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Ceriantharia (Cnidaria) from Australia, New Zealand and Antarctica with Descriptions of Four New Species

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Abstract. The fauna of Ceriantharia (tube-anemones) in the South Pacific is poorly studied with only four shallow-water species formally described and these animals are known from few regions in very specific reports. Ceranthids are organisms that live in a tube constructed with a special type of cnidae and are currently grouped in an exclusive subclass of Anthozoa. This study addresses specimens from three natural history collections, the Australian Museum and the Museum and Art Gallery of the Northern Territory (both Australia), and the National Institute of Water & Atmospheric Research (NIWA) Invertebrate Collection (New Zealand), focusing on specimens from the Coral Sea, Tasman Sea and Antarctic Ocean. As a result, four new species are described and one synonymized. This highlights the ongoing need for taxonomic studies in the region, especially for marine organisms. Also, in this study, we offer tables with morphological characters that can be useful for species identification in each genus.

Introduction

Members of the subclass Ceriantharia are often the focus of photographic records in several regions of the world, but especially in areas where diving activities are concentrated (Stampar *et al.*, 2010, 2016a), including Australia and New Zealand (e.g., Grange & Brook, 2010; Wallace & Crowther, 2019). Despite this, Ceriantharia diversity is poorly studied in most parts of the world, especially because of the difficulties in sampling (Stampar *et al.*, 2016a). The Tasman Sea, between Australian and New Zealand coasts, is well studied for some taxa and locations (e.g., Polychaeta—Hutchings, 1992; Williams, 2019) but is contiguous with the Southern Ocean, in which the level of biodiversity exploration is still incipient (Butler *et al.*, 2010; Griffiths, 2010). Within the Tasman Sea, there are only four species of Ceriantharia recorded and these are so far known from very limited localities. From Australia, *Pachycerianthus nobilis* Haddon & Shackleton, 1893, was described as a member of the genus *Cerianthus* from Torres Strait, Queensland. *Arachnanthus australiae* Carlgren (1937) is from Low Island (north of Port Douglas) also in Queensland. Two species were described by from Sydney Harbor, New South Wales, *Pachycerianthus delwynae* Carter, 1995 and *P. longistriatus* Carter, 1995. The state of knowledge about Ceriantharia from New Zealand is substantially poorest, because there are few records, without

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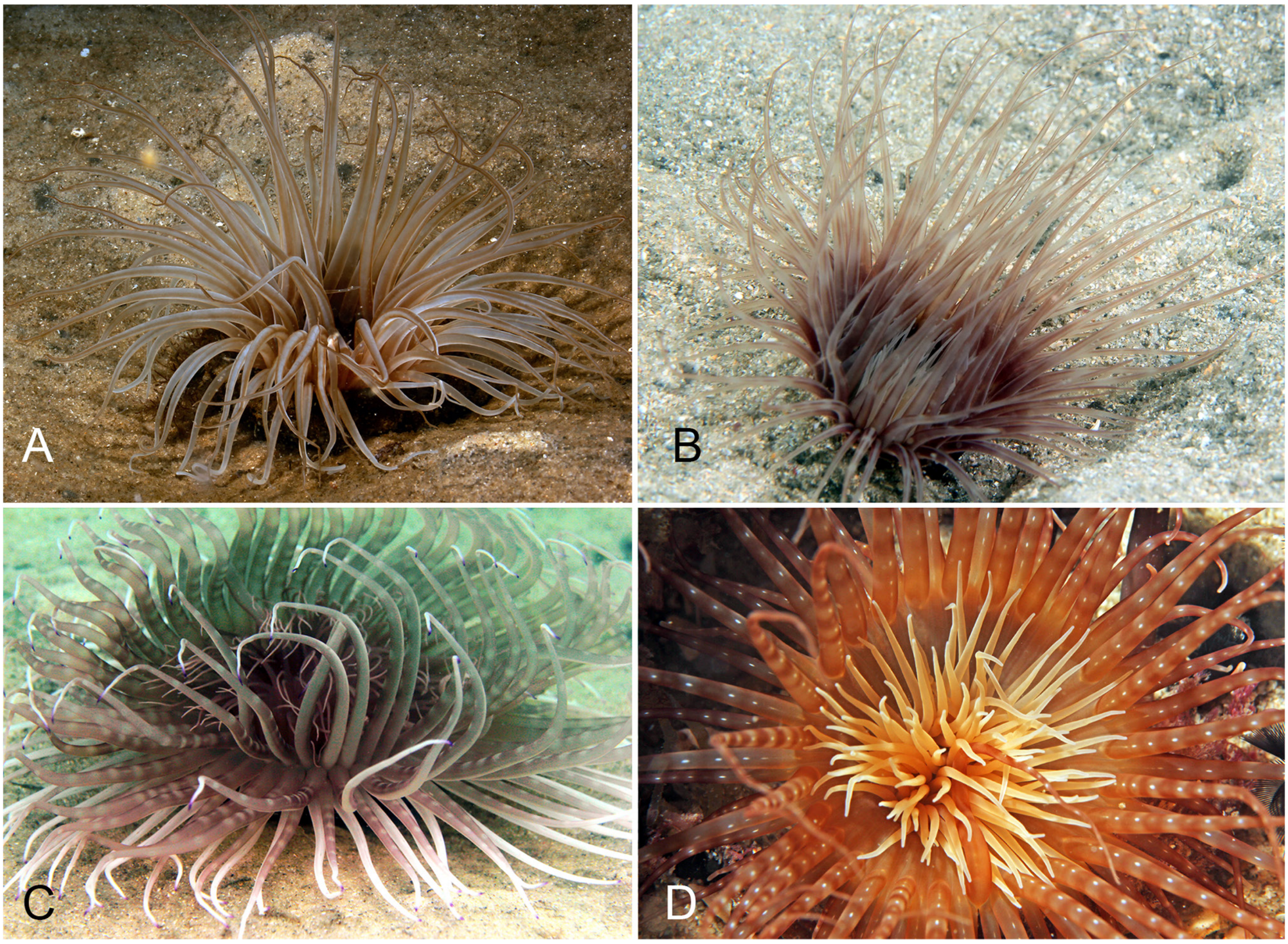

Figure 1. Specimens of *Pachycerianthus delwynae* in New South Wales, Australia. *(A, B)* Tentacles with longitudinal lines and *(C, D)* banded tentacles. Images: Tony Strazzani.

any identification except "Ceriantharia", "*Cerianthus*" or "*Pachycerianthus*". Doak (1971) describes the discovery of a cerianthid on a night dive at the Poor Knights Islands in an open sandy section of a rocky wall. Grange *et al.* (1981) mention an undescribed species of cerianthid anemone, probably in genus *Cerianthus* observed dominating the soft sediment community in Long Sound, Fiordland. Cairns *et al.* (2009) discuss the existence of two undescribed species and also the occurrence of larvae of the genus *Arachnanthus*. Grange & Brook (2010) report the occurrence of two species of *Cerianthus* (*Cerianthus* sp.1 and *Cerianthus* sp.2) and one species of *Pachycerianthus* sp., however, there is limited discussion about how these identifications were made and availability of material for further examination.

This study addresses this knowledge gap, reviewing previous records and describes new species of two genera, *Ceriantheopsis* and *Pachycerianthus* from the South Pacific Ocean, including the Coral Sea, Tasman Sea and Antarctic Ocean. Additional information on characters used to differentiate species in these genera is also provided.

Material and methods

Ceriantharia from the Australian Museum, Sydney (AM), Museum and Art Gallery of the Northern Territory, Australia (NTM) and National Institute of Water & Atmospheric Research (NIWA) Invertebrate Collection (NIC) (New Zealand) were studied, totalling 35 specimens. Anatomical study of the polyps and cnidome were based on criteria defined by several authors (van Beneden, 1897; Carlgren, 1912; den Hartog, 1977; Stampar *et al.*, 2014, 2016b). Specimens were sectioned through the ventral side (opposite to the siphonoglyph) using surgical scalpels (carbon steel), then the dissected polyp was fastened using acupuncture needles.

The classification of cnidae follows den Hartog (1977) and England (1991), but nomenclature is based solely on England (1991). Thirty measurements (undischarged capsules) were taken from each cnida type out of each body region from two specimens of each species. The cnidome was analyzed under an Olympus BX53 compound microscope with phase contrast and Olympus image system. All parts of the body were analyzed separately so that any contamination was avoided. The two parts of mesenterial filaments (cnidoglandular tract and ciliated tract) were analyzed together using 30 measurements from each part. Each species name is formed as a noun in apposition to match the gender of the species with the gender of the genus.

Taxonomy

Subclass Ceriantharia Perrier, 1893

Order Spirularia den Hartog, 1977

Family Cerianthidae
Milne Edwards & Haime, 1851

Genus *Pachycerianthus* Roule, 1904

Type species. *Pachycerianthus multiplicatus* Carlgren, 1912 (see details in Kelly & Keegan, 2000).

Diagnosis (*sensu* Arai, 1965). Cerianthidae with second couple of protomesenteries short and sterile. Arrangement of mesenteries in each quartette M,B,m,b (1,3,2,4), more or less distinct.

Distribution. This genus is distributed worldwide.

Pachycerianthus delwynae Carter, 1995

Fig. 1A–D

Pachycerianthus delwynae Carter, 1995: 2–3; figs 1b, 2.
Pachycerianthus longistriatus Carter, 1995: 3–4, junior synonym.

Specimens examined. Australian Museum (AM)—Australia, Sydney—G15399 (holotype of *P. delwynae*) Port Jackson, Chowder Bay, 33°50'30"S 151°15'12"E (15/ix/1989), depth 15 m; G15404 Port Jackson, Manly Pool, 33°50'S 151°17'E (1957); G14526, Port Jackson, Camp Cove, 33°50'S 151°16'E (2 specimens); G15808 Port Jackson, Vaucluse Bay, 33°51'S 151°16'E (many specimens); G15400 (paratype of *P. delwynae*) Port Jackson, Bottle and Glass Rocks, 33°50'54"S 151°16'12"E (13/vii/1989), depth 5 m; G15401 (paratype of *P. delwynae*) Port Jackson, Bottle and Glass Rocks, 33°50'54"S 151°16'12"E (20/vii/1989), depth 7 m; G12555 (paratype of *P. longistriatus*) Port Jackson; G15403 (paratype of *P. longistriatus*) Port Jackson, Chowder Bay, 33°50'S 151°17'E; G12554 (paratypes of *P. longistriatus*) Port Jackson (09/1886) (5 specimens in jar but only 3 in good condition and only 3 cited by Carter (1995)); G15406 (paratypes of *P. longistriatus*) Port Jackson, Off Dawes Point, 33°50'S 151°12'E (2 specimens); G12553 (paratype of *P. longistriatus*) Port Jackson; G13558 (paratype of *P. longistriatus*) Port Jackson; G13561 (paratype of *P. longistriatus*) Port Jackson, G15405 (paratype of *P. longistriatus*) Port Jackson, Drummoyne (viii/1963); G15402 (holotype of *P. longistriatus*) Port Jackson, Taylors Bay, 33°50'S 151°17'E (20/vii/1989), depth 5 m.

