, margins subvertical. Disc and arms covered by thin skin, which has numerous, close-set, minute grains. Granulation more scattered near disc margin. Radial shields extend from arm-base to near disc centre, almost meeting, distally widely separated. Genital clefts on subvertical disc margin, relatively wide; genital plate extends over upper end of cleft, but not continuous across interradii. Oral shield very small, adoral shields longer than wide, meeting within. Jaws protrude, lateral margins of jaw with small granules, close-set. Teeth blunt.

Arms generally higher than wide; at arm-base, segments are swollen and covered with minute grains. Narrow dorsal arm-plates form arcs over arm-base, absent beyond. Lateral arm-plates meet on ventral midline, ventral arm-plates fragmented; a single arm-spine on segments 2-8, then 2; inner spine longer, as long as arm width or more, outer spine

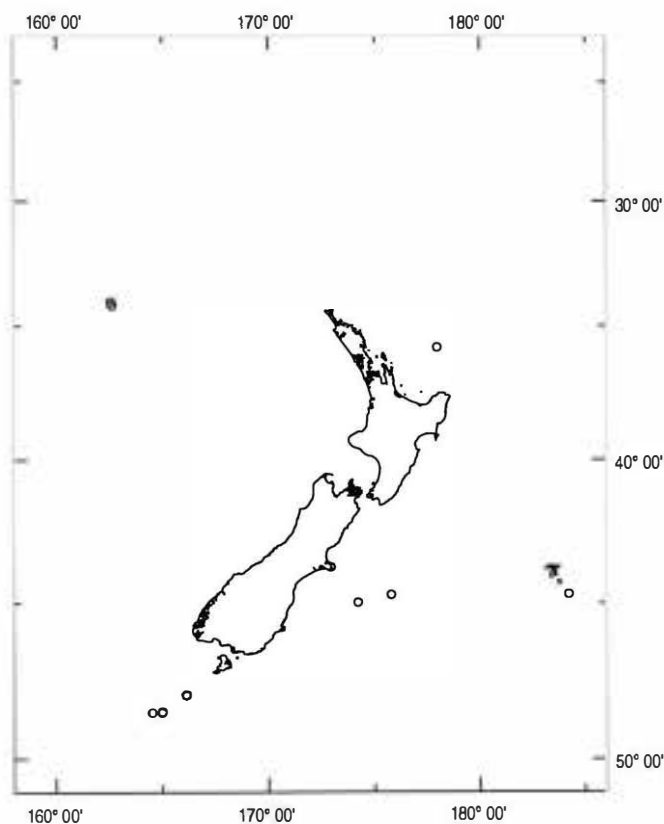


Fig. 12. New Zealand records of *Ophiocreas mortenseni*.

about half length of inner. Outer spine tapering, finely thorny, inner spine thickened distally, more coarsely thorny. Distally spines equal in length, in form of flat hooks, with 6 lateral teeth.

**COLOUR:** Pale brown, lighter below (dried specimen). Recorded as disc red or pink, with paler arms (in ethanol).

**DISTRIBUTION:** This species is known from Indonesia, the Kermadec Islands, Three Kings Rise, and north-eastern New Zealand, south to Bay of Plenty; Lord Howe Rise; also Ascension Island, Atlantic Ocean, 700–2000 m.

**REMARKS:** One specimen from NIWA Stn Z8481 has an additional radial shield; this extends from the disc margin to about half way to the disc centre, and is more or less interradial in position; the shield from which it arises at the disc margin is otherwise normal.

Specimens from Stn Z8481 have disc diameters 8–12 mm; those from Stn Z8483 differ in radial shields. Normally, as figured by Baker (1980), shields extend from the margin almost to the disc centre and more or less meet; in newly examined specimens some shields are shorter, reaching only about half way to

the disc centre, where they terminate abruptly. A specimen from Stn Z8483 (disc diameter ca. 8 mm) has 6 arms; radial shields are short – half disc diameter or less – irregular, and 2 arms lie close together; on the underside are 6 jaws. Arms are too close to see if genital slits intervene; on the dorsal surface there are only 3 radial shields; one, more or less triangular and widest at margin, is shared by 2 arms. One other specimen has a small tubercular prominence at the outer interradial end of 2 shields.



Plate 12. *Ophiocreas oedipus* Lyman. NIWA Stn F881, disc diameter 5 mm, dorsal view.

*Ophiocreas sibogae* Koehler, 1904 (Fig. 14, Pl. 13)

*Ophiocreas sibogae* Koehler, 1904: 165, pls 32 (9–11), 36 (1);

Baker 1980: 28 (with synonymy); McKnight 1993: 174.

*Ophiocreas longipes* Mortensen, 1924: 102, pl. 3.

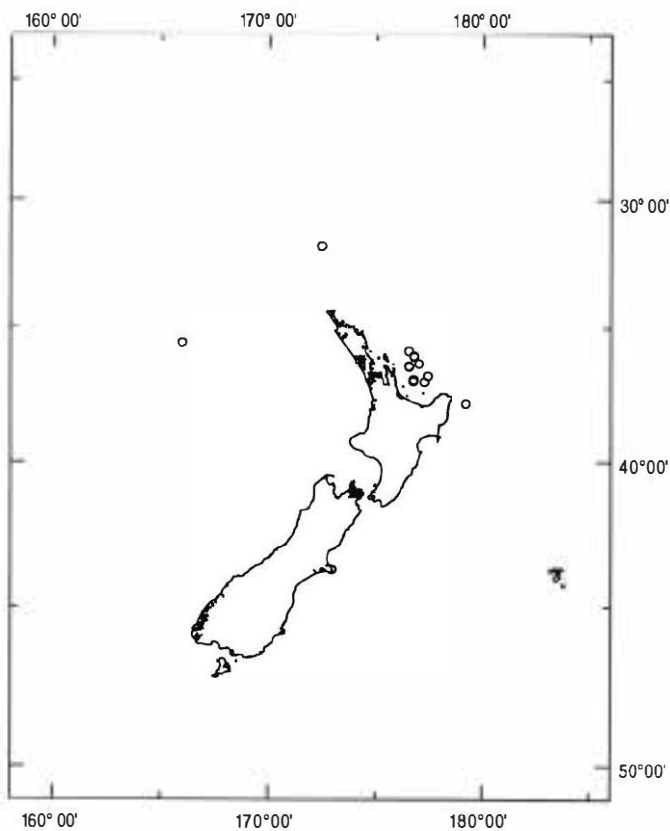


Fig. 13. New Zealand records of *Ophiocreas oedipus*.

**MATERIAL EXAMINED:**

NIWA Stns C632(2), C645(1, fragments), E841(4), I63(1), J676 (1), J683(1), S194 (1), T29(1), U594(1), X369(1), X371(1), X483 (1), X693(1), (all specimens det. Dr A.N. Baker, except for Stns S194, T29, U594, X483, X693).

**DESCRIPTION:** NIWA Stn J676, disc diameter 13 mm, arms coiled, about 300 mm long.

Disc inflated, slightly sunken at centre, margins almost vertical, disc a little indented in interradii. Disc and arms covered by smooth skin, without any ornamentation. Radial shields long and narrow, widest distally, extending to near disc centre, where they meet. Proximal part of shields slightly lower than remainder, ending in an obtuse point; shields diverge distally. Genital clefts entire, narrow, the pair somewhat oblique, in a common depression; upper end of cleft margined by genital plate which extends partly across interradius. Adoral shields large, meeting within, oral shields present, very small. Jaws protrude, margin of jaw with a series of low tubercles or granules, set well down into oral slit. Teeth triangular, lowest often in several pieces.

Arms higher than wide, ventral surface narrow, flat. Dorsal arm-plates form 2 series on each arm segment, each of small, flat overlapping plates beneath the skin, arising from a single rounded plate lying just above arm-spines. Lateral arm-plates join on ventral midline; ventral arm-plates small, lying distal to each pair of laterals. One spine present from arm-segment 2, 2 spines from about segments 7-10; inner spine longer, sometimes almost equal to arm width, outer spine about half length of inner. Inner spine with many small, curved thorns, often swollen in distal part, due to presence of glandular tissue; outer spine more tapering, finely rugose. Distal spines are hooks with 2-4 teeth.

**COLOUR (ex ethanol):** Dorsal surface of disc dark, almost black, radial shields light brown, conspicuous; arms and entire ventral surface dull, light brown, arm-spines slightly darker.

Also recorded with a red disc, radial shields and arms pink, and arm-spines red-tipped.

**DISTRIBUTION:** This species is recorded from northern New Zealand, south to about 42°S, 262-1920 m. It has also been recorded from Indonesia and southern Australia, 204-1089 m.

*Ophiocreas willsi* n.sp. (Fig. 15, Pl. 14)

**MATERIAL EXAMINED:**

NIWA Stns Z9592(2), Z9594(1).

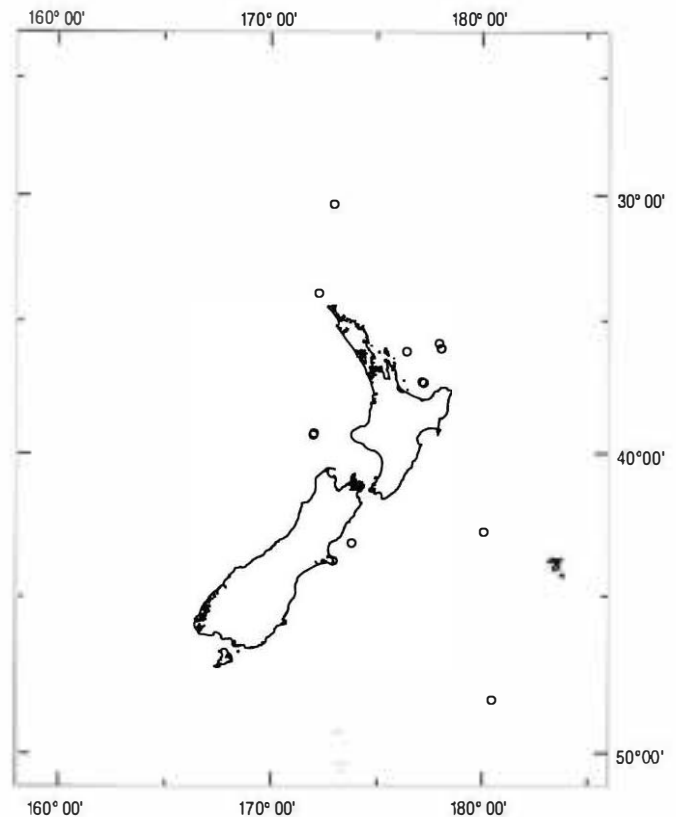


Fig. 14. New Zealand records of *Ophiocreas sibogae*.

**DESCRIPTION:** NIWA Stn Z9594 (holotype specimen). Disc diameter 16 mm, arms broken, at least 380 mm long, with a marked dorsal furrow over proximal tenth of length.

Disc slightly indented in interradii, sunken at centre. Radial shields prominent, raised, meeting near disc centre. Shields widest at margin, tapering more or less evenly to the pointed inner ends. Dense granulation covers shields and centre of disc, granules slightly spaced apart; on rest of disc granules spaced further apart, becoming least dense between outer ends of radial shields. Granules small, circular or ovoid in outline and flattened, the surface very finely rugose. At disc margin, interradii space smaller than that between the shields of each pair. Genital plates not extending across interradii. Margin of disc sloping, spaced granules present on genital plates and on membrane between genital slits. Genital plates more or less parallel, not converging ventrally. Oral area with scattered, well-spaced granules.

Oral plates convex, protruding. Lateral margin of oral slit with a few low granules; oral tentacle with small granules on surface. Only the pointed lowest tooth visible.

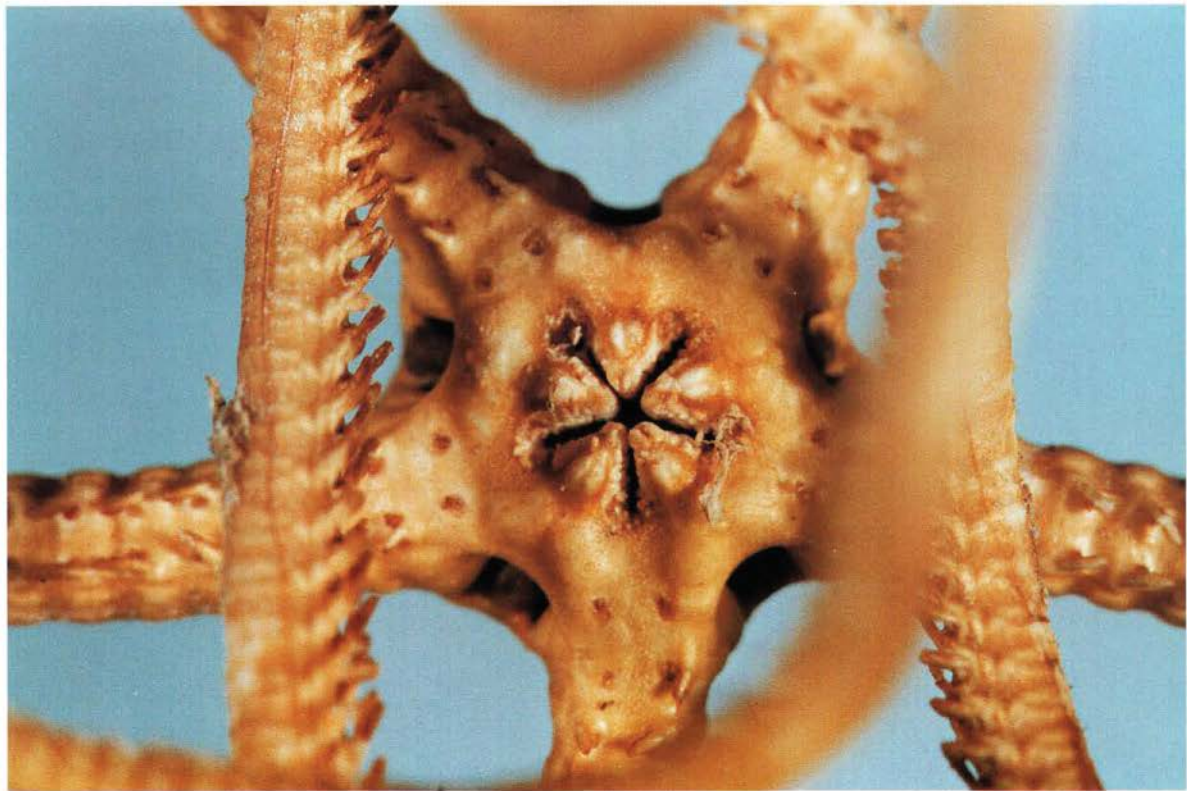


Plate 13. *Ophiocreas sibogae* Koehler. NIWA Stn J676, disc diameter 13 mm, dorsal and ventral views.

Adoral plates large, slightly convex, oral shields not apparent.

Arms more or less inverted U-shape in section. Dorsal furrow well marked on proximal part of arm. Granulation of disc extending onto dorsal and lateral surfaces of arms; relatively dense proximally, granules becoming smaller and more widely spaced distally, with only a few present on attenuate distal portion of arm. Dorsal arm-plates in a single series on either side of dorsal furrow proximally; plates rectangular, wider than long, a shorter plate adjacent to the lateral arm-plate. Dorsal arm-plates in 2 rows near end of dorsal furrow, the rows becoming separate beyond, converging to the lateral arm-plate on side of arm. Dorsal arm cavity large lacking any spongy tissue although gonads are visible; ventral surface of arm skin-covered, lateral plates meeting on midline, margins parallel or slightly expanded, not narrow or pointed; ventral arm-plates small, triangular, absent distally, first 3-5 tentacles with a few small granules on surface. First pore lacks spines, second usually with 1 spine, 2 spines from second or third pore. Tentacle-pore small, immediately distal to spines, more or less hidden by them. Initially spines almost equal in length, the outer only a little shorter than the inner; both slightly flattened and taper to a blunt point; a thick skin covers spines until dried; then both are seen to have several teeth along dorsal half of the proximal margin. At about the midarm where spines are longest the inner about equal to 1.5 arm-segments, the outer 1.2. Distal spines shorter than an arm-segment, both nearly equal in length with 3 or 4 curved teeth on outer quarter of proximal margin.

COLOUR: (frozen specimens): Dull reddish-brown.

REMARKS: This species is characterised by the granulation present in the adult, the non-pointed ends to the lateral arm-plates, and the more or less hidden tentacle-pores.

DISTRIBUTION: Known only from west of the Snares Islands, south of New Zealand, ?940-1186 m.

HOLOTYPE: Deposited in the NIWA collection, Wellington, H-727 (from Stn Z9594).

PARATYPES: Two specimens deposited in the NIWA collection, Wellington, P-1191 (from Stn Z9592, disc diameters 10 and 13 mm).

ETYMOLOGY: Named for the collector, Mr J. Wills, scientific observer, Ministry of Fisheries.

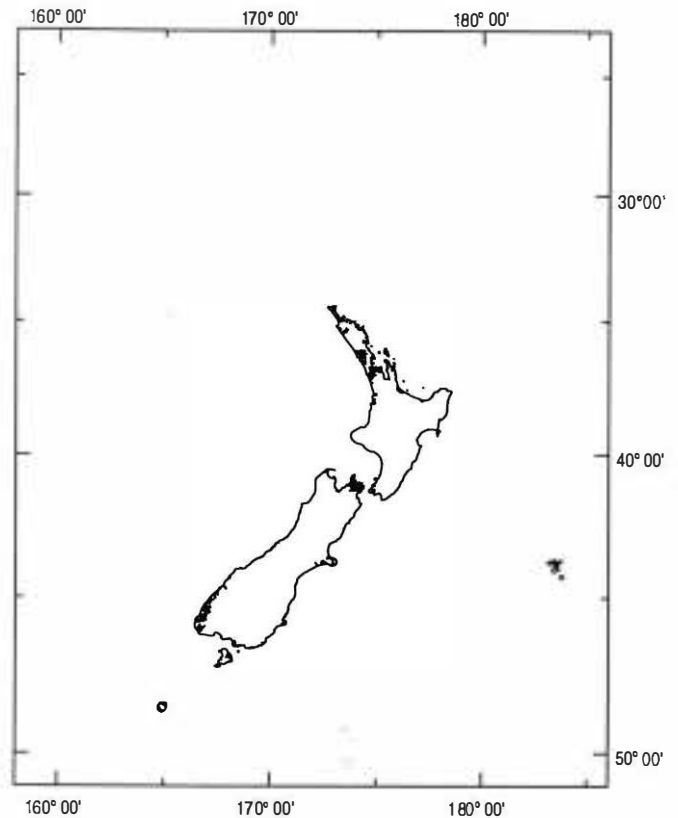


Fig. 15. New Zealand records of *Ophiocreas willsi*.

*Astrobrachion* Döderlein, 1927  
(restricted Mortensen 1933)

Arms very long, disc and arms skin covered, without granulation; ventral arm-plates separate lateral arm-plates.

