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PENNATULACEA (SEA PENS) DESCRIPTIONS FOR THE NEW ZEALAND REGION

A field guide of commonly sampled New Zealand sea pens including illustrations highlighting technical terms and sea pen morphology

Gary Williams, Di Tracey and Erika Mackay

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Preface

This guide builds on the 3rd edition of 'A guide to common deepsea invertebrates in New Zealand waters' (Tracey et al. 2011) and the 'Coral Identification Guide' (Tracey et al. 2008).

The authors wish to thank the various NIWA staff who have contributed to the at-sea sample collection, curation, and database extracts. Particularly we acknowledge Kate Neill who has enabled the authors to produce an improved final version, Kareen Schnabel and Sadie Mills, NIWA Invertebrate Collection for access to samples, Rob Stewart for sourcing in situ DTIS images, Peter Marriott for photographing various specimens, Brent Wood for his production of the distribution plots, and Sean Handley for providing the *in situ* images from the Fiordland region under the Department of Conservation Project DOC09304. We also thank David Fisher (NIWA) and the Data Management team (MPI) for providing MPI species codes.

Various funding agencies are acknowledged: Gary Williams was funded to visit NIWA by the visiting scientist fund (SA123093) and the Ministry of Business, Innovation and Employment (MBIE) who provided support for Gary to participate as a panellist in the December 2–3, 2011 Marine Think Tank session *Deep-sea coral research to enhance conservation* as part of the International Congress on Conservation Biology (ICCB) Symposium. This output builds on the New Zealand Joint Committee Meeting (JCM) on Science and Technology Cooperation and cross cutting theme 2.4: Marine and Ocean Research. Collaborations and activities under this theme will improve management of marine resources and marine conservation in the Pacific (MBIE13301). Additional funding to help produce this guide was provided by NIWA under Coasts and Oceans Research Programme 2 (2012/13 SCI). Project code COBR1302 and we thank NIWA Chief Scientist Barb Hayden (Coast and Oceans) and Principal Scientists Malcolm Clark, Wendy Nelson, Michelle Kelly for this core funding support.

Finally we thank the Ministry for Primary Industries (MPI), particularly Richard Ford for supporting the printing of this guide and Marianne Vignaux for her insightful editorial comments. Phil Alderslade (CSIRO, Hobart, Australia), provided a thorough review and we acknowledge his effort and expertise.

PENNATULACEA (SEA PENS) DESCRIPTIONS FOR THE NEW ZEALAND REGION

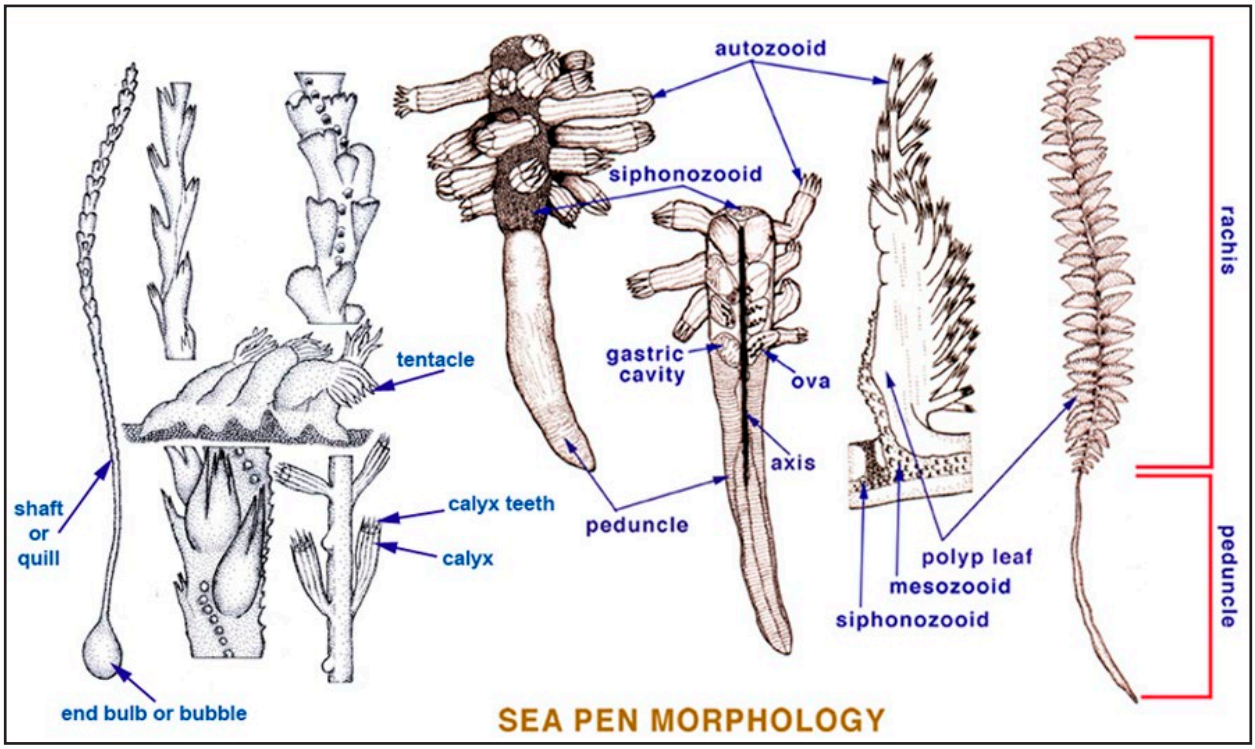
INTRODUCTION

Corals are cnidarian animals whose range of diversity exhibits an extremely high morphological variability. Coral species are distributed in all the world's seas, including the polar regions, as well at virtually all depths (from intertidal to 8600 m). Several groups form a hard skeleton that is composed of calcium carbonate, or a dense and usually dark protein, or a combination of the two. Only about fifteen percent of corals actually build coral reefs – the hermatypic hard corals (Williams & Cairns, 2013).

