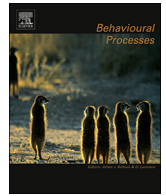




ELSEVIER

Contents lists available at ScienceDirect

Behavioural Processes

journal homepage: www.elsevier.com/locate/behavproc

Habitat selection of intertidal caprellid amphipods in a changing scenario

G. Martínez-Lañiz^{a,*}, M. Ros^{a,b}, C. Navarro-Barranco^{a,c}, J.M. Guerra-García^a^a Laboratorio de Biología Marina, Departamento de Zoología, Facultad de Biología, Universidad de Sevilla, Avda Reina Mercedes 6, 41012, Sevilla, Spain^b Departamento de Biología. CASEM, Facultad de Ciencias del Mar y Ambientales, Campus Universitario de Puerto Real, 11510, Puerto Real, Cádiz, Spain^c Departamento de Biología, Unidad de Zoología, Universidad Autónoma de Madrid, Campus de Cantoblanco, 28049, Madrid, Spain

ARTICLE INFO

Keywords:

Substrate selection
Amphipoda
Macroalgae
Structural complexity
Habitat strategies
Rocky intertidal

ABSTRACT

Habitat selection is a complex process, dependent on numerous fluctuating conditions and key to species coexistence. In a changing global scenario, it will greatly determine the fate of marine organisms and hence is an important subject to be explored. The present study evaluates host specificity of two caprellid amphipod species, *Caprella grandimana* and *Caprella takeuchi*, dwelling on a rocky intertidal where the calcifying macroalgae *Jania rubens* and *Ellisolandia elongata* show opposite seasonal fluctuation patterns throughout the year. To avoid confounding preference with other factors, the substrate selection experimental design included both multiple choice and non-choice treatments. Macroalgal structure analyses using fractals and interstitial space index were included in the study, as substrate complexity is a main factor driving preference for epifauna. *Caprella grandimana* actively selected *J. rubens*, whereas *C. takeuchi* did not show any preference; both behaviours remaining consistent regardless of the original substrate. Preference for *J. rubens* is probably owed to its interstitial space and thalli characteristics, as the complexity analysis suggested, since these allow for better refuge against predators and a more suitable surface for grasping. Meanwhile, the plasticity of *C. takeuchi* seems to favor an ongoing taking over of its congener at the time of the year when *J. rubens* drops. We highlight the need for rigor when performing substrate selection experiments; the importance of including habitat selection lessons in conservation strategies and modelling studies dealing with global change; and the risk in generalizing results within the family or genus level, which is occasionally inadequate for understanding the functioning of the ecosystem as a whole.

1. Introduction

Habitat selection is a complex process due to the diversity of available spaces and fluctuating environmental conditions (e.g. food resources). It is constantly modulated by events such as predation, competence or parasitism, which alter habitat quality (Camacho and Thacker, 2013; MacNeil et al., 2003), and these relationships are vital to species coexistence (Rosenzweig, 1981). A habitat is a place where an organism lives; it can usually be characterized by some particular physical and biological features. Organisms can exhibit habitat preferences, meaning that they actively select one or more habitats from a range of potential ones (Olabarria et al., 2002). This preference can be observed at different stages, from the settlement of larvae to adult life (Aikins and Kikuchi, 2001; Padua et al., 2013; Soeparno et al., 2013; Mendo et al., 2015). Habitat preference also provides valuable information for managing conservation strategies (Rönnbäck et al., 2002; Young et al., 2011).

Habitat preference has been widely studied for a range of different

marine taxa: mammals (Retana et al., 2013; Andersen et al., 2013), shorebirds (Murchison et al., 2016; Cunningham et al., 2016) and especially fishes (Barriga et al., 2013; Donaldson et al., 2013), in which predators and refuges have proved to play a major role (Brooker et al., 2013). The role of the substrate is especially relevant in the case of mobile epifauna invertebrates; they show remarkable morphological and functional adaptations to their habitat (Cadieu and Brusca, 1993; Kumagai, 2008; Baumgartner et al., 2009). However, studies are scarce for this group, particularly for amphipod crustaceans (Lacerda and Masunari, 2011; Vázquez-Luis et al., 2012; Gestoso et al., 2013; Cunha et al., 2017). Amphipods occur in a huge variety of marine habitats and stand out as a dominant component of marine macrofauna (Hughes and Ahong, 2016). More specifically, caprellids are common in littoral habitats distributed worldwide (see records in Fig. 5 Thiel et al., 2003). They are useful bioindicators of marine pollution and environmental stress (Aono and Takeuchi, 2008; Guerra-García et al., 2009), and constitute an important trophic link between primary producers and higher trophic levels (Woods, 2009), feeding mainly on detritus and

* Corresponding author.

