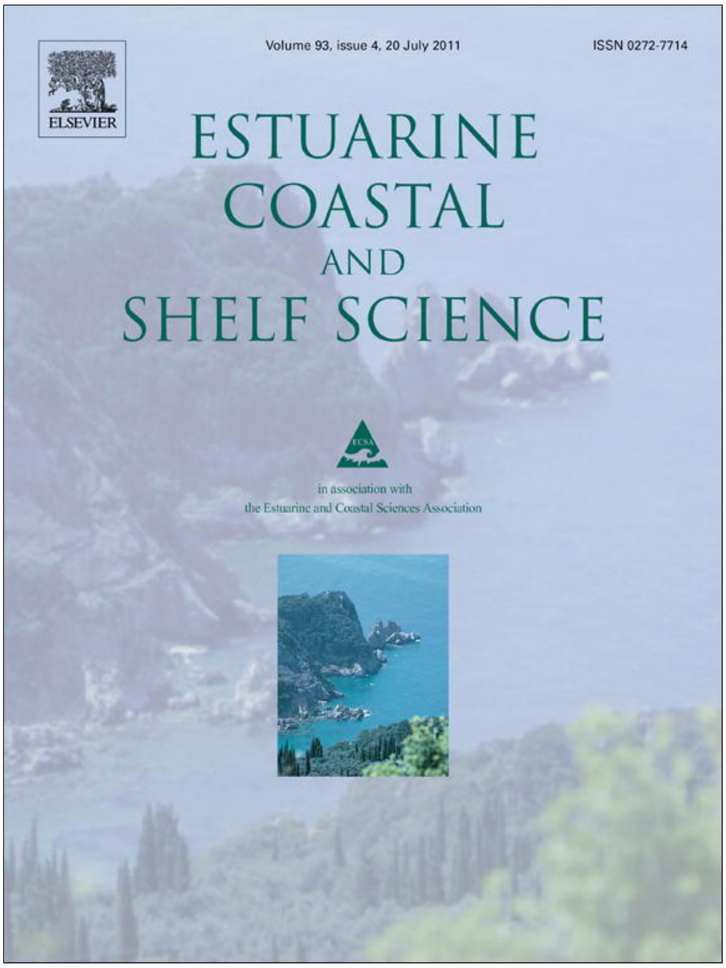
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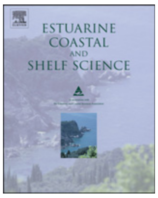

The effects of brine disposal on a subtidal meiofauna community

Rodrigo Riera [a,*], Fernando Tuya [b], Alicia Sacramento [a], Eva Ramos [a], Myriam Rodríguez [a], Óscar Monterroso [a]

[a] *Centro de Investigaciones Medioambientales del Atlántico (CIMA SL), Arzobispo Elías Yanes, 44, 38206 La Laguna, Tenerife, Canary Islands, Spain*
[b] *BIOGES, Universidad de Las Palmas de G.C., 35017 Las Palmas, Canary Islands, Spain*

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ABSTRACT

Desalination plants generate notable (>1,000 s m^3) quantities of hypersaline brine which potentially affect the biological communities in the receiving area. We assessed whether proximity to a brine discharge point located off Gran Canaria (Canary Islands, eastern Atlantic) altered patterns in the abundance and assemblage structure of subtidal, soft-bottom, meiofauna. Samples were collected twice (May 2008 and January 2009) at 0, 15 and 30 m away from the brine discharge point, corresponding to a change in salinity from 45 to 36. Proximity to the brine discharge point affected overall meiofaunal abundances: lowest abundances were observed at 0 m (64.55 ± 39.86 ind 10 cm^{-2}, mean ± SD) than at 15 (210.49 ± 121.01 ind 10 cm^{-2}) and 30 m (361.88 ± 102.64 ind 10 cm^{-2}) away from the brine discharge point. This pattern was particularly notable for the most conspicuous meiofaunal groups: nematodes and copepods, and meiofaunal assemblage structure also differed with varying proximity to the brine discharge point. Although multivariate techniques identified changes in salinity as a relevant driver of patterns in meiofaunal assemblage structure with varying proximity to the brine outfall, a shift in particle size composition between May 2008 and January 2009 also contributed to explain differences in meiofaunal abundances and assemblage structure with varying proximity to the brine discharge point. Hence, meiofauna can be considered a suitable tool to monitor environmental impacts derived from the discharge of hypersaline effluents on subtidal, soft-bottom, assemblages if potential confounding drivers, i.e. here temporal changes in particle size composition, are accounted for to avoid possible confusing interpretations.

