Comparison of epifaunal assemblages between *Cymodocea nodosa* and *Caulerpa prolifera* meadows in Gran Canaria (eastern Atlantic)

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ABSTRACT

Epifaunal invertebrates are sensitive to changes in the identity of the dominant host plant, so assessing differences in the diversity, abundance and structure of epifaunal assemblages is particularly pertinent in areas where seagrasses have been replaced by alternative vegetation (e.g. green seaweeds). In this study, we aimed to compare the diversity, abundance and structure of epifaunal assemblages, with particular emphasis on amphipods, between meadows dominated by *Cymodocea nodosa* and the green algae *Caulerpa prolifera* on shallow soft bottoms of Gran Canaria Island, determining whether patterns were temporally consistent. The epifaunal assemblage structure (abundance and composition) consistently differed between both plants, being more diverse and abundant epifaunal assemblages associated with *C. prolifera*-dominated beds than those inhabiting *C. nodosa* meadows. Amphipods constituted ca. 70% of crustaceans for the overall study, including 37 species belonging to 16 families. The amphipods abundance recorded was ca. 3 times larger in *C. prolifera*-dominated beds (1248.13 ± 136.83 ind. m^{-2}, mean ± SE) than in *C. nodosa* meadows (396.88 ± 77.36 ind. m^{-2}). Multivariate analysis of the community showed significant differences between habitats, with a clear segregation of the species. For instance, *Microdeutopus stationis, Dexamine spinosa, Aora spinicornis, Ischyrocerus inexpectatus* and *Apherusa bispinosa* were more abundant in *C. prolifera*-dominated beds; while the new genus, new species of caprellid, *Mantacaprella macaronensis,* dominated in *C. nodosa* meadows. However, some species such as *Pseudoprotella phasma* and *Ampithoe ramondi* were found without significant differences in both habitats.

Keywords: Amphipoda, epifauna, assemblage structure, ecosystem services, seagrass, Canary Islands.

1. Introduction

On subtidal soft bottoms, seagrasses form one of the most productive ecosystems worldwide, providing high-value ecosystem services such as delivery of food and habitat for a wide range of organisms (Costanza et al., 1997; Duffy, 2006; Thomsen et al., 2012), support of commercial fisheries, nutrient cycling, sediment stabilization and sequestration of carbon (Duarte et al., 2000; Waycott et al., 2009). Seagrasses, and the services they provide, are, however, threatened by impacts derived from coastal development and growing human population, as well as by impacts caused by climate change (Duarte, 2002; Orth et al., 2006; Waycott et al., 2009). Conservation of these valuable habitats is, therefore, important, particularly since seagrass meadows are declining worldwide, mainly in areas of intense human activities (Hughes et al., 2009).

Cymodocea nodosa (Ucria) Ascherson is a seagrass distributed across the Mediterranean Sea and adjacent areas of the Atlantic Ocean, including the Macaronesian archipelagos of Madeira and the Canaries (Reyes et al., 1995; Tuya et al., 2012). Meadows constituted by *C. nodosa* are the dominant vegetated communities on shallow soft substrates throughout the Canary Islands (Pavón-Salas et al., 2000; Barberá et al., 2005; Monterroso et al., 2012), where they provide food and shelter for diverse invertebrate and fish assemblages, including a 'nursery' habitat for larval and juvenile fish stages (Tuya et al., 2006; Espino et al., 2011a, 2011b). However, *C. nodosa* meadows are severely decreasing at local scales, as a result of a range of human-mediated impacts (Martínez-Samper, 2011; Tuya et al., 2013). In these coastal areas, the decline of *C. nodosa* seagrass meadows often results in the replacement by opportunistic green algae of the genus *Caulerpa*, *Caulerpa prolifera* (Forsskål) J.V. Lamouroux in particular (Martínez-Samper, 2011; Tuya et al., 2013).

Caulerpa prolifera is a native seaweed in the Canary Islands (Haroun et al., 2003), forming extensive beds on soft bottoms in waters from ca. 5 to 50 m depth. Several *Caulerpa* species contain caulerpenyne, a major secondary metabolite, which varies depending on the species, locations and seasons (Jung et al., 2002; Box et al., 2010), and appears to possess toxic and feeding deterrent properties against faunal herbivores (Smyrniotopoulos et al., 2003). Caulerpenyne may also act as an antimitotic substance, preventing settlement of most epiphytes (Sánchez-Moyano et al., 2001a). In addition, the high sediment-retention capacity of *Caulerpa* beds induces organic enrichment (Hendriks et al., 2010), potentially altering the distribution and abundance of associated animal populations (Sánchez-Moyano et al., 2001a).

When seagrasses are replaced by seaweeds, the quantity and quality of habitat for associated faunal assemblages may be altered, as well as flows of energy and matter through the ecosystem (Thomsen et al., 2012). In particular, epifaunal invertebrates are sensitive to changes in plant abundance and structure (e.g. through plant attributes such as plant size, biomass, shoot density, etc.), so differences in the diversity, abundance and structure of invertebrate assemblages are expected between different types (identities) of vegetation within the same geographical and environmental context (Sirota and Hovel, 2006).

The aim of this study was to compare the diversity, abundance and structure of epifaunal assemblages between meadows dominated by *Cymodocea nodosa* and *Caulerpa prolifera* on shallow soft bottoms of Gran Canaria Island, determining whether patterns were temporally consistent. Particular emphasis was concentrated on amphipod assemblages, since amphipods are one of the most quantitatively and important groups of invertebrates associated with coastal vegetated habitats, while these organisms also play an important role as trophic resources for fish populations (Sánchez-Jerez et al., 1999; Vázquez-Luis et al., 2009). In this sense, amphipods respond to habitat alterations and can, therefore, be used as an indicator of environmental impacts on vegetated habitats (Virnstein, 1987; Conradi et al., 1997; Sánchez-Jerez et al., 2000; Vázquez-Luis et al., 2008, 2009).

2. Material and methods

2.1. Study area and sampling design

The study was carried out in Gran Canaria (Canary Islands, eastern Atlantic), at a range of localities across the island (Table 1) dominated by either subtidal mono-specific *Cymodocea nodosa* meadows or beds constituted by *Caulerpa prolifera*.

Table 1. Sampled localities to compare epifaunal assemblages between *Cymodocea nodosa* seagrass meadows and *Caulerpa prolifera*-dominated beds at Gran Canaria Island.

Habitat	Locality	UTM X	UTM Y	Depth (m)	Date
C. nodosa	L1	421440	3080993	11.3	Nov'11
C. nodosa	L2	462235	3082272	10	Nov'11
C. nodosa	L1	461982	3081367	11.3	Oct'12
C. nodosa	L2	462114	3082872	8.8	Oct'12
C. prolifera	L1	463559	3089684	13.7	Nov'11, Oct'12
C. prolifera	L2	463105	3089320	14.6	Nov'11, Oct'12

Each habitat (i.e. *C. nodosa vs. C. prolifera*-dominated beds) was sampled at each of two localities, where n=10, randomly allocated, samples were collected by SCUBA divers, using a 20x20 cm quadrat. Collections were performed cutting the seagrass/seaweed immediately above the sediment surface, keeping the vegetation with the associated epifauna in unbleached woven cotton bags (Brearley et al., 2008; Gartner et al., 2013). Sampling was repeated twice (November 2011 and October 2012) to merely assess whether patterns in the diversity, abundance and structure of epifaunal assemblages between beds dominated by *C. nodosa* and *C. prolifera* were temporally consistent.

Labelled samples were preserved in a freezer (-20 ºC) until processed. In the laboratory, samples collected were initially defrosted and subsequently sieved through a 500 μm mesh to retain macrofaunal organisms. Specimens were sorted and counted into different taxonomic groups under a binocular microscope and preserved in 70% ethanol. Four main functional groups: Crustacea, Mollusca, worms (including Annelida and Sipuncula) and other fauna (Chelicerata, Chordata and Echinodermata) were considered. All organisms were identified to species level, whenever possible. In particular, amphipods were identified to the lower taxonomic resolution (species in most cases), because amphipods was the most abundant taxa and because of their importance as biological indicators of human-induced alterations (Sánchez-Jerez et al., 2000). The amount of vegetated biomass (wet weight) was obtained for each replicate to account for differences in the amount of habitat (vegetation) among samples.

