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WATER QUALITY INITIATIVE MONITORING PROGRAM

Water Quality Report 2011

RiverStone
ENVIRONMENTAL SOLUTIONS INC.

WATER QUALITY INITIATIVE

2011 Water Quality Report

Prepared for: Muskoka Lakes Association

December 2011

RiverStone Environmental Solutions Inc.

RIVERSTONE
ENVIRONMENTAL SOLUTIONS INC.

December 2011
RS#2009-06

Mr. Mike Logan
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SUBJECT: Muskoka Lakes Association Water Quality Initiative – 2011 Water Quality Report

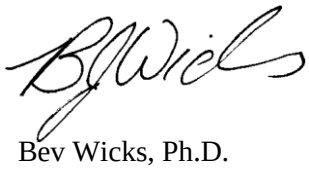
Dear Mike:

RiverStone Environmental Solutions Inc. is pleased to provide you with the attached 2011 Water Quality Report.

Please contact us if there are any questions regarding the report, or if further information is required.

Best regards,

RiverStone Environmental Solutions Inc.



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Executive Summary

The Water Quality Initiative's (WQI) overall purpose is "to maintain and improve water quality through water quality monitoring and lake stewardship activities." A major component of meeting the seven detailed objectives of the WQI is a science-based monitoring program established by the Muskoka Lakes Association (MLA) over a decade ago. In 2011, the MLA elected to adjust the historic program to better support the objectives and to update the program so that it was consistent with current scientific direction and sampling methodologies.

The major program changes included:

- Method updates that required filtering phosphorus samples, collection of samples at secchi disk depth, and collection of duplicate samples.
- A change in many of the phosphorus and *E. coli* sampling sites based on a complete review of all the historic data and input from volunteers and the community. Twenty-three new sites were added in 2011 in identified areas of concern or in high use areas with the potential for concern.
- Sampling frequency was reduced from eight sampling events to four, to allow for the collection of duplicate samples and calcium samples, while maintaining sampling sites. The reduced sampling frequency will not compromise the intent of the program.
- Calcium sampling was undertaken, in addition to spring turnover phosphorus, to increase the depth of the WQI program. This additional data could be valuable to support further regulation of vulnerable areas.
- *E.coli* sampling was completed during the warmest months (July and August) at carefully selected sites when the highest levels were expected to occur. The new sampling protocol supported immediate follow-up sampling if levels greater than 50 cfu/100mL were detected at a site. An action plan was also in place to allow the MLA to contact the appropriate parties if a concern was identified.

The WQI and volunteers successfully implemented the revised program, sampling 180 sites in 50 sampling areas throughout the District Municipality of Muskoka and the Township of Seguin. Bacteria measurements were made at 116 sites, spring turnover phosphorus measured at 47 reference sites, and nearshore phosphorus at 75 sites.

Each summary page presents area specific information including a map and written area description, volunteer recognition, a summary of the 2011 data, trends, and comments and recommendations. Graphs illustrating long-term spring turnover and yearly mean phosphorus concentrations, and *E. coli* yearly means are included in each summary.

New to the 2011 program was calcium sampling. Calcium is a key factor in maintaining stable populations of species that feed on algae and aquatic plants. Should populations of algae eating species decline, algae could increase regardless of trends in phosphorus concentrations. The site-specific 2011 calcium data is provided in the area summaries with a summary of the calcium data for all sampling areas in **Figure 1.**

Each year the WQI provides some level of analysis and or data review for newly collected information. The following comments provide the general trends noted in the 2011 data:

- Based on a review of the phosphorus, secchi depth, and *E. coli* data the monitored lakes have consistently good water quality that is suitable for recreational use.
- The phosphorus concentrations in 2011 were slightly elevated as compared to the historic data for many sampling sites and areas. The increase was more noticeable in the spring turnover samples as compared to the yearly means. Despite the apparent increase, the majority of the sampling areas were still within the range observed over the past 10 years.
- *E. coli* levels in 2011 were consistent with historic data. *E coli* levels greater than 50 cfu/100 ml occurred at 11 of the 116 sampling sites. MBA-12 and MSN-5 had regular occurrences of high *E. coli.* Additional sampling was completed at the two beach areas at the outlet of the Hoc Roc River to determine if there should be additional concerns; the extra sampling at these sites did not indicate a need for concern. There were no areas sampled that required contact with outside agencies.
- Twenty-three new sites were added to the 2011 WQI, based on volunteer input and areas identified with the potential for concern during the 2010 review. None of the data, either phosphorus or bacteria, collected at the new sites indicated water quality concerns.
- The 2011 calcium data indicates that most of the areas sampled appear to be at or below the threshold concentration required to maintain stable populations of many of key algae consuming species as described on Figure 1
- As part of the revised phosphorus sampling protocol, the collection of duplicates was completed. Analysis of the duplicate data allowed for the removal of 23 bad splits and ensured that each sampling area had an accurate phosphorus data point for each sample collected in 2011.

Outside of the direct water quality monitoring program, the WQI as part of its objectives, provides a Stewardship program and assistance to interested communities in identified areas of concern. Through 2010-2011, a successful Stewardship Initiative was undertaken in Cox Bay and work was well underway for Muskoka Bay. Other areas that could benefit from the development of a future Stewardship Initiative and community support from the MLA were identified in both 2010 and 2011. These include Hamer Bay, Windermere, Minett, Muskoka Sands, and the Indian River.

RiverStone has also included in this Water Quality Report program recommendations for the 2012 sampling year. The general recommendations include continued training for all the volunteers, with

particular focus on team leaders. The volunteers should also continue to be supported by a field co-ordinator. Particular emphasis needs to be placed on the *E. coli* sampling and resampling protocols due to the time sensitive nature of the sampling program. The overall methods for sampling in 2012 should be the same as those utilized in 2011, with the possible exception of the *E. coli* program that could benefit from site changes and increased sampling frequency through July and August.

In order to direct change and maintain the existing water quality in our lakes, RiverStone further recommends that the MLA continue to monitor the development practices of each municipality. Communities and municipal planning and building departments need to work together to ensure that policy, by-laws, and site plans are implemented and enforced to protect both lakes and watercourses in Muskoka.

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List of Area Summaries

1. INTRODUCTION

The Muskoka Lakes Association (MLA) has been conducting a water quality monitoring program since 2001. The program has continuously evolved, and in 2011 the MLA chose to revise the program based on a thorough review of the first 10 years of data and the sampling program. The revised program continues to meet the objectives of the Water Quality Initiative (WQI) that have been provided below.

Water Quality Initiative Purpose

To maintain and improve water quality through water quality monitoring and lake stewardship initiatives.

Water Quality Objectives

1. To maintain and improve water quality.

2. To provide a phosphorous monitoring program for areas of concern which are identified both by the DMM modeling and community members. In those cases where the spring turnover results are either over threshold or trending higher near shore samples and/or other forms of sampling or testing are taken to determine if the source of phosphorous can be identified.

3. To provide additional data to support regulation of vulnerable areas within Muskoka that should be protected. Monitoring will be concentrated in:

   a) lakes, bays and rivers with areas of concern identified by DDM,
   b) lakes, bays and rivers where past MLA data indicates an area of concern,
   c) lakes, bays and rivers where the DMM does not monitor.

4. To provide a bacteria monitoring program to monitor Coliform and *E. coli* and to respond in a timely and appropriate manner in contacting appropriate parties if a concern is identified.

5. To promote effective stewardship of land and water at both the individual and community level. Provide a Stewardship program as well as financial assistance to those areas where the monitoring data indicate an area of concern. Provide a similar Stewardship program to any interested community that wishes to become more involved recognizing that everybody can impact the health of the watershed regardless of what the monitoring data may indicate.

6. To obtain an annual written report on the data collected that includes an analysis of the data, information on trends and clear and comprehensive recommendations for future activities both for the WQP and the individual communities involved.

7. To provide clear and appropriate communication about the annual WQI report to all interested parties, appropriate levels of government and the general community.

October, 2010

The revised WQI program addresses a number of key issues and is focussed on meeting the Water Quality objectives. Changes to the program are summarized below and additional details are found in the main text of the report.

- **To improve data sharing potential and to allow for accurate comparisons between the MLA data and other available data,** field methods were updated to be consistent with current scientific protocols and with government and other volunteer programs in Muskoka.
- **To allow for the collection of better data in areas of concern or areas that have the potential for concern,** it was determined that summer sampling frequency could be reduced and the sampling of some of the nearshore sites discontinued based on the analyses of many years of data. The reduction in the number of sampling locations allowed for the collection of replicates, thus improving the reliability of each data point. This program change will not compromise the historic data set and allows for the selection of new sites.
- **To address areas of concern,** twenty-three new sites were added to the 2011 program. The selection of new sampling sites was based on volunteer input, identified areas of concern, and areas of high use with the potential for concern. These new sites included both phosphorus and *E. coli* sampling locations.
- **To increase the reliability of the MLA data** duplicates for all phosphorus samples were collected in 2011. Reliable data can be used by other agencies to assist in the development of appropriate regulations.
- **Scientists have recognized that threats to recreational water quality and overall health are related to multiple stressors. One of the stressors of concern in lakes on the Canadian Shield is declining calcium concentrations. Calcium is a key factor in maintaining stable populations of species that feed on algae and aquatic plants.** Should populations of algae eating species decline, algae could increase regardless of trends in phosphorus concentrations. In keeping with current scientific research, the MLA has added a calcium monitoring component to the 2011 program.

In the revised 2011 sampling program, the WQI volunteers sampled 180 sites in 50 **sampling areas** throughout the District Municipality of Muskoka (DMM) and the Township of Seguin. This monitoring program continues to be made possible through the dedicated efforts of the many volunteers who engage in data collection and management, and program administration and development. A great effort was put forward by this year's WQI volunteers to learn the new sampling methods and collect data from new sites. RiverStone Environmental Solutions Inc. (hereafter RiverStone) continues to provide scientific and technical support for program development, during the field season, and in the analysis of the data and preparation of the annual report. Again, we extend our congratulations to all of those dedicated individuals who contribute to the program; the MLA water quality monitoring program would not be possible without the continued effort of volunteers like you!

Each year, a report is prepared so that the MLA can summarize and distribute the results of its water quality monitoring program. The 2011 Water Quality Report follows the same format as the 2010 report and provides a general outline of the initiative and summaries for each of the **sampling areas** that were part of the 2011 program. Note that throughout the written text of this report, several terms are presented in a bold font. These terms are defined in **Section 6.** For those interested, a detailed description of the WQI's program and methods is maintained on the MLA website.

RiverStone has prepared a two-page summary for each **sampling area** using data collected in 2011 and has incorporated some of the historical data collected by the MLA. Long-term trends and noteworthy individual water quality measurements were reviewed for each **sampling area** so that general and specific comments could be made. New in the summaries this year, are calcium data for each area. This is a concentration to watch over the next several years, since decreasing calcium may be one of the key stressors experienced in the lakes of Muskoka. The comments provided in the area summaries are intended to increase awareness of the water quality conditions in "your lake neighbourhood." Ideally, these targeted comments will provide the basis for improved and evolving water quality monitoring of specific areas, while continuing to encourage active involvement in monitoring and stewardship activities.

In reviewing the area summaries, it is important to recognize that despite the many proactive steps that you may have taken as waterfront stewards, your results may not be noticeable on the graphs illustrating the long-term data. Large-scale factors play a key role in controlling aquatic plant and algae growth. Global scientists are now identifying complex combinations of stressors that affect lake health. Responding to current science, the MLA has expanded its sampling program to include monitoring calcium, which is declining in lakes on the Canadian Shield. Calcium decline is just one of many stressors that may affect recreational water quality; others include global climate change, and increased ice-free periods and water temperatures. Good data for one of these stressors, calcium, could allow the MLA to provide additional information to regulatory agencies in future years to assist in reducing negative impacts and maintaining lake health.

While improved water quality is the major objective of the WQI, it is also important for the WQI, through our volunteers, to promote effective stewardship of land and water amongst all generations and to encourage engagement in good stewardship practices by all members of our lake communities. The MLA provides a stewardship program to communities where monitoring data has suggested a concern. In 2010, through the support of the WQI, the Cox Bay Stewardship Group implemented a

successful program and an Action Plan was in the works for Muskoka Bay. Both areas had historically been identified as areas of concern through the WQI. We should also recognize that stewardship initiatives undertaken by MLA members on their properties and in their communities to improve water quality are also beneficial to other components of the natural environment.

2. PROGRAM CHANGES FOR 2011

This year, the MLA water quality monitoring program has undergone significant changes. The sections below provide a general review of the program changes and rationale.

2.1. Field Protocols

Over the past several years, there has been a major collaborative effort throughout the region to establish standardized water quality monitoring protocols and procedures. This has allowed for better comparability between datasets and enhances the usability of data collected. The MLA chose to revise its monitoring protocols for the 2011 program accordingly. The current MLA water quality monitoring program compliments and expands upon other programs conducted in the region by government agencies and volunteer groups. Some of the key method changes include the collection of duplicates for all phosphorus samples, collection of deep-water phosphorus samples at the secchi depth, and use of filters for phosphorus samples

2.2. Phosphorus

A revised monitoring program has been adopted for phosphorus. Phosphorus sampling continues to include a **spring turnover** sample; however seasonal monitoring during the summer months for the calculation of the **yearly mean phosphorus** has been reduced to three events. **Water clarity** and temperature are monitored during the phosphorus sampling events.

The above changes stem from a comprehensive review of the historical WQI dataset conducted in 2009/2010. Based on data analyses and peer consultation with a number of research limnologists considered experts in their field, it was decided that the best application of nearshore phosphorus data was for potentially identifying areas of concern, both in the short-term and as part of a long-term monitoring program. To support this application of the data, the MLA reduced its nearshore phosphorus monitoring program in 2011 to focus on control sites, areas requested by the MLA, and areas of concern identified during the 2009/2010 detailed data analysis. The nearshore program

continues for sites with extensive historical datasets; these have been retained for the purpose of monitoring long-term phosphorus trends in nearshore areas. To meet the WQI objectives the MLA will continue to assess the need for new sites and review annually existing sites in areas of concern or potential areas of concern to determine if continued monitoring is required.

2.3. Bacteria

For the most part, elevated bacteria levels in lakes and rivers are a human health concern and not a lake health issue. Bacteria levels also tend to fluctuate with the seasons, with the highest levels occurring during heavy rainfall periods and during the hottest months during the summer. To address these key components of bacteria cycles, the MLA has adjusted both the monitoring sites and the frequency and timing of the sampling events. Sampling of historic sites where bacteria concentrations were never or rarely elevated was discontinued in 2011; however, sites identified as areas of concern remained in the program. New sites for 2011 were selected based on volunteer input, on level of use by people, or in highly developed areas. All bacterial sampling was scheduled for the months of July and August. When samples had ***E. coli*** levels of 50 cfu/100ml or greater, re-sampling was to be completed the following week. This type of protocol meets the WQI objectives by identifying areas with chronically elevated ***E. coli*** *levels* and allows the MLA to consider possible sources and notify appropriate parties.

2.4. Calcium Monitoring

Calcium monitoring has been introduced to the MLA WQI program in response to recent scientific findings that suggest that calcium concentrations in lakes in Muskoka are currently declining faster than expected as part of a long-term natural process. Since calcium monitoring is new to the MLA's WQI, some general information regarding the importance of calcium in our lakes is provided below.

Where does the calcium in our water come from?

Calcium makes its way into our lakes and rivers from a number of sources including soil and exposed bedrock. Calcium is released from soil and bedrock and transported into waterways by acid rain. Decomposing vegetation is also a source of calcium, as decomposing vegetation returns calcium to the soil, which in turn is washed into lakes and rivers.

Why is calcium important?

Many aquatic organisms need calcium to develop portions of their body, shells, skeletons, etc. (Watmough et al. 2005). Some of these organisms, such as Daphnia, feed on microscopic aquatic vegetation (e.g. algae) and are important in controlling the growth of species such as algae in lakes and rivers (Edwards et al. 2009). Crayfish, which can play a key role in controlling attached algae and nearshore vegetation (Momot 1995), also require adequate levels of calcium for the development of their shells. Without sufficient calcium in the water, many species are unable to maintain stable populations or survive at all (**Table 1**). Many of these small organisms aid in nutrient cycling by consuming dead plant and animal matter, feeding on algae and other plants, and acting as a primary food source for many species of fish.

Why are calcium levels declining?

Reduced calcium levels in lakes and rivers have been linked to the amount of calcium in the soil surrounding the waterbody (Jeziorski et al. 2008). Acid rain can cause short-term increases in calcium levels in a waterbody, as the rain dissolves calcium from the top layer of the soil before washing it into lakes and rivers. The calcium that is washed into the waterbody creates a short term increase in the calcium levels within the lake; however, the rate at which calcium is removed from the soil is often faster than the rate at which it can be returned through natural processes (Watmough et al. 2005). Recent declines in acid rain have resulted in lower amounts of calcium being removed from the soil and washed into waterways (Watmough et al. 2005). Unfortunately, at the same time, logging activities have been removing considerable numbers of trees from areas around lakes and rivers. These trees contain considerable amounts of calcium that would normally have been returned to the soil when the trees died (Jeziorski et al. 2008). Over time, the loss of trees in a given area causes the amount of available calcium in the soil to decrease and therefore results in a decrease in the calcium levels in the surrounding lakes and rivers (Jeziorski et al. 2008). The difference in the speed at which calcium is removed from the soil and the speed in which it is returned results in an eventual decline in the amount of calcium in the watercourse.

What does the loss of aquatic calcium mean?

Recent studies have found that when calcium levels drop below 2 mg/L, the lakes population of daphnia and crayfish die off quickly (Carins and Yan 2009). Without daphnia and crayfish, many of the fish in the waterbody will be without food and populations could decline as well. Daphnia have

been called the "living lawnmower" as they eat considerable amounts of algae (McCauley et al. 1999). When daphnia populations decline or are lost from a waterbody, algae is able to grow into large blooms that can result in negative impacts to other species and water quality as a whole. Crayfish act as predators of numerous species and are decomposers of much of the dead plant and animal material in a waterbody (Edwards et al. 2009). Loss of crayfish from a waterbody results in a reduced amount of food availability for species at the top of the food chain, as well as a reduction in the cycling of nutrients (e.g., calcium), back into the ecosystem (Edwards et al. 2009).

More simply stated, without sufficient calcium in our lakes, many of the aquatic organisms that presently help control algae would not be able to survive. Without these key species, algae could increase even if phosphorus concentration remained stable.

Table 1. Critical limits of calcium for freshwater organisms.

Species/Group	Ca Critical Limits	Role Within the Ecosystem	Reference
Crayfish	5.0 mg/L for population stability 1.0-2.5 mg/L for individuals to survive	Feed on dead animal and plant tissue to aid in decomposition. Feed on algae communities. Food for larger fish and mammals	Carins and Yan (2009) Holdich and Rogers (2000)
Freshwater Snails	4.0 mg/L for population to thrive 2.0 mg/L for individuals to survive	Freshwater snails graze on algae communities to help keep growth in check Food for larger fish and mammals	Nduko and Harrison (1976)
Mussels and Bivalves	2.5 mg/L for individuals to survive	Filter feed on microscopic plants and animals Food for larger fish and mammals	McMahon (2002)
Zebra Mussels	12.0 mg/L for individuals to survive	Filter feed on microscopic plants and animals Food for larger fish and mammals	Neary and Leach (1991)
Zooplankton (Daphnia, Gammarus)	1.5-2.0 mg/L for populations to survive	Feed on algae communities, keeping algae blooms under control Food for fish	Cairns and Yan (2009)

3. GENERAL METHODS AND WATER QUALITY PARAMETERS

A detailed description of the WQI program and methods can be found on the MLA website (www.mla.on.ca). The following points provide a brief overview of the area summary data that has been included in this report:

- Monitoring schedule – Water quality indicators including, **total phosphorus**, calcium, bacteria, and **Secchi depth** were measured during the sampling season which began in mid-May and ended in late August, 2011. The four scheduled sampling periods for 2011 were as follows: May 14-23, July 1-4, July 29-August 1, and August 26-29.
- **Total Phosphorus** (spring turnover) – Samples collected within or prior to the first sampling period (May 14th to May 23rd) are considered **spring turnover total phosphorus** samples and represent the average phosphorus concentration of a lake. Prior to May 23rd, most lakes in our region have not yet stratified (separated into layers); therefore, the concentration of phosphorus in samples taken during this period can be considered the average within the waterbody.
- **Total Phosphorus** (yearly mean) – In some **sampling areas**, phosphorus samples were collected from deep-water and nearshore **sampling sites** on four separate occasions throughout sampling season. **Yearly mean total phosphorus** concentrations were calculated for sites in these areas.
- **Calcium** – During the spring turnover sampling period (May 14th to May 23rd), calcium samples were collected from one deep-water reference site in each **sampling area**. The concentration of calcium in samples taken during this period can be considered the average within the waterbody.
- Bacteria – **Total coliform** and ***E. coli*** samples were collected from nearshore sites during the second and third sampling periods, when bacterial levels are typically highest. Follow-up sampling for ***E. coli*** was to be conducted when results greater than 50 cfu/100 ml were recorded. Bacteria can be indicators of failing septic systems or other forms of fecal contamination.
- Secchi depth – Secchi discs were used to record depths at deep-water sites in each **sampling area. Secchi depth** provides a general indicator of **water clarity**.

4. UNDERSTANDING THE AREA SUMMARIES

Based on both the historic data and the data collected in 2011, overall water quality conditions in the lakes monitored by the MLA are good to excellent. A detailed analysis of the long-term data was completed in 2009 and supports this conclusion (see the 2009 Technical Report, available on the MLA website).

The area summaries included in this report are designed to describe the various **sampling areas**, summarize the 2011 data, and explain the general long-term water quality trends associated with each **sampling area** and **sampling site**. The area descriptions were developed based on local knowledge,

aerial photos, Ontario Base Maps, and information provided by the DMM by means of surveyed shoreline land-use maps and historical lake data. The names of volunteers involved in water quality monitoring for each area are listed under "Volunteer Recognition", with team leaders identified in bold.

The data in the area summaries are calculated "averages" that provide a general overview of the water quality at individual **sampling sites** over the sampling season. In some cases, unusually high phosphorus concentrations were not representative of the lake's true nutrient condition and were more likely the result of a contaminated sample. These values were identified as "outliers" when compared to long-term data in the same **sampling area**. Please note that historical results presented in this report may differ from those presented in previous reports due to differences in data analysis methodology (i.e., RiverStone has removed bad duplicate splits from the historical dataset according to the DMM protocol. As such, historical yearly mean phosphorus values presented in this report may differ from those presented in earlier reports).

The "Trends" and "Comments" sections are included to provide basic interpretations of the area graphs and enhance your understanding of the water quality conditions in "your lake neighbourhood."

4.1. Water Clarity

Secchi depth was used to provide a measure of **water clarity** at deep-water **sampling sites**. **Secchi depth** values are determined by averaging the "up" and "down" measurements recorded by volunteers using a Secchi disc. Depth data listed in the area summaries represent the **arithmetic mean** of values obtained from individual **sampling sites** throughout the sampling season. Because **water clarity** in most lakes in Muskoka is affected by dissolved organic carbon (DOC), which results in tea coloured water, and not just by algal concentrations, the **Secchi depths** alone cannot be considered an indicator of nutrient (phosphorus) status; however, this data remains important for monitoring long-term water quality trends.

4.2. Phosphorus

Spring turnover and **yearly mean total phosphorus** data have been provided for all sites monitored in 2011. Current and historical **total phosphorus** data for deep-water control sites within each **sampling area** are presented in a graph to show long-term trends. Where appropriate, graphs show MLA data in relation to the **threshold** concentration set by the DMM or Seguin Township. The DMM

is still in the process of reviewing the Recreational Water Quality Monitoring Program; however, an update to the Program was not available at time this report was prepared.

On the graphs illustrating long-term phosphorus levels, **threshold** concentrations have been represented by a single black dashed line. For **sampling areas** in the DMM, these values were verified by the DMM. Sampling areas without graphed threshold lines have not been modelled and are not comparable to other areas as confirmed through consultation with the DMM. Spring turnover and yearly mean phosphorus as measured by the MLA is shown in µg/L on the y-axis and sampling year is indicated on the x-axis.

Duplicate samples collected for phosphorus were analyzed for bad splits followed by outlier analysis. Twenty-three of the 403 samples collected were removed from the data set as bad splits; this was 5.7 % of the data collected. Following the removal of the bad splits, outlier analysis was completed for all spring turnover data following the DMM protocol. Two outliers were identified, one at ART-0 and one at STN-0. Also of note is that the spring turnover sample from FTB-0 only passed one of the two-outlier tests. These three data points were included in the area summaries with a comment indicating that they had been identified as outliers.

Spring Turnover

Spring turnover total phosphorus concentration was calculated as the **arithmetic mean** of the spring or mid-May duplicate sample measurements. **Spring turnover total phosphorus** concentrations for the deep-water reference sites have been represented graphically as a blue line with diamonds or as single blue diamonds, if consecutive years of data were not available. Note that in previous years, duplicate spring turnover samples were not consistently collected at some sites and for these sites, a single spring turnover sample has been reported.

Yearly Mean

Yearly Mean total phosphorus concentration in 2011 was calculated as the **arithmetic mean** of all four measurements from an individual **sampling site** within the sampling season, including duplicate sample measurements, where available. **Yearly Mean total phosphorus** concentrations at the deep-water reference sites have been represented graphically in the area summaries as a red line with circles or as single red circles, if consecutive years of data were not available.

4.3. Bacteria

Total coliform and ***E. coli*** data have been summarized for all sites monitored in 2011. Current and historical ***E. coli*** data have also been presented graphically. ***E. coli*** concentrations are reported as the number of colony forming units observed in 100 mL of lake water (cfu/100 mL) on the y-axis and **sampling sites** are indicated on the x-axis. For the ***E. coli*** graphs, each **sampling site** is represented as a cluster of bars and different sampling seasons (years) are represented by different coloured bars. Each graph also compares ***E. coli*** levels to the MLA upper limit, which is represented by a grey dotted line. The upper limit value (10 cfu/100 mL) was established as a reasonable limit for maintaining existing water quality in Muskoka for the WQI and is based on advice provided by Dr. Karl Scheifer (2003). It is important to note that a "potential health hazard exists if the fecal coliform **geometric mean** density for a series of water samples exceeds 100 CFU/100 ml" (Ontario Ministry of the Environment).

4.3.1. Total Coliforms

Total coliform data is summarized for areas where bacterial monitoring was conducted in 2011. **Total coliform** concentrations are reported as yearly averages calculated as the **geometric mean** of all available measurements, including follow-up measurements, for an individual **sampling site**. **Total coliform** measurements of <3 cfu/100 mL were assigned a value of 1 cfu/100 mL for the purpose of calculating means. **Geometric means** presented in the area summaries were rounded to the nearest colony forming unit.

4.3.2. *E. coli*

E. coli data is summarized for areas where bacterial monitoring was conducted in 2011. ***E. coli*** levels are presented as yearly averages calculated as the **geometric mean** of all available measurements, including follow-up measurements, for an individual **sampling site**. Current and historical ***E. coli*** levels are also illustrated graphically in area summaries. ***E. coli*** measurements of <3 cfu/100 mL were assigned a value of 1 cfu/100 mL for the purpose of calculating means. For the ***E. coli*** graphs in the area summaries, every site that was sampled had a minimum value of 1 cfu/100 mL; where no bar is shown for a particular site/year, no data was collected. **Geometric means** presented in the area summaries were rounded to the nearest colony forming unit.

The MLA WQI established a new field protocol for 2011 that required volunteers to re-sample a site weekly if ***E. coli*** levels were found to be greater than 50 cfu/100 mL. This cautious approach allowed the MLA to monitor sites that demonstrated potential for ongoing concern. Following this protocol, ***E. coli*** levels exceeded 50 cfu/100 mL at 11 of the 116 bacteria **sampling sites** in 2011. Follow-up bacteria samples were collected at three of these sites; of these three, only MBA-12 had a second sample greater than 50 cfu/100 ml. Two sites, MBA-12 and MSN-5 (Hoc Roc River), had regular occurrences of high ***E. coli***; however, this has not been identified as a significant concern as both sampling sites are located in a creek. It is not usual for creeks that drain wetlands to have elevated *E. coli* counts. Additional sampling at two beaches at the outlet of the Hoc Roc River was completed in 2011 to address the identified area of concern; neither site showed elevated ***E. coli*** levels.

4.4. Calcium

Separate water samples were collected from the deep-water reference sites during the spring turnover period for the purpose of calcium monitoring. Individual measurements are listed in the area summaries.

Summary of 2011 Calcium Monitoring

Results of the 2011 calcium monitoring indicate that nearly all of the sampled lakes appear to be at, or below, the **threshold** levels of calcium that are required for populations of many freshwater organisms to exist at stable levels (**Table 1**). Furthermore, some of the lakes and areas sampled are already below **threshold** levels for survival of several key species (**Table 1** and **Figure 1)**.

Recommendations Based on Calcium Monitoring

The data relating to calcium collected in 2011 is only a single snapshot in time. It is recommended that calcium monitoring be continued to gather information on changes over time of this key nutrient in our lakes and rivers. This component of the MLA monitoring program could be expanded to include nearshore water sampling and/or crayfish or other indicator species sampling to provide a better understanding of area specific issues and to identify areas of concern based on a second stressor. It might also be useful, through a review of the existing literature, to determine how the MLA's **sampling areas** compare with calcium samples collected in other studies. Both the DMM and Ministry of Environment (Dorset) collect data relating to calcium and indicator species, so coordination of any future research efforts might be beneficial.

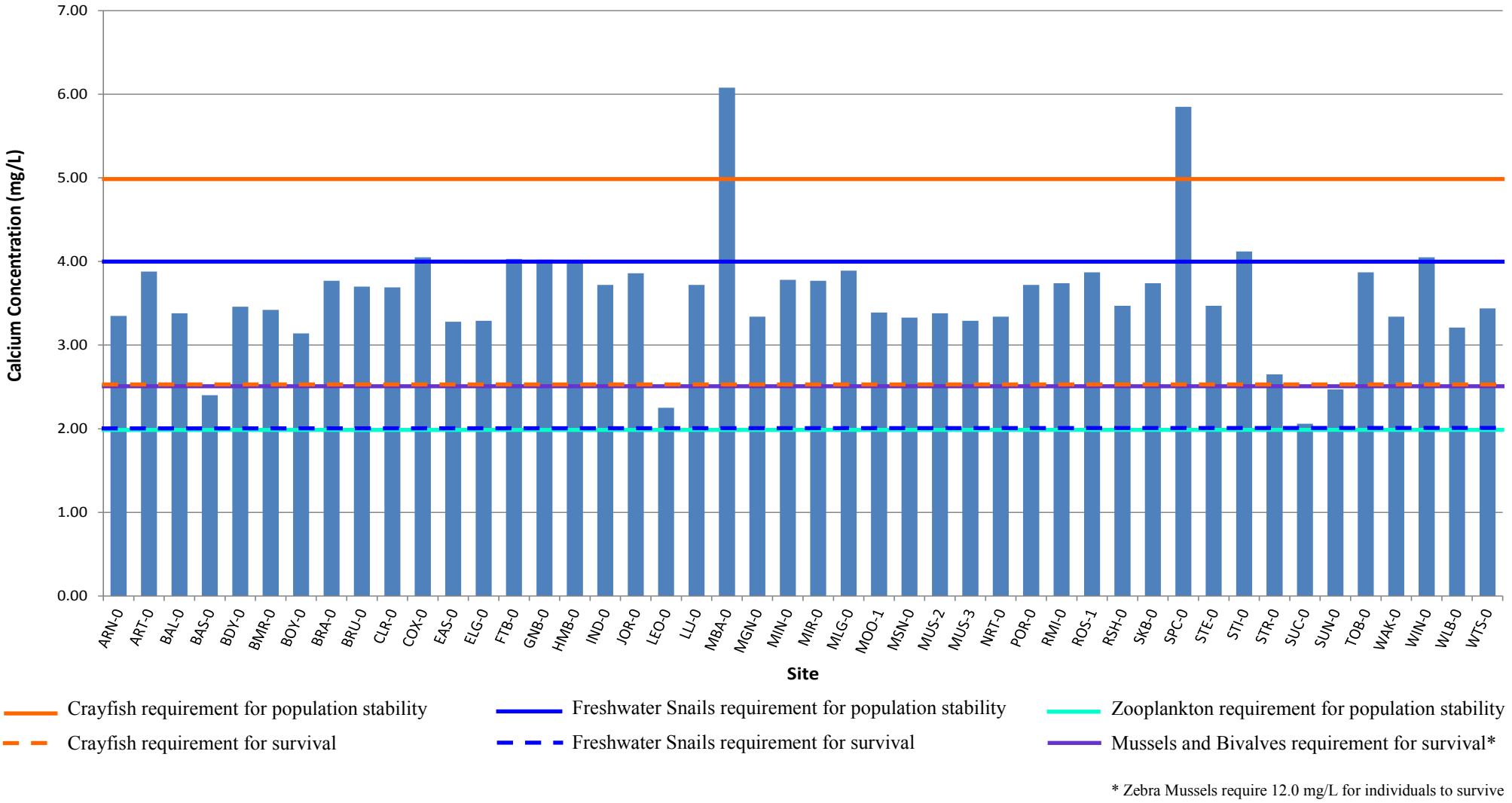


Figure 1. Summary of the Spring Turnover Calcium Concentrations at MLA Reference Sites in 2011 compared to the threshold values for selected freshwater species.