1. Introduction

In recent decades, water resources have been intensively used in numerous coastal, Mediterranean-like, climatic regions. This, together with low precipitation regimes typically associated with these regions, has resulted in freshwater scarcity. Desalination of seawater has then been proposed as an alternative, and so the number of constructed, as well as projected, desalination plants has increased considerably in recent years (Latteman and Höpner, 2008). Currently, there are more than 12,500 desalination plants worldwide across 120 countries, and the total world capacity is approaching 42 million m^3/day of potable water (GWI, 2006). For example, Spain has ca. 900 desalination plants and a production of 1.5 million m^3/day of potable water, with approximately 10 desalination plants with a production >60.000 m^3/day (Martínez de la Vallina, 2008). In the Canary Islands, there are currently 328 desalination plants, with a production of 215,000m^3/day (Ávila-Prats et al., 2011).

Desalination plants generate large quantities of hypersaline effluents, which are then discharged into the sea. The difference in density between the brine and the seawater induce the formation of a stratified system (Shiau et al., 2007), creating a bottom layer that can subsequently affect recipient benthic communities (Del Bene et al., 1994; Gacía and Ballesteros, 2001; Del Pilar-Ruso et al., 2008). Marine organisms live in an osmotic balance with their environment, and an increase in salt concentration may result in a dehydration of cells, a decrease in turgor pressure and, ultimately, death of larvae and young individuals (Einav et al., 2002). Brine discharges may contain chemicals used as antifouling materials (e.g. biocides, flocculants, etc), but their low concentrations and high dilution rates suggest that brine is the major stressor for recipient benthic communities (Morton et al., 1996; Younos, 2005). Available information regarding the effect of these hypersaline effluents over animal assemblages is, however, limited (e.g. Chesher, 1975; Castriota et al., 2001; Raventos et al., 2006; Del Pilar-Ruso et al., 2007, 2008). The majority of studies assessing the

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[*] Corresponding author.
E-mail address: rodrigo@cimacanarias.com (R. Riera).

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environmental effects of brine disposal have focused on seagrass physiology and morphology (Vries et al., 1997; Tomasko et al., 1999; Buceta et al., 2003; Fernández-Torquemada and Sánchez-Lizaso, 2005; Fernández-Torquemada et al., 2005a, b; Gacía et al., 2007; Koch et al., 2007; Ruiz et al., 2009), even in laboratory conditions (Pagés et al., 2010). Studies on the effects of brine disposal on subtidal, soft-bottom, infaunal and/or epifaunal communities are comparatively scarce (e.g. Castriota et al., 2001; Raventos et al., 2006; Del Pilar-Ruso et al., 2008). In particular, there is no study analyzing the potential impacts of brine disposal on subtidal meiobenthic assemblages (i.e. microscopic invertebrates, typically composed by metazoan animals than can pass through a 0.5 mm mesh, but retained by a 0.042–0.063 mm mesh, Giere, 1993).

Variations in the abundance and structure of meiobenthic assemblages have been previously observed along salinity gradients in estuaries, since different meiofaunal taxa have different capacities to withstand changes in osmotic cell pressure (Ingole and Parulekar, 1998; Nozais et al., 2005). In this study, we hypothesized that a change in salinity with varying proximity to a brine discharge point would alter the assemblage-level responses of soft-bottom meiofauna.

2. Material and methods

2.1. Study area and sampling strategy

This study was conducted around 'Las Burras' desalination plant, located on the south coast off Gran Canaria (27°763′48 N, 15°550′86 W, Canary Islands, Fig. 1). The plant has a brine outfall of approximately 300 m running offshore. The diameter of the outfall is ~ 60 cm and discharges at 7 m depth on a sandy bottom without vegetation. The volume of seawater collected for desalination is approximately 42,000 m^3 day^{-1}, with an estimated production of potable freshwater around ca. 25,000 m^3 day^{-1}. The volume of discharged brine is ca. 17,000 m^3 day^{-1}. Salinity at the brine discharge point typically ranges between 47-50 (Table 1). At 30 m away from the brine disposal point, salinity ranges at 'natural' values, i.e. between 36.6 and 36.8 (Table 1). Indeed, a dilution from 75 to 38 within 20 m of a brine outlet has been registered in a zone adjacent to the study area (Sadhwani et al., 2005).

