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ORIGINAL PAPER

First assessment of the rocky intertidal communities of Fildes Bay, King George Island (South Shetland Islands, Antarctica)

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Abstract Studies on Antarctic intertidal fauna are comparatively scarce compared to those from the sublittoral and the deep sea. In order to contribute to filling this gap in knowledge, during the 2006 BENTART Spanish Antarctic Expedition, we conducted a quantitative and qualitative study on the fauna inhabiting the intertidal rocky platform of Fildes (=Maxwell) Bay, King George Island (South Shetlands Archipelago). This platform is dominated in its middle and lower area by the brown algae *Adenocystis utricularis*, which covers ca. 100 % of the rocky surface. Three quantitative samples of 20 × 20 cm were taken in the community of *A. utricularis,* and one additional sample of 20 × 20 cm in the tide pools community dominated by the gigartinacean rhodophyceae *Iridaea cordata*. In addition, qualitative samples of invertebrates that live under the boulders were also taken. Quantitative samples yielded a total of 9950 individuals belonging to 41 species. Mollusks were the most abundant group with a total of 9522 specimens belonging to 11 species, being the gastropod *Eatoniella kerguelenensis regularis* the most abundant with 6763 specimens. Crustaceans were represented by 295 specimens and 7 species and annelid polychaetes with 133 specimens and 20 taxa. The Shannon diversity indexes calculated for the quantitative samples of *A. utricularis* ranged between 0.803 and 1.030 with values of 1.577 for the *I. cordata* community. Our study confirms that the intertidal area of Fildes Bay hosts a surprisingly rich community in terms of abundance and biodiversity.

Keywords Marine communities · Invertebrates · Abundance · Diversity

Introduction

The Southern Ocean intertidal environment is perhaps one of the marine areas subjected to the most extreme environmental conditions on Earth, including very low temperatures at low tide, UV irradiation, ice cover during winter and freshwater flow during summer (Peck et al. 2006). As a consequence of this, for a long time, it was thought that very little flora and fauna were able to survive the harsh intertidal conditions of the Southern Ocean (Knox 1960; Peck et al. 2006). The supralitoral zone had been considered to be very poor in terms of biodiversity with only some species of seaweeds growing in the mid- and lower tide pools and few mollusks associated with them such as *Nacella* and *Margarella* spp. (Knox 1960).

The Antarctic Peninsula and the South Shetland Islands area are currently undergoing the faster effects of climate change on Earth, leading to a significant decrease in the thickness of the layer of ice, exposing large coastal areas during the summer period as a result of the retreat of the continental ice (Clarke et al. 2007). One of the islands in the South Shetland's archipelago, King George Island, located north of the Antarctic Peninsula, is known to have

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large areas of its south and west coasts devoid of ice during summer developing a rich intertidal community of algae and invertebrates (Sicinsky et al. 2011). The presence of an airport and international scientific bases on King George Island has led to numerous and varied ecological studies on marine sublittoral communities mainly in Admiralty Bay and Fildes Bay (see Sicinsky et al. 2011). After the first investigations on the biodiversity of this island (Arnaud et al. 1986, at Admiralty Bay), there have been numerous studies about sublittoral communities including those about biodiversity on algae (Quartino et al. 2001, 2005; Oliveira et al. 2009), benthic invertebrates (Sicinsky et al. 2011) and megafauna (Ferraz et al. 2000), polychaetes (Bromberg et al. 2000; Sicinski 2004), benthic faunal associations on soft substrates (Sahade et al. 1998) or the macrozoobenthic biomass (Pabis and Sicinski 2011). Recently, Sicinsky et al. (2011) provided a list of 1300 species of benthic organisms (excluding bacteria, fungi and parasites) inhabiting the Admiralty Bay area at depths ranging 0–500 m, with polychaetes, bivalves and the amphipods being the predominant groups. Sakurai et al. (1996) carried out a fish and epibenthic invertebrates study and one of the first SCUBA diving observations on communities at Fildes Bay, on depths between 0 and 40 m, concluding that only 7 species inhabited the rocky intertidal of Fildes Bay. Apart from the studies cited above, the study about the invertebrate fauna associated with algal communities in the area has been addressed (Pabis and Sicinski 2010, polychaetes associated with *Himantothalus grandifolius*) and also the seasonal fluctuation of vagile benthos in a pebble beach of Admiralty Bay (Jazdzewski et al. 2001).

