Polar Biology (2020) 43:1519–1534
https://doi.org/10.1007/s00300-020-02725-z

ORIGINAL PAPER

Biodiversity of Isopoda and Cumacea (Peracarida, Crustacea) from the Marine Protected Area Namuncurá-Burdwood Bank, South-West Atlantic

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Received: 20 March 2019 / Revised: 21 July 2020 / Accepted: 3 August 2020 / Published online: 24 August 2020
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Abstract
Burdwood Bank is a shallow seamount located south of the Malvinas (Falkland) Islands and east of Tierra del Fuego. In 2013, the area down to 200 m depth of this bank was declared the first open-sea (non-coastal) Marine Protected Area (MPA) in Argentina, and named "Namuncurá" (MPAN-BB). The present study aimed to evaluate the biodiversity of the isopods and cumaceans from the MPAN-BB. The studied material was collected on board the Argentine RV *Puerto Deseado* during the *Campaña Antártica de Verano* 2013. Three stations from the MPAN-BB, respectively, located in the core, buffer, and transition sectors, were sampled. A total of 17,076 specimens were sorted and 70 taxa distributed in 22 families were identified. Thirty-five new records of distribution and eight species most probably new to science are herein reported. Paramunnidae and Diastylidae were the most abundant and diverse families among isopods and cumaceans, respectively. Our records, together with those obtained from the literature, make a total of 55 nominal species so far known from Burdwood Bank. Except for one nominal species, which had been reported from the Puerto Rico Trench and the Argentine Basin, all the remaining species had also been recorded from other localities within the Magellan Region. In contrast, only nine out of the 55 nominal species had also been reported from the Antarctic Peninsula and/or Scotia Arc. This indicates that the isopods and cumaceans from Burdwood Bank are typically Magellanic, and there is little correspondence between this fauna and that from the Antarctic Peninsula and Scotia Arc.

Keywords MPA Namuncurá-Burdwood Bank · Isopods · Cumaceans · Species richness · Faunal affinities

Introduction

Burdwood Bank (55°S, 59°W) is a shallow seamount, 300 km long and 60 km wide, located about 200 km south of the Malvinas (Falkland) Islands and 150 km east of Isla de los Estados (Staten Island). This bank is part of the North Scotia Ridge, and along with the Davis and Aurora Banks, the Shag Rocks and the South Georgia Island form the northern boundary of the Scotia Sea (Pandey et al. 2010; Cavallotto et al. 2011; Torres Carbonell et al. 2014).

To the north, Burdwood Bank is surrounded by the Malvinas (Falkland) Channel, which extends in a west–east direction (Fig. 1). The depth of this channel increases from 400 to 3000 m toward the east. The bank is separated from the Patagonian shelf by a relatively narrow and shallow channel—80 km wide and 400 m deep—which connects the Scotia Basin with the Malvinas Channel. On its east margin, it is surrounded by another channel—130 km wide and as deep as 1800 m—which also connects the Scotia Basin with

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s00300-020-02725-z) contains supplementary material, which is available to authorized users.

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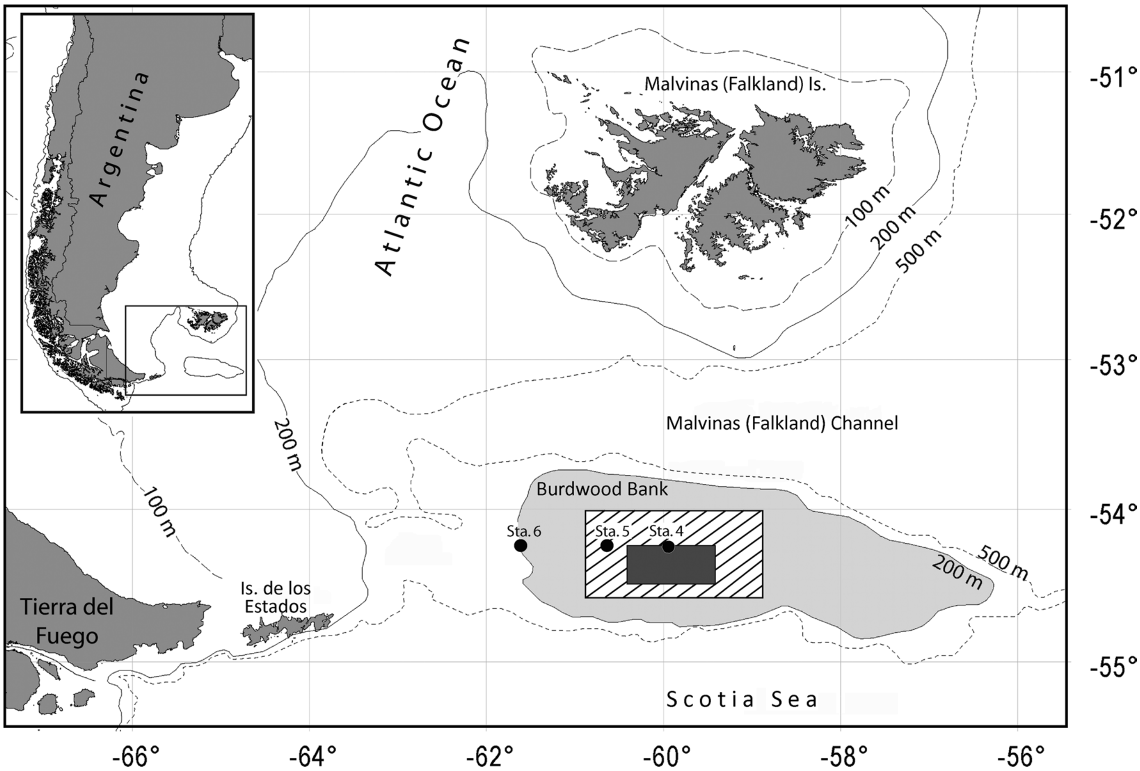

Fig. 1 Stations sampled in the core (dark gray), buffer (dashed) and transition (light gray) sectors of the Marine Protected Area Namuncurá-Burdwood Bank (MPAN-BB)

the Malvinas Channel (Guerrero et al. 1999). To the south, the bank extends along a complex and steep slope incised by a system of canyons (Harris and Whiteway 2011; Bozzano et al. 2017).