Collection of samples took place at 0, 15 and 30 m away from the brine discharge point through 3 radial transects. Collections at 0 m were as close to the brine discharge point as possible; a slight underestimation of the real distance was then assumed, although in terms of sampling design we refer this level as '0 m'. Sediment cores (3.6 cm of inner diameter, 10 cm^2) were pushed into the sediment, using a hammer, to a depth of 30 cm. Five replicates were collected randomly for faunal determination at each distance per transect, while one extra core at each distance (per transect) was collected for the analysis of abiotic variables. The level of replication was based on a previous study (Riera et al., 2011). Sampling was conducted in May 2008 and January 2009.

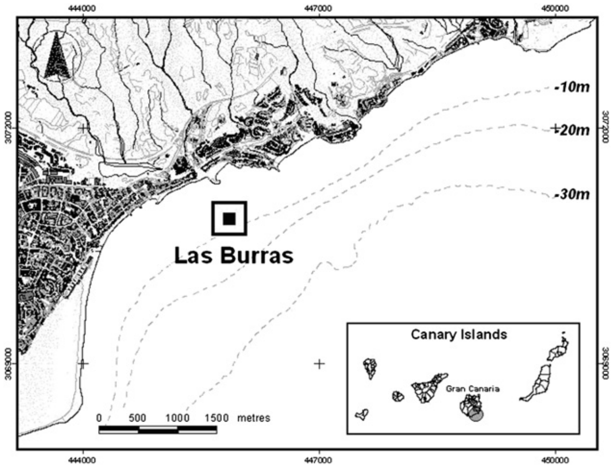

Fig. 1. Map of the study area, indicating the location of the brine discharge point.

2.2. Analysis of environmental factors

Since sediment features (e.g. particle size and organic matter content) can notably influence soft-bottom meiofaunal assemblages (Pearson and Rosenberg, 1978; Gray, 1981), we quantified these two attributes to estimate their potential confounding effects on the patterns of abundance and assemblage structure of meiofauna. To assess the particle size composition of the sediment, ca. 100 g of sediment from each sample was oven dried at 105 °C, passed through a graded series (2 mm, 1 mm, 0.5 mm, 0.25 mm, 0.125 mm and 0.063 mm) of sieves, and then dry-weighed (Buchanan, 1984). The method of Walkley and Black (1934) was used to determine the organic matter content of the sediment. Additionally, total nitrogen was determined following the Kjeldahl method (Bradstreet, 1965) and total phosphorus concentration calculated using a spectro-photometric method (Murphy and Riley, 1962).

2.3. Analysis of meiofauna

Samples were preserved in 10% seawater formaldehyde solution. A 0.5 mm sieve was used and the residue collected from a 0.063 mm sieve. The residue was then separated into different taxonomical groups under a binocular microscope, and preserved in 70% ethanol. Meiofaunal specimens were determined to a 'broad taxonomic group' level by means of a binocular microscope, or in a LEICA DMLB microscope equipped with Nomarski interference contrast (Higgins and Thiel, 1988; Somerfield and Warwick, 1996).

2.4. Statistical analysis

Differences in meiofaunal assemblage structure with varying proximity to the brine discharge point (i.e. distance: 0, 15 and 30 m) through the two surveys (May 2008 vs. January 2009) were tested by means of a permutational multivariate ANOVA (PERMANOVA) that included the factors: 'Distance' (fixed factor) and 'Time' (random factor, orthogonal to 'Distance'). The same model, but in a univariate context via permutation-based ANOVAs, tested for differences in overall meiofaunal abundance and the abundance of the two dominant meiofaunal groups (nematodes and copepods). Data from each distance were pooled among the 3 transects; this increased the power to detect differences among distances away from the brine discharge point from survey to survey. Despite variances remained heterogeneous, in all cases, despite transformations, we reduced an increase in a type I error by reducing the α value to a 0.01 level (Underwood, 1991). ANOVA is robust to such departures for balanced studies, and so ANOVA was carried out on untransformed data. Permutation-based pairwise tests were used to resolve differences in meiofaunal abundances among distances separately for each year.

