



# extraordinary echinoderms

a guide to the echinoderms of New Zealand

Version 1, 2014

outstanding ophiuroids  
heavenly holothurians  
amazing asteroids  
exquisite echinoids  
curious crinoids

Sadie Mills  
Kate Neill  
Owen Anderson  
Niki Davey

with Michelle Kelly & Blayne Herr

## about this guide

Echinoderms are found everywhere and are adapted to live in many habitats, from the intertidal zone down to the continental shelf, deep ocean trenches, and abyssal plains. They are an extraordinary and diverse group and we hope you will enjoy reading and using this guide to help identify them in the field.

EXTRAORDINARY ECHINODERMS is a fully illustrated working e-guide to the most commonly encountered shallow water species of sea stars, brittle stars, sea cucumbers, sea urchins and feather stars of New Zealand. It is designed for New Zealanders like you who live near the sea, dive and snorkel, explore our coasts, make a living from it, and for those who educate and are charged with kaitiakitanga, conservation and management of our marine realm. It is one in a series of e-guides on New Zealand marine invertebrates that NIWA's Coasts and Oceans group is presently developing.

The e-guide starts with a simple introduction to living echinoderms, followed by a morphology (shape) index, species index, detailed individual species pages, and finally, icon explanations and a glossary of terms. As new species are discovered and described, new species pages will be added and an updated version of this e-guide will be made available.

Each echinoderm species page illustrates and describes features that enable you to differentiate the species from each other. Species are illustrated with high quality images of the animals in life. As far as possible, we have used characters that can be seen by eye or magnifying glass, and language that is non-technical. Information is provided in descriptive text or quick reference icons that convey information without words. Icons are fully explained at the end of this document and a glossary explains unfamiliar terms.



Sadie Mills, Kate Neill, Owen Anderson, Niki Davey

The contributors to this guide are:

**Sadie Mills**

Ophiuroidea (brittle, basket and snake stars)

**Kate Neill**

Asteroidea (sea stars)

**Owen Anderson**

Crinoidea (feather stars and sea lilies)

Echinoidea (sea urchins)

**Niki Davey**

Holothuroidea (sea cucumbers)

For any ID advice on echinoderms that you encounter, please email your questions and images to [Sadie.Mills@niwa.co.nz](mailto:Sadie.Mills@niwa.co.nz)

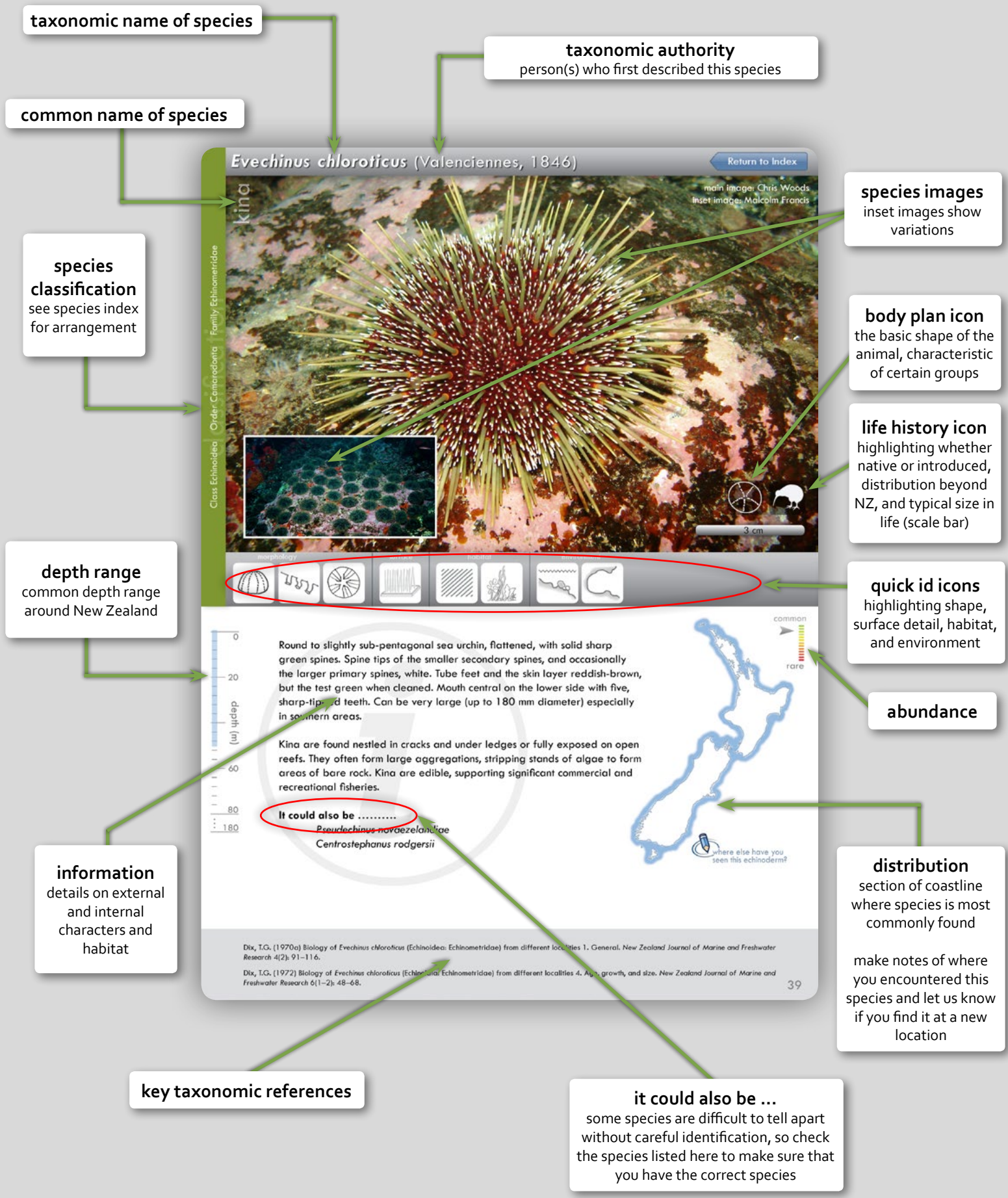
*Remember to check out*

<http://www.niwa.co.nz/coasts-and-oceans/marine-identification-guides-and-fact-sheets>



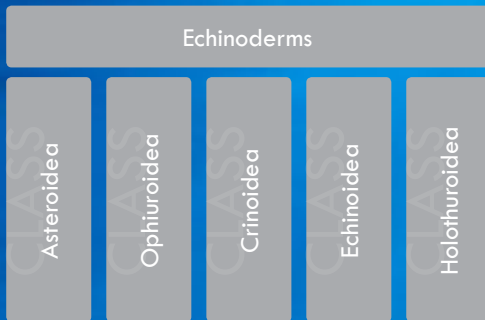
*for any updated versions!*

# a typical species page layout



## about echinoderms

Echinoderms are found in a great number of habitats from the shallow intertidal zone, at snorkelling and diving depths, right through to the deepest trenches and abyssal plains of our oceans. So it is quite likely that whenever you are in or on the sea an echinoderm won't be far away.



There are **five** classes of echinoderms, the **Asteroidea** (sea stars), **Ophiuroidea** (brittle, basket and snake stars), **Crinoidea** (feather stars and sea lilies), **Echinoidea** (sea urchins) and **Holothuroidea** (sea cucumbers).

The five classes are arranged throughout this guide according to their position in three subphyla Asterozoa (Asteroidea, Ophiuroidea), Crinozoa (Crinoidea) and Echinozoa (Echinoidea, Holothuroidea).

Echinoderm means 'spiny skin' and this is seen in many of the echinoderm species, though not all of them have obvious spines. The basic body plan of an echinoderm is made up of a five-sided (pentaradial) symmetry and they don't have a head or eyes. They all share a water vascular system, usually with tube feet, which helps them with breathing, feeding and movement in their habitat.

Within all of the groups there are species that are filter feeders, deposit feeders, scavengers and predators. With few exceptions the echinoderms have separate sexes and breed by fertilisation to create an embryo, but the sexes are usually very difficult or impossible to tell apart.

Echinoderms are fed on by fish, other echinoderms and humans. The most well-known species that make up part of the human diet are kina, *Evechinus chloroticus* (Valenciennes, 1846), and the sea cucumber *Australostichopus mollis* (Hutton, 1872). Some echinoderms have the remarkable ability of autonomous self-regeneration if they are about to be eaten or picked up. Sea cucumbers are able to eviscerate or spew out their internal organs and regrow a new set, while sea stars and brittle stars can drop an arm (or several) and regenerate it.

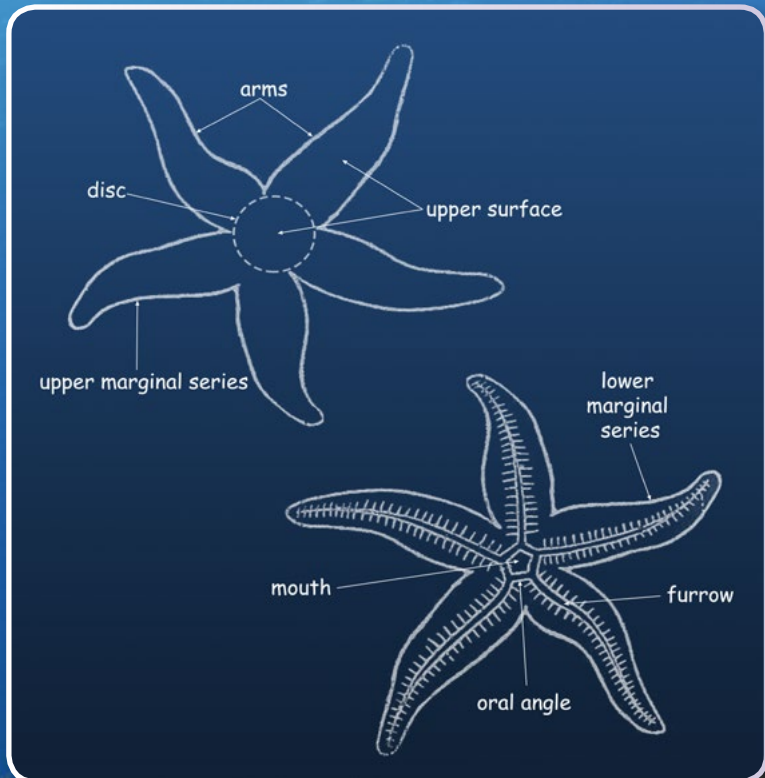


# amazing asteroids

sea stars, starfish

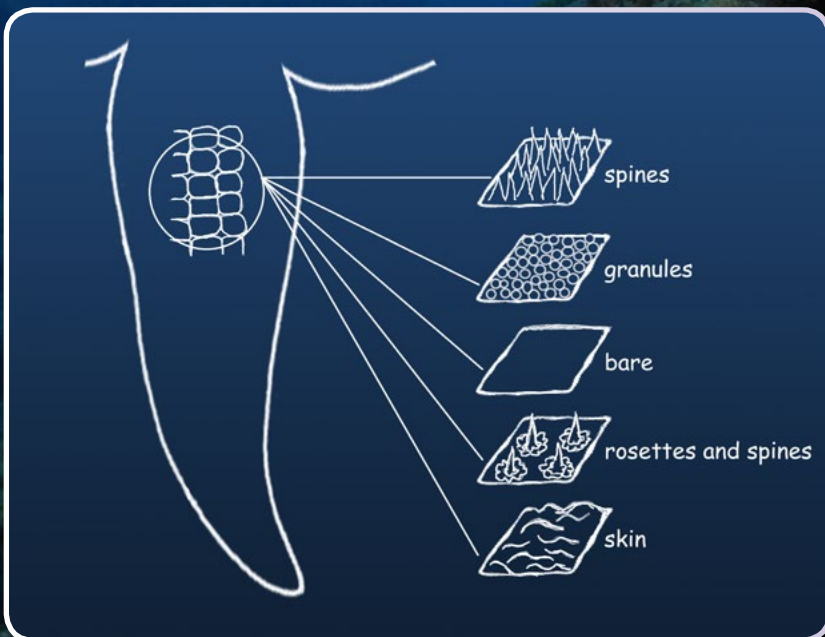
The Asterozoa are the group of echinoderms commonly known as starfish or sea stars. Many are star-shaped with a central disc, and five arms, however there are also many species with more than five arms. Arms may be long or short and the relationship between the sizes of the disc and the arms can be different between species. The bodies of starfish are made up of calcified plates which are either really obvious (like paving) or are partially or totally covered in skin, spines, and granules. Starfish can be distinguished from Ophiurozoa (brittle stars, etc) by the presence of a canal or furrow on the underside of their arms. These furrows contain the tube feet which are usually in rows of two or four.

There are seven orders of starfish; all seven orders are found in New Zealand waters and three are currently included in this guide.



**Paxillosida** This large group are predominantly found in soft sediment habitats. They lack an anus and their tube feet lack suckers.

**Valvatida** A very large order of many families, the Valvatida are dominated by species with five arms and two rows of tube feet. They include many biscuit-like starfish with obvious marginal plates but also some longer armed forms.



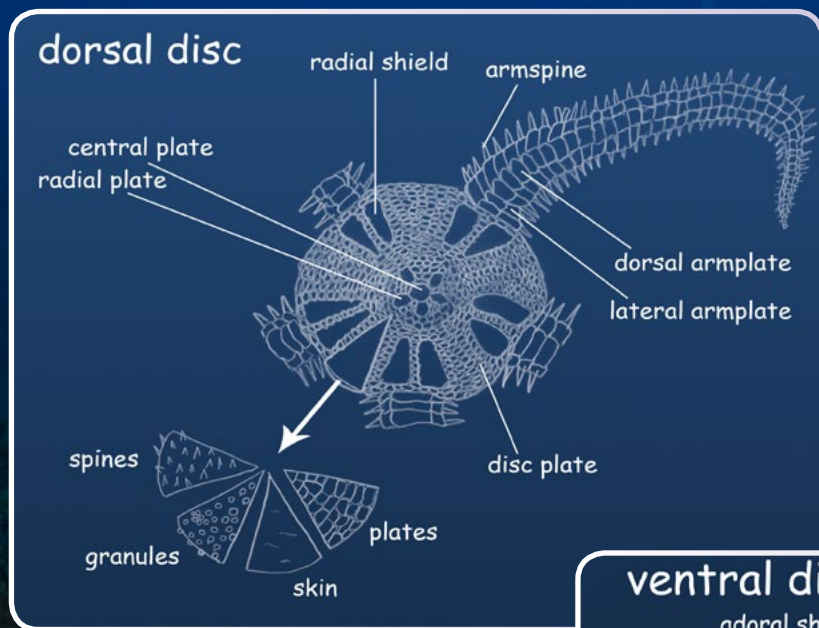
**Forcipulatida** The Forcipulatida are named after the forceps-like structure of the pedicellariae found in this group. This group contains several large, common predatory starfish that occur in the intertidal waters of New Zealand. Deep sea members are also relatively common.



Echinoderms				
Asterozoa	Ophiurozoa	Crinozoa	Echinozoa	Holothurozoa

# outstanding ophiuroids

## brittle, basket & snake stars

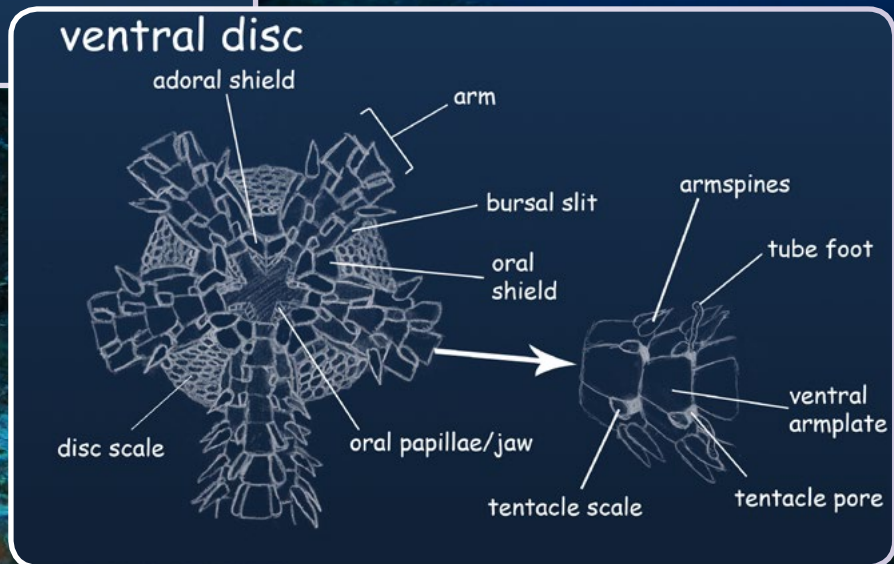


The Ophiuroidea are star-shaped echinoderms with a distinct central disc, and five slender arms, though there are some species with six, seven or eight arms.

Ophiuroids can be distinguished from Asteroidea (sea stars) by the underside of their arms, which lack a grooved canal. Their tube feet emerge from small pores in the underside of their arms, which are sometimes covered by bony scales. They are split into two orders, which look quite different from each other.

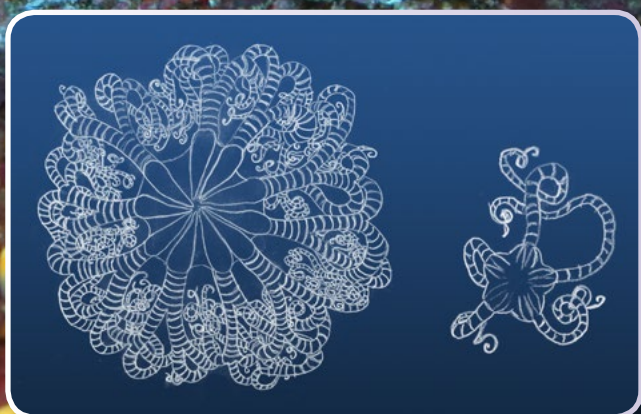
### Euryalida (basket stars and snake stars)

The arms of this group coil vertically like a monkey tail and both sides of the disc and arms are covered in skin, sometimes with granules or small spines. The arms usually number five at the base, but some groups have more than five arms or arms that branch into a large number and form a coiled basket. These animals are quite often associated to corals or sponges that they cling to as a perch to reach up into the water column to catch food.



### Ophiurida (brittle stars)

The arms are simple, unbranching and individual disc and arm plates are usually obvious with a few exceptions. The arm spines can be relatively spiny or smooth, very long or very short and inconspicuous, and similarly the disc plates can be unadorned forming a simple rosette pattern or can be covered in spines or granules obscuring some or all of the plates.



Echinoderms				
Asteroidea	Ophiuroidea	Crinoidea	Echinozoidea	Holothuroidea

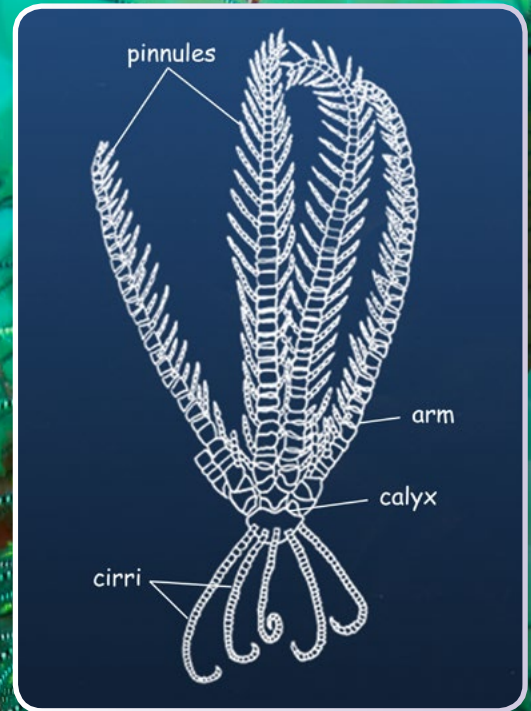
## curious crinoids feather stars

Crinoids are the most ancient of the living classes of echinoderms and are split into two groups:

**stalked crinoids (sea lilies)**, which are usually permanently attached to rock and live exclusively in the deep sea (> 100 m); and the mobile and more diverse **feather stars (comatulids)**, which occur in all depths.

The main body of the crinoid is called the crown which consists of a calyx (cup) housing the internal organs and numerous upward-pointing feather-like arms, composed of many small jointed segments, used to filter small organic particles from the passing currents.

The anus and mouth lie adjacent to each other on the upper surface of the calyx, leaving the underside free to bear the numerous slender jointed cirri used to grip the substrate.



### Echinoderms

Asteroida	Ophiuroidea	<b>Crinoidea</b>	Echinozoa	Holothuroidea
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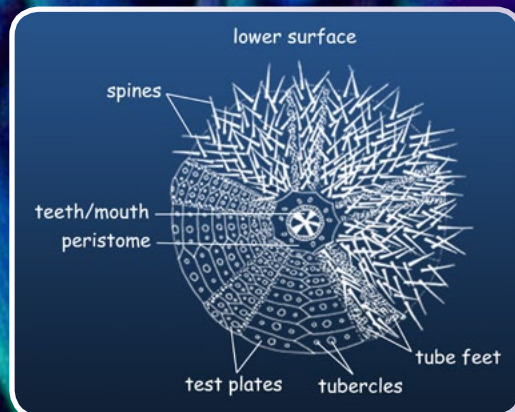
# exquisite echinoids

## sea eggs

The Echinoidea are generally circular or oval-shaped echinoderms, and come in two main forms: **the ball-shaped “regular” echinoids** such as the common kina, and the more **variable “irregular” forms** including heart urchins and sand dollars. Regular echinoids are usually found on rocky reefs while irregular species live almost exclusively on soft substrates. All New Zealand echinoids are native, but some are also found in Australia and others have a worldwide distribution. Although there are over 100 echinoid species recorded from New Zealand many either live deeper than 150 m or are tropical species found at the southern limit of their range only in the far north.