Remarks. Closely related sympatric species always arouse much curiosity, especially regarding how the processes of speciation have occurred. However, the occurrence of two species of *Pachycerianthus* described from Sydney (Port Jackson) by Carter (1995) are not supported. Carter (1995) notes that separation of the two species based on anatomy is difficult because the differences in mesenterial organization are slight, but the external morphology, especially tentacle colouration, is more consistent with banded marginal tentacles in *P. delwynae* and with distinctive longitudinal stripes on the marginals in *P. longistriatus*. However, colour patterns have been shown to be highly variable in Cnidaria, especially in Ceriantharia, where numerous examples of different colour morphs have been found to represent a single species when other characters are considered (e.g., Molodtsova *et al.*, 2011; Stampar *et al.*, 2012 (including molecular data); Stampar *et al.*, 2015). Some species have different colour morphs depending on the reproduction season that each polyp was produced (Stampar *et al.*, submitted), consequently, colour is not a reliable taxonomic character in Ceriantharia. Leaving aside tentacle colouration patterns, the two main anatomical features listed by Carter (1995) that differentiate the species are not consistent, presenting variations that overlap. The first of these is the arrangement of mesenteries. Carter (1995) indicates that in *P. delwynae* the M2 mesentery is longer than the M1 and indicates an opposite pattern in *P. longistriatus*, in which mesentery M2 is shorter than M1. Observing the same specimens studied by Carter (1995) it is possible to verify this pattern is only present in some individuals, in other specimens this pattern does not exist or is not as evident as described. However, two specimens (AM G12554 and AM G15405, both nominally paratypes of *P. longistriatus*) display a mixture of both morphological patterns; one side (from siphonoglyph to multiplication chamber) has mesenteries with the M2 longer than the M1, the other side has the inverse mesentery M1 is longer than the M2. The other character used to justify the separation into two species is the distribution of the insertion of the tentacles. This character is much more inconsistent than the form of the mesentery, at least four different arrangements occur. However, the most important aspect is that there is no difference in the number of pseudocycles of the tentacles of each type (marginal or labial) in all specimens. Therefore, it is not possible to keep these specimens as two separate species, *Pachycerianthus delwynae* is retained instead of *P. longistriatus* based on page precedence in Carter (1995).

Pachycerianthus fiordlandensis sp. nov.

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Figs 2–4, Table 1

Cerianthus bollonsi Wing, 2003 (p. 247, in image caption); Wing, 2008 (p. 35 in image caption and p. 46), **nomen nudum**. (The name is cited, but there is no formal description of the species or designation of type material so it does not meet the criteria for acceptance as defined by the ICZN).

Holotype. NIWA Invertebrate Collection (NIC)—NIWA 139391 New Zealand, off Moeraki, Otago, 45.30°S 170.80°E (vii/1970), depth 82 m. **Paratypes**. New Zealand—NIWA 139397 Doubtful Sound, Fiordland, New Zealand Oceanographic Institution (NZOI) Station O869, 45.44°S 167.12°E (07/iii/1985), depth 5–35 m, (1 specimen); NIWA 139400 Milford Sound, Fiordland, NZOI Station W27, 44.66°S 167.91°E (13/xi/1985), depth 3–26 m, (1 specimen); NIWA 56235 Great Exhibition Bay, Northland, RV *Tangaroa* Station TAN0906/140, 34.57°S 173.20°E to 34.57°S 173.21°E (13/vii/2009), depth 117–120 m, (1 specimen); NIWA 35103 Milford Sound, Fiordland, 44.58°S 167.78°E (03/ix/1996), depth 20–25 m (3 specimens).

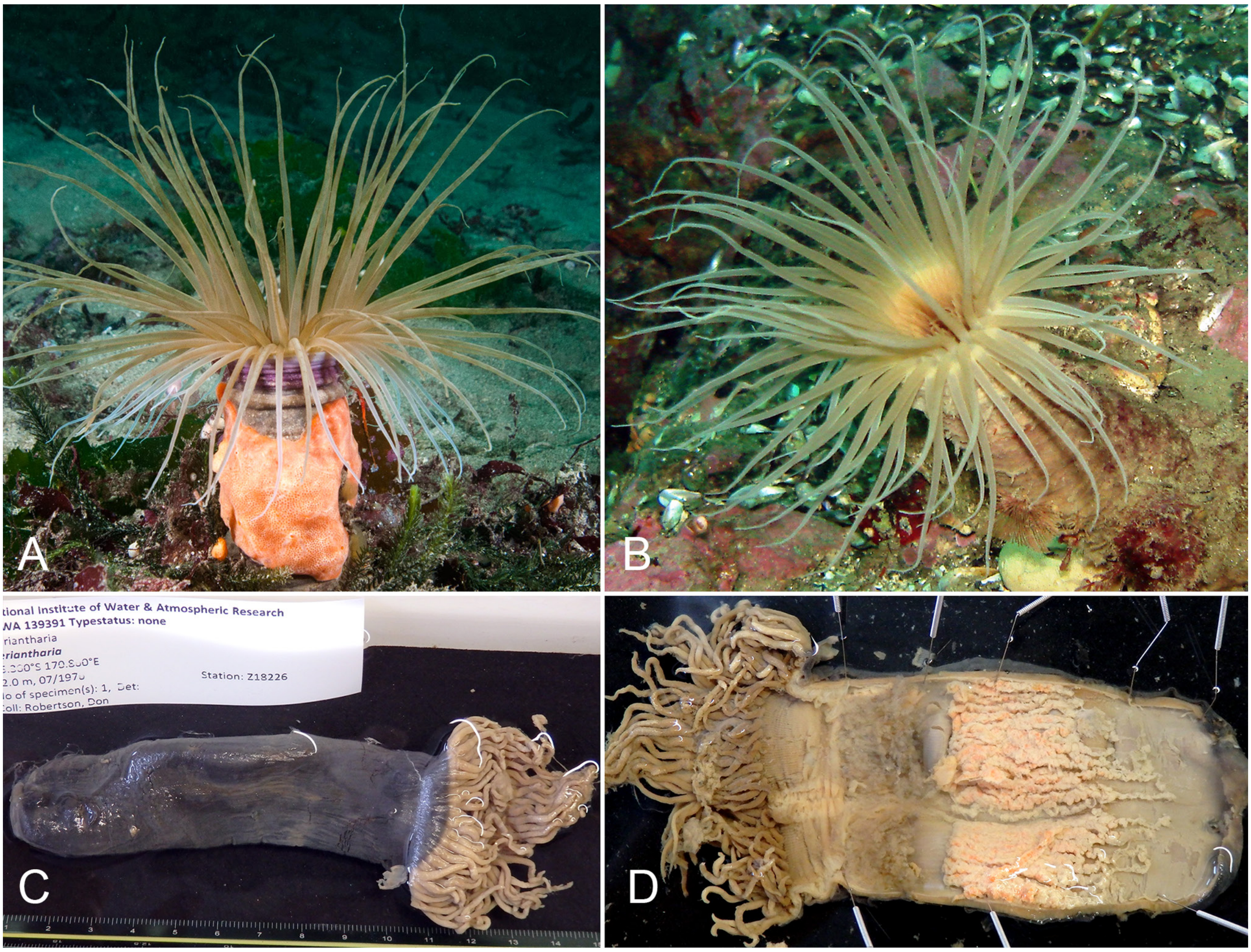

Figure 2. Specimens of *Pachycerianthus fiordlandensis* sp. nov. *(A)* Dusky Sound specimen, Fiordland, New Zealand, photo by Malcolm P. Francis; and *(B)* Milford Sound specimen, Fiordland, NZ, photo by Chris Woods; *(C, D)* holotype, NIWA 139391.

Diagnosis. Marginal tentacles brown to light brown. Six mesenteries attached to siphonoglyph, very long P2 mesentery, long m mesenteries and presence of directive labial tentacle.

Variation. Slightly long (up to 110 mm long) and thin (20–25 mm width) ceriantid; 60–88 brown to light brown (Fig. 1) marginal tentacles (110–120 mm in preserved specimens), arrangement 1243.2314.2314…, with more than 6 pores per tentacle, 56–72 dark brown labial tentacles (up to 50 mm long in preserved specimens), arrangement (2)312.1321.3213…, unpaired labial tentacle present; pleated stomodeum extending over 1/4 of total body length, hyposulcus 4–6 mm long, hemisulci distinct; siphonoglyph rather narrow, connected to directives, P2 and P3 (6 mesenteries); free parts of sterile directive mesenteries 1/3 of length of siphonoglyph, without mesenterial filaments. Second protomesenteries long, 2/3 of gastral cavity, fertile, bearing ciliated tracts with bundles of craspedonemes, with short (1/5 of mesentery length) cnido-glandular tract and long (~90% of the mesentery) craspedion tract. Third protomesenteries sterile, three times longer than directives, with short craspedonemes. M and m-metamesenteries long, fertile; M1 and M2 reaching almost aboral pore (M2 shorter than M1), with bundles of craspedonemes; B and b-mesenteries, steriles, B longer than b; see Fig. 3 for schematic arrangement of mesenteries. The cnidome of the species (Fig. 4) is composed of spirocysts, atrichs, microbasic b-mastigophores (four types) and ptychocysts distributed as shown in Table 1.

Holotype description (NIWA 139391). Somewhat elongated polyp, 9.6 cm long, 25 mm diameter just below marginal tentacles and 20 mm near aboral end. Marginal tentacles 88, arranged in four pseudocycles, 110–120 mm long and 2 mm in diameter near the base, light brown. The space between cycles of marginal and labial tentacles brown colored. Labial tentacles 72, about 50 mm long, dark brown, directive labial present, arrangement of marginal tentacles 1243.2314.2314… and labial tentacles (2)312.1321.3213… Oral disk 25 mm wide, stomodeum 24 mm long, dark brown, siphonoglyph narrow and elongate with 6 mesenteries attached, hyposulcus 3 mm long with short hemisulci 1.5 mm long. Free parts of directive mesenteries without mesenterial filaments. Second protomesenteries with 2/3 of gastral cavity, fertile, bearing ciliated tract with bundles of craspedonemes. Third protomesenteries sterile, three times longer than directives, with short craspedonemes. M1 and M2 reaching almost aboral pore (M2 shorter than M1), with bundle of craspedonemes; B and b-mesenteries, sterile, B longer than b.

Table 1. Cnidome of *Pachycerianthus fiordlandensis* sp. nov. based on two specimens (NIWA 139391; 139400). Mean and range given for each cnida.

