

Time Series Measurements of Temperature, Current Velocity, and Sediment Resuspension in Saginaw Bay

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Overview

The hydrodynamic model of Saginaw Bay being developed as part of the Multi-stress program requires current velocity and temperature data for calibration and verification. These measurements will be made as part of this project. Measurements of sediment resuspension during the spring are needed for the ecological models being constructed because suspended sediment may act as a source of nutrients to the lower food web, and because the presence of suspended sediment can limit the amount of light available to the biota in the bay.

Objective

Increase number of regional coastal and marine ecosystems delineated with approved indicators of ecological health and socioeconomic benefits that are monitored and understood.

Proposed Work

Acoustic doppler current profilers and thermistor strings were deployed at several locations in Saginaw Bay during the summer of 2008 (Fig. 1). An additional adcp will be deployed in the southern part of the bay in the spring of 2009 as part of the RECON program, and two additional adcps will also be available after they are retrieved from the Alpena area in early June. The adcps presently deployed in Saginaw Bay will be retrieved in July, serviced and redeployed along with the 2 additional adcps. Although these adcps provide good vertical coverage in deeper water (greater than 10 m), they are unsuitable for use in shallower areas. Since much of Saginaw Bay has water depths of 5 m or less, we propose to buy 2 additional adcps designed for use in shallow water. These will be deployed in July but, because of the danger of damage by ice in the winter, will be retrieved in October.



Figure 1: Location of adcps during 2009-2010.

We will deploy two of my tripods in April to monitor sediment resuspension in the bay during the spring. Measurements of sediment resuspension are important because sediments can transport nutrients needed by the lower food web, and because suspended sediment may limit the amount of light available to the biota in the bay. These two moorings will be retrieved in May. The instruments needed to make these measurements are already available but will need some repair and modification before they can be used.

Scientific Rationale

Saginaw Bay is a shallow, semi-enclosed, highly-stressed bay on the southwestern shore of Lake Huron. Average water depth in the inner bay is less than 6 m, and less than 15 m in the outer bay. Excess nutrient loadings, the presence of anthropogenic pollutants, and excess sedimentation have led to proliferation of nuisance algae, degradation of benthos, loss of fishery habitats, and declining fish and wildlife populations. These problems have resulted in the designation of the bay as an Area of Concern by the International Joint Commission. Last year, a multiple-PI group lead by Dr. Craig Stow at GLERL successfully proposed a research program to NOAA's Center for Sponsored Coastal Research to examine the impact of multiple stressors on the bay. The program (MultiStress 07 Adaptive Integrated Framework: a new methodology for managing impacts of multiple stressors in coastal ecosystems) includes the development of a set of numerical models that will be applied to the bay, and an observation program driven by the needs of the models to be developed. The models include a three-dimensional circulation model for the bay that will provide circulation patterns and residence times of materials in the bay, the temperature field, and the sediment resuspension potential of the bay's sediments. The outputs of this model will be used as input to the ecosystem models that will be developed.

Governmental/Societal Relevance

The MultiStress program directly address objectives and milestones in two of NOAA's ecosystem research areas: 1) the programs address the milestone 'increasing the number of ecological characterizations that meet management needs' in the performance objective 'increasing the number of regional coastal and marine ecosystems delineated with approved indicators of health and socioeconomic benefits that are monitored and understood,' and 2) the programs address the milestone 'define the primary forcing factors and time and space scales that affect water quality and quantity for selected ocean, coastal, and Great Lakes regions' in the performance objective 'increase number o coastal communities incorporating ecosystem and sustainable development principles into planning and management.' This particular part of the program will aid in the development of a hydrodynamic model of the bay by providing current and temperature data for model calibration and verification. Measurements of bottom resuspension during the spring will aid in the development of the ecological models by providing data on the magnitude, timing, and conditions necessary to resuspend the algae that make up the algal muck.

Relevance to Ecosystem Forecasting

The data collected will be used for calibration and verification of the ecosystem forecasts being developed for Saginaw Bay as part of the multi-stressor program.