SCI. MAR., 63 (Supl. 1): 155-170 SCIENTIA MARINA 1999

MAGELLAN-ANTARCTIC: ECOSYSTEMS THAT DRIFTED APART. *W.E. ARNTZ and C. RÍOS (eds.)*

Biodiversity and community structure of the mega-epibenthos in the Magellan region (South America)*

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SUMMARY: Epibenthic communites have been investigated at 55 stations in the Magellan region by underwater photography at water depths between 15 and 430m. Five species assemblages were identified of which the two shallow and the two deep ones in the channel system differed considerably in abundance, number of taxa, diversity and species composition. The dominant systematic group of the shallow assemblages were ascidians. In one of these assemblages decapod crustaceans, in the other mainly sessile suspension feeders e.g. sponges, anthozoans and bryozoans were the characteristic taxa. In the deeper assemblages echinoderms were most abundant. The fifth assemblage, consisting of several offshore stations south of the eastern entrance of the Beagle, was more similar to the shallow stations in the channel system in terms of dominant life forms. Various hypotheses were confirmed or rejected: The benthos at the deeper stations in the channel system was not more homogeneous than at the shallow stations. At both the channel and the offshore stations filter feeders were most dominant whereas at the bottom of the channels deposit feeders were more abundant. Differences between the wide Straits of Magellan and the narrow and steep Beagle Channel were not very distinct. The benthic assemblages inside the channel system did not differ considerably from the assemblage outside the channel system with the exception of the stations close to the continental slope of the Atlantic. Differences due to Pacific or Atlantic influences were not recognisable. The biological patterns could best be explained by the environmental parameters water depth, occurrence of soft sediment and biogenic debris.

Key words: Mega-epibenthos, Magellan region, community analysis, biodiversity.

RESUMEN: BIODIVERSIDAD Y ESTRUCTURA DEL MEGA-EPIBENTOS EN LA REGIÓN DE MAGALLANES (AMÉRICA DEL SUR). – Se estudiaron las comunidades epibentónicas en 55 estaciones de la región de Magallanes en profundidades entre 15 y 430 m mediante fotografía subacuática. Se identificaron cinco comunidades distintas. Las dos comunidades someras y las dos profundas en el sistema de canales revelaron diferencias considerables en lo que se refiere a abundancia, número de taxones, diversidad y composición específica. Las ascidias predominaron en las comunidades someras. En una de ellas, los crustáceos decápodos fueron el taxón característico mientras en la otra lo fueron los suspensívoros sésiles tales como esponjas, antozoos o briozoos. En las comunidades de mayor profundidad los equinodermos fueron el grupo más notable. La quinta comunidad, compuesta por varias estaciones situadas al sur de la entrada este del Canal del Beagle, resultó ser muy parecida a la de las estaciones someras en el sistema de canales en términos de formas de vida dominantes. Se aceptaron o rechazaron varias hipótesis. El bentos en las estaciones más profundas del sistema de canales no se mostró más homogéneo que en las estaciones someras. Tanto en las estaciones cercanas como en las estaciones fuera de la costa predominaron los suspensívoros, mientras que los detritívoros fueron el grupo dominante en el fondo de los canales. No se detectaron diferencias muy marcadas entre el Estrecho de Magallanes, de configuración ancha, y el Canal del Beagle de forma estrecha y pendiente fuerte. Con excepción de las estaciones cercanas al talud continental atlántico, las comunidades fuera del sistema de canales no se distinguieron mucho de las de dentro. No se evidenciaron diferencias faunísticas causadas por influencia pacífica o atlántica. Los patrones biológicos se pueden explicar mejor por los parámetros ambientales profundidad del agua, presencia de sedimentos blandos y escombros biogénicos.

Palabras clave: mega-epibentos, región magallánica, análisis de comunidades, biodiversidad.

This is AWI conntr. no. 1750
*Accepted November 6, 1998.

INTRODUCTION

The objective of this study was a faunistic-ecological survey of the mega-epibenthos in deeper waters of the Straits of Magellan, the Beagle Channel, and the channel system southeast of Tierra del Fuego. Contrary to a number of shallow-water (<15 m) studies of a primarily ecological character (e.g., Ojeda and Santelices, 1984; Dayton, 1985; Castilla, 1985) most former benthic investigations in this area centred around either taxonomic questions (e.g., Retamal, 1973; 1974; Jaramillo, 1981; Moyano, 1992; Sarà, 1992) or focused on single economically interesting species (e.g., Guzmán *et al.*, 1987; Vinuesa *et al.*, 1989; Vinuesa, 1991). In contrast, in this investigation we tried to consider the mega-epibenthos as a whole. Thus the results can contribute to understanding whether certain ecological paradigms can, or cannot, be confirmed for this area. They can also serve as a baseline for a comprehensive coastal management including aspects of nature conservation, much more so since this study was embedded in the "Joint 'Victor Hensen' Magellan Campaign", in which many different compartments of the ecosystem were investigated with similar objectives.

With this backgound in mind sampling sites with different characteristics were chosen in order to check the following ecological hypotheses:

- In shallow areas the benthos is more heterogeneous due to strongly varying environmental factors than in deeper areas, where the environment is supposed to be more stable.
- At slopes inside the channel system and offshore as well as in shallow waters close to the coast, filter feeders are supported by the environmental conditions, e.g. horizontal transport of particulate organic matter, whereas at the bottom of the channels sediment feeders are favoured due to a higher amount of deposited detritus.
- The benthos of the wide Straits of Magellan is significantly different compared with the benthic communities in the narrow and steep Beagle Channel.
- The benthos inside the channel system differs from that which is more exposed to the open oceans because the (partly deep) channel system is separated from the continental coast by shallow sills.
- The influence of either Pacific or Atlantic faunal elements is recognizable in different parts of the investigation area.

The following aspects were analyzed in detail:

1. Identification and quantification of all mega-epibenthic organisms as accurately as possible.
2. Classification of different benthic communities according to available physical (environmental) parameters which may explain the biological pattern.
3. Characterization of species assemblages in terms of abundance and composition of the taxa, key species, and their biodiversity.

Due to this approach underwater photography was used because it provides quantitative data mainly for sessile animals. It covers sampling sites of sufficient extension even for the large, and therefore less abundant, taxa. In addition the biological results from different sites are directly comparable because sampling is not biased by sediment characteristics.

MATERIAL AND METHODS

Field work

The investigation was carried out during the "Joint 'Victor Hensen' Magellan Campaign" during austral summer 1994 and during the expedition ANT XIII/4 with R/V "Polarstern" in May 1996. A 70 mm underwater camera (Hasselblad 500EL/M with two Metz Mecablitz 40 CT4 flashes) was deployed at 55 stations at water depths between 15 and 430m (Fig. 1; Table 1); for exact position of stations cf. Table 13 (Annex) in Arntz and Gorny (1996) and Arntz *et al.*

TABLE 1. – Station list according to station clusters; upper part: stations used for community analysis, lower part: additional stations classified according to firstly calculated key species. For positions of A-F see Fig. 2.

	clusters			
SNE	S	DE 1	DE 2	OS
921	A	C	F	110A
964	B	D	1078	110B
1163	890	E	1079	112A
1167	917	1125	1985	112B
1193	927	1311		113A
1208	951			113B
1224	957			116A
	959			116B
	968			
	1177			
	1205			
	1217			
	1219			
	1276			
	1293			
	1299			
	1312			
1229	880	879	1106	
1239	1285	1090		
1243				
1284				
1285				

