

## REPORT

# INTERNATIONAL SYMPOSIUM ON CYANOBACTERIA IN LAKE WATERS

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Held at the Algonquin Resort, St. Andrews, NB

October 25<sup>th</sup>, 2014

October 25<sup>th</sup>, 2014 and a good crowd of interested people from around our watershed, from the NBALA (New Brunswick Alliance of Lake Associations), from various parts of our province, from the Department of Environment and from academia converged on the Algonquin Resort to hear key-note speaker Dr. Kenneth Wagner's address: Cyanobacteria: effects and mitigation.

Ken Wagner holds degrees from Dartmouth College and Cornell University, with his Ph.D. earned in Natural Resource Management in 1985. He has over 36 years of experience working on a variety of water resources assessment and management projects, including lake, river and watershed assessment and management, regulatory processes, and educational programs. In 2010 he started Water Resource Services, a small company with a focus on water supply protection and lake management consulting. He is a former President of the North American Lake Management Society and recently retired Editor in Chief of Lake and Reservoir Management, a peer-reviewed journal.

Dr. Wagner's dynamic presentation left no doubt in the minds of his listeners that what we are dealing with in the lake is an ancient organism that is found in waters from the north to the south of the North American Continent and that can grow under a variety of temperature variants in rivers and lakes. They contain certain pigments, which with their chlorophyll, often give them a blue-green colour; however, some species are actually, red, brown, green, yellow or black. Some are capable of nitrogen fixing, while others contain pigments that allow them to produce free oxygen as a byproduct of photosynthesis and under proper conditions can reproduce explosively, forming dense concentrations called blooms, some of which we have seen in our lake.

He noted that some species of cyanobacteria produce neurotoxins, hepatotoxins, and dermatotoxins and the literature supports that some forms of these toxins are dangerous to both animals and humans. However, we should "recognize a potential risk, but not assume toxicity." Where it is deemed necessary, public advisories should be issued, but advisories are only part of the awareness. There is still a need to identify what algae are present and to understand the situation.



He talked about the different formation of blooms, citing that not all blue-green algae are created the same. Some are organic growth in the upper water layer using sunlight and nutrients; some form at the thermocline from a starter population normally found in sediment, that rises to the near the thermocline and growth depending on high efficiency of light, and some form at the bottom that start from spores that in turn absorb PH at the water interface, that form gas vessels that create buoyancy and allow the colonies to rise to the surface quickly.

Dr. Wagner continued with a discussion on Bloom trends and talked about the increase and frequency of the blooms. One major contributor is Phosphorus (P) and an increase in this element, combined with a decrease in the Nitrogen to phosphorus ratio will favor cyanobacteria. Rising temperatures in water will also increase the frequency of blooms. The obvious increasing global temperatures, shallow water, rich nutrient bases, light and sediment mixing all have an impact on the potential for blooms. Increases in temperature favor metabolism of sugars and this favors cyanobacteria. The more frequent and intense our storms are directly impacts the increase in run off and more nutrients reaching our water. “However erratic inputs, fluctuating winds and variable oxygen loss lead to less predictable conditions, the best control is finding a way to control the phosphorus”.

All of this, in turn, leads to the need to have an effective watershed management program. Understanding the watershed and finding reasonable ways to manage it are key. Such things as: controlling pollutants, implementing source control, being vigilant and adopting a proactive stance are all part of that management plan. There is a great need to understand the quality of the sediment, the fish populations, water temperature and above all water quality. He described a number of ways in which a lake with cyanobacteria might be managed, but most are either too costly or inappropriate measures to clean up the situation. He spoke of selected withdrawal of water, flushing, sonification, the application of phosphorus binders, additives such as dyes, algaecides, oxygenation and circulation at the water surface and of copper or peroxide applications. He noted that most of these measures were reactive and not always workable and stressed that it is better to “prevent the blooms, not to get rid of them.”