When compared to studies on sublittoral communities, the investigations on intertidal Antarctic and sub-Antarctic environments are comparatively scarce, and the later have mainly been focused on the ecological contrast of the land–sea interface (Waller et al. 2006a, b), the variation of the communities in a latitudinal gradient (Waller 2008) or the possible latitudinal clines in encrusting intertidal communities (Barnes and Arnold 1999). Other studies have been directed to investigate the spatial variation in the community structure of intertidal habitats (Smith and Simpson 2002, at the sub-Antarctic Macquarie Island), the ecophysiological strategies to freezing conditions of Antarctic intertidal invertebrates (Waller et al. 2006a, b), the supercooling of marine invertebrates at Signy Island (Block 1984) or the seasonal algae and herbivorous browsers on the intertidal (Kim 2001). Interestingly, Lawrence and McClintock (2008) found that the intertidal shores (tide pools included) of the Bay of Morbihan at Kerguelen Island were depauperate in number of macroinvertebrate and macroalgal species, while Bick and Arlt (2013) have recently described rich intertidal macro- and meiobenthic communities in the soft bottoms of Fildes Bay.

In our study, qualitative and quantitative samples were taken during the 2006 BENTART Spanish Antarctic Expedition with the aim to assess for the first time in Fildes Bay (King George Island) the faunal composition and abundance of invertebrates inhabiting the intertidal rocky platform associated with the predominant seaweed assemblages.

Materials and methods

Study area description

King George Island is the largest of the South Shetland Islands covering an area of 1150 km^2, with over 90 % of its surface covered by ice. It is 95 km long per 25 km wide and reaches a maximum height of 655 m, and it has three large bays: Fildes Bay, Admiralty Bay, and King George Bay. Fildes Peninsula is located at the west end of the island, where several Antarctic bases are found, including Frei (Chile), Escudero (Chile), Great Wall (China), Bellingshausen (Russia), and Artigas (Uruguay).

The intertidal platform studied here is located in the north of Fildes Bay (Fig. 1; 62°12′4″S 58°57′45″W). This intertidal platform is about 500 m from the Bellingshausen Russian Research Base and reveals an important bedrock area with almost flat tide pools. During the winter, the intertidal platform is usually covered by ice for several weeks or months (members of the Antarctic Chilean Escudero Base, personal communication).

In order to better understand the structure and the composition of intertidal communities settled on the rocky platform, prior to sample collection, an overview of the area was made from the upper level of the platform to the water level at low tide, where different communities were described and photographed (Fig. 2). In the upper zone, the platform was mainly composed by boulders of gray or blackish volcanic rock without algae coverage, although in the boulders closer to the seawater, green (*Enteromorpha* sp.) and brown algae were occasionally found. In its middle and lower areas, the platform was dominated by the brown algae *Adenocystis utricularis* (Phaeophyceae, Adenocystaceae), which covered up to 100 % of the rocky surface. In the mid-tidal area, numerous individuals of the patellogastropoda *Nacella polaris* were found, which tended to congregate in the edges of large tide pools or inside the small cavities at the top of the rocks. In the lower intertidal area, abundant ponds were found with light pink encrusting Rhodophyceae as *Lithothamnion* sp. almost completely covering the bottom of the ponds and soft fronds of the red algae *Iridaea cordata* (Rhodophyta, Gigartinaceae), which replaces *A. utricularis* in the ponds. Associated with the fronds of *A. utricularis* abundant amphipods of the species