Pachycerianthus fiordlandensis sp. nov.		
	length (in µm)	width (in µm)
column		
pytchocysts	63.7 (55.7–71.2)	18.5 (14.5–22.2)
atrichs	32.5 (26.2–41.5)	6.85 (5.1–8.2)
b-mastigophores ii	32.1 (29.5–34.5)	6.6 (5.4–7.3)
b-mastigophores iv	14.8 (12.6–15.7)	3.5 (3.1–3.9)
marginal tentacles		
b-mastigophores i	36.5 (34.6–37.5)	6.2 (5.6–6.9)
b-mastigophores ii	31.5 (29.5–33.8)	6.5 (5.8–7.2)
atrichs	33.5 (31.5–36.5)	6.6 (5.6–7.6)
labial tentacles		
b-mastigophores i	36.8 (34.9–37.6)	6.2 (5.8–6.8)
b-mastigophores iii	17.7 (15.8–18.9)	4.5 (3.9–5.3)
atrichs	33.4 (31.5–36.2)	6.5 (5.5–7.7)
stomodeum		
b-mastigophores i	36.5 (33.9–37.8)	5.9 (5.2–6.7)
b-mastigophores ii	30.8 (29.1–31.9)	6.3 (5.8–6.4)
atrichs	31.3 (28.8–33.5)	5.9 (5.1–6.9)
mesenteries Type b		
b-mastigophores ii	30.5 (29.1–32.1)	6.3 (5.8–6.4)
atrichs	33.1 (30.1–33.8)	6.4 (5.7–6.8)
mesenteries Type m		
b-mastigophores ii	31.2 (29.8–32.3)	6.4 (5.9–6.7)
atrichs	31.9 (30.1–32.5)	6.1 (5.5–6.6)

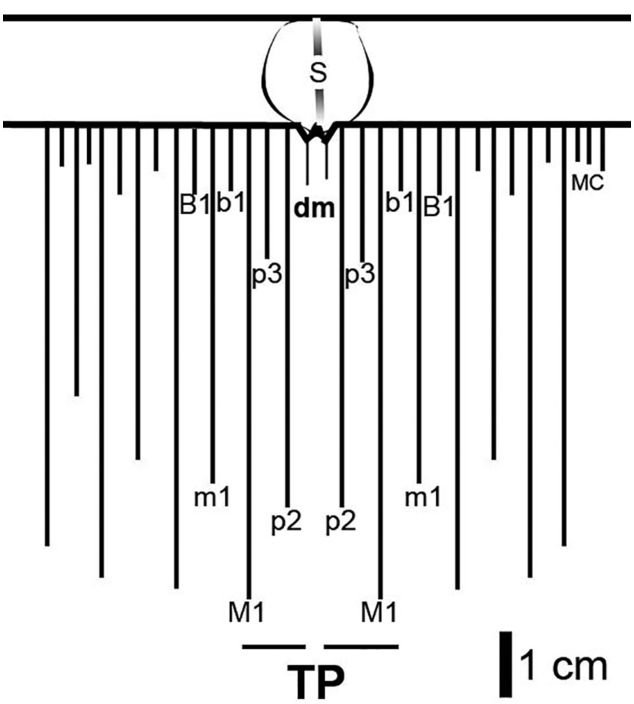

Figure 3. Graphical representation of the arrangement of mesenteries of *Pachycerianthus fiordlandensis* sp. nov. Abbreviations: *M.C.,* multiplication chamber; *dm,* directives; *T.P.,* terminal pore; *S,* siphonoglyph; *B,* betamesenteries (convoluted mesentery); *M,* metamesenteries (double filament); *P,* protomesenteries.

Remarks. Specimens of this species have previously been recorded in photographs by divers (Fig. 2A,B) and discussed in some general books on marine biodiversity for the coastal region of New Zealand (e.g., Cairns *et al.*, 2009; Grange *et al.*, 1981 (as *Cerianthus* sp.); Grange & Brook, 2010; Wing, 2003, 2008 [as *Cerianthus bollonsi*]). It is noted by divers for its long flowing tentacles and very rapid "disappearing act" when disturbed (Francis, pers. comm.; Wing, 2008). The species ranges from shallow areas from about 15 m to around 100 m deep. This wide range is not very common in Ceriantharia, except for a few species such as *Ceriantheopsis americana* and *Pachycerianthus borealis* (Shepard *et al.*, 1986). It is usually found in an upright position with its tube buried in coarse sediments or shell hash on sand slopes or sediment filled ledges in the deep rock wall zones in the fiords (Grange *et al.*, 1981; Wing, 2003; Woods, pers. comm.). All specimens had well developed gonads with deep orange oocytes. This has also been observed in other species of the genus, such as *Pachycerianthus schlenzae* (Stampar *et al.*, 2014) and may be linked to high levels of egg yolk.

Distribution. New Zealand and adjacent areas (from shallow waters to 120 m).

Etymology. The specific name "*fiordlandensis*" is based on the area of occurrence, Fiordland, New Zealand, in which specimens are commonly observed.

Pachycerianthus antarcticus sp. nov.

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Figs 5–7, Table 2

Holotype. NIWA Invertebrate Collection (NIC) NIWA 36894 Ross Sea, Antarctica, RV *Tangaroa* Station TAN0802/100, 76.2020°S 176.2480°E (18/ii/2008), depth 447–451 m. **Paratype**. NIWA 103267 Off Young Island, Antarctica, RV *Tangaroa* Station TAN0402/252, 66.3647°S 162.5762°E (05/iii/2004), depth 942 m (1 specimen).

Diagnosis. Marginal tentacles in two pseudocyles and labial tentacles in four pseudocycles. Four mesenteries attached to siphonoglyph, M and m or B and b with almost the same length and absence of directive labial tentacle.

Variation. Short (up to 36 mm long) and broad (10 mm width) cerianthid; 20–32 white marginal tentacles (practically absent in both specimens, only the base is present) (Fig. 4), arrangement 1212.1212.1212; 28–36 white tentacles (up to 4 mm long in preserved specimens), arrangement 2134.3142.3142, unpaired labial tentacle absent; pleated stomodeum extending over 1/5 of total body length, hyposulcus less than 1 mm long, hemisulci absent; siphonoglyph narrow, connected only to directives and P2 (4 mesenteries); free parts of sterile directive mesenteries very short, without mesenterial filaments. Second protomesenteries (P2) short, sterile, bearing ciliated tracts without craspedonemes, followed by a long cnido-glandular tract (c. 80% of the mesentery). Third protomesenteries sterile, longer than P2, with craspedonemes. M and m-metamesenteries long, almost equal length (M longer than m), fertile; M1 and M2 reach more than 1/2 of gastral cavity with a small bundle of craspedonemes; B and b-mesenteries, short, sterile, almost equal length; see Fig. 6 for schematic

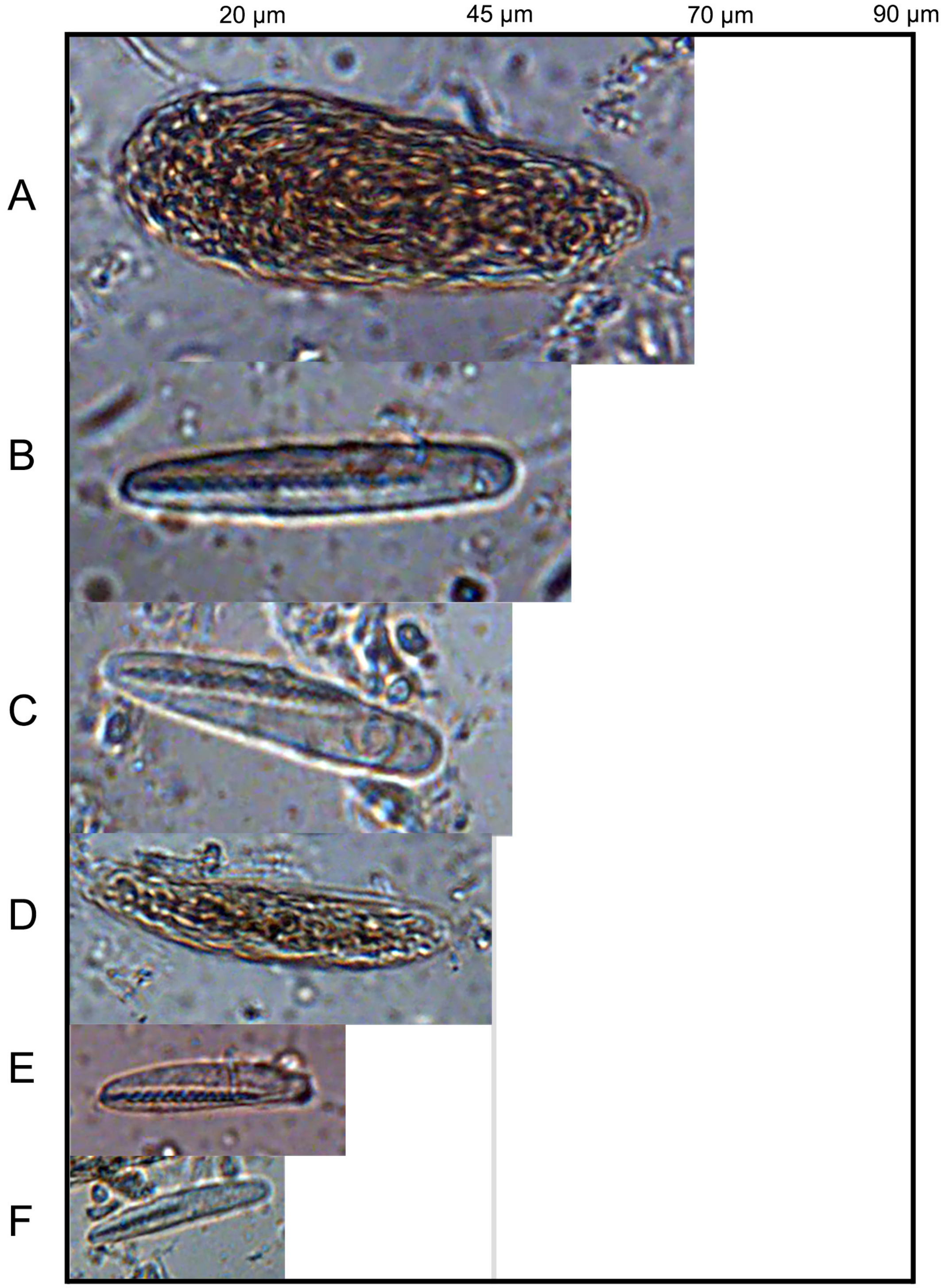

Figure 4. Cnidome of *Pachycerianthus fiordlandensis* sp. nov. based on two specimens (NIWA 139391; 139400).

arrangement of mesenteries. The cnidome of the species (Fig. 7) is composed of spirocysts, holotrics, atrichs, microbasic b-mastigophores (four types) and ptychocysts distributed as shown in Table 2.