TYPE SPECIES: *Ophiocreas constrictus* Farquhar, 1900

*Astrobrachion adhaerens* (Studer, 1884)  
(Fig. 16, Pl. 15)

*Ophiocreas adhaerens* Studer, 1884: 54, pl. 5(11a-e).  
*Astrobrachion (Astroscolex) adhaerens*: Mortensen 1933: 68, pl. 5(3).  
*Astrobrachion adhaerens*: Baker 1980: 27 (with synonymy); McKnight 1989a: 11; 1989b: 25.

MATERIAL EXAMINED:

NIWA Stns K812(2) (det. Dr A.N.Baker); P960(1), Q72 (4).





Plate 14. *Ophiocreas willsi* n.sp. NIWA Stn Z9594, disc diameter 16 mm, dorsal view.

DESCRIPTION: NIWA Stn Q72. Disc diameter 5 mm, arms tightly coiled, estimated at about 100 mm long; disc and arms covered by smooth skin.

Disc slightly inflated, interradially excavate. Radial shields prominent, narrow, extending from arm-base to disc centre, almost touching; shields diverge distally. Margin of disc subvertical; genital clefts narrow, converging below. Adoral plates large, wider than long, meeting within; oral shields small. Margin of jaw generally smooth, with 2 or 3 small granules near tip. Teeth flattened, pointed.

Arms narrow, just higher than wide, ventral surface flat, dorsal surface arched. Arm-plates concealed by skin. Dorsal arm-plates, near arm-base in 4 pieces, 2 near midline, not meeting, and 2 longer plates extending over side of arm; distally plates are more fragmented with about 8 on each segment. Lateral arm-plates form a Y-shaped group, 3 on side of arm, 1 ventral bearing the spines. 1 spine from arm-base, then 2; spines shorter than arm width, the inner longer, usually with 1 large tooth and several smaller; outer spine simple, bluntly tipped. Distal arm-spines flattened, with 1 or 2 terminal and 2 lateral teeth. Ventral arm-plates small, separating lateral plates, more or less triangular in shape, widest distally, distal margin concave.



Plate 15. *Astrobrachiion adhaerens* (Studer). NIWA Stn Q72, disc diameter 5 mm, dorsal view.

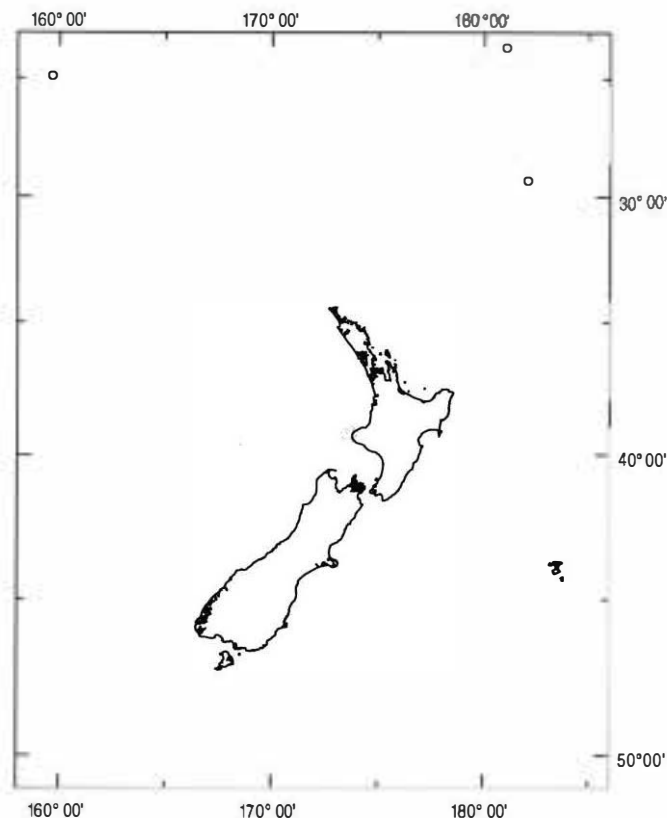


Fig. 16. New Zealand records of *Astrobrachion adhaerens*.

**COLOUR (ex ethanol):** Dull reddish, with indications of longitudinal darker red and whitish lines on dorsal midline of arms; these are more prominent distally. Recorded colours are red and whitish-yellow, usually with some longitudinal markings along arms.

**DISTRIBUTION:** This species is known from northern and western Australia, New South Wales, Capel Guyot, northern Tasman Sea, the Kermadec Islands, and the Minerva Reefs, 10–183 m.

**REMARKS:** One specimen from NIWA Stn Q72 has small whitish spots along the arms and over the radial shields. These appear to be small calcareous nodules enclosed in the skin.

***Astrobrachion constrictum* (Farquhar)**  
(Fig. 17, Pl. 16)

*Ophiocreas constrictus* Farquhar, 1900: 405.  
*Ophiocreas constrictum*: H.L. Clark 1915: 178; Mortensen 1924: 99.  
*Astrobrachion constrictum*: Baker 1980: 24 (with synonymy); Guille *et al.* 1986: 166.

**MATERIAL EXAMINED:**

NIWA Stns I622(1), I627(1), P108(1), P109(2) (det. Dr A.N. Baker), Q100(1), Q104(6), Q749(1), S233(2), T109(2), X121(1), Z2699(1), Z8691(1), Z8797(1), Z9041(3), Z9042 (2), Z9043(7), Z9044(5), Z9417(4).

NMNZ : Off North Cape, 128 m (2); off Doubtless Bay, 73 m (1); Cavalli Islands, 36 m (2); Poor Knights Islands, 73 m (4); Little Barrier Island, (3); Whale rock, 110 m (1); off Mayor Island, 110 m (8); off White Island, 110 m (24); Putney Rocks, 22 m (3); 12 miles east of Gisborne, 91 m (1); Jackson Bay, (1); Bligh Sound, 55 m (1); Preservation Inlet (1).

**DESCRIPTION:** NIWA Stn S233. Disc diameter 18 mm, arms about 350 mm, long, broken near tip.

Disc and arms covered by soft, smooth skin. Disc low, slightly inflated, but slightly depressed at centre; radial shields raised, prominent, extending from arm-base almost to disc centre, convergent, but not touching. Interradial margin subvertical, margined above and laterally by genital plate, below by outer edge of oral frame. Genital slits prominent, in a common depression, closest orally. Plates of oral area obscured by skin; adoral plates large, meeting broadly proximally, extending to distal margin of oral area; oral shields smaller, of variable outline, about half size of adoral shields; jaws protruding; sides of jaw may have

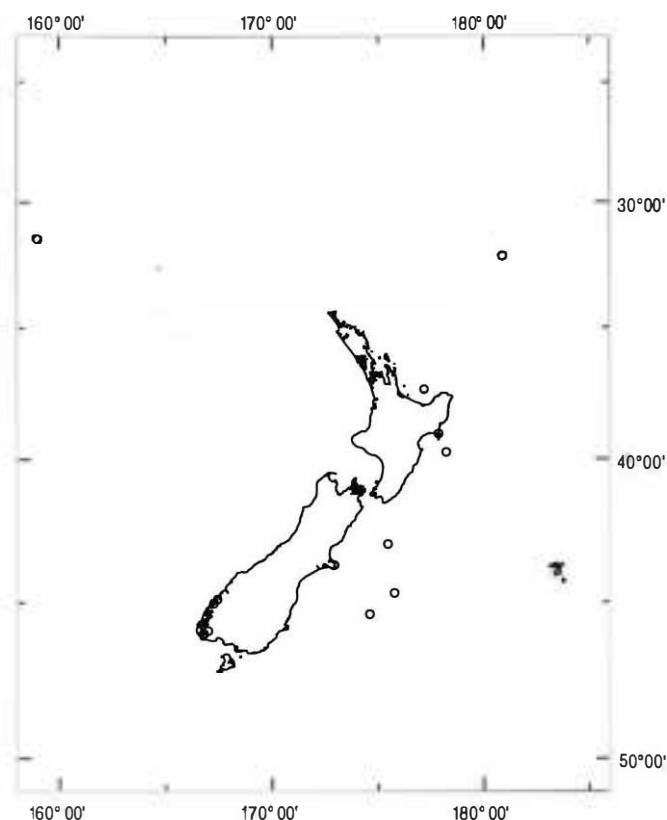


Fig. 17. New Zealand records of *Astrobrachion constrictum*.

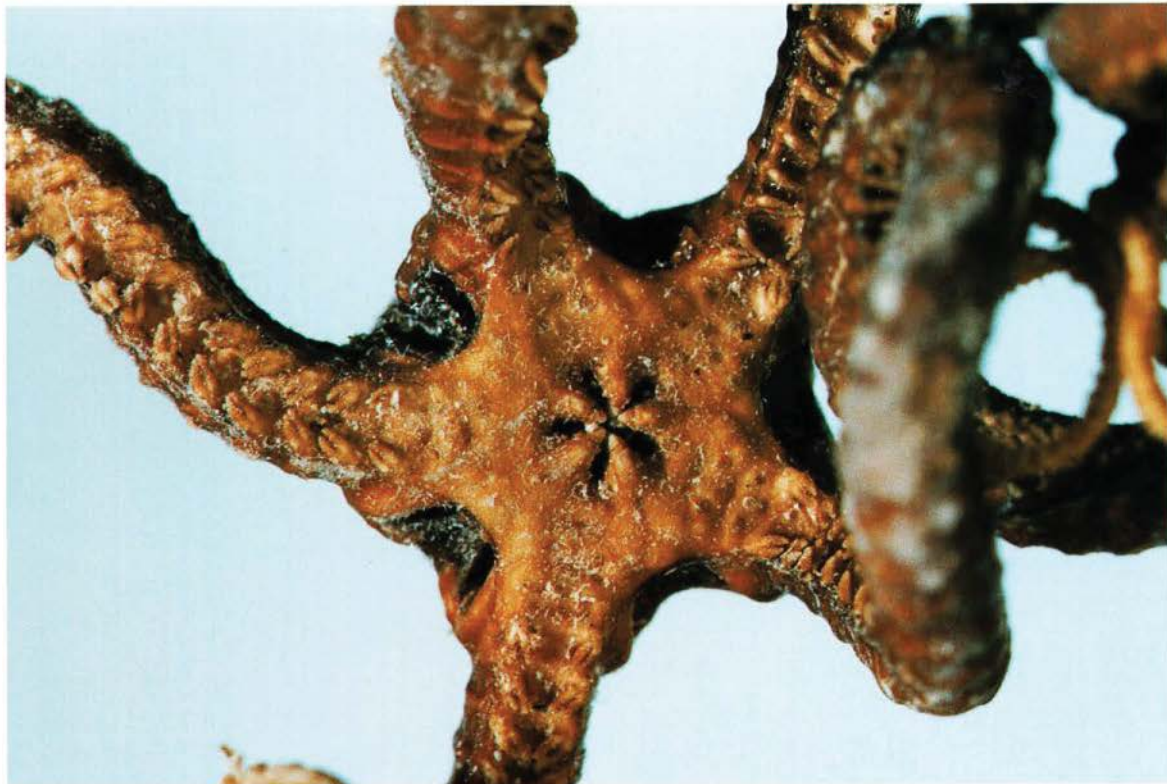


Plate 16. *Astrobrachion constrictum* (Farquhar). NIWA Stn S233, disc diameter 18 mm, dorsal and ventral views.

2 or 3 low, domed granules, or are smooth; usually 2 or 3 granules flank lowest tooth, and may occur on oral surface at jaw tip. Teeth pointed, lowest smooth, others with irregular margins. Outer oral tentacle more or less superficial, prominent, sheathed.

Arms higher than wide, ventral surface flat, cross-section of arm horseshoe-shaped. Dorsal arm-plates, near arm-base in 4 pieces, 2 small plates, not meeting in midline, and 2 larger narrow plates extending over side of arm; distally these latter plates divide to form a double row of plates across each arm-segment; lateral arm-plates form a double or alternate series, usually 6 plates present. Ventral arm-plates small, wider distally, bluntly triangular in outline, separating lateral arm-plates. First 2 or 3 arm segments without spines, 1 spine to about segments 4 and 5, then 2, rarely 3. Spines blunt-tipped, with thorny tips; inner spine longest, shorter than arm width, tip slightly widened; outer spine shorter, tip may be widened. Distal spines flattened, becoming compound hooks, with 2-4 lateral teeth. Tentacle-pore placed just distal to inner spine, proximal tubefoot with a distinct sheath, or thickened at base.

**COLOUR:** Variable. The present specimen is like most preserved specimens seen — dull, uniform brown all over. In life the species is either uniform reddish or yellowish, with the spines sometimes darker; or with black and white bands on the arms. A longitudinal colour pattern apparently is absent from this species.

**DISTRIBUTION:** This species is known from throughout New Zealand, southeastern Australia, Lord Howe Island, and New Caledonia, 6–540 m.

#### Family EURYALIDAE Gray, 1840

Arms simple or branching; skin naked or tuberculate; no hooks on dorsal side of arms; distal arm-spines may be transformed into hooks with a serially perforated lamina; gonads extending into arms; vertebrae with ventral furrow closed.

#### *Astroceras* Lyman, 1879

Arms not branching, with a dorsolateral ridge of scattered tubercles or spines, sometimes spines or tubercles on radial shields and disc; ventral surface more or less naked; no interradiial plates distal to adoral shields.

**TYPE SPECIES:** *Astroceras pergamena* Lyman, 1879

#### *Astroceras elegans* (Bell, 1917) (Fig. 18, Pl. 17)

*Asteroschema elegans* Bell, 1917: 7.

*Astroceras elegans*: Mortensen 1924: 107, pl. 4(3); 1933: 53;

Baker 1980: 66 (with synonymy).

*Astroceras maui* McKnight, 1968: 516.

#### MATERIAL EXAMINED:

NIWA Stns C527(7)\*, E312(5)\*, E389(3), E636(2), E859(1)\*, F779(2)\*, G822(2)\*, I94(3), I622(1), P16(1)\*, P62(1), P946(1); Q99(1), Q769(1), S233(3); Z2371(1), Z2374(1), Z2376(1), Z8253(1) (\*det. Dr A.N. Baker).

NMNZ: North of Three Kings Islands, 256 m (31); West of Three Kings Islands, 119 m (4); east of North Cape, 146 m (71); off Cape Karikari, 165 m (6); off Westland, 220 m (130); Hokitika Canyon, 300 m (718).

**DESCRIPTION:** NIWA Stn I94, identified by Dr A.N. Baker.

Disc diameter 9 mm, arms rounded, longest about 70 mm, total length estimated at about 95 mm.

Disc slightly inflated, sunken slightly at centre, interradii a little indented, margins subvertical. Disc and arms covered by skin. Radial shields slightly raised, in contact for most of length, extending to near disc centre, almost meeting; shields divergent in distal third; shields with 1–3 low tubercles on distal half.

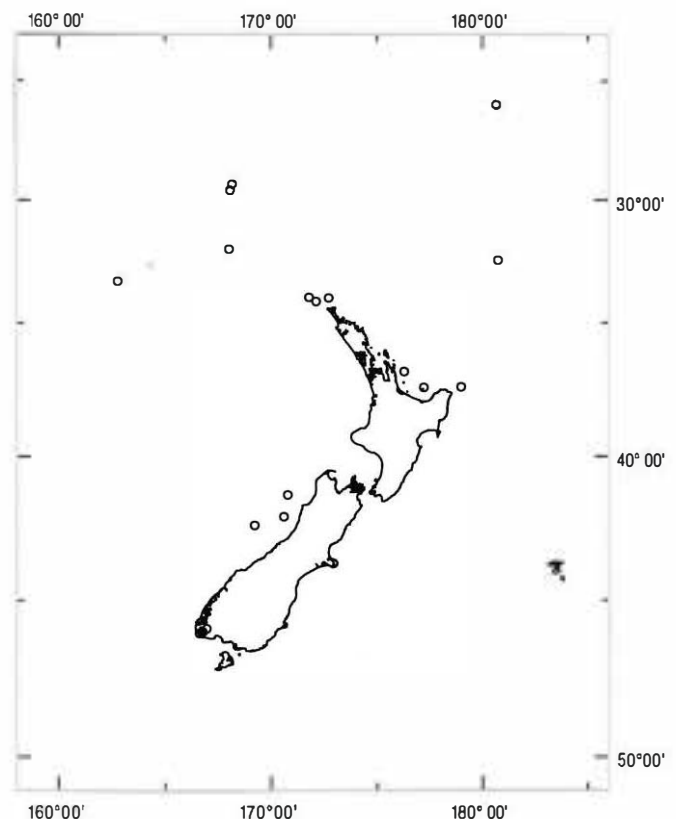


Fig. 18. New Zealand records of *Astroceras elegans*.

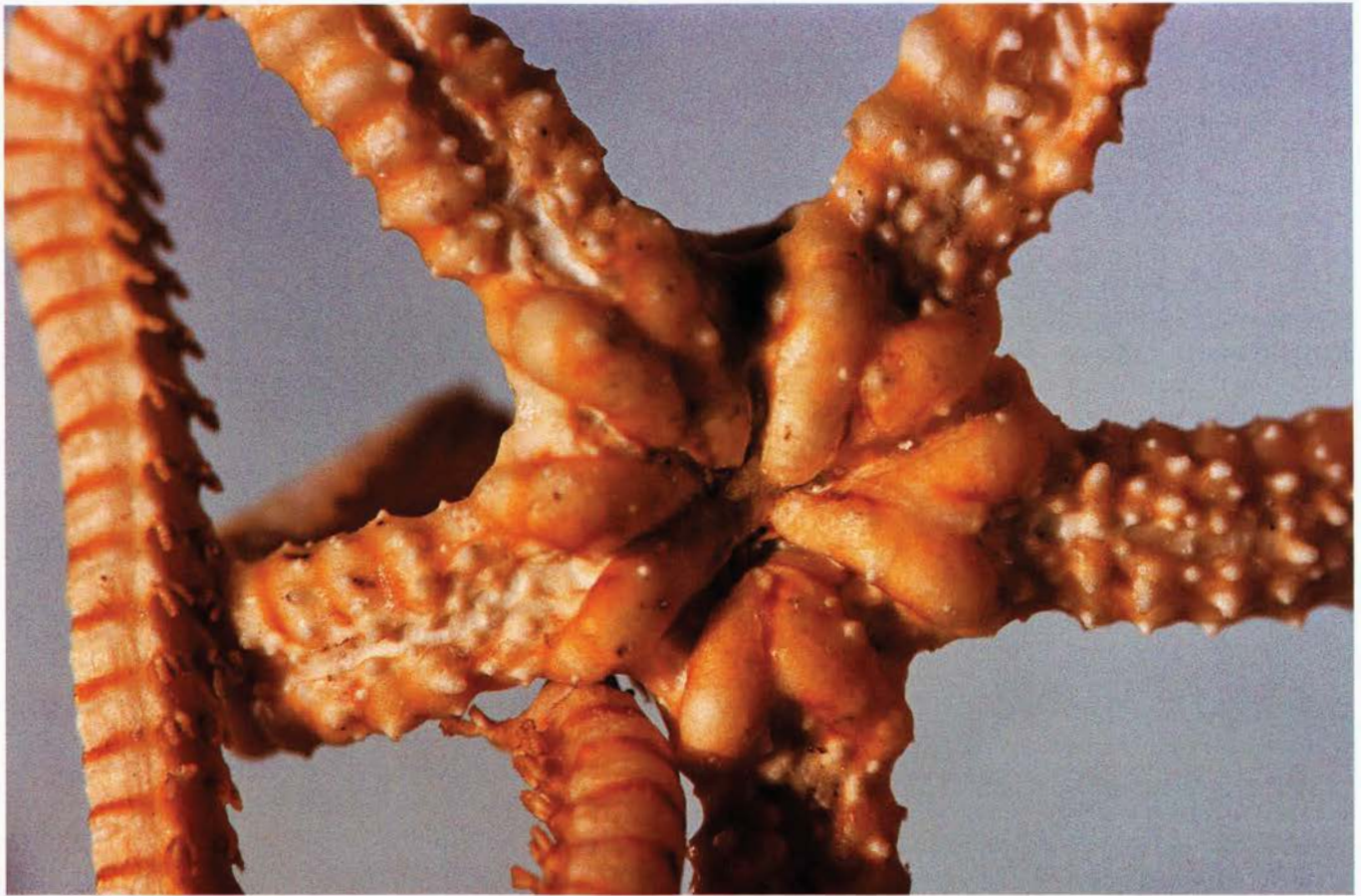


Plate 17. *Astroceras elegans* (Bell). NIWA Stn R432, disc diameter 4.0 mm, dorsal and ventral views.

