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# Decapods of the Southern Tip of South America and the Marine Protected Area Namuncurá–Burdwood Bank: A Nearshore–Offshore Comparison

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**Abstract:** The Marine Protected Area (MPA) Namuncurá−Burdwood Bank was created in 2013 to protect the benthic community. After five years of multidisciplinary research, it was reorganized, and a second, contiguous MPA Namuncurá−Burdwood Bank II was created. The objectives of this study were to evaluate the decapod assemblages in both the previous and current management zones and to compare them with the neighboring areas of southern South America. The decapod fauna was studied integratively by comparing captured species onboard scientific expeditions with online records. Our study showed that the original design of the MPAN−BB had the lowest decapod species richness. However, the constitution of a larger protected area, including the slope, increased the species richness, with unique records of *Campylonotus arntzianus* and *Lithodes couesi*. The MPA could be considered ecologically representative as it shares various species with the nearby areas (the Beagle Channel and the Atlantic). Furthermore, we theorize it could act as a "hub" for decapod species as marine currents provide the Burdwood Bank with new individuals from the west and disperse them northward to the Patagonian Shelf and eastward to the Scotia Arc. This result shows the great value of protecting this area, ensuring the conservation of the decapod fauna of southern South America.

**Keywords:** benthic communities; connectivity; conservation; crustacean fauna; management; marine protected area

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## 1. Introduction

A biogeographic feature of the southern high latitudes is the strikingly low diversity of decapod crustaceans south to the Antarctic convergence, which contrasts with other, more diverse groups such as polychaetes, gastropods, and amphipods [1]. "Crushers" such as crabs and lobsters were once present in the current Antarctic latitudes, but are now extinct due to the Antarctic cooling, as a consequence of the opening of the Drake passage during the last 35 million years [2–4]. The only exception is the lithodid crabs suspected to have colonized the Antarctic deep waters about 132,000 years ago, well after the cooling process [3]. By contrast, the sub−Antarctic waters of southern South America have about 90 species of decapods, with many brachyuran and anomuran species [5–7]. The shallows through the Scotia Arc are physically connected between the sub−Antarctic and Antarctic benthic faunas [4]. The North Scotia ridge is understood as continental fragments sharing geological affinities with the Fuegian Andes [8,9], and these shallow banks and shelves were proposed as “hopping stones” for the South American benthic fauna, driven eastwards by the circumpolar current [4]. Along the northern Scotia ridge, decapod fauna is typical to that of South America, and the South Georgia island represents an ecotone zone in which some Antarctic decapods also occur [10].

The Burdwood Bank (BB) is part of the Scotia Arc and the nearest hopping stone to the south American continental coasts and shelf and is also an area of conservation concern for Argentina. Currently, the plateau and the neighboring southern slope constitute a marine protected area (MPA) under the management of the Argentine Administration of National Parks (Figure 1A). A first MPA, Namuncurá−Burdwood Bank, was created in 2013 over the plateau at <200 m depth (Law 26,875), with the main objective of protecting the benthic community. Three management areas were initially established at this MPA (Figure 1(B1)). After five years of research and a socio−scientific process, the management zones were adapted to both the new regulations given by Law 27,037 of the National System of MPAs and the management zones of a new, second, contiguous MPAN−BB II. Both areas were integrated in 2019 and now have three different conservation levels equivalent to the following: (i) no−touch (strict national marine reserve, RNME), (ii) only research allowed (marine national park, PNM), and (iii) sustainable extractive activities (national marine reserve, RNM) (Figure 1(B2); [11]).

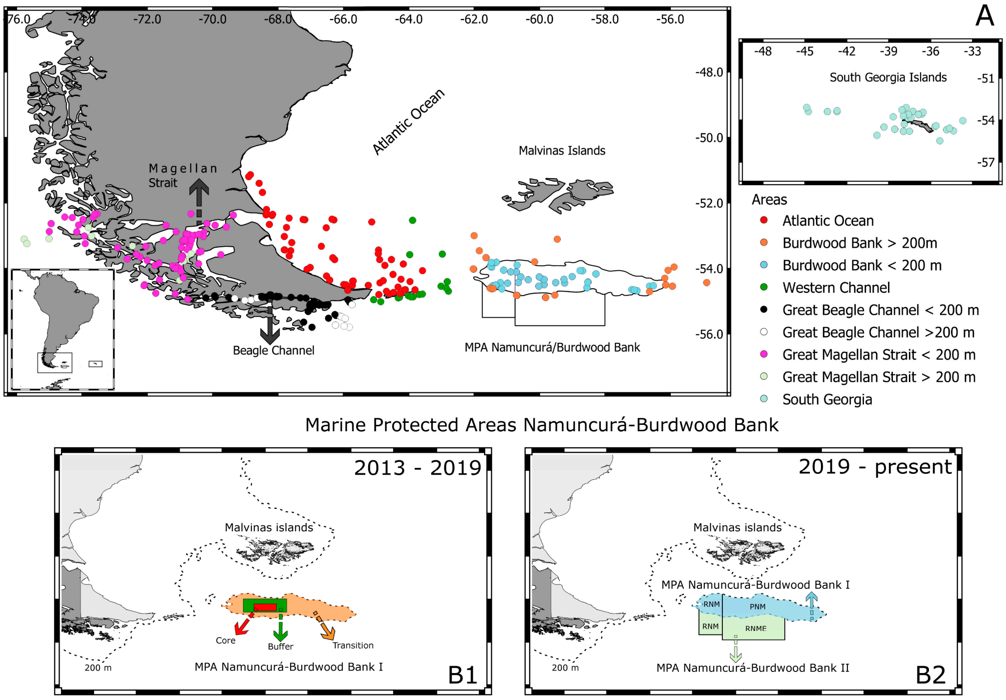

**Figure 1.** Studied region including decapod species rarefied occurrence records and the location of the Marine Protected Areas Namuncurá−Burdwood Bank (MPAN−BB; (**A**)) and their management zones (**B**). (**B1**): MPAN−BB I management zones in force between 2013 and 2019 (core, buffer, and transition areas). (**B2**): Current management zones of the MPAN−BB I and the new, second, contiguous MPAN−BB II. References: RNM: national marine reserve (a category of Argentine MPAs allowing sustainable extractive activities); PNM: national marine park (allows research); RNME: strict national marine reserve (no−touch zone).

The creation of the MPAN−BB boosted the research in the area and highlighted the differences between this open−sea area, the nearby shelf, and the coastal waters. One of the main features of the BB is that the bank is an area of water retention for up to 70 days [12]. The water column over the bank is homogeneous due to high energy vertical mixing processes [13]. Surface chlorophyll is low, and the microbial plankton community is dominated by small fractions of phytoplankton and different from those from coastal areas [14] with blooms of tychoplanktonic diatoms in spring [15], both likely capable of sustaining the benthic suspension feeders. The zooplankton community structure shows a west–east heterogeneity, probably driven by anticyclonic gyres over the bank [16]. This food web is typically oceanic, sustained only by phytoplankton, with C and N of the baselines relatively impoverished in $^{13}$C and $^{15}$N, compared to coastal areas, mainly due to a colder water regime through the influence of the Antarctic Circumpolar Current waters [17]. The trophic web has a few abundant species of an intermediate trophic level: the Fuegian sprat *Sprattus fuegensis* (Jenyns, 1842), longtail southern cod *Patagonotothen ramsayi* (Regan, 1913), and the squat lobster *Grimothea (=Munida) gregaria* (Fabricius, 1793), all playing a key role in this wasp−waist structured food web [17]. These species exert a bottom−up control on top predators and prey on lower levels, as registered for *P. ramsayi*, with a generalist strategy, consuming mainly polychaetes, amphipods, decapods, and other crustaceans [18].

At the bank, benthic communities conform to what are known as “animal forests” [19], i.e., three−dimensional structures formed by sessile suspension feeders, and here composed of sponges, stylasterid corals, and bryozoans over the plateau [20], and of a variety of cold−water corals—Primnoidae, Scleractinia, Stylasterida, and Alcyonacea—on the slopes [21]. All these communities are structural engineers providing complex substrates that can enhance biodiversity by offering refuge and food for other mobile species [22]. Moreover, such assemblages are also considered indicators of vulnerable marine ecosystems, which deserve conservation measures to prevent impacts from bottom fisheries, especially at high latitudes [23,24]. All these three−dimensional structures provide different habitats for mobile fauna, such as decapods [19,20,25]. For invertebrates other than decapod crustaceans, the role of the BB on their distribution is variable. For example, in the BB, isopods, cumaceans, polychaetes, or bryozoans are typically Magellanic [26–28], whereas asteroids have higher richness at the BB than off the Atlantic coast of southern South America [29]. The distribution of molluscs, one of the most diverse groups at the BB, is controversial according to different authors: they are likely segregated by depth, distributed according to water masses and extending their distribution northwards through deep, cold waters [30], or the BB could be a place for endemism for some groups [31].

Our objective was to characterize the decapod assemblages of the Burdwood Bank and the surrounding areas to determine if the MPA contains representative fauna of the Magellanic region. Furthermore, we tested if the past and present management zonation of the MPAN−BB I and II, respectively, have been adequate for decapod crustacean conservation.

