Ecological features of Terebellida fauna (Annelida, Polychaeta) from Ensenada de San Simón (NW Spain)

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Abstract

Ecological features of Terebellida fauna (Annelida, Polychaeta) from Ensenada de San Simón (NW Spain).— Ecological features of Terebellida (Annelida, Polychaeta) inhabiting the intertidal and subtidal soft–bottoms of Ensenada de San Simón (NW Spain) were analysed by means of quantitative sampling. A total of 4,814 specimens belonging to five families (Ampharetidae, Pectinariidae, Terebellidae, Trichobranchidae and Sabellariidae) and ten species were collected in a variety of substrata and depths. Ampharetidae was the numerically dominant family mostly due to the abundance of *Ampharete finmarchica* and *Melinna palmata*; these species accounted for up to 94% of the total Terebellida abundance. Intertidal areas colonised by the seagrasses *Zostera marina* L. and *Z. noltii* Hornem. One thousand eight hundred and thirty–two harboured low densities of Terebellida, whereas the deeper subtidal muddy bottoms showed high abundances of ampharetids. Multivariate analyses suggested that Terebellida assemblages are highly correlated with sediment composition.

Key words: Terebellida, Polychaeta, Biodiversity, Soft bottoms, Ensenada de San Simón, Atlantic Ocean.

Resumen

Características ecológicas de los Terebellida (Annelida, Polychaeta) de la Ensenada de San Simón (NO de España).— Las características ecológicas de los Terebellida (Annelida, Polychaeta) presentes en los fondos blandos intermareales y sublitorales de la Ensenada de San Simón (NW España) son analizadas por medio de muestreos cuantitativos. Un total of 4.814 individuos pertenecientes a cinco familias (Ampharetidae, Pectinariidae, Terebellidae, Trichobranchidae y Sabellariidae) y diez especies fueron recolectados en distintos sustratos y profundidades. Los Ampharetidae fueron la familia dominante en términos numéricos debido a la abundancia de *Ampharete finmarchica* y *Melinna palmata*; estas especies constituyeron hasta el 94% del total de los Terebellida. Las áreas intermareales estaban colonizadas por las fanerógamas *Zostera marina* L. y *Z. noltii* Hornem. Mil ochocientos treinta y dos presentaron bajas densidades de Terebellida; por el contrario, los fondos fangosos sublitorales más profundos mostraron una gran abundancia de anfarétidos. Los análisis multivariantes indicaron que las agrupaciones de Terebellida estaban altamente correlacionadas con la composición del sedimento.

Palabras clave: Terebellida, Polychaeta, Biodiversidad, Fondos blandos, Ensenada de San Simón, Océano Atlántico.

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Introduction

Polychaetes play a major role in the functioning of benthic communities in terms of recycling and reworking of marine sediments (Hutchings, 1998). They are often the numerically dominant macrobenthic taxon in marine sediments (Jumars & Fauchald, 1977). Due to their high diversity of trophic behaviours and their great ability to adapt to different habitats (Fauchald & Jumars 1979), they are considered good indicators of community structure in benthic invertebrate assemblages (Olsgard et al., 2003). Moreover, some polychaetes are either sensitive or tolerant to a variety of perturbations and therefore have been regarded as indicators of marine environmental conditions (Grall & Glémarec, 1997; Tomassetti & Porrello, 2005).

In the search for strategies and management plans to achieve sustainable use of protected areas, quick measures of their biodiversity are needed. In this sense, among the polychaetes, Terebellida species frequently represent an important component of the benthic habitat assemblages in terms of abundance and biomass, and they have been found to be a good indicator of polychaete species richness and main faunal patterns in biodiversity studies of marine benthic communities (Olsgard et al., 2003). The order Terebellida consists of large, long–lived and taxonomically well–defined polychaetes that occur at all depths and in all sediment types (Olsgard et al., 2003). They are usually tubicolous and surface deposit–feeders (Fauchald & Jumars, 1979), irrigating the substrate and actively transporting oxygen into their burrows, and therefore considerably affecting the sediments and their associated faunal communities (Fauchald & Jumars, 1979).

Numerous faunistic and ecological works on the macrobenthic communities of the Galician coasts (NW Iberian peninsula), and specially their highly productive rias, have been carried out in recent years (Garmendia et al., 1998; Olabarria et al., 1998; Troncoso et al., 2005; Moreira et al., 2006). The soft–bottom polychaete faunas of the rias have been exhaustively studied (Parapar et al., 2000; Moreira et al., 2006; Cacabelos et al., 2008a; Lourido et al., 2008). Nevertheless, the role of terebellids is less understood. We here describe the diversity and assemblage structure of the order Terebellida inhabiting intertidal and subtidal soft substrata at Ensenada de San Simón (NW Iberian Peninsula), a Special Conservation Zone of the Nature 2000 Network. Furthermore, we investigated the main abiotic factors structuring the Terebellida populations at Ensenada de San Simón and tested whether the Terebellida is a useful indicator group to predict the species' richness in soft bottoms of the Galician rias, as suggested by Olsgard et al. (2003) for the North Atlantic.