Genital clefts almost oval in outline, set in common depression. Adoral shields large, meeting broadly within, oral shields absent. Lateral margin of jaws with a continuous series of small granules. Teeth bluntly pointed, more or less triangular.

Arms higher than wide at base, basal segments slightly swollen, arms evenly tapering beyond; ventral surface of arms flat; lateral and dorsal surfaces slightly convex. Basal 3 or 4 arm-segments with 3 to 4 tubercles on either side of centreline, extending slightly down side of arm; beyond base, segments with 2 or 3 tubercles; beyond about one-third arm length tubercles become lower, smaller, and are absent distally. Lateral arm-plates widely separated by ventral plates, these in 2-4 pieces. Two arm-spines present from second arm-segment; spines shorter than arm width, subequal, with tip rounded and prickly; from about one-third arm length, inner spine becomes a little longer. Distal spines are transformed into flattened hooklets, with 2 or 3 teeth.

**COLOUR** (dried, ex ethanol): Disc and arms more or less uniform dull light-brown, arms banded from about one-third length; bands are darker, almost purplish, and occur between every segment. Disc may have brown bands between the radial shields. Some preserved specimens (e.g., NIWA Stn S233) have the dorsal tubercles yellow.

**DISTRIBUTION:** This species is recorded from New Zealand, south to Fiordland on the west coast, but only to near East Cape on the east coast; also Norfolk Island, Tasman Sea, 9-875m. The two shallow records, (Scuba collections) are from Fiordland and Three Kings Islands.

*Astroceras kermadecensis* Baker, 1980  
(Fig. 19, Pl. 18)

*Astroceras kermadecensis* Baker, 1980: 68.

**MATERIAL EXAMINED:**

NIWA Stns K806(11, type material), R435(1), R438 (several); R439(2).

**DESCRIPTION:** NIWA Stn R438. Specimen has 6 arms, one of which is slightly narrower than the others; disc diameter 4.0 mm; arms coiled, estimated at about 12 mm in length, tips missing.

Disc indented in interradii, more or less flat on dorsal surface, covered with closely packed fine granulation, which continues onto ventral surface and along arms; 10-15 granules in 1 mm. Radial shields scarcely evident, except distally where they project slightly.



Plate 18. *Astroceras kermadecensis* Baker. NIWA Stn R438, disc diameter 4.0 mm, dorsal and ventral views.

Shields parallel, small, extending to about half disc diameter or less. Margin sloping; genital clefts small, quite distinct, separated, widest proximally, some

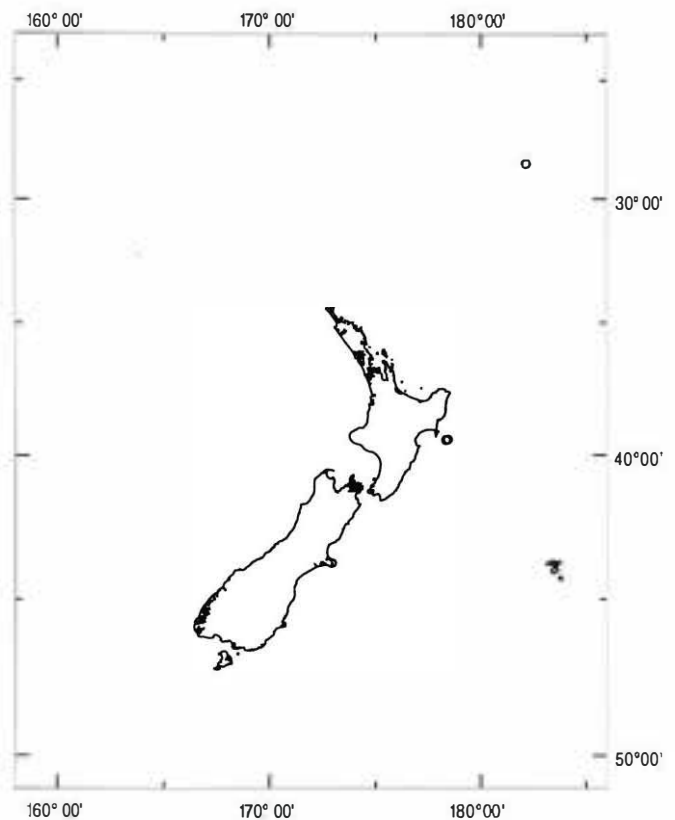


Fig. 19. New Zealand records of *Astroceras kermadecensis*.

cleft covered by thin skin. Oral area covered with fine granules, slightly more spaced than on dorsal surface. Oral papillae granule-like, larger than other ventral granules, 3 or 4 border each side of the jaw; one jaw smaller and lacks oral papillae. Teeth pointed, triangular. Adoral plates relatively large, outlines indistinct. A small, subtriangular oral plate in each interradius, none enlarged, all appear to be madreporites.

Arms a little higher than wide at base, gently tapering throughout; at base all of arm surface covered by granulation, this becoming sparser then absent distally. Most of ventral surface is simply skin-covered. Lateral arm-plates separated from arm-base, i.e., ventral furrow is closed. A small ventral plate present proximally, lying just distal to laterals, this absent distally. 1, rarely 2, arm-spines present from segment 2, short, blunt, and cylindrical. Distal spines are flattened hooks, with 2-6 teeth. Tubefoot lies immediately behind arm-spine, is small, lacks any sheath.

COLOUR (ex ethanol): Dull, uniform light-brown to dull, uniform cream.

REMARKS: Small specimens from the same sample, with disc diameter down to 2.0 mm have the genital clefts scarcely apparent. Of 50 specimens examined from NIWA Stn R438, 7 had 5 arms, 39 had 6 arms, and 4 had 7. Specimens with unequal arms comprised about half of the total although more than half of the 6-armed forms had the arms more or less equally developed.

DISTRIBUTION: This species is known only from the Kermadec Islands and southeast of Mahia Peninsula, east coast, North Island, New Zealand, 985-1165 m.

### Family GORGONOCEPHALIDAE Ljungman, 1867

Arms branching or simple; skin usually tuberculate or granulate; dorsal side of arms with transverse rows of hooks, without a lamina and lacking regularly arranged perforations; gonads restricted to disc; vertebrae with open ventral groove.

#### TABULAR KEY TO GENERA OF GORGONOCEPHALIDAE

	1	2	3	4	5	6
<i>Asteropora</i>	s	a	a	-	-	4-7
<i>Astroboa</i>	b	b	a	4+	no	2-4
<i>Astrocladus</i>	b	b	a	1-2	no	2-4
<i>Astrodendrum</i>	b	b	a	0	no	2-3

	1	2	3	4	5	6
<i>Astroniwa</i>	s	b	b	-	-	2-5
<i>Astrothorax</i>	s	b	a	-	-	10
<i>Astrothrombus</i>	s	b	a	-	-	2-5
<i>Astrotoma</i>	s	b	b	-	-	2-3
<i>Gorgonocephalus</i>	b	b	a, b	0	yes	2-5

- 1 s = arms single; b = arms branch
- 2 Girdle hooklets extend onto disc: a = yes, b = no
- 3 Girdle hooklets with 1+ secondary tooth: a = with, b = without
- 4 Arm-spines begin at arm fork
- 5 Plates at disc margin
- 6 Arm-spines

#### TABULAR KEY TO SPECIES OF *Gorgonocephalus*

	1	2	3	4	5	6	7
<i>G. chilensis</i>	d-m	p	yes	p, t	a	no	4-5
<i>G. dolicho</i> <i>dactylus</i>	d-m	t	no	g	b	yes	3
<i>G. pustulatum</i>	s-a	t	no	p	c	yes	3-4
<i>G. sundanus</i>	s-a	p, i	no	n	d	no	1-2 (3)

- 1 Tuberculation of radial shields dense, moderate, sparse, absent
- 2 Taper of shields: p = proximal, t = throughout, i = irregular
- 3 Tubercles on marginal disc plates continuous with those of radial shields
- 4 Ventral side of disc naked, pustular, grains, tubercles
- 5 Arm cover near base: a = scattered tubercles; b = plates and low tubercles, scattered; c = low smooth plates; d = spaced plates
- 6 Girdle bands continuous from arm base
- 7 Number of arm-spines

### *Gorgonocephalus* Leach, 1815

Arms 5, branching from near disc; arm-spines present before first arm fork; disc and arms with small granules and a marginal zone of plates; radial shields elongate, bar-like; normally one madreporite.

TYPE SPECIES: *Asterias capitmedusae* Linnaeus, 1758

### *Gorgonocephalus chilensis* (Philippi, 1858) (Fig. 20, Pl. 19)

*Astrophyton chilense* Philippi, 1858: 268.  
*Gorgonocephalus chilensis*: Lyman 1882: 261; Döderlein 1927: 3; Fell 1958: 20; Baker 1980: 51.  
*Gorgonocephalus chilensis* var. *novaezealandiae*: Mortensen 1924: 109, pl. 4 (1).

MATERIAL EXAMINED:

NIWA Stns G200(1), G355(1), J55(4) (det. Dr A.N. Baker), S121(2), Z6482(1), Z8566(5), Z8879(3), Z9413(2), Z9414(1), Z9415(1), Z9418(3).

NMNZ: Cook Strait, 182 m (91); Cook Strait, 256 m (1); Cook Strait, 640–658 m (5).

DESCRIPTION: NIWA Stn J55, disc diameter 42 mm, arms tightly coiled, forking at least ten times.

Disc slightly inflated, strongly indented in inter-radii; radial shields elongate and narrow, extending more or less to disc centre where they meet; shields taper at proximal end only; with a moderate cover of conical tubercles, mostly higher than wide. Other areas of disc skin-covered, with numerous scattered smaller tubercles. Plates of marginal ring conspicuous, with a few larger tubercles, these forming a more or less continuous series with those of radial shields. Ventral interradii with a parchment-like skin, covered with small low granules of varying sizes. Genital slits conspicuous, interradii margin with larger granules of tubercles, usually higher than wide, forming 2 irregular rows. Single large madreporite at edge of oral frame. Oral area covered with smooth skin, outline of large oral shields partly visible; a few

scattered small granules on oral shields. Oral plates short, much wider than long. Oral papillae and teeth similar, spiniform.

Arms rounded on dorsal surface, covered with round or domed small tubercles, sometimes these absent, especially on sides of arms; beyond 2nd or 3rd arm-fork tuberculation dense. Girdle bands from about 2nd arm fork, firstly as isolated groups, continuous from about 4th fork; bands raised from about 6th or 7th fork. In midarm region bands preceded by a transverse row of tubercles, raised above general surface, and arm appears annulated. Hooklets have a small secondary tooth. First arm-segment lacks arm-spines; spines increase from 1 or 2 at arm-base to 4 or 5, then falling to 2 or 3 from about 5th fork. Spines are much shorter than arm width, slightly flattened, unevenly pointed. Distal spines are multitoothed hooks. Tentacles enclosed in a tube. Ventral arm surface flat, relatively smooth near base, beyond with widely scattered small granules.

COLOUR (dried specimen): Uniform creamy-white; also noted as disc pale brown; arms, radial shields, and tubercles cream.

DISTRIBUTION: Recorded from central New Zealand, Cook Strait, and the Chatham Rise, 198–658 m; also known from South America, Falkland Islands, South Africa, and Kerguelen Island. The range of latitude is small in comparison with the other species of *Gorgonocephalus*.

REMARKS: Two smaller specimens from NIWA Stn J55, disc diameter 16 mm, dorsal surface of disc closely covered by tubercles, larger tubercles along radial shields and a few between; smaller in interradii and between shields; larger tubercles continue across interradii, on the marginal ring plates. Ventral interradii with a close cover of small granules; oral area with a few small granules; first arm-fork just beyond disc; arms fork at least six times. Genital slits conspicuous.

*Gorgonocephalus dolichodactylus* Döderlein, 1911  
(Fig. 21, Pl. 20)

*Gorgonocephalus dolichodactylus* Döderlein, 1911: 34, pls 1(4,5); 7(3,4b); 1927: 27, 52; A.H. Clark 1949: 13; Baker 1980: 52.

MATERIAL EXAMINED:

NIWA Stns: E716(1), F871(1), F874(1), G821(1), I45(1) (det. Dr A.N. Baker), I705(4), S66(1), S71(10), S121(2), Z6482(1), Z8255(1), Z8528(2), Z8883(1), Z8987(2), Z8988(5), Z8989

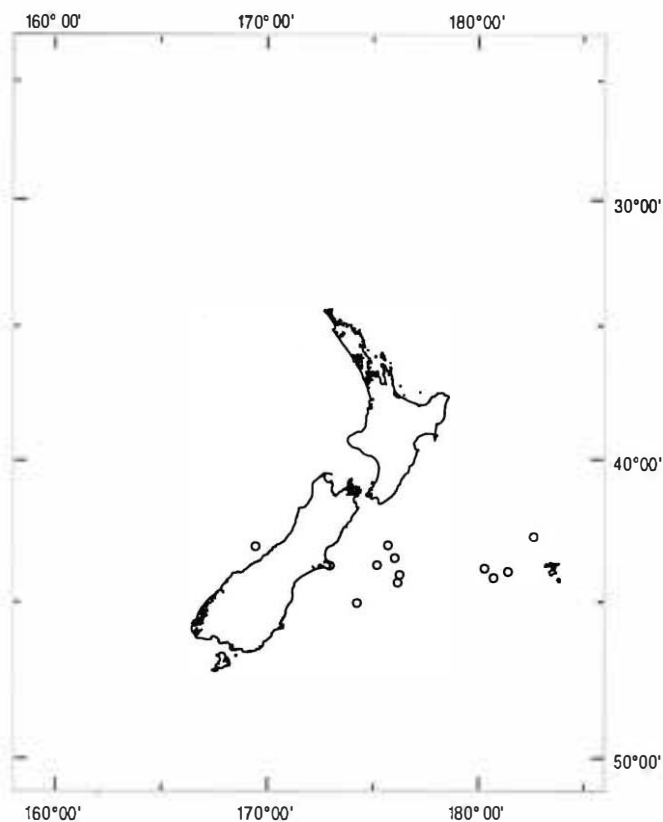


Fig. 20. New Zealand records of *Gorgonocephalus chilensis*.





Plate 19. *Gorgonocephalus chilensis* (Philipp). NIWA Stn J55, disc diameter 42 mm, dorsal view.

(6), Z8990(1), Z8991(2), Z8992(1), Z8996(10), Z8997(8), Z8999 (16, with small specimens on pennatulids), Z9000(4), Z9001(4), Z9007(2, with 1 small specimen on pennatulid), Z9008(2), Z9018(1), Z9020(5), Z9021(2), Z9022(2).

NMNZ: Off Cuvier Island, 480–455 m (3); off Mayor Island 482–550 m (6), 475–420 m (1), off Cape Campbell, 939–1019 m (1).

DESCRIPTION: NIWA Stn F871, disc diameter 58 mm, (det. Dr A.N. Baker).

Disc highest at margin, strongly and broadly excavate interradially. Radial shields raised, prominent, tapering evenly throughout length; extending from margin to near disc centre where they almost meet. Shields with a moderate cover of tubercles, higher than wide. Disc centre skin-covered, other disc areas also skin-covered, some with 1–3 small tubercles. Marginal ring of plates prominent, plates with a few tubercles, clearly separate from those of radial shields. Ventral interradial with a cover of usually spaced tubercles or granules. Genital clefts conspicuous, interradial margins with a single row of larger tubercles, those toward dorsal surface the largest. Madreporite single, not prominent. Oral area covered with smooth skin, outer margin, adjoining ventral interradial with a few, scattered low tubercles, largest

at margin. Oral papillae elongate, spiniform, teeth similar, larger.

Dorsal arm surface rounded; at arm-base surface paved with flat plates and a few tubercles; beyond base covering is mainly closely packed tubercles forming a transverse ridge distal to girdle bands. Girdle bands continuous across arm before first arm-fork; bands slightly depressed, with a double row of hooklets. Girdle hooklets have terminal tooth strongly curved, sometimes with a rudimentary secondary tooth also present. Arm-spines usually present from 2nd arm segment; 2 spines near arm base, then 3; distally 2, then 1 spine. Arm-spines short and rounded in section, blunt tip with small points. Distal arm-spines are 2-toothed hooks. Ventral surface of arms flat, covered with smooth skin, and also with a few scattered grains or small granules, in proximal part.

COLOUR (dried specimen): Dull light brown, lighter below; also noted as with a dark brown or reddish disc with paler radial shields and the arms pinkish or grey.

DISTRIBUTION: Throughout New Zealand, from off Bay of Islands to Bounty Platform, also Lord Howe Rise,



Plate 20. *Gorgonocephalus dolichodactylus* Döderlein. NIWA Stn F871, disc diameter 48 mm, dorsal and ventral views.

335–1357 m. Other records are from Australia, the Philippines, and Japan, 150–897 m.

REMARKS: Small specimen (NIWA Stn G821, det. Dr A.N. Baker), disc diameter 13 mm, arms branch at least four times. Radial shields with a relatively dense coat of tubercles, almost all higher than wide. Centre of disc with a dense cover of smaller granules; other areas of disc with lower tubercles and granules, and a few small, flat plates between radial shields.

Plates of marginal ring conspicuous, with larger tubercles, these continuous with those of shields. Ventral interradii covered with flattened granules. Madreporite prominent, genital clefts conspicuous. Oral shields and ventral arm-plates with scattered very small tubercles, higher than wide.