2.2. Statistical analysis

2.2.1. Univariate analysis

Differences in the abundance and species density (the number of species per area) of the dominant groups (here, Crustacea, Mollusca, Amphipoda, worms and other fauna) between habitats, localities within habitats and times were tested using a 3-way ANCOVA, which incorporated the factors: ʽHabitat' (fixed with 2 levels: *C. nodosa vs. C. prolifera*), ʽLocality' (random and nested within ʽHabitat', 2 levels: L1 and L2), and

‘Time’ (fixed with 2 levels: Nov’11 *vs.* Oct’12); ‘Leaf biomass’ was included as a covariate to account for differences in the amount of available habitat for epifauna among samples. Data were square root transformed prior to analyses, and analyses based on Euclidean distances (Anderson, 2001a). For each ANCOVA, we estimated the relative contribution of each factor to explain differences in the response variable through calculation of their corresponding variance components.

2.2.2. Multivariate analysis

Differences in the multivariate structure (what includes the abundance and composition) of assemblages between habitats (*C. nodosa vs. C. prolifera*) were visualized through a non-metric multidimensional scaling (nm-MDS) ordination plot, based on Bray-Curtis similarities. The significance of these multivariate differences were tested by a 3-way PERMANOVA (Anderson, 2001b), using ‘Time’, ‘Habitat’ and ‘Locality’ as factors, following the same design outlined above. The leaf biomass of each replicate was, again, included as a covariate. PERMANOVA data were square root transformed prior to analyses, and analyses were based on Euclidean distances. The individual contribution of each amphipod species to the dissimilarity between habitats (*C. nodosa vs. C. prolifera*) was calculated by the SIMPER routine, based on Bray-Curtis similarities.

All uni- and multivariate procedures were carried out by means of the PRIMER 6.0 & PERMANOVA statistical package.

3. Results

3.1. Epifaunal assemblages

A total of 4655 epifaunal individuals, belonging to 105 taxa (Appendix 1), were counted within the four dominant functional groups: crustaceans (3594 individuals), mollusks (777), worms (138) and other fauna (146). The abundance of crustaceans, which proved to be the dominant group (representing the 77.2 % of the total abundance), was significantly larger in *Caulerpa prolifera*-dominated beds (1792.5 ± 181.18 ind. m^{-2}, mean ± SE) than in *Cymodocea nodosa* meadows (562.5 ± 81.92 ind. m^{-2}) at both sampling times (Fig. 1; 3-way ANCOVA: 'Habitat', P=0.0002, Table 2). The species density of crustaceans was also larger in *C. prolifera*-dominated beds than in *C. nodosa* meadows (12.03 ± 0.52 *vs.* 5.8 ± 0.47 sp. 0.04 m^{-2}, respectively) (Fig. 2; 3-way ANCOVA: 'Habitat', P=0.0002, Table 2). The abundance of mollusks was, again, significantly larger in *C. prolifera*-dominated beds (415.63 ± 71.4 ind. m^{-2}) than in *C. nodosa* meadows (70 ± 15.14 ind. m^{-2}) (Fig. 1; 3-way ANCOVA: 'Habitat', P=0.0002, Table 2), as well as the species density of mollusks (3.45 ± 0.23 *vs.* 1.6 ± 0.2 sp. 0.04 m^{-2}, respectively) (Fig. 2; 3-way ANCOVA: 'Habitat', P=0.0002, Table 2). Worms showed a different pattern between sampling times, but abundance and species density were, on average, larger in *C. prolifera*-dominated beds (80 ± 16.32 ind. m^{-2} and 1.33 ± 0.09 sp. 0.04 m^{-2}, respectively) than in *C. nodosa* meadows (26.25 ± 6.39 ind. m^{-2} and 0.65 ± 0.07 sp. 0.04 m^{-2}) (Fig. 1 and 2; 3-way ANCOVA: 'Habitat', P=0.0002, Table 2). Finally, other faunal individuals were more abundant in *C. prolifera*-dominated beds (70 ± 20.16 ind. m^{-2}) than in *C. nodosa* meadows (70 ± 15.14 ind. m^{-2}), but without significant differences (Fig. 1; 3-way ANCOVA: 'Habitat', P=0.6590, Table 2). The species density of other fauna (0.7 ± 0.12 *vs.* 0.45 ± 0.35 sp. 0.04 m^{-2}, respectively) (Fig. 2) was not significant either (3-way ANCOVA: ‘Habitat’, P=1.0000, Table 2).

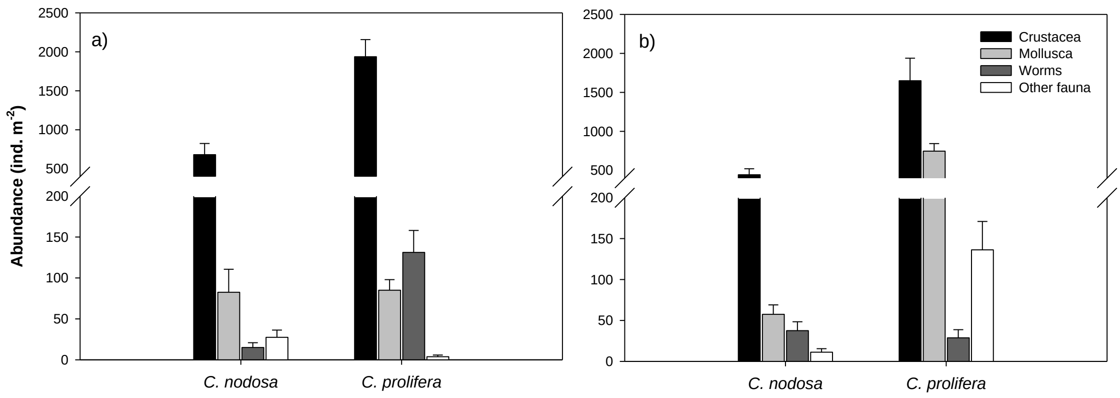

Figure 1. Mean abundance (ind. m^{-2} ± SE) of the 4 functional groups at each habitat in (a) November 2011 and (b) October 2012.

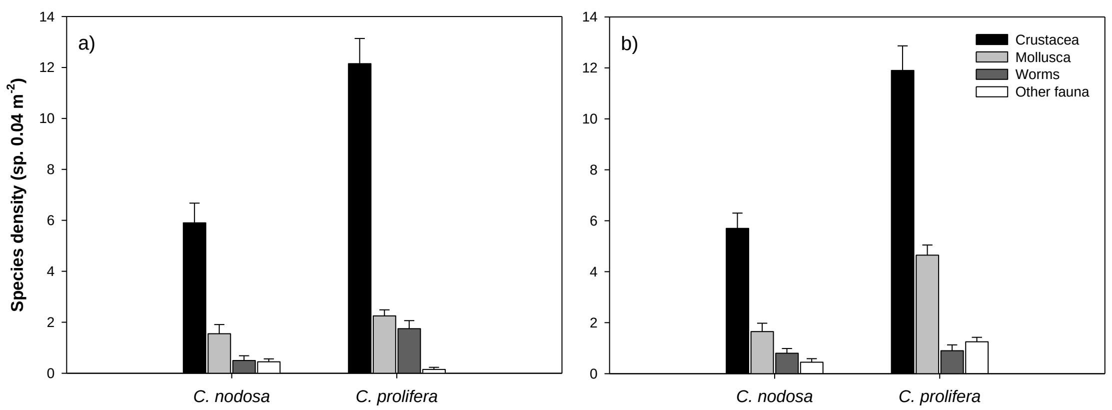

Figure 2. Mean species density (number of species ± SE) of the 4 functional groups at each habitat in (a) November 2011 and (b) October 2012.

Table 2. Results of 3-way ANCOVAs testing for differences between habitats, times and localities within habitats, for the abundance and species density of each functional group. *Significant difference at *P*<0.05. The amount of variance (%CV) explained by each factor is included.