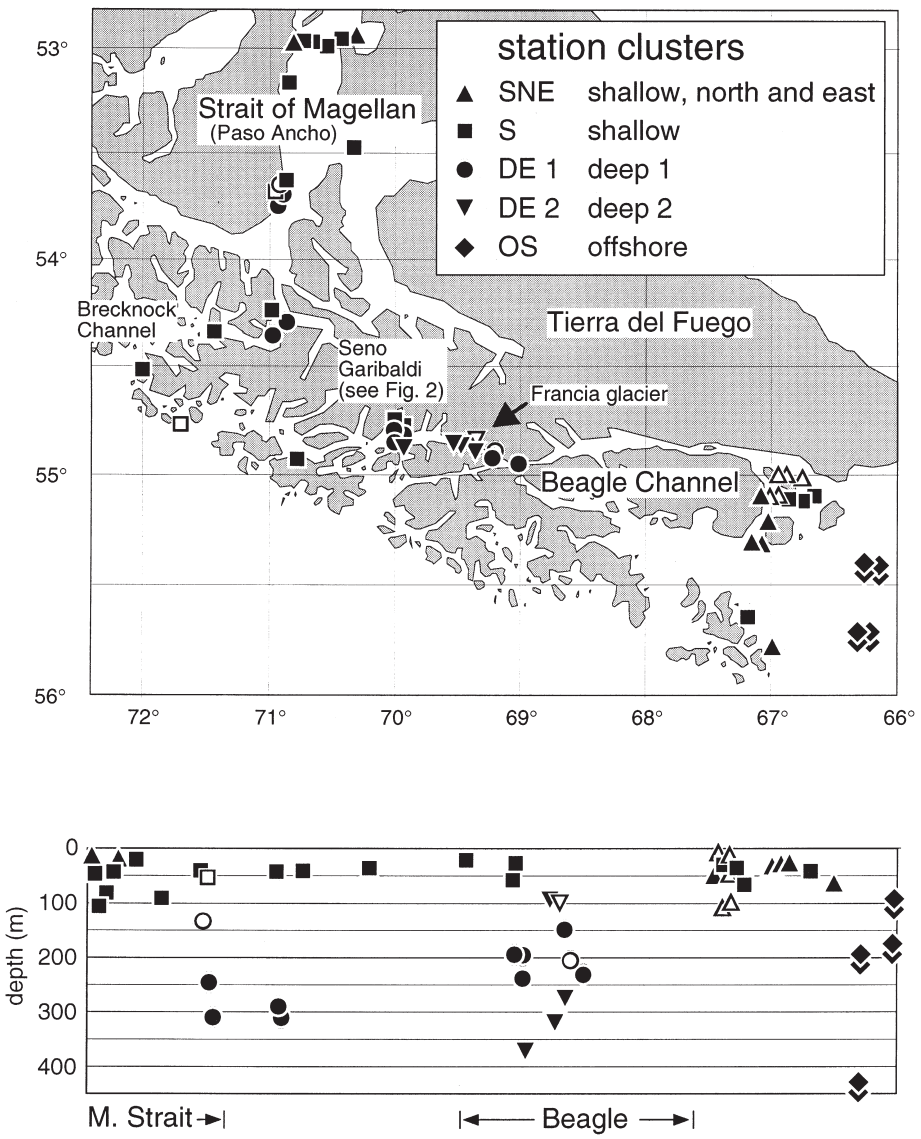

FIG. 1. – Station map. In the lower part stations are aligned (from left to right) along a transect starting at the northern part of Paso Ancho (Straits of Magellan) through the channel system east of Tierra del Fuego into the Beagle Channel and further east to the offshore stations south of the eastern mouth of the Beagle. Symbols represent different clusters according to cluster analysis. Open symbols indicate stations classified only by key taxa.

(1997). The camera was triggered at a constant distance above the seafloor. The optical resolution was 0.3 mm using a Kodak Ektachrome 64 film. The size of the area vertically photographed (0.9 m^2 +/- 3% per frame) was calculated by reference to two stations where the trigger weight was photographed and served as a spatial scale. The photographs from the original sampling sites 1030, 1035, 1041, 1057, and 1058 were recombined to a total of six stations (A-F) according to water depth along a transect starting inside the Seno Garibaldi at 70m, crossing two sills at approx. 15m and 190m depth, and ending in the centre of the Beagle Channel at 370m water depth (Fig. 2). The offshore sites sampled during the expedition ANT XIII/4 (original stations 110, 112, 113, and 116) were split into four pairs of pseudo-replicates (total of eight stations: 110A, 110B, ..., 116A, 116B). From 30 stations 40 photographs each, and from another 15 stations slightly less photographs (35-39 each), were used for the community analysis and diversity study. The 1753 photographs represent an area of 1577.7 m^2 of seafloor. The community structure at an additional 10 stations with clearly less than 40 photographs or with photographs of low quality, e.g. due to much suspended matter in the water column, was classified on the basis of key taxa determined beforehand for the material analyzed in more detail.

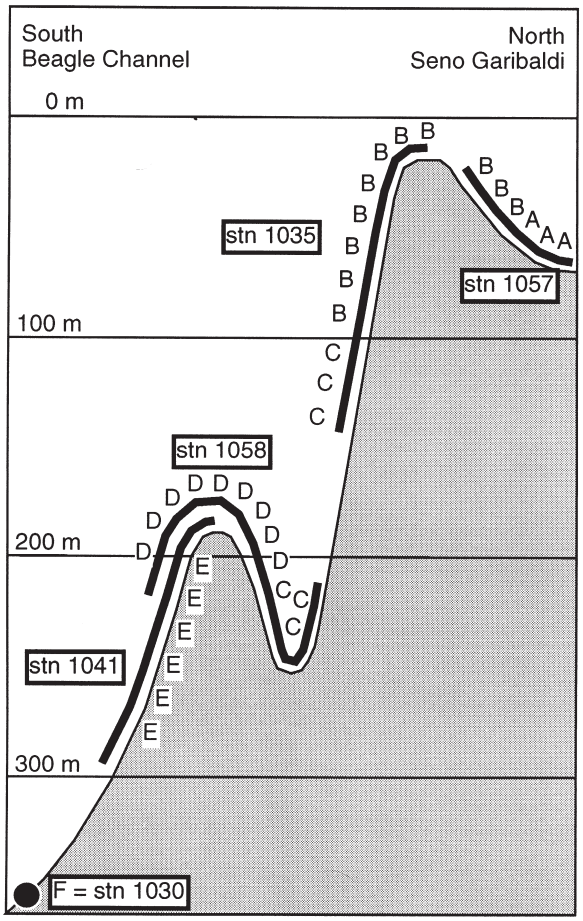

FIG. 2. – Photographic transects at the entrance of the Seno Garibaldi with original station numbers and rearranged stations (A-F) according to water depth and position.

Identification and counting

Identification was supported by experts: S. Cornejo, C. Dahm, C. Jara, H. I. Moyano, E. Mutschke, M. Pansini, C. Ríos, I. S. Wehrtmann. The "taxon" Synascidian(s) does not refer to the systematic classification, it describes a life form which occurs in different families of ascidians which also include solitary species.

With few exceptions all photographed organisms >0.5cm were counted. Small encrusting forms were not considered. For most bryozoans, all algae, and the taxon Polychaeta sp. 2 the cover of the seafloor was determined in percent to obtain a value roughly equivalent to the abundances of other taxa. For other colonial taxa, e.g. hydrozoans and synascidians, the colonies were counted as one individual. These values were treated in further calculations as true abundances in order not to exclude any life forms only due to the fact that single organisms cannot be counted. Infaunal species were considered when part of their body was visible. Abundances were standardized as numbers per $10m^2$.

Community analysis and key taxa

Taxa which occurred at less than three stations were not considered because the common presence of two extremely rare taxa -which is due to chance- would lead to an erroneous high similarity between the taxon clusters. Only organisms identified to the species or genus level were analyzed. Double square root transformation was used (45 stations, 125 taxa) because, in combination with the Bray-Curtis index (Bray and Curtis, 1957), the similarity coefficient is invariant to a scale change (Field *et al.*, 1982). The results for the stations are shown in a Multidimensional Scaling (MDS) plot (Fig. 3) as a method of ordination (Field *et al.*, 1982) which shows the similarities of all stations to each other on a two-dimensional scale. The result from the classification by a cluster analysis were superimposed in the MDS. The order and grouping of the taxa resulting from the cluster analysis (dendrogram) was used for their arrangement in the community table (Table 2).

Key taxa which served as discriminators for the classification of stations were determined by a modified Bray-Curtis index (Clarke, 1993). Good discriminators perform a high contribution to the average dissimilarity between each station cluster and all other stations (d_i) and a high quotient between d_i and its standard deviation (SD).

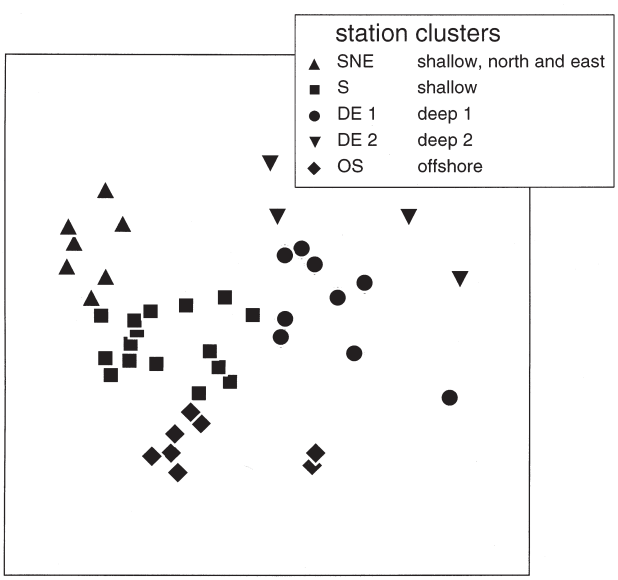

FIG. 3. – MDS plot; Bray-Curtis index, double square root transformation, stress: 0.22. Five different assemblages of taxa are represented by different symbols (c.f. Fig. 1) superimposed from the cluster analysis.

