PROJECT SUMMARY

Project title: OA2015 Interactions between ocean acidification and eutrophication in estuaries: Modeling opportunities and limitations for shellfish restoration

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Requested Funding: $1,492,710 (science budget) $1,876,677 (science + ship budget)

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Abstract: Oyster populations have received widespread attention in recent years for a variety of compelling reasons, including their functional extinction in most coastal zones, significant federal, state and local initiatives for restoration, and the documented detrimental effects of acidification on aquaculture. The decline in oyster populations is also of interest because they provide the valuable ecosystem services of particle filtration and nutrient removal, thereby influencing the widespread coastal eutrophication problem. Of the many challenges to oyster restoration, ocean acidification has only recently emerged as a topic of interest in estuaries and coastal zones. This is in part due to the complexity of processes that influence carbonate chemistry across multiple temporal and spatial scales in these dynamic habitats, but also because eutrophication coupled with increasing atmospheric CO_2 results in additive acidification effects on carbonate chemistry. These barriers to restoration, combined with gaps in data on carbonate chemistry, limited understanding of organismal interactions with acidification, and future uncertainty in nutrient loads and climatic conditions, present a formidable research and management challenge. The objective of this project is to make significant strides in bridging the gap between scientific knowledge and current management needs by integrating existing biogeochemical model frameworks, field measurements, and experimental work toward the goals of (1) delineating atmospheric and eutrophication drivers of Chesapeake Bay acidification and improve our understanding of estuarine carbonate chemistry, (2) developing a spatially explicit framework to identify shellfish restoration areas most and least prone to acidification impacts, and (3) better understanding feedbacks associated with future environmental conditions and shellfish restoration goals estuary-wide and within a model tributary. This effort includes (1) a field campaign to make the first comprehensive study of the spatial and temporal variability in the carbonate system in Chesapeake Bay, (2) experiments to quantify *both* carbonate and nutrient exchange between intact oyster reefs and the surrounding water while measuring response of these fluxes to reef structure and acidification, and (3) an advancement in numerical modeling tools to simultaneously simulate the dynamics of eutrophication, hypoxia, carbonate chemistry, and oyster reef growth and interaction with the water-column under present and future conditions.