

## Study of macrobenthic community structure at mesophotic depths in the South Ryukyus based on ROV and AUV seafloor imaging

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Mesophotic coral reef habitats (30-150 m) are still largely unexplored despite their importance in biology (e.g., marine biodiversity studies, genetic connectivity between shallow and deep communities, ecological shift from photosynthetic to heterotrophic communities along a depth/light gradient) and in geology (e.g., study of sea-level changes and reef growth history during Quaternary sea-level lowstands). Here we report on new seafloor observations conducted by remotely operated vehicles (ROVs) and an autonomous underwater vehicle (AUV) at depths of 30-65 m around the Sekisei lagoon, Yaeyama Islands, South Ryukyus, Japan. In this study, new seafloor imaging was carried out at six sites along the northern (N1-N2) and southern (S1-S4) margins of the Sekisei Lagoon by two ROVs (BlueRov 2, Blue Robotics Inc., and FullDepth DiveUnit 300, FullDepth Co., Ltd.) and one AUV (HATTORI 2). HATTORI 2 is designed to acquire high-resolution video images of the seafloor at a constant elevation along a pre-programmed path, which enables the creation of a 3D topographic map of the seafloor based on structure-from-motion photogrammetry. In addition, HATTORI 2 was equipped with depth, temperature, salinity and light sensors. We combine these new observations with data obtained during previous ROV and AUV surveys to investigate the community structure of benthic organisms, particularly scleractinian corals, at mesophotic depths, and examine its relationship with water depth, seafloor topography, substrate type, and other major environmental parameters (i.e., light penetration, water temperature and salinity). Previous surveys revealed a clear bathymetric zonation at site S1 with a shift from a “coralgal” community (dominated by scleractinian corals and coralline algae) to a “mixed” community (including scleractinian corals, algae, octocorallians, sponges, and foraminifers) at a depth of ~60 m, and showed also that scleractinian corals become rare below 70 m. A preliminary analysis of images acquired during our latest survey indicates that coral cover in the upper mesophotic zone (30-40 m) varies greatly from one site to another: up to 100% in the area of sites N1 and N2 (*Leptoseris* and *Acropora* colonies locally abundant), 35% or less in the area of S1, close to 0% at sites S2 and S3, and 30-60 % at site S4. Our new data confirm that substrate type and seafloor topography are likely important factors controlling the distribution of corals at upper mesophotic depths (higher coral cover on hard rocky substrate and topographic highs), but they alone cannot explain the full range of our observations.

Keywords: Coral reefs, Mesophotic habitat, Coral communities, ROV, AUV