E-mail address: martinezlaiz@us.es (G. Martínez-Lañiz).

completing their diet with a wide range of organisms (see Guerra-García and Tierno de Figueroa et al., 2009; Baeza-Rojano et al., 2014; Martínez-Laiz and Guerra-García, 2015). Interestingly, caprellids usually occur as epibionts on a huge range of substrata, on which they move by crawling. They inhabit algae, hydroids, ascidians, anthozoans, bryozoans, sponges and seagrasses, among others. They have limited swimming capabilities; instead, they cling on both natural (e.g. macroalgae, tortoise carapace) and artificial floating structures (e.g. buoys, ship/boat hulls, ropes, and litter). This facilitates their passive dispersal, which is crucial in the case of alien species such as *Caprella scaura* Templeton, 1836 (Krapp-Schickel et al., 2006), *Paracaprella pusilla* Mayer, 1890 (Ros et al., 2016) and *Caprella mutica* Schurin, 1935 (Ashton et al., 2007). On intertidal environments, they are the dominant macroepifauna on macroalgae (Hay et al., 1987), which are a key substrate for a number of mobile epifauna and provide food resources and shelter against hydrodynamics, rapid changes in environmental conditions, and predation (Gestoso et al., 2013; Queiroz and Dias, 2014).

When evaluating the quality of a macroalgal species as a substrate (host) a series of intrinsic factors are to be considered: cell wall components, chemical defenses, palatability and nutritive value, color of the tissue, toughness, longevity, etc. In any case, complexity is a major feature influencing habitat selection (Grabowski and Powers, 2004; Christie et al., 2007; Gestoso et al., 2013). It is usually associated with great food availability (Corona et al., 2000) and can influence predator-prey interactions (Hay, 1991); for example, some macroalgae are unpalatable to herbivorous or omnivorous fish and thus provide a better shelter for motile epifauna (Duffy and Hay, 1991; Roff et al., 2013). Architectural complexity in plants and macroalgae has been previously assessed with different metrics such as: surface/volume ratio (S/V), fractal analysis for convolution or rugosity (McAbendroth et al., 2005; Warfe et al., 2008), compactness index based on theoretical versus real volume (Sánchez-Moyano et al., 2000), and Interstitial Spatial Index (ISI) for the analysis of the interstitial space associated within the plant (Dibble et al., 1996; Dibble and Thomaz, 2006). Each one of these metrics properly detects different characteristics regarding structure complexity and their use is to be determined while considering the relevant scale for the fauna using the substrate as a habitat. When working at the intertidal caprellid scale for example, we consider the macroalgae's branching degree, convolution, and interstitial space are important characteristics to look at.

In the rocky intertidal of Tarifa Island (Natural Park of the Strait of Gibraltar, southern Spain), several species of caprellids dwell at different heights, associated with a range of macroalgae species that experience abundance fluctuations throughout the year, which probably drives amphipod composition as well (Guerra-García et al., 2010, 2011). However, substrate preference (as an active behavior) has not yet been tested for these amphipods. We chose the caprellids *Caprella grandimana* (Mayer, 1882) and *Caprella takeuchii* (Guerra-García, 2001) for performing our experiments as they are highly abundant in this area and dwell at the same height in the intertidal, and thus associate with the same macroalgal species: the Corallinaceae algae *Jania rubens* (Linnaeus) J.V.Lamouroux, 1816 and *Ellisolandia elongata* (J. Ellis and Solander) K.R.Hind and G.W.Saunders, 2013. Moreover, their seasonal abundance in the field has been previously assessed (Guerra-García et al., 2011), providing baseline information for the present study. *Caprella grandimana* is a common amphipod species spread throughout the Mediterranean Sea (Krapp-Schickel, 1993) and the Atlantic African coast (Bellan-Santini and Ruffo et al., 1998) and it is also an interesting potential resource in aquaculture (Baeza-Rojano et al., 2014). *Caprella takeuchii* is a species belonging to *Caprella acanthifera* species complex Leach, 1814. Its ecology is poorly known; its only records are from algae and intertidal sediment under rocks from Tarifa, and from sheltered infralittoral communities in Ceuta (North Africa) (Guerra-García, 2001; Guerra-García et al., 2001). Moreover, the mentioned macroalgae have opposed abundance patterns in Tarifa Island intertidal; *J. rubens*

