SCIENTIA MARINA

THE MAGELLAN-ANTARCTIC CONNECTION: LINKS AND FRONTIERS AT HIGH SOUTHERN LATITUDES.
W.E. ARNTZ, G.A. LOVRICH and S. THATJE (eds.)

Mesozooplankton assemblages in two bays in the Beagle Channel (Argentina) during January 2001*

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SUMMARY: This paper describes the composition and abundance of mesozooplankton of Bahía Ushuaia and Bahía Golondrina. These small bays are located in the northern Beagle Channel. Sampling was carried out from January 20 to 23, 2001 and samples were collected from the upper layer at nine stations. This study is the first research on mesozooplankton in this part of the Beagle Channel. Due to their dominance in the mesozooplankton community, we compared our Copepoda data with those reported by other authors from Antarctic coastal environments. By applying cluster analysis, we found two station groups in both bays: one in slightly polluted zones and the other in undisturbed external zones. Four assemblages in Bahía Ushuaia and two in Bahía Golondrina were determined by using non-metric multidimensional scaling (MDS) and cluster analysis. Mesozooplanktonic assemblages showed a certain resemblance in zones with and without anthropogenic influence. Most of the copepod species in our samples are typical of the sub-Antarctic region. *Oithona similis* (=*O. helgolandica sensu* Ramírez, 1966), *Oncaea curvata*, and *Ctenocalanus citer* show either similar or higher abundances at Antarctic coastal sites, including the upper layer in oceanic areas, in comparison with sub-Antarctic coastal localities. This suggests that, in agreement with other findings, the Polar Front is probably not a major geographic boundary for the distribution of these species.

Keywords: mesozooplankton, copepods, Beagle Channel, assemblage, *Oithona*, *Oncaea*, *Ctenocalanus*, Antarctic.

RESUMEN: ASOCIACIONES MESOZOOPLANCTÓNICAS EN BAHÍA USHUAIA Y BAHÍA GOLONDRINA (CANAL BEAGLE, ARGENTINA) DURANTE ENERO DE 2001. – Se describe la composición y abundancia mesozooplanctónica en Bahía Ushuaia y Bahía Golondrina, pequeñas bahías ubicadas al norte del Canal Beagle. El muestreo se realizó del 20 al 23 de enero de 2001 y las muestras se colectaron en el estrato superficial en nueve estaciones. Este estudio constituye la primera investigación realizada sobre el mesozooplancton, en las dos bahías del Canal Beagle. Debido a su dominancia en la comunidad mesozooplanctónica, los datos de copépodos fueron comparados con datos de otros autores para ambientes costeros de la Antártida. Los análisis de cluster y MDS revelaron dos grupos de estaciones en ambas bahías, uno en zonas levemente contaminadas y el otro en zonas más externas no perturbadas. Los mismos análisis permitieron determinar cuatro asociaciones de especies en Bahía Ushuaia y dos en Bahía Golondrina. Las asociaciones encontradas en ambas bahías presentaron una cierta semejanza en zonas con y sin influencia antrópica. La comparación del grupo Copepoda mostró que la mayoría de las especies de nuestras muestras son típicas de la región subantártica. Los copépodos *Oithona similis* (=*O. helgolandica sensu* Ramírez, 1966), *Oncaea curvata* y *Ctenocalanus citer* presentan similar o mayor abundancia en los ambientes costeros de la Antártida, incluyendo el estrato superficial de áreas oceánicas, que en los sitios costeros subantárticos. En coincidencia con otros hallazgos, el Frente Polar no parece ser una importante barrera geográfica para la distribución de dichas especies.

Palabras clave: mesozooplancton, Copepoda, Canal Beagle, asociaciones, *Oithona*, *Oncaea*, *Ctenocalanus*, Antártida.

INTRODUCTION

The mesozooplankton of the Magellan Straits, the Chilean channels and fjords, and the Beagle Channel have been studied with certain detail in relation to the oceanographic and bio-ecological conditions (Mazzocchi *et al.*, 1995; Antezana *et al.*, 1997; Antezana, 1999; Sabatini *et al.*, 2001; Thatje *et al.*, 2003). In these areas, different assemblages constituted by a variable proportion of holoplanktonic and meroplanktonic forms have been observed (Defren-Janson *et al.* 1999; George and Schminke, 1999; Hamamé and Antezana, 1999; Pagès and Orejas, 1999). However, only a few zooplankton studies on different aspects have so far been carried out in the eastern Beagle Channel (Lovrich, 1999; Pagès and Orejas, 1999; Sabatini *et al.*, 2001; Thatje *et al.*, 2003). The coastal embayments near the most populated area on the channel coast such as Bahía Ushuaia (BU) and Bahía Golondrina (BG) are a poorly studied region. Particularly in these two bays, this is the first study on the mesozooplankton.

From a zoogeographical point of view, the Fuegian district (Lovrich, 1999) is part of the Magellan Province (Hamamé and Antezana, 1999) belonging to the sub-Antarctic neritic domain (Boltovskoy *et al.*, 1999). As such, it is an area of great interest on account of its very recent relationship with both the Atlantic and Pacific fauna since the environment has been marine only for the last 9000 years (Rabassa *et al.* 1986). In addition, the faunal exchange between the Antarctic and South America appears to be greater than that between any other pair of continents, despite the isolation caused by the independent evolution of the fauna of those two continents (Lovrich, 1999). The geographical proximity probably makes the relationship between the Magellan Province and the Antarctic more evident. Furthermore, the findings about the Antarctic plankton in the sub-Antarctic (Magellan) domain (Antezana, 1999; Mazzocchi *et al.*, 1995) and vice-versa (Thatje and Fuentes, 2003) demonstrate a planktonic exchange of certain forms in agreement with what Lovrich (1999) inferred in relation to anomuran and brachyuran decapod larvae. In the present study, we assume a possible link between the small-sized copepods from the Antarctic and those from the Fuegian district.

