NGOMEX 2006 - Spatially-explicit, High-resolution Mapping and Modeling to Quantify Hypoxia Effects on the Living Resources of the Northern Gulf of Mexico

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PROJECT SUMMARY

As a direct consequence of eutrophication, there has been an alarming increase in the spatial and temporal extent of low oxygen bottom waters in estuarine and coastal waters. Although hypoxia is prevalent in many US coastal systems, such as Chesapeake Bay and the Laurentian Great Lakes, most prominent has been the advancement of hypoxia in the northern Gulf of Mexico (NGOMEX).The temporal and spatial extent of hypoxia in the NGOMEX has increased as a result of excessive nitrogen inputs from the Mississippi River. Despite this increase in hypoxia, the trophic consequences of low oxygen waters on pelagic communities remain poorly understood. Given the economic importance of the Gulf of Mexico commercial fisheries (about 20% of the U.S.'s total domestic fishery landings representing about $991 million) and recreational fishing (generating ~30% of the nation's saltwater fishing expenditures and supporting nearly 25% of the nation's recreational saltwater jobs), it is imperative that knowledge of the ecosystem effects of hypoxia in NGOMEX be increased.

The objectives of the proposed research are to:

- conduct high-resolution mapping of the NGOMEX pelagic food web (including bacteria, phytoplankton, microzooplankton, mesozooplankton, and fish) in relation to hypoxia;
- integrate these ecosystem measurements through a variety of models designed to assess the effects of hypoxia on NGOMEX pelagic food webs and production;
- quantify habitat suitability for economically and economically important fishes; and
- provide tools to forecast food-web interactions, habitat suitability, and fish production in relation to hypoxia.

High-resolution mapping of the major ecosystem components of the NGOMEX will be conducted. Automation of sampling, analysis, and classification of pelagic organisms using new technologies offers a practical, cost-effective way to intensify survey efforts in the NGOMEX so that ecosystem components are sampled at the fine-scale and broad-scale resolutions necessary to understand the effects of hypoxia. This approach will yield information on phenomena that would have been missed by a fixed or bottom-focused sampling regime, and enhance the functionality of monitoring and observations. Mapping results will be incorporated into spatially explicit bioenergetics-based growth rate potential, size-spectrum, dynamic optimization, foodweb, and statistical models to provide managers with essential information for improved ecosystem-based management of the NGOMEX, including information to quantify and forecast the ecological consequences of changes in hypoxia on the living resources of the NGOMEX. The results of this research will be highly integrated into NOAA operations and strategic planning through direct

NOAA involvement, tightly integrated with other programs in the region and elsewhere, and broadly disseminated to resource managers and the scientific community through the WWW, presentations at meetings, Sea Grant Extension and peer-reviewed publications. Undergraduates, graduate students, postdoctoral scholars, and teacher interns will be involved in all aspects of this research.