

STUDY TITLE: Physical/Biological Oceanographic Integration Workshop for the DeSoto Canyon and Adjacent Shelf

REPORT TITLE: Physical/Biological Oceanographic Integration Workshop for the DeSoto Canyon and Adjacent Shelf, October 19-21, 1999

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BACKGROUND: The U.S. Department of the Interior's Minerals Management Service (MMS) conducts all leasing and resource management functions on the Outer Continental Shelf. The MMS sponsors scientific research to effectively manage and protect the environment. While MMS has sponsored substantial oceanographic studies in the northeastern Gulf, demand for scientific information continues to be high. Recently completed, and ongoing, MMS studies in the Northeastern Gulf also suggest that more integration is needed between the biological and physical oceanographic disciplines.

From the perspective of information needs concerning any future OCS activities, the geographic area of interest for this workshop is defined as an area encompassing the western portion of the Florida panhandle westward into the Alabama and Mississippi and includes the DeSoto Canyon and adjacent areas going into deeper waters. This geographic area, of course, cannot be studied by itself, it must include the influences from coastal bays and estuaries, as well as the offshore currents including the Loop Current and eddies impinging on the continental shelf.

OBJECTIVES: 1) To synthesize physical, geological, chemical and biological oceanographic information of the DeSoto Canyon and adjacent shelf area; 2) Identify the critical components and processes which need to be delineated, measured and modeled in order to understand the important physical and biological phenomena that occur in the DeSoto Canyon and adjacent continental shelf region; 3) Identify significant knowledge and/or data gaps germane to these components and processes; and 4) formulate recommendations for research elements, based on the results from items 1) and 2).

DESCRIPTION: The Northeastern Gulf of Mexico continental shelf is an ecologically heterogeneous marine ecosystem. The shelf region is bounded onshore by a number of estuaries and bays acting as nutrient sources and serving as fertile nursery areas. Offshore, the DeSoto Canyon, an area serving as an important fisheries ground and upwelling site, dominates the shelf. The health of the shelf ecosystem depends on physical habitat, environmental and climatic factors, nutrient availability, and oceanographic processes. These physical processes link the biotic components of the ecosystem. Hydrographic and sedimentological information suggest an east-west change of water column nutrients and physico-chemical properties near Cape San Blas; however, the information available is not enough to elucidate and characterize this change. Ongoing oceanographic studies in this region will provide a comprehensive and synoptic data set that can help prove this transition or provide an alternative paradigm. Ongoing biological studies suggest a number of data gaps that need investigating. This includes levels of production, taxonomic and trophic structure of coastal and shelf communities, coupling between water column and benthic communities, impacts of freshwater on shelf ecosystems, impacts of catastrophic events, and status and trends in fisheries resources and management.

To assess our state of knowledge for the area and to address the issue of additional information needs, particularly that of the integration of any future data collection and analysis efforts, a workshop was sponsored by the MMS and co-hosted by The University of Alabama and the Dauphin Island Sea Lab. This workshop brought together experts who summarized what was known about the area; determined critical issues; and provided input to the design of an integrated physical and biological study.

SIGNIFICANT CONCLUSIONS: Study questions recommended by Working Group I: 1) Physical processes create or enhance biological anomalies. Can they be used to help find or forecast them? 2) Are the surface and bottom Ekman layers responsible for across-shelf transport of substances and/or larvae? 3) What is the relative importance of nutrient derived from terrigenous/riverine versus deepwater upwelling sources? Is the water chemistry of the shelf different than in deepwater? 4) Are there spatial and temporal differences in the trophodynamic (energy/food transfer) processes in the area of interest? 5) Are benthic habitats stable over space and time? 6) Are there specific areas that are consistently important for fish spawning and recruitment? Is there a relationship between the distribution of certain species and spawning? Can current patterns and water mass movement predict the distribution and abundance of fish

larvae? 7) Is there a relationship between sediments or current flow and fish species life history requirements such as essential fish habitat and recruitment? 8) Does primary and/or secondary production vary spatially and/or temporally? 9) What catastrophic phenomena occur in the area? Do these catastrophic phenomena (e.g., hurricanes) have the potential to impact fishes and benthic organisms? How important are these effects? 10) Can marine reserves serve as a useful tool in evaluating the impacts of activities in the area such as fishing and potential OCS activities? Do OCS activities significantly affect natural processes in the study area over some space and time scales? Are these effects localized, positive or negative?