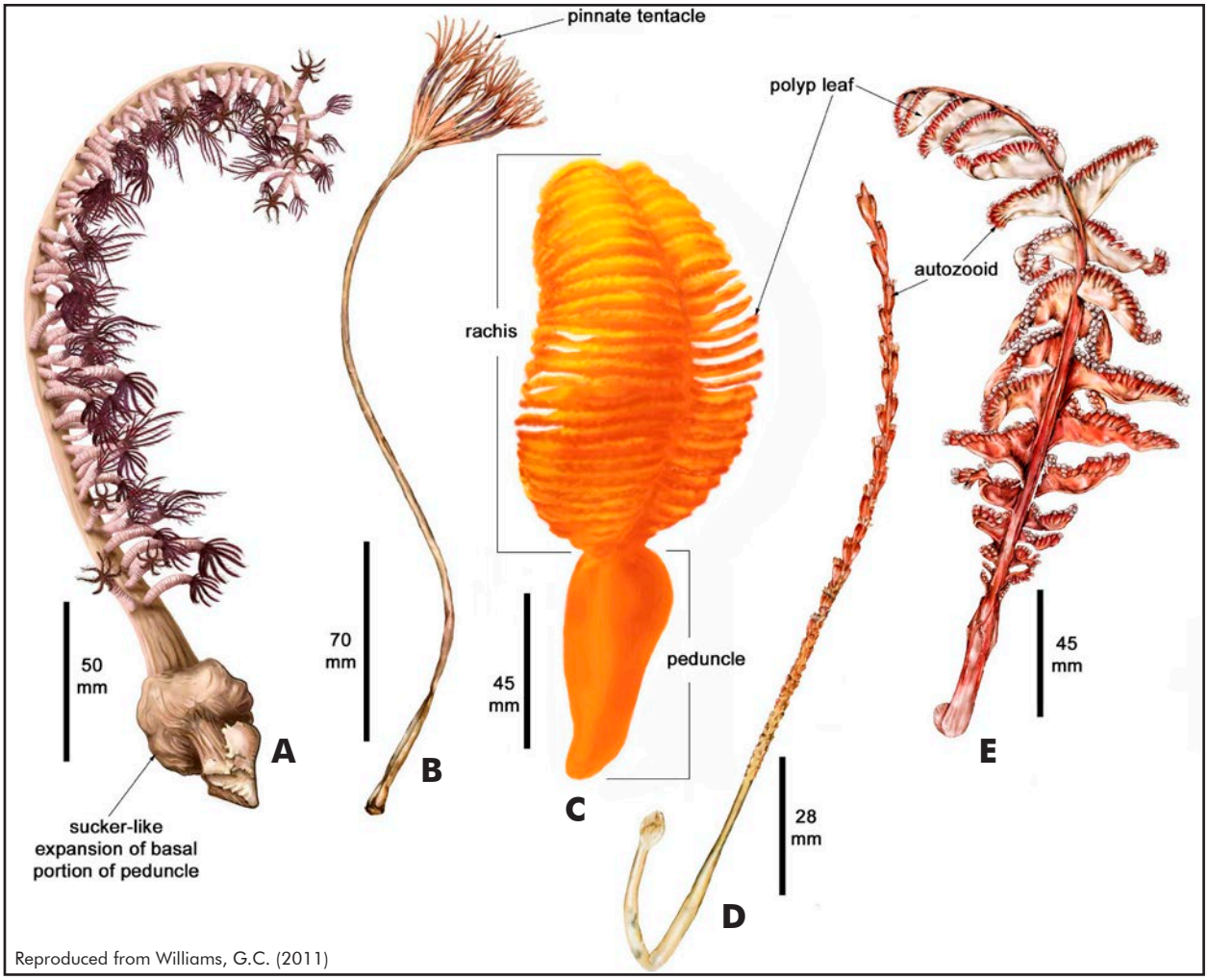
The pennatulaceans (commonly called sea pens) are specialized and morphologically distinct and are thus unlike other octocorals (such as soft corals or sea fans), or any other kind of coral for that matter (Williams, 2011). The single oozooid or primary polyp forms the body of the adult colony and gives rise to several kinds of secondary polyps: autozooids for feeding and sexual reproduction, siphonozooids for internal water circulation, mesozooids for exhalent water circulation, and acrozooids for asexual (vegetative) reproduction. Autozooids and siphonozooids occur in all sea pens, while mesozooids and acrozooids are found only in a few species of the genera *Pennatula* and *Pteroeides* (Williams et al., 2013). Virtually all sea pens attach to the soft substrata of benthic sediments by an unbranched rootlike and sausage-shaped muscular peduncle enabling them to stand erect, with the exception of four species of "rockpens" that attach to deep-sea rocky outcrops by a sucker-like modification of the base of the peduncle (Williams & Alderslade, 2011).

The aim of this guide is to introduce users to the commonly occuring sea pens found in the New Zealand region. Nine families comprising over 15 species are described. Where available *in situ* as well as specimen images are shown.

Pennatula sp.



Reproduced from Williams, G.C. (2001–2013)



Reproduced from Williams, G.C. (2011)

Variation in shape and form of sea pens. A. *Anthoptilum*, family Anthopitilidae. B. *Umbellula* (family Umbellulidae). C. *Ptilosarcus* (family Pennatulidae, similar to *Pteroeides* and Sarcoptilus). D. *Protoptilum* (family Protoptilidae, similar to Distichoptilum and Funiculina). E. *Pennatula* (family Pennatulidae).

The commonly sampled sea pens for the New Zealand region:

LIST OF SPECIES

Order PENNATULACEA

Family ECHINOPTILIDAE

Echinoptilum spp.

Family KOPHOBELEMNIDAE

Kophobelemnon stelliferum

Family ANTHOPTILIDAE

Anthoptilum grandiflorum

Anthoptilum gowlettholmesae

Family FUNICULINIDAE

Funiculina quadrangularis

Family PROTOPTILIDAE

Distichoptilum gracile

Protoptilum spp.

Family UMBELLULIDAE

Umbellula spp.

Family HALIPTERIDAE

Halipteris cf. *willemoesi*

Family VIRGULARIIDAE

Stylatula austropacifica

Acanthoptilum longifolium

Family PENNATULIDAE

(Note: Pteroeididae is a synonym of Pennatulidae)

Pennatula phosphorea

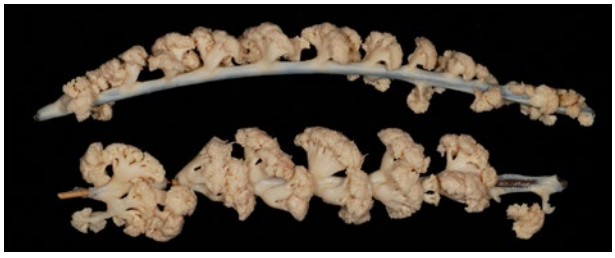
Pennatula spp.