Holotype description (NIWA 36894). Small polyp, 3.6 cm long, 11 mm diameter just below marginal tentacles and 4 mm near aboral end. Marginal tentacles 20, arranged in two pseudocycles. The space between cycles of marginal and labial tentacles white. Labial tentacles 28, about 3 mm long, white, directive labial absent, arrangement of marginal tentacles 1212.1212.1212… and labial tentacles 2134.3142.3142... . Oral disk 11 mm wide, stomodeum 6 mm long, white, siphonoglyph narrow and elongate with 4 mesenteries attached, hyposulcus 2 mm long with short hemisulci 1 mm long. Free parts of directive mesenteries very short, without mesenterial filaments. Second protomesenteries short, sterile, bearing small ciliated tracts with bundles of craspedonemes. Third protomesenteries sterile, short, with craspedonemes. M and

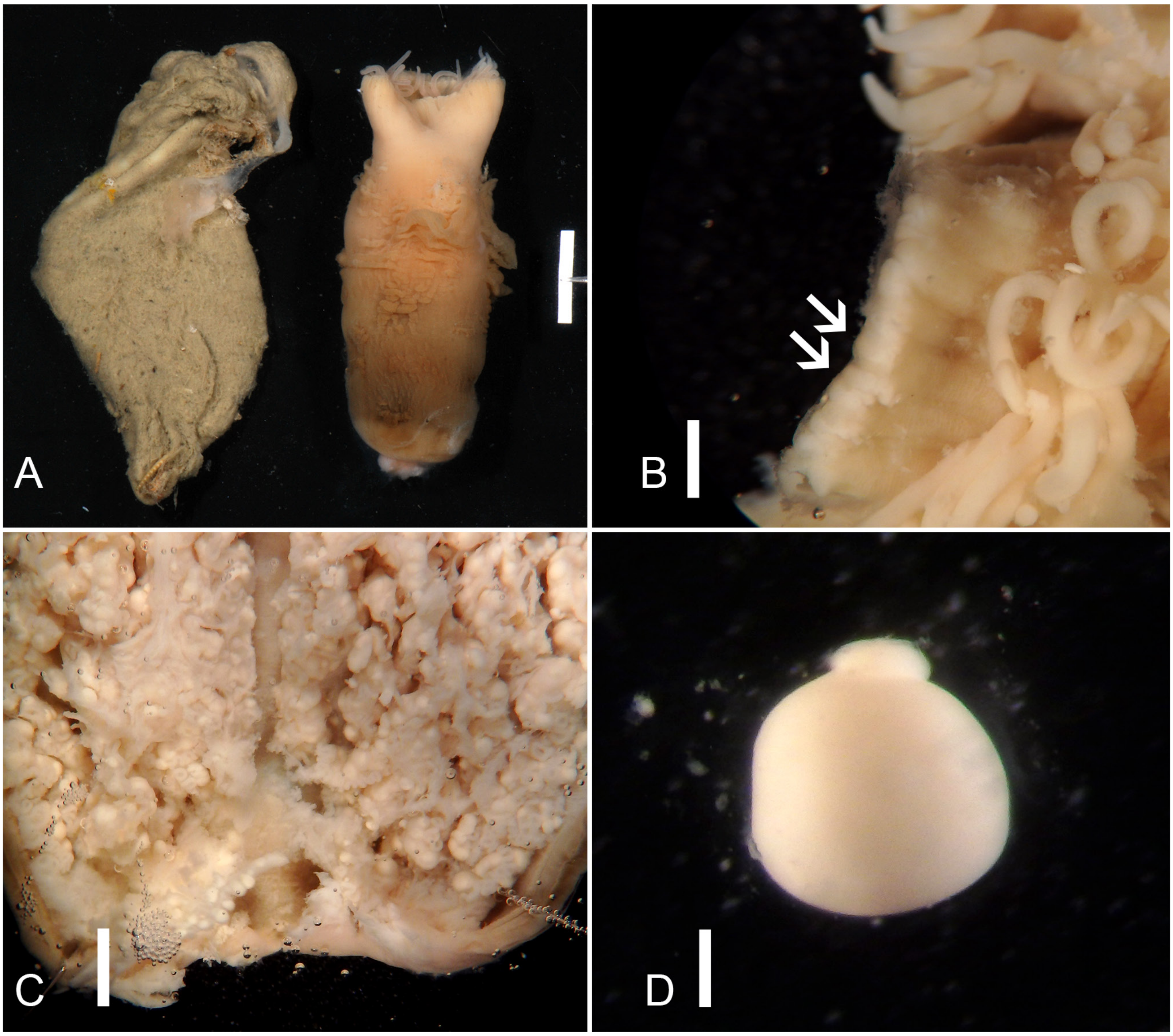

Figure 5. Specimens of *Pachycerianthus antarcticus* sp. nov. *(A)* Whole specimen with tube, NIWA 36894, holotype (photo: Stefano Schiaparelli, MNA Genoa, IPY-CAML); *(B)* detail of insertion area of marginal tentacles (arrows); *(C)* detail of mesenteries full of eggs; and *(D)* eggs (fertilized?).

m-metamesenteries long and almost equal length, fertile; M1 and M2 reaching almost aboral pore (M1=M2), with bundles of craspedonemes; B and b-mesenteries sterile, B two times longer than b.

Remarks. *Pachycerianthus antarcticus* is the first species of Ceriantharia to be recorded for the Antarctic region. In contrast to the pattern of species occurrence in the Arctic, records in the southern hemisphere have previously been restricted to semitropical or temperate regions (e.g., Molodtsova *et al.*, 2011; Stampar *et al.*, 2014).

Some aspects related to the species biology are important to highlight. The first is the presence of oocytes that appear to be fertilized in the gastrovascular cavity. Internal fertilization is not unknown in Ceriantharia (Nyholm, 1943), but appears to be rare and there is no data on the fertilization process. Presently it is unclear if self-fertilization or oral sperm capture occurs. Another aspect concerns the size of the ptychocyst capsules and the tube construction. Based on the small pieces of tube close to the specimen body, it is possible to observe a coarse grain size in the sediment used, so the construction of the tube must require longer ptychocyst filaments to be able to use this sediment as part of the tube (Stampar *et al.*, 2015). Based on current data, no further conclusions are possible, but a deeper analysis of the relationship between ptychocyst capsule size and sediment particle size would be useful to examine in future studies because the ecological role of these organisms can be quite important in modifying benthic environments (e.g., Shepard *et al.*, 1986).

Distribution. Southern Ocean, Antarctica.

Etymology. The specific name "antarcticus" (derived from the ancient Greek ἀνταρκτικός opposite to the Arctic) refers to the geographical occurrence of the specimens.

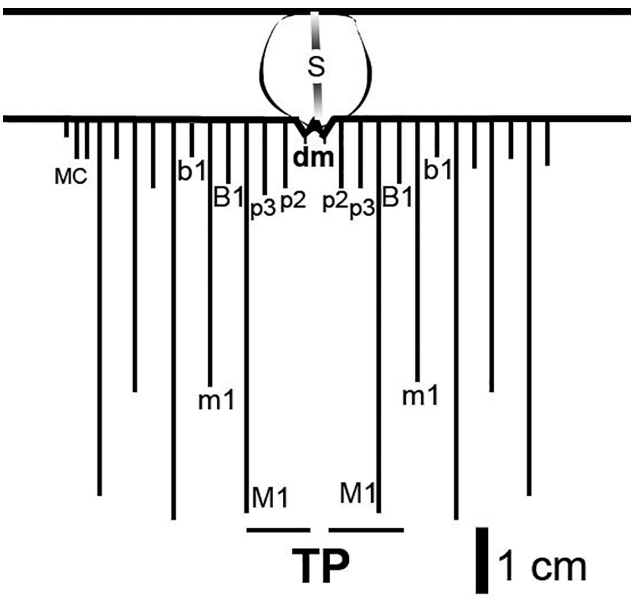

Figure 6. Graphical representation of the arrangement of mesenteries of *Pachycerianthus antarcticus* sp. nov. Abbreviations: *M.C.,* multiplication chamber; *dm,* directives; *T.P.,* terminal pore; *S,* siphonoglyph; *B,* betamesenteries (convoluted mesentery); *M,* metamesenteries (double filament); *P,* protomesenteries.

Table 2. Cnidome of *Pachycerianthus antarcticus* sp. nov. based on two specimens (NIWA 36894 and 103267). Mean and range given for each cnida.

Pachycerianthus antarcticus sp. nov.		
	length (in µm)	width (in µm)
column		
pytchocysts	59.9 (53.5–65.2)	16.5 (14.5–19.2)
holotrich	64.5 (59.5–69.3)	18.2 (14.5–19.2)
atrichs	36.4 (32.5–40.5)	8.2 (5.1–9.9)
b-mastigophores ii	29.5 (27.7–33.5)	6.9 (5.8–7.7)
b-mastigophores iii	26.8 (23.9–27.9)	7.6 (6.5–8.6)
marginal tentacles		
b-mastigophores iv	18.7 (75.6–92.3)	6.1 (5.4–6.9)
atrichs	32.6 (31.7–36.6)	7.2 (6.6–7.9)
labial tentacles		
b-mastigophores i	86.7 (75.6–92.3)	10.1 (8.9–11.7)
b-mastigophores ii	29.4 (26.3–32.9)	6.6 (5.7–7.5)
atrichs	38.5 (34.1–40.6)	8.3 (5.5–10.2)
stomodeum		
b-mastigophores i	84.5 (72.5–89.6)	9.8 (8.5–10.9)
b-mastigophores ii	28.6 (27.1–29.9)	6.6 (6.2–7.2)
atrichs	30.7 (29.2–32.5)	7.9 (7.1–8.6)
mesenteries Type b		
atrichs	30.9 (29.4–33.2)	8.1 (6.9–9.2)
mesenteries Type m		
b-mastigophores ii	30.8 (29.2–33.1)	6.7 (6.2–7.3)

Pachycerianthus nobilis (Haddon & Shackleton, 1893)

Cerianthus nobilis Haddon & Shackleton, 1893: 116, 118; Carlgren, 1896: 174; Haddon, 1898: 400–401; Pax, 1910: 167.
Pachycerianthus nobilis Molodtsova, 2000: 19; Molodtsova, 2007: 133; Stampar *et al.*, 2014: 350, 352.

Specimens examined. AM G16074, Dunwich, Stradbroke Island, Moreton Bay, Queensland, Australia, 27.50°S 153.40°E (1974); AM G18351, Dunwich, Stradbroke Island, Moreton Bay, Queensland, Australia (06/viii/1961), on sand flats (5 specimens); Museum and Art Gallery of the Northern Territory: NTM CO14354, Town Hall, Channel Island, Darwin Harbor, Darwin, Northern Territory, Australia, 12.550°S 130.833°E, 6–8 m depth.

Remarks. The specimens studied come from southern Queensland and the northern part of the Northern Territory. As this species has been described from Torres Strait in northern Queensland, the distribution appears to be quite broad, encompassing the Timor Sea, Arafura Sea and Coral Sea. The polyps generally have a whitish-green color in the tentacle region and reddish-brown color in the column. However, some live specimens have different tentacle colors, including purple to green marginal tentacles. All specimens examined were fertile, including those smaller than 3 cm in length. This indicates that reproductive maturity is reached rapidly and long before specimens reach the maximum reported size for the species (10 cm in preserved specimens). This is a very little studied species but is apparently common and of commercial importance as it is sold in aquarium stores to amateur hobbyists (SNS personal observation). Therefore, an assessment of conservation status and reproductive patterns of this species would be valuable.

Distribution. Queensland and Northern Territory, Australia, New Caledonia, depth: shallow waters.

Genus *Ceriantheopsis* Carlgren, 1912

Type species. *Ceriantheopsis americana* (Agassiz in Verrill, 1864) by subsequent designation (Carlgren, 1912, p. 24).

Diagnosis. Ceriantharids with alternating sterile and fertile mesenteries. Second protomesenteries fertile, reaching aboral pole. Metamesenteries arranged in mBMb. Length of all but M-metamesenteries diminishes toward multiplication chamber. Length of M-metamesenteries of first 2–4 quartets can increase toward the multiplication chamber. M3 and further mesenteries can diminish in length towards multiplication chamber (Carlgren, 1912).