Regarding the impact of Burdwood Bank on the oceanic circulation, Piola and Gordon (1989) reported that, upon encountering this bank, the Antarctic Circumpolar Current (ACC) splits into two branches, which flow around its margins. Matano et al. (2019) presented a suite of numerical simulations to characterize the circulation over Burdwood Bank, which showed energetic and persistent uplifting of deep waters in the area. These waters are potentially rich in micronutrients and might contribute to the fertilization of the upper layers of the southwestern Atlantic region, which is one of the most fertile areas of the Southern Ocean. However, Matano et al. (op. cit) stated that although the results of the model are robust, there is insufficient observational evidence to corroborate them.

Burdwood Bank is a hotspot of benthic diversity, including long-lived species with a very slow recovery time after perturbation events (Schejter et al. 2016, 2017b, 2020). To preserve this fragile ecosystem, in 2013, the Argentine government created the Marine Protected Area Namuncurá-Burdwood Bank (MPAN-BB). In addition, in 2018, the Argentine government established two other MPAs: the "Namuncurá-Burdwood Bank II" (MPAN-BB II), which extends the MPAN-BB southwards and to deeper waters, and the MPA "Yaganes", which is located just off the southern tip of Tierra del Fuego, extending southwards into the Drake Passage.

Since 2013, an intensive sampling program of the benthic community at Burdwood Bank has been carried out on board the Argentine RV *Puerto Deseado* (surveys CAV 2013, BBB 2016, PD-BB-ABR 2017, among others). As a preliminary result of these surveys, Schejter et al. (2016) presented a checklist of benthic organisms (mainly mega and macrofauna). Later on, Schejter et al. (2017b) provided the first submarine images of the MPAN-BB, which revealed highly heterogeneous substrata in the area, and briefly described the faunas of two rocky environments and an area dominated by coarse biogenic sediments. More recently, Schejter et al. (2020) studied the megabenthic communities on the slope of Burdwood Bank and neighboring areas (≥ 200 m depth), reporting "coral gardens" mainly composed of alcyonaceans, as well as pennatulacean aggregations and communities dominated by sponges.

In addition, exhaustive species inventories, descriptions of new species, new records of distribution, and studies on reproductive biology and biogeography have been recently published on the fauna from Burdwood Bank (Güller and Zelaya

2017; Penchaszadeh et al. 2017, 2019; Schejter et al. 2017a; Fraysse et al. 2018, 2020; García Alonso et al. 2018; López Gappa et al. 2018; Taverna et al. 2018; Urcola and Zelaya 2018; Bremec et al. 2019; Di Luca and Zelaya 2019; Gordillo et al. 2019; Teso et al. 2019; Teso and Penchaszadeh 2019; Pérez-Barros et al. 2020; Roccatagliata 2020; among others).

Regarding the isopods and cumaceans, only a few species, mostly collected by foreign surveys (Swedish Antarctic Expedition 1901–1903, HMS *William Scoresby* 1926–1932, Soviet Antarctic Expedition 1955–1958, RV *Vema* 1961, RV *Eltanin* 1962, ANTARKTIS XIX/5 (LAMPOS) 2002), have been recorded from Burdwood Bank. Most recently, a few additional records also came from the Argentine expeditions CAV 2013 and BBB 2016. As a result of all these surveys, a total of 13 isopods and 8 cumaceans have been reported from the area (see Discussion section for citations). It should be noted that neither isopods nor cumaceans were reported by the Scottish National Antarctic Expedition 1902–1904, despite the exceptional abundant sample ("*The largest and richest catch of the Expedition, totalling about half a ton.*") taken at Burdwood Bank during that survey (Wilton et al. 1908).

So far, no comprehensive study on the Peracarida from Burdwood Bank has been performed. The large amount of peracarids, including thousands of amphipods, isopods, cumaceans and tanaidaceans, recently collected by the RV *Puerto Deseado* in the MPAN-BB gives us the opportunity to achieve better knowledge about this fauna. As the first step in this direction, the isopods and cumaceans are herein investigated. In particular, the aims of this paper were: (1) to analyze the species composition of Isopoda and Cumacea in the MPAN-BB, (2) to report new species and new records of distribution, and (3) to discuss the faunal similarities between Burdwood Bank and its neighboring areas.

Study area

The MPAN-BB has a minimum depth of about 50 m and is circumscribed by the 200 m isobath. Three sectors were defined for managing purposes (see Falabella 2017): (1) the core sector, which is the central portion of the MPAN-BB and is under strict protection; (2) the buffer sector, which surrounds the core, and where extracting activities are allowed only for scientific research; and (3) the transition sector, which is the most external area of the MPAN-BB, and where productive and extractive activities contemplated in the Management Plan are allowed (Fig. 1).

Material and methods

The studied specimens were collected on board the RV *Puerto Deseado* during the *Campaña Antártica de Verano* (CAV) 2013. Three stations, one in each sector of the MPAN-BB (core, buffer and transition; Fig. 1, Table 1), were sampled using a Rauschert sledge (see Lörz et al. 1999) equipped with a net of 1 mm mesh size. On each station, the sledge was hauled on the ocean floor for about 10 min with the vessel moving at 1–2 knots. On deck, the specimens were sieved with a 250-μm mesh, and then fixed in 10% sea-water buffered formalin. Additionally, some specimens were preserved directly in 96% ethanol for later molecular studies. Once in the laboratory, the samples fixed in formalin were transferred to 70% ethanol and all the isopods and cumaceans were sorted by species under a stereoscopic microscope Leica MZ8.

Species were identified to the lowest taxonomic level possible. The species that are most probably new to science were provisionally designated with letters (e.g., "n. sp. A") and will remain in open nomenclature until the formal description is published. Species identified with the abbreviation "cf." (Latin *confer*, "compare") means that most diagnostic characters correspond to the given species but some characters are unclear and, thus, that the identification is provisional. *Chaetarcturus* sp. A and B are two distinct species with unresolved taxonomic status. Finally, taxa identified to the genus or family levels (denoted with "sp." and "indet.", respectively) include only single species.

The Jaccard similarity index (JSI) was used to compare how similar a pair of stations was: the closer the value to 1, the greater the similarity between the stations analyzed.

All previous records of isopods and cumaceans from Burdwood Bank were compiled from the literature. Besides, the Ocean Biogeographic Information System (OBIS) was checked, and only species identified by a taxonomist with expertise in isopods or cumaceans were considered.

Although MPAN-BB is defined as the submerged plateau limited by the 200 m isobath, the specimens obtained up to 500 m depth by previous expeditions were taken into account in the Discussion section and are listed in Table 3.

