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Polychaetes from Aysén Fjord, Chile: distribution, abundance and biogeographical comparison with the shallow soft-bottom polychaete fauna from Antarctica and the Magellan Province*

J. I. CAÑETE[1,2], G. L. LEIGHTON[1] and F. F. AGUILERA[1]

[1]Instituto de Oceanología, Universidad de Valparaíso, Casilla 13-D, Viña del Mar, Chile
[2]Present address: Departamento de Ciencias y Recursos Naturales, Facultad de Ciencias, Universidad de Magallanes, Casilla 113-D, Punta Arenas, Chile; icanete@aoniken.fc.umag.cl

SUMMARY: This paper analyzes the composition, abundance and biogeographical relationship of the benthic polychaetes collected in three shallow subtidal locations (mouth of Cuervo and Condor rivers and Acantilada Bay) from Aysen Fjord, AF, Chile (45ºS, 73ºW), and provides a comparison with data on shallow soft-bottom polychaetes from Antarctica and other locations of the Magellan Province: Dalcahue Channel, DC (42º22'S, 73º39'W), Puerto Cisnes, Puyuhuapi Channel, PC (44º43'S, 72º42'W) and Magellan Straits, MS. AF polychaete fauna comprises 38 species, the macrobenthic taxon being most representative in terms of abundance and species richness. The importance of polychaetes seems to be higher in fjords than in channels. Low numbers of common species were detected among DC, PC, MS and AF, indicating differences along the influence area of the Cape Horn Current or along the Magellan Province. The polychaetes from AF show low affinities with Antarctica; maximum number of common species was observed with the Antarctic Peninsula, whereas the lowest values were recorded from locations in the Ross and Weddell Seas. Coincidence in some ecological attributes between AF and Antarctica indicate that polychaetes may play an important and similar ecological role in both environments.

Key words: Polychaeta, biodiversity, biogeography, Chile, Magellan Province, Antarctica.

RESUMEN: POLIQUETOS DEL SENO AYSÉN, CHILE: DISTRIBUCIÓN, ABUNDANCIA Y COMPARACIONES BIOGEOGRÁFICAS CON LA FAUNA DE POLIQUETOS DE ÁREAS SOMERAS DE LA ANTÁRTIDA Y LA PROVINCIA DE MAGALLANES. – Se analiza la composición, abundancia y relaciones biogeográficas de poliquetos bentónicos recolectados en tres localidades someras (desembocadura de los ríos Cuervo y Cóndor y Bahía Acantilada) del Seno Aysén, SA, Chile (45ºS, 73ºO), y se efectúa una comparación con los poliquetos de la Antártida y otras localidades de la Provincia de Magallanes: Canal Dalcahue, CD (42º22'S, 73º39'O), Puerto Cisnes, Canal Puyuhuapi, CP (44º43'S, 72º42'O) y Estrecho de Magallanes, EM. La poliquetofauna del SA se compone de 38 especies, siendo el taxón más representativo del macrobentos en términos tanto de abundancia como de riqueza de especies. La importancia de los poliquetos parece mayor en fiordos que en canales. Se detectaron escasas afinidades entre CD, CP, EM y SA, indicando diferencias geográficas del papel de los poliquetos en la Provincia de Magallanes o en el área influenciada por la corriente del Cabo de Hornos. Existen escasas afinidades entre los poliquetos del SA y la Antártida; el mayor número de especies comunes fue compartido con la Península Antártica, mientras que ocurría lo contrario con localidades de los Mares de Ross y Weddell. La similitud de algunos atributos ecológicos entre SA y la Antártida sugieren que los poliquetos juegan un papel ecológico similar en ambos ambientes.

Palabras clave: Polychaeta, biodiversidad, biogeografía, Chile, Provincia de Magallanes, Antártida.

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INTRODUCTION

The southern end of South America represents one of the most interesting Subantarctic areas from both a biogeographical and an ecological point of view. The relative closeness of this area to the Antarctic continent, which is separated by the Scotia Arc, and the continuity with the coast of the American continent, define this zone as a crossroad in terms of biogeography and biodiversity. The peculiar hydrological conditions of the West Wind Drift current which influences the eastern Pacific border to the south of 40ºS (limit of the Subtropical Convergence) to Cape Horn (latitude 55º59'S) through the Cape Horn Current (CHC), might affect the marine biota producing affinities in biodiversity, composition, abundance and geographical similarities between Chiloé Island, the Magellan Straits and Cape Horn including the Patagonian shelf and the Falkland Islands, and dissimilarities between the Magellan Province and Antarctic benthic communities (Moyano, 1982; Brattström and Johanssen, 1983; Arntz *et al*., 1994; Arntz and Gorny, 1996; Arntz and Ríos, 1997).