4.5. Maps

Updated 2008 aerial photos were extracted from the Muskoka Web Map website and the West Parry Sound Geography Network website and were labelled to show **sampling sites** for the 2011 season. Site information was compiled using the MLA Water Quality Results map, with information for the new or altered sites provided by MLA staff or directly from volunteers. Yellow dots indicate nearshore sites, red stars represent deep-water sites, and green triangles represent watercourse sites.

5. COMMENTS, CONCLUSIONS AND PROGRAM RECOMMENDATIONS FOR 2011

5.1. Comments

The 2011 WQI underwent a considerable redesign process. The revised design allows the WQI to better meet its objectives as discussed through-out the report. The redesign was a coordinated effort between the WQP and RiverStone and was successfully implemented by the volunteers. The new program included the following major changes.

1. Sampling frequency was reduced to four events; a spring sample and three other events spread out over the summer. The new schedule was successfully implemented by the volunteers.
2. Areas of concern continued to be monitored in 2011. Twenty-three new sites were added to the 2011 WQI, based on volunteer input and areas identified with the potential for concern during the 2010 review. None of the data, either phosphorus or bacteria, collected at the new sites indicated water quality issues.
3. *E. coli* sampling in 2011 was targeted to areas of concern and was focussed in warm weather months when levels could be sufficient to cause concern. Additional sampling completed when areas of concern were identified allowed the potential to contact appropriate parties.
4. The MLA's WQI field methods were updated so that MLA data was collected using the same techniques as government and other volunteer based water sampling programs in the area. The updating of field methods will allow the MLA to provide additional data to agencies, as needed, to support regulation of vulnerable areas. After the first field season using the new methods and equipment, it is possible that some modifications to the equipment for 2012 will make sampling easier for the volunteers.
5. As part of the new methodology, the collection of duplicates allowed for the removal of 23 bad splits and ensured that each **sampling area** had an accurate phosphorus data point for each sample collected in 2011.
6. The use of filters for the phosphorus samples has reduced the variability and has increased the reliability of each phosphorus data point.

5.2. Conclusions/Trends

The data collected by the WQI in 2011 can be used to draw a number of conclusions, or to postulate general trends in terms of water quality in the lakes in Muskoka. The data and volunteer feedback can also be used to draw conclusions about the program itself. The following conclusions/trends are based on the 2011 data.

1. The trend for spring turnover phosphorus at the deep-water reference sites has been generally downward over the past several years; however, in 2011 the spring samples tended to be elevated. The majority of the phosphorus concentrations in the spring of 2011 were within the range recorded over the past 10 years. The potential for sampling and lab error was investigated thoroughly to rule out, to the extent possible, that error has caused the increasing trend. At the time of report preparation, complete data from other agencies was not available for comparison. Of note is that the yearly means showed a similar trend for some **sampling areas**, but not to the same extent as the spring data.
2. The ***E. coli*** values recorded for the vast majority of the sites sampled are well within the expected range of values that would occur naturally, with most being below the MLA's desired upper limit of 10 cfu/100 ml. Most new sites added in 2011 also followed this trend. Any sites that showed chronic elevation or spikes have been identified in the area summaries and would benefit from additional monitoring in 2012. In 2011, the WQI monitoring identified 11 **sampling areas** where ***E. coli*** exceeded 50 cfu/100ml, the MLA limit set as a trigger for re-sampling. Based on the 2011 *E. coli* data, there were no areas that had elevated levels requiring contact with appropriate parties as per the MLA's monitoring objective.
3. Calcium data collected in 2011 suggests that calcium concentrations in the majority of the areas sampled are in a range that will limit the success of many organisms that play important roles in lake health. Leonard, Sucker, Bass and Star Lake had very low concentrations in 2011, which suggests that these lakes may not be able to support species such as crayfish and other grazers. Muskoka Bay and Silver Lake both have relatively high concentrations of calcium, sufficient to support stable populations of crayfish.

5.3. Recommendations

Based on the revised program and data collected in 2011, RiverStone would provide the following recommendations for the various components of the WQI program:

1) Training

- *All team leaders need to attend the training sessions and encourage as many team members as possible to attend.*
- *To ensure that **E. coli** sampling is conducted according to the protocol, both the team leader and the field co-ordinator need to carefully review the data immediately following sampling. Any **E. coli** site that exceeds 50 cfu/100ml needs to be re-sampled the following week. Should the second sample exceed 50 cfu/100ml or any sample exceed 100 cfu/100ml, a MLA director and the scientific advisor should be consulted to determine the next step.*

2) Methods

- *Continue with the reduced number of phosphorus sampling events, one in the spring and three during the summer months. The two mid-summer **E. coli** sampling events should occur during the warmest weather months (mid-July and mid-August) and allow time for the collection of follow-up samples for **E. coli**, should elevated numbers be recorded. Additional **E. coli** sampling events could be completed during the months of July and August in the high use areas or historic areas of concern to improve the ability to detect E. coli levels that might be of concern.*
- *Continue with the new 2011 methods for 2012 including the collection of duplicate samples, filtering all phosphorus samples using an 80 micron filter, and sampling at secchi depth.*
- *Continue to have a Field Coordinator to support the volunteers and manage data.*
- *Continue to have the Field Coordinator review data forms and data after every sampling period, including the **E. coli** results, and follow up quickly to obtain missing information and confirm that the volunteer has resampled should **E. coli** levels be elevated.*

3) Education and Policy Input

- *Continue to work with and create additional Stewardship Initiative Groups where potential water quality issues have been identified. Potential areas of concern identified as part of the detailed analysis completed in 2009/2010 include Windermere, Muskoka Sands, and Indian River. Additional areas that may warrant further attention are Hamer Bay and Minett. A detailed land-use review for these areas would be a starting point in developing a more detailed Stewardship objective and remedial action plan. New initiatives for the 2012 program may include expanded sampling or volunteer based research relating to calcium concentrations.*
- *Continue to monitor the development practices of each municipality and provide input when possible for district official plan updates, and local official plans and zoning by-laws. Work with each new government/councillors such that a better understanding of water quality issues is developed early in new member's term. Sound planning decisions and enforcement are key factors in maintaining and improving water quality.*

4) Program

- *Based on the recommendations provided for each specific area, team leaders and the field co-ordinator should review the **E. coli sampling sites**. Sites that have measured below the MLA's upper limit for the past three years should be replaced with new **sampling sites in 2012** to allow for increased monitoring, unless a specific site is located in a public swimming area.*
- *Continue to monitor all existing deep-water reference sites for spring turnover and yearly mean phosphorus concentrations in 2012. This is very important based on the trend indicated on the 2011 data; the next several years of will provide a better indication of the long-term trend.*
- *If the MLA would like to have a comparison between the MLA's data and other agency data consider changing the deadline for delivery of the Water Quality Monitoring Report.*
- *Depending on the release date for the updated DMM Lake System Health Program review the existing phosphorus monitoring sites to determine if the addition or removal of sites is warranted in 2012.*

- *Consider the development of a different research component to identify sources of phosphorus. One suggestion would be the measurement of deep-water phosphorus and possibly dissolved oxygen during late summer (when the lakes are stratified) to determine if elevated phosphorus concentrations occur in deep-water zones. Elevated phosphorus in deep-water, when compared to surface water, can indicate an area that has become anoxic, resulting in the release of phosphorus from the sediments. This type of research would require the purchase of a temperature/dissolved oxygen meter, a composite sampling unit (i.e. Van Dorn) and a volunteer commitment for sampling every two weeks. Some areas of concern that might benefit from such monitoring include Brackenrig Bay, Hamer Bay, and Muskoka Bay.*

6. DEFINITIONS

Arithmetic mean: This type of average is calculated by adding together a group of numbers and dividing the sum by the number of numbers.

E. coli*:** Fully known as *Escherichia coli*, it is a subset of total coliforms, and is exclusively associated with fecal waste (Schiefer, 2001) making it a good indicator of faecal contamination. There are many different strains of *E. coli*; most waterborne strains are themselves not harmful, but some (such as ***E. coli O157:H7) can cause serious illness.

Geometric mean: This type of average is calculated by multiplying together a group of *n* numbers and then taking the n^{th} root of the resulting product. Geometric mean is used to indicate the central tendency or typical value of a set of numbers. It is typically used to calculate average bacteria counts because as a living organism, bacteria counts are highly sporadic and inconsistent.

Lake System Health Monitoring Program: A field-based program designed and operated by the DMM that monitors approximately 192 sample locations across Muskoka on a rotating basis depending upon development pressures and the specific characteristics of the lake. The purpose of the program is to establish a long-term record of key water quality parameters so that trends in water quality can be identified. Spring turnover total phosphorus results of this program inform Muskoka's Recreational Water Quality Model.

Mesotrophic: A mesotrophic lake typically has phosphorus concentrations between 10 and 20 µg/L (Level 2–mid-range, MOE). Mesotrophic lakes are lakes with an intermediate level of productivity, greater than oligotrophic lakes, but less than eutrophic lakes. These lakes are commonly clear water lakes and ponds with beds of submerged aquatic plants and medium levels of nutrients.

Muskoka Recreational Water Quality Model: An advanced numerical model operated by the District of Muskoka designed to predict the response of all individual lakes in Muskoka to the input of phosphorus. The model is based on the Ontario Lakeshore Capacity Simulation Model, originally published in 1986 by a Provincial inter-ministerial working group. This model was substantially updated in 2005 by Dr. Neil Hutchinson of Gartner Lee Ltd. for the District of Muskoka (Gartner Lee 2005). The model includes a detailed phosphorus budget. Its inputs are the results of the District's Lake System Health Monitoring Program. Among the model's outputs is lake-specific Natural Phosphorus, Phosphorus Threshold and predicted phosphorus concentrations.

Oligotrophic: An oligotrophic lake typically has phosphorus concentrations less than 10 µg/L (Level 1–nutrient-poor, MOE). These lakes have low primary productivity, due to the low nutrient content.

These lakes have low algal production, and consequently, often have very clear waters, with high drinking-water quality. The bottom waters of such lakes typically have ample oxygen; thus, such lakes often support many fish species, like lake trout, which require cold, well-oxygenated waters.

Sampling Area: A geographic location encompassing a group of WQI monitoring sites.

Sampling Site: The discrete and unique location where samples are to be collected and measurements are to be taken.

Secchi Depth: A measure of water clarity, measured using a Secchi disc - a small disc attached to a rope. Alternating quarters of the top side of the disc are coloured white and black. The Secchi depth is the depth of water whereby the sampler can no longer distinguish the white and black quarters of the disc.

Spring Turnover Total Phosphorus: A single phosphorus concentration measurement taken in a typically stratified lake during the spring turnover period. This measurement has been shown to adequately represent the overall phosphorus concentration in a lake (Clarke 2002). Typically the spring turnover lasts for a few days when the temperature of the entire water column is consistent (usually 4˚C) allowing the water column to mix. In practice, measurements taken anytime in May are considered to be adequate by Ontario's Ministry of the Environment (http://www.ene.gov.on.ca/envision/water/lake_partner/index.htm).

Threshold: The "Threshold" phosphorus concentration is 50% more than the baseline (Background) concentration calculated by the District of Muskoka or Seguin Township. The threshold is used to classify lakes and bays as requiring a higher level of development control as a precautionary action to protect the long-term health of the waterbody.

Total Coliform: Coliform include a variety of bacteria. In practice, detectable coliform are usually enteric, found in the intestinal tracts of humans and other warm-blooded species.

Total Phosphorus: Phosphorus is a chemical element that is essential for all living cells. Amongst other sources, it is found in fertilizers, soaps, and in human waste. Typically phosphorus is not removed from waste streams by conventional private treatment systems (septic systems) nor by some municipal treatment systems.

Water Clarity: Water clarity is a measure of how much light penetrates through the water column. The clarity of water is influenced both by suspend particulate matter (sediment, and plankton) and by coloured organic matter (tea coloured lakes). Clarity can provide some indication of a lake's overall water quality, especially the amount of algae present.

Yearly Mean Total Phosphorus: The arithmetic mean of phosphorus concentration measurements taken above a stratified water column's thermocline over the ice-free period. *Note: yearly mean phosphorus concentration as reported by the WQI is for spring and summer months only.*

Note: several of these definitions have been taken from the WQI Monitoring Program Summary Report - Citizens Environment Watch 2009.

7. REFERENCES

Carins, A. and N. Yan. 2009. A review of the influence of low ambient calcium concentrations on freshwater daphniids, gammarids, and crayfish. Environmental Review **17**:67-79.

Clarke, S. J. 2002. Vegetation growth in rivers: influences upon sediment and nutrient dynamics. Progress in Physical Geography **26**:159-172.

Edwards, B. A., D. A. Jackson, and K. M. Somers. 2009. Multispecies crayfish declines in lakes: implications for species distributions and richness. Jounral of the North American Benthological Society **28**:719-732.

Gartner Lee. 2005. Recreational Water Quality Management in Muskoka. Gartner Lee Limited, Bracebridge ON. 98 pp.

Holdich, D. and D. Rogers. 2000. Habitat requirements of the white-clawed crayfish, *Austropotamobius pallipes*. Pages 45-50. Environment Agency International Association of Astacology, Leeds.

Jeziorski, A., N. D. Yan, A. M. Paterson, A. M. DeSellas, M. A. Turner, D. S. Jeffries, B. Keller, R. C. Weeber, D. K. McNicol, M. E. Palmer, K. McIver, K. Arseneau, B. K. Ginn, B. F. Cumming, and J. P. Smol. 2008. The widespread threat of calcium decline in fresh waters. Science **322**:1374.

McCauley, E., R. M. Nisbet, W. W. Murdoch, A. M. de Roos, and W. S. C. Gurneyk. 1999. Large-amplitude cycles of *Daphnia* and its algal prey in enriched environments. Nature **402**:653-656.

McMahon, R. F. 2002. Evolutionary and physiological adaptations of aquatic invasive animals: r selection versus resistance. Canadian Journal of Fisheries and Aquatic Science **59**:1235-1244.

MOE. 1994. Water Management – Policies, Guidelines, Provincial and Water Quality Objectives of the Ministry of Environment and Energy. Queen‟s Printer for Ontario, 1994.

Momot, W. T. 1995. Redefining the role of crayfish in aquatic ecosystems. Reviews in Fisheries Science **3**:33-63.

Nduko, W. K. and A. D. Harrison. 1976. Calcium as a limiting factor in the biology of biomhalaria pfeifferi (Krauss), (Gastropoda: Planorbidae). Hydrobiologica **49**:143-170.

Neary, B. P. and J. H. Leach. 1991. Mapping the potential spread of the zebra mussel (Dreissena polymorpha) in Ontario. Canadian Journal of Fisheries and Aquatic Science **49**:406-415.

Watmough, S. A., J. Aherne, C. Alewell, P. Arp, S. Bailey, T. Clair, P. Dillon, L. Duchesne, C. Eimers, I. Fernandez, N. Foster, T. Larssen, E. Miller, M. Mitchell, and S. Page. 2005. Sulphate, nitrogen and base cation budgets at 21 forested catchments in Canada, the United States and Europe. Environmental Monitoring and Assessment **109**:1-36.

AREA SUMMARIES

COX BAY (COX)

Area Description

Cox Bay is the southernmost bay of Lake Joseph. The bay is 1.84 km² in area and is up to 12 m in depth. A large resort and golf course are located adjacent to the lake, along with a marina and a canal crossing into Lake Rosseau at Port Sandfield. Most of the shoreline area is developed, but many residences maintain a forested cover on their properties. More than 15% of the shoreline is open lawn, pavement or is intensely landscaped. The Cox Bay Stewardship Initiative group has identified ten permanent watercourses that drain into the bay. Cox Bay is classified as moderately sensitive and over-threshold by the DMM.

Volunteer Recognition

Cox Bay was monitored in 2011 by **Gord Ross**.

2011 Data

COX-0: TP-Spring turnover = 6.4 µg/L
TP-Yearly mean = 4.8 µg/L
Calcium = 4.05 mg/L
Secchi = 6.3 m

COX-2: TP-Yearly mean = 6.1 µg/L

COX-4: TP-Yearly mean = 5.4 µg/L

Trends

Monitoring of Cox Bay started in 2002.

The 2011 spring turnover TP at COX-0 is consistent with historical data and greater than the DMM threshold.

Nearshore yearly mean TP values were slightly higher than 2010 data.

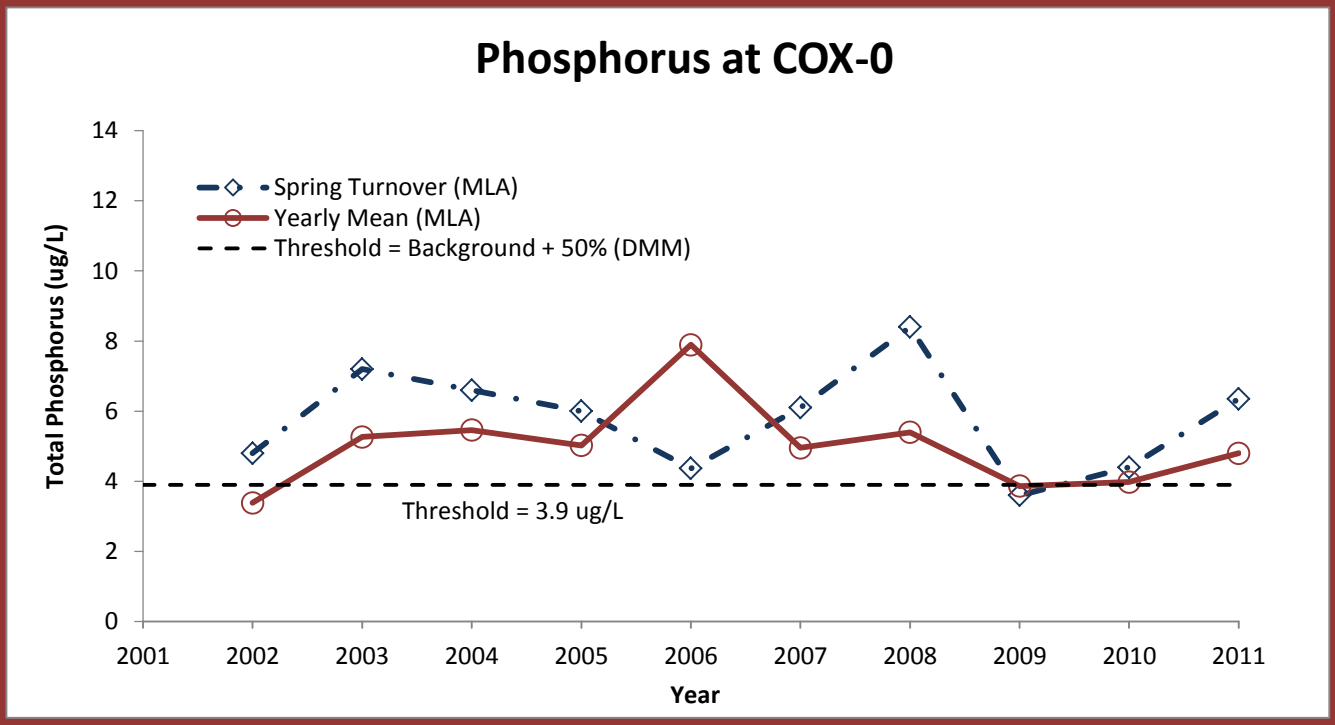
Calcium concentration in Cox Bay is one of the higher recorded values for 2011.

Productive discussions regarding water quality were held with representatives from ClubLink in 2011 as part of the Stewardship initiative.

Recommendations

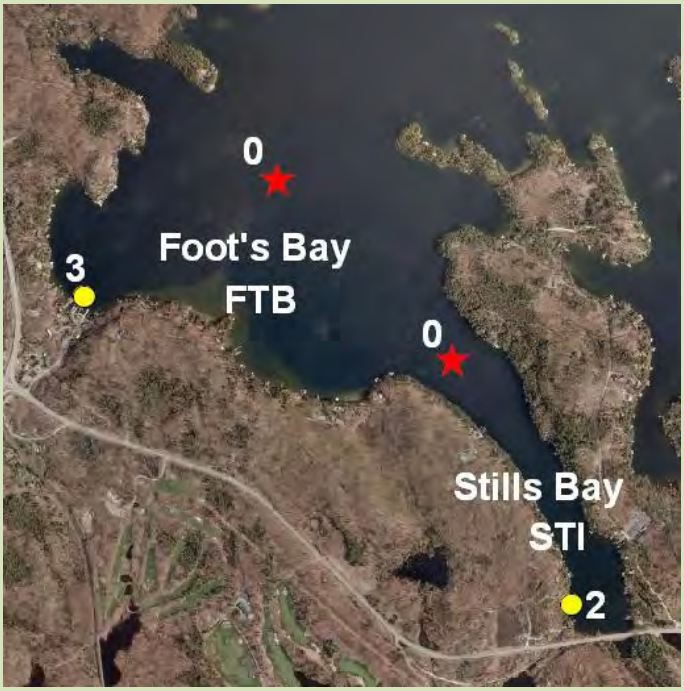
Continue existing sampling protocol to monitor long-term trends.

(COX) COX BAY



Notes:

FOOT'S BAY & STILLS BAY (FTB/STI)



Area Description

Foot's Bay and Stills Bay are connecting bays in the south-eastern portion of Lake Joseph. Stills Bay is long, narrow, and moderately developed. The southern end of the bay is directly adjacent to highway 169. This bay receives drainage from watercourses that are adjacent to a golf course. Foot's Bay has a higher intensity of development in the southern section, with areas that are adjacent to the highway and a marina. There are still large areas of shoreline with mostly intact forests. The main basin of Lake Joseph is classified as highly sensitive by the DMM.

Volunteer Recognition

Foot's Bay and Stills Bay were monitored in 2011 by **Joanne Brown**, Jane Craig, **Neil Shaw** and Pixie Shaw.

2011 Data

FTB-0: TP-Spring turnover = 10.5 µg/L*
TP-Yearly mean = 6.0 µg/L
Calcium = 4.03 mg/L
Secchi = 5.2 m

FTB-3: TP-Yearly mean = 5.0 µg/L

STI-0: TP-Spring turnover = 5.3 µg/L
TP-Yearly mean = 4.2 µg/L
Calcium = 4.12 mg/L
Secchi = 5.2 m

STI-2: TP-Yearly mean = 6.8 µg/L

(* identified as an outlier in one of the two tests used in the DMM protocol.)

Trends

Monitoring of Foot's Bay started in 2009

The 2011 spring turnover TP and yearly mean TP at FTB-0 were the highest recorded concentrations in the sampling history.

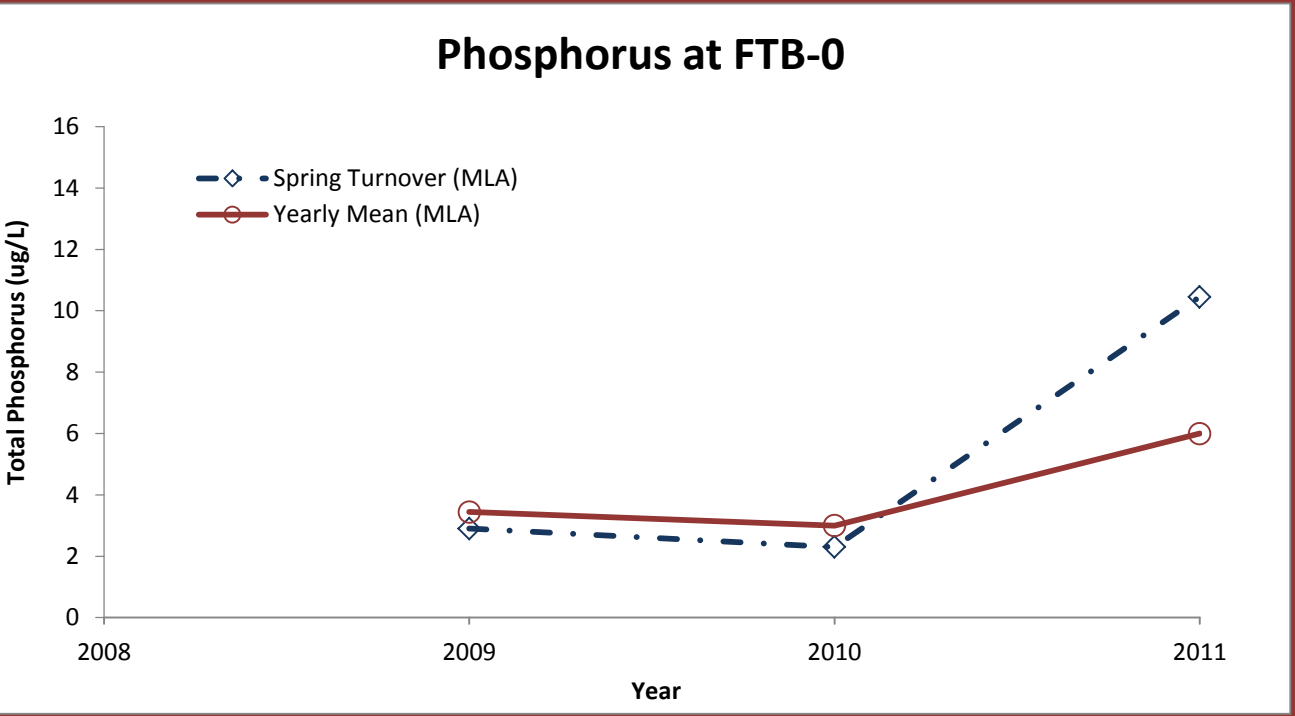
Monitoring of Stills Bay started in 2003.

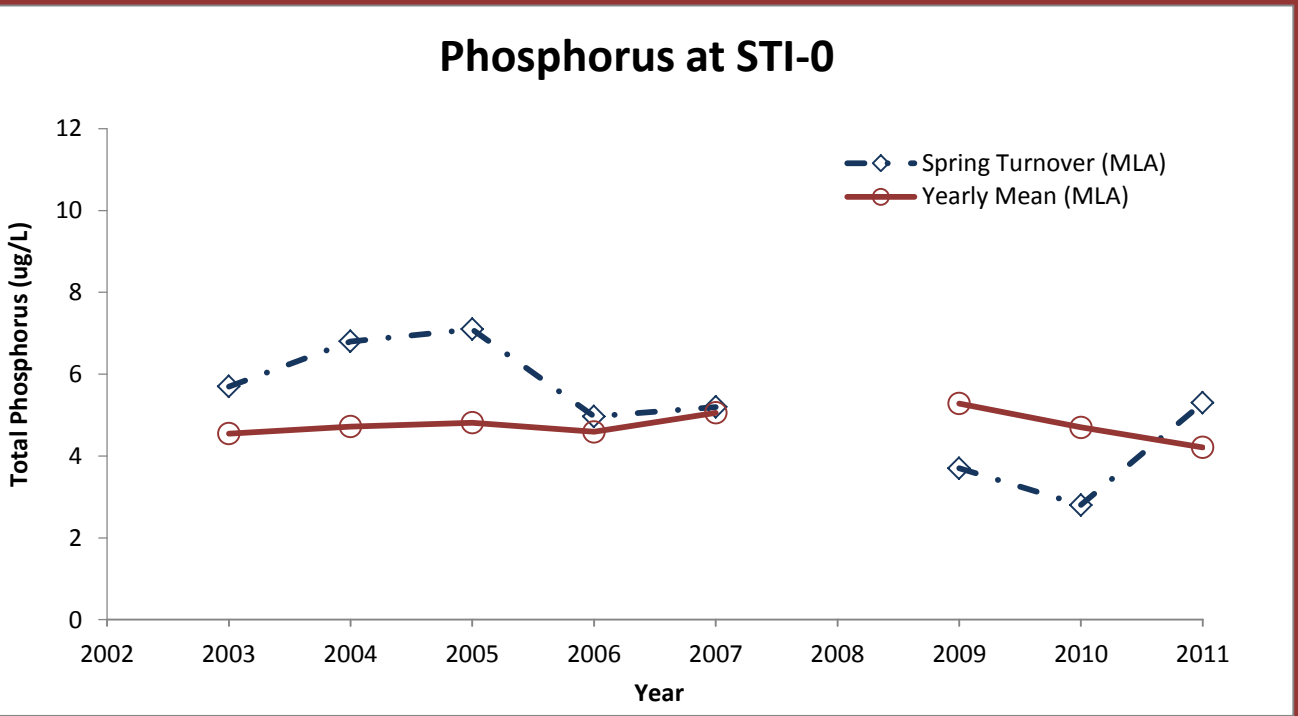
The 2011 spring turnover TP and yearly mean TP concentrations at STI-0 were consistent with historical values.

Recommendations

Continue existing sampling protocol in 2012 to monitor long-term trends.

(FTB/STI) FOOT'S BAY & STILLS BAY





GORDON BAY (GNB)

Area Description

Gordon Bay is in the northwestern part of Lake Joseph. This bay is moderately developed and highway 169 follows along the shoreline for a large portion of the bay. There is a large marina in the northern part of the bay where one of three creeks discharges into the bay. The main basin of Lake Joseph is classified as highly sensitive by the DMM.

Volunteer Recognition

Gordon Bay was monitored in 2011 by **Brian Smith**.

2011 Data

GNB-0: TP-Spring turnover = 6.0 µg/L
TP-Yearly mean = 4.0 µg/L
Calcium = 4.02 mg/L
Secchi = 5.8 m

GNB-5: TP-Yearly mean = 5.1 µg/L
Total coliforms = 3 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

Trends

Monitoring of Gordon Bay started in 2004.