TABLE 2. – Abundances of all mega-epibenthic taxa, investigated by underwater photography for station clusters, with presences and total abundances for the entire area of investigation. Taxa ordered according to result of cluster analysis. Abreviations: ALC (Alcyonaria), ALG (Algae), ANT (Anthozoa), ASC (Ascidiacea), AST (Asteroidea), BIV (Bivalvia), BRA (Brachiopoda), BRY (Bryozoa), CEP (Cephalopoda), CRI (Crinoidea), CRU (Crustacea), DEC (Decapoda), ECN (Echinoidea), ECU (Echiurida), GAS (Gastropoda), GOR (Gorgonaria), HOL (Holothuroidea), HYD (Hydrozoa), ISO (Isopoda), OPH (Ophiuroidea), PEN (Pennatularia), PIS (Pisces), POC (Polychaeta), POP (Polyplacophora), POR (Porifera).

(a) Community table with all taxa used for the community analysis and all other calculations.

		presence (%)	total abundance (n/10m^2)	abundances per cluster (n/10m^2)* SNE	S	DE 1	DE 2	OS
photographs (n)			1753	275	674	345	156	303
area photographed (m^2)			1577.7	247.5	606.6	311	140.4	272.7
Celleporinidae sp. 1	BRY	6.7	0.06		0.16			
Asteroidea sp. 13	AST	6.7	0.02		0.03			0.04
Asteroidea sp. 14	AST	6.7	0.06		0.15			
Asteroidea sp. 22	AST	13.3	0.12		0.30		0.07	
Osthimosia sp. 1	BRY	15.6	0.28		0.46	0.13		0.47
Asteroidea sp. 24	AST	17.8	0.11		0.18	0.03		0.18
Cidaridae sp. 1	ECN	13.3	0.18		0.07			0.92
Asteroidea sp. 27	AST	11.1	0.08		0.15	0.06	0.07	
Natantia sp. 2	CRU	6.7	0.04		0.07			0.07
Gastropoda sp. 3	GAS	6.7	0.06		0.15			
Smittina sp. 1	BRY	15.6	0.20		0.41	0.13		0.07
Colyptraster tenuissimus (?)	AST	6.7	0.03		0.05	0.03		0.04
Porifera sp. 24	POR	6.7	0.39		1.01			
Psolus patagonicus	HOL	6.7	1.35		3.51			
Dendrochirotida sp. 2	HOL	13.3	0.41		0.66	0.80		
Gorgonaria sp. 1	GOR	13.3	2.81		6.61	1.35		
Alcyonaria sp. 1	ALC	11.1	0.27		0.61	0.16		
Ophiuroidea sp. 5	OPH	17.8	15.50		39.02	2.19	0.57	0.11
Apodida sp. 1	HOL	20.0	4.68		12.15	0.06		
Algae / Bryozoa sp. 1		17.8	0.13					0.77
Mytilus chilensis	BIV	11.1	0.10	0.04				0.55
Crinoidea sp. 1	CRI	8.9	0.39					2.27
Synascidian sp. 6	ASC	17.8	4.03		0.66			21.86
Ascidiacea sp. 8	ASC	13.3	3.44					19.88
Porifera sp. 55	POR	13.3	1.59					9.20
Celleporinidae sp. 4 (%)	BRY	13.3	1.03					5.98
Bryozoa sp. 28	BRY	13.3	2.16					12.47
Polyplacophora sp. 1	POP	31.1	1.67	0.04	0.82			7.77
Lanice (?) spp.	POC	26.7	8.53	0.12	10.12	1.48		25.01
Lithothamnion sp. or *Messophyllum* sp.	ALG	22.2	6.35	1.15	16.05			
Algae sp. 3 (%)	ALG	35.6	6.84	4.69	15.7	0.21		0.13
Chaetopterus (?) spp. or large Serpulidae (%)	POC	40.0	2.73	0.53	6.85	0.05		
Serpulidae spp.	POC	31.1	3.51		8.18	1.45		0.44
Echinoidea sp. 2	ECN	28.9	0.28	0.32	0.51	0.03		0.15
Callophyllis variegata, C. atrosanguinea, or *Iridaea codata*	ALG	35.6	10.46	37.29	11.98			
Munida subrugosa	CRU	64.4	28.14	69.94	42.25	0.06		5.28
Macrocystis pyrifera	ALG	37.8	1.49	3.21	2.53	0.06		
Peltarion spinosulum	CRU	51.1	1.86	4.61	2.74	0.06	0.85	
Nototheniidae sp. 1	PIS	35.6	0.23	0.36	0.38	0.06	0.07	0.07
Cosmasterias lurida	AST	31.1	0.57	0.24	1.37	0.03		
Anthozoa sp. 25	ANT	31.1	0.34		0.87	0.03		
Celleporinidae sp. 3	BRY	48.9	1.44	0.04	3.36	0.29		0.48
Porifera (?) sp. 2	POR	42.2	2.23		4.53	2.48		
Trophon sp.	GAS	35.6	0.29	0.65	0.46	0.03		
Pseudechinus magellanicus and/or *Loxechinus albus*	ECN	33.3	3.68		8.54	0.10		2.16
Photinula caerulescens	GAS	24.4	0.77	0.08	1.95	0.03		0.04
Gastropoda sp. 2	GAS	33.3	0.22	0.12	0.46	0.03		0.07
Ophiacantha vivipara	OPH	73.3	58.91	25.21	136.75	1.93	13.32	4.73
Pagurus gaudichaudii or *P. comptus*	CRU	64.4	10.45	10.14	18.63	0.06		9.75
Terebratula dorsata or *Magellania venosa*	BRA	57.8	27.10	0.48	68.41	0.50		3.59
Caliptraea pileolus	GAS	46.7	7.72	0.93	18.02	0.16		3.56
Chlamys patagonica and/or *C. vitrea*	BIV	66.7	27.32	0.36	25.34	1.32	0.07	99.82
Smittina sp. 2 (%)	BRY	37.8	3.73		8.61			2.42
Cyclostomata sp. 2 (%)	BRY	53.3	4.20		10.48	0.27	0.07	0.64
Reteporella magellensis (%)	BRY	33.3	0.60		0.85	0.06		1.50
Porifera sp. 1	POR	26.7	1.54		3.66			0.77
Ulva lactuca (%)	ALG	11.1	0.03	0.06	0.06			
Brachyura spp.	CRU	8.9	0.08	0.40	0.03			0.04
Polisiphonia anisogona (%)	ALG	15.6	1.90	5.25	2.80			0.02

TABLE 2. (Cont.) – Abundances of all mega-epibenthic taxa, investigated by underwater photography for station clusters, with presences and total abundances for the entire area of investigation. Taxa ordered according to result of cluster analysis.

(a) Community table with all taxa used for the community analysis and all other calculations.

