Summer Village of Grandview

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Hon. Shannon Phillips
Minister of Environment and Parks
208 Legislature Building
10800 - 97 Avenue
Edmonton, AB
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Dear Honorable Minister:

Re: Research Project into the Mitigation of the Effects of Cyanobacteria on Alberta's Lakes

The Summer Village of Grandview at Pigeon Lake has been supporting investigations into possible mitigation strategies for the adverse effects of cyanobacteria in Alberta's recreational lakes. We have championed the research project currently underway at the University of Alberta into how interference of the food web in Pigeon Lake could be affecting water quality (the "trophic cascade"). This work is being supported by the Alliance of Pigeon Lake Municipalities (APLM).

In addition, on behalf of the Association of Summer Villages of Alberta (ASVA), our Summer Village has undertaken an investigation of the possible beneficial effects of removing algae from a water body as a means of breaking the nutrient cycle. Although we have made significant advances in our quest to find strategies to address the problems caused by cyanobacteria, it has become apparent that a project of this importance and magnitude will require support from the provincial government.
The projects currently underway and the scientific basis for the work are outlined below. Following that is a description of the proposed work, for which we are requesting your participation and support.

Research into the Trophic Cascade

Dr. Rolf Vinebrooke, professor of biology at the University of Alberta, is undertaking a two-year research project at Pigeon Lake to investigate how disruption in the natural ecological balance may have caused an imbalance in the food web in favor of cyanobacteria. If the project confirms the hypothesized link, it will suggest possible bioremediation strategies to restore a more favorable balance.
The first year of the study has been completed and has revealed some significant results. High minnow populations and abnormally low populations of certain types of zooplankton (daphnia) were found. In the second year of the project, investigations into various environmental conditions will be studied through the use of mesocosms.

It is hoped that the results from these investigations will form the basis for possible action plans for Pigeon Lake and other lakes experiencing similar problems. A summary of Dr. Vinebrooke's results from the first year is attached.

The Nutrient Cycle and the Potential for Harvesting Algae

Research published in 2015 (references 1 and 2) indicates that once cyanobacteria gains a foothold in a waterbody, a positive feedback loop develops, exacerbating the problem. Basically, the concept is that cyanobacteria benefits from the nutrients in the sediment through biological extraction, fixes nitrogen from the atmosphere, blooms, and then dies. The released nitrogen and phosphorous from the decaying algae then provide the nutrients for additional algal growth, which results in further extraction of nutrients from the sediments. The cycle continues with increasing severity. The increase in the temperature of lakes currently being experienced throughout the world (and certainly at Pigeon Lake) is an important factor in the recent spate of terrible algae blooms.
We are undertaking an investigation into how the removal of a large amount of cycanobacteria from a lake could possibly have a beneficial effect on water quality by breaking the nutrient cycle. On behalf of many Summer Villages and Counties throughout Alberta, our village recently applied to Municipal Affairs for a Community Partnership grant to undertake this work. The application was structured to support a feasibility study, a field test of harvesting algae, and a research project to identify the possible beneficial effects of removing nutrients from the nutrient cycle. Unfortunately, we were recently advised that our application was unsuccessful. Our work is continuing with involvement with the University of Alberta, but to achieve success, we will require financial support.

The project into recovering nutrients through the removal of cyanobacteria from the lake ("algae harvesting") has three components, which are discussed below:

1. Feasibility Study

This study will examine the amount of nutrients (phosphorous and nitrogen) that can be realistically removed from a waterbody through a mechanical recovery means. Our preliminary analysis indicates that it is possible to remove a significant portion of the phosphorous from the nutrient cycle over the time period when blooms occur. Harvesting a meaningful quantity of phosphorous would be a monumental task, but when compared to alternatives such as adding huge quantities of chemicals, it appears potentially more practical.

To our knowledge, this will be the first attempt to improve water quality by harvesting algae to break the nutrient cycle. It also seems to be the only in-lake, non-invasive possibility currently being considered to solve this world-wide problem affecting lakes.