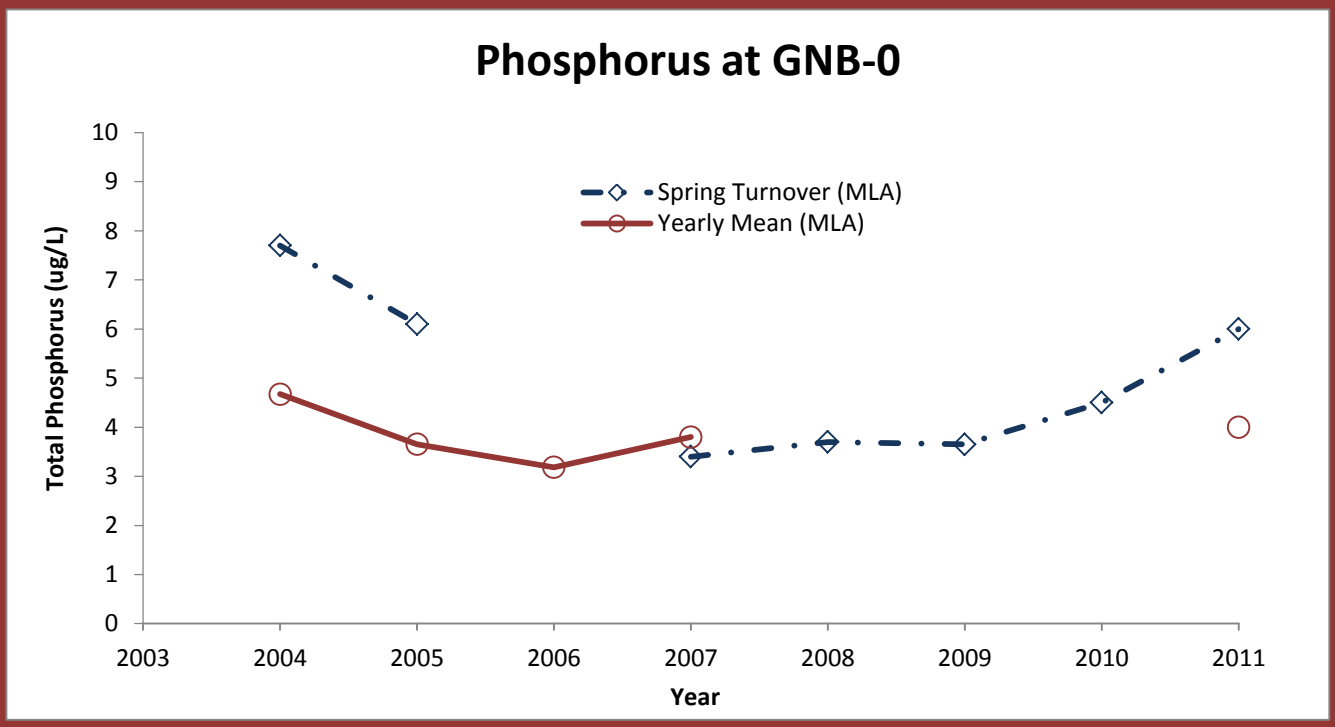
The 2011 spring turnover TP and yearly mean TP concentrations at GNB-0 were within the historic range of values.

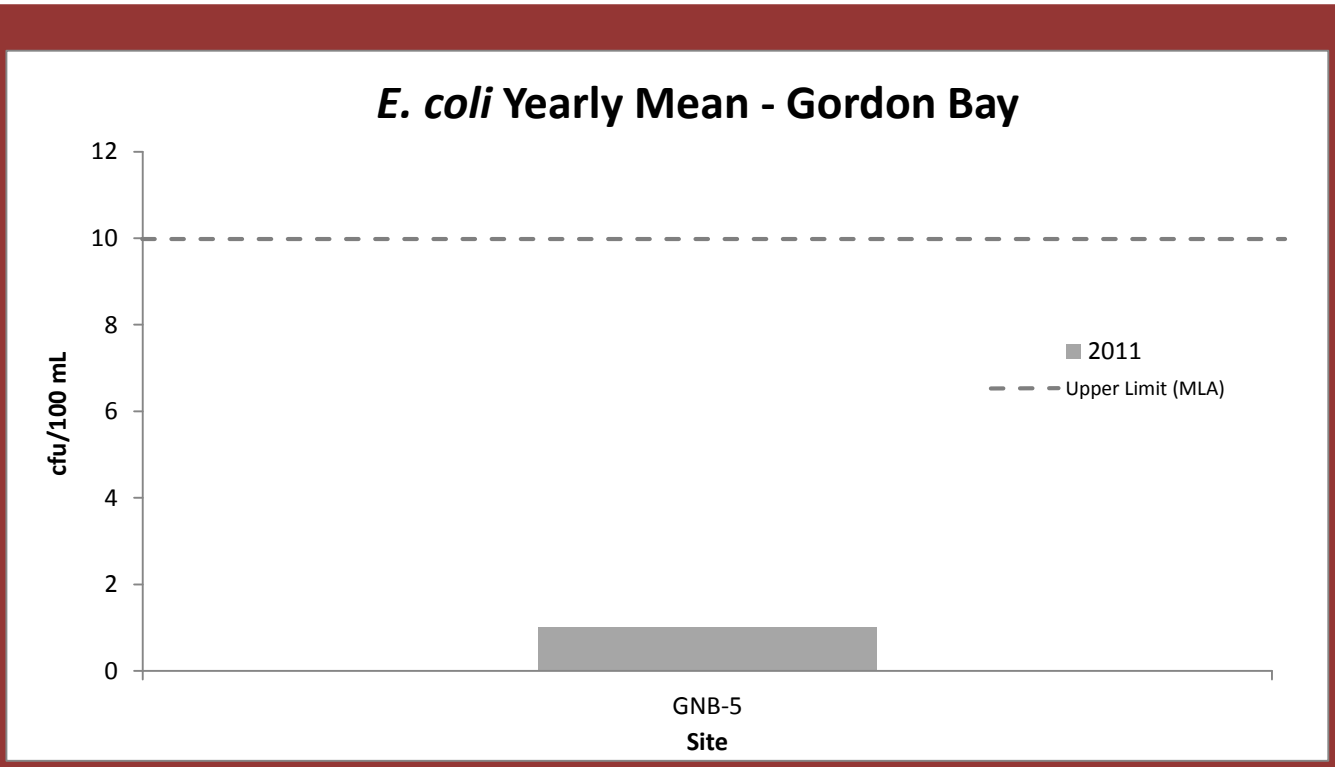
E. coli levels at GNB-5 were less than the MLA upper limit.

Recommendations

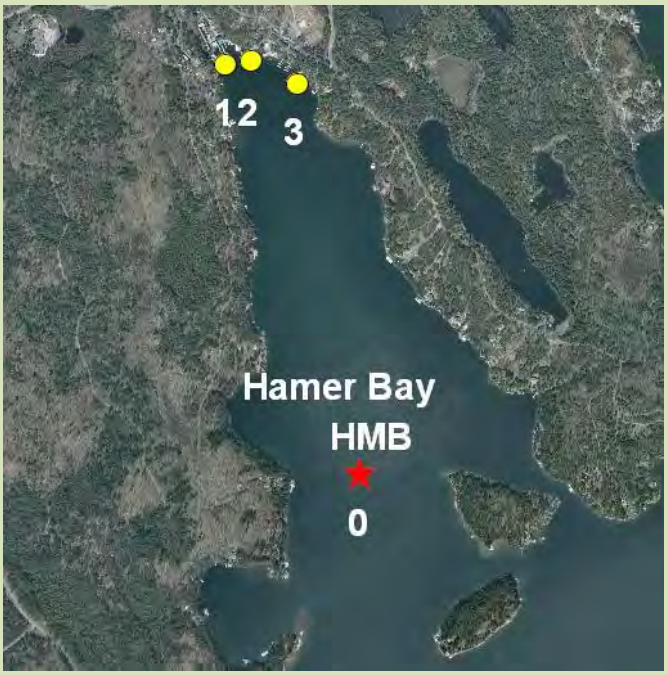
Continue existing sampling protocol in 2012 to monitor long-term trends.

(GNB) GORDON BAY





HAMER BAY (HMB)



Area Description

Hamer Bay is a large bay in the northern part of Lake Joseph. This bay receives drainage from a variety of natural and anthropogenic sources. There are three creeks that outlet into the bay, one flows through a large golf course and wetland in the north, and the others through smaller lakes and wetlands. There is a large marina with several parking lots, a resort, and many residential properties along most of the available shoreline. The main basin of Lake Joseph is classified as highly sensitive by the DMM.

Volunteer Recognition

Hamer Bay was monitored in 2011 by Jim McLellan, Vick McLellan, and **Brian Smith**.

2011 Data

HMB-0: TP-Spring turnover = 7.3 µg/L
TP-Yearly mean = 5.8 µg/L
Calcium = 4.01 mg/L
Secchi = 5.7 m
Total coliforms = 9 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

HMB-1: TP-Yearly mean = 9.8 µg/L
Total coliforms = 77 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

HMB-2: TP-Yearly mean = 5.6 µg/L
Total coliforms = 52 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

HMB-3: TP-Yearly mean = 7.1 µg/L
Total coliforms = 25 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

Trends

Monitoring of Hamer Bay started in 2002.

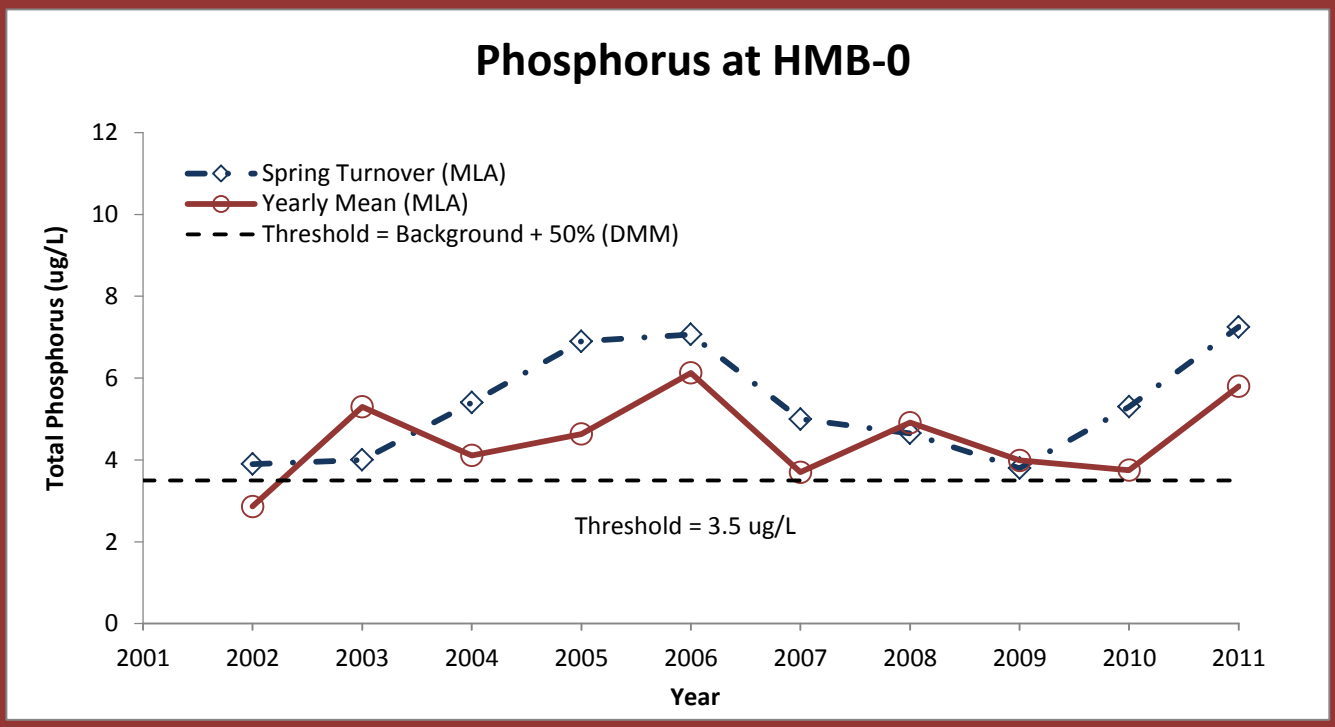
The 2011 spring turnover TP and yearly mean TP concentrations at HMB-0 were among the highest recorded concentrations in the sampling history and were greater than the DMM threshold value.

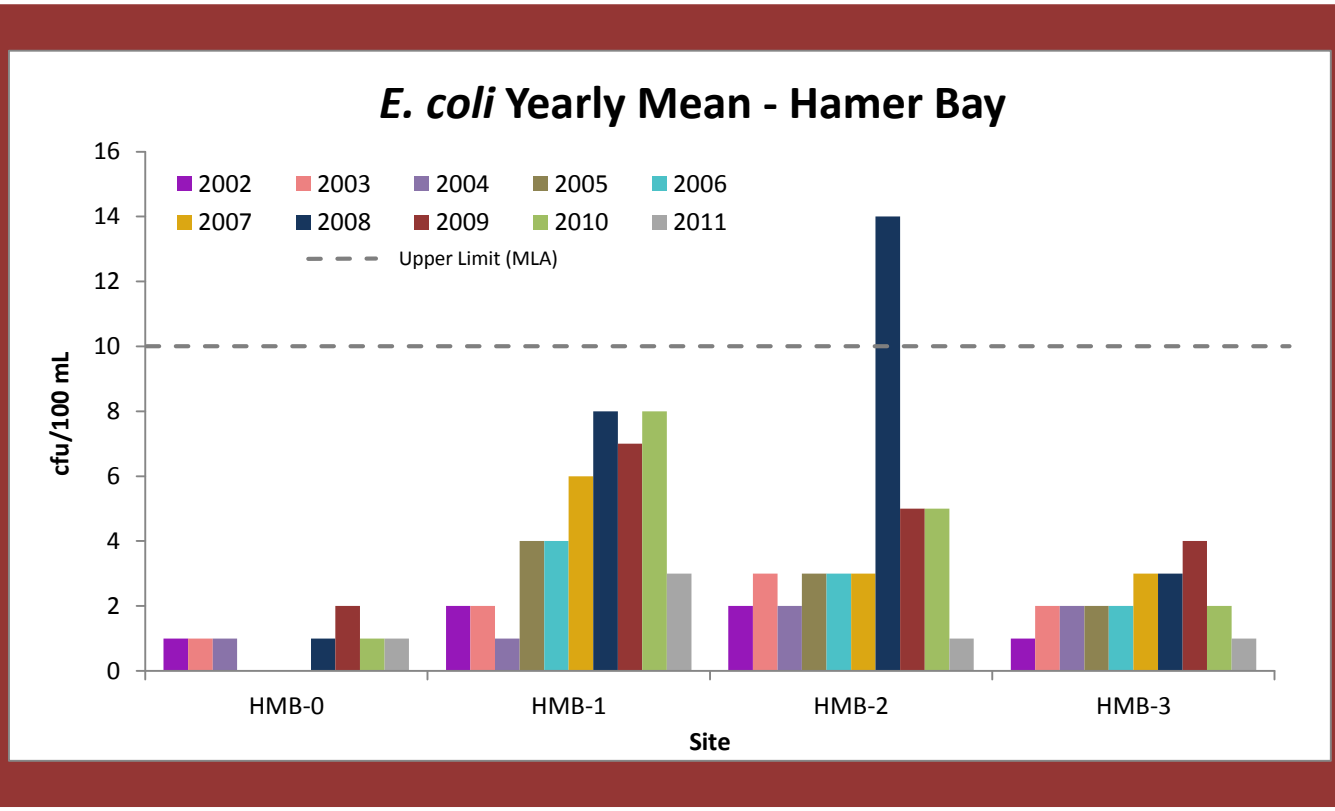
E. coli levels were generally lower than in 2010 and were less than the MLA upper limit at all sites.

Recommendations

Continue existing sampling protocol in 2012 to monitor long-term trends.

(HMB) HAMER BAY





LAKE JOSEPH (JOS-1)

Area Description

Lake Joseph is a large lake with a surface area of 50.9 km² and water depths of up to 60 m. Wetlands account for a small portion of the lake area at approximately 5%. The lake has various points of inflow and outflow, with drainage from north to south. The Lake Joseph watershed area is 55 km² and has a coldwater fishery. The DMM has classified the main basin of the lake as highly sensitive.

Volunteer Recognition

Lake Joseph was monitored in 2011 by Charlie Dalton, Judy Dalton, and **Brian Smith**.

2011 Data

JOS-1: TP-Yearly mean = 3.3 µg/L*
Secchi = 6.2 m**

Note: A calcium sample was not collected for this sampling area.

(*based on 2 sampling events)
(** based on 3 measurements)

Trends

Monitoring of Lake Joseph started in 2002.

This area has been selected as a long-term monitoring site.

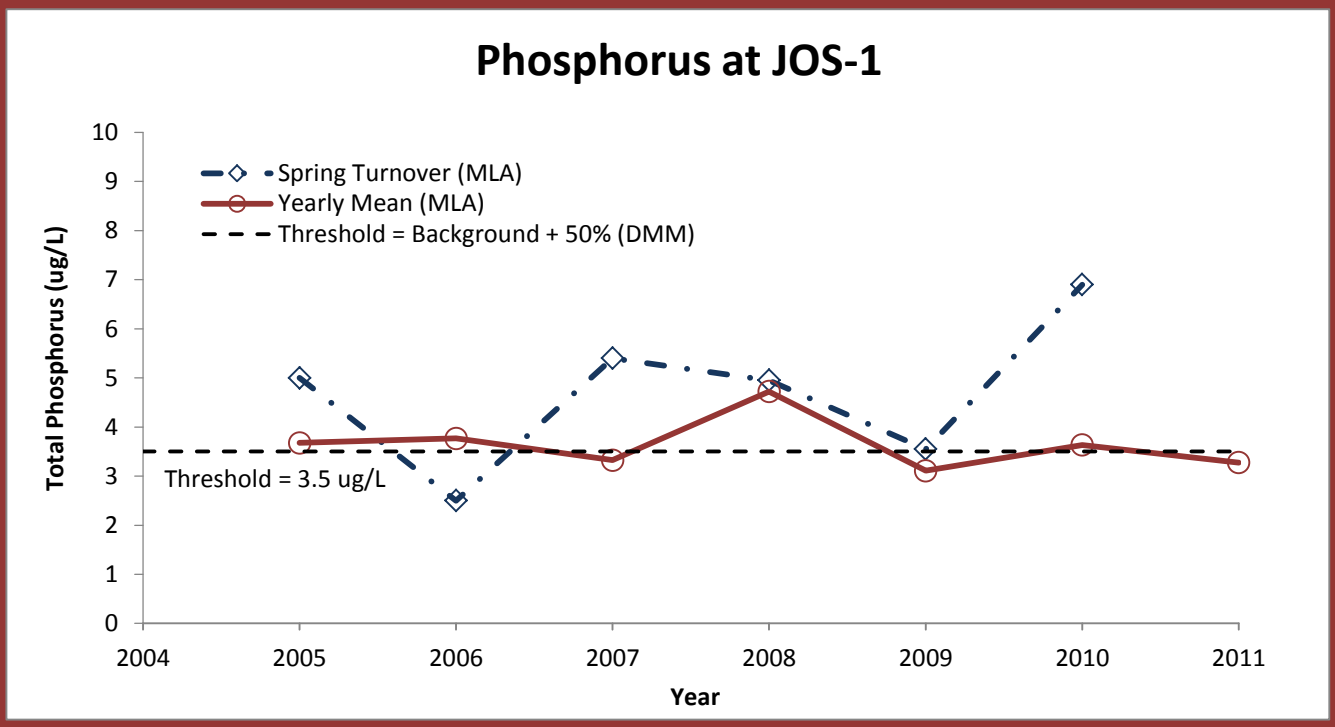
No spring turnover data were collected in 2011.

The 2011 yearly mean TP concentration was consistent with historic values.

Recommendations

Continue sampling spring turnover phosphorus annually to monitor long-term trends. Begin collecting calcium samples annually to monitor long-term trends.

(JOS-1) LAKE JOSEPH



Notes:

LITTLE LAKE JOSEPH (LLJ)

Area Description

Little Lake Joseph is an isolated arm 2.8 km² in size off the eastern side of Lake Joseph. This is a deep bay with depths of up to 40 m. Most of the shoreline is in a natural state despite many cottages. Three small wetlands outlet into the bay and the DMM has classified Little Lake Joe as moderately sensitive.

Volunteer Recognition

Little Lake Joseph was monitored in 2011 by Denis Jean-Marie, Mark Johnstone, and **Dirk Soutendijk**.

2011 Data

LLJ-0: TP-Spring turnover = 5.2 µg/L
TP-Yearly mean = 6.1 µg/L
Calcium = 3.72 mg/L
Secchi = 5.8 m

LLJ-12: Total coliforms = 47 cfu/100 mL
Total *E. coli* = 9 cfu/100 mL

LLJ-13: Total coliforms = 30 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

Trends

Monitoring of Little Lake Joseph started in 2005.

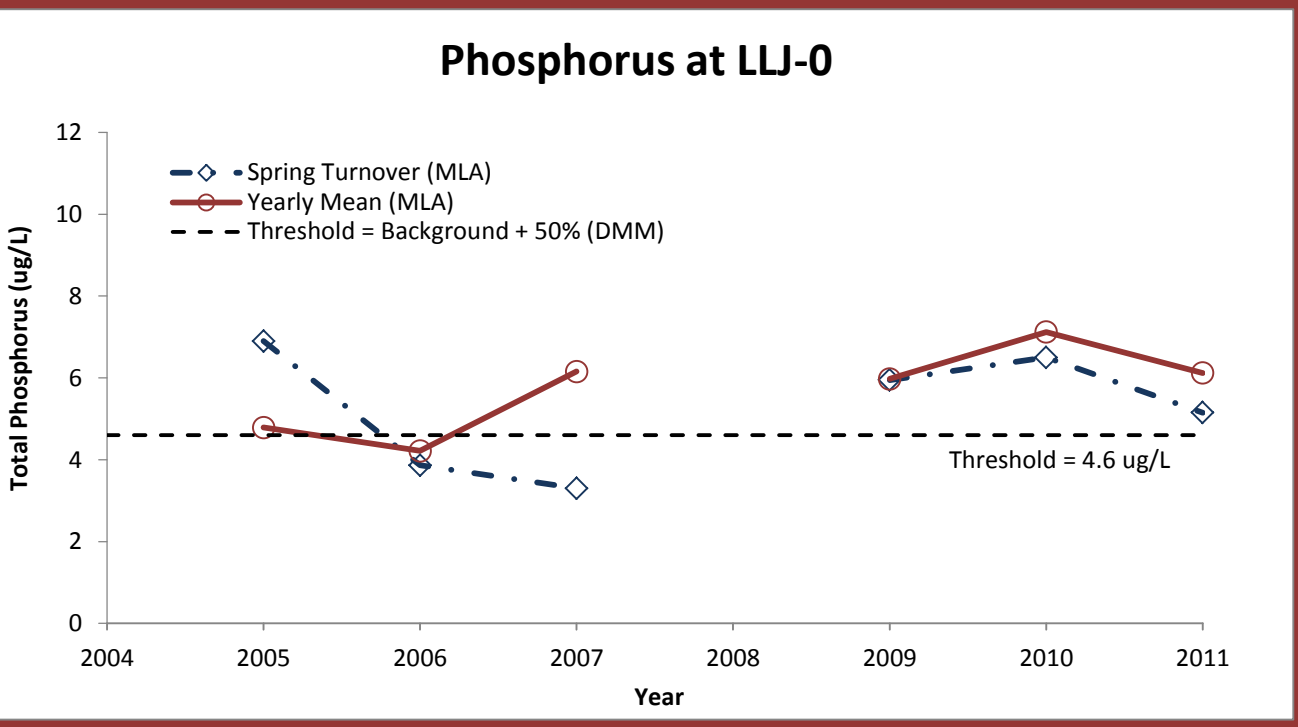
The 2011 spring turnover TP and yearly mean TP concentrations at LLJ-0 are consistent with historical values and are greater than the DMM threshold value.

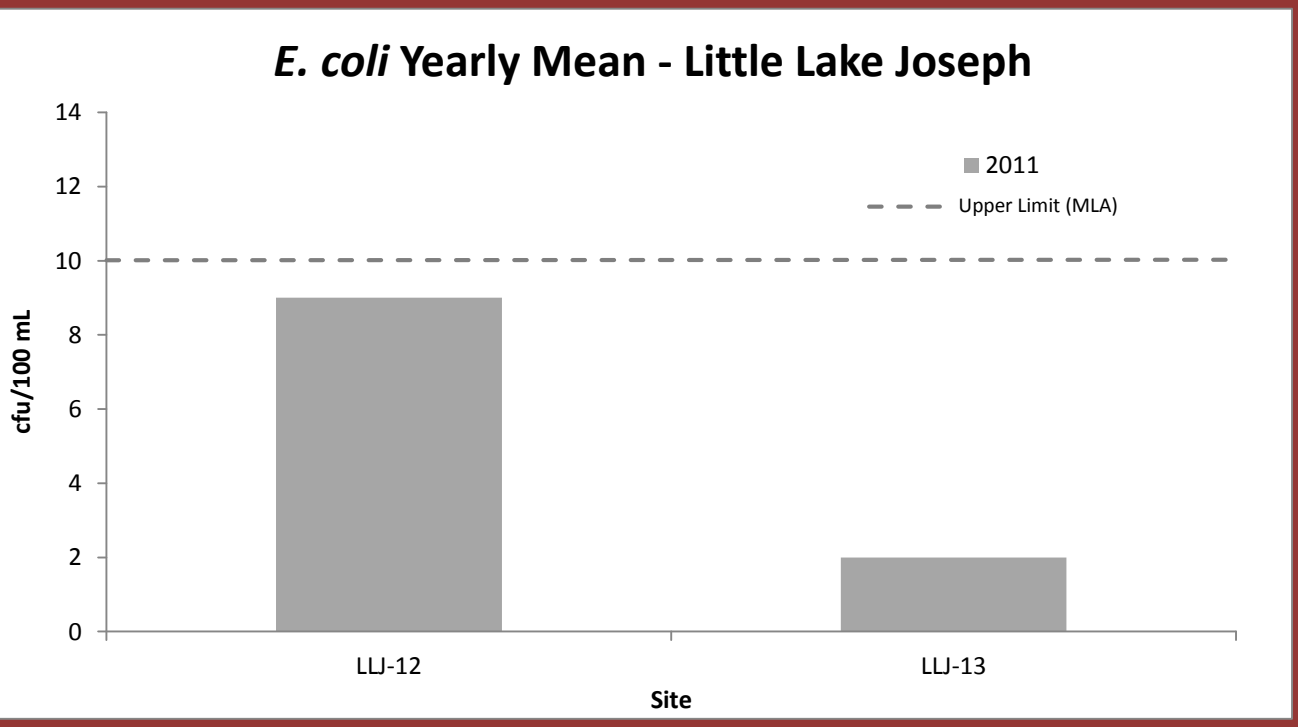
In 2011, new bacteria monitoring sites (LLJ-12 and LLJ-13) were established at high use areas. *E. coli* values at these sites were less than the MLA upper limit.

Recommendations

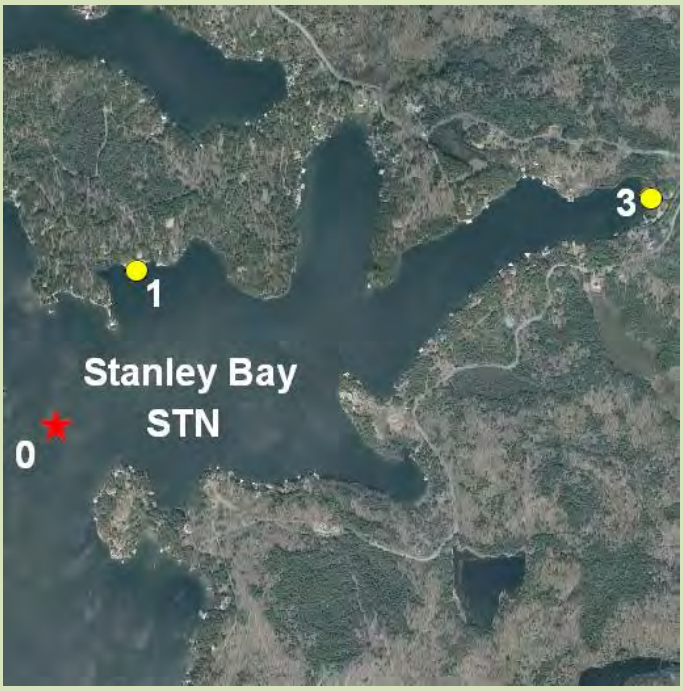
Continue existing sampling protocol in 2012 to monitor long-term trends.

(LLJ) LITTLE LAKE JOSEPH





STANLEY BAY (STN)



Area Description

Stanley Bay is located on the north-east side of Lake Joseph. This deep water bay has evenly distributed development with largely intact forest cover along the shoreline. STN-3 is located in a shallow, sandy area at the end of a small bay where a creek outlets. There are several roads around this bay and a moderate level of residential development, but no marinas, large resorts, commercial or agricultural development which could negatively impact water quality.

Volunteer Recognition

Stanley Bay was monitored in 2011 by Charlie Dalton, Judy Dalton, and **Brian Smith**.

2011 Data

STN-0: TP-Spring turnover = 29.1 µg/L*
TP-Yearly mean = 10.0 µg/L
Secchi = 6.0 m

STN-1: TP-Yearly mean = 4.0 µg/L

STN-3: TP-Yearly mean = 4.7 µg/L**

(* identified as an outlier based on the DMM protocol.)

(** based on 2 sampling events)

Trends

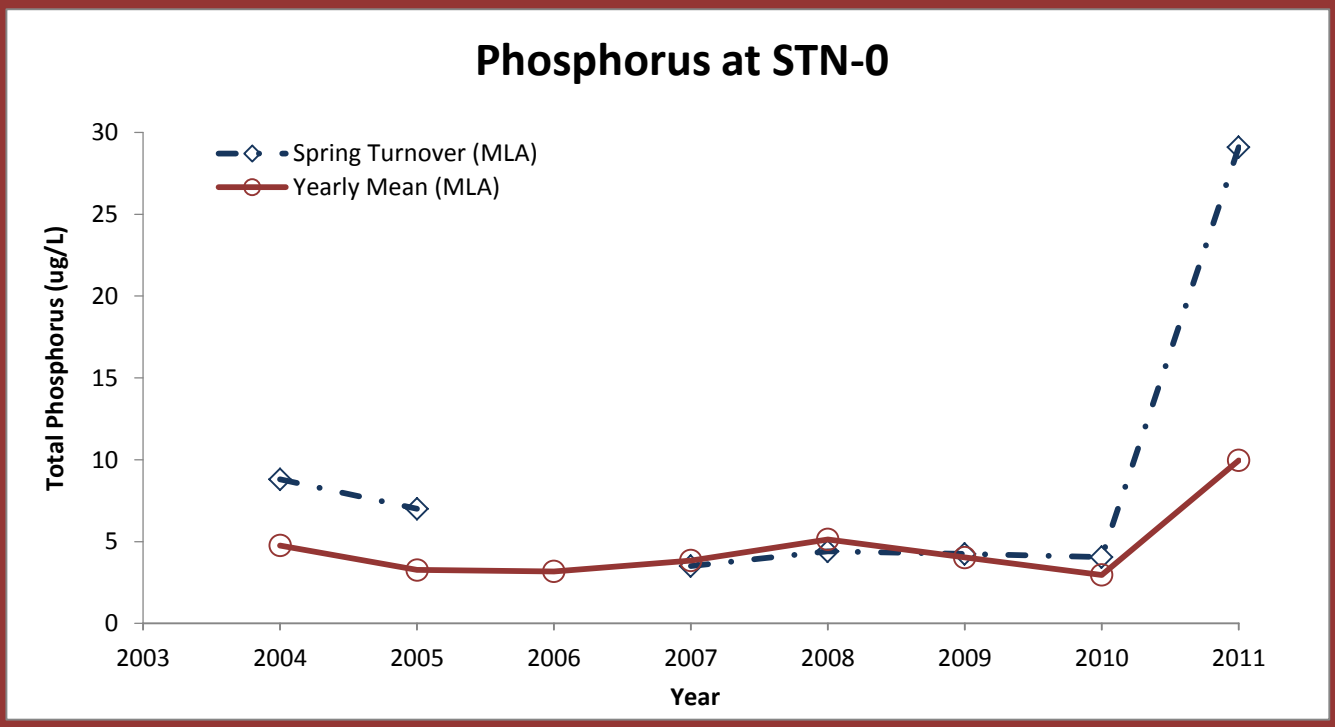
Monitoring of Stanley Bay started in 2004

The 2011 spring turnover TP and yearly mean TP at STN-0 were the highest recorded concentrations in the sampling history and was greater than the DMM threshold value. **Note** however, that the 2011 concentration has been identified as a outlier based on the DMM protocol.

