Methods Development for a Spatially Explicit Population-Level Risk Assessment, Quantitative Uncertainty Analysis, and Comparison with Risk Quotient Approaches

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The standard framework of Ecological Risk Assessment (ERA) uses organism-level assessment endpoints to qualitatively determine the risk to populations. While organism-level toxicity data provide the pathway by which a species may be affected by a chemical stressor, they neither indicate the probability that an effect (i.e., reduced survival, reduced reproduction) will impact the population in a natural system, nor the magnitude of that impact. Population models have the potential to be used in risk characterization; however they are not applied in ERA because uncertainty analyses and minimum data requirements are unknown. To quantify uncertainties in risk estimation (e.g. confidence in parameter estimation), we will apply spatially explicit population models of the sheepshead minnow (*Cyprinodon variegatus*) in a case study risk assessment of the Deepwater Horizon Oil Spill in Barataria Bay, LA. Sediment samples were collected throughout Barataria Bay in the fall of 2010 and will provide an interpolated, quantitative layer of PAH exposure to estuarine organisms. We will conduct full life cycle sediment toxicity tests to obtain chronic dose response functions for the sheepshead minnow exposed to PAHs. Exposure and concentration response layers will be applied to a spatially-explicit, density dependent sheepshead minnow population model. We will conduct several levels of ERA of varying complexity, including a traditional ERA using standard risk quotient based approaches, a simple non-spatial population-level ERA, and spatial population-level ERAs of varying complexity. Uncertainty analyses of each ERA will identify the relationship between ERA complexity, uncertainty, and data requirements.