### Regular echinoids

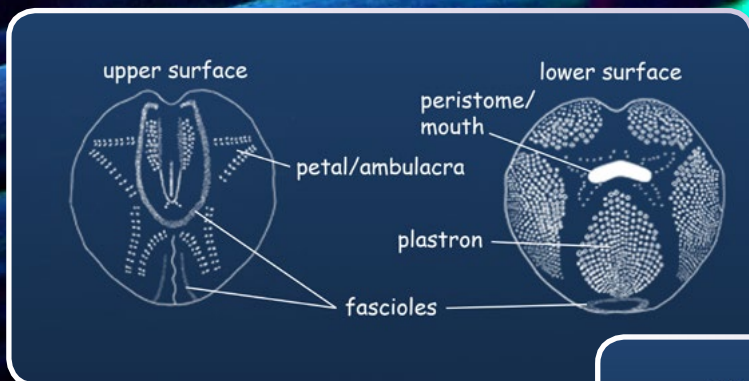
Apart from a few species not present in New Zealand, all species in the 12 living orders of regular echinoids have a round body-plan with pentamer symmetry based around 20 columns of calcium carbonate plates, and range from almost spherical to discus-shaped. They are covered in sharp spines used mainly for defence, and numerous tube feet used for movement, respiration, feeding, and defence. The five teeth visible on the lower surface are the sharp end of a complex feeding apparatus unique to this group called Aristotle’s Lantern.



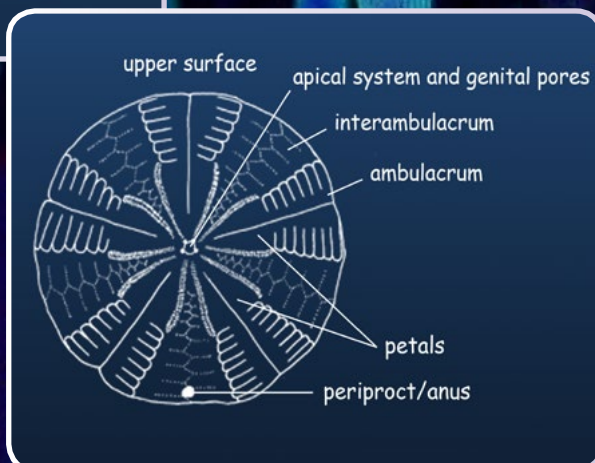
### Irregular echinoids

Irregular echinoids are also composed of 20 columns of calcium carbonate plates, but are distinguished from regular echinoids by their bilateral symmetry and usually live buried in soft sediment. They are mainly deposit feeders, either ingesting large amounts of sediment rich in organic material and excreting the inorganic component (cassiduloids), or selectively plucking organic particles and transporting them

to the mouth with their tube feet via ciliated food-grooves (clypeasteroids) or a funnel to the surface (spatangoids). In most groups the ambulacral columns (those bearing the tube feet) form distinctive petals, and the spatangoids have bands of ciliated spines (fascioles) which create currents to aid respiration and waste management.



The strongly flattened clypeasteroids (sand dollars) have several specialisations including internal buttresses for added strength and much widened ambulacra to accommodate additional tube feet for food collecting and other tasks.



Echinoderms				
Asteroida	Ophiuroidea	Crinoidea	<b>Echinoidea</b>	Holothuroidea



# heavenly holothurians

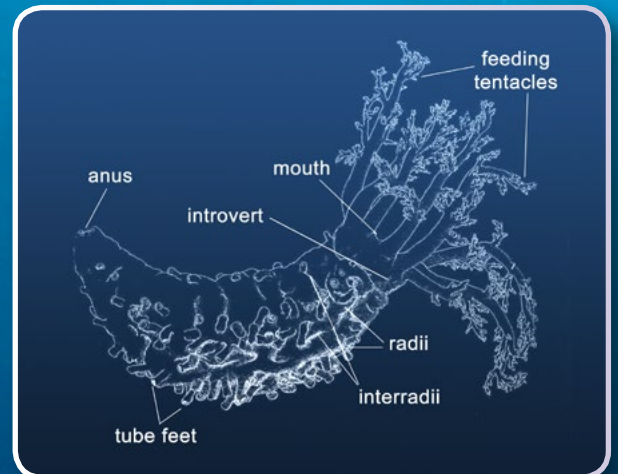
## sea cucumbers

The Holothuroidea differ more than superficially from other echinoderms as they do not possess the conspicuous 'spiny skeleton'; their body walls are soft or leathery. They are generally slow moving and/or sedentary often causing them to be targeted as food for fish and crustaceans, however, toxic compounds in body wall and a well known ability to eviscerate (discharge interior organs) and regenerate gives them quite a survival advantage.

On closer inspection the holothurians do contain remnants and features of the general echinoderm body plan. Their calcified skeleton is made up of microscopic ossicles embedded in the body wall. These ossicles display beautiful geometric shapes ranging from perfect wheels, to anchors, cups, tables and plates. These ossicles are often unique and are used to distinguish species.

They have a water vascular system which consists of anterior feeding tentacles which are actually modified tube feet and also true tube feet (Orders Molpadida and Synaptida do not have these). These tube feet vary in their arrangement on the body wall. Branching respiratory trees occupy the posterior end of the coelomic cavity and are aerated by the cloaca movements.

Holothurians are often common and conspicuous in New Zealand waters but mostly in offshore habitats. *Australostichopus mollis* is common in the intertidal zone, in rockpools and in the shallow subtidal zone.



There are **six** living **orders** of Holothuroidea: Synaptida, Elapipoda, Aspidochirotida, Dendrochirotida, Molpadida and Gephyrothuriida, of which the three represented in this guide are described below.



**Aspidochirotida** are deposit feeders with short pelate scooping tentacles. The ventral tube feet are locomotory and the dorsal are modified into papillae. Ossicles include tables, plates, rods, buttons and C-bodies. This order is the only one commercially exploited and in New Zealand waters contains the well-known conspicuous species *Australostichopus mollis*.

**Dendrochirotida** have a thick dense body wall and branching tentacles used for suspension feeding. A few have modified dendritic tentacles to enable deposit feeding. The tentacles are mucus covered catching small food items. Tube feet are usually over entire body or at least confined to the five radii. Ossicles include tables, perforated plates, baskets, cups and rods.

**Molpadida** have 15 modified digitate tentacles and have a clearly elongated tail. They are often smooth bodied as tube feet are absent. Ossicles contain tables, elongated rods, rocket shaped plates and caudinid cups.

# morphology index



*Stegnaster inflatus*

21



*Eurygonias hyalacanthus*

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*Pentagonaster pulchellus*

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*Patriella regularis*

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*Diplodontias dilatatus*

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*Asterodiscides truncatus*

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*Astropecten polyacanthus*

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*Sclerasterias mollis*

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*Astrostole scabra*

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*Luidia australiae*

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*Coscinasterias muricata*

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*Stichaster australis*

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*Ophiomyxa brevirima*

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*Cryptopelta tarltoni*

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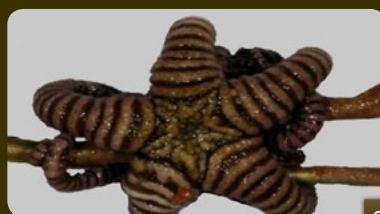
*Astrobrachion constrictum*

26



*Astroceras elegans*

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*Asteroporpa australiensis*

28



*Ophionereis fasciata*

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*Ophiopsammus maculata*

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*Ophiocentrus novaezelandiae*

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*Ophiactis resiliens*

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# morphology index



*Clarkcoma bollonsi*

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*Ophiopteris antipodum*

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*Cenolia novaezealandiae*

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*Oxycomanthus benhami*

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*Fellaster zelandiae*

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*Echinocardium cordatum*

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*Pseudechinus novaezealandiae*

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*Pseudechinus albocinctus*

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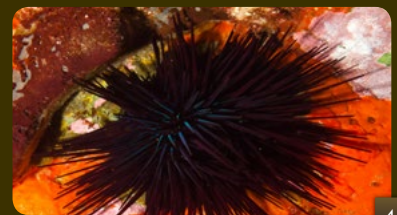
*Evechinus chloroticus*

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*Pseudechinus huttoni*

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*Centrostephanus rodgersii*

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*Paracaudina chilensis*

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*Holothuria integra*

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*Amphicyclus thomsoni*

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*Heterothyone alba*

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*Australostichopus mollis*

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*Squamocnus brevidentis*

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		Family Ophiocomidae		
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		Family Ophiodermatidae		
		<i>Cryptopelta tarltoni</i>	33	
		<i>Ophiopsammus maculata</i>	34	
Family Ophiomyxidae				
<i>Ophiomyxa brevirima</i>	35			
Family Ophionereididae				
<i>Ophionereis fasciata</i>	36			
CLASS Crinoidea	ORDER Comatulida	Family Comasteridae		
		<i>Cenolia novaezealandiae</i>	37	
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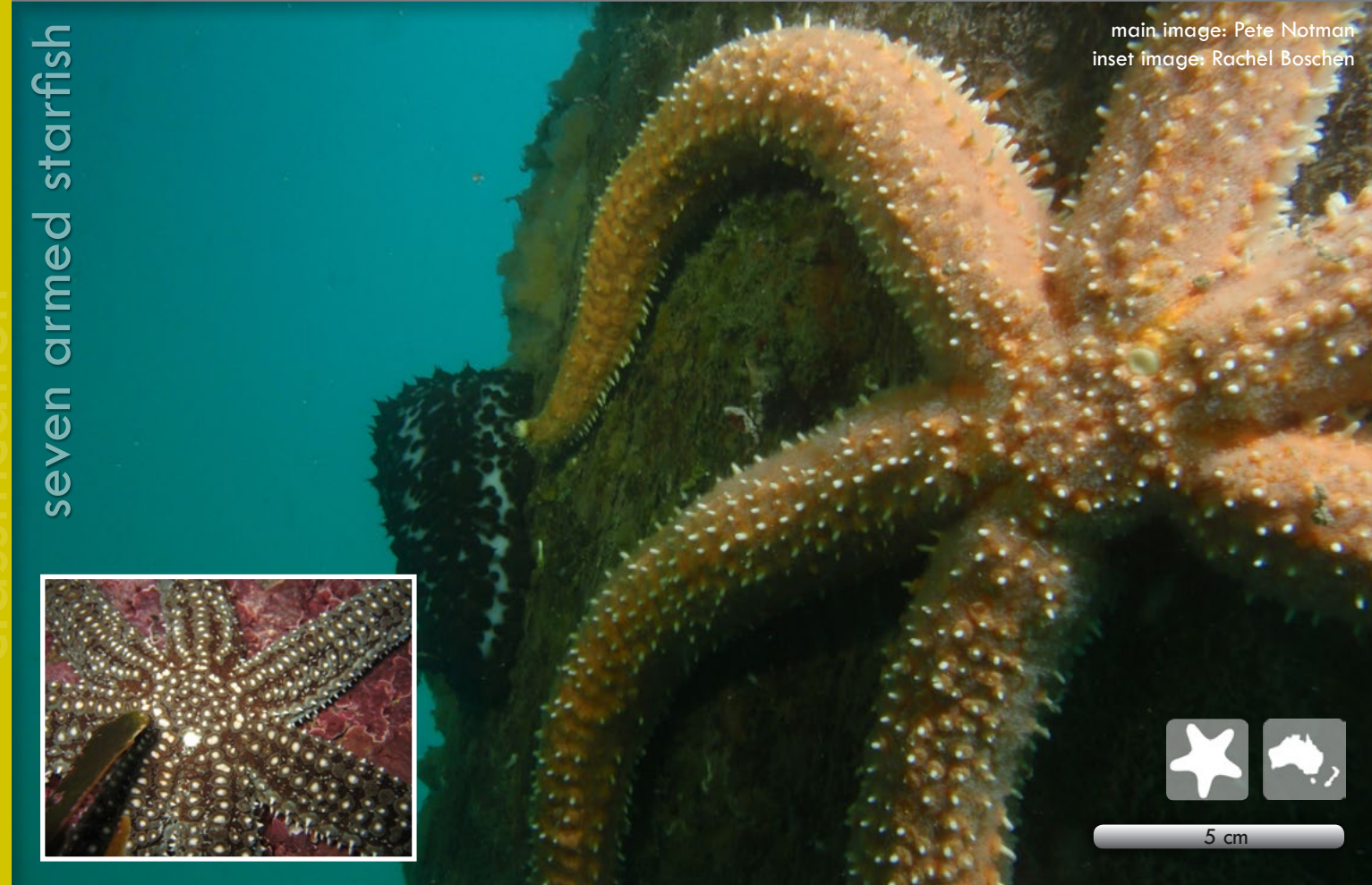
# species index

PHYLUM Echinodermata	CLASS Echinoidea	ORDER Camarodonta	Family Echinometridae	
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		ORDER Clypeasteroidea	Family Clypeasteridae	
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main image: Pete Notman  
inset image: Rachel Boschen

## seven armed starfish

Class Asterozoa | Order Forcipulatida | Family Asteroidea



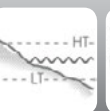
5 cm

morphology

surface

habitat

environment



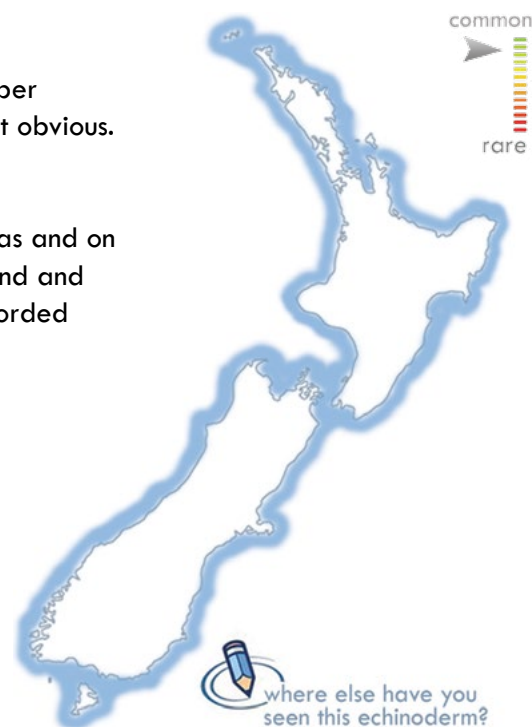
Seven arms, with disc radius about 1/10 the length of the arms. Upper surface fleshy with rows of single pointed spines, marginal plates not obvious. Dark red, blue-grey.

Intertidal to subtidal. This predatory species is common in rocky areas and on man-made structures, e.g. wharf piles. Found throughout New Zealand and the Chatham Islands, also southwards to the Snares Islands. Also recorded from Australia.

**It could also be .....**

*Coscinasterias muricata* (11 arms)

*Sclerasterias mollis* (5 arms)



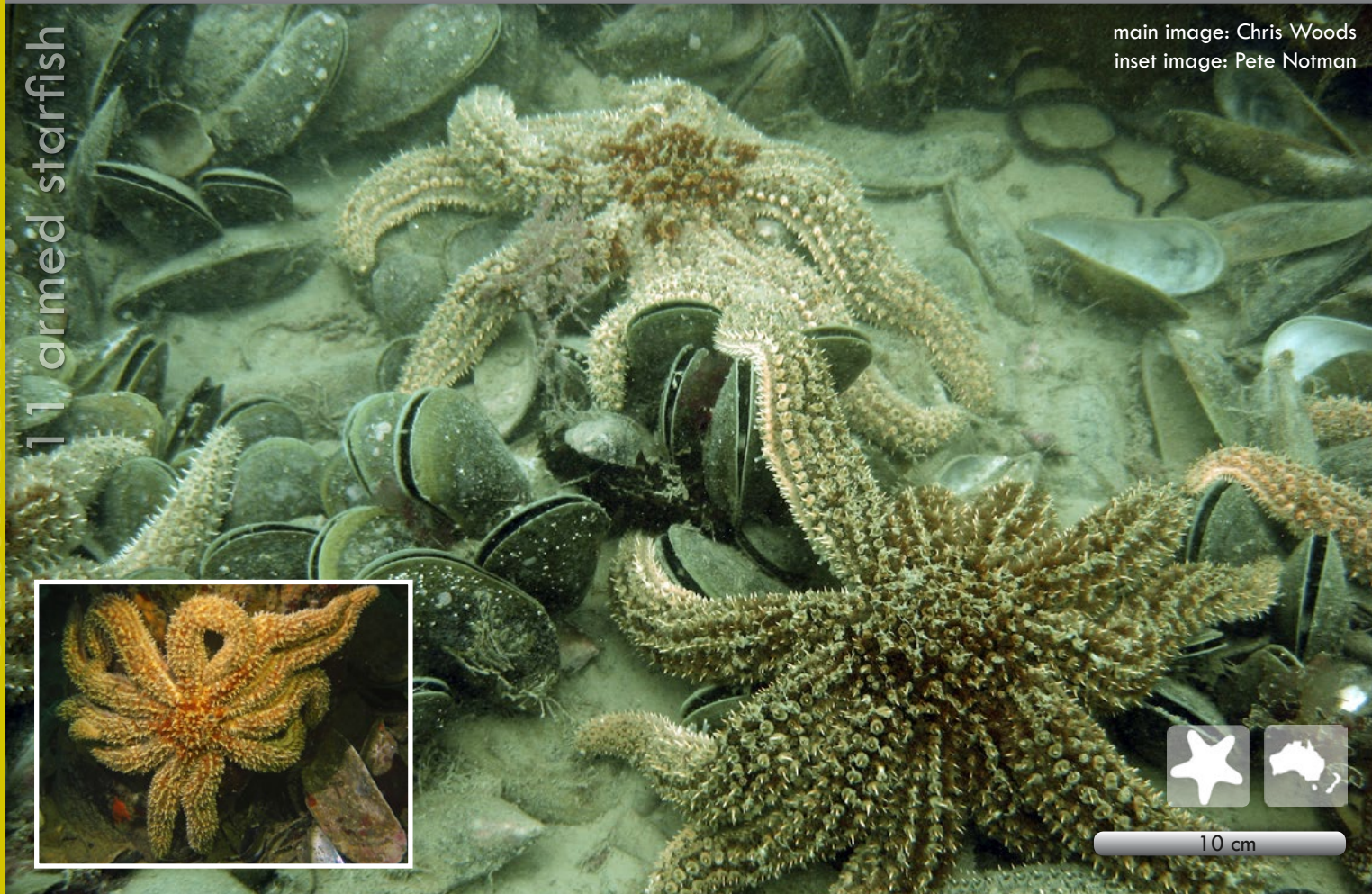
McKnight, D.G. (2006) The Marine Fauna of New Zealand: Asterozoa (sea-stars). 3. Orders Velatida, Spinulosida, Forcipulatida, Brisingida with addenda to Paxillosida, Valvatida. *NIWA Biodiversity Memoir* 120: 1–187.

Town, J.C. (1981) Prey characteristics and dietary composition in intertidal *Astrostole scabra* (Echinodermata: Asterozoa). *New Zealand Journal of Marine and Freshwater Research* 15(1): 69–80.

main image: Chris Woods  
inset image: Pete Notman

## 11 armed starfish

Class Asterozoa Order Forcipulatida Family Asteriidae



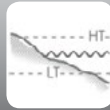
10 cm

morphology

surface

habitat

environment



Eleven arms, disc radius  $\sim 1/6$  the length of the arms. Upper surface with rows of single pointed spines, spines inside little rosettes, marginal plates not obvious. Pale orange, grey/blue.

Intertidal to subtidal. This predatory species is common in sandy and rocky areas where prey abundance is high, such as on rocky reefs, and on man-made structures such as wharf piles and under mussel farms. Found throughout mainland New Zealand and Australia.

**It could also be .....**  
*Astrostole scabra* (7 arms)



where else have you seen this echinoderm?

McKnight, D.G. (2006) The Marine Fauna of New Zealand: Asterozoa (sea-stars). 3. Orders Velatida, Spinulosida, Forcipulatida, Brisingida with addenda to Paxillosida, Valvatida. *NIWA Biodiversity Memoir* 120: 1–187.

Skold, M., Barker, M.F., Mladenov P.V. (2002) Spatial variability in sexual and asexual reproduction of the fissiparous sea star *Coscinasterias muricata*: the role of food and fluctuating temperature. *Marine Ecology Progress Series* 233: 143–155.

# *Sclerasterias mollis* (Hutton, 1872)

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main image: Roberta D'Archino  
inset image: Chris Woods

Class Asterozoa Order Forcipulatida Family Asteriidae



3 cm

morphology



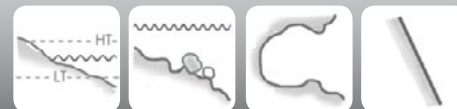
surface



habitat



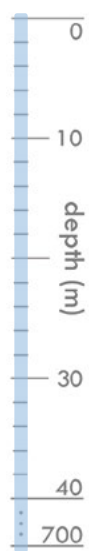
environment



Five arms, sometimes six. Upper surface covered in rows of skin-covered plates, each plate bears a single pointed spine which sits in a small rosette, marginal plates not obvious. Apricot to orange or red.

