The Influence of Structural Complexity on the Fine-Scale Diurnal Space Use of Reef Fishes

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The habitat preferences of many reef fishes are well established, but the use of space within these habitats by non-site-attached species is poorly studied. These movement patterns are likely to be influenced by a range of factors, particularly structural complexity. Critically, new insights into the effect of complexity on fish movement are now possible using structure-from-motion technology that allows high-resolution modeling of reef structure. These models allow the derivation of metrics such as viewshed, the amount of the surrounding reef that can be seen from any location. This study examined the space use of a functionally important mesopredator, graysby (*Cephalopholis cruentata*) and herbivore, juvenile striped parrotfish (*Scarus iseri*), on six patch reefs in the Florida Keys. A 1 m^2-scale grid was constructed on each reef and 16 individual *C. cruentata* were tracked diurnally *in situ* to identify space use, along with ~80 5-min focal follows of individual *S. iseri* per reef that recorded space use and spatial bite patterns. At the patch reef scale, larger *C. cruentata* were more active and had larger observed home ranges, although home ranges were also affected by fish density and the abundances of prey and predators. The total time in each grid cell was only significantly positively correlated with the height of carbonate structures, likely because the cavities they enclose are particularly suitable for predator avoidance, resting, and ambushing prey. In addition to examining spatial patterns, we analyzed *C. cruentata* waiting times in each grid cell before moving. These times were best approximated by a truncated power-law (heavy-tailed) distribution, indicating a “bursty” pattern of relatively long periods of inactivity interspersed with multiple periods of activity. Such a pattern has previously been identified in a range of temperate ambush predators, and we extend this move-wait behavior, which may optimize foraging success, to a reef fish for the first time. For *S. iseri*, metrics of high complexity including increased grazeable area and maximum height positively correlated with cell use and foraging, but significant correlations with viewshed and fish group size suggest that predation risk may also affect behavior. In particular, the effect of viewshed highlights the importance of structure for shaping predator-prey interactions on reefs. Since three-dimensional complexity affects small-scale grazing decision-making it is likely in turn to shape the distribution of macroalgae on patch reefs. Understanding how predators, prey, and functionally important groups like grazers use space and time is critical to fully identify their functional role and better predict the implications of fishing and loss of reef structure on the functioning, resilience, and ecosystem services of Caribbean reefs.