CRUSTACEA		**Abundance**				**Species density**			
	df	**MS**	**F**	**P**	**%CV**	**MS**	**F**	**P**	**%CV**
Covariate = Leaf biomass	1	903.86	2.1887	0.1462	5.35%	1.74	1.0657	0.3052	1.52%
Time	1	75.89	0.0460	0.8266	0%	0.13	0.0357	0.8410	0%
Habitat	1	7085.30	5.9660	0.0002*	30.42%	23.86	4.8950	0.0002*	33.16%
Locality(Ha)	2	1574.70	24.2620	0.0002	18.76%	6.49	38.1210	0.0002	23.33%
TixHa	1	80.91	0.0617	0.8100	0%	0.60	0.2138	0.6791	0%
TixLo(Ha)	2	1642.10	25.3000	0.0002	28.09%	3.52	20.6610	0.0002	24.87%
Residual	71	64.90			17.39%	0.17			17.12%
Total	79								
MOLLUSCA		**Abundance**				**Species density**			
	df	**MS**	**F**	**P**	**%CV**	**MS**	**F**	**P**	**%CV**
Covariate = Leaf biomass	1	386.81	3.3939	0.0762	4.7916	0.97	0.7060	0.3910	0.0000
Time	1	2262.20	7.8276	0.1048	19.3216	4.94	4.4910	0.1550	14.5368
Habitat	1	1292.50	3.9539	0.0002*	14.7938	8.75	2.1964	0.0002*	17.7108
Locality(Ha)	2	433.26	23.6670	0.0002	11.8233	5.29	26.3780	0.0002	22.3086
TixHa	1	1472.90	6.7506	0.1099	24.6531	2.03	2.6053	0.2347	13.2611
TixLo(Ha)	2	271.08	14.8070	0.0002	13.5152	0.93	4.6486	0.0108	12.3886
Residual	71	18.31			11.1013	0.20			19.7949
Total	79								
WORMS		**Abundance**				**Species density**			
	df	**MS**	**F**	**P**	**%CV**	**MS**	**F**	**P**	**%CV**
Covariate = Leaf biomass	1	8.46	0.3701	0.5430	0%	0.04	0.1204	0.7252	0%
Time	1	53.98	0.3520	0.5856	0%	0.09	0.0520	0.8190	0%
Habitat	1	310.50	8.6372	0.0002*	20.06%	3.74	9.7138	0.0002*	24.00%
Locality(Ha)	2	42.50	2.5050	0.0854	7.46%	0.39	1.1012	0.3414	3.04%
TixHa	1	254.03	2.0613	0.2672	20.24%	1.66	0.9854	0.4229	0%
TixLo(Ha)	2	151.36	8.9221	0.0004	25.06%	2.03	5.6634	0.0042	30.23%
Residual	71	16.96			27.18%	0.36			42.73%
Total	79								
OTHER FAUNA		**Abundance**				**Species density**			
	df	**MS**	**F**	**P**	**%CV**	**MS**	**F**	**P**	**%CV**
Covariate = Leaf biomass	1	180.77	6.1752	0.0182	8.46%	0.0024	0.0045	0.9442	0%
Time	1	474.15	11.0950	0.0758	21.43%	3.73	3.1454	0.2040	15.22%
Habitat	1	0.63	0.0114	0.6590	0%	0.08	0.0603	1.0000	0%
Locality(Ha)	2	68.69	3.9334	0.0182	9.85%	1.75	10.1600	0.0006	15.99%
TixHa	1	264.64	7.4973	0.1146	24.99%	4.07	4.4363	0.1566	27.08%
TixLo(Ha)	2	40.02	2.2915	0.1050	9.57%	1.11	6.4597	0.0024	18.08%
Residual	71	17.46			25.70%	0.17			23.62%
Total	79								

The two-dimensional MDS plot showed a separation of epifaunal assemblages by habitats and times: epifauna associated with *Cymodocea nodosa* meadows are in the left-hand side of the ordination space, while epifauna inhabiting *Caulerpa prolifera*-dominated beds are in the right-hand side of the plot. In addition, samples corresponding to November 2011 are in the top side, whereas those corresponding to October 2012 are in the bottom side of the plot (Fig. 3). This multivariate response, however, was only statistically significant between habitats (3-way PERMANOVA: 'Habitat', P=0.0002; Table 3).

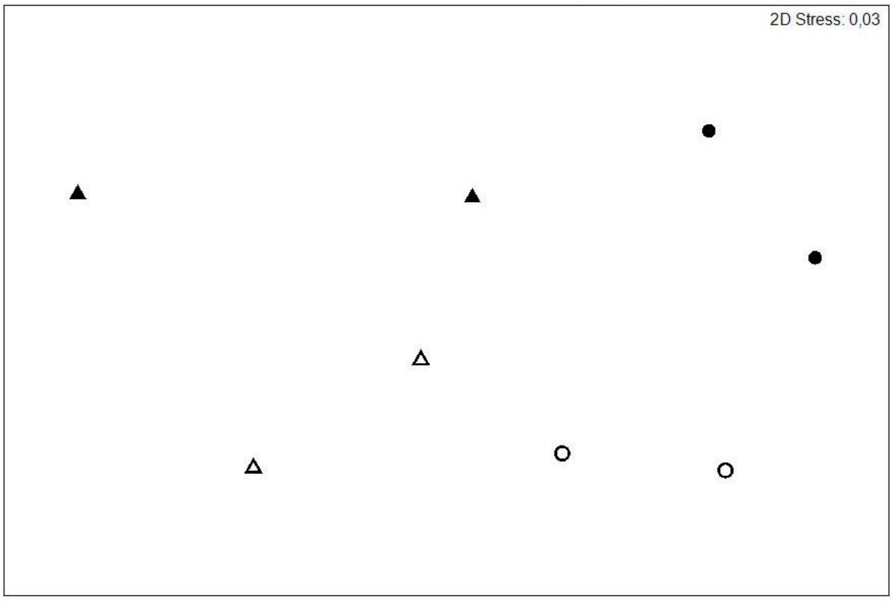

Figure 3. Two-dimensional MDS plot showing similarities in the epifaunal assemblage structure between habitats and times. Each symbol corresponds to a sampling locality within each habitat. Triangles: *C. nodosa*, circles: *C. prolifera*. Filled symbols: Nov'11, unfilled symbols: Oct'12.

Table 3. Results of 3-way PERMANOVA testing for differences between habitats, times and localities within habitats, for the epifaunal assemblage structure. *Significant differences for P<0.05. The amount of variance (%CV) explained by each factor is included.

	df	MS	F	P	%CV
Covariate = Leaf biomass	1	5212.7	3.0345	0.001	5.97%
Time	1	13002	2.6701	0.1278	13.67%
Habitat	1	11108	2.4333	0.0002*	13.41%
Locality(Ha)	2	5987.8	13.656	0.0002	15.05%
TixHa	1	7014.8	1.8769	0.2272	13.87%
TixLo(Ha)	2	4610.3	10.515	0.0002	19.12%
Residual	71	438.47			18.92%
Total	79				

3.2. Amphipod assemblages

A total of 37 amphipod species, belonging to 16 families, were recorded (Appendix 1). The abundance of amphipods constituted ca. 70% of crustaceans for the overall study and was significantly larger in *Caulerpa prolifera*-dominated beds (1248.13 ± 136.83 ind. m^{-2}, mean ± SE) than in *Cymodocea nodosa* meadows (396.88 ± 77.36 ind. m^{-2}) at both sampling times (Fig. 4*a*; 3-way ANCOVA: ‘Habitat’, P=0.0002, Table 4). A similar pattern was found for amphipod species density (7.05 ± 0.47 *vs.* 4.25 ± 0.38 sp. 0.04 m^{-2}, respectively; Fig. 4*b*), but differences were not statistically significant (3-way ANCOVA: ‘Habitat’, P=0.3406, Table 4).

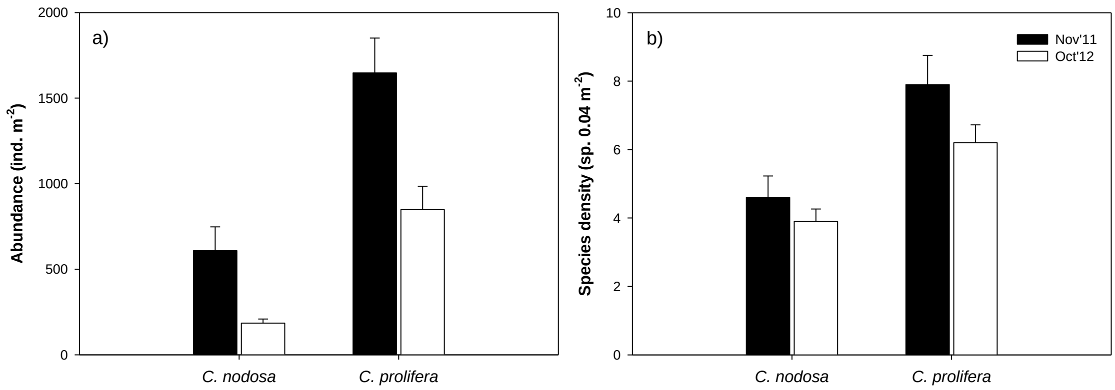

Figure 4. (a) Mean abundance (ind. m^{-2} ± SE) and (b) mean species density (number of species ± SE) of amphipods at each habitat and time.