Distribution. Previously restricted to the Atlantic Ocean (Caribbean Sea, Gulf of Mexico, US Coast and South Africa Coast), expanded in this study to the South Pacific with the description of a new species.

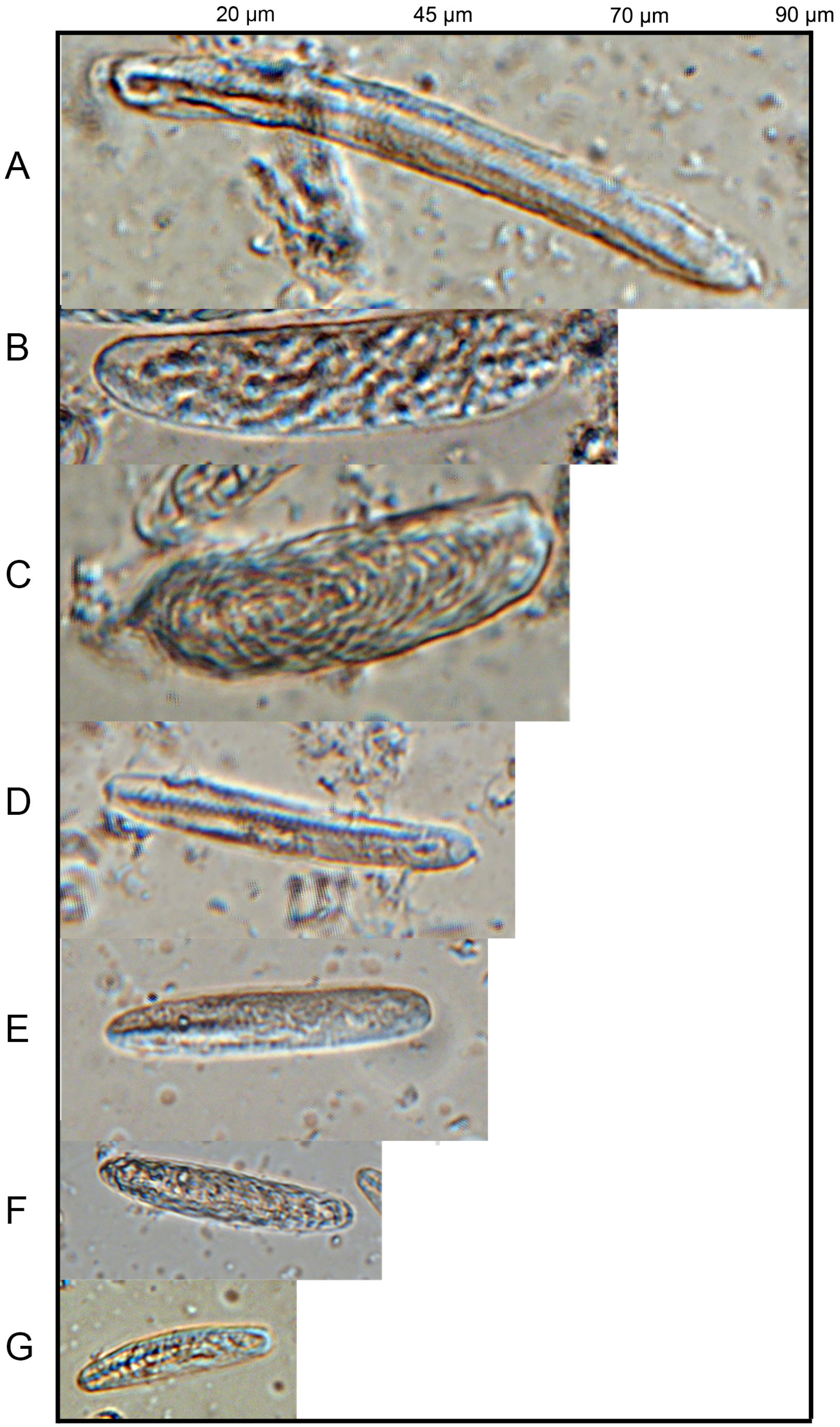

Figure 7. Cnidome of *Pachycerianthus antarcticus* sp. nov. based on the holotype.

Ceriantheopsis microbotanica sp. nov.

urn:lsid:zoobank.org:act:965A7558-90F3-4061-AA9C-9C3C8DA0BDFE

Figs 8–10, Table 3

Holotype. Australian Museum G18354, Botany Bay, west of Port Botany, New South Wales, Australia 33.98°S 151.20°E (13/ii/1975), depth not recorded. **Paratypes**. Botany Bay, New South Wales, Australia (12/x/1995), all Smith-McIntyre grab, AM G18356, 33.97°S 151.19°E, 15.5 m (1 specimen), AM G18357, 33.97°S 151.18°E, 16.3 m (2 specimens), AM G18358 33.96°S 151.18°E, 16.3 m (1 specimen).

Diagnosis. Labial tentacles in two pseudocycles. Only directive mesenteries attached to siphonoglyph, presence of directive labial tentacle, M and m mesenteries with almost same length and very short mesenterial structures.

Variation. Elongated (up to 40 mm long) and narrow (3–4 mm width) cerianthid; 20–38 brown marginal tentacles (3–4 mm in preserved specimens), arrangement 1212.1212.1212…, no visible pores on tentacle; 16–36 brown labial tentacles (up to 2 mm long in preserved specimens), arrangement (2)131.3212.3212…, unpaired labial tentacle present; slightly smooth stomodeum extending over 1/6 to 1/7 of total body length, hyposulcus 2 mm long, hemisulci 1 mm long; siphonoglyph narrow, connected only to directives; free parts of sterile directive mesenteries almost the half length of siphonoglyph, without mesenterial filaments. Second protomesenteries almost reaching aboral pole, fertile, with very short cnido-glandular tracts (c. 20% of the mesentery). Third protomesenteries sterile, longer than 1/4 of P2, with craspedonemes at middle region. M and m-metamesenteries long, fertile; M1 and m1 almost reach aboral pore with bundles of craspedonemes and cnido-glandular tracts (c. 30% of the mesentery); B and b-mesenteries, sterile, B mesenteries 30% longer than b; see Fig. 9 for schematic arrangement of mesenteries. The cnidome of the species (Fig. 10) is composed of spirocysts, microbasic b-mastigophores (three types) and ptychocysts distributed as shown in Table 3.

Table 3. Cnidome of *Ceriantheopsis microbotanica* sp. nov. based on two specimens (AM G18354 and AM G18358). Mean and range given for each cnida.

Ceriantheopsis microbotanica sp. nov.	length (in µm)	width (in µm)
column		
pytchocysts	52.5 (49.6–58.2)	18.5 (16.5–22.2)
b-mastigophores i	42.6 (36.8–45.5)	9.2 (8.7–10.1)
atrichs	41.5 (36.5–44.5)	8.9 (7.6–9.9)
marginal tentacles		
b-mastigophores i	41.5 (36.9–43.7)	9.1 (8.5–9.9)
b-mastigophores ii	16.5 (12.5–19.4)	7.2 (6.6–7.9)
labial tentacles		
b-mastigophores ii	16.7 (13.2–18.2)	7.6 (6.8–7.9)
stomodeum		
b-mastigophores ii	16.4 (12.8–17.6)	7.3 (6.5–8.1)
mesenteries Type m		
b-mastigophores iii	11.2 (9.4–12.1)	3.7 (3.2–4.3)

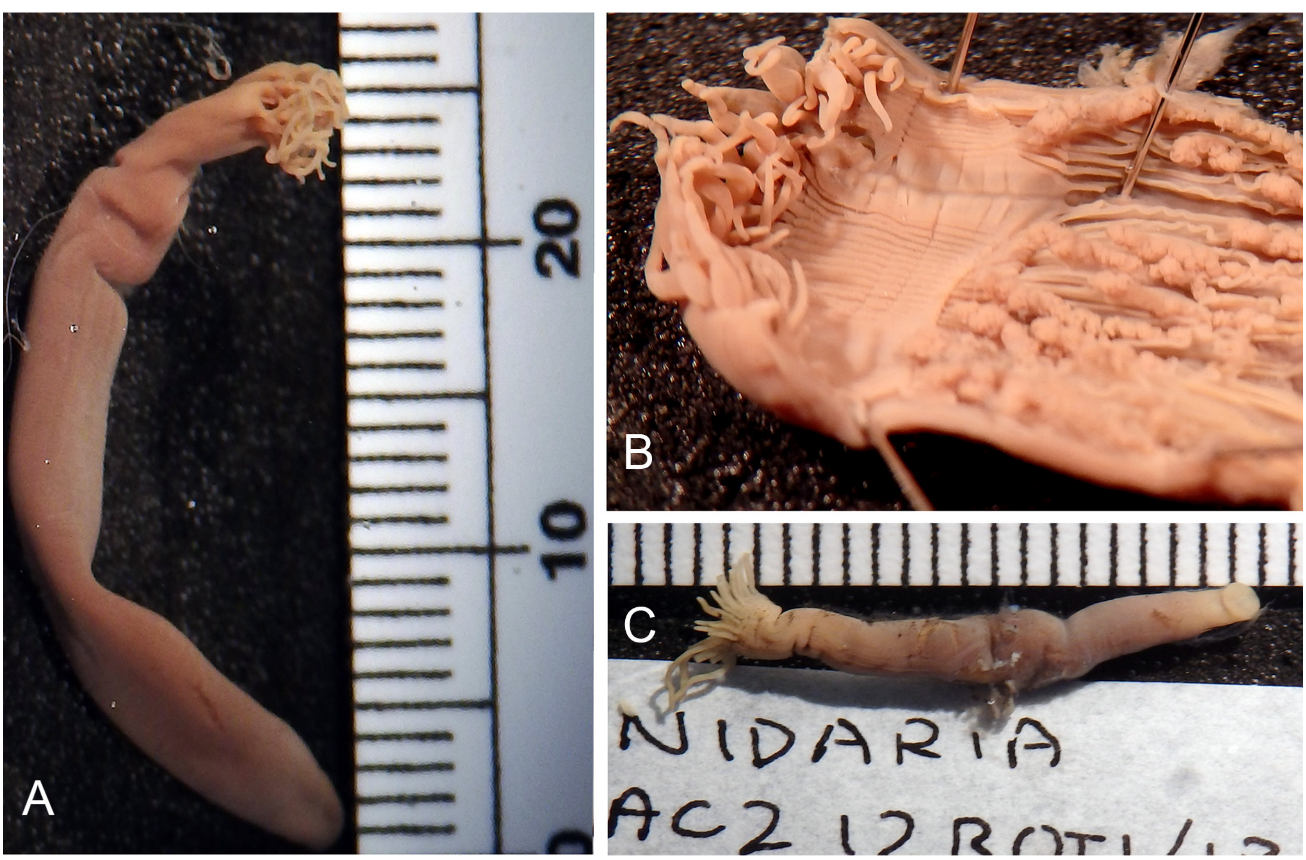

Figure 8. Specimens of *Ceriantheopsis microbotanica* sp. nov. (AM G18357). *(A, C)* Whole specimens; *(B)* detail of siphonoglyph.