## 2. Materials and Methods

### 2.1. Decapod Records

For the present study, the decapod crustacean records were compiled from different sources. For the MPAN−BB, our primary sources were three scientific expeditions carried out by the RV “ARA Puerto Deseado”: CAV2013 [32], BOPD2016 [33], and BOPD2017 [34]. The two latter surveys also included samples from the area between the MPAN−BB and the continental shelf off the Isla Grande de Tierra del Fuego, including Isla de los Estados (Figure 1A). Sampling was designed to include the three different management areas of the first layout of the MPAN−BB, which was in force between 2013 and 2019 (Figure 1(B1)). Additional samples from the shelf break surrounding the plateau were also included for further comparisons, independently of their later inclusion in the current management plan of the MPA and its expansion (Figure 1A). Decapod samples were obtained from 47 stations (2 in 2013, 20 in 2016, and 25 in 2017) at a depth range from 40 to 785 m, by using bottom otter trawls. Most hauls were undertaken with a rectangular otter−board trawl (total length = 6 m, headrope and footrope length = 6 m, wing mesh = 25 mm, cod−end mesh = 10 mm, horizontal opening = 1.8 m, vertical opening = 0.60 m), while other hauls were undertaken with a Super−V otter−board trawl (horizontal opening = 9.1 m, mesh size = 40 mm). All samples were preserved in a seawater−formaldehyde 10% solution for taxonomic identification.

To compare the decapod fauna of the marine protected area with the surrounding regions, we compiled data from previous scientific surveys (Table S1). Decapod records were included from two surveys from the continental shelf off Tierra del Fuego, carried out with the same research vessel in 2009 and 2012 [35,36]. The present study also included data from the inner Beagle Channel (54°52′ S between 67°55′ and 68°36′ W) obtained in monthly samplings during 1999 and 2000 [37,38]. Furthermore, we also included in our database records for the Burdwood Bank and South Georgia Island taken during the RV "Polarstern" research cruise through the Scotia Arc [10,39]. For the Magellan Straits and the southern slope of the Isla Grande de Tierra del Fuego, we used records reported by Arntz et al. [40] taken on board the RVs "Vidal Gormaz" and "Polarstern", respectively.

Further records of decapod species were obtained from GBIF [41] and OBIS [42] databases. Our query was performed on a geographical basis by getting all the occurrences within the following polygon delimited by the coordinates: −71.54297 −56.74219; −33.39844 −56.74219; −33.39844 −52.06641; −71.54297 −52.06641; −71.54297 −56.74219. The obtained records were first filtered, and only the georeferenced records with depth values were selected (Table S1). Every record was curated for consistency, and single records of unusual species were removed from our database. For instance, we deleted 10 records of Caribbean species in a single sampling station of the Strait of Magellan. These conflicting records and the decision criteria for their deletion were reported in Table S2. Finally, decapod records were sorted by their sampling site: Atlantic shelf off Tierra del Fuego (ATL), Burdwood Bank plateau (BBP), Burdwood Bank slope (BBS), Western Channel (WC), "Great" Beagle Channel (GBC), "Great" Magellan Straits (GMS), and South Georgia (SG). The term "Great" refers to samples from neighboring areas close to the channel and straits, not strictly within their geographical limits (Figure 1A).

### 2.2. Species Identification

All the decapods were determined to the species level according to the available literature [7,43–49] and when necessary, original descriptions. There were some particular issues regarding the identification of the *Eurypodius* spp. samples. Our material from the surveys after 2016 was determined as *E. longirostris* [48], as the genetics confirmed the morphological differences with *E. latreillei* (Guérin, 1828). As we could not verify its presence from previous samplings (e.g., [38,40]), we here reported all our material as *Euripodius* spp. for all our datasets. *Lithodes santolla* (Molina, 1782) and *L. confundens* (Macpherson, 1988) were here considered two different species since they are morphologically distinguishable [50,51], although their specific status is still to be determined given the incongruence found between mitochondrial and morphological characters [51].

### 2.3. Statistical Analyses

The decapod records were compiled from various sources and, therefore, came from surveys with different sampling efforts. Thus, accessible or more intensively studied areas (e.g., the Beagle Channel) included far more records than the remote ones (e.g., South Georgia Island). Therefore, occurrence records were rarefied using the R package spThin [52] with a 10 km minimum distance to avoid biases derived from heterogeneous samplings.

Sample−size−based rarefaction and extrapolation sampling curves for the decapod communities were calculated by using iNEXT online [53,54]. The incidence−based sampling curves were carried out using the following parameters: diversity order q = 0 (species richness), the endpoint set at 30, and the number of bootstraps set at 50.

Non−parametric analyses were used to determine the decapod assemblages in the study area. Due to heterogeneous sampling gears, we chose binary data (presence/absence) to construct the species similarity matrix. The Bray–Curtis index was used to build the data matrix [55]. Hierarchical clustering was obtained using the group linkage clustering technique to analyze species composition similarities among areas, and displayed graphically in a dendrogram. We compared the structure and composition of different areas of decapod assemblages with multivariate analyses of similarities (ANOSIM [56]). ANOSIM compared the ranking of Bray–Curtis similarities among the different areas. Additionally, we identified each species' contribution percentage to these similarities using a SIMPER (similarity percentage) routine [56]. Similarities and differences in decapod species among areas were explored using non−metric multidimensional scaling (nMDS). PRIMER version 6.1 from the Plymouth Marine Laboratory was used for all the analyses [55,56]. Principal component analyses (PCAs) were used to visualize the similarities between areas and were estimated using Infostat [57].

## 3. Results

In total, we obtained 1484 occurrence records of decapod species, which were then rarefied, resulting in a final count of 701 records (Table 1). The decapod species richness included 52 species belonging to 26 families and 32 genera. The species records were dominated by numerous species with very low record counts or by a small number of species with very high record counts (Figure 2). Five species (*Eurypodius* spp., *Grimothea gregaria*, *Pagurus comptus* (White, 1847), *Peltarion spinulosum* (White, 1843), and *Halicarcinus planatus* (Fabricius, 1775)) were the most frequent in the studied region, comprising 48.9% of the total decapod records.

**Table 1.** Decapod species records at different areas: Atlantic (ATL), Burdwood Bank plateau (BBP) and slope (BBS), Western Channel (WC), Great Beagle Channel (GBC), Great Magellan Strait (GMS), and South Georgia (SG). Records from GBC and GMS were divided by the 200 m isobath. Depth range was included for each species obtained from the bibliography (noted with superscript numbers) and our scientific expeditions.

| | Depth Range (m) | | Records | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Species** | **Bibliography** | **This Study** | **ATL** | **BBP** | **BBS** | **WC** | **GBC <200** | **GBC >200** | **GMS <200** | **GMS >200** | **SG** | **Total** |
| *Acanthocyclus albatrossis* | 0–2 $^{1,2}$ | - | | | | | 1 | | 1 | | | 2 |
| *Allopetrolisthes angulosus* | 0–20 $^{2}$ | - | | | | | | | 1 | | | 1 |
| *Austropandalus grayi* | 24–414 $^{2,3}$ | 4–330 | 4 | | 1 | 3 | 13 | 2 | 5 | | | 28 |
| *Betaeus truncatus* | 0–107 $^{2,3}$ | 17–208 | 1 | | | | 7 | | 1 | | | 9 |
| *Campylonotus arntzianus* | 475–589 $^{4}$ | 415–785 | | | 2 | | | | | | | 2 |
| *Campylonotus capensis* | 140–1300 $^{4}$ | 133 | 1 | | | | | | | | | 1 |
| *Campylonotus semistriatus* | 30–2086 $^{3,5}$ | 4–785 | | | 3 | 2 | 8 | 6 | 7 | 1 | 1 | 28 |
| *Campylonotus vagans* | 18–506 $^{2,3}$ | 15–209 | 6 | 16 | 2 | | 10 | | 1 | | | 35 |
| *Chorismus antarcticus* | 15–915 $^{3,6}$ | - | 4 | | 1 | | 1 | | | | 1 | 7 |
| *Chorismus tuberculatus* | 400–815 $^{3,6}$ | 392–642 | | | 4 | 2 | | 1 | | | | 7 |
| *Curtonida spinosa* | 100–1250 $^{6,12}$ | 767–785 | | | 4 | | 1 | | | | | 5 |
| *Eualus dozei* | 13–385 $^{2,3}$ | 17–165 | 1 | 1 | | | 7 | | | | | 9 |
| *Eurypanopeus crenatus* | 2–40 $^{2}$ | - | | | | | | | 1 | | | 1 |
| *Eurypodius* spp. | 8–1507 $^{2,3}$ | 4–516 | 29 | 20 | 5 | 9 | 16 | 2 | 17 | 1 | 1 | 100 |
| *Grimothea gregaria* | 0–1095 $^{2}$ | 4–294 | 14 | 17 | 5 | 3 | 16 | 3 | 18 | 1 | | 77 |
| *Halicarcinus planatus* | 0–270 $^{2}$ | 23–208 | 7 | 1 | | | 7 | | 26 | 2 | | 43 |
| *Lebbeus antarcticus* | 450–2598 $^{7}$ | - | | | | | | 1 | | | | 1 |
| *Libidoclaea granaria* | 30–450 $^{2,6}$ | 60–263 | | | | | 1 | 1 | 2 | | | 4 |
| *Libidoclaea smithii* | 18–2060 $^{2}$ | 205–210 | | | | | 1 | | 4 | | | 5 |
| *Lithodes confundens* | 0–775 $^{8,9}$ | 40–642 | 10 | 23 | 5 | | | | 1 | | | 39 |
| *Lithodes couesi* | 221–1200 $^{10}$ | 608 | | | 1 | | | | | | | 1 |
| *Lithodes santolla* | 5–700 $^{6}$ | 15208 | 6 | | | 1 | 8 | 1 | 6 | | | 23 |
| *Lithodes* sp. | – | 122 | 1 | | | | | | | | | 1 |
| *Lithodes turkayi* | 70–1410 $^{9,11}$ | 205–230 | | | | | | 1 | | | | 1 |
| *Metacarcinus edwardsii* | 0–40 $^{2}$ | - | | | | | 1 | | 1 | | | 2 |
| *Munidopsis aspera* | 100–2800 $^{2}$ | - | 1 | | | | | | 4 | 1 | | 6 |
| *Munidopsis opalescens* | 700–1000 $^{2}$ | - | | | | | | | 1 | | | 1 |
| *Nauticaris magellanica* | 1–746 $^{2,3}$ | 15–208 | 1 | | | | 8 | 2 | | | | 11 |
| *Nematocarcinus lanceopes* | 550–4000 $^{13}$ | - | | | | | | 3 | | | | 3 |
| *Neolithodes diomedeae* | 640–2450 $^{11}$ | - | | | | | | | | 1 | 1 | 2 |
| *Notocrangon antarcticus* | 250–1500 $^{2,6}$ | - | | | | | | | | | 8 | 8 |
| *Pagurus comptus* | 2–400 $^{3,14}$ | 7–460 | 20 | 7 | 4 | 5 | 12 | 2 | 13 | | | 63 |
| *Pagurus forceps* | 1–660 $^{15}$ | - | 1 | | 1 | | | | 1 | | | 3 |
| *Pandalopsis ampla* | 130–1250 $^{3,6}$ | 483–785 | | | 1 | 3 | | | | | | 4 |
| *Paralomis anamerae* | 130–1250 $^{3,11}$ | - | | | | | | | | | 1 | 1 |
| *Paralomis formosa* | 320–2075 $^{11,16}$ | - | | | | | | | | | 7 | 7 |
| *Paralomis granulosa* | 2–568 $^{2,3}$ | 15–191 | 6 | 8 | | | 10 | | 5 | | | 29 |