Material and methods

Ensenada de San Simón is located in the inner part of the Ría de Vigo, between 42º 17' and 42º 21' N and between 8º 37' and 8º 39' W (fig. 1). Intertidal and shallow subtidal areas of this inlet are colonised by *Zostera noltii* Hornem. 1832 and *Z. marina* L. meadows, and their soft bottoms are mainly muddy with high organic matter contents (Vilas et al., 1995). The inlet is subjected to large freshwater inputs, resulting in salinity fluctuations on both a tidal and seasonal basis (Nombela & Vilas, 1991). In addition, culture of mussels on rafts is a common practice in the inlet.

Terebellida specimens were collected in Ensenada de San Simón during XI and XII 99. Twenty–nine sites were sampled (fig. 1) with a van Veen grab (0.056 m^2; five replicates per site) and samples were sieved through a 0.5 mm mesh. The retained material was fixed in 10% buffered formalin, and fauna were sorted from the sediment and preserved in 70% ethanol for later identification. Temperature and pH were measured *in situ* both from the water and the sediment. Additional samples were taken at each site for later sediment analyses (calcium carbonate and total organic matter contents and grain–size analysis; see Cacabelos et al., 2008b for further details).

We determined several cological indices (total abundance, number of species, Shannon–Wiener's diversity index, Pielou's evenness index and Soyer's frequency index) depending on the presence and abundance of the species for each site. Assemblages were determined using non–parametric multivariate techniques (Plymouth Routines of the Multivariate Ecological Research software package, PRIMER; Clarke & Warwick, 1994), and SIMPER analysis was used to identify which species contributed most to dissimilarity among the groups of sites determined by classification and ordination analyses. Relationships between abundance of Terebellida and environmental variables were studied using Spearman's non–parametric correlation coefficients and the BIOENV procedure (PRIMER package). Environmental variables expressed in percentages were previously transformed by log (x + 1) and all of them were normalised.

Results

Physical characteristics of the water and sediments of Ensenada de San Simón are shown in table 1. Subtidal soft bottoms were characterised by a predominance of muddy sediments (silt/clay fraction: 67.1% ± 5.4, mean ± SE) with a high total organic matter (17.7% ± 1.8) and low calcium carbonate content (6.8% ± 0.8). Sandy sediments were present in intertidal areas (silt/clay fraction: 37.7% ± 11.0), where the lower organic matter contents were found (12.9% ± 3.6). Polychaetes were the numerically dominant macrobenthic taxon in Ensenada de San Simón (Cacabelos et al., 2008b).

A total of 4,814 specimens of Terebellida belonging to five families and ten species were identified (table 2). The inner intertidal area of the inlet, colonised by the seagrasses *Zostera marina* and *Z. noltii*, showed very low abundance or total absence (sites 1, 2, 4, 5, 6, 10, 15 and 29) of Terebellida. Most of the Terebellida were found in muddy subtidal

