CSMI 2015

Lake Michigan Cooperative Science and Monitoring Initiative

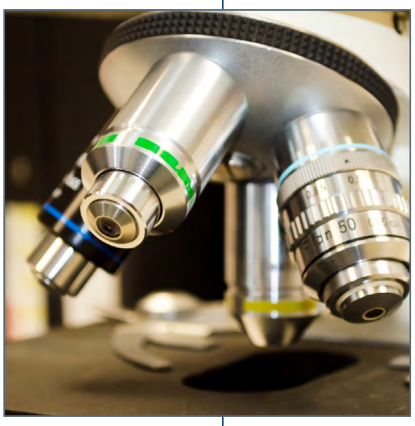
2015

The Cooperative Science and Monitoring Initiative (CSMI) is a binational effort that coordinates monitoring and research efforts on each Great Lake over a five-year cycle to improve understanding of aquatic ecosystems. CSMI field sampling is guided by priorities identified in Lakewide Action and Management Plans (LaMPs) and the results inform the development of future management programs.

The 2015 CSMI will coordinate a system-wide investigation of the links between Lake Michigan nearshore and offshore habitats. This will address a key knowledge gap identified by the Lake Michigan LaMP and the fishery management community: understanding the distribution and abundance of nutrients and biota such as invertebrates and fish across a nearshore to offshore gradient. The results will facilitate the development of the nearshore strategy called for in the 2012 Great Lakes Water Quality Agreement.

Illinois-Indiana Sea Grant hopes to provide regular updates on the progress of the 2015 CSMI effort through 2016. Although these will not deliver scientific results commensurate with a peer-reviewed publication, our goal is to provide updates on sampling progress and the key scientific questions being addressed.

We encourage interested stakeholders to contact Paris Collingsworth at pcolling@purdue.edu with feedback on the kinds of information they want reported.



Planned CSMI Efforts

U.S. Geological Survey Great Lakes Science Center

USGS will conduct sampling along eight nearshore-to-offshore transects in accordance with a sampling design that emphasizes broader spatial coverage. This is in response to CSMI research in 2010 that sampled two transects with high temporal frequency. Water, plankton, and fish will be sampled seasonally (spring, summer, autumn) at bottom depths of 18, 46, and more than 100 meters at each transect. The transects vary in their proximity to tributary inputs of phosphorus—ranging from adjacent to high-loading tributaries, such as the St. Joseph River, to adjacent to no tributaries, such as offshore of Arcadia, MI. The hypothesis is that transects near high-loading tributaries will support the highest biomass of plankton and fish nearshore.