**Table 1.** *Cont.*

| | Depth Range (m) | | Records | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Species** | **Bibliography** | **This Study** | **ATL** | **BBP** | **BBS** | **WC** | **GBC <200** | **GBC >200** | **GMS <200** | **GMS >200** | **SG** | **Total** |
| *Paralomis spinosissima* | 160–812 [9,16] | 607–785 | | | 3 | | | 1 | | | 13 | 17 |
| *Pasiphaea acutifrons* | 110–1550 [2,6] | 38–205 | | | | | 6 | 3 | 3 | 1 | | 13 |
| *Pasiphaea dofleini* | 110–653 [2,3] | - | | | | | 1 | 1 | 1 | | | 3 |
| *Pasiphaea scotiae* | 1000–3200 [17] | - | | | | | | | | | 2 | 2 |
| *Peltarion spinulosum* | 5–1138 [2,3] | 4–263 | 21 | 1 | | | 15 | 5 | 16 | 1 | | 59 |
| *Pinnixa transversalis* | 1–5 [2] | - | | | | | | | 1 | | | 1 |
| *Pinnixa valdiviensis* | 0–10 [2] | - | | | | | 1 | | 1 | | | 2 |
| *Propagurus gaudichaudii* | 0–746 [3,6] | - | 2 | 1 | | | 1 | | 1 | | | 5 |
| *Pseudocorystes sicarius* | 5–100 [2,3] | - | | | | | | | 1 | | | 1 |
| *Stereomastis suhmi* | 200–2200 [18] | - | | | | | 1 | 2 | 1 | | | 4 |
| *Sympagurus dimorphus* | 70–750 [3,6] | 263–294 | | | 1 | 1 | | 1 | | | | 3 |
| *Thymops birsteini* | 122–2516 [19,20] | 209–642 | | | 5 | 3 | | 1 | | 1 | 1 | 11 |
| *Thymops* sp. | – | 415–785 | | | 3 | 1 | | | | | | 4 |
| *Thymops takedai* | 220–1720 [21] | - | | | 1 | | | | | | 1 | 2 |
| *Thymopsis nilenta* | 220–2886 [21,22] | - | | | | | | | | | 5 | 5 |
| Total records | | | 136 | 95 | 52 | 33 | 153 | 39 | 141 | 10 | 42 | 701 |
| Species count | | | 19 | 10 | 19 | 11 | 23 | 19 | 27 | 9 | 12 | |

Bibliography: [1] Vinuesa et al. [58]; [2] Retamal and Arana [47]; [3] Arntz et al. [40]; [4] Thatje [59]; [5] Torti and Boschi [60]; [6] Boschi et al. [43]; [7] Nye et al. [61]; [8] Lovrich et al. [10]; [9] Anosov et al. [62], [10] Stevens and Lovrich [63]; [11] Macpherson [50]; [12] Petraroia [64]; [13] Raupach et al. [65]; [14] Spivak et al. [7]; [15] Mantelatto et al. [66]; [16] López Abellan and Balguerías [67]; [17] Basher et al. [68]; [18] Farias et al. [69]; [19] Holthuis [70]; [20] Laptikhovsky and Reyes [71]; [21] Ahyong et al. [46]; [22] Holthuis [45].

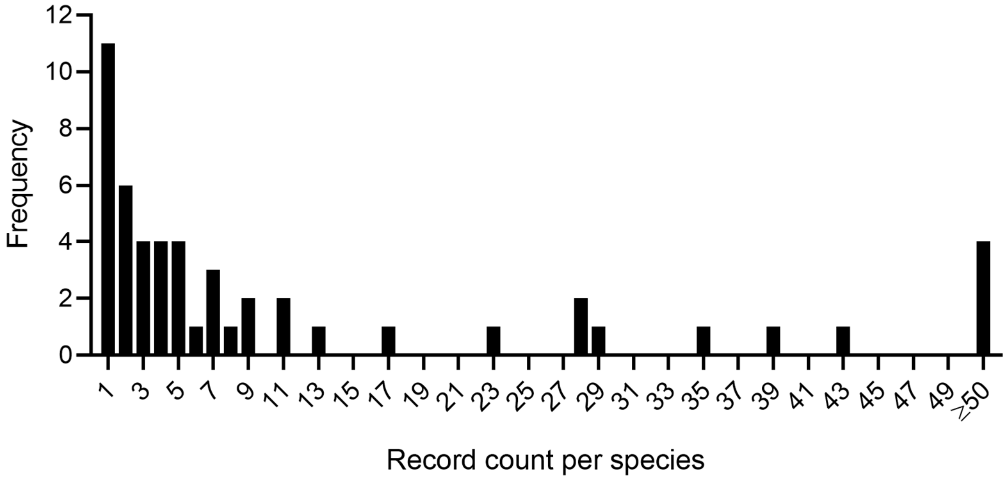

**Figure 2.** Species frequency in the studied area. Species are ranked according to the number of distinct locations where samples were recorded.

Decapod richness differed throughout the sampling areas (Figure 3): the highest value was in the Beagle Channel (BC, 31 species), followed by the Magellan Strait (MS, 30 species), the Atlantic (ATL, 25 species), the Burdwood Bank (BB, 24 species), and finally South Georgia (SG, 12 species). The Burdwood Bank plateau and slope (BBP and BBS, respectively) shared most of the decapod richness with the ATL (79%), less with the BC and the MS (71% and 54%, respectively), and only a few with SG (50%). Interestingly, both ends of the longitudinal distribution, the MS and SG, presented the largest number of unique species records (n = 5).

From the sample—size—based rarefaction analysis, the BBS and BBC > 200 potentially had a higher species richness than the other areas, as judged from the extrapolation sampling curves (Figure 4). Furthermore, the BBS presented a much higher richness with few sampling units (n = 8) compared to that estimated in the BBP with a larger number of sampling units (n = 19).

The nMDS analyses for the studied area showed that decapod assemblages presented similarities among the shallowest areas: GBC < 200—GMS < 200 and ATL—BBP (Figure 5A).

Furthermore, similar decapod species were found between the BBS, GBC > 200, and WC. On the other hand, SG and the GMS > 200 presented no similarities with the other sampling areas. The hierarchical clustering yielded two well−defined groups (Figure 6A) associated by depth: one group comprised coastal and shelf areas <200 m depth, and the other, WC, the BBS, and the GBC > 200, characterized by higher depths. The outgroups were SG and the GMS > 200, with unique decapod assemblages, dissimilar to any other areas (i.e., *Notocrangon antarcticus* (Pfeffer, 1887), *Paralomis anamerae* (Macpherson, 1988), *Paralomis formosa* (Henderson, 1888), *Pasiphaea scotiae* (Stebbing, 1914), *Thymops nilenta* (Holthuis, 1974), and *Neolithodes diomedeae* ((Benedict, 1895); Table 1).

