

The Helm

Illinois-Indiana Sea Grant // September 2020

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COVID-19: All hands on deck

Like everyone, Illinois-Indiana Sea Grant (IISG) has faced challenges this year due to the COVID-19 outbreak. In addition to canceling a number of events, we have been exploring new tools and approaches to reach our audiences and have been looking for ways to help residents in the two states address new questions as well as setbacks that have come up during the pandemic.

For starters, three episodes of Teach Me about the Great Lakes, IISG's podcast series, focused on the risks and benefits of spending time outdoors and in nature, especially during the "stay at home" phase of this crisis.

To help teachers, as well as parents who suddenly find themselves teaching homeschool, IISG has compiled an online climate change curriculum to make explaining this complicated topic easier. We also contributed to the National Sea Grant Office effort to share network-wide educational resources for parents and teachers who may struggle to keep children engaged in learning.

IISG is investing over \$150,000 to help some local businesses navigate COVID-19 and prepare for a more resilient future. We are engaging with Lake Michigan charter captains in Illinois and Indiana to understand how COVID-19 has affected them and to provide information on government programs that can help stabilize their businesses. IISG is also leading a pilot-study project to help aquaculture producers receive critical training so they can process their fish in commercial kitchens during times when normal distribution channels are interrupted.

Building better rain gardens to reduce runoff



IN MANY COMMUNITIES, expanding urban growth and larger storms have led to more flooding. In addition, rainwater that hits pavement and flows into drains—and then to nearby water bodies—picks up pollutants along the way. Installing green infrastructure, including rain gardens, can help reduce flooding and protect water quality. It allows rainwater to soak into the ground, where pollutants are filtered by plants.

Through training, research, and boots on the ground, IISG is helping communities build strategic and effective rain gardens.

IISG has collaborated with Purdue Extension on the Rainscaping Education Program since 2013. Through program workshops, master gardeners, stormwater managers, professionals from green industries and conserva-

tion agencies, and other community members learn rainscaping techniques. The latest Indiana counties to engage in this training are Johnson and Posey—participants are using program resources to launch rain garden education programs in their communities.

Cumulatively, demonstration rain gardens installed as part of this training have the capacity to reduce runoff annually by nearly 410,000 gallons. Rain gardens that have been designed, facilitated, or installed by participants, or their partners, will reduce runoff even more.

This year, the path has been cleared for University of Illinois Extension to begin rainscaping training throughout the state. Additionally, an online workshop will be available this fall to meet remote learning needs.

As the first rain garden on the University of Illinois campus, the Red Oak Rain Garden was established in 2006, but in recent years, neglect and time all but erased the efforts of the previous decade. Less than 10 percent of the original plants survived, the rocks had become saturated with sediment, and bare patches exposed tattered landscape fabric. The rain garden still soaked up rainfall, but when larger storms hit, sidewalks started to flood again.

In 2019, the rain garden was expanded and renovated to improve both the garden's aesthetics and its functionality. The approximately 9,200 square foot garden now has 45 plant species and has a capacity of 27,000 gallons. It also provides an education venue—so far, engaging classes in horticulture, engineering, and even linguistics. The garden is included in the Illinois

Illinois strategy report highlights efforts to reduce nutrient pollution

Illustration by Joel Davenport

EXCESS NUTRIENT LOSS from agricultural runoff, point source waste, and urban stormwater can cause downstream water quality issues. In fact, Illinois is a significant contributor of nitrate-nitrogen and total phosphorus that reach the Gulf of Mexico. There, they can fuel algal growth, creating a large bloom that depletes oxygen when it decomposes. In Illinois, algae can also be a concern in local lakes and streams.

IISG joined with stakeholders across the board to develop and implement the Illinois Nutrient Loss Reduction Strategy. Released in 2015, it outlined best management practices to reduce nitrogen and phosphorus reaching Illinois waterways by 45 percent.

The 2019 biennial report, coordinated by IISG, describes efforts throughout the state, including dramatic reductions in total phosphorus discharges from some of the largest wastewater treatment facilities in Illinois. These reductions are due to facility investments to meet more stringent nutrient permit limits. One 2025 strategy goal has already been met—a 25% reduction of phosphorus from the point source sector. 🍃

🔗 bit.ly/illinois-nutrient-loss-reduction-strategy



Rendering "Red Oak Rain Garden" by Layne Knoche,
Photo "Red Osier Dogwood" by Layne Knoche
@RainGardenUIUC [f](#) [t](#) [v](#) [i](#)

Climate Action Plan 2020, is noted as a best management practice in the university's Resilient Landscape Strategy, and has been certified by several environmental organizations for supporting wildlife.