This study is the first contribution of a larger survey aimed at the study of the structure and dynamics of zooplankton in the two bays. To this end, we describe the mesozooplankton assemblages of the upper layer in BU and BG during mid-summer (January, 2001). In order to test the above-mentioned hypothesis, we compare our results on Copepoda with similar data from the coastal Antarctic embayments during the same season.

MATERIAL AND METHODS

The study area was restricted to Bahía Ushuaia and Bahía Golondrina (Tierra del Fuego, Argentina), which are two small embayments located on the northern coast of the Beagle Channel (54°79'–54°85'S and 68°22'–68°36'W).

Sampling was carried out from January 20 to 23, 2001 (Fig. 1). Nine stations were sampled (6 in BU and 3 in BG). The samples were collected in the daytime, usually between 9 am and 4 pm (local time). At each station, an oblique tow was performed at 0-5 m depth using a Nansen open net (with a Kahlsico® flowmeter) with a 0.53 m mouth diameter and a 0.2 mm mesh size. Small individuals, such as meroplankton and copepod eggs, naupliar, and the youngest copepodite stages, were not sampled quantitatively due to the relatively large mesh size used. However, due to their high abundances, their distribution pattern is included. Tow duration was 10-15 min, and towing speed was approximately 3.7 km h^{-1}. Samples were preserved in 4% sodium borate-buffered formalin. Data on the physical and chemical variables of this campaign in BU and BG were reported by Esteves *et al.* (2003).
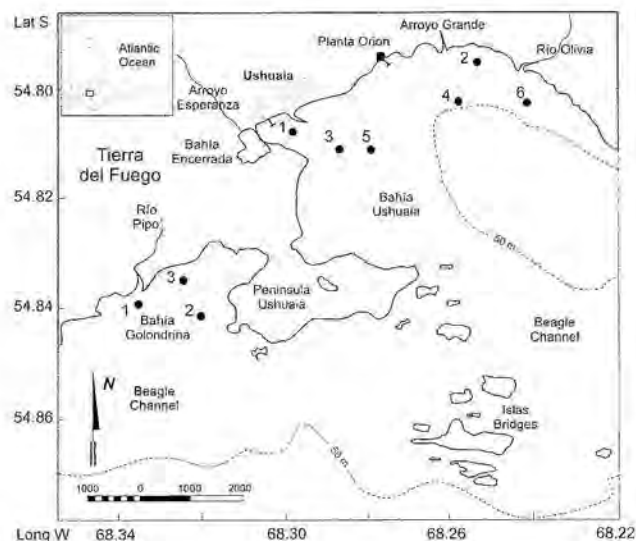

FIG. 1. – Map of the study area showing the location of sampling stations.

In the laboratory, the mesozooplankton was identified to the lowest possible taxonomic level under a stereoscopic microscope. In each sample, at least 100 individuals of the most abundant species were counted. Adult copepods were identified to species level, while copepodite stages, nauplii, and eggs were pooled together. In Argentinean waters, *Oithona similis* has not been cited as such but as *Oithona helgolandica* (Ramírez, 1966, 1970a,b). There is a synonymy problem with this species. Therefore, in this paper we decided to cite it as *Oithona similis* (=*O. helgolandica sensu* Ramírez, 1966). Although in this study we registered *Ctenocalanus citer* according to Heron and Bowman (1971), Sabatini *et al.* (2001) reported *C. vanus* for stations near our study area. Considering that these congeneric species closely resemble each other, further studies would be needed in order to verify the presence of the two species in the area. Abundance is reported in number of individuals per cubic metre. The percentage of occurrence was calculated taking into account the number of stations in which each taxon was present. The filtered volume was calculated from the number of revolutions of the flowmeter, the mouth area, and the flowmeter constant (0.27 m rev^{-1}).

Statistical parametric tests were used to test differences between the two bays. Statistical multivariate analyses were carried out with the PRIMER software package (Clarke and Warwick, 1994). Non-metric multimensional scaling (MDS) (Kruskal and Wish, 1978) was applied to order stations and species in a two-dimensional plot. Square root transformed data and the quantitative Bray-Curtis index were used. Hierarchical agglomerative clustering under the same conditions and an average linking were also used to determine the groups to be superimposed on the MDS plots when their stress values were <0.2 and >0.1. The same clustering technique was used to classify the stations according to depth, temperature, and chlorophyll *a*. These variables were utilised with the permission of Esteves *et. al* (2003).

