

## Lake Erie Nutrient Research and Monitoring Summary

There are currently over 500 monitoring and research projects underway within the Lake Erie basin, with numerous others planned or are going through the planning process. Of these projects, approximately 70, or 14%, deal directly or indirectly with nutrient levels within the lake and surrounding areas.

18 of these programs directly state continued nutrient monitoring activities within their descriptions. Of these, eight are conducted by Environment Canada, with 3 focusing on the open waters of Lake Erie (Great Lakes Surveillance Program, Open Lake Surveillance, Open Lake Nutrient Assessment), 2 on nutrient loads coming into the lake (Wet Deposition of Nutrients and Major Ions (GLPN), Detroit River Upstream/Downstream Monitoring), 1 focusing on nutrients leaving the lake (Lake Erie Exit Loadings of Chemical Parameters), with the final 2 dealing with agriculture and non-point source nutrient loading (Agricultural Non-point Sources of Pollution, Nutrient Control in Agriculture by Best Management Practices).

5 additional projects deal with tributary (river/stream) nutrient loading (Tributary Priority Pollutants Monitoring, Provincial (Stream) Water Quality Monitoring Network (PWQMN), Tributary Loadings of Chemical Parameters, Annual Loads and Flow-weighted Mean Concentration Measurements as Raw Materials for the Lake Erie Quality Index, Sediment and Nutrient Concentrations in the River Basin) two of which are being conducted by the Ontario Ministry of the Environment, and the other three by the Water Quality Laboratory at Heidelberg College. Heidelberg College is also doing nutrient assessments in coastal wetlands throughout Lake Erie; one project (Coastal Wetlands: Ability to Trap Non-point Source Pollutants) aims at monitoring pollutants which include sediments, nutrients, and pesticides, while another research project, "An Ecosystem Approach to Lake Erie Coastal Wetlands: Sediment, Nutrients, and Pesticide Budgets," is aimed at modeling the role of wetlands as sinks, transformers and/or sources of sediment, nutrients, pesticides and other pollutants.

The United States also has an "Open Lake Surveillance" program which monitors nutrients, and is conducted by the U.S. Environmental Protection Agency. Additionally, the Ohio EPA has a sediment program (Ohio Sediment Inventory), which studies metals, industrial contaminants, and nutrients within Lake Erie.

Additional monitoring programs are also set up throughout the basin to study overall water quality, which may be related to nutrient levels within the watershed. Canada currently has four projects underway; "St. Clair Water Quality Monitoring Program" (Environment Canada), "St. Clair and Detroit River Water Quality Monitoring Program" (Environment Canada), "Corridor Water Quality Monitoring" (Environment Canada), and "Nearshore monitoring and assessment" (Ontario Ministry of the Environment). Ohio Lake Management Society's current monitoring program is the "Citizen Lake Awareness and Monitoring (CLAM)" while Ohio Environmental Protection Agency also has a "Statewide Biological and Water Quality Monitoring & Assessment." New York

and Michigan also have similar water quality monitoring programs set up: the "Water Quantity Management" project and "Michigan Water Quality Standards" respectively.

In addition to monitoring of nutrients, several research projects are also underway within the Lake Erie watershed. Kent State University is currently working on a project entitled, "Field and Laboratory Tests of the Microbial Shunt Hypothesis of Phosphorus Availability in the Great Lakes" which is trying to test the Microbial Shunt Hypothesis of P-Availability (MSH) under a wide range of field conditions in Lake Erie and other of the Laurentian Great Lakes. The U.S. EPA is also working on a "Lake Erie Eutrophication Modeling" project.

Point source and non-point source pollution is another issue when considering nutrient loadings into the lakes and at least four projects are currently listed in the available databases: "Clean Water Regulation (MISA) Monitoring Data Ontario Point Sources" (Ontario Ministry of the Environment), "Coastal Nonpoint Pollution Control Program" (Ohio Department of Natural Resources); "Coastal Nonpoint Pollution Program (CNPP)" (Pennsylvania State Government); and the "Duck and Otter Creeks Partnership Inc." (University of Toledo) which is looking at Duck and Otter Creeks which are two small streams within the larger Maumee Area of Concern, both impacted by both point source and non-point source pollution.

