A Remote Video Survey of the Coral Communities from Deep Water Mesophotic Reef Habitats in the Northern Gulf of Mexico

Un Sondeo de Video-remoto de las Comunidades de Corales de Arrecifes Mesofóticos en Aguas Profundas al Norte del Golfo de México

Une Enquête Vidéo à Distance des Communautés de Coraux des Habitats Récifaux d'eau Profonde Mésophotique dans le Nord du Golfe du Mexique

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EXTENDED ABSTRACT

The Pinnacle reefs are deep water (60 –110 m) natural rock reefs that project up to 20 m from the seafloor on the edge of the continental shelf in the northern Gulf of Mexico. These mesophotic reefs provide unique habitat for diverse invertebrate and fish communities. From September to October 2014, a stratified random ROV video survey was used to count and identify benthic invertebrate species from three reef height classifications: low (0 - 3 m), medium (4 - 10 m) and high (> 10 m) vertical relief, and from two reef habitat types: reef top and reef slope. Still photographs were taken from video transects and analyzed to obtain percent cover of invertebrate species by overlaying 32 points on each image and identifying the epibenthic biota or substrate at each point.

The ahermatypic, heterotrophic benthic community was dominated by gorgonian corals (mean percent cover: 6.1%), scleractinian corals (5.9%), antipatharian or black corals (3.6%), comatulid crinoids (1.7%), and sponges, (both erect and encrusting forms, 9.9%). Mean total benthic percent coverage was 27.2% and maximum total benthic percent coverage was 60.3%. Based on previous identifications from earlier studies that collected coral samples, we were able to classify 21 genera and species of sessile benthos in the photographs. Species included *Rhizopsammia manuelensis* (4.9%), *Antipathes atlantica* (1.9%), *Bebryce* sp. (1.2%), *Swiftia exserta* (1.1%), and *Nicella* sp. (1.1%).

Benthic community composition differed among reef heights (PERMANOVA, Pseudo-$F_{2,133}$ = 5.06, p = 0.001) with high relief reefs supporting greater total biotic coverage than low relief reefs (Z = -4.49, p < 0.0001). High relief reefs supported greater percent coverage of most individual taxa. Exceptions included *R. manuelensis, H. pendula, T. nivea*, and *S. leutkeni*, which showed greater coverage on low relief reefs.

Benthic communities also differed between reef top and slope habitat types (PERMANOVA, Pseudo-$F_{1,133}$ = 14.83, p = 0.001). Flat reef top habitats were characterized by thin sediment layers and greater percent coverages of erect sponges and gorgonians, for example *S. exserta, H. pendula*, *Villogorgia* sp., *Nicella* sp., and *Bebryce* sp. Reef slope habitats were characterized by steep rocky surfaces and greater coverage of encrusting organisms and scleractinian corals, including *R. manuelensis*, *Oculina* sp., *and Madracis* sp.

Environmental factors of depth, percent hard substrate, habitat complexity, latitude and longitude also contributed to variance in coral community composition (RELATE, *Rho* = 0.35, p =0.001). The strongest explanatory factors for this variation when separated out were depth, longitude and percent hard substrate (BEST, *Rho* = 0.41). Lesser et al. (2009) also reported coral assemblage changes with depth, primarily due to changes in solar radiation. Sedimentation may also influence coral abundances (Rogers 1990), and generally increases with proximity to the Mississippi River plume.

The biological fish community (Beyea and Szedlmayer 2017) was compared to the total biotic benthic cover and environmental factors. Latitude, longitude, depth, percent hard substrate, habitat complexity, and total percent benthic cover all contributed to variation in the fish community (RELATE, *Rho* = 0.32, p = 0.001). The strongest explanatory factors were percent hard substrate, habitat complexity and total percent benthic coverage (BEST, *Rho*=0.36). A partial correlation after removing the influence of percent hard substrate and habitat complexity showed a significant positive correlation between total percent benthic coverage and total fish abundance (r = 0.30, n =135, p = 0.0005). This positive correlation remained significant (r = 0.25, n = 62, p = 0.05) when applied to high relief reefs alone, indicating that it was not simply the amount of hard reef structure driving this correlation.

This benthic ecosystem may be affected by multiple anthropogenic influences. For example, the Pinnacles region was an area of concern after the Deepwater Horizon oil spill in 2010 due to its proximity to the wellhead. Etnoyer et al. (2015) and Silva et al. (2015) recorded rates of coral injury up to 50% in gorgonian species on the Pinnacles and they attributed this injury to the Deepwater Horizon oil spill and dispersants in the water column. However, these reports do not discuss another likely source of anthropogenic influence, the Mississippi River outflow. For example, heavy sedimentation can smother and damage suspension feeding coral colonies (Fabricius 2005). Also, increased nutrient levels from the Mississippi River outflow from agricultural runoff may lead to changes in planktonic production and a perennial, expanding hypoxic zone offshore (Rabalais et al. 2007). Many other pollutants are also present in the outflow from pesticides, herbicides, and industrial effluent, which can have a negative effect on fish, shellfish and coral communities (Walker et al. 1996, Mead 1996, Gittings et al. 1992). Thus, the Mississippi river plume is a more likely stressor, both acute and chronic, for the mesophotic reef system in the northern Gulf of Mexico.

KEYWORDS: Mesophotic reef, benthic communities, ROV

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