Manuscript Details

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Title	Macrofaunal assemblages in canyon and adjacent slope of the NW and Central Mediterranean systems
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Abstract

Macrofaunal assemblages were studied along bathymetric transects in six canyons and four adjacent open slopes of the Mediterranean Sea. The different areas investigated were located approximately along a longitudinal gradient at similar latitudes. Three regions were investigated: the Catalan (from 334 to 1887 m depth), the Ligurian (from 222 to 2005 m depth) and the South Adriatic margins (from 196 to 908 m depth). The analysis of the meso-scale distribution of assemblage structure and biomass showed significant differences among regions, which resulted in high values of δ-diversity. Clear differences in trophic composition were also observed, and a decreasing pattern in the individual body size of macrofaunal organisms moving Eastward. These patterns were apparently linked to changes in food supply, whereas macrofaunal abundance and number of taxa showed a decrease pattern with increasing water depth. When the assemblage structure was compared between canyons and adjacent open slope, a very high β-diversity was observed, indicating that the bottom topography exerted a strong effect on the assemblage characteristics.

Keywords	Macrofauna; biomass; biodiversity; deep-sea; canyons; Mediterranean Sea
Manuscript category	Biological Oceanography

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Suggested reviewers	Georges Stora, Francisco Sardà, Maite Louzao

Submission Files Included in this PDF

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Covazzi Harriague et al response to reviewers second round.docx [Response to Reviewers]

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Figure 1.tif [Figure]

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Figure 3.tif [Figure]

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Figure 5.tif [Figure]

Figure 6.tif [Figure]

Figure 7.tif [Figure]

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Point by point response to Reviewers. In black the reviewer's observations and suggestions, in red our response.

-Reviewer 1

Line 130: …..(Gage, 2003). this gradient is CHANGE TO "This" Done

LINES 143-145: CHANGE TO: a very high number of canyons whose complexity reflect the features …. Done

LINE 155 "to tidal currents" I WOULD SPECIFY that tides re negligible in the Mediterranean Done

LINE 196: You should, quote along with Mamouridis et al., 2011 also:

TECCHIO S., RAMÍREZ-LLODRA E., AGUZZI J., FLEXAS M.M., COMPANY J.B., SARDÀ F. 2013. Seasonal fluctuations of deep megabenthos: Finding evidence of standing stock accumulation in a flux-rich continental slope. Progress in Oceanography 118: 188-198

Done

LINE 220: i) SHOULD BE ii) Done

LINES 235-262 THESE INFO SHOULD BE CONDENSED INTO Table 1 adding new columns for N replicates and for R/V name.

The info on the R/V name and sampling period was added in the Table 1. The number of replicates was always 3 and it was reported in the text.

LINE 286: Split the paragraphs (a new argument is starting). Done

LINE 308-309: this is a single phrase and should be joined into the previous paragraph (although it is a different argument). Done

LINE 430 sp SHOULD BE CHANGED TO sp. Done

LINE 505 "Notwithstanding" SHOULD BE CHANGED for "Despite" Done

LINE 517: CHANGE TO (21%) Done

LINE 594: You should also quote:

Coll M., Piroddi C., Steenbeek J., Kaschner K, Ben RaisLasram F., Aguzzi J., et al. 2010. Biodiversity of the Mediterranean Sea: status, patterns and threats. PLoS ONE (5): e11842

Done

LINES 535-637: Quotations need to be added in chronologic mode). Done

LINES 681-683: You declare that "…. we observed a lack of relationships between the macrofaunal parameters and grain size". A DESCRIPTION FO THESE RESULTS SHOULD BE GIVEN IN THE RESULT SECTION (Table S3 should be reported there). Done

LINE 808: eliminate one indent (too large paragraph space). Done

Table 1: ADD SEPARATION IN Catalanmargin, Ligurianmargin Done

Also, ub this table you codes the sampling areas (add the head name in that column) as e.g. Southern Open Slope (SOS) or Cap de Creus Canyon (CCC)…..but then in Tables 3 and 4, those codes are forgotten. Please, choose if eliminate the codes form Table 1 or changes names of areas in Table 3 and 4 for those codes for consistency. Done

In table 3. All percentage values should be with numerals e.g. 3rd line form above of values as

33 0 0 33 0 33 is equals top 99!

We add the decimal values

In Table S1: ALL "sp" should be "sp." Done

In Table S2. Add space in "…diversity),between" Done

Also here…Canyon and Open Slope should be written with the first capital letters as in the Tables before (and please, DO THE SAME FOR Table S1). Done

Also:

MODIFY "Table S3.Result" for "Table S3. Result" Done

NOT commas for decimals but DOTS as in all other numbers. Done

-Reviewer 2

Dear authors.

I recommend minor revisions. These concerns mostly to the discussion which still needs improvement for a better understanding of it. The authors begin the discussion by explaining the differences in community structure between the three investigated regions, then follow by examining patterns observed in the canyon and open slope within each region. Next, the authors use food availability to explain longitudinal patterns in biomass, individual size and trophic composition and then the same variable to explain the variability in trophic composition between canyon and open slope. Food availability could be used in the canyon vs open slope topic and elaborate the discussion in this part that sometimes is vague. In fact, the reason why there were no differences between canyon and open slope in the Ligurian margin, is at the end of the discussion, while in my opinion it is missing in the part where is discussed the local patterns.

Also, the canyon and open slope results discussion has some confusion and inconsistencies. For example, the authors compare changes in the assemblage structure between canyon and open slope that were not significant with significant differences found in community structure with other canyons. Also, the authors give examples of species that can explained the differences in dissimilarity between canyon and open slope but is not clear how the presence of one of these species, the ophiurid *Amphiura filiformis* in both canyon and open slope explain the dissimilarity. The next part is somehow confusing because the authors indicate studies (Gage et al., 1995; Vetter and Dayton, 1999; Curdia et al., 2004) that are in accordance with the present results in relation to the lower number of taxa found inside some canyons but next indicate discrepancy of these findings with previous studies. It is not clear which results and in which canyons are the authors referring to establish the comparison.

I indicate these and other minor comments throughout the discussion in the document. In addition, some comments in the remaining sections, also indicated in the document.

We reorganized the Discussion following carefully all the reviewer suggestions and we took into account all the reviewer comments indicated in the document.

Introduction

Missing reference in the sentence:

"The analyses conducted on macrofaunal assemblages along longitudinal gradients at large spatial-scales (from the Gulf of Lyon to the Ligurian Sea and Southern Adriatic) in the Mediterranean Sea support the important role of these variables and the importance of these systems in promoting deep-sea biodiversity. "

This sentence was deleted

Material and methods:

Please indicate the dissimilarity measure used in the MDS (bray Curtis measure). Done

Please indicate how diversity was estimated (number of taxa). Done

Results:

In the subsection *Macrofaunal assemblage structure* please change "more significant" to "significant". Done

In the subsection *Macrofaunal biomass* please add the results of the regression analysis of biomass according to the longitude.

For the relationship between individual biomass and longitude we have highlighted a general trend. A statistical analysis such as regression was not performed because longitude data were considered not a quantitative parameter as, for instance, depth is, but something more similar to a nominal variable. The individual biomass data in each area (Catalan, Ligurian and South Adriatic margins) are referred to very similar longitude values, therefore regression output would be somehow influenced by this homogeneity. Maybe the sentence was misleading, suggesting that a regression result should exist. We change the sentence.

Some comments on figures and tables:

Figure 2: The legend should indicate that the two MDS images correspond to two different analysis.

Done

The authors indicate that the available data on mud contribution to the sediment composition were added but is missing.

The data of mud contribution to the sediment composition are presented in Table 1 (the last column)

A table with the ANOSIM results for the trophic composition should also be added.

We added the ANOSIM results for the trophic composition in the table 2

Finally, some typos were assigned throughout the text.

- Macrofauna was studied along bathymetric transects in three areas of the Mediterranean
- Canyons and open slopes were investigated in Catalan, Ligurian and South Adriatic margins
- Assemblages were significantly different among regions, as shown by high δ-diversity
- This was likely due to changes in food supply as a consequence of the longitudinal position
- Canyons and adjacent open slope showed a very high β-diversity

Macrofaunal assemblages in canyon and adjacent slope of the NW and Central Mediterranean systems

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Abstract

Macrofaunal assemblages were studied along bathymetric transects in six canyons and four adjacent open slopes of the Mediterranean Sea. The different areas investigated were located approximately along a longitudinal gradient at similar latitudes. Three regions were investigated: the Catalan (from 334 to 1887 m depth), the Ligurian (from 222 to 2005 m depth) and the South Adriatic margins (from 196 to 908 m depth). The analysis of the meso-scale distribution of assemblage structure and biomass showed significant differences among regions, which resulted in high values of δ-diversity. Clear differences in trophic composition were also observed, and a decreasing pattern in the individual body size of macrofaunal organisms moving Eastward. These patterns were apparently linked to changes in food supply, whereas macrofaunal abundance and number of taxa showed a decrease pattern with increasing water depth. When the assemblage structure was compared between canyons and adjacent open slope, a very high β-diversity was observed, indicating that the bottom topography exerted a strong effect on the assemblage characteristics.

Key words: Macrofauna, biomass, biodiversity, deep-sea, canyons, Mediterranean Sea.

1. Introduction

The Mediterranean Sea is characterised by a clear gradient in primary productivity with lowest values in the eastern basin (Danovaro et al., 1999). Since food supply to deep-sea benthic fauna depends on the productivity of the euphotic zone (Gage, 2003). This gradient is typically reflected by a decreasing abundance, biomass and species richness of the deep benthic assemblages moving eastward (Tselepides et al., 2000; Danovaro et al., 2008; Tecchio et al., 2011). One of the reasons for the extreme oligotrophy of the eastern Mediterranean basin is phosphorous depletion (Salihoglu et al., 1990), while in the western region the fluvial, atmospheric and upwelling inputs contribute to a higher productivity (Bas, 2009). Another main feature of the Mediterranean continental margins is the presence of a very high number of canyons, whose complexity reflect the features of the fluvial basins of the continent (Bas, 2009).