		presence (%)	total abundance (n/10m²)	abundances per cluster (n/10m²)*				
				SNE	S	DE 1	DE 2	OS
photographs (n)			1753	275	674	345	156	303
area photographed (m²)			1577.7	247.5	606.6	311	140.4	272.7
Eurypodius latreillii	CRU	33.3	0.38	0.24	0.65	0.06	0.14	0.44
Pareuthria plumbea (?)	GAS	24.4	0.20	0.12	0.41		0.14	0.04
Gastropoda sp. 10	GAS	15.6	0.11	0.16	0.16	0.10		
Macrocystis sp. / *Lessonia* sp. (%)	ALG	8.9	0.57	0.08	1.44			
Gastropoda sp. 12	GAS	13.3	0.08	0.12	0.15			
Asteroidea sp. 16	AST	6.7	0.04		0.12			
Venus antiqua (?)	BIV	6.7	0.03		0.08			
Synascidian sp. 2	ASC	17.8	56.16	233.98	50.59			0.04
Ascidiacea sp. 4	ASC	15.6	234.73	0.12	609.83	1.09		0.15
Synasc./Porif./Asc. sp. 1		8.9	44.65					258.34
Ascidiacea sp. 7	ASC	6.7	26.22		10.42			128.49
Laternula sp.	BIV	11.1	5.67	10.71				23.10
Gorgonaria sp. 4	GOR	8.9	0.35		0.20	0.03		1.58
Hydrozoa/Gorgonaria sp. 1		8.9	1.46		0.12			8.18
Asteroidea sp. 30	AST	8.9	0.03		0.03			0.07
Crinoidea sp. 2	CRI	6.7	0.19					1.10
Carbasea ovoidea	BRY	13.3	0.34					1.96
Gastropoda sp. 18	GAS	6.7	0.41					2.35
Gorgonaria sp. 5	GOR	6.7	0.21					1.21
Fussitriton sp. (?)	GAS	11.1	0.06		0.05			0.22
Bryozoa sp. 18 (%)	BRY	6.7	0.04					0.22
Aspidochirotida sp. 2	HOL	11.1	0.09		0.03	0.29		0.11
Natantia sp. 1	CRU	20.0	0.27			0.84	0.64	0.26
Serpula narconensis (?)	POC	28.9	5.86		2.93	11.06		14.74
Hornera sp. 1 (%)	BRY	28.9	0.29		0.27	0.21		0.86
Synascidian sp. 3	ASC	20.0	12.90		33.10	0.55		0.37
Cyclostomata (?) sp. 1	BRY	11.1	19.62		50.53	1.00		
Adeonella sp. 2 (%)	BRY	24.4	1.30		3.33	0.03	0.04	0.04
Celleporinidae sp. 2	BRY	22.2	0.86		2.13	0.13		0.07
Ascidiacea sp. 6	ASC	11.1	3.32		8.24			0.88
Solaster regularis	AST	6.7	0.06		0.16			
Holothuroidea (?) sp. 12	HOL	6.7	0.55		1.43			
Synascidian sp. 1	ASC	40.0	5.53	0.16	8.24	11.86		
Dendrochirotida sp. 3	HOL	17.8	2.54		5.24	2.67		
Ophiuroglypha lymani	OPH	44.4	3.72		1.45	6.37	3.63	9.13
Dendrochirotida sp. 1	HOL	31.1	5.80		5.51	18.68		
Trypilaster spp.	ECN	28.9	1.87		0.03	4.50	10.9	
Ophiocten amitinum	OPH	26.7	20.19		0.02	101.83	0.14	0.55
Anthozoa sp. 11	ANT	13.3	3.21		0.02	16.11	0.36	
Anthozoa sp. 5	ANT	13.3	1.20		0.08	5.40	1.14	
Anthozoa sp. 4	ANT	8.9	0.17		0.02	0.42	0.93	
Ascidiacea sp. 2	ASC	8.9	0.04	0.04	0.07	0.03		
Haplosclerida sp. 2	POR	6.7	0.07		0.13	0.10		
Lophaster (?) spp	AST	8.9	0.03		0.02	0.10		
Ascidiacea sp. 1	ASC	8.9	0.10		0.03	0.42		
Odontocymbiola sp.	GAS	17.8	0.06		0.08	0.06		0.07
Ascidiacea sp. 3	ASC	15.6	1.32	0.12	3.12	0.55		
Flustridae sp. 1 (%)	BRY	11.1	0.11		0.26	0.06		
Serolidae spp.	ISO	15.6	0.25	1.21	0.16			
Gellidus rudis (?)	POR	6.7	0.06	0.04	0.15			
Labidiaster radiosus / *(Solaster regularis)*	AST	13.3	0.04		0.12			
Porania antarctica	AST	26.7	0.29		0.64	0.23		
Alcyonidium australe (%)	BRY	20.0	2.68	0.02	6.95	0.02		
Ganeria spp or *Asterodon* spp	AST	8.9	0.03		0.07	0.03		
Campylonotus vagans	CRU	6.7	0.06		0.16			
Porifera sp. 8	POR	8.9	0.04		0.10	0.03		
Bathybiaster loripes	AST	6.7	0.03			0.10		0.07
Asteroidea sp. 1	AST	11.1	0.04		0.03	0.16		
Trophon geversianus or *Ximenopsis muriciformis*	AST	8.9	0.04		0.02			0.18
Carberea darwini (%)	GAS	6.7	0.01					0.06
Porifera (?) sp. 52, (Synascidian?)	BRY	6.7	0.02					0.11
Errinopora spp (%)	HYD	11.1	0.18		0.01			1.03
Bryozoa sp. 27	BRY	8.9	0.38					2.20
Bryozoa sp. 26	BRY	6.7	0.12		0.13			0.40

TABLE 2. (Cont.) – Abundances of all mega-epibenthic taxa, investigated by underwater photography for station clusters, with presences and total abundances for the entire area of investigation. Taxa ordered according to result of cluster analysis.

(b) Taxa not used for the community analysis but all other calculations e.g. diversity.

		presence (%)	total abundance (n/10m^2)	abundances per cluster (n/10m^2) *				
				SNE	S	DE 1	DE 2	OS
Axinellidae (?) spp.	POR	4.4	0.79					4.58
Cinachyra (?) spp.	POR	4.4	0.02		0.05			
Haplosclerida sp. 1	POR	4.4	0.22					1.28
Mycale magellanica (?)	POR	4.4	0.05					0.29
Porifera sp. 17	POR	2.2	0.01			0.06		
Porifera (?) sp. 32	POR	4.4	0.02		0.02			0.07
Porifera (?) sp. 33	POR	4.4	0.94					5.43
Porifera (?) sp. 34	POR	4.4	2.41					13.97
Porifera (?) sp. 35	POR	4.4	0.86					4.99
Porifera sp. 44	POR	4.4	0.05					0.29
Porifera sp. 46	POR	4.4	0.48					2.75
Smittina/*Parasmittina* sp. 1	BRY	4.4	0.05		0.13			
Smittinidae sp. 1	BRY	4.4	0.11		0.30			
Cellaria sp. 1 (%)	BRY	2.2	0.01		0.02			
Adeonella sp. 1 (%)	BRY	2.2	0.01			0.03		
Cyclostomatida sp. 1 (%)	BRY	2.2	0.01					0.04
Cheilostomatida sp. 1 (%)	BRY	2.2	<0.01					0.02
Stylasteridae sp. 1	HYD	2.2	0.01		0.02			
Hydrozoa sp. 4	HYD	4.4	0.35				0.07	2.02
Hydrozoa sp. 6	HYD	4.4	0.86					4.99
Scleractinaria spp.	ANT	4.4	0.16					0.95
Anthozoa sp. 1	ANT	4.4	0.03		0.03	0.06		
Anthozoa sp. 2	ANT	2.2	0.01			0.03		
Anthozoa sp. 6	ANT	2.2	0.04		0.12			
Anthozoa sp. 10	ANT	4.4	1.30			6.59		
Anthozoa sp. 12	ANT	2.2	0.01			0.06		
Anthozoa sp. 13	ANT	2.2	0.10			0.51		
Anthozoa sp. 15	ANT	4.4	0.82					4.77
Anthozoa sp. 19	ANT	4.4	0.01					0.07
Anthozoa sp. 20	ANT	4.4	0.13					0.73
Anthozoa sp. 21	ANT	2.2	0.07					0.40
Anthozoa sp. 24	ANT	2.2	0.01		0.03			
Anthozoa sp. 26	ANT	4.4	0.02		0.05			
Alcyonaria sp. 2	ALC	2.2	0.01		0.03			
Alcyonaria sp. 3	ALC	2.2	0.01		0.02			
Pennatularia sp. 1	PEN	2.2	0.02		0.05			
Gorgonaria sp. 7	GOR	2.2	0.01					0.07
Gorgonaria sp. 8	GOR	4.4	0.17		0.43			0.04
Gorgonaria sp. 9	GOR	2.2	0.01					0.04
Gorgonaria sp. 3	GOR	4.4	0.03			0.03		0.15
Aulacomya ater	BIV	2.2	0.06		0.16			
Bivalvia sp. 1	BIV	2.2	0.01			0.03		
Octopoda spp.	CEP	4.4	0.01					0.04
Echiuroidea sp. 1	ECU	2.2	0.07			0.35		
Praxillune spp.	POC	2.2	0.53					3.08
Paralomis granulosa	CRU	4.4	0.03	0.08	0.05			
Reptantia sp. 1	CRU	2.2	0.01			0.06		
Crustacea sp. 6	CRU	2.2	0.06			0.32		
Aspidochiorodida sp. 1	HOL	4.4	0.03		0.02	0.10		
Holothuroidea sp. 14	HOL	4.4	0.05		0.13			
Asteroidea sp. 6	HOL	2.2	0.01		0.02			
Asteroidea sp. 8	AST	4.4	0.02		0.05			
Asteroidea sp. 17	AST	4.4	0.04		0.10			
Cycethra verrucosa (or *Ganeria falklandica*)	AST	2.2	0.01		0.02			
Ceramaster spp or *Odontaster* spp	AST	2.2	0.02		0.05			
Asteroidea sp. 26	AST	4.4	0.01		0.02	0.03		
Asteroidea sp. 28	AST	4.4	0.01		0.02	0.03		
Ceramaster patagonicus or *Odontaster* spp	AST	4.4	0.03		0.08			
Asteroidea sp. 39	AST	2.2	0.02					0.11
Asteroidea sp. 40	AST	2.2	0.01					0.04
Ophioscolex nutrix	OPH	4.4	0.17			0.84		0.07
Gorgonocephalus chilensis	OPH	4.4	0.02			0.03		0.04
Ophiuroidea sp. 6	OPH	4.4	0.01		0.02	0.03		
Ascidiacea sp. 5	ASC	2.2	0.01		0.03			
Synascidian sp. 4	ASC	4.4	1.42			7.20		
Synascidian sp. 5	ASC	2.2	0.13			0.64		
Synascidian sp. 7	ASC	4.4	14.05					81.30