Gyrophyllum sibogae

Pteroeides spp.

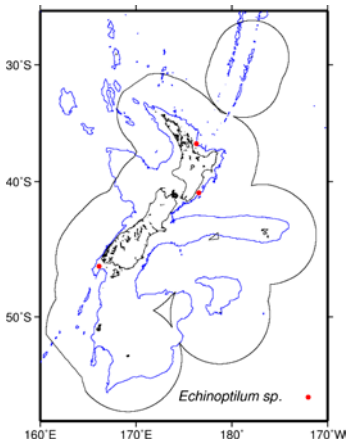
Anthoptilum gowlettholmesae

Anthopitilidae

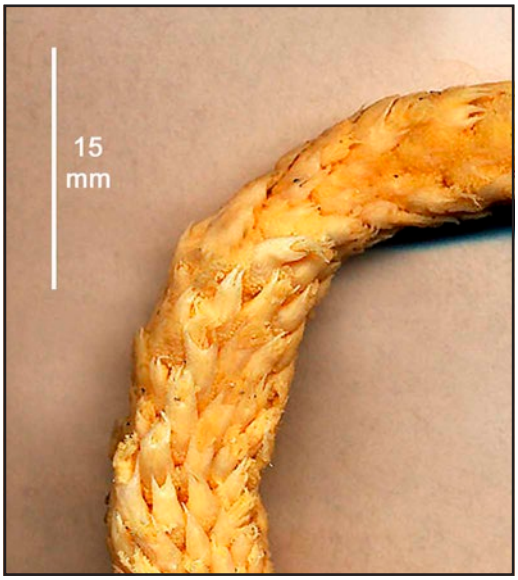


Sea-pen-look-alike Primnoid *Ainigmaptilon*. Note the branching in the polyp leaves which distinguishes this coral from a sea-pen.

Phylum Cnidaria
Class Anthozoa
Subclass Octocorallia
Order Pennatulacea (sea pens) (PTU)
Family Echinoptilidae



Echinoptilum sp. (Prickly sea pen) (ECP)



Distinguishing features: Relatively small sea pens (usually less than 80 mm in length). They are stout, cylindrical, and generally curved in shape with densely-set, conspicuously two-toothed calyces. A longitudinal line devoid of polyps is present on the concave surface of the colonies. Image is of *Echinoptilum* sp. (species indeterminate, species name is not identifiable at the present time).

Colour: Colonies are either cream-white or red-orange in colour.

Size: Maximum length 100 mm.

Distribution: The genus occurs in the Indo-Pacific from East Africa to Hawaii; only occasionally encountered in New Zealand waters.

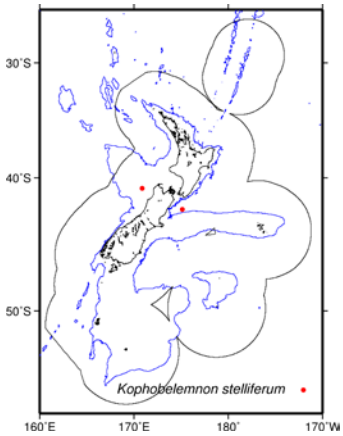
Depth: Encountered in New Zealand between 50 and 750 m.

Similar species: The sea pen *Actinoptilum molle* is endemic to South Africa and superficially resembles species of *Echinoptilum*, but no other species in New Zealand waters is easily confused with the genus.

References: Hickson, S.J. (1915). The Pennatulacea of the Siboga Expedition, with a general survey of the order. *Siboa Expeditie Monograph 14, Livr. 77*: 1–265.

Williams, G.C. (1995a). Living genera of sea pens (Coelenterata: Octocorallia: Pennatulacea): illustrated key and synopses. *Zoological Journal of the Linnean Society 113*: 93–140.

Phylum Cnidaria
Class Anthozoa
Subclass Octocorallia
Order Pennatulacea (sea pens) (PTU)
Family Kophobelemnidae



Kophobelemnon stelliferum (Club sea pen) (KST)

Distinguishing features: Somewhat club-shaped sea pens, as the rachis is wider toward the distal end of the colony. Rough textured surface of rachis. The polyps are relatively large, usually 20–40 in number, and are distributed more-or-less in two longitudinal rows along the length of the rachis.

Colour: Grey, tan, or brown.

Size: Usually less than 300 mm in length.

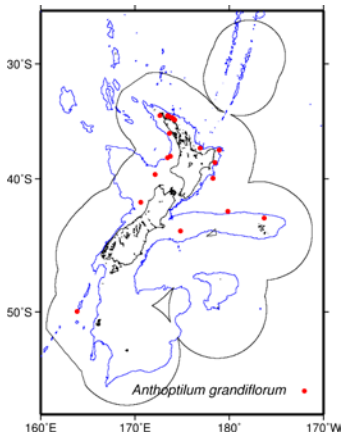
Distribution: Commonly encountered in New Zealand, but is widespread and found in many parts of the Pacific and Atlantic Oceans.

Depth: The species has a wide bathymetric range, generally 200 to over 1000 m.

Similar species: Other species of the genus *Kophobelemnon* are shorter and have fewer polyps (some other species may have as few as two large polyps only).

References: Williams, G.C. (1995a). Living genera of sea pens (Coelenterata: Octocorallia: Pennatulacea): illustrated key and synopses. *Zoological Journal of the Linnean Society 113*: 93–140.

Phylum Cnidaria
Class Anthozoa
Subclass Octocorallia
Order Pennatulacea (sea pens) (PTU)
Family Anthoptilidae



Anthoptilum grandiflorum (Flower sea pen) (AGF)

Distinguishing features: Elongate and narrow sea pens with numerous, large polyps that do not retract and are either arranged separately or in short oblique rows along the rachis.

Colour: Reported to be orange-red in life, turning to tan or brown when preserved in alcohol.

Size: 300 to greater than 1000 mm in length.

Distribution: Very commonly encountered in the New Zealand region. In addition, this is one of the most widespread sea pens in the world found throughout much of the Pacific, Indian, and Atlantic Oceans and as far north as the Arctic Circle.

