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Geographic ranges of ascidians from Antarctica and the southeastern Pacific

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Abstract Historical and novel data on the geographic and bathymetric distribution of ascidians from Antarctic, Magellan and Chilean waters are compiled, and an inventory of taxa comprising 162 species reported over a 150 year period from the Antarctic region South Polar Province (SPP) compiled. The ascidian fauna from the South Shetland Islands (SSI) is compared with that of the Magellan region, Patagonia and the Chilean coast. We collected 46 ascidian species along the Chilean coast, and during four expeditions to King George Island (SSI) by SCUBA between 2003–2012. About 15% of King George Island (SSI) species are observed to occur also in shallow waters of southern Chile (SCL). Few species known from warm temperate southeastern Pacific (Northern Chile, NCL) waters are absent from the Chilean part of the Magellan Province (SCL). With most data contributed from the Chilean coast coming from the SCL, and with limited sampling having been undertaken at depths exceeding 100 m in the NCL, apparent differences in species richness along the Chilean coast could be attributabed to differential sampling effort. We detail 12 species from our Antarctic and Chilean collections in detail, including one, *Diplosoma listerianum*, not previously reported from Chilean waters, and the genus *Botryllus*, previously known from them on the basis of a single record.

Keywords **Antarctica, Ascidiacea, *Botryllus*, Chile, *Diplosoma*, Tunicata, Zoogeography**

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1 Introduction

Given its geographic and hydrographic isolation, and presumed novelty, the Antarctic marine fauna has been the subject of considerable taxonomic interest. The South American continent lies closest to the Antarctic shelf, through which faunal bridges may exist via the South Shetland Islands. Unsurprisingly, the relationship between the Magellan and Antarctic faunas has been the subject of intensive research, particularly over the last 20 years[1-2], but from the second half of the nineteenth century[3-4] when nearly 50 species were recorded[5]. Over the century that followed many additional taxa were recognized, culminating in 136 species being reported from it by Primo and Vázquez[6]. We report 163 species from the same region, of which at least 106 have been collected from depths shallower than 1 000 m[7], though it is important to note that differences in the number of taxa recognized from this region not only reflect an increased knowledge of ascidians from this area, but also differences in what borders have been used to subdivide

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Antarctic regions[8].

Relationships between ascidian faunas of the Antarctic, subantarctic and South American biogeographic regions have been only recently studied by Ramos-Esplá et al.[8] and Primo & Vázquez[6], wherein relationships between the ascidian faunas of the Antarctic continent, Antarctic peninsula and South Orkney Archipelago have been evaluated[8]. Since the work of Ramos-Esplá et al.[8], new taxa and distribution records have been described from Antarctic, Magellan and Chilean waters, and further earlier records having been critiqued[9-14]. More recently Primo and Vázquez[7] compared the marine species composition within different Antarctic sectors, demonstrating the Antarctic ascidian fauna to be homogeneous with a high level of endemism.

Although the Magellan and Chilean Patagonian ascidian faunas have been studied intensively over recent decades (Appendix 1), only one inventory of the Chilean fauna[15] and one checklist have been compiled[16]. We present an updated species list for the Chilean fauna as defined by its exclusive economic zone (EEZ), dividing it into the Patagonian region south of about 40°S, a transition zone between 40°S and 30°S, and the Peruvian Province up to 13°S, and provide taxonomic notes on 12 species that occur within it.

Whereas Primo and Vázquez[6] focused on evaluating relationships between faunas of Antarctica and neighboring regions, our research followed a geographic gradient extending from the South Shetland Islands to the Magellan region, then along the Chilean coast to 13°S, to determine at what point(s) ascidian faunal discontinuities became apparent to define ecoregion boundaries. Additionally, in contrast to the account of Primo and Vázquez[7], we do not limit our data to taxa reported to 1 000 m, but included all known species from each region with their maximum depth distribution records. Some of these species were known from the Antarctic deep-sea only[14].

2 Material and methods

2.1 Study area

The biogeographic boundary used for the Antarctic or South Polar Province (SPP) is that proposed by Briggs[18], and Primo and Vázquez[6] (Figure 1). Apart from the Antarctic continent it includes the South Shetlands (60°30′S, 60°W), South Orkney (60°30′S, 45°W) and South Sandwich (59°S, 27°W) Islands, South Georgia, Province (54°30′S, 36°W) and Bouvetøya Province (55°S, 3°30′E). For other regions we mainly follow the ecoregion concept of Knox[19], and Spalding et al.[20], where the South Shetland Islands are considered a separate ecoregion within the South Polar Province. For the Magellan region we include two of four ecoregions proposed by Spalding et al.[20] (Figure 2).

The EEZ of Chile is geo-political boundary as opposed to biogeographic boundary, and is included purely to compiling an inventory of taxa from Chilean waters. The coastline of Chile extends almost 36 degrees in latitude, from about 18°30′S to 55°S. As former investigations revealed changes in faunal composition cannot be described by splitting these waters into Magellanic and Peruvian provinces[21], we divide them into (1) its Southern Province (SCL), (2) the Transition Zone (TCL), and (3) the Peruvian Province (NCL) following Knox[19]. SCL is also a part of the Magellan Province (MAG), which also includes waters of neighboring southern Argentina.

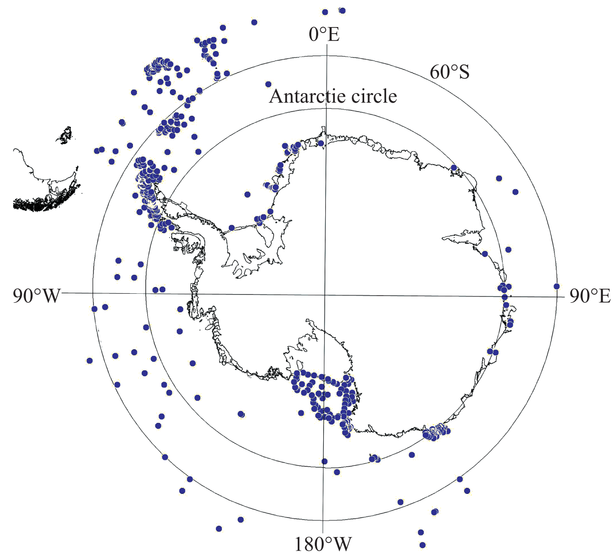

Figure 1 Ascidians collected between 1866 and 2013 in the South Polar Province; boundaries according to Briggs[18], Primo and Vázquez[6].

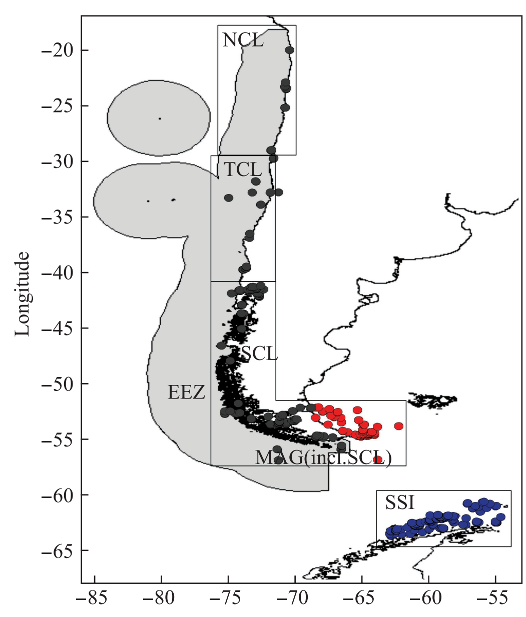

Figure 2 Ascidians collected between 1866 and 2013 in four different sectors: northern Chile (NCL, southern limit < 30°S); Transition Zone between 30°S and 40°S (TCL); Magellan Province, with stations inside the South Chilean EEZ (SCL; gray dots) and outside (red dots); and South Shetlands and surroundings (SSI). Only stations north of the Antarctic Peninsula are shown; the gray area represents the Chilean EEZ.

2.2 Data collection

Our material was collected from the intertidal or by SCUBA to 40 m depth. Most colonies or specimens were photographed in vivo to document colony form, habitat and substratum type. SCUBA collections from (1) King George Island, Admiralty Bay and Maxwell Bay (King George Island) and (2) along the Chilean coast were made between 2003 and 2012. Material from Chile was taken between 53°S and 25°S, mostly between 2007 and 2011. Upon collection samples were bagged and labelled, fixed in 4% formalin-seawater, and deposited in the collection of Kamchatka Branch of the Pacific Institute of Geography. Copies of images taken from living specimens are available on request.

An inventory of taxa (presence/absence matrix) reported from each region was compiled from records contained within 53 publications (Appendix 1) and two databases, the Australian government's 'Atlas of living Australia', and the Smithsonian Institute 'Antarctic Invertebrate'. These data sources, augmented by our own data, comprise in excess of 6 000 records. On the basis of these data, 163 species are recognized from this region, and their geographic and bathymetric distributions throughout the Southern Ocean region are described. Records lacking specific geographic information were excluded from analyses unless a general location of collection was provided, as was typically the case in the oldest literature.