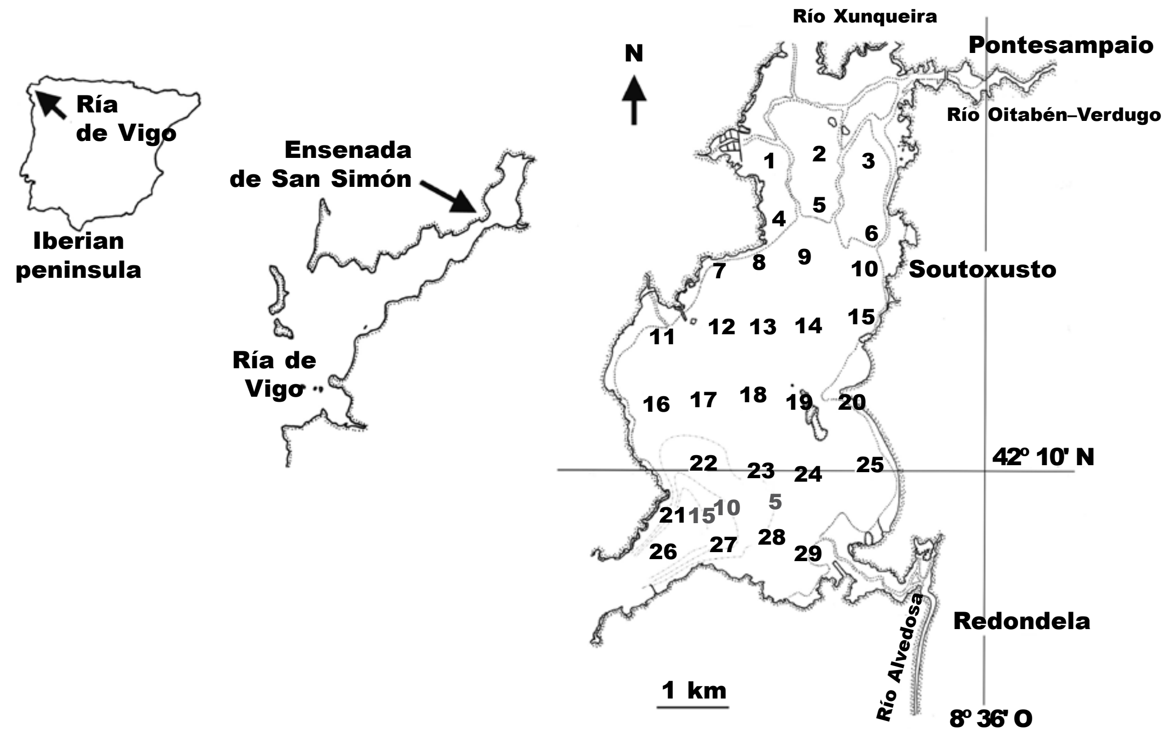

Fig. 1. Location of Ensenada de San Simón (Ría de Vigo) and position of the 29 sampling sites.

Fig. 1. Localización de la Ensenada de San Simón (Ría de Vigo) y posición de las 29 estaciones de muestreo.

bottoms (99.6% of total abundance). The ampharetids *Ampharete finmarchica* and *Melinna palmata* were the numerically dominant species, representing 60.2% and 34.4% ,respectively, of total abundance, and reaching densities up to 2,114 and 990 ind./m^2, respectively. The aforementioned species appeared distributed all over the subtidal part of the inlet, increasing their densities along the central channel: in sites 14, 17, 19, 21, 22, 23, 26 and 27, densities of both species considered together ranged from 1,161 to 2,711 ind./m^2. According to Soyer's frequency (*F*) index, only two out of ten species were characterized as Constant ($F \geq 50$, namely *M. palmata* and *A. finmarchica*), three species as Common ($25 < F < 49$; *Lagis koreni*, *Lanice conchilega* and *Terebellides stroemi*) and the rest as Rare ($F < 25$). The number of Terebellida species in the inlet showed a direct relationship with the polychaete and the overall macrobenthic species richness (Cacabelos et al., 2008a; fig. 2).

Ecological indices of sites at which Terebellida were found are shown in table 3. The highest densities were recorded at sites 22, 27, 26 and 14 (2,239.3 to 2,767.9 ind./m^2), due to the high abundance of *A. finmarchica* and *M. palmata*. These sites, together with sites 19 and 21, showed the largest number of species (6–10). The Shannon–Wiener's diversity index reached maximum values up to 1.5 in sites 9 and 25.

Dendrogram obtained through cluster analysis based on abundance data showed three main groups (fig. 3): Group A, composed of sites 11, 3 and 7, Group B (sites 28, 13, 24, 8, 9 and 25) and Group C (sites 12, 18, 22, 26, 27, 21, 23, 16, 17, 14 and 19). Site 20 appears clearly separated from the others due to the presence of only one specimen of *Polycirrus* sp.; Ordination of sites through MDS analysis confirmed the results of the dendrogram (stress: 0.04). The physical features of these assemblages are shown in table 4. Group A is poorly represented in terms of number of species; sites composing this group are located in the marginal part of the inlet, in shallow sediments subjected to strong variations of salinity close to the mouth of the river Oitabén–Verdugo and the small freshwater discharge near the western harbour (fig. 1). Sites from group B are muddy bottoms with low densities of species but high diversity indices due to the low dominances of *L. koreni*, *M. palmata*, *A. finmarchica* and *L. conchilega*. Finally, group C is characterized by deeper subtidal sites showing coarser sediments (table 4). The species that contributed most to the similarity and dissimilarity among groups of sites are listed in table 5. *A. finmarchica* strongly contributed to the similarity within the groups A, B and C, whereas *L. koreni* showed a high ratio coefficient in group B. *A. finmarchica* and *M. palmata* showed a

Table 1. Parameters measured in water and sediment and bathymetry in sampling sites at Ensenada de San Simón (based in Cacabelos et al., 2008a): Tªw. Temperature of water (ºC); Q_{50}. Median grain size (mm); Gravel, sand and silt/clay fractions in %; D. Depth (m); Tªs. Temperature of sediment (ºC); OM. Organic matter content (%); CO_3. Calcium carbonate content (%).

