NOAA National Centers for Coastal Ocean Science, Financial Assistance Awards for Fiscal Year 2016

Coastal Hypoxia Research Program (CHRP)

Predicted Impacts of Climate Change on the Success of Alternative Management Actions in the Chesapeake Bay: Using Multiple Community Models in Support of Hypoxia Management Decision-Making

Applicant: Virginia Institute of Marine Science
Recommended Funding: $1,395,630
Award Length: 5 years

Coastal hypoxia is an increasingly critical stressor for living resources in the Chesapeake Bay, not only because of excess nutrient inputs derived from agriculture, sewage and storm water runoff, but also because of predicted increases in atmospheric temperatures and changes in precipitation patterns. Together, the combined effects of anthropogenic nutrient inputs and climate change are leading to one of society's major environmental challenges. In order to address this problem, water quality assessment and projection tools that can account for both climate and nutrient impacts must be developed and operationalized. This project will apply a trans-disciplinary approach to aid in the development of sustainable solutions for managing nutrient reduction in the face of a changing climate. The two overarching goals of the proposed work are to quantitatively predict: (1) the impacts of future changes in climate and anthropogenic nutrient inputs on the spatial and temporal extent of hypoxia in the Chesapeake Bay and (2) the impacts of climate change on the effectiveness of various alternative management actions designed to reduce hypoxia and improve water quality.

Partners: Environmental Protection Agency, Chesapeake Bay Program; United States Geological Survey, Chesapeake Bay Program; The Pennsylvania State University; School of Forestry and Wildlife Sciences, Auburn University; Old Dominion University.

Operational Lake Erie Hypoxia Forecasting for Public Water Systems Decision Support

Applicant: NOAA Great Lakes Environmental Research Laboratory
Recommended Funding: $1,542,314
Award Length: 5 years

In Lake Erie, it is common for strong water quality differences to exist between surface and bottom water during summer stratification. Weather-driven dynamics during stratification can cause water intakes to be alternately exposed to surface or bottom water, requiring public water systems to adapt treatment processes to changing raw water quality. Surface water has higher pH, and may have high concentrations of phytoplankton, dissolved organic matter, and algal toxins. In contrast, the bottom water is usually hypoxic, with a low pH and elevated iron

and manganese concentrations, requiring expensive treatment. To give public water systems advance warning of lake circulation events that are likely to cause changes in raw water quality the development of an operational dissolved oxygen forecast model for Lake Erie, coupled to an existing real-time, fine-scale hydrodynamic model is proposed. This coupled system will allow drinking water managers to prepare when conditions that promote hypoxic water movement into the vicinity of water intakes occur.

Partners: University of Michigan; City of Cleveland Division of Water; Purdue University

Ecological Effects of Sea Level Rise (EESLR) Program

Codevelopment of Modeling Tools to Manage Sediment for Sustainable and Resilient Coastal Lowland Habitat in Southern California

Applicant: University of California-Irvine
Recommended Funding: $1,150,000
Award Length: 4 years

The project will advance scientific, engineering and policy perspectives on the most fundamental Natural and Nature--based Feature (NNBF): sediment. In this project we will develop modeling tools to study the effect of sediment management practices on the resiliency and vulnerability of coastal communities and coastal wetlands under climate change scenarios projected through approximately 2100. Modeling tools will enable analysis of flood risk, instability and erosion risk, and habitat distributions afforded by alternative sediment management practices. We will also develop a framework to improve the characterization of extreme events (flood hazards) associated with multiple drivers, such as a combination of storm tides, streamflow, and precipitation. This important modeling challenge facing coastal areas has yet to be systematically addressed, and is a fundamental issue for analyzing and comparing alternative strategies to adapt coastal lowlands.