TABLE 2. (Cont.) – Abundances of all mega-epibenthic taxa, investigated by underwater photography for station clusters, with presences and total abundances for the entire area of investigation. Taxa ordered according to result of cluster analysis.

(b) Taxa not used for the community analysis but all other calculations e.g. diversity.

		presence (%)	total abundance (n/10m^2)	abundances per cluster (n/10m^2) * SNE	S	DE 1	DE 2	OS
Synascidian sp. 10	ASC	2.2	0.04		0.12			
Chondrichthyes sp. 1 (unknown for the area)	PIS	4.4	0.01		0.02	0.03		
Congiopodus peruvianus	PIS	2.2	0.01			0.03		
Coelorhinchus fasciatus (?)	PIS	4.4	0.03	0.04	0.05			
Lepidion ensiferus (?)	PIS	2.2	0.01					0.04
Macrouridae sp. 1	PIS	2.2	0.01			0.03		
Myxinidae sp. 1	PIS	2.2	0.01		0.02			
Nototheniidae or Bovichthidae *(Cottoperca)*	PIS	2.2	0.01		0.02			
Rajidae sp. 1 (unknown for the area)	PIS	2.2	0.07		0.18			
Desmarestia confervoides, D. distans, or *D. anceps* (%)	ALG	4.4	0.39		1.01	0.02		
Algae sp. 21	ALG	2.2	2.91		7.58			
Algae / Bryozoa sp. 2		2.2	<0.01					0.02
indet. sp. 7		4.4	0.02			0.06	0.07	
indet. sp. 12		4.4	0.01					0.07

(c) Taxa of coarse identification level, not used for the community analysis and diversity calculation.

Porifera spp.	57.8	2.39	1.41	2.18	1.90		5.54
Bryozoa spp. (%)	31.1	0.10		0.09	0.02		0.35
Hydrozoa spp.	6.7	0.04					0.26
Anthozoa spp.	26.7	0.30		0.18	0.29	0.14	0.92
Alcyonaria spp.	2.2	0.01		0.02			
Gorgonaria spp.	17.8	0.38		0.23		0.07	1.65
Gastropoda spp.	26.7	0.15	0.04	0.18			0.44
Bivalvia spp.	6.7	0.02		0.03		0.07	
Polychaeta spp.	15.6	0.09		0.10	0.13		0.15
Crustacea spp.	42.2	0.22	0.24	0.28	0.03	0.07	0.33
Pycnogonida spp.	17.8	0.08	0.04	0.10	0.10		0.07
Holothuroidea spp.	13.3	0.05		0.13			
Crinoidea spp.	8.9	0.03					0.18
Echinoidea spp.	13.3	0.05		0.05			0.18
Asteroidea spp	37.8	0.37		0.82	0.19		0.07
Ophiuroidea spp.	26.7	0.52		0.46	0.19	0.07	1.72
Ascidiacea spp.	20.0	0.19		0.08	0.06		0.84
Synascidians spp.	15.6	0.22		0.05			1.17
Pisces spp.	6.7	0.02		0.03			0.04
Algae spp. (%)	37.8	0.18	0.14	0.20	0.03	0.11	0.40
indet. spp.	4.4	0.23					1.32
∑ (total)	100.0	768.12	415.41	1325.08	221.06	33.83	849.92
number of t˙axa	234		47	161	104	27	127

* Taxa for which no abundances but the cover of the sediment surface was determined are indicated by (%) after the name of the taxon.

Diversity

The calculations were based on all organisms identified to the genus and/or species level including rare taxa. The Shannon index (using $\log_e$; Shannon and Weaver, 1964) was calculated separately for each station (alpha diversity) and in addition, for the complete set of data of each cluster (overall diversity). High values indicate a combination of many species and an even distribution of the specimens over the species. The evenness was determined by the Pielou index (Pielou, 1977) which is independent from the number of taxa. Values close to the maximum of 1 show uniform abundances of the taxa. The values for the station groups, which result from cluster analysis, were compared by a Wilcoxon test (2-tailed, $p<0.05$).

Relationship between physical and biological data (after Clarke and Ainsworth, 1993)

Six physical parameters were used for the BIOENV analysis: water depth, abundance of photographs with more than 5% cover of the sediment by phytodetritus, with soft sediment surface (no structure indicating sandy sediment recognizable on

the photographs), with sand and gravel (sandy structure with grain size < 1cm diameter visible), with more than 10 stones (>1cm diameter), and with more than 5% cover of the sediment by biogenic debris. None of these parameters were correlated when tested by pairs ($p<0.05$, $r<0.65$). Corresponding to the biological similarity matrix between stations (see above) the data set for the physical factors was calculated by the Euclidean distance. Finally, the Spearman rank correlation was calculated between these similarity matrices. Concerning the physical data the calculation was performed for the single parameters and for all their possible combinations.

RESULTS

A total of 121,202 megabenthic specimens were counted on 1753 underwater photographs from 45 stations. This includes values of the percent cover of the sea-floor by taxa which could not be counted (e.g. bryozoans and algae). A total of 226 taxa were separated. For an additional 10 stations a classification of the species assemblages was possible based on the occurrence of firstly calculated key taxa. Total average abundances, presences with reference to all 45 stations analyzed in detail, and abundances per station cluster are given in Table 2. In Table 2a the stations and taxa are ordered according to the result of the cluster analysis. The 82 taxa listed in Table 2b were additionally used for the diversity calculations but not in the cluster analysis or MDS. Table 1c contains 21 taxa of a coarse identification level. All species not shown in Fig. 4, but mentioned in the text and in Table 3 (key species), which were not determined, are briefly described in the annex. Due to technical reasons during the analysis the names of a few undetermined species are not consecutively numbered.

Abundances and presences

Highest abundances per station were found for Ascidiacea sp. 4 (9570.3/10m^2, stn 1219 and 698.9/10m^2, stn 1312), synascidian sp. 1 (1572.2/10m^2, stn 1167 and 685.3/10m^2, stn 1219), the brittle star *Ophiacantha vivipara* (1273.3/10m^2, stn B), and the bryozoan *Cyclostomata* (?) sp. 1 (888.0/10m^2, stn 1239). In the total area of investigation the decapod crustacean *Munida subrugosa*, the brachiopod(s) *Terebratula dorsata* / *Magellania venosa*, the bivalve(s) *Chlamys patagonica* / *C. vitrea*, Ascidiacea sp. 7 and the brittle star *Ophiocten amitinum* had abundances >20/10m^2 (Table 1) in addition to the above mentioned taxa. However, 74% of all taxa were rare (<1/10m^2) and 44% were very rare (<0,1/10m^2). Taxa with highest presence values (found at >60% of all stations) were *O. vivipara*, *Chlamys patagonica* / *C. vitrea*, *M. subrugosa*, and the hermit crabs *Pagurus gaudichaudii* and/or *P. comptus* whereas 56% had low presences (<10%). Highest abundances for all taxa (>2000/10m^2) were counted at station 1219 (eastern entrance of Beagle Channel), station 112A (offshore), station B (Beagle

TABLE 3. – Key taxa which serve as discriminators between one cluster and the rest of the stations (according to Clarke, 1993).