Submarine canyons contribute to the formation of a number of different habitats that show spatial as well as temporal variability, and are often characterised by peculiar benthic assemblages (Curdia et al., 2004). The dynamic characteristics of these environments, subject to tidal currents albeit tides are negligible in Mediterranean, sediment gravity flows and turbidity changes (Canals et al., 2006; de Stigter et al., 2007), increase the physical forcing, habitat heterogeneity and the complexity of the morphological features of the seafloor (Thistle and Levin, 1998). Canyons are areas with enhanced transfer of materials from the continental shelf to bathyal depths (Epping et al., 2002; Martin et al., 2006; Sanchez-Vidal et al., 2008; Thomsen et al., 2017), and provide an important food supply to the deep-sea benthos (Epping et al., 2002; Gunton et al., 2015). The canyons act also as collectors of land-derived organic material, which contribute to shape and sustain benthic assemblages (de Stigter et al., 2007). For instance, massive inputs of organic materials, including macrophyte detritus (Rowe et al., 1982; Vetter and Dayton, 1999), are transported from the shelf to the deep sea during periodic flushing events (Canals et al., 2006). These processes contribute to make the Mediterranean canyons hotspots of benthic production and ecosystem functioning (Vetter and Dayton, 1999; Pusceddu et al 2010; Fernández-Arcaya et al., 2017) and are responsible for their generally high macrofaunal abundance and biomass (Vetter and Dayton, 1999; Duineveld et al. 2001; Gunton et al. 2015). For this reason, studies conducted in Mediterranean Sea have, in many cases, highlighted the presence of differences between canyons and the adjacent open slopes (Mamouridis et al., 2011; Tecchio et al., 2013). Such differences include also the presence of some taxa that are exclusively or preferentially associated to canyon sediments (Bianchelli et al., 2010) and are the result of the combined action of habitat heterogeneity and food availability.

In the present study, macrofaunal assemblages were investigated within the frame of several cruises conducted in different regions at depths comprised approximately from 200 to 2000 m depth. The following hypotheses were tested: i) structural and functional features of the macrofaunal assemblages among different continental margins change along a longitudinal gradient; ii) macrofaunal variables change between canyons and adjacent open slopes in the same area.

2. Material and Methods

Sampling strategy

Samples were collected in the Western and Central Mediterranean Sea during several multidisciplinary oceanographic cruises. Three regions were studied from 196 to 2005 m depth. The Catalan margin was sampled during the HERMES cruises in the Gulf of Lyon (11 sampling stations), the Ligurian margin was sampled during the BioLig (Ligurian Canyons) cruise (12 sampling stations) and the South Adriatic margin was sampled during the

CANYON BARI 2006 (SETE-06) cruise (11 sampling stations) (see Figure 1, Table 1 for details).

Three replicate samples were collected in each station, using either multi-corer (3 maxicorer, with inner diameter 9.3 cm for each replicate) and box-corer (29x29 cm). On board, all the sediment collected was washed and sieved through 500 µm mesh size. After that, the residual was frozen at -20°C.

Macrofaunal variables

In laboratory, sediment of all the stations was sorted and organisms were identified down to species level (Table S1), whenever possible, and counted. Taxonomical identification (Fauvel, 1923; 1927; Parenzan, 1976; Bellan-Santini et al., 1982; 1989; 1993; Pancucci-Papadopoulou et al., 1999) was checked with the World Register of Marine Species (http://www.marinespecies.org). The number of taxa, intended as a proxy of diversity, was calculated for each station

To determine the biomass, organisms were dried at 60°C for 24 hours and weighed. Data of number of organisms and weight were normalised to square meter to determine abundance and biomass applying the following formula: abundance/biomass = organism number/organism weight of the sample/sampled area in square meter. The individual biomass of organisms was calculated as the ratio between biomass and abundance. Trophic groups were determined according to Fauchald and Jumars, 1979; Jangoux and Lawrence, 1982; Grahame, 1983; Russell-Hunter, 1983 and Gambi and Giangrande, 1985.

Statistical analyses

The PRIMER 6 package (Clarke and Warwick 2001) on presence/absence data was used to perform the multidimensional scaling (MDS, Bray-Curtis similarity index) and the analysis of similarities (ANOSIM), to test the differences in community structure within and between the sites. Moreover the similarity percentages-species contributions (SIMPER) was performed, based on a Bray-Curtis similarity matrix, to evaluate the turnover local diversity (hereafter called β-diversity) and regional turnover diversity (hereafter called δ-diversity) (Gray, 2000; Danovaro et al., 2009). In order to homogenize the data, the taxonomical level family was used for all analysis. The analysis of similarities (ANOSIM) was performed on the presence/absence data of the trophic composition in order to verified differences between sites. The relationship between community parameters and depth and mud contribution to the sediment composition were verified with the regression analysis.

3. Results

Macrofaunal assemblage structure

The MDS ordination (Figure 2) showed that the stations of the Ligurian margin are grouped together, while the other two sites are not clearly separated. Notwithstanding, the analysis of similarities (ANOSIM) showed significant differences in the structure of the communities between the three regions (Table 2A).

The trophic composition of the assemblages was significantly different between the Ligurian margin and the Catalan and South Adriatic margins (ANOSIM, Table 2B).

δ-diversity between the three regions was high: Catalan margin vs Ligurian margin 97% (4 common taxa: Cirolanidae, Golfingidae, Nuculidae, Paraonidae), Catalan margin vs South Adriatic margin 97% (3 common taxa: Canalipalpata, Terebellidae, Xanthidae) and Ligurian margin vs South Adriatic margin 98% (3 common taxa: Copepoda, Phascolosomatidae, Spionidae). Each region was characterized by different taxa that determined the regional variability: in the Ligurian margin the main part of them belonged to polychaetes, while in the

Catalan margin the half of the taxa and in the South Adriatic margin only one family belonged to this class (Figure 3).

- Catalan margin

The macrofaunal abundance varied between 0 and 254.6±28.9 ind × m^{-2} (average 91.2±24.1 ind. × m^{-2}). The highest values were found in the shallowest stations of the NOS and LDC (Table 3). The average value was higher in the open slope station than in the canyon ones (Figure 4A). The distribution of abundances was significantly influenced by the depth (Figure 5A). On the whole 30 taxa were identified, 14 in the canyon and 17 in the open slope assemblages, notwithstanding the average values of the two areas were quite similar (Figure 4B). Canyon and open slope communities showed only 1 common taxa, leading to a very high local β-diversity (95%; Table S2). Although the community structure did not show a significant differences between habitats (Table 2A). The number of taxa, instead, did not show a significant relationship with depth (Figure 5B). The structural parameters did not show any correlation with the contribution of the mud fraction (Table S3). Assemblages were dominated by Annelida (50%), followed by Crustacea (19%), Echinodermata (13%), Sipuncula (10%), Mollusca (5%) and others (Platyhelminthes and Nemertea; 3%). The first group was the most important in the canyon area, reaching 70% of the abundance, while in the open slope area 86% of the abundance was composed by Annelida, Crustacea and Echinodermata (Table 3). The trophic structure of the communities was different in the two areas: in the assemblages of the canyons the principal contributors to the abundance were organisms with mixed strategies, deposit-suspension (such as *Onchnesoma steenstupii steenstupii* and Terebellidae) and deposit-grazer feeders (such as *Notomastus* sp.), while in the open slope assemblages suspension feeders (such as *Jassa marmorata* and *Thalassema gigas*), deposit feeders (such as Chaetopteridae and Paraonidae) and predators (such as *Ancistrosyllis* cf. *groenlandica*) were the most abundant (Figure 6).

- Ligurian margin

The higher abundances were observed in the shallow stations (see Table 3). The maximum value was 396.4±97.4 ind × m^{-2} in the shallow station of the PC and the minimum 15.0±15.0 ind. × m^{-2} in the deepest station of the LMOS (average 141.6±39.2 ind. × m^{-2}). Contrary to the Catalan margin, the average abundance in the canyon areas was slightly higher than that observed in the open slope ones (see Figure 4A). In general, a significant decreasing trend of macrofaunal abundance with depth was observed (see Figure 5A). In the Ligurian margin 43 taxa were found, 23 in the open slope area and 34 in the canyons, and 14 were observed in both areas. Here the β-diversity was 82%, the lowest of the three sites (Table S2). Despite, the community structure of the both habitats did not differ significantly (Table 2A). The average values of the number of taxa were higher in the canyon (see Figure 4B). A significant decrease of the number of taxa with depth was observed (Figure 5B). The structural parameters did not show any correlation with the contribution of the mud fraction (Table S3). Total abundance was composed by Annelida (76%) and Crustacea (15%). In the canyon areas these groups represented 70% and 15%, respectively, of the total abundance, while in the open slope assemblages they represented 83% and 12% respectively (see Table 3). From a trophic point of view, the composition of the assemblages in the canyons and open slope was quite similar, being dominated by deposit feeders (such as Maldanidae and Onuphidae) (55% and 60%, respectively), followed by predators (such as Eunicidae and Lumbrineridae) (18% and 14%, respectively) and deposit-suspension feeders (such as Spionidae and *Urothoe* cf. *elegans*) (13% and 11%, respectively) (see Figure 6).