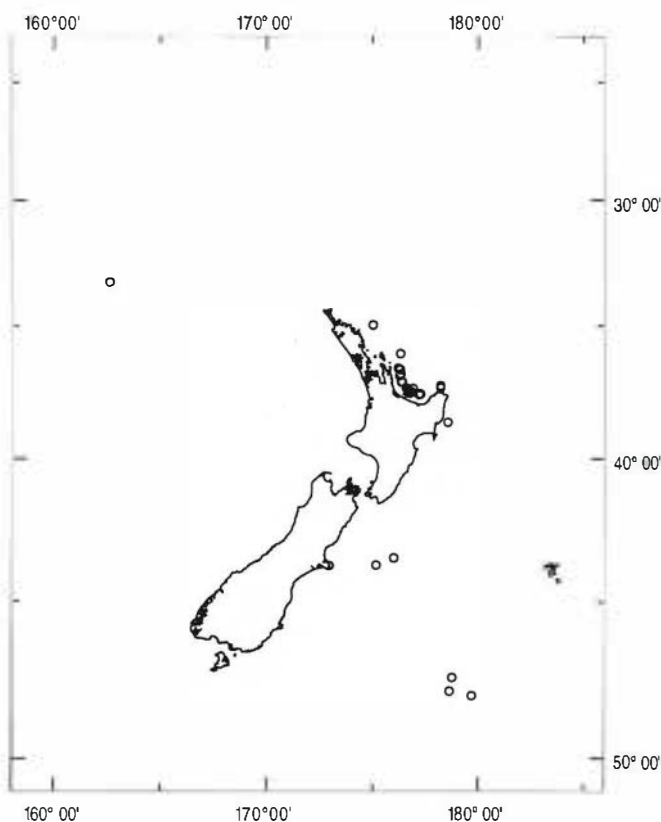


Fig. 21. New Zealand records of *Gorgonocephalus dolicho-dactylus*.

*Gorgonocephalus pustulatum* (H.L. Clark, 1916)  
(Fig. 22, Pl. 21)

*Astrodendrum pustulatum* H.L. Clark, 1916: 84, pl. 34 (1,2)  
*Gorgonocephalus moluccana* Döderlein, 1927: 26, pl. 2 (2,2b)  
*Gorgonocephalus pectinatus* Mortensen, 1933: 281, pl. 18 (1,2)  
*Gorgonocephalus pustulatum*: Baker 1974: 252; Baker 1980: 54.

MATERIAL EXAMINED:

NIWA Stns E906(1), G886(2) (det. Dr A.N. Baker), Q83 (3), Q343(2), S70 (numerous).

DESCRIPTION: NIWA Stn G886 (det. Dr A.N. Baker), disc diameter 69 mm, arms strongly coiled, branching at least seven times.

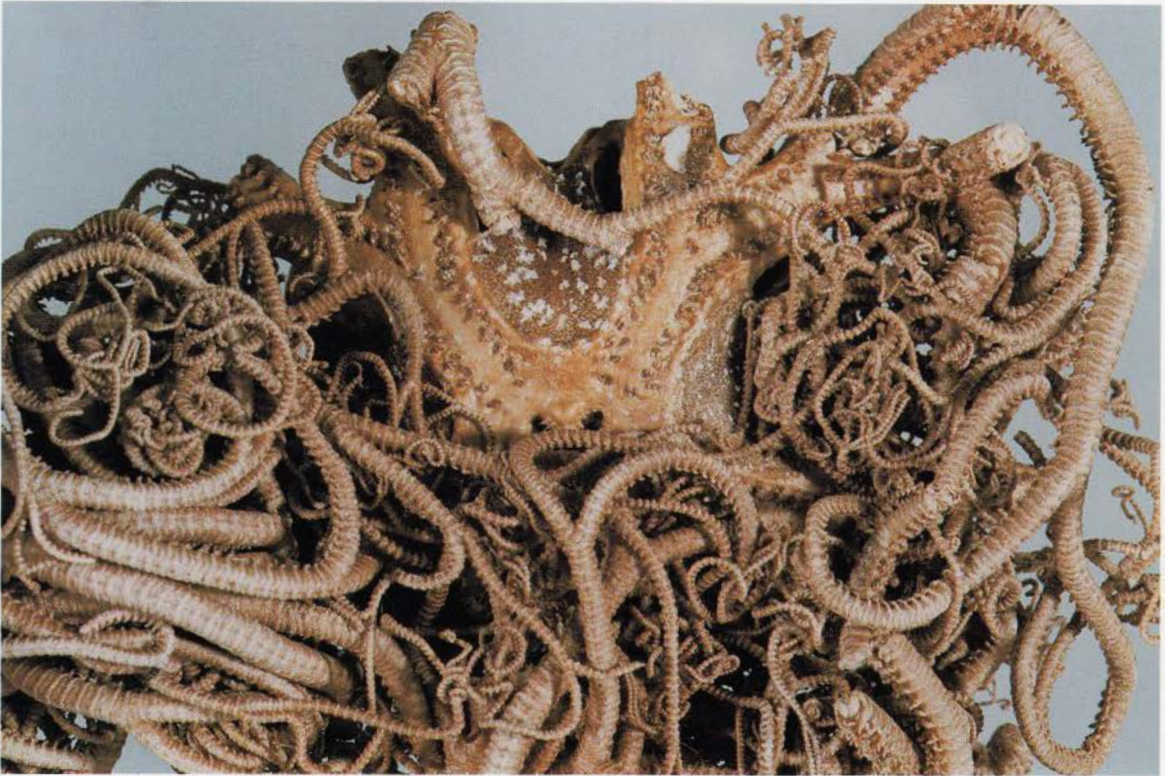
Disc highest at margin, sunken centrally, deeply and broadly excavate interradially; oral surface flat. Radial shields raised, prominent, elongate, narrow, tapering throughout length, to proximal point. Shields extending to near disc centre where they almost meet. Shields with moderately dense covering of tubercles, mostly higher than wide; remainder of disc covered with skin. Marginal ring of plates naked, thin, conspicuous. Ventral interradii areas with a close cover of small flat scales or plates. Genital slits large, conspicuous, interradii margin with small tubercles, absent from upper or outer end, where genital plate margins the slit. Madreporite not evident, probably obscured by coiled arms. Outer edge of oral area with a few, very small tubercles, higher than wide, remaining area covered with smooth skin. Oral papillae and lower teeth spiniform, upper teeth flattened, bluntly tipped.

Arms rounded on dorsal surface, at base paved with smooth, irregular, transversely elongate plates. Girdle bands continuous from near arm-base, slightly raised and clearly sinuous. Girdle hooklets have a very small secondary tooth. Ventral arm surface flat, smooth, skin-covered, with scattered small granules or grains. First arm-segment lacks arm-spines; next 4–6 have 2 spines, then 3 or 4. Distally spines reduce to 2, then 1. Spines are short, cylindrical and have a prickly, blunt tip. Distal arm-spines multitoothed hooks.

COLOUR (dried specimen): Dull brown, radial shields and ventral surface lighter. Also recorded with a red disc.

DISTRIBUTION: New Zealand, with isolated records from Lord Howe Rise, off Cape Egmont, Chatham Rise, and Bounty Platform, 335–816 m. Also recorded from Australia, Indonesia, and western Indian Ocean, 421–751 m.

REMARKS: Small specimen (NIWA Stn S70, disc diameter 14 mm), arms branching at least 4 times; radial shields with a moderately dense cover of tubercles; a few tubercles at disc centre, 1 or 2 between shields or in interradii, and a few small tubercles on marginal disc plates. Ventral interradii with small flat plates, more or less smooth; genital clefts large, interradii margin with relatively large tubercles. Oral area



**Plate 21.** *Gorgonocephalus pustulatum* (H.L. Clark). NIWA Stn G886, disc diameter 69 mm, dorsal and ventral views.

mainly smooth, with occasional scattered grains, and a few tubercles on outer margin. Single madreporite present. Oral papillae few, like small swellings along side of jaw. Lower teeth pointed, others flattened, bluntly tipped. Girdle bands sinuous.

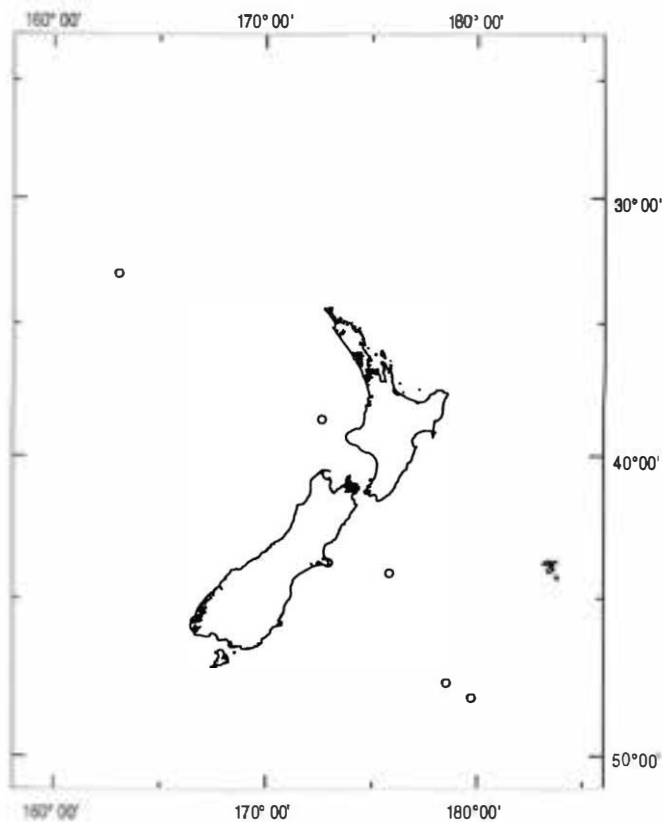


Fig. 22. New Zealand records of *Gorgonocephalus pustulatum*.

*Gorgonocephalus sundanus* Döderlein, 1927

(Fig. 23, Pl. 22)

*Gorgonocephalus sundanus* Döderlein, 1927: 25, pl. 2 (1, 1b);  
Baker 1980: 56.

MATERIAL EXAMINED:

NIWA Stns S30(1), Z8968(2), Z9268(1).  
NMNZ: Off White Island, 521 m (1) (Ech. 1192).

DESCRIPTION: NIWA Stn S30, disc diameter 54 mm, arms tightly coiled, branch at least 7 times.

Disc highest at margin, lowest near centre; excavate interradially. Radial shields prominent, raised, flat-topped, irregularly divided into smaller closely united plates. Shields extending to near disc centre, all are slightly separated from their neighbours.

Shields widest at about midlength, pointed proximally, with somewhat irregular margins, distally with a slight taper, then widening abruptly at distal end. Shields with small tubercles on proximal half or more, distally smooth or very finely granulose and covered by skin. Remainder of disc skin-covered, although between 2 radial shields at about half disc radius from centre is a large flat plate of irregular outline. Marginal ring thin, conspicuous, at most 1 or 2 small tubercles present in each interradius. Ventral inter-radii skin-covered, sometimes with a few small plates immersed in the skin. Genital slits conspicuous, interradial margin with small tubercles. Oral area skin-covered, small grains present beneath skin, and a few small tubercles along outer margin. Small grains also present at tip of jaws and continuing down between teeth. Oral papillae few, small, teeth spiniform.

Arms rounded dorsally, first branch within disc; arms initially paved with small flat plates; girdle bands continuous from about 2nd fork, and inter-girdle areas then with small, domed plates and also flat plates. Girdle bands slightly sinuous, raised, hook-

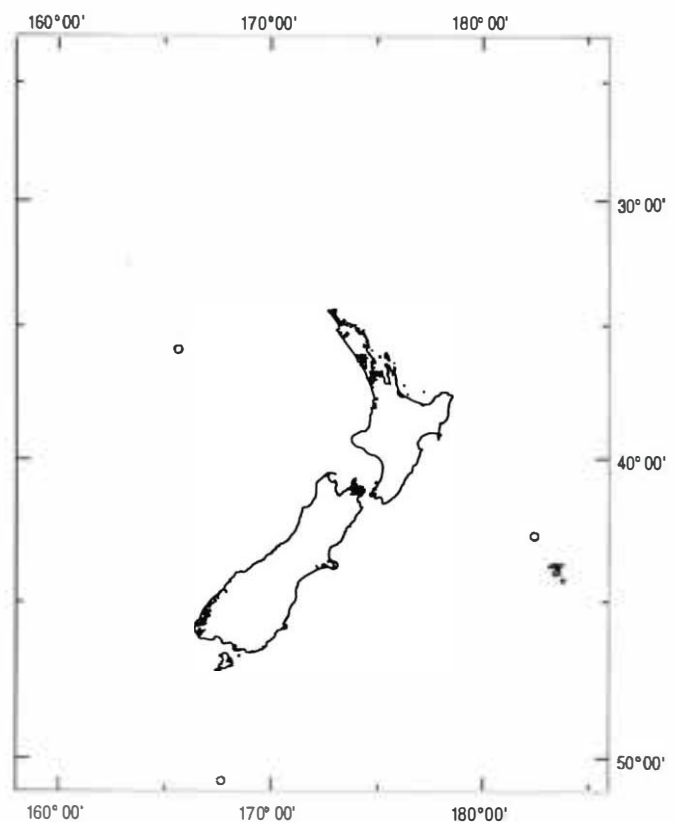


Fig. 23. New Zealand records of *Gorgonocephalus sundanus*.

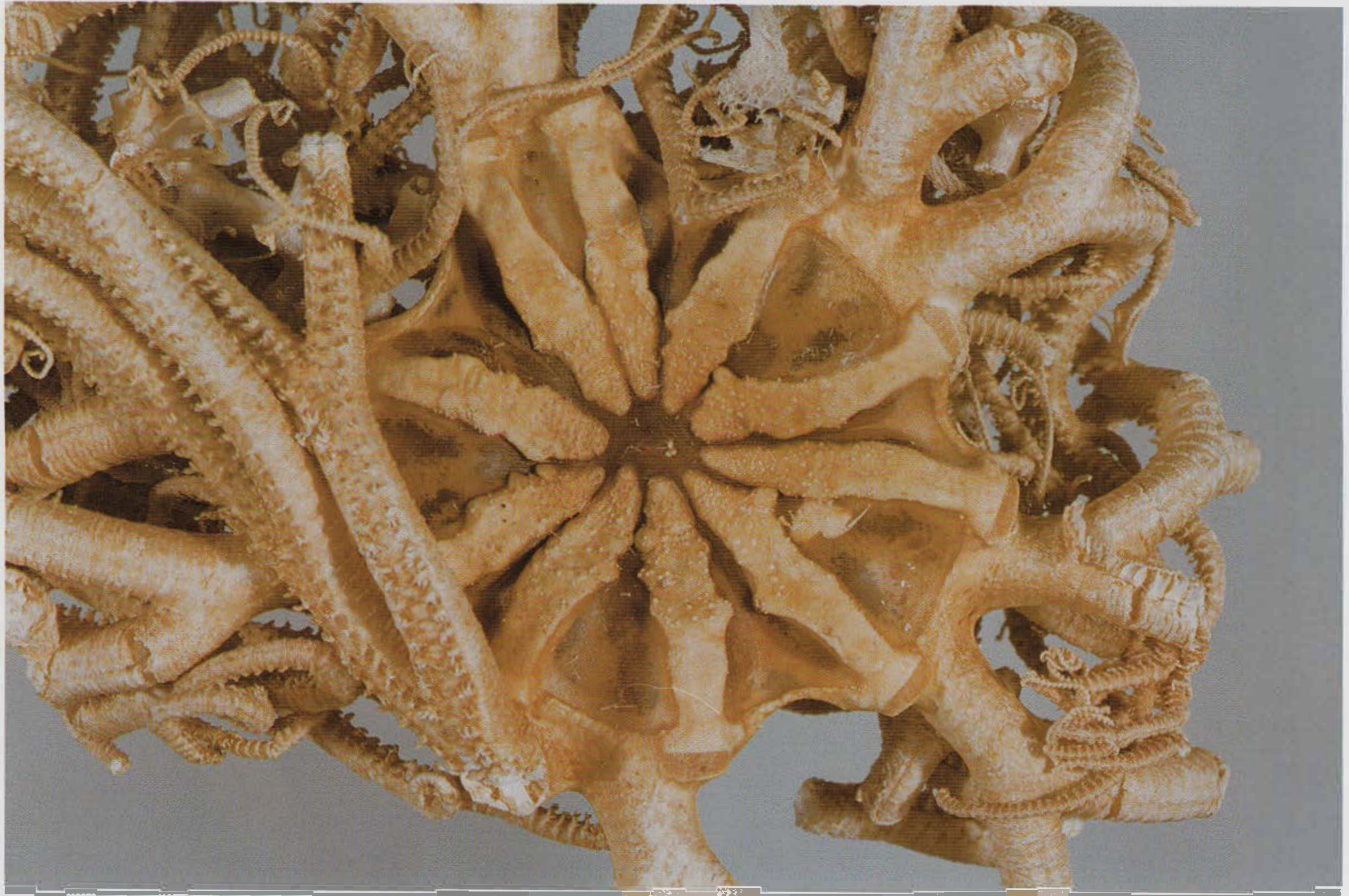


Plate 22. *Gorgonocephalus sundanius* Döderlein. NIWA Stn S30, disc diameter 54 mm, dorsal and ventral views.

lets with a conspicuous secondary tooth. Ventral surface of arms flat, skin-covered with occasional small granules or grains. First arm-segment lacks spines, segments then with 1 or 2 (rarely 3) spines; 2 or 3 spines over most of arm. Spines small, with prickly tips, distally becoming flattened hooks with a terminal tooth and 1 or 2 secondary teeth, all curved.

**COLOUR** (dried specimen): Radial shields light brown, rest of disc darker; arms light brown; underside lighter.

**DISTRIBUTION:** In New Zealand known only from off White Island, Bay of Plenty and off Auckland Islands to the south of New Zealand, 265–521 m. Also recorded from Indonesia, 834 m.

### *Astrocladus* Verrill, 1899

Five arms, branching near disc, arm-spines absent before first arm-fork, beginning near edge of disc, after first or second arm-fork; warts or tubercles usually present on disc; radial shields elongate; single madreporite placed at inner border of soft interbrachium.

**TYPE SPECIES:** *Asterias euryale* Retzius, 1783

### *Astrocladus tonganus* Döderlein, 1911 (Fig. 24, Pl. 23)

*Astrocladus tonganus* Döderlein, 1911: 77, 107, pl. 9(8); 1927: pl. 5 (10); Baker 1980: 64; Cherbonnier & Guille 1978: 14, pl. 11 (3, 4); McKnight 1984: 137.

