What happens under the reef? A study towards the identity and functioning of the cryptobenthic community in two contrasting coral reef habitats

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Hidden in the gaps, cracks and crevices of the coral reef three-dimensional framework, complex benthic communities reside. These communities are largely composed of filter feeders such as sponges and ascidians and it becomes increasingly clear that this community plays a vital role in retaining nutrients on the reef. Little is known on how the species composition of the cryptobenthic community relates to its ecological functioning (e.g. biochemical cycling), despite the cryptic habitat being the largest surface area on coral reefs. Here we show -for the first time- how the composition of the cryptobenthic community influences it's biochemical cycling (oxygen and organic carbon) in two distinct reef habitats. These habitats are the hard coral dominated outer reef of Mo'orea (French Polynesia) and the 'shifted' reef of Curacao (Dutch Caribbean), where algae and cyanobacteria have become the dominant benthos. In both locations, we deployed 36 experimental structures using the established ARMS (Autonomous Reef Monitoring Structures) methodology. We adapted the methodology by 1) adjusting the size of the standard ARMS (to each miniARMS totaling a 0.14m^2 surface area) and 2) equipping part of the structures with nutrient dispensers to test for the effect of environmental perturbation on community composition and functioning. After 15 months of colonization, we quantified metabolic fluxes (respiration of oxygen in the light and dark, uptake of dissolved and total carbon, bacteria and nutrients) of the miniARMS communities using in situ respiration chambers. We subsequently determined the composition of the sessile and mobile communities using pictures (Photoquad) and metabarcoding. Preliminary data from Mo'orea show a clear distinction between the upper surface and cryptic spaces, with 83% of the miniARMS being net phototrophic in the light (mean Pn 38.04 mmol O_2 m^{-2} day^{-1}) and heterotrophic during dark incubations (mean Rd -36.89 mmol O_2 m^{-2} day^{-1}). The upper surface of the ARMS were largely dominated by CCA, whereas ascidians were most abundant in the cryptic spaces. From the large mobile fraction (>2mm), we retrieved on average 5.6 phyla per ARMS and 213 animals m^{-2}, with gastropods (24%), bivalves (24%), crabs (21%) and hermit crabs (19%) being the most dominant groups. Future analyses will integrate carbon flux data with community composition to improve our understanding of the ecological role of the cryptobenthos in different reef systems.