STUDY AREA AND ENVIRONMENTAL FEATURES

Bahía Ushuaia and Bahía Golondrina display different physical and hydrological features. Both their size and their bathymetry are highly different. BU is 9 km long while BG is 2.2 km long. BU is deeper
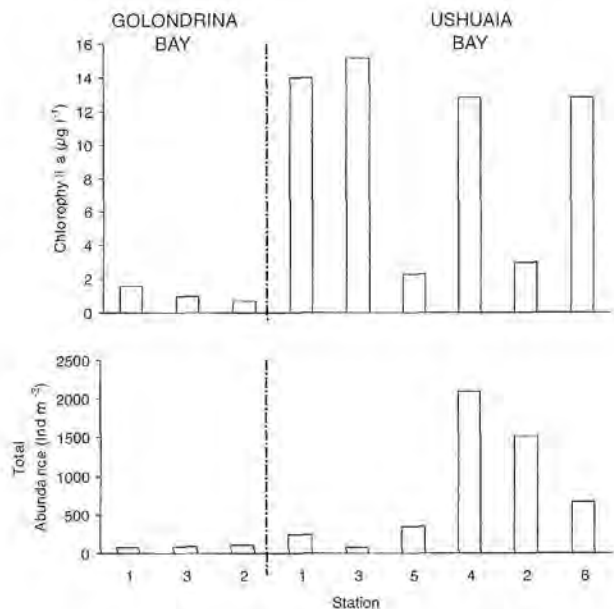

FIG. 2. – Chlorophyll *a* (after Esteves *et al.*, 2003) and total mesozooplankton abundance at each station of Bahía Ushuaia and Bahía Golondrina.

eastwards and towards the Beagle Channel, reaching 130 m depth, whereas BG is shallower (20 m approx.). The two bays also differ in the type of bottom. BG displays a soft-bottom surface whereas BU has a more consolidated soft bottom with stones and shells (Comoglio, 1994). Balestrini *et al.* (1998) report for the Bahía Golondrina and Bridges Island areas permanent currents flowing from the southwest with maximal velocities of 2.6 and 15.6 cm sec^{-1} respectively. In BU a permanent strong current moves west along the northern coast of the bay at 2 cm sec^{-1}, and then progresses to the southeast along the southern coast at 16.3 cm sec^{-1} (Balestrini *et al.*, 1998). Both bays receive effluents from Ushuaia city and the industries situated in the surroundings. As a result, coastal waters are slightly polluted (Amín *et al.*, 1996; Commendatore and Esteves, 2001). In the stations considered in this study, depth varied from 4 to 33 m (BU) and from 2.7 to 5 m (BG); temperature ranged from 8.5 to 9.9°C (BU) and from 8.8 to 11.7°C (BG). Chlorophyll *a* concentration ranged from 2.3 to 15.2 mg m^{-3} (BU) and from 0.68 to 1.59 mg m^{-3} (BG) (Fig. 2).

RESULTS

Total mesozooplankton abundance per station varied from 77 to 2087 ind m^{-3} in BU and from 68 to 109 ind m^{-3} in BG (Fig. 2). The differences observed

TABLE 1. – Taxa list at Bahía Ushuaia and Bahía Golondrina. Mean: mean abundance (Ind. m⁻³). SE: standard error. O%: percentage of occurrence in all samples. L: larvae

Taxa	BAHIA USHUAIA			BAHIA GOLONDRINA		
	Mean	SE	O %	Mean	SE	O %
Calanus australis	0.17	0.17	16.66	-	-	-
Centropages brachiatus	0.67	0.42	33.33	0.67	0.33	66.66
Drepanopus forcipatus	4.50	2.99	50	4.00	1.73	100
Clausocalanus brevipes	18.33	11.26	83.33	1.33	0.67	66.66
Acartia tonsa	17.17	12.87	83.33	5.00	1.73	100
Eurytemora americana	7.33	4.70	66.66	0.33	0.33	33.33
Paracalanus parvus	1.17	0.79	50	0.33	0.33	33.33
Ctenocalanus citer	38.33	20.79	100	4.00	2.52	100
Calanoida copepodids	480.00	264.23	100	26.00	11.60	100
Calanoida nauplii	61.67	38.58	100	3.00	1.53	66.66
Calanoida eggs	58.00	29.43	100	-	-	-
Oncaea curvata	1.50	1.31	33.33	-	-	-
Oithona similis	94.33	46.38	83.33	8.67	2.91	100
Tisbe varians	0.33	0.33	16.66	0.67	0.67	33.33
Harpacticus furcatus	0.83	0.48	50	1.33	1.35	33.33
Parathalestris clausi	0.17	0.17	16.66	-	-	-
Harpacticoida spp.	0.33	0.21	33.33	0.33	0.33	33.33
Monstrilloida sp.	0.17	0.17	16.66	-	-	-
Podon leuckarti	6.17	2.40	83.33	0.33	0.33	33.33
Bosmina longirostris	-	-	-	0.33	0.33	33.33
Amphipoda	0.17	0.17	16.66	-	-	-
Decapoda (L)	1.33	1.33	16.66	-	-	-
Euphausiacea (L)	0.20	0.17	16.66	-	-	-
Cirripedia spp. (L)	5.00	2.97	50	2.00	0.58	100
Bryozoa (L)	1.83	1.25	66.66	4.00	1.00	100
Polychaeta	1.33	1.33	16.66	0.33	0.33	33.33
Polychaeta (L)	0.50	0.34	33.33	20.67	17.7	100
Autolytus sp.	-	-	-	0.33	0.33	33.33
Bivalvia (L)	-	-	-	1.33	0.33	100
Obelia sp.	21.33	12.70	100	3.67	2.67	100
Total	801.53			84.98		

in the mesozooplankton abundance in the two bays were statistically significant (t =2.24, p<0.05). Calanoid copepodids were the dominant taxon, with mean abundances of 480 ind m⁻³ (BU) and 26 ind m⁻³ (BG) (Table 1). The other most abundant taxa were *O. similis* (94.33 ind m⁻³) and calanoid nauplii (61.67 ind m⁻³) in BU and polychaete larvae (20.67 ind m⁻³) and *O. similis* (8.67 ind m⁻³) in BG.