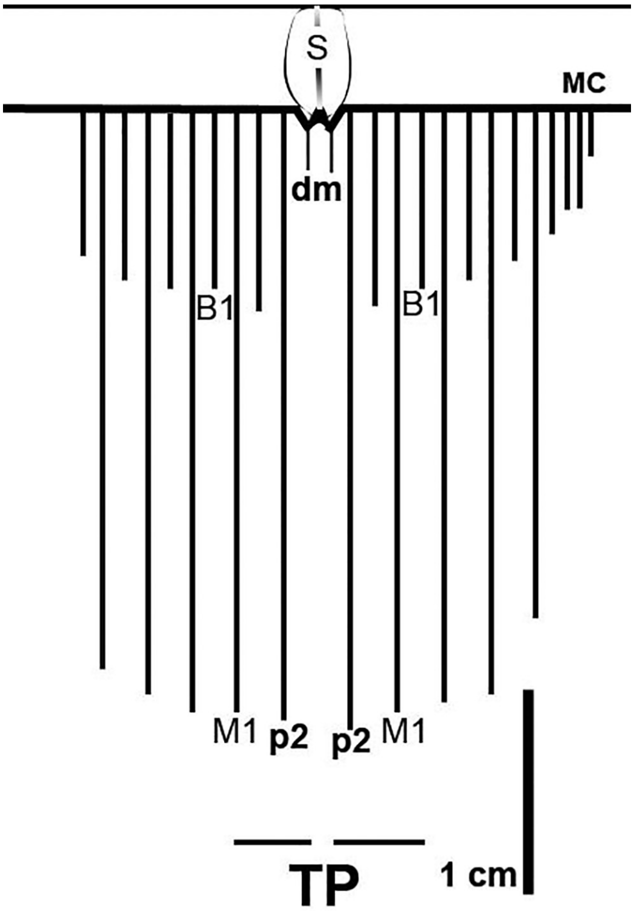

Figure 9. Graphical representation of the arrangement of mesenteries of *Ceriantheopsis microbotanica* sp. nov. Abbreviations: Abbreviations: *M.C.,* multiplication chamber; *dm,* directives; *T.P.,* terminal pore; *S,* siphonoglyph; *B,* betamesenteries (convoluted mesentery); *M,* metamesenteries (double filament); *P,* protomesenteries.

Holotype description (AM G18354). Elongated polyp, 38 mm long, 4 mm diameter just below marginal tentacles and 3 mm near aboral end. Marginal tentacles 38, arranged in two pseudocycles, 3–4 mm long and 0.5 mm in diameter near the base, brown with a lighter longitudinal line. The space between cycles of marginal and labial tentacles short and light brown. Labial tentacles 36, arranged in four pseudocycles, about 2 mm long, brown, directive labial present, arrangement of marginal tentacles 1212.1212.1212… and labial tentacles (2)131.3212,3212…. Oral disk 4 mm wide, stomodeum 5 mm long, light brown, siphonoglyph narrow and elongate with 2 mesenteries attached (directives), hyposulcus 1.7 mm with short hemisulci 0.7 mm long. Free parts of directive mesenteries rather short, without mesenterial filaments. Second protomesenteries almost reach aboral pole, fertile, bearing ciliated tract at first 1/4 of the mesentery. Third protomesenteries sterile, longer than 1/4 of the P2, with craspedonemes at first 1/4 of the mesentery. M and m-metamesenteries indistinct with the same length, fertile; M1 and m1 almost reach the aboral pore (9/10 of gastral cavity) with mesenteric filaments at first 1/4 of each mesentery; B mesenteries 30% longer than b mesenteries.

Remarks. This species has a very unusual form, probably due to the small body size. The organization of the mesentery seems to have been restricted and it is not possible to verify a clear difference between the same type of mesenteries, B or M. Still, the genus *Ceriantheopsis* is the most suitable placement for this species, because of the mesenterial arrangement (with long and fertile P2). This species is unusual because of its small size and also seems endemic to a very restricted area. All specimens were collected in benthic surveys. In one of these studies, two estuaries, Botany Bay and Pittwater, were evaluated for comparative purposes with many samples (Wilson *et al.*, 1998). The distance between these two regions is only 50 km. Interestingly, samples of *Ceriantheopsis microbotanica* only come from Botany Bay. Perhaps there is some strong biological or other reason that has restricted collections to date to this location. This is also potentially a very interesting species for studies of evolutionary developmental mechanisms (evo-devo) because its small size can be compared with the well-known biological model *Nematostella vectensis* (Darling *et al.*, 2005; He *et al.*, 2019).

Distribution. Botany Bay, Sydney, Australia.

Etymology. The species name is derived from a mixture of the locality name (Botany Bay) and the size of the specimens (micro).

Ceriantheopsis zealandiaensis sp. nov.

urn:lsid:zoobank.org:act:BC26F829-165B-4AA4-B4CF-0AF6673C72E7

Figs 11–13, Table 4

Holotype. NIWA Invertebrate Collection (NIC), NIWA 87139, Gaer Arm, Whale Rock, Fiordland, 45.2825°S 167.1211667°E (19/ii/2013), depth c. 15 m. **Paratype**. NIWA 145027, same details as holotype.

Diagnosis. Labial tentacles dark brown. Eight mesenteries attached to siphonoglyph, P2 with 3/4 of gastral cavity, labial tentacles in three rows.

Variation. Long (up to 150 mm long) and thin (10–20 mm width) cerianthid; 64–70 light brown marginal tentacles (20–22 mm in preserved specimens), at least one line over marginal tentacle length, arrangement 3412.3412.3412, with more than 6 pores per tentacle; 56–62 dark brown labial tentacles (up to 07 mm long in preserved specimens), arrangement (2)313.2123.2123, unpaired labial tentacle present; pleated stomodeum extending over 1/6 to 1/7 of total body length, hyposulcus 3 mm long, hemisulci distinct; siphonoglyph wide, connected to four pairs of mesenteries; free parts of sterile directive mesenteries shorter than siphonoglyph length, without mesenterial filaments. Second protomesenteries almost reaching aboral pole with 3/4 of gastral cavity, fertile, bearing ciliated tracts with bundles of craspedonemes at the very beginning, followed by very short cnido-glandulars tract and long (c. 90% of the mesentery) craspedion tracts. Third protomesenteries sterile, longer than B1 and much longer than directives, with craspedonemes. M and m-metamesenteries long, fertile; M1 reach 3/5 of total body length and M2 reaching almost the same, but shorter than M1, with bundles of craspedonemes; B and b-mesenteries, sterile, with B almost twice length of b;

Figure 10. Cnidome of *Ceriantheopsis microbotanica* sp. nov. based on two specimens (AM G18354 and AM G18358).

see Fig. 12 for schematic arrangement of mesenteries. The cnidome of the species (Fig. 13) is composed of spirocysts, holotrichs, microbasic b-mastigophores (three types) and ptychocysts distributed as shown in Table 4.

Holotype description (NIWA 87139). Rather elongated polyp, 7 cm long, 19 mm diameter just below marginal tentacles and 7 mm near aboral end. Marginal tentacles 64, arranged in four pseudocycles, 20–22 mm long and 0.8–1 mm in diameter near the base, light brown with longitudinal line. The space between cycles of marginal and labial tentacles dark brown coloured. Labial tentacles 56, about 07 mm long, brown, directive labial present, arrangement of marginal tentacles 3412.3412.3412… and labial tentacles (2)313.2123.2123.... Oral disk 16 mm wide, stomodeum 10 mm long, dark brown, siphonoglyph wide and rather short with 8 mesenteries attached, hyposulcus 3 mm long with short hemisulci 1 mm long. Free parts of directive mesenteries without mesenterial filament. Second protomesenteries almost reach aboral pole, fertile, bearing ciliated tract with bundle of craspedonemes. Third protomesenteries sterile, longer than B1, with craspedonemes. M and m-metamesenteries long, fertile; M1 and M2 reach 3/4 of total body length and M1 longer than M2, with bundle of craspedonemes; B and b-mesenteries, B twice longer than b.

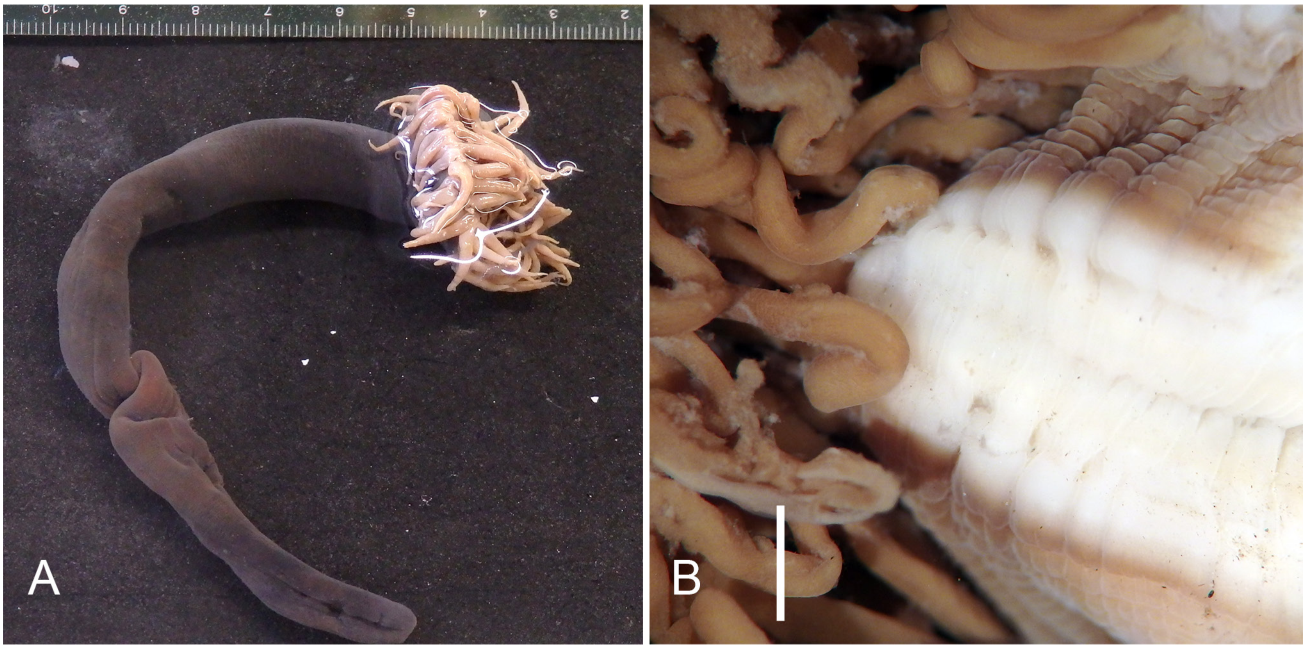

Figure 11. Holotype specimen of *Ceriantheopsis zealandiaensis* sp. nov., NIWA 87139. *(A)* Whole specimen; *(B)* detail of syphonoglyph.

Remarks. This species is only known from two specimens collected from a rock wall habitat in Fiordland at scuba diving depths. Environmental conditions in the fjords create unique conditions in the shallow sub-tidal zone, just below the low-salinity layer, making it similar to deep-sea habitats; hence many deep sea dwelling and ancient species can be found at a much shallower depth in Fiordland than anywhere else in the world (Wing, 2003). Ceriantharia have

Table 4. Cnidome of *Ceriantheopsis zealandiaensis* sp. nov. based on two specimens (NIWA 87139;145027). Mean and range given for each cnida.

