

Invasive Algae Widespread in Indiana

Among the usual visitors to Indiana lakes during the summer of 2001 was a new and unwanted one – a blue-green alga called *Cylindrospermopsis raciborskii* (see Figure 1). This tropical species, which had never before been identified in Indiana, was first identified by Dr. Ann St. Amand from samples collected on August 15, 2001 from Ball Lake, a 75-acre natural lake in Steuben County. The Ball Lake sample contained 320,000 cells per ml. Its presence has since been confirmed independently in several Indiana reservoirs. The occurrence of *C. raciborskii* in Indiana caused quite a stir because these organisms are known to produce potent toxins.

Toxin-producing blue-green algae appear to release toxins primarily under stressful conditions such as during blooms or when treated with algaecides. *Cylindrospermopsis raciborskii* produces three toxins: cylindrospermopsin and saxitoxin (both affecting the liver) and anatoxin-a (a nerve toxin). While there have been no confirmed human deaths from *Cylindrospermopsis*, it was linked with 149 cases of hepato-enteritis in Australia, and with livestock deaths.

Figure 1. *Cylindrospermopsis raciborskii* has two primary forms – straight and curled. Each filament is only 2-3 microns wide and may contain 3 or more cells (for comparison, a human hair may be 25 – 60 microns wide). Photos courtesy of Ann St. Amand



Indiana state government responded rapidly to this potential threat. A Public Health Advisory was issued for Ball Lake and water samples were driven to the laboratory of Dr. Wayne Carmichael at Wright State University in Ohio, who confirmed the toxins' presence.

A task force of representatives from the DNR, IDEM, Indiana Department of Health, U.S. Army Corps of Engineers, Indianapolis Water Company, Indiana Lakes Management Society, Purdue University, and Indiana University was convened on 9/26/01 and has met periodically since then to address policy and health concerns related specifically to *Cylindrospermopsis* and other toxin-producing blue-green algae. However, without information on the distribution and abundance of this species in Indiana, state policies and mitigation measures could not be developed. The Toxic Algae Task Force recommended further study to gather this information.

The Study

For the past three years, Professor Bill Jones and graduate student Sarah Sauter of Indiana University's School of Public and Environmental Affairs (SPEA) have been studying the distribution and abundance of *Cylindrospermopsis* in Indiana lakes and reservoirs. The study was funded by a Clean Water Act Section 205(j) grant administered by the Indiana Department of Environmental Management (IDEM).

During the summers of 2002 and 2003, 166 lakes and reservoirs included in the Indiana Clean Lakes Program (CLP) routine lake assessment schedule were also sampled for *Cylindrospermopsis*. During 2004, an additional six

CLP lakes were sampled and 11 lakes were sampled by citizens participating in the Volunteer Lake Monitoring Program. The 2004 samples were only collected when conditions indicated a potential bloom of *Cylindrospermopsis*. These 2004 samples were thus considered as "targeted" rather than "routine." Not all of Indiana was surveyed during this period.