taxa		cluster	averaged abundance within the cluster	averaged abundance outside the cluster	d_i average dissimilarity	$d_i/SD(d_i)$
Peltarion spinosulum	(CRU)	SNE	4.63	1.32	2.12	1.31
Munida subrugosa	(CRU)	SNE	70.46	19.93	4.36	1.22
Porifera (?) sp. 2	(POR)	S	4.52	0.77	1.56	1.51
Anthozoa sp. 25	(ANT)	S	0.88	0.01	1.05	1.49
Celleporinidae sp. 3	(BRY)	S	3.37	0.25	1.39	1.46
Cosmasterias lurida	(AST)	S	1.39	0.07	1.01	1.27
Ophiuroglypha lymani	(OPH)	DE 1	5.83	1.40	2.34	1.50
Trypilaster spp.	(ECN)	DE 1	4.50	1.25	2.05	1.17
Dendrochirotida sp. 1	(HOL)	DE 1	18.12	2.67	2.61	1.14
Trypilaster spp.	(ECN)	DE 2	11.10	1.00	3.80	1.66
Algae / Bryozoa sp. 1		OS	0.79	0.00	1.27	3.54
Bryozoa sp. 28	(BRY)	OS	12.50	0.00	2.12	1.51
Synascidian sp. 6	(ASC)	OS	22.32	0.32	2.39	1.50
Celleporinidae sp. 4	(BRY)	OS	6.02	0.00	1.68	1.44
Polyplacophora sp. 1	(POP)	OS	8.02	0.38	1.71	1.42
Ascidiacea sp. 8	(ASC)	OS	20.85	0.00	2.14	1.40

FIG. 4. – Underwater photographs from the Magellan region (area photographed approximately 0.6m^2). Fotos: J. Gutt, A. Buschmann, T. Schickan. a) Stn 1148 (SNE), 15 m: *Munida subrugosa*. b) Stn 1193, 64 m: *Paralomis granulosa*. c) Stn 880 (S), 56 m: *Chaetopterus* spp. or large Serpulid, *Porania antarctica*. d) Stn 927 (S), 40 m: *Terebratula dorsata* / *Magellania venosa*, *Alcyonidium australe*, Echinoidea sp. 2. e) Stn 1035 (S), 45 m: *Cosmasterias lurida*, *Psolus patagonicus*. f) Stn 1217 (S), 67 m: Synascidian sp. 2. g) Stn 885 (DE 1), 246 m: Aspidochirotida sp. 1, Reptantia sp. 1 (large), Crustacea sp. 6 (several small specimens, juveniles of Reptantia sp. 1?), *Ophiuroglypha lymani*. h)Stn 1041 (DE 1), 210 m: *Ophiuroglypha lymani*, Aspidochirotida sp. 2. i) Stn 1030 (DE 2), 370 m: *Trypilaster* spp., *Ophiuroglypha lymani*. j) Stn 1073 (DE 2), 314 m: *Coelorhinchus fasciatus* (?). k) Stn 110 (OS), 100 m: Bryozoa sp. 28 (rosate, encrusting), *Chlamys patagonica* or *C. vitrea*. l) Stn 110 (OS): *Smittina* sp. 2, *Chlamys patagonica* or *C. vitrea*. m) Stn 110 (OS): Porifera sp. 45 (left, grey with oscula), *Smittina* sp. 2 (orange, lower margine), *Errinopora* spp. (red, branched), *Chlamys patagonica* or *C. vitrea*, *Pseudechinus magellanicus*, Algae/Bryozoa sp. 1 (cushion-shaped, brush-like surface, centre right). n) Stn 112 (OS) 400 m: Gorgonaria sp. 7. o) Stn 113 (OS) 200 m: *Odontocymbiola* sp., Polyplacophora sp. 1.

Channel), and station 1293 (Brecknock Channel), lowest values (<40/10m^2) were found at stations 1073, 1079, and F (all Beagle Channel).

Community analysis and key taxa

The stations were grouped into five clusters at a similarity level of 4%: "shallow, north and east (SNE)", "shallow (S)", "deep 1 (DE 1)", "deep 2 (DE 2)", and "offshore (OS)". This grouping could also be recognized in the MDS plot (Fig. 3). For the taxa 13 clusters were created at the 0% similarity level. Taxa and stations were ordered in Table 2a according to these results. In Fig. 4, some examples are presented for the various clusters and key species.

In station cluster SNE, synascidians were most common followed by crustaceans (Fig. 5a), to which both best discriminator species, *Peltarion spinosulum* and *Munida subrugosa* belonged (Table 3). The latter species reached even higher abundances at a few stations of cluster S, however, it was much more evenly distributed in cluster SNE. On a coarse taxonomic level these two clusters have a similar composition although in cluster S the solitary and in cluster SNE the compound ascidians were dominant. On the other hand the key taxa of cluster S differed totally: one sponge (?), one anthozoan, one bryozoan, and the asteroid *Cosmasterias lurida*. The average abundances were less than half in cluster SNE compared with cluster S which included one extremely high value of 10,650/10m^2 (Fig. 6). The two deep clusters, DE 1 and DE 2 were dominated by echinoderms with a considerable percentage of holothurians in cluster DE 1 and of echinoids in cluster DE 2. For DE 1 three taxa from three different classes of echinoderms turned out to be the best key taxa: *Ophiuroglypha lymani* (Ophiuroidea), Dendrochirotida sp. 1 (Holothuroidea), and *Trypilaster* spp. (Echinoidea), which was also the only key taxon for cluster DE 2. In terms of total abundance cluster DE 1 was comparable to cluster SNE, and cluster DE 2 was the poorest. In cluster OS the dominant groups were most evenly distributed: synascidians, Ascidiacea, Polychaeta, Bivalvia, Porifera, and Bryozoa. For this cluster the highest number of good key taxa which belonged to a variety of systematic groups were calculated: Algae/Bryozoa sp. 1, Bryozoa sp. 28 , Celleporinidae sp. 4, *Reteporella magellensis* (both Bryozoa), Polyplacophora sp. 1, Ascidiacea sp. 8, and synascidian sp. 6. The median for the abundance was similar to that of cluster S.

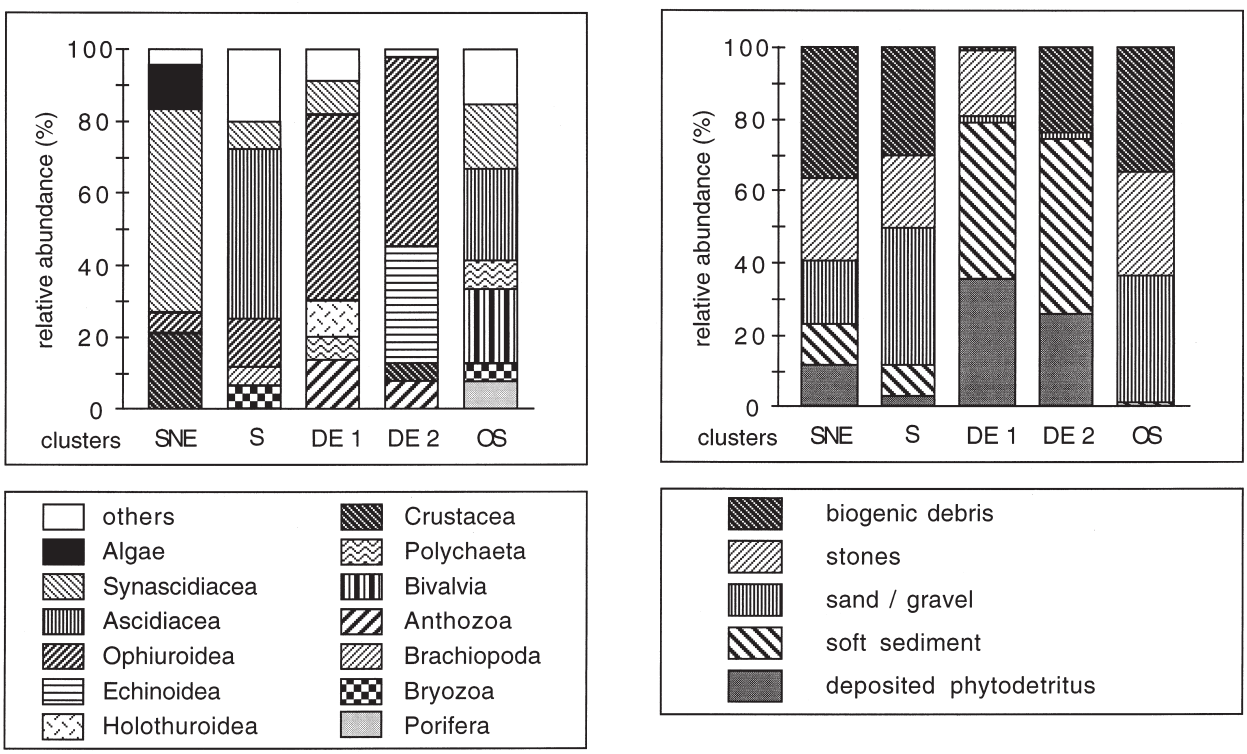

FIG. 5. – Relative abundance (dominance) of higher taxa (left), only values >5% per cluster considered, and sediment characteristics (right) for the five assemblages of taxa.