3 Results

3.1 Geographic distribution

About 45% (75 species) of the 163 ascidian species recognized from the South Polar Province (SPP) occurred around the South Shetland Islands (SSI). The MAG shared 54 species with the SPP and 36 species with the SSI. The SCL contained only 74% (67 species) of those taxa known from it. North of 41°S ten species were present in the Chilean EEZ and SPP: *Didemnum studeri*, *Lissoclinum caulleryi*, *Aplidium falklandicum*, *A. fuegiense*, *Corella eumyota*, *Molgula pedunculata*, *Molguloides immunda*, *Paramolgula gregaria*, *Pyura chilensis* and *Polyzoa opuntia*.

Within the SPP stolidobranch ascidians were most abundant (44%, 72 species), followed by aplousobranch (38%, 60 species) and phlebobranch ascidians (18%, 30 species). The most species-rich families within the SPP, the MAG, and along the Chilean coast, were Polyclinidae, Molgulidae and Styelidae (Table 1).

Species identified for the first time from Admiralty Bay and Maxwell Bay, King George Island, were *Aplidium imbutum*, *A. loricatum*, *Synoicium georgianum* and *Didemnum* spp., though all have been previously reported from the SSI.

A total of 90 species are known from the MAG, whereas only 67 species were found in the SCL. The reduced species richness is due to the fact that southern Chile forms only a part of the Magellan Province (Figure 2).

Table 1 Species richness in ascidian families in the: South Polar Province (Antarctic waters; SPP), South Shetland Islands (SSI), Magellan Region (MAG), southern Chile (SCL), Chilean Transition Zone (TCL), northern Chile (NCL), and Chile (CHL)

Order/Family	SPP	SSI	MAG	SCL	TCL	NCL	CHL
Aplousobranchia	60	32	40	28	8	7	32
Didemnidae	8	3	10	9	2	2	9
Holozoidae	9	7	6	6	1	1	6
Placentelidae	1	0	0	0	0	0	0
Polycitoridae	3	3	2	1	0	1	2
Polyclinidae	36	18	22	12	5	3	15
Ritterellidae	3	1	0	0	0	0	0
Phlebobranchia	30	12	10	7	1	2	7
Agneziidae	9	5	3	1	0	0	1
Ascidiidae	4	3	3	2	0	0	2
Cionidae	1	0	1	1	0	1	1
Corellidae	7	3	2	2	1	1	2
Diazonidae	1	1	1	1	0	0	1
Dimeatidae	2	0	0	0	0	0	0
Octacnemidae	6	0	0	0	0	0	0
Stolidobranchia	72	30	40	32	9	10	39
Molgulidae	27	12	15	10	4	3	13
Styelidae	27	11	18	15	4	4	17
Pyuridae	18	7	7	7	1	3	9
Sum of species	162	74	90	67	18	19	78

Along the Chilean coast, only four species (*Aplidium peruvianum*, *Eudistoma clivosum*, *Aplidiopsis chilensis* and *Pyura praeputialis*) occurring within the NCL do not occur in SCL, whereas all species from TCL occur within SCL. None of these species has been found south of 30°S, three of them have been only recently described[11, 22] and one is introduced[23]; all four species are known from the intertidal to depths of 23 m.

Diplosoma listerianum and *Botryllus* sp. have not been previously reported from the Chilean coast, and have never been reported from Antarctic waters. *Diplosoma listerianum* has been found frequently overgrowing algae, other ascidians and mussels in SCL. It is very common on the long lines of mussel farms on the Island of Chiloe, but also occurs further south in areas with minimum or without apparent human impact. An unidentified species of *Botryllus* was found once only, attached to a salmon cage at about 0.5 m in Chinquihue, Puerto Montt.

Species richness within TCL and NCL was low in comparison to SCL, though collection effort in these regions is not comparable to that within SCL, and available samples are largely shallow water intertidal or SCUBA collected (Appendix 1).

3.2 Depth distribution

Limited collections exist from depths greater than 500 m along the Chilean coast. Only two species, *Oligotrema lyra* and *Styela brevigaster*, are known exclusively from depths greater than 500 m, and nine other species from depths greater than 100 m. All other species are occur in shallower waters, with 15 of these (19%) known only from the intertidal to a maximum depth of 50 m (Table 2). In contrast, 44 species (27%) are known only from depths greater than 500 m in the SPP, and 43% of species were unknown from depths shallower than 100 m. About 40% of species occur in waters more shallow than 50 m, but these species also extend to 500 m or more. Only three species were limited to depths more shallow than 50 m: *Aplidium annulatum*, *Corella antarctica* and *Pyura stubenrauchi*. The reported depth distribution of *Corella antarctica* is questionable as this species has been historically confused with *C. eumyota*, and may be confused with other taxa, and the other two species are known from single depth records.

Table 2 Species richness according to depth ranges: South Polar Province (Antarctic waters; SPP), South Shetlands Islands (SSI), Magellan Region (MAG), southern Chile (SCL), Chilean Transition Zone (TCL), northern Chile (NCL), and Chile (CHL). Each species is represented only in one depth category per region

Depth/m	SPP	SSI	MAG	SCL	TCL	NCL	CHL
0–50	1	3	10	9	5	7	14
0–100	1	0	3	2	0	1	2
0–500	27	14	19	15	1	0	15
0– >500	40	33	27	22	7	7	22
50–500	13	5	11	8	0	1	9
50– >500	8	7	3	3	0	0	3
100–500	16	4	8	2	1	0	3
100– >500	10	5	4	3	3	2	6
>500	44	2	1	1	1	0	2
unknown	2	0	4	2	0	1	2
Sum	162	73	90	67	18	19	78

3.3 Systematics

Didemnum biglans (Sluiter, 1906) (Figure 3a)

This species forms thin (about 3 mm or less) colonies that encrust hard substrata, such as stones, algae, shells of living or dead molluscs, and even other ascidians. The common test is colorless, though calcareous spicules render the colony white to dirty white in life and when preserved. Kott[24] reported white, pinkish or pale buff-gray colonies, though the latter two were not represented amongst our material. Spicules are burr-like, usually not more than 25 µm diameter, densely packed in the upper colony layer, and sparse within the lower layer. Preserved zooids are 1.5–2 mm in length, with short 6-lobed branchial siphons with wide atrial openings and small atrial languets. Zooids lack a retractor muscle. The sperm duct turns 4 or 5 times around the testis, which may be represented by a single or double follicle.

Species of the genus *Didemnum* are difficult to identify. Though *D. biglans* appears rather common in Antarctic waters, with several detailed descriptions of it available[12, 24-27], identification can be difficult as characters cited as to differentiate taxa are sometimes difficult to follow. For example, Kott[24] distinguished *D. biglans* from *D. studeri* (which is said to be a mostly subantarctic species) by several features including the size, shape and distribution of the spicules (mainly in superficial layers of the test in *D. biglans* and evenly distributed in the test of *D. studeri*). Spicule distribution in our colonies was somewhat transitional, in that they were more abundant in superficial layers, but also distributed throughout the colony. Given Monniot et al.[12] obtained highly divergent COI partial cytochrome oxidase I sequences for specimens referred to *D. biglans* from Antarctic waters, this species may actually comprise several cryptic species.

Didemnum studeri Hartmeyer, 1911 (Figure 3b)

Our colonies were thin, encrusting, and white colored, whereas those of Kott[24] were white, pinkish, or pale buff-gray. The surface of preserved colonies was smooth. In life common cloacal canals were small, sparsely distributed, inflated and somewhat raised from the surface of the colony, with several short common cloacal canals merging to common cloacal openings. Calcareous spicules were stellate, with 8–12 short blunt rays in optical section[24], 40–45 µm diameter, and densely distributed throughout the colony test. Individual zooids have narrow branchial sacs, with 5 or 6 stigmata per row; the large atrial opening lacks an atrial languet. The retractor muscle is usually present. The sperm

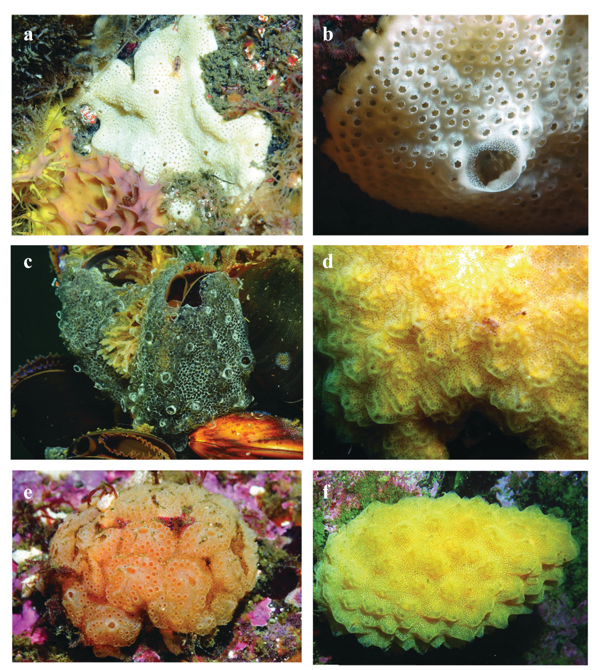

Figure 3 In vivo images of Antarctic and subantarctic ascidians. **a**, *Didemnum biglans*; **b**, *Didemnum studeri*; **c**, *Diplosoma listerianum*; **d**, *Distaplia colligans*; **e**, *Aplidium falklandicum*; **f**, *Aplidium fuegiense*.

duct turns 6 times around the testis.