Recommendations

Continue existing sampling protocol in 2012 to monitor long-term trends. Focus on obtaining more samples for yearly mean TP in 2011.

(STN) STANLEY BAY



Notes:

ARUNDLE LODGE (ARN)

Area Description

The Arundle Lodge sampling area is in south-central Lake Muskoka, east of Hardy Lake Provincial Park and south of Walker's Point. ARN-0 is located in Skinner Bay, adjacent to Miller Island and Firebrand Island. A creek draining three wetland areas runs along part of Arundle Lodge Rd. and outlets northeast of this site.

Volunteer Recognition

Arundle Lodge was monitored in 2011 by Susan Murphy, Stephen Sims, Carrie Tate, and Doug Tate.

2011 Data

ARN-0: TP-Spring turnover = 6.1 µg/L
Calcium = 3.35 mg/L
Secchi = 3.5 m

Trends

Monitoring of Arundle Lodge started in 2008.

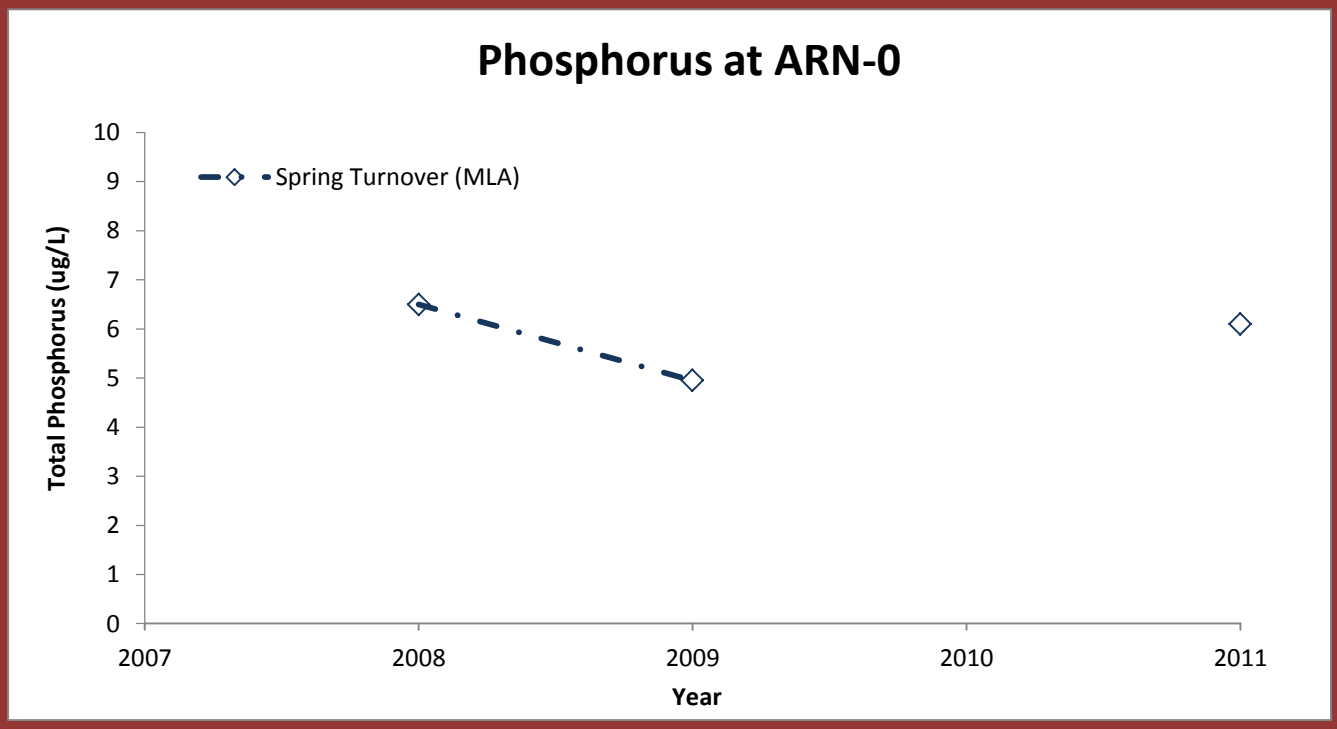
This area has been selected for long-term monitoring.

The 2011 spring turnover TP concentration is consistent with historical values.

Recommendations

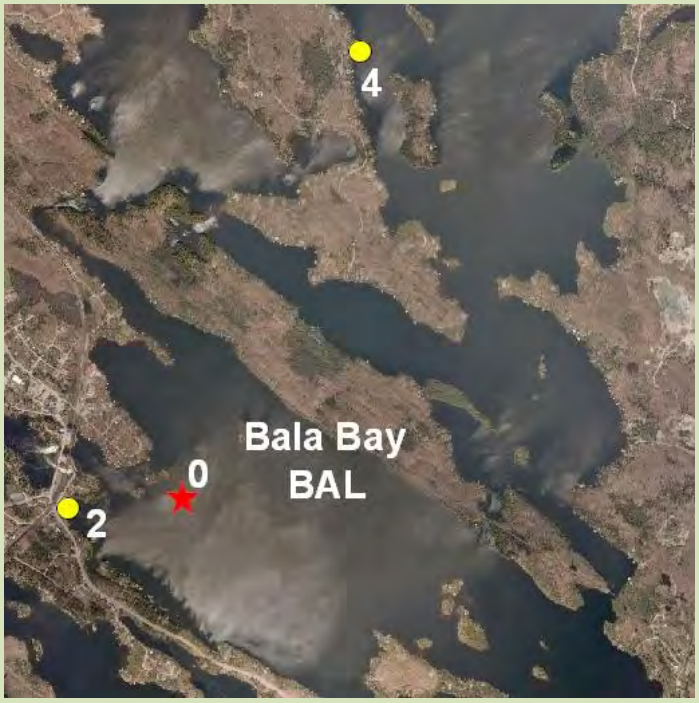
Continue sampling spring turnover phosphorus and calcium annually to monitor long-term trends.

(ARN) ARUNDLE LODGE



Notes:

BALA BAY (BAL)



Area Description

Bala Bay is a large isolated bay in the eastern part of Lake Muskoka. Most of the bay is densely developed but there is intact forest cover along most of the shoreline area. Drainage from the village of Bala does enter the bay along the western shore. The entire Muskoka River Watershed drains through Bala Bay into the Moon River System. There are also two small wetlands that drain into the bay.

Volunteer Recognition

Bala Bay was monitored in 2011 by Alan Hutton and **Peter Joel**.

2011 Data

BAL-0: TP-Spring turnover = 7.9 µg/L
TP-Yearly mean = 6.5 µg/L
Calcium = 3.38 mg/L
Secchi = 4.0 m

BAL-2: Total coliforms = 73 cfu/100 mL
Total *E. coli* = 5 cfu/100 mL

BAL-4: Total coliforms = 60 cfu/100 mL
Total *E. coli* = 5 cfu/100 mL

Trends

Monitoring of Bala Bay started in 2003.

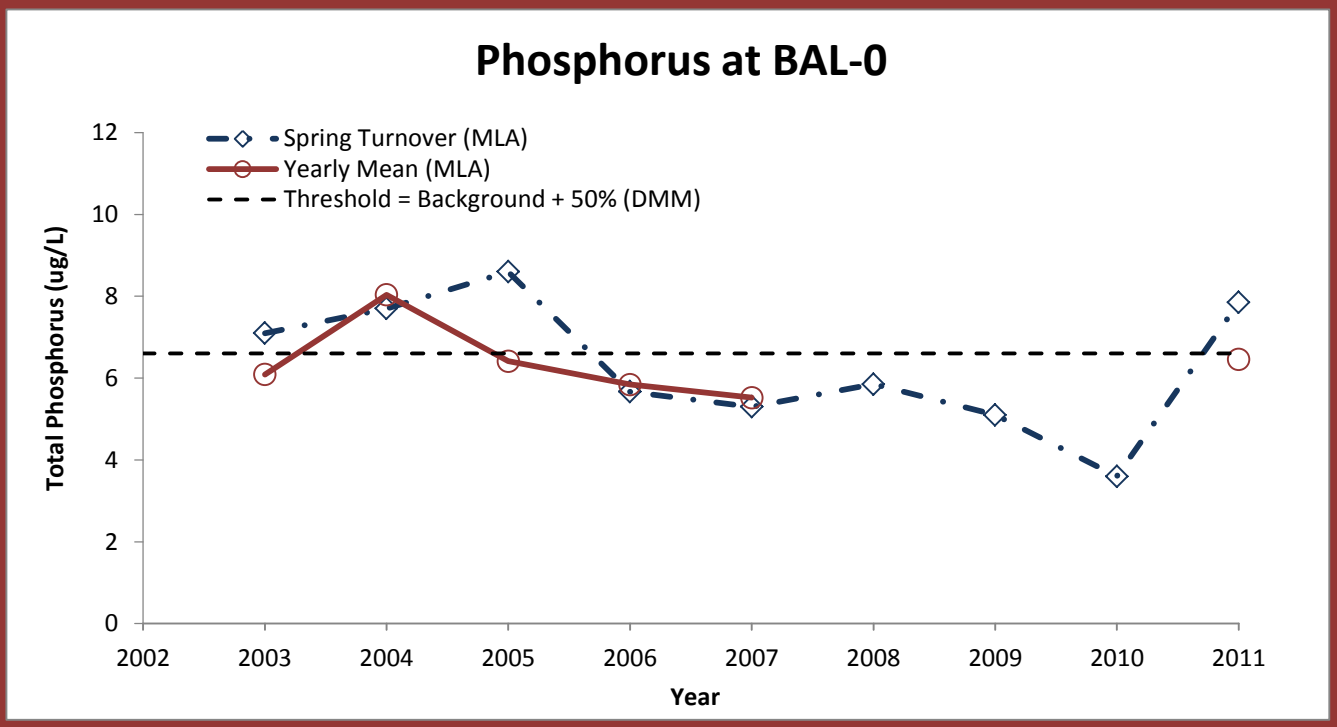
The 2011 spring turnover TP at BAL-0 was greater than the DMM threshold value; however, both the spring turnover TP and the yearly mean TP at BAL-0 were within the range of historic values.

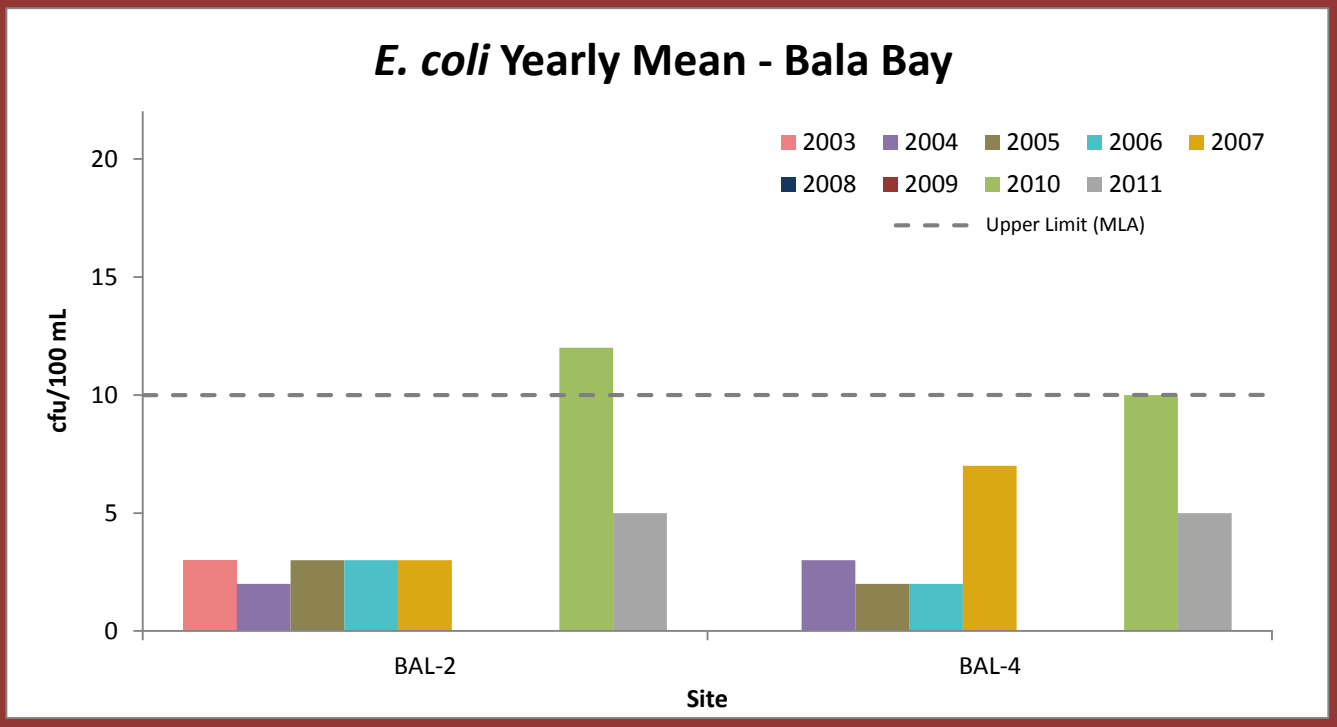
E. coli levels at BAL-2 and BAL-4 were lower than 2010 and less than the MLA upper limit.

Recommendations

Continue existing sampling protocol in 2012 to monitor long-term trends.

(BAL) BALA BAY


Phosphorus at BAL-0
Spring Turnover (MLA)
Yearly Mean (MLA)
Threshold = Background + 50% (DMM)
Total Phosphorus (ug/L)
0
2
4
6
8
10
12
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
Year


E. coli Yearly Mean - Bala Bay
2003
2004
2005
2006
2007
2008
2009
2010
2011
Upper Limit (MLA)
cfu/100 mL
0
5
10
15
20
BAL-2
BAL-4
Site

BEAUMARIS (BMR)

Area Description

This island in the Milford Bay area of northeastern Lake Muskoka is approximately 132 ha in size. A golf course takes up much of the island, which is associated with a small private club and marina. Most of the natural shoreline vegetation is intact, but there are many large boathouses in this area. There is a large wetland to the east where the causeway links mainland and the island.
BMR-8 is located near the mainland where Milford Bay Road is in close proximity to Lake Muskoka.

Volunteer Recognition

Beaumaris was monitored in 2011 by **Louise Cragg** and Alan Flye.

2011 Data

BMR-0: TP-Spring turnover = 7.1 µg/L
TP-Yearly mean = 8.0 µg/L
Calcium = 3.42 mg/L
Secchi = 3.3 m

BMR-2: TP-Yearly mean = 5.1 µg/L
Total coliforms = 163 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

BMR-4: Total coliforms = 1508 cfu/100 mL
Total *E. coli* = 6 cfu/100 mL

BMR-6: TP-Yearly mean = 6.6 µg/L

BMR-8: TP-Yearly mean = 6.4 µg/L
Total coliforms = 283 cfu/100 mL
Total *E. coli* = 2 cfu/100 m

Trends

Monitoring of Beaumaris started in 2002.

Yearly mean TP at BMR-0 was the highest recorded concentration in the sampling history. Late summer TP duplicate measurements at BMR-0 were notably high (11.4 and 11.3 µg/L) .

The spring turnover TP and yearly mean TP concentrations were greater than the DMM threshold.

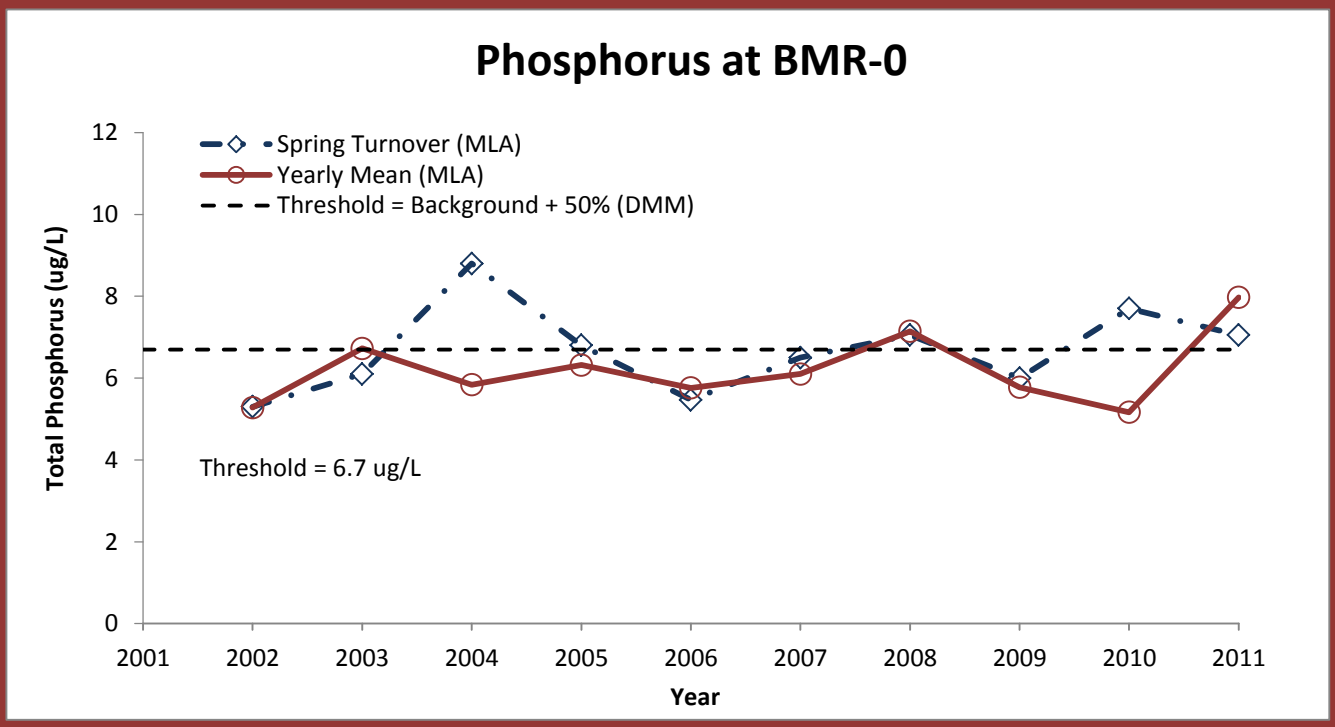
TP yearly mean concentrations at nearshore sites were consistent with data collected in 2010.

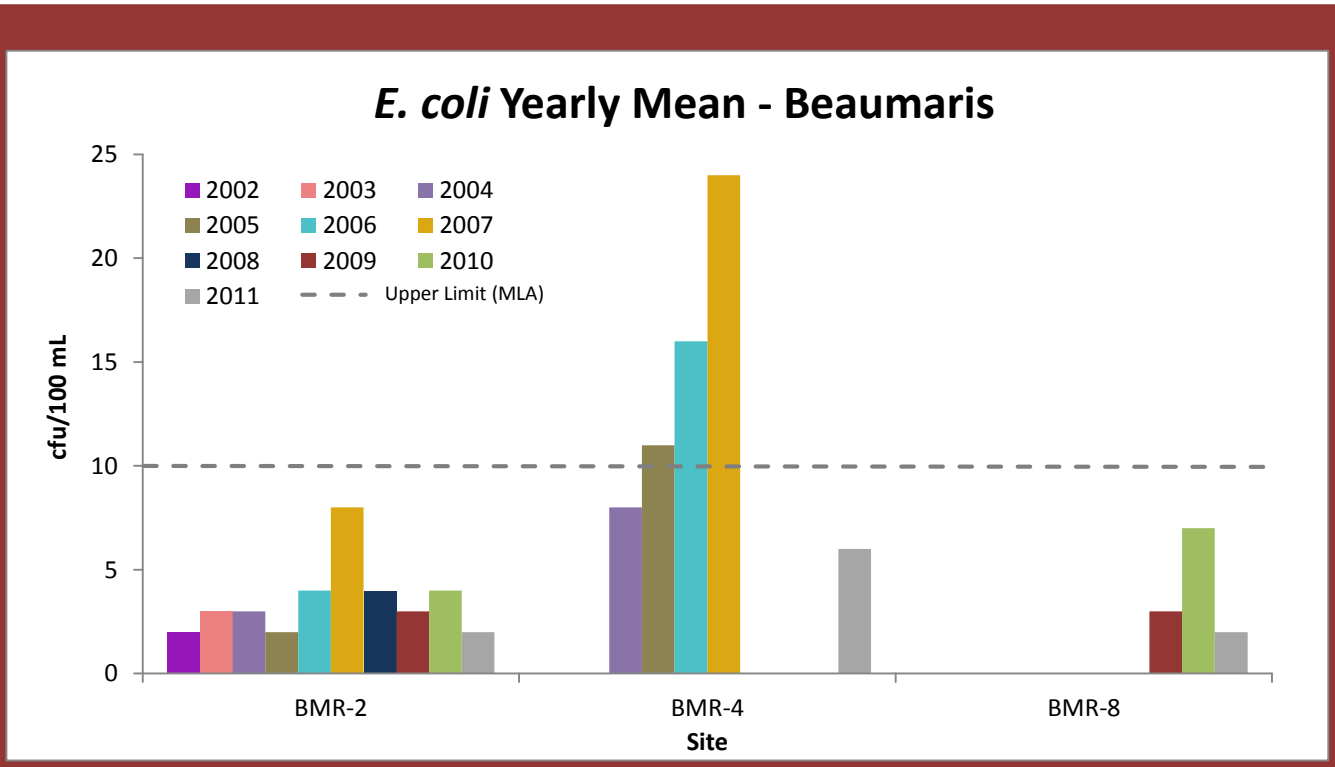
E. coli levels were generally lower than 2010 and less than the MLA upper limit.

Recommendations

Continue existing sampling protocol in 2012 to monitor long-term trends.

(BMR) BEAUMARIS





BOYD BAY (BOY)

Area Description

Boyd Bay is a small bay in the central part of eastern Lake Muskoka. The water quality in Boyd Bay is influenced by several natural and man-made features, including a marina in the southeast, a large wetland in the north, Highway 118 to the east and several inflowing creeks. The creeks that drain into the bay are potentially influenced by agricultural areas. Much of the shoreline is developed and many residential properties have manicured lawns along the shoreline.

Volunteer Recognition

Boyd Bay was monitored in 2011 by Chris & Rayma Blaymires, Lynn & Dave Langford, and **John Wood**.

2011 Data

BOY-0: TP-Spring turnover = 8.8 µg/L
TP-Yearly mean = 8.2 µg/L
Calcium = 3.14 mg/L
Secchi = 2.7 m

BOY-3: TP-Yearly mean = 8.4 µg/L
Total coliforms = 152 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

BOY-4: TP-Yearly mean = 9.5 µg/L
Total coliforms = 288 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

BOY-5: TP-Yearly mean = 8.0 µg/L
Total coliforms = 26 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

Trends

Monitoring of Boyd Bay started in 2006.

The 2011 spring turnover TP and yearly mean TP concentrations were within the historical range of values.

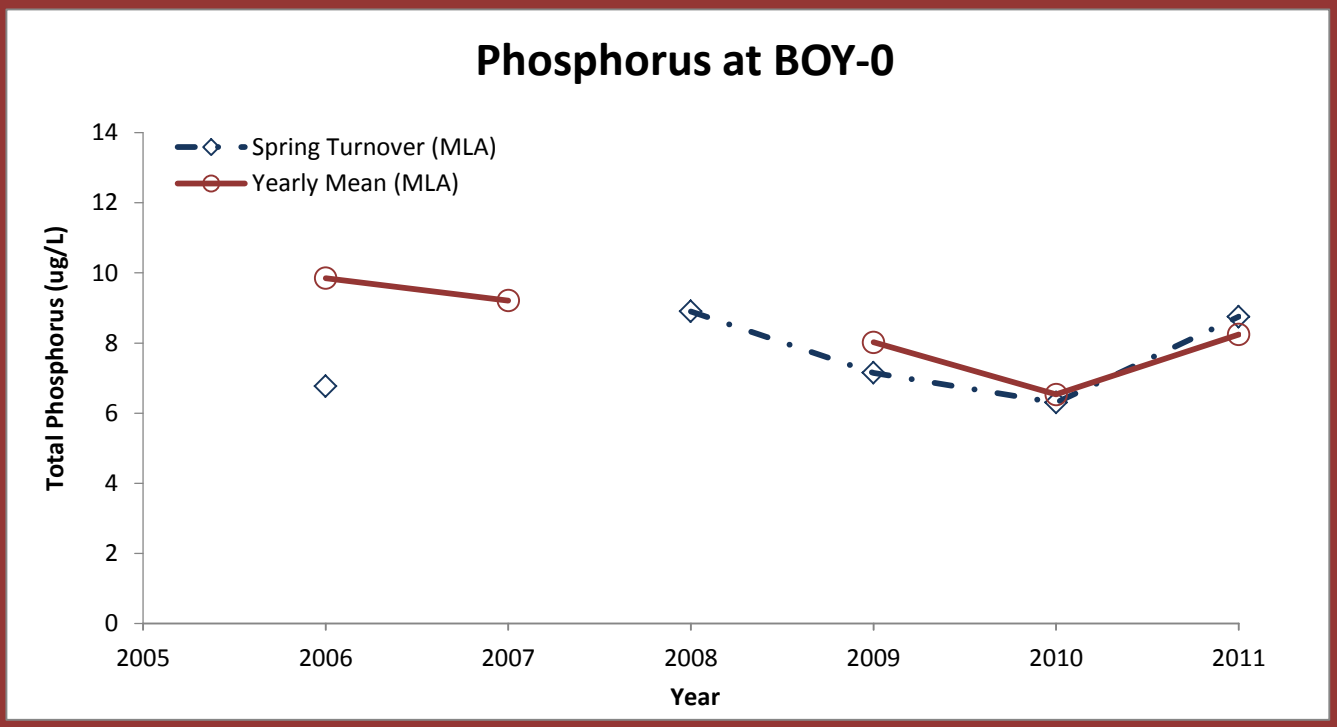
In 2011, *E. coli* levels at BOY-3 were lower than in previous years.

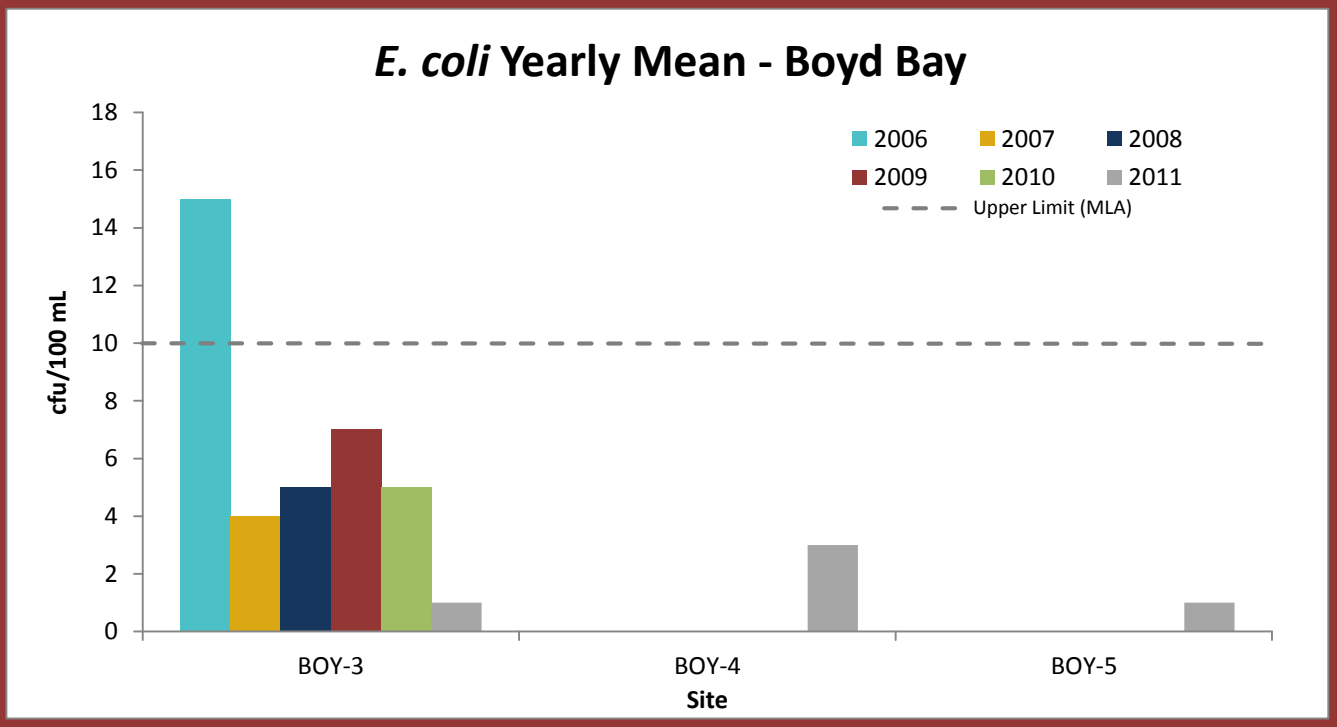
E.coli levels at newly established sites located in high use areas (BOY-4 and BOY-5) were below the MLA upper limit.

Recommendations

Continue existing sampling protocol in 2012 to monitor long-term terms.

(BOY) BOYD BAY


Phosphorus at BOY-0
Spring Turnover (MLA)
Yearly Mean (MLA)
Total Phosphorus (ug/L)
0
2
4
6
8
10
12
14
2005
2006
2007
2008
2009
2010
2011
Year


E. coli Yearly Mean - Boyd Bay
2006
2007
2008
2009
2010
2011
Upper Limit (MLA)
cfu/100 mL
0
2
4
6
8
10
12
14
16
18
BOY-3
BOY-4
BOY-5
Site

DUDLEY BAY (MUS-2 & DUD)

Area Description

Dudley Bay is located in eastern Lake Muskoka, and is approximately 3.6 km² in size with a maximum depth of 20 m. It is considered moderately developed, with primarily residential properties and several roads, including Highway 169, that are in close proximity to the shoreline. Several creeks and wetlands drain into the bay, including that from the cranberry marsh. Dudley Bay is classified as moderately sensitive by the DMM.

Volunteer Recognition

Dudley Bay was monitored in 2011 by Benjamin Butler, **Eleanor Lewis,** and Jim Lewis.