- South Adriatic margin

The higher abundance was observed in the shallowest station of the open slope (2747.3±1066.7 ind. × m^{-2}), while the deepest stations of the two canyons showed the minimum value (0 ind. × m^{-2}, see Table 3). A significant decrease of the abundance with depth was observed (see Figure 5A). Between the two areas, the open slope displayed a higher average value than canyon one (see Figure 4A). On the whole, 22 taxa were found in the South Adriatic margin, 13 in the open slope and 12 in the canyon areas. Despite the similar number, the average values were different, open slope displayed the highest one (see Figure 4B). Only 3 taxa were common at the two areas and the β-diversity was 88% (Table S2). Nevertheless, the analysis of similarities didn't show significant differences between the two habitats (Table 2). The number of taxa showed a significant decrease trend with depth (see Figure 5B). Abundance did not show any correlation with the contribution of the mud fraction, while a significant correlation was found for the number of taxa (Table S3). Communities were composed by Crustacea (28%) followed by Annelida (22%), Echinodermata (21%), Mollusca (14%), others (Nematoda) (10%) and Sipuncula (5%). Assemblages on the canyon areas were composed principally by 35% of Mollusca and 35% of Echinodermata, while in the open slope, the Annelida and Crustacea reached 72% of the total abundance (see Table 3). Also, the trophic composition was different for the two areas: in the canyon sites 70% of the abundance was represented by suspension feeders (such as *Amphiura filiformis* and *Clausinella fasciata*), while in the open slope 77% was represented by deposit-suspension feeders (such as Spionidae), deposit feeders-predators (such as Nematoda) and predators (such as *Acanthephyra eximia*) (see Figure 6).

Macrofaunal biomass

Values of biomass and the relative contribution of each taxa to the biomass are presented in Table 4. The decapod *Xantho pilipes* was the responsible for the highest value (13422.9 mg × m^{-2}) observed in the shallowest station of the SOS in the Catalan margin. The contribution of the different groups was quite similar for Ligurian and South Adriatic margins, but in the Catalan margin 93% of the total biomass was due to Crustacea and Echinodermata. The three sites showed a distribution of the biomass in the canyon and open slope areas similar to the abundance one (see Figure 4C). In general, macrofaunal biomass did not show a significant relationship with depth. Only in the Catalan margin a significant decrease of the values with increasing water depth was observed (see Figure 5C). Biomass did not show any correlation with the contribution of the mud fraction (Table S3).

The individual biomass was determined, highlighting a general decreasing trend moving eastward. The highest values were observed in the western area (Figure 7A). The average value for the canyon areas was 1.7± 1.1, 1.4±1.4 and 1.3±1.6 mg ind^{-1} for the Catalan, Ligurian and South Adriatic Margins respectively. A high variability was observed for the open slope values: 40.4±67.5, 0.3±0.2 and 2.6±2.5 mg ind^{-1} for the Catalan, Ligurian and South Adriatic Margins respectively. The relationship with depth was not significant ($R = 0.1735$, $n = 32$, $p>0.05$; Figure 7B).

4. Discussion

The ANOSIM analysis indicated the presence of significant differences in the structure of the macrobenthic assemblages among the different sampling regions along the longitudinal gradient. Such differences were observed also in terms of high turnover diversity among different investigated regions which resulted in a high δ-diversity. Only Oligochaeta and, within the polychaetes, the family Capitellidae, were reported from all of the investigated regions. The observed variability at regional scale of the macrofaunal assemblages is apparently linked to the specific environmental features, including differences in primary productivity and organic carbon fluxes, which decreased moving Eastward, with consequent decrease of the organic matter available to consumers in deep-sea sediments (Gambi and Danovaro, 2006; Coll et al., 2010). Also the temporal variability should be considered, the regions were sampled in different years and different seasons. The importance of food source in structuring deep-sea assemblages was underlined also by Mamouridis et al., (2011) who reported seasonal changes in macrofaunal communities of the Besos canyon.

The trophic composition of macrofaunal assemblages showed differences between the three regions, in accordance with the differences reported in terms of food availability (Pusceddu et al., 2010). In fact, where the quality and quantity of the sedimentary organic matter were higher, such as in the Catalan margin, the dominant trophic guild were the deposit feeders and suspension-deposit feeders. Conversely, in the South Adriatic margin where lower food resources where available the macrofaunal assemblages were dominated by suspension feeders and predators. The predator contribution to the abundance (Figure 6) increased from West to East. All meiofaunal variables investigated in the same expeditions decreased moving Eastward (Bianchelli et al. 2010), we could hypothesize a predatory pressure of the macrofauna on meiofauna and/or competition between those benthic compartments. On the other hand, the food resources in the sediment of Mediterranean Sea decrease eastward reaching a strong oligotrophic condition in the Levantine basin (Danovaro et al. 1999). In such conditions predators are facilitated in obtaining food due to their higher motility (Danovaro et al., 2008). The same result was reported by Baldrighi et al. (2014) from the analysis of the deep macrofaunal assemblages across a longitudinal gradient in Mediterranean open slopes.

The structure of the assemblages within each of the three regions changed also comparing the two habitats considered (canyon and open slope). Such changes resulted in high values of the β-diversity between the habitats. Duineveld et al. (2001) and Gunton et al. (2015), comparing the Whittard canyon with the adjacent continental slope, reported significant differences in macrofaunal assemblages. The macrofaunal dissimilarity between canyons and slopes reported in the present study was slightly higher than that reported for the rare taxa of the meiofaunal communities in the Catalan and South Adriatic margins by Bianchelli et al. (2010), and higher than the dissimilarity for the nematodes assemblages for the same regions (Danovaro et al., 2009). One possible explanation of the observed patterns is that the fauna inhabiting each habitat are adapted to the local environmental features such as the dynamic characteristics of the canyons, where there is a large transport of energy and materials from the shelf to the deep-sea (Vetter and Dayton, 1998; 1999; Canals et al., 2006; de Stigter et al., 2007). For instance, we found some individuals of the bivalve *Thyasira flexuosa* inside the Polcevera canyon and a conspicuous population of the ophiurid *Amphiura filiformis* inside both canyons, eight-fold higher than in the open slope, in the South Adriatic region. Both species are considered as indicators of high organic matter loads. In fact, the bivalve belongs to the first order opportunistic group and the ophiurid to the second order opportunistic group (Simboura and Zenetos, 2002).

The lower number of taxa in canyons than in adjacent slopes observed in the Catalan and Adriatic margins, are consistent with a number of other studies (Gage et al., 1995; Vetter and Dayton, 1999; Curdia et al., 2004).

Previous studies of macrofauna in canyons reported higher abundance and biomass than in the adjacent slope (Duineveld et al., 2001). This holds true also for the Ligurian margin, where the macrofaunal assemblages of the canyon stations showed a higher abundance than those of the slope, but contrasts with the Catalan and South Adriatic margins where an opposite pattern was reported. As previously mentioned, one of the key factors driving the community structure of the deep-sea fauna is the food supply (Ruhl and Smith, 2004). Previous studies conducted in the Catalan and South Adriatic margins (Pusceddu et al. 2010) showed that the food availability was similar in canyon and open slope habitats. These findings are consistent with the macrofaunal distribution observed in the present study. In addition, the mud contribution to the sediment composition was quite similar between the two habitats in all regions studied. Also water depth played a potentially important role in structuring macrofaunal assemblages in both habitats at the Ligurian and South Adriatic systems, and this finding is in accordance with the observations reported in other areas such the Toulon Canyon (Stora et al., 1999) and the Aviles Canyon (Louzao et al., 2010).

The local variability observed also between the topographic habitats in the Catalan and South Adriatic systems, can contribute to explain the observed differences, as the Catalan canyons dominated by organisms with mixed trophic strategies (deposit-suspension feeders and deposit feeders-grazers), pointing to the role of organic materials transported from the shelf to the deep-sea habitats (such as macrophyte detritus, Rowe et al., 1982; Vetter and Dayton, 1999) during periodic flushing events and sedimentation of the transported material (Canals et al., 2006). Conversely, the South Adriatic, was dominated by suspension feeders, confirming the importance of primary production and the export of organic matter to the deep sea (Pusceddu et al., 2010). In the Ligurian margin the trophic composition of macrofaunal assemblages did not show differences between canyon stations and slope ones, and this finding is consistent with the fact that the two habitats showed similar amount of bioavailable organic matter (Carugati et al., this issue).

The trophic characteristics of the sediments (as quality and quantity of sedimentary organic matter) of the Catalan and South Adriatic margins (Pusceddu et al., 2010) can also contribute to explain the observed patterns in macrofaunal biomass, with highest values in the Catalan margin and a decreasing pattern Eastward. These findings are consistent with patterns observed for meiofauna by Gambi and Danovaro (2006) and are reflected also by patterns in individual size of the organisms, which decreased moving Eastward according to the depletion of the available food source (Pusceddu et al., 2010). Finally water depth did not play an important role in driving these faunal variables (see Figure 5C and 7B). We also observed the lack of any relationships between macrofauna and grain size (Table S3) suggesting that the textural characteristics did not play any significant key role in controlling the faunal distribution.

In conclusion, the analyses conducted on macrofaunal assemblages along longitudinal gradients at large spatial-scales (from the Gulf of Lyon to the Ligurian Sea and Southern Adriatic) in the Mediterranean Sea suggest that canyons by increasing β-diversity (i.e., the species turnover between canyons and open slopes) due to the spatial and trophic variability observed between canyons and slopes and among the different biogeographic regions.

Acknowledgements

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Figure captions

Figure 1. Location of the sampling stations in the three sites of Western and Central Mediterranean Sea. Black circles: open slope stations, grey circles: canyon stations.

Figure 2. The multidimensional scaling (MDS) applied on presence/absence data of the three regions considered. The upper panel represents the analysis of all the data, in the lower panel are presented the results of analysis excluding the three outliers.

