Water Column

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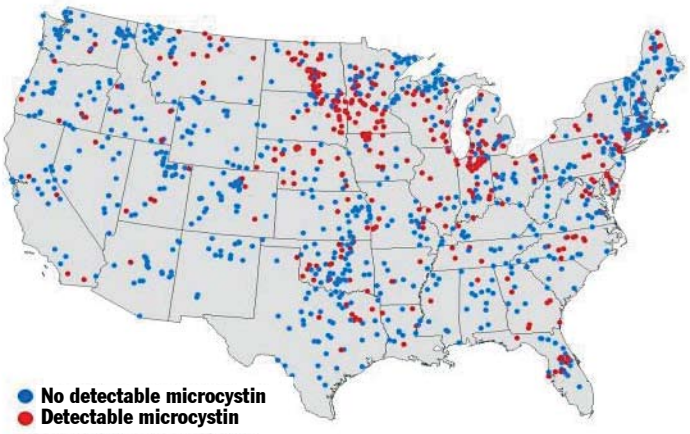
NLA Results Show Many Indiana Lakes with Algal Toxins

During the summer of 2007, the U.S. EPA conducted a survey of the nation's lakes, known as the "National Lakes Assessment (NLA)." This study selected lakes randomly in order to get an unbiased, statistically relevant snapshot of the quality of lakes and reservoirs in the United States. More than 1,000 lakes and reservoirs over ten acres in size were sampled across the U.S., with 50 Indiana lakes included.

Water samples were collected from one site over the deepest water of each lake. Results for the water chemistry samples are being analyzed by I.U. SPEA and this report should be available soon.

Results for total microcystin, a toxin produced by several common species of cyanobacteria, were recently released by the U.S. EPA. These results (see table, next page) found detectable levels (>1 µg/L) of microcystin in 34 of the 50 (68 percent) Indiana waterbodies tested. The national average for presence of microcystins was 32 percent. Therefore, significantly more Indiana lakes and reservoirs had detectable microcystins than did lakes and reservoirs in the rest of the U.S.

What do these results mean for Indiana lakes? First of all, there are no U.S. standards for algal toxins, including microcystin, in fresh waters. However, the U.S. EPA is working to establish standards. Several states have "action level" guidelines at which they post advisories on lakes. These levels range from 6-20 µg/L of total microcystin, so the NLA results for Indiana fall below these action levels.



Issues to Consider

The NLA data were the result of one sample over the deepest water of each lake so one must consider the following issues in interpreting the results:

- Since cyanotoxin production is extremely variable throughout the summer, the single NLA sample may not represent the maximum concentration present in the summer.
- The open water sampling location likely underestimates the true extent of toxin occurrence and magnitude. Winds are known

to blow the toxins to downwind shores.

- Absence of a hit does not indicate that no risk exists. Presence of only low-risk concentrations does not imply lack of greater risk.

The most definitive conclusion we can make about NLA microcystin results is that microcystins are widespread throughout Indiana and they are present at a higher percentage of Indiana lakes than the mean for other states. These results provide further justification for developing a regular, statewide cyanotoxin monitoring program in Indiana.

Indiana Lakes and Reservoirs with Detectable Microcystin

Lake	*County*	*Total Microcystin (µg/L)*
Skinner Lake	NOBLE	3.40
South Chain Lake	ST JOSEPH	3.30
Bischoff Reservoir	RIPLEY	2.70
Cedar Lake	LAKE	1.80
Mud Lake	KOSCIUSKO	1.20
Tamarack Lake	NOBLE	1.10
Whitewater Lake	UNION	1.10
Cedar Lake	LAKE	1.00
Crooked Lake	STEUBEN	0.84
James Lake	KOSCIUSKO	0.81
Waldron Lake	NOBLE	0.74
Unverified	RIPLEY	0.70
Fish Lake	ELKHART	0.68
Rock Lake	FULTON	0.60
Bruce Lake	FULTON	0.40
Koontz Lake	STARKE	0.40
Lake James	STEUBEN	0.39
Lazy Lake	MONROE	0.34
Crystal Lake	KOSCIUSKO	0.33
Big Bass Lake	STARKE	0.31
Lake Maxinkuckee	MARSHALL	0.27/ 0.17
Fletcher Lake	FULTON	0.25
Round Lake	NOBLE	0.25
Morse Reservoir	HAMILTON	0.21
Robinson Lake	KOSCIUSKO	0.21
Big Bass Lake	STARKE	0.17
Blackman Lake	LAGRANGE	0.17
Palestine Lake	KOSCIUSKO	0.16
Round Lake	WHITLEY	0.16
Harper Lake	NOBLE	0.14
Heritage Lake	PUTNAM	0.12
Big Barbee Lake	KOSCIUSKO	0.11
Heritage Lake	PUTNAM	0.11
Whippoorwill Lake	MORGAN	0.11