Thirty mesozooplankton taxa were recorded (Table 1). Nineteen taxa were common to both bays, 8 were present in BU only, and 3 were found in BG only. A higher number of taxa were encountered in Ushuaia Bay than Golondrina Bay (27 and 22 respectively).

In both bays, holoplankton represented more than 50% of the taxa observed in the present study, whereas the remaining percentage was constituted by meroplankton and tychoplankton (organisms carried into the plankton by dynamic factors). Within the holoplankton, calanoid copepods predominated the total abundance followed by the cyclopoid copepod *Oithona similis*. In BU, the medusa *Obelia* and the cladoceran *Podon leuckarti* also occurred in relatively high numbers. In both

bays, copepodite stages of calanoid copepods, mainly corresponding to *Drepanopus forcipatus*, *Clausocalanus brevipes* and *Ctenocalanus citer* (unpubl. data), occurred in the highest abundances (Table 1). Meroplankton was represented by bryozoan cyphonautes, cirriped nauplii and cypris, decapod zoeae, and benthic polychaete nectochaets. In BU only nine taxa presented the highest occurrence: *C. citer*, *Obelia* sp. and copepodids, nauplii and eggs of Calanoida (100%), and *C. brevipes*, *A. tonsa*, *O. similis* and *P. leuckarti* (83%). In contrast, in BG almost half of the taxa presented 100% occurrence.

The stations within each bay were arranged by cluster analysis according to the abundance and presence of mesozooplanktonic taxa (Fig. 3a, b). In BU, the presence of two groups (1 and 2) was determined at the 50% similarity level. Group 1 (G1) was constituted by Sts. 2, 4, and 6 (eastwards) and group 2 (G2) by Sts. 1, 3, and 5 (westwards) (Fig. 3a). In BG, two groups were observed: group 1 (G1) with Sts. 1 and 2 and group 2 (G2) with only Stn. 3 (Fig. 3b). The arrangement of the stations relative to depth, surface temperature and chlorophyll *a* values
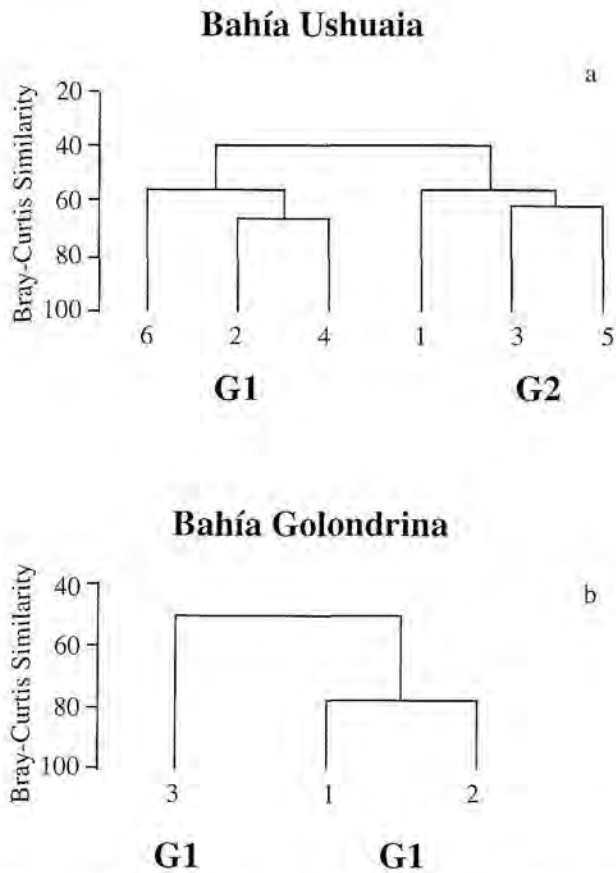
Bahía Ushuaia

Bahía Golondrina

FIG. 3. – Clusters showing the station groups for Bahía Ushuaia (a) and Bahía Golondrina (b).

showed a slightly different pattern, but it was not possible to infer any relationship between these variables and the mesozooplankton distribution pattern. This was probably due to the absence of clear gradients of such variables but also to the low number of observations.

MDS plots revealed the existence of 4 mesozooplanktonic assemblages (A, B, C, and D) in BU (Fig. 4a) and 2 assemblages (A and B) in BG (Fig. 4b), with stress values of 0.14 and 0.08 respectively. These assemblages were also identified through cluster analysis at the 20% similarity level. In BU, assemblage A represented the most abundant taxa which mainly occurred at all stations (calanoid copepodids and nauplii, *C. citer*, and *O. similis*), but also DL, P and Oc were present with low abundances (Table 1 and 2). Assemblage B included low abundance taxa mainly occurring at Sts. 1, 3, 5 (G2) with the exception of bryozoan larvae and *C. brachiatus*. Assemblages C and D included taxa with low abundances. C presented only one species (*P. clausi*), which was found only at Sts. 1, 3, 5, whereas D presented two taxa (Amphipoda and *C.*

australis) occurring only at Sts. 2, 4, 6 (G1). If a similarity level of 10% was considered, A, B and C would form only one assemblage. In BG, assemblage A represented all taxa occurring at Sts. 1 and 2 (G1), some of which were also found at Stn. 3 (G3), mainly those which were found in higher numbers. Assemblage B represented taxa which were observed only at Stn. 3 (Table 1 and 3).