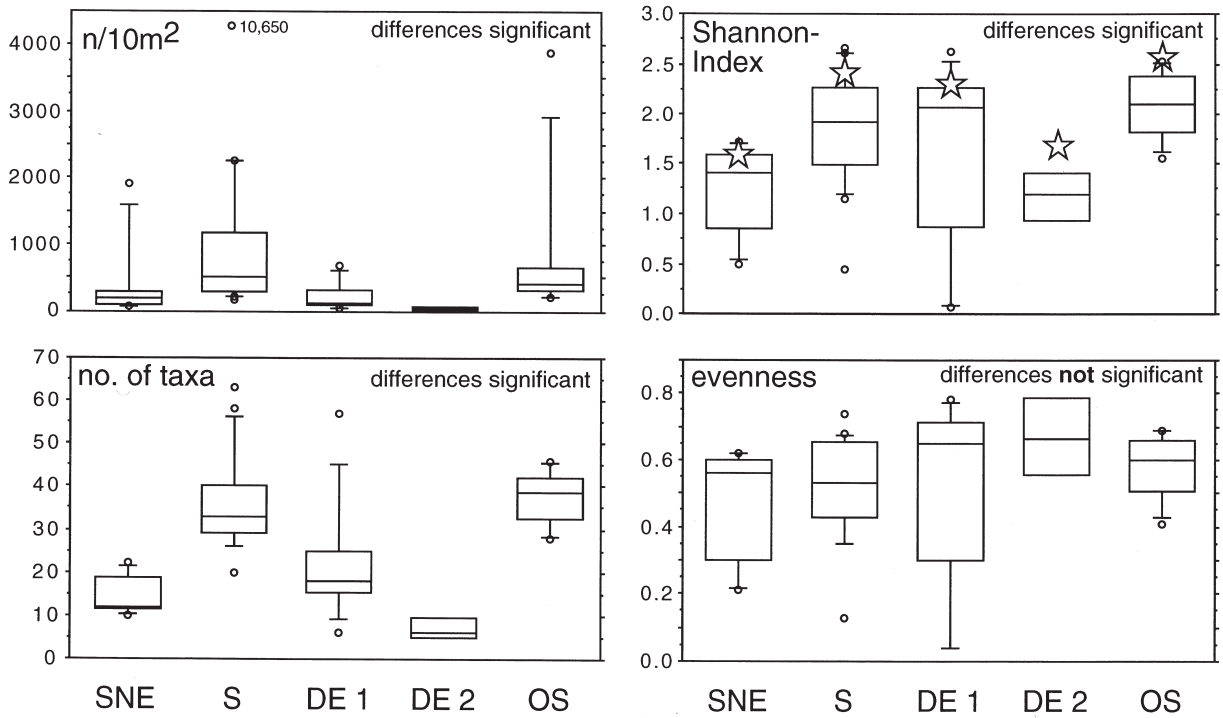

FIG. 6. – Number of taxa, absolute abundance, diversity and evenness for the five assemblages of taxa. Box plots indicate median (central line), 25% and 75% percentils (lower and upper line of the box), 10% and 90% percentils (lower and upper limit of vertical line), and single values outside the 10% and 90% limits (circles). Diversities for the complete data set per station cluster (overall diversity) are shown as stars.

Diversity

The number of taxa (only those of a fine determination level considered, see Table 2a and 2b) was highest for the stations of cluster S and OS with a maximum of 63 taxa at stn 1299 (Fig. 6). Cluster DE 1 performed the widest range (14-57) in this parameter. The other clusters, SNE and DE 2 had less than 25 and 10 taxa per station, respectively. A Kruskal-Wallis test ($p<0.05$, 2-tailed) showed that the numbers of taxa did not belong to one statistical population. Highest diversity values (Shannon index) were calculated also for the clusters S, DE 1, and OS of which again cluster DE 1 had the widest range from 0.07 to 2.63. The medians for the two other clusters, SNE and DE 2 were between 1.2 and 1.5, which led to significant differences between the clusters. The evenness values did not differ significantly from each other, however, the highest value was reached by cluster DE 2 which was poorest in abundance, number of taxa and diversity.

Relationship between physical and biological data

The relative abundance of photographs with the sediment characteristics for the five clusters is shown in Fig. 5b. The relationship between the biological pattern and these physical parameters together with water depth showed the highest correlation coefficient (0.56) when the combination of depth, soft sediment, and debris was considered (Table 3). The same calculation for single physical parameters led to correlation coefficients ≤ 0.51.

TABLE 4. – Results of the BIOENV analysis (according to Clarke and Ainsworth, 1993). Highest rank-correlation coefficients (r) are listed for relationships between megabenthic distribution and one combination of environmental factors, and single environmental factors indicated by X.

number of abiotic parameters	Spearman correlation coefficient (r)	depth	phyto-detritus	soft sediment	sandy sediment	stones	biogenic debris
3	0.56	X		X			X
1	0.51	X					
1	0.32						X
1	0.26			X			

DISCUSSION

The faunistic and ecological results yielded clear differences in the structure of the mega-epibenthos for the area of investigation. This was obvious for the number and composition of taxa and life forms, e.g. feeding types, their abundance, and diversity. Despite these differences between single stations, the benthos exhibited rather a continuum between different species assemblages than distinct communities which therefore could be classified only with difficulties. As a consequence the hypotheses put forward in the introduction could only be confirmed or rejected based on trends:

The hypothesis that the shallower benthos (clusters SNE and S) is more heterogenous than the deeper benthos (clusters DE 1 and DE 2) was not confirmed. For both depth ranges two separate clusters were calculated. If in terms of dominant taxa the shallow stations would differ more from each other than the deeper stations, we would expect a relatively low alpha and a high overall diversity for the shallow stations and similar values for alpha and overall diversity for the deeper stations. Our results showed, however, at each depth level one cluster with an overall diversity being close to the average of the alpha diversity (clusters SNE and DE 1) and one cluster with a slightly higher overall than alpha diversity (clusters S and DE 2). Also the deeper clusters differed considerably in most of the above mentioned structural characteristics. However, there are indications for a more heterogenous benthos in the shallower areas. Firstly, the abundances of the shallow stations showed a broader range than those of the deeper clusters. Secondly, the key species of the clusters SNE and S differed significantly. The benthic assemblage of cluster SNE was characterized by two reptant decapod custaceans: the brachyuran *Peltarion spinosulum* and the anomuran *Munida subrugos*a whereas for cluster S one sponge, one anthozoan, one bryozoan, and the asteroid *Cosmasterias lurida* were calculated to be the best discriminating taxa. For cluster DE 2 only one key taxon, the sea urchins *Trypilaster* spp. were found, which belonged also to the key taxa of cluster DE 1, where in addition two more echinoderms were determined as key taxa: *Ophiuroglypha lymani* and Dendrochirodida sp. 1. From this we conclude that cluster DE 2 represented an extremely impoverished fauna of the DE 1 assemblage. Also in the environmental factors some differences within both depth ranges were obvious. The heterogeneity in shallow waters might be the effect of complex environmental processes which led to a more than twofold higher value for sand/gravel in cluster S than in cluster SNE. The sediments in the deeper clusters differed in the absence of debris and presence of stones in DE 1 and reverse conditions in DE 2. At a few stations in the Paso Ancho investigated by Lorenti and Mariani (1997) the isopod fauna exhibited extreme variations between stations with similar water depths which confirms our general result of a certain heterogeneity independent from water depth.