Like the preceding species, identification of *D. studeri* can also be problematic, with purportedly species-specific characters proving to be expressed in a number of taxa. For example Sanamyan et al.[11] reported colonies that agreed in most respects to this species, but in which spicules were distributed mainly in the test superficial layers (as in *D. biglans*). It is possible that *D. studeri* also comprises several sibling species.

Diplosoma listerianum (Milne-Edwards, 1841) (Figure 3c)

Chilean colonies form extensive sheets, the size of which is difficult to determine for they are very soft and shapeless in preservative; the largest we have reaches ~10 cm greatest dimension, though it has obviously contracted at collection and shrunk in preservative. Colonies consist of a thin solid basal sheet and an upper sheet, separated by an extensive cloacal cavity. The basal and upper sheets are connected by numerous thin vertical strands of the test, each branching at their upper end, into which the zooids are embedded just below the surface layer of colony; each zooid is located in its own branch of the strand and isolated from other zooids. The test is transparent, with dark-gray freshly preserved colonies fading to brown with a purple tint after several years in preservative.

Contracted zooids are typically 1.0–1.2 mm in length. The abdomina and in part thoraces of freshly preserved material were black, but only some retained pigmentation after having been preserved for several months. Stigmata are arranged in four rows of nine (counted in less-contracted zooids), comparable to Australian specimens (8–10 stigmata per row)[28]. The testis consists of two follicles with a straight sperm duct. Larvae of several ages and ova are simultaneously present, crowded in the basal layers of the test and parts of the vertical test strands in the cloacal cavity; the larval trunk is nearly round, about 0.5–0.6 mm diameter, with a tail that winds 3/4 the way around it.

The species is regarded as one of the few "truly cosmopolitan" ascidians[28], being known from many parts of the world in both cold and warm waters.

Distaplia colligans Sluiter, 1932 (Figure 3d)

This species forms thin colonies encrusting stones, rock or other hard substrata. Live colonies are bright yellow, though formalin and alcohol-fixed colonies are invariably dark brown or almost black. The species is easy to identify—its zooids are small, no more than several millimeters length, and the body is divided into thorax with branchial sac (with four rows of stigmata) and abdomen with gut loop and gonads. The branchial siphon of each zooid opens directly on the colony surface, whereas atrial siphons open into a common cloacal cavity which opens separately to the exterior by a cloacal opening (though this is difficult to see in both preserved specimens and on the basis of live-colony photographs). No other *Distaplia* species with thin encrusting colonies are known from the region.

Aplidium fuegiense Cunningham, 1871 (Figure 3f)

The genus *Aplidium* is the most species rich of Ascidiacea, comprising about 250 taxa distributed worldwide. Species are distinguished on the basis of zooid anatomy, especially the numbers of the rows of stigmata in the branchial sac and the longitudinal folds of the stomach, and structures of larvae and colony shape. Zooid structure is readily discerned in most well-preserved colonies, though mature larvae are not always present, at times precluding accurate identification.

The taxonomic value of colony structure was underestimated for a long time. Although details of the structure of colony and organization of cloacal systems are difficult to determine on preserved colonies, they can be easily determined from macro images of in vivo specimens.

Aplidium fuegiense belongs to a group of species for which colony and zooid shape are considered variable, and as a species it has a complex synonymy. Millar[26] considered *A. variabile*, at the time synonymized with it, distinct, and rediagnosed it with 10-or-more stomach folds, compared with the five folds for *A. fuegiense*. However, several Antarctic and subantarctic species have five folds, some of which presently can be distinguished only if mature larvae are present in the colony (e.g. *A. falklandicum*), whereas others are too imperfectly described to enable accurate identification.

Details of colony structure may assist with identification of species of *Aplidium*, but for most Antarctic species insufficient details are known (Figure 3e, 3f).

Although colonies of *A. fuegiense* are described as extremely variable and irregular, and indeed all preserved colonies are thick irregular masses without recognizable systems, our in vivo images reveal a characteristic colony shape, the surface of which is raised into several-to-numerous large conical lobes with a single cloacal siphon atop each, with zooids opening on the sides of these lobes arranged along rather-wide anastomosing cloacal canals that converge at the top[11]. Occasionally crowded dark rounded opaque granules are apparent in the outer layer of the test of some colonies.

Synoicum georgianum Sluiter, 1932 (Figure 4a)

The genus *Synoicum* includes about 70 colonial species differentiated from *Aplidium* by the absence of longitudinal stomach folds. Consequently the zooids of many *Synoicum* species are uniform in their structure, with many taxa being presently separable on the basis of shape and colony structure only. Van Name[25] treated this species and several others as synonyms of *S. adareanum*, a common large Antarctic species. Although zooids of the two species are similar, with a body divided into thorax (containing the branchial sac), abdomen (with gut loop) and postabdomen (with gonads), Millar[26] differentiated *S. georgianum* from *S. adareanum* on the basis of the number of rows of stigmata (13–15, and 18–20 respectively) and stomach shape, pear-shaped in *S. adareanum* but not in *S. georgianum*. Fully developed colonies of *S. georgianum* comprise many small heads arising on usually rather slender stalks from a basal mass of root-like processes, with each head containing one to several systems of zooids, whereas those of *S. adareanum* form massive heads, sometimes on short, thick stalks, each containing numerous zooid systems, though these differences are less apparent in preserved material with small colonies or heads separated from each other.

Agnezia biscoei Monniot & Monniot, 1983 (Figure 4b)

Despite the relatively large size (for the genus *Agnezia*) of this solitary ascidian, 4 cm or more in greatest dimension, it can be difficult to find as it resembles a sandy oval-shaped potato-like mass, its body densely covered in sand or gravel. Its test, impregnated with sand, is also brittle and hard in touch, with the siphons usually withdrawn into it on collection. The branchial sac has spiral stigmata that coil up to 12 times, interrupted in vertical and horizontal axes. Infundibula are low and supported by diagonal parastigmatic vessels extending from the corners of each square spiral to the infundibulum summit. Each transverse row of stigmata is separated by transverse vessels with finger-like papillae, and the female genital aperture is turned back (in contrast to *A. glaciata* where it is directed upward), suggestive of peribranchial cavity egg incubation.

Kott[24] synonymized many southern and several northern hemisphere *Agnezia* species with *A. glaciata*, the type species of the genus described from Tierra del Fuego, though Monniot and Monniot[27] recognized A. biscoei to be distinct from it. This distribution of this species is limited to the Antarctic continental shelf[29], known from the Weddell Sea and several locations on the Antarctic peninsula; ours is the first record from King George Island.

Corella eumyota Traustedt, 1882 (Figure 4c)

Our Chilean specimens are not large, usually 1–3 cm in greatest dimension. The ovoid body is laterally compressed. Branchial and atrial siphons are almost sessile, the branchial one situated terminally or slightly displaced dorsally, the atrial mid-dorsally. The cartilaginous test is usually smooth and free of foreign matter, though occasional epibionts like bryozoans or hydroids may occur; in life the animal is colorless, with the visceral mass (gut loop and gonad) visible as a dull-rose opaque mass through the semitransparent test. In vivo images facilitate differentiation of this species from similarly looking ascidians (e.g. *Ascidia* or *Molgula*) by the position of the gut loop on the right side of the body. The body removed from the test is thin walled, with its muscles developed on the left side only. The branchial sac has regular spiral stigmata and internal longitudinal vessels, and the gonads of both sexes have sessile apertures located on the gonad itself, in the gut loop.

Monniot[30] recognized this species to be widely distributed, with Chilean specimens (the type locality) conspecific with those from New Zealand, Amsterdam Island, South Africa and France.

Corella antarctica Sluiter, 1905 (Figure 4d)

Specimens from King George Islands resemble Chilean *C. eumyota*, from which this species has been only recently removed from synonymy. It has long gonoducts extending along the intestine, and distinct male and female genital apertures that open above the anus on long papillae. It is also generally larger than *C. eumyota*.