From the results of the multivariate analysis it was possible to detect the relevant taxa characterising different zones (station groups) within each bay (Table 2 and 3). In BU, calanoid copepodids and *O. similis*, which comprised 65 and 11% of the total abundance respectively, were indicators of group 1. The same
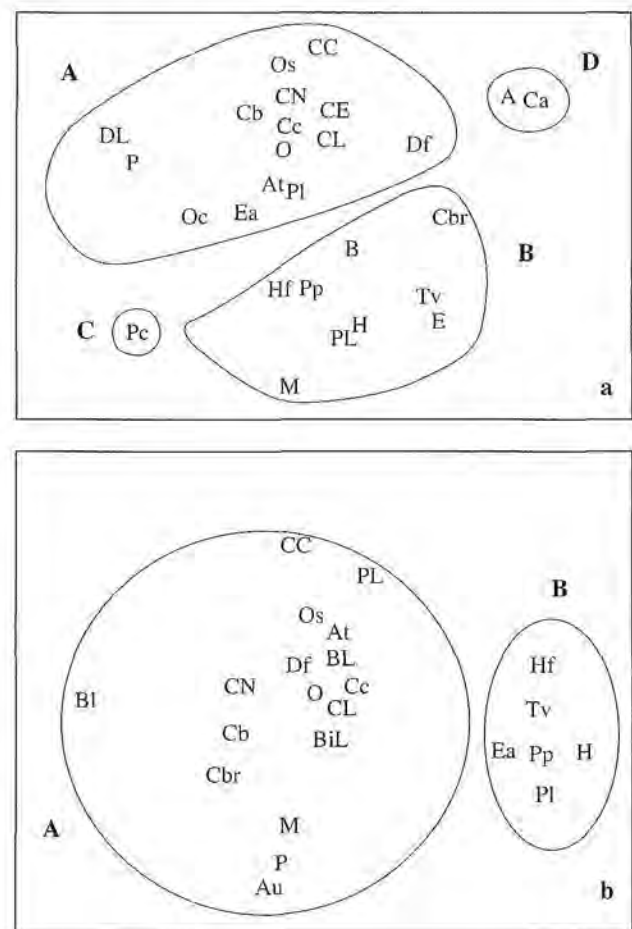

FIG. 4. – MDS plots displaying mesozooplankton assemblages for Bahía Ushuaia (a) and Bahía Golondrina (b). Ca: *Calanus australis*. Cbr: *Centropages brachiatus*. Df: *Drepanopus forcipatus*. Cb: *Clausocalanus brevipes*. At: *Acartia tonsa*. Ea: *Eurytemora americana*. Pp: *Paracalanus parvus*. Cc: *Ctenocalanus citer*. CC: Calanoida copepodids. CN: Calanoida nauplii. CE: Calanoida eggs. Oc: *Oncaea curvata*. Os: *Oithona similis*. Tv: *Tisbe varians*. Hf: *Harpacticus furcatus*. Pc: *Parathalestris clausi*. H: Harpacticoida spp. M: Monstrilloida sp. Pl: *Podon leuckarti*. Bl: *Bosmina longirostris*. A: Amphipoda. DL: Decapoda larvae. EL: Euphausiacea larvae. CL: Cirripedia spp. larvae. BL: Bryozoa larvae. P: Polychaeta. PL: Polychaeta larvae. A: *Autolytus* sp. BiL: Bivalvia larvae. O: *Obelia* sp.

TABLE 2. – Mean abundance (Ind. m⁻³), standard error (SE) and abundance percentage (%) of each taxon in the different assemblages (A, B, C and D) and at each station group present in Bahía Ushuaia. In bold, highest percentages of abundance.

	Taxa	Group 1 (Stn. 2, 4, 6) Mean	SE	(%)	Group 2 (Stn. 1, 3, 5) Mean	SE	(%)
A	Calanoida nauplii	102.33	75.86	7.19	21.00	6.82	9.43
	Ctenocalanus citer	70.00	33.87	4.92	6.67	3.49	2.99
	Oithona similis	160.00	78.57	**11.25**	28.67	16.77	**12.87**
	Obelia sp.	30.33	25.94	2.13	12.33	7.34	5.54
	Clausocalanus brevipes	34.33	19.36	2.41	2.33	1.86	1.05
	Calanoida eggs	57.33	41.38	4.03	58.67	51.24	**26.35**
	Calanoida copepodids	931.67	380.7	**65.49**	28.33	17.44	**12.72**
	Cirripedia spp. larvae	-	-	-	10.00	4.36	4.49
	Podon leuckarti	3.00	2.52	0.21	9.33	3.53	4.19
	Eurytemora americana	10.00	10.01	0.70	4.67	1.77	2.10
	Acartia tonsa	3.33	2.40	0.23	31.00	25.14	**13.92**
	Drepanopus forcipatus	8.67	5.21	0.61	0.33	0.34	0.15
	Polychaeta	2.67	2.67	0.19	-	-	-
	Decapoda larvae	2.67	2.67	0.19	-	-	-
	Oncaea curvata	2.67	2.67	0.19	0.33	0.34	0.15
B	Harpacticus furcatus	-	-	-	1.67	0.66	0.75
	Paracalanus parvus	-	-	-	2.33	1.34	1.05
	Polychaeta larvae	-	-	-	1.00	0.58	0.45
	Harpacticoida spp.	-	-	-	0.67	0.34	0.30
	Bryozoa larvae	2.67	2.67	0.19	1.00	0.00	0.45
	Monstrilloida	-	0	-	0.33	0.34	0.15
	Euphausiacea larvae	-	0	-	0.33	0.34	0.15
	Tisbe varians	-	0	-	0.67	0.66	0.30
	Centropages brachiatus	0.67	0.66	0.05	0.67	0.66	0.30
C	Parathalestris clausi	-	0.00	-	0.33	0.34	0.15
D	Autolytus sp.	0.33	0.34	0.02	-	-	-
	Calanus australis	0.33	0.34	0.02	-	-	-

TABLE 3. – Mean abundance (Ind. m⁻³), standard error (SE) and abundance percentage (%) of each taxon in the different assemblages (A and B) and at each station group present in Bahía Golondrina. In bold, highest percentages of abundance.

