

ABSTRACT

Spatiotemporal Patterns of Microhabitat use of Sympatric Cleaner Gobies, *E. Evelynae* and *E. Prochilos* in Barbados

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Elacatinus evelynae and *E. prochilos* are the predominant cleaner fish in the Caribbean and their diverse clientele across multiple trophic levels suggests that their presence might be key in structuring reef fish assemblages. Both species can exhibit a dichotomy in microhabitat use, inhabiting scleractinian coral as singles or couples (coral-dwellers) or barrel sponges (*Xestospongia muta*) in large groups (sponge-dwellers). However, their microhabitat use varies across locations. Thus, their microhabitat preference and ultimately, its consequence on fitness and population dynamics is unclear. They are also competitively similar and yet, co-occur, which raises the question of their coexistence mechanisms. As most studies in these systems have been relatively short (a few months at a time) and focused on either a single species or a single microhabitat type, there is no description of the population dynamics of both species on both microhabitats. Thus, this study sought to shed light on the above questions by conducting a long-term monitoring of co-occurring *E. evelynae* and *E. prochilos* in both microhabitat types. A 900m² permanent plot was delineated in a patch reef at Carlisle Bay, Barbados, and the number and surface area of all corals and sponges (units) with a longest measurement ≥ 9 cm were recorded. Both goby populations were then surveyed on all units in the plot approximately twice per week for one year (January through December 2018), producing 90 consecutive surveys.

Throughout the year, peaks in total abundance between species bore some similarity - *E. evelynae* from March through July and August through October, and *E. prochilos* from July through December - yet their temporal abundance patterns were still significantly correlated. This suggests substantial temporal overlap between the two. *E. prochilos* recruitment was significantly associated with the lunar cycle (peak recruitment during the darkest phases), but not that of *E. evelynae*, possibly due to lower precision in its series. Spatially, most *E. prochilos* (90%) occupied sponges in groups (average group size per unit: 6 gobies), while most *E. evelynae* (65%) occupied corals as singles or pairs. This grouping combined with much the higher total sponge area (72%) likely resulted in *E. prochilos* being 3-times more abundant than *E. evelynae* overall. Both gobies also frequently occurred in their less used microhabitat, making this the first report of these species inhabiting both microhabitat types in respectable abundances at the same site. Yet, only *E. prochilos* showed a difference in size-structure between both microhabitats, as the estimated size of coral-dwellers was smaller than sponge-dwellers.

Examining the occupancy rates of corals versus sponges with increasing goby abundance and resource selection analysis also showed that *E. prochilos* used sponges more than expected by chance, particularly as post-recruits. Thus, these suggest that *E. prochilos* prefers sponges and

due to this preference, also likely undergoes an ontogenetic shift in microhabitat use from coral to sponge. These two analyses also showed that *E. evelynae* recruits and post-recruits consistently used corals more than expected by chance, strongly supporting its preference for coral throughout its life. The short-term population dynamics of *E. evelynae* and *E. prochilos* also showed less fluctuations (more stability) in coral and sponge respectively, suggesting that these were more stable (better quality) microhabitats. Interestingly, the stability of *E. evelynae* on corals, coupled with its putative preference for coral which (unlike sponges) was in limited supply, and higher than expected overlap due to increased *E. evelynae* on sponges, supported that the *E. evelynae* population is regulated by a buffer effect, which has rarely been reported in marine species. Moreover, this finding contrasts that of a previous study in Barbados that concluded a buffer effect in *E. prochilos*. However, evaluation of that study's data revealed inconsistencies that warranted caution in its conclusions. Finally, the spatial partitioning between both species and the disparity in abundance between sponge area (and *E. prochilos*) than coral area (and *E. evelynae*), allude to the occurrence of the spatial storage effect, which might be the mechanism of stable coexistence between the two.

Key words: Coral reef fish; Monitoring; Resource use; Coexistence; *Elacatinus*.