Effects of hypoxia on harvest dynamics and economics of the shrimp fishery in the northwestern Gulf of Mexico

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Increasingly severe, seasonal hypoxia occurs on the northwestern Gulf of Mexico shelf during the height of the Gulf shrimp fishery, historically one of the most valuable single species fisheries in the US. However, the effects of hypoxia on the harvest dynamics and economic condition of the fishery are largely unknown. Managers want to known the effects of hypoxia on important and quantifiable aspects of the Gulf ecosystem, such as its ability to support fisheries, but these effects have not been studied directly to date. We hypothesize that hypoxia has substantial effects on the harvest dynamics and economic rents (i.e., profits) realized by the fishery and that these effects are mediated in part by the spatial dynamics of the fishery in response to large-scale hypoxia. Using a combination of retrospective analysis of historical data sets, targeted field efforts, econometric modeling, and quantitative policy evaluation we propose to address several research objectives designed to elucidate the effects of hypoxia on the shrimp fishery. The objectives of this proposal are to: (1) evaluate the effects of hypoxia on the spatial and temporal dynamics of shrimping effort and catch and the associated consequences for quantitative assessment models currently used to inform management of the fishery, (2) determine the spatial extent and nature of hypoxia effects on the spatial behavior and fishing activities of individual shrimp vessels, (3) quantify the economic consequences of hypoxia on the fishery using discrete choice models of fishing behavior, (4) identify the causal impact of hypoxia the economics of the fishery using quasi-experimental methods, and (5) develop a bioeconomic model of the shrimp fishery that can be used to assess the economic consequences of alternative nutrient and fishery management policies. This research will provide the first direct investigation of hypoxia effects on the harvest dynamics and economic condition of the Gulf shrimp fishery. By linking hypoxia directly to impacts on fisheries we help bridge the gap that has historically existing between those charged with managing nutrient loading to coastal watersheds and those charged with managing coastal fishery resources. This work will provide managers a means to evaluate the likely impacts of eutrophication and hypoxia on fisheries, the associated economic costs of habitat degradation, and the benefits of environmental policies to reduce nutrient pollution, thereby providing a quantifiable means to evaluate the 2008 Action Plan goal of reducing the spatial extent of hypoxia in the northwestern Gulf of Mexico.