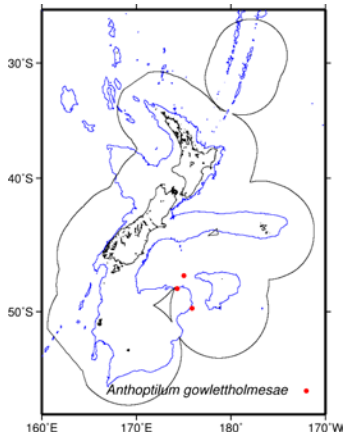
Depth: Wide-ranging bathymetrically: 240–2500 m.

Similar species: *Anthoptilum gowlettholmesae* looks similar but has a blunt, sucker-like structure at the base of the peduncle for anchoring to rocky substrata, whereas *Anthoptilum grandiflorum* has a slender and terminally-pointed muscular peduncle for anchoring in soft substrata.

References: Williams, G.C. (1995a). Living genera of sea pens (Coelenterata: Octocorallia: Pennatulacea): illustrated key and synopses. *Zoological Journal of the Linnean Society 113*: 93–140.

Williams, G.C. (2011). The global diversity of sea pens (Cnidaria: Octocorallia: Pennatulacea). *PLoS One 6(7)*: 1–11.

Phylum Cnidaria
Class Anthozoa
Subclass Octocorallia
Order Pennatulacea (sea pens) (PTU)
Family Anthoptilidae



Anthoptilum gowlettholmesae (Rock pen) (AGH)

Distinguishing features: Large and robust sea pens, only known from the deep-sea benthos on rocky substrata. Unlike other sea pens, the base of the peduncle is modified into a sucker-like structure for adhering to hard rocky outcrops on the sea bottom. This is one of only four known species of Rock Pen and is by far the largest.

Colour: Orange in life, tan to brown when alcohol-preserved.

Size: Maximum length 300–430 mm.

Distribution: occurs in southern Tasmania (Australia) and New Zealand and south to Antarctic waters as well.

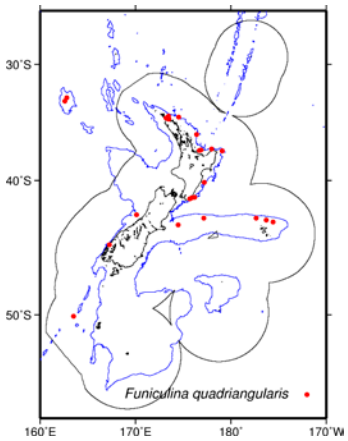
Depth: Bathymetric range approximately 1000–1700 m.

Similar species: One other undetermined species of rockpen occurs in New Zealand waters and is much smaller and narrower (less than 200 mm in length).

References: Williams, G.C. (1995a). Living genera of sea pens (Coelenterata: Octocorallia: Pennatulacea): illustrated key and synopses. *Zoological Journal of the Linnean Society 113*: 93–140.

Williams, G.C.; and Alderslade, P. (2011). Three new species of pennatulacean octocorals with the ability to attach to rocky substrata (Cnidaria: Anthozoa: pennatulacea). *Zootaxa 3001*: 33–48.

Phylum Cnidaria
Class Anthozoa
Subclass Octocorallia
Order Pennatulacea (sea pens) (PTU)
Family Funiculinidae



Funiculina quadrangularis (Rope-like sea pen) (FQU)

Distinguishing features: Narrow, elongate, whip-like sea pens with tubular, eight-toothed calyces of the polyps (autozooids) and conspicuous, smaller polyps (siphonozooids). Both kinds of polyps are densely-set along the rachis. The axis is square in cross-section.

Colour: Mostly ivory white with brown to gray autozooids and white siphonozooids.

Size: Up to one metre or more in length.

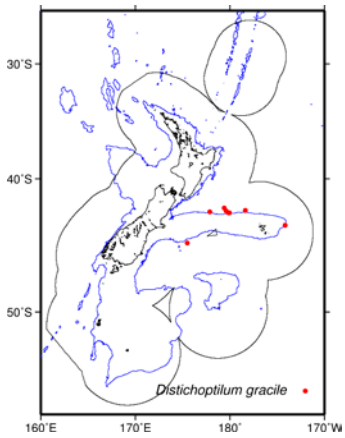
Distribution: Extensive, throughout much of the Pacific and Atlantic Oceans; frequently seen in New Zealand waters.

Depth: Commonly-encountered organisms of the deep-sea, but with a wide depth range (60–2600 m).

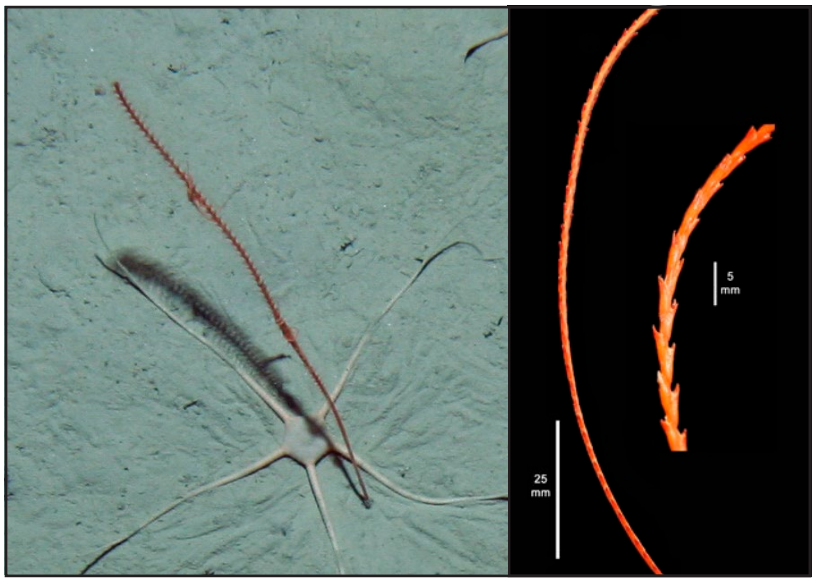
Similar species: The two other species of the genus that are considered valid are known only from the Indian Ocean and California.

References: Williams, G.C. (1995a). Living genera of sea pens (Coelenterata: Octocorallia: Pennatulacea): illustrated key and synopses. *Zoological Journal of the Linnean Society 113*: 93–140.

Phylum Cnidaria
Class Anthozoa
Subclass Octocorallia
Order Pennatulacea (sea pens) (PTU)
Family Protoptilidae



Distichoptilum gracile (Two-lined sea pen) (DGR)



Distinguishing features: Long, very narrow sea pens with two oppositely-placed longitudinal rows of closely-adjacent polyp calyces along the rachis that are elongate and acutely-pointed at the apexes.