Where you place a rain garden can be key to its success, and soil type is part of that equation. Green infrastructure planning and design that use data to understand the interactions between native soil properties, length and duration of rain events, and the size of the rain garden and drainage area, can maximize the garden's performance.

In the Calumet region, which includes southeast Chicago and nearby suburbs, IISG and University of Illinois researchers have been working with two communities to fill in soils data gaps. They are integrating rele-

vant factors into site selections and creating optimized design strategies.

Calumet City and Midlothian now have green infrastructure designs developed at the neighborhood scale as well as modeling of design effectiveness. The researchers estimated block-by-block volume reduction and identified areas where more stormwater mitigation is needed. The Calumet City design project won a Student Collaboration award from the American Society of Landscape Architecture. The IISG team is in the process of developing a toolkit to provide optimal green infrastructure design resources to communities throughout the Calumet region. 🍃



03

Regional & local efforts focus on growing aquaculture

Photos by Hope Charters





IN THE UNITED STATES, seafood is the second-largest natural resources trade deficit behind oil. In Illinois and Indiana, as around much of the country, aquaculture producers compete for customers with suppliers of imported seafood, which comes at a much cheaper price.

To help ensure their businesses turn a profit, local producers need the most up-to-date knowledge and technology. IISG is focused on helping producers have efficient and profitable businesses.

From a big-picture standpoint, IISG is a partner in the Great Lake Aquaculture Collaborative (GLAC), bringing together six Sea Grant programs in the region. The collaborative is identifying regional barriers that inhibit industry growth and, going forward, will provide science-based initiatives that support an environmentally responsible, competitive, and sustainable aquaculture industry. The team communicates with farmers, regulators, and other stakeholders to provide insight and guidance to project researchers.

Locally, the IISG aquaculture team formed state aquaculture advisory groups in Illinois and Indiana composed of producers, researchers, and regulators who will all contribute their perspectives and experiences to GLAC discussions related to industry growth.

Many Illinois and Indiana aquaculture producers focus on growing non-native fishes, such as tilapia, but farmed fish with a local identity may be more successful in the marketplace. For example, walleye has a strong association with the Midwest, is available in restaurants as a commercially caught species, and may be suitable for aquaculture. However, currently, there is little walleye aquaculture in the two states.

IISG convened the Walleye Aquaculture Working Group, bringing together researchers, producers, and extension personnel, to engage in dialogue about developing a farmed walleye market. At its first workshop, the group identified key production and market challenges to developing a walleye aquaculture market in Illinois and Indiana. These discussions will inform future research and outreach around walleye aquaculture in the region.

Producers face other barriers as they work toward meeting the region's seafood demand. For example, they need an efficient and affordable way to feed some newly and recently hatched larval fish indoors.

An innovative approach, developed through IISG-funded research, shows promise for robust and healthy largemouth bass larvae as well as a potential new market for invasive Asian carp.

Karolina Kwasek at Southern Illinois University used the digestive system of adult largemouth bass to break down bighead carp muscle into simpler nutritional components so they would be readily available for larval fish. The larval largemouth bass fed pre-digested bighead carp protein were larger in weight and length than those fed intact bighead carp muscle.

IISG is also on the ground and in communities offering guidance and information. In 2019, we started a conversation at the Indiana Land Use Summit with 21 local decision makers and others about opportunities for aquaculture and aquaponics businesses. IISG also visited about 25 aquaculture and aquaponics operations in Illinois and Indiana, from small-scale to large commercial outfits. Through IISG guidance, several farmers have improved their technology and fish feed formulations. These visits also help inform future outreach to producers in the two states. ♡

Left (opposite): Mike Searcy
Owner/operator, White Creek Farms of Indiana LLC

Center: Stuart Carlton
Assistant director, IISG

Right: Amy Shambach
Aquaculture marketing outreach associate, IISG



Water supply management is more effective with more information

Photo on left by Irene Miles

DESPITE SITTING ALONG the shores of Lake Michigan, the Chicago region faces water supply management challenges. There are legal constraints to using the lake as a water source, and groundwater as well as surface water resources have sustainability and water quality issues. Add to that, much of the water infrastructure in the region is overdue for costly repairs or replacement.