For the zoogeographic analysis, we investigated the occurrence in the neighboring localities of the isopods and cumaceans reported from Burdwood Bank. A group-averaged cluster analysis and a non-metric multidimensional scaling analysis (MDS), both based on a species presence/absence matrix, were performed with the PRIMER v5.2.2 program (Clarke and Warwick 2001). The Bray–Curtis similarity index was used. The localities considered were

Table 1 Stations sampled in the MPAN-BB on board the RV *Puerto Deseado*, March 21st, 2013

	Latitude (S)	Longitude (W)	Depth (m)
Sta. 4 (Core)	54º 15.80′	59º 59.04′	103
Sta. 5 (Buffer)	54º 14.89′	60º 37.71′	117
Sta. 6 (Transition)	54º 15.04′	61º 35.47′	202

the following: Burdwood Bank, the Pacific Sector of the Magellan Region (from Drake Passage to Chiloé Island), the Magellan Strait, the Beagle Channel, the Atlantic Sector of the Magellan Region (from Drake Passage to Península Valdés, and, from there, extending north up to ~35ºS at a distance of 100–150 km from the coast, see Doti et al. 2014, Fig. 4), the Malvinas (Falkland) Islands, the Scotia Arc and the Antarctic Peninsula (including the South Shetland Islands).

Results

Species richness and abundance were lowest in the buffer sector for both isopods and cumaceans, highest in the core sector for isopods, and highest in the transition sector for cumaceans (Table 2).

The Jaccard similarity index (JSI) for the comparison between the core and buffer sectors was 0.50, whereas that for the comparison between the transition and core sectors and that for the comparison between the transition and buffer sectors were lower (0.35 and 0.33, respectively).

A total of 70 taxa (57 isopods and 13 cumaceans) distributed in 22 families (18 of isopods and 4 of cumaceans) were identified (Table 2, Online Resource 1). Of the 70 taxa identified, 50 correspond to nominal species, eight are most probably new species to science (designated by code letters), two are species provisionally identified (with the abbreviation "cf." preceding the specific epithet), and 10 were identified to genus or family level. As many as 35 (70%) nominal species are recorded from the MPAN-BB for the first time (Table 2).

At the family level, for Paramunnidae, Janiridae, Diastylidae, Munnidae, Leuconidae, Joeropsididae and Nanastacidae three or more species were recorded. These seven families were found in the three sectors and all together accounted for 88.4% of the total specimens collected. Antarcturidae was the exception because although four species were recorded, this family was found only in two sectors and was represented by a few specimens. In contrast, Santiidae, Lampropidae, Stenetriidae, Anthuroidea, Chaetiliidae, Aegidae and Pseudidotheidae were represented by one species each, and all together accounted for only 0.15% of the total specimens collected. The remaining families were represented by one or two species with a moderate number of specimens (Fig. 2).

The 35 new records herein reported, plus the previous records from the literature, make a total of 55 nominal species currently known from Burdwood Bank (Table 3). None of these species is endemic to Burdwood Bank. Moreover, all of them, except *Abyssianira dentifrons*, were recorded from the Magellan Region (Table 3). Furthermore, the eight most probably new species (herein designated as "n. sp. A, B or C") were also found in the Atlantic Sector of the Magellan Region (Table 2).

According to their depth distribution, the species from Burdwood Bank are divided in three major groups: 13 are known only from shallow waters (< 200 m), 32 reach intermediate depths (as deep as 1000 m), and 10 extend beyond 1000 m depth. The bathymetric range of 21 species is herein extended (Table 3).

Regarding the faunal similarities between Burdwood Bank and its neighboring areas, both multivariate analyses were congruent. The cluster analysis showed that Burdwood Bank and the Atlantic Sector of the Magellan Region (AS) presented the highest similarity (Fig. 3a), whereas the MDS analysis showed that Burdwood Bank was grouped more closely together with the AS (Fig. 3b). In particular, 42 out of the 55 nominal species from Burdwood Bank are also known from the AS. In contrast, only nine out of the 55 nominal species are known from the Antarctic Peninsula or the Scotia Arc (Table 3).

Discussion

Biodiversity remarks

The large number of new records and new species of Isopoda and Cumacea herein reported can be ascribed to the fact that, for the samplings, we used an epibenthic sledge equipped with a net of 1-mm mesh size, which allowed us to collect a very large number of specimens (as many as 17,076 specimens in only three samples). It should be noted that the gears so far used in the MPAN-BB were not appropriate to collect small crustaceans. For instance, by using a bottom otter trawl, Schejter et al. (2016) reported only five species of isopods and no cumaceans.

Isopods have a remarkably high biodiversity in Burdwood Bank, with the following 13 species previously recorded from this area: *Acanthoserolis schythei*, *Aega semicarinata*, *Ianthopsis laevis*, *Joeropsis curvicornis*, *J. intermedius*, *Munnogonium falklandicum*, *Neoserolis exigua*, *Paramunna integra*, *Pleurosigunum magnum*, *Natatolana pastorei*, *Serolis kempi*, *Iathrippa longicauda*, and *Cymodopsis* cf. *baegeli* (Nordenstam 1933; Sheppard 1933; Kussakin 1967; De Broyer et al. 2003; Schejter et al. 2016; OBIS 2019).

Except for the last four, the remaining species listed above were also recorded in the current study (Table 2). Concerning the species not found in the current study, some clarifications are needed. *Natatolana pastorei* and *Serolis kempi* are distributed along the Patagonian coast (see Table 3) and although they were not present in any of the three samples herein analyzed, they have been found at other samples recently sorted from the MPAN-BB (unpublished data). *Iathrippa longicauda* was originally described from New

Table 2 List of isopods and cumaceans and their abundance, in the core, buffer and transition sectors from the MPAN-BB. (*) Species previously recorded from Burdwood Bank