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## MANAGING CYANOBACTERIA IN DRINKING WATER

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The second presenter was **Mary Jane Dillingham**, a biologist who currently serves as the Water Quality Manager for the Lewiston Water Division and the Auburn Water District in Maine. Mary Jane is well acquainted with the issues around water quality and resource and serves as Vice President of the Maine Volunteer Lake Monitoring Program. She is also the public drinking water representative for the State of Maine Task force on Invasive Aquatic and Nuisance Species.

She came today to talk about managing cyanobacteria in drinking water. Since Chamcook Lake is the designated water source for the Town and for other users, her presentation was very interesting. She spoke of the challenges faced, resolved and the ongoing monitoring of the water

systems. She outlined the history of the notice of significant blue-green algae Gloeotrichia, followed by microcystis and Anabaena in Mid-August of 2011 and of the notice of a significant decrease in the dissolved oxygen below the thermocline. The turbidity level had also increased dramatically. The Maine Lake Monitoring Program was consulted and winter sampling increased and watershed phosphorus contributions reviewed. By 2012, the surface water temperatures were well above record temperatures and the summer saw algal blooms of Gloeotrichia and Anabaena. By mid-September, dissolved oxygen decreased so that below 9 meters had low/no oxygen and in September of that year, there was a massive fish kill of over 200 lake trout.

The resulting analysis of the data that had been collected showed a relationship to the turbidity and the occurrence in 2011 of Hurricane Irene. More frequent testing measures were put in place and there was a strengthening of watershed management programs. The result that in the data presentation for May of 2014, the plan seems to be working well and the treatment of the municipal water source is well within acceptable standards for safe water. What her presentation spoke of with respect to our situation is that a strong and effective lake monitoring system is one way an effective and positive outcome can occur.

This is the web link to the Lake Auburn Study Results and well worth the look.

<http://lakeauburnwater.org/wp-content/uploads/2014/05/Watershed-Study-Presentation-CDM.pdf>

The third presenter was **Dr. Jennifer Dingman**, Team leader for the City of Moncton Water Quality Project. Jennifer holds a B. Sc. in Environmental Biology from UNB and a Ph. D. in Algal Biology. Jennifer spoke about the project which began in the Irishtown Reservoir in 2009 when a green slime was found on the water. Since then, and in partnership with the Universite de Moncton, there has been a program of systematic monitoring of the water quality, algae growth and land use in the Irishtown Watershed. The project has expanded to include monitoring in three other reservoirs in the city of Moncton.

Jennifer spoke of the continued efforts to provide the city of Moncton, Dieppe and the town of Riverview with clean safe, drinking water. One of the efforts put forward by Jennifer and her team in 2014 will be the implementation of a nutrient remediation program and an expansion of the public education information section.

The forth presenter was our own **Mayor, Stan Choptiany**, an environmental steward with a long history in education and who holds a M. Sc., B.Ed., and B.Sc. from the University of Toronto. Stan has demonstrated his commitment and leadership in the effort to have safe drinking water for the town. His presentation focused on the historical rise of interest and information on cyanobacteria since it was first detected in Chamcook Lake in 2010 up to an including the latest meeting held with Environment just this past week. He spoke of the need to have knowledge on various factors within the watershed and to move in a progressive, reasonable and proactive way to determine what is best as a management plan. He alluded to the ongoing efforts of the town to

test the water and cited that he was unaware of any health concern, all be it that some concerns may not be manifest for generations, but that in the current window, the tests being conducted would say the water is safe. He did say that the response plan within the town was in place and with the assistance of all media, town workers, the local town website; the Department of Health and Department of Environment, that notification to citizens could be carried out immediately, if any risk to the water supply was declared.

He said the control of the cyanobacteria in the Lake came down to two key choices: Identify the source and limit the nutrient phosphate and nitrogen and to develop a water budget with water allocations noted that could allow for a flushing of the blooms over the dam in the late summer. He did note that this year the incidence of blooms was less, perhaps due in part to a cooler spring and early summer. He did speak to the identification of a Phosphorus and Nitrogen source in our Oligotrophic Lake at the Ducks Unlimited Wetland intake but noted that further study was in the works there.