Tabla 1. Parámetros medidos en el agua y en el sedimento y batimetría en los lugares de muestreo en la Ensenada de San Simón (basados en Cacabelos et al., 2008a): Tªw. Temperatura del agua (ºC); Q_{50}. Mediana del tamaño de grano (mm); Fracciones de grava, arena y limo/arcilla en porcentajes; D. Profundidad (m); Tªs. Temperatura del sedimento (ºC); OM. Contenido de materia orgánica (%); CO_3. Contenido en carbonato cálcico (%).

Site	Tªw	Q_{50}	Gravel	Sand	Silt/clay	Bottom type	D	Tªs	OM	CO_3
1	13.6	0.009	0.084	16.833	83.083	Mud	1.6	14.5	26.52	5.52
2	13.8	0.014	2.211	32.929	64.86	Mud	1.6	13.9	23.30	5.60
3	13.9	0.075	0	56.736	43.264	Sandy mud	1.6	13.8	19.05	6.12
4	14.5	0.320	17.793	73.985	8.222	Muddy sand	1.6	14.3	2.16	6.00
5	14.8	1250	29.959	64.363	5.678	Muddy sand	1.8	14.7	4.90	7.33
6	13.7	1150	21129	76826	2045	Very coarse sand	1.6	13.9	0.95	11.98
7	13.1	0.145	0.32	74.302	25.378	Sandy mud	3.4	12.1	3.95	6.31
8	13.1	0.040	0.631	35.894	63.475	Mud	3.2	10.1	10.88	5.80
9	12.9	0.010	0.871	27.674	71.455	Mud	2.9	14.7	18.12	4.28
10	17.3	0.008	0	2.333	97.667	Mud	2.9	15	36.93	4.28
11	12.4	0.010	0	8.858	91.142	Mud	3.6	12.7	26.50	4.81
12	12.4	0.009	1.103	19.183	79.714	Mud	3.8	12.3	19.93	2.12
13	12.4	0.012	3.014	22.995	73.991	Mud	3.5	12.3	23.00	2.36
14	15.8	0.013	7.074	24.365	68.561	Mud	4.6	12.1	19.78	2.28
15	15.6	0.740	3.493	94.385	2.122	Coarse sand	1.8	14.7	1.00	8.35
16	17.3	0.008	0.953	15.479	83.568	Mud	4.2	20.9	21.47	4.53
17	17.5	0.015	4.723	31.111	64.166	Mud	3.7	18.4	18.93	5.90
18	16.1	0.010	1.982	19.971	78.047	Mud	4.5	16	15.20	4.52
19	16.1	0.010	0	13.941	86.059	Mud	4.7	17.2	21.05	4.53
20	14.1	0.210	11.831	77.685	10.484	Muddy sand	2.6	14.1	1.80	4.85
21	17.7	0.010	0.587	26.354	73.059	Mud	18	14.6	19.50	4.61
22	16.6	0.013	1.028	37.383	61.589	Mud	10.4	16.7	12.98	5.51
23	18.2	0.011	1.254	25.148	73.598	Mud	5.9	16.3	22.17	5.40
24	18.1	0.005	0	12.589	87.411	Mud	4.1	19.2	21.42	4.07
25	18	0.012	6.847	31.79	61.363	Mud	1.6	16.9	23.72	5.47
26	16.5	1500	40.166	48.34	11.494	Muddy sand	28.2	16.1	7.22	40.46
27	16.1	0.013	9.297	28.211	62.492	Mud	11.5	16.8	10.60	8.61
28	17.2	0.011	2.367	19.031	78.602	Mud	4.7	16.3	22.32	4.61
29	17	0.013	0.093	31.707	68.2	Mud	2	17	14.33	4.45

similar pattern of distribution along the inlet according to their average abundance. The trichobranchid, *T. stroemi*, was only present in group C and also greatly contributed to average similarity within this group.

Cluster analysis based on abundance data of species showed three main groups (fig. 4). The first group was composed of *Amphitritides gracilis*, *Sabellaria spinulosa* and *Paramphitrite tetrabranchia*, species

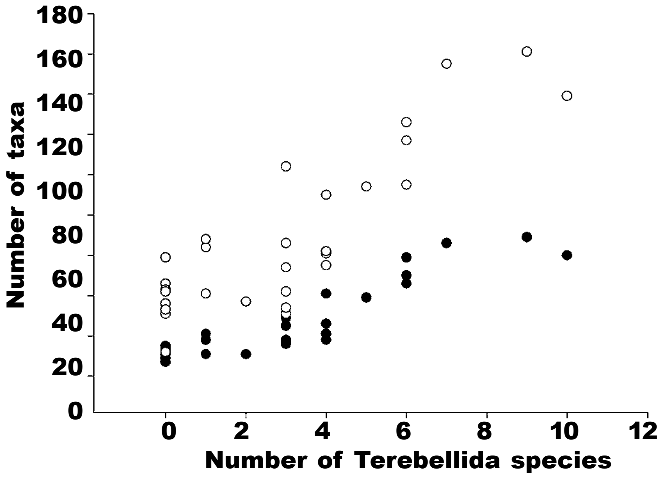

Fig. 2. Relationship between total number of benthic polychaete species (●) and total benthic taxa (○) (data from Cacabelos et al., 2008b and 2008a respectively) and number of Terebellida species ($y = 12.09x + 32.22$, $R^2 = 0.73$ and $y = 6.15x – 8.43$, $R^2 = 0.82$).

