Cyanobacterial and Microcystin Study of Swan Lake Outflow Samples – 2011

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Cyanobacteria proliferate in lakes where nutrients are elevated and the water is relatively still. If the lakes overflow into rivers, their numbers can become significant enough to affect river water quality and the efficiency of water treatment by drinking water utilities. Furthermore, cyanotoxins can develop making the lakes an unhealthy environment for recreation. Microcystins are a class of cyanotoxins that affect the nerves, skin, and kidneys.

This study was designed to determine the species of the cyanobacteria proliferating in Swan Lake and the prevalence of microcystins throughout the season.

Swan Lake is a small lake that feeds into a chain of three others just southeast of Estherville, Iowa. Their water eventually flows into the Des Moines River. It was selected for study, because the personnel of The Iowa Soy Bean Association believed it to have an historical appearance of algal and cyanobacterial blooms.

The **World Health Organization** developed provisional guidelines for cyanobacterial and microcystin levels in recreational waters, which are illustrated in the following chart.

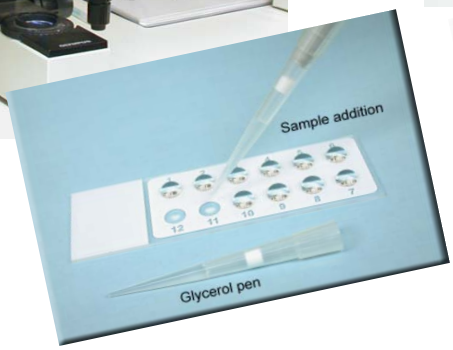
		Cyanobacterial cells/ml	Microcystins in ug/L
Recreational Bathing Waters	**Low Risk**	**20,000**	**4 ug/L**
	Moderate Risk	**100,000**	**20 ug/L**
	High Risk	**Scums**	
Drinking Water			**1 ug/L**

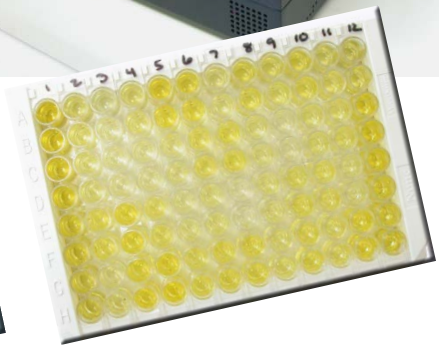
The **Iowa Department of Natural Resources** enforces a microcystin advisory level of 20ug/L. Many Iowa and Minnesota lakes have cyanobacterial counts that greatly exceed the WHO's provisional guidelines.

Method

Samples were collected on a weekly basis by personnel of The Iowa Soy Bean Association from the outflow of Swan Lake. Despite frequent rain throughout the year, the amount of rainfall did not fill the lake sufficiently for its water to overflow for many of the sampling days. For the entire season, only four samples were selected for microcystin studies. They were based on the presence of *Microcystis* or on the overall cyanobacterial count, and spanned between June 1 and July 24.