New Information About Algae: How They Can Adapt to Low Phosphorus

Greg Bright

One of the things lake managers learn early in their careers is that phytoplankton (the algae that live in water) grow faster in water that has more phosphorus. A side-by-side test of two Canadian lakes treated and untreated with phosphorus in 1973 demonstrated this convincingly. In most lakes, phosphorus is thought to be the "limiting factor" for algae growth. If we cut the phosphorus, algae will be less of a problem.

A recent article in *Nature* magazine suggests things aren't as simple as we supposed. Phosphorus is an important building block for all living cells. Until recently, scientists thought that the cell wall of algae required phosphorus as one of its components. If phosphorus concentrations aren't high enough, algae can't grow cell walls and therefore can't grow at all. However, studies in parts of the ocean where phosphorus levels are quite low still have lots of algae. Surprisingly, what happens in these areas is that algae start substituting sulfur molecules for phosphorus molecules when their cell walls are formed. That saves the scarce phosphorus molecules for more important areas of the cell (like DNA). Algae in these parts of the ocean still do just fine without the phosphorus.

Whether freshwater algae can also use sulfur in their cell walls when phosphorus concentrations are low is not known at this time. Phosphorus is still important for algae growth. We should still try to reduce it in our lakes. But this new information teaches us that even simple plant life can adapt to changing conditions and things aren't always as predictable as we previously imagined. For more information, check out the September 2009 microbe blog at **www.smallthingsconsidered.us**.

No More Phosphorus in Wisconsin Lawn Fertilizer

Wisconsin Governor Doyle signed the "Clean Lakes" bill (2009 Wisconsin Act 9) into law on April 14th. Wisconsin now has a statewide law that prohibits the display, sale, and use of lawn fertilizer containing phosphorus, with certain exceptions. Citizens, conservation groups, natural resource professionals, elected officials, businesses, and others partnered on this bill. The law will take effect in 2010, which gives retailers time to order phosphorus-free lawn fertilizer for next year.

To read the statute, go to **http://nxt.legis.state.wi.us** and click the "2009-10 Session Related" folder, then open "2009 Wisconsin Acts."

What is Sediment and Why Should I Care?

Sediment is the #1 water pollutant by volume in the United States. Sediment is the loose sand, clay, silt, and other soil particles that are carried from a site by runoff water that eventually settles at the bottom of streams, rivers, lakes, and ponds. Sediment comes from soil erosion. Water runoff, stormwater from rain or melting snow, flows from rooftops, over paved streets, sidewalks, parking lots, across bare soil, through lawns and fields. As it flows, the runoff collects and transports soil as sediment, pet waste, salt, pesticides, fertilizer, oil and grease, litter, and other potentially toxic pollutants. This water drains directly into storm drains or nearby drainageways into creeks, streams, and rivers most often without receiving any treatment at a sewage plant.

Sediment is the most common pollutant in our waterways. While natural soil erosion produces about 30 percent of waterway sedimentation, accelerated erosion from human modifications of the land accounts for the remaining 70 percent. The most concentrated sediment releases come from construction activities, which can often exceed 100 times that from agricultural use of the land.

Why should you care? Sediment entering stormwater can cause severe water quality degradation of the waterways that we depend on for our drinking water, that provide fish and wildlife habitat, and that provide us with recreation in the form of swimming, fishing, and boating. Excess sediment can also cause flooding, severe streambank erosion, and undesirable physical and chemical changes to our lakes and ponds. It increases the cost of treating our drinking water and it can affect the odor and taste. Sediment fills up storm drains, catch basins, roadside ditches, and streams creating costly drainage, flooding, and associated problems.

Nutrients transported by sediment can activate blue-green algae that release toxins that make swimmers sick. Sediment deposits in rivers can alter the flow of water and reduce water depth, making navigation and recreational use more difficult. Water polluted by sediment disrupts the natural food chain by destroying the habitat of the smallest stream organisms and causing massive declines in fish populations. It can also cause the water to become cloudy, preventing animals from seeing food.