**MATERIAL EXAMINED:**  
NIWA Stn T220(1).

**DESCRIPTION:** NIWA Stn T220, disc diameter 43 mm, arms branch at least 12 times, tightly coiled in distal half.

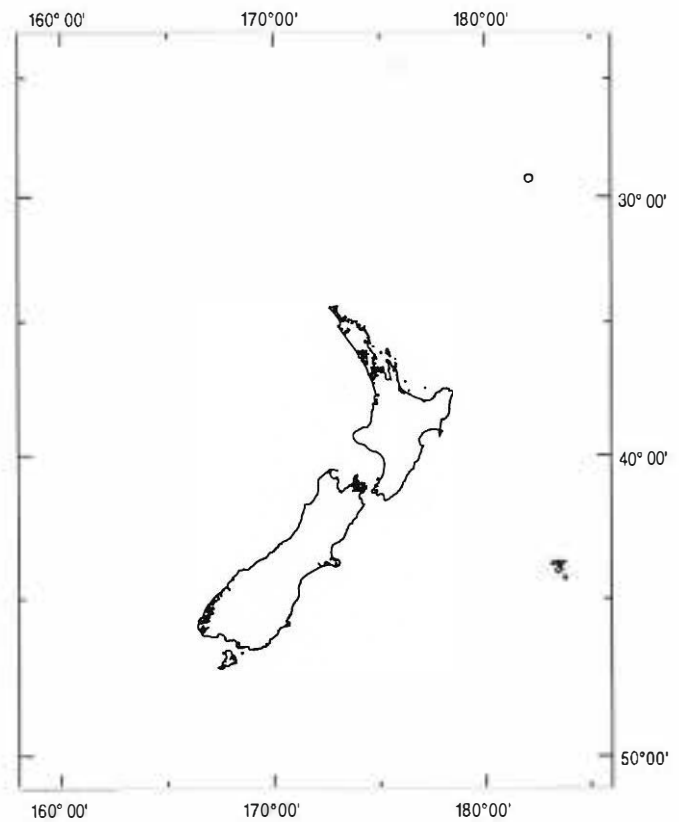
Disc slightly inflated, strongly so on radial shields; interradial strongly indented; margin rounded at dorsal edge, then sloping to flat ventral surface. Disc covered with thin skin, fine grains or granules, and small, conical tubercles terminating in 1–3 sharp points. Radial shields conspicuous, narrow, gradually tapering to a proximal point, arched, extending from margin almost to sunken disc centre; outer end of shields with a small concave plate. Ventral interradial areas similarly armed, though tubercles are sparser, except along margins of genital slits, where they are relatively numerous. Genital slits small, narrow,

inconspicuous. One large madreporite at edge of oral frame. Oral area with a dense pavement of small, low, often flat-topped granules. Oral papillae short, pointed, teeth similar but larger.

First arm-fork at disc margin, subsequent forks with 4–10 segments. Proximally, rounded dorsal surface of arms with granules and tubercles like those of disc; distally tubercles disappear, while small segments near tip often have only girdle hooklets. Girdle bands continuous across arm from about 6th to 7th branch, hooklets have a strong secondary tooth. Ventral surface of arms flat, paved like oral area; arm-spines present from about 3rd arm fork, 1 or 2 on first segments, rising to 4; spines short, stubby, and slightly flattened, terminating in 2–4 short points. Distal spines are hooks with 2 large teeth.

**COLOUR** (ex ethanol): Dull light brown above, paler below. Distal parts of arms whitish.

**DISTRIBUTION:** Recorded from the northern Tasman Sea (Capel Guyot) and Kermadec Islands; other records are from Tonga and New Caledonia, 2–66 m.



**Fig. 24.** New Zealand records of *Astrocladus tonganus*.

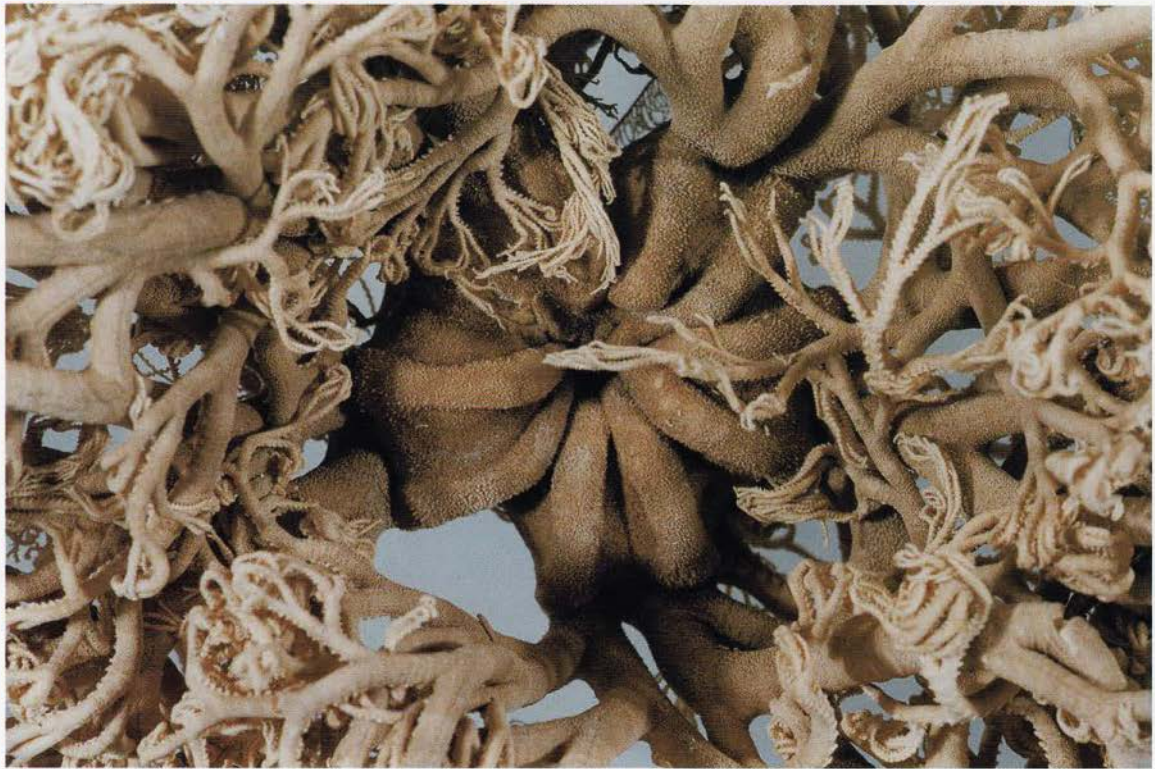


Plate 23. *Austrocladus tonganus* Döderlein. NIWA Stn T220, disc diameter 43 mm, dorsal and ventral views.



*Astrodendrum* Döderlein 1911

Five arms, branching near disc; arm-spines present before first arm-fork; radial shields elongate; disc with small granules, these sometimes enlarged; disc margin without calcareous plates; single madreporite; girdle hooklets with one secondary tooth, occurring in patches.

TYPE SPECIES: *Gorgonocephalus sagaminus* Döderlein 1902

*Astrodendrum elingamita* Baker 1974

(Fig. 25, Pl. 24)

*Astrodendrum elingamita* Baker, 1974: 248; 1980: 56.

*Astrodendrum pustulatum*: Döderlein 1927: 32, pl. 1 (5, 5a), not *Gorgonocephalus pustulatum* (H.L. Clark).

MATERIAL EXAMINED:

NIWA Stn 190(1).

NMNZ: Off Three Kings Islands (1) (Ech.1191, Holotype)

DESCRIPTION: (taken from Baker 1974, 1980)

Disc diameter up to 25 mm, strongly excavate in interradii, and lacking plates at the periphery. Radial shields distinct, slightly raised, narrowed proximally, where they almost meet, widest distally. Disc covered dorsally and ventrally with closely packed granules. These generally domed and in two sizes, the smaller closely spaced, the larger more widely spaced. On ventral surface of disc, tubercles smaller and more spaced. Madreporite single, small, placed at edge of oral frame. Oral papillae spiniform, pointed, teeth similar. Oral area paved with flattened granules, except for oral plates which are bare. Genital clefts extend from about 4th to 8th arm segments.

Arms branch at least 10 times, first branch at or near disc margin. Arms completely covered with small rounded or polygonal granules, closely packed. First tentacle-pore lacks arm-spines, other proximal arm-segments with 2 or 3 spines, distal pores with 2 then 1. Arm-spines short, usually with 1 or 2 (sometimes 3) terminal glassy points. Distal arm-spines flattened with a small terminal hook, and smaller teeth below. Girdle bands more or less prominent from arm-base, more prominent distally. Girdle hooklets occur in patches with the individual hooklets in 2 alternating series. Hooklets with a large, strongly curved terminal tooth and 1 shorter secondary tooth, directed downwards.

COLOUR (in alcohol): Disc pink with the arms lighter.

DISTRIBUTION: Known from the Philippines, Norfolk

Island, and the Three Kings Islands, 71–365 m.

REMARKS: The small specimen from Norfolk Island apparently differs from the larger specimens in having shorter, less prominent radial shields, less conspicuous proximal girdle bands, and transformed arm-spines from near the first fork.

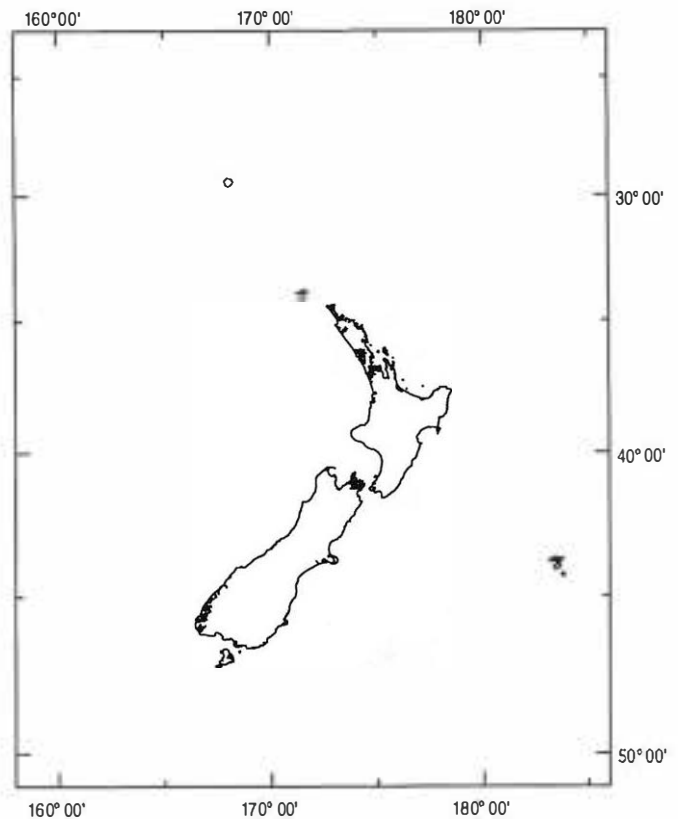


Fig. 25. New Zealand record of *Astrodendrum elingamita*.

*Asteroporpa* Oersted & Lutken, 1856

Five simple arms; disc covered by granulation, but without coarse projecting tubercles or spikes; arms annulated by alternating belts of granules and hooklets; belts continuing onto radial shields at least, sometimes across entire disc; girdle hooklets with one secondary tooth.

TYPE SPECIES: *Asteroporpa annulata* Lutken, 1856

Subgenus *Asteroporpa*

Concentric ridges and furrows on arms and disc; girdle bands raised.



Plate 24. *Astrodendrum elingamita* Baker. Holotype, NMNZ Ech. 1191, disc diameter up to 25 mm, dorsal and ventral views.

*Asteroporpa australiensis* H.L. Clark

(Fig. 26, Pl. 25)

*Asteroporpa australiensis* H.L. Clark, 1909: 547; 1916: 80; Baker 1980: 35.

*Asteroporpa wilsoni* Bell 1917: 7; Mortensen 1924: 106, pl. 6 (8, 9); A.M. Clark 1966: 697; McKnight 1968: 519; 1975: 61.

*Asteroporpa australiense*: Koehler 1930: 13, Pl. 1 (11-13), 2 (1), in part; H.L. Clark 1946: 178.

MATERIAL EXAMINED:

NIWA Stns: C527(2), C758(3), E312(1), E323(?), E336(1), E845(1), E865(6), P7(1) (all specimens det. Dr A.N. Baker), Z9041(2), Z9042(1), Z9043(1), Z9044(1).

NMNZ: Off North Cape, 256 m (7); 146 m (1); off Cape Brett, 32 m (2).

DESCRIPTION: NIWA Stn E845, disc diameter 18 mm, arms coiled, about 78 m, long.

Disc and arm bases merge, so that outline is that of 5 widened wedge-shaped arm-bases. Disc more or less flat above and below; centre with small, slightly raised plates, slightly separated from each other. Plates with small tubercles, usually higher than wide, sometimes with a small, glassy thorn at tip; area between plates with small flat platelets or granules; raised plates forming a star-shaped figure, outside of which are concentric ridges. Ridges composed of small tuberculate plates enclosing a group of girdle hooklets; between ridges are narrower, sunken bands of smaller plates and granules. Ridges continue along arms, area of radial shields slightly raised, covered with plates and tubercles; girdle bands continue across shields. Underside of disc covered with small, irregularly shaped plates, covered with small tubercles, lower than on dorsal surface. Genital clefts small, extending for about 2 arm-segments. Over oral area tubercles are a little higher, often higher than wide; surface of jaws with lower, flatter tubercles. Oral papillae spiniform, continuing along sides of jaw, more numerous near tip; teeth spiniform, like the oral papillae.

Arms rounded dorsally, annulated by girdle bands; underside paved with small, flat plates and tubercles; lateral arm-plates project slightly on ventral surface; 4-7 short, flat arm-spines, innermost spine most flattened; spines have 3-5 terminal points. Girdle hooklets with 1 long secondary tooth.

COLOUR (dried specimen): Disc and arms generally creamy-white, depressed areas between girdle bands dark.

DISTRIBUTION: New Zealand, Kermadec Islands south to about the Bay of Plenty, Tasman Sea (Wanganella Bank), southeastern Australia, 55-508 m.

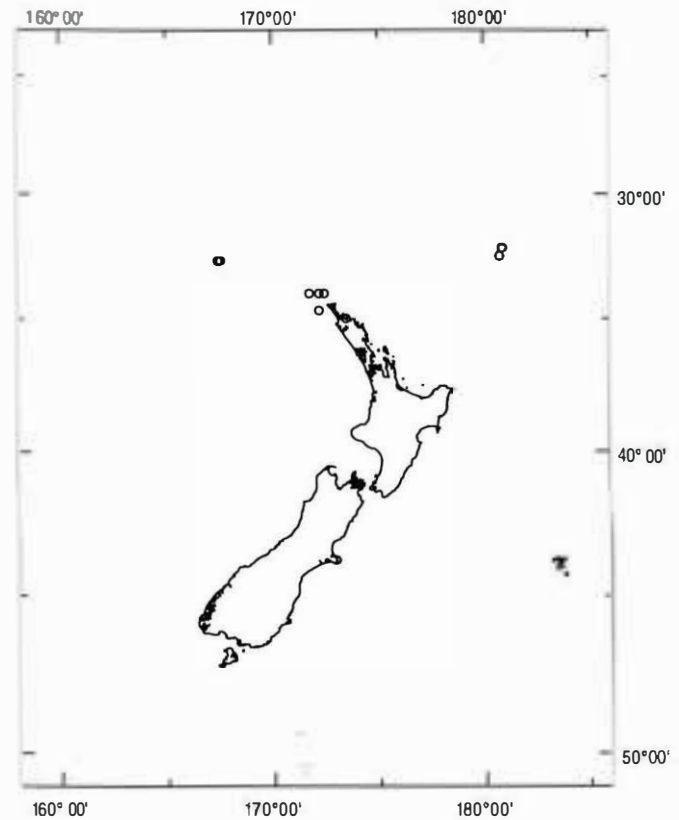


Fig. 26. New Zealand records of *Asteroporpa australiensis*.

Subgenus *Astromoana* Baker, 1980

No concentric ridges and furrows on arms and disc; girdle bands depressed.

TYPE SPECIES: *Asteroporpa (Astromoana) reticulata* Baker, 1980

*Asteroporpa (Astromoana) reticulata* Baker, 1980 (Fig. 27, Pl. 26)

*Asteroporpa (Astromoana) reticulata* Baker, 1980: 38.

MATERIAL EXAMINED:

NIWA Stns: I85(3), I90(3), P26(1), P39(2). All type material, det. Dr A.N. Baker.

DESCRIPTION: NIWA Stn I85, holotype specimen, disc diameter 9 mm, arms coiled.

Disc with small interradial indentations, radial shields raised and elongate, and narrow interradial depressions; arms-bases slightly widened. Disc with a fine, regular network of small, finely rugose plates and tubercles; larger tubercles rounded or pentagonal



Plate 25. *Asteroporpa australiensis* H.L. Clark. NIWA Stn E485, disc diameter 18 mm, dorsal and ventral views.

surface rounded or flat; smaller granules situated around the larger, often at angles, these joined by even smaller tubercles. Girdle bands commence near distal end of inflated radial shield area; bands consisting of separated, flat, slightly depressed plates with a group of hooklets, separated by rows of small granules, giving arms a striated appearance; bands wider than intervening areas. Hooklets with 1 or 2 secondary teeth. Sunken interradial areas with a close-set pavement of polygonal or rounded tumid plates. Oral area covered with low rounded tubercles, separated by narrow skin-covered areas. Oral papillae short, spiniform. Teeth spiniform. Genital slits very small, nearly semicircular, length about equal to 1 arm segment.

Arms just higher than wide at base, ventral surface flat, covered with skin and spaced small granules or pustules. 3 arm-spines on second and third segments, then 4, rarely 5; arm-spines short, cylindrical, with 1 or 2 terminal points; outermost 2 arm-spines with associated hooklets. Distal arm-spines modified as hooklets.

COLOUR: Disc and arms pink and white, interradial areas brown.

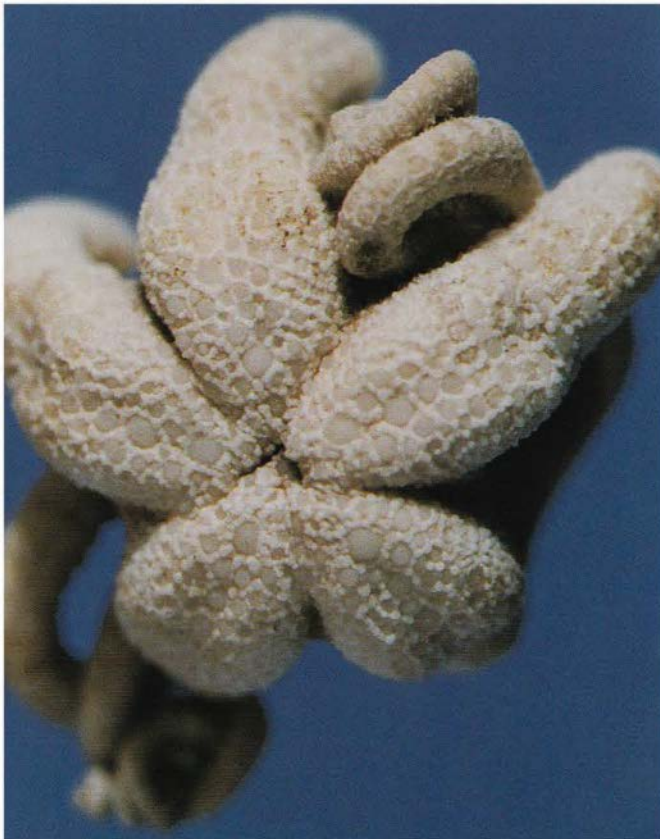


Plate 26. *Asteroporpa reticulata* Baker. NIWA Stn I85, disc diameter 9 mm, dorsal view.