Fig. 2. Relación entre el número total de especies de poliquetos bentónicos (●) y taxones bentónicos totales (○) (datos de Cacabelos et al., 2008b y 2008a, respectivamente) y el número de especies de Terebellida ($y = 12{,}09x + 32{,}22$; $R^2 = 0{,}73$ y $y = 6{,}15 x – 8{,}43$; $R^2 = 0{,}82$).

present in site 27 and scarcely distributed along the inlet. The second group was defined by *A. finmarchica* and *M. palmata* at an 87.6% similarity level; these taxa were distributed all along the subtidal bottoms of the inlet appearing in very high densities. The third group was formed at a lower similarity level (45%) and was composed of *L. koreni*, *L. conchilega*, *T. stroemi*, *Pista cristata* and *Polycirrus* sp., which appeared also in the subtidal bottoms of the inlet but in low densities, only surpassing the value of 42 ind./m^2 in the case of *P. cristata* in site 26, where it reached a beak density of 282 ind./m^2.

The combination of temperature of bottom water, coarse sand, fine sand, very fine sand and carbonate content showed the highest correlation with distribution and abundance of Terebellida (BIOENV, $p_w = 0.50$). The sabellariid, *S. spinulosa*, showed high positive correlations with the coarse fractions of sediment (gravel, very coarse and coarse sand) and mean grain size (Spearman's correlation coefficient (r_s = 0.73–0.91), depth ($r_s = 0.82$) and carbonate content ($r_s = 0.94$). On the other hand, *A. finmarchica*, *P. tetrabranchia*, *P. cristata* and *Polycirrus* sp. were also positively correlated with depth ($r_s > 0.5$), while the last two species showed positive correlations with coarse fractions of sediment and carbonate content ($r_s > 0.7$), and *T. stroemi* was positively correlated with temperature of sediment ($r_s = 0.54$).

Discussion

This study showed that Ensenada de San Simón has a diverse Terebellida fauna; some species presented very high densities in the deep and muddy habitats of the mouth of the inlet. In general, diversity values of Terebellida were high in comparison to other Galician rías. For example, in the muddy sands of Ría de Aldán (Lourido et al., 2008), with high organic matter contents, *A. finmarchica*, *M. palmata* and *T. stroemi* were also abundant, but they reached smaller densities than in San Simón, only up to 564 ind./m^2 for *A. finmarchica* and up to 21 ind./m^2 for the other two species.

Three major Terebellida assemblages were determined in Ensenada de San Simón through multivariate analyses. Discrimination between these groups was mainly correlated to the Ampharetidae density, as shown by the SIMPER analysis. *A. finmarchica* and *M. palmata* showed the highest similarity (87.6%, see also fig. 4) and were much more abundant within the deeper muddy bottoms of the mouth of the inlet. These species showed high similarity since both were distributed in wide ranges of depth and sediment temperatures, appearing from intertidal bottoms to 28.2 m and from 10.1ºC to 20.9ºC, within the higher silt/clay and organic matter contents (up to 91% and 26% respectively). Other surface deposit–feeder polychaetes, such as paranoids (Cacabelos et al., 2008a), have also shown high abundances in these bottoms,. This is in agreement with the reported dominance of this trophic group in the assemblages from intertidal and shallow areas of other Galician rías (Anadón, 1980; Mazé et al., 1993; Moreira et al., 2006) and estuaries in Portugal (*e.g.* Gaudêncio & Cabral, 2007).

Some of the Terebellida from San Simón have been reported as target species (Greham, 1986; Hiscock et al., 2004). *M. palmata* was a key species in determining the detected groups of sites in Ensenada de San Simón, its densities being much

Table 2. List of identified Terebellida species found in Ensenada de San Simón, indicating the number of individuals found at each site in the inlet (ind./m^2).