Monniot[30] considered specimens of this species from various depths and locations from the Antarctic Peninsula and the Australian sector of the Antarctic to be variable and concluded more material was required to determine if all were conspecific.

Botryllus sp. (Figure 4e)

The single colony, about 1.5–2 cm in greatest dimension, was attached to thin branches of a hydrozoan. The preserved colony is soft, colorless, and translucent, with the zooid thoraces distinctly apparent through the test. The arrangement of the system is not discernible, though the zooids most probably are arranged in several circles. Zooids are 1.2–1.3 mm long, oval in outline with rather long atrial siphon and in general resemble those of *B. tuberatus*, though they have seven rows of stigmata (rather than four in *B. tuberatus*). The second row is incomplete. The gonads are not developed and we were not able to determine the structure of the stomach (an important species-specific feature in this genus).

Van Name[15](p.10) identified *B. schlosseri* (Pallas, 1766) from Chile on the basis of "one very small colony, consisting of three small systems and a few apparently unattached zooids". His material may be conspecific with ours, but there are no signs indicating that it was correctly identified—historically many taxa have been lumped as *B. schlosseri*. Given the immaturity of our material, and incompleteness in description we can proffer for it, we elect to identify it to genus only.

Alloeocarpa bacca Arnback, 1929

Our Chilean colonies were attached to smooth hard stones and shells. In general they resembled associations of separated zooids, connected by a thin, inconspicuous membrane that firmly adhered to the substratum. Individual

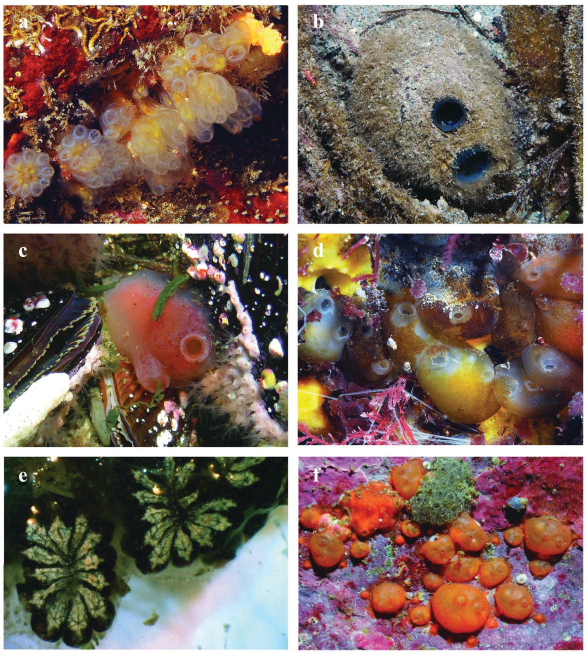

Figure 4 In vivo images of Antarctic and subantarctic ascidians. **a**, *Synoicium georgianum*; **b**, *Agnezia biscoei*; **c**, *Corella eumyota*; **d**, *Corella antarctica*; **e**, *Botryllus sp.*; **f**, *Polyzoa opuntia*.

zooids are irregularly spaced, never touch, and of variable size, the largest in preserved material about 5 mm diameter. In life, and especially in preservative, the zooid profile is rather low, almost flat or low dome-shaped, and a dirty gray with yellow tint in color. The branchial sac has six internal longitudinal vessels on the right side and five on the left. Male and female gonads are separate. Seven or nine small ovaries, each consisting of several variably sized eggs, lie in a row on the right side of the body running along and in close proximity to the endostyle. Two or three ovaries may occur on the anterior part of the left side of the body. The male gonad comprises three or four follicles which are ramified and coherent with each other to form an elongated mass just above the pole of the gut loop.

Two other *Alloeocarpa* species known from the region can be differentiated from *A. bacca* on the basis of zooid association and color[31]: *A. incrustans* (Herdman, 1886) and *A. bridgesi* Michaelsen, 1900, both of which have coalescent zooids and red living zooids; *A. incrustans* also has more numerous longitudinal branchial vessels (10–18 on each side)[24-25]. Within that material available to us is a colony from Chile with separate zooids similar to those of *A. bacca*, but with 10 branchial vessels on each side, exceeding the number reported for this species (no more than 7), but somewhat intermediate between *A. bacca* and *A. incrustans*. The gonads of this specimen were poorly preserved and it was not possible to clarify if other differences existed.

Alloeocarpa bridgesi is said to form red encrusting colonies with embedded zooids[25] with almost the same number of internal branchial vessels as *A. bacca*. The only reported difference between these two species is the shape of the colony. Previous distribution records, especially those not accompanied with descriptions, should be treated with caution.

Polyzoa opuntia Lesson, 1830 (Figure 4f)

Chilean specimens form large colonies 10 cm or more in extent, comprising numerous zooids averaging about 10 mm height and 4 mm diameter. Zooids are typically cylindrical and connected by a basal test only (they are not immersed to a common test). Colonies are usually found on thin elongated objects, such as polychaete tubes or branches. In preservative the zooids are dull gray, the test is leathery and often wrinkled, and its surface is clean of foreign bodies. The body wall of zooids removed from their test is muscular and thick. The branchial sac lacks folds and has eight internal longitudinal vessels. Hermaphrodite gonads are profusely developed in some specimens, each with a large elongated male follicle, on the mesial surface of which is a small ovary comprising several eggs; up to about nine gonads were apparent on the left side of the body, lying in a single row along the endostyle from the pole of the gut loop to the anterior end of the body, and 20 gonads on the right side, lying in a wide arc along the entire ventral as well as dorsal sides of the body.

Present colonies agree closely with the description of *P. reticulata* (Herdman, 1866), the colonies of which are described with almost separate zooids, rather than *P. opuntia*, whose colonies are described as pedunculated heads with zooids almost completely immersed to a common test[24-25]. These two species have been synonymized by Monniot and Monniot[27], with whose opinion we follow.

4 Discussion

We will likely never know how many ascidian species exist in the SPP, because differences in ascidian species morphology are often slight, whereas other characteristics like COI sequences appear to be more divergent[12], indicating the existence of sibling taxa. Whereas about 50 taxa were recognized from this region at the beginning of the 20th century[5], 136 taxa were known from it nearly 100 years later by Primo and Vázquez[6], and it is highly likely that additional taxa will be reported from it with additional multidisciplinary systematic research.

Our updated species inventory excludes synonyms, and accesses more data sets than historically possible. Despite this, it has its shortcomings. Because of the definition of the SPP used by Primo and Vázquez[6], some species of the Magellan and Peruvian Provinces, such as *Pyura chilensis* and *Polyzoa opuntia*, have been included within the SPP, despite material never having been sampled at latitudes greater than 60°S. The systematic status of several other taxa is also in need of revision (e.g., *Didemnum* and *Corella*).

With the exceptions of *Pyura chilensis*, *Didemnum studeri* and *Corella eumyota*, few species are common to both the TCL and NCL. Although *Molguloides immunda* was found in the Antarctic between 128 and 183 m depth, it was known from the Chilean EEZ at 5 929 m[32], though this difference is not really surprising given the known overlap between Antarctic and deep-sea faunas[33-34].

The extensive geographic distributions of *Aplidium falklandicum* and *A. fuegiense* should be treated with caution, as several species of *Aplidium* occur in the SPP and MAG, and distribution records of some taxa when uncritically accepting literature could be based on misidentifications. Genetic evaluation of taxa that have been identified using traditional morphological criteria might assist resolution of any species complexes, should they exist.

Significant differences in sampling hamper detailed comparison of the Antarctic ascidian fauna with that of the MAG and continental Chile (Figure 1). Most Antarctic samples were collected by research vessels from depths exceeding 100 m, and only over the last few decades has material been collected by divers in shallow water[35-37], whereas this situation is reversed for collections of specimens from Chilean waters[11,15,38-40].

Of the 163 species now recognized from the SPP, two rare species occur exclusively within shallow water: *Aplidium annulatum* and *Pyura stubenrauchi*. Several Chilean species are known only from shallow water. Most collections were made in deeper waters of the SCL, especially from the Strait of Magellan, or they were collected further south, taken on cruises to the Antarctic. Of the 78 known species from

Chile's EEZ, 67 are distributed in SCL, whereas only 11 are known exclusively from TCL and NCL (*Eudistoma clivosum*, *Aplidiopsis chilensis*, *Aplidium longum*, *A. peruvianum*, *Molgula diaguita*, *M. ficus*, *Molguloides immunda*, *Pyura praeputialis*, *P. stolonifera*, *Styela brevigaster* and *S. change*), though *A. longum* and *M. immunda* are known also from the SPP. The shallow water species of TCL and NCL likely have extended geographic ranges within the Peruvian Province, as has been demonstrated for *A. peruvianum*[11,22], though more northern distribution records are unknown.