In addition to the projects that directly monitor nutrient concentrations in the lake, extrapolating data from other monitoring projects currently underway can also provide added information on nutrient levels. While other factors affect the populations of plants and animals in the lake, nutrients are another factor that must be considered. As such, by monitoring plants (phytoplankton and algae) and animals (dreissenids) some insight into nutrient levels can be obtained. There are three projects that are dealing with plankton; "Plankton Program" (U.S. Environmental Protection Agency), "Monitoring and Event Response for Harmful Algal Blooms" (SUNY - State University of New York) and a research project, "Significance of Dissolved Organic Phosphorus Compounds to Plankton Communities Developing in Sandusky Bay" being conducted by Kent State University. SUNY is similarly doing a monitoring project on toxic cyanobacteria, "MERHAB - Tier-Based Monitoring of Toxic Cyanobacteria in the Lower Great Lakes." There are also 18 research or monitoring projects underway dealing with Lake Erie Dreissenids, including projects such as: "Effects of Zebra Mussels (Sub-project to Open Lake Nutrient Assessment)" (Environment Canada); "Growth and Filtering Rates of Dreissenids in Western Lake Erie" (National Oceanic and Atmospheric Administration); "Dreissena Abundance, Biomass, and Physiological Condition in the Western Basin of Lake Erie" (National Oceanic and Atmospheric Administration); "The Role of Zebra Mussels in Promoting Microcystis Blooms and Other Ecosystem Changes in Saginaw Bay and in Lake Erie" (National Oceanic and Atmospheric Administration); "Molecular Characterization of Microbial Populations Associated With Zebra Mussels in the Great Lakes" (University of Toledo); and "Pennsylvania Zebra Mussel Monitoring Network" (Pennsylvania Department of Environmental Protection.)

Increased levels of primary production have another deleterious affect on Lake Erie: hypoxia within the central basin. The U.S. EPA currently has two programs underway which relate to this issue; the ongoing "Lake Erie Dissolved Oxygen Depletion" program and the more recently started "Lake Erie 'Dead Zone'" which is aiming to determine the cause of the oxygen depletion in Central Lake Erie. In 2006 the National Oceanic and Atmospheric Administration began an Ecological Forecasting project, "Ecological Forecasting (ECOFORE 2006): Hypoxia in Assessment in Lake Erie" which is aiming to better understand and forecast the exact conditions that lead to a hypoxic state. Also, in 2006 the University of Michigan began a research project "Forecasting the Cause, Consequences, and Potential Solutions for Hypoxia in Lake Erie" which will create, test and apply models to forecast how anthropogenic and natural stresses influence hypoxia formation and ecology, with emphasis on fish production potential.

While U.S. water quality reports for drinking water only monitor water leaving the treatment plants (in the process of being changed), Canada tests both water entering and leaving the treatment plants. Several nutrients (phosphates, nitrites, nitrates) are routinely measured and can provide additional information about the water quality of the lake. While all treatment facilities are required to put out such a report, three monitoring programs have also been set up: "Drinking Water Reporting System" (Pennsylvania Department of Environmental Protection), "Drinking Water Supply Program, Well Protection and Education Code" (Oakland County), and "Drinking Water Surveillance Program (DWSP)" (Ontario Ministry of the Environment).

Additionally, there are two projects which are aimed at reducing sediment pollution and runoff from agricultural lands, which would decrease the overall nutrient loading from these sources: "Lake Erie Conservation Reserve Enhancement Program (CREP)" (Ohio Department of Natural Resources), "Ohio Lake Erie Buffer Program" (U.S. Department of Agriculture).

The U.S. EPA, in conjunction with Purdue University, Michigan State University, and the U.S. Geological Survey, has also created or applied a wide range of geographic information and decision support tools which together have unique capabilities in assessing the overall environmental situations; prioritizing problems, sites and responses; and examining the relations and connections between multiple watersheds and multiple variables, such as stressors. These tools are part of the "Vision into Decision: Western Lake Erie, the Maumee Basin, and the Decision Support Tools of the Midwest Spatial Decision Support System Partnership."

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