Figure 3. Results of the SIMPER analysis between the three regions and characteristic taxa .

Figure 4. Average values ± standard error of A: abundance, B: number of taxa, C: biomass.

Fig. 5. Linear regression between depth and macrofaunal parameters in the three sites. A: abundance, B: number of taxa and C: biomass.

Fig. 6. Relative abundance of the trophic groups in the assemblages of the two topographic habitats (canyon and open slope) in the three sites studied. Susp: suspension feeders, dep-susp: deposit-suspension feeders, dep: deposit feeders, dep-graz: deposit feeders-grazers, dep-pred: deposit feeders-predators, pred: predators.

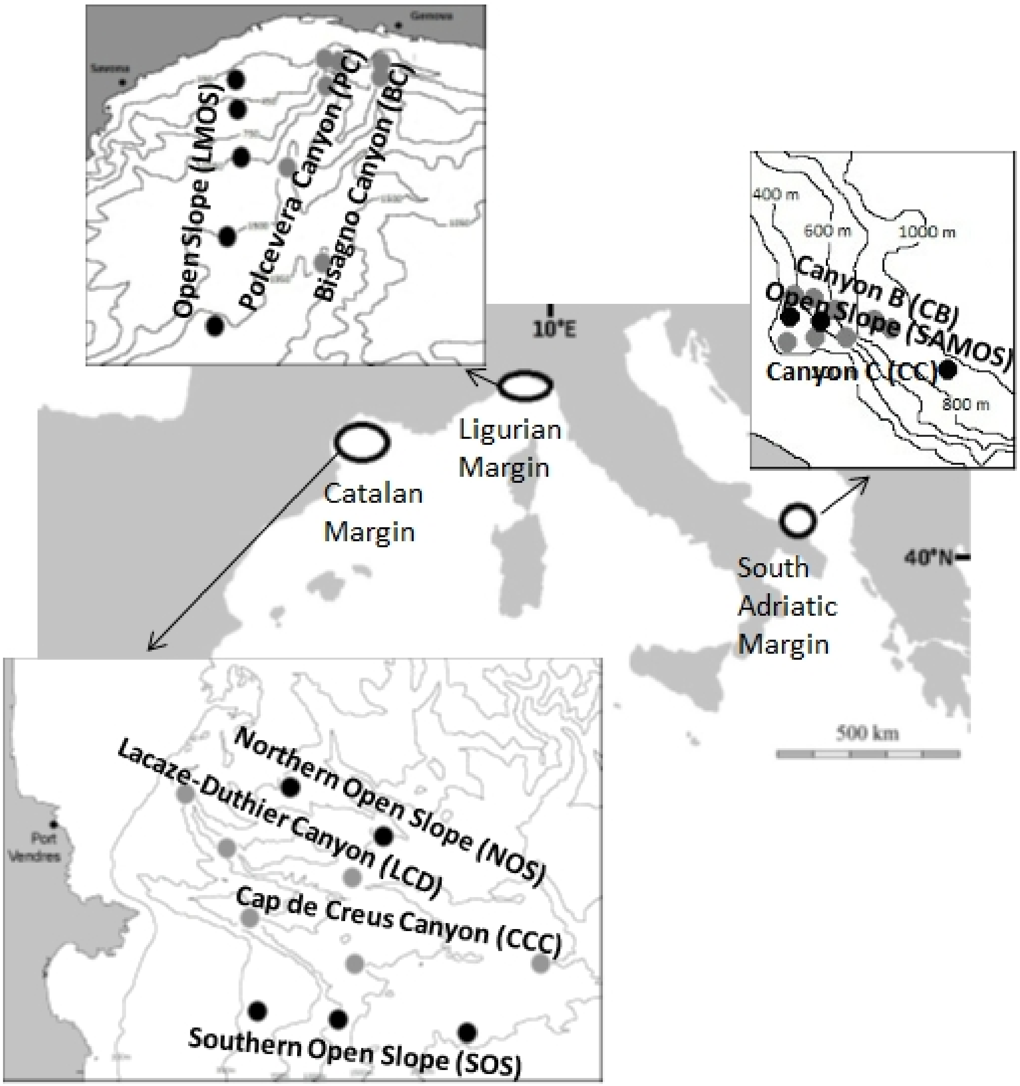
Fig. 7. Relationship between organism individual size vs longitude (A) and vs depth (B). Black triangles represent the average value; standard error is indicated, when not visible it is included in the marker size.

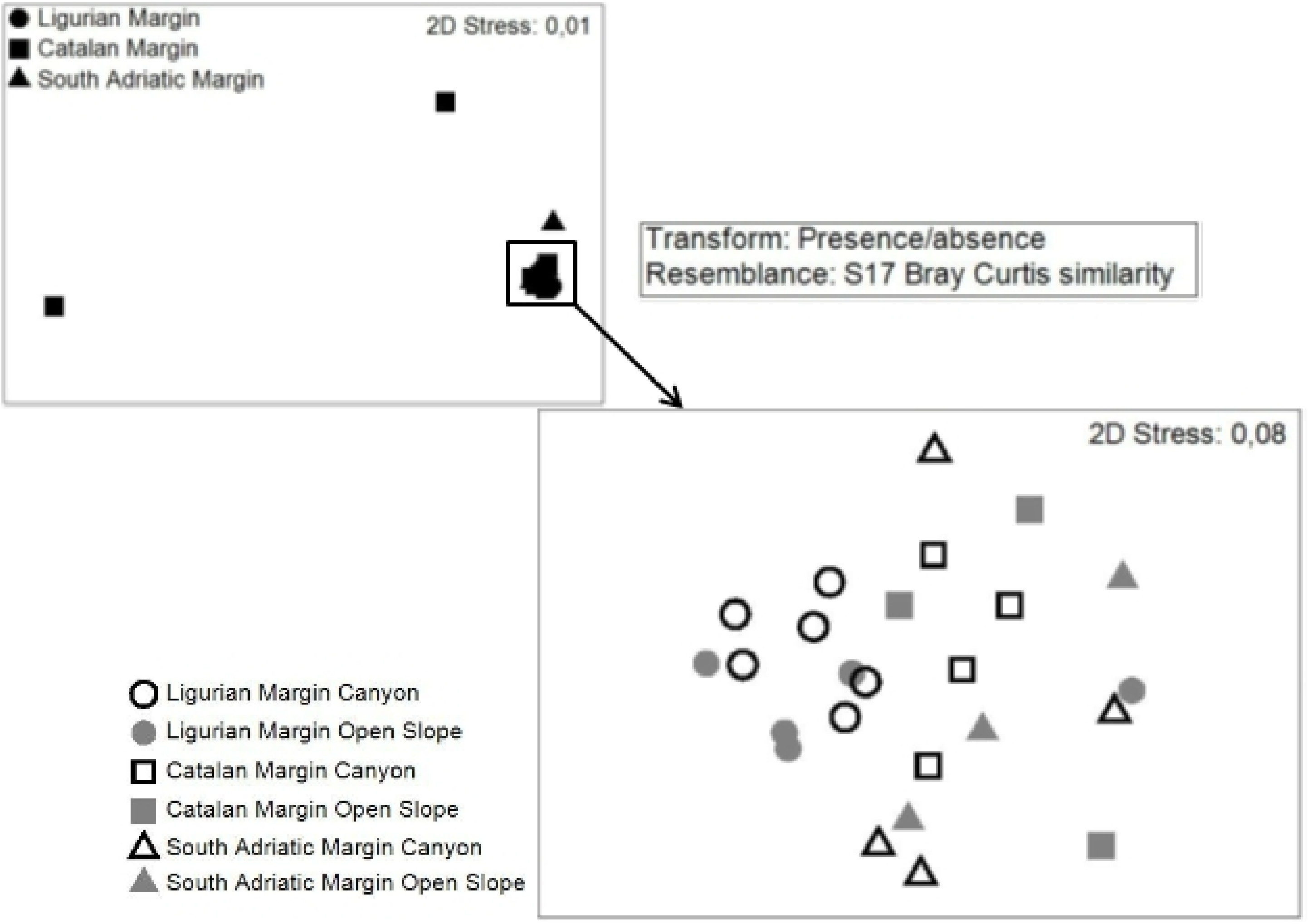
Supporting Material

Table S1. Complete list of taxa found in the three studied areas.