A plume of eroded soil from a construction site enters Winona Lake. Source: Indiana DNR.

Sediment can clog fish gills, which reduces resistance to disease, lowers growth rates, and affects fish egg and larvae development. Murky water prevents natural vegetation from growing. Sediment pollution causes an estimated $16 billion in environmental damage each year in the U.S. Truly, an ounce of prevention could save a pound of cure, and free up funds for other priority issues.

What can you do to help "Stop that Dirt?" Citizens should be on the lookout for signs of offsite erosion from construction sites and other areas. If you see sediment leaving a site or find an active construction site without erosion control measures such as silt fence installed, please contact your county Soil and Water Conservation District (SWCD). The SWCD works with local government units in helping control such erosion and resulting sedimentation.

[Adapted from: Marion County SWCD]

Sediment loss from a poorly managed construction site.

Grants Announced for 26 Lake, River Projects

New grants totaling more than $925,000 have been awarded for the care of Indiana's waterways this year through the Lake and River Enhancement (LARE) program, part of the DNR's Division of Fish and Wildlife.

"In a time when all spending is scrutinized for cost-effectiveness, these boater-funded LARE grants are an important way to address problems in public lakes and river watersheds across Indiana," DNR director Robert E. Carter Jr. said. "The grants direct funds toward projects that protect and enhance the very resources used in aquatic recreational activities, including fishing and boating."

The 26 projects were submitted by local sponsors who commit to sharing a portion of the total cost. DNR's portion comes from the lake enhancement fee paid annually by boat owners to the Bureau of Motor Vehicles. It is a variable fee based on the value of the boat when new. "The LARE grants are crucial to local organizations enabling them to tackle natural resource concerns that can be impossible for them to address on their own," said Gwen White, an aquatic biologist with LARE.

White said some projects can require years of planning and diligence to complete. The new grants feature biological and engineering projects, including diagnostic, design, and engineering feasibility studies, and construction projects.

Several watershed land treatment projects received funding to assist landowners with water quality concerns near locally important streams. These grants complement the $1.33 million in LARE grant awards Carter announced in March to address nuisance aquatic vegetation and dredging of sediment in publicly accessible lakes.

"Our goal is to provide grant funds in projects that provide improved aquatic habitat in lakes and rivers," White said. "As a side benefit, these projects also promote a positive economic impact resulting from better access to improved water resources. In this way, LARE funds help improve the experiences for boating, fishing, swimming, while enhancing and improving the aquatic environment for fish and other inhabitants of Indiana's waters."

A list of projects by water body, county, project type, and grant award can be found at: **http://www.in.gov/dnr/fishwild/3304.htm**.

Male Bass with Female Features Found in U.S.

Intersex fish problem linked to hormone treatments

The Associated Press

Government scientists figure that one out of five male black bass in American river basins have egg cells growing inside their sexual organs, a sign of how widespread fish feminizing has become.

The findings come from the U.S. Geological Survey in its first comprehensive examination of intersex fish in America, a problem linked to women's birth control pills and other hormone treatments that seep into rivers. Sporadic reports of feminized fish have been reported for a few years.

The agency looked at past data from nine river basins, which cover about two-thirds of the United States – and found that about six percent of the nearly 1,500 male fish had a bit of female in them.

The study looked at 16 different species, with most not affected. The fish most feminized are two of the most sought-after freshwater sport fish: the largemouth and smallmouth, which are part of the black bass family. Those two species also were the most examined, with nearly 500 black bass tallied.

"It's widespread," said USGS biologist Jo Ellen Hinck. She is the lead author of the study, published online in September in the journal *Aquatic Toxicology*. She said 44 percent of the sites where black bass were tested had at least one male with egg cells growing inside.

Past studies have linked the problem to endocrine-disrupting hormones, such as estrogen from women's medicines. While the fish still can reproduce, studies have shown they do not reproduce as well, Hinck said. Intersex fish also are seen as a general warning about what some experts see as a wider problem of endocrine disruptors in the environment.

The egg cells growing in the male fish's gonads can be seen only with a microscope after the fish has been caught and dissected. The study used data from 1995 to 2004, when the government stopped funding the research. The only river basin examined that did not show any problems was Alaska's Yukon River Basin.