2011 Data

MUS-2: TP-Spring turnover = 4.7 µg/L
TP-Yearly mean = 4.9 µg/L
Calcium = 3.38 mg/L
Secchi = 3.2 m

DUD-1 Total coliforms = 30 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

Trends

Monitoring of Dudley Bay started in 2005.

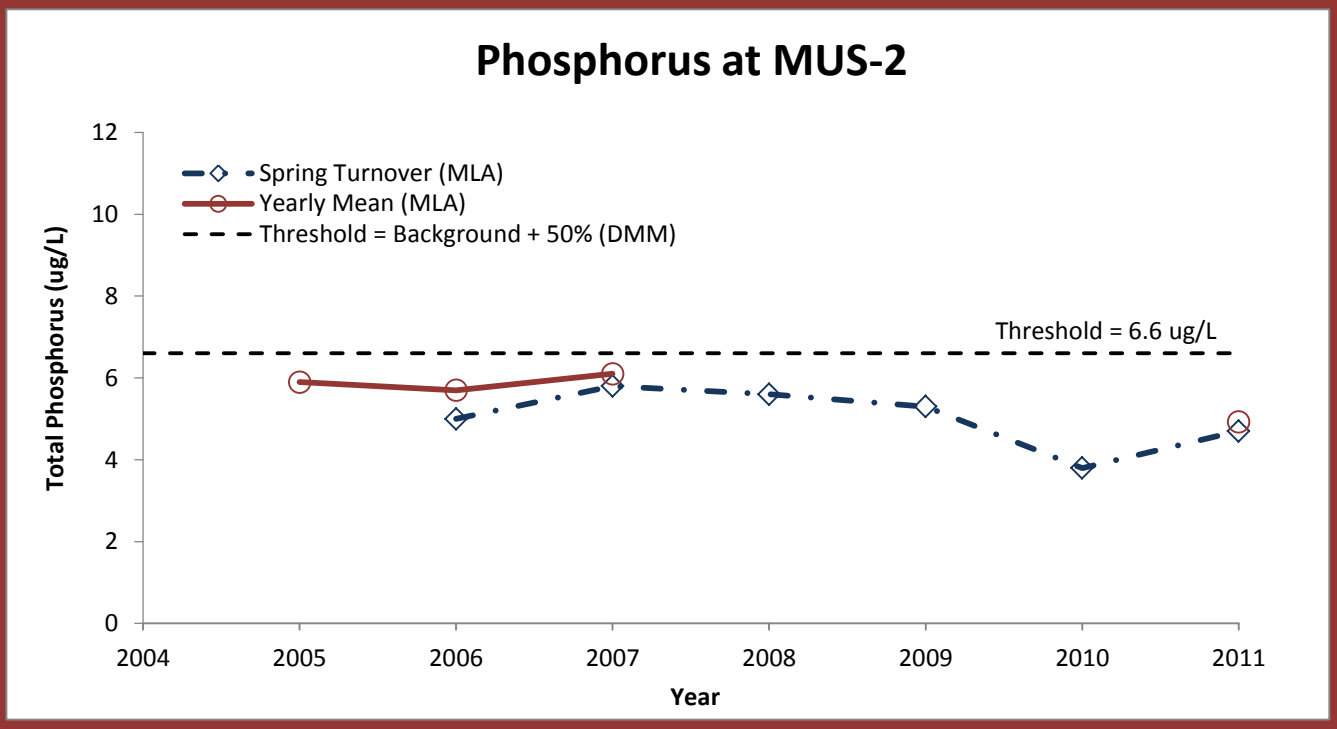
The 2011 spring turnover TP and yearly mean TP concentrations at MUS-2 were consistent with historical values and were both less than the DMM threshold value.

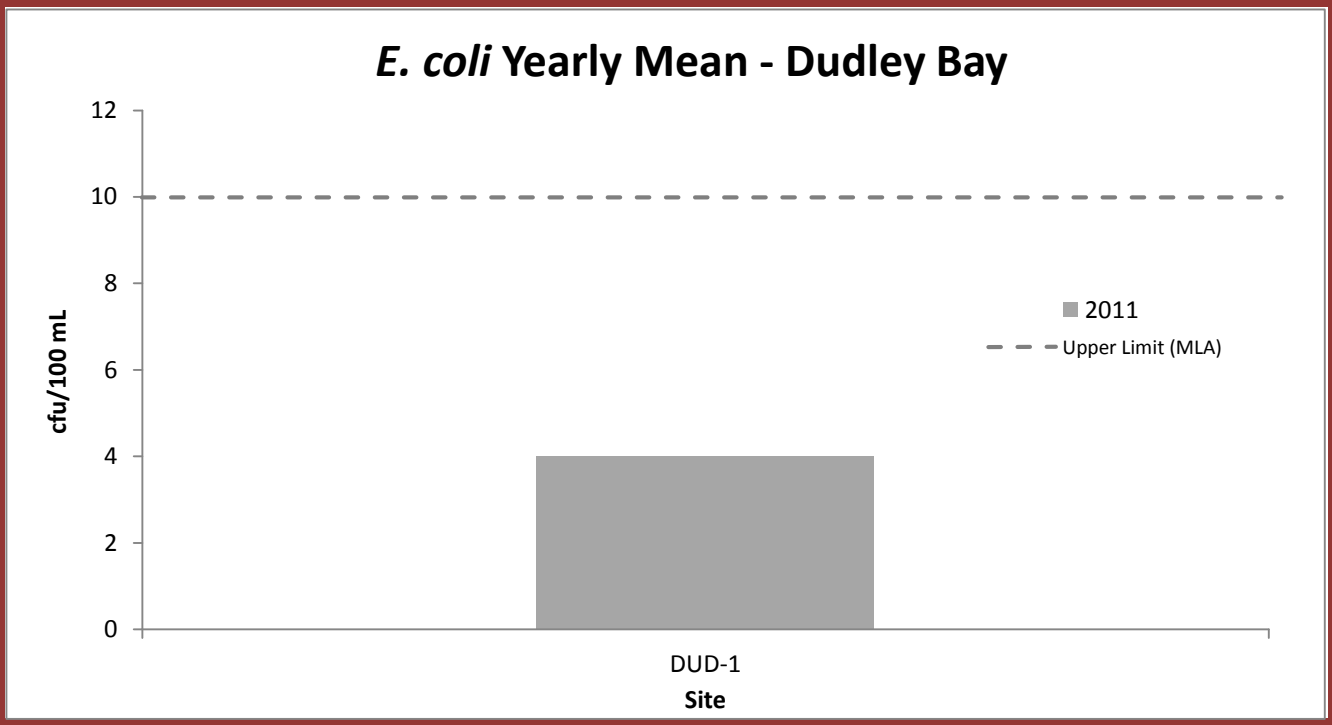
E.coli levels at the newly established site located in a high use area (DUD-1) were below the MLA upper limit.

Recommendations

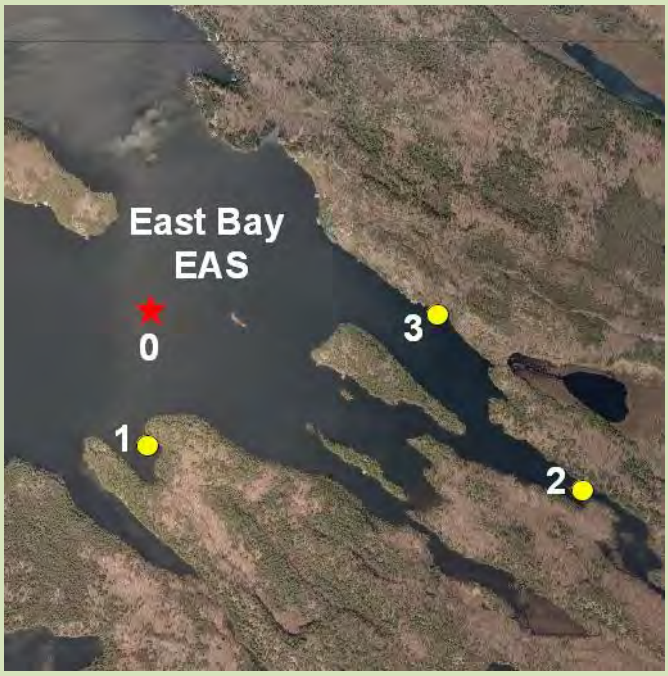
Continue existing sampling protocol in 2012 to monitor long-term trends.

(MUS-2 & DUD) DUDLEY BAY





EAST BAY (EAS)



Area Description

East Bay is in the western portion of Lake Muskoka and is part of Hardy Lake Provincial Park. This is a low development area with very few cottages/residences and no access roads. Several long narrow bays form the drainage area where five creeks outlet into the main bay from the park. These creeks also drain wetland areas into East Bay.

Volunteer Recognition

East Bay was monitored in 2011 by **Louise Cragg**, Gary & Janice Getson, and Lloyd Walton,

2011 Data

EAS-0: TP-Spring turnover = 6.7 µg/L
TP-Yearly mean = 6.5 µg/L*
Calcium = 3.28 mg/L
Secchi = 3.8 m

EAS-1: TP-Yearly mean = 6.8 µg/L

EAS-2: TP-Yearly mean = 8.5 µg/L

EAS-3: TP-Yearly mean = 6.3 µg/L

(* one of four samples consisted of 50% filtered lake water and 50% unfiltered lake water)

Trends

Monitoring of East Bay started in 2002.

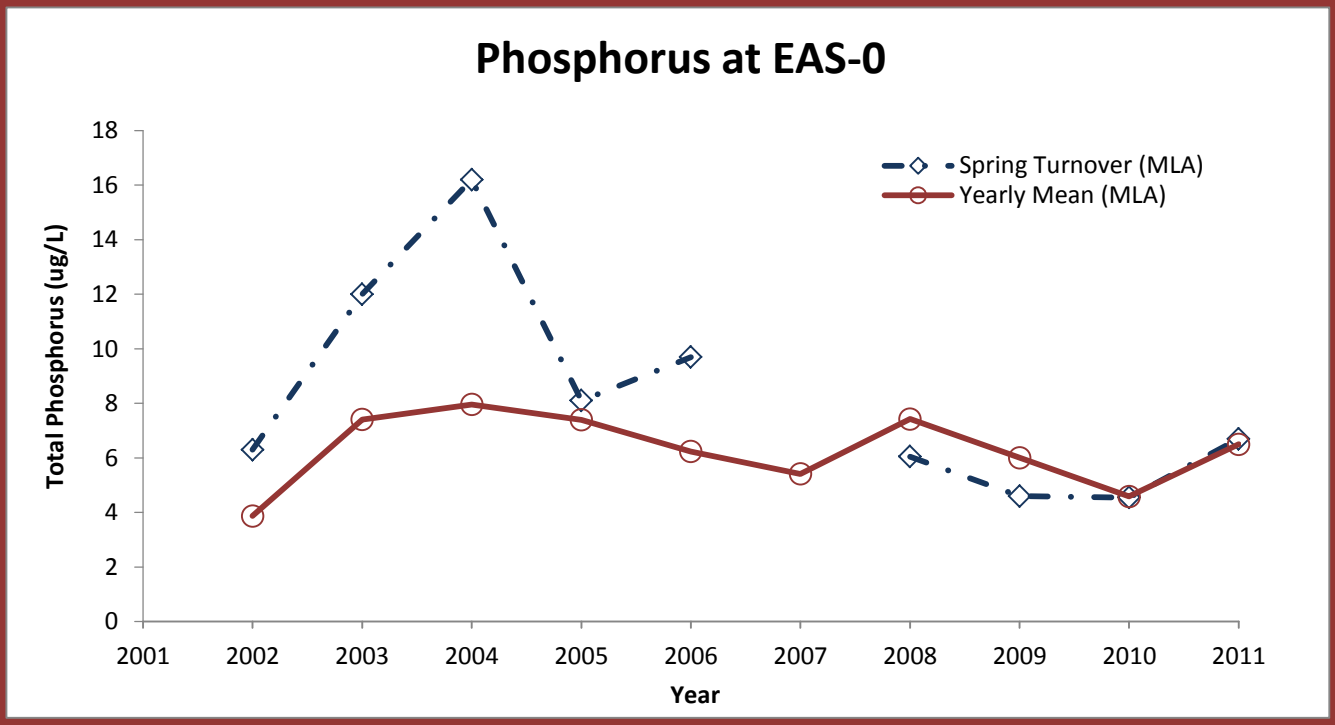
The 2011 spring turnover TP at EAS-0 was within the historic range of values and greater than the DMM threshold.

2011 yearly mean TP values were consistent with 2010 data.

Recommendations

Continue existing sampling protocol in 2012 to monitor long-term trends.

(EAS) EAST BAY



Notes:

EILEAN GOWAN ISLAND (ELG)

Area Description

Eilean Gowan Island is located in the eastern part of Lake Muskoka and is largely developed with residential cottages. Most of these properties appear to retain a well-vegetated shoreline with the exception of a few lawns and tennis courts directly adjacent to the lake. The interior of this island is completely forested and two small streams outlet from upland areas at sampling sites ELG-1 and ELG-3.

Volunteer Recognition

Eilean Gowan Island was monitored in 2011by **Susan Murphy**, Alastair Sims, Stephen Sims, Carrie Tate, and Doug Tate.

2011 Data

ELG-0: TP-Spring turnover = 8.0 µg/L
TP-Yearly mean = 6.8 µg/L
Calcium = 3.29 mg/L
Secchi = 3.2 m

ELG-1: Total coliforms = 86 cfu/100 mL
Total *E. coli* = 13 cfu/100 mL

ELG-2: Total coliforms = 144 cfu/100 mL*
Total *E. coli* = 19 cfu/100 mL*

ELG-3: Total coliforms = 65 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

(* includes one sample with elevated *E. coli* levels; however, no follow-up samples were collected)

Trends

Monitoring of Eilean Gowan Island started in 2002.

The 2011 spring turnover TP at ELG-0 was the highest recorded concentration in the sampling history and was equal to the DMM threshold value.

The yearly mean TP at ELG-0 was consistent with the historic values.

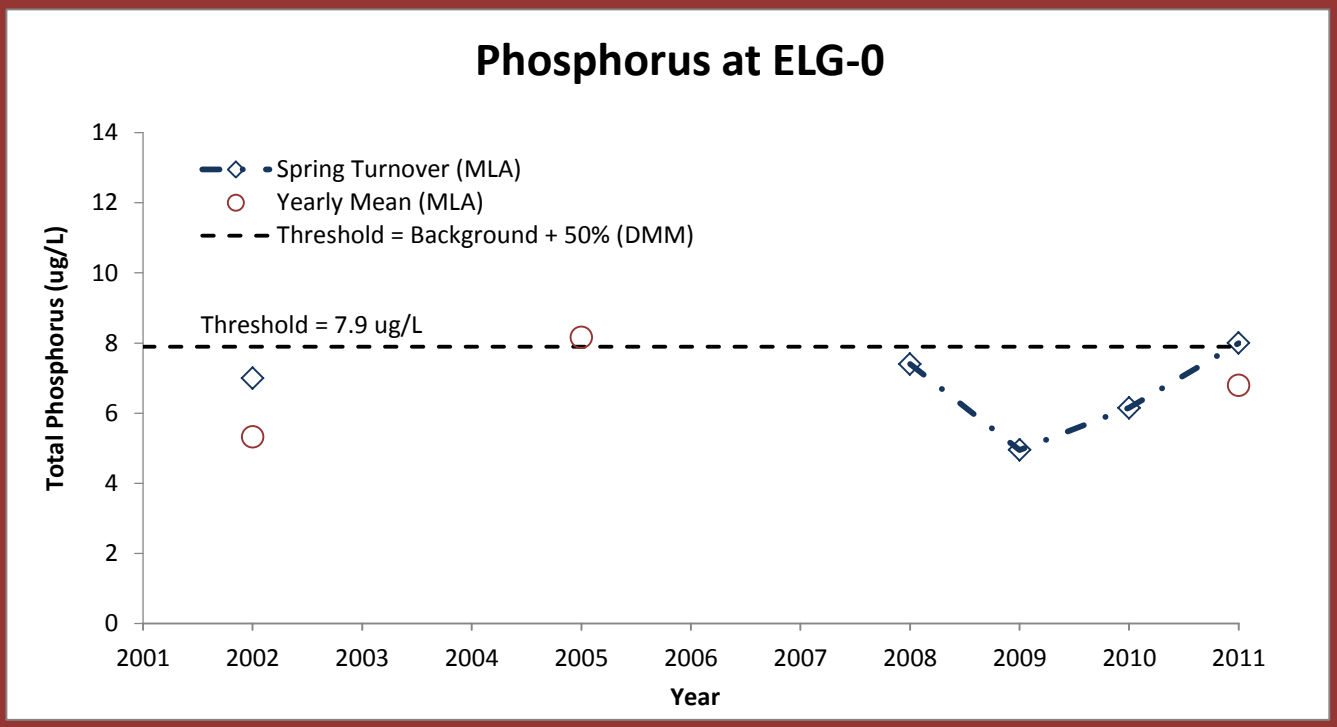
2011 *E.coli* levels were above the MLA upper limit with the exception of ELG-3.

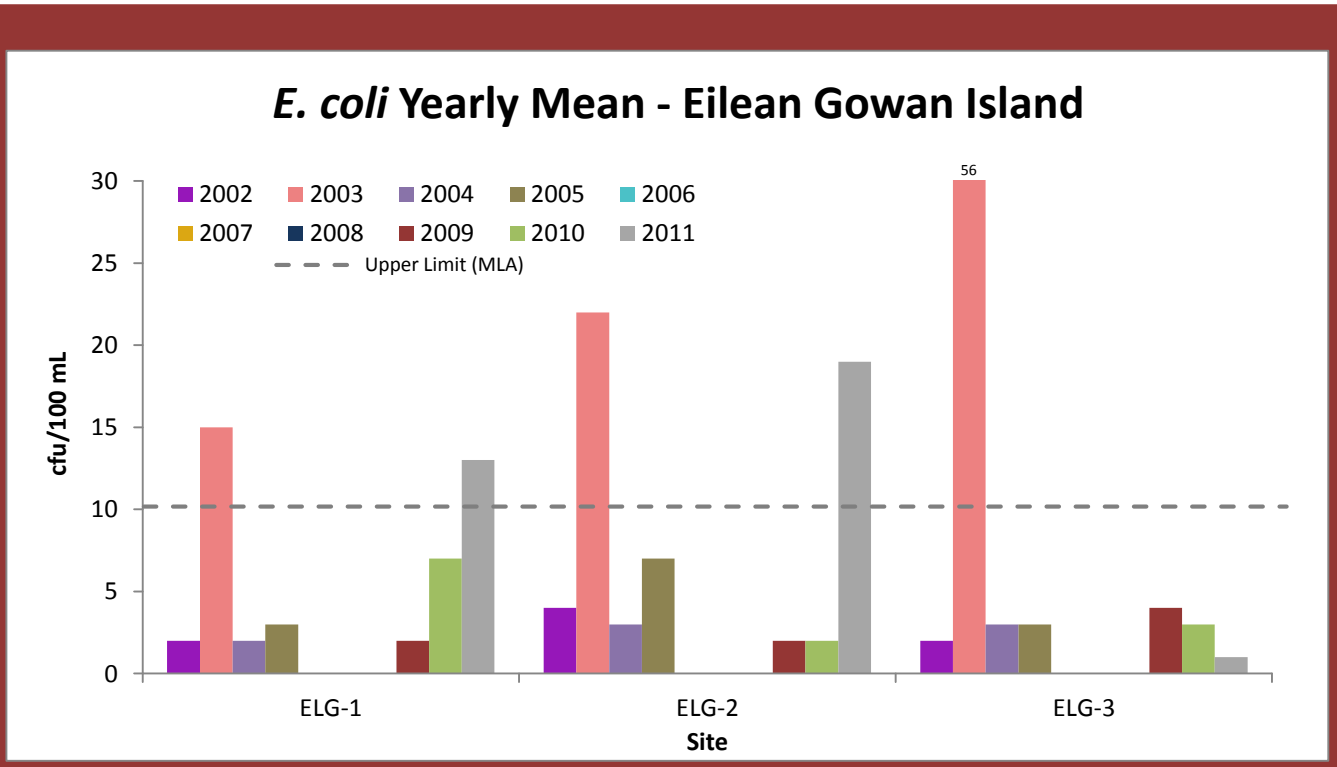
Recommendations

Continue existing sampling protocol in 2012 to monitor long-term trends.

Ensure that follow-up bacterial samples are collected from sites with elevated *E. coli* levels.

(ELG) EILEAN GOWAN ISLAND





LAKE MUSKOKA (MUS-3)

Area Description

With a surface area of approximately 121 km^2 and with water depths of up to 73 m, Lake Muskoka is the largest inland lake within the District of Muskoka. The Lake Muskoka watershed area is 4600 km^2 and approximately 10.5% of the watershed is covered by wetlands. The lake has various points of inflow and outflow, most notably being the outflow into the Moon River.

Volunteer Recognition

Lake Muskoka Main Basin was monitored in 2011 by Chris Blaymires and Rayma Blaymires.

2011 Data

MUS-3: TP-Spring turnover = 5.8 µg/L
Calcium = 3.29 mg/L
Secchi = 3.2 m$^{\pm}$

($^{\pm}$based on 3 measurements)

Trends

Monitoring of Lake Muskoka Main Basin started in 2005.

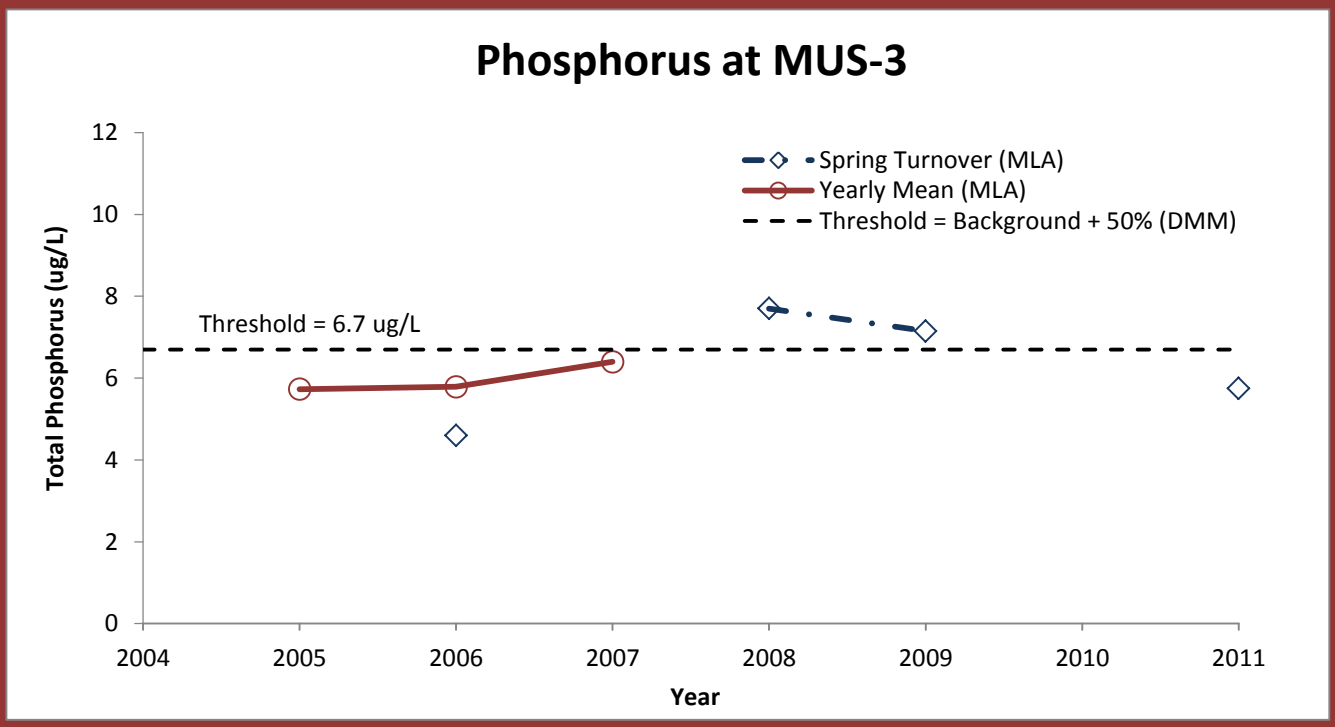
This area has been selected as a long-term monitoring site.

Spring turnover TP concentration in 2011 was consistent with historical values and was less than the DMM threshold value.

Recommendations

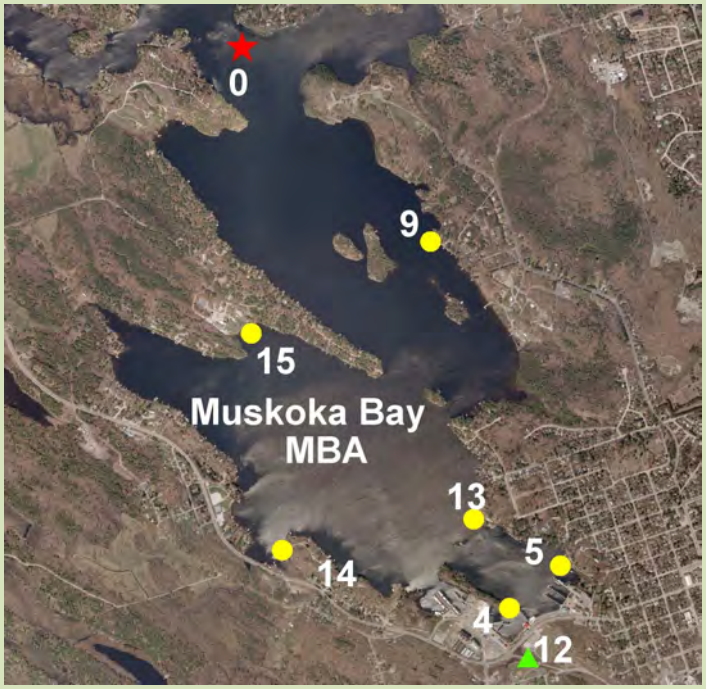
Continue sampling spring turnover phosphorus and calcium annually to monitor long-term trends.

(MUS-3) LAKE MUSKOKA



Notes:

MUSKOKA BAY (MBA)



Area Description

Muskoka Bay is the southernmost bay in Lake Muskoka. The bay has a long history of industrial uses and nutrient issues. While water quality in the bay has improved dramatically since the 1970s, it is still classified as moderately sensitive and over threshold by the DMM. Although the bay has a high intensity of development, 80% of the shoreline is presently in a natural state. The southern end of this bay includes a large commercial development and is the receiver of most of Gravenhurst's urban storm water. Several creeks outlet into the bay and wetlands account for 9.4% of the shoreline.

Volunteer Recognition

Muskoka Bay was monitored in 2011 by Karen Abells, George Genereux, **Brian Yeates**, and Diane Yeates.

2011 Data (* includes two samples with elevated *E. coli* levels and one follow-up sample)

MBA-0: TP-Spring turnover = 7.9 µg/L
TP-Yearly mean = 7.1 µg/L
Calcium = 6.08 mg/L
Secchi = 4.3 m

MBA-4: Total coliforms = 100 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

MBA-5: Total coliforms = 221 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

MBA-9: TP-Yearly mean = 6.4 µg/L

MBA-12: TP-Yearly mean = 25.3 µg/L
Total coliforms = 2152 cfu/100 mL*
Total *E. coli* = 658 cfu/100 mL*

MBA-13: TP-Yearly mean = 8.0 µg/L
Total coliforms = 59 cfu/100 mL
Total *E. coli* = 6 cfu/100 mL

MBA-14: Total coliforms = 63 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

MBA-15: Total coliforms = 49 cfu/100 mL
Total *E. coli* = 7 cfu/100 mL

Trends

Monitoring of Muskoka Bay started in 2002.

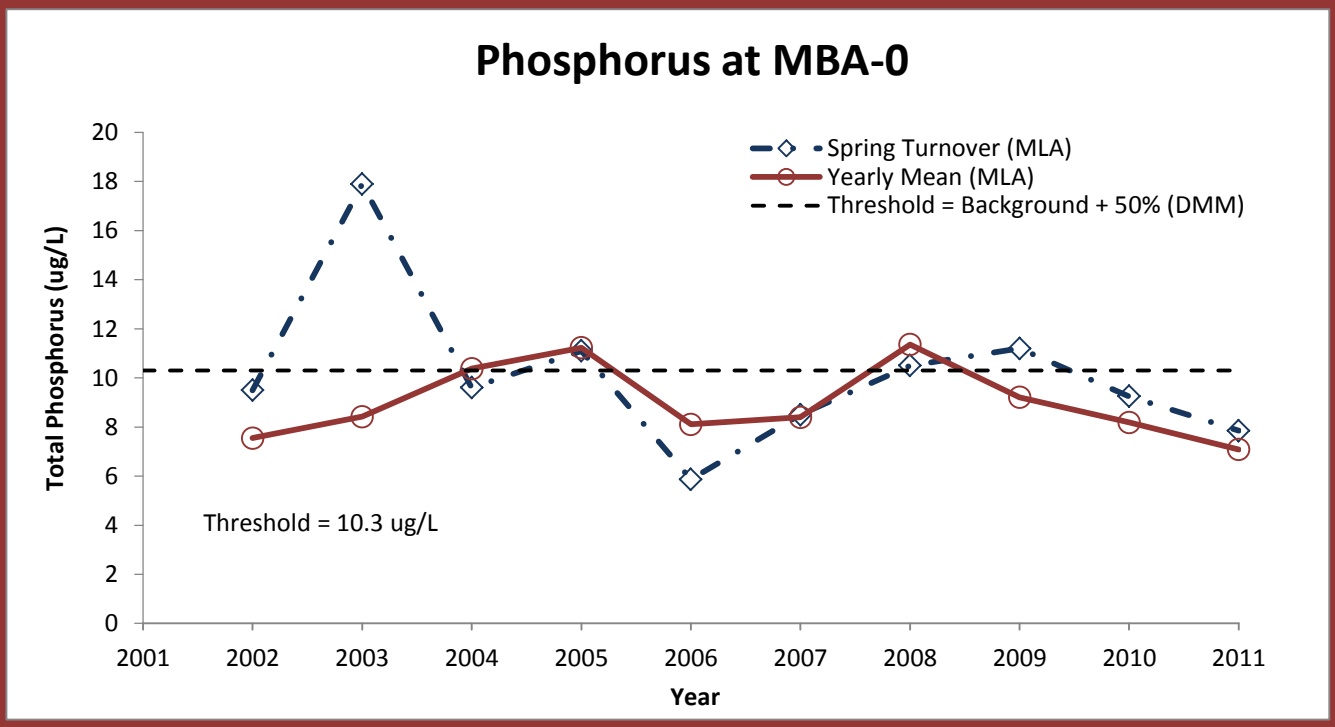
2011 spring turnover TP and yearly mean TP concentrations at MBA-0 are consistent with historical values and are both below the DMM threshold value

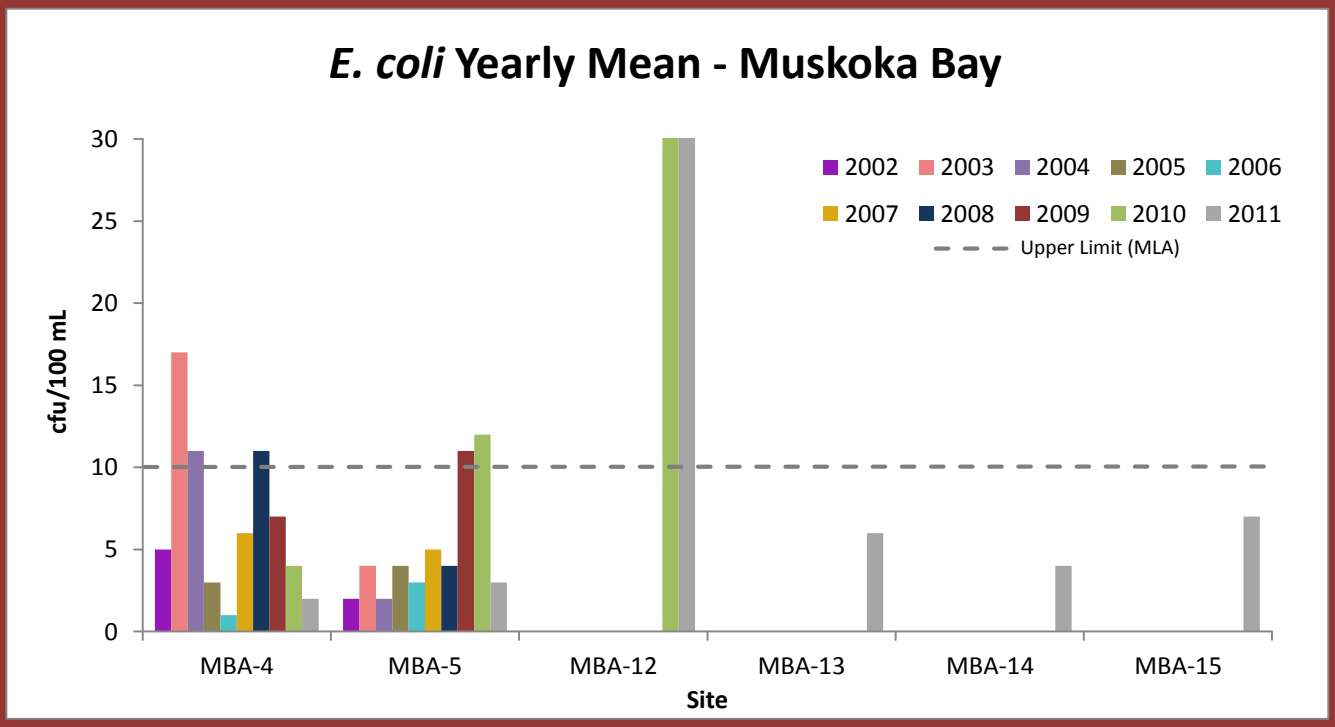
2011 *E. coli* values were less than the MLA upper limit with the exception of MBA-12. Note that MBA-13, -14, and –15 are newly established bacteria monitoring sites located in high use areas.