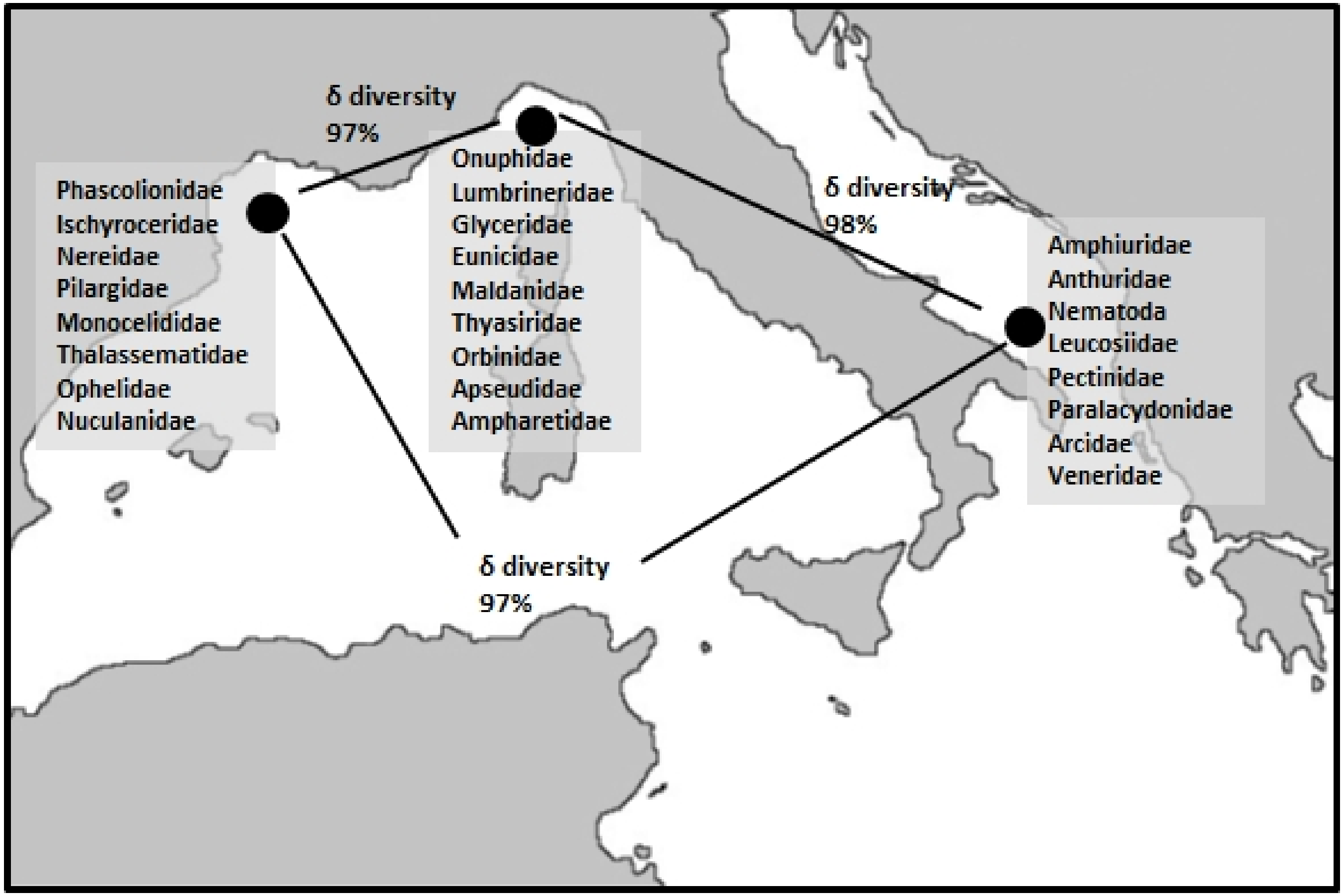
Table S2. Species contributions, in percent, to the dissimilarity (β−diversity), between canyon and open slope within each site.

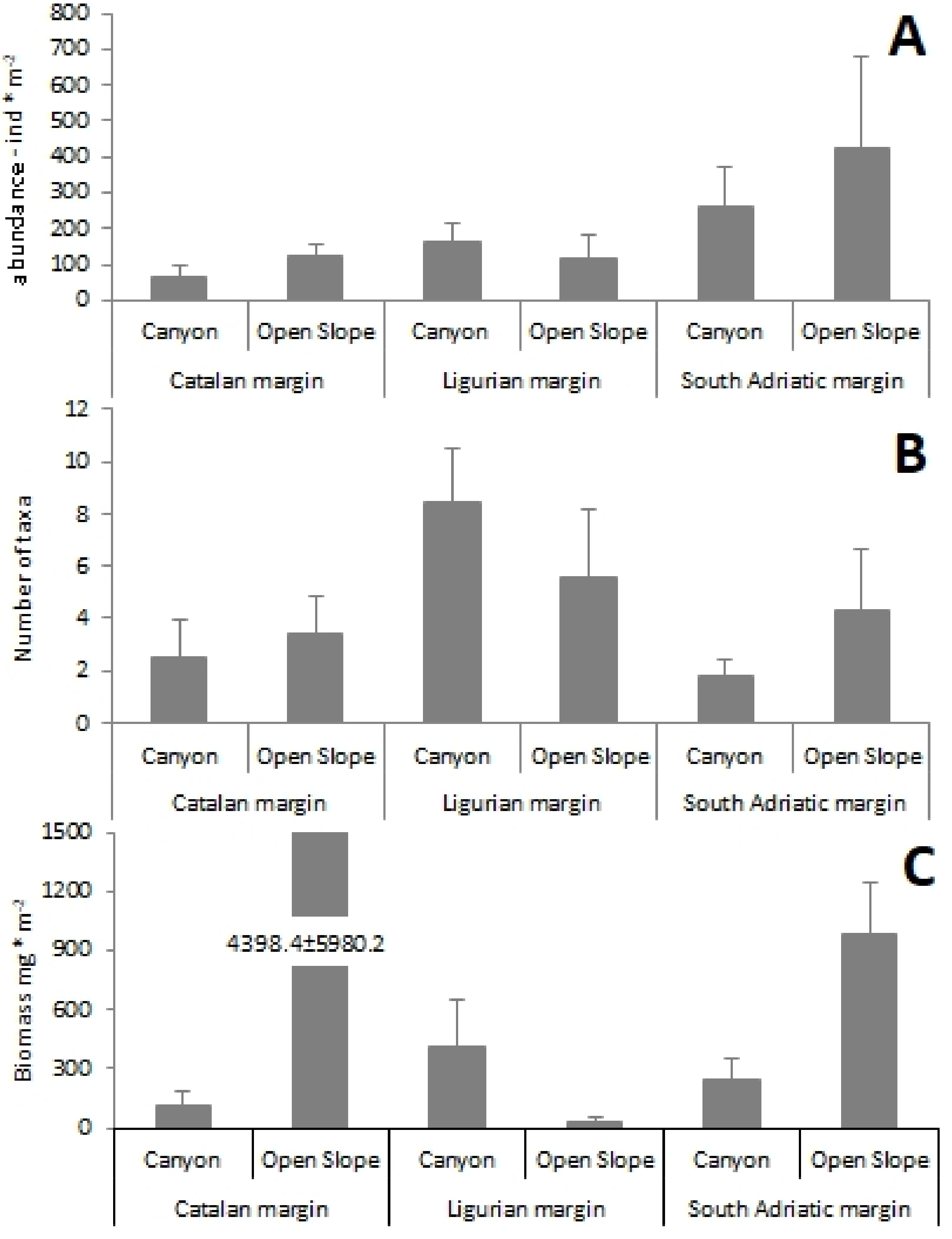
Table S3. Result of the regression analysis between the contribute of the mud fraction to the sediment composition and the principal macrofaunal parameters.

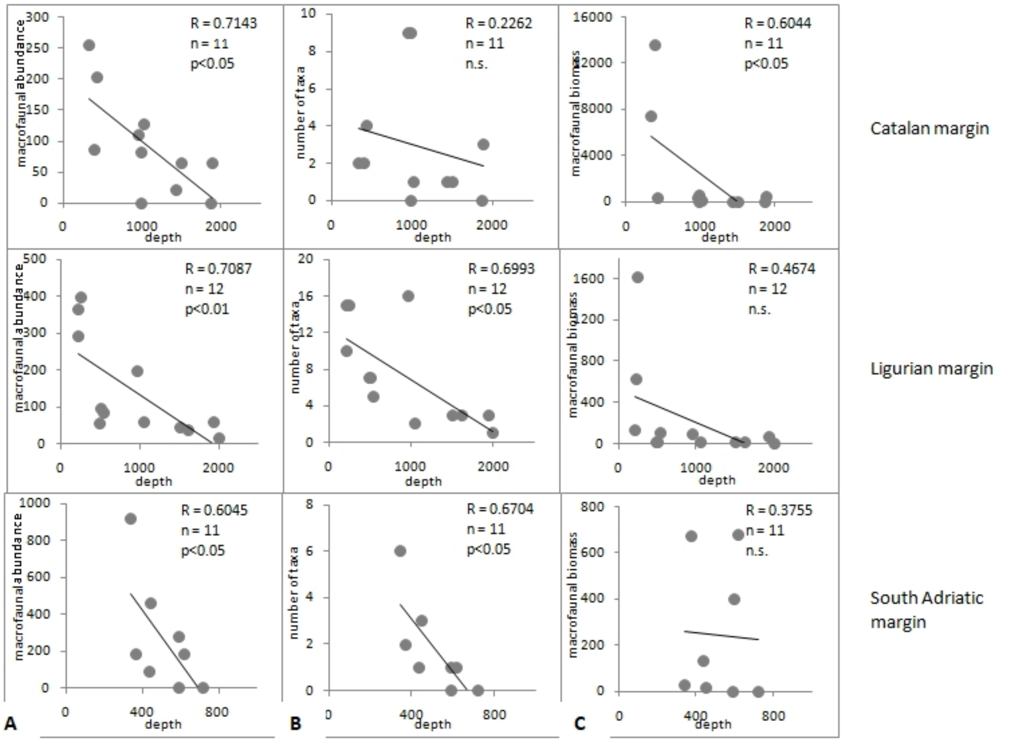

Genova
Savona
Open Slope (LMOS)
Polcevera Canyon (PC)
Bisagno Canyon (BC)
10°E
Ligurian Margin
Catalan Margin
400 m
600 m
1000 m
800 m
Canyon B (CB)
Open Slope (SAMOS)
Canyon C (CC)
South Adriatic Margin
40°N
500 km
Port Vendres
Northern Open Slope (NOS)
Lacaze-Duthier Canyon (LCD)
Cap de Creus Canyon (CCC)
Southern Open Slope (SOS)



