

# LAKE MICHIGAN GENOME PROJECT

**PROJECT SUMMARY** 

## WHAT IS THE LAKE MICHIGAN GENOME PROJECT?

Inspired by the Human Genome Project and work being done in marine systems, the Lake Michigan Genome Project is a project of the University of Wisconsin-Milwaukee (UWM) School of Freshwater Sciences to select ecologically and/or culturally important Lake Michigan species, sequence their DNA at the UWM Great Lakes Genomics Center, provide analysis to map each organism's genome, and make data available through publication. In this first phase the school will work on three species that can benefit immediately from genomics data, including Yellow Perch and the Green Bay Mayfly. A third species—possibly Lake Whitefish, Lake Trout, Northern Pike or Muskellunge—will be selected based on input from partners.

The long-term goal of the project is to develop a library of whole genome sequences of Lake Michigan species and to make this information available to scientists and water managers doing work in ecosystem management, fisheries management, and gene expression as an indicator of lake health.

### HOW DOES IT WORK?

Genes control an organism's response to its environment — how it grows, reproduces, fights disease, interacts with other organisms, and responds to external stresses. In fact, all sorts of environmental conditions will cause an organism's genetic machinery to react in very specific ways. If one imagines an organism having a control room full of switches that turn on and off in very specific sequences to respond to exposure to disease, contaminants, food and nutrition, and other things in its environment, you start to get an idea of how genes and gene expression work.

By decoding what these switches are and how they function — in other words, an organism's genetic makeup and expression — we can determine how an organism reacts to its environment and why. This enables us to understand the true linkages among human activities, environmental conditions, and ecosystem response, as well as natural conditions affecting the organism, and subsequently to take appropriate action to manage the Lake Michigan ecosystem in support of better health, wealth, and quality of life for people in the Great Lakes region.

### WHY IS THIS WORK IMPORTANT?

According to a 2011 report by the Michigan Sea Grant program, the Great Lakes support 1.51 million American jobs, including 173,969 jobs in Wisconsin and 380,786 in Illinois. On the flip side, a 2012 study by the U.S. Army Corps of Engineers found that the Lake Michigan commercial fishing harvest declined steadily in recent decades, from almost 18 million pounds of fish worth approximately \$31 million in 1992 to 6 million pounds of fish worth \$10 million in 2009. Making informed decisions about the management and protection of valuable natural resources is critical to our regional economic prosperity and the health and quality of life of residents in the Great Lakes states.

The ability to "map the genome of the ecosystem" opens avenues of research central to all phases of freshwater protection and management — measuring biodiversity and ecosystem health; managing sustainable supplies of clean, fresh water for human consumption and recreation; developing more efficient tools for monitoring, treating, and reclaiming water; and mitigating the impacts of pollution, climate change, urbanization, and other stressors.

The implications of the Lake Michigan Genome Project and UWM's work to map the genomes of individual species will impact our scientific understanding of Lake Michigan for decades, in much the same way the Human Genome Project has revolutionized human medicine and medical research. For each species whose genome we map, we open entirely new avenues of research for that species and others like it. The Lake Michigan Genome Project will provide a foundational set of tools for future studies by scientists at the UWM School of Freshwater Sciences and across the Great Lakes. They will be able to cite these genetic maps and build upon this research. We expect the following work to be made possible by the Lake Michigan Genome Project:

- Ecosystem management, including development of environmental DNA markers to detect and monitor rare species and genetic information that will aid in tracking and understanding the health of populations and biodiversity;
- **Fisheries management**, including studies that look at how genetics play a role in the success of species, sensitivity of species to environmental change, and information that can inform aquaculture;
- Gene expression as an indicator of lake health, including how contaminants impact aquatic organisms and the creation of tools that allow indicator species to be used to warn when lake health is at risk.

### HOW IS THE PROJECT BEING FUNDED?

The Fund for Lake Michigan is providing a \$100,000 grant to underwrite DNA sequencing and analysis for the three pilot species. A smaller grant from the U.S. Department of Agriculture also will support part of the project, and UWM is providing almost \$70,000 of in-kind support.

Since 2012, the Fund for Lake Michigan has supported more than \$1 million worth of research and other projects at the UWM School of Freshwater Sciences aimed at improving water quality and habitat conditions in Lake Michigan. It was a primary funder of the Great Lakes Genomics Center's DNA sequencing lab.

### WHOM SHOULD I CONTACT IF I WANT TO LEARN MORE?

Rebecca Klaper, a professor in the UWM School of Freshwater Sciences and director of the Great Lakes Genomics Center, is the lead investigator on the Lake Michigan Genome Project. She can be reached at <u>rklakper@uwm.edu</u> or 414-382-1713. Media may also contact Michelle Johnson, director of Media Services for UWM, at <u>john3453@uwm.edu</u> or 414-229-7490.