One species is reported from Chilean waters for the first time, and a second taxon is reported for the second time only (*Diplosoma listerianum* and *Botryllus* sp. respectively), both associated with aquaculture nets and, in the case of *D. listerianum*, mussel long lines. *Botryllus* was encountered once only within an aquaculture facility, though *D. listerianum* frequently overgrew algae and other epibenthic organisms along the southern Chilean coast. Because *D. listerianum* was not recorded in a former intensive study[15] we assume it to have only recently invaded Chilean waters.

Differential sampling effort limits our understanding of the distribution of ascidians along a geographic gradient extending from Antarctic waters to northern Chile. Those few shallow water species known from the SPP and TCL or NCL belong to taxa of variable morphological characteristics, and additional systematic research would benefit from a more multidisciplinary approach, including sequencing data, to resolve true species richness within any. Finally, we believe the number of taxa that occur within the Chilean EEZ is greater than we recognize, given restricted sampling effort in the north and at depths exceeding 100 m.

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Appendix 1 Ascidian species of the South Polar Province (Antarctic waters; SPP), South Shetland Islands (SSI), Magellan Region (MAG), southern Chile (SCL), Chilean Transition Zone (TCL), northern Chile (NCL), and Chile (CHL). Species marked with an asterisk (*) were found by the authors between 2001 and 2013.

Taxon	Region	Depth/m	Latitude/(°S)	Reference(s)
<u>Aplousobranchia</u>				
Didemnidae				
Didemnum bentarti Varela & Ramos-Esplá 2008	SPP / ___ / ___ / ___ / ___ / ___ / ___	426	71	44
**D. biglans* (Sluiter, 1906)	SPP / SSI / MAG / SCL / ___ / ___ / CHL	2–3 495	53–78	4, 5, 12, 24, 32, 45-47
D. chilense Ärnbäck, 1929	___ / ___ / MAG / SCL / ___ / ___ / CHL	0–91	41	15, 31
D. psammatode (Sluiter, 1895)	SPP / ___ / ___ / ___ / ___ / ___ / ___	659–686	55	32
**D. studeri* Hartmeyer, 1911	SPP / ___ / MAG / SCL / TCL / NCL / CHL	3–4 804	30–62	5, 11, 24, 32, 38, 40, 46
Diplosoma antarcticum Kott, 1969	SPP / ___ / ___ / ___ / ___ / ___ / ___	100-150	65–66	32
**D. listerianum* (Milne-Edwards, 1841)	___ / ___ / MAG / SCL / TCL / ___ / CHL	0.5–10	39–43	
D. longinquum (Sluiter, 1912)	SPP / ___ / ___ / ___ / ___ / ___ / ___	62-357	43–65	32
Leptoclinides rufus (Sluiter, 1909)	___ / ___ / MAG / ___ / ___ / ___ / ___	51–115	22–54	32, 46, 48
Lissoclinum aff. caulleryi (Ritter & Forsyth, 1917)	___ / ___ / MAG / SCL / ___ / ___ / CHL	?	42	40
L. caulleryi (Ritter & Forsyth, 1917)	___ / ___ / MAG / SCL / ___ / NCL / CHL	?	20–60	15, 49
Polysyncraton chondrilla (Michaelsen, 1924)	SPP / SSI / MAG / SCL / ___ / ___ / CHL	55–1 120	54–78	24, 32, 46
P. trivolutum (Millar, 1960)	SPP / SSI / MAG / SCL / ___ / ___ / CHL	13–677	54–78	12, 29, 32, 50
**Trididemnum auriculatum* Michaelsen, 1919	___ / ___ / MAG / SCL / ___ / ___ / CHL	5–2 023	41–54	31, 38
Holozoidae				
**Distaplia arnbackae* Sanamyan, Schories, Sanamyan 2010	___ / ___ / MAG / SCL / TCL / NCL / CHL	0–35	29–43	11, 15, 31
**D. colligans* Sluiter, 1932	SPP / SSI / MAG / SCL / ___ / ___ / CHL	2–428	42–77	12, 24, 32, 38, 40, 45, 47
**D. cylindrica* (Lesson, 1830)	SPP / SSI / MAG / SCL / ___ / ___ / CHL	7–695	51–78	5, 12, 24, 32, 35, 37, 38, 43, 45-48, 50-52
D. megathorax Monniot & Monniot, 1982	SPP / ___ / ___ / ___ / ___ / ___ / ___	1 565–1 674	71	32
Hypsistozoa fasmeriana (Michaelsen, 1924)	SPP / ___ / ___ / ___ / ___ / ___ / ___	55–146	45–67	32, 48
Protoholozoa pedunculata Kott, 1969	SPP / SSI / MAG / SCL / ___ / ___ / CHL	374–5 340	49–66	14, 24, 32, 46, 50, 53
Sigillina moebiusi (Hartmeyer, 1905)	SPP / SSI / ___ / ___ / ___ / ___ / ___	240	61	24
**Sycozoa gaimardi* (Herdman, 1886)	SPP / SSI / MAG / SCL / ___ / ___ / CHL	5–238	44–65	32, 35, 37, 38, 43, 45, 51, 52
**S. georgiana* (Michaelsen, 1907)	SPP / SSI / ___ / ___ / ___ / ___ / ___	30–400	62–72	24, 32, 43, 47
**S. sigillinoides* Lesson, 1830	SPP / SSI / MAG / SCL / ___ / ___ / CHL	15–769	35–76	4, 5, 12, 24, 31, 32, 35, 46, 48, 52, 54, 55
Placentelidae				
Placentela translucida Kott, 1969	SPP / ___ / ___ / ___ / ___ / ___ / ___	370–375	66	24, 32
Polycitoridae				
**Cystodytes antarcticus* Sluiter, 1912	SPP / SSI / ___ / ___ / ___ / ___ / ___	10–306	62–67	12, 24, 32, 46, 47, 50

Taxon	Region	Depth/m	Latitude/(°S)	Reference(s)
**Eudistoma clivosum* Sanamyan, K., Schories & Sanamyan, N. 2010	___ / ___ / ___ / ___ / ___ / NCL / CHL	15–23	25–29	11
**E. magalhaensis* (Michaelsen, 1907)	___ / ___ / MAG / SCL / ___ / ___ / CHL	5-–8	44–53	39, 42
Polycitor glareosus (Sluiter, 1906)	SPP / ___ / MAG / ___ / ___ / ___ / ___	30–272	54–65	4, 32, 50
Tetrazona ciemari Primo & Vazquez, 2007	SPP / SSI / ___ / ___ / ___ / ___ / ___	138–142	63	56
Polyclinidae				
**Aplidiopsis chilensis* Sanamyan, Schories & Sanamyan, 2010	___ / ___ / ___ / ___ / ___ / NCL / CHL	20	29	11
A. discoveryi Millar, 1960	SPP / ___ / MAG / ___ / ___ / ___ / ___	40–112	52–65	24, 32
Aplidium abyssum Kott, 1969	SPP / ___ / ___ / ___ / ___ / ___ / ___	2 513–3 694	8–56	24, 46
A. annulatum (Sluiter, 1906)	SPP / ___ / ___ / ___ / ___ / ___ / ___	30	64	4
A. aurorae (Harant & Vernières, 1938)	SPP / ___ / ___ / ___ / ___ / ___ / ___	238–329	66	32
A. balleniae Monniot & Monniot, 1983	SPP / SSI / ___ / ___ / ___ / ___ / ___	55–622	62–76	32, 56, 57
A. bilinguae Monniot & Monniot, 1983	SPP / ___ / ___ / ___ / ___ / ___ / ___	57–238	54–66	32
**A. circumvolutum* (Sluiter, 1900)	SPP / SSI / MAG / ___ / ___ / ___ / ___	21–1 120	43–63	24, 32, 43, 46-48
A. cyaneum Monniot & Monniot, 1983	SPP / SSI / ___ / ___ / ___ / ___ / ___	55–1 674	54–74	4, 5, 14, 24, 29, 32, 46, 47, 56
**A. falklandicum* Millar, 1960	SPP / SSI / MAG / SCL / TCL / NCL / CHL	25–799	29–71	11, 12, 32, 50, 58, 59
*A. fuegiense (Cunningham, 1871)	SPP / SSI / MAG / SCL / TCL / ___ / CHL	0–598	29–72	3, 4, 11, 15, 24, 32, 38, 40, 46, 54, 59
A. globosum (Herdman, 1886)	SPP / SSI / MAG / ___ / ___ / ___ / ___	106–642	54–63	32, 50
A. gracile Monniot & Monniot, 1983	___ / ___ / MAG / ___ / ___ / ___ / ___	73–115	51–55	32
**A. imbutum* Monniot & Monniot, 1983	SPP / SSI / ___ / ___ / ___ / ___ / ___	38–870	54–73	32
A. irregulare (Herdman, 1886)	SPP / SSI / MAG / SCL / ___ / ___ / CHL	31–439	44–63	24, 32, 46
A. longum Monniot, 1970	SPP / ___ / ___ / ___ / TCL / ___ / CHL	106–110	33–65	32
**A. loricatum* (Harant & Vernières, 1938)	SPP / SSI / ___ / ___ / ___ / ___ / ___	20–357	60–72	24, 32, 56
**A. magellanicum* Sanamyan & Schories, 2003	___ / ___ / MAG / SCL / ___ / ___ / CHL	5–21	42–54	38, 40
A. meridianum (Sluiter, 1906)	SPP / SSI / MAG / ___ / ___ / ___ / ___	2–1 674	47–77	10, 12, 14, 29, 32, 56, 59
A. millari Monniot & Monniot, 1994	SPP / SSI / ___ / ___ / ___ / ___ / ___	96–309	63–75	29, 56, 59
A miripartum Monniot & Monniot, 1983	SPP / SSI / ___ / ___ / ___ / ___ / ___	31–310	63–66	32, 56
A. novaezealandiae Brewin, 1952	___ / ___ / MAG / ___ / ___ / ___ / ___	?	55	32
A. ordinatum (Sluiter, 1906)	SPP / ___ / ___ / ___ / ___ / ___ / ___	22–329	64–66	4, 32
A. ovum Monniot & Gaill, 1978	___ / ___ / MAG / ___ / ___ / ___ / ___	84–353	55	32
A. pellucidum (Leidy, 1855)	___ / ___ / MAG / SCL / ___ / ___ / CHL	92–101	53	46
A. pererratum (Sluiter, 1912)	SPP / ___ / ___ / ___ / ___ / ___ / ___	55–302	57–67	32
**A. peruvianum* Sanamyan & Schories, 2004	___ / ___ / ___ / ___ / TCL / NCL / CHL	5–17	14–30	11, 22
A. polarsterni Tatian, Antacli & Sahade, 2005	___ / ___ / MAG / ___ / ___ / ___ / ___	272	54	50
**A. radiatum* (Sluiter, 1906)	SPP / SSI / ___ / ___ / ___ / ___ / ___	15–412	61–78	4, 24, 32, 35, 37, 46, 48, 51-53, 56
A. recumbens (Herdman, 1886)	SPP / SSI / MAG / SCL / ___ / ___ / CHL	86–586	53–62	24, 32, 46
A. siderum Monniot & Monniot, 1983	SPP / ___ / ___ / ___ / ___ / ___ / ___	32–167	65–66	12, 32