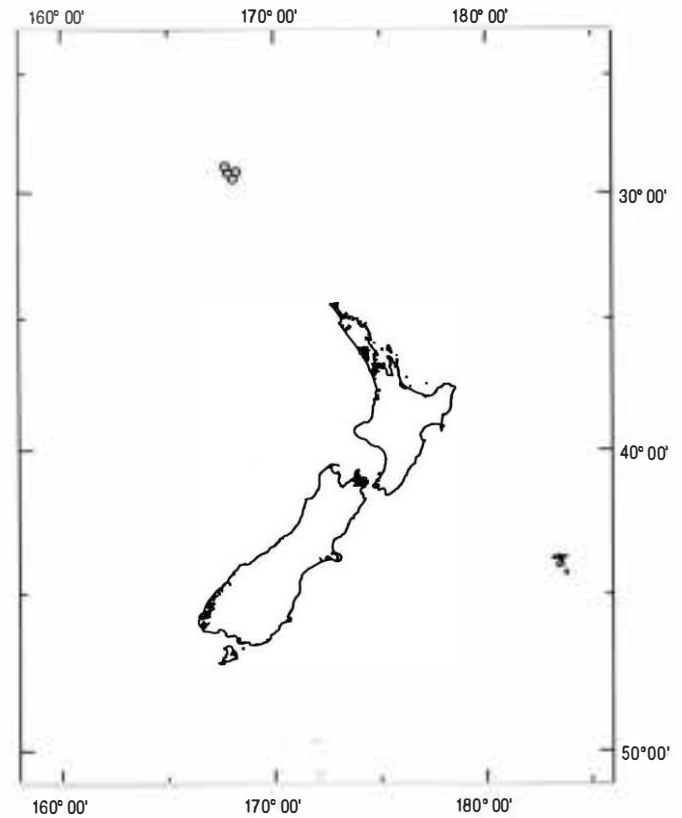


Fig. 27. New Zealand records of *Asteroporpa reticulata*.

DISTRIBUTION: Near Norfolk island, Tasman Sea, 71–301 m.

#### *Astroboa* Döderlein, 1911

Five arms, branching near disc; radial shields elongate; arm-spines absent before at least fourth fork; radial shields without tubercles or spines. Girdle hooklets with one secondary tooth.

TYPE SPECIES: *Astrophyton clavatum* Lyman, 1861

#### *Astroboa granulatus* (H.L. Clark) (Fig. 28, Pl. 27)

*Astrocladus granulatus* H.L. Clark, 1938: 206, pl. 23 (3); H.L. Clark 1946: 181; not Cherbonnier & Guille 1978: 12, pl. 11 (5, 6).

*Astroboa granulatus*: Baker 1980: 62

#### MATERIAL EXAMINED:

NIWA Stns: I732(1), I733(1), P98(1)\*, P103(1)\*; P108(1)\*, Q51(1) (\*det. Dr A.N. Baker).

NMNZ: Norfolk Island (1).

DESCRIPTION: NIWA Stn P98, disc diameter 60 mm (det. Dr A.N. Baker); arms branch repeatedly, at least 20 times.

Disc inflated, interradially strongly excavate, ventral surface flat; margin near vertical in interradii. Disc with a dense covering of very fine granules or grains, and also scattered larger granules, densest on radial shields. Radial shields elongate and narrow, extending from margin to near depressed disc centre where they more or less meet; shields raised and conspicuous. Outer end of shields with a large, ovoid plate, giving a concave distal margin to shield. Interradial areas on ventral surface with fine grains and a few scattered larger granules. One madreporite present, at edge of solid oral frame. Teeth and oral papillae small, spiniform. Genital slits concealed by coiled arms.

Arms branching at least 20 times, first fork at disc margin; dorsal surface of arms rounded, covered with grains and granules like the disc; ventral surface flat, closely paved with small flattened granules. Girdle bands present as isolated patches from about 4th arm-fork, continuous after about 14th; quite conspicuous distally; hooklets have a downward sloping secondary tooth; terminal tooth is strongly curved. Arm-spines present after 5th or 6th fork, at first rudimentary; spines generally 1, then 2 or 3; 4 spines from about 10th fork. Spines are short and stubby, with 2 or 3

blunt points; distally spines become flattened with 2 teeth.

COLOUR (dried specimen): Dull dark brown.

DISTRIBUTION: Tasman Sea, (Lord Howe and Norfolk Islands), western and northeastern Australia, 6–60 m.

*Astroboa* sp. juv. (Fig. 29, Pl. 28)

MATERIAL EXAMINED:

NIWA Stn I90 (det. Dr A.N. Baker).

DESCRIPTION: Disc diameter 6.5 mm, arms coiled, branch at least 6 times.

Disc indented in interradii, covered with small closely packed granules. Granules varying slightly in size, the larger rugose, domed, flat-topped. Radial shields swollen, each pair varying in size, length up to about one-third disc diameter; larger shields meeting on midline, smaller 2 pairs short and separate.

Ventral surface of disc completely covered with small densely packed low granules; each side of jaw with 5 or 6 spiniform oral papillae, increasing in size towards tip. Of the 4 visible interradii, 2 have a single very short, almost pore-like genital slit, other 2 with 2 more elongate slits. Madreporite not apparent.



Plate 27. *Astroboa granulatus* H.L. Clark. NIWA Stn P98, disc diameter 60 mm, dorsal view.

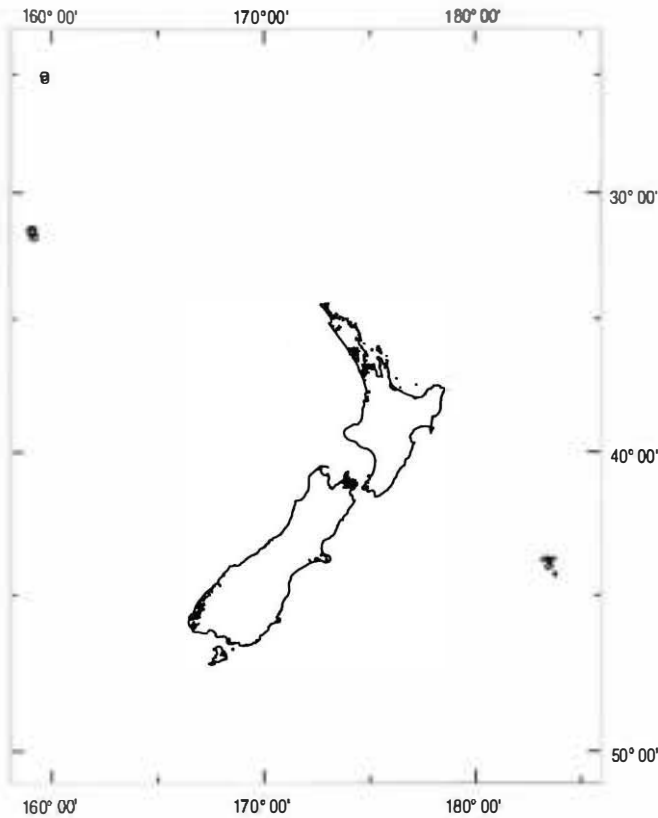


Fig. 28. New Zealand records of *Astroboa granulatus*.

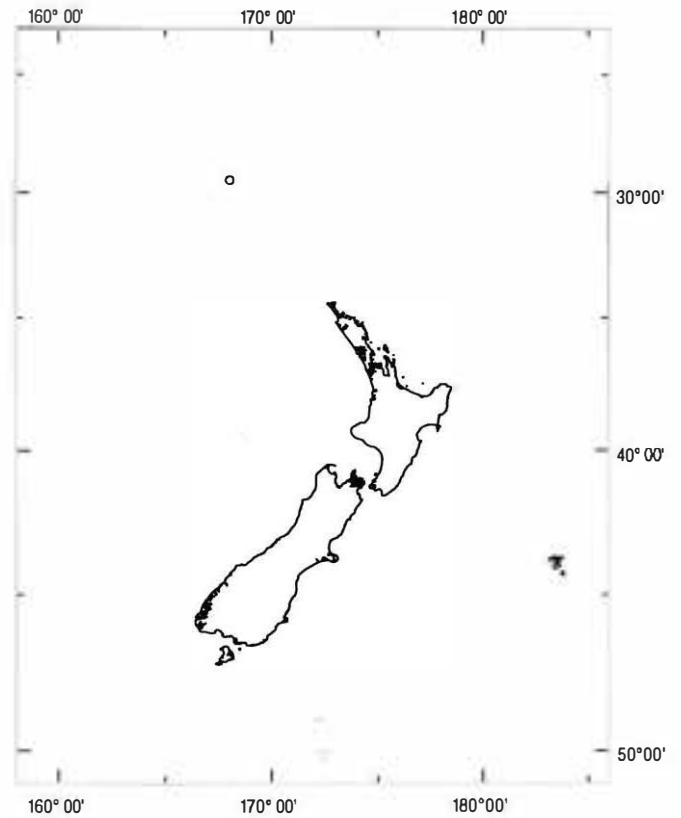


Fig. 29. New Zealand records of *Astroboa* sp.

2 interradial with a single larger, smooth, glassy tubercle placed to one side of midline; a further similar tubercle present just beyond 1 arm-base.

Dorsal and ventral surfaces of arms with dense cover of granules, first arm-branch at segments 4 or 5, a little beyond distal end of radial shields. Girdle bands absent basally, apparent from second or third arm-branch, initially incomplete. Girdle hooklets with 1 secondary tooth as well as the terminal.

On ventral surface the granules are smaller and lower than dorsally. Arm-spines may be present from second tentacle pore, if so, are very small. From about segment 4 or 5, spines distinct, small, hooked, with a single secondary tooth. On some segments on second arm-branch 1 or 2 granules just proximal to the pore may be slightly enlarged.

COLOUR (dried): Uniform very light brown.

REMARKS: This specimen from Norfolk Island is too small to clearly identify it with any of the known species of *Astroboa* recorded from the Southwest Pacific Ocean.

#### *Astrothorax* Döderlein, 1911

Arms simple, disc covered above by granulation; 5-10 arm-spines; girdle hooklets with 1 secondary tooth.

TYPE SPECIES: *Astrothorax misakiensis* Döderlein, 1911

#### *Astrothorax waitei* (Benham) (Fig. 30, Pl. 29)

*Astrotoma waitei* Benham, 1909: 10; Mortensen 1924: 104, pl. 4 (2); Fell 1952: 13.

*Astrothammus rugosus* H.L. Clark, 1916: 85, pl. 35 (1, 2); 1946: 177.

*Astrocrius waitei*: Döderlein 1927: 21.

*Astrothammus furtivus* Koehler, 1930: 6, pl. 1 (1, 2); Mortensen 1933: 22, pl. 5 (33); H.L. Clark 1946: 177.

*Astrothorax waitei*: Döderlein 1930: 380, pl. 2 (2, 2a); Fell 1958: 21; 1962: 54; Baker 1980: 30.

*Astrothorax furtivus*: McKnight 1975: 61.

#### MATERIAL EXAMINED:

NIWA Stns: A910(1), C60(1), C617(13), C957(1), D876 (8), D899(9), E845(3\*), E863(1\*), G169(1), I92(1\*), I94(1), J58 (1), J59(1), P46(1), Q24(1), Q31(1), Q38(4), S6(1), S13(1?), T235(1), U600(1), X152(1), X488(1), W426(1), W427(?), W430

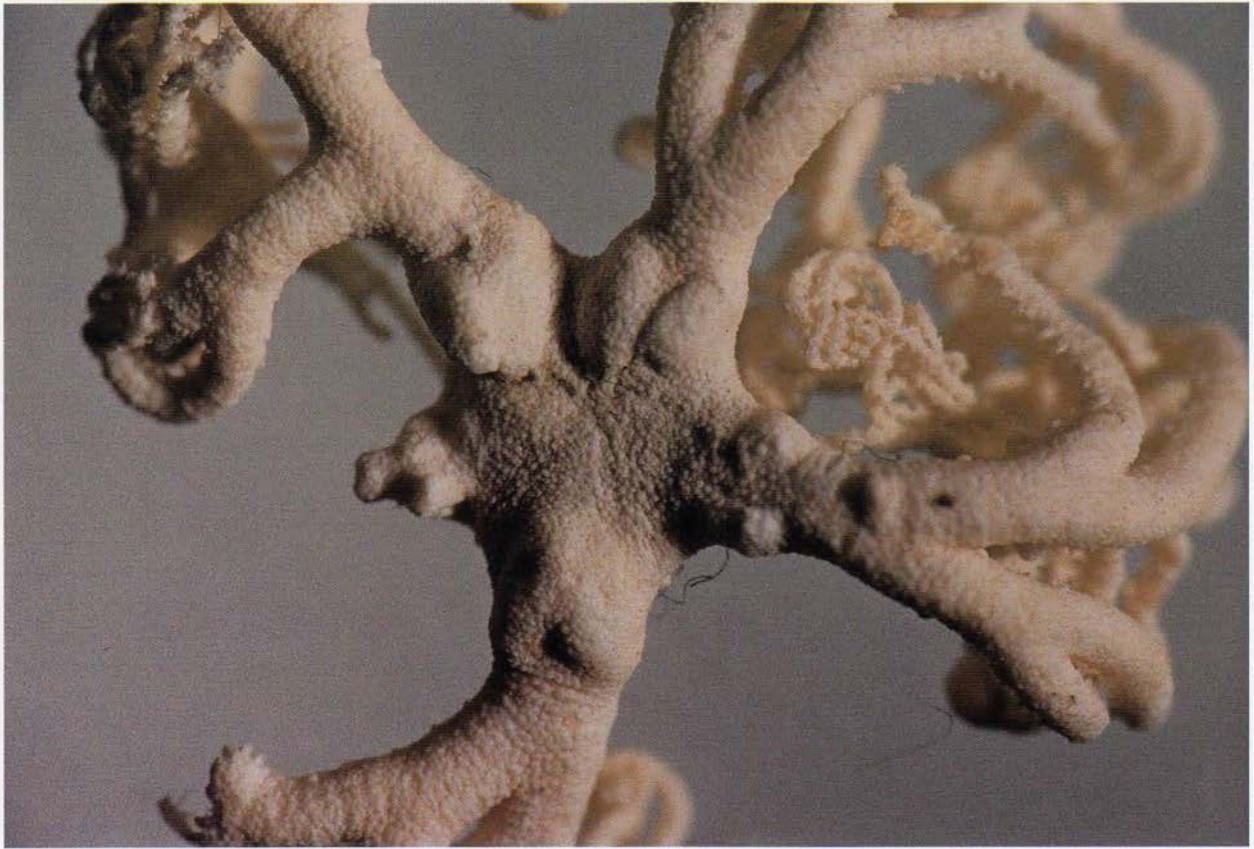


Plate 28. *Astroboa* sp. juv. NIWA Stn I90, disc diameter 6.5 mm, dorsal and ventral views.



(2), Y18(4), Z2371(1\*), Z2374(1), Z2375(5), Z8-422(1), Z8797(2), Z8882(1), Z9026(2), Z9279(1), TAN 9801/012(12); KAH 9701/026 (3) (\*det. Dr A.N. Baker).

NMNZ: Off Castlepoint, 73–109 m (19); Cook Strait, 73–548 m (56); 44°23'S, 176°49'W, 345 m (6); off Cape Foulwind, 240–221 m (1); off Mt Cook, 329 m (3).

DESCRIPTION: NIWA Stn E845, disc diameter 16 mm, arms coiled, about 60 mm long (specimen det. Dr A.N. Baker).

Disc more or less tumid above, flat below, slightly excavate interradially, margins near vertical in inter-radii. Disc completely covered above with numerous tubercles, usually wider than high, rounded or flat-topped, smooth or with fine glassy prickles; about 2 or 3 tubercles in 1 mm. Tubercles abut, or separated by smaller granules or grains. Area of radial shields slightly inflated, not otherwise differentiated. Margin of disc paved with low, smooth granules, genital clefts entire, conspicuous in this specimen. Underside of disc and arms covered with similar low granules, presenting a relatively smooth surface. Granulation conceals plates of oral area; oral papillae spiniform, along side of jaw to tip, those at tip largest.

Arms rounded dorsally; girdle bands commence at disc margin; bands bordered by tubercles like those of disc; hooklets with a secondary tooth; bands continue down side of arms and terminate at a larger, smooth plate between each set of arm-spines; marginal rows of tubercles separated by a narrow sunken zone of smooth, small plates or flattened tubercles. Arm-spines commence at 2nd arm segment, with 3 or 4 spines, 5–10 spines over most of arm. Arm-spines short, with 2–4 glassy points. Distal arm-spines with a strong terminal tooth, and a smaller secondary tooth. Underside of arm relatively smooth, like the oral area.

COLOUR (dried specimen): Uniform creamy-white.

DISTRIBUTION: Recorded from New Zealand, Tasman Sea (Norfolk Island), southeastern Australia and South Africa, 73–998 m.

*Astrothrombus* H.L. Clark, 1909

Arms simple; disc coarsely granulated; a zone of enlarged tubercles at edge of oral frame interradially; a cluster of spines on oral plates; up to 5 arm-spines; girdle bands not constructed of separated plates; hooklets with 3–6 secondary teeth.

TYPE SPECIES: *Astrothrombus rugosus* H.L. Clark, 1909

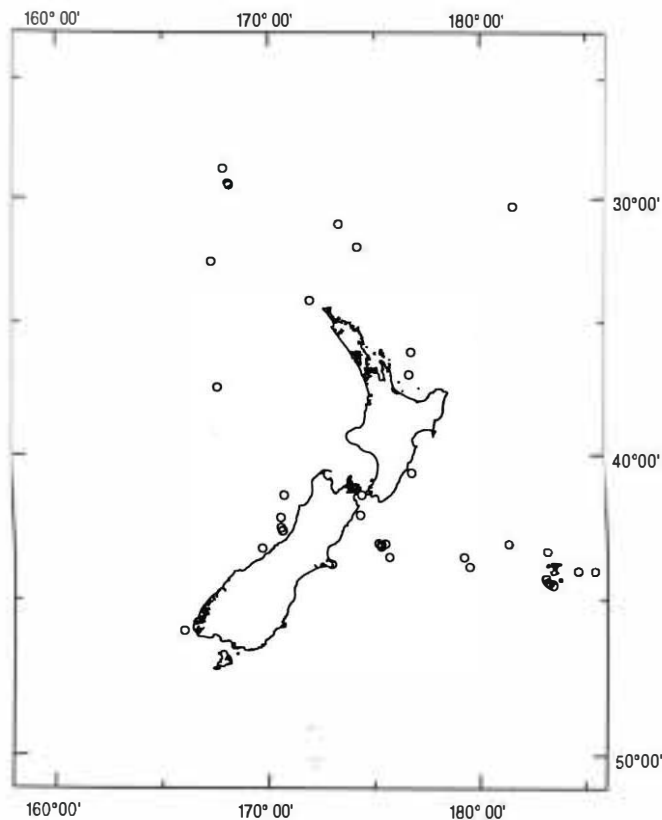


Fig. 30. New Zealand records of *Astrothrombus waitei*.