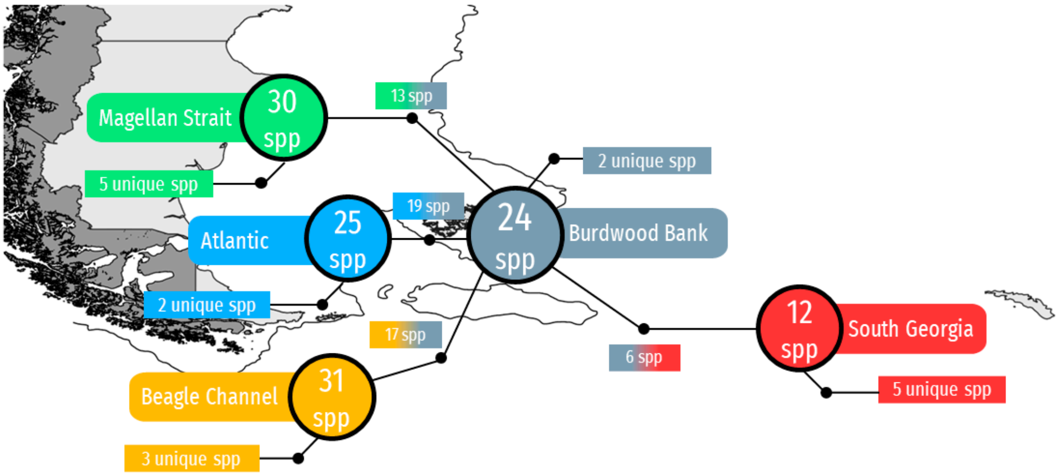

**Figure 3.** Decapod richness among the different studied areas.

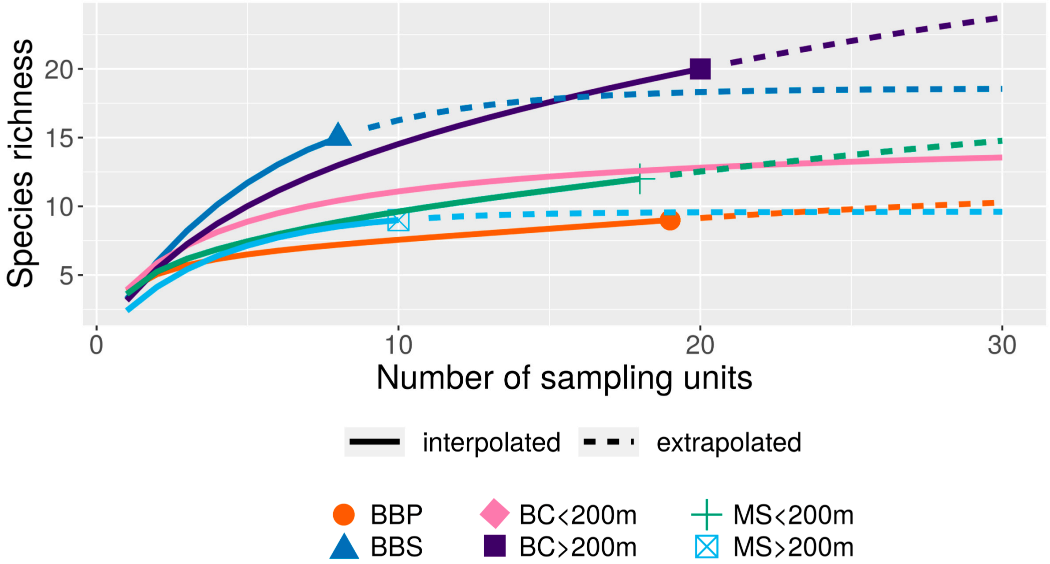

**Figure 4.** Sample−based rarefaction curves (Mau Tao) for decapod diversity in the studied area: the Burdwood Bank plateau (BBP) and slope (BBS), the Beagle Channel (BC), and the Magellan Strait (MS). Records from the BC and MS were divided by the 200 m isobath.

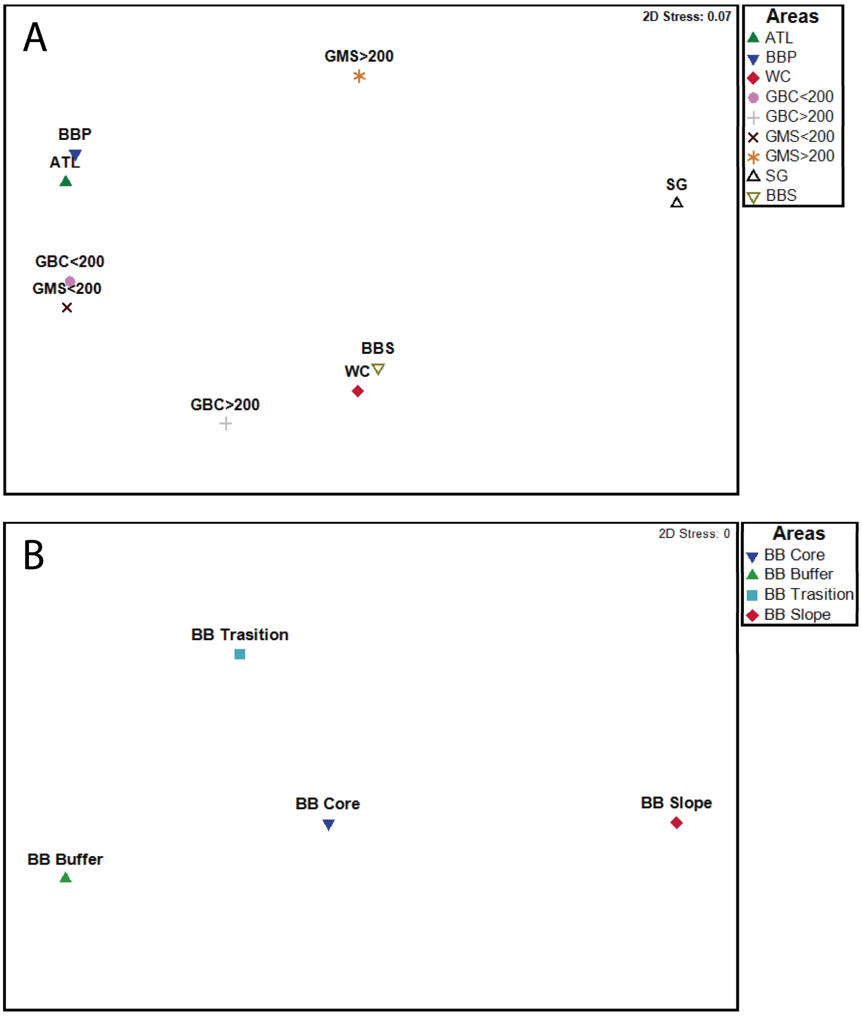

**Figure 5.** Two−dimensional nMDS ordination plot for decapod species distribution in the studied area (**A**) Atlantic (ATL), Burdwood Bank plateau (BBP) and slope (BBS), Western Channel (WC), Great Beagle Channel (GBC), Great Magellan Strait (GMS) and South Georgia (SG). (**B**) A particular study was carried out for the former Marine Protected Area Namuncurá−Burdwood Bank management zones (core, buffer, and transition areas) and the Burdwood Bank slope.

The first two axes of the PCA explained 47.9% of the total variation (Figure 7A) and showed similar results, grouping shallower (GBC < 200, GME < 200, ATL, and BBP) and deeper (GBC > 200, WC, and BBS) areas. The SG and GMS > 200 were again segregated from the rest of the areas. *Eurypodius* spp., present in all areas, was at the center of the ordination, whereas different species were typical of different locations, and were ordered accordingly. For example, *Thymops* spp., *Thymops birsteini* (Macpherson, 1988), *Campylonotus semistriatus* (Spence Bate, 1888), and *Chorismus antarcticus* (Pfeffer, 1887) were present in deeper waters, whereas *P. spinulosum*, *H. planatus*, and *Paralomis granulosa* (Hombron & Jacquinot, 1846) were typical of shallow waters. Species of SG as *P. formosa*, *P. anamerae*, *N. diomedeae* were ordered near this location. Furthermore, the SIMPER analysis revealed which decapod species contributed most to each area similarity (Table A1): *Eurypodius* spp. at ATL and WC; *L. confundens* at BBP; *T. birsteini* at BBS; *P. spinulosum* at GBC < 200; *C. semistriatus* at GBC > 200, *H. planatus* at both the GME areas; and *Paralomis spinosissima* (Birstein & Vinogradov, 1972) at SG.

