Hydroacoustic and Video Surveys in the Northern Gulf of Mexico in Support of Louisiana's Artificial Reef Planning Area: A Comparison of Biomass and Community Structure

Vídeo y– Hidroacústica Encuestas en el Norte del Golfo de México en Apoyo del Arrecife Artificial Área de Planificación: Una Comparación de la Biomasa y Estructura de la Comunidad

Hydroacoustiques et Vidéo des Enquêtes dans le Nord du Golfe du Mexique à l'Appui de la Louisiane du Récif Artificiel Zone de Planification : Une Comparaison de la Biomasse et de la Structure Communautaire

EMILY M. REYNOLDS[1*] and JAMES H. COWAN, JR[1]
[1]*Department of Oceanography and Coastal Sciences, Louisiana State University, Baton Rouge, Louisiana 70803, USA.*
*ereyno4@tigers.lsu.edu.

EXTENDED ABSTRACT

There has been relatively little study on the efficacy of decommissioned oil and gas platforms as artificial reef habitats for fish assemblages in the northern Gulf of Mexico (GOM). The GOM platforms create the world's largest artificial reef complex (Dauterive 2000). A variety of fish species have been reported to occur at these reefs, but the species biomass distribution and community structure have not been studied thoroughly. The Louisiana Artificial Reef Program (LARP) was established in 1986 as a program under the Louisiana Department of Wildlife and Fisheries (LDWF) to take advantage of decommissioned oil and gas platforms to provide important habitat for fish species targeted by many of Louisiana's coastal fishers (Wilson et al. 1987).

The scientific investigation of fish assemblages at petroleum platforms did not begin until the late 1970s and consisted of visual diver surveys that provided a glimpse of the fishes at each site. Many factors contribute to the challenges encountered while attempting to sample fishes at toppled and standing platforms including, but not limited to, the platforms complex under water structure, limited visibility, extreme water depths, and the selectivity of gears (Stanley and Wilson 1997). Hydroacoustic and video surveys have been used successfully in previous studies to determine structure-associated fish assemblages, and to quantify local distribution, density, and community structure (Boswell et al. 2010, Stanley and Wilson 2000).

Hydroacoustic and video surveys were conducted from June 2013 to June 2014 to gain information about the differences between the community structure of two toppled and three standing platforms located approximately 130 km off the coast of Louisiana in the northern Gulf of Mexico, at 90 m depth (Figure 1). The decommissioned platforms in our study are a part of LARP and have been in place since 2002. Stereo-cameras are utilized for the video surveys at standing platforms, allowing us to post-process the lengths and frequencies of the fishes recorded. Go-Pro camera arrays are utilized at the toppled platform, due to the difficulty of deploying camera gear at the sites. Hydroacoustics are used to define the spatial distribution of reef-associated fishes, measured by mean-volume backscattering strength (MVBS, dB), which is used as a proxy for biomass, in relation to depth and distance from the structure up to 500 m from the center of each site.

To model the fish biomass distributions around the structures, an ANOVA was performed with SAS (v 9.4) to compare biomass changes in relation to depth and distance at two types of sites (standing and toppled platforms). The water column was divided into thirds (Layers 1, 2, and 3) for all analyses. The video data were processed with the max N analysis and the counts were organized by site and cruise in PRIMER 6 to compare community structure and assemblages at standing and toppled platforms. A SIMPER analysis was performed to determine the species driving both similarities and differences between layers and type of structure.

Results show a clear pattern of biomass decreasing rapidly with distance from both standing and toppled platforms, with the highest levels of biomass within approximately 40 m of the structures and leveling off around 100 m distance from the structures. MVBS (Sv, dB) was significantly different ($\alpha = 0.05$) between types of structures when including distance and depth (layer) as factors. Additionally, the lower water column had the highest MVBS and the upper water column has the lowest MVBS at both types of sites.