Between 1990 and 1997 the Instituto de Oceanología of the University of Valparaíso, Chile, carried out various studies in the Aysen Fjord, considering the oceanography (Sievers and Prado-Fiedler, 1994; Sievers and Vega, 1996) as well as the structure and biodiversity of pelagic (Avaria *et al*., 1996) and benthic communities (Leighton *et al*., 1994). In the latter, it was observed that polychaetes represent an important taxon in terms of number of species and abundance in shallow waters. This taxon is quite unknown (Wesenberg-Lund, 1962; Hartmann-Schröder, 1962,1965), although according to Rozbaczylo *et al*. (1997) there are 182 species distributed in 10 orders, 35 families and 112 genera only in the area between 49ºS and 55º59'S.

In this paper we analyze the composition, species richness, abundance and the biogeographical affinities of the polychaete fauna from Aysen Fjord, Magellan Province (Moyano, 1982; Brattström and Johanssen, 1983). A comparison is made with some published data on the shallow, subtidal soft-bottom polychaete fauna from Antarctica (south of the Antarctic Convergence; ~60º S), and other sites of the Magellan Province (Dalcahue, 42º22'S, 73º39'W, Chiloé Island; Puerto Cisnes, 44º43'S, 72º42'W; and Magellan Straits).

MATERIAL AND METHODS

Aysen Fjord is one of numerous fjords of southern Chile (Fig. 1 and 2a). It has an east-west orientation, is 72 km long, and connected with the channels Moraleda and Costa. As for others fjords and channels in this area, low salinity has been reported for the Aysen Fjord due to numerous water sheds that flow into the fjord, in particular the Aysen River, which is located at the fjord head. The effects of the continuous rain (~2500 mm m^{-2} per year) are also important. Shallow bottoms are scarce in the fjord, which in its center has a depth of > 350 m. In general, shallow soft bottoms are located near the

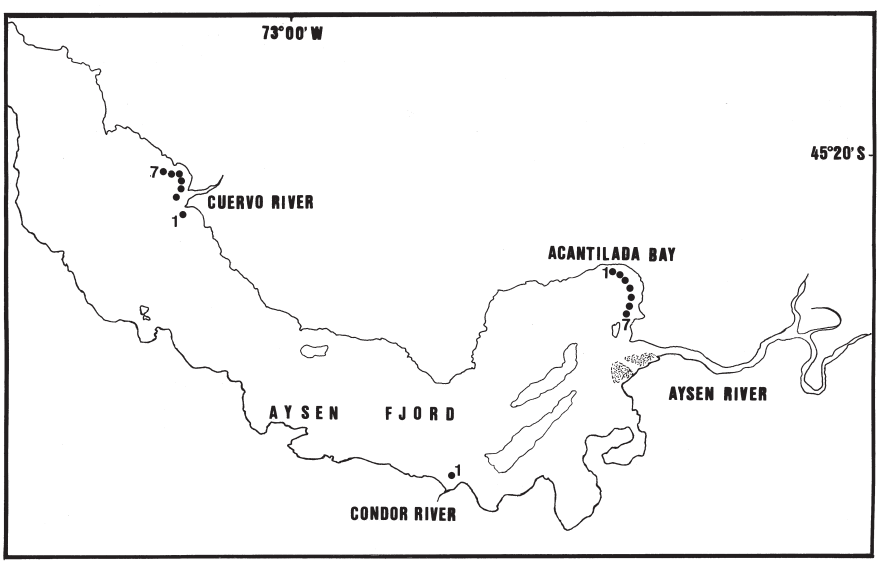

FIG. 1. – Map showing the three study sites (Cuervo, Condor and Acantilada Bay) located along Aysen Fjord, southern Chile. The black circles show the sampling stations at each study site.

mouth of small rivers such as Condor and Cuervo, where the present study took place (Fig. 1). In Acantilada Bay, greatest depths and cliffs are present close to the coastal line, and the nearest site is located at the mouth of Aysen River (Fig. 1). During the period of study, salinity clearly showed a two layer structure separated by a halocline of variable intensity (10 m depth). The low salinity surface layer reached a thickness of 20 to 30 m with values between 3.6 to 23.9º/oo. The surface waters were well oxygenated, 4 to 8 ml O_2 l^{-1}, and sometimes supersaturated up to a maximum of 130%. The surface temperature varied between 11.7 and 12.9ºC with small variation in depth (Silva *et al.*, 1995). Significant changes were observed in temperature and salinity along the fjord, showing variations of density that could have important biological implications for composition and spatial distribution of the macrobenthos, including the polychaetes.

The shallow soft-bottom sediments in Aysen Fjord showed different composition according to the place. In Acantilada Bay the sediments were composed mainly of very coarse sand ($\phi = 0$) and coarse silt ($\phi = 5$) with presence of shell debris at some stations; only at station 2 was the presence of pebbles ($\phi = -4$) to very coarse sand detected. The organic matter content varied between 1.27 and 9.69%. In Condor River no sample was collected for sediment analyses. In Cuervo River the sediments showed a similar composition to Acantilada Bay (very coarse sand to coarse silt, with a high percentage of fine sand, 30%), with a lower percentage of organic matter (1.2 to 2.4%) than in Acantilada Bay. The depth of the stations was 11 m in Condor River, where only one station was considered, between 5 to 10 m in Cuervo River (average = 7 m), and between 2 and 26 m in Acantilada Bay (average =8 m).