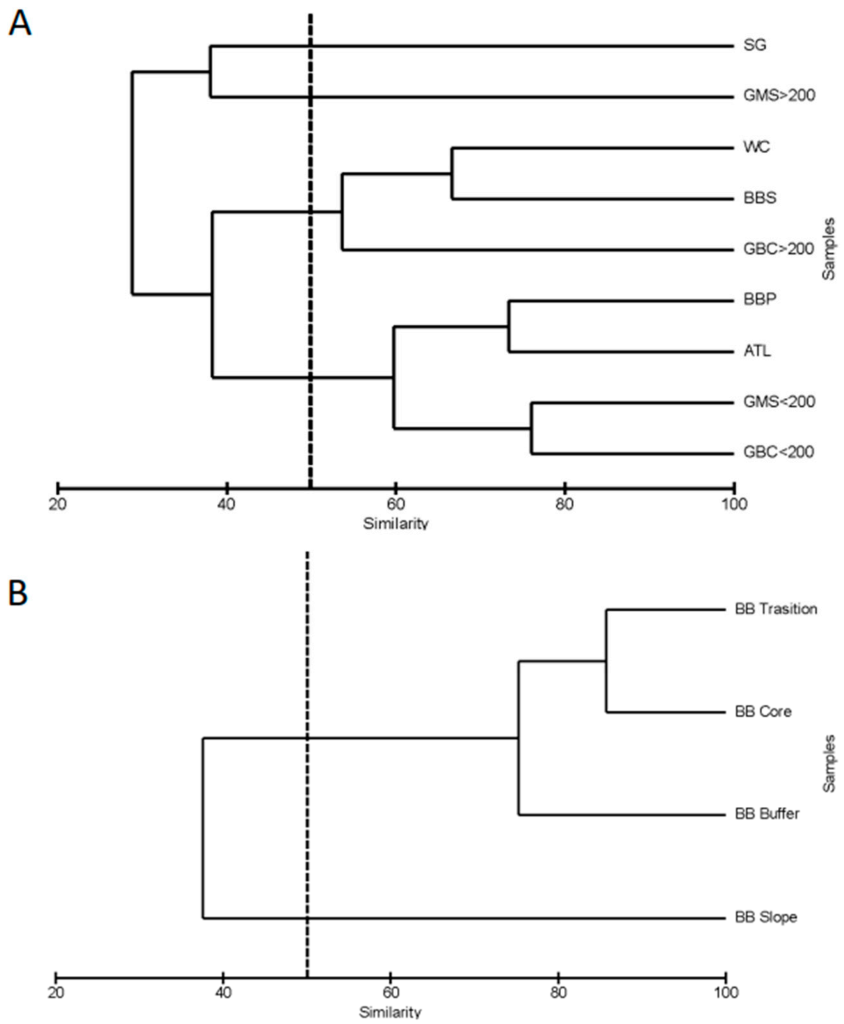

**Figure 6.** Group average cluster of decapod species using the Bray–Curtis distance, setting the grouping threshold to 50% similarity (vertical line). This analysis was carried out for the whole studied area (**A**) Atlantic (ATL), Burdwood Bank plateau (BBP) and slope (BBS), Western Channel (WC), Great Beagle Channel (GBC), Great Magellan Strait (GMS) and South Georgia (SG). (**B**) A separate analysis was performed for the former Marine Protected Area Namuncurá−Burdwood Bank management zones (Core, Buffer, and Transition areas) and the Burdwood Bank slope.

The species assemblages of the decapod community differed between the analyzed areas (ANOSIM, R Global = 0.143; $p < 0.001$). Pairwise comparisons showed differences among all the areas, as dissimilarity values were generally high (Table A2). It was noteworthy that the WC presented fewer dissimilarities from the other areas, and there were no significant differences in the GBC and the GMS between both depth ranges.

A particular analysis was conducted for the former management zones (core, buffer, and transition areas) of the Marine Protected Area Namuncurá−Burdwood Bank (MPA N−BB) and the Burdwood Bank slope. The nMDS ordination plot showed that decapod assemblages were similar within the MPAN−BB, throughout the plateau. However, they were different from that in the BBS (Figure 5B). Furthermore, cluster analysis showed a similar pattern where the decapod assemblages for the core, buffer, and transition areas were similar (Figure 6B).

The PCA biplot explained 81.1% of the total variation and showed an ordination according to the depth of the MPAN−BB management zones: the plateau areas on the negative abscissas and the bank slope on the positive abscissas. Species with a deeper distributional range occurred at the slope (Figure 7B; Table 1). The SIMPER routine identified the species that contributed most to the similarity in the BB areas (Table A3). In the core and transition areas, the species that contributed most to their similarity was *Lithodes confundens*. In the buffer area, the species was *Eurypodius* spp., while in the bank slope, *T. birsteini* was the one that contributed most to their similarity. The one−way ANOSIM of the decapod assemblages yielded no significant differences among the BB areas (ANOSIM. R Global = 0.004; $p$ = 0.479), revealing a similar community composition throughout the former MPAN−BB management zones and the BB slope (Table A4).

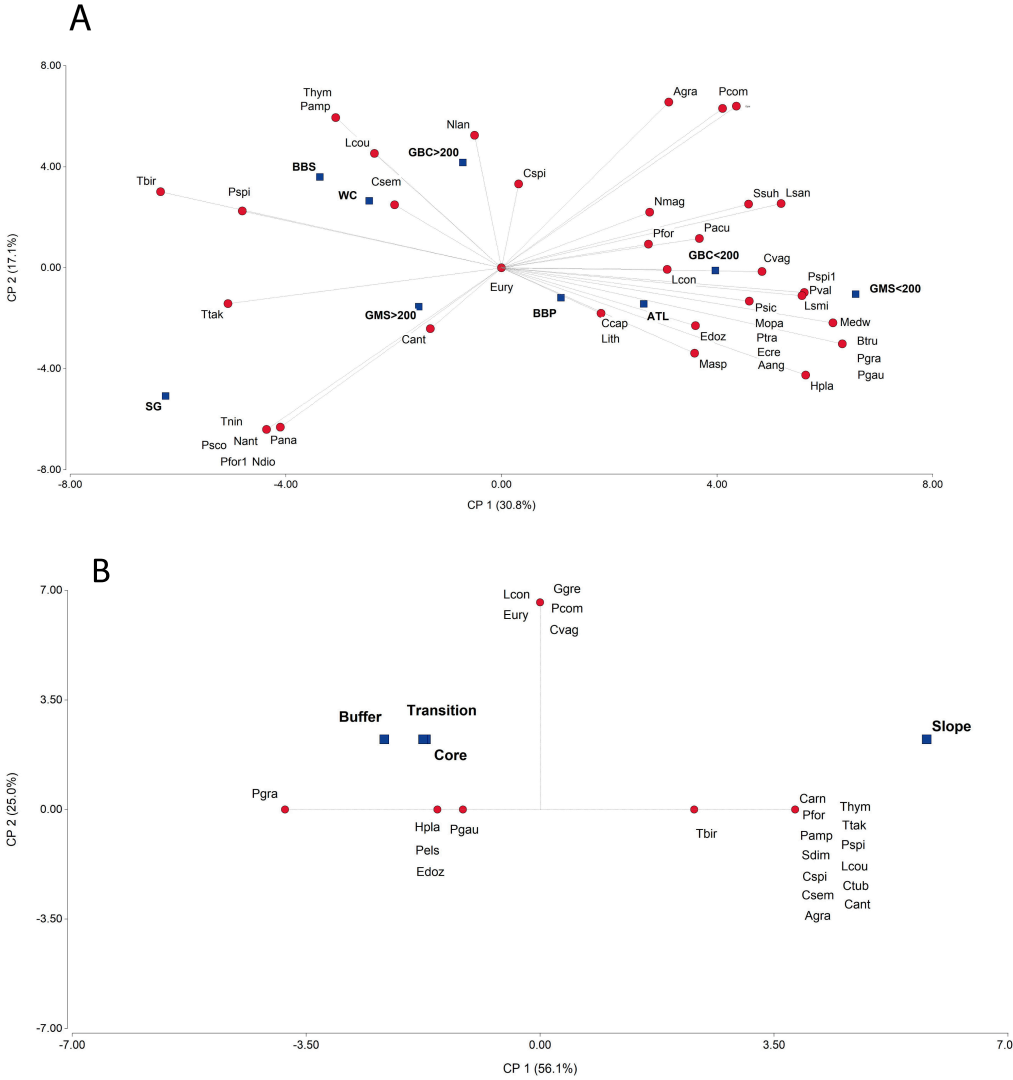

**Figure 7.** Principal component analysis diagram for decapod assemblages in different areas. This analysis was carried out for the whole studied area (**A**) Atlantic (ATL), Burdwood Bank plateau (BBP) and slope (BBS), Western Channel (WC), Great Beagle Channel (GBC), Great Magellan Strait (GMS) and South Georgia (SG). (**B**) A separate analysis was performed for the former Marine Protected Area Namuncurá−Burdwood Bank management zones (core, buffer, and transition areas) and the bank slope. Species codes are the first letter of the genus and the three first letters of the species except for Psp1: *Peltarion spinulosum* and Pfor1: *Paralomis formosa*.

## 4. Discussion

Our study shows that a notable fraction of the decapod fauna recorded for southern South America is present in the Marine Protected Area (MPA) Namuncurá/Burdwood Bank. The original design of the MPA, i.e., only the plateau < 200 m depth, contains about half of the species found at this submerged mount, representing one of the areas with the lowest decapod species richness (Table 1). Therefore, its enlargement and the inclusion of the slope increased the species richness for the MPAN−BB to 23 decapod species. The unique records of *Campylonotus arntzianus* (Thatje, 2003) and *Lithodes couesi* (Benedict, 1895) were registered at the BB slope. Our sampling at the MPAN−BB in 2016 and 2017 was circumscribed to the upper slope, down to approximately 800 m depth, which explains the apparent limitation in the number of found species.

