

## **Narragansett Bay Monitoring/Modeling Program**

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We envision a comprehensive program for Narragansett Bay that integrates an extensive monitoring program with essential modeling and education-apprenticeship components. Each of these components depends upon the others for a successful long-term program.

### **I. Monitoring**

At present the nutrients along the North-South axis of the Bay decrease exponentially from the Providence River to Rhode Island Sound. Parameters from primary production to clams also decrease down Bay with the controlling nutrient gradient. Thus the impact of decreased nutrients, as sewage treatment plants decrease their effluent nitrogen, can be forecast for phytoplankton, zooplankton and with less certainty for clams and larval fish. These forecasts will need to be verified with measures of secondary production for Narragansett Bay.

While the Bay Window program, and the Narragansett Bay Research Reserve and the Ports program will continue to provide buoy and monthly survey data of variables that are readily monitored by instruments (temperature, salinity, depth, oxygen, chlorophyll, and perhaps some nutrients), they will not address the most important biological and ecological responses of the bay to changing nutrient inputs - changes in the growth rates, sizes, and abundance of the animals in the Bay and adjacent RI coastal waters. This is a serious gap. We need now to design and implement programs to monitor these

slower response variables that are so important to the public, including zooplankton, bottom living invertebrates (polychaetes, amphipods, and bivalves - especially the quahog), and larval and juvenile fish. We must also keep our eyes on what is coming down the rivers into the Bay as the point discharges directly to the Bay change.

## **II. Modeling**

In moving towards a fuller understanding of marine ecosystems, there is a natural interplay that develops between observations and modeling. Modest, ongoing efforts already are providing important insights from physical data sets that have been recently collected within the Bay. Essential aspects of our vision for a combined modeling and observational effort are just now beginning, in pilot program mode, with continued funding from the Narragansett Bay Commission. This initial work will contribute to the development of a modeling tool for simulating, and eventually forecasting, physical aspects of the upper Bay/Providence River and represents an important first step towards development of an ecosystem model for Narragansett Bay.

The ultimate goal will be the design and implementation of a fully coupled, data-assimilating ecological-biogeochemical-physical model of the Bay. There are a number of extensive international efforts underway for developing just such a comprehensive modeling system, with GSO scientists leading one of the largest of those programs. The expertise exists, both locally and nationally, to leverage these significant efforts now for achieving our fundamental objectives for long-term monitoring and forecasting of the Bay.

### **III. Education/Apprenticeship**

A number of exciting opportunities exist for refining the graduate educational program at GSO towards something that more fully integrates interdisciplinary coastal ocean science while developing stronger ties to the Narragansett Bay Commission and other state agencies. Such a program would benefit both the state and GSO, and serve as a mechanism through which each might better achieve their management and research goals.