International Field Years on Lake Erie (IFYLE) Program

A long-term goal of NOAA is to provide enhanced ecosystem forecasts that predict patterns of biological, physical, and chemical variables in response to natural and human-induced changes to the system (e.g., extreme natural events, climate change, land and resource use, pollution, invasive species, fisheries impacts), across a variety of spatial and temporal scales. These forecasts ultimately should benefit coastal communities, including the Great Lakes, by providing the foundation for 1) improved decision-making for resource stewardship, 2) mitigation of potentially hazardous human activities, 3) reduced impacts of natural hazards, 4) enhanced communication between scientists and managers, and overall, 5) more effective prioritization of science.

It is well recognized that water quality and ecosystem health issues persist within the Great Lakes that are of concern to the user community and researchers, and which remain a challenge to Great Lakes resource management. These include, but are not limited to, harmful algal blooms (HABs), reduced oxygen availability (hypoxia/anoxia), and exotic species, all of which have the potential to negatively influence food web dynamics, native biodiversity, and biological production (e.g., fisheries yield). Clearly, development of tools that provide reliable forecasts of the Great Lakes ecosystem and its chemical, biological, and physical subsystems would help resource agencies choose among potential management options.

To improve our ability to provide reliable ecosystem forecasts in the Great Lakes, the NOAA Great Lakes Environmental Research Laboratory has been working toward development of an integrated (multi-agency), multidisciplinary research program for Lake Erie that deals with important such management issues as harmful algal blooms, hypoxia/anoxia, and fish production. Four attributes make Lake Erie ideal for piloting the development of an ecosystem-forecasting framework. First, although Lake Erie is large, it is small relative to coastal marine systems and the other Great Lakes, so cost-effective, field sampling can be performed to test hypotheses over the entire Lake. Second, a wealth of historical monitoring and research data has been compiled for this system, which can be used immediately for model parameterization/calibration, validation, and ecological scenario testing. Third, several predictive physical models exist for Lake Erie (watershed-hydrology and hydrodynamics models). Finally, a large research and policy infrastructure (e.g., Lake Erie Millennium Group, Lake Erie Lakewide Management Plan) already exists, which will facilitate our effort to develop truly integrative, multidisciplinary programs aimed at conducting the needed research for ecosystem forecasting.

This effort to develop a large-scale, integrative research program on Lake Erie was began this past winter with NOAA Ship Support to charter one or more large research vessels. In turn, the International Field Years on Lake Erie (IFYLE) program was initiated. This program derives largely from research hypotheses, ideas, and needs generated at a large, international Lake Erie Science Planning Workshop, hosted by NOAA-GLERL on March 4-5, 2004, which discussed three important issues: 1) anoxia/hypoxia, 2) HABs, and 3) coupling physics with forecasts of fish production. A description of this workshop's goals and accomplishments can be found at http://www.glerl.noaa.gov/rsch/erie/workshops/workshop_final2004.pdf). More specifically, the three primary objectives of the IFYLE program are to:

1. Quantify the spatial extent of hypoxia across the lake, and gather information that can help forecast its timing, duration, and extent;
2. Assess the ecological consequences of hypoxia to the Lake Erie food web, including phytoplankton, bacteria, microzooplankton, mesozooplankton, and fish;
3. Identify factors that control the timing, extent, and duration of HAB (including toxin) formation in Lake Erie, as well as enhance our ability to use remote sensing as a tool to rapidly map HAB distributions in the lake.

The IFYLE program has become the largest international, multidisciplinary research effort of its kind in Lake Erie's history, costing ~$5 million and involving ~ 40 scientists from NOAA, academia, and private institutions throughout North America, Canada, and Europe. This program can truly be considered integrative, given involvement by numerous US and Canadian universities and federal, state, and provincial agencies, and serves as an example of how NOAA and other federal agencies are fulfilling the Presidential Executive Order (#13340) to execute the Great Lakes Regional Collaboration among agencies. Vessel support comes primarily from NOAA Ship Support, US EPA-Great Lakes National Program Office, and NOAA-GLERL, whereas funds for external researchers were provided by the National Sea Grant College Program and the Ohio and New York Sea Grant

College programs. Environment Canada deployed several moorings to collect physical data in collaboration with this program, while the US Army Corps of Engineers provided continued dock space for NOAA vessels. In addition, the project has been offered in-kind support (e.g., historical data, technical assistance with aging fish, vessel support) from all of the state and provincial fishery management agencies on the lake, including the Ohio Department of Natural Resources, the New York State Department of Environmental Conservation, the Michigan Department of Natural Resources, the Pennsylvania Fish and Boat Commission, and the Ontario Ministry of Natural Resources.