Intertidal to subtidal. Throughout New Zealand, from the Kermadec to the Auckland Islands.

**It could also be .....**  
*Astrostele scabra* (7 arms)



Grange, K.R., Singleton, R. I., Richardson, J. R., Hill, P. J., Main W. de L. (1981) Shallow rock-wall biological associations of some southern fiords of New Zealand. *New Zealand Journal of Zoology* 8(2): 209–227.

McKnight, D.G. (2006) The Marine Fauna of New Zealand: Asterozoa (sea-stars). 3. Orders Velatida, Spinulosida, Forcipulatida, Brisingida with addenda to Paxillosida, Valvatida. *NIWA Biodiversity Memoir* 120: 1–187.



main image: Kate Neill  
inset image: Rachel Boschen

reef star

Class Asteroidea Order Forcipulatida Family Stichasteridae



5 cm

morphology

surface

habitat

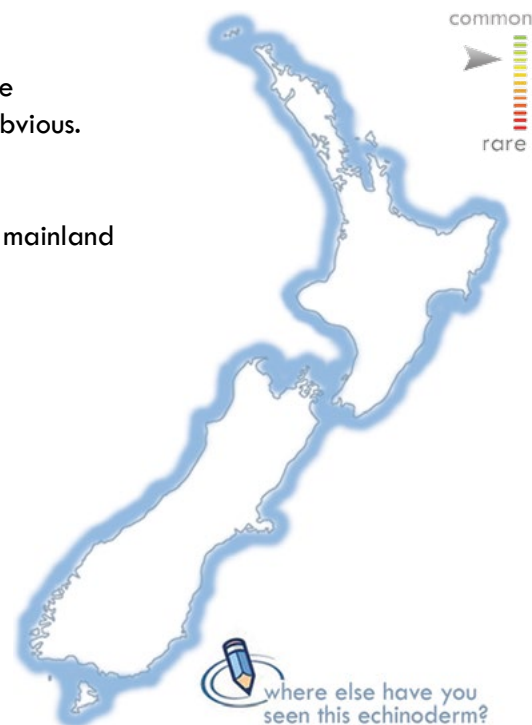
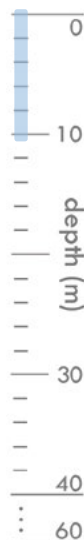
environment



Eleven arms, disc radius  $\sim 1/3$  the length of the arms. Upper surface covered in ordered rows of multiple granules, marginal plates not obvious. Purple-pink and apricot.

Intertidal to shallow subtidal. Common throughout the New Zealand mainland plus Snares and Chatham Islands.

**It could also be .....**  
*Coscinasterias muricata*



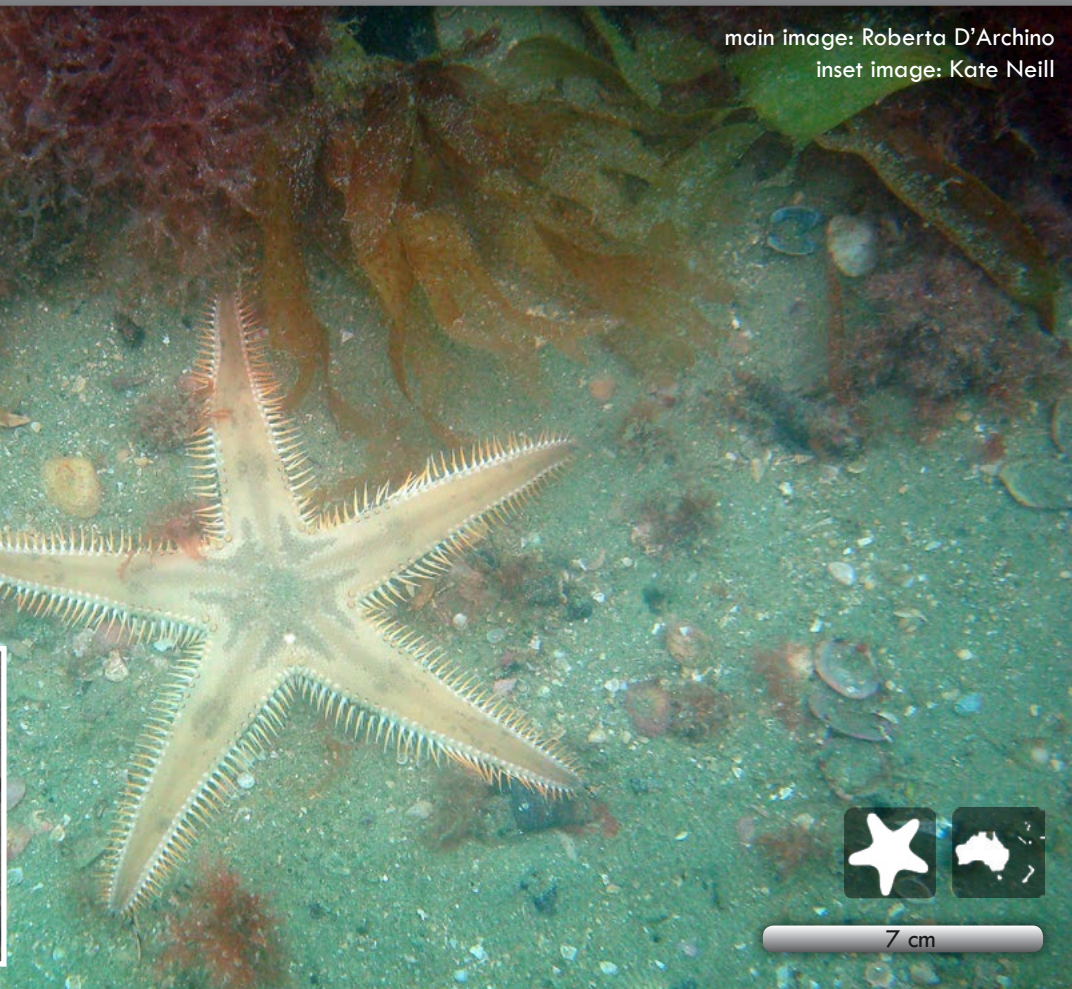
McKnight, D.G. (2006) The Marine Fauna of New Zealand: Asteroidea (sea-stars). 3. Orders Velatida, Spinulosida, Forcipulatida, Brisingida with addenda to Paxillosida, Valvatida. *NIWA Biodiversity Memoir* 120: 1–187.

Barker, M.F. (1979) Breeding and recruitment in a population of the New Zealand starfish *Stichaster australis* (Verrill). *Journal of Experimental Marine Biology and Ecology* 41(3): 195–211.

main image: Roberta D'Archino  
inset image: Kate Neill

comb star

Class Asteroidea Order Paxillosida Family Astropectinidae



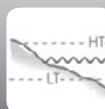
7 cm

morphology

surface

habitat

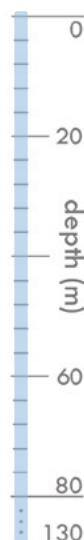
environment



Five arms, disc radius  $\sim 1/5$  the length of the arms. Upper surface carpeted with small spines, marginal plates obvious and carry pointed spines. Plates in angle between arm and disc carry two, upright pointed spines. Biege, brown, orange, often banded or mottled.

Intertidal to subtidal. Often occurs on soft substrates, e.g. sand. In the New Zealand region, found around the Kermadec Islands and very common in northern New Zealand, particularly the Bay of Plenty and Bay of Islands with occasional records further south. Also widespread in other areas of the Pacific.

It could also be .....



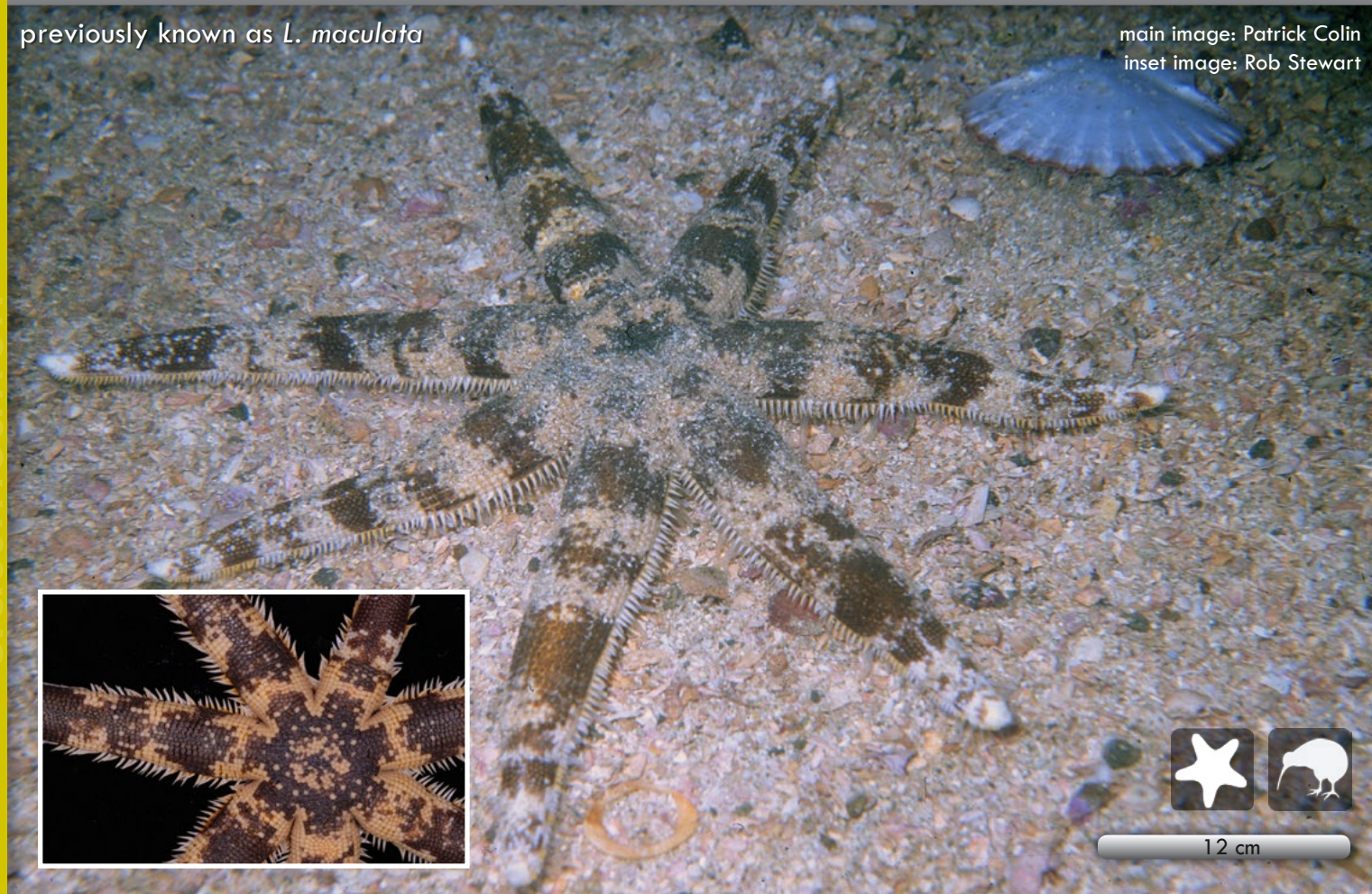
# *Luidia australiae* Döderlein, 1920

[Return to Index](#)

previously known as *L. maculata*

main image: Patrick Colin  
inset image: Rob Stewart

Class Asteroidea Order Paxillosida Family Luidiidae



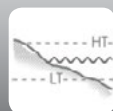
12 cm

morphology

surface

habitat

environment



Seven arms, disc radius about 1/8 or 1/9 the length of the arms. Upper surface covered in closely packed bundles of small spines, marginal plates not obvious, but carry enlarged spines. Banded and mottled dark grey and cream or beige and brown.

Intertidal to subtidal. Often occurs on soft substrates, e.g. sand or gravel. Found at the Kermadec Islands and around the northern North Island where it is most common from the Bay of Islands to East Cape.

**It could also be .....**  
*Astrostole scabra* (7 arms)



main image: Pete Notman  
inset images: Kate Neill & Chris Woods

cushion star

Class Asterozoa | Order Valvatida | Family Asterinidae



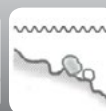
6 cm

morphology

surface

habitat

environment



Five arms, sometimes four or six, disc radius  $\sim 2/3$  the length of the arms or less. Upper surface covered in overlapping, scale-like plates, plates are irregularly arranged, marginal plates not obvious. Plates along the centre of the arms are crescent-shaped. Colour very variable, red, orange, pink, yellow, olive green, etc. Sometimes mottled.

Intertidal to subtidal. Endemic to New Zealand, including the Chatham Islands. Has spread to southern Australia and Tasmania.

It could also be .....  
*Stegnaster inflatus*



where else have you seen this echinoderm?

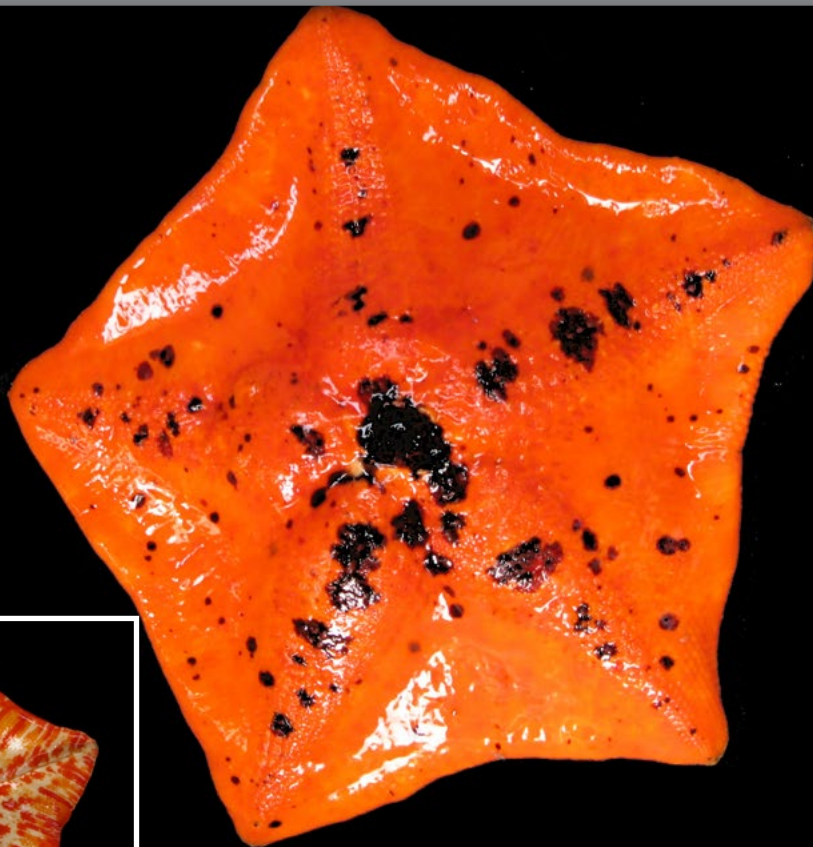
Clark, H.E.S., McKnight, D.G. (2001) The Marine Fauna of New Zealand: Echinodermata: Asterozoa (sea-stars) order Valvatida. NIWA Biodiversity Memoir 117: 1-269.

O'Loughlin, P.M., Waters, J.M., Roy, M.S. (2002) Description of a new species of *Patiriella* from New Zealand, and review of *Patiriella regularis* (Echinodermata, Asterozoa) based on morphological and molecular data. *Journal of the Royal Society of New Zealand* 32(4): 697-711.

main and inset image: Andy Miller

## ambush starfish

Class Asteroidea | Order Valvatida | Family Asterinidae



3 cm

morphology



surface



habitat



environment



Five arms, disc radius about 2/3 the length of the arms. Upper surface covered in overlapping skin-covered plates, marginal plates not obvious. Colour highly variable, red, orange, pink, yellow, olive green, etc. Sometimes mottled.

Intertidal to shallow subtidal. Known as the ambush star as this predatory species raises itself off the substrate, creating a refuge underneath for small invertebrates. The starfish then lowers itself onto them, trapping them and eating them. Widespread throughout New Zealand in shallow water.

It could also be .....  
*Patiriella regularis*



Clark, H.E.S., McKnight, D.G. (2001) The Marine Fauna of New Zealand: Echinodermata: Asteroidea (sea-stars) order Valvatida. NIWA Biodiversity Memoir 117: 1–269.

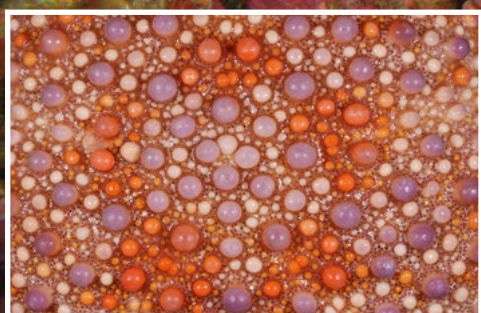
Grace, R.V. (1974) Feeding behaviour of *Stegnaster inflatus* Hutton (Class: Asteroidea, Family: Asterinidae). *Tane* 20: 163–165.

# Asterodiscides truncatus (Coleman, 1911)

main image: Crispin Middleton  
inset image: Rob Stewart

fire brick star

Class Asteroidea Order Valvatida Family Asterodiscididae



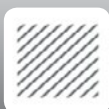
4 cm

morphology

surface

habitat

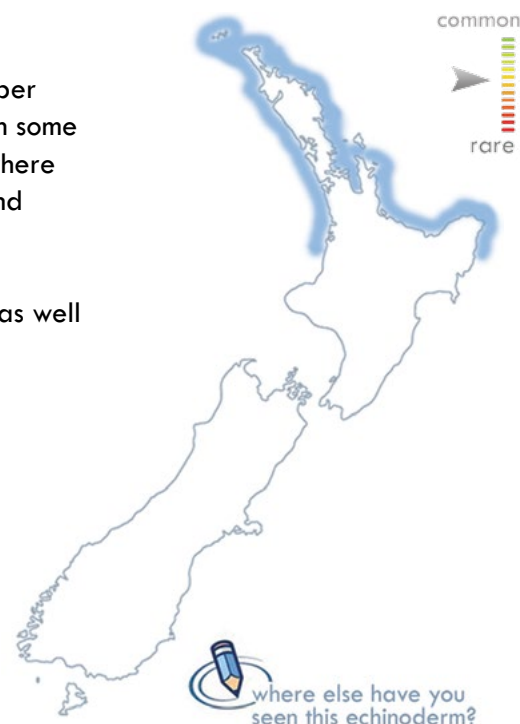
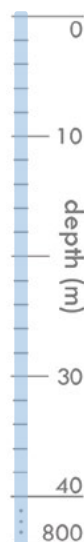
environment



Five arms, disc radius approximately 1/2 the length of the arms. Upper surface covered with large and medium granules and tubercles, with some spaces in between. Marginal plates not obvious except at arm tips where they are enlarged. A brightly coloured mix of purple, orange, red and beige.

Subtidal. Found in northern New Zealand and the Kermadec Islands as well as southern and southeastern Australia.

It could also be .....  
*Pentagonaster pulchellus*



Clark, H.E.S., McKnight, D.G. (2001) The Marine Fauna of New Zealand: Echinodermata: Asteroidea (sea-stars) order Valvatida. *NIWA Biodiversity Memoir* 117: 1–269.

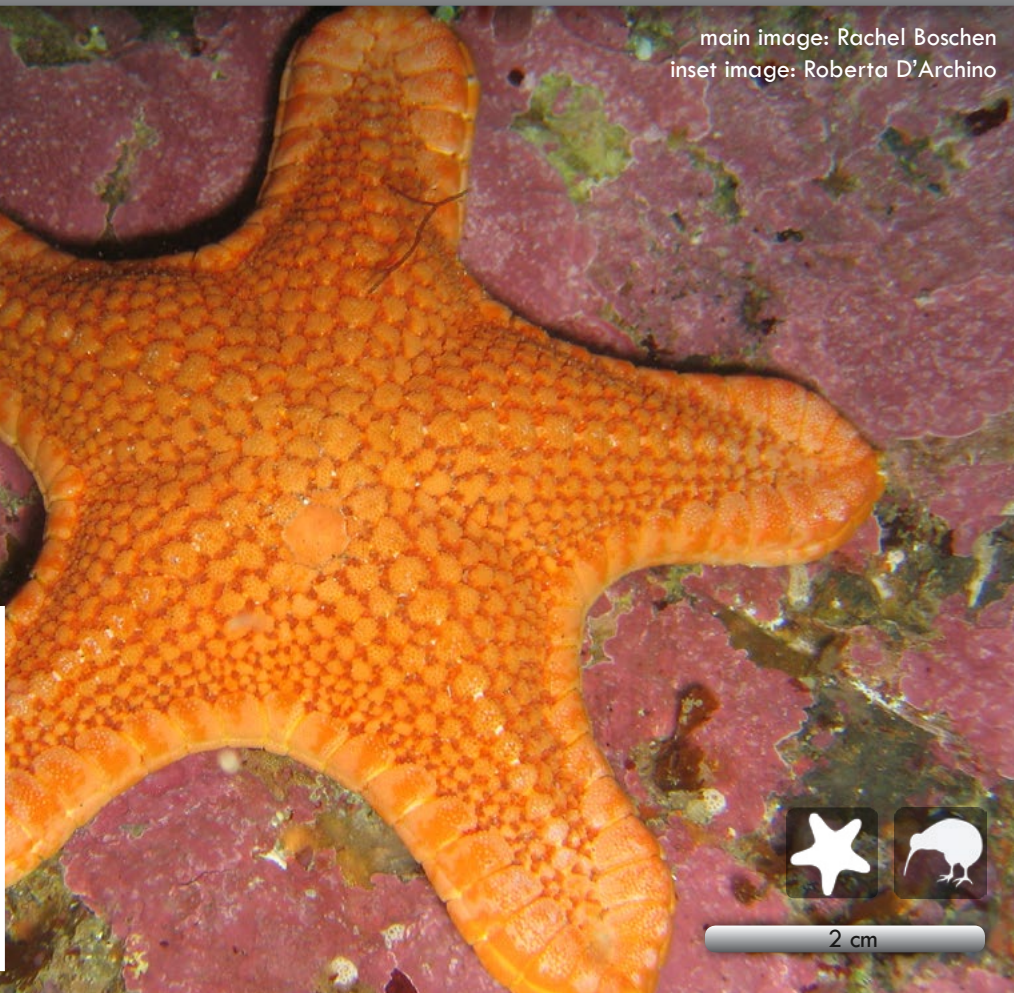
Lane, D.J.W., Rowe, F.W.E. (2009) A new species of *Asterodiscides* (Echinodermata, Asteroidea, Asterodiscididae) from the tropical southwest Pacific, and the biogeography of the genus revisited. *Zoosystema* 31(3): 419–429.