Colour: Often a vivid red-orange throughout.

Size: Maximum length less than one metre.

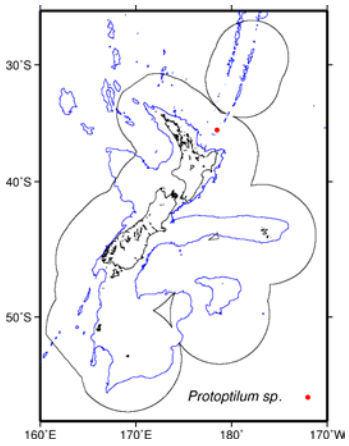
Distribution: Wide-ranging throughout much of the Pacific and Atlantic Oceans.

Depth: Infrequently seen constituent of deep-sea communities, 650–4300 m.

Similar species: The appearance of colonies of this species with the two opposite columns of narrow, sharply-pointed polyp calyces is unlike any other species.

References: Williams, G.C. (1995a). Living genera of sea pens (Coelenterata: Octocorallia: Pennatulacea): illustrated key and synopses. *Zoological Journal of the Linnean Society 113*: 93–140.

Phylum Cnidaria
Class Anthozoa
Subclass Octocorallia
Order Pennatulacea (sea pens) (PTU)
Family Protoptilidae



Protoptilum sp. (Worm-like sea pen) (PPT)

Distinguishing features: Elongate, narrow sea pens with flattened polyp calyces in oblique rows of less than 5 polyps per row. The calyces are variable and may have 0–8 terminal teeth. Image is of *Protoptilum* sp. *indet.* (species indeterminate, species name is not identifiable at the present time).

Colour: Rachis white to pale pink with red polyp calyces.

Size: Mostly less than 300 mm in length.

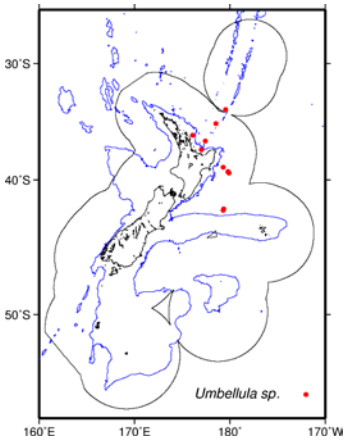
Distribution: This genus of perhaps six species is widely-distributed throughout much of the Pacific and northern Atlantic Oceans.

Depth: Wide bathymetric range: 250–4000 m.

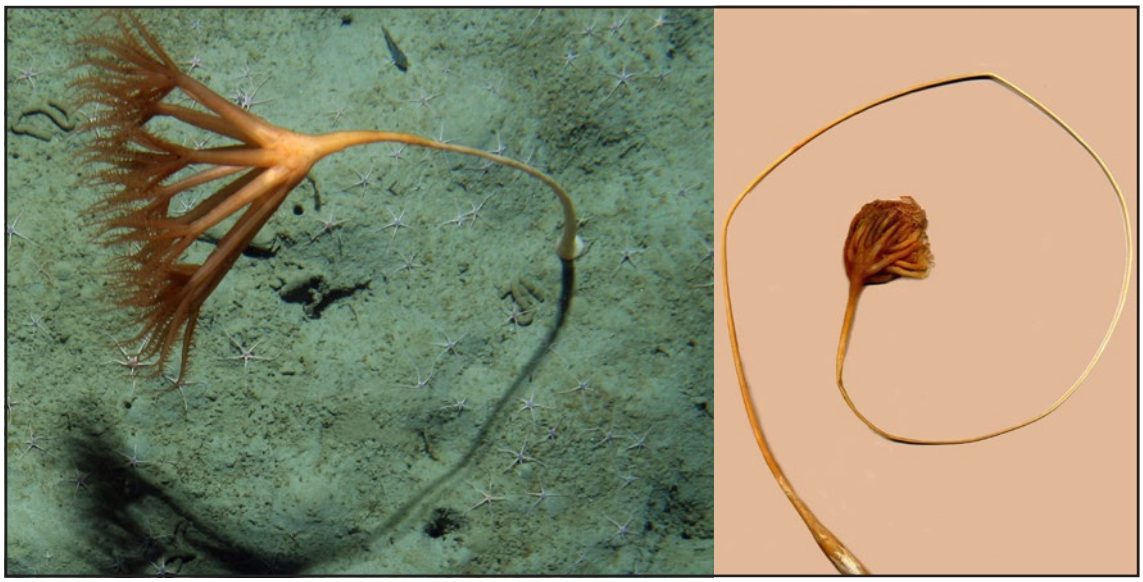
Similar species: Most closely resembles *Protoptilum carpenteri* from the North Atlantic region in that both species share conspicuous red colouration of the polyp calyces, rachis mostly paler or white in colour, and calyces without clearly-defined terminal teeth.

References: Williams, G.C. (1995a). Living genera of sea pens (Coelenterata: Octocorallia: Pennatulacea): illustrated key and synopses. *Zoological Journal of the Linnean Society 113*: 93–140.

Phylum Cnidaria
Class Anthozoa
Subclass Octocorallia
Order Pennatulacea (sea pens) (PTU)
Family Umbellulidae



Umbellula sp. (Umbrella sea pen) (UMB)



Distinguishing features: The number of valid species is questionable and species are difficult to distinguish. The morphology is striking and unique: a cluster or whorl of large polyps tops a smooth, long, thin stalk that is devoid of polyps. Species of *Umbellula* are considered characteristic organisms of deep-sea and abyssal environments. Image is of *Umbellula* sp. (species indeterminate, species name is not identifiable at the present time).

Colour: Greyish-white when alcohol-preserved.

Size: Highly variable: approximately 150–3000 mm in maximum length.

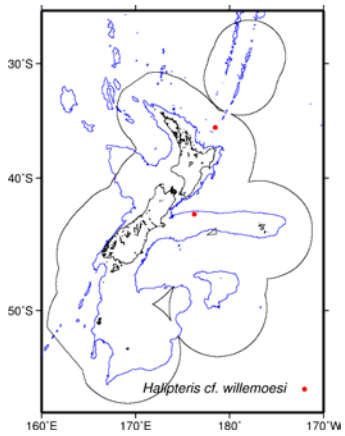
Distribution: The genus *Umbellula* is widely distributed worldwide in all oceans including the Ross Sea.