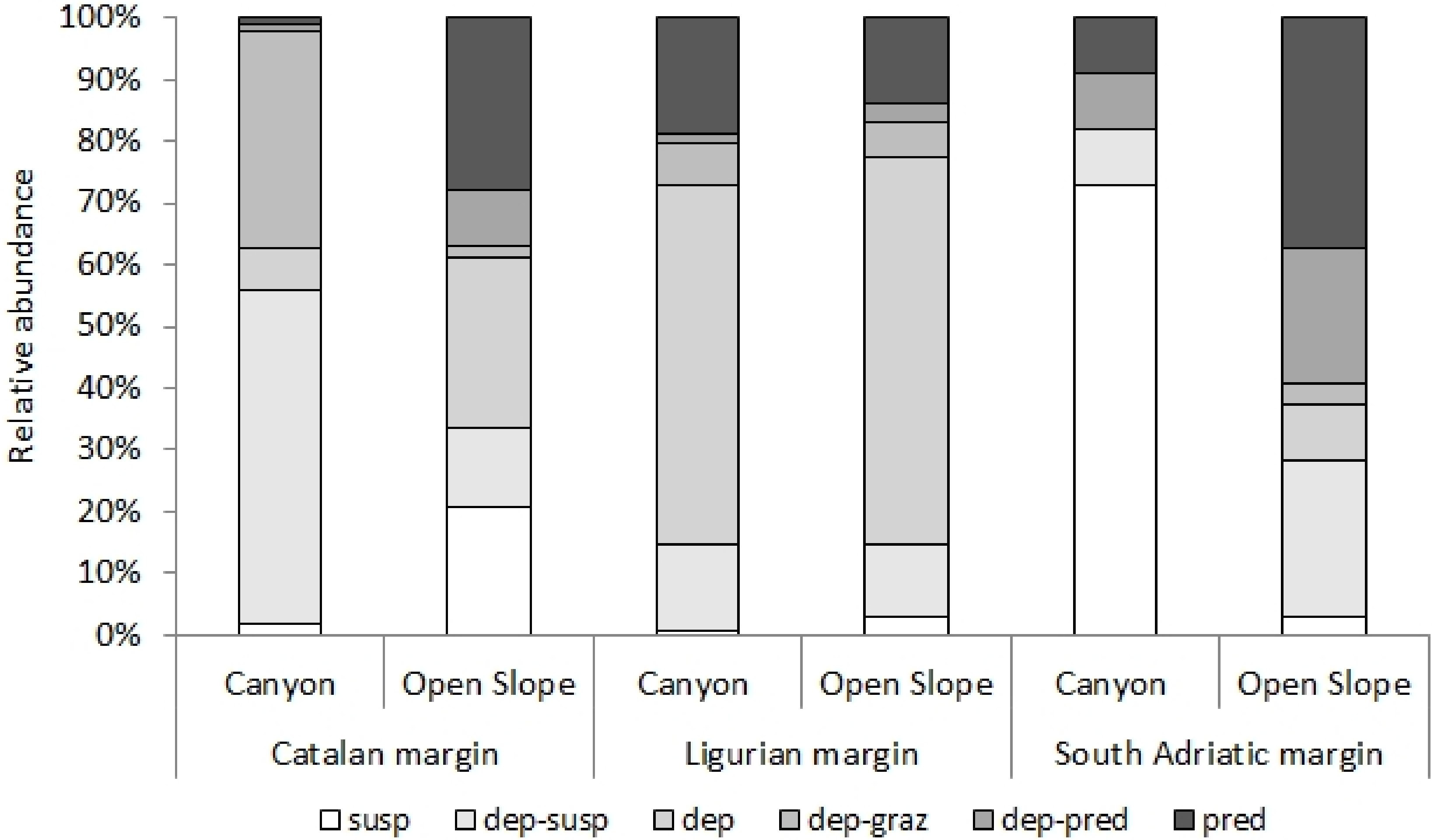
Ligurian Margin
Catalan Margin
South Adriatic Margin
2D Stress: 0,01
Transform: Presence/absence
Resemblance: S17 Bray Curtis similarity
2D Stress: 0,08
Ligurian Margin Canyon
Ligurian Margin Open Slope
Catalan Margin Canyon
Catalan Margin Open Slope
South Adriatic Margin Canyon
South Adriatic Margin Open Slope


δ diversity
97%
Phascolionidae
Ischyroceridae
Nereidae
Pilargidae
Monocelididae
Thalassematidae
Ophelidae
Nuculanidae
Onuphidae
Lumbrineridae
Glyceridae
Eunicidae
Maldanidae
Thyasiridae
Orbinidae
Apseudidae
Ampharetidae
δ diversity
98%
Amphiuridae
Anthuridae
Nematoda
Leucosiidae
Pectinidae
Paralacydonidae
Arcidae
Veneridae
δ diversity
97%


A
abundance - ind * m-2
800
700
600
500
400
300
200
100
0
Canyon
Open Slope
Canyon
Open Slope
Canyon
Open Slope
Catalan margin
Ligurian margin
South Adriatic margin
B
Number of taxa
12
10
8
6
4
2
0
Canyon
Open Slope
Canyon
Open Slope
Canyon
Open Slope
Catalan margin
Ligurian margin
South Adriatic margin
C
Biomass mg * m-2
1500
1200
900
600
300
0
4398.4±5980.2
Canyon
Open Slope
Canyon
Open Slope
Canyon
Open Slope
Catalan margin
Ligurian margin
South Adriatic margin



R = 0.7143
n = 11
p<0.05
R = 0.2262
n = 11
n.s.
R = 0.6044
n = 11
p<0.05
Catalan margin
R = 0.7087
n = 12
p<0.01
R = 0.6993
n = 12
p<0.05
R = 0.4674
n = 12
n.s.
Ligurian margin
R = 0.6045
n = 11
p<0.05
R = 0.6704
n = 11
p<0.05
R = 0.3755
n = 11
n.s.
South Adriatic margin
macrofaunal abundance
number of taxa
macrofaunal biomass
depth
A
B
C


100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Relative abundance
Canyon
Open Slope
Canyon
Open Slope
Canyon
Open Slope
Catalan margin
Ligurian margin
South Adriatic margin
susp
dep-susp
dep
dep-graz
dep-pred
pred

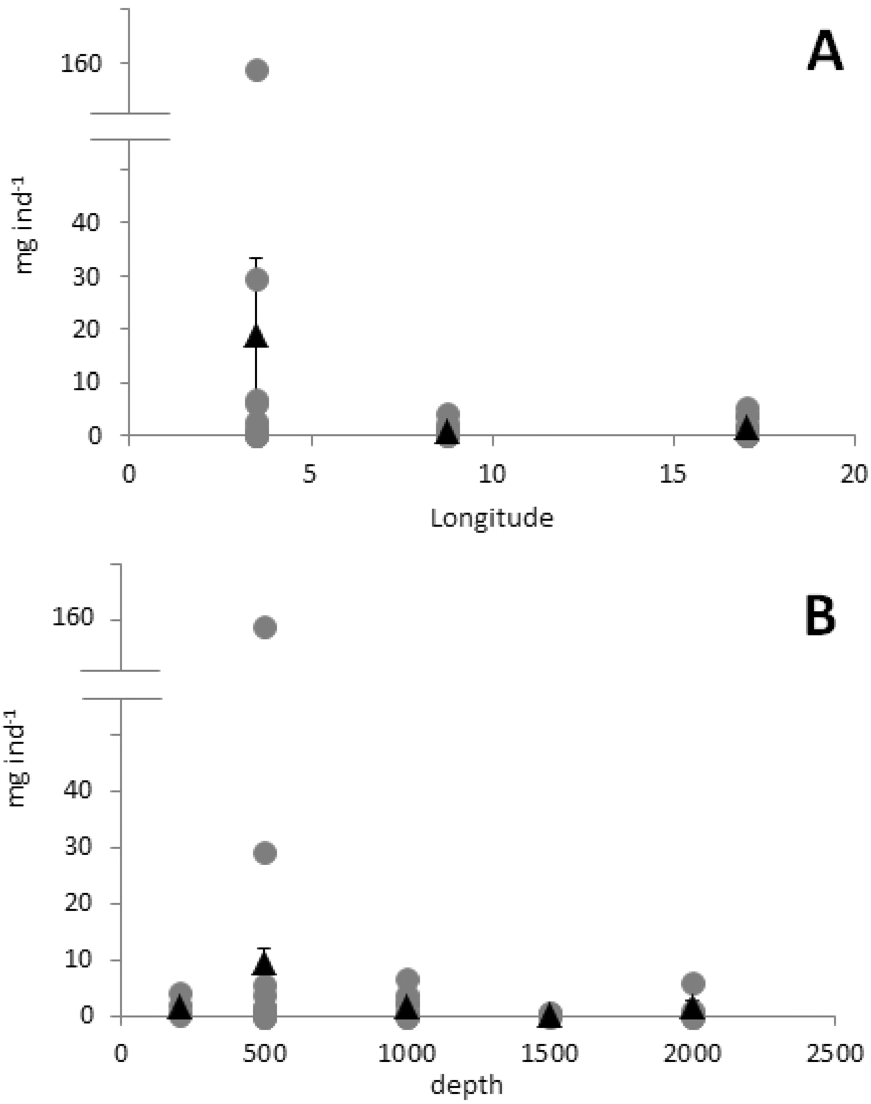

A
160
40
30
20
10
0
mg ind-1
0
5
10
15
20
Longitude
B
160
40
30
20
10
0
mg ind-1
0
500
1000
1500
2000
2500
depth

Table 1. Station depth, geographic coordinates, sampling device and percentage of mud in the sediment texture. N.d.: not determined.