Taxon	Region	Depth/m	Latitude/(°S)	Reference(s)
A. stanleyi Millar, 1960	SPP / ___ / ___ / ___ / ___ / ___ / ___	62–320	55–65	32, 46
A. triplex (Sluiter, 1906)	SPP / SSI / MAG / SCL / ___ / ___ / CHL	60–310	54–65	4, 32
A. undulatum, Monniot & Gaill, 1978	___ / ___ / MAG / SCL / ___ / ___ / CHL	40–247	53–54	32
A. vanhoeffeni Hartmeyer, 1911	SPP / ___ / ___ / ___ / ___ / ___ / ___	380–385	60	5
**A. variabile* (Herdman, 1886)	SPP / ___ / MAG / SCL / TCL / ___ / CHL	5–494	38–56	5, 24, 32, 38, 40, 46
A. vastum (Sluiter, 1912)	SPP / ___ / ___ / ___ / ___ / ___ / ___	75–134	65–72	32
**Synoicum adareanum* (Herdman, 1902)	SPP / SSI / MAG / SCL / ___ / ___ / CHL	15–867	53–78	4, 5, 12, 24, 29, 32, 35, 37, 43, 45-47, 50, 52, 56, 59
**S. georgianum* Sluiter, 1932	SPP / SSI / MAG / ___ / ___ / ___ / ___	6–552	54–66	24, 32
S. giardi (Herdman, 1886)	SPP / ___ / MAG / ___ / ___ / ___ / ___	46–108	49–55	5, 32
S. kuranui Brewin, 1950	SPP / ___ / MAG / SCL / ___ / ___ / CHL	73–293	18–69	24, 32, 48
S. ostentor Monniot & Monniot, 1983	SPP / ___ / ___ / ___ / ___ / ___ / ___	30–867	60–67	12, 32, 56
S. polygyna Monniot & Monniot, 1980	SPP / SSI / ___ / ___ / ___ / ___ / ___	142	63	56
S. ramulosum Kott, 1969	SPP / ___ / ___ / ___ / ___ / ___ / ___	183–2 827	59–65	14, 24, 32
S. stewartense (Michaelsen, 1924)	___ / ___ / MAG / SCL / ___ / ___ / CHL	97–115	54–56	24, 32, 46
S. tentaculatum Kott, 1969	SPP / ___ / ___ / ___ / ___ / ___ / ___	2 800	58	32
Ritterellidae				
Pharyngodictyon mirabile Herdman, 1886	SPP / ___ / ___ / ___ / ___ / ___ / ___	1 226–5 631	56–61	24, 32, 53
Ritterella chetvergovi Sanamyan & Sanamyan, 2002	SPP / ___ / ___ / ___ / ___ / ___ / ___	4 664–5 631	56	53
R. mirifica Monniot & Monniot, 1983	SPP / SSI / ___ / ___ / ___ / ___ / ___	142–568	63–66	12, 32, 56
Phlebobranchia				
Agneziidae				
Adagnesia antarctica Kott, 1969	SPP / SSI / ___ / ___ / ___ / ___ / ___	3–101	54–70	24, 32
A. charcoti Monniot and Monniot, 1973	SPP / ___ / ___ / ___ / ___ / ___ / ___	5 110–5 120	62	53
A. henriquei Monniot & Monniot, 1983	___ / ___ / MAG / ___ / ___ / ___ / ___	119–123	53	32
A. weddelli Monniot & Monniot, 1994	SPP / ___ / ___ / ___ / ___ / ___ / ___	462–1 223	28	29
Agnezia abyssa Sanamyan & Sanamyan, 2002	SPP / ___ / ___ / ___ / ___ / ___ / ___	7 694–8 116	55	53
**A. biscoei* (Monniot & Monniot, 1983)	SPP / SSI / ___ / ___ / ___ / ___ / ___	30–187	63–71	29, 32
A. glaciata Michaelsen, 1898	SPP / SSI / MAG / SCL / ___ / ___ / CHL	37–184	55–69	24, 32, 43, 47, 55
A. tenue (Monniot & Monniot, 1983)	___ / ___ / MAG / ___ / ___ / ___ / ___	18	55	32
Caenagnesia bocki Ärnbäck-Christie-Linde, 1938	SPP / SSI / ___ / ___ / ___ / ___ / ___	16–1 253	61–78	24, 29, 32, 46, 47, 50
C. schmitti Kott, 1969	SPP / SSI / ___ / ___ / ___ / ___ / ___	45–1 120	62–75	24, 32, 43
Proagnesia depressa (Millar, 1955)	SPP / ___ / ___ / ___ / ___ / ___ / ___	3 160–5 120	17–62	53
Ascidiidae				
**Ascidia challengeri* Herdman, 1882	SPP / SSI / ___ / ___ / ___ / ___ / ___	16–4 512	44–78	4, 5, 12, 14, 24, 29, 32, 35, 37, 46-48, 51, 52, 56, 60-62
A. meridionalis Herdman, 1880	SPP / SSI / MAG / SCL / ___ / ___ / CHL	13–583	43–67	12, 24, 32, 46, 50, 56, 63