Results

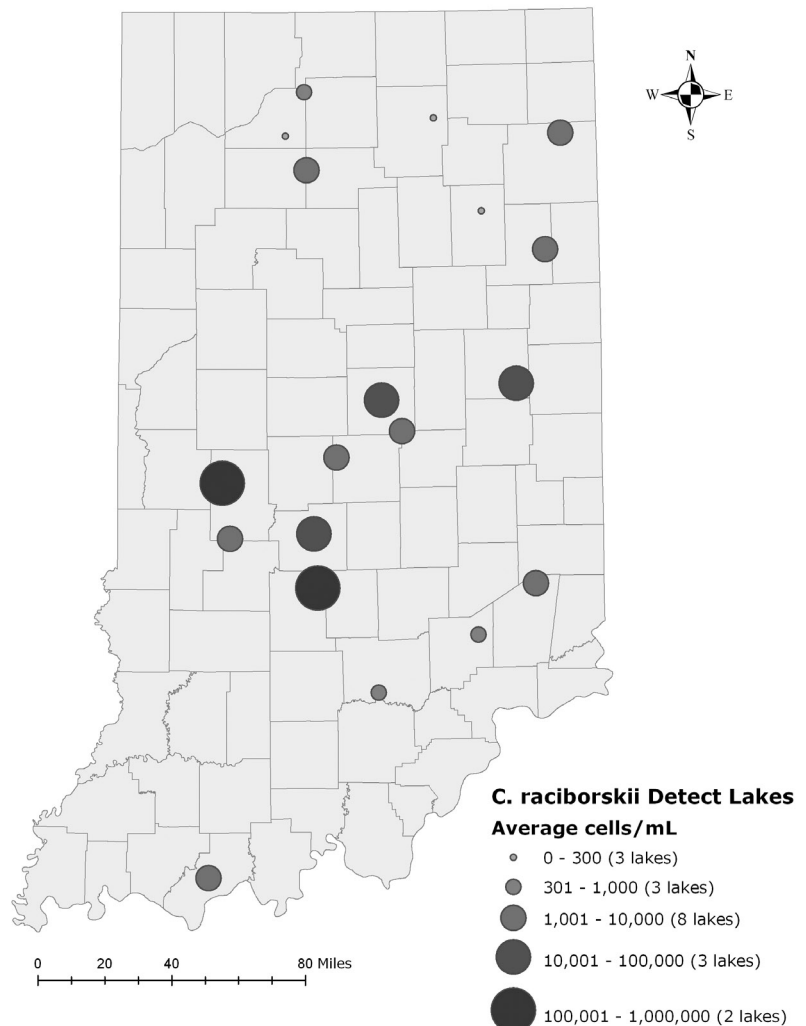
Of 183 lakes and reservoirs sampled, *Cylindrospermopsis* was detected in 19. More reservoirs (14) than natural lakes (4) had detectable levels along with one quarry. Most of the "detect" waters were in central Indiana – and five

of them are public water supplies (Figure 2). In addition, more detects occurred in August samples than in samples collected in July. Experience suggests that because this species is of tropical origin, it reaches peak growth in temperate regions in late summer.

Results for each lake are shown in the following table. Three samples were collected from Lake Lemon in Monroe County during two different years and all three samples contained the greatest densities of *Cylindrospermopsis* in our study.

Lakes with detectable *Cylindrospermopsis raciborskii*: (a) were shallower, (b) had lower Secchi disk transparency, (c)

Figure 2. Distribution and abundance of *Cylindrospermopsis* in Indiana. Lakes and reservoirs in western, south-central, and north-central Indiana were not included in this study due to lack of time.



Got a question about your lake? Or lakes in general? Or about something you've read? Write to us at the WaterColumn and we will do our best to answer it.

Table 1. *Cylindrospermopsis* Densities in Indiana Lakes and Reservoirs.

Lake Name	County	Date	cells/mL
Lemon (Riddle Pt)	Monroe	7/7/2002	357,592
Lemon (Reed Pt)	Monroe	8/18/2004	315,632
Lemon (Reed Pt)	Monroe	7/7/2002	246,642
Glen Flint	Putnam	8/7/2002	204,251
Prairie Creek	Delaware	8/20/2002	84,257
Morse Reservoir	Hamilton	8/14/2002	19,640
Ole Swimming Hole	Morgan	8/16/2004	17,894
Cagles Mill	Putnam	8/7/2002	7,292
Bischoff	Ripley	7/22/2002	3,445
Cedarville	Allen	8/13/2002	2,131
Geist Reservoir	Marion	8/14/2002	1,861
Kunkle	Wells	8/20/2002	1,389
Eagle Creek	Marion	8/14/2002	1,364
Chrisney	Spencer	7/15/2002	1,250
Bruce	Fulton	8/16/2004	1,072
Koontz	Starke	8/17/2004	747
Brush Creek	Jennings	7/16/2002	624
Starve Hollow	Jackson	7/16/2002	416
Bass	Starke	8/16/2004	289
Clare	Huntington	8/19/2002	163
Irish	Kosciusko	8/18/2003	64

had higher phosphorus and chlorophyll concentrations, and (d) had warmer bottom water temperatures than lakes without detected *Cylindrospermopsis* (Table 2). Warm sediment temperatures are important for the germination of over-wintering resting cells of this alga so this may explain why reservoirs, which usually have more extensive shallows, had more detectable cells.