	Sites							
Order Terebellida	3	7	8	9	11	12	13	14
Family Sabellariidae Johnston, 1865								
Sabellaria spinulosa Leuckart, 1849								
Family Pectinariidae Quatrefages, 1865								
Lagis koreni Malmgren, 1866		7.1	7.1			10.7	25.0	10.7
Family Ampharetidae Malmgren, 1866								
Ampharete finmarchica (Sars, 1866)	14.3	3.6	25.0	60.7	3.6	42.9	32.1	1,310.7
Melinna palmata Grube, 1870		3.6	42.9	3.6	228.6	17.9	846.4	614.3
Family Terebellidae Malmgren, 1867								
Amphitritides gracilis (Grube, 1860)								
Lanice conchilega (Pallas, 1766)			3.6	10.7				42.9
Paramphitrite tetrabranchia Holthe, 1976								
Pista cristata (Müller, 1776)								
Polycirrus sp.					3.6		3.6	
Family Trichobranchidae Malmgren, 1866								
Terebellides stroemi Sars, 1835						7.1		10.7

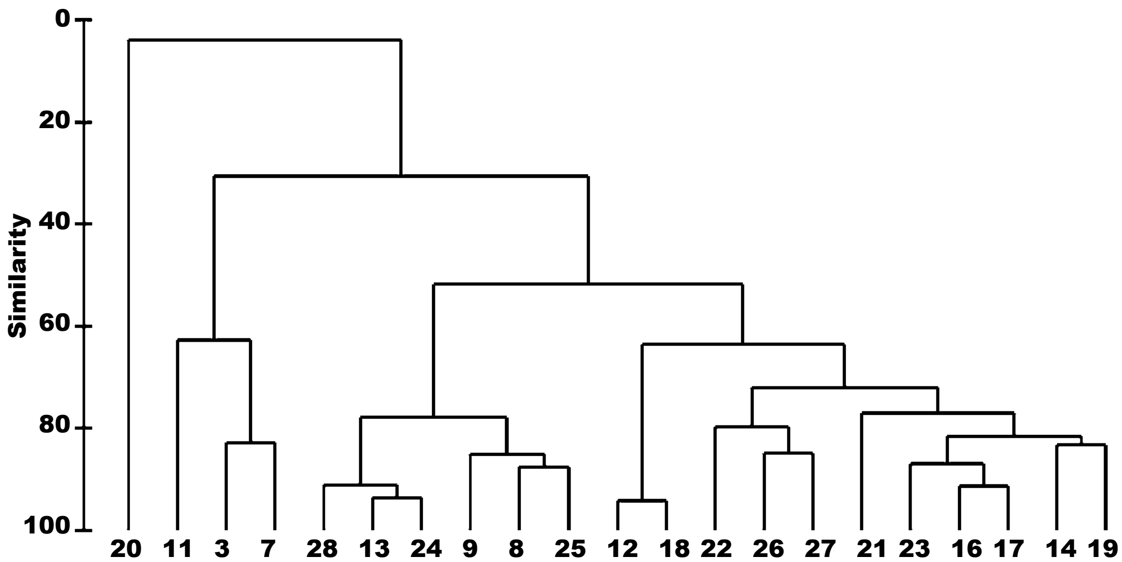

Fig. 3. Dendrogram using Bray–Curtis similarity coefficient showing the classification of sites.

Fig. 3. Dendrograma confeccionado utilizando el coeficiente de similitud de Bray–Curtis, que muestra la clasificación de las estaciones.

Tabla 2. Lista de especies de Terebellida identificadas, encontradas en la Ensenada de San Simón, indicándose el número de individuos encontrados en cada estación de la ensenada (ind./m²).

Sites												
16	17	18	19	20	21	22	23	24	25	26	27	28
										32.1	14.3	
32.1		14.3			7.1		7.1	14.3	25.0	7.1	10.7	
435.7	582.1	92.9	450.0	0.0	792.9	1717.9	825.0	50.0	10.7	1,642.9	2,114.3	150.0
621.4	267.9	710.7	0.0	321.4	992.9	582.1	35.7	7.1	260.7	325.0	28.6	
											7.1	
			7.1		3.6				21.4	10.7	28.6	
						3.6				3.6	7.1	
		7.1		7.1	10.7				282.1	3.6		
	3.6	3.6	10.7				28.6	3.6				
25.0	39.3	3.6	17.9		3.6	25.0	28.6			10.7	10.7	