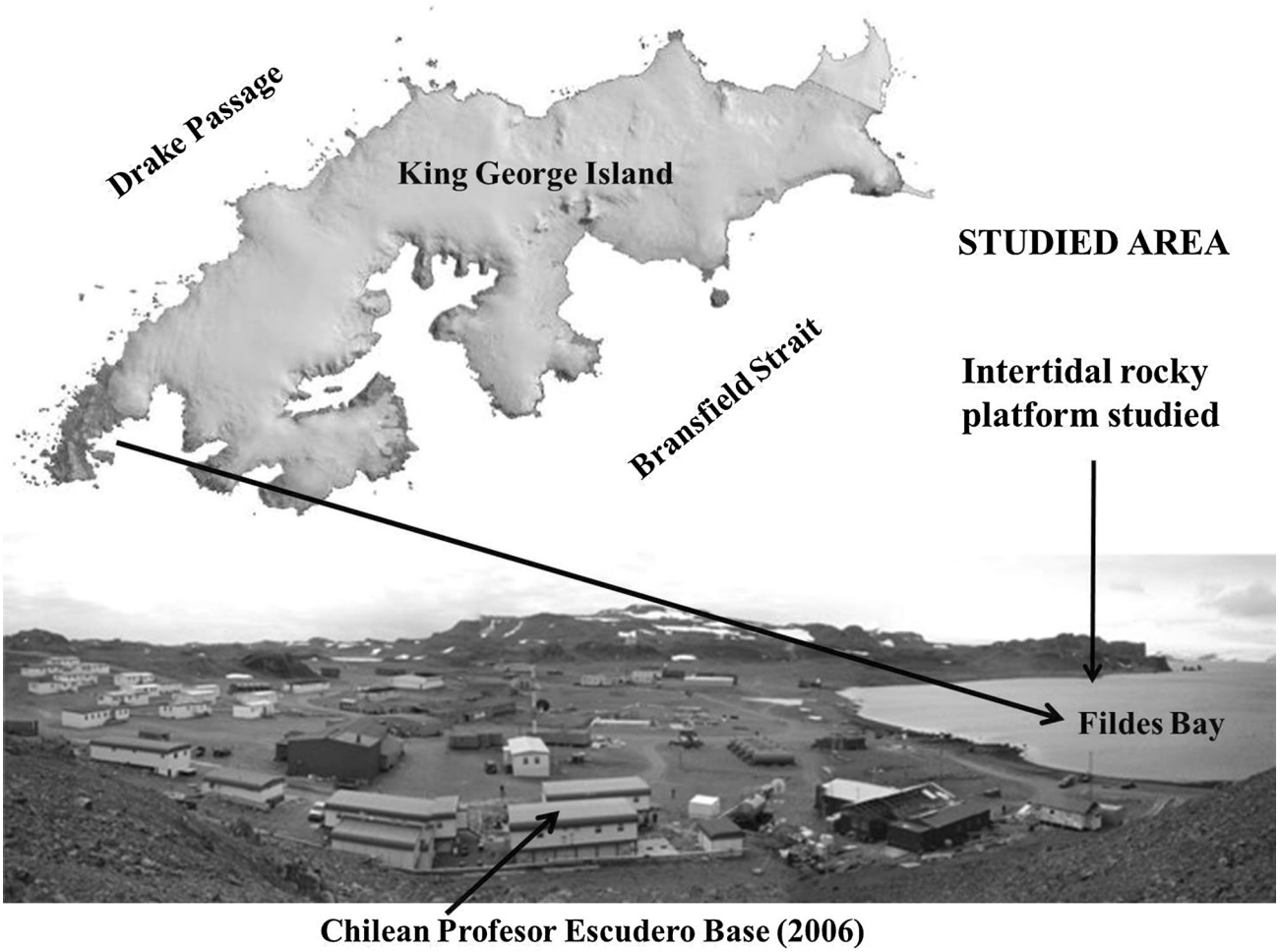

Fig. 1 Sampling zone

Cheirimedon femoratus were found, while in tide pools dominated by *I. cordata* numerous large-sized (up to 4 cm) red amphipods of the species *Bovallia gigantea* occurred. Also, on the rocky platform, there were boulders under whose surface numerous bivalves (*Kidderia subquadrata*), turbellarians (*Obrimoposthia wandelii*), spirorbid polychaetes, encrusting bryozoans (*Inversiula nutrix*), littorinid gastropods (*Laevilitorina caliginosa*), starfishes (*Granaster nutrix* and *Adelasterias papillosa*) and nemerteans (*Antarctonemertes* spp.) were occasionally found. Among the stones, several specimens of the fish *Harpagifer antarcticus* were found perfectly camouflaged in the substrate.

Sampling and samples study

The sampling took place at low tide on January 30, 2006. Tidal height was 0.13 m at 13:16 local time. Quantitative samples comprised three quantitative samples taken from the community of *Adenocystis utricularis* (*S*1, *S*2 and *S*3), and one additional sample collected from the tide pools communities dominated by *Iridaea cordata* (*S*4). In addition, qualitative samples of invertebrates living under the boulders or in the tide pools were also taken.

Quantitative samples were taken with a metal quadrat of 20 × 20 cm, collecting all algal thalli and invertebrates observed on the surface of the rock devoid of algae. Samples were put into plastic bags and transported to the laboratory, at the Professor Julio Escudero Chilean Antarctic Base, where they were fixed in 70 % ethanol and sieved through a 200-μm mesh. Organisms were sorted, quantified and identified to the lowest taxonomical level at the Department of Animal Biology, University of Barcelona. Individuals were identified under a binocular ZEISS microscope STEMI 2000 and under a ZEISS light microscope PRIMO STAR. Several specimens were photographed alive in their natural habitat and in the laboratory at the Antarctic Chilean base. Photographs of living specimens and intertidal community were taken with a compact camera Olympus SP-350 and with a digital (reflex) SLR