IISG works closely with partners in the region to help initiate and advance water supply planning to ensure continued availability and access to water for all users. Providing local decision makers with more information is key.

In the greater Chicago metropolitan region, from 2008 to 2018, the average residential monthly water rate almost doubled. At the same time, household income has been essentially stagnant, particularly for working class wages. A growing number of households will find their water bills unaffordable as water rates continue to rise.

IISG collaborated with the Metropolitan Planning Council and Elevate Energy to understand the extent of water affordability issues in northeastern Illinois. As part of this effort, the project team

developed a suite of resources, including a final [report](#) and the [Northeastern Illinois Water Affordability Dashboard](#), which is an easy-to-use tool for researchers, reporters, and others looking for water affordability statistics broken down by municipalities in the Chicago area.

The project has already proven helpful to the City of Chicago as it developed a new program to help low-income residents keep up with water bills. The Utility Billing Relief program, which was enacted this year, provides reduced water and sewer rates, eliminates late payment penalties and provides debt relief for those who qualify. Predictions are that it will assist about 20,000 households in the city.

When local and regional planners can estimate future water demand in light of availability, this encourages actions to conserve water, protect supply, or pursue alternative water sources. IISG and the Chicago Metropolitan Agency for Planning (CMAP) have been working to fill information gaps and provide a range of useful data.

One approach was to develop forecasts of regional water demand for 245 municipalities in northeastern Illinois to help inform relevant local decisions on land use, transportation, and infrastructure.

In 2019, over 350 local decision makers learned about the ON TO 2050 Regional Water Demand Forecast results, data, and recommendations.

IISG and CMAP also created the first-of-its-kind water data tool, showing past water use, forecasted demand, and water and sewer rates for municipalities in the region. State agencies, regions, sub-regions, counties, and communities can freely access water data related to their locality on the [CMAP Data Hub](#).

And finally, the [Northeast Illinois Water and Wastewater Rates Dashboard](#) allows over 200 communities in the Chicago area to benchmark their water rates more easily and set comparisons to similar communities. The dashboard, which provides free water rate data in 11 states, was created by the University of North Carolina Environmental Science Center. IISG helped establish the dashboard for the Chicago region's seven counties, Cook, DuPage, Kane, Kendall, Lake, McHenry, and Will, and continues to update it—now with 2019 data. [👉](#)

Science & scientists become real for students and teachers



Photos courtesy Kristin TePas and Ethan Charlebois-Berg

WHEN STUDENTS ARE ABLE to collect and analyze real data with actual equipment used by scientists in the field or they have the unique opportunity to communicate directly with scientists, this helps them understand real-world issues as well as the real-world application of what they are learning in the classroom. It also inspires excitement about the work of science and opens their eyes to science careers.

IISG developed the Scientists to Students (S2S) program for Great Lakes researchers on board the EPA research vessel, the *Lake Guardian*, to connect with schools throughout the region via videocasts. While out on the lakes, scientists can visit classrooms and talk with students about aquatic science, water quality monitoring, careers, and life on a ship. In 2019, IISG organized videocasts with 10 schools in Illinois, Indiana, Ohio, New York, and Wisconsin, reaching over 450 students.

This spring, due to COVID-19, as with most events, S2S videocasts needed to be rethought, if the program happened at all. Working with several teachers, IISG refashioned the get-togethers with everyone in their homes, both scientists and students alike.

The first event included prerecorded videos created when convenient—introductory videos from scientists describing their work, students posing questions, and scientists’ recorded answers. Many of the questions focused on Great Lakes conditions and issues, but some

were more personal in nature, such as what is your favorite thing about being a scientist?

“Quite a few of my students expressed how much they learned by having these virtual conversations with the scientists and that it sparked their interest to want to explore the Great Lakes with their families,” said Holly Yee, a middle school teacher in Elgin, Illinois.

In addition to Yee’s classes, scientists connected with high school students in Mishawaka, Indiana, where the focus was fisheries and aquaculture, and in Waterton, New York with biology students. At these events, scientists and students were able to interact from home in real time.