Dalcahue Channel is a shallow site (maximum 22 m depth) located between Chiloé Island and Quinchao Island (Fig. 2a, b), and represents the northern end of the Magellan Province. The stations were located along the middle line of the channel, with station 1 between Quiquel Point (Chiloé Island) and Degan Point (Quinchao Island) (Fig. 2b). The bottom temperature varied between 12.3 and 13.0ºC and the salinity showed small variation, between 32.3 and 32.4 ‰ (Leighton *et al.*, 1998). The deeper water column is well oxygenated (>7.2 ml O_2 l^{-1}), with little variation among stations. Grain size analyses revealed the presence of very coarse sand ($\phi = 0$) to fine sand ($\phi = 3$) with shell debris at stations 4 and 5.

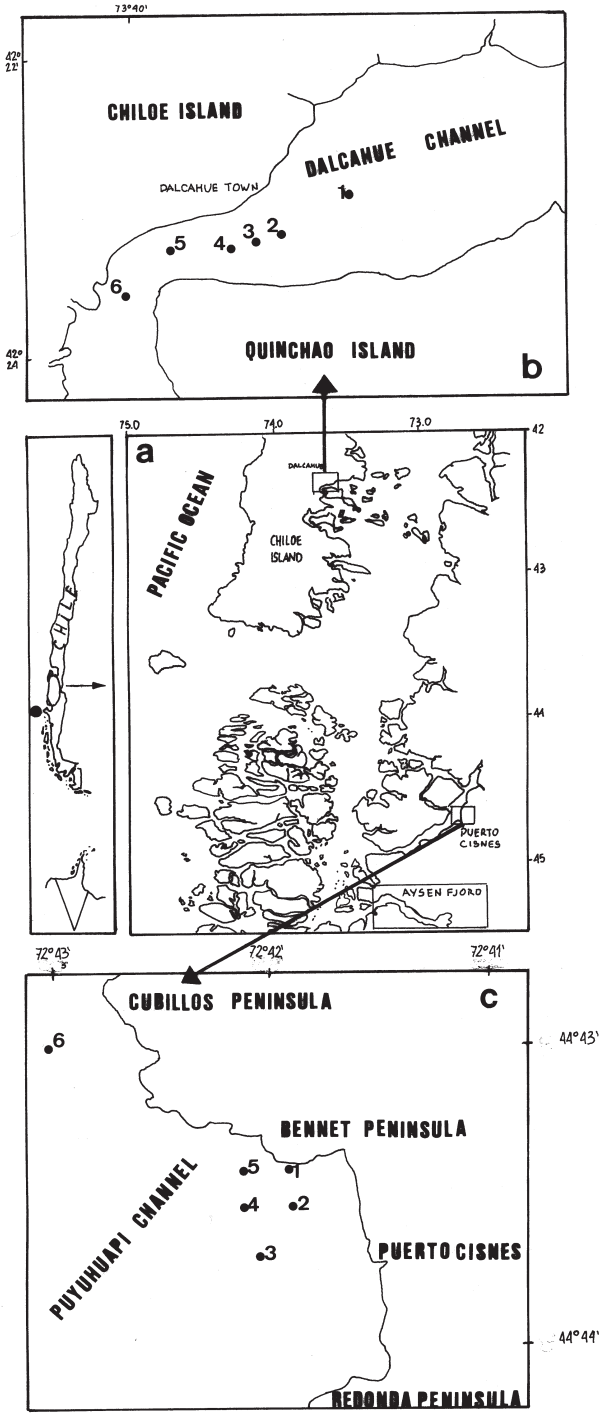

FIG. 2. – a) Map showing Chile, the Straits of Magellan and the geographical position of the three study areas located in the northern part of the Magellan Province. The black circle in the Chilean map shows the Taitao Peninsula. b) Spatial distribution of sampling stations along Dalcahue Channel, Chiloé Island. c) Spatial distribution of sampling stations at Puerto Cisnes, Puyuhuapi Channel.

Puerto Cisnes is located within Puyuhuapi Channel (Fig. 2a, c). Five stations were located between Bennett Point and Redonda Point, while station 6 was located off Cubillos Point (Fig. 2c). At the

southern end of the channel is the mouth of the Cisnes River which defines the hydrological features of this area (not shown in Fig. 2c). The bottom temperature varied between 10.5 and 11.8ºC below 15 m depth, while salinity varied between 30.0 and 31.5‰ (Leighton *et al*., 1997). As in Aysen Fjord, deep waters are well oxygenated with lowest values above 5.3 ml O_2 l^{-1}.

