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STUDY TITLE: Offshore Petroleum Platforms: Functional Significance for Larval Fish Across Longitudinal and Latitudinal Gradients

REPORT TITLE: Offshore Petroleum Platforms: Functional Significance for Larval Fish Across Longitudinal and Latitudinal Gradients

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APPLICABLE PLANNING AREA(S): North-central Gulf of Mexico

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KEY WORDS: North-central Gulf of Mexico; oil and gas platforms; fish larvae and juveniles; ichthyoplankton; artificial habitat; light-traps; diversity; spatial distribution; temporal periodicity; reef fishes.

BACKGROUND: The introduction and proliferation of offshore oil and gas platforms in the northern Gulf has undoubtedly affected the marine ecosystem. These structures provide additional hard-substrate to areas of the continental shelf that are dominated by sand/silt/mud. Because fish populations are usually limited by available energy, recruitment or habitat, it is important to determine if platforms: 1) serve as new or additional spawning habitat; 2) provide critical habitat for early life history stages; 3) influence energy flow through the ecosystem by aggregating prey.

OBJECTIVES: (1) To characterize the larval and juvenile fish assemblages at platforms by depth gradients (latitudinal) and by east/west of the Mississippi River Delta (longitudinal). (2) To assess how platforms affect the local distribution and abundance of larval and juvenile fishes. (3) To provide ecological information on the early life history stages of reef fishes, and, in particular, address whether platforms have a nursery/refugia function for these habitat-limited fishes.

DESCRIPTION: Larval and juvenile fishes were sampled at two platforms east of the Delta. Santa Fe-Snyder's Main Pass (MP) 259, which stands in 120 m of water on the outer shelf (29º19'32"N, 88º01'12"W), was sampled twice-monthly during new and full moon phases from May to September 1999. Murphy Oil's Viosca Knoll (VK) 203, which stands in 35 m of water at mid-shelf (29º46'53"N, 88º19'59"W), was also sampled twice-monthly during new and full moon phases from May to October 2000. Larval and juvenile fishes were collected in surface waters within the platform using passively-fished plankton nets and light traps, and off-platform (20 m down-current of the platform) using light traps. Environmental data for water temperature, salinity, turbidity, microzooplankton biomass, and current speed and direction were also collected at each platform. Data collected at MP 259 and VK 203 were analyzed with data from previous sampling efforts at platforms west of the Delta [i.e., the inner shelf platform South Timbalier (ST) 54G, the mid-shelf platform Grand Isle (GI) 94B, and the outer shelf platform Green Canyon (GC) 18].

SIGNIFICANT CONCLUSIONS: The higher abundance and diversity of larval and juvenile fishes within the platform, as compared with adjacent open-waters, indicated that platforms have a significant impact on the distribution of larval and juvenile fishes in the northern Gulf. These fishes may have been attracted by the platform's nighttime light-field and/or concentrations of prey that may be found in the waters around platforms. Platforms may also provide nursery/recruitment habitat for certain reef taxa, i.e., blenniids and pomacentrids. Blenniids and pomacentrids were the most commonly collected settlement-size reef larvae at platforms. Their collection in discrete pulses during darker moon phases further suggests that blenniids and pomacentrids settled at platforms. Other settlement-size reef taxa (e.g., lutjanids and serranids) were relatively rare as settlement-size larvae and, therefore, probably do not utilize platforms as nursery/recruitment habitat.

STUDY RESULTS: Patterns of larval and juvenile fish abundance and diversity were primarily influenced by across-shelf gradients of increasing water depth. Larval fish total densities from plankton nets were highest for the inner shelf platform ST 54, and decreased with increasing depth. Light trap total CPUEs were highest for the mid-shelf platforms VK 203 and GI 94, and were generally low at the outer shelf platforms. Diversity and taxonomic richness were both generally greatest at the mid-shelf platforms. Cluster analysis found three general assemblages of non-clupeiform larval and juvenile fishes at platforms: an inner shelf assemblage (ST 54), a mid-shelf assemblage (GI 94 and VK 203) and an outer shelf assemblage (GC 18 and MP 259). High densities of sciaenids, synodontids and other coastal taxa characterized the inner shelf assemblage. The mid-shelf assemblages were characterized by blenniids, synodontids, and *Bregmaceros cantori*. The mid-shelf platforms also had the highest abundance and diversity of reef fishes, particularly blenniids, lutjanids and pomacentrids. The outer shelf assemblage was primarily composed of oceanic pelagic taxa, such as carangids and scombrids, and mesopelagic taxa. The only differences observed in the larval and juvenile fish assemblages across longitudinal gradients (i.e., east or west of the Delta) were differences in the abundance of certain taxa.