In partnership with EPA, IISG has also coordinated the Limno Loan program for eight years. Educators can borrow a Hydrolab, which is water quality monitoring equipment used by scientists, for classroom and field use. In 2019, 26 educators borrowed the Hydrolab, reaching more than 1,500 students. Most of these educators spent extra time teaching about aquatic science due to the Hydrolab—from one day to three weeks. Altogether, since 2011, more than 10,000 students have engaged with the Limno Loan program.

IISG, along with The Nature Conservancy, hosted the 7th annual Grand Calumet River Stewardship Day in 2019. Fourth-grade students from East Chicago, Indiana visited nearby Seidner Dune and Swale to experience

science outdoors. Local experts guided 40 students through bird watching, learning about fish, identifying macroinvertebrates, and planting trees. The students increased their “sense of place” related to the Grand Calumet River. This social science concept captures one’s place attachment and is predictive of future environmental stewardship there.

IISG also led a day-long teacher workshop in 2019 at Indiana’s Douglas Center for Environmental Education, providing science-based information related to the impact of medicine disposal on the environment. IISG specialists shared Great Lakes and water quality activities that the 25 participating teachers could bring back to the classroom. They also introduced the Hydrolab. Several teachers engaged their students in stewardship activities such as trash collecting, gardening, and reducing use of single-use plastics. Students created art, informational campaigns, and Earth Day events. ♡

“Quite a few of my students expressed how much they learned by having these virtual conversations with the scientists and that it sparked their interest to want to explore the Great Lakes with their families.”

Stewardship volunteers turn training into action

Photo by Joe Exl



ONE WAY FOR local organizations to improve and protect the Lake Michigan watershed is to recruit volunteers to take leadership roles in their communities by cleaning up streams and restoring natural ecosystems. IISG joined with regional and federal partners to develop the Indiana Master Watershed Steward Program (IMWS), including a peer-reviewed natural resource curriculum.

In 2019, 14 people completed the first round of IMWS training and 11 of those became full-fledged stewards by completing 35 volunteer hours. As part of their volunteering, two stewards provided information on septic system maintenance and repair to communities identified as contributing to water quality problems. Others earned their stewardship by removing invasive species, monitoring stream water quality, cleaning up beaches, rehabilitating wildlife, and planting rain gardens. ♡

Communities set natural resource priorities and create action plans

Photo "Bonneyville Mill Park in Elkhart County" by David Arment

WITH A CHANGING CLIMATE, limited natural resources, and population shifts, communities face challenges now and in the future. IISG has joined with Purdue Extension to help local decision makers apply the best available science to the planning process to maintain or improve quality of life, including economic and social well-being, without adversely affecting environmental conditions—in other words, to be resilient.

In 2019, Fayette County and Connersville in Indiana engaged with the Enhancing the Value of Public Spaces program to plan community-based efforts that target quality of life and economic development. The process engaged over 64 community members and representatives from key agencies and stakeholder organizations.

The result is an action plan that integrates health and wellness into several community initiatives, such as downtown public space revitalization. Connersville's mayor authorized \$100,000 for the purchase of downtown property, which has become a community garden known as The Oasis. One planning participant described ongoing ideas for the property, "We want it to be a green space people can use."

The Conservation through Community Leadership program serves as a roadmap for Indiana communities tackling complex land use and natural resource challenges. In addition to publishing the peer-reviewed program curriculum in 2019, the team worked with a community group in Indiana's Pulaski County to complete

an action planning meeting series. The group developed a plan that is particularly focused on the problem of invasive species as it guides local conservation and management of ecological resources.

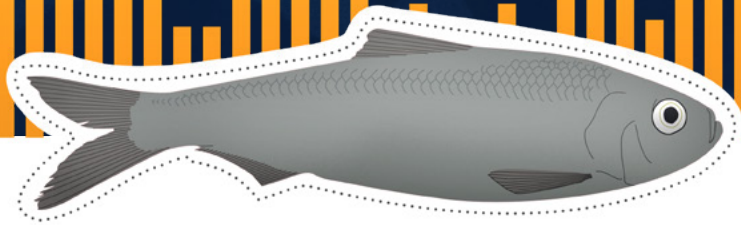
The team also published the curriculum and developed county-focused dashboards for Tipping Point Planner (TPP), a decision support tool for the Great Lakes region. Protecting natural resources while enhancing resilience requires communities to understand and determine tipping points, which trigger rapid, sometimes irreversible shifts in ecosystem functions. TPP helps communities identify land use and water quality issues affecting watershed health and guides them through prioritizing management practices and policies.