Stations close to the coast and at slopes represented either by shallow stations in the channel system (clusters S and SNE) or by the offshore stations close to the continental shelf break (cluster OS), and stations at the bottom of the channels (clusters DE 1 and DE 2) differed considerably. The fauna of the entire depth range between 15 and 430 m was numerically dominated by filter feeders, mainly by ascidians inside the channel system and, in addition, sponges, polychaetes and bivalves at the offshore stations. Also crustaceans belonged to the most abundant taxa in cluster S, of which one, *Munida subrugosa* occurred with a relatively high presence also in cluster OS. At the bottom of the channels (clusters DE 1 and DE 2) deposit feeders and omnivorous echinoderms were dominant. One exception concerning dominance and the role as a key taxon is the filter-feeder Dendrochirotida sp. 1, which lives partly infaunally. Also in other regions, e.g. the high Antarctic shelf, such holothurians belong to benthic communities with a poor sessile fauna (Gutt, 1991a; 1991b). Another exception were anthozoans which were relatively more abundant in both deeper clusters than in shallow or offshore areas. Also the sediment characteristics of the offshore cluster OS were more similar to the two shallow (slope) clusters despite the clear difference in water depth. Here the almost total lack of soft sediment and deposited phytodetritus indicates an even higher current velocity than inside the channel system from which the suspension feeders profit most. The amount of phytodetritus may also have been influenced by the different times when the photographs were taken (early summer and autumn, respectively). These results, showing a coarser sediment in the northern Straits of Magellan and the eastern entrance of the Beagle Channel, are in accordance with Brambati *et al.* (1991) and Colizza (1991). At the bottom of the channel system, in both deeper clusters DE 1 and DE 2, the high abundance of soft sediment and

deposited phytodetritus indicates a low current velocity at these stations. Differences in current velocity might also be the reason why based on a statistical comparison the benthic structure could be best explained by the combination of the environmental parameters water depth, soft sediment, and biogenic debris. Also Mariani *et al*. (1996) conclude from their results on polychaetes and isopods in the Straits of Magellan that at a medium spatial scale different environmental situations create a "diversified mosaic of biotopes".

There were only partly differences between the benthos of the narrow Beagle Channel and the wide Straits of Magellan at least on the level of distinction referred to in this paper. In the Beagle Channel we found two assemblages (S and DE 1) which occurred also in the rest of the area of investigation, especially in the Straits of Magellan. The very poor deep cluster (DE 2) was restricted to the Beagle Channel. Two reasons can be assumed for the impoverished epifauna in this cluster: the effect of glaciers with a high input of inorganic particles, and general characteristics at the bottom of such troughs such as a low current velocity, with the consequence of high sedimentation rates of particulate organic matter leading to a dominance of soft sediments. Another hint for the relevance of glaciers for the epibenthos are the two stations directly in front of the Francia glacier which belonged to the poor cluster DE 2 although they were fairly shallow, approx. 100m. In the narrow and steep Beagle Channel such water depths belong to the slope where in areas without glaciers we found the richest assemblages. A peculiarity of the narrow Beagle Channel was the assemblage of cluster SNE which did not occur in the Straits of Magellan. However, what has been described above as a continuum of different benthic assemblages is here also visible: the dominant higher taxa of this cluster SNE, compound ascidians and crustaceans, also occurred in the Beagle Channel. Another reason not to assume a distinct benthic composition for the Beagle Channel is the fact that the six stations directly in front of and inside the Seno Garibaldi belonged to three different clusters.

All stations close to the shore and those exposed to the open oceans, e.g. at the eastern and western entrance of the Beagle Channel, belonged to the clusters S and SNE which are also represented inside the entire channel system. Thus, apparently, shallow sills especially in the northeastern part of the Straits of Magellan (<50m) do not seem to be a barrier for shallow benthic assemblages, as speculated by Stuardo (1964). On the other hand the two deeper clusters DE 1 and DE 2 from which the offshore stations of cluster OS differed considerably were restricted to the channel system. However, areas close to the shore of comparable depth (100-300m) were not studied by the imaging method.

The benthos inside the channel system did not reveal a greater affinity either to an Atlantic or a Pacific faunistic province or district. This finding is in accordance with a number of zoogeographical classifications summarized by Brattström and Johanssen (1983); e.g. Ekman (1953) described that "At Tierra del Fuego the south Chilean fauna continues immediately into the Patagonian Atlantic fauna which exhibits great similarity with the fauna of the Falklands...". Hedgpeth (1969) came to a similar classification. He established for the entire coastal area from 43° to 57°S the Magellan Province belonging to the Subantarctic region. North of this area Balech (1954), Knox (1960) and Stuardo and Valdovinos (1992) distinguished a Central Chilean and an Argentinian Province. The two latter authors also identified various districts within the Magellan Province (which would seem to be partly in contrast

Table 5. Comparison of the results of this study with those from other shelf regions.

	Magellan region southern South-America offshore stations this study	Weddell and Lazarev Seas Antarctic 3 shallow clusters Gutt and Starmans (1998)	Northeast Greenland Arctic Meyer and Piepenburg (1996) 190m	370m
no. of stns	4 (+4 pseudo-replicates)	53 (=24+13+6)	1	1
dominant taxa	Ascidiacea Bivalvia Porifera Polychaeta	Bryozoa Ophiuroidea Ascidiacea Holothuroidea Polychaeta Ceriantharia	Polychaeta (Ophiuroidea)	Ophiuroidea Crustacea Polychaeta Porifera
n/m^2 (median)	35	10-75	200	25
no. of taxa	38	36-92	22	51
diversity (Shannon)	2.2	1.6-2.5	0.6	3.5

to Stuardo (1964) and our results), however, not in the channel system and the southern offshore area referred to in this paper.

A comparison between our findings and those from other regions of the world ocean (Table 5) is only possible if the studies are based on a similar scientific approach, and if geomorphological characteristics as well as the methods are comparable. Our results from the Subantarctic offshore shelf can best be compared with those of Gutt and Starmans (in press) from the high Antarctic Weddell and Lazarev Seas' shelf and two stations of Meyer and Piepenburg (1996) on the northeastern Greenlandic shelf and shelf edge. Despite the extremely varying sampling effort we come to a few general conclusions: In the high Antarctic echinoderms and bryozoans seem to play a more important role in terms of relative abundance at ecologically comparable sampling sites whereas bivalves and sponges were more dominant at the Magellan off-shore stations. Absolute abundances and numbers of taxa can be higher in the Weddell and Lazarev Seas, diversities were found to be similar in the Antarctic and the Magellan region. The fauna off northeastern Greenland seems to be extremely heteogeneous. One station was poor in the number of taxa, and was totally dominated by a dense concentration of polychaetes. A second station was very diverse and had some important taxa which were also dominant in the Magellan region and in the high Antarctic, e.g. ophiuroids, polychaetes, and sponges. A more detailed comparison demands more conformity in the choice of sampling sites and criteria of the analyses.

Summarizing, megabenthic epifaunal communities in the Magellan region exhibit a distinctly patchy distribution which seems to be determined rather by specific medium-scale environmental conditions than by large-scale regional differences.

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ANNEX

Short description of unidentified species mentioned in the text, not shown in Fig. 2:

Porifera (?) sp. 2 - white encrusting sponge (?).

Cyclostomata (?) sp. 1 - more or less spheric organisms, white, approx. 1 cm in diameter.

Celleporinidae sp. 3 - half spheric organisms with cone shaped elevations on surface, no oscula visible.

Bryozoa sp. 29 - colonies 2-7 cm large, white, small specimens almost spheric, larger specimens with very thick and short roundish branches.

Anthozoa sp. 25 - infaunal anthozoans, only the white tentacles (<20) on the sediment surface, size: <1 cm in diameter.

Ascidiacea sp. 4 - egg-shaped ascidians, size: approx. 1 cm in diameter, yellow translucent, incurrent siphon slightly elevated at the upper tip of the body, excurrent siphon close to it, occurring in masses on hard substrata.

Ascidiacea sp. 7 - oval to spheric, white translucent, size: approx. 1cm in diameter, incurrent and excurrent siphons not elevated but with a white margine.

Ascidiacea sp. 8 - spheric to oval, yellow translucent, size: approx. 1cm in diameter, incurrent and excurrent siphons very slightly elevated.

Synascidian sp. 1 - stalked colony, tulip shaped, translucent grey (in contrast to the orange Synascidian sp. 2), stalks can be branched, total length: approx. 5 cm, stalk 2-5mm in diameter, length of stalk approx. two-thirds of total length, zooids longitudinally arranged in the body at both sides of a common cloaca channel.

Synascidian sp. 6 - encrusting to cushion shaped greenish grey colonies, “cushions” single or several connected to each other with a slightly conically elevated cloaca opening in centre.

Note: After final submission of the manuscript some doubts arose about the identification of some of the “synascidians”. Some structures observed at the seafloor may have been mistakenly classified as “synascidians” when they were, in fact, squid egg cases. This has, however, no influence on the conclusions in this paper.