Depth: Species of the genus *Umbellula* are perhaps the deepest known octocorals and are wide-ranging from about 200 m down to a new record of 6260 m, recently been recorded by Williams (2001–2013, Octocoral Newsletter for June, 2013).

Similar species: All species of the genus are superficially similar in their unique overall morphology, which is unlike all other octocorals.

References: Williams, G.C. (1995a). Living genera of sea pens (Coelenterata: Octocorallia: Pennatulacea): illustrated key and synopses. *Zoological Journal of the Linnean Society 113*: 93–140.

Phylum Cnidaria
Class Anthozoa
Subclass Octocorallia
Order Pennatulacea (sea pens) (PTU)
Family Halipteridae



Halipteris willemoesi (Two-toothed sea pen) (HWL)

Distinguishing features: Colonies long, slender, and whip-like, often called sea whips (along with several other unrelated marine organisms) distinct bare racchis opposite to diagonal rows. The polyps occur in oblique rows and each has a calyx that has two conspicuous, broad teeth.

Colour: Stalk often white or tan-white, while the polyp calyces are grey or bluish grey.

Size: Usually less than one metre in length.

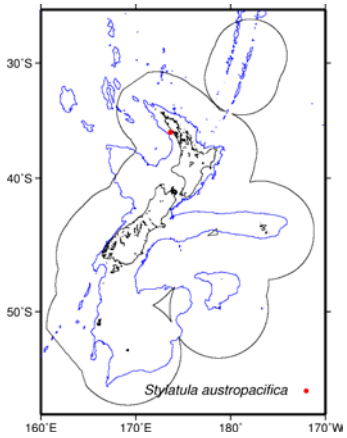
Distribution: Occurs throughout much of the Pacific Ocean, common in the New Zealand region.

Depth: Commonly encountered in the deep-sea, 36–1950 m.

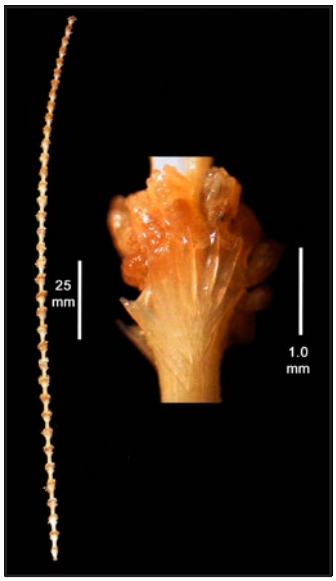
Similar species: Besides *Halipteris willemoesi*, there is perhaps one more species of this genus in New Zealand waters, *Halipteris willemoesi* and an undetermined species. The latter is an undetermined species that is more slender and has fewer polyps per row.

References: Williams, G.C. (1995a). Living genera of sea pens (Coelenterata: Octocorallia: Pennatulacea): illustrated key and synopses. *Zoological Journal of the Linnean Society 113*: 93–140.

Phylum Cnidaria
Class Anthozoa
Subclass Octocorallia
Order Pennatulacea (sea pens) (PTU)
Family Virgulariidae



Stylatula austropacifica (Armoured sea pen) (STF)



Distinguishing features: Very thin and somewhat brittle sea pens. Each polyp leaf is subtended by a fan-shaped array or armature or spine arrangement easily seen under the microsope of 7–8 large, smooth, spindle-like sclerites. Sclerites are octocoral spicules that are skeletal components composed of calcium carbonate.

Colour: Mostly white with tan polyp leaves.

Size: Up to approximately 200 mm in length.

Distribution: Recently described and presumably endemic to New Zealand, west coast of the North Island of New Zealand.

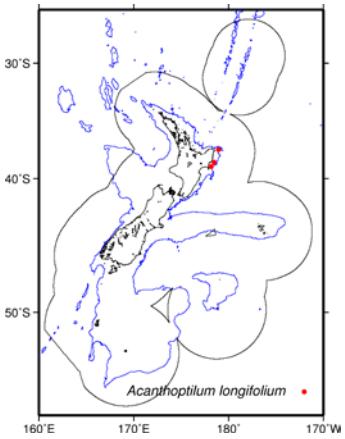
Depth: Depth range 190–196 m.

Similar species: All other species of the genus are known only from North and South America.

References: Williams, G.C. (1995a). Living genera of sea pens (Coelenterata: Octocorallia: Pennatulacea): illustrated key and synopses. *Zoological Journal of the Linnean Society 113*: 93–140.

Williams, G.C. (2007). New species of the pennatulacean genera Acanthoptilum and Stylatula (Octocorallia: Virgulariidae) from New Zealand and the Campbell Plateau: both genera previously considered endemic to the west coast of the Americas and Atlantic Ocean. *Proceedings of the California Academy of Sciences 58(15)*: 339–348.

Phylum Cnidaria
Class Anthozoa
Subclass Octocorallia
Order Pennatulacea (sea pens) (PTU)
Family Virgulariidae



Acanthoptilum longifolium (Long-leaf sea pen) (ALF)

Distinguishing features: Soft, flexible, somewhat fleshy sea pens; the polyp leaves are elongate and sickle-shaped, and extend laterally and perpendicularly from the rachis. There are usually about 9–13 polyps disposed on each polyp leaf. Axis can be circular to square.

Colour: White or cream-white throughout.

Size: Up to 450 mm in length.

Distribution: A recently described species and apparently endemic to New Zealand waters, east coast North Island, Challenger Plateau, southwestern part of the South Island of New Zealand, and the Campbell Plateau.

Depth: Known from 30–200 m.

Similar species: All other species in the genus are known only from North America.

References: Williams, G.C. (1995a). Living genera of sea pens (Coelenterata: Octocorallia: Pennatulacea): illustrated key and synopses. *Zoological Journal of the Linnean Society 113*: 93–140.

Williams, G.C. (2007). New species of the pennatulacean genera Acanthoptilum and Stylatula (Octocorallia: Virgulariidae) from New Zealand and the Campbell Plateau: both genera previously considered endemic to the west coast of the Americas and Atlantic Ocean. *Proceedings of the California Academy of Sciences 58(15)*: 339–348.

