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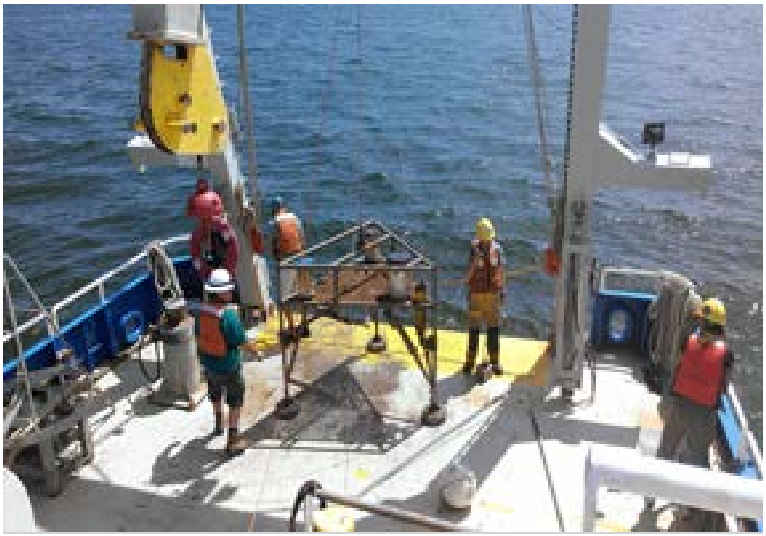

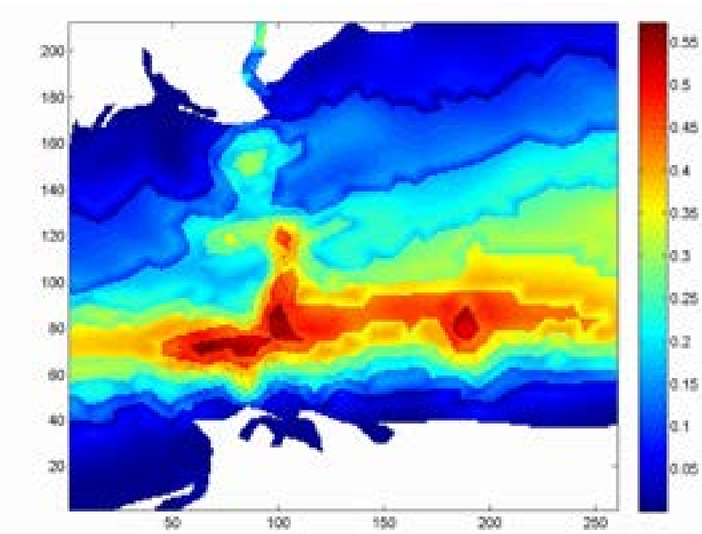

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(Left) INSTRUMENT RECOVERY from the *Research Vessel Connecticut*. The data collected will help researchers determine the bottom stress on the seafloor. (Right) MAP OF ESTIMATED maximum bottom stress in the Stratford Shoals region. Red areas show very high bottom stress, while blue areas indicate low bottom stress as measured in Newtons/square meter.

Characterizing the Physical Environment of Long Island Sound

Understanding and predicting the impacts of management actions on ecosystems requires an appreciation of the environment. Characterization of the benthic habitat is particularly important, since temperature, dissolved oxygen (DO), salinity, acidity, nutrient concentrations, turbidity, and light levels can affect how some species live and reproduce. Some of these parameters, and their correlation scales, have structure that varies with seasons. Bottom temperature and DO, for example, have annual cycles that are well established in the deeper areas of the Sound.

The physical stability of the seabed and the processes that control the exchange of materials into and out of the seafloor are also important to inform and understand habitat dynamics, so parameters like wave and current-induced bed stress, bottom roughness, and critical erosion shear stress are necessary complements to the sediment size and density maps. Bottom stress and the fate of materials, both suspended and dissolved, introduced to the Sound by riverine discharge and construction activities, are largely controlled by water movement (i.e., circulation and waves).

The central challenge of the Physical Environment component of the LIS Seafloor Mapping Program is to combine existing data with new observations to create user-friendly maps of these critical variables that can be easily used by planners, managers, and scientists.

Since we can't make measurements everywhere or hope to observe all possible conditions at a site over a short-term instrument deployment, we have developed a strategy that combines theoretical predictions with actual observations. We have developed a mathematical model that we are refining so that it is consistent with the observations we do have. We will then use it to predict distributions of the physical seabed stress in areas for where we don't have data. Our maps will then be consistent with our theoretical understanding of the processes that are operating and actual measured values.

The model, called FVCOM (Finite Volume Coastal Ocean Model), is a sophisticated three dimensional representation of the density, flow, and waves throughout the Sound and inner continental shelf off the east coast. For the pilot, we have determined preliminary estimates of the stress on the seafloor in the vicinity of Stratford Shoal. To put this into a common context, there are areas where bottom currents are moving at 50 centimeters per second (or just over 1 mile per hour). Even at this relatively low speed, the pressure these currents exert on sediments and organisms is roughly equivalent to what if feels like to put your hand outside the window of a car moving at 30 miles per hour.

INITIAL RESULTS show a reasonably robust fit between observations collected and modeled data used to characterize surface currents and maximum ebb and flow values. However, subsurface current models depicting stress near the seafloor itself have thus far shown greater variability between observed and predicted values.

Having this new understanding of the seafloor physical dynamics of the Sound and this evolving predictive capability, when combined with the new knowledge of the sediment and organism distribution, will provide new insights into how the Sound changes and reacts over time in the face of increasing physical disturbance.

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—James O'Donnell, PhD, is a Professor at the University of Connecticut