Taxon	Region	Depth/m	Latitude/(°S)	Reference(s)
A. tenera Herdman, 1880	SPP / SSI / MAG / SCL / ___ / ___ / CHL	70–448	52–62	43, 55, 63
A. translucida Herdman, 1880	SPP / ___ / ___ / ___ / ___ / ___ / ___	?	65	32
Ascidiella aspersa (Müller, 1776)	___ / ___ / MAG / ___ / ___ / ___ / ___	2–55	35–48	48
Cionidae				
Ciona antarctica Hartmeyer, 1911	SPP / ___ / ___ / ___ / ___ / ___ / ___	100–394	60–75	5, 12, 29, 32
**C. intestinalis* (Linnaeus, 1767)	___ / ___ / MAG / SCL / ___ / NCL / CHL	0–10	2343	15, 64
Corellidae				
**Corella antarctica* Sluiter, 1905	SPP / SSI / ___ / ___ / ___ / ___ / ___	5–525	62–67	4, 13, 30
**C. eumyota* Traustedt, 1882	SPP / SSI / MAG / SCL / TCL / NCL / CHL	0–1 105	30–78	5, 12, 15, 24, 29, 31, 32, 35, 37, 40, 43, 45-48, 51, 52, 55, 56, 60, 61, 65
Corynascidia cubare Monniot & Monniot, 1994	SPP / ___ / ___ / ___ / ___ / ___ / ___	457–462	75	29
C. lambertae Sanamyan & Sanamyan, 2002	SPP / SSI / ___ / ___ / ___ / ___ / ___	1 256–1 376	62	53
C. mironovi Sanamyan & Sanamyan, 2002	SPP / ___ / ___ / ___ / ___ / ___ / ___	5 110–5 120	62	53
C. suhmi Herdman, 1882	SPP / ___ / MAG / SCL / ___ / ___ / CHL	214–6 195	33–68	5, 12, 24, 29, 32, 46, 53
Mysterascidia symmetrica Monniot & Monniot, 1984	SPP / ___ / ___ / ___ / ___ / ___ / ___	3 459–3 492	66	14, 32
Diazonidae				
**Tylobranchion speciosum* Herdman, 1886	SPP / SSI / MAG / SCL / ___ / ___ / CHL	15–2 897	54–78	12, 24, 29, 32, 35, 37, 43, 46, 47, 50-52, 56
Dimeatidae				
Dimeatus attenuatus Sanamyan, 2001	SPP / ___ / ___ / ___ / ___ / ___ / ___	5 680–6 145	61	53, 66
D. mirus Monniot & Monniot, 1981	SPP / ___ / ___ / ___ / ___ / ___ / ___	4 978–5 043	60	14, 32
Octacnemidae				
Cibacapsa gulosa Monniot & Monniot, 1983	SPP / ___ / ___ / ___ / ___ / ___ / ___	567–810	58–75	29, 32, 50
Kaikoja multitentaculata (Vinogradova, 1975)	SPP / ___ / ___ / ___ / ___ / ___ / ___	4 485–4 520	70	53
Megalodicopia hians Oka, 1918	SPP / ___ / ___ / ___ / ___ / ___ / ___	146–174	43–78	32
M. rineharti (Monniot and Monniot, 1989)	SPP / ___ / ___ / ___ / ___ / ___ / ___	3 700–3 970	60	53
Octacnemus kottae Sanamyan & Sanamyan, 2002	SPP / ___ / ___ / ___ / ___ / ___ / ___	3 700–3 910	55	53
Situla rebainsi Vinogradova, 1975	SPP / ___ / ___ / ___ / ___ / ___ / ___	3 700–3 970	61	53
Stolidobranchia				
Molgulidae				
Asajirus indicus (Oka 1913)	SPP / ___ / ___ / ___ / ___ / ___ / ___	2 763–2 818	64	32
Eugyra greenwichensis (Monniot & Monniot, 1974)	SPP / SSI / ___ / ___ / ___ / ___ / ___	61	62	43
E. kerguelenensis Herdman, 1881	SPP / SSI / ___ / ___ / ___ / ___ / ___	21–845	45–68	24, 32, 46, 47, 63
E. polyducta (Monniot & Monniot, 1983)	SPP / SSI / ___ / ___ / ___ / ___ / ___	44–574	57–75	29, 32, 50
Fungulus cinereus Herdman, 1882	SPP / ___ / ___ / ___ / ___ / ___ / ___	2 925–5 918	46–64	24, 32, 46, 63
F. perlucidus (Herdman, 1881)	SPP / ___ / ___ / ___ / ___ / ___ / ___	4 664–5 225	38–56	53
Molgula diaguita Monniot & Andrade, 1983	___ / ___ / ___ / ___ / TCL / NCL / CHL	400–550	12–31	64, 65, 67
**M. enodis* (Sluiter, 1912)	SPP / SSI / MAG / ___ / ___ / ___ / ___	8–548	55–69	24, 32, 35, 37, 43, 52, 68
M. estadosi Monniot & Monniot 1983	___ / ___ / MAG / ___ / ___ / ___ / ___		.	

Taxon	Region	Depth/m	Latitude/(°S)	Reference(s)
M. euplicata Herdman, 1923	SPP / SSI / MAG / ___ / ___ / ___ / ___	30–928	54–78	12, 24, 29, 32, 46
M. ficus (Macdonald, 1859)	___ / ___ / ___ / ___ / ___ / NCL / CHL	2	23–27	64
M. hodgsoni Herdman, 1910	SPP / SSI / ___ / ___ / ___ / ___ / ___	19–604	53–76	29, 32, 50, 56
M. malvinensis Ärnbäck, 1938	SPP / SSI / MAG / ___ / ___ / ___ / ___	3–494	3978	24, 32, 46, 48
M. marioni Millar, 1960	SPP / ___ / MAG / SCL / ___ / ___ / CHL	49–330	53–65	32
M. millari Kott, 1971	SPP / ___ / ___ / ___ / ___ / ___ / ___	3 089–4 218	51–61	14, 32, 46, 53
M. mortenseni (Michaelsen, 1922)	___ / ___ / MAG / SCL / ___ / ___ / CHL	64–115	38–54	32, 48
**M. pedunculata* Herdman, 1881	SPP / SSI / MAG / SCL / TCL / NCL / CHL	7–2 846	30–78	4, 5, 12, 29, 32, 35, 37, 46-48, 50-52, 56, 60-64, 67, 69
M. pigafettae Monniot & Monniot, 1983	___ / ___ / MAG / ___ / ___ / ___ / ___	119–124	54	32
M. pulchra Michaelsen, 1900	SPP / ___ / MAG / SCL / ___ / ___ / CHL	13–358	43–66	24, 32, 46, 47
M. pyriformis Herdman, 1881	SPP / ___ / MAG / SCL / ___ / ___ / CHL	13–1 080	37–55	5, 24, 32, 63
M. riddlei F. Monniot, 2011	SPP / ___ / ___ / ___ / ___ / ___ / ___	817	66	12
M. robini, Monniot & Monniot, 1983	SPP / ___ / ___ / ___ / ___ / ___ / ___	94–714	65–78	29, 32
M. setigera Ärnbäck, 1938	SPP / ___ / MAG / SCL / ___ / ___ / CHL	40–494	43–65	24, 32, 46
Molguloides coronatum Monniot, 1978	SPP / ___ / ___ / ___ / ___ / ___ / ___	301–531	71	29
M. cyclocarpa Monniot & Monniot, 1982	SPP / ___ / ___ / ___ / ___ / ___ / ___	3 138–6 070	56	14, 32, 53
M. immunda (Hartmeyer, 1909)	SPP / SSI / ___ / ___ / TCL / ___ / CHL	128–5 929	32–65	24, 32
M. vitrea (Sluiter, 1904)	SPP / ___ / ___ / ___ / ___ / ___ / ___	3 788–3 944	58	32, 46
Oligotrema lyra Monniot & Monniot, 1973	SPP / ___ / MAG / SCL / ___ / ___ / CHL	2 028–3 575	56–70	32
O. psammites Bourne, 1903	SPP / SSI / ___ / ___ / ___ / ___ / ___	2 672–5 340	14–61	24, 32, 46, 48
Paramolgula canioi Monniot & Monniot, 1983	___ / ___ / MAG / SCL / ___ / ___ / CHL	485	54	32
P. filholi (Pizon, 1898)	___ / ___ / MAG / SCL / ___ / ___ / CHL	115	55	24
**P. gregaria* (Lesson, 1830)	SPP / SSI / MAG / SCL / TCL / ___ / CHL	0–641	36–75	3, 10, 15, 24, 32, 40, 43, 46, 48, 54, 63
Pareugyrioides arnbackae (Millar, 1960)	SPP / SSI / ___ / ___ / ___ / ___ / ___	31–1 890	53–77	14, 24, 29, 32, 43, 46, 47
P. galatheae (Millar, 1959)	SPP / ___ / ___ / ___ / ___ / ___ / ___	1 976–6 070	55–66	14, 24, 32, 46, 53
Pyuridae				
Bathypera splendens Michaelsen, 1904	SPP / SSI / MAG / SCL / ___ / ___ / CHL	55–46 436	56–78	5, 12, 14, 24, 29, 32, 46, 56, 69
Culeolus anonymus Monniot & Monniot, 1976	SPP / ___ / ___ / ___ / ___ / ___ / ___	3 386–5 801	38–65	14, 32, 53
C. antarcticus Vinogradova, 1962	SPP / ___ / ___ / ___ / ___ / ___ / ___	233–5 631	53–75	12, 14, 32, 53
C. likae Sanamyan & Sanamyan, 2002	SPP / ___ / ___ / ___ / ___ / ___ / ___	4 664–5 631	38–56	53
C. murrayi Herdman, 1881	SPP / ___ / ___ / ___ / ___ / ___ / ___	84–5 340	35–68	24, 32 14, 46, 63, 69
C. pinguis Monniot & Monniot, 1982	SPP / ___ / ___ / ___ / ___ / ___ / ___	2 818–2 846	65	32
C. wyvillethomsoni Herdman, 1881	SPP / ___ / ___ / ___ / ___ / ___ / ___	4 465–4 557	30–64	32, 63
**Pyura bouvetensis* (Michaelsen, 1904)	SPP / SSI / ___ / ___ / ___ / ___ / ___	21–2 350	50–79	4, 12, 14, 24, 29, 32, 35, 46, 47, 50, 52, 53, 56, 69
**P. chilensis* Molina, 1782	SPP / ___ / MAG / SCL / TCL / NCL / CHL	0–3 144	20–57	15, 32, 40, 54, 64, 65
P. discoveryi (Herdman, 1910)	SPP / SSI / ___ / ___ / ___ / ___ / ___	8–1 159	54–78	5, 12, 14, 29, 35, 37, 46, 48, 50, 52, 56, 68, 69