# Diplodontias dilatatus (Perrier, 1875)

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main image: Rachel Boschen  
inset image: Roberta D'Archino

Class Asteroidea Order Valvatida Family Odontasteridae



2 cm

morphology



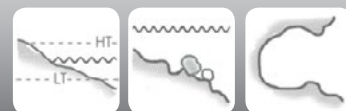
surface



habitat



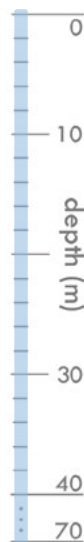
environment



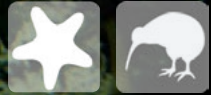
Five arms, disc radius ~ 1/2 the length of the arms. Upper surface with plates covered in granules, marginal plates obvious and also covered in granules. Marginal plates towards arm tips are enlarged. Dull to bright orange.

Intertidal to subtidal. From Cook Strait southwards to the Snares Islands.

It could also be .....  
*Pentagonaster pulchellus*

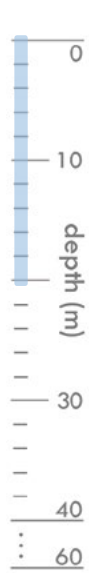


main image: Malcolm Francis  
Inset image: Roberta D'Archino



10 cm

morphology		surface		habitat		environment				



Five arms, disc radius ~ 2/3 the length of the arms. Upper surface with plates bearing rounded, pom pom-like structures, marginal plates obvious and slightly enlarged towards arm tips. Marginal plates and pompoms are cream, upper surface is apricot to orange.

Intertidal to shallow subtidal. East coast from Cook Strait southwards to the Snares Islands.

**It could also be .....**  
*Pentagonaster pulchellus*



Clark, H.E.S., McKnight, D.G. (2001) The Marine Fauna of New Zealand: Echinodermata: Asteroidea (sea-stars) order Valvatida. NIWA Biodiversity Memoir 117: 1-269.

Fenwick, G.D., Horning, D.S. Jr (1980) Echinodermata of the Snares islands, southern New Zealand. *New Zealand Journal of Marine & Freshwater Research* 14(4): 437-445.



main image: Chris Woods  
 Inset image: Rachel Boschen

biscuit star

Class Asteroidea Order Valvatida Family Goniasteridae



4 cm

morphology

surface

habitat

environment



Five arms, disc radius  $\sim 2/3$  the length of the arms. Upper surface covered in hard, naked plates, marginal plates very obvious. Marginal plates at arm tips are enlarged. Red, orange or purple/brown.

Intertidal to subtidal. From northern North Island south to the Snares Islands, and east to the Chatham Islands. Particularly common in Cook Strait and around the South Island.

**It could also be .....**  
*Diplodontias dilatatus*



Clark, H.E.S., McKnight, D.G. (2001) The Marine Fauna of New Zealand: Echinodermata: Asteroidea (sea-stars) order Valvatida. *NIWA Biodiversity Memoir* 117: 1–269.

McKnight, D.G. (1993) Records of echinoderms (excluding holothurians) from the Chatham Islands. *New Zealand Journal of Zoology* 20(3): 191–200.



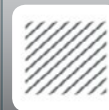
5 cm

morphology

surface

habitat

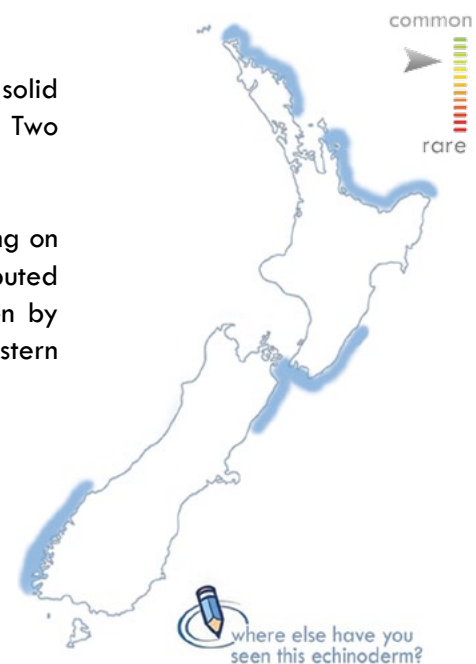
environment



Disc diameter 15 mm, five long coiling arms. Several colour morphs: solid dark red/brown, creamy yellow, or black and white striped (pictured). Two armspines. Body covered in skin, smooth to the touch.

Lives mutualistically on black coral, such as *Antipathella fiordensis*, feeding on planktonic particles collected in the mucus of the host coral. They are distributed down to 307 m in New Zealand, and are well-known from being seen by scuba divers in Fiordland. Also known from the Tasman Sea and south-eastern Australia down to 540 m.

**It could also be .....**  
*Asteropora australiensis*  
*Astroceras elegans*



McKnight, D.G. (2000) The Marine Fauna of New Zealand: Basket-stars and snake-stars (Echinodermata: Ophiuroidea: Euryalida). *NIWA Biodiversity Memoir* 115: 1–79.

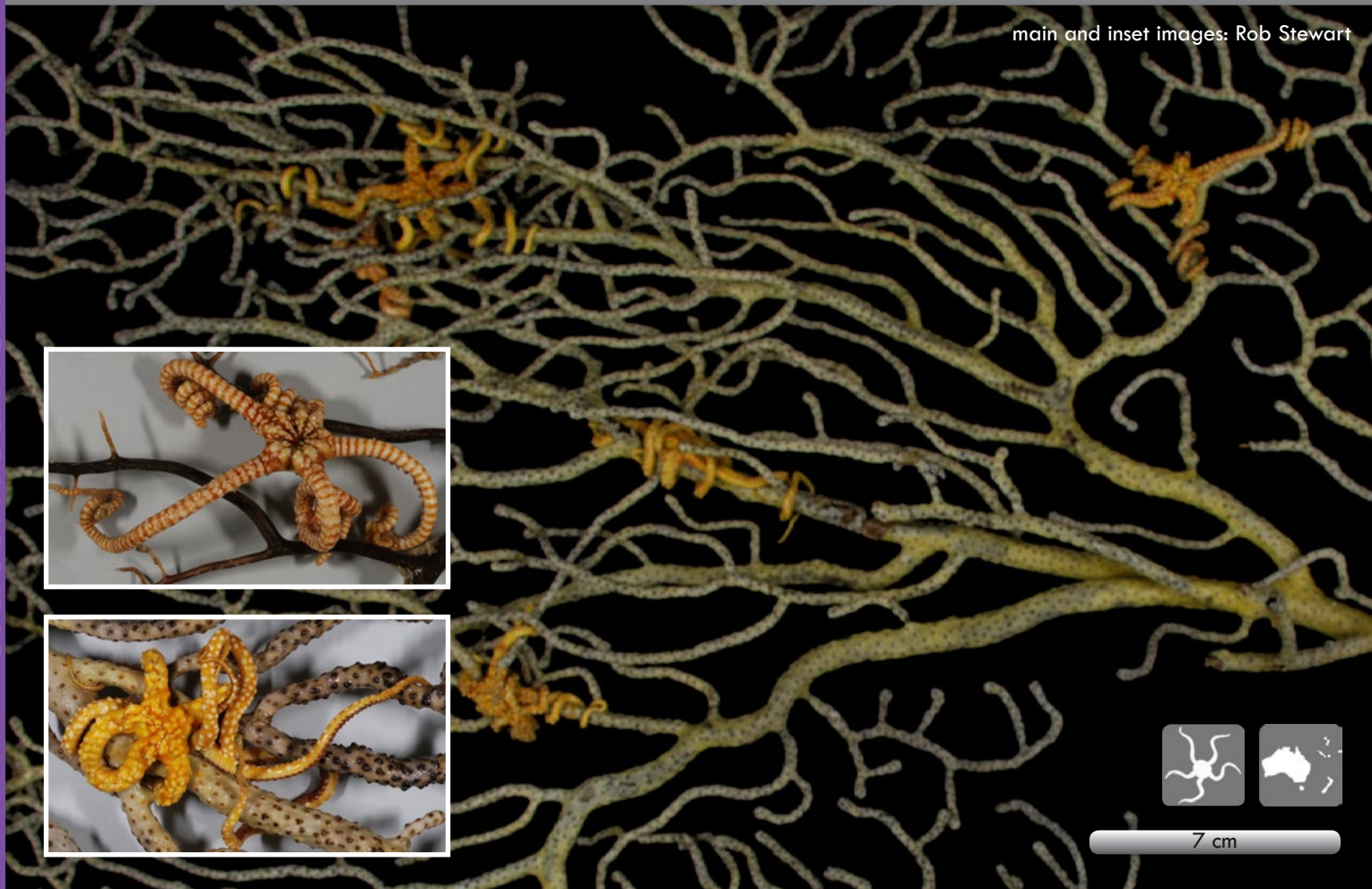
Mills, V.S., O'Hara, T.D. (2013) Ophiuroids (Echinodermata: Ophiuroidea) of biogenic habitats on the continental shelf of New Zealand. *Zootaxa* 3613(5): 401–444.

# Astroceras elegans (Bell, 1917)

[Return to Index](#)

main and inset images: Rob Stewart

Class Ophiuroidea Order Euryalida Family Euryalidae



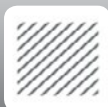
7 cm

morphology

surface

habitat

environment



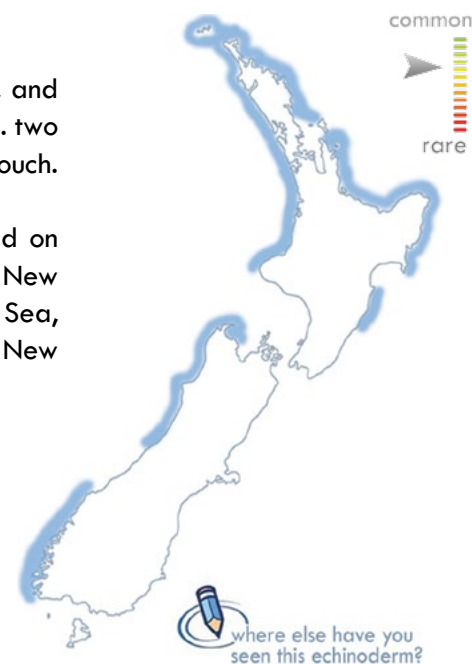
Disc diameter 10 mm, five coiling arms. Two colour morphs: solid yellow, and tan and cream banded (see inset images), both with white spiny tubercles. two armpines. Body covered with skin and tubercles, slimy and rough to the touch.

Found on branching corals, such as plexaurid sea fans, where they feed on plankton from the water column. They are distributed down to 705 m in New Zealand, and are also found between 300 and 875 m in the Tasman Sea, around 140 m in eastern Australia and between 350 and 700 m in New Caledonia.

It could also be .....

*Asteropora australiensis*

*Astrobrachion constrictum*



McKnight, D.G. (2000) The Marine Fauna of New Zealand: Basket-stars and snake-stars (Echinodermata: Ophiuroidea: Euryalinea). *NIWA Biodiversity Memoir* 115: 1–79.

Mills, V.S., O'Hara, T.D. (2013) Ophiuroids (Echinodermata: Ophiuroidea) of biogenic habitats on the continental shelf of New Zealand. *Zootaxa* 3613(5): 401–444.

main image: Peter Marriott  
inset image: Sadie Mills

Class Ophiuroidea Order Euryalida Family Gorgonocephalidae



1 cm

morphology



surface

habitat

environment

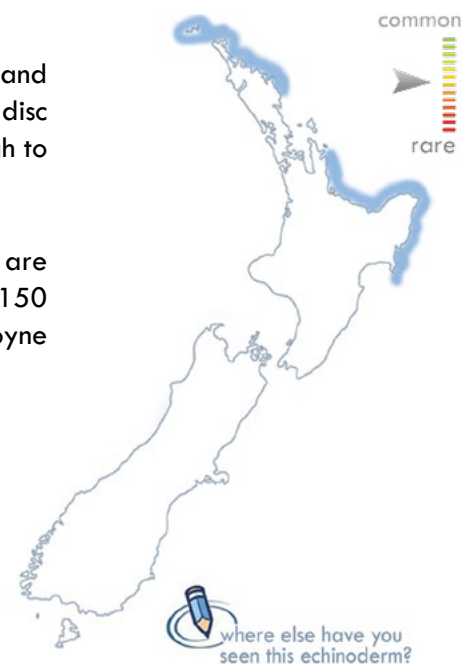
Disc diameter up to 10 mm, five arms. Black and white stripes around arms and across disc. Microscopic rings of tubercles and hooks arranged in bands on disc and arms. Three to seven armspines with spiny points. Body hard and rough to the touch, arms coil tightly.

Lives on branching corals, such as primnoid and plexaurid sea fans. They are distributed from about 30 to 510 m in north-eastern New Zealand, from 150 to 350 m at Norfolk Island and Wanganella Bank, about 140 m at Gascoyne Seamount and are also found down to about 470 m in southern Australia.

It could also be .....

*Astrobrachion constrictum*

*Astroceras elegans*



McKnight, D.G. (2000) The Marine Fauna of New Zealand: Basket-stars and snake-stars (Echinodermata: Ophiuroidea: Euryaliniida). *NIWA Biodiversity Memoir* 115: 1–79.

Mills, V.S., O'Hara, T.D. (2013) Ophiuroids (Echinodermata: Ophiuroidea) of biogenic habitats on the continental shelf of New Zealand. *Zootaxa* 3613(5): 401–444.

main and inset image: Peter Marriott

Class Ophiuroidea | Order Ophiurida | Family Amphiuroidae



2 cm

morphology

surface

habitat

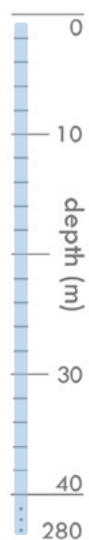
environment



Disc diameter 10 mm, five brittle spiny arms. Even cover of spines on dorsal and ventral disc plates. Six to ten armspines. Large open tentacle pores with no covering plates. Disc soft, tears easily, but would feel spiny to the touch.

Found on soft sandy or muddy substrates, predominantly west coast of North Island and Marlborough Sounds.

It could also be .....  
*Ophiactis resiliens*

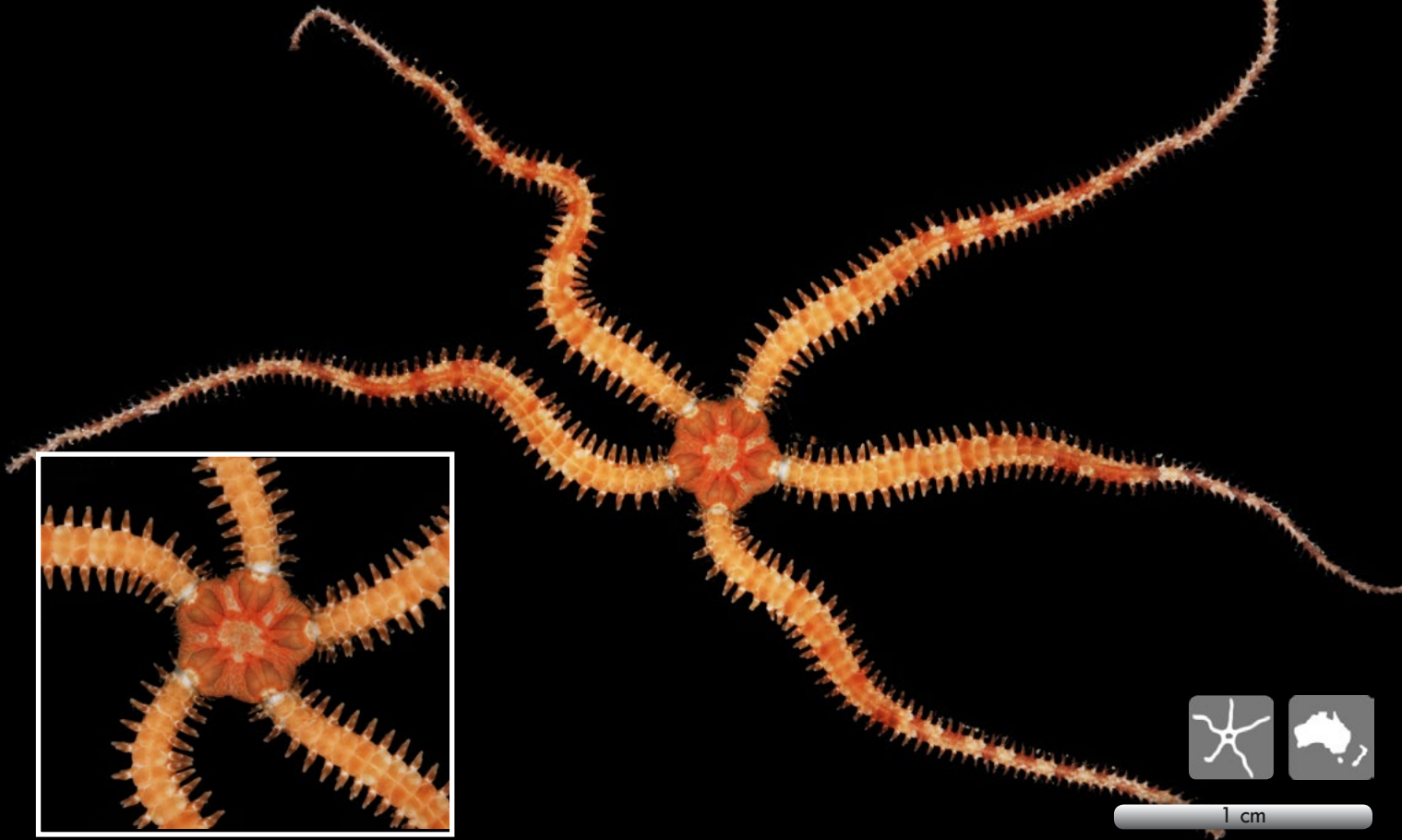


Mills, V.S., O'Hara, T.D. (2013) Ophiuroids (Echinodermata: Ophiuroidea) of biogenic habitats on the continental shelf of New Zealand. *Zootaxa* 3613(5): 401–444.

Mortensen, T. (1924) Echinoderms of New Zealand and the Auckland-Campbell Islands. II. Ophiuroidea. *Videnskabelige Meddelelser fra Dansk Naturhistorisk Forening* 77: 91–177.

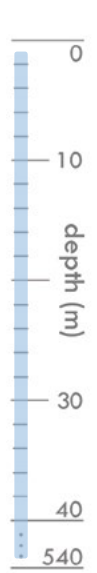
main and inset image: Peter Marriott

Class Ophiuroidea | Order Euryalida | Family Ophiactidae



1 cm

morphology	surface	habitat	environment



Disc diameter to 10 mm, five brittle arms. Variable patterning on reddish disc, white blotches at distal tip of radial shields. Numerous spines on disc margin, on dorsal disc in juveniles. Seven erect, blunt armspines at disc margin, four spines by mid arm. Single tentacle scale. Body is hard.

Well camouflaged, lives in interstices of irregular rock surfaces and algae holdfasts, raises its arms to suspension feed, capturing particles with its tube feet. Found around New Zealand down to about 210 m, but also in the Tasman Sea and southern Australia down to 520 m.

**It could also be .....**  
*Ophiocentrus novaezelandiae*



Mills, V.S., O'Hara, T.D. (2013) Ophiuroids (Echinodermata: Ophiuroidea) of biogenic habitats on the continental shelf of New Zealand. *Zootaxa* 3613(5): 401–444.