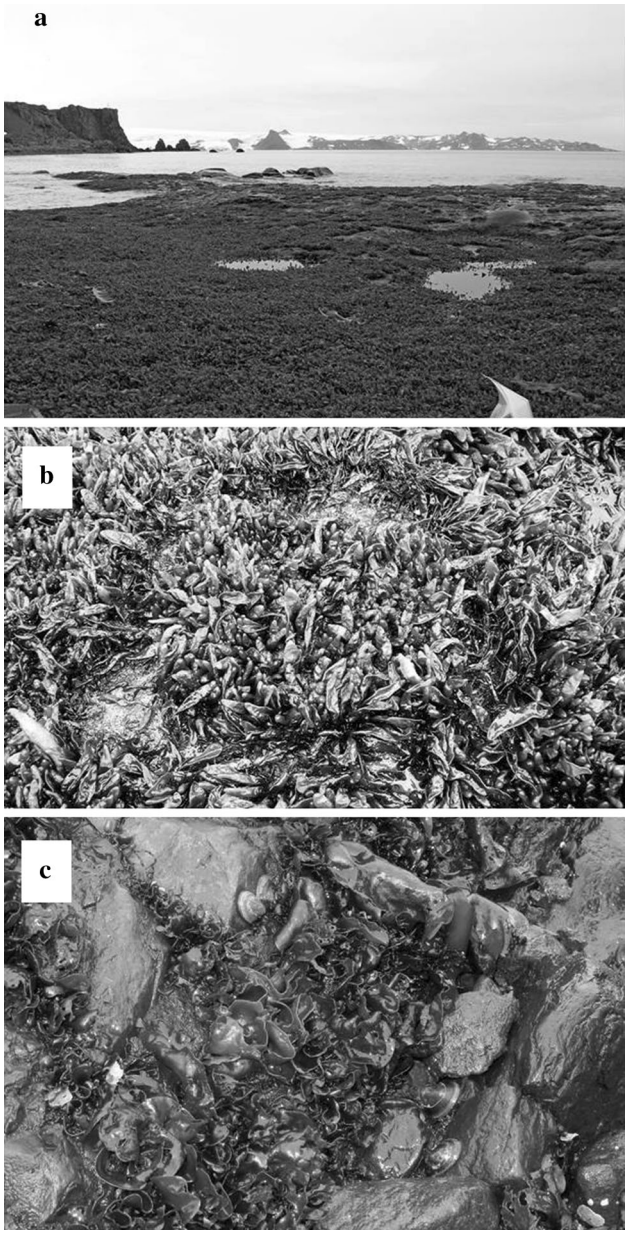

Fig. 2 Intertidal rocky platform (**a**) and sampling substrate (**b** *Adenocystis utricularis* community **c** tide ponds with *Iridaea cordata*)

camera Konica Minolta with 100-mm macrolens and external flash.

For the taxonomical identification, we used different monographies such as Fauchald (1977) for polychaetes, Ponder (1983), Dell (1990) and Engl (2012) for mollusks, and De Broyer et al. (2007) for amphipods. For the current taxonomy and nomenclature of specific taxa, we followed the recommendations of the Register of Antarctic Marine Species (RAMS).

For each quantitative sample, we studied its abundance (individuals/sample and individuals/m^2), species richness, Shannon–Wiener's diversity index (H′) and Pielou's evenness index (J′) (Table 1). Biodiversity indices were calculated from abundance data matrix using the program PREMIER 6.0.

Results

Quantitative samples

Quantitative samples yielded a total of 9950 individuals and 41 species or higher taxa belonging to the taxonomic groups of Mollusca, Polychaeta and Crustacea (Table 2). The total number of individuals per sample was 3286 in *S*1 (82,150 ind./m^2), 3892 in *S*2 (97,300 ind./m^2), 1619 in *S*3 (40,475 ind./m^2) and 1153 in *S*4 (28,825 ind./m^2) (Table 1). Besides, in the quantitative samples, we identified fragments of 3 Bryozoa species (*Inversiula nutrix, Antarctothoa bougainvillei* and *Escharoides tridens*), which were not included in the tables because it was not possible to determine whether they belong to one or more colonies. Our data will be available for consultation on biodiversity OBIS platform.

Mollusks were the most abundant group in all quantitative samples with 9522 individuals (95.67 %), comprising the gastropoda Eatoniellidae (6817 individuals, of which 6763 correspond to *Eatoniella kerguelenensis regularis*) and Littorinidae (576 individuals), and the bivalves Cyamiidae (1960 individuals) the most abundant families. Crustacea and Polychaeta were represented by 295 (2.96 %) and 133 (1.33 %) individuals, respectively. Among Polychaeta, the families Syllidae (44 individuals), Terebellidae (37 individuals) and Phyllodocidae (24 individuals) were the most abundant, while the family Lysianassidae (order Amphipoda) was for Crustacea. Polychaeta was the taxonomic group with a highest species diversity with 20, particularly the families Syllidae (5 species) and Phyllodocidae (3 species), followed by Mollusca (11 species), represented by gastropods (8 species) and bivalves (3 species). Crustacea were represented by 7 species (Amphipoda 6 species). The highest species richness was observed in the sample *S*4 with 29 species (15 Polychaeta, 9 Mollusca and 5 Crustacea; Table 2).

