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

Un Sondeo de Video-remoto de las Comunidades de Peces en Aguas Profundas Mesofoticas de Habitats Arrecifales al Norte del Golfo de Mexico

Une Enquête Vidéo à Distance des Communautés de Poissons 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 reef habitats are home to a diverse reef fish community. In September and October 2014, a stratified random ROV video survey was used to count and identify reef fish species from three reef categories: low (0 - 3 m), medium (4 - 10 m) and high (> 10 m) vertical relief, and from two habitat types: reef top and reef slope.

A total of 54 reef fish species were identified. This reef fish community was dominated by two species of *Serranidae*, subfamily *Anthiinae*: Roughtongue Bass, *Pronotogrammus martinicensis* (33.3%), and Red Barbier, *Baldwinella vivanus* (33.1%). An additional 21.5%, were either *P. martinicensis* or *B. vivanus*, but could not be distinguished. Thus, these two species made up 87.9% of the total community. Other common reef fish included Pufferfish, *Canthigaster* sp. (1.5%), Short Bigeye, *Pristigenys alta* (1.0%), Greenband Wrasse, *Halichoeres bathyphilus* (0.9%), Gobies, *Gobiidae* sp. (0.7%), Bank Butterflyfish, *Prognathodes aya* (0.7%), and Yellowtail Reeffish, *Chromis enchrysura* (0.7%).

Fish communities differed among reef relief categories (PERMANOVA, *Pseudo-*$F_{2, 210} = 3.5$, $p = 0.004$) where high relief reefs had significantly higher abundances of *P. martinicensis* (Kruskall-Wallis, $\chi^2 = 30.6$, $p < 0.001$) and *B. vivanus* (Kruskall-Wallis, $\chi^2 = 34.1$, $p < 0.001$, Figure 1). High relief reefs also had significantly greater species richness (Kruskall-Wallis, $\chi^2 = 32.5$, $p < 0.001$), but no significant differences were detected in diversity (Shannon-Weiner diversity, Kruskall-Wallis, $\chi^2 = 0.67$, $p = 0.7$).

Fish communities also showed distinct compositions when compared between reef top and slope habitat types (PERMANOVA, *Pseudo-*$F_{1, 211} = 10.2$, $p = 0.002$). Abundances of *P. martinicensis* (Wilcoxin, $Z = 4.5$, $p < 0.0001$) and *B. vivanus* (Wilcoxin, $Z = 2.9$, $p = 0.003$) were significantly greater on the reef slope habitat (Figure 2). Diversity was significantly higher on reef tops (Shannon-Weiner diversity, Wilcoxin, $Z = 5.0$, $p < 0.0001$), while no significant differences were detected for species richness between habitat types (Wilcoxin, $Z = 0.5$, $p = 0.6$).

Geographical location, depth, and percent hard substrate cover also contributed to variance in community composition (RELATE, $Rho = 0.256$, $p = 0.001$). The environmental factor with which the fish abundance data were most strongly correlated was percent hard substrate cover ($Rho = 0.296$). This factor is influenced by degree of sedimentation, which in turn is influenced by the site's proximity to the Mississippi River plume. Sedimentation effects from the Mississippi plume were also previously observed over the Pinnacles reef systems in spring and summer 1997 - 1999 (CSA and TAMU 2001). Sedimentation and turbidity can negatively affect mesophotic epifaunal communities (Gittings et al. 1992) and zooplanktivores like *P. martinicensis* and *B. vivanus* by reducing feeding rates (Gardner 1981, Leahy et al. 2011). The outflow of the Mississippi River also carries increased levels of nutrients and pollutants, which could have a substantial negative effect on the reef community (Walker et al. 1996, Mead et al. 1996).

Weaver et al. (2001) also quantified the Pinnacles reef fish community using ROV video transects in 1997, on six of the same reef sites as the present study. A comparison of this earlier study with the present study allowed evaluation of possible effects from the 2010 Deepwater Horizon oil spill on the Pinnacles reef fish community. Weaver et al. (2001) reported fish counts per min, but did not report area surveyed. In the present study we report abundances in terms of both survey times and areas (fish/min/m). In these comparisons no significant DWH oil spill effects were detected. Mean abundance of *P. martinicensis* on these six reefs was 7.6 fish/min/m in 2014, compared to 2.8 fish/min in 1997. Mean abundance of *B. vivanus* was 10.3 fish/min/m in 2014, compared to 5.1 fish/min in 1997. All comparisons of major reef fish for before and after the DWH spill showed similar patterns. An exception was large predators, which were uncommon in ROV surveys, making abundance patterns difficult to assess. Top predators in this community include members of Carangidae, Lutjanidae, and Serranidae, which feed directly on the reef fish community (Bryan et al. 2013, Weaver et al. 2001) and provide important commercial and recreational fishing resources. Also observed in the present study was the continuing invasion of lionfish, *Pterois volitans*, which has progressed to the Pinnacles, with lionfish being ranked 14 out of 54 total species in abundance (3.9 fish/hr/m).

KEYWORDS: Mesophotic reef, fish communities, ROV

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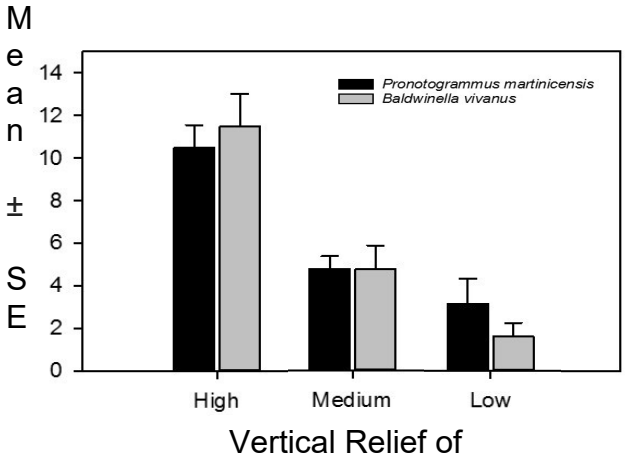

Figure 1. Mean ± SE abundances of *P. martinicensis* and *B. vivanus* (min/m) from ROV surveys on the Pinnacles reef system for high, medium, and low vertical relief reef types.

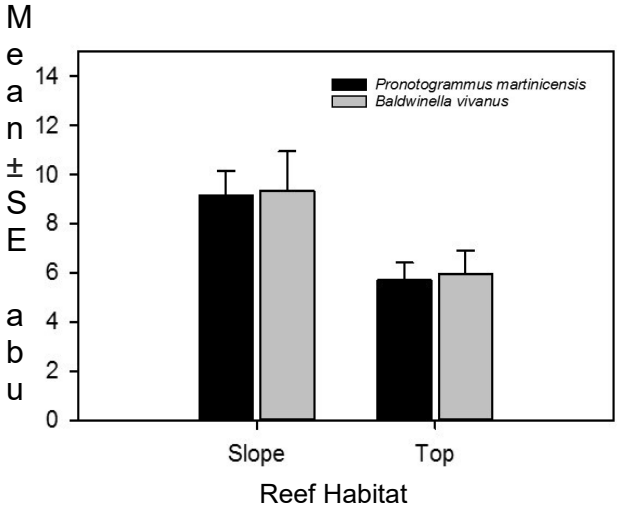

Figure 2. Mean ± SE abundances of *P. martinicensis* and *B. vivanus* (min/m) from ROV surveys on the Pinnacles reef system for reef slope and reef top habitat types.