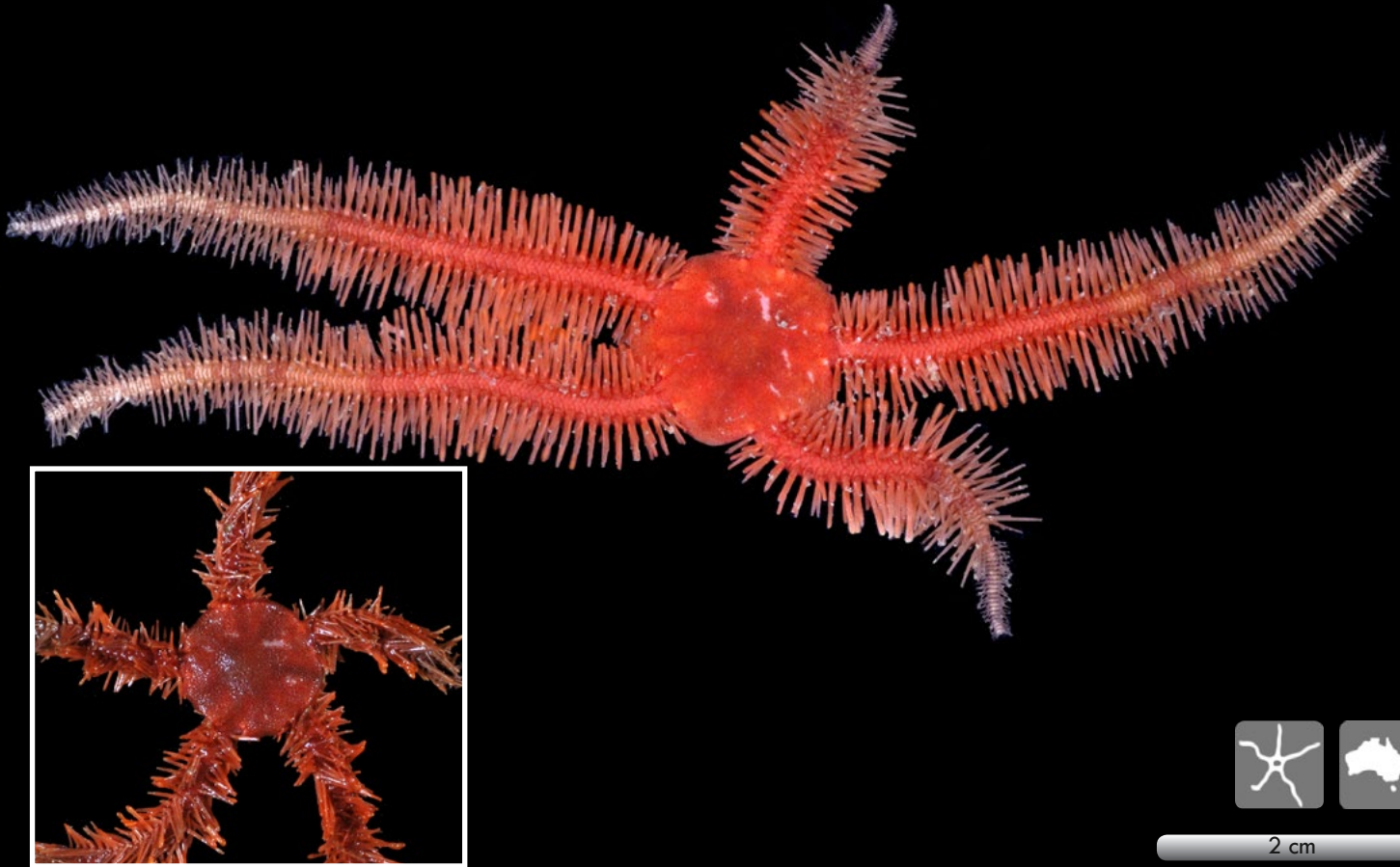
Lyman, T. (1879) Ophiuridae and Astrophytidae of the exploring voyage of H.M.S. *Challenger*, under Prof. Sir Wyville Thomson, F.R.S. Part 2. *Bulletin of the Museum of Comparative Zoology, Harvard University* 6: 17–83.

# Clarkcoma bollonsi (Farquhar, 1908)

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main and inset image: Alan Hart

Class Ophiuroidea Order Euryalida Family Ophiocomidae



2 cm

morphology

surface

habitat

environment



Disc diameter to 17 mm, five brittle arms. Dark red colour. Dense covering of granules on dorsal disc, no spines and disc plates visible on ventral disc close to oral (mouth) plates. Seven thin, flattened armspines. Two tentacle scales. Body hard.

Lives in a wide range of habitats similar to *Ophiopteris antipodum*, and the two are hard to tell apart without microscopic examination. Distributed from the Three Kings Islands throughout New Zealand south to Stewart Island down to about 370 m deep. Also found in Southern Australia down to 630 m.

It could also be .....  
*Ophiopteris antipodum*

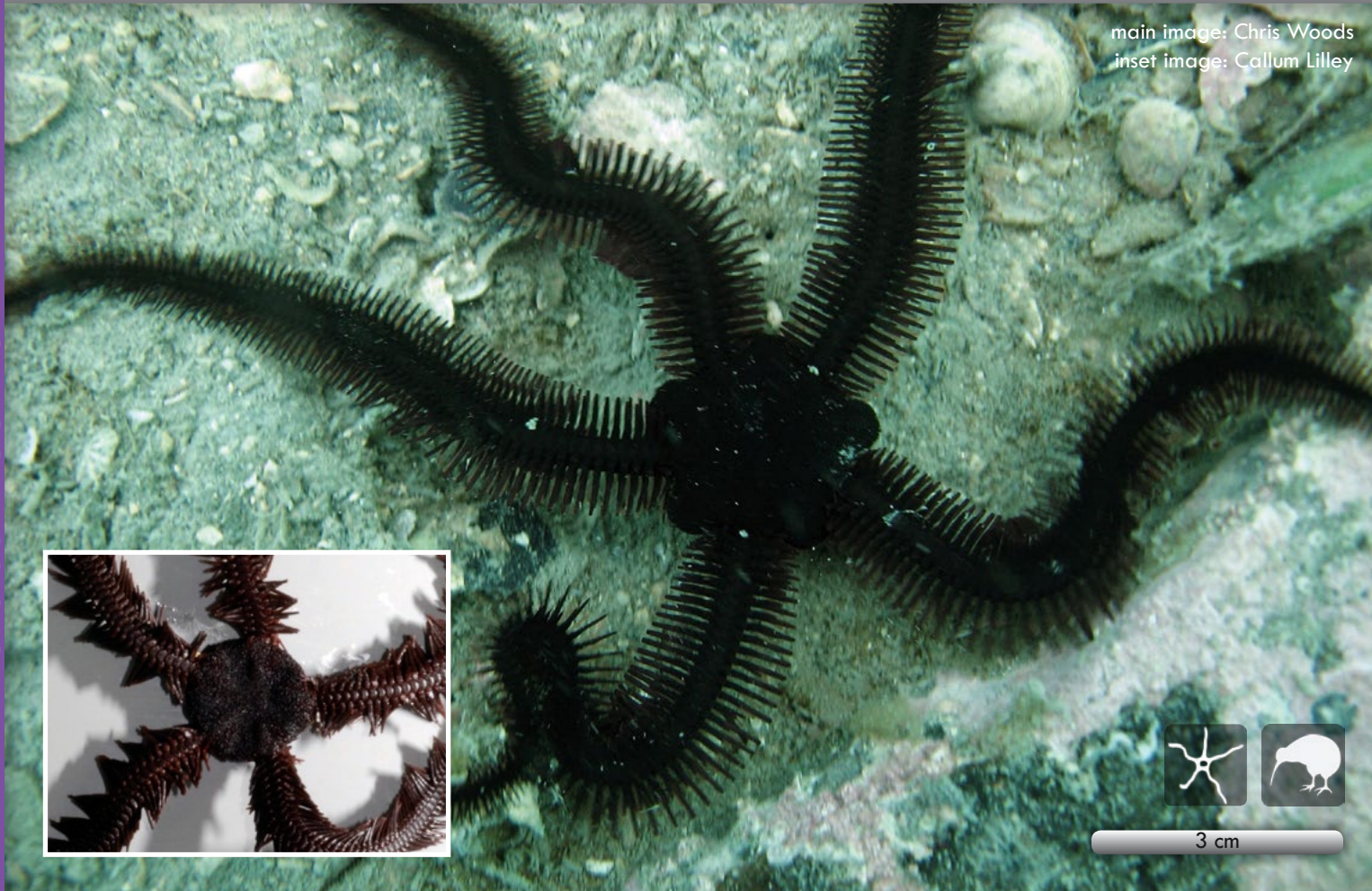


Mills, V.S., O'Hara, T.D. (2013) Ophiuroids (Echinodermata: Ophiuroidea) of biogenic habitats on the continental shelf of New Zealand. *Zootaxa* 3613(5): 401–444.

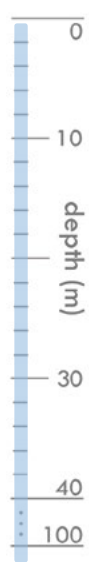
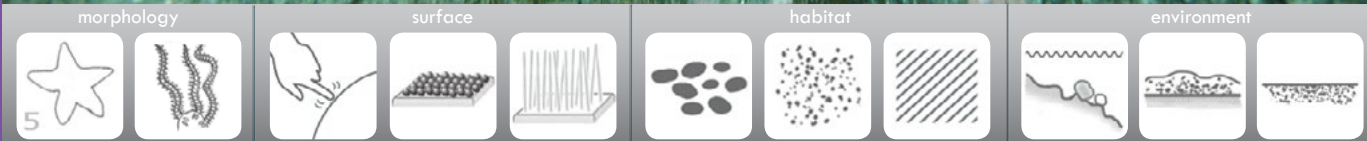
Mortensen, T. (1924) Echinoderms of New Zealand and the Auckland-Campbell Islands. II. Ophiuroidea. *Videnskabelige Meddelelser fra Dansk Naturhistorisk Forening* 77: 91–177.

main image: Chris Woods  
inset image: Callum Lilley

Class Ophiuroidea Order Ophiurida Family Ophiocomidae



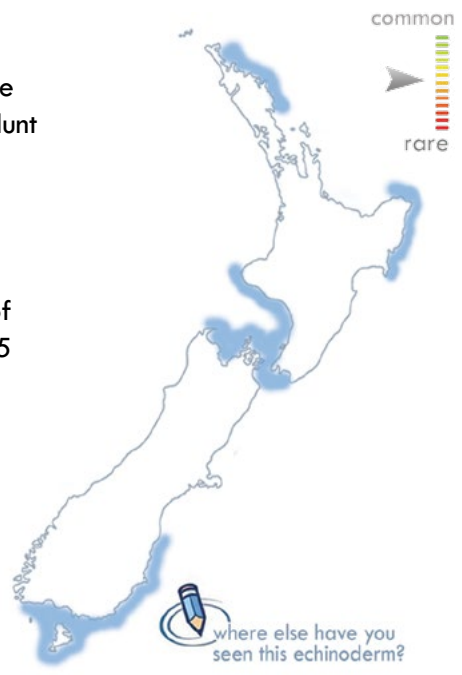
3 cm



Disc diameter to 20 mm, five brittle arms. Dark purple/brown colour. Dense covering of small granules on dorsal disc and first two arm plates. Short blunt spines cover ventral disc and margin. Five oar-like arm spines, with upper spine modified into a square flat scale. Single tentacle scale. Body hard.

Lives in a range of rocky and sandy habitats from sponge gardens to bryozoan beds, feeding on small invertebrates. Distributed from the Bay of Islands in the North Island, down to Stewart Island in the south down to 105 m deep.

**It could also be .....**  
*Clarkcoma bollonsi*



Mills, V.S., O'Hara, T.D. (2013) Ophiuroids (Echinodermata: Ophiuroidea) of biogenic habitats on the continental shelf of New Zealand. *Zootaxa* 3613(5): 401–444.  
Mortensen, T. (1924) Echinoderms of New Zealand and the Auckland-Campbell Islands. II. Ophiuroidea. *Videnskabelige Meddelelser fra Dansk Naturhistorisk Forening* 77: 91–177.

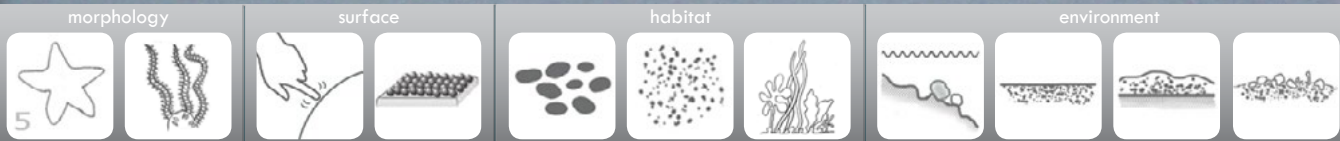


main image: Rob Stewart  
inset image: Peter Marriott



2 cm

Class Ophiuroidea Order Ophiurida Family Ophiodermatidae



Disc diameter 12–15 mm, five brittle arms. Orange disc, dark brown and cream banded arms. Dense covering of small granules on dorsal and ventral disc, except for oral shields, scattered elongate granules on dorsal disc margin. Seven armspines, pressed close to arm. Single large tentacle scale. Body hard.

Found well camouflaged in amongst coralline algae turf and rhodolith beds. Found mainly off Northland, New Zealand, occasionally found as far south as Cook Strait down to 150 m deep.

**It could also be .....**



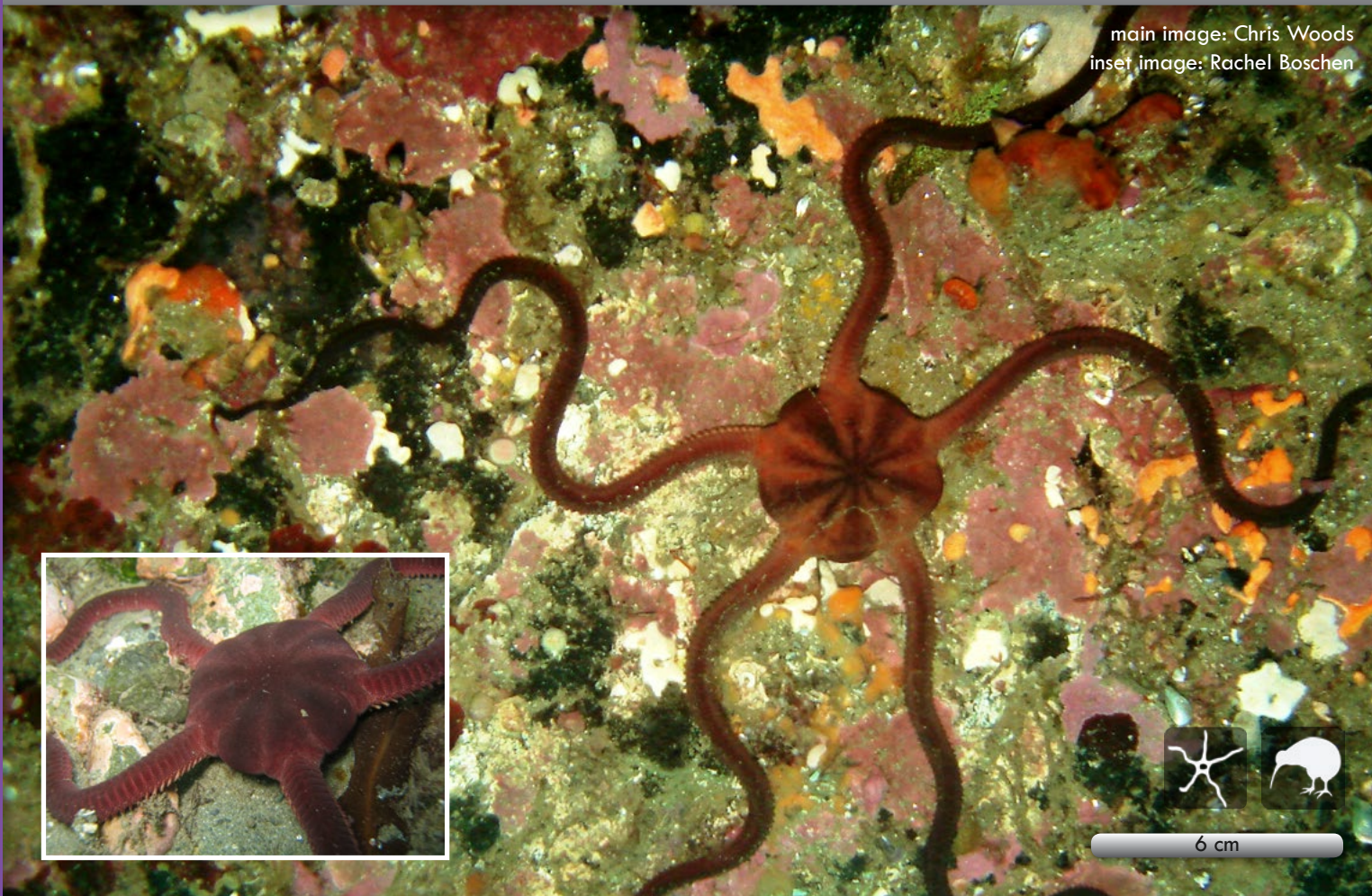
Mills, V.S., O'Hara, T.D. (2013) Ophiuroids (Echinodermata: Ophiuroidea) of biogenic habitats on the continental shelf of New Zealand. *Zootaxa* 3613(5): 401–444.

Baker, A.N. (1974) New species of brittle stars from New Zealand (Echinodermata: Ophiuroidea). *Records of the Dominion Museum, Wellington*, 8: 247–266.

# *Ophiopsammus maculata* (Verrill, 1869)

[Return to Index](#)

main image: Chris Woods  
inset image: Rachel Boschen



6 cm

Class Ophiuroidea Order Ophiurida Family Ophiodermatidae

morphology



5



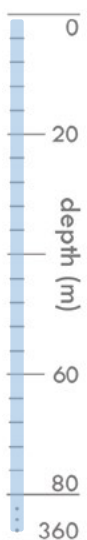
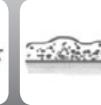
surface



habitat



environment



Large, common, disc diameter up to 48 mm, five snaky arms up to four times size of disc diameter. Dark crimson with distinctive small red spots over entire dorsal surface and ventral disc. Rounded granules cover dorsal and ventral disc plates. Ten to 11 short, blunt arm spines pressed close to arm. Two tentacle scales. Body hard.

Lives on rocky shores and bryozoan beds, common subtidally but can occasionally be found in deep intertidal rock pools. One of the largest brittle stars, they are agile predators. Distributed from Bay of Islands to Stewart Island.

**It could also be .....**

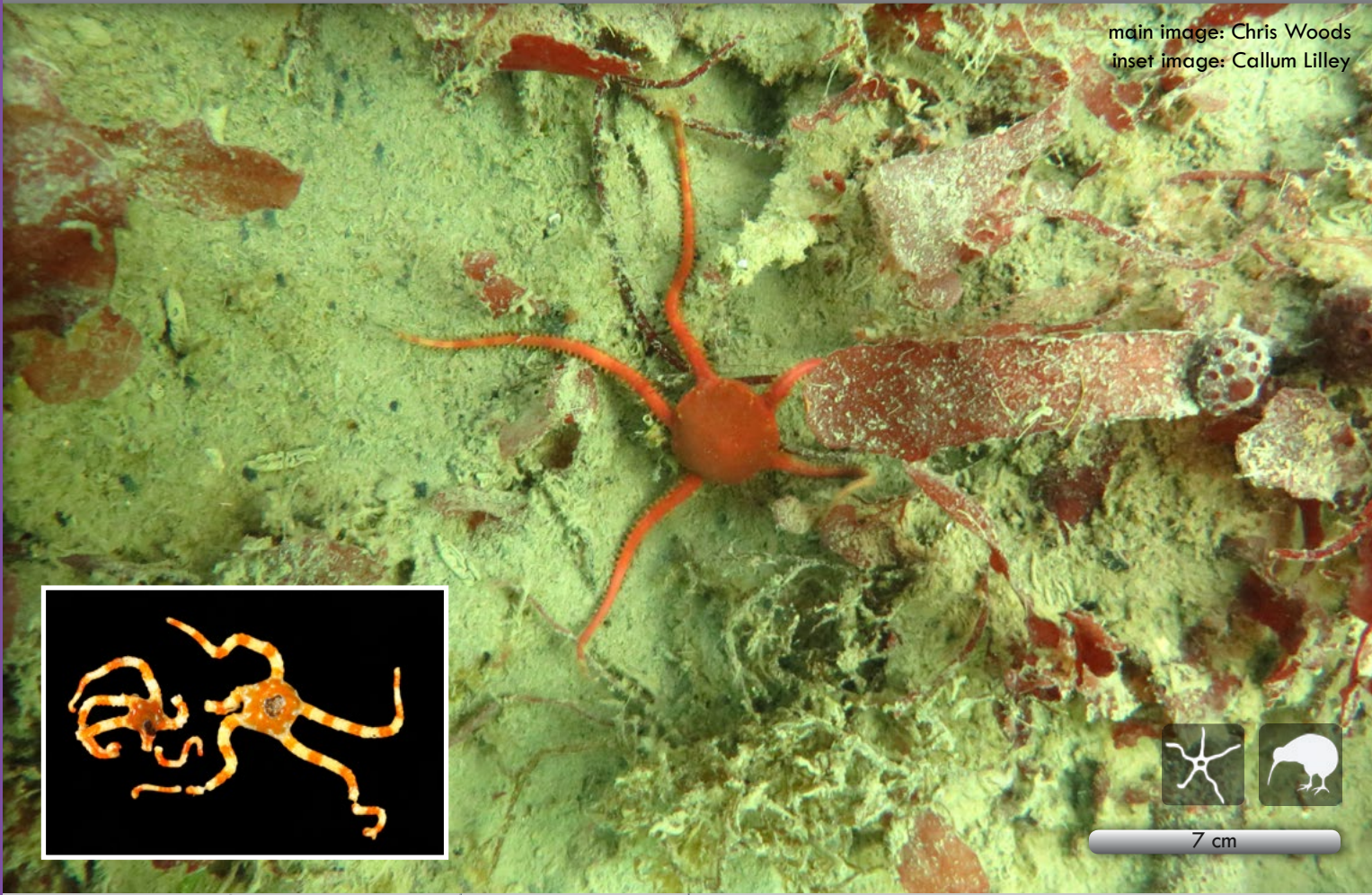


Mills, V.S., O'Hara, T.D. (2013) Ophiuroids (Echinodermata: Ophiuroidea) of biogenic habitats on the continental shelf of New Zealand. *Zootaxa* 3613(5): 401–444.