In general, the hydrological features at the three sites considered in this study show small variation in terms of oceanography, thus allowing community comparison. The three sites belong to the northern sector of austral fjords as defined by Pickard and Stanton (1980).

The biological material was collected between 21 and 26 September 1995 at three sites along the Aysen Fjord, mouth of rivers Cuervo and Condor and Acantilada Bay (see Fig. 1). The platform of work was the 15 m boat "Piruca". At each site, the samples were collected using a small grab (Wildo-Ekman bottom dredge; 0.02 m^2), activated at the bottom by a hooka diver. Three replicates were obtained at each of six or seven sites selected at each location. In Condor River only one station with three replicates was sampled. The samples were fixed in 10% formalin and preserved in 70º alcohol. The macrofauna was sieved on a 0.5 mm mesh screen and the material retained was observed under a stereo microscope. The polychaetes were identified and counted. The references used for identifications were Wesenberg-Lund (1962), Hartmann-Schröder (1962, 1965) and Ehlers (1901). The identification of polychaetes collected at the different sites was carried out by one of the authors (JIC). The samples obtained from Dalcahue and Puyuhuapi Channels were collected during February 13 and 17, 1997, respectively. Three replicates per station were collected at each study site.

Species diversity indices, evenness and dominance were calculated for each site using the abundance as an ecological attribute, being incorporated in software provided in Ludwig and Reynolds (1988). The formulas for each index used were:

Shannon index of diversity (H'):

$$H' = - \Sigma\, n_i/N \ln (n_i/N)$$ (Shannon and Weaver, 1949)

Evenness (J):

$$J = H'/H_{max} = H'/\ln S$$ (Pielou, 1977)

Simpson index (D):

$$D = \Sigma\, ((n_i\, (n_i-1)/N\, (N-1))$$ (May, 1981),

where n_i = number of individuals in the i^{th} species, N = total number of individuals, and S = number of species.

The biogeographic analyses were carried out through comparison with benthic studies published in the Magellan area, in particular the Magellan Straits (Fig. 2a), as well as results obtained by us (Leighton *et al*., 1997, 1998) for Dalcahue and Puerto Cisnes (Fig. 2a-c). The biogeographic comparisons with the Antarctic polychaete fauna were carried out including data published by other authors. The number of common species was used to assess the similarities between the Aysen Fjord polychaete fauna with those of the Magellan Province as well as of Antarctica.

To identify the geographic origin and the affinities of the benthic polychaetes from Aysen Fjord, four categories were used to classify their geographical distribution (Rozbaczylo, 1985):

a = species present only within the limits of the Magellan Province: south of the Subtropical Convergence (40º S) and sites located to the north of the Antarctic Convergence (~60ºS)

b = species present along the Chilean coast from Arica (18º S) to north of the Antarctic Convergence

c = species present in the Magellan Province and sites located to the south of the Antarctic Convergence

d = species present in a, b and c.

RESULTS

Species composition and abundance

The benthic polychaetes from shallow marine communities of Aysen Fjord include 38 species belonging to 24 families and 28 genera. Six taxa were identified only to family level, 6 to genus level and 25 to species level. According to the traditional classification in which the polychaetes were separated in the subclasses Errantia and Sedentaria, 22 taxa were found in the Errantia and 16 in the Sedentaria (Table 1). According to the actual scheme of taxonomy classification to the order level, in the Errantia the Phyllodociformia predominate while in Sedentaria there is no predominance. Among the taxa not identified to species level, each family name denotes at least a single taxon. There is a low number of species per family (maximum 3 or 4; families Nereididae and Orbiniidae, respectively).

TABLE 1. – Composition and abundance of benthic polychaetes of three sites from Aysen Fjord, Chile, collected between September 21 and 25, 1995. Abundance expressed as individuals per 0.02 m^2. Cu: Cuervo R.; Co: Condor R; Ac: Acantilada B.