	Taxa	Group 1 (Stn. 1, 2) Mean	SE	%	Group 2 (Stn. 3) Abundance	%
A	Obelia sp.	5.0	3.27	5.65	1	1.12
	Ctenocalanus citer	5.0	3.27	5.65	2	2.25
	Cirripedia spp. larvae	2.0	0.82	2.26	2	2.25
	Bryozoa larvae	5.0	0.00	5.65	2	2.25
	Drepanopus forcipatus	5.5	1.23	6.21	1	1.12
	Calanoida nauplii	4.5	0.41	5.08	-	-
	Oithona similis	11.0	2.45	**12.43**	4	4.49
	Acartia tonsa	5.0	2.45	5.65	5	5.62
	Clausocalanus brevipes	2.0	0.00	2.26	-	-
	Centropages brachiatus	1.0	0.00	1.13	-	-
	Bivalvia larvae	1.5	0.41	1.69	1	1.12
	Polychaeta larvae	3.0	0.82	3.39	56	**62.92**
	Calanoida copepodids	36.5	6.95	**41.24**	5	5.62
	Bosmina longirostris	0.5	0.41	0.56	-	-
	Polychaeta	0.5	0.41	0.56	-	-
	Autolytus sp.	0.5	0.41	0.56	-	-
B	Harpacticus furcatus	-	-	-	4	4.49
	Tisbe varians	-	-	-	2	2.25
	Podon leuckarti	-	-	-	1	1.12
	Harpacticoida spp.	-	-	-	1	1.12
	Paracalanus parvus	-	-	-	1	1.12
	Eurytemora americana	-	-	-	1	1.12

taxa (both with 13%), calanoid eggs (26%) and *A. tonsa* (14%) characterised group 2. In BG, calanoid copepodids and *O. similis* comprised 41 and 12% respectively and characterised group 1. Polychaete larvae (63%) were the best indicator of group 2.

DISCUSSION

Despite the physical and hydrological differences between Bahía Ushuaia (BU) and Bahía Golondrina (BG), Esteves *et al.* (2003) found no important dif-

TABLE 4. – Summarised Copepoda data of Bahía Ushuaia and Bahía Golondrina Bay (Beagle Channel) and data of studies in Antarctic areas. N: number of samples. In bold, taxa cited for the Antarctic region; in normal type, for the sub-Antarctic region of South America and underlined for both regions. * These authors observed more copepod species without month specification

Region (Authors)	Year	N	Mesh (mm)	Depth (m) (haul)	Copepods	Mean (Ind. m⁻³)	Total Zooplankton Mean
Bahía Ushuaia and Bahía Golondrina (Beagle Channel) 54°79'-54°85'S 68°22'-68°36'W	2001	9	0.2	0-5 (oblique)	_Oithona similis_	65.77	541.89
					Ctenocalanus citer	26.88	
					Acartia tonsa	13.11	
					Clausocalanus brevipes	12.66	
					Eurytemora americana	5	
(present study)					_Drepanopus forcipatus_	4.33	
					Oncaea curvata	1	
					Paracalanus parvus	0.88	
					Centropages brachiatus	0.66	
					Calanus australis	0.11	
					Tisbe varians	0.44	
					Harpacticus furcatus	1	
					Parathalestris clausi	0.11	
					Harpacticoida spp.	0.33	
					Monstrilloida sp.	0.11	
					Calanoida nauplii	42.11	
					Calanoida copepodids	328.66	
					Calanoida eggs	38.66	
Ezcurra Inlet, Admiralty Bay (King George Island, South Shetland Islands) 62°09'S 58°28'W	1978	17	0.203	0-75 (vertical)	_Oithona similis_	>50%	10.6
					Oithona frigida		
					Oncaea spp.		
					Drepanopus pectinatus		
					Calanoides acutus		
(Chojnacki and Weglenska, 1984)					**Calanus propinquus**		
					Rhincalanus gigas		
					Metridia lucens		
					Metridia longa		
					Metridia gerlachei		
					Metridia curticauda		
					Calanus simillimus		
					Scolecithricella glacialis		
					Euchaeta antarctica		
					Pleuromamma robusta		
					Harpacticoida spp.		
					Copepoda nauplii		
Potter Cove (King George Island, South Shetland Islands) 62°15'S 58°39'W	1996 1997	6	0.055	0-38 (vertical)	_Oithona similis_	69.37	85.83
					Oncaea curvata	< 10	
					Ctenocalanus citer	< 10	
(Elwers and Dahms, 1998)*							
West coast Antarctic Peninsula and Shetland Islands 62°14'-64°52' S 58°44'-63°36' W	1998	7	0.3	0-20 (oblique)	**Calanoides acutus**	< 0.1	0.35
					Calanus propinquus	< 0.1	
					Rhincalanus gigas	< 0.1	
					Subeucalanus longiceps	< 0.1	
					Microcalanus pygmaeus	< 0.1	
					Ctenocalanus citer	< 0.1	
					Metridia gerlachei	< 0.1	
(Hoffmeyer and Schiel, unpubl. data.)					**Paraeuchaeta antarctica**	< 0.1	
					Paralabidocera antartica	< 0.1	
					Oithona similis	<1.0	
					Oithona frigida	< 1.0	
					Oncaea curvata	< 0.1	
					Harpacticoida spp.	< 0.1	