Ceriantheopsis zealandiaensis sp. nov.		
	length (in µm)	width (in µm)
column		
pytchocysts	71.0 (62.5–76.8)	28.2 (22.5–35.2)
holotrich	70.5 (66.4–73.3)	17.2 (16.1–18.9)
atrichs	26.2 (22.5–32.5)	7.8 (6.5–8.4)
b-mastigophores ii	28.4 (26.9–29.8)	6.4 (5.6–7.5)
marginal tentacles		
b-mastigophores ii	28.2 (26.5–29.7)	6.3 (5.5–7.5)
atrichs	30.5 (29.2–32.1)	8.2 (7.8–8.9)
labial tentacles		
b-mastigophores i	41.2 (37.5–43.5)	15.4 (13.9–16.7)
b-mastigophores ii	28.2 (26.5–29.7)	6.3 (5.5–7.5)
atrichs	26.4 (24.1–29.4)	6.1 (5.6–6.8)
stomodeum		
b-mastigophores i	42.8 (38.9–46.5)	15.8 (14.6–16.4)
b-mastigophores ii	26.7 (25.7–28.7)	6.4 (6.0–7.1)
b-mastigophores iii	13.5 (12.4–14.6)	3.8 (3.3–4.2)
atrichs	28.7 (25.6–30.2)	7.8 (6.9–8.3)
mesenteries Type b		
atrichs	27.8 (25.5–29.2)	7.6 (6.7–8.2)
mesenteries Type m		
b-mastigophores ii	25.5 (24.7–27.7)	6.2 (5.8–7)

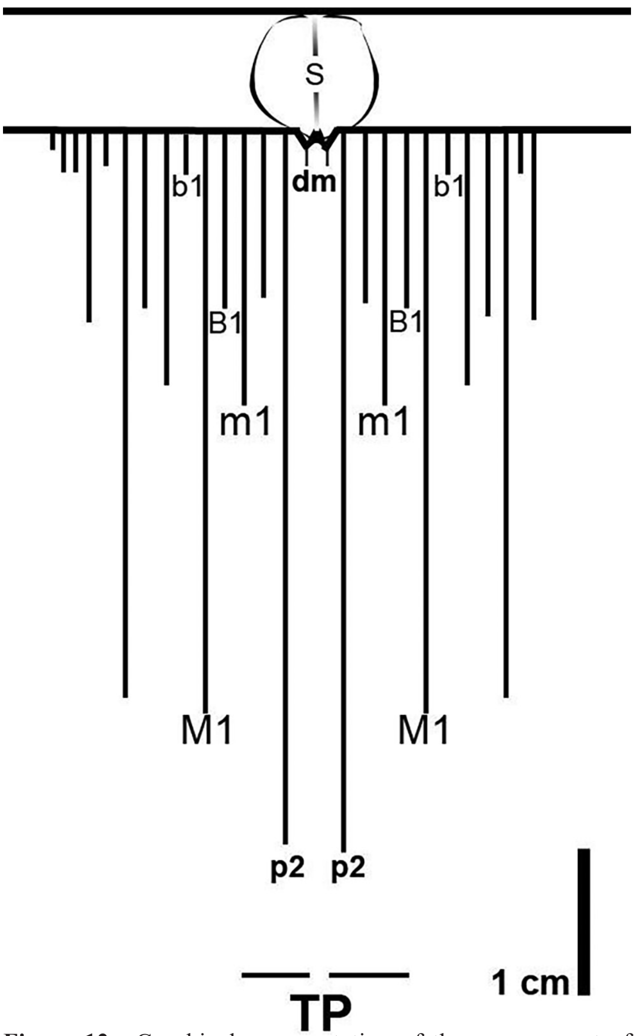

Figure 12. Graphical representation of the arrangement of mesenteries of *Ceriantheopsis zealandiaensis* sp. nov. Abbreviations: *M.C.,* multiplication chamber; *dm,* directives; *T.P.,* terminal pore; *S,* siphonoglyph; *B,* betamesenteries (convoluted mesentery); *M,* metamesenteries (double filament); *P,* protomesenteries.

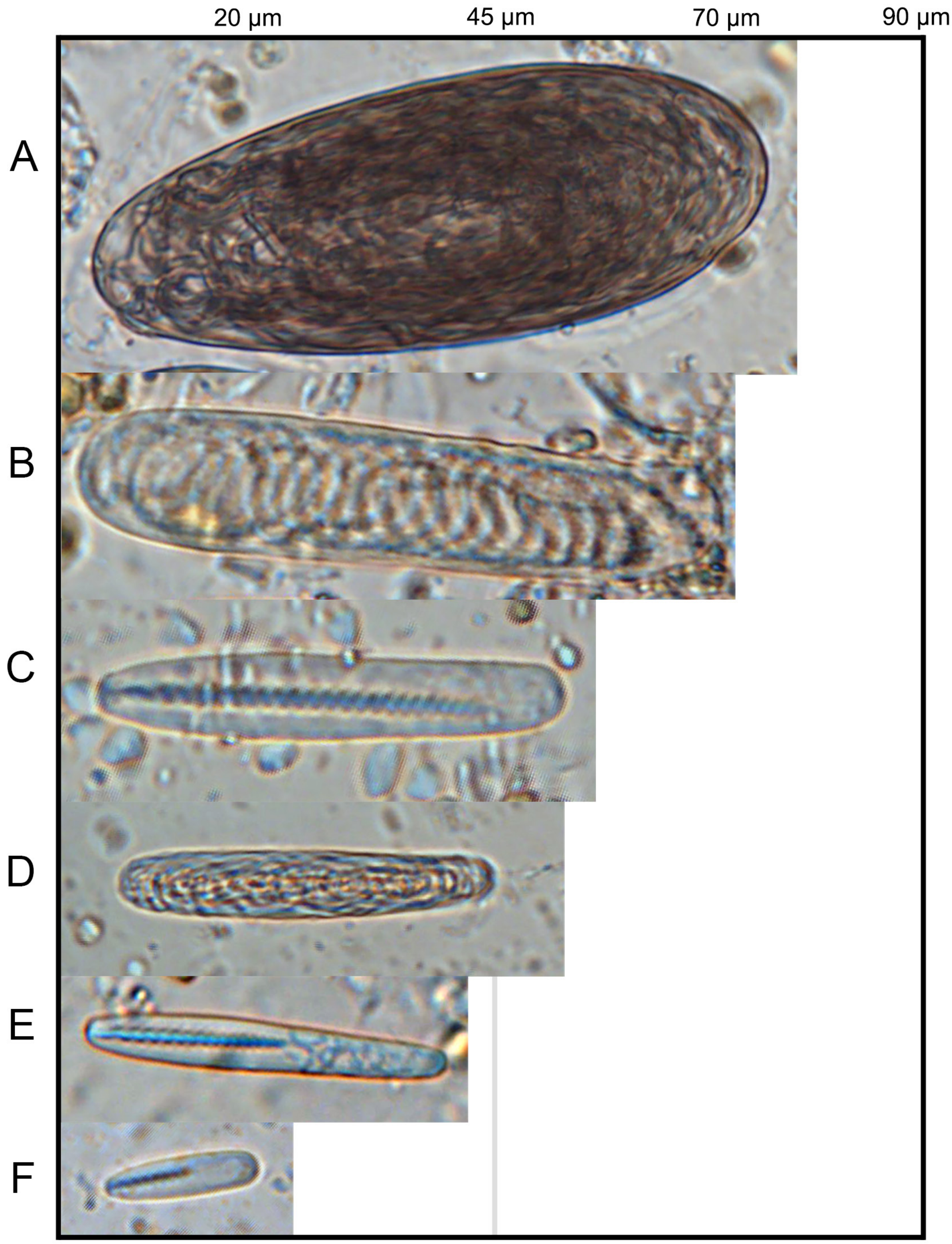

Figure 13. Cnidome of *Ceriantheopsis zealandiaensis* sp. nov. based on two specimens (NIWA 97139, 145027).

been recorded as dominant members of the soft sediment community on the sand slope areas of the rock wall zone in Fiordland (Grange *et al*., 1981), but their ability to escape from the tube they occupy into the sediment is a reason for loss in most sampling attempts (Stampar *et al*., 2016). Thus, while image-based records of Ceriantharia by divers and underwater camera systems are numerous, corresponding instances of specimens are rare. The range of this species is very close to that recorded for *Pachycerianthus fiordlandensis* sp. nov. and they are probably sympatric in some localities. Although the anatomy is quite distinct, based solely on external morphology it is quite difficult to discern between the two species. However, like all species of the genus *Ceriantheopsis*, *C. zealandiaensis* is quite thin and long compared to *Pachycerianthus* and this may give a gross guide in the field. Unlike *Pachycerianthus antarcticus*, *Ceriantheopsis zealandiaensis* does not appear to maintain already fertilized oocytes: although both specimens examined are already fully mature, there is no sign of these in the gastrovascular cavities.

Distribution. Fiordland, New Zealand.

Etymology. The specific name, *zealandiaensis*, is based on the name of the ancient submerged continent that contains New Zealand, the country where the specimens were collected.

Order Penicillaria Hartog, 1977

Family Arachnactidae McMurrich, 1910

Genus *Isarachnanthus* Carlgren, 1924

Type species. *Isarachnanthus maderensis* (Johnson, 1861).

Diagnosis (*sensu* Carlgren, 1924). Arachnactidae with second couple of protomesenteries long, sterile with acontioids. Directive labial tentacle present. Arrangement of metamesenteries in each quartette M,B,m,b (1,3,2,4), more or less distinct.

Distribution. This genus is distributed worldwide.

Isarachnanthus bandanensis Carlgren, 1924

Isarachnanthus bandanensis Carlgren, 1924: 187–190, 195; Cutress, 1977: 145; den Hartog, 1977: 235; Cutress & Arneson, 1987: 54, 56–58; den Hartog, 1997: 352; Stampar *et al.*, 2012: 1–2, 5–9.

Specimen examined. AM G18865, South end of Casuarina Beach, Lizard Island, Queensland, Australia (near rock on rubble reef), 14.6811°S 145.4470°E (xii/1974), low tide.

Remarks. This is a nocturnal species, so observing individuals of it requires a specific approach and opportunities for this are limited in many locations. The specimen examined is not complete and is a young individual with no gonads, but it is possible to verify it has a well-formed mesentery. Carlgren (1924) described the species based on specimens from the Banda Islands, Indonesia. From this text, the diagram of the mesenteries, part of the cnidome and the tentacle organization match the specimen examined here, however there are also similarities to *Isarachnanthus panamensis* Carlgren, 1924 which need to be resolved through comparison of material from the type locality of both species. Additionally, there is a need for a review of the genus, especially with the use of molecular data, to verify the consistency of Pacific Ocean species.

Distribution. Australia, French Polynesia, Hawaii, and Indonesia, depth: shallow waters.