The most abundant species in the three samples associated with the *A. utricularis* community was *E. k. regularis*, which was represented in samples *S*1, *S*2 and *S*3, respectively, with 2545 individuals (63,625 ind./m^2), 2614 individuals (65,350 ind./m^2) and 1214 individuals (30,350 ind./m^2), followed in *S*1 by *Laevilitorina caliginosa* with 329 individuals (8225 ind./m^2) and *Mysella subquadrata* with 211 individuals (5275 ind./m^2), while in *S*2 was followed by *M. subquadrata* with 1046 individuals (26,150 ind./m^2) and *L. caliginosa* with 104 individuals (2600 ind./m^2). In *S*3, the most abundant species after *E. k. regularis*

Table 1 Abundance (total and ind. × m^{-2}), species richness, Shannon–Wiener diversity (H′) and Pielou's evenness (J′)

Taxon	S1			S2			S3			S4		
	Abund.	Ind. × m^{-2}	Richness	Abund.	Ind. × m^{-2}	Richness	Abund.	Ind. × m^{-2}	Richness	Abund.	Ind. × m^{-2}	Richness
Mollusca	3093	77,325	5	3801	95,025	6	1558	38,950	9	1070	26,750	9
Crustacea	185	4625	2	49	1225	2	45	1125	1	16	400	6
Polychaeta	8	200	6	42	1050	9	16	400	6	67	1675	15
Total	3286	82,150	13	3892	97,300	17	1619	40,475	16	1153	28,825	30
Diversity H′		0.803 ± 0.030			0.891 ± 0.027			1.004 ± 0.055			1.577 ± 0.069	
Evenness J′		0.313			0.314			0.362			0.463	

were *M. subquadrata* with 175 individuals (4375 ind./m^2) and *Laevilacunaria antarctica* with 70 individuals (1750 ind./m^2). The amphipod *Cheirimedon femoratus* was also abundant in those samples but with lower number of individuals (184 individuals; 4600 ind./m^2 in *S*1) than mollusks. Associated with the *I. cordata* community (*S*4), *M. subquadrata* was the most abundant taxon with 528 individuals (13,200 ind./m^2) followed by *E. k. regularis* with 390 individuals (9750 ind./m^2) and *Laevilitorina umbilicata* with 62 individuals (1550 ind./m^2). Among Polychaeta, the Phyllodocidae and Terebellidae were the most abundant in *S*4 and *S*2 with 20 individuals each (500 ind./m^2), while the Syllidae was in *S*4 with 19 individuals (475 ind./m^2) (Table 2).

The Shannon–Wiener diversity (H′) values of *A. utricularis* quantitative samples (*S*1, *S*2 and *S*3) ranged between 0.803 and 1.03 (Table 1), while the same diversity parameter for the *I. cordata* sample (*S*4) was 1.577 (Fig. 3a). Low values of Pielou's evenness (0.313, 0.314, 0.362 and 0.463 in samples *S*1, *S*2, *S*3 and *S*4, respectively) indicate the abundances distribution of the different species in each sample is not homogeneous, meaning that one or a few species represent the greatest proportion of individuals in the sample. This is the case of *M. subquadrata* and *E. k. regularis* in samples *S*1, *S*2, *S*3 and *S*4 and *L. caliginosa* in samples *S*1, *S*2 and *S*3. In order to eliminate the influence of the most abundant species in the diversity indexes, we removed the species *E. k. regularis* and *M. subquadrata* from the analysis and obtained diversity H′ values ranging between 0.83 (*S*1) and 2.59 (*S*4) (Fig. 3b). In this case, the Pielou's indexes were 0.35 (*S*1), 0.64 (*S*2), 0.72 (*S*3) and 0.79 (*S*4).

Qualitative samples

A total of 18 species were identified from the qualitative samples, 10 of which did not appear in the quantitative samples. Two of these species are echinoderms from the family Asteriidae, *Granaster nutrix* and *Adelasterias papillosa*, frequently found under the stones in shallow Antarctic waters. Also, on the underside of stones, we found the tricladid platyhelmintha *Obrimoposthia wandeli* and *Synsiphonium liouvilli*, nemerteans (*Parborlasia corrugatus, Antarctonemertes valida*, and *A. riesgoae*), encrusting bryozoans (*Inversiula nutrix*), mollusks (the bivalvia *M. subquadrata* and the gastropoda *L. caliginosa*), an abundance of small calcareous tubes of Spirorbinae polychaetes, and the fish *Harpagifer antarcticus*. Numerous individuals of the patellogastropoda *Nacella polaris* appeared in the middle tidal area, which tend to congregate at the edges of the large tide pools or inside small cavities that remain above the rocks.