	Core (103 m)	Buffer (117 m)	Transition (202 m)
ISOPODA			
ASELLOTA			
Acanthaspidiidae			
Ianthopsis laevis Menzies, 1962*	113	99	41
Desmosomatidae			
Desmosoma sp.			109
Janiridae			
Austrofilius furcatus Hodgson, 1910	6		
Austrofilius n. sp. A[b]	7		
Caecianiropsis cf. *ectiformis* (Vanhöffen, 1914)	4		
Ianiropsis sp.	3		
Iathrippa menziesi Sivertsen and Holthuis, 1980	51		
Iathrippa multidens Menzies, 1962		77	22
Iathrippa n. sp. A[b]			5
Neojaera antarctica (Pfeffer, 1887)	204	32	3
Joeropsididae			
Joeropsis curvicornis (Nicolet, 1849)*	250	94	16
Joeropsis intermedius Nordenstam, 1933*	299	137	1
Joeropsis n. sp. A[c]	117	43	32
Munnidae			
Munna gallardoi Winkler, 1992	69	39	
Munna longipoda Teodorczyk and Wägele 1994	171		
Munna pallida Beddard, 1886	43		19
Uromunna nana (Nordenstam, 1933)	947		4
Uromunna sp.	121	496	
Munnopsidae			
Coperonus comptus Wilson, 1989			54
Echinozone n. sp. A[b]			246
Paramunnidae			
Abyssianira argentenensis Menzies, 1962	294	6	306
Abyssianira dentifrons Menzies, 1956	881	5	2
Abyssianira n. sp. A[a]	1		129
Abyssianira n. sp. B[a]			2
Abyssianira n. sp. C[b]	60	22	
Advenogonium fuegiae (Doti and Roccatagliata, 2005)	322		
Allorostrata ovalis Winkler, 1994	587	65	
Allorostrata scutifrons Just and Wilson, 2004	1		
Austronanus dentatus (Nordenstam, 1933)	193	18	
Cryosignum sp.	1	3	
Meridiosignum menziesi (Winkler, 1994)	130	1	
Meridiosignum undulatum Doti and Roccatagliata, 2009			3
Munnogonium diplonychia Doti and Roccatagliata, 2013	32		
Munnogonium falklandicum (Nordenstam, 1933)*			1
Neasellus argentinensis Doti, 2017	7		6
Neasellus bicarinatus Doti, 2017			2
Paramunna integra Nordenstam, 1933*	191	26	5
Pleurosignum chilense Menzies, 1962	46	59	
Pleurosignum magnum Vanhöffen, 1914*	9	44	226
Quetzogonium dentatum (Winkler 1994)	11	7	1
Sporonana sp.	10		

Table 2 (continued)

	Core (103 m)	Buffer (117 m)	Transition (202 m)
Santiidae			
Santia compacta Sivertsen and Holthuis, 1980	5	3	
Stenetriidae			
Tenupedunculus cf. *dentimanum* (Kussakin, 1967)[d]			5
SPHAEROMATIDEA			
Serolidae			
Acanthoserolis schythei (Lutken 1858)*			17
Neoserolis exigua (Nordenstam, 1933)*	361		237
Sphaeromatidae			
Moruloidea darwini (Cunningham, 1871)	110	1	96
VALVIFERA			
Antarcturidae			
Chaetarcturus sp. A			1
Chaetarcturus sp. B			1
Fissarcturus patagonicus (Ohlin, 1901)			9
Litarcturus americanus (Beddard, 1886)		2	
Chaetiliidae			
Macrochiridothea stebbingi Ohlin, 1901	1		1
Pseudidotheidae			
Pseudidothea miersi (Studer, 1884)			1
Rectarcturidae			
Rectarcturus kophameli (Ohlin, 1901)	8		
Rectarcturus tuberculatus Schultz, 1981	93		28
CYMOTHOIDA			
Aegidae			
Aega semicarinata Miers, 1875*		1	
Gnathiidae			
Gnathia sp.	218	69	39
Anthuroidea indet		3	1
TOTAL OF SPECIMENS	5976	1352	1674
TOTAL OF SPECIES	39	25	35
CUMACEA			
Diastylidae			
Diastylis granulata Zimmer, 1921			594
Diastylis hammoniae Zimmer, 1902*			10
Diastylis planifrons Calman, 1912*	91	32	3610
Ekleptostylis heardi McLelland and Meyer, 1998*	746	138	346
Ekleptostylis vemae (Băcescu-Meşter, 1967)*			136
Holostylis uniramosa Roccatagliata and Alberico, 2016*			25
Lampropidae			
Hemilamprops chilensis Gerken and Haye, 2018	5		
Leuconidae			
Eudorella n. sp. A[b]			363
Eudorella sp.		36	2
Leucon septemdentatus Zimmer, 1902	69	66	1383
Nannastacidae			
Campylaspis bacescui Muradian, 1976			19
Campylaspis frigida Hansen, 1908	8		277
Cumella argentinae Jones, 1984*	23	5	90
TOTAL OF SPECIMENS	942	277	6855

Table 2 (continued)

	Core (103 m)	Buffer (117 m)	Transition (202 m)
TOTAL OF SPECIES	6	5	12

[a]Species previously recorded and labeled with the same letter in Doti et al. (2014)

[b]Species not previously recorded but found in other samples recently collected by the RV *Puerto Deseado* in the Argentine Continental Shelf

[c]Mentioned as *Joeropsis* sp. by Doti et al. (2014)

[d]*Tenupedunculus dentimanum* (Kussakin 1967) = "Stenetriidae *incertis sedis*" after Song et al. (2018)