ferences in the surface temperature except that chlorophyll _a_ was different in the two bays in January 2001. They also observed a higher nutrient concentration, except for ammonia, as well as a lower chlorophyll _a_ concentration in BG. In our study, mesozooplankton abundance showed an inverse trend with respect to that of chlorophyll _a_ at most of the stations of both bays. However, in BU the values corresponding to both variables (abundance and chlorophyll _a_) were an order of magnitude higher than those of BG. This could be due to the higher ammonia concentration supply due to anthropogenic activities and freshwater flow in BU (particularly waste-water effluents) than in BG (Esteves _et al._, 2003).

Pelagic copepods were the most abundant group in BU and BG. This is in agreement with studies carried out in the Magellan region and western Beagle Channel (Defren-Janson *et al.*, 1999), the Antarctic Peninsula (Chojnacki and Weglenska, 1984, among others), and the Santa Cruz and Tierra del Fuego coasts (Sabatini *et al.*, 2001). Of 45 species found in the Magellan Straits at all depths (Mazzocchi *et al.*, 1995), nine occurred in our study area in the upper 5 m of the water column. Eight of them (*Centropages brachiatus, D. forcipatus, C. brevipes, Acartia tonsa, Paracalanus parvus, C. citer, Oncaea curvata* and *O. similis*) were recorded in both bays whereas *Calanus australis* was only recorded in BU. At some stations of the eastern Beagle Channel, which is close to the study area, Sabatini *et al.* (2001) observed that the most important species was *D. forcipatus* in autumn and spring while *C. vanus* was abundant only in spring. In the present study, *D. forcipatus, C. brevipes,* and *C. citer* copepodids were dominant in January in both bays. *Calanus australis* was poorly represented in BU and was absent in BG. However, Sabatini *et. al.* (2001) recorded this species in spring at the station nearest to BU with approximately 50 ind m⁻³. The presence at station 1 of BG of *Bosmina longirostris*, a casual and typically fresh-water cladoceran, could be due to the discharge from Río Pipo. Among the cnidarians mentioned by Pagès and Orejas (1999), *Obelia* sp. was found between Ballenero Channel and the stations located on the eastern mouth of the Beagle Channel. This taxon, which was more abundant in BU than in BG, was the only Cnidarian found in our samples.

Although they were not taxonomically examined in detail, a high diversity of both meroplankton and tychoplankton (in particular benthic harpacticoids) was noticeable in the samples. This phenomenon and its high occurrence in both bays might be indicative of the existence of an important benthopelagic coupling as reported by Antezana (1999) and Cattaneo-Vietti *et al.* (1999) for the Magellan Straits and western Beagle Channel. BU and BG, however, are shallower than the above studied sites. The contribution of meroplankton, which is completely different in the two bays (1% and 33.33% of total mean abundance in BU and BG respectively), could be a consequence of depth differences. However, such values are similar in magnitude (15%) to those reported by Defren-Janson *et al.* (1999) for a deep station (270 m) located to the west of the Beagle Channel in the "Victor Hensen" Campaign in November 1994. At this station, as well as in others located in the mouth of the Beagle Channel (30-100 m depth), Thatje *et al.* (2003) recorded mean abundances of Bryozoa, Cirripedia, Bivalvia, and Polychaeta which were higher than those found in the present study. Defren-Janson *et al.* (1999) and Thatje *et al.* (2003) obtained zooplankton samples through vertical hauls from the seafloor to the surface. Thatje *et al.* (2003) observed a high diversity of decapod larvae (17 taxa) and a great variability in abundance (7-12,300 ind.m⁻³). Lovrich (1999) found five taxa with an average density ranging between less than 10 and almost 100 ind 10 m⁻³ in samples collected from bottom to surface in the Beagle Channel (i.e. including BU and BG) during January. We found only one type of decapod larvae at Stn. 2 (BU) but with a similar density (8 ind m⁻³). These abundance-diversity differences may be due to the type and date of sampling.

In the two bays, the station groups defined by cluster analysis may reflect different environment conditions and water quality. In BU, G1 was distributed in an area relatively more external and apparently with less anthropogenic influence. Conversely, G2 was located in a port area that receives effluents with a high organic content (Esteves *et al.*, 2003). The mesozooplankton assemblages found in this bay correspond basically to the following two types: a) those that include the majority of holoplanktonic taxa with either highest or lowest abundance (A and D), and b) those that group meroplankton and tychoplankton (B and C) that characterise G1 and G2 respectively. In BG, G1 was located in a slightly more external area than G2. It could be under the influence of both Río Pipo (Stn. 1) and the area adjacent to the Beagle Channel (Stn. 2). Group 2 (Stn. 3) was distributed near *Macrocystis* (kelp), which would favour the presence of harpacticoid copepods. Although the assemblages found in BG share some taxa with those of BU, they are different in composition and abundance. However, in both bays, mesozooplankton assemblages from zones with or without anthropogenic influence show a certain resemblance.

