

Raquel Sánchez de Pedro (rsdpc@uma.es)¹, Andrea Fernández (an.fernández@uma.es)¹, María Jesús García-Sánchez (mjgs@uma.es)¹, Antonio Flores-Moya (floresa@uma.es)¹, Elena Bañares-España (elbaes@uma.es)¹

Microclimate accounts for demographic, morphological and reproductive differentiation of two neighbour peripheral populations of the canopy-forming *Fucus guiryi*

Demography, reproductive ecology and thermal regime of *Fucus guiryi* from the Strait of Gibraltar was monitored between 2018-2019, at two populations ca. 7 km apart (Tarifa and Guadalmeśí, South Spain). Due to its peripheral and southern range distribution, they are characterized by low population density and minimum length of reproductive individuals, shorter individuals, and higher individual bushiness in comparison to their northern counterparts. Significant interactions were detected among populations and sampling locations and related to local environmental conditions. Tarifa population had higher population density, cover, extent, and more aggregated individuals, while Guadalmeśí had a patchier distribution. Outside the canopies of *F. guiryi* in Tarifa there is a plethora of biota growing on the numerous protruding rocks, leading to varying microhabitats, while at Guadalmeśí, there is only barnacle-covered bare rock. Accordingly, specimens from Tarifa had greater mean and maximum individual lengths, a higher minimum length of reproductive individuals, a greater proportion of mature receptacles and higher individual bushiness. Thermal regime and wave exposure confirmed that *F. guiryi* from Guadalmeśí is exposed to higher disruptive stress due to higher summer temperatures, which is less buffered due to its scattered distribution. Between summer and fall 2018, high summer air temperatures, exceeding overall mean historical records, caused the breakage of apical fronds at Guadalmeśí, disrupting the expected parallel seasonal dynamics. Thallus height declined towards the upper intertidal limits to a similar extent, regardless of the population. Canopies of *F. guiryi* ameliorated understory microclimatic conditions despite their low population densities, by reducing the temperature in 5-7°C and surface irradiance by 10-16%. Demographic, morphological and reproduction-related variables from these populations consistently “fit in” the core to edge trends reported along Portuguese Iberian coasts. This study highlights the importance of identifying mesoscale effects and *in situ* thermal regimes when studying long-scale functional variability, especially in peripheral populations.

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