Subclass/Family/Species	Stations Cu	Co	Ac
ERRANTIA			
Polynoidae			
Harmothoinae undet.	1	0	0
Pholoidae			
Pholoe polymorpha (Hartmann-Schröder, 1962)	36	6	2
Amphinomidae			
Pseudeurythoe annulata Hartmann-Schröder 1965	0	2	0
Phyllodocidae			
Anaitides longipes (Kingberg, 1866)	1	0	1
Eteone sculpta Ehlers,1897	1	0	0
Hesionidae			
Hesionides arenaria Friedrich, 1937	1	0	0
Syllidae			
Syllidae und.	2	2	0
Sphaerosyllis sp.	4	1	0
Nereididae			
Namanereis quadraticeps (Blanchard, 1849)	2	2	0
Perinereis gualpensis Jeldes, 1963	2	0	31
Platynereis australis (Schmarda, 1861)	1	0	0
Nepthyidae			
Aglaophamus sp.	2	0	0
Aglaophamus macroura (Schmarda, 1861)	13	5	10
Glyceridae			
Hemipodus longipapillatus Hartmann-Schröder 1965	2	0	0
Hemipodus heteropapillatus Hartmann-Schröder 1962	4	2	1
Goniadidae			
Goniadidae und.	1	0	0
Glycinde armata (Kinberg, 1866)	1	0	0
Lumbrineridae			
Lumbrineris cingulata (Ehlers, 1897)	11	0	0
Ninoe falklandica Monro, 1936	0	0	6
Arabellidae			
Arabella mutans (Chamberlin, 1919)	2	0	0
Dorvilleidae			
Schistomeringos longicornis (Ehlers, 1901)	5	0	1
Meiodorvillea chilensis Hartmann-Schröder 1965	2	1	0
SEDENTARIA			
Orbiniidae			
Leitoscoloplos kerguelensis (McIntosh, 1885)	22	21	46
Phylo felix Hartmann-Schröder 1965	2	0	0
Scoloplos sp.	37	2	0
Paraonidae			
Aricidea sp. 1	493	187	159
Aricidea sp. 2	9	1	2
Spionidae			
Prionospio patagonica Augener, 1923	111	73	2206
Spiophanes soederstroemi Hartman, 1953	86	33	0
Cirratulidae			
Cirratulidae undet.	82	10	20
Flabelligeridae			
Flabelligeridae undet.	1	0	0
Opheliidae			
Travisia kerguelensis McIntosh, 1885	8	0	0
Capitellidae			
Mediomastus branchiferus Hartmann-Schröder 1962	13	7	35
Capitella sp.	0	2	0
Pectinariidae			
Cistenides ehlersi (Hessle, 1917)	3	9	2
Ampharetidae			
Sosanides glandularis Hartmann-Schröder 1965	123	12	119
Terebellidae			
Terebellidae undet.	1	3	2
Sabellidae			
Sabellidae undet.	1	0	25
Number of species	35	20	17
Total Abundance	1086	381	2668

A total of 4135 individuals were collected. The spionid *Prionospio patagonica* was the species with the highest frequency and abundance of all polychaetes, about 57.8% of the total abundance of polychaetes, mainly in Acantilada Bay. At the other locations the paraonid *Aricidea* sp. 1 was most abundant. Average abundance ranged from 52 to 148 indiv. 0.02 m^{-2} (Table 2), while the mean species richness varied between 12 (Acantilada Bay) and 20 species 0.02 m^{-2} (Acantilada Bay). The number of individuals per species decreased from Acantilada Bay to Cuervo River, as did the mean abundance, while species richness increased (Table 2). The mouth of Cuervo River shows the maximum number of species and Acantilada Bay the lowest (Table 1). In general, the polychaetes were of small size, the pectinariid *Cistenides elhersi* and the orbiniid *Leitoscoloplos kerguelensis* being the largest in these communities (~ 20 mm in length).

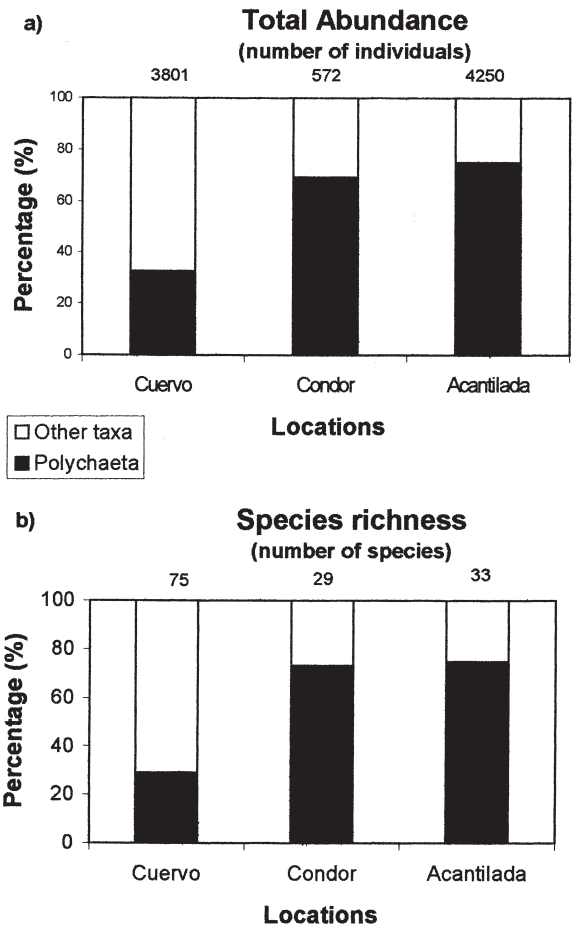

FIG. 3. – Comparison between Polychaeta and other invertebrate taxa collected in shallow, subtidal macrozoobenthos communities from three localities in Aysen Fjord, Chile. Sampling carried out September 21 to 26, 1995. The numbers over each bar represent the total number of individuals or species found at each study site: a) total abundance, b) number of species.

