



Illinois-Indiana Sea Grant

# Discovery Grant Projects

Just as a gardener hopes that their scattered seeds will eventually bloom into a lush garden, Illinois-Indiana Sea Grant awards Discovery Grants, or “seed” grants, to a number of projects in the hopes that the initiatives will grow into something larger. This publication highlights some results from recently funded projects.

IISG has funded 35 projects that relate closely to key concerns the program is committed to address.

For example, several researchers studied how fish are impacted by changes in their environment. Zachary Blevins and Cory Suski at the University of Illinois examined how land use patterns affect the physiology of stream fish while Yang Cao, also at the U of I, modeled 10-year changes in juvenile fish populations in Lake Michigan nearshore waters.

Contaminants were also a focus. Antony Acushia at Purdue University was funded to develop a web-based tool to measure environmental quality standards for phosphorus, one of the most troublesome pollutants in the Great Lakes. Purdue’s Maria Sepulveda experimented with a new method for assessing toxicity and the need for remediation in contaminated waters.

Brian Deal at the U of I studied a new way for addressing another key concern, land use planning in Illinois to be more sustainable by incorporating the value of ecosystem services into the process.

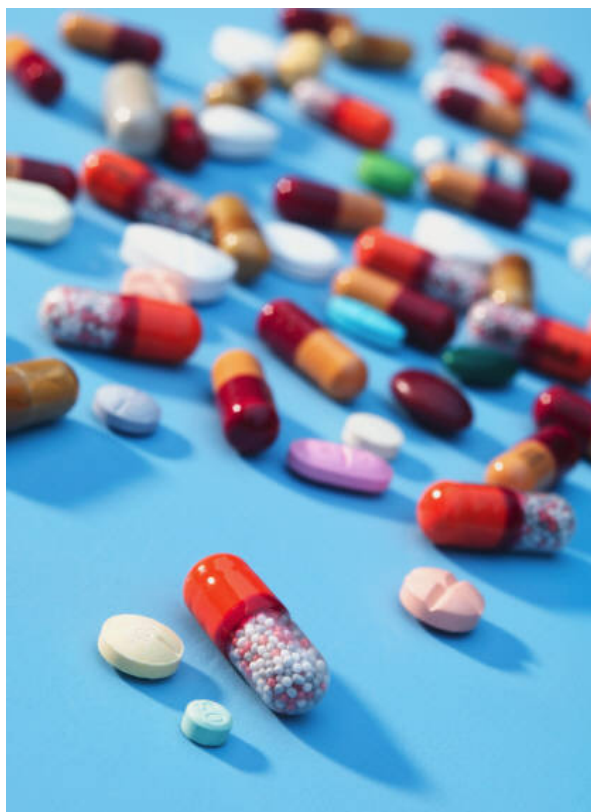
Turn the page to read results and implications of featured Discovery Grant projects.

## Lake Michigan shoreline water is a medicine cocktail

During his research to measure pharmaceutical abundance along the shorelines of Lake Michigan, Ball State University biologist Thomas Lauer said he and his fellow researchers found chemical compounds “practically everywhere.”

Lauer and Melody Bernot, also from Ball State, repeatedly sampled four southern Lake Michigan sites and found antibiotics, mood-stabilizing drugs, pain-relievers, antibacterials, and more. “To get large, measurable numbers, consistently, in all those places was a bit surprising to us,” Lauer said. “It is an intimidating thought, considering how big the lake is.”

While the observed chemical concentrations are not toxic to humans, they can be a concern if these medications enter our drinking water. A 2008 Associated Press investigation found pharmaceuticals in the drinking water supplies of at least 41 million Americans. In addition, there is a long list of negative effects



these chemicals can have on aquatic organisms. For example, medicines have been shown to disrupt reproductive development in frogs, cause irreversible masculinization in fish, and impair predator avoidance in minnow and shrimp.

The Lake Michigan study focused on Michigan City and East Chicago, Indiana; St. Joseph, Michigan; and Chicago. At each site, surface and bottom water samples were taken near drinking water intake points, and at the mouth of incoming rivers.

Bernot and Lauer have applied for larger grants to further understand the fate of these chemicals in the environment and ultimately how humans may be affected.

## Recreation reduces Karner blue butterfly reproduction

Patrick Zollner, a Purdue University ecologist, studied the impact that people walking on nature trails have on the reproduction habits of the Karner blue butterfly, a federally endangered species found in the Indiana Dunes National Lakeshore.



The study shows that human recreation can disrupt the breeding patterns of this butterfly, as well as other species.

Using data of actual butterfly behavior in a simulation model, Zollner's team found that Karner blue butterflies lay significantly fewer eggs on their host plant, wild lupine, when the plants are 10-15 meters from the trail. They laid more eggs on plants that were farther away.

“Depending on the circumstances, about 17 percent of females are only laying half of their potential eggs because of human disturbance,” Zollner said. To minimize negative effects on this endangered species, Zollner suggests that wild lupine plots be at least 25 meters from the trail.