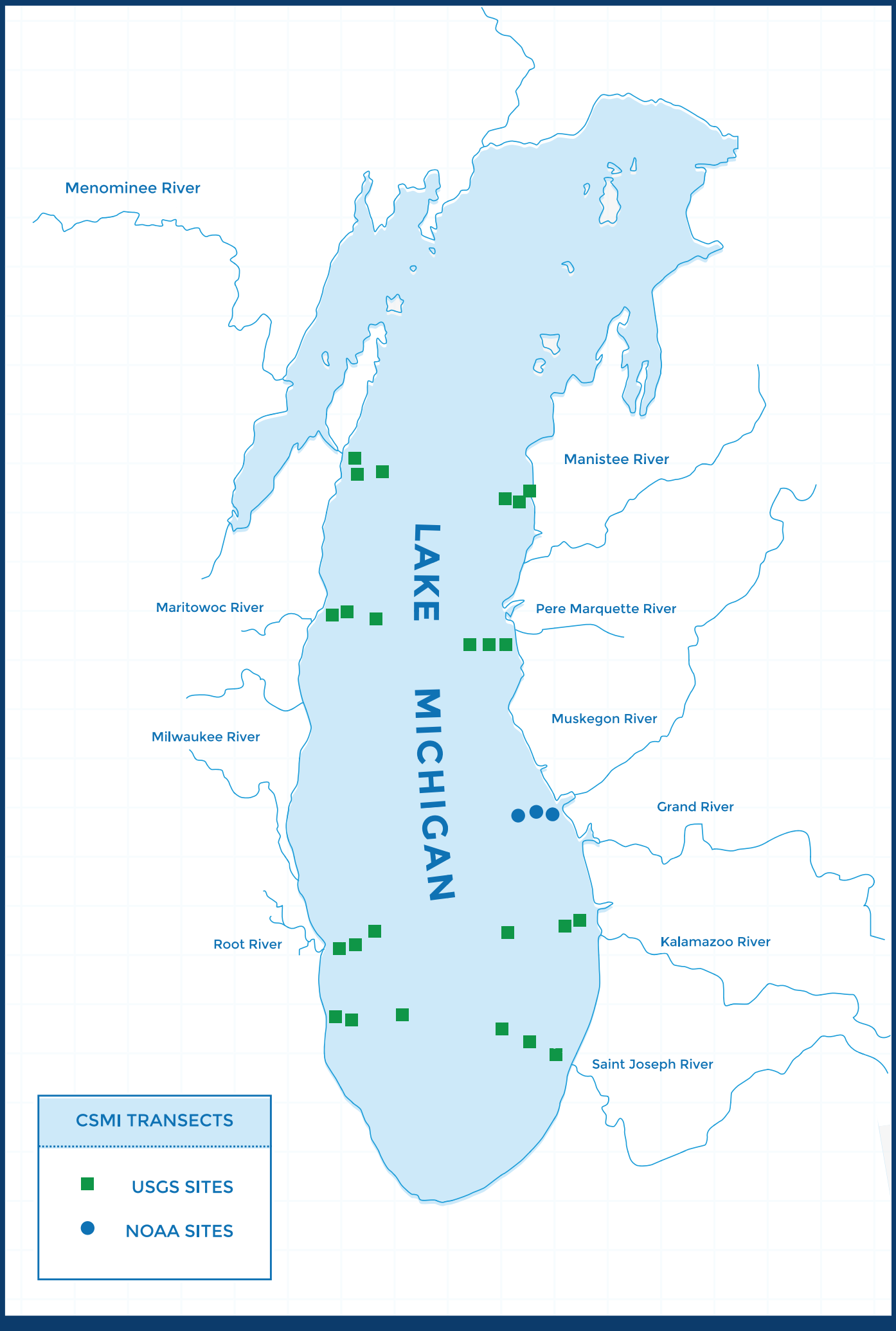
USGS is also coordinating with universities and other agencies to describe biota in areas shallower or deeper than our sampling design, as well as the densities of microbes and benthic macroinvertebrates.

Beyond estimating biomass, USGS will compare the physiological condition of common planktivorous forage fishes and conduct size-spectrum modeling to predict the lake-wide biomass of fishes. Finally, transect and size-spectrum data collected from Lake Michigan will be compared to data collected from the other Great Lakes during their respective CSMI years. These efforts will improve understanding of the food web linkages between nearshore and offshore.

National Oceanic and Atmospheric Administration Great Lakes Environmental Research Laboratory (GLERL)

GLERL will examine the spatial coupling of nutrients and the entire food web—microbes to fishes— during 24-hour sampling at monthly intervals from April to September along a 30-km inshore-to-offshore transect near Muskegon, MI. A variety of technologies will be used, including a plankton survey system (V-fin with CTD, fluorometer, laser optical plankton counter, PAR, CDOM, and turbidity sensors) and fishery acoustics to map fine-scale vertical distributions of temperature, chlorophyll, light, turbidity, zooplankton, and fish abundance along the transect. Fish trawls will be done to characterize signals from acoustics and define fish diets. Water samples will be taken at points along the transect for nutrient analysis and microbial food web characterization using microcopy and genetic methods. These efforts will be augmented with one or two glider missions from Muskegon to Milwaukee to characterize the cross-lake chlorophyll and thermal structure. The collected data will provide insight into spatial coupling, including diel vertical migration during the time of early stratification, which is critical for deep chlorophyll layer formation as well as zooplankton and larval fish production.