TABLE 2. – Comparative analysis of the polychaete fauna of shallow subtidal soft bottom communities of three locations from the Magellan Biogeographical Province. Sampling carried out between 1995 (September; Aysen Fjord) and 1997 (February; Dalcahue and Puerto Cisnes; data from Leighton *et al*., 1997, 1998). In brackets: coefficient of variation (%).

Parameters	Dalcahue Channel, Chiloé Island	Puerto Cisnes, Puyuhuapi Channel	Cuervo River, Aysen Fjord	Condor River, Aysen Fjord	Acantilada Bay, Aysen Fjord
Mean depth (m)	14 (34)	31 (69)	7 (27)	11 (0)	8 (116)
Number of replicates	18	18	21	3	18
Total abundance (N° ind.)	33	302	1086	381	2668
Mean abundance (Ind 0.02 m^{-2})	2 (88)	17 (48)	52	127	148
Total species richness	11	5	35	20	17
Mean species richness (species 0.02 m^{-2})	1.33 (77)	2.8 (25)	20 (65)	13 (21)	12 (40)
Abundance/species richness (indiv $species^{-1}$)	3	60	31	19	157
Shannon index (H')	0.4	0.9	2.0	1.8	0.8
Evenness (J)	0.8	0.5	0.6	0.6	0.3
Dominance (D)	0.2	0.5	0.4	0.4	0.7
Polychaete species most abundant	*Lumbrineris magalhaensis*	*Capitella* sp.	*Aricidea* sp.1	*Aricidea* sp. 1	*Prionospio patagonica*

Eleven species were common at the three study sites in Aysen Fjord: *Pholoe polymorpha, Aglaophamus macroura, Hemipodus heteropapillatus, Leitoscoloplos kerguelensis, Aricidea* spp., *Prionospio patagonica,* Cirratulidae undet., *Cistenides ehlersi, Sosanides glandularis* and Terebellidae undet. These species were the most abundant and showed high frequency (Table 1).

The polychaetes were the most abundant taxon within the benthic communities from Aysen Fjord, in particular at the mouth of the Condor River and in Acantilada Bay. At both sites, the richness of species as well as the total abundance were over 55% of total macrofauna. Only in Cuervo were the polychaetes less important (Fig. 3). Besides Polychaeta, in Cuervo 13 major taxa were identified including Anthozoa, Nemertea, Platyhelminthes, Oligochaeta, Sipunculida, Bivalvia, Polyplacophora, Gastropoda, Nudibranchia, Arthropoda, Echinodermata and Hemichordata. In Condor 7 major taxa were identified: Anthozoa, Nemertea, Oligochaeta, Bivalvia, Gastropoda, Arthropoda and Hemichordata. In Acantilada Bay only 6 higher taxa were collected, namely Anthozoa, Nemertea, Oligochaeta, Bivalvia, Gastropoda and Arthropoda.

A comparison among the three sites shows that in the mouth of Condor River the most abundant polychaete species were *Aricidea* sp. 1, *Prionospio patagonica*, *Spiophanes soederstroemi* and *Leitoscoloplos kerguelensis*. At this site polychaetes were the most abundant group with 398 individuals and 21 taxa. In the Cuervo River mouth, the polychaetes were predominant only in terms of species richness (48% of the total number); the small paraonid *Aricidea* sp. 1 being the most abundant. In Acantilada Bay the most representantive taxon in terms of abundance were the polychaetes with 3210 individuals and 17 species. At this site the spionid *Prionospio patagonica* was the most abundant species (Table 1 and 2).

Biogeographical analyses

A first comparison of the polychaete fauna within the Magellan Province was carried out with Dalcahue and Puerto Cisnes, both within the limits of the Magellan Province (Moyano, 1982; Brattström and Johanssen, 1983), and both of them channels. There is a latitudinal gradient in terms of abundance and species richness of the polychaetes, the values of Aysen Fjord being highest (Table 2) (Leighton *et al*., 1997, 1998). In Dalcahue Channel the abundance and species richness are two or three orders of magnitude less than in Aysen Fjord and the parameters related with diversity show lowest values respect to Aysen Fjord. Seven species were common to Dalcahue and/or Puerto Cisnes and the Aysen Fjord locations; these species are: *Eteone sculpta*, Syllidae undet., *Perinereis gualpensis*, *Platynereis australis*, *Aglaophamus macroura, Hemipodus longipapillatus* and *Prionospio patagonica*.

A second comparison was done with published data obtained in the Magellan Straits. There are few reports about the shallow associations of polychaetes from the Magellan Straits. According to a list of polychaete taxa found during the Italian Campaign in the Straits of Magellan in February and March 1991 (Gambi and Mariani, 1997) there are only five common species between the latter and Aysen Fjord. The species are: *Leitoscoloplos kerguelensis*, *Phylo felix*, *Glycinde armata*, *Lumbrineris cingulata* and *Cistenides elhersi* (Table 2). How-

TABLE 3. – Comparative analyses of the polychaete fauna from shallow subtidal soft bottom communities in Antarctica with Aysen Fjord, Chile. ns = not shown. * represents mean of the three sites indicated in Table 2.

