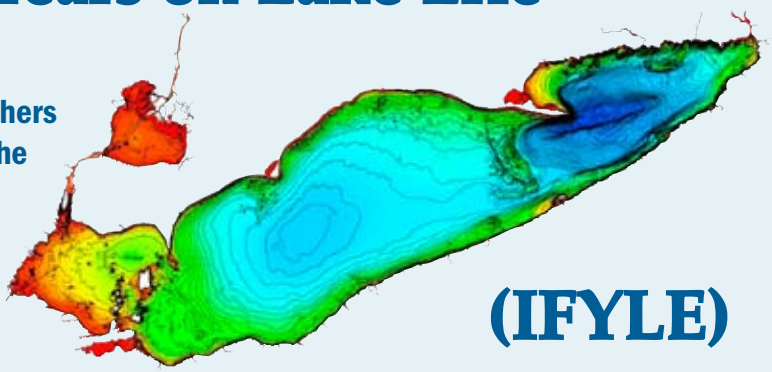
International Field Years on Lake Erie

NOAA's Great Lakes Environmental Research Laboratory (GLERL) in collaboration with researchers from the U.S. and Canada have initiated one of the largest, most comprehensive Lake Erie research field programs ever conducted. The project, the International Field Years on Lake Erie (IFYLE), began in May 2005, with a focus on hypoxia and harmful algal blooms.



(IFYLE)

Introduction

Water quality and ecosystem health issues persist within the Great Lakes and are of concern to the user community, managers, and researchers. 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).

One of NOAA's long-term goals is to provide enhanced ecosystem forecasts to 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 will 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 (5) more effective prioritization of science.

A Focus on Lake Erie

The Lake Erie ecosystem faces wide and varied threats to its health and integrity, including harmful algal blooms (HABs) in the west basin, recurring low oxygen episodes ("dead zones") in the central basin, and invasive species. Each of these threats has the potential to disrupt normal food web and ecosystem processes, and in turn, jeopardize the ability of Lake Erie to provide valued ecosystem services (e.g., recreational and commercial fish production, safe drinking water, and clean, bacteria-free beaches).

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 (e.g., watershed-hydrology and hydrodynamics models). Finally, a large research and policy infrastructure (e.g., Lake Erie Millennium Network, Lake Erie Lakewide Management Plan, and Lake Erie Committee) already exists, which will facilitate NOAA's effort to develop truly integrative, multidisciplinary programs aimed at conducting the needed research for ecosystem forecasting.

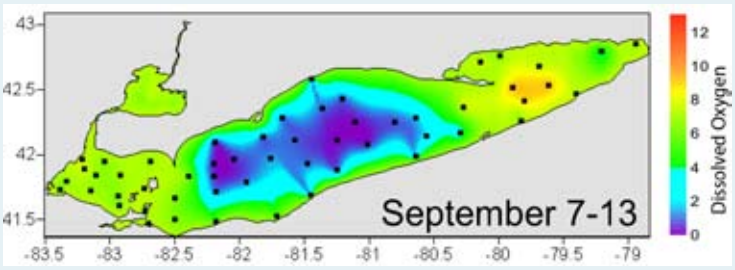
What are IFYLE's Key Goals?

The science priorities are based upon years of planning by NOAA GLERL and Great Lakes scientists throughout the region. The general goals of this research are to examine the causes and consequences of low-oxygen events and harmful algal bloom formations (HABs) in Lake Erie. The ultimate application of this research is to increase our understanding of anoxia and HABs, which can then be used to develop forecast tools that can aid decision-making processes. More specifically, IFYLE program goals are to:

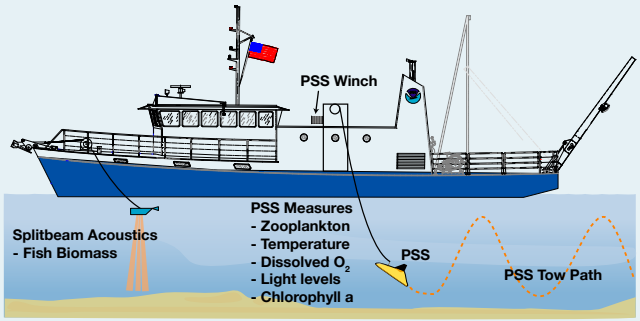
1. Quantify the spatial extent of hypoxia across the lake, and gather information that can help forecast its timing, duration, and extent;
2. Assess the ecological consequences of hypoxia to the Lake Erie food web, including phytoplankton, bacteria, microzooplankton, mesozooplankton, and fish;
3. Identify 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.