What to Do?

Our study was not able to test for algal toxins so until we know more about the relationship between *Cylindrospermopsis* density and toxin production, we should remain vigilant with increased monitoring. Recent studies in Wisconsin have not detected toxin production in lakes with *Cylindrospermopsis* densities of 240,000 cells/ml so there is not a clear link between cell density and toxin production.

Unlike other blue-green algae, *Cylindrospermopsis* does not form surface mats or scums, but rather,

its highest densities are several feet or more beneath the water surface. A sudden decrease in Secchi disk transparency along with a dark, green appearance to the water at depth are symptoms of *Cylindrospermopsis* blooms. Remember that although *Cylindrospermopsis* does not form surface mats, other toxin-producing blue-green algae do. *Never* let your children play in water having surface algal mats and don't let your pets or livestock drink from such waters.

Out of necessity, this study did not sample all the lakes and reservoirs in Indiana and sampled some in July, when there was less likelihood of high *Cylindrospermopsis* growth. Because of this, non-detect lakes in this study do not automatically get a "clean bill of health." State officials and citizens alike must keep a watchful eye on their lakes, especially in shallow, nutrient-enriched lakes in late summer.

Table 2. Some Characteristics of Detect and Non-Detect Lakes.

Parameter	Mean, Detect Lakes	Mean, Non-Detect Lakes
Max. Depth (m)	8.7	12.5
Secchi depth (m)	0.706	2.26
Epilimnetic Total Phos. (mg/L)	0.081	0.037
Epilimnetic Chlorophyll a (µg/L)	17.58	7.40
Temp @ Max. Lake Depth (°C)	18.2	11.8

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DNR Awards Grants to Improve Hoosier Lakes Agency funds 53 projects in 17 counties

Hoosiers will soon begin to see an increase in local projects to protect and restore Hoosier lakes. More than \$1 million will be awarded to target invasive aquatic plants and sediment issues.

The Soil Conservation Board has awarded grants to 53 lake improvement projects in 17 counties, some pending final plan approvals. The grants are for two areas of concern, aquatic plant management and sediment removal.

"Indiana is blessed with an abundance of lakes that provide

recreational opportunity as well as important habitat," said DNR Director Kyle Hupfer. "These new grants are a vital part of the partnership we have with local groups to protect and maintain our precious natural resources."

Projects to manage exotic aquatic plants will prevent aggressive non-native plants from taking over and destroying recreational opportunities, native plants, and ecosystems. Grants totaling \$664,315 will be distributed in 14 counties to 41 aquatic plant management projects in 57 lakes. Fifteen projects are awaiting final approval by DNR staff.

Sediment removal projects will eliminate recreational obstacles, making Hoosier lakes more enjoyable and accessible for boating, fishing, and swimming. A total of \$388,425 will be distributed in 11 counties to 12 sediment removal projects in 16 local lakes.

Funding for these targeted projects comes from the Lake and River Enhancement fee paid by boat owners. In 2003 the legislature increased the fee, which had been a flat \$5 per boat, to a variable amount based on the value of each boat. The new fee structure increased the total money generated annually from \$1.2 million to approximately \$3.3 million.

Indiana law also requires one-third of the money to be used by the DNR for lake projects that remove sediment or control exotic or invasive plants or animals. The remaining two-thirds must be split between the DNR's division of law enforcement and the Lake and River Enhancement (LARE) program.

The law enforcement division will use their share to help fund local boating safety programs and the LARE program will continue its use the money for a variety of

local grants. Those grants will be announced in mid-summer.

The entire list of LARE awards for 2005-05 can be viewed on the following Web site: www.ai.org/dnr/soilcons/programs/lare.html.

Perspectives

The Water is Silent

The fish in the water is silent,
the animals on the earth is noisy,
the bird in the air is singing.
But man has in him the silence of
the sea,
the noise of the earth
and the music of the air.

Source: www.poetseers.org

Have you checked out the Indiana Clean Lakes Program Web page lately?

Take a look at

<http://www.spea.indiana.edu/clp/>

and see what's new and happening with the Program and with Indiana lakes!



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