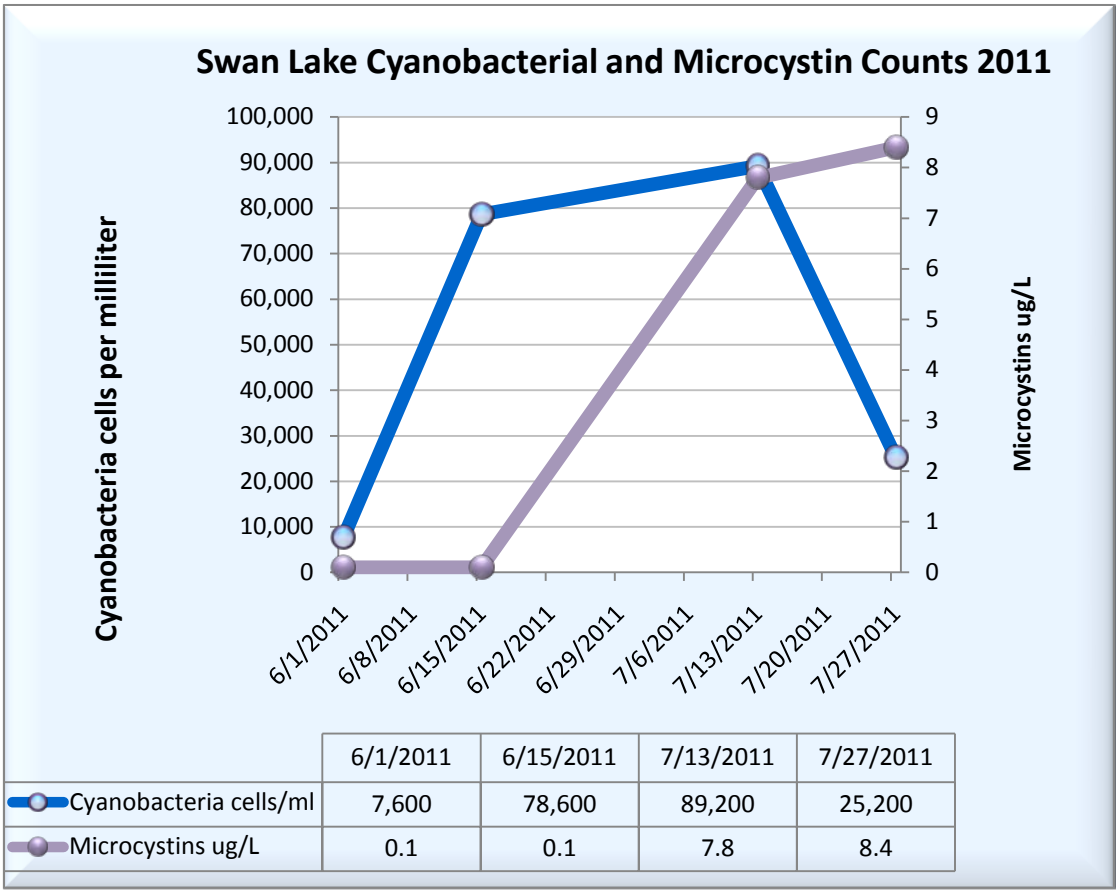
Cyanobacterial and algal studies were performed by using Des Moines Water Work's well slide with glycerol phytoplankton method, and the microcystin studies were performed by using the Abraxis microcystins ELISA method.





Results

The cyanobacterial counts were below 10,000 cells/ml on June 1 and dramatically bloomed to 78,600 cells/ml within a week. They then leveled off, peaking at 89,200 cells/ml and finishing with a precipitous drop to 25,200 cells/ml within two weeks, giving a typical arched growth curve. The microcystins did not follow the growth curve as is often the case, but they did rise to a maximum of 8.4ug/L during the stationary and death phases of growth when the cyanobacteria began to die. Cyanotoxins are entities of the bacterial cell walls. Once the cells die, the toxins are released.



	6/1/2011	6/15/2011	7/13/2011	7/27/2011
Cyanobacteria cells/ml	7,600	78,600	89,200	25,200
Microcystins ug/L	0.1	0.1	7.8	8.4

Summary

The cyanobacteria of Swan Lake were unique from other Iowa lakes examined in the year, in that they were largely composed of the genus *Microcystis*, the genus after which the microcystin toxins were named. The Swan Lake cyanobacterial bloom approached WHO's moderate recreational risk category, but remained modest relative to the counts of several hundred thousand or millions that other similar Iowa lakes have reached in previous years. Whether or not the Swan Lake counts were higher in previous years is unknown.

The maximum microcystin value of 8.4ug/L fell between the low risk and high risk categories, and was below the Iowa Department of Natural Resources advisory level of 20ug/L for recreational use.