Decapods of the BB are typical to the Fueguia province, south to 51° S [72]. We here report the occurrence of 23 out of 94 species reported for the Magellan region, representing 24% of the total for this region [6,7] (Table A5). Boschi [6] originally reported 79 species for the Magellan Region; the species count increased to 94 by adding occurrences from a more recent catalogue [7]. Boschi and Gavio [73] extend the zoogeographic Magellan region around southern South America south to 42° S, coinciding roughly with the definitions of Briggs [74], Spalding et al. [75], and Briggs and Bowen [76] (see Brun et al. [72] for a review). On the Atlantic side, this region extends over the shelf break up to 30° S, and includes decapod fauna that range northwards—over the deeper waters of the shelf break (e.g., *L. santolla*) or southwards near the coast—such as the shrimps *Artemesia longinaris* (Spence Bate, 1888) or *Pleoticus muelleri* (Spence Bate, 1888). Therefore, many species occurring north 42° S were also considered Magellanic fauna [6]. However, this region is so ample that it includes species never registered in southern Patagonia. Also, Boschi [6] categorized the Magellanic species into three groups: Atlantic, Pacific, or occurring on both sides of southern South America. For the sake of comparison of the BB decapod fauna, we found it more appropriate to do it with the Fueguia province (see Figure 5c in [72]), including waters mainly south to 51° S, in both the Atlantic and Pacific waters. The total of 23 species here reported for the BB represents 32% of the 73 species of this province. The BB decapod records represent better the fauna from both the Atlantic and Pacific coasts of Fueguia, 18 of the 39 species (46%), plus the other 5 species occurring only on the Atlantic side of this province (Table A5). At the BB there are no "Pacific" species occurring, since for most of the 18 of the latter species, the Strait of Magellan represents their southernmost occurrence of an extended distributional range over the southeastern Pacific coast of South America. Therefore, it is unlikely for them to be found on the Atlantic side of southern Patagonia (e.g., cancrid crabs). Some other species are predictably absent from the BB such as intertidal crabs (e.g., *Acanthocyclus albatrossis* (Rathbun, 1898)), or due to sampling limitations of the bottom otter trawls, such as the infaunal *Thalassinidea* (e.g., *Notiax* spp., *Upogebia* sp.), the commensal pinnotherid crabs, or the pelagic shrimps (e.g., *Pasiphaeidae*) [7].

The BB shares most of the species with its nearby areas, the Atlantic continental shelf off Tierra del Fuego and the Western Channel (WC), and hence is representative of this off−coast shelf decapod fauna. However, the deeper sectors of the studied areas seem to be under−sampled since their rarefaction curves were not asymptotical (Figure 3) compared to the more intense sampled areas at the Magellan Strait (GMS) and Great Beagle Channel (GBC). Moreover, both the Beagle Channel (BC) and the MS presented a higher species richness than the BB. This difference may be attributed to a higher habitat diversity in the coastal waters of channels and straits. Species' ranges can be shaped by three main factors: (i) the presence of environmental conditions (e.g., temperature, salinity, currents) under which they can establish, survive, and reproduce; (ii) the biotic environment characterized by competition or predation interactions; and (iii) the area that is accessible to the species via its movement or dispersal capabilities [77]. Nearshore studied areas include intertidal environments, kelp forests, and other three−dimensional shallow structures [38,78,79], and also sponges and bryozoans; the latter also present in the shallow areas of the BB [20]. In those habitats, currents deliver nutrients, driving growth rates of both pelagic and habitat−forming primary producers [80], such as the giant kelp *Macrocystis pyrifera*. The presence of this ecosystem engineer increases species richness and food−web complexity by creating spatial structure and influencing physical conditions and ecosystem processes [81]. Therefore, we suggest that more complex benthic habitats support higher decapod species richness.

We posit that including deeper waters in the protected area provides new habitats, which increases the number of species under protection. Habitat structure complexity has often been associated with high biodiversity, with a more complex habitat providing a wider range of niches, allowing for a higher number of resident species [82], either juveniles or adults of species of small size [25]. At the BB, the benthic sessile megafauna constitutes animal forests, which also are considered vulnerable marine ecosystems [19,20,83,84]. Over the plateau, the benthic community is relatively homogeneous and is constituted by sponges, bryozoans, and biogenic material, likely providing a low variability of three−dimensional habitats [20,85]. Hence, we hypothesize that the decapod fauna is less rich at the plateau at <200 m depth, which was the original design of the MPAN−BB. The southern slope of the bank is steep, rocky, and incised by submerged canyons, whereas the northern slope is less abrupt with soft bottoms [85]. For example, *Thymops* spp. inhabits holes made in these soft bottoms [71], whereas *L. couesi* was found in the rocky bottoms of the southern slope [63,86]. Moreover, each slope has different megabenthic sessile fauna: alcyonaceans (in the southern slope) and pennatulaceans (in the north) [84], which provide different three−dimensional structures that can be associated with different invertebrate fauna (e.g., [87]). In the northern Atlantic Ocean, deep−sea decapods are associated with octocorals [88]. The benefit of such associations is still unknown; however, there are many hypotheses: the octocoral branches could provide the decapod fauna both physical [89,90] and chemical protection from predators while also facilitating feeding for both organisms [88,91].

Two important features in conservation strategies for MPA candidates are as follows: first, areas lacking connectivity, which are therefore considered less resilient and, hence, in need of special protection, and secondly, key areas with a stepping−stone role that are central in the connectivity network between isolated regions [92]. At a regional scale, we theorize that the BB could act as a “hub” for decapod species since it is located in a position affected by the regional circulation: the Antarctic Circumpolar Current (ACC) and the Malvinas Current (MC) [93] (Figure A1). Dominant currents derived from the ACC transport particles both northwards and eastwards [93], connecting the coastal environments (the MS and the BC) with the Atlantic shelf and the BB. As there are no physical barriers in the BB [4,26,51], the shared decapod species (17 and 13 with the BC and MS, respectively) could be a product of larval transport from the west, as the water−retention process on the BB lasts approximately 70 days [12] allowing larval settlement.

The Malvinas current originates at the BB, mainly from upwelling in the southern margin, and transit northwards over the shelf break, distributing particles along the continental slope [12]. As this current is relatively fast moving at 40 cm $s^{-1}$ [94], larvae hatching at the BB could complete their development on the way north and settle in the northern environments of the continental slope. Recent studies report the faunal affinities between the BB and the Mar del Plata Canyon (ca. 38° S), with molluscs [30], isopods [95], and echinoderms [96] species occurring in both locations. As for decapods, the BB shears 6 of the 13 reported species present in the Mar del Plata Canyon [97].

The ACC is another dispersive driver of fauna [98] which connect the southern region of South America with the South Georgia shelf, through the northern branch of the Scotia Arc [2,99]. However, the Polar Front also represents a pronounced barrier to dispersal or gene flow, depending on the taxa [100,101]. Most decapod species potentially can disperse due to their larval condition as planktotrophic and pelagic [102]. Some larvae can trespass this physical barrier, especially around SG, through eddies and a turbulent regime associated with shallow banks and shelves [103,104]. However, many species of Brachyura and Anomura have thermal sensitivity and a low metabolic rate, which limits their occurrence in the cold, Antarctic waters [105]. The BB and SG share 6 species out of the 12 reported for SG, suggesting that the eastern flow of larvae seems more likely for deep water species (*P. spinosissima*, *T. birsteini*, and *T. takedai*) or species with an extended bathymetric range (*C. semistriatus*, *C. antarcticus*, and *Eurypodius* spp.), which in turn should be physiologically able to thrive in polar waters.

Among invertebrates, another well−known distribution pattern is the bathymetric zonation: a progression of changing species with depth, as the fauna over the continental slope is distinct from that present at the shelf and the abyssal plain. In our study, depth defined the different decapod assemblages: slope species were characterized by *Thymops* spp. and some lithodid crabs, as well as the common species to all areas but SG (*G. gregaria*, *P. spinulosum*, and *P. comptus*), as their bathymetric distribution was the continental shelves and the upper slope (Table 1; [5]). Samplings in the BB enabled the extension of the depth range for two species: *Betaeus truncatus* and *C. arntzianus*, and the BB represents a new locality for them (Table 1). Some families have representatives over the plateau and the slope of the bank. For example, *L. confundens* occurs over the plateau and in shallow waters (Table 1; [106,107]), whereas along the northern branch of the Scotia Arc lithodid species are segregated by depth: *L. confundens*, *Lithodes turkayi* (Macpherson, 1988), and *N. diomedeae* distribute at depths of, 315–775, 315–1410, and 840–1300 m., respectively [62]. Likewise, as for Munididae or Campylotidae, *G. gregaria* or *Campylonotus vagans* (Spence Bate, 1888) occurs mainly over the plateau and at the shallow waters of channels and straits whereas, *Curtonida spinosa* (Henderson, 1885) or *Campylonotus semistriatus* occurs in deeper waters (Table 1).

The depth−dependant composition of the decapod species observed in this study (GBC > 200, GMS > 200, and BBS) is consistent with previous findings in the Magellan Biogeographic Province [5,73]. Deep species constitute a different assemblage, composed mainly of typical Antarctic species occurring at the continental slope of southern South America, at South Georgia, or Antarctic shelves [5,73]. The latter author proposed the extension of the northern limit of the Antarctic region to the southern tip of South America. At a global scale, both Briggs and Bowen [76] and Spalding et al. [75] subdivided the cold temperate region of southern South America or the Magellan region into four or five provinces or ecoregions, respectively, although overlooking the fauna beyond 200 m depth. Gorny [5] stated that deep−sea decapods' endemism is high, such as e.g., *Nematocarcinus lanceopes* (Spence Bate, 1888) or *T. birsteini*. However, our data compilation reveals that deep−sea surveys are still scarce in our studied area, particularly along the Magellan region. Rare species are probably poorly surveyed because the continental slopes have been less investigated; therefore, unique catches have been considered endemic species. However, *T. birsteini* can be considered a good example of an endemic slope species, confirming its presence along the southern continental slope of the Southwestern Atlantic [71]. We posit that a new biogeographical entity should be considered to encompass the Atlantic continental slope under the influence of the CCA and Malvinas Current after further studies confirm the existence of common and unique species along this particular habitat, different from those occurring over the continental shelves and coastal waters.

