

Relationship between Habitat Complexity and *Pterois* spp. Abundance in Parque Nacional Marino de Punta Francés, Isla de la Juventud (Cuba)

Relación entre la Complejidad del Hábitat y las Densidades de *Pterois* spp. en el Parque Nacional Marino de Punta Francés, Isla de la Juventud (Cuba)

Relation Entre la Complexité de l'Habitat et Densités de *Pterois* spp. dans le Parque Nacional Marino de Punta Francés, Isla de la Juventud (Cuba)

GIULIA CARDOSO^{1*}, HOLLY TREW² and ROBERT A. FRANCIS¹

¹Department of Geography, King's College London, Strand, London WC2R 2LS United Kingdom.

*giulia.cardoso@kcl.ac.uk.

²Operation Wallacea, Wallace House, Old Bolingbroke, Lincolnshire PE23 4SX United Kingdom.

KEY WORDS: Lionfish, Cuba, habitat preferences, lionfish control, invasion management

EXTENDED ABSTRACT

Introduction

Areas with high lionfish (*Pterois volitans* and *P. miles*) abundances are considered high-priority in targeted removals programmes (Akins 2012). In this sense, establishing which habitat characteristics positively correlate with lionfish presence would be beneficial, as it would simplify the identification of areas with high lionfish abundances. Habitat complexity is a characteristic that is thought to positively correlate with lionfish abundance, both at the site (km²) and microhabitat scale (cm²) (Green et al. 2013, Valdivia et al. 2014). In particular, site scale complexity could majorly contribute to culling programmes improvement as it can be easily and quickly mapped with remote sensing techniques (Mumby et al. 1997). Few studies, however, have sought to test these assumptions, and have focused only on site scale complexity (Anton et al. 2014, Bejarano et al. 2015).

This study investigated variations in lionfish abundances across habitat types of different complexity and attempted to determine if, and at which scale (site vs. microhabitat), complexity positively correlates with lionfish presence and abundance.

Methods

Study Sites — The study took place in the Parque Nacional Marino de Punta Francés, Isla de la Juventud (Cuba). Seven study sites were selected to include three habitat types that differed in rugosity (continuous coral cover, patchy reef and spur-and-groove reef).

Sampling Design — Rugosity was used as a proxy for habitat complexity and measured with the traditional chain-and-tape method in three 30 x 30 m sample areas. In every sample area, a 2 m long chain with a link length of 0.5 mm was draped over the reef every 5 m along six 30 m transects; rugosity was then calculated as the ratio between the straight and the draped length of the chain. Microhabitat rugosity was also measured by repeating the same process whenever a lionfish was sighted. In this case, the mid-point of the chain was placed on the spot of first sighting and then draped in the direction that best represented the underlying structure. To obtain an estimate of abundance, all lionfish sighted were counted as long as the habitat type remained consistent with that of the sample areas.

Results

Sites were grouped in three categories according to their median rugosity index. Lionfish abundance did not significantly differ between the rugosity categories (Kruskal-Wallis test, $H(2) = 3.75$, $p = 0.0765$, 1-tailed) and the variables were actually found to negatively correlate, albeit extremely weakly and not statistically significant (Pearson's correlation, $r = -.082$, $p = .855$; Figure 1).

At the microhabitat scale, 47% of lionfish were found to occupy structures with rugosity = 200, i.e. vertical structures such as overhangs, showcasing a significant preference for high-rugosity microhabitats. Lionfish were also often observed to congregate, with the highest number of and the biggest groups found in vertical structures (Figure 2).

Conclusion

Habitat rugosity holds little potential as a proxy for lionfish abundance, as demonstrated by this and other studies (Anton et al. 2014, Bejarano et al. 2015); abundance could instead be more strongly influenced by habitat type. This study, however, confirmed the anecdotal knowledge that lionfish preferentially occupy high-rugosity structures and that often do

so in large groups. This suggests that focusing culling efforts on areas where these structures are highly present could yield more abundant lionfish catches and therefore increase their cost-benefit effectiveness.

