Are amphipods influenced by *Posidonia oceanica* seagrass features?

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1 Context

In the Mediterranean Sea, the seagrass *Posidonia oceanica* plays an important role as habitat for invertebrates, among which amphipod crustaceans represent a dense and diverse assemblage (Fig 1). Recent studies have observed that amphipod density and biomass vary significantly on small spatial scales. This patchiness may be caused by different factors, such as recruitment, competition, and predation; however, habitat features, resulting in availability of resources such as food or shelter, may also be important in structuring these assemblages.

Fig 1. *Posidonia oceanica* meadow and the amphipod species *Atylus guttatus*

2 Methods

This study examined the relationships between amphipod and habitat features in a *P. oceanica* meadow of the Revellata Bay (Fig 2). The sampling was carried out in a continuous meadow colonizing soft substrates at constant depth (11-13m) in August 2007 and 2008. We quantified the density and biomass of each amphipod species, as well as habitat features, namely shoot density, leaf and epiphyte biomasses, percentage of leaves per shoot having alteration marks and litter biomass.

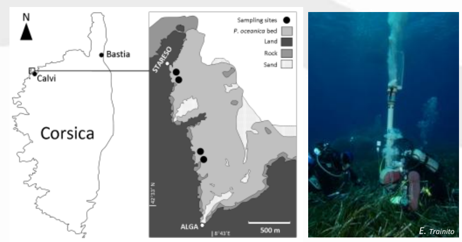

Fig 2. Location of sampling sites (black points) and distribution of the different benthic ecosystems at Revellata Bay (NWCorsica, Mediterranean Sea) - in the center and left side.Arlift sampling of amphipods in *P. oceanica* - right side

3 Results and discussion

A total of 3337 amphipod specimens belonging to 36 species and 22 families were identified in this study (Table 1).

Using multiple regression analyses, few weak significant relationships were identified between amphipod and habitat features. The number of species and the diversity appeared unaffected by the measured habitat features. In contrast, total amphipod density and biomass were generally positively related to the shoot density and epiphyte biomass of *P. oceanica*, respectively. Overall, habitat features accounted for 0-30% of the variation in the densities of the amphipod species (Table 2).

Table 1 Mean density (individuals · m−2) of the amphipod taxa in the two zones in 2007 and 2008 (gaps indicates absent)

	Zone 1		Zone 2	
	2007	2008	2007	2008
Gammaridea				
Ampelisca rubella (Costa, 1864)			·	·
Ampithoe helleri (Karaman, 1975)	•	●	•	•
Aora gracilis (Bate, 1857)	·			
Aora spinicornis (Afonso, 1976)	⬤	⬤	●	●
Apherusa chiereghinii (Giordani-Soika, 1950)	⬤	⬤	⬤	⬤
Apolochus neapolitanus (Della Valle, 1893)	•	●	•	●
Atylus guttatus (Costa, 1851)	·	•	·	·
Cymadusa crassicornis (Costa, 1853)			·	
Dexamine spiniventris (Costa, 1853)	•	●	•	•
Dexamine spinosa (Montagu, 1813)	•	•	·	·
Ericthonius punctatus (Bate, 1857)		•		•
Eusiroides dellavallei (Chevreux, 1899)	•	•	•	·
Gammarella fucicola (Leach, 1814)	·	·		·
Guernea coalita (Norman, 1868)	·			
Hyale camptonyx (Heller, 1866)		•		
Iphimedia minuta (Sars, 1882)	•	•	•	•
Jassa ocia (Bate, 1862)				·
Leptocheirus guttatus (Grube, 1864)		·	·	•
Leucothoe spinicarpa (Abildgaard, 1789)		•	•	·
Liljeborgia dellavallei (Stebbing, 1906)	•	•	•	•
Lysianassa pilicornis (Heller, 1866)				•
Lysianassina longicornis (Lucas, 1849)		•		·
Maera grossimana (Montagu, 1808)			·	
Microdeutopus sp.			·	
Orchomene humilis (Costa, 1853)	•	·		
Orchomene similis (Chevreux, 1912)		·		
Peltocoxa marioni (Catta, 1875)		·	·	·
Siphonoecetes dellavallei (Stebbing, 1899)		·	•	·
Stenothoe monoculoides (Montagu, 1815)		·		·
Synchelidium longidigitatum (Ruffo, 1947)		·		
Tmetonyx nardonis (Heller, 1866)	·	•		·
Tritaeta gibbosa (Bate, 1862)	·			
Caprellidea				
Caprella acanthifera (Leach, 1814)	•	•	·	•
Caprella sp. *(armata-group)* (see Krapp-Schickel & Vader, 1998)		•		·
Phtisica marina (Slabber, 1769)	●	⬤	●	●
Pseudoprotella phasma (Montagu, 1804)	•	●	•	•

· < 1 • 1-10 ● 11-50 ⬤ 51-200 ind.m⁻²

Table 2. Results of multiple linear regression analyses. Only general descriptors and amphipod species for which habitat variables presented significant partial correlation(s) (PC; * p ≤ 0.05) are listed. The values of adjusted R^2 and significances (p) are presented. + = positive relationships. ns: not significant

	Overall regression		Habitat variable			
	R^2adj	p		+ / -	PC	p
Total density	0.235	ns	Density	+	0.49	*
Total biomass	0.116	ns	Epiphyte biomass	+	0.45	*
Caprellidea	0.263	ns	Density	+	0.53	*
			Coefficient A	+	0.47	*
Phtisica marina	0.174	ns	Density	+	0.47	*
			Coefficient A	+	0.44	*
Pseudoprotella phasma	0.209	ns	Density	+	0.55	*

A distance-based linear model explained a total of 25.8% of the variation of the amphipod assemblages of which 18.6% was explained by litter biomass (Fig 3).

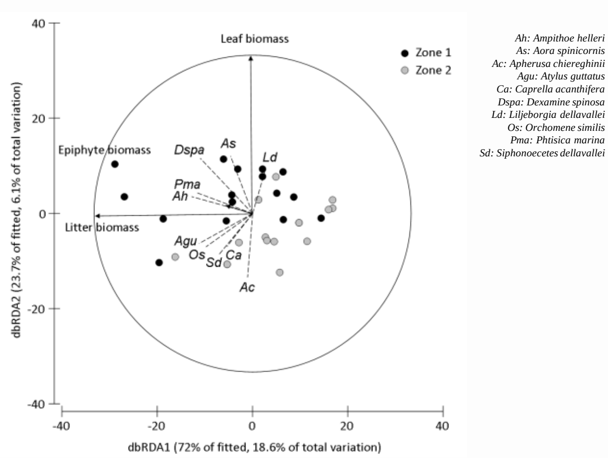

Fig. 3. Distance-based redundancy ordination (dbRDA) for amphipod species and habitat features. Full and indented vectors indicate the direction of increasing values of the significant habitat variables (p ≤ 0.05; litter, leaf and epiphyte biomasses) and amphipod species, respectively. Only species with correlations ≥0.25 to the ordination axes are plotted. Vector length represents partial correlation strength with the dbRDA axes; the circle is a unit circle (radius = 1), whose relative size and position of origin is arbitrary with respect to the underlying plot. Plot points indicate individual amphipod samples, coded by zone

4 Conclusions

Amphipods are therefore influenced by some *P. oceanica* features, but only weakly. Furthermore, some features appeared to influence individual species whereas others functioned at the assemblage level. The main challenge remains in evaluating the scale at which these features act and the way in which they influence the structure of assemblages.

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