Our study may present some sampling limitations, mainly attributed to technical difficulties. The sample size could be considered limited, especially due to the remoteness of the studied area and the resources needed to carry out scientific cruises. Moreover, international databases such as GBIF or OBIS are incomplete or fragmentary, especially in this area. However, the sampling carried out monthly for two years in the BC can be considered to accurately depict the decapod fauna (Figure 4; [38]), and presents similar results to the BB. In both the zones, decapod richness in the shallow areas reached the asymptotic maximum while the deep areas did not, suggesting that a sampling−effort increase would yield more species. Nonetheless, this technical limit at which the depth samples could be obtained does not modify our results: at offshore areas, deep sampling sites are richer in decapod species. Furthermore, future samplings will add records to these zones and possibly also lead to the discovery of new deep−sea decapod species.

Two rare species occurred in the BB: *C. arntzianus* and *Lithodes couesi*. We cannot sustain endemicity at the BB because *L. couesi* could be a case of tropical submergence and polar re−emergence, as it also occurs in the Northeast Pacific [63,108], and therefore is not an endemic species. In the southwestern Atlantic, *L. couesi* is morphologically similar to *L. turkayi* and previously identified as such with morphological and genetic features (e.g., [62,86]). *Campylonotus arntzianus* was initially described from the South Sandwich Islands and our record is the second after the original description [59]. Furthermore, in this study we also extend its bathymetric distribution. This latter species is likely to be endemic to the Scotia Arc, but a thorough sampling in different southern ocean sectors should confirm this condition.

Boschi [6] establishes 18 endemic species for the Magellan Region, but two of them are absent from Fueguia Province as the Magellanic region reaches up to southern Brazil at the upper continental slope (Table A5). Of these 16 endemic species, five are present at the BB (31%: *C. semistriatus, C. antarcticus*, *L. confundens*, *P. granulosa*, and *P. spinosissima*). Even though it would be desirable for a MPA to include more endemic species to be protected, it is a valuable discovery as some of them are under fishing pressure. In commercial species, overharvesting drives the loss of genetic diversity [109], reducing variability, and thus affecting the population's adaptive potential, stability, and resilience [110]. Once genetic diversity is lost, it can be restored by genetic mutation or immigration of individuals from a population with high genetic diversity [111]. In our case study, the MPA protects five exploited decapod species (*L. confundens, P. granulosa, P. spinosissima, G. gregaria*, and *T. birsteini;* [112]), and thus has great potential for reducing the effects of genetic loss in harvested species. Thus, MPAs are a key component of fisheries management as they alleviate anthropogenic pressures and ensure sustainable use of marine resources [113].

The UN Convention on Biological Diversity establishes that MPAs should be ecologically representative and well−connected [114]. This study provides evidence that, regarding the decapod fauna, the new design of the MPA Namuncurá−Burwood Bank would meet both requirements. First, it could be considered ecologically representative of the decapod fauna of the southern Atlantic as it shares various species with the surrounding areas, especially the Beagle Channel and the Atlantic area. Secondly, the marine currents surrounding the MPAN−BB would be responsible for distributing new individuals from the west and have the potential to disperse them northwards to the Patagonian shelf and eastwards through the Scotia Arc. Nevertheless, further genetic studies must be carried out to detail the connectivity degree between the areas.

**Supplementary Materials:** The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/d15111143/s1, Table S1: Compilation of decapod species records from the Marine Protected Area Namuncurá−Burdwood Bank and surrounding regions; Table S2: Conflicting online records and the decision criteria for their deletion.

**Author Contributions:** Conceptualization, P.D.S., M.J.D. and G.A.L.; methodology, P.D.S., M.J.A., F.T. and P.P.-B.; formal analysis, P.D.S. and M.J.A.; data curation, P.D.S., M.J.A., M.J.D. and G.A.L.; investigation, P.D.S., F.T. and P.P.-B.; visualization, P.D.S. and M.J.D.; writing—original draft preparation, P.D.S., M.J.A., M.J.D. and G.A.L.; writing—review and editing, P.D.S., M.J.A., M.J.D. and G.A.L.; project administration, G.A.L.; funding acquisition, G.A.L.; supervision, G.A.L. All authors have read and agreed to the published version of the manuscript.

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**Data Availability Statement:** The data presented in this study are available in the Supplementary Materials (Table S1).

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## Appendix A

**Table A1.** SIMPER summary of decapod species contributing to the Bray–Curtis similarity within each studied area. Species were included with up to 50% cumulative similarity contribution.

| Sampling Zone | Average Similarity | Species | Contribution (%) |
|---|---|---|---|
| Atlantic | 20.59 | *Eurypodius* spp. | 39.73 |
| | | *Peltarion spinulosum* | 19.56 |
| Burdwood Bank plateau | 37.95 | *Lithodes confundens* | 34.60 |
| | | *Eurypodius* spp. | 26.96 |
| Burdwood Bank slope | 9.08 | *Thymops birsteini* | 20.74 |
| | | *Chorismus tuberculatus* | 14.89 |
| | | *Lithodes confundens* | 12.60 |
| | | *Eurypodius* spp. | 10.21 |
| Western Channel | 20.85 | *Eurypodius* spp. | 59.58 |
| | | *Pagurus comptus* | 16.44 |
| "Great" Beagle Channel < 200m | 12.31 | *Peltarion spinulosum* | 16.33 |
| | | *Eurypodius* spp. | 13.78 |
| | | *Grimothea gregaria* | 13.15 |
| | | *Austropandalus grayi* | 10.99 |
| "Great" Beagle Channel > 200m | 15.90 | *Campylonotus semistriatus* | 39.44 |
| | | *Peltarion spinulosum* | 29.61 |
| "Great" Magellan Strait < 200m | 15.49 | *Halicarcinus planatus* | 52.06 |
| "Great" Magellan Strait > 200m | 2.78 | *Halicarcinus planatus* | 100.00 |
| South Georgia | 19.10 | *Paralomis spinosissima* | 51.51 |

**Table A2.** SIMPER pairwise dissimilarity comparisons of decapod species in the studied area: Atlantic (ATL), Burdwood Bank plateau (BBP) and slope (BBS), Western Channel (WC), Great Beagle Channel (GBC), Great Magellan Strait (GMS) and South Georgia (SG). Bold numbers indicate significant differences (ANOSIM, $p < 0.05$).

| | ATL | BBP | BBS | WC | GBC < 200 | GBC > 200 | GMS < 200 | GMS > 200 | SG |
|---|---|---|---|---|---|---|---|---|---|
| ATL | - | **78.23** | **91.82** | 82.31 | **86.77** | **89.77** | **86.97** | **92.35** | **99.23** |
| BBP | - | - | **87.52** | **82.17** | **87.36** | **93.72** | **89.24** | **93.94** | **99.29** |
| BBS | - | - | - | 88.72 | **94.76** | **93.82** | **95.48** | **95.48** | **96.03** |
| WC | - | - | - | - | 88.50 | **91.08** | 89.86 | **92.84** | **98.68** |
| GBC < 200 | - | - | - | - | - | 88.56 | **89.20** | **93.20** | **99.43** |
| GBC > 200 | - | - | - | - | - | - | 91.19 | **92.19** | **98.23** |
| GMS < 200 | - | - | - | - | - | - | - | 88.45 | **99.53** |
| GMS > 200 | - | - | - | - | - | - | - | - | **98.90** |
| SG | - | - | - | - | - | - | - | - | - |

**Table A3.** SIMPER summary of decapod species contributing to the Bray–Curtis similarity within the former Marine Protected Area Namuncurá−Burdwood Bank management zones (core, buffer, and transition areas) and the Burdwood Bank slope. Only species adding up to 50% cumulative contribution were included.

| Sampling Zone | Average Sismilarity | Species | Contribution (%) |
|---|---|---|---|
| MPA N−BB buffer | 49.38 | *Eurypodius* spp. | 34.80 |
| | | *Grimothea gregaria* | 23.68 |
| MPA N−BB core | 48.73 | *Lithodes confundens* | 37.76 |
| | | *Eurypodius* spp. | 21.43 |
| MPA N−BB transition | 30.36 | *Lithodes confundens* | 45.23 |
| | | *Eurypodius* spp. | 23.16 |
| BB slope | 9.08 | *Thymops birsteini* | 20.74 |
| | | *Chorismus tuberculatus* | 14.89 |
| | | *Lithodes confundens* | 12.60 |
| | | *Eurypodius* spp. | 10.21 |

**Table A4.** SIMPER pairwise dissimilarity comparisons of decapod species for the former Marine Protected Area Namuncurá—Burdwood Bank management zones (core, buffer, and transition areas) and the Burdwood Bank slope.

| | **Buffer** | **Core** | **Transition** | **Slope** |
|---|---|---|---|---|
| Buffer | - | 48.03 | 60.65 | 85.90 |
| Core | - | - | 59.96 | 85.11 |
| Transition | - | - | - | 88.50 |
| Slope | - | - | - | - |

**Table A5.** Decapod records distribution in the Magellan Region [6,7], the Fueguia Province [72], and the Burdwood Bank. Additionally, endemic species of the Fueguia Province were highlighted.