He talked a bit about the tasks at hand and outlined that a clear governance structure with clear lines of communication, authority, responsibility and accountability was essential. He spoke to a need to develop a management plan that included a risk management and contingency model and he had high praise for the Chamcook Watershed Landowners' Association for its part to play in the completion of a plan as well as being a voice for resident concerns and an avenue for information dissemination. Because the town does not own this watershed, there needs to be one governance model that best serves everyone and he was pleased with the cooperation of the association.



He also told guests that as recent as the past couple of weeks, the Chamcook Watershed Landowners' Association had put in place a special committee to look at a Critical Incident Plan for the lake. He saw this as a vital part of the overall strategy to maintain healthy water. He also said that a meeting with Environment had alluded to the potential for multi-year ETF funding for identified projects, and further nutrient source investigations and water monitoring by the Department of Environment together with a robust Volunteer Lake Monitoring Project. He expressed the importance of the continued work to develop a water budget and alluded to the results so far from the Stantec Report and the identification of the aging infrastructure of the dam.

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## GLOEOTRICHIA TOXICITY IN OLIGOTROPHIC LAKES

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Presented by **Dr. Holly Ewing**, Ph. D. in Ecology from the University of Minnesota and an Associate Professor at Bates College in Lewiston, Maine, this portion of the program dealt with Gloeotrichia toxicity. As part of her work in the Environmental Studies Program, she has conducted research to examine the linkages among atmospheric, terrestrial, and aquatic ecosystems. She is particularly interested in combining approaches from modern ecology and paleoecology in the investigation of history and the drivers of change in terrestrial and aquatic ecosystems. Her current aquatic projects include an investigation of cyanobacteria as potential drivers of changes in lakes, a study of mercury in stream food webs and the development of a smart phone application to enable citizen scientists to contribute data about lakes to a central database.

She spoke of the seven year study conducted at Lake Sunapee in New Hampshire and the attempt to determine what was considered to be drivers for the Gloeotrichia recruitment at the surface of this large lake. They looked at whether the precipitation, air and water temperature and ice out dates were significant drivers. Over the course of the multi-year study, they were able to determine that there was an inter-annual variation in the Gloeotrichia recruitment that may be related to regional climate variability and this is important because this species seems to be increasing in low nutrient lakes across the Northeastern US and in Canada.



She outlined how the samples were taken using a downward facing transparent glass funnel attached to plastic collection bottles and how the samples were collected on a regular basis and how the data gained enabled them to quantify the abundance of the species. Over the course of the study they were able to gain insight into changes from year to year. She talked about the effect of early ice out as compared to late ice out and how this had an overall effect on the population. Ice out late was a better situation.

She did indicate that the smart phone application was available for android phone operating systems, but for the IOS platform it would be a bit longer before the application would be marketed. This smart phone application will provide a vehicle to input lake data to a central database.

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## CYANOBACTERIA RESEARCH IN NB

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The final presenter for the symposium was **Dr. Allen Curry** from the Canadian Rivers Institute. At UNB Fredericton, NB. Allen Curry holds a Ph. D. in Zoology from the University of Guelph and M.Sc. in Watershed Ecosystems from Trent University and an HonsBES (Geography and Biology) from the University of Waterloo. He spoke today about the Long term Lake Monitoring Program where in nine core lakes have been identified and their collected data will form them as “reference “Lakes in this long term project.

He indicated how the group had arrived at the identification of the lakes and how the long term referencing would take place. The lakes will be monitored for depth, temperature, for chemical structure and for aquatic life. Any lake which is being referenced to these will be graded as normal based on this established criteria and those outside of the reference will be further tested. Chamcook Lake is designed to be one of the reference lakes.

He did speak to the NB Rivers Initiative and said that it was temporarily not able to collect data, but that his had hopes of reactivating this initiative in the future.

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## FINAL COMMENTS

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This was an extremely interesting symposium and offered various views on the central theme of Cyanobacteria in Lake Waters. In his closing remarks, ECW Executive Director, Donald Killorn, thanked everyone for participating in this the third year of Lake Conferences.