Taxon	Region	Depth/m	Latitude/(°S)	Reference(s)
P. gangelion (Savigny, 1816)	SPP / SSI / ___ / ___ / ___ / ___ / ___	15-220	62–65	24, 32, 35, 37, 46, 52, 56
P. georgiana (Michaelsen, 1898)	SPP / SSI / ___ / ___ / ___ / ___ / ___	2–5 223	44–78	24, 32, 37, 43, 45, 46, 48, 50, 55
**P. legumen* (Lesson, 1830)	SPP / ___ / MAG / SCL / ___ / ___ / CHL	5–124	42–65	3, 24, 32, 38, 46, 54, 55, 63
P. multiruga Monniot & Monniot, 1982	SPP / ___ / ___ / ___ / ___ / ___ / ___	2 273–2 800	65–71	14, 32, 70
P. paessleri (Michaelsen, 1900)	___ / ___ / MAG / SCL / ___ / ___ / CHL	22–494	52–56	24, 32, 46
P. pilosa Monniot & Monniot, 1974	___ / ___ / MAG / SCL / ___ / ___ / CHL	30–110	54–55	32
P. praeputialis (Heller, 1878)	___ / ___ / ___ / ___ / ___ / NCL / CHL	0	24	64, 71, 72
**P. setosa* (Sluiter, 1905)	SPP / SSI / MAG / SCL / ___ / ___ / CHL	14–638	53–78	4, 24, 32, 35, 37, 45, 47, 48, 51, 52, 56, 57, 61, 68
P. squamata Hartmeyer, 1911	SPP / ___ / ___ / ___ / ___ / ___ / ___	17–2 060	40–78	32, 50
P. stolonifera (Heller, 1878)	___ / ___ / ___ / ___ / ___ / NCL / CHL	0–100	2–35	65, 69, 71
P. stubenrauchi (Michaelsen, 1900)	SPP / SSI / MAG / SCL / ___ / ___ / CHL	13–92	42–62	15, 41, 43
P. tunica Kott, 1969	SPP / ___ / ___ / ___ / ___ / ___ / ___	184	65	24, 32
Styelidae				
Alloeocarpa affinis Bovien, 1921	___ / ___ / MAG / ___ / ___ / ___ / ___	104–115	54	32
**A. bacca* Ärnbäck, 1929	___ / ___ / MAG / SCL / TCL / ___ / CHL	6–45	29–41	15
A. bridgesi Michaelsen, 1900	___ / ___ / MAG / SCL / ___ / ___ / CHL	64–101	53–54	32, 46
**A. incrustans* (Herdman, 1886)	SPP / ___ / MAG / SCL / ___ / ___ / CHL	13–494	41–56	32, 40, 46
**Asterocarpa humilis* (Heller, 1878)	___ / ___ / MAG / SCL / ___ / NCL / CHL	2–8	23–43	64
Bathyoncus mirabilis Herdman, 1882	SPP / SSI / ___ / ___ / ___ / ___ / ___	300–5 631	46–75	14, 32, 46, 53, 63, 69, 70
Bathystyeloides enderbyanus (Michaelsen, 1904)	SPP / ___ / ___ / ___ / ___ / ___ / ___	3 947–4 063	55	32
**Botryllus* sp.	___ / ___ / MAG / SCL / TCL / ___ / CHL	0–0.5	30	15
Cnemidocarpa acanthifera F. Monniot, 2011	SPP / ___ / ___ / ___ / ___ / ___ / ___	817	66	12
C. areolata (Heller, 1878)	SPP / ___ / ___ / ___ / ___ / ___ / ___	?	18–64	32, 48
C. bathyphila Millar, 1955	SPP / ___ / ___ / ___ / ___ / ___ / ___	4 078–5 120	51–61	5, 32, 53
C. bythia (Herdman, 1881)	SPP / ___ / ___ / ___ / ___ / ___ / ___	2 273–5 120	42–71	14, 32, 46, 53, 63
C. digonas Monniot & Monniot, 1968	SPP / ___ / ___ / ___ / ___ / ___ / ___	3 138–4 008	55–57	14, 32
C. drygalskii (Hartmeyer, 1911)	SPP / SSI / ___ / ___ / ___ / ___ / ___	85–1 376	42–74	5, 12, 32, 48, 50, 53, 63
C. eposi Monniot & Monniot, 1994	SPP / ___ / ___ / ___ / ___ / ___ / ___	498	75	29
**C. nordenskjoldi* (Michaelsen, 1898)	SPP / SSI / MAG / SCL / ___ / ___ / CHL	18–5 314	13–72	5, 12, 24, 32, 40, 46, 69
C. ohlini (Michaelsen, 1898)	___ / ___ / MAG / SCL / ___ / ___ / CHL	80–320	70–72	32, 46, 55
C. pfefferi (Michaelsen, 1898)	SPP / SSI / MAG / SCL / ___ / ___ / CHL	15–771	54–77	12, 29, 32, 56
C. platybranchia Millar, 1955	SPP / ___ / ___ / ___ / ___ / ___ / ___	5 110–5 120	62	53
C. univesica F. Monniot, 2011	SPP / ___ / ___ / ___ / ___ / ___ / ___	817–1 096	66	12
**C. verrucosa* (Lesson, 1830)	SPP / SSI / MAG / SCL / ___ / ___ / CHL	2–5 845	45–78	3-5, 12, 24, 29, 32, 35, 37, 45-48, 50-52, 54-57, 60-63, 68, 73, 74
C. victoriae Monniot & Monniot, 1983	___ / ___ / MAG / ___ / ___ / ___ / ___	119–358	54–55	32
Dicarpa insinuosa (Sluiter, 1912)	SPP / SSI / ___ / ___ / ___ / ___ / ___	15–605	54–57	4, 24, 29, 32, 35, 52, 56
D. misogyna Monniot & Monniot, 1982	SPP / ___ / ___ / ___ / ___ / ___ / ___	2 818–2 827	59	32
D. tricostata (Millar, 1960)	SPP / SSI / ___ / ___ / ___ / ___ / ___	493	76	32

Taxon	Region	Depth/m	Latitude/(°S)	Reference(s)
Monandrocarpa abyssa Sanamyan & Sanamyan, 1999	SPP / ___ / ___ / ___ / ___ / ___ / ___	2 800	65	70
Polyandrocarpa placenta (Herdman, 1886)	___ / ___ / MAG / ___ / ___ / ___ / ___	100–400	6–55	32, 69
Polyzoa opuntia Lesson, 1830	SPP / ___ / MAG / SCL / ___ / NCL / CHL	15–842	49–57	5, 24, 32, 47, 69
Styela brevigaster Millar, 1988	___ / ___ / ___ / ___ / TCL / ___ / CHL	730–2 514	7–34	32, 64, 65
S. canopus (Savigny, 1816)	___ / ___ / MAG / SCL / ___ / ___ / CHL	14–180	52–53	5, 55
S. changa Monniot & Andrade, 1983	___ / ___ / ___ / ___ / TCL / NCL / CHL	400–4 753	5–32	64, 65, 67
S. gelatinosa (Traustedt, 1886)	SPP / ___ / ___ / ___ / ___ / ___ / ___	588	61	69
S. glans Herdman, 1881	SPP / SSI / ___ / ___ / ___ / ___ / ___	91–1 097	37–78	32, 63
**S. magalhaensis* Michaelsen, 1898	SPP / SSI / MAG / SCL / TCL / NCL / CHL	13–539	30–65	15, 31, 32, 47, 64, 67
S. materna Monniot & Monniot,1983	SPP / ___ / ___ / ___ / ___ / ___ / ___	46–486	54–57	32
S. paessleri Michaelsen, 1898	___ / ___ / MAG / SCL / ___ / ___ / CHL	0–79	42–55	15, 32
S. schmitti Van Name, 1945	SPP / SSI / MAG / SCL / ___ / ___ / CHL	21–240	37–61	24, 32
S. squamosa Herdman, 1881	SPP / ___ / MAG / SCL / ___ / ___ / CHL	165–4 753	37–75	14, 29, 32, 63
**S. wandeli* (Sluiter, 1911)	SPP / SSI / ___ / ___ / ___ / ___ / ___	8–33	53–78	24, 32, 35, 37, 46, 50, 52, 56, 68