The 2005 field program centered on determining the factors driving the distribution of oxygen concentrations in Lake Erie (Figure 1) and the consequences of low oxygen on the abundances and distributions of fish and their prey. The remainder of 2005 and all of 2006 were devoted to sample processing, data analysis, testing and refining hypotheses, and building models that can be used for both understanding and forecasting purposes. During 2007, we expect to conduct another intensive field season, with more focused sampling objectives.

For more information on the IFYLE program can be found at http://www.glerl.noaa.gov/ifyle/, or by contacting Dr. Stuart A. Ludsin (Stuart.Ludsin@noaa.gov) or Dr Stephen B. Brandt (Stephen.B.Brandt@noaa.gov), co-coordinators of the IFYLE program.

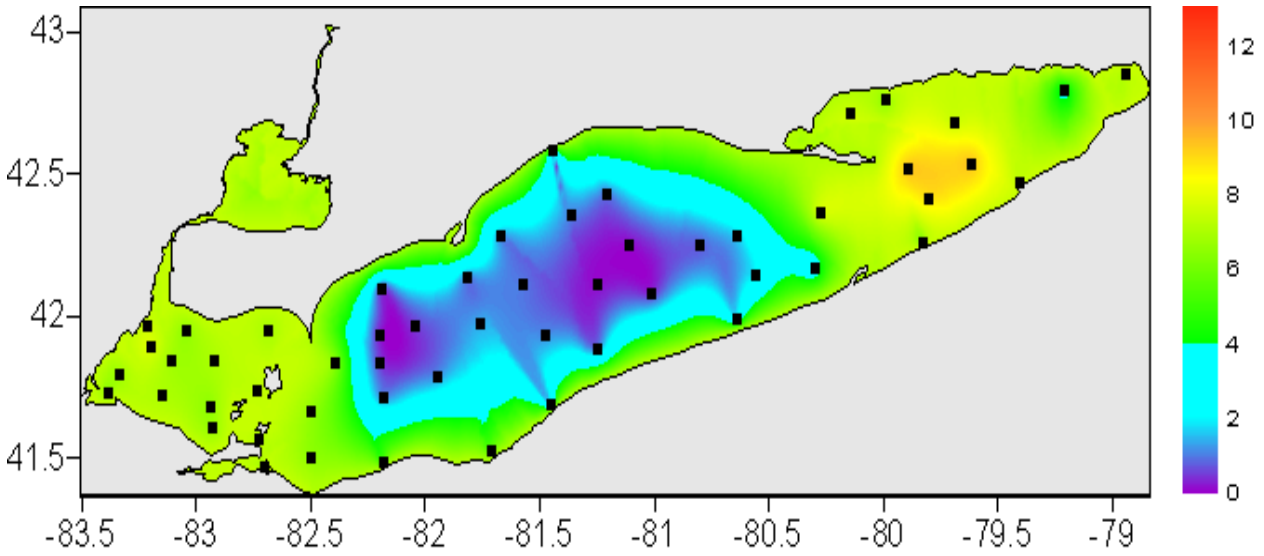

Figure 1. Preliminary estimation of dissolved oxygen concentrations (mg/l) in Lake Erie during September 7-11, 2005. Sampling stations are denoted with black dots. Note the large area of bottom hypoxia (i.e., dissolved oxygen levels < 4 mg/l) in the central basin, which can be stressful to fish. The thickness of this low-oxygen layer ranged from 1 to 7 m above the lake bottom (surface waters had sufficient oxygen). Data were collected as part of the IFYLE program, coordinated by scientists at NOAA's Great Lakes Environmental Research Laboratory (GLERL) in Ann Arbor, Michigan. This figure is not to be used without the permission of Stuart Ludsin (Stuart.Ludsin@noaa.gov) or Tom Johengen (Tom.Johengen@noaa.gov).