To visualize affinities in meiofaunal assemblage structure, a nm-MDS (non-metric multidimensional scaling) ordination was carried out on square-rooted transformed abundance data via the Bray–Curtis similarity index. A distance-based redundancy analysis (db-RDA, Legendre and Anderson, 1999) tested whether variation in any of the measured abiotic variables significantly contributed to

Table 1
Mean (±SD) values of abiotic variables with varying proximity (0, 15 and 30 m) from the brine discharge point.

	May 2008		
	0 m	15 m	30 m
Pore water salinity (psu)	45.6 ± 1.2	38.7 ± 0.7	36.6 ± 0.2
Water column salinity (psu)	48.9 ± 2.7	40.1 ± 1.2	36.7 ± 0.2
Temperature (°C)	20.64 ± 0.3	20.61 ± 0.04	20.61 ± 0.04
pH	8.17 ± 0.02	8.17 ± 0.02	8.17 ± 0.02
Chlorophyll (μg/l)	0.3 ± 0.2	0.2 ± 0.2	0.2 ± 0.2
Sediment: Total Nitrogen (mg/kg)	<1	<1	<1
Sediment: Total Phosphorus (mg/kg)	7.80 ± 2.33	3.93 ± 0.55	3.13 ± 0.77
Sediment: Organic matter (%)	0.39 ± 0.06	0.25 ± 0.01	0.21 ± 0.06
Sediment: % of gravels (>2 mm)	1.28 ± 0.61	0.34 ± 0.17	0
Sediment: % of very coarse sands (1–2 mm)	8.28 ± 2.05	0.99 ± 0.85	0
Sediment: % of coarse sands (0.5–1 mm)	46.67 ± 5.15	4.99 ± 3.80	0
Sediment: % of medium sands (0.25–0.5 mm)	16.84 ± 4.13	4.56 ± 2.78	0.26 ± 0.13
Sediment: % of fine sands (0.125–0.5 mm)	6.67 ± 0.96	28.10 ± 2.19	21.07 ± 5.03
Sediment: % of very fine sands (0.063–0.125 mm)	14.26 ± 3.82	48.33 ± 6.63	61.08 ± 4.12
Sediment: % of silt/clay (<0.063 mm)	6.01 ± 1.47	12.68 ± 1.29	17.61 ± 1.16
	January 2009		
	0m	15 m	30 m
Pore water salinity (psu)	45.1 ± 1.4	38.5 ± 0.6	36.4 ± 0.3
Water column salinity (psu)	48.4 ± 2.5	40.1 ± 1.3	36.8 ± 0.3
Temperature (°C)	19.54 ± 0.4	19.12 ± 0.2	19.11 ± 0.3
pH	8.15 ± 0.03	8.16 ± 0.02	8.17 ± 0.03
Chlorophyll (μg/l)	0.2 ± 0.1	0.2 ± 0.2	0.2 ± 0.1
Sediment: Total Nitrogen (mg/kg)	1 ± 0.1	1.2 ± 0.2	1.2 ± 0.3
Sediment: Total Phosphorus (mg/kg)	6.17 ± 1.83	4.33 ± 0.55	9.30 ± 4.26
Sediment: Organic matter (%)	0.48 ± 0.02	0.63 ± 0.10	0.46 ± 0.07
Sediment: % of gravels (>2 mm)	2.33 ± 1.18	36.98 ± 17.72	5.11 ± 3.51
Sediment: % of very coarse sands (1–2 mm)	9.98 ± 1.78	9.78 ± 2.34	17.71 ± 2.72
Sediment: % of coarse sands (0.5–1 mm)	50.97 ± 3.14	31.43 ± 14.46	55.49 ± 3.59
Sediment: % of medium sands (0.25–0.5 mm)	14.94 ± 3.32	14.22 ± 3.93	17.50 ± 1.23
Sediment: % of fine sands (0.125–0.5 mm)	8.79 ± 2.92	3.98 ± 2.33	2.30 ± 1.05
Sediment: % of very fine sands (0.063–0.125 mm)	12.47 ± 5.68	2.97 ± 2.06	1.33 ± 1.01
Sediment: % of silt/clay (<0.063 mm)	0.51 ± 0.11	0.63 ± 0.2	0.56 ± 0.18

explain variation in the meiofaunal assemblage structure with varying proximity to the brine discharge point. Multivariate multiple regression, using the DISTLM routine (Anderson, 2001), then tested the significance of these relationships by fitting a linear model based on Bray–Curtis dissimilarities on square-rooted transformed abundance data. To retain variables with good explanatory power, the AIC routine was used as a selection criterion (the smaller the value the better the model, Legendre and Anderson, 1999). Analyses were based on a 'forward' selection procedure. All multivariate procedures were carried out via the PRIMER 6.0 and PERMANOVA + statistical package.