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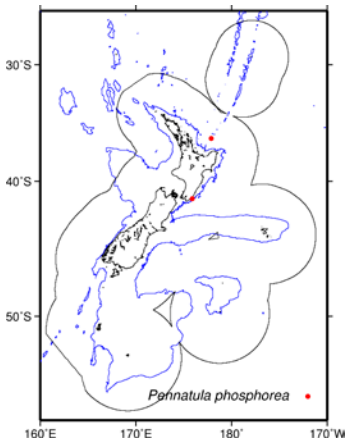
Order Pennatulacea (sea pens) (PTU)
Family Pennatulidae



Pennatula cf. *phosphorea* (Purple sea pen) (PPH)

Distinguishing features: Relatively short sea pen (usually less than150 mm in length) with red to purple fan-like leaves of polyps. The polyps have calyces with eight needle-like teeth.

Colour: Beige to white stalk with dark red to deep or dark purple polyp leaves.

Size: Up to 20 cm.

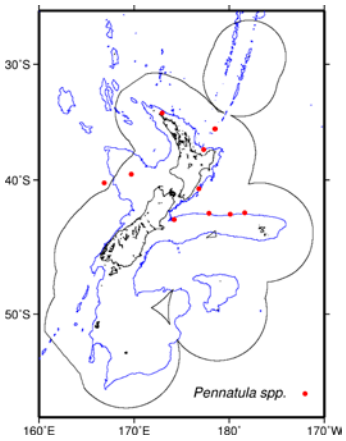
Distribution: Widespread in New Zealand waters, on soft and muddy bottoms.

Depth: The genus is commonly encountered throughout much of its nearly cosmopolitan distribution, ranging from 36 to 1950 m.

Similar species: Among the short sea pens, *Pennatula* is the only genus with polyp leaves that have a spiky or sharp appearance to the margins of the polyp leaves. Other sea pens either have thick and fleshy polyp leaves (e.g. *Gyrophyllum*) or are narrow and whip-like without prominent polyp leaves. (e.g. *Distichoptilum*).

References: Williams, G.C. (1995a). Living genera of sea pens (Coelenterata: Octocorallia: Pennatulacea): illustrated key and synopses. *Zoological Journal of the Linnean Society 113*: 93–140.

Phylum Cnidaria
Class Anthozoa
Subclass Octocorallia
Order Pennatulacea (sea pens) (PTU)
Family Pennatulidae



Pennatula spp. (Feathery sea pens) (PNN)

Distinguishing features: A variety of undetermined species of Pennatula have been collected in the New Zealand region. Colonies are often large and feather-like with prominent, often firm polyp leaves. Each polyp has a calyx with eight needle-like, terminal teeth.

Colour: Colony colour can vary from white to red, orange, and yellow.

Size: Usually less than 160 mm in length.

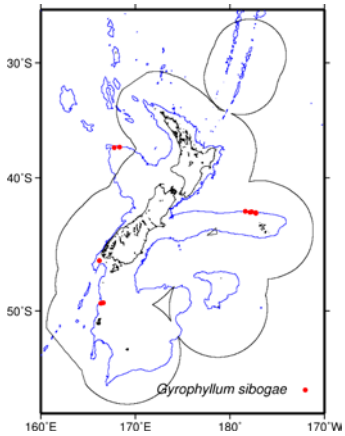
Distribution: Widespread global distribution, occasionally encountered in New Zealand.

Depth: The genus has a broad bathymetric range and has been recorded from 18–2825 m.

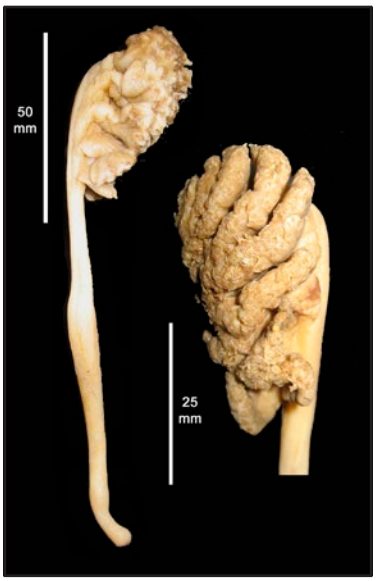
Similar species: The genus is in need of taxonomic revision and the species are often difficult to distinguish.

References: Williams, G.C. (1995a). Living genera of sea pens (Coelenterata: Octocorallia: Pennatulacea): illustrated key and synopses. *Zoological Journal of the Linnean Society 113*: 93–140.

Phylum Cnidaria
Class Anthozoa
Subclass Octocorallia
Order Pennatulacea (sea pens) (PTU)
Family Pennatulidae



Gyrophyllum sibogae (Siboga sea pen) (GYS)



Distinguishing features: This unusual sea pen is relatively short and robust with a terminal cluster of very fleshy polyp leaves arranged on both sides of the colony axis.

Colour: Ochre to brown.

Size: Up to 150 mm.

Distribution: Widespread in New Zealand waters, on soft and muddy bottoms.

Depth: 500 to 1200 m.

Similar species: Other sea pens such as *Pennatula* and *Ptereoides* sp., can also have short and robust colonies but they are never as fleshy and thick as *G. sibogae*.

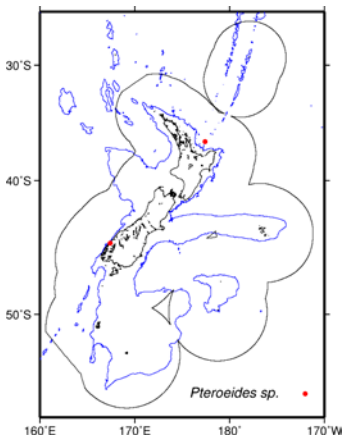
References: Reyes F.; Arda A.; Martin R.; Fernandez R.; Rueda A.; Montalvo D.; Gomez C.; Jimenez C.; Rodriguez J.; Sanchez-Puelles J.M. (2004). New cytotoxic cembranes from the sea pen *Gyrophyllum sibogae*. *Journal of Natural Products 67(7)*: 1190–1192.

Williams, G.C. (1995a). Living genera of sea pens (Coelenterata: Octocorallia: Pennatulacea): illustrated key and synopses. *Zoological Journal of the Linnean Society 113*: 93–140.

Williams, G.C. (1995b). The enigmatic sea pen genus Gyrophyllum – a phylogenetic reassessment and description of *G. sibogae* from Tasmanian waters (Coelenterata: Octocorallia). *Proceedings of the California Academy of Sciences 48 (15)*: 1–13.

Williams, G.C. (2001–2013). Octocoral Research Center website http://researcharchive.calacademy.org/research/izg/orc_home.html. Accessed 20 May 2013.

