BOEM ENVIRONMENTAL STUDIES PROGRAM: ONGOING STUDIES

BOEM OCS Region: Gulf of Mexico

Title: Current-Topography Interaction and Its Influence on Water Quality and Contaminant Transport Over Shelf-Edge Banks (GM-10-05)

Planning Area: Western

Total Cost: $717,500.00 **Period of Performance:** FY 2010-2013

Conducting Organization: Naval Research Laboratory

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Description:
Background: The northwestern shelf of the Gulf of Mexico has many topographic banks some of which have hermatypic coral communities, the Flower Garden Banks (FGB) being the archetypical example. These banks are large enough to affect the impinging water flow. These topographic interactions can substantially modify advection and transport of water and matter over reef communities. Unlike nearshore reefs of shallower waters which are wave dominated and strongly influenced by runoff, the ecology of shelf-edge bank communities seems to be dominated by current-topography interactions. The resulting flows provide an energy subsidy for nutrient uptake, waste removal, dispersal of larvae, and regulates the physical environment that allows these communities to grow.

Effects from storms have been evident on GOM shelf-edge banks in recent years. The autumn of 2005 saw the worst bleaching event on record for corals at the FGB which coincided with two significant storms (Hurricanes Katrina and Rita) that crossed the banks. It was followed by disease outbreaks affecting the coral at the FGB. Measurement of water quality parameters before and after these events was patchy and unreliable.

Natural variations in water quality can produce effects similar to anthropogenic effects, thus confounding a determination of cause. Runoff from major storms carrying excess nutrients and contaminants can potentially reach these offshore banks. Bottom sediments disturbed by storms and currents can carry contaminants onto low relief features but debate remains whether they reach the upper portions of banks. Knowledge of natural changes in water quality is necessary to enable the BOEM to identify potential effects resulting from oil and gas activities. An initial assessment of these interactions was conducted by a single study in the early 1980s using limited current meters and

hydrographic observations. Today, we have better technology and greater knowledge that allows deeper insight into the ecological role of the current-topography interaction affecting the ecology of these reefs.

The BOEM and the NOAA Flower Garden Banks National Marine Sanctuary have a long history of cooperating in monitoring shelf-edge bank communities. This cooperation will continue throughout this proposed study which will include providing ship facilities and time. The Sanctuary has a dedicated research vessel to provide an oceanographic platform for studies of this magnitude.

Objectives: The purpose of this study is to elucidate the role of water circulation and its interaction with topography in the maintenance of reef communities. The objectives are:

- To produce a 3-dimension view of the flow and fields around a selected bank and extrapolate that view to describe other banks in the region;

- To increase our understanding of the effects of topography and water stratification on circulation around the banks and the resulting energy subsidy to reef communities;

- To gather information on water quality to characterize environmental conditions (e.g., light, nutrients, temperature, flow, etc.) affecting the biota and larvae dispersal at the bank; and

- To assess pathways for potential oil and gas impacts on bank communities from adjacent shunting and surface discharge activities.

Methods: The study will conduct current and hydrographic measurements over two years at a selected bank using ADCPs and CTDs placed around the bank and supplemented with satellite-tracked drifter deployments upstream at the bank. Water quality parameters to be measured will include turbidity, pH, dissolved oxygen, photosynthetically active radiation (PAR, chlorophyll a, and others. Measurements during standard hydrographic cruises will include nutrients and selected pollutants. Sediment traps may be used to sample for immigrating contaminants. Tracer studies with rhodomine will also be conducted to reveal details of the flow-topography interaction.

The Flower Garden Banks are the largest banks with the shallowest crest and they support the most sensitive reef community in the northern GOM. A location at the Flower Garden Banks will be the selected site for the study.

Upon completion of the field work, analysis and data interpretation leading to a final report and perr-reviewed publications will follow. Additionally, it is expected that the database produced can assist with validation and calibration of numerical model of the shelf circulation.

Products: Synthesis Reports, Datasets, and Peer Reviewed Publications

Importance to BOEM: This study will shed light on circulation and environmental

conditions affecting reef organisms on sensitive habitats of the Gulf of Mexico (GOM) Outer Continental Shelf (OCS) and support management decisions regarding oil and gas activities near mid-shelf or shelf-edge banks. This study will evaluate the degree of entrainment of near bottom waters and sediments (with potential detrimental factors) onto the mixed layer where sensitive biological features are located. Results of this study will confirm the basic assumptions for shunting, shunting zones and No Activity Zones in use for the past 30+ years. It will also determine natural water quality conditions over time and throughout the water column for the first time at a selected bank. Questions about potential transport and origins of contaminants to reef communities can be answered.

Current Status: Field work has been completed and data analysis will start in full throttle. We are requesting a modification to add a non-hydrostatic modeling effort.

Final Report Due:	February 2013
Publications:	None
Affiliated WWW Sites:	None
Revised date:	December 2011
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