3. Results

A total of 13,095 meiobenthic specimens were collected, belonging to 11 taxonomic groups (Amphipoda, Copepoda, Cumacea, Mysidacea, Nematoda, Oligochaeta, Ostracoda, Polychaeta, Sipuncula, Tanaidacea and Turbellaria). The most abundant group was nematodes (9852 ind, 75.2% of the overall abundance), followed by copepods (1919 ind, 14.6%). Cumaceans and mysids were, in contrast, rarely observed (only 1 ind) (Table 2). Total meiofaunal abundances differed among distances from the brine discharge point inconsistently between surveys ('Distance × Time', $P = 0.0002$, Table 3). This was due to a change in the magnitude of these differences, rather than a change in the direction of the pattern (Fig. 2a). Total abundances at 15 m and 30 m from the brine outfall were significantly larger than at 0 m at both surveys (Fig. 2a, pairwise comparisons), while total abundances at 30 m away were larger than at 15 m from the brine discharge point in May 2008, but not in January 2009 (Fig. 2a, pairwise comparisons). The abundance of nematodes showed the same pattern with varying proximity to the brine discharge point as total meiofaunal abundances (Fig. 2b,

Table 2
Mean abundances (±SD) of meiofaunal taxonomic groups (10 cm^{-2}) with varying proximity (0, 15 and 30 m) from the brine discharge point.

Group	May 2008			January 2009		
	0 m	15 m	30 m	0 m	15 m	30 m
Amphipoda	0	5.11 ± 5.11	2.78 ± 3.45	0	0	0
Copepoda	4.89 ± 4.48	11.33 ± 9.88	33.33 ± 9.18	3.42 ± 3.07	31.68 ± 29.71	67.68 ± 69.88
Cumacea	0	0	0.07 ± 0.21	0	0	0
Misidacea	0	0	0	0.11 ± 0.33	0	0
Nematoda	76.78 ± 58.51	237.22 ± 117.46	566.67 ± 121.12	9.70 ± 5.32	103.06 ± 123.67	21.56 ± 8.99
Oligochaeta	10.33 ± 10.95	0.22 ± 0.44	0.11 ± 0.33	5.30 ± 2.96	24.21 ± 12.61	14.93 ± 10.12
Ostracoda	0.11 ± 0.33	0.11 ± 0.33	0.44 ± 0.52	1.95 ± 1.89	0.62 ± 1.04	3.91 ± 5.50
Polychaeta	1.78 ± 1.56	1.0 ± 1.0	3.33 ± 2.12	4.95 ± 2.48	4.60 ± 2.68	3.97 ± 4.01
Sipuncula	0	0	0	0	0.14 ± 0.28	0
Tanaidacea	0	0.11 ± 0.33	0.11 ± 0.33	0	0.07 ± 0.21	0
Turbellaria	9.89 ± 13.89	0.22 ± 0.67	2.22 ± 3.15	0	1.19 ± 1.15	2.58 ± 1.70
Total	103.78 ± 70.45	255.33 ± 123.31	609.11 ± 128.66	25.33 ± 9.27	165.65 ± 118.72	114.65 ± 76.62

Table 3

Results of multi- and univariate ANOVA testing for differences in meiofaunal assemblage structure, overall meiofaunal abundance, and nematode and copepod abundances with varying proximity to the brine discharge point ('Distance', fixed factor) through successive years ('Time', random factor, orthogonal to 'Distance'). *P*-values in bold denote significant values ($P < 0.01$).