When municipalities tackle comprehensive planning, agriculture and natural resources can prove particularly challenging due to the technical nature of these sectors. IISG and Purdue Extension, along with the Indiana State Department of Agriculture and Indiana Land Resources Council, have developed a guidebook that provides an overview, examples from communities that have engaged in these issues, and additional resources. Information from *Community Planning for Agriculture and Natural Resources: A Guide for Local Government* was shared with over 150 local planners and others at the 2019 Indiana Land Use Summit. ♡

🔗 bit.ly/iisg-sustainable-plan



“ The anglers were the most important contributor—they took time out of their days to provide us with what we needed. ”



Lake Michigan Chinook salmon stick with declining alewife as their main meal

Illustration by Joel Davenport

OVER THE PAST FEW decades, invasive species like zebra and quagga mussels have been eating up much of the base of Lake Michigan’s food web, affecting organisms throughout the lake, including alewife, a staple meal for salmon and trout. As menu options shift for these top predators, their success going forward may depend on expanding their diets.

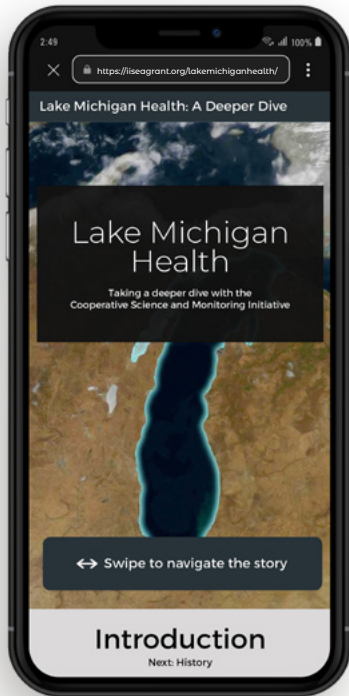
A lake-wide study of salmon and trout conducted in 2015–16 found that diet flexibility varies among salmon and trout species, but Chinook salmon, the favorite of many anglers, are basically eating only alewife. This project was funded by IISG and the Great Lakes Fishery Trust.

Scientists from around the region got to the bottom of what five salmon and trout species in Lake Michigan eat in a direct way—they analyzed stomach contents. To do this on a lake-wide scale, they relied on help from the U.S. Fish and Wildlife Service (USFWS) and state Departments of Natural Resources around the lake. Agency creel survey clerks interviewed anglers and gathered data as well as fish stomachs. The Little Traverse Bay Bands of Odawa Indians also contributed from what they caught in their nets.

“It was a huge effort to accomplish something like this, so we needed help from just about everybody around the lake,” said Ben Leonhardt, who worked on this project as part of his Purdue University master’s degree and is now with the USFWS. “The anglers were the most important contributor—they took time out of their days to provide us with what we needed.”

The research team found that all five salmon and trout species ate alewife. But, unlike Chinook salmon, which almost exclusively consumed alewife, coho salmon also ate aquatic invertebrates. Lake trout and brown trout were less reliant on alewife, adding round goby to their diets, while rainbow trout also ate insects.

“Previous to this study, for coho salmon, brown trout, and rainbow trout, resource managers have used diet compositions from the 1980s,” said Austin Happel, a research biologist with Shedd Aquarium who has continued to be involved in this project since his tenure as a University of Illinois doctoral student. “Now we know those species are not only eating just alewife anymore. This can be included into stocking models to get a more complete prediction of how many fish—salmon and trout of different species—that the lake can handle.”



New resource features Lake Michigan science and history

Photo "the Great Lakes" courtesy NOAA

THE COOPERATIVE SCIENCE and Monitoring Initiative (CSMI) is a program that leads intensive research, rotating around the Great Lakes. Each year, scientists coordinate their efforts to answer critical questions and fill information gaps for one of the lakes. The main purpose of CSMI is to share research findings with lake partnership groups to help them better manage their respective lake. Unfortunately, research results haven't been making it into managers' hands.