Vail, L.L., Rowe, F.W.E. (1989) Status of the genera *Ophiopeza* and *Ophiopsammus* (Echinodermata: Ophiuroidea) in Australian waters, with the description of a new species. *Proceedings of the Linnean Society of New South Wales* 110: 267–288.

main image: Chris Woods  
inset image: Callum Lilley

Class Ophiuroidea Order Ophiurida Family Ophiomyxidae



7 cm

morphology



habitat

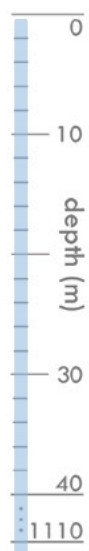


environment

Disc diameter 8–35 mm, five brittle arms. Variable greenish, reddish or yellowish brown colour with banded arms. Thin skin on disc and arms, tears easily if captured. Armspines alternating 3–4 per segment. Oral papillae glassy with serrated edge. Body is soft.

Found on sandy substrates in kelp holdfasts and in sponge gardens around New Zealand down to about 1100 m.

It could also be .....



Mills, V.S., O'Hara, T.D. (2013) Ophiroids (Echinodermata: Ophiuroidea) of biogenic habitats on the continental shelf of New Zealand. *Zootaxa* 3613(5): 401–444.

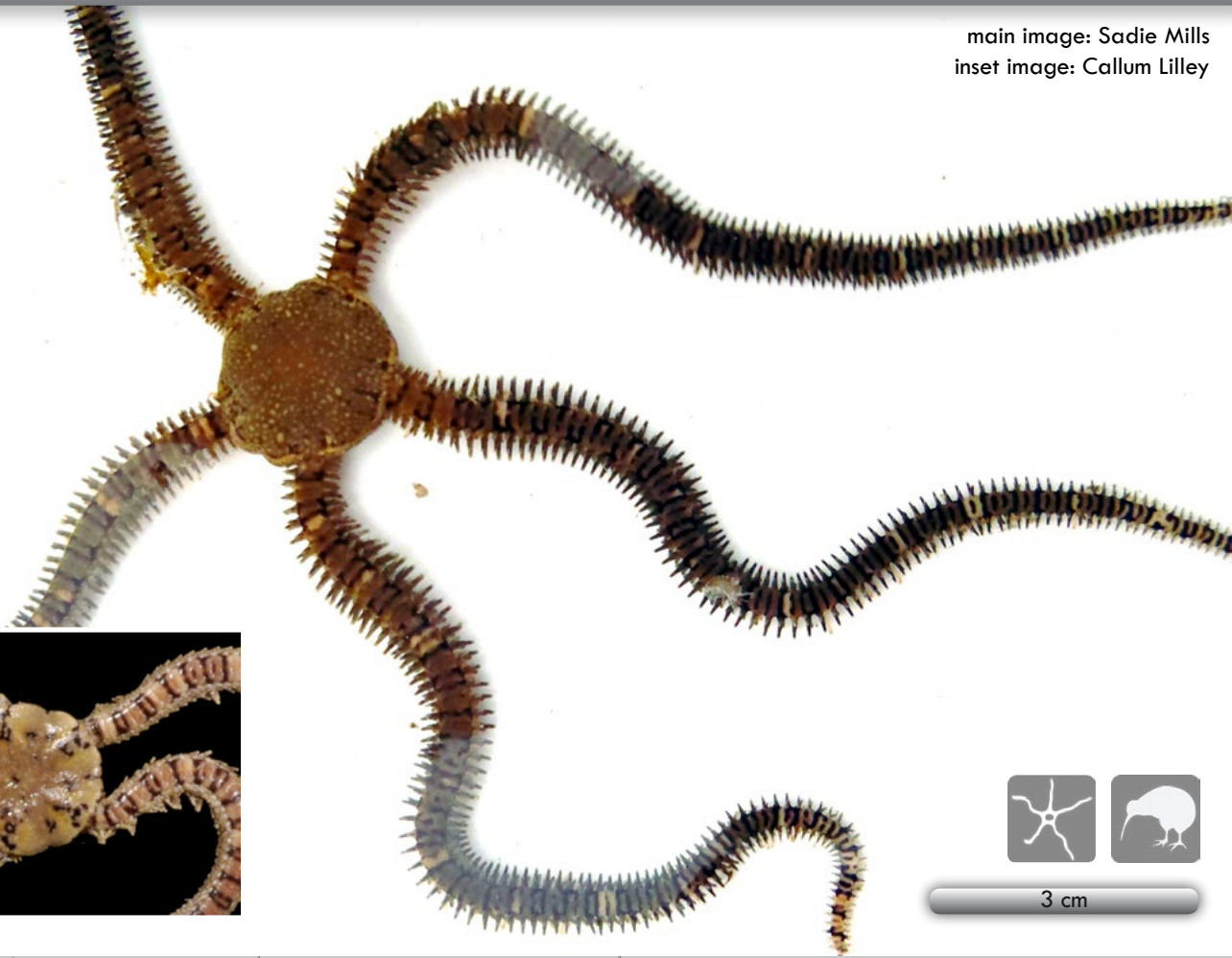
Clark, H.L. (1915) Catalogue of recent ophiurans: based on the collection of the Museum of Comparative Zoology. *Memoirs of the Museum of Comparative Zoology, Harvard University* 25: 165–376.

# *Ophionereis fasciata* Hutton, 1872

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main image: Sadie Mills  
inset image: Callum Lilley

Class Ophiuroidea Order Ophiurida Family Ophionereididae



3 cm

morphology



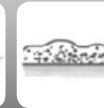
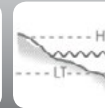
surface



habitat



environment



Disc diameter to 16 mm, five brittle arms. Disc patterned with random blotches of black on lighter grey/brown. Black, white and grey-banded arms. Four short blunt armspines, single oval tentacle scale. Body is hard.

Found underneath stones in the shallow subtidal rocky shores and out to deeper subtidal habitats. Feeds by filtering coarse suspended detritus through mucus screens between the armspines and transports this to the mouth with its tube feet. Distributed on open shores around New Zealand down to about 300 m deep.

It could also be .....  
*Ophiactis resiliens*

common  
rare



Mills, V.S., O'Hara, T.D. (2013) Ophiuroids (Echinodermata: Ophiuroidea) of biogenic habitats on the continental shelf of New Zealand. *Zootaxa* 3613(5): 401–444.

Hutton, F.W. (1872) *Catalogue of the Echinodermata of New Zealand, with diagnoses of the species*, Colonial Museum and Geological Survey Department, Wellington, 17 p.

main and inset image: Crispin Middleton

Class Crinoidea Order Comatulida Family Comasteridae



7 cm



Feather star with usually 10–20 feather-like arms composed of a central segmented spine bearing dozens of branching segmented pinnules, the main food-gathering device. They are mainly dark reddish-purple, with distinctive yellowish tips to the arm pinnules. There are 17–40 cirri (appendages used to anchor the animal to the substrate), each comprising 12–21 individual segments. *Oxycomanthus plectrophorum* is a similar colour but has more arms (usually > 20) and uniform coloured arm pinnules.

This species typically clings to rock surfaces or other organisms and can move short distances by using their arms to swim. Found in the north of the North Island, and widespread around Australia and the southwest Pacific

**It could also be .....**  
*Oxycomanthus plectrophorum*



McKnight, D.G. (1977) Additions to the New Zealand crinoid fauna. *New Zealand Oceanographic Records* 3(11): 93–112.

Naughton, K.M., O'Hara, T.D., Appleton, B., Gardner, M.G. (2014) Sympatric cryptic species in the crinoid genus *Cenolia* (Echinodermata: Crinoidea: Comasteridae) delineated by sequence and microsatellite markers. *Molecular Phylogenetics and Evolution* 78: 160–171.

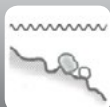


7 cm

morphology

habitat

environment



Feather star with usually 31–44 feather-like arms composed of a central segmented spine bearing dozens of segmented pinnules, the main food-gathering device. There are 33–73 cirri (appendages used to anchor the animal to the substrate), each comprising 30–37 segments. Colour mainly burgundy, chocolate-purple, deep brown, or black. They cling to rock surfaces or other organisms, e.g. black corals, and can move short distances by using their arms to swim. *Cenolia spanoschistum* is a similar colour but has fewer arms (usually < 20) and has yellowish tips to the arm pinnules.

Found all around New Zealand and widespread around Australia and the southwest Pacific. In Fiordland they are common as shallow as 8 m, but elsewhere are usually deeper than 30 m.

**It could also be .....**

*Cenolia spanoschistum*



McKnight, D.G. (1977) Additions to the New Zealand crinoid fauna. *New Zealand Oceanographic Records* 3(11): 93–112.

Naughton, K.M., O'Hara, T.D., Appleton, B., Gardner, M.G. (2014) Sympatric cryptic species in the crinoid genus *Cenolia* (Echinodermata: Crinoidea: Comasteridae) delineated by sequence and microsatellite markers. *Molecular Phylogenetics and Evolution* 78: 160–171.

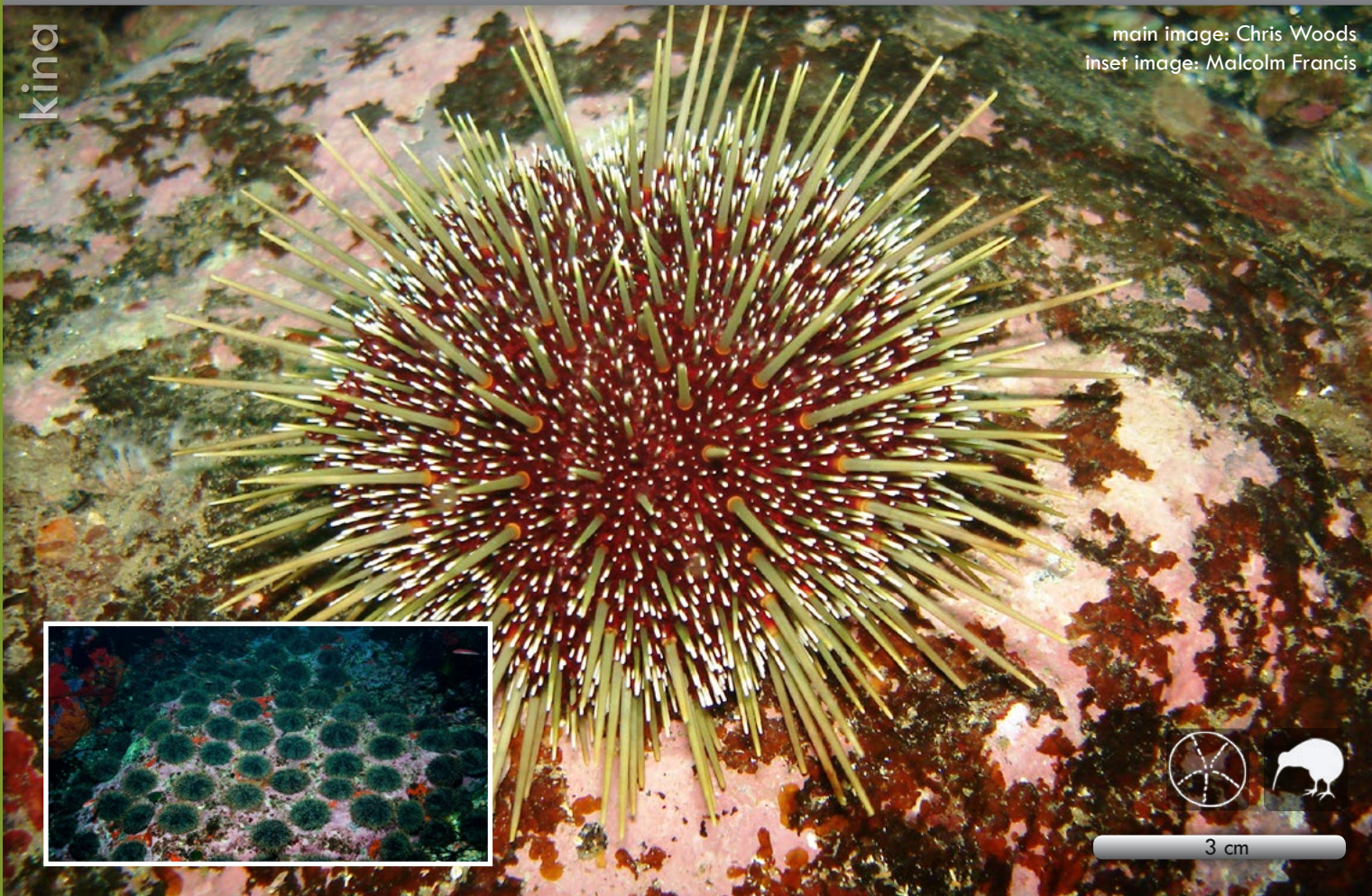
# *Evechinus chloroticus* (Valenciennes, 1846)

[Return to Index](#)

main image: Chris Woods  
inset image: Malcolm Francis

kina

Class Echinoidea  
Order Camarodonta  
Family Echinometridae



3 cm

morphology



surface



habitat



environment



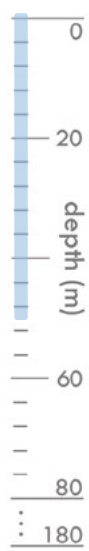
Round to slightly sub-pentagonal sea urchin, flattened, with solid sharp green spines. Spine tips of the smaller secondary spines, and occasionally the larger primary spines, white. Tube feet and the skin layer reddish-brown, but the test green when cleaned. Mouth central on the lower side with five, sharp-tipped teeth. Can be very large (up to 180 mm diameter) especially in southern areas.

Kina are found nestled in cracks and under ledges or fully exposed on open reefs. They often form large aggregations, stripping stands of algae to form areas of bare rock. Kina are edible, supporting significant commercial and recreational fisheries.

**It could also be .....**

*Pseudechinus novaezelandiae*

*Centrostephanus rodgersii*



Dix, T.G. (1970a) Biology of *Evechinus chloroticus* (Echinoidea: Echinometridae) from different localities 1. General. *New Zealand Journal of Marine and Freshwater Research* 4(2): 91-116.

Dix, T.G. (1972) Biology of *Evechinus chloroticus* (Echinoidea: Echinometridae) from different localities 4. Age, growth, and size. *New Zealand Journal of Marine and Freshwater Research* 6(1-2): 48-68.

image: Owen Anderson

Class Echinoidea  
Order Camarodonta  
Family Temnopleuridae

1 cm

morphology



surface



habitat



environment



Ball-shaped, slightly flattened dorso-ventrally. Spines short and solid, up to 10–12 mm long, and generally red-brown or purplish with distinctive white tips; those at the widest point of the test may be slightly flattened. The bare test is purplish-pink to greyish-brown; the tubercles a lighter shade, as are the pore-zones (tube feet) producing a sometimes distinctive radial stripe pattern.

Feeding apparatus (central on the lower side) with five, sharp-tipped teeth. Particularly abundant in the Marlborough Sounds, and often found semi-buried in coarse shell-rubble substrate, or on rocky reefs.

**It could also be .....**

*Pseudechinus huttoni*

*Pseudechinus novaezealandiae*



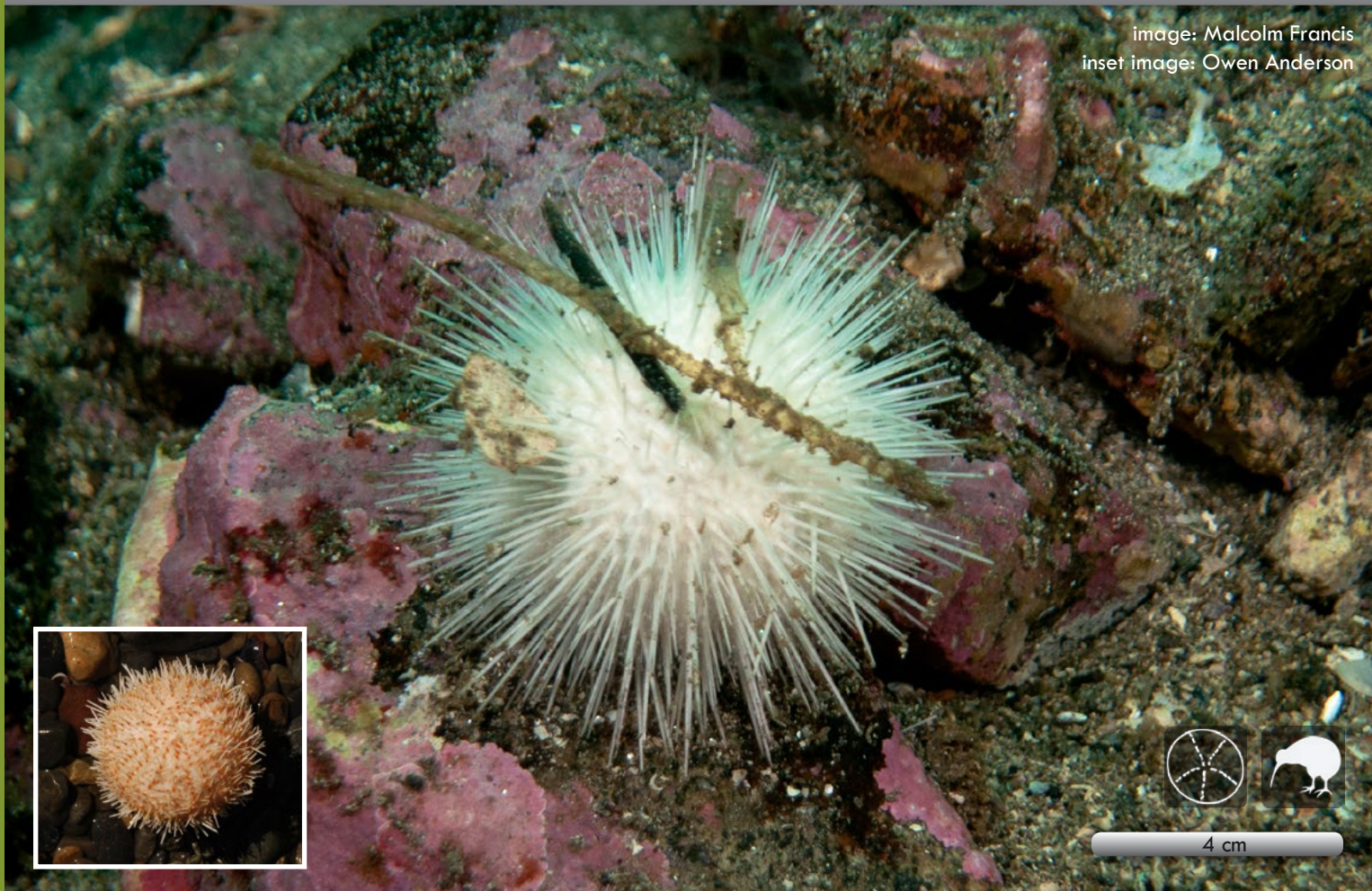
McKnight, D.G. (1979) An outline distribution of the New Zealand shelf fauna. Benthos survey, station list, and distribution of the Echinoidea. *New Zealand Oceanographic Institute Memoir* 47: 1–91.

Fell, H.B. (1952) Echinoderms from Southern New Zealand. *Zoology Publications of Victoria University* 18: 1–37.



image: Malcolm Francis  
inset image: Owen Anderson

Class Echinoidea  
Order Camarodonta  
Family Temnopleuridae



4 cm

morphology



surface



habitat



environment



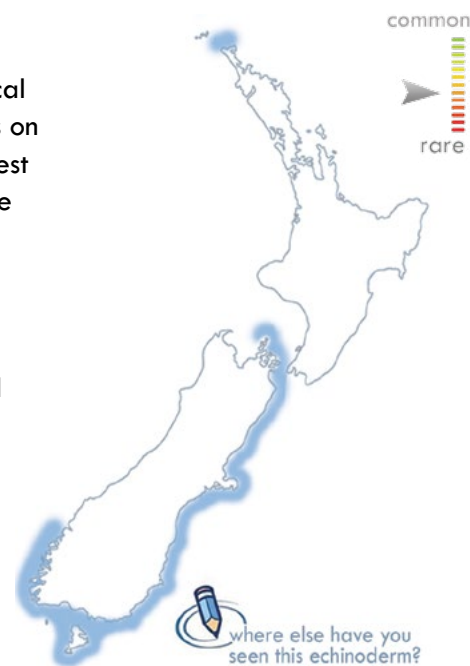
Ball-shaped, varying in height from moderately flattened to slightly conical on the upper surface. On larger specimens tubercles form distinctive rows on the widest part of the test. Spines short and solid, to about 10–12 mm. Test and spines white to pink in life, straw coloured when dried; spines may be greenish in some or a darker colour around the base.