Source of variation	df	Assemblage structure			Meiofaunal abundance			Nematode abundance			Copepod abundance		
		MS	Pseudo-F	*P*	MS	F	*P*	MS	F	*P*	MS	F	*P*
Distance (D)	2	7521.5	2.17	0.1518	546.5	3.56	0.2194	375.5	1.35	0.4172	19532	3.17	0.2092
Time (T)	1	18429	48.19	**0.0002**	356.6	24.15	**0.0002**	1075.8	70.06	**0.0002**	19532	7.89	**0.0014**
D × T	2	3460.7	9.05	**0.0002**	153.3	10.38	**0.0004**	276.5	18.01	**0.0002**	6145.9	2.48	0.0782
Residual	3	382.3			14.7			15.3			2474.8		

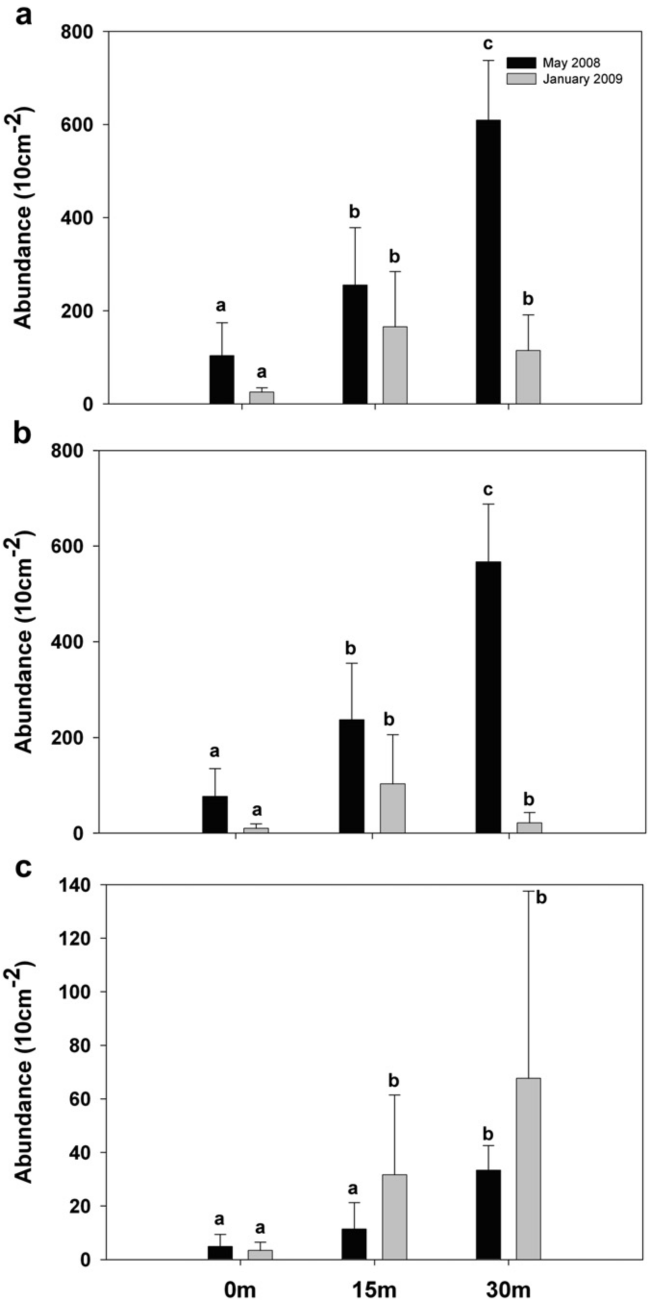

Fig. 2. Meiofaunal abundances (+SD) at 0, 15 and 30 m away from the brine discharge point; (a) total meiofauna, (b) nematode abundance and (c) copepod abundance. Different letters above bars indicate significant differences (pairwise comparisons), separately for each year.

Table 3); thus, the fewest nematodes were detected at 0 m at both surveys (Fig. 2b, pairwise comparisons). Copepods showed lower abundances at 0 m than at 30 m away from the brine discharge point at both surveys (Fig. 2c, pairwise comparisons). Differences in copepod abundance between 0 and 15 m from the brine discharge point were observed in January 2009, but not in May 2008, while differences in copepod abundance between 15 and 30 m were observed in May 2009, but not in January 2008 (Fig. 2c, pairwise comparisons). Distance from the brine discharge point influenced patterns in meiofaunal assemblage structure inconsistently between surveys (PERMANOVA, 'Distance × Time', $P = 0.0002$, Table 3). A clear separation of meiofaunal assemblages at 0 m from assemblages at 15 and 30 m away from the brine discharge point was observed in the nm-MDS plot for both surveys (Fig. 3).