Table 4. Results of 3-way ANCOVA testing for differences between habitats, times and localities within habitats, for the total abundance and species density of amphipods. *Significant difference at P<0.05. The amount of variance (%CV) explained by each factor is included.

		Total abundance				**Total species density**			
	df	**MS**	**F**	**P**	**%CV**	**MS**	**F**	**P**	**%CV**
Covariate = Leaf biomass	1	1550.8	4.5936	0.0396	9.42%	14.06	0.3522	0.5544	0%
Time	1	994.15	0.7567	0.4326	0%	5.54	0.0705	0.8078	0%
Habitat	1	4804.3	4.8642	0.0002*	27.43%	196.15	1.6149	0.3406	17.65%
Locality(Ha)	2	1312.5	28.8590	0.0002	19.27%	162.20	49.5220	0.0002	31.39%
TixHa	1	12.32	0.0123	0.9186	0%	0.02	0.0004	0.9896	0%
TixLo(Ha)	2	1253.2	27.5540	0.0002	27.55%	74.69	22.8030	0.0002	30.82%
Residual	71	45.48			16.32%	3.28			20.14%
Total	79								

The two-dimensional MDS plot showed a clear segregation of amphipod assemblages mainly by habitat: amphipods associated with *Cymodocea nodosa* meadows are in the left-hand side of the plot, while amphipods associated with *Caulerpa prolifera*-dominated beds are in the right-hand side. Samples collected in November 2011 were more dissimilar to each other than those obtained in October 2012

(Fig. 5). However, the structure of amphipod assemblages was only statistically significant between habitats (3-way PERMANOVA: ‘Habitat’, P=0.0002, Table 5).

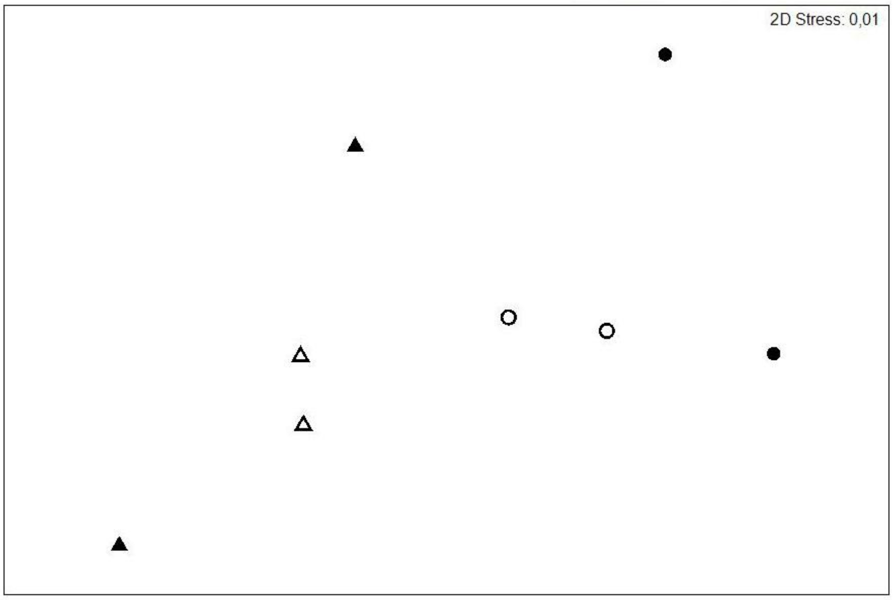

Figure 5. Two-dimensional MDS plot showing similarities in the amphipod assemblage structure between habitats and times. Each symbol corresponds to a sampling locality within habitats. Triangles: *C. nodosa*, circles: *C. prolifera*. Filled symbols: Nov’11, unfilled symbols: Oct’12.

Table 5. Results of 3-way PERMANOVA testing for differences between habitats, times and locations within habitats, for the amphipod assemblage structure. *Significant differences for P<0.05. The amount of variance (%CV) explained by each factor is included.

	df	MS	F	P	%CV
Covariate = Leaf biomass	1	1528.4	1.2753	0.2314	2.97%
Time	1	4796.5	1.4492	0.3056	9.45%
Habitat	1	8107.8	2.4173	0.0002*	18.48%
Locality(Ha)	2	4431.1	19.278	0.0002	21.18%
TixHa	1	2188.6	0.86856	0.4874	0%
TixLo(Ha)	2	3125.6	13.598	0.0002	25.76%
Residual	71	229.86			22.15%
Total	79				

The amphipod species which most contributed to dissimilarities between habitats were: *Microdeutopus stationis*, *Dexamine spinosa*, *Aora spinicornis*, *Mantacaprella macaronensis*, *Pseudoprotella phasma*, *Ampithoe ramondi*, *Ischyrocerus inexpectatus* and *Apherusa bispinosa*. These species made up ca. 60% of the total abundance of amphipods. Amphipod assemblages showed a clear segregation, with different species contributing to the dissimilarity between habitats. For example, the abundance of *M. stationis*, *D. spinosa* and *A. spinicornis* was significantly larger in *C. prolifera*-dominated beds (Fig. 6*a, b, c*; 3-way ANCOVA: 'Habitat', $P<0.05$, Table 6), while the new species of caprellid *M. macaronensis* (Fig. 7; Vázquez-Luis et al., 2013; *in revision*) significantly dominated in *C. nodosa* meadows (Fig. 6*d*; 3-way ANCOVA: 'Habitat', $P=0.0002$, Table 6). The other caprellid species, *P. phasma*, also showed larger abundances in *C. nodosa* meadows, although the difference with respect to *C. prolifera*-dominated beds was not statistically significant (Fig. 6*e*; 3-way ANCOVA: 'Habitat', $P=0.6612$, Table 6). The gammarid *A. ramondi* was found in both habitats, with larger abundances in *C. prolifera*-dominated beds, but without significant differences (Fig. 6*f*; 3-way ANCOVA: 'Habitat', $P=0.6800$, Table 6). Finally, *I. inexpectatus* and *A. bispinosa* were more abundant in *C. prolifera*-dominated beds, but no significant differences were detected between habitats, probably masked by the high variability between localities (Fig. 6*g, h*; 3-way ANCOVA: 'Habitat', $P>0.05$, Table 6).