Research & Results

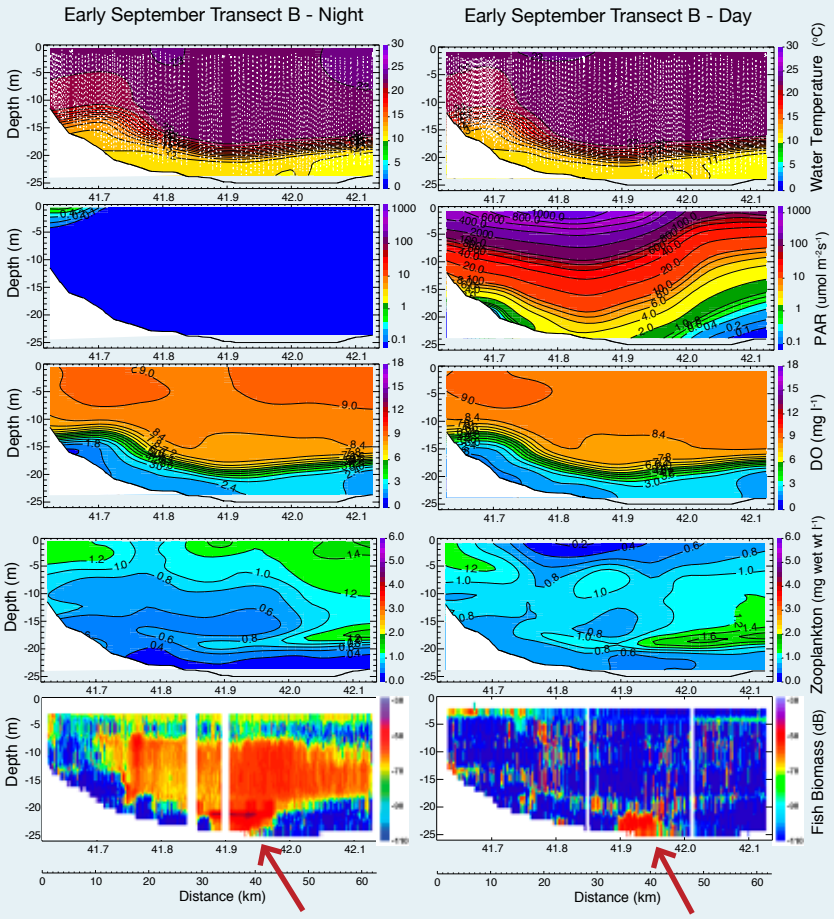
The IFYLE program field sampling occurrs from May to September using a number of research vessels and more than a dozen observational buoys. Sampling focuses on physical processes and the entire food web, from microbes and phytoplankton on up to the highest fish predators. Understanding how hypoxia can influence fish and zooplankton is difficult, however, with the advent of new technologies, such as a Plankton Survey System (PSS) and fish acoustics, we now have the tools needed to shed insight into this arena.



Dissolved oxygen concentrations (mg/l) in Lake Erie during September. 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.



We use these new technologies to determine how the distribution of phytoplankton, zooplankton, and fish varies vertically and horizontally in relation to oxygen concentrations. Measurements taken during both the day and night in the hypoxic zone in the central basin of Lake Erie revealed that fish like smelt and perch were found in a small area in the bottom waters (see arrows on figure at right) of highest dissolved oxygen concentration, but not in adjacent areas where dissolved oxygen was less than 2.4 mg/L. This compression of fish into a limited area depletes their food resources and possibly makes them more vulnerable to predation by big fish like walleyes if they too move into the same area.



Vanderploeg et al. (in review).

Who is Involved?

The IFYLE program has become the largest international, multidisciplinary research effort of its kind in Lake Erie's history, involving scientists from NOAA, 17 different universities, and private institutions spread across 7 states and 4 countries. 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, Pennsylvania, and New York Sea Grant College programs. Environment Canada deployed several moorings to collect physical data, while the US Army Corps of Engineers provided dock space for vessels. In addition, the project has been offered in-kind support (e.g., historical data, technical assistance, 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.

For more information about the IFYLE program:

http://www.glerl.noaa.gov/ifyle

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