The first two axes from the db-RDA explained 71.5% of the total variation in meiofaunal assemblage structure (Fig. 4). The percentage of very fine sands was positively correlated with the first axis, which explained 55.9% of the total variation in meiofaunal assemblage structure. The second axis was positively correlated with salinity and negatively correlated with the percentage of gravels and very coarse sands, which accounted for 15.6% of the total variability in meiofaunal assemblage structure (Fig. 4). The former three abiotic variables (very fine sands, gravels and salinity) were selected as those variables that most contributed to explain variability in meiofaunal assemblage structure (sequential tests in the multivariate multiple regression, Table 4). A strong colinearity was observed among several environmental variables, particularly among the percentages of the different sedimentary types. A similar particle size composition was observed at 0 m, the brine discharge point in the two surveys (May 2008 and January 2009), with the exception of silt and clay content. However, samples at 15 and 30 m away from the brine discharge point showed a change in

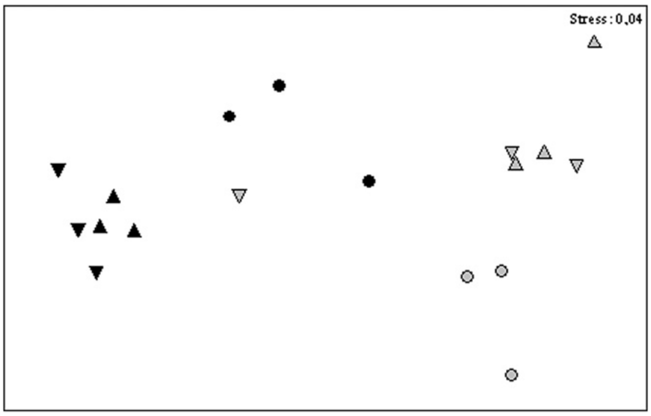

Fig. 3. Ordination (nm-MDS) of meiofaunal assemblages with varying proximity to the brine discharge point. ●: 0 m, ▼: 15 m, ▲: 30 m. Black: May 2008; White: January 2009.

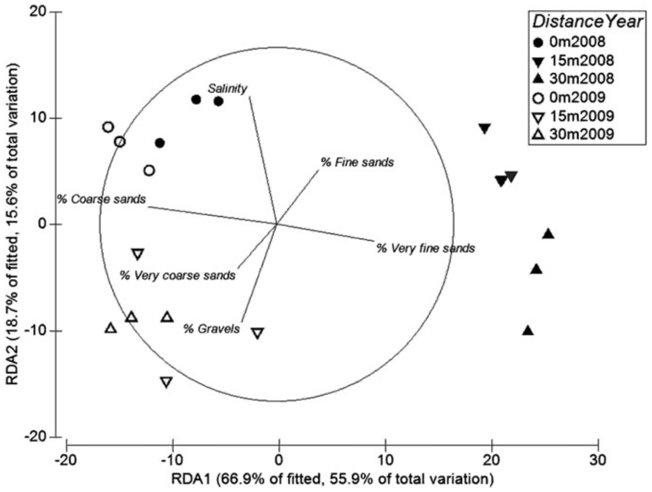

Fig. 4. Distance-based redundancy analysis (db-RDA) biplot of first and second axes relating those abiotic variables that better explain meiofauna assemblage structure with varying proximity to the brine discharge point (see Table 1). Centroids for each distance and transect are plotted.

fine-grained sedimentary fractions (silt/clay, very fine sands and fine sands) between both surveys (Fig. 4). These results suggest that, although variation in salinity with varying proximity to the brine outfall might have been a relevant driver explaining patterns in assemblage structure, variations in particle size composition explained a large portion of the biota variability with varying distances from the brine discharge point.