Table 2 Species abundance and distribution in the quantitative (Qt) and qualitative (Ql) samples

Taxon	Qt					Ql
	*S*1	*S*2	*S*3	*S*4	N	
Platyhelminthes						
Obrimoposthia wandeli (Hallez, 1906)						xxx
Synsiphonium liouvilli (Hallez, 1911)						x
Nemertea						
Antarctonemertes valida (Bürger, 1893)						xx Ov
A. riesgoae Taboada, Junoy, Andrade, Giribet, Cristobo & Avila, 2013						x
Parborlasia corrugatus (McIntosh, 1876)						x
Polychaeta						
Phyllodocidae indet		2		10	12	
Eteone sculpta Ehlers, 1897				1	1	
Austrophyllum cf. charcoti (Gravier, 1911)	2			9	11	
Dorvilleidae indet	1			1		
Leitoscoloplos kerguelensis (McIntosh, 1885)				2	2	
Nereididae indet		1		1	2	
Sphaerodoridae indet				1	1	
Chaetozone indet				4	4	
Cirratulidae indet	1		2	1	4	
Polycirrus indet 1	1			8	9	
Polycirrus indet 2		1			1	
Terebellidae indet		19	2	6	27	
Sabellidae indet			1		1	
Micronephthys indet		1	1		2	
Capitellidae indet		6		5	11	
Eusyllinae indet 1	1	1	2		4	
Eusyllinae indet 2		1		3	4	
Eusyllinae indet 3	2	10	8	8	28	
Exogone indet 1				7	7	
Exogone indet 2				1	1	
Spirorbinae indet.						xxx
Mollusca bivalvia						
Mysella subquadrata (Pelseneer, 1903)	211	1046	175	528	1960	20
Mysella charcoti Lamy, 1906		1		11	12	
Lissarca miliaris (Philippi, 1845)			18	18	36	
Mollusca gastropoda						
Nacella polaris (Hombron & Jaquinot, 1841)			1	6	7	xxx
Eatoniella kerguelenensis regularis (E.A.Smith, 1915)	2545	2614	1214	390	6763	
Eatoniella caliginosa (E.A.Smith, 1875)			8	46	54	
Laevilitorina caliginosa (Gould, 1849)	329	104	39		472	xxx
Laevilitorina umbilicata	3	16	32	62	113	
Pfeffer in Martens & Pfeffer, 1886						
Laevilacunaria antarctica (Martens, 1885)	5	20	70	5	100	1
Pellilitorina pellita (Martens, 1885)				4	4	
Trochidae indet.juv			1		1	
Mollusca polyplacophora						
Polyplacophora indet						x
Crustacea						
Epimeria monodon Stephensen, 1947				1	1	

Table 2 continued

Taxon	Qt					Ql
	*S*1	*S*2	*S*3	*S*4	N	
Cheirimedon femoratus (Pfeffer, 1888)	184	48	45	2	279	71
Bovallia gigantea Pfeffer, 1888				1	1	38
Eurymera monticulosa Pfeffer, 1888				7	7	15
Gondogeneia antarctica (Chevreux, 1906)		1		3	4	
Gammaridea indet	1				1	
Isopoda indet				2	2	
Bryozoa						
Inversiula nutrix Jullien, 1888		x		x		xxx
Antarctothoa bougainvillei (d'Orbigny, 1842)			x	x		
Escharoides tridens (Calvet, 1909)		x				
Echinodermata						
Granaster nutrix (Studer, 1885)						4
Adelasterias papillosa (Koehler, 1906)						5
Pisces						
Harpagifer antarcticus Nybelin, 1947						2
Total	3286	3892	1619	1153	9950	

N total individuals number of each taxa in all the samples (*S*1, *S*2, *S*3 and *S*4), *Ov* Ovigerous capsules, *x* presence; *xx* abundant; *xxx* very abundant

Discussion

Our survey made in the intertidal platform of Fildes Bay shows an extraordinary abundance and biodiversity of small invertebrates associated with algal thalli of the phaeophyceae *Adenocystis utricularis* and the rhodophyceae *Iridaea cordata*, with values reaching up to nearly 100,000 individuals/m^2. These data are consistent with those obtained by Bick and Arlt (2013) at soft substrate samples in the same intertidal area, which obtained, by means of 5 cm^2 cores, estimated average abundances of 130,000 individuals/m^2. Contrastingly, sampling with a square of 0.25 m^{-2} at the intertidal of Adelaide Island (Antarctic Peninsula), Waller (2008) found an invertebrate abundance of 7358 individuals/m^2. Also, densities from 200 to 54,000 individuals/m^2 sampling were recorded between 0.5 and 1 m depth on a pebble beach at Admiralty Bay, with an average of biomass of 180 g/m^2 (Jazdzeswki et al. 2001).