Parameters	Admiralty Bay, King George Island	Terra Nova Bay, Ross Sea	Southeastern Weddell Sea shelf	Chile Bay, Greenwich Island	Aysen Fjord (*)
Mean abundance (Ind. m^{-2})	60-3300	40-12000	26-5593	ns	5450
Total species richness	25	77	ns	206	38
Number of polychaete families	17	24	ns	26	24
Common species with Aysen fjord	2	1	ns	3	—
Mean species richness (species m^{-2})	11	2-40	ns	ns	15
Shannon index (H')	0.2-2.4	0.2-4.0	ns	ns	1.5
Evenness (J')	0.1-0.9	0.05-1.00	ns	ns	0.5
Polychaete species most abundant (>50%) within the taxon	*Capitella capitata* *Scoloplos marginatus*	*Tharyx cincinnatus* *Spiophanes tcherniai*	ns	*Maldane sarsi* *Tharyx cincinnatus*	*Aricidea* sp. 1 *Prionospio patagonica*
Reference	Sicinski & Janowska, 1993	Gambi *et al*., 1997	Gerdes *et al*., 1992	Gallardo *et al*., 1988	Present study

ever, many of the taxa were identified by Gambi and Mariani (1997) to genus level only.

Biogeographical affinities with the Antarctic polychaete fauna

In order to assess biological affinities between the polychaete fauna from Aysen Fjord with Antarctica, several ecological parameters were compared with the literature available: the number of common species, the mean abundance, the richness of species and the Shannon index of diversity when possible. It is observed that the Aysen Fjord polychaete fauna has a low number of common species with Antarctica (*L. kerguelensis*, *A. macroura, L. cingulata, P. felix* and *S. soederstroemi*), except Chile Bay (Greenwich Island), although the total richness of species, the mean richness, and the number of families present similarity in the values. With the exception of Terra Nova Bay, the mean abundance of polychaetes is close to the values detected in the Antarctic benthos (Table 3). The Shannon index of diversity shows that the biodiversity of Aysen Fjord is similar to that reported for shallow benthic communities from Admiralty Bay and Terra Nova Bay (Table 3), in particular for depths less than 30 m.

Geographical origin of the benthic polychaetes from Aysen Fjord

In relation to the geographical origin of the benthic polychaetes from Aysen Fjord identified to specific level it is observed that eleven species are found between Arica, northern limit of Chile, and the limit of the Antarctic Convergence; three species are found between Arica and Antarctica; one species is restricted to the Magellan Province and the Antarctic, and nine species are restricted to the Magellan Province (Table 4). Within these nine species, at least four species are present in other areas such as New Zealand (*N. quadraticeps, P. australis and A. macroura*), southwestern Australia (*P. australis and A. macroura*) and southern Africa (*A. longipes*).

TABLE 4. – Composition of benthic polychaetes from Aysen Fjord in relation to geographical origin (geographical distribution based on Rozbaczylo, 1985). Categories are: **a**, species present only within the limits of the Magellan Province: Subtropical Convergence (40ºS) and sites located to the north of the Antarctic Convergence (~60ºS); **b**, species present along the Chilean coast from Arica (18ºS) to north of the Antarctic Convergence; **c**, species present in the Magellan Province and Antarctica (sites located to the south to the Antarctic Convergence); **d**, species present in a, b and c.

a (N = 9)	b (N = 11)	c (N = 1)	d (N = 4)
P. annulata	*P. polymorpha*	*A. macroura*	*A. longipes*
N. quadraticeps	*H. arenaria*		*E. sculpta*
G. armata	*P. gualpensis*		*L. kerguelensis*
N. falklandica	*P. australis*		*S. soederstroemi*
S. longicornis	*H. longipapillatus*		
M. chilensis	*H. heteropapillatus*		
P. felix	*L. cingulata*		
T. kerguelensis	*A. mutans*		
C. elhersi	*P. patagonica*		
	M. branchiferus		
	S. glandularis		

DISCUSSION

The present study shows that the Aysen Fjord polychaete fauna comprises 38 species. Polychaetes are the most representative taxon in terms of abundance and species richness in two of the three sites sampled (Fig. 3). This situation seems to be common in other sites of the Magellan Province such as

in Campos de Hielo Sur (45º to 53º S) (Mutschke *et al*., 1996) and the Beagle Channel (Arntz and Gorny, 1996), although the importance of the polychaetes decreases towards the northern limit of the Magellan Province, showing low number of species and reduced abundance in Dalcahue and Puerto Cisnes (Leighton *et al*., 1997, 1998) (Table 2). In addition to a latitudinal pattern in abundance and richness of species, an east-west zonation was detected along the Aysen Fjord in terms of mean abundance and species richness (Table 2). According to Sievers and Prado-Fiedler (1994), significant changes are observed in the oceanographic parameters such as temperature, salinity and density from Acantilada Bay to Cuervo River, possibly causing biological gradients in benthic communities. According to the salinity, the benthic polychaetes of shallow bottoms from Aysen Fjord as well as the other two locations (Puerto Cisnes and Dalcahue Channel) could be considered as typical of estuarine environments with well oxygenated waters.