Partners: Southern California Coastal Water Research Project

Dynamic Sea Level Rise Assessments of the Ability of Natural and Nature-based Features to Mitigate Surge and Nuisance Flooding

Applicant: Louisiana State University
Recommended Funding: $1,200,000
Award Length: 4 years

Extensive transdisciplinary efforts since 2010 in the northern Gulf of Mexico (MS, AL, and the FL panhandle) have resulted in a capability to model the coastal dynamics of sea level rise and assess hydrodynamic and ecological impacts at the coastal land margin. The establishment of this paradigm shift (i.e., beyond “bathtub” approaches) was made possible, in no small part, by directly involving coastal resource managers at the initial stages and throughout the project process. Potential deleterious effects of sea level rise (SLR) to barrier islands, shorelines, dunes,

marshes, etc., are now better understood. The paradigm shift, input from coastal resource managers and future conditions provide a rationale to evaluate and quantify the ability of Natural and Nature-based Feature (NNBF) approaches to mitigate the present and future effects of surge and nuisance flooding.

The objectives for this transdisciplinary project are to: (1) refine, enhance, and extend the coupled dynamic, bio-geo-physical models of coastal morphology, tide, marsh, and surge; (2) advance the paradigm shift for SLR assessments by linking economic impact analysis and ecosystem services valuation directly to these coastal dynamics of SLR; (3) establish and engage a Management Transition Advisory Group (MTAG) throughout the entire project process; and (4) deliver our results via a flexible, multi-platform mechanism that allows for region-wide or place-based assessment of NNBFs.

Partners: Dauphin Island Sea Lab, University of Central Florida, University of South Carolina, Texas A&M University-Corpus Christi.

Marshes on the Margins: Developing Tidal Wetlands Adaptation Strategies in Southern California

Applicant: State Coastal Conservancy
Recommended Federal Funding: $989,472
Award Length: 4 years

The project will investigate how the dynamic estuarine systems of Southern California will be affected (physically and biologically) by sea level rise and will determine how and where nature-based solutions can be used to provide resilience to those effects. First, the project will integrate existing sea level rise and habitat evolution models to understand how the physical and habitat-level changes will occur with rising tides and associated storm events. The project will then develop various conceptual models of changing estuarine inlet dynamics to refine model outputs.

Storm Surge and Sea Level Rise on a Changing Landscape

Applicant: Louisiana State University
Recommended Funding: $100,000
Award Length: 1 year
Hampton Roads, Virginia, is rated second only to New Orleans as the most vulnerable area to relative sea level rise in the United States. Hampton Roads is home to the deepest water harbor on the U.S. East Coast, which hosts a robust shipbuilding and repair industry, a thriving export coal trade and the sixth largest containerized cargo complex in the United States, infrastructure currently at risk under current sea level rise scenarios. To address this issue and advance sea level rise/storm surge modeling, NOAA is participating in the Hampton Roads Sea Level Rise

Preparedness and Resiliency Intergovernmental "Pilot." The Hampton Roads Pilot project is coordinating activities to maximize the effectiveness of Federal, state, local government, university, and private sector activities. In support of the Pilot, NOAA National Ocean Service (NOS) has launched a suite of targeted projects that leverage agency capabilities and investments to meet the needs of stakeholders in the Hampton Roads Region. The purpose of the requested work is to collaborate with NOAA and its partners to transition and apply the Dynamic Surge tool to the Hampton Roads region to quantify the dynamic effects of sea level and projected landscape changes on storm surge. Results from this project will be centered on scenario projections of storm surge depth and extent under a suite of storm conditions, sea level rise rates, landscape changes, and possible management actions.
Partners: Northern Gulf Institute at Mississippi State University

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Gulf of Mexico Ecosystems and Hypoxia Assessment (NGOMEX) Program

User-Driven Tools to Predict and Assess Effects of Reduced Nutrients and Hypoxia on Living Resources in the Gulf of Mexico

Applicant: George Mason University
Recommended Funding: $900,000
Award Length: 3 years