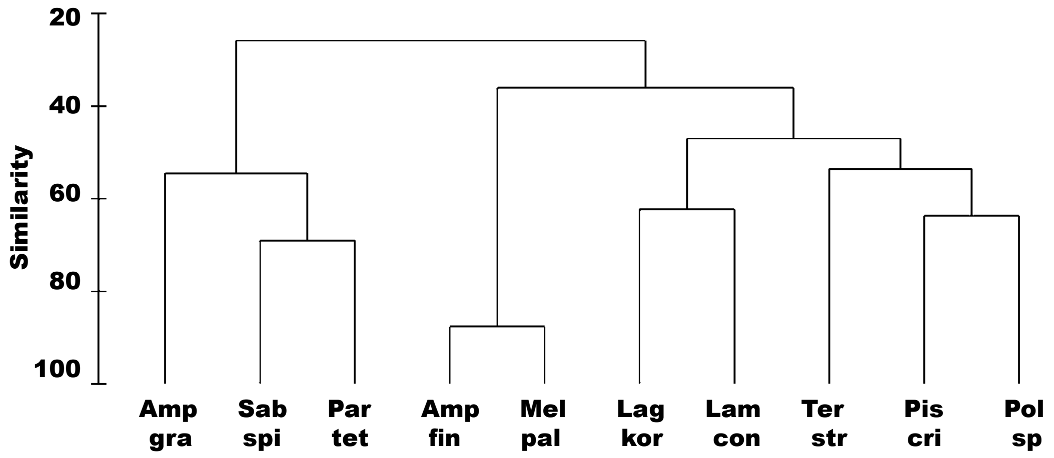

Fig. 4. Dendrogram using Bray–Curtis similarity coefficient showing the classification of species. Species codes: Amp gra. *Amphitritides gracilis*; Sab spi. *Sabellaria spinulosa*; Par tet. *Paramphitrite tetrabranchia*; Amp fin. *Ampharete finmarchica*; Mel pal. *Melinna palmata*; Lag kor. *Lagis koreni*; Lan con. *Lanice conchilega*; Ter str. *Terebellides stroemi*; Pis cri. *Pista cristata*; Pol sp. *Polycirrus* sp.

Fig. 4. Dendrograma confeccionado utilizando el coeficiente de similitud de Bray–Curtis, que muestra la clasificación de las especies. Código de las especies: Amp gra. Amphitritides gracilis*; Sab spi.* Sabellaria spinulosa*; Par tet.* Paramphitrite tetrabranchia*; Amp fin.* Ampharete finmarchica*; Mel pal.* Melinna palmata*; Lag kor.* Lagis koreni*; Lan con.* Lanice conchilega*; Ter str.* Terebellides stroemi*; Pis cri.* Pista cristata*; Pol sp.* Polycirrus *sp.*

Table 3. Faunistic parameters at each site where species of Terebellida were found: Ns. Number of species/0.28 m^2; N. Total abundance/m^2; *J'*. Pielou's evenness; *H'*. Shannon Wiener's diversity index (log_2).

Tabla 3. Parámetros faunísticos en cada estación donde se hallaron especies de Terebellida: S. Número de especies por 0,28 m^2; N. Abundancia total/m^2; J'. *Índice de equitatividad de Pielou;* H'. *Índice de diversidad de Shannon Wiener (log_2).*

Site	Ns	N	*J'*	*H'*
3	1	14.29	–	–
7	1	3.57	–	–
8	4	39.29	0.75	1.49
9	4	121.43	0.79	1.58
11	2	7.14	1.00	1.00
12	3	278.57	0.50	0.79
13	3	60.71	0.91	1.45
14	6	2,239.29	0.47	1.22
16	4	1,085.71	0.59	1.19
17	5	1,278.57	0.57	1.33
18	3	364.29	0.56	0.89
19	6	1,207.14	0.48	1.23
20	1	3.57	–	–
21	6	1,132.14	0.39	1.00
22	7	2,767.86	0.40	1.12
23	3	1,435.71	0.69	1.10
24	3	92.86	0.82	1.30
25	4	53.57	0.94	1.89
26	9	2,296.43	0.44	1.40
27	10	2,521.43	0.25	0.84
28	3	189.29	0.58	0.91

higher than those observed for example by Oyenekan (1988) in British waters (up to 990 ind./m^2). A great impact of the high density of this tube–builder over the associated community may be inferred: *M. palmata* is a large and gregarious polychaete and it has a significant impact on the community structure in soft–bottom subtidal habitats, such as those of copepods (Olafsson et al., 1990), by forming faecal casts on the sediment surface, which could affect the associated meiofauna community. Moreover, the dynamics of its populations can be useful to determine the environmental status of the littoral and sublittoral muds and sublittoral mixed sediments (Hiscock et al., 2004). For example, the abundance of this species increases in habitats suffering organic enrichments, such as those impacted by salmon farming (Kempf et al., 2002). The high densities of *M. palmata* in San Simón could be related with the high organic matter content of the sediments, derived from both the hydrodynamic conditions in the area and the pellet production of the mussels cultured there. Guillou & Hily (1983) detected a high organic matter flux over their studied area, but the redox potential conditions avoided the settlement of *M. palmata* and therefore the establishment of large populations. Only after favourable redox conditions were reached could organic enrichment positively contribute to the growth of the *M. palmata*. This species also served as indicator species of the environmental conditions, increasing its density after an increase of fine sediments derived from some anthropogenic source (Dauvin et al., 2007). However, in San Simón the effect of the high organic matter content on *M. palmata* density can be restricted depending on the state of the populations and on the interaction with other abiotic factors, since no significant correlation was detected through statistical analyses. Another terebellid, *T. stroemi,* can be used to detect metals in sublittoral muds, and its density decreases in the case of organic enrichment or after trawling pressures. Therefore, the results shown here can be useful for further comparative analysis to determine the ecological status along a protected area, *i.e.* the Ensenada de San Simón, and to take the appropriate control measures.