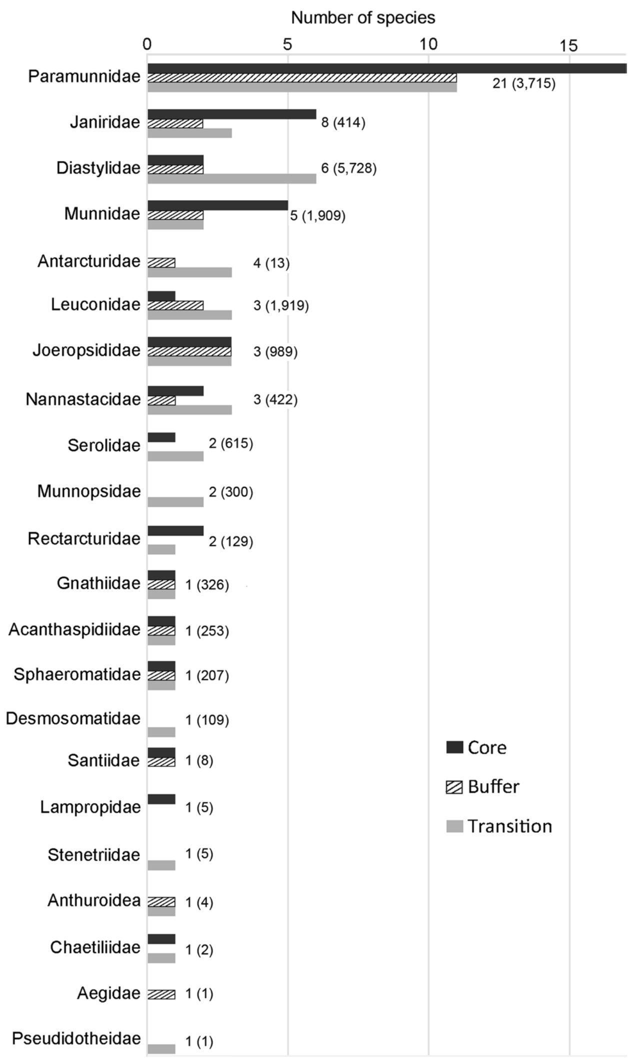

Fig. 2 Isopods and cumaceans collected in the core, buffer and transition sectors of the MPAN-BB. Families are sorted in decreasing order of number of species, and then of abundance. On the right of each bar, the number of species and abundance (between parentheses) are shown

Zealand, and afterwards reported from numerous subantarctic islands as well as from South America. In particular, Nordenstam (1933) recorded this species from the Malvinas (Falkland) Islands and from Burdwood Bank. Based on the broad geographic distribution and the variety of habitats reported for this species, Wilson and Wägele (1994) suggested that *I. longicauda* is a complex of species. It is noteworthy that none of the 155 specimens of *Iathrippa* herein examined belong to the *I. longicauda* complex.

The family Paramunnidae has a global distribution but its diversity in the temperate-cold waters of the southern hemisphere is remarkably high (Wilson 1980). In the current study, Paramunnidae was the most speciose and abundant family, which is in line with the results previously obtained for the Atlantic Sector of the Magellan Region (Doti et al. 2005, 2014).

Regarding Desmosomatidae, only one species, *Eugerdella falklandica*, is known from the Magellan Region (Malvinas/Falkland Islands, Nordenstam 1933). Among the material examined, 109 specimens were provisionally identified as *Desmosoma* sp. (Table 2). Among the Munnopsidae, *Echinozone* n. sp. A represents the first record of this genus for the South-West Atlantic. Regarding Stenetriidae and Antarcturidae, five and three species, respectively, have been reported from localities in the vicinity of Burdwood Bank (Schultz 1982; Kussakin and Vasina 1984, 1998). In the current study, only five specimens of Stenetriidae and 13 specimens of Antarcturidae were collected (Table 2). The Stenetriidae and Antarcturidae recorded from the South-West Atlantic were found from 400 to 4696 m depth. This may explain why, in our samples, these two families were represented by only a few specimens.

Very little information is available on the cumaceans from Burdwood Bank. Only eight species have been previously reported (Table 3). Six of them have been obtained from only two samples, viz., *Cumella argentinae* and *Leucon assimilis* were collected by the RV *Vema* 17, Sta. 59, 54º53.5′S, 60º26.5′W, 426–432 m, whereas *Diastylis hammoniae*, *D. planifrons*, *Ekleptostylis heardi*, and *E. vemae* were collected by the RV *Eltanin* Cr. 6, Sta. 344, 54º04′S, 58º46′W, 119 m (Petrescu 1994, 1995; McLelland and Meyer 1998; Roccatagliata and Mühlenhardt-Siegel 2000; Błazewicz-Paszkowycz and Heard 2005). More recently, Roccatagliata and Alberico (2016) recorded *Holostylis uniramosa*, based on specimens collected by the Argentine survey CAV 2013 at Sta. 4, 103 m (this is one of the stations herein studied) and Roccatagliata (2020)

Table 3 List of the nominal species of isopods and cumaceans recorded from Burdwood Bank, their distribution in neighboring areas and their bathymetry

	Magellan Region					Scotia Arc		AP	Other	Depth ranges	References
	BC	MS	MI	AS	PS	SG	SO				
ISOPODA											
ASELLOTA											
Acanthaspidiidae											
Ianthopsis laevis Menzies, 1962	X	X		X	X					3–272	Doti et al. (2014)
Janiridae											
Austrofilius furcatus Hodgson, 1910	X	X	X	X		X	X	X		15–190	Doti et al. (2014); Castelló (2004)
Iathrippa longicauda (Chilton, 1884)*			X	X						13–310	Doti et al. (2014)
Iathrippa menziesi Sivertsen and Holthuis, 1980	X	X		X						1–300	Doti et al. (2014)
Iathrippa multidens Menzies, 1962		X								1–**202**	Doti et al. (2014)
Neojaera antarctica (Pfeffer 1887)	X	X	X	X				X		1–700	Doti et al. (2014); Castelló (2004)
Joeropsidiidae											
Joeropsis curvicornis (Nicolet 1849)	X	X	X	X					X	0–641	Doti et al. (2014); Kensley (1975)
Joeropsis intermedius Nordenstam, 1933	X	X	X	X	X			X		3–641	Doti et al. (2014); Castelló (2004)
Munnidae											
Munna gallardoi Winkler, 1992	X	X		X						9–**117**	Doti et al. (2014)
Munna longipoda Teodorczyk and Wägele, 1994	X		X					X		15–285	Doti et al. (2014)
Munna pallida Beddard, 1886			X							3–173	Doti et al. (2014)
Uromunna nana (Nordenstam 1933)	X	X	X						X	1–**103**	Doti et al. (2014); Sivertsen and Holthuis (1980)
Munnopsidae											
Coperonus comptus Wilson, 1989				X						**202**–2707	Doti et al. (2014)
Paramunnidae											
Abyssianira argentenensis Menzies, 1962	X			X						70–2681	Doti et al. (2014)
Abyssianira dentifrons Menzies, 1956									X	**103**–5293	Doti and Roccatagliata (2006)
Advenogonium fuegiae (Doti and Roccatagliata, 2005)	X			X						5–**103**	Doti et al. (2014)
Allorostrata ovalis Winkler, 1994	X	X		X						2–**117**	Doti et al. (2014)
Allorostrata scutifrons Just and Wilson, 2004		X								9–**103**	Doti et al. (2014)
Austronanus dentatus (Nordenstam 1933)	X		X							5–**117**	Doti et al. (2014)
Meridiosignum menziesi (Winkler 1994)	X	X		X						9–**117**	Doti et al. (2014)
Meridiosignum undulatum Doti and Roccatagliata, 2009				X						129–**202**	Doti et al. (2014)
Munnogonium diplonychia Doti and Roccatagliata, 2013				X						9–**103**	Doti and Roccatagliata (2013)
Munnogonium falklandicum (Nordenstam 1933)			X							22–150	Doti et al. (2014)
Neasellus argentinensis Doti, 2017				X						**103**–1140	Doti (2017)
Neasellus bicarinatus Doti, 2017				X						110–284	Doti (2017)
Paramunna integra Nordenstam, 1933	X		X	X						40–**202**	Doti et al. (2014)