In relation to the role of the Cape Horn Current (CHC) in contributing to the ecological and biogeographical aspects of the shallow-water benthic polychaetes of the three study sites located along of the northern end of the Magellan Province, important differences in composition, abundance and diversity were observed. A latitudinal gradient is observed from Dalcahue to Aysen Fjord showing an increment in species richness, diversity and abundance towards the south (Table 2). This pattern could be explained by the mix of species living north of the Subtropical Convergence with those of Subantarctic origin in Aysen Fjord (Table 4). On local scale, comparing Aysen Fjord with the channels (Puyuhuapi and Dalcahue), it seems as though the benthic polychaetes were less important in the channels in comparison to other taxa. This situation seems to be caused by the strong currents produced by great tidal changes and the reduced accumulation of fine sediments and organic matter at the bottom (Leighton *et al*., 1997, 1998).

The total number of species from Aysen Fjord is lower than that in the Magellan Straits where 118 species have been reported (Gambi and Mariani, 1997). This difference may be related to the smaller depth range investigated in the present study as well as the different types of sampling gear used.

A reduced number of common species were detected between Aysen Fjord and the Magellan Straits (Gambi and Mariani, 1997). Viviani (1969; *fide* Moyano, 1982), taking into account littoral Bryozoa, considered the southern end of Chile as two subprovinces of the Magellan area: northern Patagonica (40ºS-46ºS) and southern Patagonica (46ºS-56ºS). Considering the high number of common species between Dalcahue and Puerto Cisnes and the low overlap of the polychaete fauna of these sites with the Magellan Straits (Table 2 and 4), the hypothesis of Viviani (op. cit.) seems to be supported by our data. This pattern is also observed in other taxa such as anthozoans, gastropods, bivalves, asteroids and holothurians (Brattström and Johanssen, 1983). Brattström and Johanssen (1983) indicate that the Taitao Peninsula (~46ºS) is the main barrier to the fauna of both areas (Fig. 2a).

After more than 20 million years of separation between South America and the Antarctic continent there are, however, basic differences in species and family composition of polychaetes in shallow, soft bottom, benthic communities. This holds true, particularly, for the absence of some families of polychaetes common and rich in species in the Antarctic such as Polynoidae, Euphrosinidae and Maldanidae. Other differences between Antarctic and Aysen polychaetes are the size and the low number of species per genus, indicating a poor potential of evolutionary radiation at the Aysen coast. Coincidence of the values of ecological parameters such as abundance and diversity in Antarctica and in Aysen Fjord (Table 3) demonstrate that the benthic polychaetes seem to occupy a similar role in both biogeographical regions. Studies carried out in the Weddell Sea and the Beagle Channel revealed that polychaete abundance contribute to 47 and 62% of the total abundance of the macrobenthic communities, respectively (Arntz and Gorny, 1996), values that are within the ranges observed in Aysen Fjord.

Scarce affinities in the polychaete fauna exist between Antarctica and the northern sites of the Magellan Province, with only five common species (categories c and d; Table 4). This situation is similar to that of other marine taxa of the Magellan Province such as decapod crustaceans, gastropods and crinoids (Arntz and Ríos, 1997). The benthic polychaetes from Aysen Fjord show low affinities with the Antarctic polychaetes of shallow soft bottoms (Table 4). The maximum number of common species was observed with Chile Bay, Greenwich Island (Gallardo *et al*., 1988), Antarctic Peninsula. In contrast, lowest overlap values were recorded with locations in the Ross and the Weddell Seas (Gerdes *et al*., 1992; Sicinski and Janowska, 1993; Gambi *et al*., 1997).

The polychaetes collected in Aysen Fjord and reported from Antarctica show wide bathymetric distributions, some species being collected up to 4000 m depth (e.g. *Leitoscoloplos kerguelensis*), although most common species are distributed to 600 m depth (Rozbaczylo, 1985). The invasion of marine Antarctic fauna to more northerly latitudes via great depths has been considered as a potential mechanism of colonizing the southern end of South America (Briggs, 1974).

The identification to specific level of some polychaetes collected in this study, as well as those collected on various national and international expeditions to the Magellan Province, will be necessary to improve our biogeographic knowledge about this taxon and of the degree of endemism in this Province, and to eventually establish the biological relationship between different sites of the Magellan Province and the Antarctic continent.

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