IISG is making a concerted effort to get the 2015 Lake Michigan research results—the most recent field year—out to a broader audience. With input from CSMI scientists, IISG has developed products that share the story of the lake's changing food web and related research results, including an executive summary and whitepaper and an ESRI Story Map called Lake Michigan Health: A Deeper Dive. This resource provides historical context and recent research results about Lake Michigan's lower food web, prey fish, and contaminant levels. 📍

📍 iiseagrant.org/lakemichiganhealth



AWARD OF DISTINCTION



PFAS can stick to microplastics in Lake Michigan

Illustration by Joel Davenport

EVER-PRESENT IN OUR world, it's not surprising that plastics have been found in waterways virtually everywhere, often broken down to microscopic size. Another group of contaminants, PFAS (per- and polyfluoroalkyl substances) are, likewise, being detected in the environment all over the world. Both are resistant to breaking down in lakes, rivers, wildlife, and people. PFAS can have health effects, such as increasing the risk of cancer, decreasing fertility, and impacting growth and learning in infants and children.

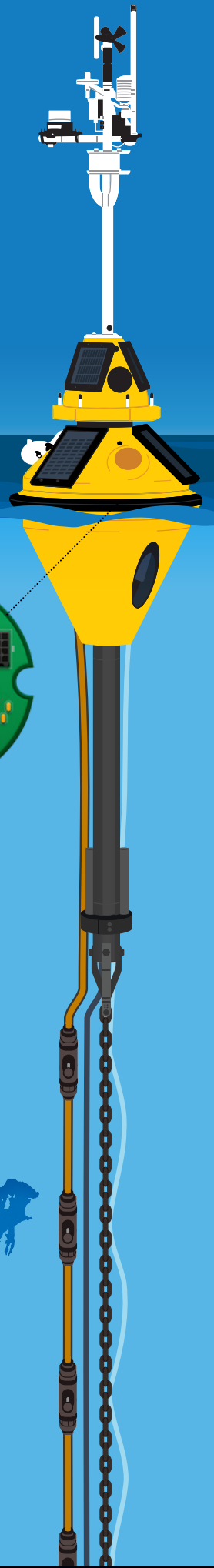
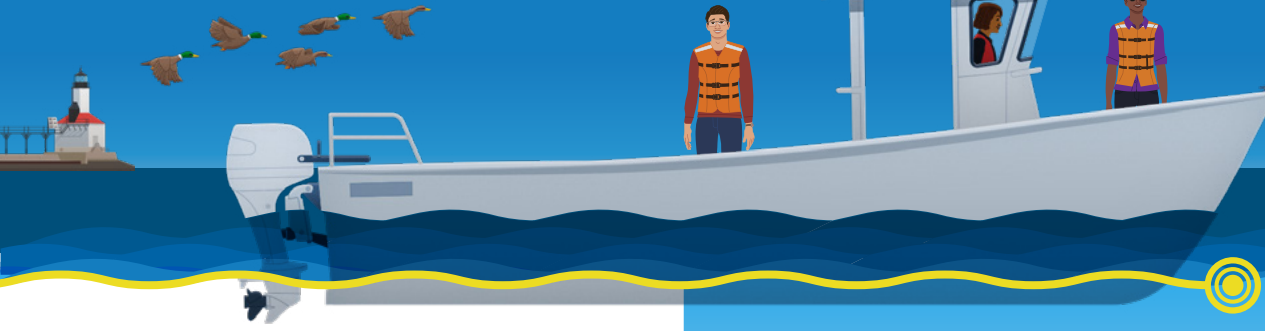
We funded a team of researchers to understand the extent to which PFAS attach to microplastics in waterways. The team from the Illinois Sustainable Technology Center, Robert B. Annis Water Resources Institute, and Grand Valley State University used three common types of plastic, testing them in the waters of Muskegon Lake, which sits adjacent to Lake Michigan along the Michigan coast. They also did similar testing in a controlled environment using laboratory water.

