Micro-ROV Survey Methodology for Submerged Oil and Gas Platform Reefs

Micro-ROV Metodología para Sumergido Petróleo y Gas Plataforma Arrecifes

Micro-ROV Méthodologie de L'enquête Submergé Récifs Pétrole et de Gaz Plate-forme

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EXTENDED ABSTRACT

A major impediment to understanding the function of offshore artificial habitats to fish production has been the ability of researchers to study assemblages situated in these relatively inaccessible environments. Submerged oil and gas platform reefs, for example, are often located at depths beyond most recreational and scientific diving limits (30 – 60 m) and thus present a suite of logistical and sampling restraints. Due to reductions in their size and cost, and the ability to maneuver around deep and complex habitats, remotely operated vehicles (ROVs) have become increasingly used by scientists to survey fish communities on artificial structures. However, in the Gulf of Mexico, developed methods only exist for relatively small reefs such as pyramids (Dance et al. 2011, Patterson et al. 2009).

We explored the utility of using a micro-ROV (VideoRay Pro4) in characterizing fish assemblages associated with an artificial reef complex along the south Texas continental shelf dominated by toppled and partially removed (i.e., cutoff) oil and gas platforms. Given the deeper habitat, higher relief (some 40 - 50 m from bottom to top), and larger spatial footprint of these structures compared to traditional pyramids (Figure 1), we used both depth-interval (DIT) and continuous roving transects (CRTs) to document fish communities. The DIT involved 1-min stops along a vertical transect at 10 m increments facing the down-current side of the reef, while CRTs mimicked a roving diver and spanned the horizontal extent of the top and bottom of the reef.

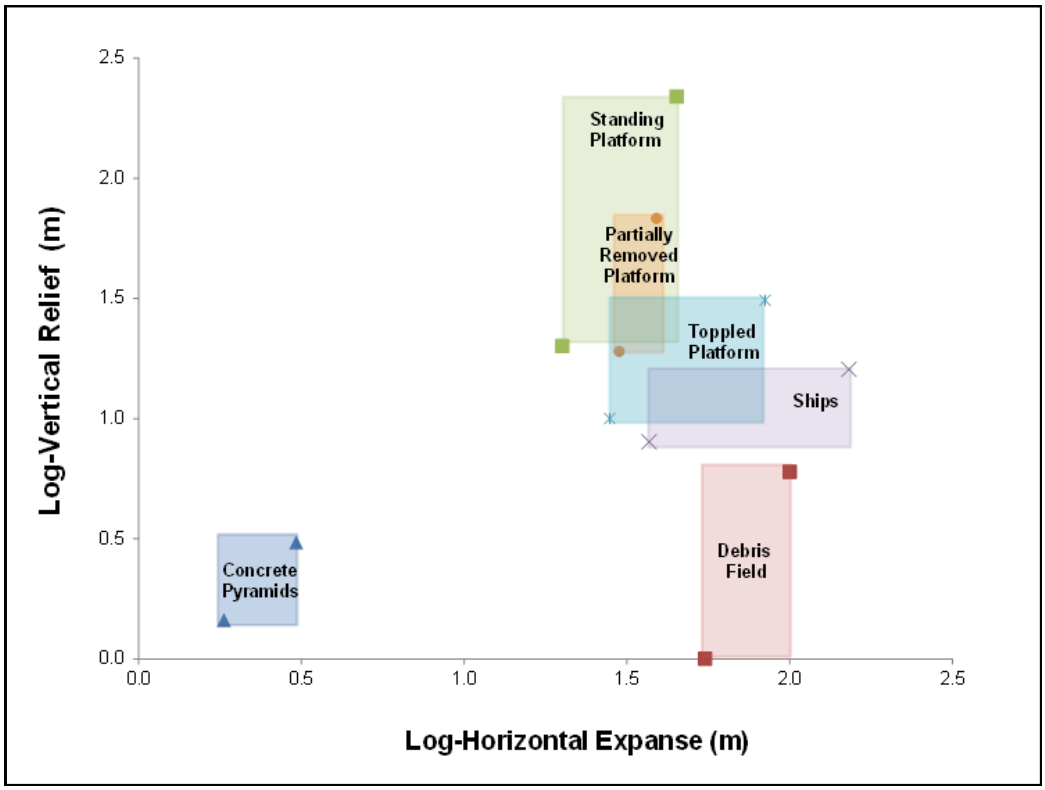

Figure 1. Scatter plot showing horizontal and vertical dimensions (polygons depict range) of various artificial reef types in the Gulf of Mexico. To date, micro-ROV survey methods have been primarily developed for much smaller concrete pyramid reefs. Values are log-transformed to assist visual interpretation.

Persistent currents and benthic nepheloid layers generally restricted the majority of sampling to the down-current side of the reefs and above the seabed. Despite these environmental challenges, we were able to document heterogeneous distributions of diverse fish assemblages across the artificial reefs. Divergent trends in fish vertical distribution were observed between cutoff and toppled reefs based on DITs. On cutoffs, maximum fish proportional abundance was evident at or near the shallowest depths of the structure while fish were mainly observed towards the lower half of the reef (despite deteriorating visual conditions) on toppled platforms. These findings were consistent with previous work using hydroacoustics to document fish densities on similar reef types (Stanley and Wilson 2000). The fish abundance estimates based on CRTs found structure type may play a role in fish abundance and diversity (Table 1), yet low sample sizes are currently limiting statistical comparisons. A multivariate comparison of the two survey types found no significant differences in community assemblage (PERMANOVA, p = 0.331); however, we noted that DITs considerably underestimated abundance for several key species of interest (e.g., Red Snapper).

Although survey design and implementation will vary based on research needs and site characteristics, our methodology provides a non-extractive and repeatable approach to documenting fish communities on submerged oil and gas platform reefs. However, due to visibility limitations associated with the deeper portions of these reefs, we propose that micro-ROV surveys are supplemented with additional approaches to quantify demersal species use of these habitats.

KEY WORDS: Artificial reef, Red snapper, ROV, fish community, oil and gas platforms

LITERATURE CITED

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Table 1. Description of micro-ROV survey sites and fish observation rates.

Survey Date	Site Name	Reefing Date	Reef Type	Ambient Depth (m)	Relief (m)	Dive Time (min)	Fish Obs Rate (fish/min)	Species Richness
6/7/2012	MI-712	7/17/1991	deck	40	13	39	11.0	23
6/7/2012	MU-828	8/29/2001	topple	50	20	26	5.5	9
6/18/2012	MI-A-7	11/25/2002	cutoff	60	33	39	2.2	16
9/21/2012	MU-A-16	8/22/2006	topple	83	18	35	2.5	17
9/21/2012	MU-A-16	8/22/2006	cutoff	83	56	19	0.9	11
9/21/2012	MU-A-85	10/3/2006	cutoff	84	55	48	1.5	16
9/21/2012	MU-A-85	7/12/2011	cutoff	84	23	36	1.8	11
10/12/2012	MU-802	6/1/1976	ship	34	5	35	0.9	9
10/17/2012	MI-616	6/1/1976	ship	36	7	54	1.7	16
10/17/2012	MI-616	6/1/1976	ship	36	9	40	1.5	16