Smallmouth bass, part of the black bass family, are among the fish most affected by feminization of males. U.S. Fish and Wildlife Service

The Mason Lake Project: An Innovative Approach to Using Aquatic Herbicides

The residents on Mason Lake in Mason County, Washington have developed an innovative idea to lower herbicide use and more effectively target small populations of Eurasian watermilfoil (*Myriophyllum spicatum*) along the lake shoreline. Homeowners on Mason Lake have struggled with finding a good chemical control tool for an early invasion of Eurasian watermilfoil. Mason Lake (over 1,000 acres) has a number of springs and currents, and coupled with small patches of milfoil growing along the shorelines, liquid herbicides have not been effective because there isn't enough contact time between the plants and herbicides. Although residents and their contractors are also hand pulling milfoil, residents found that in spite of thorough attempts to remove all plants and fragments, milfoil keeps returning to the same locations year after year.

The residents came up with the idea of creating plastic "tents," which are deployed into the water and placed over small clumps of milfoil. They then inject minute (22 ml/100 ft^2) amounts of fast-acting selective herbicide (triclopyr TEA - Renovate) into the tents, and leave the tents in place for 24 hours. The tents hold the herbicide in contact with the plants for sufficient time to ensure good kill of the milfoil. Lake residents will be also using other herbicides such as 2,4-D and fluridone to compare effectiveness between herbicides.

Lake residents designed and tested several prototypes before settling on the tent-like design pictured at the beginning of this article. They used commonly purchased items such as tent poles, children's swimming noodles, and gorilla tape to manufacture the tents. The tents are floated out to the milfoil-infested area and when placed in position by a diver, they are deployed by removing the floats (pink floats in the photograph). Within a minute or so the tent sinks over the plants and the diver anchors it in place, using rocks (if needed).

The diver injects the herbicide through mesh at the top of the tent and then covers the mesh with a plastic flap. The tent is marked with a buoy. After 24 hours, the lake residents pull up the tent using the buoy. The tents are designed to be collapsible so they can be easily pulled up by lake residents, stacked on a boat, and redeployed to other sites. Several tents may be needed to cover all the plants at any one site.

Results

The chemical company representative initially recommended using a concentration of 2.0 ppm of Renovate (triclopyr) in the tents. He thought that the tents would allow more water exchange leading to relatively rapid dilution of the herbicide within the tents. However, the tents held the concentration very well and this concentration proved too high (and ineffective in killing the plants). It is likely the plants shut down rapidly (high concentration and long exposure) and did not translocate the herbicide. Concentrations of 0.75 ppm and 1.0 ppm triclopyr worked much better. The lake residents reported 100 percent kill of Eurasian watermilfoil at these lower concentrations.

Questions about this story? Contact Kathy Hamel by e-mail at **kham461@ecy.wa.gov**.

WATER COLUMN
School of Public and Environmental Affairs
Room 347
1315 E. Tenth Street
Indiana University
Bloomington, IN 47405-1701

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See a color version of this WATER COLUMN newsletter at: http://www.indiana.edu/~clp/ under "Publications."

Have you checked out the Indiana Clean Lakes Program Web page lately? Take a look at http://www.indiana.edu/~clp/ and see what's new and happening with the program and with Indiana lakes!

Don't Dump Aquariums into Local Waters

Aquarium owners who are moving and can't take their aquarium's contents with them should avoid dumping the contents in local waters.

Most of the fish won't survive the winter, and the plants can thrive and cause serious environmental damage.

Dumping aquarium fish into public waters without a stocking permit is a Class C misdemeanor that can carry a fine of up to $500 and 30 days in jail, plus court costs. If an aquarium owner cannot find someone who will take the fish, the DNR recommends sealing the fish in a plastic bag, putting them in a freezer, and then disposing of them in the trash. They should never be flushed down a toilet or dumped into local lakes, ponds, streams, or rivers.

Alternatives for those who don't want their fish to die as a result of their move include:

- Giving the fish to another aquarium owner
- Donating the fish to a local aquarium society
- Contacting aquarium stores for possible return

The plastic-bag technique also is the best option for getting rid of unwanted aquarium plants. Unlike the fish, many aquarium plants thrive in local waters, crowding out native plants and adversely affecting fishing, boating, and the water's appearance, and can cost thousands to eradicate.

Source: Indiana DNR.

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Address all correspondence to:
William W. Jones, Editor
SPEA 347, 1315 E. Tenth Street
Indiana University
Bloomington, IN 47405-1701

E-mail: joneswi@indiana.edu
Phone: (812) 855-4556
FAX: (812) 855-7802