Table 3 (continued)

	Magellan Region					Scotia Arc		AP	Other	Depth ranges	References
	BC	MS	MI	AS	PS	SG	SO				
Pleurosignum chilense Menzies, 1962	X	X								0–**117**	Doti et al. (2014)
Pleurosignum magnum Vanhöffen, 1914	X		X	X						22–385	Doti et al. (2014)
Quetzogonium dentatum (Winkler, 1994)	X	X		X						12–**202**	Doti et al. (2014)
Santiidae											
Santia compacta Sivertsen and Holthuis, 1980	X	X		X						5–**117**	Doti et al. (2014)
SPHAEROMATIDEA											
Serolidae											
Acanthoserolis schythei (Lutken, 1858)	X	X	X	X	X	X		X		0–300	Bastida and Torti (1973)
Neoserolis exigua (Nordenstam, 1933)			X	X					X	25–545	Bastida and Torti (1973); Wägele (1994)
Serolis kempi Sheppard, 1933*			X	X						121–304	Bastida and Torti (1973)
Sphaeromatidae											
Moruloidea darwini (Cunningham, 1871)	X	X	X	X					X	40–217	Brandt (1998)
VALVIFERA											
Antarcturidae											
Fissarcturus patagonicus (Ohlin, 1901)				X						95–**202**	Park and Wägele (1995)
Litarcturus americanus (Beddard, 1886)		X	X	X				X		75–680	Nordenstam (1933); Kussakin (1967); Castelló (2004)
Chaetiliidae											
Macrochiridothea stebbingi Ohlin, 1901	X	X	X	X	X					0–309	Sheppard (1957); Lorenti and Mariani (1997); Ríos et al. (2003)
Pseudidotheidae											
Pseudidothea miersi (Studer, 1884)			X	X						102–800	Doti et al. (2008)
Rectarcturidae											
Rectarcturus kophameli (Ohlin, 1901)	X[a]	X		X						10–208	Park and Wägele (1995)
Rectarcturus tuberculatus Schultz, 1981		X								26–3590	Park and Wägele (1995)
CYMOTHOIDA											
Aegidae											
Aega semicarinata Miers, 1875		X	X		X				X	11–1076	Bruce (2009)
Cirolanidae											
Natatolana pastorei (Giambiagi, 1925)*	X	X				X				30–920	Keable (2006)
CUMACEA											
Diastylidae											
Diastylis granulata Zimmer, 1921	X			X						61–**202**	Moretti and Roccatagliata (2007)
Diastylis hammoniae Zimmer, 1902	X	X		X						82–335	Alberico and Roccatagliata (2011)
Diastylis planifrons Calman, 1912	X	X		X	X					12–**202**	Alberico and Roccatagliata (2008)
Ekleptostylis heardi McLelland and Meyer, 1998	X	X		X						33–**202**	Roccatagliata and Mühlenhardt-Siegel (2000)

Table 3 (continued)

	Magellan Region					Scotia Arc		AP	Other	Depth ranges	References
	BC	MS	MI	AS	PS	SG	SO				
Ekleptostylis vemae (Băcescu-Meşter, 1967)	X	X		X					X	35–665	Roccatagliata and Mühlenhardt-Siegel (2000)
Holostylis uniramosa Roccatagliata and Alberico, 2016				X						127–530	Roccatagliata and Alberico (2016)
Lampropidae											
Hemilamprops chilensis Gerken and Haye, 2018	X	X			X					19–347	Mühlenhardt-Siegel (2003); Gerken and Haye (2018)
Platytyphlops sarahae Roccatagliata, 2020*				X[b]						271–1398	Roccatagliata (2020)
Leuconidae											
Leucon septemdentatus Zimmer, 1902	X	X	X	X	X					1–1240	Petrescu (1994)
Leucon assimilis Sars, 1887*	X	X	X	X	X			X	X	75–820	Brandt et al. (1999); Mühlenhardt-Siegel (1999), (2011); Corbera (2000); Corbera et al. (2009)
Nannastacidae											
Campylaspis bacescui Muradian, 1976	X	X	X	X						82–1679	Jones (1984); Brandt et al. (1999); Mühlenhardt-Siegel (1999)
Campylaspis frigida Hansen, 1908	X	X	X	X	X			X	X	17–3845	Jones (1984); Ledoyer (1993); Corbera (2000); Petrescu and Heard (2000); Rehm et al. (2007)
Cumella argentinae Jones, 1984		X		X	X					60–665	Jones (1984); Petrescu (1995)

BC Beagle Channel, *MS* Magellan Strait, *MI* Malvinas (Falkland) Is., *AS* Atlantic Sector of the Magellan Region, *PS* Pacific Sector of the Magellan Region, *SG* South Georgia Is., *SO* South Orkney Is., *AP* Antarctic Peninsula (including the South Shetland Is.). In bold, species recorded for the first time from Burdwood Bank and extensions in the bathymetric ranges

*Species previously recorded from Burdwood Bank but not found in the samples herein studied