Discussion

The Tasman Sea and adjacent areas are relatively well studied for several invertebrate groups, especially Crustaceans and Polychaeta (Glasby & Alvarez, 1999; Williams *et al.*, 2010; Przeslawski *et al.*, 2011). However, some taxa remain poorly known, including a large part of the Cnidaria. One of the cnidarian clades with the lowest number of studies in the region is the subclass Ceriantharia, which has been the focus of only three specific studies in the last 120 years as outlined below.

The first study addressing this group was by Haddon & Shackleton (1893) describing a shallow water species for the northwest region of Australia, *Pachycerianthus nobilis* (as *Cerianthus nobilis*). The present study presents some new data to complement the original description of this species and allow better comparison to other species. Accordingly, it has been possible to validate the status of the species in relation to the others described from the region. Apparently, *P. nobilis* is a warm water species and tolerates some subtropical (mild-cold) waters in southern Queensland.

More than forty years after this first study, Carlgren (1937) described *Arachnanthus australiae* from Queensland, Australia, in the family Arachnactidae. The description is very detailed, especially in relation to generic characters. A specimen of this family examined in the present study is clearly not this species of *Arachnanthus* but matches generic characters of *Isarachnanthus*. The morphology of this specimen corresponds with the *Isarachnanthus bandanensis*, which has been described for Indonesia and this new record represents a range extension consistent with the known distribution of the species.

After a further long interval of almost 60 years, Carter (1995) described two species from Port Jackson (Sydney), New South Wales, Australia. In the current study it became evident that the characters used for differentiation of these two species are not consistent and they should be synonymized, with *P. delwynae* taking precedence.

Also, during the current study, as a result of specimens largely obtained during an environmental impact assessment of the expansion of Sydney Airport in Botany Bay (Wilson *et al.,* 1998), it was possible to recognize a new species of Ceriantharia of very small size, described here as *Ceriantheopsis microbotanica*. These specimens are so small that they were initially identified as members of Actiniaria (family Edwardsiidae). In fact, *P. microbotanica* is associated with samples of, and apparently lives among specimens of, *Edwardsia* sp., although they are slightly larger and have all the morphological characters of Ceriantharia. Therefore, this is the third species of Ceriantharia that inhabits the area between south central New South Wales to southern Queensland along with *Pachycerianthus nobilis* and *P. delwynae*.

Knowledge of New Zealand and Antarctic Ceriantharia was even more limited than reported above for Australia, with no preceding taxonomic study providing anatomical descriptions. Three new species are described in the present study for this area. The species *Pachycerianthus fiordlandensis* and *Ceriantheopsis zealandiaensis* are representatives of rather shallow water taxa occurring in some zones of fiords. *Ceriantheopsis zealandiaensis* and *C. microbotanica* are the first records of the genus in the Pacific region. Unlike the Arctic Ocean, for which some species of Ceriantharia are reported (e.g., *Pachycerianthus borealis*) (Shepard *et al.*, 1986), the Antarctic region has had no described species until now. Therefore, the description of *Pachycerianthus antarcticus* is important for discussions of biogeography. This species is also noteworthy because of the type of sediment in which these organisms live. The construction of the tube in Ceriantharia is a complex process (eg Stampar *et al.*, 2015), and in thicker and rocky sediments particularly difficult. Future studies on these species may provide new insights into the behavior and process of tube construction.

Morphological characters of new species

Although species are compared in the tables (Tab. 5 and 6) with detailed references, here we highlight diagnostic characteristics for each of them compared to species with close biogeographic affinities. For *Pachycerianthus*, within the area of the South Pacific and Southern Oceans, there are

Table 5. Comparison of anatomical features of species of *Pachycerianthus*. (? = no data or uncertain). See text for discussion.

species	directive mesenteries length	directive labial tentacle	M-mesentery (M1) length	M-mesentery (M2) length	M-mesentery (m1) length	M-mesentery (m2) length	mesenteries attached to siphonoglyph	siphonoglyph shape	no. of marginal tentacles	occurrence area	references
P. fiordlandensis	< stomodeum	present	almost reach aboral pore	M-1	4/5 of M1	2/3 of M1	6	narrow	88	New Zealand	this Study
P. antarcticus	< stomodeum	absent	almost reach aboral pore	longer than M-1	2/3 of M1	2/3 of M1	6	narrow	20–33	Antarctic Ocean	this Study
P. aestuari	> stomodeum	?	reach aboral pore	M-1	1/5 of M-1	= m-1	16	wide	30–34	USA (Pacific Coast)	Torrey & Kleeber 1909
P. benedeni	< stomodeum	?	reach aboral pore	?	?	?	6?	wide?	~125	Japan	Role, 1904
P. borealis	> stomodeum	?	reach aboral pore	= M-1	3/4 of M-1	~1/3 of M-1	8	wide	139–155	Canada, USA (North Atlantic)	Kingsley, 1904
P. curacaoensis	> stomodeum	absent	reach aboral pore	1/2 of M-1	1/4 of M-1	2/3 of m-1	4	short and narrow	74–105	Caribbean Sea (Curaçao)	den Hartog, 1977
P. delwynae	> stomodeum	present	almost reach aboral pore	longer than M-1	1/3 of M-1	1/2 of M-1	6	narrow	89–114	Australia	Carter, 1995
P. dohrni	?		half column	> M-1	?	?	?	?	~160	Mediterranean	van Beneden, 19
P. fimbriatus	> stomodeum	present	reach aboral pore	3/4 of M-1	1/3 of M-1	1/3 of M-1	8	wide and long	<60	Pacific (Canada-USA, Indonesia- Malaysia)	McMurrich, 1910 Arai, 1965
P. insignis	< stomodeum	present	almost reach aboral pore	M-1	M-1	M-2	8	?	~100	Gulf of California-Mexico	Carlgren, 1951
P. johnsoni	< stomodeum	?	reach aboral pore	3/4 of M-1	3/4 of M-1	1/2 of M-1	8	wide	~108	USA (Pacific Coast)	Torrey & Kleeber 1909
P. magnus	> stomodeum	present	almost reach aboral pore	3/4 of M-1	1/3 of M-1	1/2 of M-1	6	short and narrow	~120	Japan, China	Uchida, 1979; Stampar *et al.* , 2
P. maua	< stomodeum	absent	reach aboral pore	1/4 of M-1?	1/3 of M-1?	1/3 of M-1?	6	narrow	~150	Red Sea, Gulf of Aden, Tanzania	Carlgren, 1900, 1 Carter, 1995
P. monostichus	> stomodeum	present	reach aboral pore	M-1	1/2 of M-1	m-1	8	narrow and long	~47	Indonesia	McMurrich, 1910
P. multiplicatus	> stomodeum	absent	reach aboral pore	= M-1	1/3 of M-1	1/3 of M-1	6	narrow	175	North Sea	Carlgren, 1912;
P. nobilis	> stomodeum	present	half column	3/4 of M-1	1/3 of M-1	1/4 of M-1	8	wide	80–170	Australia	Haddon & Shackleton, 1893 study
P. schlenzae	> stomodeum	present	reach aboral pore	3/4 of M-1	1/2 of M-1	1/3 of M-1	6	long and narrow	60–85	Brazil	Stampar *et al.* , 2
P. solitarius	> stomodeum	present	reach aboral pore	M-1	1/4 of M-1	1/5 of M-1	6	narrow	~64	Mediterranean, Black Sea, Aegean Sea, Atlantic.	van Beneden, 19

Table 6. Comparison of anatomical features of species of *Ceriantheopsis*. See text for discussion

	C. americana	*C. nikitai*	*C. austroafricana*	*C. lineata*	*C. microbotanica* sp. nov.	*C. zealandiaensis* sp. nov.
marginal tentacles	up to 100–120	up to 70	up to 70	up to 60	20–38	up to 70
directive labial tentacle	present	present	present	absent	present	present
arrangement of labial tentacles	(2)413.4232.4312* (4)413.4231.4312.4312	(3)423.4232.4312.4312	(2)313.4343.4324.3124	4231.4231.4231.4231	(2)131.3212.3212	(2)313.2123.2123
actinopharynx	1/12–1/8 of gastric cavity	1/5–1/4 of gastric cavity	1/10–1/8 of gastric cavity	1/6–1/5 of gastric cavity	1/7–1/6 of gastric cavity	1/7–1/6 of gastric cavity
oral disc	0.7–1.0 cm	c. 0.6–0.7 cm	wide, c. 1.5 cm in preserved	1.0–1.5 cm in preserved	0.3–0.4 cm	1–2 cm
siphonoglyph	narrow, 4 mesenteries attached	wide, 4 mesenteries attached	wide, 4 mesenteries attached	narrow, 2 mesenteries attached	narrow, 2 mesenteries attached	wide, 8 mesenteries attached
directive mesenteries	< actinopharynx	~ actinopharynx	~ actinopharynx	< actinopharynx	< actinopharynx	< actinopharynx
P2	to aboral pole	to aboral pole	to aboral pole	almost to aboral pole	almost to aboral pole	almost to aboral pole
P3	= B	= B	= B	= B	> B	< B
M	>> B	< 2B	> B	≥ B	>> B	> B
M3	≤ M2	> M2	≤ M2	< half M2	almost = B2	< M2
cnido-glandular tract at fertile mesenteries of first quartets	present	not present	present	present	present, very small	present
craspedion tract at fertile mesenteries	6/7–8/9	3/5	6/7	c. 6/7–8/9	3/5	8/9
cnido-glandular tract at B	<< b	= b	< b	< b	= b, very short	= b
craspedonemes of craspedion at fertile mesenteries	sometimes present	absent	absent	absent	absent	absent
references	McMurrich, 1910; Carlgren, 1912; Molodtsova *et al.*, 2011, Stampar *et al.*, 2016b	Molodtsova, 2001; Molodtsova *et al.*, 2011, Stampar *et al.*, 2016b	Molodtsova *et al.*, 2011, Stampar *et al.*, 2016b	Stampar *et al.*, 2016b	this study	this study

four species, including the two new species described in this study: *P. antarcticus*, *P. delwynae*, *P. fiordlandensis* and *P. nobilis.* Of these, the easiest to discern is *P. antarcticus*, as this is the only species in which the oral tentacles do not include a directive tentacle. The most obvious differences among the remaining species are related to the organization of the mesenteries. *Pachycerianthus nobilis* has relatively short M1 mesenteries, reaching only half of the gastrovascular cavity whereas the other two species, *P. delwynae* and *P. fiordlandensis,* have M1 mesenteries reaching almost to the aboral pore. The two remaining species can be differentiated by the following mesenterial couples—*P. fiordlandensis* has M2 with the same length as M1 and m2 with 2/3 of the length of M1; conversely *P. delwynae* has M2 longer than M1 and m2 shorter than 1/2 of the length of M1. For *Ceriantheopsis*, there is no previous record of the genus in the Pacific Ocean. However, unpublished data indicate the occurrence of species in Japan and surrounding areas (SNS, personal observation). The two species described in this study can be easily identified by the difference in the number of mesenteries connected to the siphonoglyph area, *Ceriantheopsis zealandiaensis* has 8 mesenteries connected to the siphonoglyph area, whereas *C. microbotanica* has only 2.

Although ecological inferences are important, this information is almost totally unknown for these species. Further studies, especially on the life cycle, are essential for the better understanding and conservation of these species and others yet to be scientifically documented but occurring commonly, throughout the Indo-Pacific region.

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