OS33B-1782 - Living Spaces: Quantifying Morphological Differences in Acropora spp. Corals Using 3D Photogrammetry

Abstract

Since the 1980s, Acropora cervicornis and Acropora palmata corals have been declining worldwide, but their F1 hybrid Acropora prolifera has been increasingly observed on Caribbean reefs. A. cervicornis is a branching framework builder abundant in back reef waters, while the sturdier A. palmata dominates reef crests. The bush-like hybrid of these species, A. prolifera, has been found in areas common to both parents, which raises questions about the impacts of increased A. prolifera on reef habitats. We used photogrammetry to create digital 3D models of representative acroporid corals at Coral Gardens, a patch reef south of Ambergris Caye, Belize. Next, we used digital measures to determine the total surface area of living and dead coral framework. A. prolifera had the highest total surface area, with 3.3 - 3.4 m$^2$ per square meter, based on the area of the footprint of the coral colony. These values are 43 - 49% more than those for A. cervicornis (2.3 m$^2$ per square meter) and 9 - 13% higher than for palmata (2.9 m$^2$ per square meter). We also characterized available space within colonies by subtracting the volume of coral from the volume of the smallest polygon containing the colony. A. cervicornis contained the most available space (0.96 m$^3$ per cubic meter) and A. palmata the least (0.89 m$^3$ per cubic meter); A. prolifera had an intermediate range (0.91 - 0.95 m$^3$ per cubic meter). However, this metric does not account for the size distribution of available spaces; A. prolifera grows more densely than A. cervicornis and A. palmata, so the available space is distributed among a larger number of smaller spaces. Abundance of Echinometra viridis urchins, herbivores that live within coral framework, were determined in patches of A. cervicornis and A. prolifera using m$^2$ quadrats. Urchin populations were more dense in A. prolifera (averaging 31.7 urchins/m$^2$; n = 25) compared with those in A. cervicornis (21.4 urchins/m$^2$, n = 140) but urchins within A. prolifera also appeared smaller in size than those within A. cervicornis. These results suggest that the different surface areas, structural complexities, and size distributions of open spaces of acroporids each impose unique constraints on the size and movement of species that seek food and protection within the coral framework.

Authors

Mattea Horne
Pomona College

Jolie Villegas
Wesleyan University

Sydney Walters
Colgate University

David Pfaff
Washington and Lee University

Ginny Johnson
Washington and Lee University

Karl R Wirth
Macalester College

Lisa Greer
Washington and Lee University