		Depth (m)	Latitude N	Longitude E	Sampling device	Mud %
Catalan margin	Southern Open Slope (SOS)	398	42° 08.85'	03° 35.06'	multi-corer	69
		985	42° 07.72'	03° 46.63'		87
		1887	42° 07.05'	04° 02.74'		77
R/V Universitatis October 2005	Cap de Creus Canyon (CCC)	960	42° 18.47'	03° 36.60'		80
		1434	42° 12.64'	03° 49.22'		86
R/V Thetys II August 2006		1870	42° 12.88'	04° 15.43'		68
	Lacaze-Duthiers Canyon (LDC)	434	42° 34.44'	03° 24.04'		76
		990	42° 26.56'	03° 31.83'		80
		1497	42° 21.96'	03° 49.41'		56
	Northern Open Slope (NOS)	334	42° 34.13'	03° 39.19'		71
		1022	42° 26.49'	03° 51.32'		77
Ligurian margin	Open Slope (LMOS)	222	44° 18.79'	08° 40.22'	box-corer	98
		507	44° 16.22'	08° 40.30'		99
		1054	44° 11.37'	08° 40.52'		99
R/V Minerva Uno May 2013		1516	44° 03.40'	08° 39.16'		99
		2005	43° 55.02'	08° 38.17'		96
	Polcevera Canyon (PC)	252	44° 21.87'	08° 49.33'		99
		540	44° 21.23'	08° 50.19'		n.d.
		963	44° 18.72'	08° 49.88'		94
		1623	44° 10.58'	08° 45.71'		99
	Bisagno Canyon (BC)	225	44° 21.13'	08° 54.74'		96
		496	44° 20.12'	08° 54.64'		92
		1946	44° 00.71'	08° 49.10'		98
South Adriatic margin	Canyon B (CB)	370	41° 22.10'	17° 06.70'	multi-corer	39
		446	41° 21.71'	17° 07.75'		65
		590	41° 20.63'	17° 11.02'		19
N/O Urania May 2006	Open Slope (SAMOS)	196	41° 21.30'	17° 05.96'		11
		406	41° 20.08'	17° 10.32'		44
		908	41°13.70'	17° 35.15'		68
	Canyon C (CC)	341	41° 19.07'	17° 05.15'		1
		435	41° 19.47'	17° 09.75'		63
		593	41° 18.18'	17° 12.51'		57
		618	41° 18.84'	17° 14.66'		48
		721	41° 18.43'	17° 15.61'		58

Table 2. Results of Analysis of similarities (ANOSIM), applied on the presence/absence data, between sites (Catalan margin, Ligurian margin and South Adriatic margin) and between Canyon and Open Slope inside each site. A): abundance of taxa matrix, B): abundance of trophic groups matrix.

A)		R	p
Catalan margin vs Ligurian margin		0.409	0.001
Catalan margin vs South Adriatic margin		0.150	0.018
Ligurian margin vs South Adriatic margin		0.505	0.001
Catalan margin			
	Canyon vs Open Slope	-0.066	0.667
Ligurian margin			
	Canyon vs Open Slope	0.142	0.138
South Adriatic margin			
	Canyon vs Open Slope	-0.142	0.786

B)		R	p
Catalan margin vs Ligurian margin		0.222	0.005
Catalan margin vs South Adriatic margin		0.072	0.186
Ligurian margin vs South Adriatic margin		0.392	0.002
Catalan margin			
	Canyon vs Open Slope	0.263	0.079
Ligurian margin			
	Canyon vs Open Slope	0.058	0.290
South Adriatic margin			
	Canyon vs Open Slope	0.194	0.190

Table 3. Station depth, total abundance (mean±standard error), number of taxa and percentage of the contribution of the main taxa to the total abundance. An: Annelida, Cr: Crustacea, Mo: Mollusca, Si: Sipuncula, Ec: Echinodermata, Ot: others.

		Depth	Total abundance ind * m^{-2}	N. taxa	An %	Cr %	Mo %	Si %	Ec %	Ot %
Catalan margin	Southern Open Slope (SOS)	398	84.9±11.5	2	50	50	0	0	0	0
		985	81.2±44.4	9	48	4	9	26	0	13
		1887	63.7±21.2	3	33.34	0	0	33.32	0	33.34
	Cap de Creus Canyon (CCC)	960	109.4±17.9	9	56	15	21	8	0	0
		1434	21.2±11.5	1	100	0	0	0	0	0
		1870	0	0	0	0	0	0	0	0
	Lacaze-Duthiers Canyon (LDC)	434	203.7±28.9	4	62	0	13	25	0	0
		990	0	0	0	0	0	0	0	0
		1497	63.7±17.3	1	100	0	0	0	0	0
	Northern Open Slope (NOS)	334	254.6±28.9	2	50	0	0	0	50	0
		1022	127.3±23.1	1	0	100	0	0	0	0
Ligurian margin	Open Slope (LMOS)	222	364.6±57.2	15	85	11	2	0	2	0
		507	95.1±41.2	7	83	17	0	0	0	0
		1054	59.5±11.7	2	80	0	0	20	0	0
		1516	44.6±14.9	3	67	33	0	0	0	0
		2005	15.0±15.0	1	100	0	0	0	0	0
	Polcevera Canyon (PC)	252	396.4±97.4	15	76	10	8	2	4	0
		540	83.2±54.8	5	57	29	14	0	0	0
		963	198.2±28.6	16	56	24	0	20	0	0
		1623	38.6±8.9	3	100	0	0	0	0	0
	Bisagno Canyon (BC)	225	291.3±48.7	10	85	7	8	0	0	0
		496	55.5±28.6	7	72	14	14	0	0	0
		1946	57.7±57.7	3	33	67	0	0	0	0
South Adriatic margin	Canyon B (CB)	370	183.0±83.3	2	50	0	50	0	0	0
		446	457.9±183.3	3	20	0	0	20	60	0
		590	0	0	0	0	0	0	0	0
	Open Slope (SAMOS)	196	2747.3±1066.7	9	23	47	0	7	10	13
		406	183.0±57.7	2	50	0	0	0	50	0
		908	274.7±126.7	2	67	33	0	0	0	0
	Canyon C (CC)	341	915.8±366.7	6	10	0	70	0	0	20
		435	91.5±46.2	1	0	100	0	0	0	0
		593	274.5±144.3	1	0	0	0	0	100	0
		618	183.0±86.6	1	0	0	0	0	100	0
		721	0	0	0	0	0	0	0	0

Table 4. Station depth, total biomass (mean±standard error) and percentage of the contribution of the main taxa to the total biomass. An: Annelida, Cr: Crustacea, Mo: Mollusca, Si: Sipuncula, Ec: Echinodermata, Ot: others.

		Depth	Total biomass mg $*m^{-2}$	An %	Cr %	Mo %	Si %	Ec %	Ot %
Catalan margin	Southern Open Slope (SOS)	398	13546.8±7505.6	1	99	0	0	0	0
		985	545.2±397.4	15	1	0	2	0	82
		1887	385.6±172.5	8	0	0	28	0	64
	Cap de Creus Canyon (CCC)	960	314.9±187.9	51	16	1	32	0	0
		1434	12.4±6.4	100	0	0	0	0	0
		1870	0	0	0	0	0	0	0
	Lacaze-Duthiers Canyon (LDC)	434	355.2±173.2	85	0	9	6	0	0
		990	0	0	0	0	0	0	0
		1497	1.9±0.6	100	0	0	0	0	0
	Northern Open Slope (NOS)	334	7471.4±692.8	0.03	0	0	0	99.97	0
		1022	43.3±23.1	0	100	0	0	0	0
Ligurian margin	Open Slope (LMOS)	222	132.6±67.3	94	2	4	0	0	0
		507	11.6±7.8	62	38	0	0	0	0
		1054	21.2±12.7	81	0	0	19	0	0
		1516	23.2±19.6	84	16	0	0	0	0
		2005	0.1±0.1	100	0	0	0	0	0
	Polcevera Canyon (PC)	252	1620.4±885.7	45	53	0	0	2	0
		540	108.9±82.6	12	86	2	0	0	0
		963	93.8±31.1	85	2	0	13	0	0
		1623	17.5±14.9	100	0	0	0	0	0
	Bisagno Canyon (BC)	225	628.1±79.3	99	1	0	0	0	0
		496	13.5±9.8	97	1	2	0	0	0
		1946	65.6±65.6	37	63	0	0	0	0
South Adriatic margin	Canyon B (CB)	370	675.4±115.5	76	0	24	0	0	0
		446	17.4±15.6	6	0	0	21	73	0
		590	0	0	0	0	0	0	0
	Open Slope (SAMOS)	196	1435.8±1132.1	4	95	0	0.4	0.5	0.1
		406	999.3±346.4	57	0	0	0	43	0
		908	527.4±317.5	7	93	0	0	0	0
	Canyon C (CC)	341	27.7±20.2	3	0	95	0	0	2
		435	131.8±49.1	0	100	0	0	0	0
		593	400.8±109.7	0	0	0	0	100	0
		618	680.9±173.2	0	0	0	0	100	0
		721	0	0	0	0	0	0	0

Supporting Material

Table S1. Complete list of taxa found in the three studied areas. The taxonomical level used for statistical analysisis reported in bold. Und.: undetermined or damaged specimens that cannot be determined for their conditions; juv.: juvenile specimens; “+ and -”: are for present and absent.