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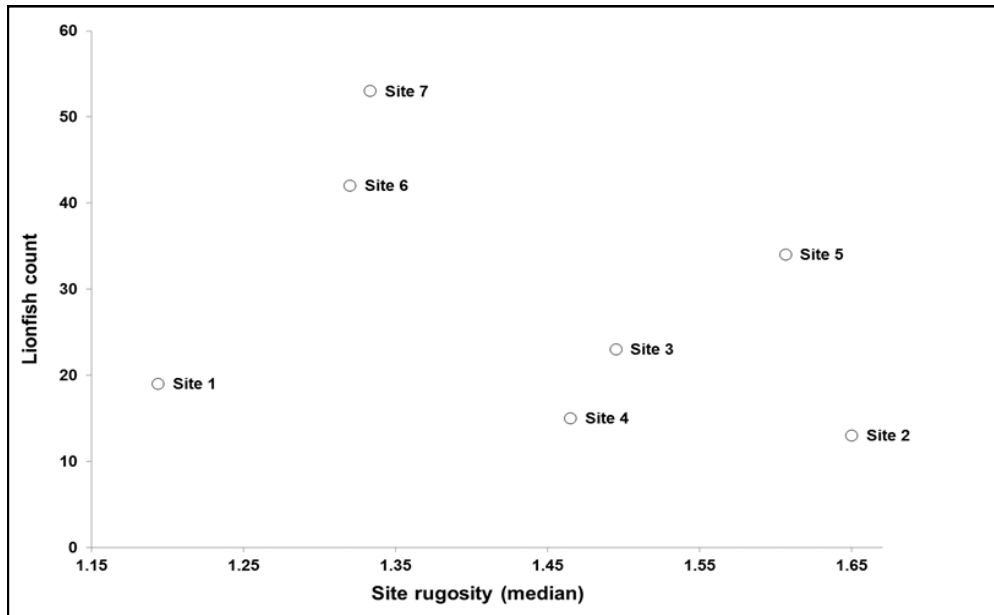


Figure 1. Lionfish abundance varies irrespectively of median site rugosity.

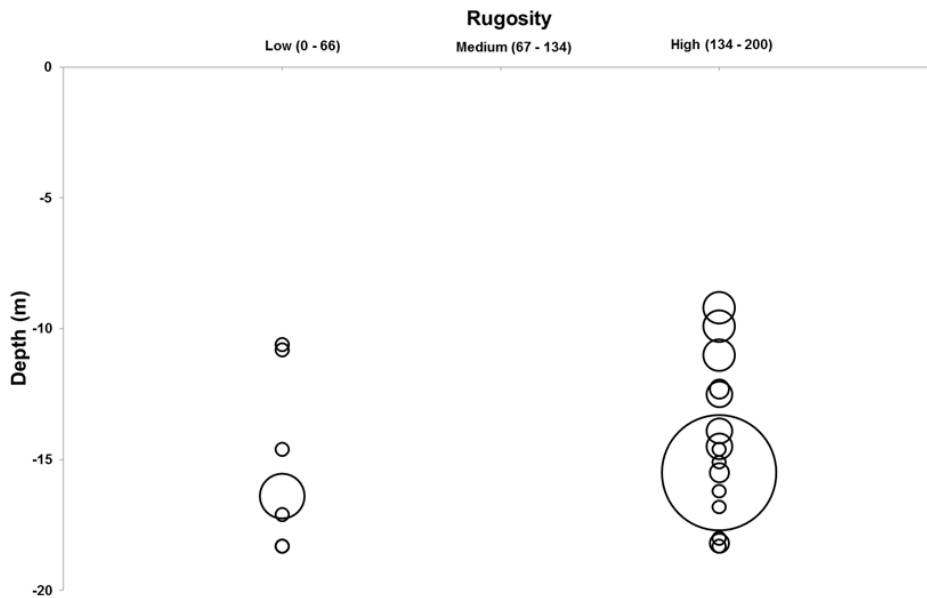


Figure 2. More and larger lionfish groups were found in high-rugosity microhabitats. The size of the bubble represents the size of the group (largest = 18 individuals, smallest = 2). Depth does not seem to affect presence or size of lionfish congregations