*Astrothrombus rugosus* H.L. Clark, 1909

(Fig. 31, Pl. 30)

*Astrothrombus rugosus* H.L. Clark, 1909: 548, pl. 54 (3); Mortensen 1933: 17; Pawson 1969: 54; Baker & Clark 1970: 7; Baker 1980: 32.

*Astrotoma benhami* Bell, 1917: 8; Mortensen 1924: 104, pl. 4 (6, 7); 1933: 14.

MATERIAL EXAMINED:

NIWA Stns: B489(3), E75(1) (det. Dr A.N. Baker), TAN 9801/021(1).

NMNZ: 36°24'S, 176°14'E, 550–560 m (8); Cook Strait, 320 m (4); Cook Strait, 448–512 m (1); off Kaikoura, 306 m (1).

DESCRIPTION: NIWA Stn B489 (det. Dr A.N. Baker).

Disc diameter 6 mm, arms coiled, about 30 mm long. Specimen coiled on a scleractinian coral.

Disc flat below, slightly tumid above, slightly excavate interradially. Disc mainly covered with irregularly placed rounded tubercles, often higher than wide; tubercles separated by small polygonal plates. Radial shields visible as small bare plates near arm-base, slightly lower than adjacent plates and tubercles.



Plate 29. *Astrothorax waitei* (Benham). NIWA Stn E845, disc diameter 16 mm, dorsal and ventral views.



Plate 30. *Astrothrombus rugosus* H.L. Clark. NIWA Stn B489, disc diameter 6 mm, dorsal and ventral views.

Ventral interradial areas with a sparse cover of small low, spaced tubercles, smaller than on dorsal surface. Genital slits scarcely evident. Oral area concealed.

Arms rounded dorsally, flat ventrally. Girdle bands begin near disc segments 1 and 2, continuous across arm from segments 3 and 4. Bands consist of a slight ridge with a double row of hooklets; hooklets have up to 6 secondary teeth. Intergirdle area with 2 rows of contiguous tubercles, largest on dorsal mid-line. Ventral surface of arm with spaced small, low tubercles. 2 to 3 arm-spines over most of arm, rarely 4, none on first segment. Spines short, cylindrical, slightly tapering and blunt. Innermost spine longest, as long or longer than arm segment.

COLOUR (dried specimen): Uniform dull cream.

DISTRIBUTION: New Zealand, southeastern Australia, 37-885 m.

REMARKS: This specimen is juvenile, and lacks the larger tubercles on the interradial edge of the oral frame.

*Astrothrombus vecors* (Koehler, 1904)  
(Fig. 32, Pl. 31)

*Astrotoma vecors* Koehler, 1904: 155, pls 21 (9), 27 (9, 10), 32(2).

*Astrothamnus vecors*: Matsumoto 1915: 59.

*Astrostephanus vecors*: Döderlein 1093: 376, pl. 1 (8).

*Astrothrombus vecors*: Baker 1980: 34.

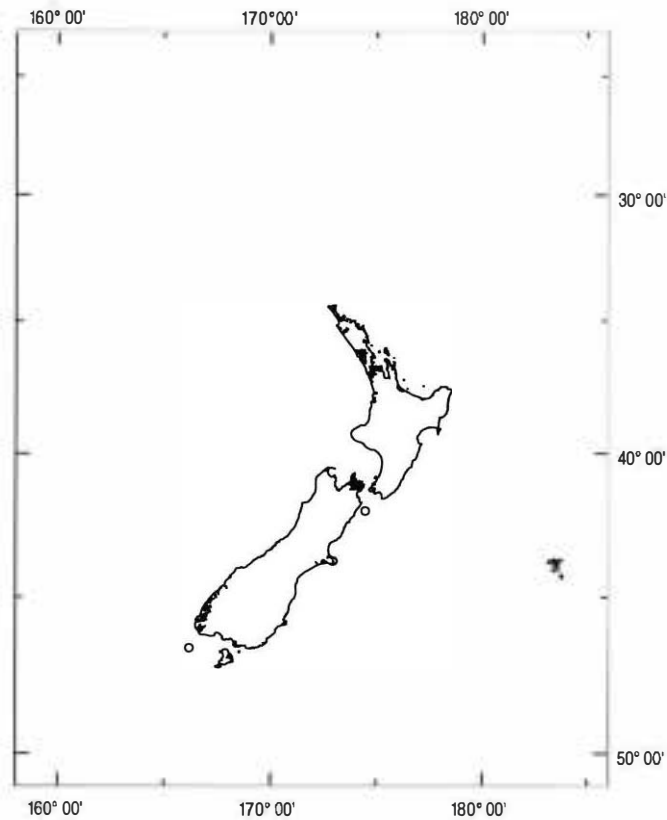


Fig. 31. New Zealand records of *Astrothrombus rugosus*.

**MATERIAL EXAMINED:**

NIWA Stns: E841 (numerous), J676(2), J683(5), P46(17)  
(det. Dr A.N. Baker).

**DESCRIPTION:** NIWA Stn J683 (det. Dr A.N. Baker).  
Disc diameter 15 mm, arms coiled, about 100 mm long.

Disc slightly inflated above, along radial shields, slightly sunken at centre; flat below; interradial areas slightly indented. Dorsal surface of disc with numerous, spaced tubercles, separated by small, flat polygonal plates. Tubercles mostly higher than wide; many smooth centrally, and bluntly pointed; tubercles taller towards margin, with tip truncate, and covered with small prickles. Largest tubercles at distal ends of radial shields. Ventral interradial areas covered with small flat plates and scattered tubercles, much more delicate than dorsally. Genital clefts slit-like, conspicuous, as long as 3 arm-segments. Oral area with low tubercles, and abruptly larger tubercles on area of concealed oral plates and oral shields. Oral papillae and teeth spiniform.

Arms rounded dorsally, flat below; girdle bands begin near arm-base, 1st or 2nd free segment, continuous from about 3rd; bands of raised ridges with a double, alternating, row of hooklets; hooklets with up

to 4 secondary teeth. Intergirdle areas slightly sunken with plates and small tubercles irregularly arranged, although a single row of tubercles usually borders girdle band. Arm-spines 4, occasionally 5, 3 on 2nd segment, absent from first. Spines with roughened tip, cylindrical, with a narrow base; innermost spine longest, about length of arm-segment.

**COLOUR:** Dull, uniform light brown.

**DISTRIBUTION:** Northeastern New Zealand, Tasman Sea (near Norfolk Island), Indonesia, 204–751 m.

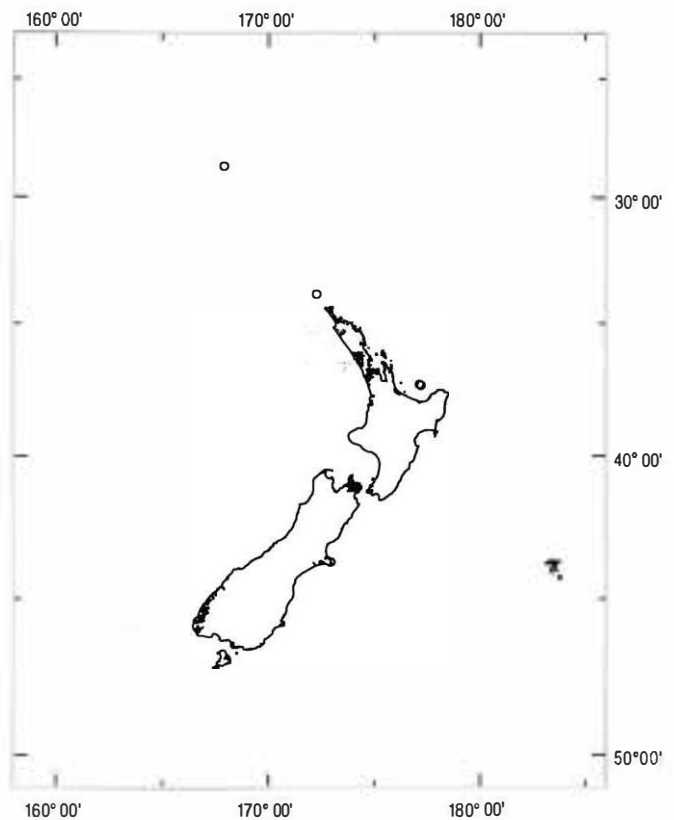


Fig. 32. New Zealand records of *Astrothrombus vecors*.

*Astrotoma* Lyman, 1875

Both surfaces of disc and arms covered by granulation; but lacking larger tubercles or spikes; girdle hooklets lack secondary teeth; madreporite within oral frame; arms five, unbranching.

**TYPE SPECIES:** *Astrotoma agassizii* Lyman, 1875

**REMARKS:** This genus contains four species: the type, *A. agassizii*, which is circumpolar Antarctic, 75–750 m (Fell 1961) and three from the Philippines



Plate 31. *Astrothrombus vecors* (Koehler). NIWA Stn B683, disc diameter 15 mm, dorsal and ventral views.

region, 720–1183 m – *A. deficiens* (Koehler), *A. manilense* Döderlein, and *A. drachi* Guille. This last species is now recorded from the New Zealand region.

*Astrotoma drachi* Guille, 1979 (Fig. 33, Pl. 32)

*Astrotoma drachi* Guille, 1979: 437, pl. 1(a-d); 1981: 417, pl. 1 (5–7).

MATERIAL EXAMINED:  
NIWA Stn I666(2).

DESCRIPTION: NIWA Stn I666, disc diameter 17 mm, arms coiled, at least 130 mm long; disc diameter 15 mm, arms broken at about 85 mm.

Disc slightly inflated above, radial shields raised, slightly sunken at centre; interradially slightly excavate; disc with a distinct, near-vertical margin; ventral surface more or less flat, jaws protruding slightly.

Arms simple, rounded dorsally, flat below, higher than wide at base. Disc covered with domed, finely rugose granules, small in interradial areas and between radial shields, abruptly larger along shields, and at dorsal disc margin; radial shields elongate, well separated at arm-base, those of each pair more or less meeting near disc centre, and the pairs only slightly separated. Centre of disc slightly depressed. Large tubercles mostly higher than wide, those at dorsal disc margin highest. Interradial margin near vertical, the area between genital clefts covered with fine granulation; just below larger tubercles on outer edge of radial shields is a narrow band of fine granulation, then a clump of larger granules, probably on upper end of genital scale. Genital clefts entire, narrow, margined by slightly enlarged tubercles. Ventral surface entirely covered by granules or plates. Ventral margin of disc with a border of distinct tubercles, mostly higher than wide, inner part of area completely paved by small, polygonal plates with occasional short granules. Oral plates with tall tubercles on ventral surface. Oral papillae and teeth spiniform, papillae extending along side of jaw. Girdle bands beginning at 1st or 2nd free arm-segment; about the 4th, bands broader than intergirdle areas, slightly raised and with small tubercles, tending to be largest dorsally. Tubercles more or less forming a single row along borders of band, also in longitudinal rows, each of 2–4, so that small groups of hooklets occur between them. Hooklets small, lacking secondary teeth? Intergirdle areas with 2 roughly regular transverse rows of small tubercles. First tentacle-pore without spines, but usually with 1–3 tubercles just proximal to it; second pore with 2 (sometimes 1) spines, rest

usually with 3; spines slightly shorter than arm-segment, scarcely tapering, thick, slightly flattened, and terminating in 3–6 irregular points. Tubercles continuous with those on the girdle bands form a series across the proximal base of the lateral arm-plate. Ventral surface of arms paved with small, flat, polygonal plates. Distal arm-spines with distal end transformed into a weakly curved hook, no secondary teeth.

Madreporite single, placed two-thirds distance to outer margin, visible in smaller specimen, in larger one interradius has a round plate in about this position.

COLOUR (ex ethanol): Dull uniform brownish (larger specimen) or cream (smaller specimen).

DISTRIBUTION: Known near eastern margin of Bounty Platform, southeast of New Zealand, 1165 m; the previous record is from the Philippines, 975–1125 m.

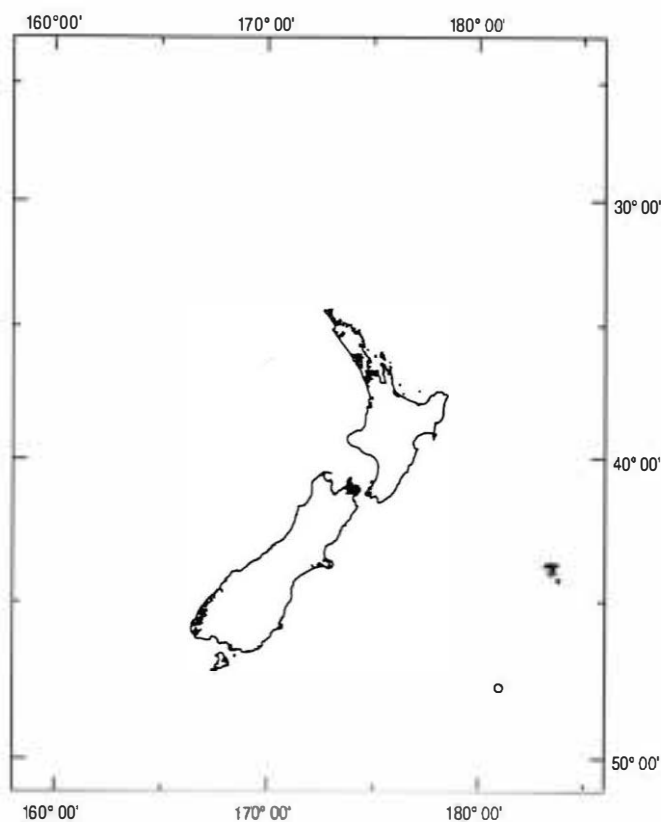


Fig. 33. New Zealand record of *Astrotoma drachi*.

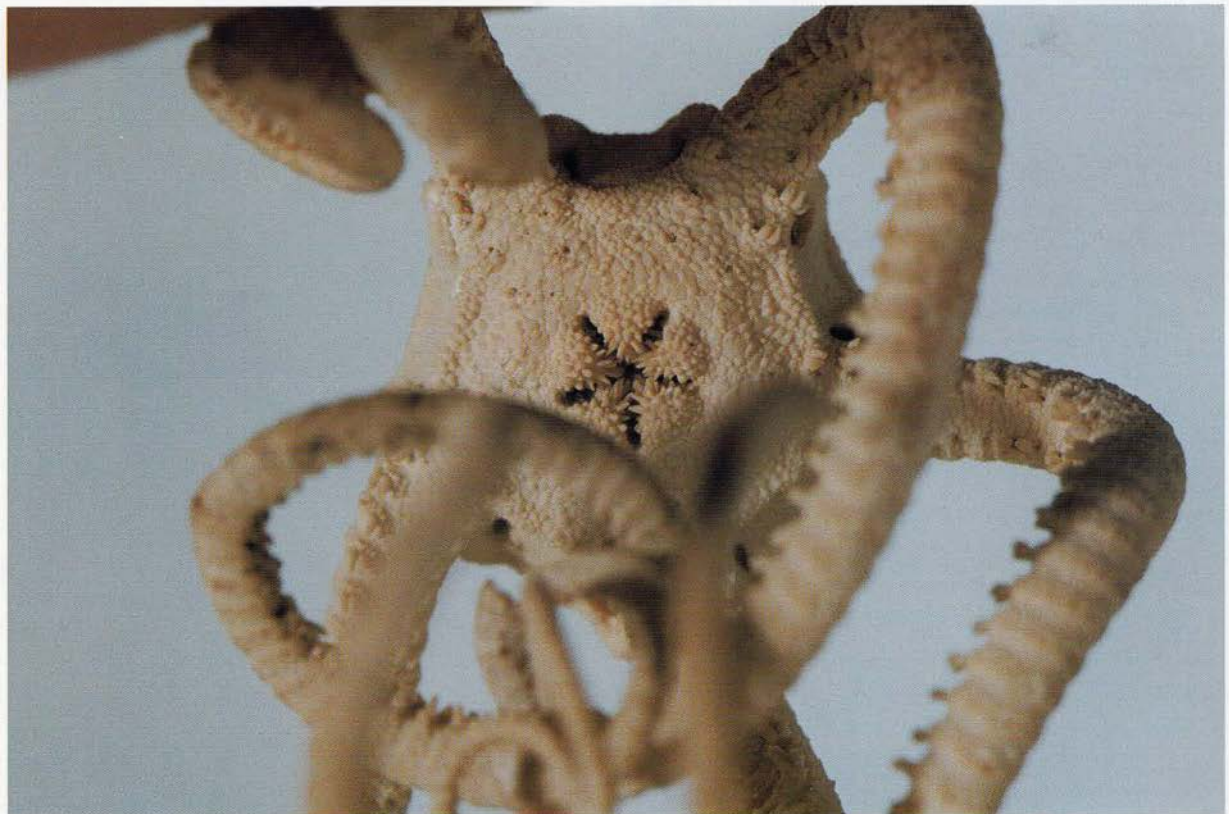
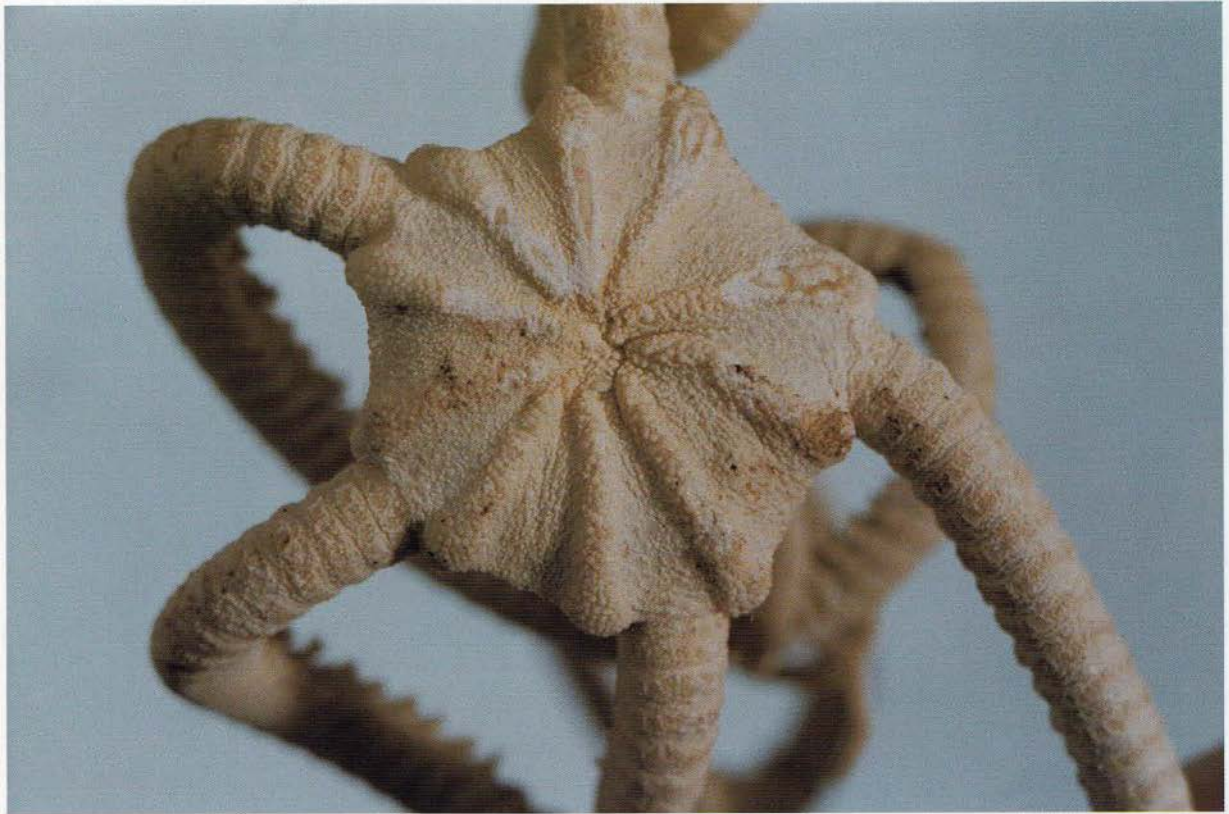


Plate 32. *Astrotoma drachi* Guille. NIWA Stn I666, disc diameter 17 mm, dorsal and ventral views.