Calcium concentration in Muskoka Bay is one of the highest recorded values for 2011.

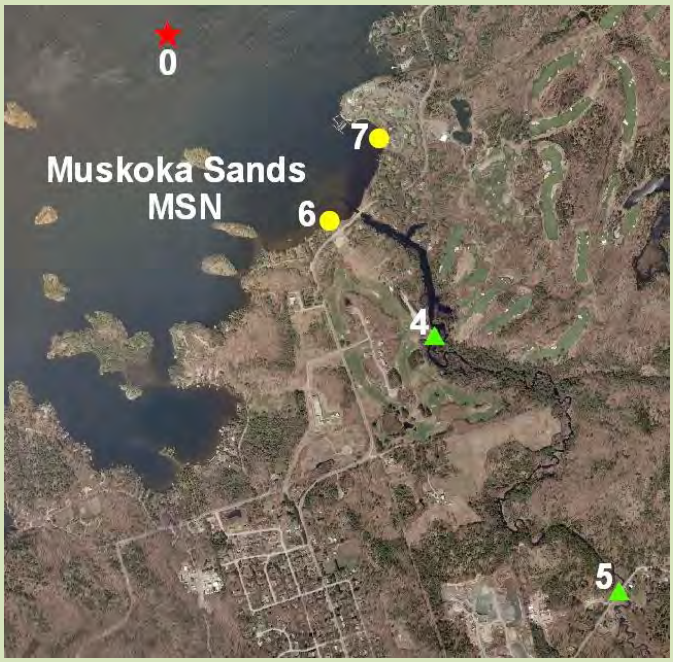
Recommendations

Continue existing sampling protocol in 2012 to monitor long-term trends.


Phosphorus at MBA-0
Spring Turnover (MLA)
Yearly Mean (MLA)
Threshold = Background + 50% (DMM)
Threshold = 10.3 ug/L
Total Phosphorus (ug/L)
Year
0
2
4
6
8
10
12
14
16
18
20
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011


E. coli Yearly Mean - Muskoka Bay
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
Upper Limit (MLA)
cfu/100 mL
Site
0
5
10
15
20
25
30
MBA-4
MBA-5
MBA-12
MBA-13
MBA-14
MBA-15

MUSKOKA SANDS (MSN)



Area Description

The Muskoka Sands sampling area is located in southeastern Lake Muskoka at the confluence with the Hoc Roc River. This area has a high intensity of development with a large resort with golf course, along with a high density of residential properties and roads adjacent to the lake. The Hoc Roc River flows through agricultural, industrial, residential and natural wetland areas before it drains into a shallow bay. Dominant northwest winds and a considerable fetch would subject this area to heavy onshore wave action.

Volunteer Recognition

Muskoka Sands was monitored in 2011 by **Al Ward** and **Carole Ward**.

2011 Data

MSN-0: TP-Spring turnover = 5.9 µg/L
TP-Yearly mean = 5.4 µg/L
Calicum = 3.33 mg/L
Secchi = 3.2 m

MSN-4: TP-Yearly mean = 28.6 µg/L
Total coliforms = 191 cfu/100 mL*
Total *E. coli* = 59 cfu/100 mL*

MSN-5: TP-Yearly mean = 25.7 µg/L
Total coliforms = 240 cfu/100 mL**
Total *E. coli* = 77 cfu/100 mL**

MSN-6: Total coliforms = 39 cfu/100 mL
Total *E. coli* = 5 cfu/100 mL

MSN-7: Total coliforms = 86 cfu/100 mL
Total *E. coli* = 9 cfu/100 mL

(* includes one sample with elevated *E. coli* levels; however, no follow-up samples were collected)
(** includes two samples with elevated *E. coli* levels; however, no follow-up samples were collected)

Trends and Recommendations

Monitoring of Muskoka Sands started in 2003, and the 2011 spring turnover TP concentration was consistent with historical values.

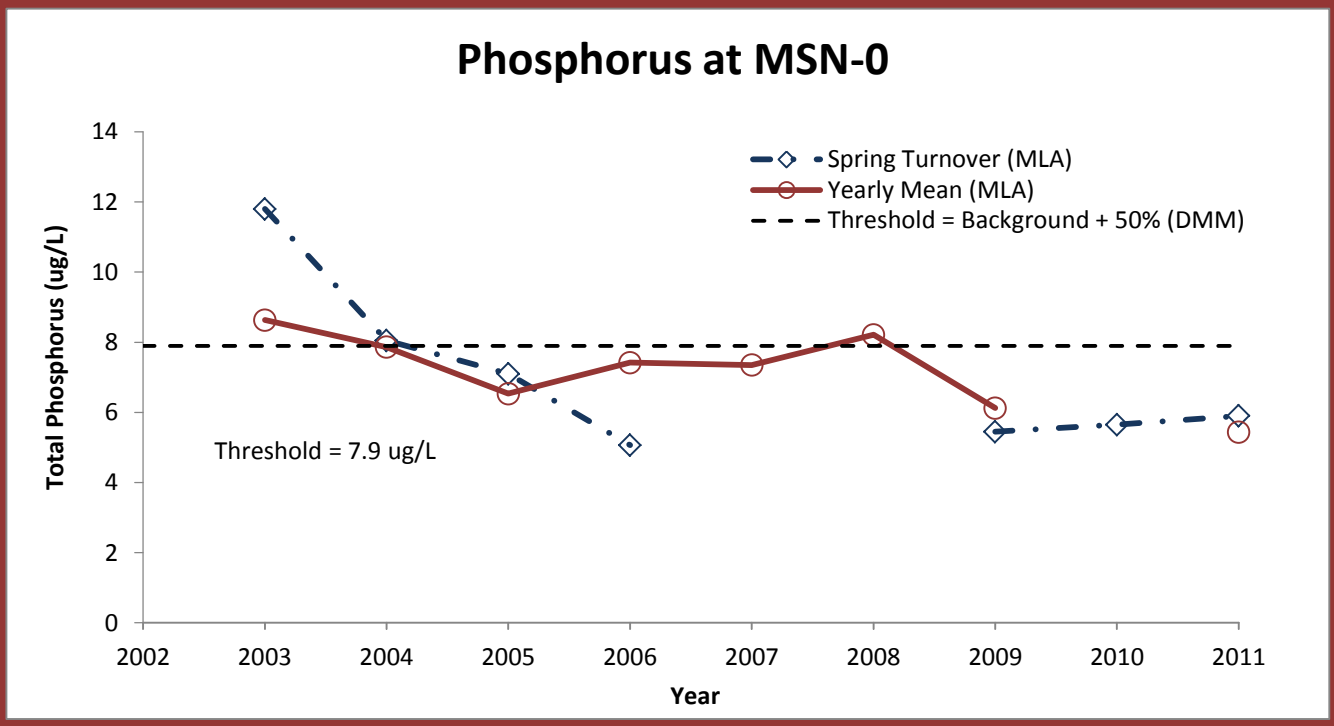
MSN-5 is a newly established watercourse site located within the Hoc Roc River to monitor upstream conditions. The yearly mean TP value at MSN-5 was similar to that at MSN-4, which is located downstream.

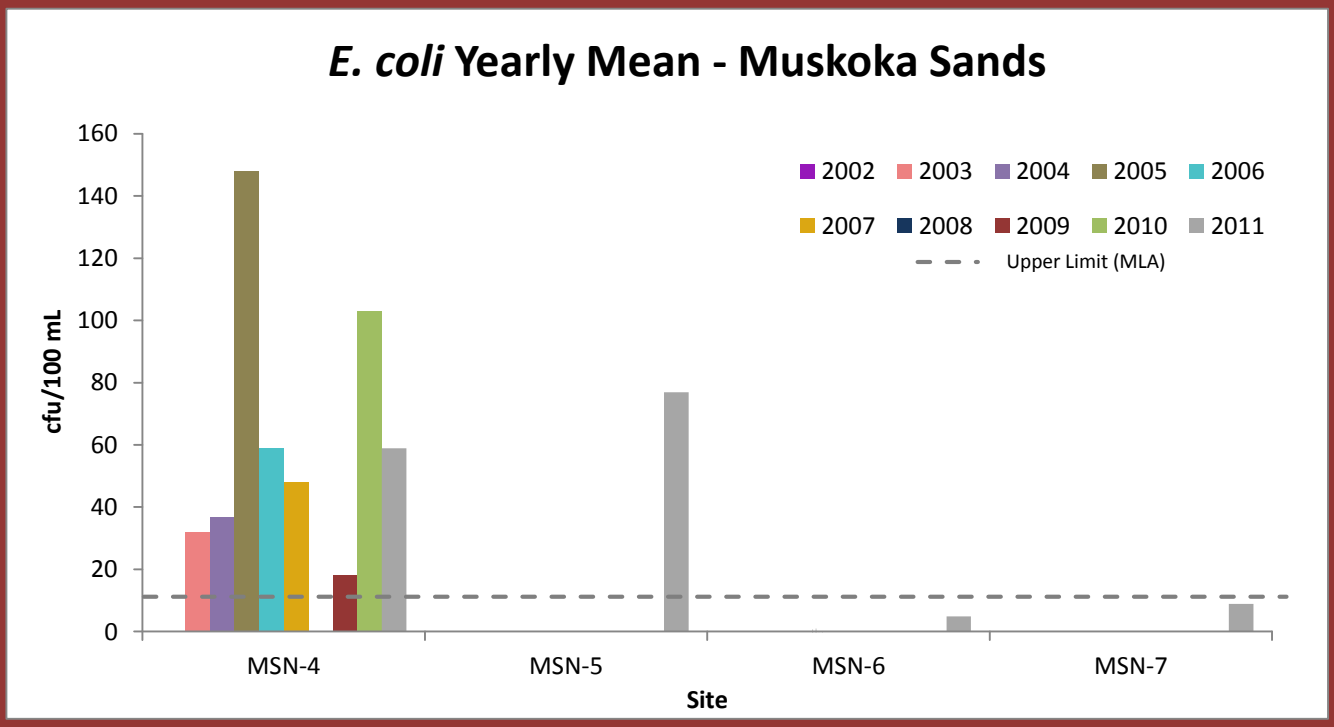
In 2011, new bacteria monitoring sites (MSN-6 and MSN-7) were established at high use areas. *E. coli* values at these sites were less than the MLA upper limit. Note that the *E. coli* figure includes both lake and watercourse sites.

Continue existing sampling protocol to monitor long-term trends.

Ensure that follow-up bacterial samples are collected from sites with elevated *E. coli* levels.

(MSN) MUSKOKA SANDS





NORTH BAY (NRT)

Area Description

The North Bay sampling area is a large bay in northwestern Lake Muskoka. A total of eight creeks outlet into the bay, several draining wetland areas and one that passes through a District landfill site north of the lake. This is a moderately developed part of the lake, having many residential properties and several roads that are in close proximity to the shoreline. Development is mostly restricted to the areas adjacent to the lake, leaving most of the upland forested areas in a natural state.

Volunteer Recognition

North Bay was monitored in 2011 by Benjamin Butler, **Eleanor Lewis**, and Jim Lewis.

2011 Data

NRT-0: TP-Spring turnover = 5.6 µg/L
TP-Yearly mean = 4.8 µg/L
Calcium = 3.34 mg/L
Secchi = 3.2 m

NRT-4: Total coliforms = 6 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

Trends

Monitoring of North Bay started in 2005.

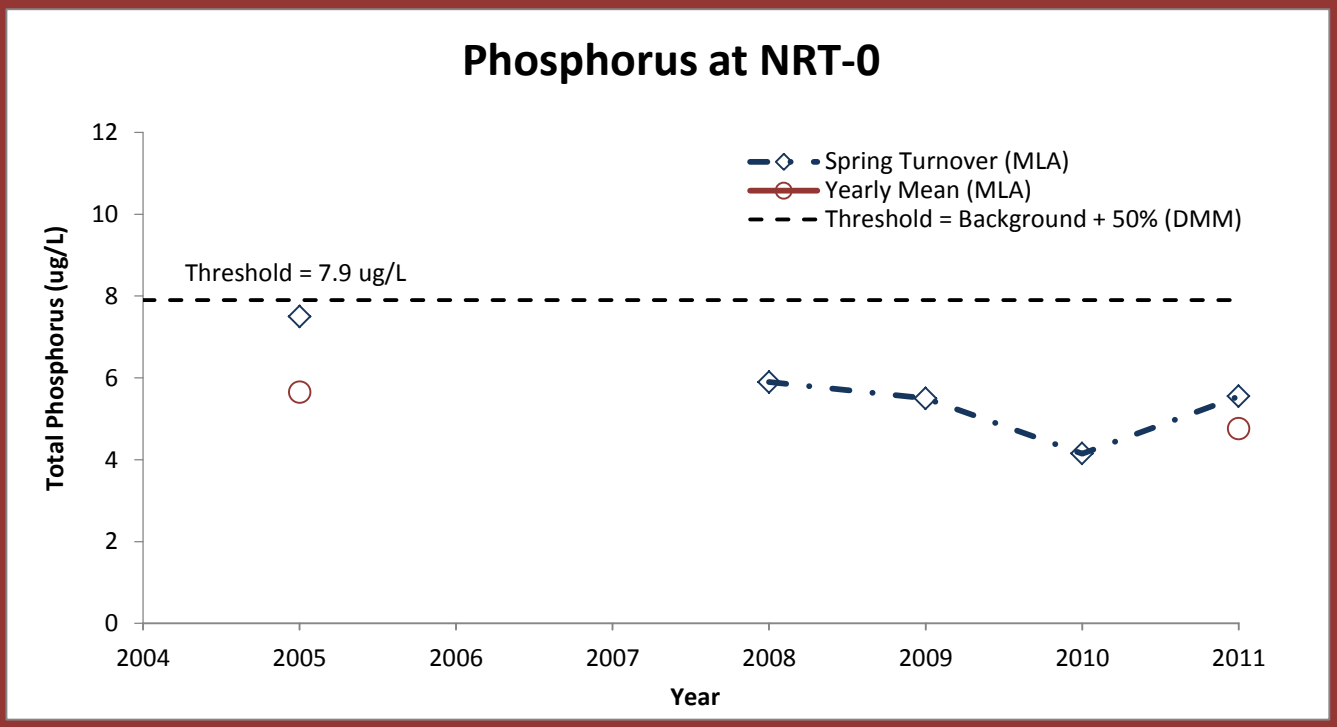
2011 spring turnover TP and yearly mean TP concentrations at NRT-0 are consistent with historical values and are less than the DMM threshold value.

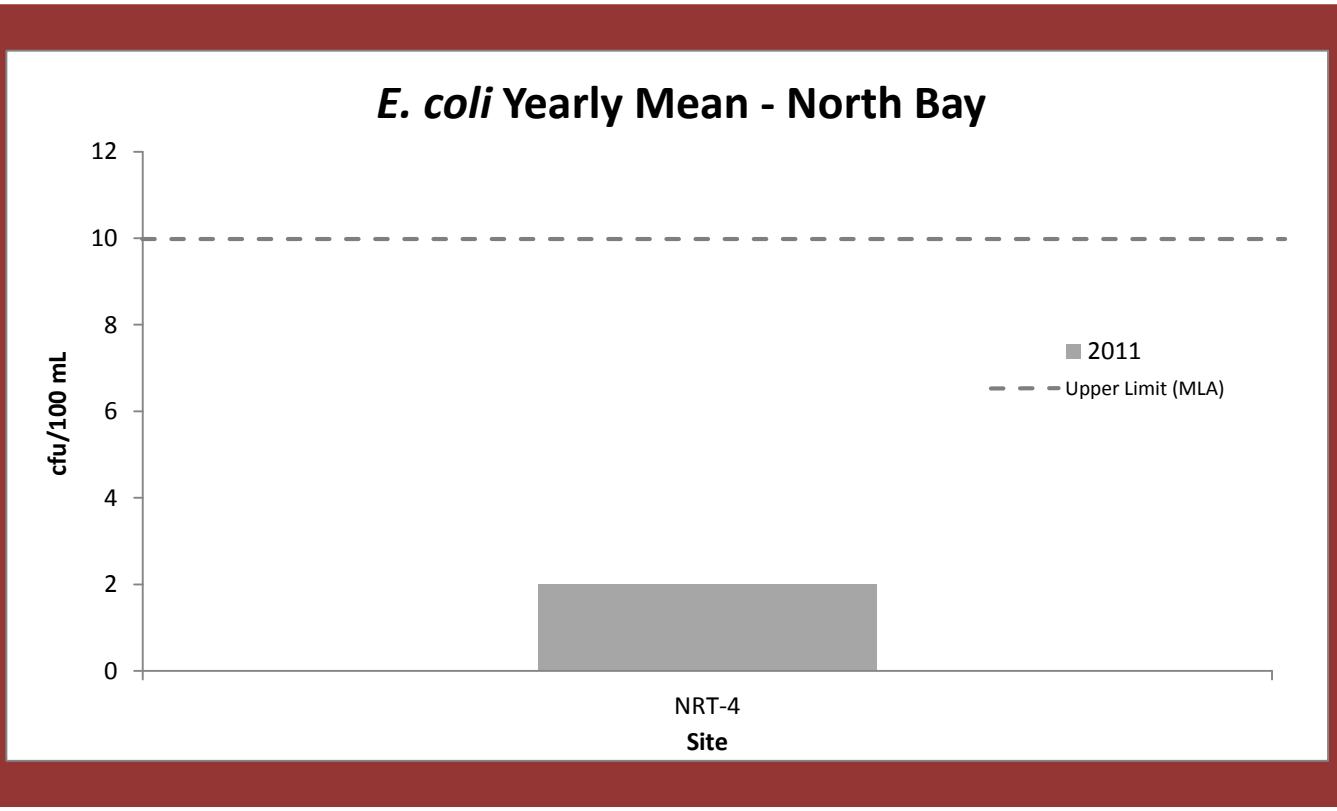
E.coli levels at the newly established site located in a high use areas (NRT-4) were below the MLA upper limit.

Recommendations

Continue existing sampling protocol in 2012 to monitor long-term trends.

(NRT) NORTH BAY





STEPHEN'S BAY (STE)

Area Description

Stephen's Bay is located in the southeastern portion of Lake Muskoka, south of the outlet of the Muskoka River. The bay contains a moderate level of shoreline development with few shoreline properties having extensive cleared areas. There are no creeks draining directly into this bay; however, two creeks outlet into Lake Muskoka, just beyond the mouth of Stephen's Bay.

Volunteer Recognition

Stephen's Bay was monitored in 2011 by Chris Blaymires and Rayma Blaymires.

2011 Data

STE-0: TP-Spring turnover = 5.6 µg/L
Calcium = 3.47 mg/l
Secchi = 3.2 m

Trends

Monitoring of Stephen's Bay started in 2008.

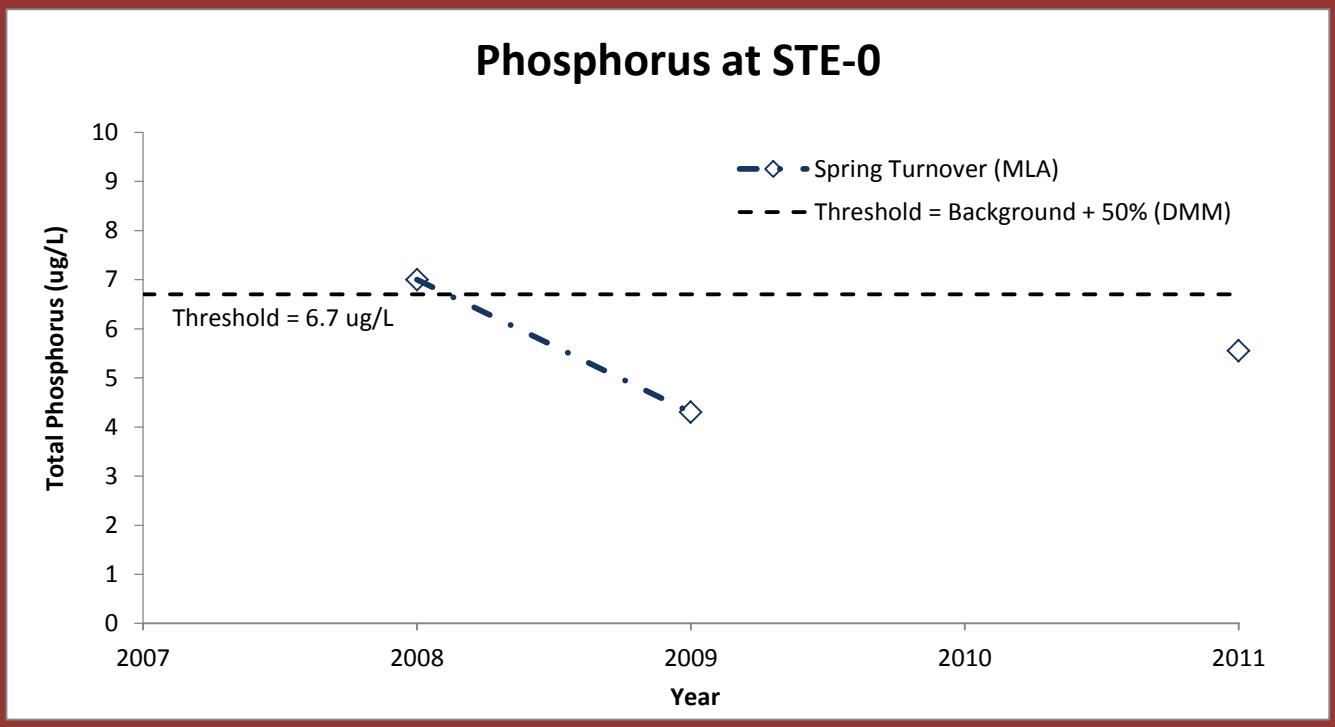
This area has been selected as a long-term monitoring site.

The spring turnover TP concentration in 2011 was consistent with historic values and less than the DMM threshold.

Recommendations

Continue sampling spring turnover phosphorus and calcium annually to monitor long-term trends.

(STE) STEPHEN'S BAY



Notes:

WALKER'S POINT (WAK)

Area Description

The Walker's Point sampling area is in southcentral Lake Muskoka, East of Hardy Lake Provincial Park and west of Browning Island. WAK-0 is located off the tip of Walkers Point, near the mouth of Walkers Bay. A single creek outlets in Walkers Bay. The sampling area includes the bay to the north that contains the outlet of a creek which drain a series of wetlands.

Volunteer Recognition

Walker's Point was monitored in 2011 by **Susan Murphy**, Alastair Sims, Stephen Sims, Carrie Tate, and Doug Tate.

2011 Data

WAK-0: TP-Spring turnover = 5.7 µg/L
TP-Yearly mean = 5.7 µg/L
Calcium = 3.34 mg/L
Secchi = 3.1 m

WAK-5 Total coliforms = 123 cfu/100 mL
Total *E. coli* = 5 cfu/100 mL

Trends

Monitoring at Walker's Point started in 2002.

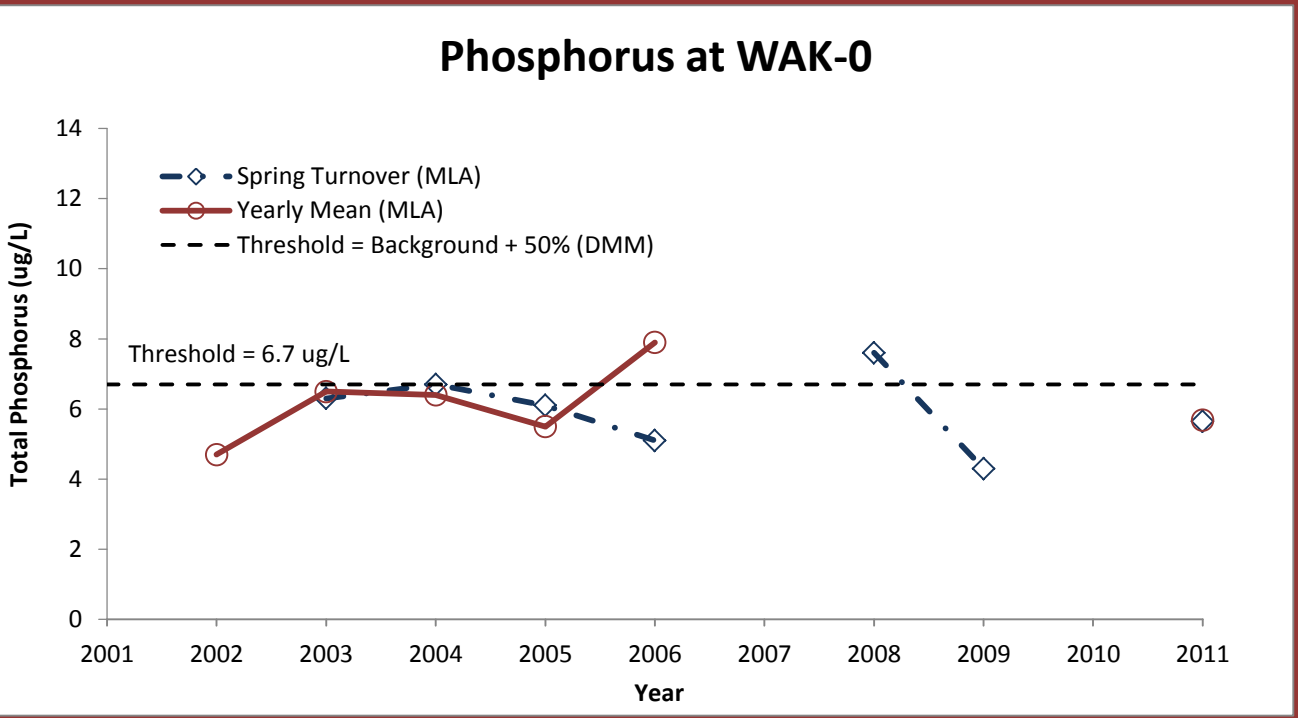
The 2011 spring turnover TP and yearly mean TP concentrations at WAK-0 are consistent with the historic values and below the DMM threshold.

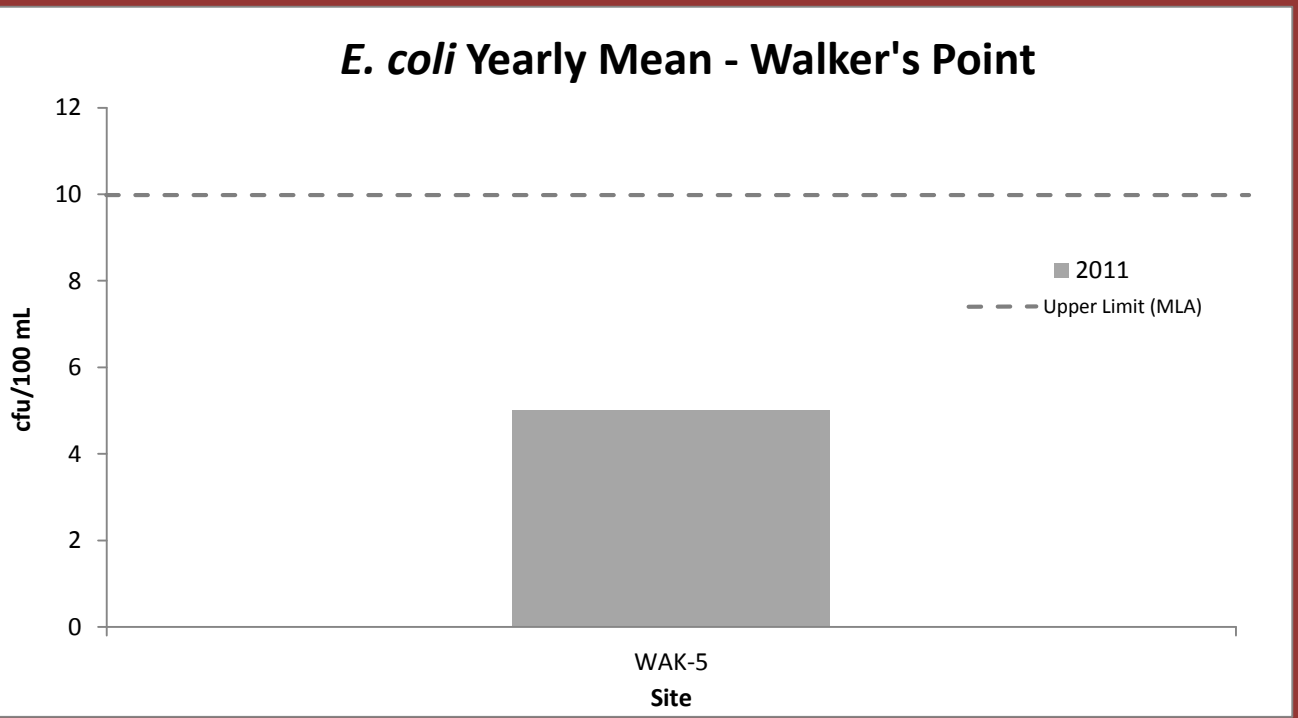
E. coli levels at WAK-5 were less than the MLA upper limit.