This information can be useful for resource managers who are under increasing pressure to implement strategies that address the negative effects of outdoor recreational activities on wildlife.

Zollner and his team have now submitted a proposal to study how the Huron-Manistee National Forest equestrian population impacts Karner blue butterflies across their range.

## X-ray chemical turns toxic in disinfected drinking water

University of Illinois geneticist Michael Plewa's study revealed that a non-toxic medical diagnostic chemical that accumulates in drinking water sources can become a toxic chemical during the disinfection process. These results led the National Science Foundation to award Plewa and his collaborators at the Federal Institute of Hydrology in Germany and the University of Akron \$495,000, with \$217,000 of that going directly to Plewa, to study this further.

"We would not have been able to get this award if it wasn't for the discovery grant," Plewa said. "We were very happy to have that opportunity, and we feel this success shows the investment was not misplaced."



The study found that water near hospitals can contain disinfection by-products due to iodinated x-ray contrast media (ICM) that is found in wastewaters from hospitals. ICM is a substance people consume

to enhance medical imaging. It is usually excreted within 24 hours, but treatment plants are unable to completely remove it from drinking water.

"These drugs serve as a catalyst for chemical reactions when you use disinfectants, such as chlorine," Plewa said, adding that he hopes there is a way to modify the ICM chemistry to eliminate the problem.

"This is one of very few examples where a nontoxic material that is put into a drinking water supply is converted to toxic material due to disinfection. The environment is so complex it boggles the mind."

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## New use for ethanol —feeding Hybrid striped bass

Recently, fish meal has become economically and environmentally unsustainable as a primary protein source for fish farming. Jesse Trushenski, an aquaculture nutritionist at Southern Illinois University Carbondale, studied the use of ethanol yeast as a fish meal replacement in feeds for hybrid striped bass.

The yeast is left over from bio-ethanol production, so Trushenski sees the idea as a "win-win" solution.

"From an aquaculture perspective, we are always protein hungry. However, traditional protein sources are not going to meet the industry's growing demand," she said. "We are always looking for protein-dense ingredients that we can use in feeds."

Trushenski found that ethanol yeast will not completely replace fish

meal, but it can significantly reduce the amount needed. The study showed that fish meal

can be reduced as low as 7.5–15 percent in ethanol yeast-based feeds without having negative side effects.

The project was done in collaboration with Archer Daniels Midland, which is funding further research on the topic.

"In Illinois, we raise more than 100,000 pounds of hybrid striped bass each year. More cost-effective feeds can help our aquaculture industry grow. So in



a sense, these seed dollars are transitioning into economic development for our region," Trushenski said, adding that saving money on fish food would greatly cut down on expenses. "Feed can represent 50 percent or more of the cost of production, so anything we can do to help our growers use regional resources to reduce costs is a move in the right direction."



## Alum can reduce phosphorus after manure spill

Accidental manure spills in the United States have been occurring more frequently in the past 20 years due to increases in the number of livestock hogs. First responders have ways to adequately remove phosphorus and ammonia directly from the water column, but they do not focus on nutrients that may have become bound in sediment.

Graduate student Shalamar Armstrong of Purdue University (now at Illinois State University), and his advisor, soil scientist Phillip Owens studied



the fate of sediment after a spill and potential treatment op-

tions, namely using aluminum sulfate as a barrier to nutrient deposition.

“We wanted to see if the response was effective, and if phosphorous and nitrogen were being treated,” said Armstrong. Under laboratory conditions, they documented that, after a spill, phosphorous is stored temporarily in the sediment and then released back into the water. In samples taken, phosphorous concentrations in the water columns well exceeded EPA water quality criteria.

Their solution, to apply aluminum sulfate to sediment in the remediation process, seems to reduce the release of phosphorus into the water column by 70-90 percent as compared to control treatments. Armstrong and Owens believe that this could be a useful step in treating some areas affected by manure spills.

This research has been published in several peer-reviewed journals and helped Armstrong receive the Purdue University Agronomy Department’s 2010 Outstanding Graduate Student Ph.D. Research Award.

## Storm tracking takes flight over Lake Michigan

University of Illinois atmospheric scientist David Kristovich tested a mobile sounding system that might help predict the fate of storms that move across Lake Michigan. This system measures temperature, humidity, and atmospheric pressure.

“The Great Lakes make it difficult to predict summer weather. One problem weather forecasters face is determining what will happen when massive storms reach one side of the lake. It is hard to figure out if those storms will make it across to the other side and cause severe weather,” Kristovich said. “We don’t have a lot of information; on the lake, we don’t have people taking observations all over the place like we do on land.”



The device they used is called a rawinsonde, which is attached to a weather balloon with a parachute. Because the system is connected to a balloon, researchers were also able to record the wind direction and speed.

Kristovich said having a test run for the device was critical for ironing out issues for future projects, which will include larger collaborative efforts with groups like the Ontario Winter Lake-effect Snow project and the AgI Seeding Cloud Impact Investigation.