	Catalan margin		Ligurian margin		South Adriatic margin	
	Canyon	Open Slope	Canyon	Open Slope	Canyon	Open Slope
Phylum Arthropoda						
Subphylum Crustacea						
Class Malacostraca						
Order Decapoda						
Infraorder Caridea						
Caridea und.	-	-	+	-	-	-
Family Acanthephyridae						
Acanthephyra eximia	-	-	-	-	-	+
Infraorder Brachyura						
Family Leucosiidae						
Ebalia sp.	-	-	-	-	-	+
Family Xanthidae						
Xantho pilipes	-	+	-	-	-	+
Infraorder Gebiidea						
Family Thalassinidae	-	+	-	-	-	-
Order Amphipoda						
Amphipoda und.	-	-	+	-	-	-
Infraorder Lysianassida						
Family Ampeliscidae						
Ampelisca sp.	-	-	-	+	-	-
Family Phoxocephalidae						
Harpinia cf. *dellavallei*	-	-	+	-	-	-
Harpinia truncata	-	-	-	+	-	-
Paraphoxus oculatus	-	-	-	+	-	-
Family Urothoidae						
Urothoe cf. *elegans*	-	-	+	+	-	-
Infraorder Corophiida						
Family Ischyroceridae						
Jassa marmorata	-	+	-	-	-	-
Family Corophiidae						
Leptocheirus cf. *mariae*	-	-	+	-	-	-
Infraorder Hadziida						
Family Maeridae						
Othomaera schmidtii	-	-	-	+	-	-
Infraorder Amphilochida						
Family Oedicerotidae						
Westwoodilla caecula	-	-	+	-	-	-

Order Isopoda						
Superfamily Anthuroidea						
Family Antheluridae						
Pilosanthura cf. *fresii*	-	-	+	-	-	-
Family Anthuridae	-	-	-	-	+	-
Superfamily Cymothooidea						
Family Cirolanidae						
Natatolana borealis	+	-	+	-	-	-
Infraorder Epicaridea	+	-	-	-	-	-
Order Cumacea						
Cumacea und.	+	-	-	-	-	-
Family Lampropidae						
Platysympus typicus	-	-	+	-	-	-
Family Leuconidae						
Leucon (Epileucon) longirostris	-	-	-	+	-	-
Order Tanaidacea						
Superfamily Apseudoidea						
Family Apseudidae						
Fageapseudes retusifrons	-	-	-	+	-	-
Class Hexanauplia						
Subclass Copepoda	-	-	+	+	-	+
Class Ostracoda						
Order Podocopida						
Family Cyprididae	-	-	+	-	-	-
Phylum Annelida						
Class Polychaeta						
Polychaeta und.	+	-	-	+	+	+
Subclass Sedentaria						
Infraclass Canalipalpata						
Canalipalpata und.	+	+	-	-	+	-
Family Spionidae	-	-	+	+	-	+
Family Ampharetidae	-	-	+	+	-	-
Family Terebellidae	+	-	-	-	-	-
Polycirrus sp.	-	-	-	-	-	+
Infraclass Scolecida						
Family Capitellidae	-	+	+	+	-	+
Notomastus sp.	+	-	-	-	-	-
Family Maldanidae	-	-	+	+	-	-
Family Ophelidae	+	-	-	-	-	-
Family Orbinidae	-	-	+	-	-	-
Family Paraonidae	-	+	+	+	-	-
Family Chaetopteridae	-	+	-	-	-	-
Subclass Echiura						
Order Echiuroidea						
Family Thalassematidae						

Maxmuelleria gigas	-	+	-	-	-	-
Subclass Errantia						
Order Eunicida						
FamilyEunicidae	-	-	+	+	-	-
Family Lumbrineridae	-	-	+	+	-	-
Family Onuphidae	-	-	+	+	-	-
Order Phyllodocida						
Family Acoetidae	-	-	+	-	-	-
Family Sigalionidae	-	-	+	-	-	-
Family Glyceridae	-	-	+	+	-	-
Family Paralacydonidae	-	-	-	-	+	-
Family Pilargidae						
Ancistrosyllis cf. *groenlandica*	-	+	-	-	-	-
Family Nereididae	-	+	-	-	-	-
Family Syllidae	-	-	-	+	-	-
Family Phyllodocidae	-	-	+	-	-	-
Class Clitellata						
Subclass Oligochaeta	+	-	+	+	-	+
Phylum Mollusca						
Class Bivalvia						
Order Pectinida						
Family Pectinidae						
Aequipecten opercularis	-	-	-	-	+	-
Order Arcida						
Family Arcidae						
Bathyarca philippiana	-	-	-	-	+	-
Order Venerida						
Family Veneridae						
Clausinella fasciata	-	-	-	-	+	-
Pitar rude	-	-	-	-	+	-
Lajonkairia lajonkairii	-	-	-	-	+	-
Superfamily Galiommatoidea						
Family Lasaidae						
Kellia suborbicularis	+	-	-	-	-	-
Order Nuculida						
Family Nuculidae						
Ennucula tenuis	-	-	+	+	-	-
Nucula sulcata	+	-	+	-	-	-
Order Nuculanida						
Family Nuculanidae						
Nuculana fragilis	-	+	-	-	-	-
Nuculana sp. juv.	+	-	-	-	-	-
Order Lucinida						
Family Thyasiridae						
Thyasira flexuosa	-	-	+	-	-	-

Phylum Echinodermata						
Class Ophiuroidea						
Ophiuridea juv.	-	-	-	+	-	-
Order Amphilepidida						
Family Amphiuridae						
Amphiura chiajei	-	-	-	-	-	+
Amphiura filiformis	-	-	-	-	+	+
Order Ophiurida						
Family Ophiuridae						
Ophiura lacertosa	-	-	+	-	-	-
Class Echinoidea						
Subclass Euechinoidea	-	+	-	-	-	-
Phylum Sipuncula					-	
Sipuncula und.	-	-	-	-	-	+
Class Sipunculidea						
Order Golfingiida						
Family Golfingiidae						
Golfingia (Golfingia) elongata	-	-	+	-	-	-
Golfingia sp.	-	+	-	-	-	-
Nephasoma (Nephasoma) constrictum	-	-	+	-	-	-
Family Phascolionidae						
Onchnesoma steenstupii steenstupii	+	+	-	-	-	-
Onchnesoma sp.	+	-	-	-	-	-
Class Phascolosomatidea						
Order Phascolosomatida						
Family Phascolosomatidae						
Phascolosma (Fisherana) capitatum	-	+	-	-	-	-
Phascolosoma (Phascolosoma) agassizii	-	-	+	-	+	-
Phascolosoma (Phascolosoma) granulatum	-	-	+	+	-	-
Phylum Platyhelminthes						
Class Rhabditophora						
Order Proseiata						
Family Monocelididae						
Boreocelis sp.	-	+	-	-	-	-
Phylum Nematoda	-	-	-	-	+	+
Phylum Nemertina	-	+	-	-	-	-

Table S2. Percentage contribution of the various taxa to the dissimilarity (β−diversity) between canyon and open slope within each sampling site. Rel. abun.: relative abundance; Cum. cont.: cumulative contribution; 0: absence; “+”: higher abundance; “-“: lower abundance.

	Catalan margin β−diversity = 95%		
	Open Slope Rel. abun.	Canyon Rel. abun.	Cum. cont.%
Oligochaeta	0	+	11.70
Ischyroceridae	+	0	19.96
Phascolionidae	-	+	27.98
Capitellidae	-	+	35.40
Euechinoidea	+	0	41.05
Pilargidae	+	0	46.70
Nereidae	+	0	51.74
Xanthidae	+	0	56.79
Terebellidae	0	+	61.70
Monocelididae	+	0	65.40
Thalassematidae	+	0	69.11
Nuculidae	0	+	72.58
Ophelidae	0	+	75.57
Canalipalpata	-	+	78.41
Nuculanidae	0	+	80.68
	Ligurian margin β−diversity = 82%		
	Open Slope Rel. abun.	Canyon Rel. abun.	Cum. cont.%
Onuphidae	+	-	8.41
Paraonidae	-	+	15.72
Lumbrineridae	-	+	21.17
Maldanidae	+	-	26.32
Eunicidae	+	-	30.67
Nuculidae	+	-	34.64
Glyceridae	-	+	38.44
Phascolosomatidae	+	-	42.04
Thyasiridae	+	0	45.64
Capitellidae	+	-	48.61
Syllidae	0	+	51.34
Caridea	+	0	54.01
Apseudidae	0	+	56.65
Orbinidae	+	0	59.27
Ampharetidae	+	-	61.88
Cirolanidae	+	0	64.48
Oligochaeta	+	-	67.01
Sigalionidae	+	0	69.26

Copepoda	+	-	71.39
Spionidae	-	+	73.25
Cypridinidae	+	0	75.09
Phoxocephalidae	-	+	76.92
Urothoidae	-	+	78.63
Ophiuridae	-	+	80.32
	South Adriatic margin		
	β−diversity = 88%		
	Open Slope	Canyon	
	Rel. abun.	Rel. abun.	Cum. cont.%
Amphiuridae	+	-	16.08
Terebellidae	+	0	27.80
Oligochaeta	+	0	36.99
Leucosiidae	+	0	45.28
Acanthephyridae	+	0	52.39
Nematoda	+	-	58.48
Veneridae	0	+	63.07
Anthuridae	0	+	67.44
Spionidae	+	0	71.73
Canalipalpata	0	+	75.12
Pectinidae	0	+	78.51
Capitellidae	+	0	81.54

Table S3. Result of the regression analysis between the mud fraction to the sediment composition and the principal macrofaunal parameters. ns: not significant.

	R	n	p
Catalan margin			
Density vs Mud fraction	0.2588	9	ns
Number of taxa vs Mud fraction	0.4569	9	ns
Biomass vs Mud fraction	0.2717	9	ns
Ligurian margin			
Density vs Mud fraction	0.0265	10	ns
Number of taxa vs Mud fraction	0.2280	10	ns
Biomass vs Mud fraction	0.1517	10	ns
South Adriatic margin			
Density vs Mud fraction	0.5643	9	ns
Number of taxa vs Mud fraction	0.6192	9	< 0.05
Biomass vs Mud fraction	0.2149	9	ns