The taxa recorded in the present study are, in general, indicative of sub-Antarctic and Antarctic coastal waters of South America (Pallares, 1968; Boltovskoy, 1981; Schnack-Schiel and Mujica, 1994; Mazzocchi *et al.*, 1995; Bradford-Grieve *et al.*, 1999; Thatje *et al.*, 2003). Among the 15 copepod taxa found (developmental stages of Calanoida not included), *A. tonsa, P. parvus, C. brachiatus, C. australis, C. brevipes, T. varians, H. furcatus,* Harpactocoida spp., and Monstrilloida spp. are

described from the sub-Antarctic to the Tropical neritic domain (e.g. Pallares, 1968; Ramírez, 1969, 1970, 1971; Björnberg, 1981; Mazzocchi *et al.*, 1995; Boltovskoy, 1999). *Drepanopus forcipatus* has been cited by Mazzocchi *et al.* (1995) for the Magellan Straits, but this species is distributed not only on the southern Argentinean and Chilean shelves in the Atlantic and Pacific oceans respectively, but also within a small area around South Georgia Island (Heron and Bowman, 1971; Hülsemann, 1985; Sabatini *et al.*, 2001). The copepod *Eurytemora americana*, typical of the estuaries and coasts of the northern hemisphere (Heron, 1964; Kos, 1977; Miller, 1983), probably develops a short planktonic pulse in these bays during summer. This species, which is considered accidentally introduced in ballast water, was previously detected in Bahía Blanca estuary with a temperature range from 8-9 to 16-17°C during its planktonic pulse (Hoffmeyer *et al.*, 2000; Hoffmeyer, 2004).

Our findings of the presence of *O. similis*, *C. citer*, and *O. curvata* in BU and BG agree with those of Mazzocchi *et al.* (1995), who recorded these species in the Magellan Straits. Among the copepods found in our study, the above-mentioned species are the only ones found in both the Antarctic and sub-Antarctic domains. In the Antarctic region, these small sized copepods are distributed in oceanic areas down to 1000 m depth as well as in coastal ones (Atkinson and Peck, 1988; Metz, 1996; Atkinson and Sinclair, 2000), although *O. similis* prefers the upper 200 m (Schnack *et al.*, 1985). They are important because of their high density and biomass and their trophic role within the system (Fransz and González, 1995; Metz, 1995; 1996; Atkinson and Sinclair, 2000). *Oithona similis* extends from the Antarctic (e.g. Schnack *et al.*, 1985; Zmijewska, 1988) to tropical domains (Ramírez, 1970a, b; 1971; Mazzocchi *et al.*, 1995; Bradford-Grieve *et al.*, 1999; Marrari *et al.*, 2004). On the other hand, *C. citer* and *O. curvata* only extend from Antarctic (Hopkins, 1985; Montú and Oliveira, 1986) to southern sub-Antarctic waters (Mazzocchi *et al.*, 1995). It is important to note that the latter author found more Antarctic copepod species in the Straits of Magellan, which were not observed in our study. This could be because we sampled only the upper 5 m of the water column.

Due to the numerical importance of copepods, we compared their occurrence and abundance in BU and BG with those reported from some Antarctic coastal sites. We used Elwers and Dahms' (1998)

data collected from Potter Cove (King George Island, South Shetland Islands), Chognacki and Weglenska's (1984) data collected from Ezcurra inlet, Admiralty Bay (South Shetland Islands), and Hoffmeyer and Schiel's (unpubl. data) data collected at coastal stations of the Antarctic Peninsula and the Shetland Islands (between 62-64°S and 58-63°W). It is evident that most of the species recorded are restricted to the Antarctic domain (Table 4). However, *O. similis* and either *O. curvata* or *Oncaea* spp. are present at all the sites considered in the present survey. *C. citer* and Harpacticoida spp. also occurred at all the sites except for Ezcurra Inlet and Potter Cove. *O. similis* abundance in BU and BG (Beagle Channel) is similar to that found in Potter Cove, and is higher than that at the other sites. The highest abundance of *C. citer* occurs in BU and BG. *Oncaea curvata* shows, in BU and BG, values which are comparable with those of Potter Cove and which are lower than those off the Antarctic Peninsula and the South Shetland Islands. The wide distributional range of *O. similis*, *O. curvata* or *Oncaea* spp., and *C. citer* (40-70°S) is in agreement with Atkinson and Sinclair (2000), indicating that the Polar Front is not exactly a biogeographical barrier to them. Moreover, their highest concentrations have been found in the Polar Front area itself (Hopkins, 1971; Franz and Gonzales, 1997; Atkinson, 1998). Antezana (1999) also coincides with these authors, who claim that the presence of some Antarctic zooplankton groups in sub-Antarctic waters results from several mechanisms of seawater circulation. Conversely, Thatje and Fuentes (2003) detected the presence of two decapod crustacean larval morphotypes, Hippidae and Pinnotheridae, as well as the copepod genus *Acartia*, which are exclusively sub-Antarctic, in Antarctic waters (Maxwell Bay, sample taken on 28 March, 2002). These authors conclude that this phenomenon could be due to an intrusion of Subantarctic water masses into the Antarctic environment.

Though preliminary, the results from the present study are relevant considering the scarce knowledge on zooplankton in Bahía Ushuaia and Bahía Golondrina. On the other hand, the finding in these bays of *O. curvata*, *C. citer*, and *O. similis*, which are common species in the Antarctic, confirms our hypothesis that their distribution extends into sub-Antarctic waters. This finding, among others, together with the records of Thatje and Fuentes (2003), suggests the existence of an important pelagic exchange—in both directions—between the Antarctic and sub-Antarctic domains.

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