### *Astroniwa* n.gen.

A genus of Gorgonocephalidae with five unbranched arms; disc covered above with thin skin and somewhat glassy granules, slightly larger over radial shields and at disc margin; ventral interradial areas with fine granulation, except for genital plate and scale, which are naked. Ventral surface of disc and arm skin-covered with a few scattered grains beneath; tooth papillae spiniform, teeth similar, 2 or 3 in each row of jaw; oral papillae usually present, a little shorter than tooth papillae, set deeper in oral slit; arm-spines absent from first tentacle-pore of arm; 3 or 4 at second tentacle-pore; 4 or 5 arm-spines beyond; from just beyond arm-base all but inner spine transformed into a hook with 3–6 teeth below the terminal.

TYPE SPECIES: *Astroniwa nukurangi* n.sp.

REMARKS: This new genus differs from *Astratoma* in having a naked ventral area in the position of the madreporite, and the transformation of the arm-spines from near the arm-base.

DISTRIBUTION: Known only from eastern margin of the Bounty Platform, southeastern New Zealand.

### *Astroniwa nukurangi* n.sp. (Fig. 34, Pl. 33)

#### MATERIAL EXAMINED:

NIWA Stn: I666(11), I674(2), I693(6), T23(12), Z9343(4).

DESCRIPTION: NIWA Stn I666, disc diameter 17 mm, arms coiled distally, at least 100 mm in length.

Disc slightly inflated dorsally, radial shields raised; more or less flat ventrally; interradial margin sloping; interradial areas slightly excavate. Disc covered by small flat plates, immersed in thin skin and slightly spaced tubercles; tubercles domed, often just higher than wide, surface smooth or finely rugose. Tubercles cover radial shields; shields visible as narrow, raised areas, convergent proximally, all more or less meet at disc centre. Interradial areas skin-covered with fine granulation, the tubercles of the dorsal surface ending abruptly; genital clefts narrow, entire, upper end margined by curved, naked genital scale. Oral area covered by skin, with widely scattered small grains or pustules, margins of plates obscured by skin. Oral papillae and teeth spiniform, oral papillae along side of jaw set quite high in oral slit. Oral tentacle prominent, with a basal sheath. Single small madreporite placed at edge of oral area.

Arms rounded dorsally, flat ventrally, higher than wide at base. Girdle bands begin from arm-base, seg-

ment 4. Bands narrower than intergirdle areas, with a double, transverse row of hooklets across arm; hooklets appear to lack secondary teeth. Intergirdle areas with low flat plates; both areas also with higher tubercles, much smaller than those of disc, these more numerous along dorsal side of arms. On distal arm-segments tubercles more or less restricted to girdle bands. Hooklets form continuous series down side of arms to arm-spines. First tentacle-pore lacks arm-spines, second has 2 or 3, and from fifth to sixth there are 5. Spines all flattened, increasing in size from outermost; all are transformed into hooks from the first spinous arm-segment, each with 4–6 secondary teeth.

HOLOTYPE: Specimen from NZOI Stn I666, deposited in the NIWA collections, Wellington, H-728.

PARATYPES: Specimens (12) from NZOI Stn T23, deposited in the NIWA collections, Wellington, P-1192.

ETYMOLOGY: *Astro* from the Latin "star", *niwa* for the institutional repository; *nukurangi* being part of NIWA's Maori name *taihoru nukurangi*, meaning where the waters meet the sky.

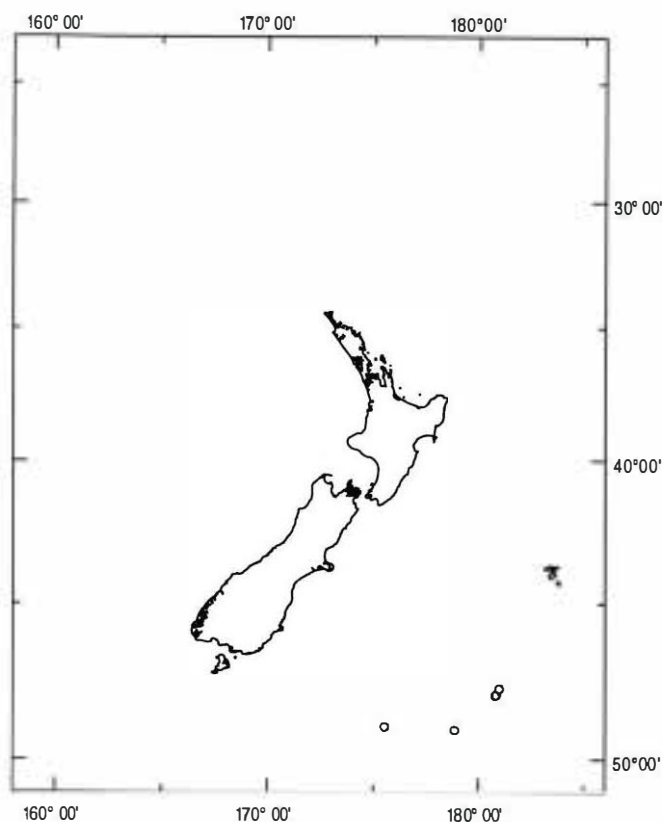


Fig. 34. New Zealand records of *Astroniwa nukurangi*.





Plate 33. *Astroniwa nukurangi* n.gen. et n. sp. NIWA Stn I666, holotype, disc diameter 17 mm, dorsal and ventral views.

COLOUR (in ethanol): White or light brown, more or less uniform, a little lighter below.

DISTRIBUTION: Known only near the eastern margin of Bounty Platform, southeast of New Zealand, 1165 m.

## DISCUSSION

### GENERAL REMARKS

The known euryalinid fauna of the New Zealand sector of the Southwest Pacific now contains some 33 species in four families (Table 1). These are recorded from 253 sites with a total of 269 records. Overall sampling coverage is poor below about 1500 m depth and there are no samples south of 50°S.

The most speciose families are the Asteroschematidae (14 species) and the Gorgonocephalidae (14 species). At the generic level only the Gorgonocephalidae has more than five genera. The fauna contains about one-third of the genera known worldwide.

### ABUNDANCE

In comparison with other ophiuroids the Euryalinida are generally not common, either in numbers of species or of individuals. Of the specimens examined, the Gorgonocephalidae is the commonest family represented, the Asteroschematidae ranks second, while the Euryalidae and Asteronychidae are not common.

At the species level some 23 species are recorded from fewer than 10 localities, and only 4 from more than 20 localities. The commonest species is *Astrothorax waitei* (Benham) with 42 station records; other common species are *Gorgonocephalus dolichodactylus* Döderlein (33 records), *Astrobrachion constrictum* (Farquhar) (29 records), and *Astroceras elegans* (Bell) (25 records).

### BATHYMETRIC DISTRIBUTION

Individual depth ranges cover depths of 0 m to over 3000 m; the fauna is more or less evenly distributed in depth zones 0–200, 200–500, and 500–1000 m; but records are few beyond, with only one from the abyssal seafloor.

The Asteronychidae is the only family with more than 25% records from depths below 1000 m and none from the continental shelf.

The Asteroschematidae has a bimodal depth distribution with peaks at continental shelf depths and also between 500 and 1000 m.

The Euryalidae shows a decline from a shelf maximum, while the Gorgonocephalidae has a maximum on the upper continental slope.

The 29 species fall into 3 main groups, based on percentage occurrence in each depth zone (see Table 1).

The first group contains 11 species, 4 of which are confined to the continental shelf –

*Astrobaea granulatus*  
*Astrobrachion adhaerens*  
*Astrocladus tonganus*  
*Astrodendrum elingamita*

and a further 7 which extend onto the continental slope –

*Asteroporpa australiensis*  
*Asteroporpa reticulata*  
*Astrobrachion constrictum*  
*Astroceras elegans*  
*Astrothorax waitei*  
*Astrothrombus rugosus*  
*Gorgonocephalus chilensis*.

The second group contains 18 species which extend across the continental slope. Five species occur only shallower than 1000 m –

*Asteroschema igloo*  
*Asteroschema migrator*  
*Asteroschema wrightii*  
*Astrothrombus vecors*  
*Gorgonocephalus pustulatum*.

Thirteen species have depth ranges that extend beyond 1000 m –

*Asteronyx loveni*  
*Asteroschema bidwillae*  
*Asteroschema salix*  
*Asteroschema tubiferum*  
*Astroceras kermadecensis*  
*Astroniwa nukurangi*  
*Gorgonocephalus dolichodactylus*  
*Gorgonocephalus sundanus*  
*Ophiocreas japonicus*

Table 1  
Abundance, depth, and latitudinal ranges  
in New Zealand

No. of station records	Depth (m)	Latitude (°S)	
<b>Asteronychidae</b>	<b>15</b>	<b>775-3391</b>	<b>39-50</b>
<i>Asteronyx loveni</i>	14	775-1760	41-50
<i>Astrodia tenuispina</i>	1	3391	39
<b>Asteroschematidae</b>	<b>80</b>	<b>0-1920</b>	<b>28-48</b>
<i>Asteroschema bidwillae</i>	4	700-1129	31-37
<i>Asteroschema horridum</i>	2	1153-1165	28-29
<i>Asteroschema igloo</i>	4	465-800	28-30
<i>Asteroschema migrator</i>	1	555	29
<i>Asteroschema salix</i>	5	341-1800	29-37
<i>Asteroschema tubiferum</i>	2	570-1090	29-30
<i>Asteroschema wrighti</i>	1	820-940	36
<i>Astrobrachion adhaerens</i>	3	10-65	23-29
<i>Astrobrachion constrictum</i>	31	0-350	31-46
<i>Ophiocreas japonicus</i>	1	940-1180	48
<i>Ophiocreas mortenseni</i>	13	660-1765	34-48
<i>Ophiocreas oedipus</i>	14	700-1260	29-37
<i>Ophiocreas sibogae</i>	13	262-1920	30-48
<i>Ophiocreas willsi</i>	2	940-1180	48
<b>Euryalidae</b>	<b>29</b>	<b>0-1165</b>	<b>25-46</b>
<i>Astroceras elegans</i>	25	0-875	25-46
<i>Astroceras kermadecensis</i>	4	985-1165	28-39
<b>Gorgonocephalidae</b>	<b>145</b>	<b>0-1165</b>	<b>25-50</b>
<i>Asteroporpa australiensis</i>	15	32-508	32-35
<i>Asteroporpa reticulata</i>	4	71-301	28-29
<i>Astroboa granulatus</i>	7	19-66	25-31
<i>Astrocladus tonganus</i>	1	0	29
<i>Astrodendrum elingamita</i>	2	71-110	29-34
<i>Astroniwa nukurangi</i>	5	750-1165	47-48
<i>Astrothorax waitei</i>	42	123-1129	28-44
<i>Astrothrombus rugosus</i>	7	198-885	36-46
<i>Astrothrombus vecors</i>	4	262-475	28-37
<i>Astrotoma drachi</i>	1	1165	47
<i>Gorgonocephalus chilensis</i>	14	182-729	41-44
<i>Gorgonocephalus dolichodactylus</i>	34	205-1357	33-48
<i>Gorgonocephalus pustulatum</i>	5	335-816	33-48
<i>Gorgonocephalus sundanus</i>	4	265-1118	33-50
<b>Totals</b>	<b>280</b>	<b>0-3391</b>	<b>23-50</b>

*Ophiocreas mortenseni*  
*Ophiocreas oedipus*  
*Ophiocreas sibogae*  
*Ophiocreas willsi*.

Two species are known only from depths between 1000 and 2000 m –

*Asteroschema horridum*  
*Astrotoma drachi*.

Only one species is known from the abyssal seafloor – *Astrodia tenuispina*.

## GEOGRAPHIC DISTRIBUTION

The total range of individual species is from 23° to 50°S latitude. To examine distribution, the percentage of each species records in five zones of latitude was determined: zones were each of 6 degrees, i.e., 24-30, 30-36, 36-42, 42-48, and 48-54°S.

For the fauna in general, species are commonest between latitudes 30° and 48°, this range covering the New Zealand continental shelf and slope. The one family departing from this pattern is the Asteronychidae, which shows a more southern distribution.

For individual species, 11 have a range of less than 6 degrees of latitude, 10 have a range of 6-12 degrees, and eight have a range of more than 12 degrees.

Seven species are restricted to the extreme north, between 24° and 30°S –

*Asteroporpa reticulata*  
*Asteroschema horridum*  
*Asteroschema igloo*  
*Asteroschema migrator*  
*Asteroschema tubiferum*  
*Astrobrachion adhaerens*  
*Astrocladus tonganus*.

Nine species occur in the north but extend their ranges further south –

*Asteroporpa australiensis*  
*Asteroschema bidwillae*  
*Asteroschema salix*  
*Asteroschema wrighti*  
*Astroboa granulatus*  
*Astroceras kermadecensis*  
*Astrodendrum elingamita*  
*Astrothrombus vecors*  
*Ophiocreas oedipus*.

Two species are more or less restricted to the central New Zealand region –

*Astrodia tenuispina*  
*Gorgonocephalus chilensis*.

Five species are distinctly southern in distribution –

*Asteronyx loveni*  
*Astrotoma drachi*  
*Astroniwa nukuraingi*  
*Ophiocreas japonicus*  
*Ophiocreas willsi*.

Lastly, nine species have more extensive ranges –

*Astrobrachion constrictum*  
*Astroceras elegans*  
*Astrothorax waitei*  
*Astrothrombus rugosus*  
*Gorgonocephalus dolichodactylus*  
*Gorgonocephalus pustulatum*  
*Gorgonocephalus sundanus*  
*Ophiocreas mortenseni*  
*Ophiocreas sibogae*.

## BIOGEOGRAPHIC RELATIONSHIPS

Of the 33 species present in the study area, 10 have not been reported elsewhere. Of the remainder, 10 are shared with the centre of the Indo-West Pacific region, namely the Philippines, Indonesia, and Malaysia –

*Asteroschema migrator*  
*Astrodendrium elingamita*  
*Astrothrombus vecors*  
*Astrotoma drachi*  
*Gorgonocephalus dolichodactylus*  
*Gorgonocephalus pustulatum*  
*Gorgonocephalus sundanus*  
*Ophiocreas mortenseni*  
*Ophiocreas oedipus*  
*Ophiocreas sibogae*.

Eleven species are shared with Australia –

*Asteronyx loveni*  
*Asteroporpa australiensis*  
*Astroboa granulatus*  
*Astrobrachion adhaerens*  
*Astrobrachion constrictum*  
*Astrodia tenuispina*  
*Astrothorax waitei*  
*Astrothrombus rugosus*  
*Gorgonocephalus dolichodactylus*  
*Gorgonocephalus pustulatum*  
*Ophiocreas sibogae*.

Three are shared with South Africa –

*Astrothorax waitei*

*Gorgonocephalus chilensis*  
*Gorgonocephalus pustulatum*.

Three species are shared with Japan –

*Asteroschema tubiferum*  
*Gorgonocephalus dolichodactylus*  
*Ophiocreas japonicus*.

with Hawaii, 1 species –

*Asteroschema tubiferum*;

and with Tonga, 1 species –

*Astrocladus tonganus*.

Three species are also shared with the Atlantic Ocean –

*Asteronyx loveni*  
*Astrodia tenuispina*  
*Ophiocreas oedipus*

On further examination, five broad patterns of distribution are apparent. An endemic element with 10 species –

*Asteroporpa reticulata*  
*Asteroschema bidwillae*  
*Asteroschema horridum*  
*Asteroschema igloo*  
*Asteroschema salix*  
*Asteroschema wrighti*  
*Astroceras elegans*  
*Astroceras kernadecensis*  
*Astroniwa nukuraingi*  
*Ophiocreas willsi*;

a generalised Indo-West Pacific element with 12 species –

*Asteroschema migrator*  
*Asteroschema tubiferum*  
*Astrocladus tonganus*  
*Astrodendrium elingamita*  
*Astrothrombus vecors*  
*Astrotoma drachi*  
*Gorgonocephalus dolichodactylus*  
*Gorgonocephalus pustulatum*  
*Gorgonocephalus sundanus*  
*Ophiocreas japonicus*  
*Ophiocreas mortenseni*  
*Ophiocreas sibogae*;

an Australasian element, not present in the Indo-West Pacific, 6 species –

*Asteroporpa australiensis*  
*Astroboa granulatus*  
*Astrobrachion adhaerens*

*Astrobrachion constrictum*  
*Astrothorax waitei*  
*Astrothrombus rugosus*;

a circumpolar element with one species, which may be a southern extension of the group of Australasian species –

*Gorgonocephalus chilensis*;

and a widespread element with three species, present in both Pacific and Atlantic Oceans, and for first two species other localities, except the polar seas –

*Asteronyx loveni*  
*Astrodia tenuispina*  
*Ophiocreas oedipus*.

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