| | **Decapod Distribution According to:** | | **Decapod Records in the Area:** | | **Endemic of** |
|---|---|---|---|---|---|
| **Species** | **Boschi (2000) [6]** | **Spivak et al. (2019) [7]** | **Fueguia Province [72]** | **Burdwood Bank** | **Fueguia Province** |
| *Acanthephyra pelagica* | - | Both | Both | - | - |
| *Acanthocyclus albatrossis* | - | Both | Both | - | - |
| *Anacalliax argentiniensis* | Atlantic | Atlantic | Atlantic | - | Yes |
| *Artemesia longinaris* | Atlantic | - | - | - | - |
| *Austropandalus grayi* | Both | Both | Both | Yes | - |
| *Bathicaris brasiliensis* | Atlantic | Atlantic | - | - | - |
| *Bellia picta* | Pacific | - | - | - | - |
| *Betaeus truncatus* | Both | Both | Both | - | Yes |
| *Campylonotus arntzianus* | - | Atlantic | Atlantic | Yes | - |
| *Campylonotus semistriatus* | Both | Both | Both | Yes | Yes |
| *Campylonotus vagans* | Both | Both | Both | Yes | - |
| *Chaecon notialis* | Atlantic | - | - | - | Yes |
| *Chorismus antarcticus* | Both | Atlantic | Both | Yes | Yes |
| *Chorismus tuberculatus* | Atlantic | Atlantic | Atlantic | Yes | - |
| *Coenobita compressus* | Pacific | - | - | - | - |
| *Coenophtalmus tridentatus* | Atlantic | - | - | - | - |
| *Corystoides chilensis* | Both | - | - | - | - |
| *Cyrtograpsus affinis* | Atlantic | - | - | - | - |
| *Cyrtograpsus altimanus* | Atlantic | - | - | - | - |
| *Cyrtograpsus angulatus* | Both | Atlantic | Both | - | - |
| *Eualus dozei* | - | Both | Both | Yes | - |
| *Eurypanopeus crenatus* | Pacific | - | Pacific | - | - |
| *Eurypodius latreillii/Eurypodius* sp. | Both | - | Both | Yes | - |
| *Eusergestes antarcticus* | Both | Atlantic | Atlantic | - | - |
| *Gomeza serrata* | Pacific | - | Pacific | - | - |
| *Grimothea gregaria* (as *Munida gregaria*) | Both | Both | Both | Yes | - |
| *Grimothea spinosa* (as *Munida spinosa*) | Atlantic | Both | Both | Yes | - |
| *Halicarcinus planatus* | Both | Both | Both | Yes | - |
| *Hemigrapsus crenulatus* | Pacific | - | Pacific | - | - |
| *Homalapsis plana* | Pacific | - | Pacific | - | - |
| *Inachoides microrhynchus* | Pacific | - | - | - | - |
| *Latreutes antiborialis* | Pacific | - | - | - | - |
| *Lebbeus antarcticus* | - | Both | Both | - | - |
| *Leucippa pentagona* | Both | - | - | - | - |
| *Leucosia planata* | Atlantic | - | - | - | Yes |
| *Leurocyclus tuberculosus* | Both | Atlantic | - | - | - |
| *Libidoclaea granaria* | Both | Both | Both | - | - |
| *Libidoclaea smithi* | Pacific | - | Pacific | - | - |
| *Liopetrolisthes mitra* | Pacific | - | - | - | - |
| *Liopetrolisthes patagonicus* | - | Pacific | Pacific | - | - |
| *Lithodes confundens* | Both | Both | Both | Yes | Yes |
| *Lithodes couesi* | - | - | Atlantic | Yes | - |
| *Lithodes santolla* | Both | Both | Both | - | Yes |
| *Lithodes turkayi* | Both | Both | Both | - | - |
| *Metacarcinus edwadsi* | Pacific | Pacific | Pacific | - | - |
| *Munidospsis aspera* | Pacific | - | Pacific | - | - |
| *Nauticaris magellanica* | Both | Both | Both | - | Yes |
| *Nematocarcinus lanceopes* | - | Both | Both | - | - |
| *Nematocarcinus longirostris* | - | Atlantic | Atlantic | - | - |
| *Neolithodes diomedeae* | - | Both | Both | - | - |
| *Notiax brachyophtalma* | Both | Both | Both | - | Yes |
| *Notiax santarita* | - | Both | Both | - | - |
| *Notocrangon antarcticus* | Both | Both | Both | - | Yes |
| *Ovalipes trimaculatus* | Both | - | - | - | - |

**Table A5.** *Cont.*

| | Decapod Distribution According to: | | Decapod Records in the Area: | | Endemic of |
|---|---|---|---|---|---|
| **Species** | **Boschi (2000) [6]** | **Spivak et al. (2019) [7]** | **Fueguia Province [72]** | **Burdwood Bank** | **Fueguia Province** |
| *Paguristes weddelli* | Pacific | - | Pacific | - | - |
| *Pagurus comptus* | Both | Both | Both | Yes | - |
| *Pagurus forceps* | - | Both | Both | Yes | - |
| *Pandalopsis ampla* | Both | Both | Both | Yes | - |
| *Paralomis anamerae* | Atlantic | - | Atlantic | - | Yes |
| *Paralomis formosa* | Atlantic | Atlantic | Atlantic | - | - |
| *Paralomis granulosa* | Both | Both | Both | Yes | Yes |
| *Paralomis spinosissima* | Atlantic | Atlantic | Atlantic | Yes | Yes |
| *Paralomis tuberipes* | Pacific | - | Pacific | - | Yes |
| *Pasiphaea acutifrons* | Both | Both | Both | - | - |
| *Pasiphaea dofleni* | Pacific | Both | Both | - | Yes |
| *Pasiphaea rathbunae* | - | Atlantic | Atlantic | - | - |
| *Pasiphaea scotia* | - | Atlantic | Atlantic | - | - |
| *Peltarion spinulosum* | Both | Both | Both | Yes | - |
| *Pentacheles validus* | - | Both | Both | - | - |
| *Petalidium foliaceum* | - | Atlantic | Atlantic | - | - |
| *Petrolisthes laevigatus* | Pacific | - | - | - | - |
| *Petrolisthes violaceous* | Pacific | - | - | - | - |
| *Pilumnoides hassleri* | Atlantic | - | Atlantic | - | - |
| *Pilumnoides perlatus* | Pacific | - | Pacific | - | - |
| *Pinaxodes chilensis* | Both | Pacific | Pacific | - | - |
| *Pinnixa valdiviensis* | Pacific | Both | Both | - | - |
| *Pinnotherelia laevigata* | Pacific | - | Pacific | - | - |
| *Pisoides edwardsii* | Pacific | - | Pacific | - | - |
| *Planes cyaneus* | Pacific | - | Pacific | - | - |
| *Pleoticus muelleri* | Atlantic | Atlantic | - | - | - |
| *Propagurus gaudichaudii* | Both | Both | Both | Yes | - |
| *Pseudocorystes sicarius* | Pacific | - | Pacific | - | - |
| *Rochinia gracilipes* | Pacific | Atlantic | Both | - | - |
| *Romaleon setosum* (as *Cancer setosus*) | Pacific | - | - | - | - |
| *Sergia potens* | Atlantic | - | Atlantic | - | - |
| *Stereomastis suhmi* | Pacific | Both | Both | - | Yes |
| *Sympagurus dimorphus* | Both | Both | Both | Yes | - |
| *Synalpheus spinifrons* | Pacific | - | Pacific | - | - |
| *Taliepus dentatus* | Pacific | - | - | - | - |
| *Thymops birsteini* | Both | Both | Both | Yes | - |
| *Thymops takedai* | - | Atlantic | Atlantic | Yes | - |
| *Thymopsis nînlenta* | - | Atlantic | Atlantic | - | - |
| *Upogebia australis* | - | Both | Both | - | - |
| *Uroptychus parvulus* | Pacific | - | Pacific | - | Yes |

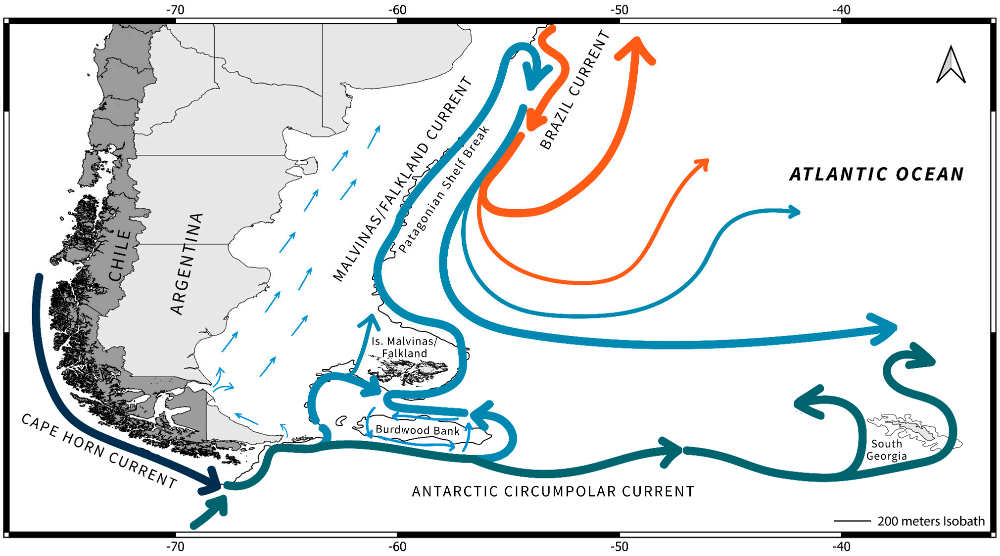

**Figure A1.** Regional currents circulation of the southern tip of South America. Based on the works by Matano et al. [12], Palma et al. [93], Matano et al. [103], and Guihou et al. [115].

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