The researchers found that PFAS stick to microplastic particles in Muskegon Lake, regardless of location, length of time, or type of plastic tested, increasing the likelihood that PFAS will end up in the food web. The amount of PFAS sticking to microplastic in laboratory water was notably less, which may be due to organic matter, metals, or bacteria that attach to microplastic in natural environments. These substances may make microplastic surfaces easier to stick to. 📍

Buoys provide key data to predict dangerous currents

Illustration by Joel Davenport

Follow our buoys @TwoYellowBuoys 🐦

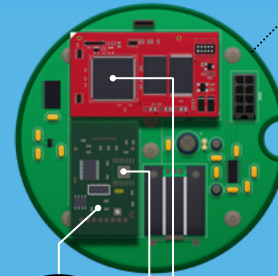


WE MAINTAIN TWO BUOYS in the nearshore waters of southern Lake Michigan—one near Michigan City, Indiana and the other near Wilmette, Illinois. These buoys are equipped with sensitive scientific instruments that can help weather forecasters as well as scientists, managers, recreational water users, and local community members keep up on Lake Michigan conditions.

The National Weather Service (NWS) uses on-the-water buoy data to verify forecasting models and to predict the likelihood of dangerous currents. Buoys are the only source of wave period data, which eliminates guesswork on conditions. To improve forecasting, the NWS also uses buoy data after a drowning to document the specific conditions when it happened. As a result, beach hazard statements for Michigan City now occur at a lower criteria than before because at that beach, dangerous currents occur in lower wave heights.

In 2018, IISG helped deploy and support two more buoys located near Waukegan and Winthrop Harbor in Illinois. They are owned and operated by the University of Illinois and the Illinois State Geological Survey, but their data are housed on iiseagrant.org. 📍

Inertial Wave Sensor
Reports wave height, wave period, and mean wave direction



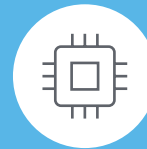
Accelerometer
Captures position on X, Y, and Z axis to determine the amplitude and period of surface waves



Digital Compass
Captures heading, pitch, and roll to determine the mean wave direction



Microcontroller
Analyzes wave data for output



● **45187** Winthrop, IL
42.491N, 87.779W

● **45186** Waukegan, IL
42.367N, 87.795W

● **45174** Wilmette, IL
42.135N, 87.655W

● **45170** Michigan City, IN
41.755N, 86.968W





The Helm

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Quick Splashes

Teach Me About the Great Lakes

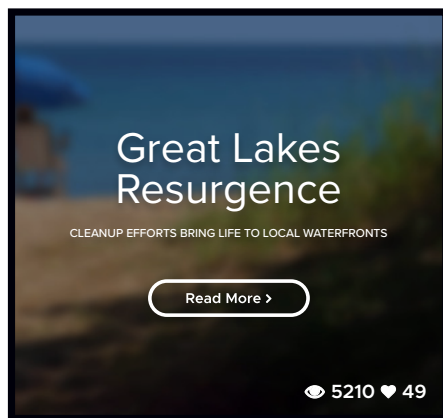
Listen to the latest podcast episode or dig into the series library to have some fun learning about the lakes through interviews of a variety of experts and enthusiasts.



 teachmeaboutthegreatlakes.com

Great Lakes Resurgence

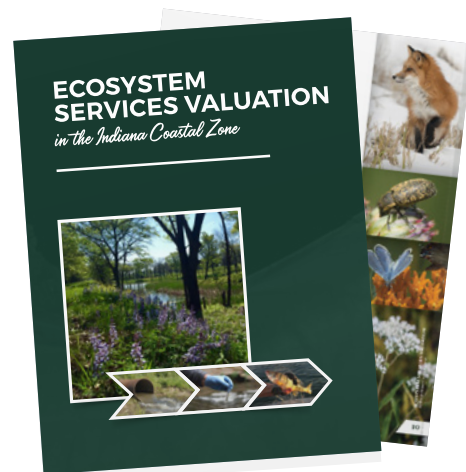
Dramatic images of the Great Lakes Areas of Concern taken by a *National Geographic* photographer Peter Essick provided an opportunity to tell stories of restoration, revitalization, and revival throughout the region.



 iiseagrant.org/great-lakes-resurgence

Ecosystem Services Valuation

The benefits that people, communities, and economies receive from nature are called ecosystem services. This primer introduces ecosystem service valuation to Indiana coastal zone managers, policy-makers, and planners.



 bit.ly/iisg-ecosystem-services



IISG20-ADM-HELM