biomass peaks from August to October and reaches minimum values from April to June, whereas *E. elongata* behaves oppositely (see Guerra-García et al., 2010). They bear a complex structure in comparison to other leaf-shaped algae inhabiting other levels of the intertidal such as *Ulva rigida* C. Agardh, 1823 or *Fucus spiralis* Linnaeus, 1753; and are presumably adequate hosts for Peracarida (Davenport et al., 1999; Zakhama-Sraieb et al., 2011). Nevertheless, no detailed structural analysis has been performed in any of the two species to provide evidence of this.

Considering these observations, we designed a laboratory experiment in order to test the substrate selection of these caprellid species for these macroalgae species. The experimental set-up was adjusted from the preference experiment of Gestoso et al. (2013). These authors explain that preference is an active behaviour that should not be confounded with other causes for greater numbers being found in some habitats rather than others. Therefore, it is also necessary to determine the pattern of occupancy of each type of habitat when available on its own (there is no choice and thus no preference) (also see Olabarria et al., 2002). The main objective of this study is to explore substrate preference of caprellid species at those times of the year when the dominance patterns of macroalgae are opposed. For addressing this purpose we will i) Conduct a fine substrate selection experiment to explore the behavioural strategies of the two caprellid species towards their shared macroalgal hosts. And ii) Examine the architectural complexity of both macroalgae species with a combination of two different metrics. Their role as hosts for caprellids and the potential implications in changing scenarios are also discussed.

2. Methods

2.1. Study area and sampling method

Sampling was conducted in the Spanish side of the Strait of Gibraltar, declared a protected area in 2003, under the marine-terrestrial Strait Natural Park (Parque Natural del Estrecho). This is an important biogeographic zone, in which fauna of the Mediterranean and the Atlantic, along one axis, and of Europe and Africa, along the other, overlap. Amphipods and macroalgae were collected at the southernmost point of Tarifa Island (Punta Marroquí, 36°00'00.7"N 5°36'37.5"W), where the richest rocky shore intertidal ecosystems of Southern Spain are located (Guerra-García and García-Gómez, 2000). During October, *C. grandimana* is the dominant caprellid species in the intertidal turf composed mainly of *J. rubens* and scarcity of *E. elongata*; whereas the presence of *C. takeuchii* is testimonial. However, *C. grandimana* is not present in April, when *C. takeuchii* is the dominant one and *E. elongata* is more abundant than *J. rubens* (Guerra-García et al., 2011; Guerra-García, personal observation). Consequently, for the substrate experiment, specimens of *Caprella grandimana* were collected at the intertidal during October (autumn) 2013 and those of *Caprella takeuchii* were taken during April (spring) 2014, coinciding with the periods in which each species showed maximum abundance, providing enough material for experiments. To have sufficient caprellid specimens for experiments, approximately 1L of the two macroalgal substrates were collected separately. Samples were taken to the laboratory in insulated containers with seawater and aeration. Later, caprellids were separated from the algae and kept in a different container with a small mesh for them to cling onto until the start of the experiment (within one day). The branches of *Jania rubens* and *Ellisolandia elongata* that had been used to sort caprellids from were discarded and not used as habitats in the laboratory experiments. Instead, additional macroalgal samples were collected, taken to the lab in the same conditions, defaunated (sorting all the associated fauna), and preserved until the start of the experiment (also within one day). Specimens were maintained at 20 °C in an AGP-570 Radiber incubator, with a photoperiod of 12 h light:12 h dark. Pieces of these macroalgae were used for the substrate selection experiment and later for the

Download English Version:

<https://daneshyari.com/en/article/8496921>

Download Persian Version:

<https://daneshyari.com/article/8496921>

[Daneshyari.com](https://daneshyari.com)