Mouth central on the lower side with five, sharp-tipped teeth. Especially common in Fiordland and other southern regions, they are often found on a shelly-sand substrate where there is an abundance of drift or attached algae, and on rocky reefs.

**It could also be .....**

*Pseudechinus albocinctus*

*Pseudechinus novaezelandiae*



McKnight, D.G. (1979) An outline distribution of the New Zealand shelf fauna. Benthos survey, station list, and distribution of the Echinoidea. *New Zealand Oceanographic Institute Memoir* 47: 1–91.

Fell, H.B. (1952) Echinoderms from Southern New Zealand. *Zoology Publications of Victoria University* 18: 1–37.

image: Owen Anderson



2 cm

morphology



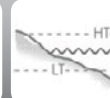
surface



habitat



environment



Ball-shaped, moderately flattened dorso-ventrally. Spines solid and very short, forming a dense, uniform coat; they are generally greenish-grey, but may be white or purple-tipped. The test is a dull grey-green, paler on the tubercles and around the pores.

Feeding apparatus (central on the lower side) with five, sharp-tipped teeth. This is a small species (maximum of about 50 mm test diameter). Known from around the South Island as well as Stewart, Campbell and Macquarie Islands.

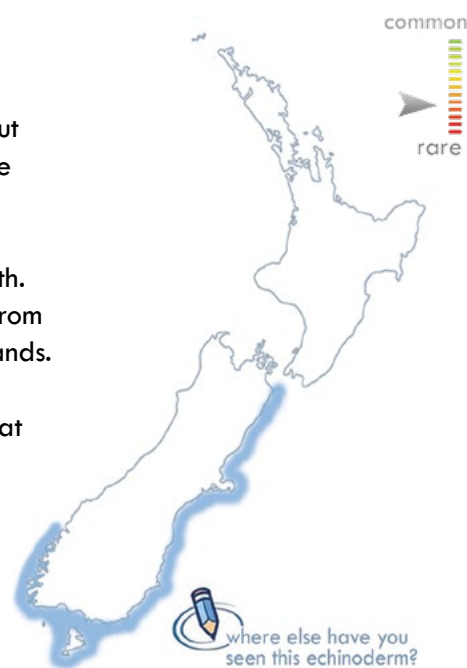
They are found mainly on hard substrates, often hidden – in the daytime at least – in narrow crevices between rocks or amongst rubble.

**It could also be .....**

*Evechinus chloroticus*

*Pseudechinus huttoni*

*Pseudechinus albocinctus*



sand dollar

 Class Echinoidea  
 Order Clypeasteroidea  
 Family Clypeasteridae


3 cm

morphology



surface



habitat



environment



Spherical, extremely flattened sea egg with a sinuous perimeter; dark to light brown or greyish-purple, with very short spines. Spine differentiation across the test visible as ten radiating stripes. The bare test is greyish-white. Petal-shaped regions adorn the upper surface and five food grooves radiate outwards from the centre on both surfaces. The anus is at the outer edge of the upper surface, the mouth in the centre of the lower side, teeth internal.

Sand dollars are highly mobile deposit feeders that live on the sand or are buried very shallow in the sand, often in high densities. Found around much of New Zealand and also the east coast of Australia including Tasmania.

**It could also be .....**



image: Malcolm Francis

## Rodgers sea urchin

Class Echinoidea | Order Diadematoidea | Family Diadematiidae



2 cm

morphology



surface



habitat



environment



Round sea urchin, quite flattened. Spines hollow, brittle, and sharp; length about equal to test diameter in small individuals but shorter in larger individuals; purplish-black and slightly iridescent green in colour with a rough, serrated outer surface. Cleaned test pale, with traces of purple and green on the upper surface. Mouth central on the lower side with five, sharp-tipped teeth. Can be quite large (to about 120 mm diameter).

They are usually found under boulders and in crevices during daylight, and come out to feed at night. Found in the north of the North Island, the east coast of Australia including Tasmania, New Caledonia, and Lord Howe Island.

It could also be .....  
*Evechinus chloroticus*

common



rare



Miskelly, A. (2002) *Sea urchins of Australia and the Indo-Pacific*. Capricornia Publications, Sydney, Australia, 180 p.

McKnight, D.G. (1979) An outline distribution of the New Zealand shelf fauna. Benthos survey, station list, and distribution of the Echinoidea. *New Zealand Oceanographic Institute Memoir* 47: 1-91.

Image: Owen Anderson

Class Echinoidea Superorder Neognathostomata Family Apatopygidae



2 cm

morphology

surface

habitat

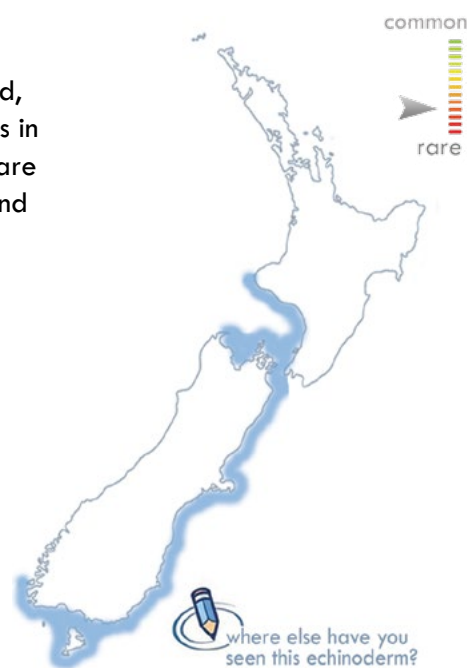
environment



This sea urchin has an oval body shape which is wider at the posterior end, flat on the underside, and rounded on the upper side. The mouth (toothless in adults) is located just forward of the centre of the lower side. The spines are solid, short on the upper side and long on the lower side. In life the test and spines are reddish-brown, the dead test is greyish-white.

They live buried typically in coarse, shelly sea bed, about 30 mm deep, where they feed by ingesting large amounts of sediment and filtering out nutritious particles.

**It could also be .....**  
*Echinocardium cordatum*



Fell, H.B. (1952) Echinoderms from Southern New Zealand. *Zoology Publications of Victoria University* 18: 1–37.

Pawson, D.L. (1962) The Echinozoan Fauna of the New Zealand Subantarctic islands, Macquarie Island, and the Chatham Rise. *New Zealand Oceanographic Institute Memoir* 42: 1–35.

# *Echinocardium cordatum* (Pennant, 1777)

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image: Owen Anderson  
inset image: Mark Spencer, AUSCAPE

heart urchin

Class Echinoidea Order Spatangoida Family Loveniidae



2 cm

morphology



surface



habitat



environment



Test heart-shaped, convex on upper surface, flatter below. The anus at the narrow end, the mouth (toothless) on the lower surface near the blunt end. The tube feet form petals on the upper surface, the anterior petal lying in a deep groove which continues down to the mouth. Spines a glistening golden to greenish grey, brushed flat against the test. Living up to several centimetres deep in soft mud or sand, they use specialised tube feet to create a respiratory shaft to the surface, and feed by extracting minute food particles from the mud that passes through their digestive tract when moving through the substrate.

Widespread around New Zealand and Australia, north and south Pacific, the Atlantic, and Mediterranean, but discontinuously. Not found in tropical seas.

**It could also be .....**

*Apatopygus recens*



McKnight, D.G. (1979) An outline distribution of the New Zealand shelf fauna. Benthos survey, station list, and distribution of the Echinoidea. *New Zealand Oceanographic Institute Memoir* 47: 1-91.

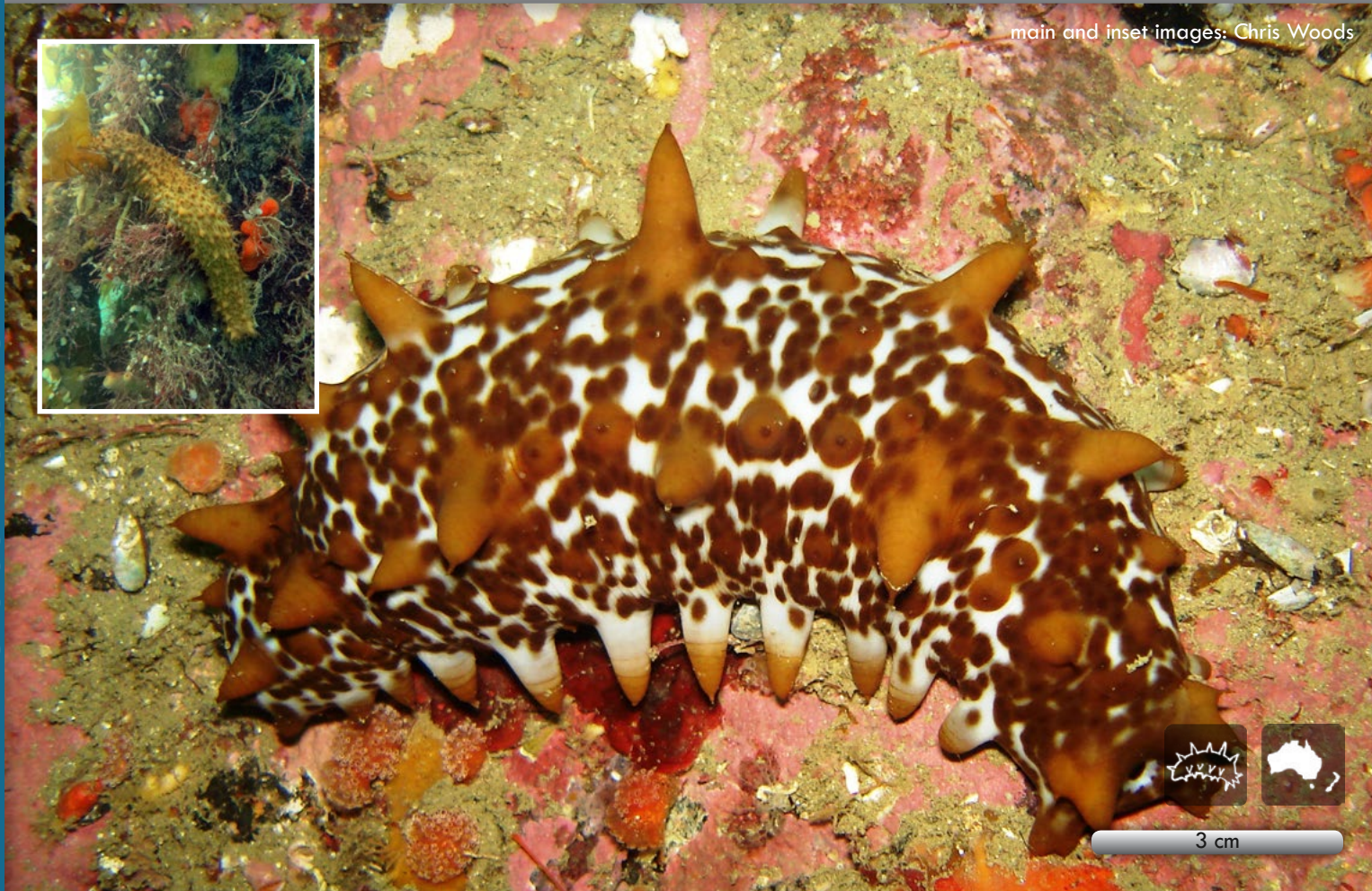
Fell, H.B. (1958) Deep-Sea echinoderms of New Zealand. *Zoology Publications from Victoria University of Wellington* 24: 1-40.

# *Australostichopus mollis* (Hutton, 1872)

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main and inset images: Chris Woods

Class Holothuroidea Order Aspidochiroidea Family Holothuridae



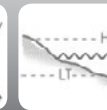
3 cm

morphology

surface

habitat

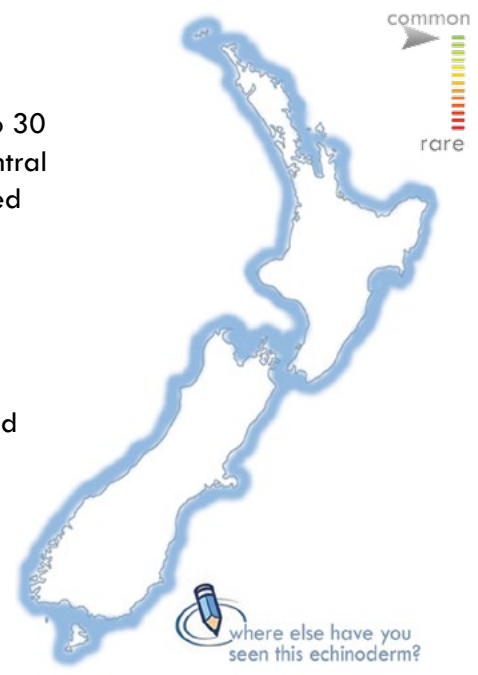
environment



*Australostichopus mollis* is New Zealand's most conspicuous sea cucumber characterised by its mottled light brown or black body. It can reach up to 30 cm long and has a warty dorsal surface with numerous radial rows of ventral tube feet, and a squishy texture. It is regularly seen with forward extended shield-shaped tentacles shoveling sediment into its mouth and a thick mud faecal coil emerging behind.

It lives in many habitats from shallow rock pools to subtidal sandy mud bottoms. It is distributed all around New Zealand with higher densities in Fiordland, Stewart Island and the Marlborough Sounds. Also found around New South Wales coast around to southwestern Australia.

It could also be .....  
*Holothuria integra*



Sewell, M.A. (1990) Aspects of the ecology of *Stichopus mollis* (Echinodermata: Holothuroidea) in north-eastern New Zealand, *New Zealand Journal of Marine & Freshwater Research* 24(1): 97–103.

Mah, C.L., McKnight, D.G., Eagle, M.K., Pawson, D.L., Ameziane, N., Vance, D. J., Baker, A.N., Clark, H.E.S., Davey, N. (2009) Phylum Echinodermata: sea stars, brittle stars, sea urchins, sea cucumbers, sea lilies. In Gordon, D.P. (Eds.), *New Zealand Inventory of Biodiversity, volume 1, Kingdom Animalia: Radiata, Lophotrochozoa, Deuterostomia*. Canterbury University Press, 371–400 pp.

main and inset image: NIWA

Class Holothuroidea Order Aspidochiroidea Family Holothuriidae



7 cm

morphology

surface

habitat

environment



*Holothuria integra* is greyish-brown with white spots, and is sausage-shaped; Little is known of its life history. Specimens collected or photographed indicate it extends to 30 cm length and has small papillae or bumps dorsally and tube feet ventrally. It is soft to touch yet has a thickish leathery body wall and pelate tentacles.

*Holothuria integra* lives on coarse shell and sand or amongst cobbles. It is known to be distributed in the northern part of New Zealand and also known from South Africa and the Philippines.

It could also be .....  
*Australostichopus mollis*





image: Niki Davey

Class Holothuroidea Order Dendrochiroidea Family Cucumariidae



1.5 cm

morphology

surface

habitat

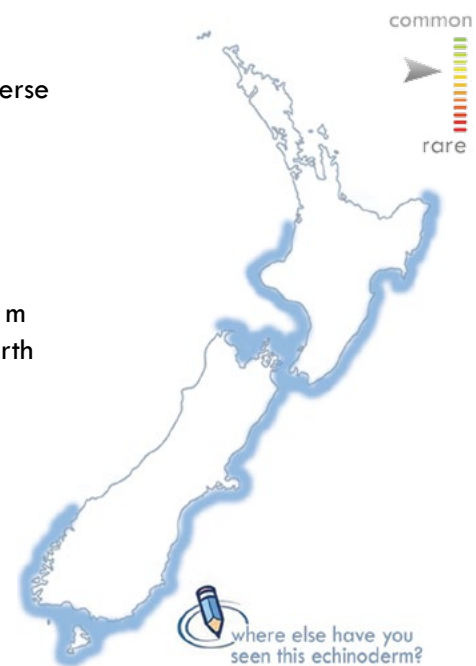
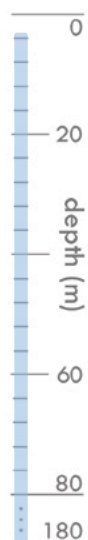
environment



*Amphicyclus thomsoni* has a pentagon-shaped body with numerous transverse wrinkles. It reaches up to 7.5 cm in length and is yellowish-brown. It has numerous tube feet radially and 25 dendritic tentacles arranged in two concentric rings. This species is squishy to touch and contracts easily.

It lives cryptically in coarse muddy shelly sand where it covers itself with debris. It is also found under and between boulders. It lives down to 180 m depth but can be seen at diveable depths and is distributed from the North Island's East Cape south to Stewart Island.

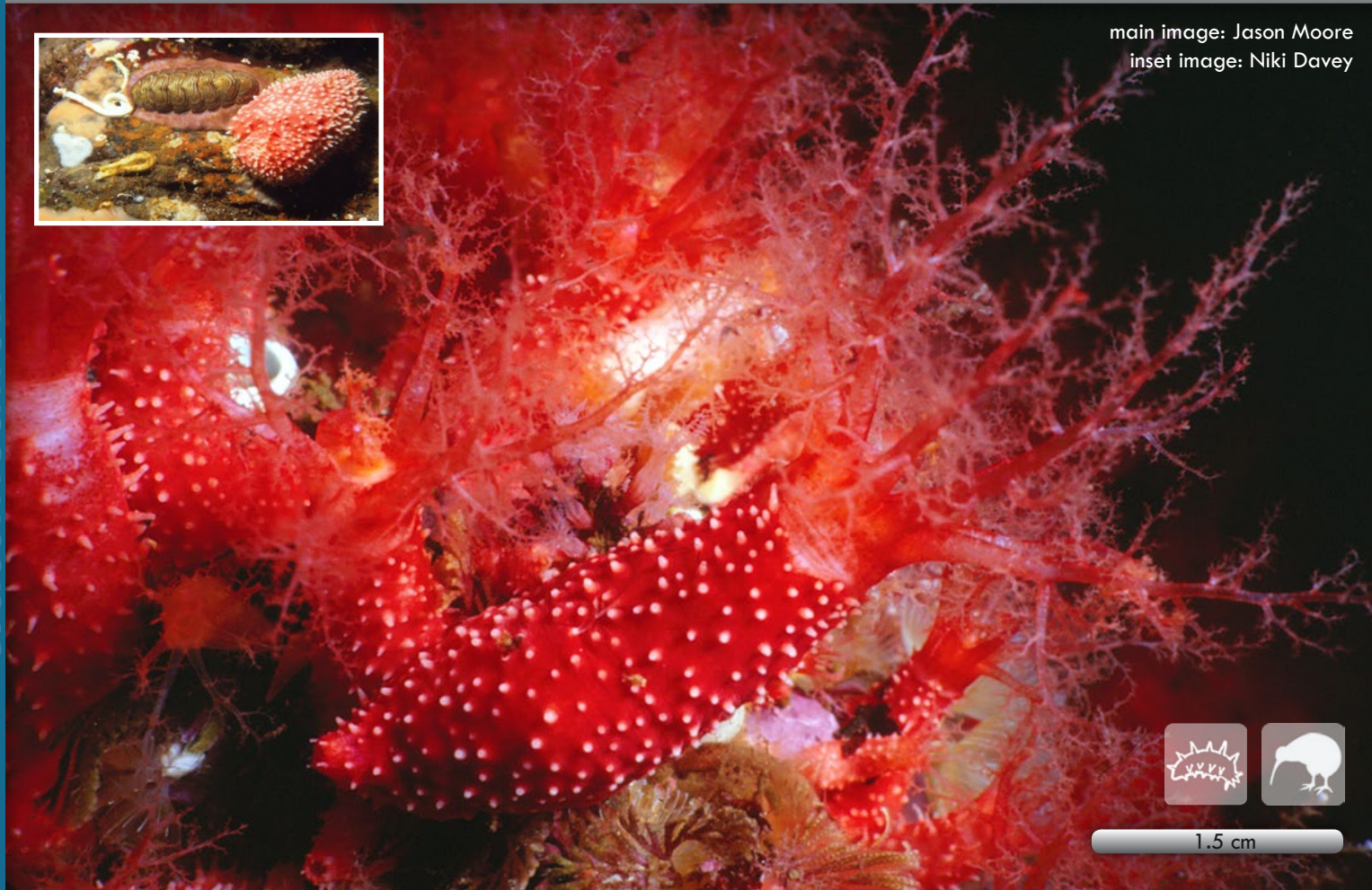
It could also be .....