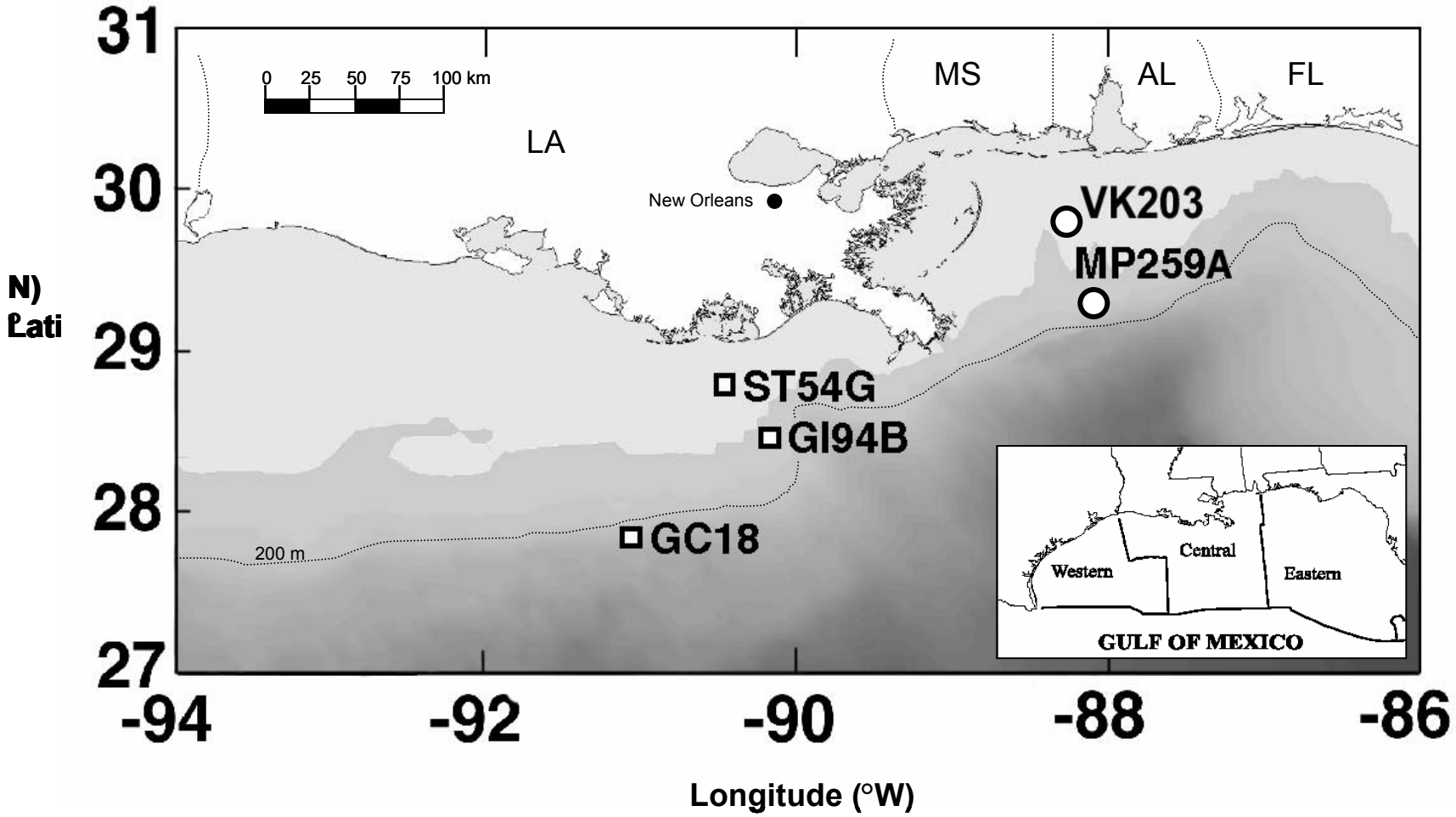
The waters within platforms had higher abundance and diversity of larval and juvenile fishes than waters immediately down-current of the platform. Clupeiforms (clupeids and engraulids) and synodontids were consistently collected in higher abundance within the platform than off-platform. Taxa collected primarily in waters down-current of the platforms included scombrids and possibly carangids. Reef fish were occasionally found in higher abundance within-platform, yet pomacentrids and the blenniid *Hypsoblennius invemar* were often found in higher abundance off-platform. These specimens, though, were collected at settlement-size and may represent individuals settling to the platforms.

The larval and juvenile reef fishes collected at platforms exhibited distinct temporal patterns of abundance. Most of the reef taxa were collected during months when surface water temperatures were at their highest, i.e., June-August. There were strong differences in the numbers and developmental stages collected between new and full moons. Many preflexion reef larvae were collected in higher numbers on either new or full moons. Postflexion larvae, however, were almost exclusively collected on new moons, which was consistent with the peak periods of settlement for many reef fishes. Coefficients of variation calculated from the mean light trap catches per sampling night and sampling trip, indicated pulses in the catches of several dominant taxa. Blenniids and pomacentrids, in particular, were primarily found in very discrete pulses that included the majority of settlement-size fishes collected at platforms. The occurrence of these pulses during darker moon phases (i.e., first quarter and new moons) further suggests that they were settlement-related.

Examination of the length frequency and developmental stages of reef taxa collected at platforms provided indirect evidence of the potential spawning and nursery/recruitment habitat provided by platforms. Recently-hatched and preflexion blenniids, holocentrids, labrid, lutjanid, scarid and serranid larvae were collected at every platform. The preponderance of platforms, as compared with natural hard bottom habitat, within the transport envelope of the larvae makes platforms the most probable source of these larvae. Blenniids and pomacentrids were the most common settlement-size reef taxa collected at platforms while settlement-size larvae of other reef taxa were relatively rare, except for possibly lutjanids at the mid-shelf platforms. Because blenniids and pomacentrids are benthically-spawned, as compared with other reef taxa that spawn pelagic eggs, their larvae may have shorter larval durations and limited dispersal and, therefore, may be able to remain in areas where suitable settlement habitat (i.e., platforms) is more available.

STUDY PRODUCT(S): Shaw, R.F., D.C. Lindquist, M.C. Benfield, T. Farooqi and J.T. Plunket. 2002. Offshore Petroleum Platforms: Functional Significance for Larval Fish Across Longitudinal and Latitudinal Gradients. A final report for the U.S. Department of Interior, Minerals Management Service Gulf of Mexico OCS Region, New Orleans, LA. Contract No. 14-35-0001-30660-19961. 122 pp.

*P.I.'s affiliation may be different than that listed for Project Manager(s).



Location of oil and gas platforms sampled in the northern Gulf of Mexico. Circles represent platforms sampled during the present study. Squares represent platforms sampled during previous studies, used for comparisons.