Studies over the last decade have shown that the Antarctic intertidal shores are not as poor as previously thought (Kim 2001; Waller et al. 2006a, b; Waller 2008), but until 2006 different authors had cited only 31 macrofaunal species in the intertidal for South Georgia, 22 species for South Orkney Islands and 18 to Adelaide Island (Peck et al. 2006). Waller (2008) found a variation in species richness between 7 and 30 species in the intertidal zone along a latitudinal gradient between the Falkland Islands, South Georgia, South Orkney Islands and Adelaide Island (Antarctic Peninsula) with the higher richness (34 species) at the southernmost locality, Adelaide Island. Recently, Barnes et al. (2009) recorded the presence of 43 intertidal species at the South Orkney Islands. Sicinski et al. (2011) showed that the amphipods *Gondogeneia antarctica* and *Paramoera edouardi* and the limpet *Nacella concinna* (=*polaris*) were the most important components of the invertebrate assemblage on rocky and stony supralittoral of Admiralty Bay. In his study of the seasonal fluctuation of vagile benthic organisms in a pebble beach of Admiralty Bay between 0.5 and 1 m deep, Jazdzeswki et al. (2001) found a very rich vagile fauna living among and below the pebbles, with a total of 20 different taxa belonging to the amphipod crustaceans (7 species), mollusks (5 species), nemerteans, flatworms, isopods crustaceans, polychaetes and oligochaetes, being the amphipod *Gondogenia antarctica* the most abundant species with 61.23 % of the total abundance. Some of the species found by these authors coincide with those in our study, like the amphipods *Gondogenia antarctica* and *Cheirimedon femoratus* or the gastropods *Laevilitorina caliginosa* and *L. umbilicata*. Bick and Arlt (2013) recently showed that intertidal soft bottoms of Fildes Bay are densely populated by a rich variety of macro- and meiofauna (58 different species in total), with several of these species appearing also on the substrates analyzed in our study.

The most abundant species in our quantitative samples was the mollusk *Eatoniella kerguelenensis regularis* (6763 individuals), a small herbivorous gastropod that find food

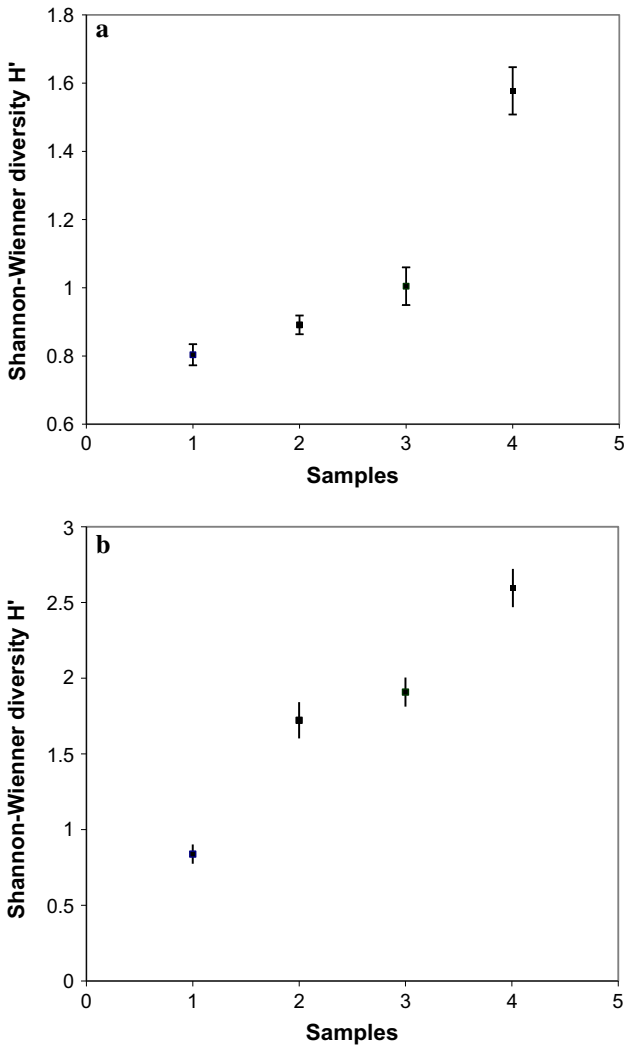

Fig. 3 **a** Shannon–Wiener diversity H′ at all the samples. **b** Shannon–Wiener diversity H′ at all the samples without the influence of *E.k. regularis* and *K. subquadrata*

and shelter mainly among *Adenocystis* fronds (Fig. 1f supplementary material). This littorinimorpha is a circum-Antarctic species that has also been recorded in the South Shetland archipelago, South Orkney, South Georgia and Falkland Islands (Aldea and Troncoso 2010) in a bathymetric range from the intertidal to more than 400 m deep. The intertidal area of Fildes Bay has proved to be an ideal habitat for littorinimorpha since, apart from *E. kerguelenensis regularis,* other littorinimorpha such as *Eatoniella caliginosa, Laevilitorina caliginosa, L. umbilicata, Laevilacunaria antarctica* and *Pellilitorina pellita* were present in the both quantitative and qualitative samples in our study (Table 2).

The small red Cyamiidae bivalve *Mysella subquadrata* (Fig. 1d supplementary material) is an Antarctic and sub-Antarctic species, homochromous with the algal fronds of *Iridaea cordata*, which proved to be very abundant on this alga in our study, although it also appeared associated with *Adenocystis utricularis*. This species has been overlooked in recent bibliographical references (does not appear in Dell 1990; Hain 1990; Aldea and Troncoso 2010; Engl 2012). Bick and Arlt (2013) found this small bivalve living in association with hard bottom in the intertidal of Fildes Bay and gave an estimated life span of about 4 years.