# *Squamocnus brevidentis* (Hutton, 1872)

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main image: Jason Moore  
inset image: Niki Davey



1.5 cm

morphology

surface

habitat

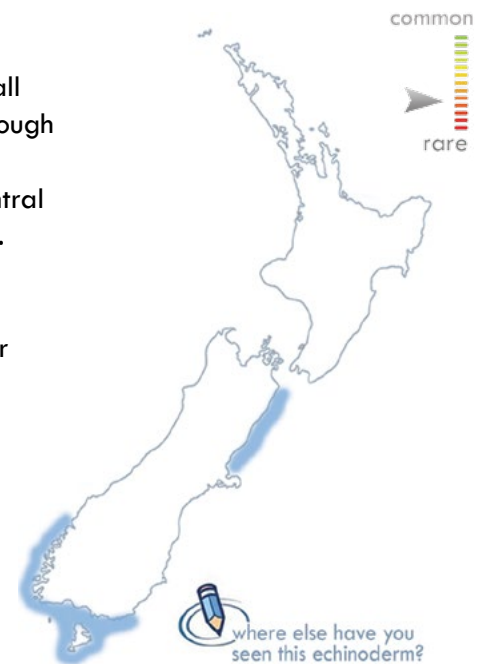
environment

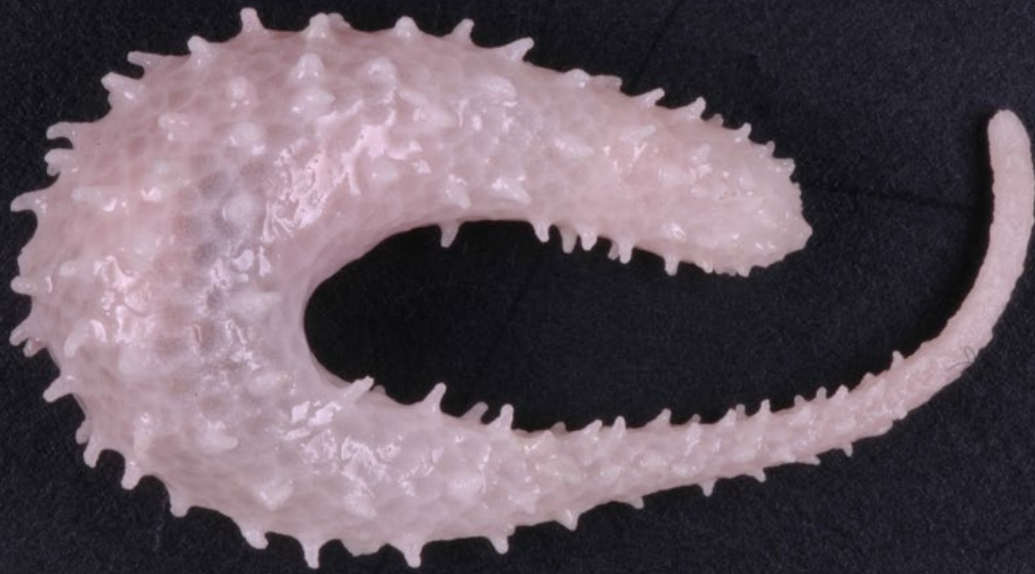


*Squamocnus brevidentis* is a stunning deep red holothurian covered in small white bumps (tubefeet or papillae) reaching lengths of 5.5 cm. It has a tough bumpy integument and extensive dendritic tentacles which are extended into the currents when feeding. The females brood their young on the ventral surface so at times tiny pink specks can be found underneath a specimen.

This species is found covering rock walls and platforms in Fiordland, in densities up to 800 per m<sup>2</sup>. Alternatively it can be found cryptically under rocks, in crevices and amongst rubble in other locations.

It could also be .....





0.3 cm

morphology

surface

habitat

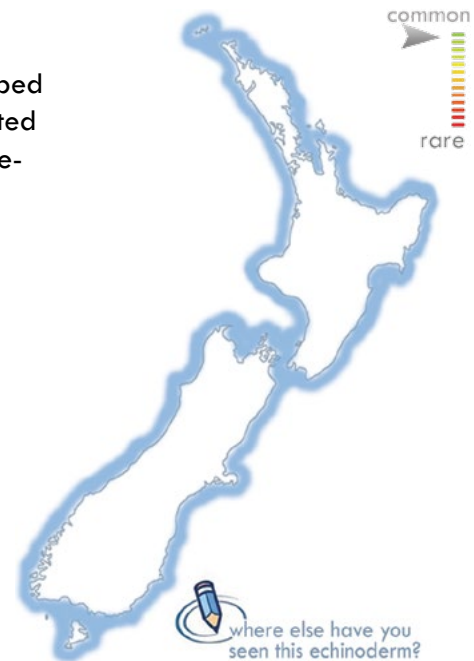
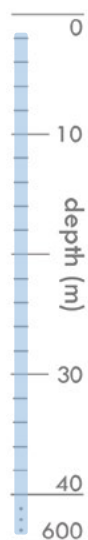
environment



*Heterothyone alba* is a very common grey to white holothurian. It is U-shaped and has a total length of up to 2.5 cm. The tentacles are normally retracted and the posterior end tapers to form a slender tail. The body wall is scale-like, thick and firm with numerous stiff tube feet. It tends to hold its shape after collection.

It lives in a sandy mud bottom, sometimes amongst fine rubble. It is found round the entire New Zealand coast and known to be eurybathic.

It could also be .....





2.5 cm

morphology



surface



habitat



environment








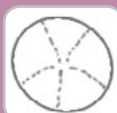

*Paracaudina chilensis* is a common holothurian that is found in sediment or cast onto the shore following a storm event. It has a distinct bulbous body and elongate tail reaching up to 15 cm. The body wall surface is wrinkled and has no tube feet. Colouration is pale cream to brown, often with grit attached to the firm integument.







It lives buried in the soft sediment with its anus and tentacles exposed for feeding and respiration. They are distributed throughout New Zealand, Australia and further widespread.

It could also be .....






























## icons

body plan		sea star	asteroid		feather star	crinoid
		brittle star	ophiuroid		sea cucumber	holothurian
		snake star	ophiuroid with coiling arms		sea egg	echinoid
		basket star	ophiuroid with branching arms			









life history		native	naturally occurring around New Zealand, endemic		southwest pacific	naturally occurring around New Zealand, Australia and other pacific locations
		range extension	since first described in NZ, this species has been recorded elsewhere		introduced	species first described from outside of New Zealand waters and is found in New Zealand and other locations, invasive
		antipodean	naturally occurring around New Zealand and Australia only		widespread	species recorded globally

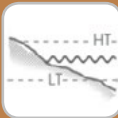






## icons

morphology		ball	spherical, globular or semi-spherical		gherkin	gherkin-shaped sea cucumber with sharp or blunt protrusions
		disk	circular, distinctively flattened, biscuit-shaped		tail	sausage-shaped sea cucumber with thinner tail
		heart	heart-shaped, cordate		snake arms	coiling vertically, can wrap coral branches
		aristotle's lantern	intricate feeding mechanism		brittle arms	can bend horizontally, no vertical coiling
		margins	an obvious series of marginal plates which may or may not bear spines		tube feet	flexible, stalked tentacles, sometimes with suckers, protruding from body wall
		5+ arms	> 5 arms, may be between 6 and 12		pelate tentacles	shield-shaped tentacles around sea cucumber mouth
		5 arms	5 long or short arms, sometimes 4 or 6 if damaged		dendritic tentacles	branching, tree-like tentacles around sea cucumber mouth
		crinoid arms	very brittle, feather-like arms in multiples of 5		digitate tentacles	finger-like tentacles around sea cucumber mouth

surface		smooth	even, hairless, silky, can be slightly undulating		warty	bearing small flattened bumps or tubercles, verrucose
		rough	irregularly pitted and ridged surface, often tough		granular	surface covered in small to medium sized granules
		soft	soft to the touch, easily compressible, elastic		hard	hard to the touch, not compressible, rigid
		spined	surface covered in spines		deeply wrinkled	bearing irregularly parallel ribs and grooves along the body wall
		spikey	surface covered in spikes		leathery	thick skin, tough, flexible, slightly elastic
		plates	bony units layered on the outer body wall			

## icons

habitat		rock	hard substrate such as mudstone, sandstone, basalt, compressed carbonates		mud	very fine muddy and silty sediments derived from terrigenous rocks, soils and clays
		rubble	shell, stone, and pebble rubble		epizoic/epiphytic	living or growing on the external surface of an animal (epizoic) or seaweed, (epiphytic)
		sand	small coarse grains of worn silica, rock, and shell		artificial substratum	anything man-made such as mooring blocks, mussel lines, wharf piles
		rockpool	indentation in rock filled with water, intertidal		algal beds	coralline algae, seagrass or algal beds

environment		intertidal	exposed shoreline zone between high and low tides, including rock flats, pools, overhangs, crevices, organisms exposed to wave action, temperature extremes, full illumination, and desiccation		covered rock	sand and rubble spread over underlying hard substrate, organisms attached to basement rock susceptible to inundation and scouring from wave surge and currents, and subdued illumination
		subtidal	zone below the low tide, including rock flats, slopes, walls, crevices, overhangs, boulder fields, organisms exposed to wave surge and currents, and subdued illumination		seabed	composed of a variety of sedimentary substrates including coarse gravels, shell hash and sands to finer sand, mud, and silts, organisms susceptible to inundation and scouring from wave surge and currents, and subdued illumination
		wall	underwater cliffs and slopes, organisms exposed to wave surge and currents, and subdued illumination		bank	seabed raised into a bank of compacted rubbles and other carbonate materials including shell, kina and sealace hash, organisms exposed to wave surge and currents, and subdued illumination
		indents	underwater caves, shelves and overhangs, organisms may experience wave surge, subdued illumination, or near darkness			

## glossary

algal beds	areas of seafloor with coralline algae, sea-grass or multiple seaweed species
amorphous	without definable shape, often with lobed surface, potato or tuber-shaped, massive
anterior	towards the front
aristotle's lantern	the intricate feeding apparatus (sometimes called 'jaws') unique to echinoids (sea urchins, sea eggs)
artificial substratum	anything man-made such as mooring blocks, mussel lines, wharf piles
asteroid	scientific name for a sea star or starfish
antipodean	naturally occurring in New Zealand and Australia, and may include seamounts and ridges to the north
ball	spherical, globular or semi-spherical
banded	stripes of two or more different colours
bank	seabed raised into a bank of compacted rubble and other carbonate materials including shell, kina and sea lace hash, organisms exposed to wave surge and currents, and subdued illumination
blunt	not sharp, rounded ends
brittle	fragile but rigid, breaks apart easily
basket star	popular name for a ophiuroid with branching arms
brittle arms	can bend horizontally, no vertical coiling, in brittle stars
brittle star	popular name for a ophiuroid
bursal slit	opening to the pouch or sac from whence juvenile ophiuroids or eggs are released
calyx	cup
cirri	appendages used to anchor crinoids (feather stars and sea lilies) to the seafloor
cordate	heart-shaped
covered rock	sand and rubble spread over underlying hard substrate, organisms attached to basement rock susceptible to inundation and scouring from wave surge and currents, and subdued illumination
crinoid	the scientific name for sea lilies and feather stars
crinoid arms	very brittle, feather like arms in multiples of 5
dendritic	tentacles branching, tree-like tentacles around sea cucumber mouth
deposit feeder	an animal that feeds on particles of organic matter present in surface sediments
diameter	the distance across the widest point of a circle
digitate	tentacles finger-like tentacles around sea cucumber mouth
disc	circular, distinctively flattened, biscuit-shaped
dorsal	upper surface of the animal
echinoid	the scientific name for a sea urchin or sea egg
endemic	naturally occurring in New Zealand, but not elsewhere
environment	physical, chemical, ecological, behavioural, and other conditions experienced by an organism
epiphytic	living or growing on the external surface of a plant
epizoic	living or growing on the external surface of an animal
eurybathic	can live or be found at many depths
feather star	popular name for a form of crinoid lacking a stalk
firm	requires some pressure to compress
fleshy	feels like skin or edam cheese, dense
food grooves	channels in the test of sand dollars used for transporting food particles to the mouth
gonad	reproductive structure
granular	surface covered in small to medium sized rounded or square granules, giving a sand-papery texture due to calcareous or siliceous minerals in or on (echinoderms) the surface of the organism
habitat	the environment and local situation in which an organism lives
hard	solid to the touch, not compressible, rigid
holothuroid	the scientific name for a sea cucumber, holothurian
indents	underwater caves, shelves and overhangs, organisms that live there may experience wave surge, subdued illumination, or near darkness
integument	outer body wall or skin
interstices	the gaps and spaces between things e.g., rocks, sand-grains or seaweed holdfasts
intertidal	exposed shoreline zone between high and low tides, including rock flats, pools, overhangs, crevices, organisms that live there are exposed to wave action, temperature extremes, full illumination, and desiccation
introduced	species first described from outside of New Zealand waters and is found in New Zealand and other locations, invasive, adventive
lateral	side of an animal
leathery	thick, tough, flexible, slightly elastic
margins	an obvious series of marginal plates which may or may not bear spines
morphology	form and structure, shape
mottled	variable, blotchy, patterning of several colours



mud	very fine silty sediments derived from terrigenous rocks, soils and clays
naked	surface unadorned by spines or granules, usually smooth
native	naturally occurring in New Zealand, but may also occur naturally elsewhere, endemic
ophiuroid	the scientific name for a brittle star, basket star or snake star
oral	related to the mouth of an animal
ossicle	a small mineral (calcium carbonate) element embedded in the body wall of an echinoderm
papillae	specialised dorsal tube feet lacking a suckered tip (holothurians), small bony scales that are attached to the jaw, mouth, disc, being free at one end (ophiuroids)
peltate	tentacles shield-shaped tentacles around sea cucumber mouth
peristome	parts surrounding the mouth of various invertebrates such as the echinoderms
petals	leaf-shaped concentrations of ambulacral pores on the tests of sand dollars and heart urchins
pinnules	small, segmented, food gathering appendages which give crinoids their feather-like appearance
plastron	in spatangoid echinoids, an enlarged area behind the mouth bearing locomotory spines
plates	bony units layered on the outer body wall of an echinoderm
pom pom	disc adornment resembling a fluffy ball
posterior	towards the rear of the organism
primary spines	long, large diameter sea urchin spines; may be a different colour to the secondary spines
radius	distance between the edge and centre of a circle
range extension	since first described in New Zealand, this species has been recorded elsewhere
refuge	safe place to hide from predators
rock	hard substrate such as mudstone, sandstone, basalt, compressed carbonates
rockpool	indentation in rock, filled with water, intertidal zone
rosette	the arrangement of small spines or plates in a radiating circle pattern
rough	irregularly pitted and ridged surface, often tough
rubble	shell, stone, and pebble rubble
sand	small coarse grains of worn silica, rock, and shell
sea lily	popular name for a stalked crinoid
sea star	popular name for an asteroid
sea cucumber	popular name for a holothurian, holothoroid
sea urchin	popular name for a echinoid
sea egg	popular name for a echinoid
seabed	composed of a variety of sedimentary substrates including coarse gravels, shell hash and sands to finer sand, mud, and silts, organisms susceptible to inundation and scouring from wave surge and currents, and subdued illumination
secondary spines	short, small diameter sea urchin spines; may be a different colour to the primary spines
sinuous	wavy pattern
smooth	even, hairless, silky, can be slightly undulating
snake star	popular name for an ophiuroid with coiled arms
snake arms	arms coiling vertically, can wrap around coral branches
soft	easily compressible, elastic
starfish	popular name for an asteroid
spined	surface covered with spines (echinoderms), or prickly bundles of very long spicules projecting from surface of the organism (sponges)
subtidal	zone below the low tide, including rock flats, slopes, walls, crevices, overhangs, boulder fields, organisms exposed to wave surge and currents, and subdued illumination
surface	patterning or ornamentation on the surface of the body of an animal
tail	sausage-shaped sea cucumber with thinner tail
test	calcium carbonate skeleton of a sea urchin, composed of twenty columns of individual plates
translucent	lets light through body wall or surface of organism, but not enough to perceive distinct details through it.
transverse	across the short axis of the body wall
tube feet	flexible, fluid-filled, stalked tentacles, sometimes with suckers, protruding from body wall
tubercles	hard, sometimes warty, calcified lumps that sit embedded in or on the body surface, in sea urchins they incorporate the basal articulation of the spines
ventral	lower surface or underside of the animal that sits on the seabed
wall	underwater cliffs and slopes, organisms exposed to wave surge and currents, and subdued illumination
warty	bearing small flattened bumps or tubercles
widespread	species recorded globally

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## further reading

### General

- Mah, C.L., McKnight, D.G., Eagle, M.K., Pawson, D.L., Ameziane, N., Vance, D. J., Baker, A.N., Clark, H.E.S., Davey, N. (2009) Phylum Echinodermata: sea stars, brittle stars, sea urchins, sea cucumbers, sea lilies. In Gordon, D.P. (Ed.), *New Zealand Inventory of Biodiversity, Volume 1, Kingdom Animalia: Radiata, Lophotrochozoa, Deuterostomia*. Canterbury University Press, 371–400 pp.
- Hendler, G.L., Kier, M.P., Miller, J.E., Pawson, D.L. (1995) *Sea stars, sea urchins and allies*. Smithsonian Institution Press, Washington, 392 p.
- Miskelly, A. (2009) *Sea urchins of the World: diversity, symmetry, and design* [Ashley Miskelly, 2009, Blackheath, N.S.W. ISBN: 9780646518961 (hbk)], 103 p.
- Paine, R.T. (1971) A short-term experimental investigation of resource partitioning in a New Zealand rocky intertidal habitat. *Ecology* 52: 1096–1106.
- Waters, J.M., Roy, M.S. (2003) Marine biogeography of southern Australia: phylogeographical structure in a temperate sea-star. *Journal of Biogeography* 30: 1787–1796.
- Willan, R.C. (1981) Soft-bottom assemblages of Paterson Inlet, Stewart Island. *New Zealand Journal of Zoology* 8(2): 229–248.
- Wing, S. (2008) *Subtidal invertebrates of New Zealand: a divers' guide*. Canterbury University Press, 148 p.

### Ophiuroids

- Bell, F.J. (1917) Echinoderma. Part 1. Actinogonidiata. *British Antarctic 'Terra Nova' Expedition 1910. Zoology* 4: 1–10.
- Clark, H.L. (1909) Scientific results of the trawling expedition of H.M.C.S. *Thetis*. Echinodermata. *Memoirs of the Australian Museum* 4: 519–564.
- Farquhar, H. (1900) On a new species of Ophiuroidea. *Transactions of the New Zealand Institute* 32: 405–406.
- Gislén, T. (1926) On the generic types of the ophiuroid genus *Ophiocentrus* Ljungman (*Amphiocnida* Verrill). *Göteborgs Kungliga Vetenskaps och Vitterhets Samhälles Handlingar* 30: 3–16.
- Lyman, T. (1879) Ophiuridae and Astrophytidae of the exploring voyage of H.M.S. *Challenger*, under Prof. Sir Wyville Thomson, F.R.S. Part 2. *Bulletin of the Museum of Comparative Zoology, Harvard University* 6: 17–83.

Mortensen, T. (1925) Echinoderms from New Zealand and the Auckland-Campbell Islands. III–V. Asteroidea, Holothuroidea and Crinoidea. *Videnskabelige Meddelelser fra Dansk Naturhistorisk Forening* 79: 263–420.

### Echinoids

- Dix, T.G. (1970b): Biology of *Evechinus chloroticus* (Echinoidea: Echinometridae) from different localities 2. Movement. *New Zealand Journal of Marine and Freshwater Research* 4: 267–77.
- Dix, T.G. (1970c): Biology of *Evechinus chloroticus* (Echinoidea: Echinometridae) from different localities 3. Reproduction. *New Zealand Journal of Marine and Freshwater Research* 4: 385–405.
- McLary, D., Barker, M. (1998) Reproductive isolation? Interannual variability in the timing of reproduction in sympatric sea urchins, genus *Pseudechinus*. *Invertebrate Biology* 117(1): 75–95.
- Miskelly, A. (2009) *Sea urchins of the world: diversity, symmetry, and design* [Ashley Miskelly, 2009, Blackheath, N.S.W. ISBN: 9780646518961 (hbk)], 103 p.

### Crinoids

- Hoggett, A.K., Rowe, F.W.E. (1986) A reappraisal of the family Comasteridae A.H. Clark, 1908 (Echinodermata: Crinoidea), with the description of a new subfamily and a new genus. *Zoological Journal of the Linnean Society* 88: 103–142.

### Asteroids

- Byrne, M., Gonzalez-Bernat, M., Doo, S., Foo, S., Soars, N., Lamare, M. (2013) Effects of ocean warming and acidification on embryos and non-calcifying larvae of the invasive sea star *Patiriella regularis*. *Marine Ecology Progress Series* 473: 235–246.
- Crump, R.G. (1971) Annual reproductive cycles in three geographically separated populations of *Patiriella regularis* (Verrill), a common New Zealand asteroid. *Journal of Experimental Marine Biology and Ecology* 7(2): 137–162.
- Georgiades, E.T., Temara, A., Holdway D.A. (2006) The reproductive cycle of the asteroid *Coscinasterias muricata* in Port Phillip Bay, Victoria, Australia. *Journal of Experimental Marine Biology and Ecology* 332(2): 188–197.
- Grange, K.R., Singleton, R.I., Richardson, J.R., Hill, P.J., Main W. de L. (1981) Shallow rock-wall biological associations of some southern fiords of New Zealand. *New Zealand Journal of Zoology* 8(2): 209–227.
- Lane, D.J.W., Rowe, F.W.E. (2009) A new species of *Asterodiscides* (Echinodermata, Asteroidea, Asterodiscididae) from the tropical southwest Pacific, and the biogeography of the genus revisited. *Zoosystema* 31(3): 419–429.
- Town, J.C. (1980) Movement, morphology, reproductive periodicity, and some factors affecting gonad production in the seastar *Astrostele scabra* (Hutton). *Journal of Experimental Marine Biology and Ecology* 44(2): 111–132.