Expansive hypoxia in the Northern Gulf of Mexico (NGOMEX) will continue to affect ecologically and economically important living resources, but the magnitude, predictability and even the direction of these changes remain elusive. Managers and stakeholders need readily available and quantitative tools to predict and evaluate the effects on living resources of planned nutrient reduction strategies aimed to minimize the hypoxic zone. We plan to develop user-friendly, management-scale relevant forecasting tools and quantitative indicators. We will also assess the minimum data needs (monitoring or modeling parameters, and time and space scales) to ensure these forecasts produce accurate and useful data required by managers and stakeholders. Previous work in the region by the P.I.s and colleagues resulted in three tested models and expansive datasets from seven cruises, which will be used to estimate effects of reduced nutrient inputs and hypoxic volume on living resources in the NGOMEX, and will form the basis of user-friendly tools to be transferred to resource managers. The coupling of two different fisheries modeling approaches (physiological-based and ecosystem-based) with the same 3D hydrodynamic/water quality model ensures that questions of varying levels of resolution can be addressed.

Partners: NMFS Mississippi Laboratories; Oregon State University; Dalhousie University; Ecopath International Initiative

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Using Linked Models to Predict the Impacts of Hypoxia on Gulf Coast Fisheries under Scenarios of Watershed and River Management

Applicant: Louisiana State University
Recommended Funding: $1,185,511
Award Length: 4 years

For this project a set of well-established models will be linked to quantify fish and shrimp population responses to various combinations of nutrient loadings and diversion operations, and to present the results so they directly inform management. There are a suite of models available related to hypoxia in the northern Gulf of Mexico (GOM). A next logical step in the modeling of hypoxia for the GOM to inform management is combine the various models to generate defensible quantitative effects of how watershed and river management actions would affect ecologically and economically important populations of fish and shellfish. This project will link the Dynamic Land Ecosystem Model (DLEM) for the watershed, Delft3D model for diversions, FVCOM-WASP for hydrodynamics and water quality, and fish and shrimp population models.

Synthesis and Integrated Modeling of Long-term Data Sets to Support Fisheries and Hypoxia Management in the Northern Gulf of Mexico

Applicant: North Carolina State University
Recommended Funding: $678,851
Award Length: 4 years

Over the past three decades, an enormous amount of data has been collected in the Northern Gulf of Mexico to study hypoxia and its impacts on coastal ecosystems and associated fisheries. These data have been collected by multiple governmental and academic institutions during monitoring cruises conducted at various spatial scales with frequencies ranging from bi-weekly to annually. While the individual data products from these cruises have been made available through scientific publications and online data repositories, there has been limited progress in synthesizing these data within a common analysis framework. The study will systematically integrate existing datasets using probabilistic, data-centric modeling approaches to more fully evaluate the spatiotemporal dynamics of hypoxia and to understand and forecast effects on fisheries and ecosystem impacts.

Partners: NOAA's National Marine Fisheries Service

Monitoring and Event Response for Harmful Algal Blooms (MERHAB) Program

An Early Warning System for *Pseudo-nitzschia* Harmful Algal Blooms on Pacific Northwest Outer-Coast Beaches

Applicant: University of Washington
Recommended Funding: $1,297,336
Award Length: 5 years

Blooms of some species of the diatom *Pseudo-nitzschia* produce a neurotoxin that accumulates in shellfish, which can cause illness and even death in humans who eat them. Shellfish managers monitor these toxins and close affected fisheries to protect public health, but these sudden closures can disrupt coastal economies. This project will result in developing a monitoring- and modeling-based forecast system for blooms of the diatom *Pseudo-nitzschia* and particulate domoic acid on beaches from Cape Flattery, Washington, to Heceta Head, Oregon.

Partners: NMFS Marine Biotoxins Program; Joint Institute for the Study of the Atmosphere and Ocean; Oregon Department of Fish and Wildlife; Olympic Region Harmful Algal Bloom (ORHAB) Program; Northwest Association of Networked Ocean Observing Systems (NANOOS); The Makah Tribe