Phylum Cnidaria
Class Anthozoa
Subclass Octocorallia
Order Pennatulacea (sea pens) (PTU)
Family Pennatulidae



Pteroeides sp. (Armoured sea feather) (PTD)

Distinguishing features: Feather-shaped sea pens with prominent, fleshy, and firm polyp leaves. The polyp leaves are densely armed and have one or more needle like sclerites or rays that subtend the length of each leaf, thereby providing the firmness of the polyp leaves. The leaves are thinner than those of *Gyrophyllum*, with almost a fur-like appearance. Image is of *Pteroeides* sp. (species indeterminate, species name is not identifiable at the present time).

Colour: Cream-white throughout.

Size: Usually 100–200 mm in length.

Distribution: This species is presently known only from New Zealand.

Depth: The genus is known to occur from 9–320 m.

Similar species: There are approximately 90 described species and subspecies referable to the genus *Pteroeides*, of these an estimated 25 are probably valid. Many poorly defined and/or inadequately-illustrated species of the genus have been described from the western Pacific. It is therefore best to consider this as an undetermined species of *Pteroeides* at present. The genus is in need of taxonomic revision and accordingly the species are often difficult to distinguish.

References: Williams, G.C. (1995a). Living genera of sea pens (Coelenterata: Octocorallia: Pennatulacea): illustrated key and synopses. *Zoological Journal of the Linnean Society 113*: 93–140.

Williams, G.C. (1995c). Revision of the pennatulacean genus Sarcoptilus (Coelenterata: Octocorallia), with descriptions of three new species from southern Australia. *Records of the South Australian Museum 28(1)*: 13–32.

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Reyes F.; Arda A.; Martin R.; Fernandez R.; Rueda A.; Montalvo D.; Gomez C.; Jimenez C.; Rodriguez J.; Sanchez-Puelles J.M. (2004). New cytotoxic cembranes from the sea pen *Gyrophyllum sibogae*. *Journal of Natural Products 67(7)*: 1190–1192.

Tracey, D.; Mackay, E.; Gordon D.; Sanchez, J.; Opresko, D. (2008). A Guide to Deepsea Coral. Report prepared for CSP Unit, Department of Conservation, DOC08309 Project (Objective 3). 15 p.

Tracey, D.M.; Anderson, O.F.; Naylor, J.R. (Comps.) (2011). A guide to common deepsea invertebrates in New Zealand waters. *New Zealand Aquatic Environment and Biodiversity Report No. 86*. 317 p.

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Williams, G.C. (1995c). Revision of the pennatulacean genus *Sarcoptilus* (Coelenterata: Octocorallia), with descriptions of three new species from southern Australia. *Records of the South Australian Museum 28(1)*: 13–32.

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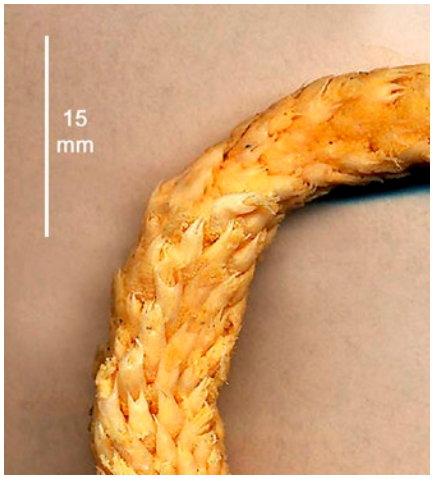
Williams, G.C.; Cairns, S.D. (2013). Biodiversity Myth Busters. In: Octocoral Research Center. http://researcharchive.calacademy.org/research/izg/orc_home.html Accessed 30 May 2013.

Williams G.C.; Hoeksema, B.W.; van Ofwegen L.P. (2013). A fifth morphological polyp in pennatulacean octocorals, with a review of polyp polymorphism in the genera Pennatula and Pteroeides (Anthozoa: Pennatulidae). *Zoological Studies 51(7)*: 1–12.

Williams, G.C. (2001–2013). Octocoral Research Center website http://researcharchive.calacademy.org/research/izg/orc_home.html. Accessed 20 May 2013.

Quick key



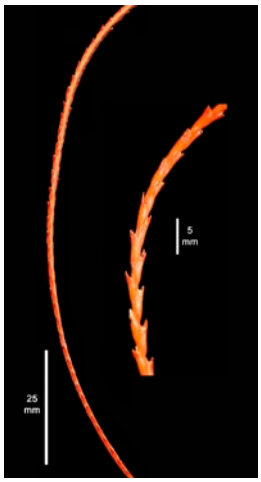
Page 6, *Echinoptilum* sp.

Page 7, *Kophobelemnon stelliferum*

Page 8, *Anthoptilum grandiflorum*

Page 9, *Anthoptilum gowlettholmesae*

Page 10, *Funiculina quadrangularis*

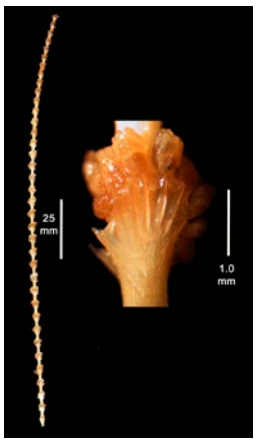


Page 11, *Distichoptilum gracile*

Page 12, *Protoptilum* sp.

Page 13, *Umbellula* sp.

Page 14, *Halipteris willemoesi*

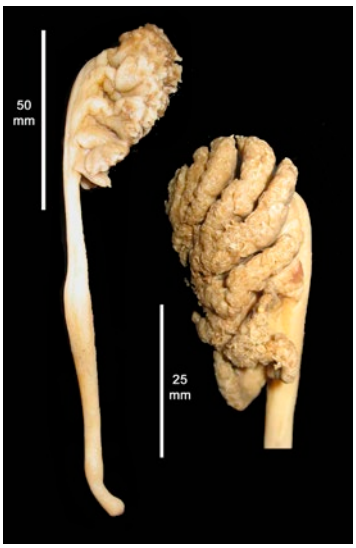


Page 15, *Stylatula austropacifica*

Page 16, *Acanthoptilum longifolium*

Page 17, *Pennatula cf. phosphorea*

Page 18, *Pennatula* spp.



Page 19, *Gyrophyllum sibogae*

Page 20, *Pteroeides* sp.