Studies recommended by Working Group II: 1) Biological-Physical Processes East of the DeSoto Canyon Out to 500m. The first element of this proposed study is a comprehensive topographical survey of the sea floor to locate hard bottom sites using acoustic mapping techniques. The study would feature several cross-shelf transects of fixed moorings creating a mooring array, as well as oceanographic stations to gather biological and physical data. Seasonal changes in water quality and nutrients; variation in the megafauna of the hard bottom areas; and variation of the infauna at the soft bottom areas are key issues. The processes which need to be described are: local circulation, carbon fluxes, import/export of carbon, transport of nutrients between the shelf and deeper waters, fluxes of nutrients in response to upwelling and eddies, and impacts of storms on benthic- and water column-dwelling organisms. 2) Trophic Dynamics of a "Small" Site West of the DeSoto Canyon. The purpose of this study would be to couple biological and physical processes on a local scale. A small study site would be located between the 40 m isobath and the 100 m isobath on the western flank of the DeSoto. The area would include both a pinnacle and other low relief features along with the surrounding sand bottom. The site would be in a region previously studied and for which there are historical data. The research plan would require 2 current meters on a mooring to measure the circulation around a pinnacle. Stable isotope measurements would be made to assess trophic linkages between the water column and benthic organisms. 3) Biological-Physical Processes West of the DeSoto Canyon Down to 1000 m. This study plan is very similar to that of Recommendation 1 and would feature several cross-shelf transects of fixed moorings, that create a mooring array. Also oceanographic stations would gather biological and physical data such as seasonal changes in water quality and nutrients, variation in the megafauna of the hard bottom areas, and variation of the infauna at the soft bottom areas. These measurements would provide information on the local circulation, import/export of carbon, transport of nutrients between the shelf and deeper waters, and the fluxes of nutrients in response to the presence of upwelling, eddies, and Loop Current rings. Information on the impacts of storms on organisms within the water column and benthos could also be measured by means of the oceanographic stations. 4) Biological-Physical Processes in Eddy-Pairs. This study is to sample the periphery of eddy-pairs and observe the edge effects such as productivity, fish/larval transport, plankton, and recruit of marine mammals. It is designed as a response team effort that would go into action by the occurrence of an eddy pair over the slope as revealed by remote sensing. If an eddy pair is detected then shipboard measurements would be made to locate the edges of the eddies. No moorings would be used for this study.

Rather, shipboard sampling would be conducted as well as collection of visual and acoustic data for marine mammals. Aircraft would be used for physical measurement of the water column.

Studies recommended by Working Group III. 1) A study of the deep biology and its correlation with deep currents in the 181-Sale Area. In the deep, southern portion of the 181-Sale Area (approximately the regions deeper than 1000 m) it is known that the Loop Current and the rings it sheds exist there for many months of the year and for comparably long-duration periods they are absent. Do the Loop Current and its rings extend to the bottom? If so, how do the near-bottom biota respond to extended periods of a strong flow followed by comparable periods of quiescent flow? 2) A continental shelf – upper slope upwelling study. It is evident from several presentations that upwelling occurs frequently in the northern region of the study area. It is also evident from studies of upwelling in other regions of the world's oceans that high levels of biological activity are associated with upwelling events. The objectives of the study would be (1) to better understand the wind-induced upwelling in the region, and (2) to assess the effect the DeSoto Canyon has on enhancing upwelling and the associated increased biological activity.

STUDY RESULTS: The workshop included the following presentations: Marine Meteorology and Air-Sea Interaction Over the DeSoto Canyon and Adjacent Shelf - A Summary; Shelf Hydrography Over the Northeastern Gulf of Mexico; DeSoto Canyon Circulation and Exchange; Some Remarks About Currents on the Continental Shelf in Relation to Their Relevance to Cross-shelf Transport; Surface Sediments of the NW Florida Inner Continental Shelf: A Review of Previous Results, Assessment and Recommendations; Shelf Nutrient Chemistry - The Gulf of Mexico; Shelf Hard Bottom Habitats; Benthic Macroinfauna of the Northeastern Gulf of Mexico OCS, Near DeSoto Canyon; Northeastern Gulf of Mexico Coastal and Marine Ecosystem Program: Ecosystem Monitoring, Mississippi/Alabama Shelf; Introduction and Overview; Regional Fisheries; Ship and Satellite Studies of Mesoscale Circulation and of Zooplankton and Micronekton Stock in Sperm Whale Habitats in the NE Gulf of Mexico During GulfCet II; Estuaries and Coastal Habitats; and Linkages.

The members of each working group were asked to utilize the information syntheses provided by the speakers, combined with their own expertise, to: 1) identify the critical components and processes which need to be delineated, measured and modeled in order to understand the important physical and biological phenomena that occur in the DeSoto Canyon and adjacent continental shelf region; 2) identify significant knowledge and/or data gaps germane to these components and processes; and 3) formulate recommendations for research elements, based on the results from items 1) and 2). These discussions would then be used to assist MMS in designing an integrated physical and biological study to complete the *Northeastern Gulf of Mexico Physical Oceanography Program* and the *Northeastern Gulf of Mexico Coastal and Marine Ecosystem Program*.

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STUDY PRODUCTS: Schroeder, W. W. and C. F. Wood (Eds.) 2000. Physical/Biological Oceanographic Integration Workshop for the DeSoto Canyon and Adjacent Shelf: October 19-21, 1999. OCS Study MMS 2000-074. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. Contract No. 1435-10-99-CA-31035. 168 pp.