The patellogastropoda *Nacella polaris* was very abundant in the tidal pools of the intertidal rocky platform here studied, where several tens of individuals can concentrate in 1 m^2, on encrusting calcareous algae or near the water surface (Fig. 1e supplementary material).

Among crustaceans, the amphipod *Cheirimedon femoratus* was the most abundant in the quantitative samples, mainly in the *Adenocystis utricularis* samples. Another amphipod, *Bovallia gigantea* (Fig. 1g supplementary material), was poorly represented in the quantitative samples due to its high swimming ability so that the individuals escaped easily when sampling in the tide pool; this species was mainly found in our study living between the thalli of *Iridaea cordata* in intertidal pools. Bone (1972) stated that *B. gigantea* is an omnivorous predator that mainly feeds relying the greatest part of its diet (70 %) on other invertebrates (copepods, other amphipods and eggs masses) and the rest on algae.

The significant difference (p value 0.0274) of the Shannon–Wiener index between the two algal communities surveyed here can be explained by the fact that *Iridaea cordata* community was in a tidal pool where environmental conditions may be more stable. Instead, the three samples of *A. utricularis* were completely exposed to air at low tide and therefore subjected to greater changes in environmental factors. As for biodiversity values, the data of our samples are slightly lower than those provided by other authors. For example, Waller (2008) cited Shannon diversity values on rocky intertidal between 1.51 and 2.19 for samples of Adelaide Island, between 0.93 and 2.47 for the South Orkney Islands, between 1.19 and 1.55 for South Georgia Islands and between 0.86 and 1.20 for Falkland Islands. On the other hand, Bick and Arlt (2013) reported values ranging from 2.61 to 3.06 in soft bottoms at the same intertidal platform that we have studied. The cause of these low values of biodiversity in our samples may be due mainly to the extraordinary abundance in the quantitative samples of 3 species of mollusks (*Mysella subquadrata, Eatoniella kerguelenensis regularis* and *Laevilitorina caliginosa*) and one crustacean (*Cheirimedon femoratus*), which is also reflected in the lower values of Pielou's evenness. Without the data of the two most abundant species in samples, *E. k. regularis* and *K. subquadrata*, the diversity values raised up to 0.83 in the sample *S*1, to 1.69 in the sample *S*2, to 1.903 in the sample *S*3 and to 2.59 in

the sample *S*4. Pielou's values also increased, reaching a value of 0.79 in the sample *S*4. With this, the values of our samples are closer to those provided by previous authors. However, even after removing these two abundant species from the analysis, the values of diversity and evenness in sample *S*1 still remained low, in part due to the effect of high abundance of two other species such as the gastropod *L. caliginosa* and the amphipod *C. femoratus*. In the other samples (*S*2, *S*3 and *S*4), the distribution of the abundance of the species was more homogeneous, which led to a significant increase in diversity and evenness values after eliminating the effect of the two most abundant species.

Taking into account both the quantitative and qualitative samples in the intertidal platform in our study, we found a total of 51 different species, belonging to the taxa of Platyhelmintha (2 species), Nemertea (3 species), Annelida Polychaeta (21 species), Mollusca (12 species), Crustacea (7 species), Bryozoa (3 species), Echinodermata Asteroidea (2 species) and Pisces (1 species). Bick and Arlt (2013) in the same intertidal rocky platform cited the presence of 28 species of invertebrates living in the intertidal phytal or at the hard substrate in their qualitative study. With our data, the biodiversity of invertebrates and fishes that live in the intertidal rocky platform of Fildes Bay increases significantly until 74 recorded species: 1 Porifera, 1 Hydrozoa, 3 Platyhelmintha, 3 Nemertea, 31 Polychaeta, 1 Oligochaeta, 13 Mollusca Gastropoda, 3 Mollusca Bivalvia, 1 Mollusca Polyplacophora, 1 Pycnogonida, 7 Crustacea Amphipoda, 3 Crustacea Isopoda, 3 Bryozoa, 2 Echinodermata and 1 Pisces. Adding the species found by the previous authors living in the soft bottom, the resulting list accounts for a total of 101 species recorded in the intertidal platform of Fildes Bay.

It can finally be concluded that despite the fact that the intertidal zone of Fildes Bay is subjected to extreme environmental conditions (below zero air temperature) and the effect of sea-surface ice during the winter, it hosts a surprisingly rich community of macrofaunal invertebrates in terms of both abundance and biodiversity Nevertheless, more studies in similar areas from King George Island as well as in other islands from the South Shetland's archipelago are encouraged to confirm our observations and to complete the knowledge about the faunal composition of Antarctic intertidal communities.

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