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STUDY TITLE: Platform Recruited Reef Fish, Phase II: Do Platforms Provide Habitat that Increases the Survival of Reef Fishes?

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BACKGROUND: To what extent do oil and gas platforms and artificial reefs contribute to the standing stocks of red snapper through their roles as nursery grounds, or as adult feeding grounds? There is substantial literature about the commonly-observed association of biological communities with platforms, but the nature and extent of fish dependency on platforms is not clearly defined. Tagging studies confirm that some red snapper do spend some periods of their lives in association with oil and gas platforms and with artificial reefs. The key question of just how long, and at what life stages, red snapper spend time at or near oil and gas platforms and artificial reefs remains largely unanswered.

A potential method to answer this question is to find some marker in individual fish that correlates portions of a fish's life span to environmental parameters in its habitat. This is easier to accomplish for artificial habitats because they introduce detectable substances in concentrations different than the natural surroundings. In 2002, the Minerals Management Service (MMS) and Louisiana State University (LSU) successfully identified components of the microchemistry of the otolith in red snapper to differentiate between individual fish caught at oil and gas platforms, fish caught at artificial reefs, and fish not associated with artificial habitats.

This new study will expand the geographic range of the work and refine the otolith technique. Substrates were sampled to compare with the otolith "platform fingerprint" and determine the source of the signature. Otoliths were examined from Texas to Florida to determine the proportion of the red snapper population that have been associated at some life stage with platforms. In addition, individual otoliths were sub-sampled to distinguish which years of fish life spans are spent in association with oil and gas platforms. Combining these results with information on habitat affinities, juvenile abundances, growth rates, diet, and trophic dynamics will allow quantification of the use and value of juvenile red snapper habitats.

OBJECTIVES: One thousand individual red snapper will be collected per year for two years from oil and gas platforms and a variety of other habitats (500 per year from platforms, 500 from other habitats); 500 total from Louisiana, 300 total from Texas, and 200 total from Mississippi/Alabama per year. In addition, 50 samples of barnacle and/or bivalve shells from platform legs and 50 samples of sediments using a Teflon®-coated Van Veen bottom grab during years 1 and 2 (100 total samples per year) were collected. In year 3, the focus shifted to adult snapper, where the otolith explicitly in annuli >2 (2+ years of age) will be examined to determine if fish that are recruiting to other habitats in the western, and especially the eastern Gulf appear disproportionately to have been reared on platforms during early life. Three hundred fish will be collected in year 3 from dockside locations in the eastern Gulf as far south as Tampa, FL, and 200 fish from Louisiana and/or Texas locations that were captured on habitats other than platforms. From a subsample of the adult otoliths, the material will be precisely milled from individual annual increments (>2 to 10+) to determine the age at which red snapper move away from more structured habitats such as platforms.

DESCRIPTION: Otoliths were removed and analyzed for the measurement of metal isotope ratios. Barnacle shell and sediment samples will be prepared and analyzed in the same way. The procedures to be used in this study will use an inductively coupled plasma-mass spectrometer (ICP-MS) for measurement in the trace element concentration range 0 ppb–20 ppb for isotopes of heavy metals recovered from high Ca background concentrations. Otoliths, barnacle and/or bivalve shells, and sediment samples will be analyzed in the ICP-MS using flow injection analysis (FIA). The flow injection system pulses a sample through the ICP-MS in a continuous flow of cleaning solution to reduce the amount of sample required and lessen the buildup of deposits on the sampler and skimmer cones.

Data obtained were analyzed with a variety of statistical techniques including multivariate analysis of variance, principle components analysis, linear discriminant analysis, and canonical discriminant analysis. Other techniques were employed as deemed appropriate.

SIGNIFICANT CONCLUSIONS: The results of this study indicate that trace metals associated with platforms can be used to develop otolith chemical signatures to differentiate among regions, and, to a lesser extent, habitats, in the Gulf. Although the overall goal was to develop oil and gas platform otolith signatures based on a suite of

trace metals, this combination of trace metals proved to work best for discriminating among regions because of unique features, e.g., the Mississippi River, that differentially affect each area. Also, evidence of the platform signature in regions devoid of platforms may not indicate that platforms enhance the production of red snapper, but instead reflect a possible western contribution to the eastern Gulf.

STUDY RESULTS: A total of 1,964 red snapper otolith samples collected from three regions across the Gulf were processed for otolith chemical analysis, but only 1,778 samples were used to determine otolith chemical signatures. The chemical signatures were significantly different among regions. All elemental concentrations differed significantly among locations and regions overall, however some elemental concentrations were not significantly different between two regions.

For the mixed red snapper sampling, a total of 500 adult otolith samples was collected from four regions across the Gulf and were processed for otolith chemical analysis, but only 487 otolith samples were compared to baseline otolith signatures to determine region and habitat origin. Mean concentrations of elements differed among regions, and all elemental concentrations differed significantly among regions overall. The suite of elements believed to be associated with platforms and other artificial habitats performed better for discriminating among Gulf regions than between habitats.

A total of 54 adult gray triggerfish otoliths were collected from Destin, FL and LA to test the validity of the platform signature on other reef-associated species, however only 30 samples were processed for otolith chemical analysis to allow even numbers to be processed from both regions/habitats. Trace metal concentrations were not significantly different among regions or habitats.

A total of 100 barnacle samples, 114 sediment samples, and 668 fish samples collected from platform habitats off LA was processed for chemical analysis. The MDS plot displayed strong separation of the three sample types; same sample types clumped together. Also, barnacle and sediment sample groupings were spaced closer together, and red snapper otolith samples were spaced farther apart. For all elements, except Cd, sediment samples had the highest mean concentrations, followed by barnacle samples and then otolith samples.

STUDY PRODUCT: Zapp Sluis, M. and J.H. Cowan, Jr. **2013**. Platform recruited reef fish phase II: Do platforms provide habitat that increases the survival of reef fishes? U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study BOEM 2013-0120 50 pp.

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