[a]Species recorded from Isla de los Estados

[b]Species recorded from the Mar del Plata submarine canyon, 540–1398 m

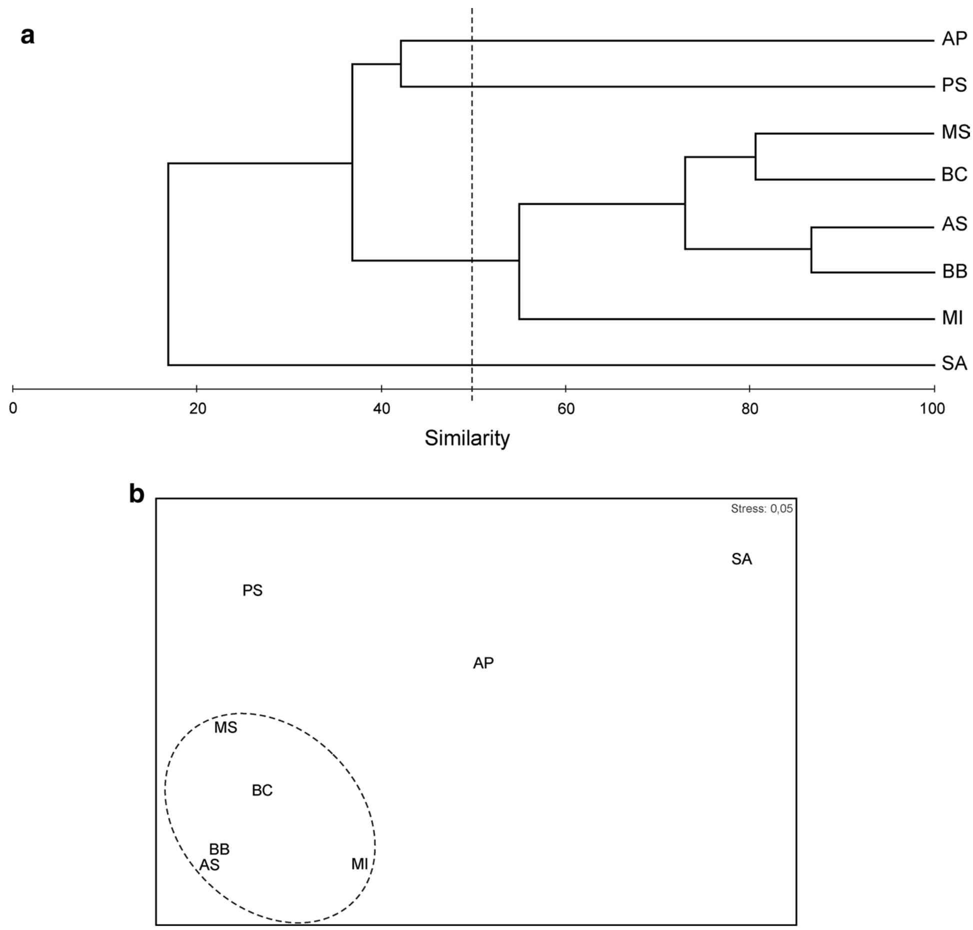

Fig. 3 Similarity between Burdwood Bank and its neighboring areas based on the isopods and cumaceans listed in Table 3. **a** Hierarchical agglomerative clustering using group-average linking (dashed line, similarity threshold 50%). **b** Non-metric multidimensional scaling plot (MDS). *AP* Antarctic Peninsula (including South Shetland Is.), *PS* Pacific Sector of the Magellan Region, *MS* Magellan Strait, *BC* Beagle Channel, *AS* Atlantic Sector of the Magellan Region, *BB* Burdwood Bank, *MI* Malvinas/Falkland Is., *SA* Scotia Arc (includes South Georgia Is. and South Orkney Is., no records from Sandwich Is.)

recorded *Platytyphlops sarahae*, based on specimens collected by the German survey ANTARKTIS XIX/5 (LAMPOS) at 271 m and by the Argentine survey BBB 2016 at 410–1000 m. The other five species found in the current contribution bring to 13 the total number of nominal species reported for Burdwood Bank (Table 3).

Concerning the family Leuconidae, the genera *Eudorella* and *Leucon* are herein reported from Burdwood Bank for the first time. Petrescu (1991) recorded *E. gracilior* Zimmer, 1907, *E. sordida* Zimmer, 1907, *E. similis* Calman, 1907 and *E. fallax* Zimmer, 1909 from the Magellan Region. Although the descriptions of these four species are incomplete, a fact that renders their identification problematic, none of them are conspecific with the two *Eudorella* species herein reported in Table 2. With regard to *Leucon assimilis*, this species has a wide range of distribution in the Southern Ocean and may indeed be a complex of cryptic species (see Mühlenhardt-Siegel 2011).

The Bodotriidae is a family of temperate latitudes, "negatively amphipolar" after Zimmer (1941) (see also Day 1975, 1978). Only one species, *Leptocuma patagonicum* Roccatagliata, 1993, is currently known from the Magellan Region and so far no species of this family have been recorded from Burdwood Bank.

Biogeography, endemism, and mechanisms of species dispersion

The isopods and cumaceans from Burdwood Bank have shown to be typically Magellanic (Fig. 3). In fact, all the species (except *Abyssianira dentifrons*) reported from Burdwood Bank are also present in the Magellan Region (see Table 3). It is worth noticing that high faunal affinities between Burdwood Bank and the Magellan Region have also been reported for other taxa, such as mollusks, bryozoans, polychaetes, decapods, and amphipods (Linse et al. 2003; Romero et al. 2003; Lovrich et al. 2005; Moyano 2005; De Broyer and Jażdżewska 2014; Bremec et al. 2019). These results suggest that the West and North channels that separate Burdwood Bank from the Argentine Continental Shelf do not form an effective barrier to species dispersion and gene flow.

No endemic isopods or cumaceans are known from Burdwood Bank (Table 3). *Abyssianira dentifrons* has not been reported from the Magellan Region but is known from the Puerto Rico Trench and the Argentine Basin (Doti and Roccatagliata 2006, and references therein). In addition, all the species most probably new to science herein reported had also been found in samples recently collected by the RV *Puerto Deseado* in other localities from the Argentine Continental Shelf (unpublished data).

Most of the Argentine Continental Shelf, which is one of the most extensive submarine platforms in the world, has been repeatedly uncovered during glacial times and flooded again during glacial terminations. During the Last Glacial Maximum (ca. 24,000 years BP), the sea level became established between −120 and −140 m below the present sea level and Burdwood Bank emerged. This paleo-island would have also emerged during older glacial cycles as well, and may have even been connected to the continent in the distant past (see Ponce et al. 2011; and references therein).

Few studies have described the biogeographic responses of marine species to the Last Glacial Maximum in the Magellan Region (see González-Wevar 2016; and citations therein). Leese et al. (2008) studied *Serolis paradoxa* (Fabricius 1775), a shallow-water isopod widely distributed in the Magellan Region. According to these authors, there is currently no effective gene flow for *S. paradoxa* between the Magellan Strait and the Malvinas (Falkland) Islands, and it has been absent for time exceeding the Last Glacial Maximum. Even more, they concluded that the specimens from these two localities very likely represent two cryptic species. Leese et al. (op. cit.) study deals with the connectivity between Patagonia and Malvinas (Falkland) Islands. Investigations over the effects of the glacial Quaternary cycles on the connectivity between Patagonia and Burdwood Bank are required.