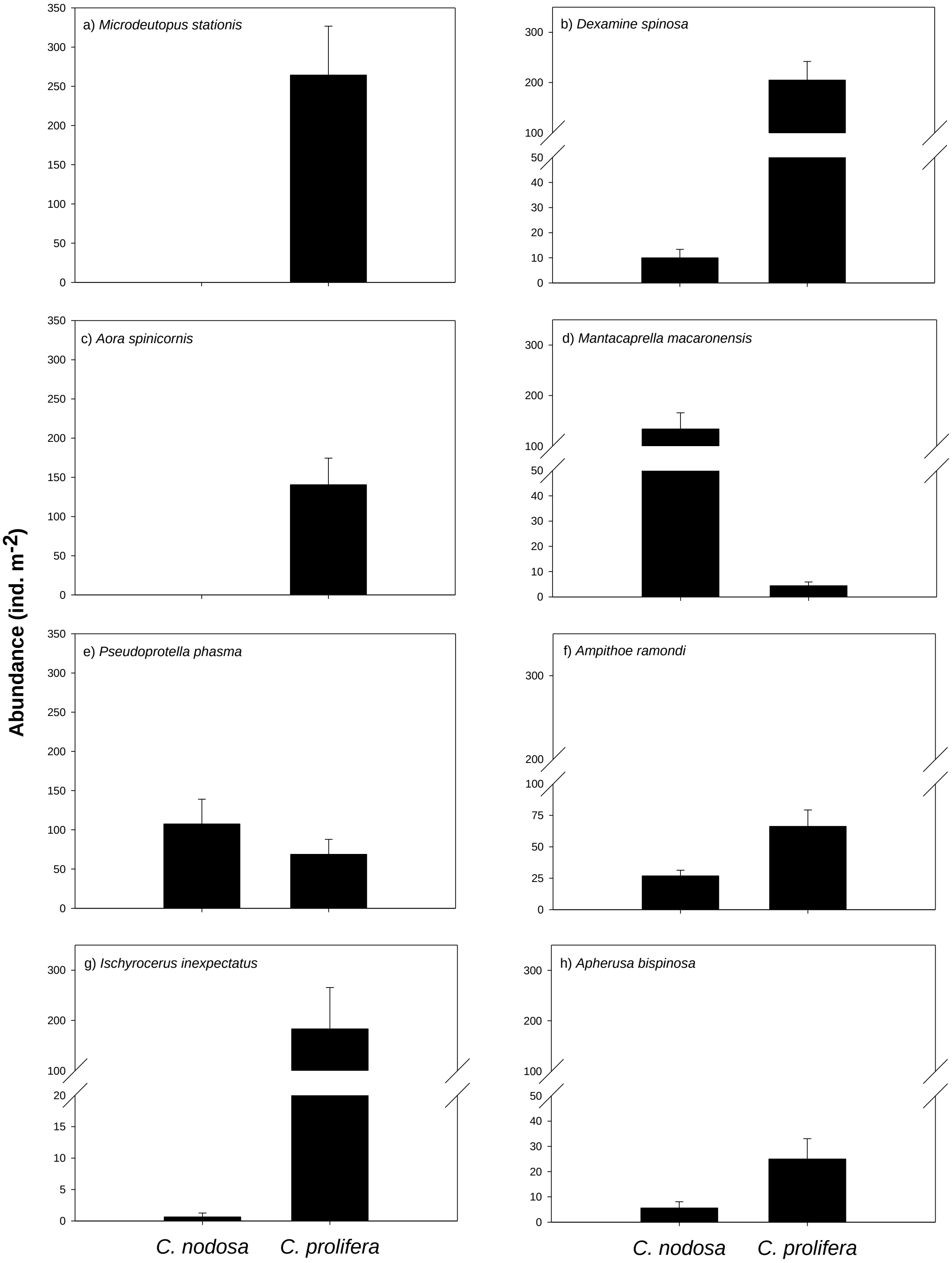

Figure 6. Mean abundance (ind. m^{-2} ± SE) of the most important amphipod species at each habitat.

Table 6. Results of 3-way ANCOVAs testing for differences between habitats, times and localities within habitats, for the abundance of the most important amphipod species. *Significant differences for *P*<0.05. The amount of variance (%CV) explained by each factor is included.

		Microdeutopus stationis				*Dexamine spinosa*			
	df	**MS**	**F**	**P**	**%CV**	**MS**	**F**	**P**	**%CV**
Covariate = Leaf biomass	1	325.79	1.1317	0.2856	2.07%	606.04	18.6590	0.0008	9.61%
Time	1	563.44	1.8731	0.2866	8.20%	1313.80	17.8540	0.0500	21.20%
Habitat	1	2414.9	2.7502	0.0002*	21.68%	1183.10	16.9750	0.0002*	21.98%
Locality(Habitat)	2	1173	51.703	0.0002	22.87%	88.29	5.6029	0.0056	6.84%
TimexHabitat	1	581.46	2.7391	0.2214	15.53%	388.08	6.6477	0.1155	17.49%
TimexLo(Habitat)	2	262.44	11.568	0.0002	15.29%	69.65	4.4201	0.0150	8.63%
Residual	71	22.69			14.36%	15.76			14.25%
Total	79								

		Aora spinicornis				*Mantacaprella macaronensis*			
	df	**MS**	**F**	**P**	**%CV**	**MS**	**F**	**P**	**%CV**
Covariate = Leaf biomass	1	119.41	2.2410	0.1502	4.29%	0.0065	0.0001	0.9942	0%
Time	1	277.33	0.6036	0.5068	0%	368.48	0.9490	0.4310	0%
Habitat	1	1436.90	10.5870	0.0002*	31.24%	1126.80	2.9057	0.0002*	26.20%
Locality(Habitat)	2	176.93	10.8940	0.0002	13.38%	518.80	66.7480	0.0002	26.57%
TimexHabitat	1	160.31	0.4498	0.5641	0%	106.09	0.3643	0.6086	0%
TimexLo(Habitat)	2	446.38	27.4850	0.0002	32.07%	366.21	47.1160	0.0002	32.59%
Residual	71	16.24			19.02%	7.77			14.65%
Total	79								

		Pseudoprotella phasma				*Ampithoe ramondi*			
	df	**MS**	**F**	**P**	**%CV**	**MS**	**F**	**P**	**%CV**
Covariate = Leaf biomass	1	18.06	0.0821	0.7754	0%	37.21	2.0019	0.1674	3.75%
Time	1	259.49	0.7038	0.4774	0%	275.43	2.2711	0.2426	16.18%
Habitat	1	28.76	0.0433	0.6612	0%	24.28	0.7197	0.6800	0%
Locality(Habitat)	2	887.31	43.9170	0.0002	38.93%	41.30	3.5043	0.0382	9.44%
TimexHabitat	1	27.01	0.0995	0.7282	0%	168.45	1.7604	0.2983	17.77%
TimexLo(Habitat)	2	337.75	16.7170	0.0002	34.50%	117.89	10.0040	0.0006	26.21%
Residual	71	20.20			26.56%	11.79			26.66%
Total	79								

		Ischyrocerus inexpectatus				*Apherusa bispinosa*			
	df	**MS**	**F**	**P**	**%CV**	**MS**	**F**	**P**	**%CV**
Covariate = Leaf biomass	1	80.94	0.4627	0.4382	0%	80.94	0.4627	0.4590	0%
Time	1	574.97	0.8736	0.4360	0%	574.97	0.8736	0.4336	0%
Habitat	1	789.99	1.6073	0.2470	14.13%	789.99	1.6073	0.2540	14.13%
Locality(Habitat)	2	649.69	19.8570	0.0002	24.76%	649.69	19.8570	0.0002	24.76%
TimexHabitat	1	369.51	0.7336	0.4693	0%	369.51	0.7336	0.4709	0%
TimexLo(Habitat)	2	628.32	19.2040	0.0002	35.63%	628.32	19.2040	0.0002	35.63%
Residual	71	32.72			25.49%	32.72			25.49%
Total	79								