Recommendations

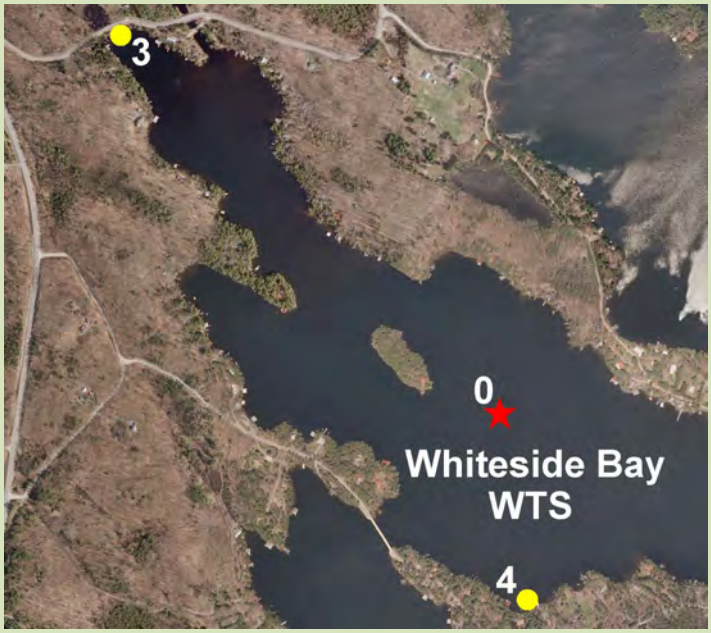
Continue existing sampling protocol in 2012 to monitor long-term trends.

(WAK) WALKER'S POINT





WHITESIDE BAY (WTS)



Area Description

Whiteside Bay is a partially isolated bay in the northwestern portion of Lake Muskoka. It is moderately developed with cottage/residential properties and has roadways that come in close proximity to the shoreline in several areas. Inflow into the lake comes from two creeks, one of which originates in an extensive wetland complex to the north.

Volunteer Recognition

Whiteside Bay was monitored in 2011 by Benjamin Butler, **Eleanor Lewis**, and Jim Lewis.

2011 Data

WTS-0: TP-Spring turnover = 5.4 µg/L
TP-Yearly mean = 4.9 µg/L
Calcium = 3.44 mg/L
Secchi = 3.3 m

WTS-3: Total coliforms = 34 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

WTS-4: Total coliforms = 29 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

Trends

Monitoring of Whiteside Bay started in 2007.

The 2011 spring turnover TP at WTS-0 is consistent with the historic values and was below the DMM threshold value.

The yearly mean TP at WTS-0 is consistent with the historic values.

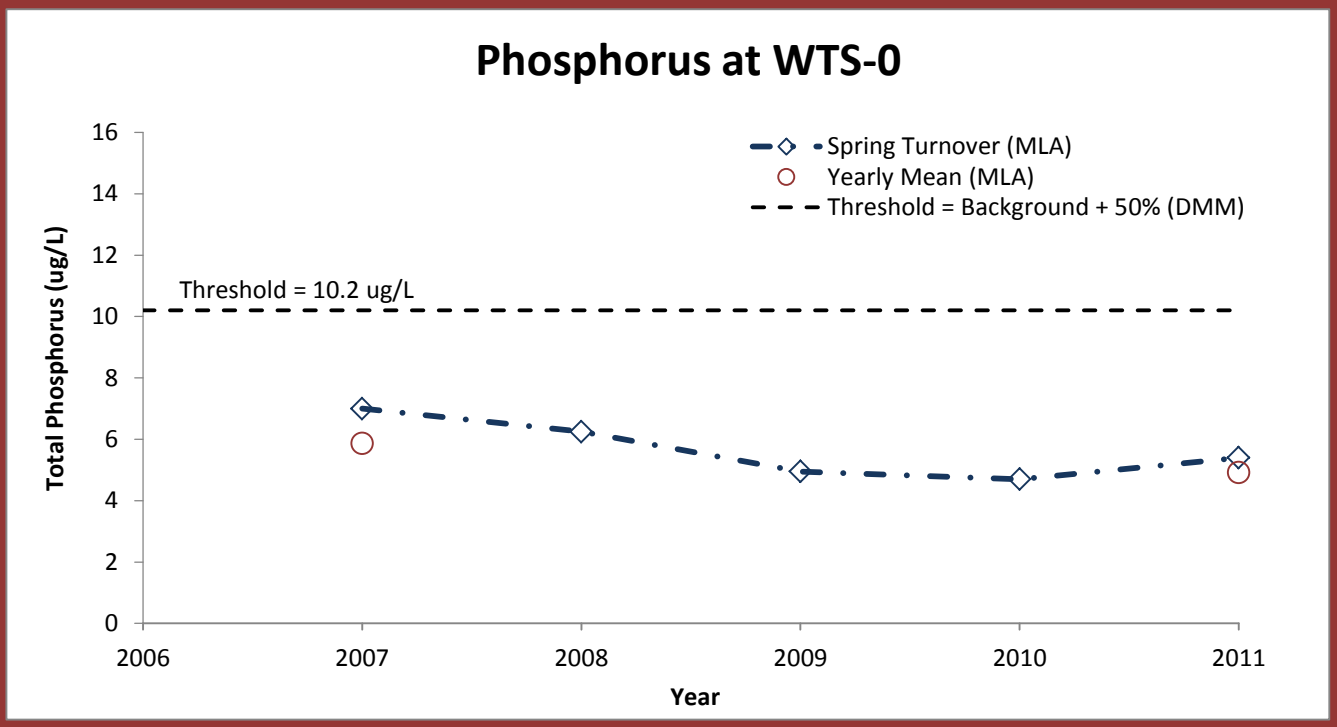
WTS-3 is a newly established site located in a high use area.

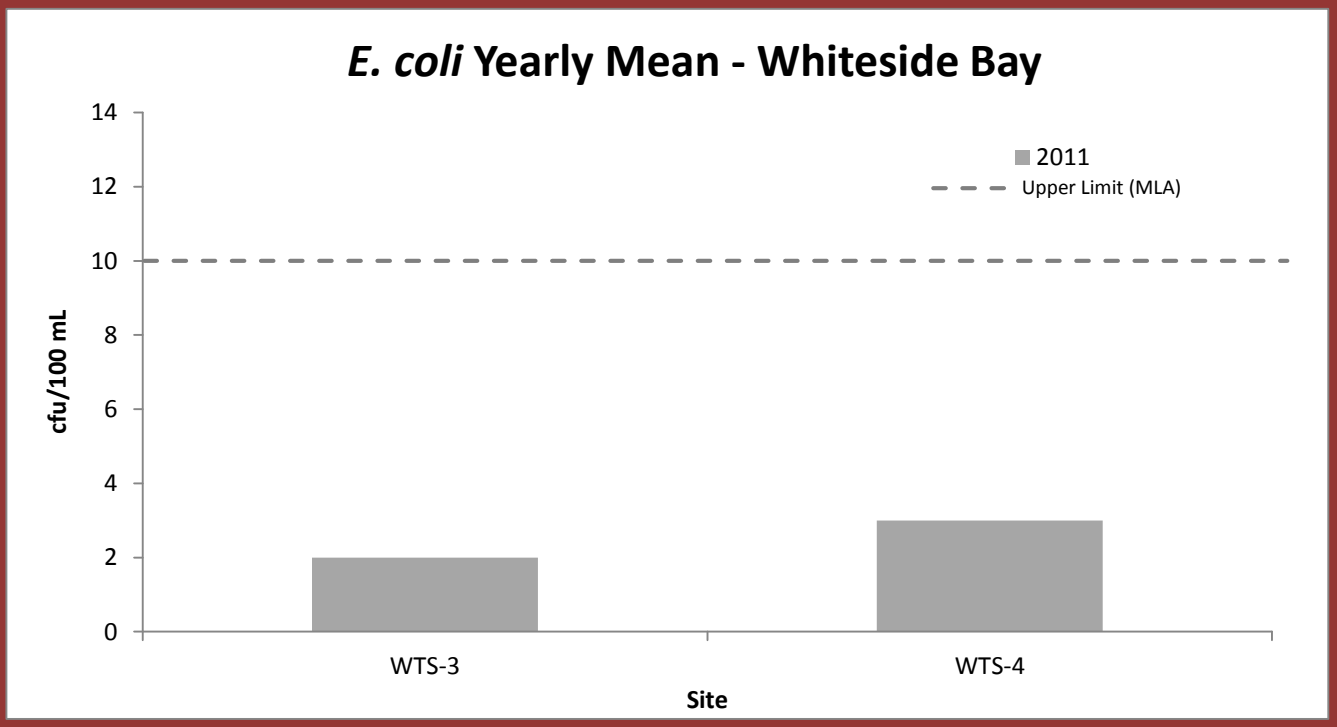
E. coli levels at WTS-3 and WTS-4 were less than the MLA upper limit.

Recommendations

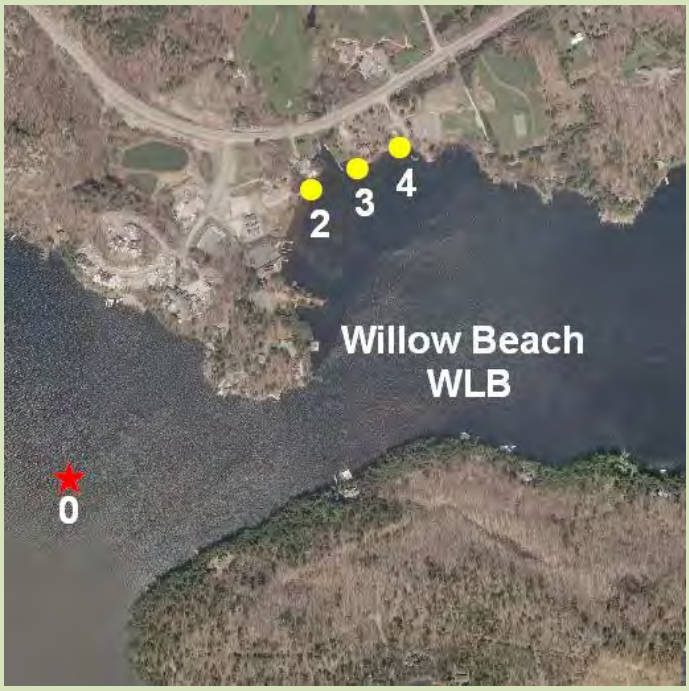
Continue existing sampling protocol in 2012 to monitor long-term trends.

(WTS) WHITESIDE BAY





WILLOW BEACH (WLB)



Area Description

The Willow Beach sampling area encompasses a highly developed section of shoreline. There is a newly re-developed resort complex, a wetland with a creek flowing through a nine-hole golf course and several larger properties with limited retained forest cover. Highway 118 is in close proximity to the shoreline along much of this reach.

Volunteer Recognition

Willow Beach was monitored in 2011 by Debbie Hastings, Peter Sisam, Sue Sisam, and **John Wood**.

2011 Data

WLB-0: TP-Spring turnover = 9.8 µg/L
TP-Yearly mean = 7.8 µg/L
Calcium = 3.21 mg/L
Secchi = 5.3 m

WLB-2: Total coliforms = 45 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

WLB-3: Total coliforms = 99 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

WLB-4: Total coliforms = 101 cfu/100 mL
Total *E. coli* = 12 cfu/100 mL

Trends

Monitoring of Willow Beach started in 2004.

The 2011 spring turnover TP was higher than in 2010.

The 2011 yearly mean TP at WLB-0 was consistent with historic data.

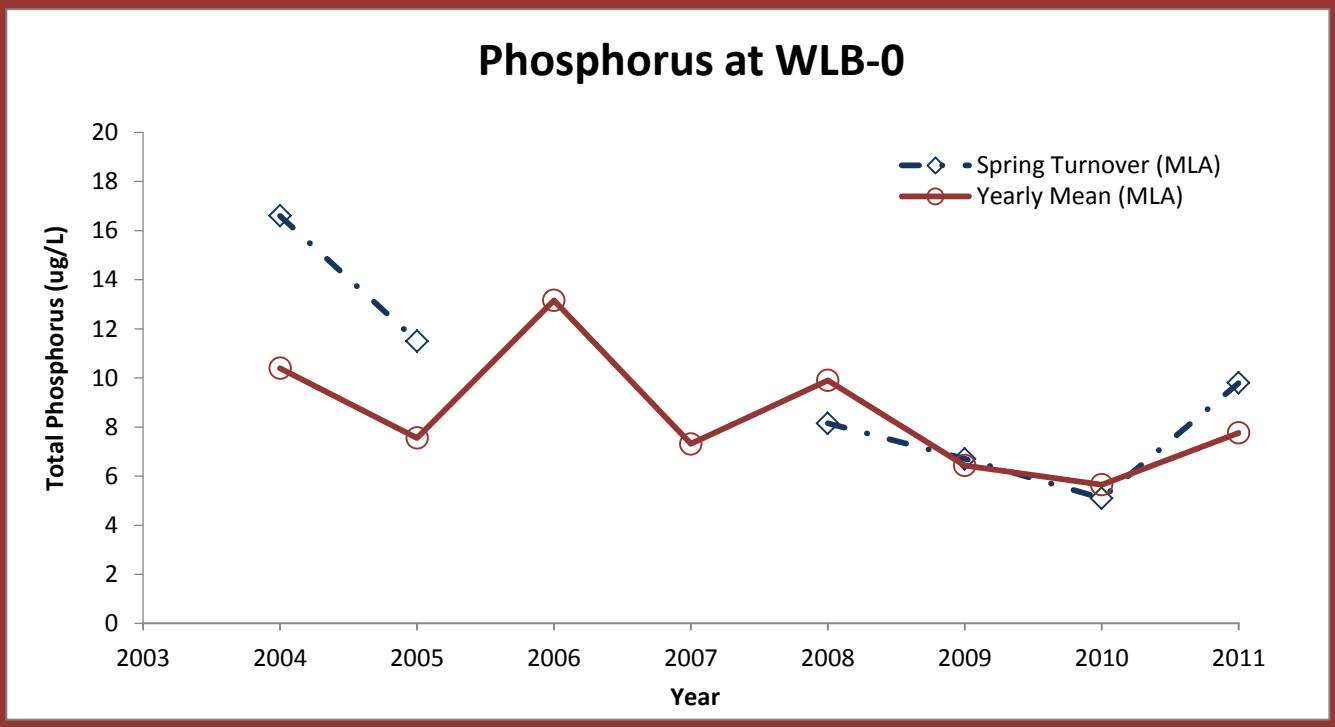
2011 *E.coli* levels were less than the MLA upper limit except at site WLB-4.

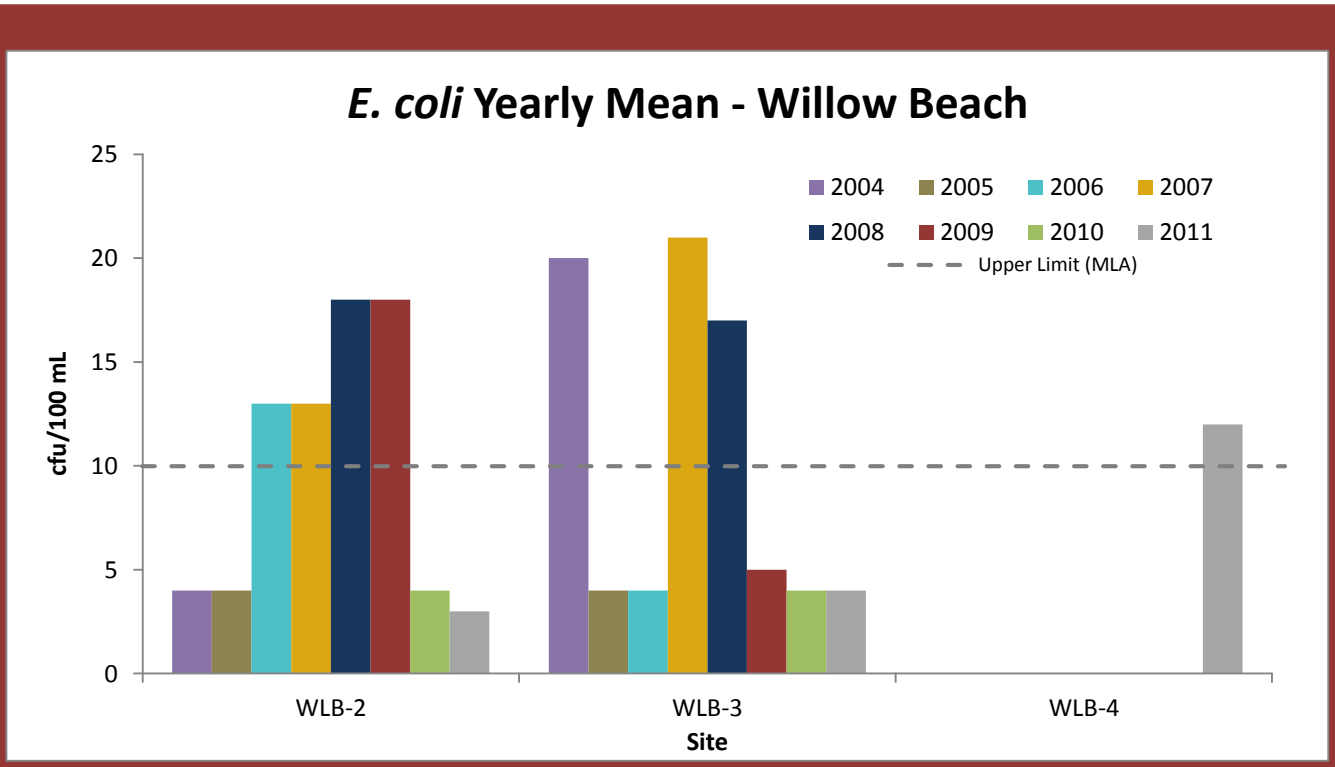
Recommendations

Continue existing sampling protocol in 2012 to monitor long-term trends.

Given that WLB-4 is located in a high use area (Boyer's Beach), bacterial levels should be closely monitored in 2012.

(WLB) WILLOW BEACH





ARTHURLIE BAY (ART)

Area Description

Arthurlie Bay is in the southern basin of Lake Rosseau. The bay is quite shallow in the southern end. Development intensity is considered moderate to high, with some shoreline properties having extensive cleared areas. This bay has several lacustrine wetlands, some of which appear to be partially filled. One creek drains into the bay, flowing through agricultural land prior to entering the lake.

Volunteer Recognition

Arthurlie Bay was monitored in 2011 by Devon Seybold, Katherine Seybold, Luke Seybold, and Peter Seybold.

2011 Data

ART-0: TP-Spring turnover = 9.4 µg/L*
Calcium = 3.88 mg/L
Secchi = 3.9 m

* Identified as an outlier based on the DMM protocol. (Average of 11.5 µg/L and 7.2 µg/L)

Trends/Comments

Monitoring of Arthurlie Bay started in 2002.

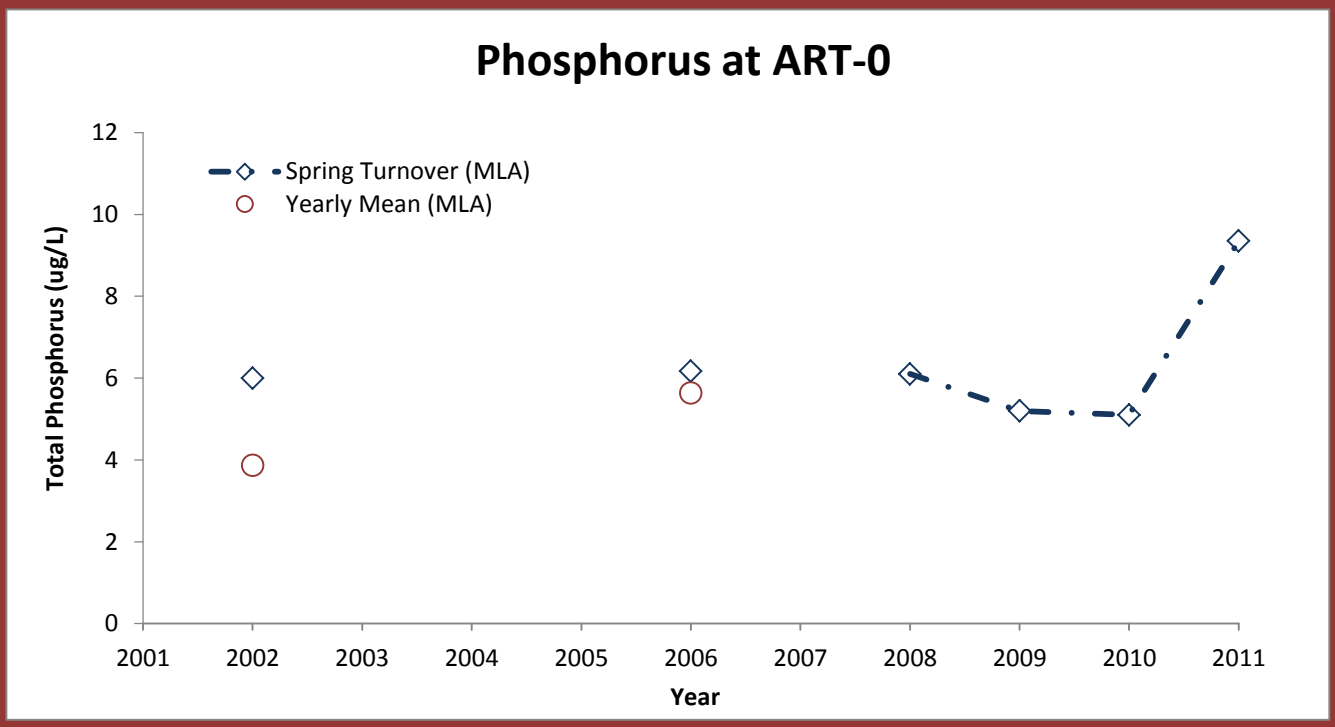
This area has been selected as a long-term monitoring site.

Spring turnover TP was the highest recorded concentration in the sampling history. Note however, that the 2011 concentration has been identified as a outlier based on the DMM protocol.

Recommendations

Continue sampling spring turnover phosphorus and calcium annually to monitor long-term trends.

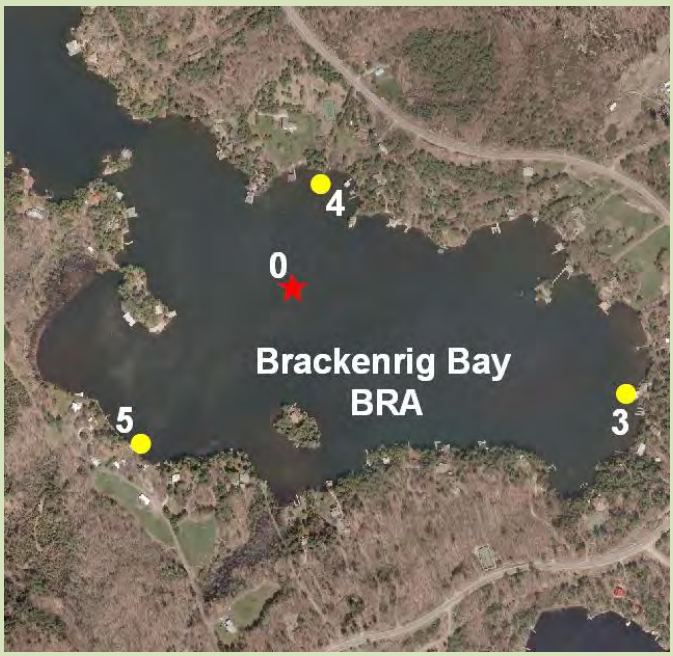
(ART) ARTHURLIE BAY



Notes:

The outlier analysis completed for the spring turnover data indicates that the 2011 data for this site is unusual compared to historic data. Spring sampling in 2012 will confirm whether this area needs further investigation. Spring turnover data should be reviewed immediately and should the concentration remain elevated, the summer monitoring program for this site may require adjustment.

BRACKENRIG BAY (BRA)



Area Description

Brackenrig Bay is located in southern Lake Rosseau, is approximately 0.44 km² in area and has a maximum depth of 3 m. This isolated bay is moderately developed with residential properties. Approximately 20% of the immediate shoreline has been altered with over 60% of backlot areas cleared of natural forest. Four creeks drain into the bay, one of which flows through an agricultural area adjacent to a garden center before entering the lake. Brackenrig road comes in close proximity to the lake along the northeast shoreline. Brackenrig Bay has been classified as moderately sensitive and over threshold by the DMM.

Volunteer Recognition

Brackenrig Bay was monitored in 2011 by **Gary & Marion Poole**, and Ross Wells.

2011 Data

BRA-0: TP-Spring turnover = 10.4 µg/L
TP-Yearly mean = 28.4 µg/L
Calcium = 3.77 mg/L
Secchi = 2.2 m

BRA-3: TP-Yearly mean = 8.5 µg/L

BRA-4: Total coliforms = 20 cfu/100 mL
Total *E. coli* = 7 cfu/100 mL

BRA-5: Total coliforms = 25 cfu/100 mL*
Total *E. coli* = 1 cfu/100 mL*

(* based on 1 sampling event. Two measurements discarded due to errors in bacterial analysis)

Recommendations

Continue existing sampling protocol in 2012 to monitor long-term terms. Consider measuring deep-water oxygen concentrations at this site.

Trends

Monitoring of Brackenrig Bay started in 2003.

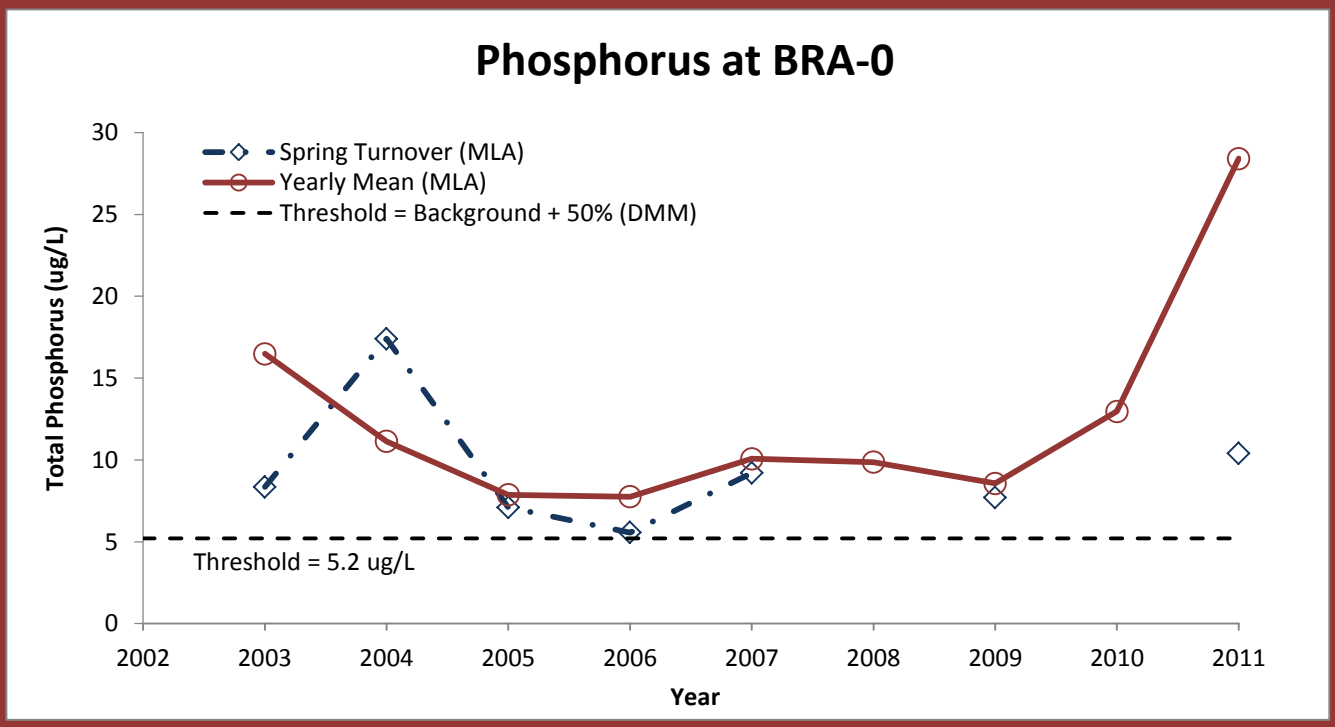
The 2011 spring turnover TP at BRA-0 was within the historical range, and as per historical sampling, greater than the DMM threshold value.

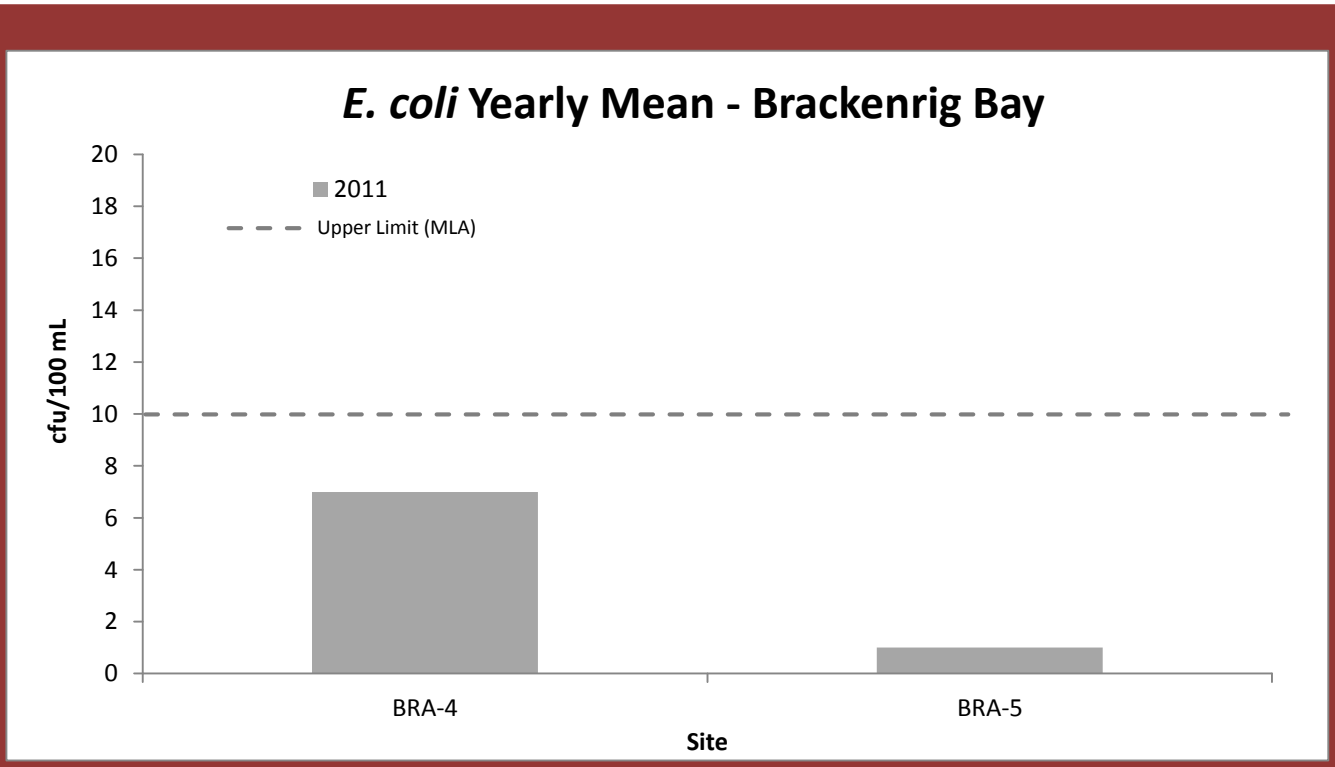
The 2011 yearly mean TP at BRA-0 was skewed by elevated duplicate measurements from the third sampling event (94.6 and 75.6 µg/L).