4. Discussion

This study demonstrates a significant decrease in meiofaunal abundances immediately adjacent (i.e. 0 m) to a brine discharge point, while meiofauna increased overall abundances at 10 s of metres away from the brine discharge point (i.e. 15 and 30 m away) in both surveys (May 2008 and January 2009). This change in meiofaunal abundances with varying proximity to the brine discharge point was accompanied by a change in meiofaunal assemblage structure. Despite the release of the hypersaline brine may explain these patterns in abundance and assemblage structure with varying proximity to the brine outfall, i.e. a decrease in seawater salinity from 45 (at 0 m) to 36 (at 30 m away from brine discharge point), our results suggest than a relevant change in the particle size composition, particularly at 15 and 30 m away from the brine discharge point, between surveys could also explain a large amount of variability in the structure of meiofaunal assemblages. For example, despite nematodes having the lowest abundances immediately adjacent (i.e. 0 m) to the brine discharge point, a decrease in nematode abundances at 30 m away from the brine discharge point was observed in January 2009. This was probably a result of the prevalence of coarse sands at 30 m away from the brine discharge point in January 2009. Coarse sands typically harbour lower abundances of nematodes than soft-bottoms dominated by fine sands; nematodes are endo- and epibenthic species mostly found in the first centimetres of fine-grained sediments (Tietjen, 1969; Coull, 1985). The copepods also showed larger abundances further away from the brine discharge point (15 and 30 m) than immediately adjacent to the brine outfall (0 m). Brine disposal, therefore, could also limit the presence of copepods immediately around the brine discharge point. Copepods, however, increased their abundances far away from the brine discharge point (30 m) in January 2009 relative to May 2008, when the particle size composition was dominated by coarse-grained sediments far away from the brine discharge point. Copepods are active swimmers and so require more oxygen for energy than other taxonomic groups such as nematodes; as a result, copepods usually show a rise in abundances in well-oxygenated coarse sands (Giere, 1993; Levinton, 1995). This change in the particle size composition between May 2008 and January 2009 may have been likely caused by differences in the magnitude of physical mechanisms, such as differences in swell height, that typically occur in the study region between summer (e.g. May 2008) and winter (e.g. January 2009, a period of rough seas with 2–3 m swells, AEMET, 2009).

Table 4
Results of multivariate multiple regression testing the relationship between the measured set of environmental variables (Table 1) and meiofaunal assemblage structure. To retain variables with explanatory power, the AIC procedure was chosen as model selection criterion (sequential tests, Legendre and Anderson, 1999). *P*-values in bold denote significant values ($P < 0.01$).

Variable	AIC	SS (trace)	Pseudo-F	*P*	Proportion of explained variation
% Very fine sands	102.35	4208.5	15.851	**0.0002**	0.497
Salinity	98.89	1111.1	5.313	**0.001**	0.131
% Gravels	93.40	728.75	5.278	**0.007**	0.0862

The impact of large-scale changes in salinity over marine ecosystems and associated biota can take a variety of forms (e.g. Young and Potter, 2002; Moscatello and Belmonte, 2004; Vega-Cendejas and Hernández-Santillana, 2004; Sánchez-Lizaso et al., 2008; Ruiz et al., 2009). In the particular case of the release of hypersaline effluents from desalination plants, several studies have showed a decrease in macrofaunal abundances, usually accompanied by severe changes in the assemblage structure of macrofauna, around brine disposal points (Del Pilar-Ruso et al., 2007, 2008, 2009). An increase in salt concentration may result in a dehydration of cells, a decrease of turgor pressure and, ultimately, death of larvae and young marine invertebrates (Einav et al., 2002). However, no significant changes in abundance were found for mega-invertebrates (>1 cm in body size) around a brine disposal point in the Mediterranean, maybe as a result of the large mobility of mega-fauna and the relatively small surface impacted by brine discharges (ca. 10 m) (Raventos et al., 2006). Meiofaunal assemblages have not been used so far to monitor the impacts of brine discharge into the environment, even though variations in the abundance and structure of meiobenthic assemblages have been formerly observed along gradients of salinity in estuaries (Ingole and Parulekar, 1998; Nozais et al., 2005), or coastal areas influenced by freshwater run-off (Montagna & Bae Yoon, 1991; Montagna et al., 2002).

Benthic invertebrates are often used as bioindicators to monitor environmental changes, because of their rapid responses to natural and/or anthropogenic pressures (Borja et al., 2009). Meiofaunal assemblages are capable of responding to both natural and anthropogenic disturbances; indeed, meiofauna have been suggested to be a suitable indicator to monitor the health of marine ecosystems (Kennedy and Jacoby, 1999). Meiofaunal organisms typically have a continuous reproduction through time, which promotes a high fertility and turnover (Giere, 1993). These features, in conjunction with a lack of pelagic larval stage, lead to high population stability over time (Schratzberger et al., 2000). This study has demonstrated that meiofauna can be considered a suitable tool to monitor environmental impacts derived from hypersaline effluents disposal over subtidal, soft-bottom, assemblages. However, differences in the particle size composition may also notably influence patterns of meiofaunal assemblage structure, and so require a careful consideration to avoid possible confounding interpretations. Disentangling the separate contributions of a change in salinity and particle size distribution with varying proximity to the brine discharge point remains untested, and require of proper experimental approaches.

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