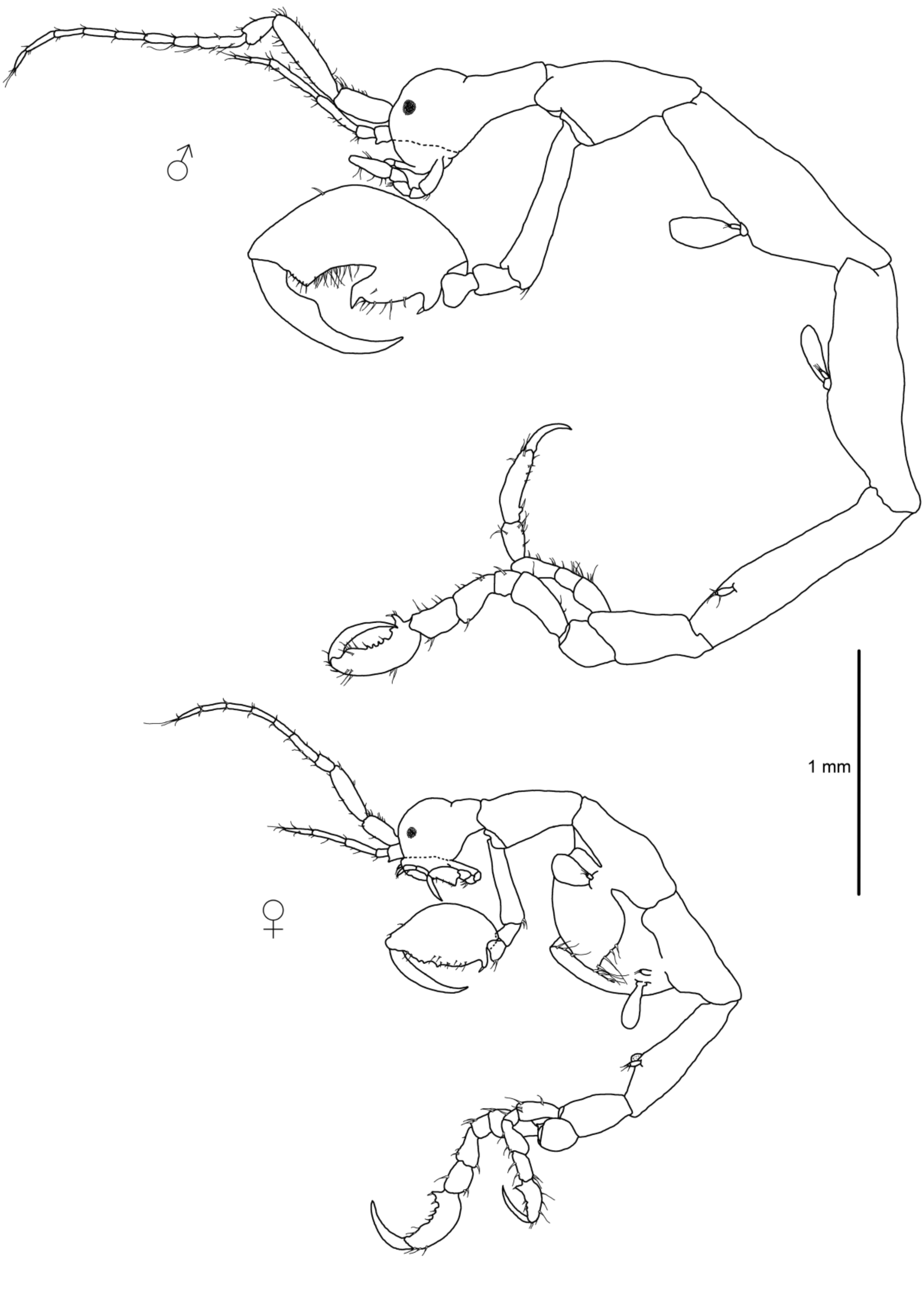

Figure 7. *Mantacaprella macaronensis* n. sp. Lateral view of holotype male (4.5 mm) and paratype female (2.7 mm). Scale bar: 1 mm.

4. Discussion

4.1. Overall epifaunal assemblage response

Our results have indicated clear differences in the multivariate structure, in terms of abundance and diversity (here quantified through the species density), of epifaunal assemblages between habitats dominated by the seagrass *Cymodocea nodosa* and the green seaweed *Caulerpa prolifera*, and patterns of differences have been consistently through times. Larger abundances and species densities were found, unexpectedly, in *C. prolifera*-dominated beds, since caulerpenyne seems to reduce macrophyte palatability and act as deterrent against some herbivore species (Erickson et al., 2006). In accordance with our results, previous studies have demonstrated that seabeds dominated by *Caulerpa prolifera* may particularly benefit crustacean assemblages (Sánchez-Moyano et al., 2007a), revealing the importance of this vegetated habitat for the maintenance of the biodiversity in coastal areas under considerable human impacts (Sánchez-Moyano et al., 2001b). A previous study conducted in the Canaries also recorded higher macrofaunal diversity in mixed bottoms of *C. prolifera* and *C. nodosa* than in mono-specific *C. nodosa* meadows (Monterroso et al., 2012). Differences in the structure, abundance and diversity of epifaunal assemblages may be due to changes in the structural complexity of the habitat (e.g. plant identity, plant morphology, floral and faunal epiphytes) (Virnstein and Howard, 1987; Taylor and Cole, 1994; Bologna, 1999), which plays an important role as space available for shelter against predators; but also due to changes in the hydrodynamic properties of the habitat. In the Mediterranean, Hendriks et al. (2010) demonstrated that, seasonally, *Caulerpa* species are able to attenuate water flow, trap particles and protect the sediment from erosion even better than seagrasses (particularly *C. prolifera vs. C. nodosa*), thus seabeds constituted by

Caulerpa spp. might affect the associated fauna compared to seagrass meadows; favoring macrofaunal assemblages mainly dominated by crustaceans and polychaetes (Hendriks et al., 2010; Monterroso et al., 2012).

Differences within invertebrate assemblages are expected between different types (identities) of vegetation within the same geographical and environmental context (Sirota and Hovel, 2006). Low epifaunal abundances associated with *C. nodosa* meadows may be explained by space limitation, so the architecture of *C. nodosa* would be less important for fauna that are limited by space in comparison to other seagrasses, such as *Posidonia sinuosa* and *Amphibolis griffithii*, which have a higher leaf surface area and algal epiphyte biomass (Gartner et al., 2013). Epifaunal assemblages are also subjected to substrate competitive exclusion due to source limitation (Duffy and Harvilicz, 2001) and to fish predatory pressure. Seagrasses provide a paramount role as habitat for nearshore fish assemblages (Espino et al., 2011a). In the study region, *C. nodosa* meadows play a 'nursery' role for the early stages of numerous fish species (Espino et al., 2011a, 2011b). The abundance of fishes is ca. 3-4 times larger in *C. nodosa* than in *C. prolifera* dominated beds (unpublished data). Epifaunal organisms, particularly crustaceans, are the main constituent of diets of seagrass-associated fishes (Yamada et al., 2010; Horinouchi et al., 2012). Hence, it is worth noting that the contrasting abundance patterns of epifaunal and fish assemblages between *C. nodosa* and *C. prolifera* bottoms might fits a classical 'predation' model, where a large abundance of predators (here, fishes) remove large quantities of prey (here, epifauna) and so explain decreasing abundance of prey in such habitats (here, *C. nodosa* seagrass meadows) (Verdiell-Cubedo et al., 2007).

4.2. Amphipod assemblage response

The amphipod assemblage structure has significantly differed between habitats at both sampling times, showing a mean abundance of amphipods ca. 3 times larger in *Caulerpa prolifera*-dominated beds (1248.13 ± 136.83 ind. m^{-2}, mean ± SE) than in *Cymodocea nodosa* meadows (396.88 ± 77.36 ind. m^{-2}). Our results of amphipods abundance do not agree, for example, with those reported by Vázquez-Luis et al. (2009) for the same habitats (313.89 ± 75.63 ind. m^{-2} in *C. prolifera* and 494.44 ± 160.17 ind. m^{-2} in *C. nodosa*, mean ± SE). Regarding the diversity of amphipods, in *C. nodosa* seagrass meadows at Gran Canaria we have recorded values of 16 amphipod species in November 2011 and 17 in October 2012, which are comparable or even lower than the number of amphipod species reported by several studies carried out in the Mediterranean Sea and the adjacent Atlantic coasts in *C. nodosa* meadows (28 species, Sánchez-Jerez et al., 1999; 13 species in September and 21 in March, Vázquez-Luis et al., 2009). On vegetated bottoms dominated by *C. prolifera*, a total of 27 and 20 amphipod species (in November 2011 and October 2012, respectively) were identified, which contrast with the 17 amphipod species recorded by Sánchez-Moyano et al. (2007) and values of 6 and 18 species reported by Vázquez-Luis et al. (2009) for the same habitat (in September and March, respectively). The variation within the total number of amphipod species among studies show a more diverse epifaunal community in *C. prolifera*-dominated beds at Gran Canaria.

Several authors have stated that amphipods are able to actively select their host habitat (Hay et al., 1990; Poore, 2005; Poore and Hill, 2006), a fact that is related to differences on vegetation palatability and food preferences by herbivores (Ortega et al., 2010). However, although the active selection appears important, it is not sufficient by itself to explain differential patterns of epifaunal distribution (Virnstein and Howard, 1987). The presence of diverse amphipods on plant species may result from ecological processes unrelated to herbivore preferences or the quality of that host for growth and survival, but from the variation in the risk of predation among hosts (Poore, 2005). As reported above, the susceptibility of amphipods to fish predation commonly varies across algal species, usually decreasing with increased structural complexity of the host or with the presence of secondary metabolites that are deterrent to omnivorous fish (Poore, 2005; Verdiell-Cubedo et al., 2007; Vázquez-Luis et al., 2010).