The feasibility study will also address such issues as regulatory approvals, disposal of recovered algae (a potential source of natural agricultural fertilizer), the capital and operating costs of harvesting algae, a quantitative analysis of the nutrient budget, and the effects of phosphorous reduction on cyanobacterial growth.

This study will continue throughout the summer and into next fall. The results of this study will provide the justification for further actions such as a field test of an algae harvester. The budget requirement for this study is $50,000.

2. Field Testing of an Algae Harvester

With an indication of project success from the feasibility study, the next step would be to undertake an actual recovery operation with the use of an algae harvester. Algae harvesters are used throughout the world to recover cyanobacteria for commercial enterprises. It is hoped that existing technology and proven techniques can be adapted for this new purpose.

This phase of the project will provide an actual quantitative measurement of the amount of algae that can be recovered from a water body during a season. It will also provide evidence of the secondary benefit derived through the reduction of nuisance algae buildup on the shoreline. You can expect to receive many communications from lake residents this year since water quality and shoreline algae buildup are predicted to be central issues because of the hot, dry conditions prevailing this summer.

The cost estimate for this operation will be determined by the feasibility study, but is thought to be in the order of $200,000. Funding of this project will be through requests from municipalities, environmental grants, and senior government assistance. This field test will provide the very important economic justification for possible removal applications in other lakes within Alberta.

3. **Scientific Research into the Beneficial Aspects of Algae Harvesting**

A removal operation would be incomplete without measurements to relate the reduction in the algae cycle and the improvement in water quality to the amount of nutrient removed. We have obtained the support of Dr. Rolf Vinebrooke to assist in undertaking a research project to help quantify these results. Dr. Vinebrooke's involvement in the feasibility study, including the nutrient recovery analysis and the subsequent field testing, we should be able to provide the necessary scientific validity to support any subsequent proposal for algae harvesting. The scope of this research would be determined during the feasibility study. The costs of this work have yet to be determined but should be within the range of existing projects relating to the trophic cascade.

Conclusion

There is no question that something drastic has been happening to Pigeon Lake over the past decade. Cyanobacteria blooms have increased in severity almost every year. Our residents are becoming very concerned about this situation and are looking for answers. While many efforts are being made to protect our watershed, it is felt that a non-invasive approach such as this must be taken to break the nutrient cycle.

Preliminary investigations suggest that the deteriorating condition of Pigeon Lake and other lakes in Alberta may be attributable to a combination of three factors: 1. the disruption of the food web from a fisheries imbalance, which has caused the algae-grazing zooplankton population, specifically the daphnia, to diminish, thereby allowing the cyanobacteria to flourish; 2. increasing water temperatures experienced over the past 30 years (approximate 1.2 degrees C increase per decade based on temperature surveys); and 3. the positive feedback loop in the nutrient cycle caused by the increased algae populations. If this hypothesis is valid, then the solution to the problem may consist of an appropriate bioremediation strategy in conjunction with removal of nutrients from the lake through mechanical harvesting as algae blooms form. Frankly, we cannot perceive any other acceptable non-invasive strategy. Maintaining the status quo does not seem to be an acceptable approach.

In summary, we would appreciate if your department could provide financial support in the order of $50,000 to assist us in undertaking our feasibility study. We would also welcome any participation your department may be able to provide in the form of scientific and/or technical assistance.

Thank you for your consideration. If you require any further information, please do not hesitate to contact me.

Yours truly,

Don Davidson
Mayor, Summer Village of Grandview

References

1: Cottingham, K. L., H. A. Ewing, M. L. Greer, C. C. Carey, and K. C.Weathers. 2015. Cyanobacteria as biological drivers of lake nitrogen and phosphorus cycling. Ecosphere 6(1):1. http://dx.doi.org/10.1890/ES14-00174.1

2. http://www.fondriest.com/news/cyanobacteria-blooms-need-foothold-lake-alter-nutrient-cycles-favor.htm