Table 4. Physical features of the groups of sites determined according to Terebellida fauna in Ensenada de San Simón (values: mean ± SD): G. group; Q_{50}. Median grain size (mm); OM. Total organic matter content (%); CO_3. Calcium carbonate content (%).

Table 4. Características físicas de los grupos de lugares determinados según la fauna de Terebellida en la Ensenada de San Simón (valores: media ± DS); G. Grupo; Q_{50}, Tamaño medio del grano (mm); OM. Contenido total de materia orgánica (%); CO_3. Contenido de carbonato cálcico (%),

G	Depth	Q_{50}	Gravel	Sand	Silt/clay	OM	CO_3
A	2.9 ± 0.6	0.18 ± 0.04	0.1 ± 0.1	46.6 ± 19.6	53.3 ± 19.6	16.5 ± 6.6	5.8 ± 0.5
B	3.3 ± 0.4	0.02 ± 0.01	2.3 ± 1.0	25.0 ± 3.5	72.7 ± 4.0	19.9 ± 2.0	4.4 ± 0.5
C	9.5 ± 2.5	0.16 ± 0.15	6.6 ± 3.9	27.0 ± 3.3	66.4 ± 6.7	17.4 ± 1.6	8.4 ± 3.6

Table 5. Results of SIMPER analysis. Species were ranked according to their average contribution to similarity/dissimilarity within/between site groups determined by cluster analysis: Av.Sim. Average similarity; Av.Diss. Average dissimilarity; Av.Abund. Average abundance (ind./m^2); Av.Sim/Diss. Average similarity/dissimilarity; Ratio. Value of similarity (or dissimilarity)/standar deviation, Sim(Diss)/SD; Contrib.%.Percentage of contribution; Cum.%. Percentage of cumulative similarity/dissimilarity.

Tabla 5. Resultados del análisis SIMPER. Se clasificaron las especies de acuerdo con su contribución media a la similaridad/disimiliaridad dentro/entre los grupos de estaciones determinados por los análisis de clasificación: Av.Sim. Similaridad media; Av.Diss. Disimilaridad media; Av. Abund. Abundancia media (Ind./m^2); Av.Sim/Diss. Similaridad/disimilaridad media; Ratio. Valor de similaridad (o disimilaridad)/ desviación estándar, Sim(Diss)/SD; Contrib.%. Porcentaje de la contribución; Cum.%. Porcentaje de similaridad/disimilaridad acumulada.

	Av.Sim.	Av.Abund	Av.Sim/Diss	Ratio	Contrib.%	Cum.%
Group A	69.36					
Ampharete finmarchica		7.14	69.36	5.61	100	100
Group B	82.22					
A. finmarchica		54.76	30.65	6.26	37.28	37.28
Melinna palmata		22.62	24.48	4.82	29.77	67.05
Lagis koreni		9.52	23.13	11.13	28.13	95.18
Group C	72.80					
M. palmata		524.68	27.37	4.2	37.6	37.6
A. finmarchica		909.74	26.03	5.31	35.76	73.36
Terebellides stroemi		16.56	10.68	4.02	14.66	88.02

	Av.Diss	Av.Abund		Av.Sim/Diss	Ratio	Contrib.%	Cum.%.
Groups A & B	56.81	Group A	Group B				
L. koreni		0.00	9.52	19.02	7.75	33.47	33.47
M. palmata		1.19	22.62	17.71	1.93	31.17	64.63
A. finmarchica		7.14	54.76	10.87	1.82	19.14	83.77
Groups A & C	76.15	Group A	Group C				
M. palmata		1.19	524.68	24.8	2.9	32.57	32.57
A. finmarchica		7.14	909.74	18.57	4.14	24.38	56.95
T. stroemi		0.00	16.56	11.21	3.18	14.73	71.68
L. koreni		0.00	11.04	6.04	1.2	7.94	79.61
Groups B & C	48.30	Group B	Group C				
M. palmata		22.62	524.68	11.45	3.28	23.71	23.71

Polychaetes were the numerically dominant macrobenthic taxon in the Ensenada de San Simón (Cacabelos et al., 2008b). The proportion of species of Terebellida in this inlet showed a direct relationship with the overall polychaete species richness found in the inlet (Cacabelos et al., 2008a); this is in agreement with previous results reported by Olsgard et al. (2003) for marine sediments. Therefore, the number of species of the order Terebellida may be used to predict the overall species richness of the polychaetes in any given area, at least in muddy sediments, and some Terebellida species can also be used as indicator species. Moreover, due to the large size of these polychaetes and their relatively rapid identification, this order can be very useful for conservation needs such as mapping of biodiversity (Olsgard et al., 2003).

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