In the current study, some species seem to show a preference for specific habitats and, in overall, it is possible to distinguish gammarid species associated with *C. prolifera*-dominated beds, while caprellids are associated with *C. nodosa* meadows. Within gammarids, individuals belonging to the family Aoridae (here, *Aora spinicornis* and *Microdeutopus stationis*) have been exclusively found in *C. prolifera*-dominated beds. This outcome contrasts with previous records; for example, *A. spinicornis* has been found among hydroids, phanerogams and algae, and on sandy bottoms as well (Ruffo, 1982); whilst *M. stationis* has been almost exclusively found on fine sand, particularly among the phanerogams *Cymodocea* and *Posidonia*, with some records on coralligenous habitats (Ruffo, 1998). However, other authors found also larger abundances of *Microdeutopus* spp. in *Caulerpa* beds and on rocky habitats (Roberts and Poore, 2005; Vázquez-Luis et al., 2008, 2009), with preference for low hydrodynamic regimes and high sedimentation rates (Conradi et al., 1997; Guerra-García and García-Gómez, 2005). Other species significantly more abundant in *C. prolifera*-dominated beds was the free-living, herbivore *Dexamine spinosa*, which is very common within algal canopies within the shallow subtidal (Lincoln, 1979; Ruffo, 1982). *Apherusa bispinosa* and *Ischyrocerus inexpectatus* were also collected in higher abundance in *C. prolifera*-dominated beds. Consistent with our results, Farlin et al. (2010) reported that ischyrocerids, such as *I. inexpectatus*, tend to feed more on algae than on seagrasses. As the previous gammarids, *Ampithoe ramondi* was, again, more abundant in *C. prolifera*-dominated beds than in *C. nodosa* meadows, although differences were not so great. Ampithoids are, cosmopolitan, herbivorous amphipods, which usually occur in shallow subtidal zones amongst native seaweeds and seagrasses (Lincoln, 1979; Ruffo, 1982; Poore, 2005; Vázquez-Luis et al., 2008, 2009), tending to feed more on seagrasses (Farlin et al., 2010). The caprellid *Pseudoprotella phasma* has been mostly found inhabiting *C. nodosa* meadows, although this species might also be found among algae, but rarely associated with hydroids (Ruffo, 1993).

Finally, it is important to highlight the new genus, new species, of caprellid, *Mantacaprella macaronensis*, which show a clear preference on *C. nodosa* seagrass meadows, but also occurring in *C. prolifera*-dominated beds. This species was firstly recorded in Cape Verde, in natural rocky and artificial habitats (shipwrecks), in 2009; and together with the results of the current study, *M. macaronensis* has been recently described by Vázquez-Luis et al. (in revision). The relatively high abundances found in the Canary Islands and Cape Verde reflects the lack of detailed studies on benthic fauna in the region, namely on amphipods, and therefore this new species is expected to be also present in other islands of the Macaronesian region.

In conclusion, our study shows that *Caulerpa prolifera*-dominated beds have a more abundant and diverse epifaunal assemblage, which significantly differs from *Cymodocea nodosa* meadows and is temporally consistent. According to the biodiversity related to *Cymodocea nodosa* seagrass meadows, this study has been used as an important tool for the taxonomical and ecological description of the new genus, new species, of caprellid, since *Mantacaprella macaronensis* has resulted one of the dominant amphipods inhabiting these meadows. This reflects the lack of knowledge on

Macaronesian invertebrates, like amphipods, and the need of further taxonomical studies to better characterise the biodiversity of this region and to design adequate programmes of management and conservation.

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Appendix 1. Abundances (ind. per m-2 ± SE) of epifaunal organisms at each habitat and time. The total abundance and number of species are also included.

			November 2011		October 2012	
Functional group	**Group**	**Species**	***C. nodosa***	***C. prolifera***	***C. nodosa***	***C. prolifera***
Worms	Nematoda	*Calyptronema* sp.	-	11.25 ± 6.57	-	-
Worms	Nematoda	*Enoplida* sp. 1	-	13.75 ± 7.74	-	-
Worms	Nematoda	Unidentified	-	-	-	3.75 ± 3.75
Worms	Oligochaeta	Unidentified	-	-	-	-
Worms	Polychaeta	*Aponuphis bilineata*	-	1.25 ± 1.25	-	-
Worms	Polychaeta	*Platynereis dumerilii*	-	2.5 ± 1.44	-	21.25 ± 12.31
Worms	Polychaeta	*Nereididae* sp. 1	-	11.25 ± 5.54	-	-
Worms	Polychaeta	*Exogone naidina*	-	2.5 ± 1.44	-	-
Worms	Polychaeta	*Salvatoria* sp.	1.25 ± 1.25	-	-	1.25 ± 1.25
Worms	Polychaeta	*Streptosyllis bidentata*	5 ± 2.89	-	-	-
Worms	Polychaeta	*Syllis* sp.	6.25 ± 4.73	-	-	-
Worms	Polychaeta	*Demonax brachychona*	-	6.25 ± 6.25	-	-
Worms	Polychaeta	*Desdemona* sp.	-	2.5 ± 1.44	-	-
Worms	Polychaeta	*Sabellidae* sp. 1	-	1.25 ± 1.25	-	-
Worms	Polychaeta	*Aonides oxycephala*	-	1.25 ± 1.25	-	-
Worms	Polychaeta	*Polyophthalmus pictus*	2.5 ± 2.5	76.25 ± 42.79	-	-
Worms	Polychaeta	*Schroederella laubieri*	-	1.25 ± 1.25	-	-
Worms	Sipunculidea	sp. 1	-	-	-	-
Other fauna	Pycnogonida	Unidentified	27.5 ± 14.79	-	10 ± 5.4	48.75 ± 14.34
Other fauna	Actinopterygii	*Opeatogenys cadenati*	-	-	1.25 ± 1.25	-
Other fauna	Asteroidea	*Coscinasterias tenuispina*	-	2.5 ± 2.5	-	-
Other fauna	Ophiuroidea	Unidentified	-	1.25 ± 1.25	1.25 ± 1.25	90 ± 54.04
Crustacea	Copepoda	Unidentified	-	1.25 ± 1.25	15 ± 7.36	50 ± 35.18
Crustacea	Cumacea	Unidentified	2.5 ± 2.5	7.5 ± 4.79	-	6.25 ± 3.75
Crustacea	Decapoda	Caridea	2.5 ± 2.5	13.75 ± 5.91	-	217.5 ± 132.83
Crustacea	Decapoda	Galatheoidea	-	-	-	13.75 ± 10.68
Crustacea	Decapoda	Paguroidea	-	15 ± 4.56	-	95 ± 25.41