Results from the SIMPER analysis in PRIMER using the video data showed that factors of type, layer, season, and the interaction of layer x season were all significantly different ($\alpha = 0.05$). Red snapper (*L. campechanus)* was the main species driving the differences between type of sites and layers within each site. Additionally, Greater amberjack (*S. dumerili)* and Little tunny (*E. alletteratus)* were both large contributors to differences between seasons and layers. The species contributing to 90% of the observed fishes at standing and toppled platforms include Red snapper (*L. campechanus),* Little tunny (*E. alletteratus),* Greater amberjack (*S. dumerili),* Horse-eye jack (*C. latus)*, Blue runner (*C. crysos)*, Crevalle jack *(C. hippos)*, and Rainbow runner *(E. bipinnulata)*.

It is important to couple hydroacoutistic and video survey data in order to ground truth what is being observed on hydroacoustics with what is visually observed on the video surveys. Stereo-cameras provide us with species, counts, and lengths of fish, which can be used to estimate weights, therefore allowing us to appropriately estimate biomass (%) of the species observed. With hydroacoustics, we can gain a biomass estimate; then using video data, apportion the biomass based upon what species we are observing.

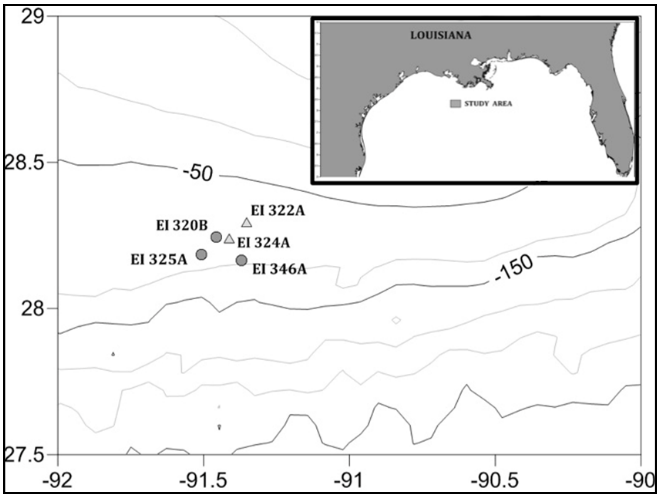

Figure 1. Map of study site approximately 130 km off the coast of Louisiana. Five study sites shown: light triangles represent toppled platform sites; dark circles represent standing platform sites.

Correlations may lead to modifications in future sampling methods for measuring fish abundances at standing and toppled platforms. This will allow for a simple, yet effective sampling procedure to continually monitor these to better determine what effects, if any, these structures are having on the fishes utilizing these habitats. Overall, results of the species biomass distribution and community structure differences or similarities between these types of sites can be applied to general management of artificial reefs as viable habitat for ecologically and economically important species.

KEY WORDS: Artificial reef, biomass, community structure, fisheries, management

LITERATURE CITED

Boswell, K.M., R.J.D. Wells, J.H. Cowan Jr, and C.A. Wilson. 2010. Biomass, density, and size distributions of fishes associated with a large-scale artificial reef complex in the Gulf of Mexico. *Bulletin of Marine Science* **86**:879-889.

Dauterive, L. 2000. Rigs-to-reefs policy, progress, and perspective. *AAUS Symposium Proceedings* **20**:64-66.

Stanley, D.R. and C.A. Wilson. 1997. Seasonal and spatial variation in the abundance and size distribution of fishes associated with a petroleum platform in the northern Gulf of Mexico. *Canadian Journal of Fisheries and Aquatic Sciences* **54**:1166-1176.

Stanley, D.R. and C.A. Wilson. 2000. Variation in the density and species composition of fishes associated with three petroleum platforms using dual beam hydroacoustics. *Fisheries Research* **47**:161-172.

Wilson, C., V. Van Sickle, and D. Pope. 1987. Louisiana artificial reef plan. *Louisiana Department of Wildlife and Fisheries Technical Bulletin* **41**:1-130.