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STUDY TITLE: Gulf Drilling Platforms as an Environmental Asset: Long-Term Artificial Reefs and Sites for Coral Recruitment

REPORT TITLE: Corals on Oil and Gas Platforms Near the Flower Garden Banks: Population Characteristics, Recruitment, and Genetic Affinity

CONTRACT NUMBER: M05AZ10668 (30951-17808)

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KEY WORDS: Platforms, Artificial Reefs, Coral, Recruitment, *Madracis decactis, Diploria strigosa, and Tubastraea coccinea*, genetic, settlement, scleractinian

BACKGROUND: Approximately 3,200 oil and gas platforms are in the northern Gulf of Mexico (GOM). These platforms provide hard substratum that extends throughout the euphotic zone, in a region where such has been rare in recent geological time. Major exceptions to this are the coral reefs of the Flower Garden Banks (FGB), ~180 km (112 mi) S-SE of Galveston, TX which rise up to within 17 m (55 ft) of the sea surface. The importance of oil and gas platforms to coral populations in the Gulf of Mexico is not well studied.

OBJECTIVES: The study objectives were 1) to determine whether extensive scleractinian coral populations have colonized these platforms, quantify them, and determine their population and community characteristics; 2) to assess coral recruitment rates on oil and gas platforms around the FGB; and 3) to determine the degree of genetic affinity among the natural populations on the FGB coral reefs and those on the surrounding platforms.

DESCRIPTION: Surveys were performed on 13 oil or gas production platforms down to 33-m (110 ft) depth, encompassing an ellipse around the FGB. In order to assess coral recruitment rates on oil and gas platforms around the FGB, terracotta settlement plates were mounted on racks, deployed on, and retrieved from six platforms at depths of 15

and 27 m (49 and 89 ft) for a period of one to two years. Plates were analyzed in the laboratory with a dissecting microscope for taxonomic identification, distribution, and abundance. To determine the degree of genetic affinity among the natural populations of coral and those on the surrounding platforms, tissue samples were collected from the East-FGB and West FGB, and seven platforms within a 65 km radius, at a depth range of 5-37 m. Genetic variation was assessed using Amplified Fragment Length Polymorphisms (AFLPs).

SIGNIFICANT CONCLUSIONS: The results of this study suggest that distance from the FGB was not related to the coral community variables measured. Density of coral spat settling on plates on the platforms was extraordinarily low when compared with other Caribbean sites or the Great Barrier Reef. The genetic affinity analyses indicated that the East and West FGB were genetically homogeneous for *Madracis decactis* and *Diploria strigosa* populations; *Montastraea cavernosa* populations, however, were significantly different between the two banks. In all species, genetic distance increased significantly with geographic distance between populations.

STUDY RESULTS: Corals occurred on most of the oil and gas platforms surveyed around the FGB, with eleven species of scleractinian corals found, eight hermatypic, two ahermatypic, and one hydrozoan. Total coral abundance increased significantly with platform age, and the community was best developed on platforms > 12-15 yrs in age. All corals exhibited a significantly non-uniform depth distribution, with total coral abundance peaking at 20-m (65-ft) and 28-m (92-ft) depths. Only three species of coral spat were found: *Tubastraea coccinea*, *Montastraea* sp. (most likely *M. cavernosa*), and *Madracis* sp. (most likely *M. decactis*), in order of abundance. There was a significant difference between coral settlement densities on platforms vs. the East FGB, where settlement was much higher. Species composition of coral spat varied substantially from that observed on the E-FGB, which was characterized by *Agaricia* and *Porites.* In all species, genetic distance increased significantly with geographic distance between populations. *M. decactis*, a brooder with extended larval release periods and near-immediate settlement competence, showed greater affinity to the FGB with distance *than D. strigosa*, a broadcaster. This brooder appears to be more effective at colonizing small, nearby target sites and expanding its geographic range at the meso-scale. The low degree of genetic affinity exhibited by all species on the platforms may be attributed to genetic drift/founder effect or relatively small sample sizes, although it should be noted that total populations were sampled within the study sites.

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