Functional group	Group	Species	November 2011		October 2012	
			C. nodosa	***C. prolifera***	***C. nodosa***	***C. prolifera***
Crustacea	Decapoda	Brachyura	2.5 ± 1.44	11.25 ± 5.54	1.25 ± 1.25	21.25 ± 9.44
Crustacea	Decapoda	Larva	-	2.5 ± 1.44	-	3.75 ± 2.39
Crustacea	Isopoda	sp. 1	1.25 ± 1.25	-	221.25 ± 106.29	2.5 ± 1.44
Crustacea	Isopoda	sp. 2	18.75 ± 11.25	3.75 ± 3.75	11.25 ± 8.0	-
Crustacea	Isopoda	sp. 3	6.25 ± 6.25	-	5 ± 3.54	17.5 ± 10.9
Crustacea	Isopoda	sp. 4	-	6.25 ± 3.75	1.25 ± 1.25	10 ± 3.54
Crustacea	Isopoda	sp. 5	-	1.25 ± 1.25	-	6.25 ± 3.75
Crustacea	Isopoda	sp. 6	-	-	1.25 ± 1.25	1.25 ± 1.25
Crustacea	Tanaidacea	*Apseudes* sp.	-	-	-	-
Crustacea	Tanaidacea	*Apseudes talpa*	-	-	-	5 ± 3.54
Crustacea	Tanaidacea	*Leptochelia savignyi*	-	-	-	338.75 ± 148.32
Crustacea	Tanaidacea	*Tanais dulongii*	-	-	1.25 ± 1.25	1.25 ± 1.25
Crustacea	Tanaidacea	*Zeuxo exsargasso*	-	-	-	-
Crustacea	Tanaidacea	Unidentified	-	-	-	1.25 ± 1.25
Crustacea	Ostracoda	Halocyprida	-	-	-	1.25 ± 1.25
Crustacea	Ostracoda	Myodocopida	-	26.25 ± 13.6	-	7.5 ± 4.79
Crustacea	Ostracoda	Podocopida	1.25 ± 1.25	18.75 ± 5.54	1.25 ± 1.25	-
Crustacea	Amphipoda	*Caprella acanthifera*	-	-	21.25 ± 6.25	1.25 ± 1.25
Crustacea	Amphipoda	*Caprella liparotensis*	58.75 ± 34.3	-	-	-
Crustacea	Amphipoda	*Phtisica marina*	23.75 ± 3.15	41.25 ± 24.86	17.5 ± 4.33	45 ± 19.04
Crustacea	Amphipoda	*Pseudoprotella phasma*	181.25 ± 107.25	108.75 ± 79.38	27.5 ± 9.46	36.25 ± 5.54
Crustacea	Amphipoda	*Mantacaprella macaronensis*	235 ± 125.62	6.25 ± 3.75	27.5 ± 7.77	2.5 ± 1.44
Crustacea	Amphipoda	*Ericthonius punctatus*	33.75 ± 15.99	97.5 ± 67.78	1.25 ± 1.25	-
Crustacea	Amphipoda	*Ischyrocerus inexpectatus*	1.25 ± 1.25	352.5 ± 307.61	-	-
Crustacea	Amphipoda	*Microjassa cumbrensis*	-	23.75 ± 16.5	-	-
Crustacea	Amphipoda	*Ampithoe helleri*	5 ± 3.54	-	-	1.25 ± 1.25
Crustacea	Amphipoda	*Ampithoe ramondi*	23.75 ± 14.05	32.5 ± 23.14	48.75 ± 19.83	122.5 ± 42.7
Crustacea	Amphipoda	*Ampithoe* sp.	3.75 ± 3.75	-	2.5 ± 2.5	-
Crustacea	Amphipoda	*Aora gracilis*	-	-	13.75 ± 8.0	-
Crustacea	Amphipoda	*Aora spinicornis*	-	231.25 ± 113.53	-	41.25 ± 34.72
Crustacea	Amphipoda	*Aora* sp.	-	-	5 ± 2.04	7.5 ± 7.5

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Crustacea	Amphipoda	*Autonoe longipes*	-	1.25 ± 1.25	-	-
Crustacea	Amphipoda	*Microdeutopus anomalus*	-	-	-	62.5 ± 38.11
Crustacea	Amphipoda	*Microdeutopus damnoniensis*	-	12.5 ± 10.9	-	-
Crustacea	Amphipoda	*Microdeutopus stationis*	-	465 ± 235.27	-	63.75 ± 41.6
Crustacea	Amphipoda	*Microdeutopus* sp.	3.75 ± 3.75	6.25 ± 6.25	-	7.5 ± 3.23
Crustacea	Amphipoda	*Cheiriphotis* sp.	-	6.25 ± 6.25	-	-
Crustacea	Amphipoda	*Corophium* sp.	-	2.5 ± 2.5	-	-
Crustacea	Amphipoda	*Leptocheirus mariae*	-	-	-	2.5 ± 2.5
Crustacea	Amphipoda	*Leptocheirus pilosus*	-	48.75 ± 45.48	1.25 ± 1.25	1.25 ± 1.25
Crustacea	Amphipoda	*Leptocheirus* sp.	-	8.75 ± 8.75	-	-
Crustacea	Amphipoda	*Medicorophium minimum*	-	1.25 ± 1.25	-	-
Crustacea	Amphipoda	*Apherusa bispinosa*	-	-	1.25 ± 1.25	46.25 ± 6.57
Crustacea	Amphipoda	*Apherusa chiereghinii*	2.5 ± 1.44	85 ± 48.95	-	10 ± 5.77
Crustacea	Amphipoda	*Apherusa vexatrix*	8.75 ± 7.18	2.5 ± 2.5	-	-
Crustacea	Amphipoda	*Apherusa* sp.	1.25 ± 1.25	1.25 ± 1.25	-	-
Crustacea	Amphipoda	*Lysianassina longicornis*	-	-	-	21.25 ±16.38
Crustacea	Amphipoda	*Amphilochus neapolitanus*	3.75 ± 3.75	2.5 ± 2.5	-	1.25 ± 1.25
Crustacea	Amphipoda	*Peltocoxa mediterranea*	-	-	-	1.25 ± 1.25
Crustacea	Amphipoda	*Dexamine spinosa*	10 ± 6.12	55 ± 16.2	10 ± 4.56	355 ± 96.46
Crustacea	Amphipoda	*Liljeborgia* sp.	-	6.25 ± 4.73	-	1.25 ± 1.25
Crustacea	Amphipoda	*Elasmopus* sp.	-	1.25 ± 1.25	-	-
Crustacea	Amphipoda	*Maera inaequipes*	-	1.25 ± 1.25	-	-
Crustacea	Amphipoda	*Harpinia sp.*	-	7.5 ± 4.33	-	2.5 ± 2.5
Crustacea	Amphipoda	*Stenothoe monoculoides*	11.25 ± 7.18	-	3.75 ± 2.39	-
Crustacea	Amphipoda	*Pereionotus testudo*	1.25 ± 1.25	-	-	-
Crustacea	Amphipoda	*Microprotopus longimanus*	-	35 ± 23.63	-	-
Crustacea	Amphipoda	Unidentified	-	3.75 ± 3.75	3.75 ± 2.39	16.25 ± 7.47
Mollusca	Bivalvia	*Cardiidae* sp. 1	-	6.25 ± 3.75	-	-
Mollusca	Bivalvia	Unidentified1	-	10 ± 5.4	3.75 ± 3.75	10 ± 2.04
Mollusca	Bivalvia	Unidentified2	-	3.75 ± 1.25	1.25 ± 1.25	12.5 ± 4.33
Mollusca	Gastropoda	*Bittium* sp.	3.75 ± 3.75	1.25 ± 1.25	-	190 ± 84.29

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Mollusca	Gastropoda	*Eulimidae* sp. 1	-	-	-	2.5 ± 1.44
Mollusca	Gastropoda	*Cerithiopsis* sp.	-	-	1.25 ± 1.25	6.25 ± 4.73
Mollusca	Gastropoda	*Nystiellidae* sp. 1	8.75 ± 5.91	1.25 ± 1.25	-	-
Mollusca	Gastropoda	*Alvania* sp.	43.75 ± 25.2	-	6.25 ± 4.73	257.5 ± 91.3
Mollusca	Gastropoda	*Rissoinae* sp. 1	-	-	16.25 ± 7.18	177.5 ± 44.37
Mollusca	Gastropoda	*Anachis* sp.	-	1.25 ± 1.25	-	-
Mollusca	Gastropoda	*Mitrella* sp.	2.5 ± 1.44	33.75 ± 11.61	-	1.25 ± 1.25
Mollusca	Gastropoda	*Vexillum zebrinum*	11.25 ± 8.26	5 ± 3.54	-	-
Mollusca	Gastropoda	*Volvarina* sp.	-	-	1.25 ± 1.25	1.25 ± 1.25
Mollusca	Gastropoda	*Pyramidella dolabrata*	-	-	1.25 ± 1.25	-
Mollusca	Gastropoda	*Retusidae* sp. 1	10 ± 6.12	11.25 ± 6.57	1.25 ± 1.25	77.5 ± 39.82
Mollusca	Gastropoda	*Nudibranchia*	-	1.25 ± 1.25	-	-
Mollusca	Gastropoda	*Smaragdia viridis*	-	8.75 ± 2.39	10 ± 2.04	1.25 ± 1.25
Mollusca	Gastropoda	*Tricolia* sp.	-	-	13.75 ± 4.73	7.5 ± 4.79
Mollusca	Gastropoda	*Trochidae* sp. 1	-	1.25 ± 1.25	-	-
Mollusca	Gastropoda	*Turbinidae* sp. 1	2.5 ± 1.44	-	1.25 ± 1.25	1.25 ± 1.25
Total abundance			**768.75 ± 397.01**	**1975 ± 338.83**	**513.75 ± 196.1**	**2561.25 ± 769.91**
Total number of species			**36**	**65**	**37**	**58**