In addition to pelagic studies, GLERL will be responsible for documenting the spatial distribution and biomasses of mussels and Diporeia. These and ongoing GLERL studies on hydrodynamics, process research, dreissenid grazing and nutrient excretion, microbial food web abundance and production, and other collaborative research will provide the data needed to build sophisticated water quality and fisheries models that will enable the prioritization of tributaries for phosphorus loading control across Lake Michigan.


Menominee River
Manistee River
LAKE MICHIGAN
Maritowoc River
Pere Marquette River
Muskegon River
Milwaukee River
Grand River
Root River
Kalamazoo River
Saint Joseph River
CSMI TRANSECTS
USGS SITES
NOAA SITES

TRIAXUS
The Triaxus sensors will be used by U.S. EPA GLNPO to continuously sample lower trophic level parameters along nearshore-to-offshore transects.

U.S. Environmental Protection Agency Mid-Continent Ecology Division

The Mid-Continent Ecology Division will conduct studies to improve understanding of the spatial and temporal scale of interactions among Great Lake watersheds and receiving waters. These studies will examine differences in ecological endpoints along the nearshore-offshore gradient of watershed influence and along a temporal gradient of response. Water quality parameters will be examined at the finest temporal/spatial scale, fish larvae at a medium scale, and integrative biotic indicators at a larger scale (food web relationships and contaminants in biota). Research efforts will include updating and applying current eutrophication models to investigate the cause-and-effect relationships between watersheds and coastal zones and to make predictions based on changing climate conditions and future land uses. They will also include collaborating with USGS on studies of nearshore-offshore and benthic-pelagic food web linkages, especially benthic-pelagic links along the nearshore-offshore depth gradient, to assess multi-habitat support and the condition of Great Lakes food webs.

Data will be collected by collaboratively sampling the inshore-offshore transects proposed by USGS with traditional vessel-based water and biota sampling from the *R/V Lake Explorer II*, as well as towed or glider-propelled sensor arrays. Additional sampling may be added to better characterize finer-scale features such as plumes and long-shore transport. The Mid-Continent Ecology Division also anticipates collaborating with NOAA to evaluate spatial patterns in biotic indicators, particularly fish larvae, and to explore applications of multiple autonomous underwater glider missions for adaptive sampling in nearshore areas.

Existing Great Lakes geospatial data, summary units, and classification frameworks will be used to characterize and classify Lake Michigan watersheds and nearshore receiving waters based on the data collected during the CSMI year. This will make it possible to rank watersheds and receiving waters according to potential stressors, resiliency, and buffering capacity, which in turn will improve understanding of watershed-nearshore-offshore linkages. The data from Lake Michigan will also be coupled with information on watershed-based remediation and restoration to explore ways to detect changes in nearshore water quality associated with both practices.

LAKE GUARDIAN
The *R/V Lake Guardian* will work extensively in Lake Michigan during the CSMI field year.
Photo Credit: Mike Milligan

U.S. Environmental Protection Agency Great Lakes National Program Office (GLNPO)

To support the Lake Michigan CSMI field year, U.S. EPA GLNPO will sample the regular, long-term suite of 11open water stations for nutrients and zooplankton during the spring and summer all-lake surveys on the *R/V Lake Guardian*. The samples will be analyzed for total phosphorus, total dissolved phosphorus, soluble reactive phosphorus, nitrite and nitrate, total nitrogen, and soluble reactive silica. Zooplankton tows at 20-meter depths and at 100 meters from the near-bottom will be taken at all stations. During the summer survey, benthos samples will be taken at a subset of the stations and at a number of shallower sites. In the nearshore, an instrument package will be towed at the 20-meter depth contour for as much of the lake as is practical.

The towed instrument package will also be used to connect USGS and NOAA transects several times during the sampling season by running along transects and cross-lake—providing additional spatial coverage and bringing together the east- and west-shore transects. This will be done in cooperation with the *R/V Lake Explorer II* from the U.S. EPA Office of Research and Development's Duluth Laboratory. GLNPO will further support the proposed transect work by making its chemical and analytical capacity available for nutrient analyses.

In addition, the *Lake Guardian* will be made available for CSMI work approximately one week a month. Some of this time will be dedicated to the supplemental towed-instrument surveys.