Floating seaweed rafts, which are very abundant in the Magellan Region, could play an important role in maintaining the genetic connectivity between the populations from Patagonia and Burdwood Bank. Crustaceans are commonly reported from macrophyte rafts and peracarids, in particular, often dominate the rafting communities (see Rothäusler et al. 2012; Thiel and Fraser 2016). Helmut et al. (1994a, b) underlined the importance of the West Wind Drift (= ACC) in transporting floating macroalgae and their associated fauna, from the vicinity of Cape Horn towards South Georgia Island. Also, Nikula et al. (2010) reported that the macroalgal rafting is an important long-distance dispersal mechanism for intertidal kelp epifauna in the Subantarctic Region.

Among peracarids, several species of isopods and amphipods (but no cumaceans) have been reported on macrophyte rafts in the Magellan Region (Thiel and Gutow 2005; Hinojosa et al. 2007; Wichmann et al. 2012). Furthermore, Leese et al. (2010) studied the isopod *Septemserolis septemcarinata* (Miers 1881) from three remote and isolated Antarctic/Subantarctic islands (South Georgia, Bouvet, and Marion Islands), and concluded that, after the initial colonization of these islands, long-distance dispersal events occurred repeatedly in the life history of this species and maybe continue to occur today. As this is a strictly benthic species and lacks (like all peracarids) pelagic larvae, Leese et al. (op. cit.) suggested that this species disperses from west to east by passive rafting on floating substrata in the ACC.

Since Burdwood Bank is a submarine plateau with a minimum depth of 50 m, its environmental conditions are quite different from those of the coastal habitats, and not necessarily favorable for the settlement, expansion and persistence of the species coming via rafting. Nevertheless, it should be noted that four asellote species, i.e., *Inathopsis laevis*, *Neojaera antarctica*, *Meridiosignum menziesi* (= *Paramunna menziesi*) and *Uromunna nana*, recorded on rafting substrata from southern Chile by Wichmann et al. (2012) were also recorded in the benthic community from Burdwood Bank (Table 3). In contrast, Sphaeromatidae and the valviferans Idoteidae, which are common on macrophyte rafts from southern Chile, seem to be very scarce or even absent on the Burdwood Bank benthos (Thiel and Gutow 2005; Wichmann et al. 2012; and Table 3). To the best of our knowledge, there are no studies on kelp rafting in the MPAN-BB. This matter needs to be further investigated.

Finally, very little is known about the isopods and cumaceans that inhabit deeper waters around Burdwood Bank. In the current study, we report four isopod species belonging to the deep-sea families Desmosomatidae, Munnopsidae and Stenetriidae (only *Tenopedunculus*) (Table 2). These four species (414 specimens in total) were found exclusively in the transition sector (202 m depth). Schejter et al. (2016) analyzed the faunal composition of three stations from Burdwood Bank (core: 101 m, buffer: 113 m, shelf break: 232 m) and found that the core and buffer stations were more related to each other than to the shelf break station. Our results also show that the species composition of the transition station (the deepest one) differs from those of the core and buffer stations, which are more alike. Moreover, Fraysse et al. (2018) studied the sea stars (Asteroidea) from the southern tip of South America and stated that the shelf break stations (203–785 m depth) from Burdwood Bank form a cluster on its own. More recently, Teso et al. (2019) found that the chitons and gastropods from Burdwood Bank (80–200 m depth) and two localities on the Argentine Continental Shelf clustered together, whereas those of the slope of Burdwood Bank (200–1000 m depth) grouped with those of the Mar del Plata submarine canyon. Based on these previous results and the fact that the transition station of the MPAN-BB included some deep-sea isopods and cumaceans, it seems likely that the recently established MPAN-BB II (depth > 200 m) contains a distinct assemblage of species.

Only 16.4% of the nominal species reported from Burdwood Bank are also known from the Antarctic Peninsula or

Scotia Arc (Table 3). This result agrees with the little correspondence previously observed at species level between the Magellanic and the Antarctic faunas, both for isopods and cumaceans (see Winkler 1994; Mühlenhardt-Siegel 1999; Castelló 2004; Choudhury and Brandt 2009).

Conclusions

The current research provides additional evidence to support the protection of the MPAN-BB. For the two taxonomic groups studied (isopods and cumaceans), we found not only a remarkably high diversity in the MPAN-BB but also a close affinity at species level between the MPAN-BB and the Magellan Region, particularly with the Argentine Sector of this region. These results prove that although the MPAN-BB is separated from the Argentine Continental Shelf by the West Channel (400 m depth) and the Malvinas Channel (400 to 3000 m depth), it definitely forms part of the Magellan Region.

The MPAN-BB II was recently created to protect the large biomass of vulnerable and fragile species (mainly corals and sponges) living on the southern slope of the bank. Very little is known about the peracarids from the slopes of the bank; however, its faunal composition is expected to differ from that reported from shallower waters (< 200 m depth). An indication of this change in the faunal composition is already present in the sample taken at the transition sector (202 m depth), which includes some deep-sea species that were absent in the core and buffer sectors (103 and 117 m depths, respectively).

This is the first comprehensive contribution on the isopods and cumaceans from the MPAN-BB. However, further studies on the peracarids from the MPAN-BB and its southern slope are necessary. These studies, together with those published and in progress on other taxonomic groups, are essential for the development of adequate conservation and management plans in the two marine protected areas mentioned above.

Acknowledgements We thank the officers and crew of the RV *Puerto Deseado* for their assistance during the CAV 2013 survey. We are also grateful to Alejandro Martínez (IBBEA, CONICET-UBA) for technical assistance at the laboratory, and Gustavo Lovrich (CADIC, CONICET), Juan López Gappa (MACN, CONICET) and Emanuel Pereira (IBEEA, CONICET-UBA) for their suggestions and help. We also thank Saskia Brix (DZMB, Germany), Martin Thiel (UCN, Chile) and an anonymous reviewer for their valuable comments, which helped to improve the quality of the manuscript. Finally, we thank María Victoria González Eusevi for revising the English. This study was supported by grants from the University of Buenos Aires (UBA-CyT 2018-2020 20020170100328BA) and CONICET (PIP 2014-2016 11220130100434CO), Argentina.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All applicable international, national and/or institutional guidelines for the care and use of animals were followed.

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