Yearly mean TP at BRA-3 was consistent with historic nearshore means.

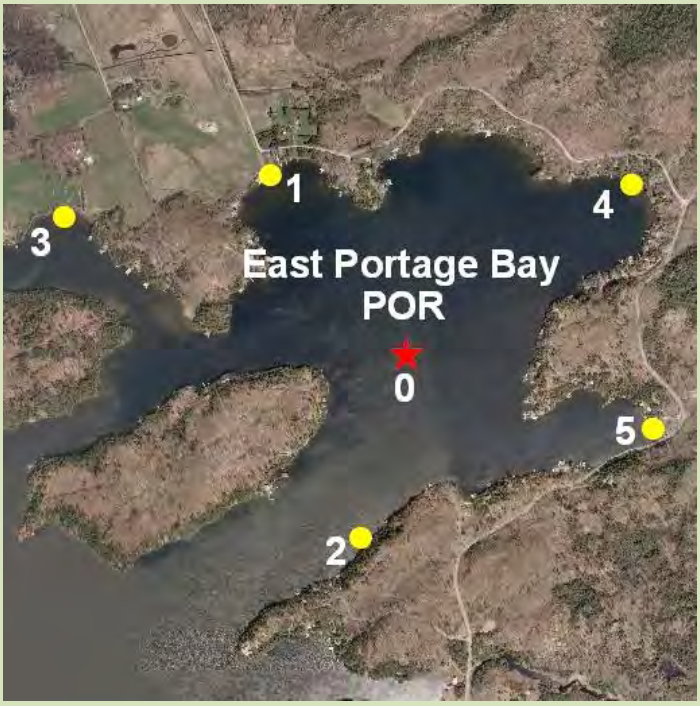
E.coli levels at newly established sites located in high use areas (BRA-4 and BRA-5) were below the MLA upper limit.

(BRA) BRACKENRIG BAY





EAST PORTAGE BAY (POR)



Area Description

East Portage Bay is located in eastern Lake Rosseau, has an area of approximately 1.33 km², and reaches a maximum depth of 12 m. This moderately developed bay has many roads, with several areas directly adjacent to the shoreline. There is also a large agricultural area adjacent to the northern shoreline of the bay. No creeks outlet into the bay and there are no wetlands draining from the upper watershed. East Portage Bay has been classified as highly sensitive and over threshold by the DMM.

Volunteer Recognition

East Portage Bay was monitored in 2011 by Bill Harvey, Marje Henke, Catherine Leboeuf, Joan McKinnon, and **Lawton Osler**.

2011 Data

POR-0: TP-Spring turnover = 6.4 µg/L
TP-Yearly mean = 4.6 µg/L
Calcium = 3.72 mg/L
Secchi = 4.6 m

POR-1: TP-Yearly mean = 5.1 µg/L

POR-2: TP-Yearly mean = 4.1 µg/L

POR-3: TP-Yearly mean = 5.9 µg/L

POR-4: TP-Yearly mean = 5.2 µg/L

POR-5: TP-Yearly mean = 5.3 µg/L

Trends

Monitoring of East Portage Bay started in 2005.

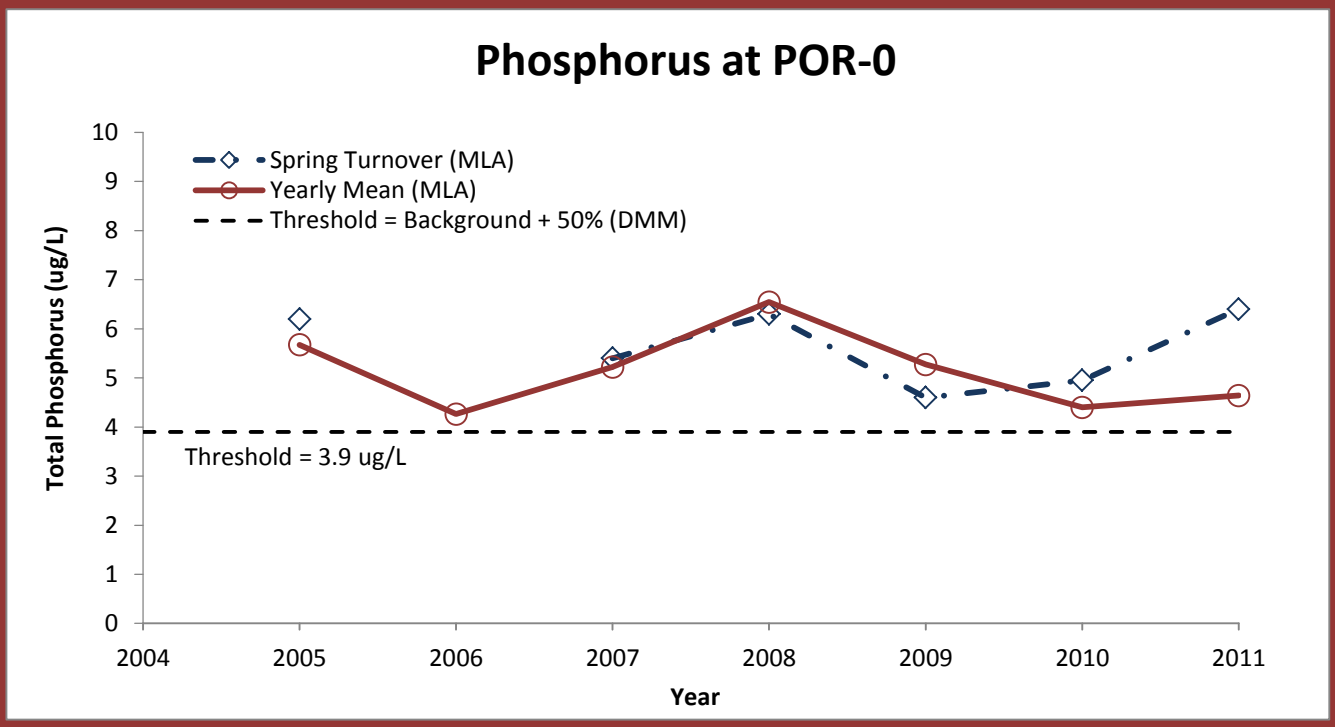
The 2011 spring turnover TP at POR-0 increased compared to 2010 and was greater than the DMM threshold value.

The yearly mean TP at POR-0 was more consistent with the historical values.

Recommendations

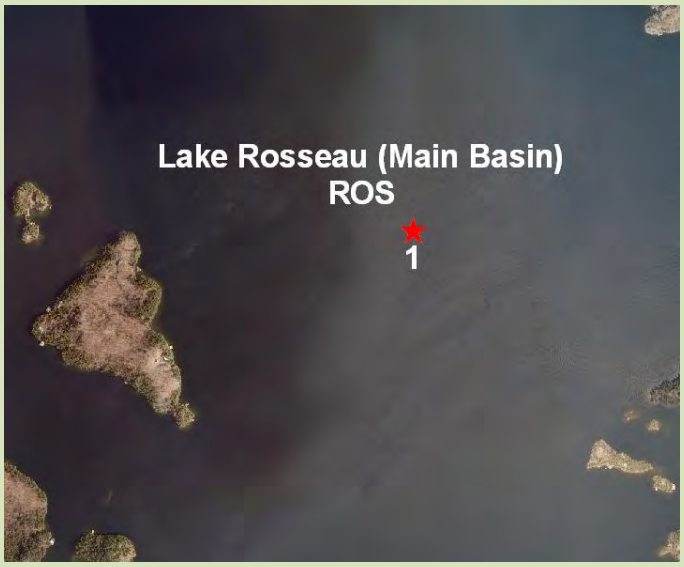
Continue existing sampling protocol in 2012 to monitor long-term trends.

(POR) EAST PORTAGE BAY



Notes:

LAKE ROSSEAU (ROS-1)



Area Description

The main basin of Lake Rosseau is approximately 55.5 km² in area with a maximum depth of 60 m. The lake is classified as a coldwater lake, and supports a naturally reproducing population of lake trout. Wetlands account for 5% of the upper watershed. The Lake Rosseau watershed, excluding the lake itself is 204.5 km². The DMM has classified the lake as moderately sensitive.

Volunteer Recognition

Lake Rosseau was monitored in 2011 by Devon Seybold, Katherine Seybold, Luke Seybold, and Peter Seybold.

2011 Data

ROS-1: TP-Spring turnover = 6.2 µg/L
Calcium = 3.87 mg/L
Secchi = 3.9 m

Trends

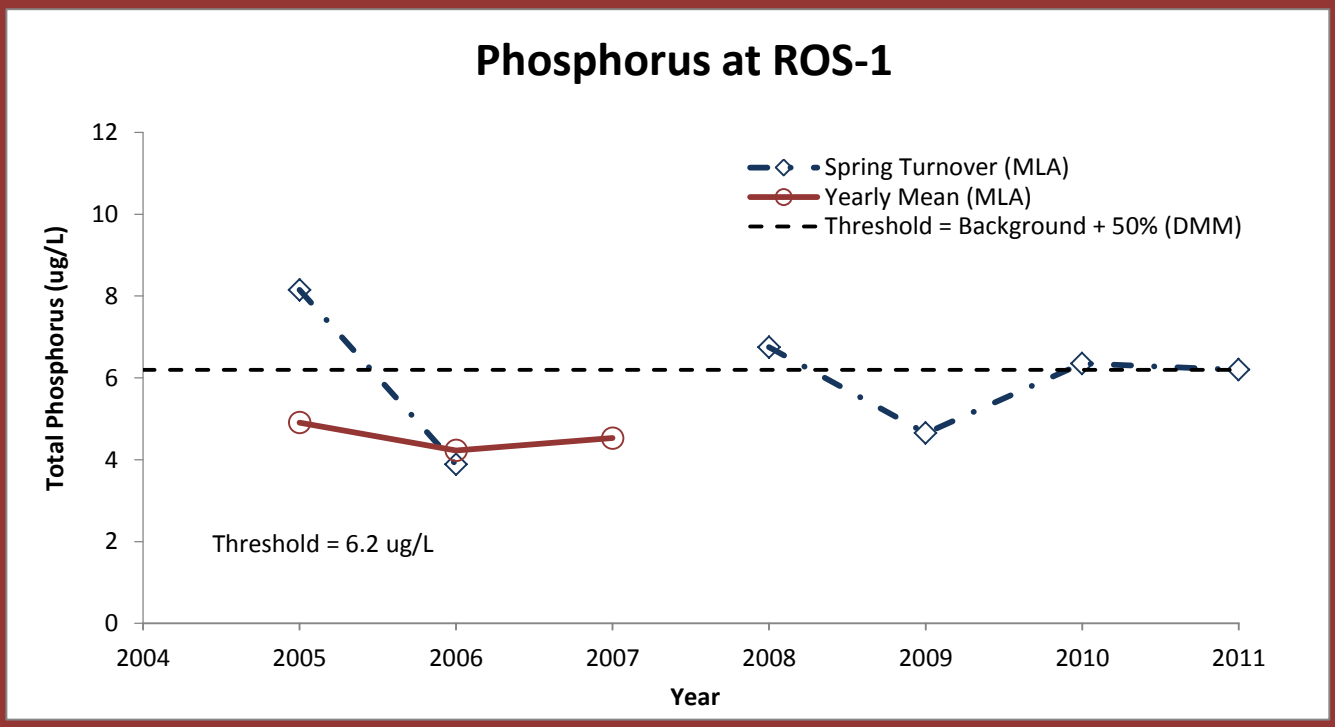
Monitoring of Lake Rosseau (Main Basin) started in 2005.

Spring turnover TP was consistent with historical values and equal to the DMM threshold value.

Recommendations

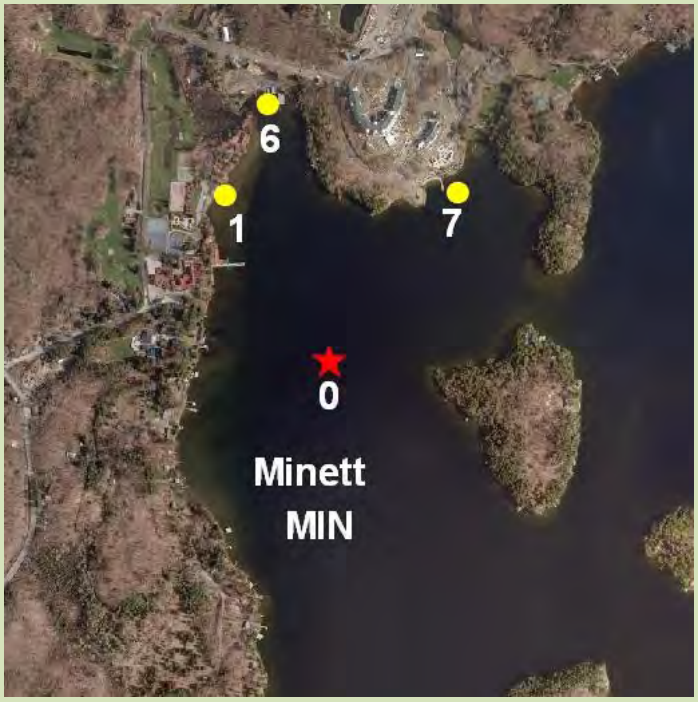
Continue existing sampling protocol in 2012 to monitor long-term trends.

(ROS-1) LAKE ROSSEAU



Notes:

MINETT (MIN)



Area Description

The village of Minett is located in western Lake Rosseau, and has four sampling sites. Sampling sites were selected with the intention of monitoring the potential effects of high intensity development in this bay. The area contains two large resorts with golf courses, several roads, a marina, and many private residential properties. There is one wetland adjacent to the lake and several other small ones in the area of the bay.

Volunteer Recognition

Minett was monitored in 2011 by Lauren Chisholm, Abby McKenzie, **Greg Thomson**, **Laurie Thomson**, Noah Thomson, and Taylor Thomson.

2011 Data

MIN-0: TP-Spring turnover = 5.4 µg/L
TP-Yearly mean = 5.2 µg/L
Calcium = 3.78 mg/L
Secchi = 4.2 m

MIN-1: TP-Yearly mean = 5.6 µg/L
Total coliforms = 86 cfu/100 mL
Total *E. coli* = 21 cfu/100 mL

MIN-6: TP-Yearly mean = 9.1 µg/L
Total coliforms = 114 cfu/100 mL
Total *E. coli* = 22 cfu/100 mL

MIN-7: TP-Yearly mean = 5.2 µg/L
Total coliforms = 73 cfu/100 mL*
Total *E. coli* = 17 cfu/100 mL*

(* includes one sample with elevated *E. coli* levels and one follow-up sample)

Trends

Monitoring of Minett started in 2003.

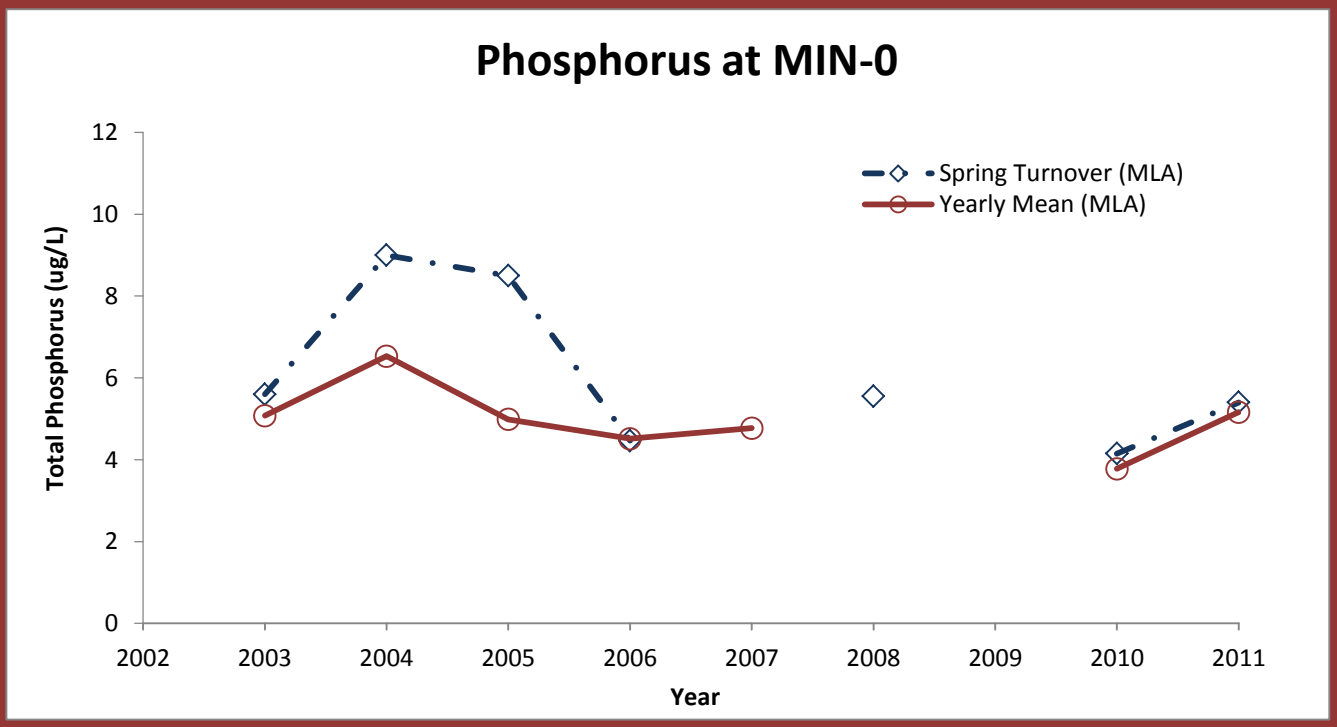
The 2011 spring turnover TP and yearly mean TP at MIN-0 were consistent with historic data.

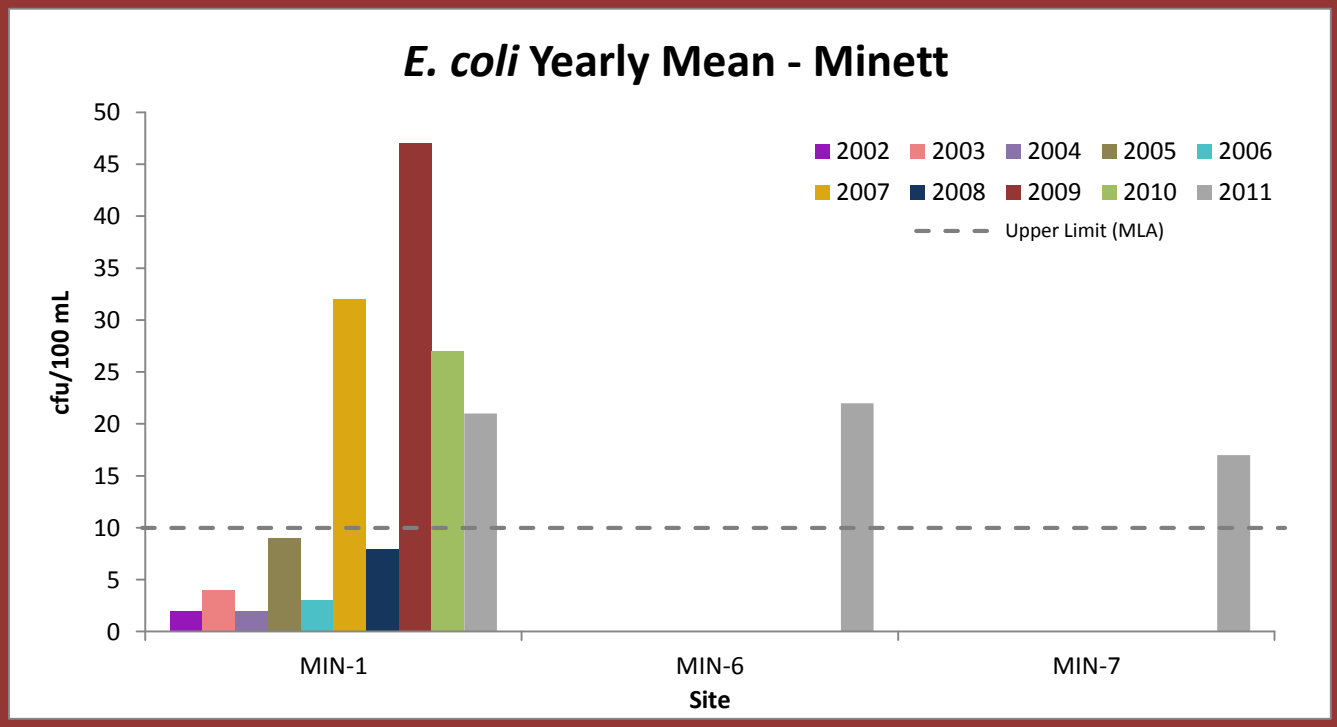
E.coli levels at newly established sites located in high use areas (MIN-6 and MIN-7) were higher than the MLA upper limit.

Recommendations

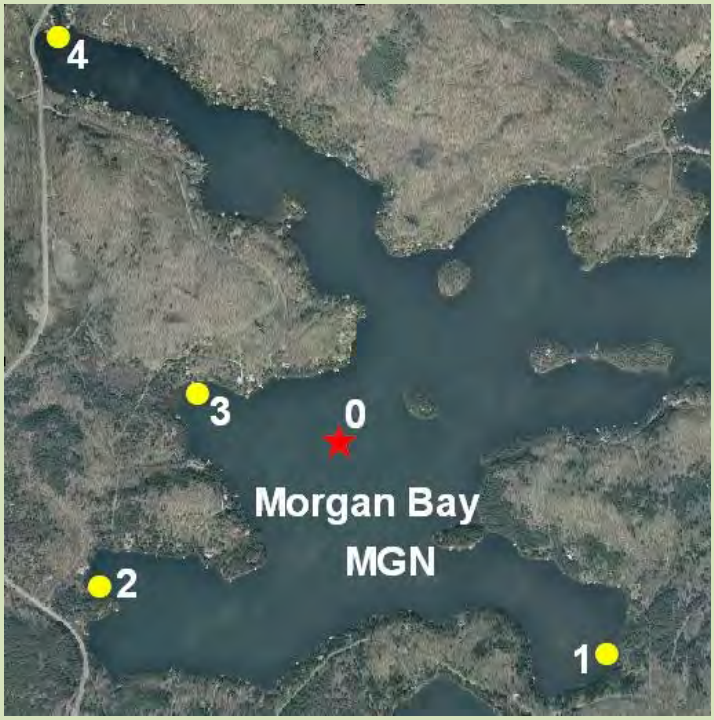
Continue existing sampling protocol in 2012 to monitor long-term trends.

(MIN) MINETT


Phosphorus at MIN-0
Total Phosphorus (ug/L)
0
2
4
6
8
10
12
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
Year
Spring Turnover (MLA)
Yearly Mean (MLA)


E. coli Yearly Mean - Minett
cfu/100 mL
0
5
10
15
20
25
30
35
40
45
50
MIN-1
MIN-6
MIN-7
Site
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
Upper Limit (MLA)

MORGAN BAY (MGN)



Area Description

Morgan Bay is in the northernmost part of Lake Rosseau, and a series of small bays make up this large sampling area. Several creeks outlet into this bay close to the nearshore sampling sites and there is a wetland adjacent to the lake at MGN-3. Most of the shoreline area is developed with residential properties, but many retain natural riparian vegetation. Nearly the entire area has road access and several of these roadways come very close to the water; this is particularly evident at MGN-4.

Volunteer Recognition

Morgan Bay was monitored in 2011 by Peter Martin, **David Peacock**, and Mary Anne Peacock.

2011 Data (*based on 2 sampling events)

MGN-0: TP-Spring turnover = 4.7 µg/L
TP-Yearly mean = 4.2 µg/L
Calcium = 3.34 mg/L
Secchi = 4.4 m
Total coliforms = 3 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

MGN-1: TP-Yearly mean = 4.5 µg/L
Total coliforms = 16 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

MGN-2: TP-Yearly mean = 4.7 µg/L*
Total coliforms = 65 cfu/100 mL
Total *E. coli* = 10 cfu/100 mL

MGN-3: TP-Yearly mean = 4.4 µg/L
Total coliforms = 8 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

MGN-4: TP-Yearly mean = 5.0 µg/L*
Total coliforms = 33 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

Trends

Monitoring of Morgan Bay started in 2008.

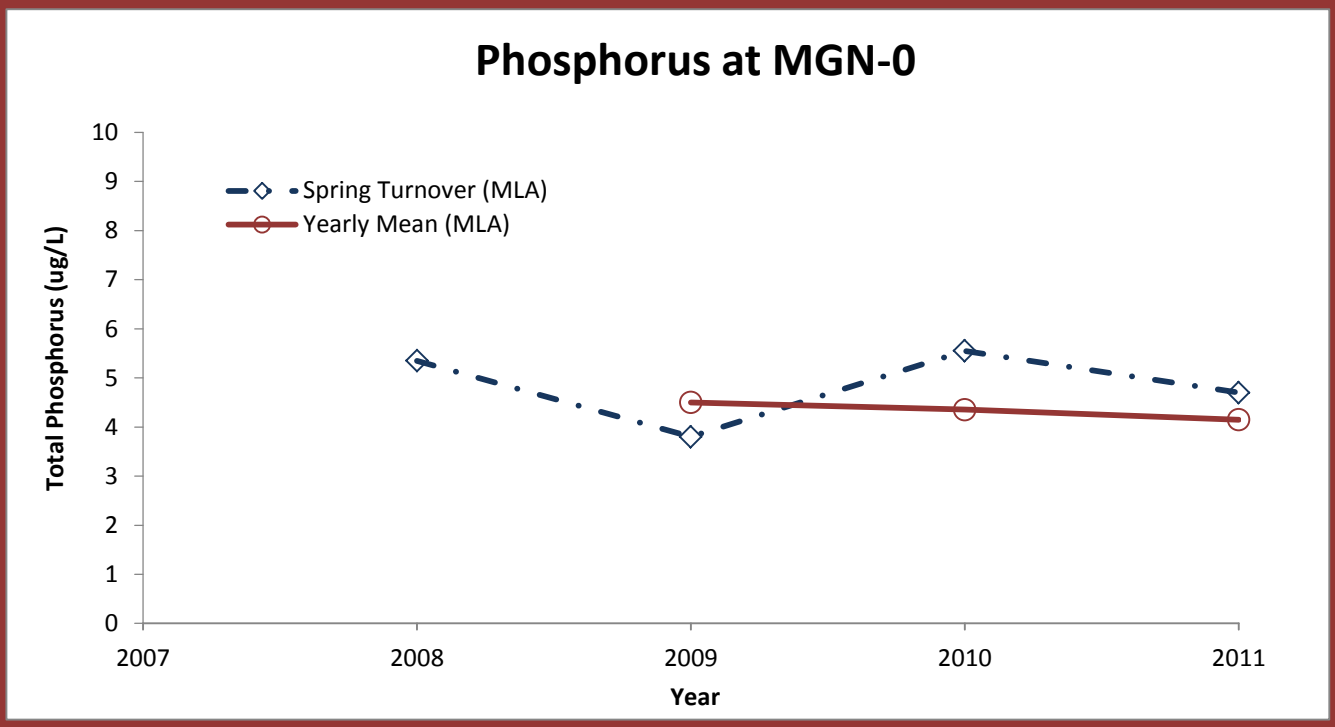
The 2011 spring turnover TP and yearly mean TP concentrations are consistent with historical values.

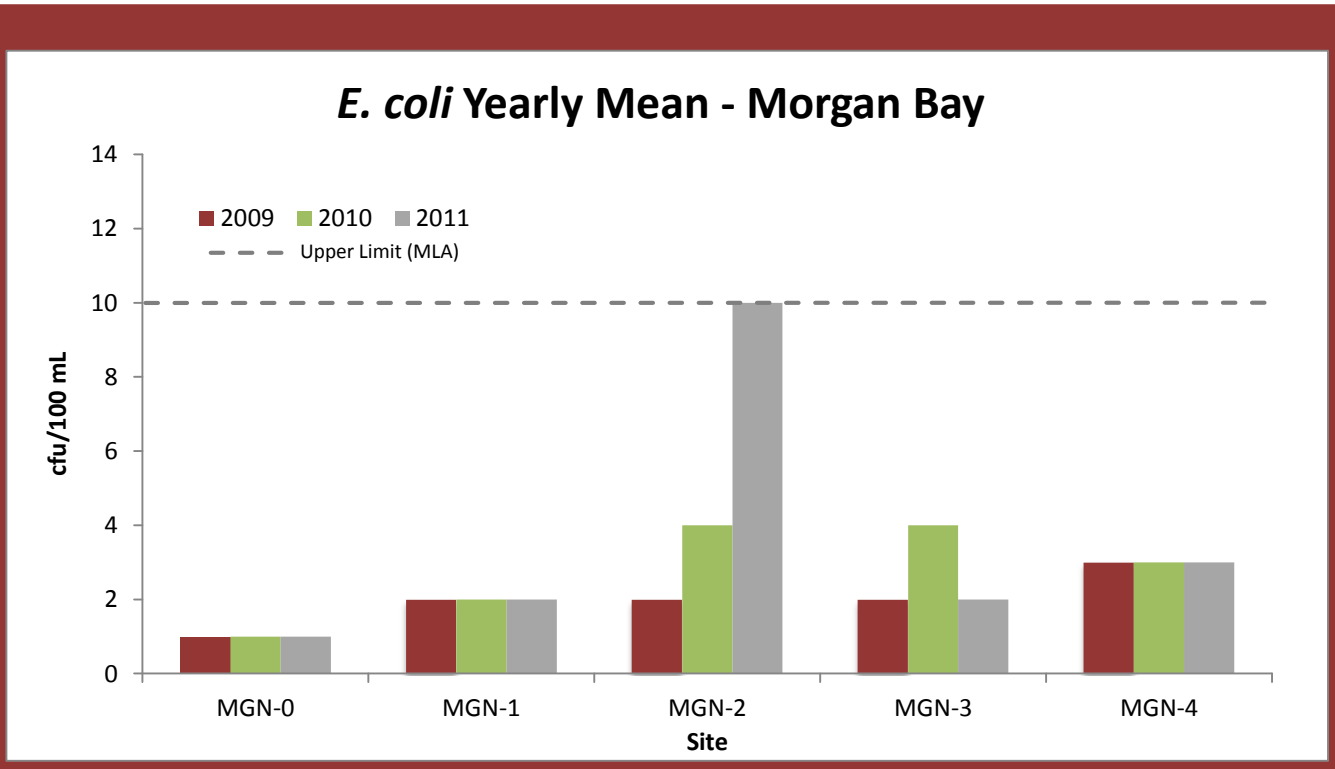
2011 *E. coli* values were similar to 2010, with the exception of MGN-2 which was at the MLA upper limit.

Recommendations

Continue existing sampling protocol in 2012 to monitor long-term trends.

(MGN) MORGAN BAY





MUSKOKA LAKES G&CC (MLG)

Area Description

The Muskoka Lakes Golf & Country Club sampling site is located along the southern shore of Lake Rosseau's main basin, near the Town of Port Carling. This bay collects run-off from a golf course area with associated clubhouse and marina. The bay also contains a large wetland that drains into the lake. Dominant northwest winds and a large fetch results in considerable wave action along the southern shoreline of the bay.

Volunteer Recognition

Muskoka Lakes Golf & Country Club was monitored in 2011 by Devon Seybold, Katherine Seybold, Luke Seybold, and Peter Seybold.

2011 Data

MLG-0: TP-Spring turnover = 5.7 µg/L
Calcium = 3.89 mg/L
Secchi = 4.1 m

Trends

Monitoring of Muskoka Lakes Golf and Country Club started in 2006.

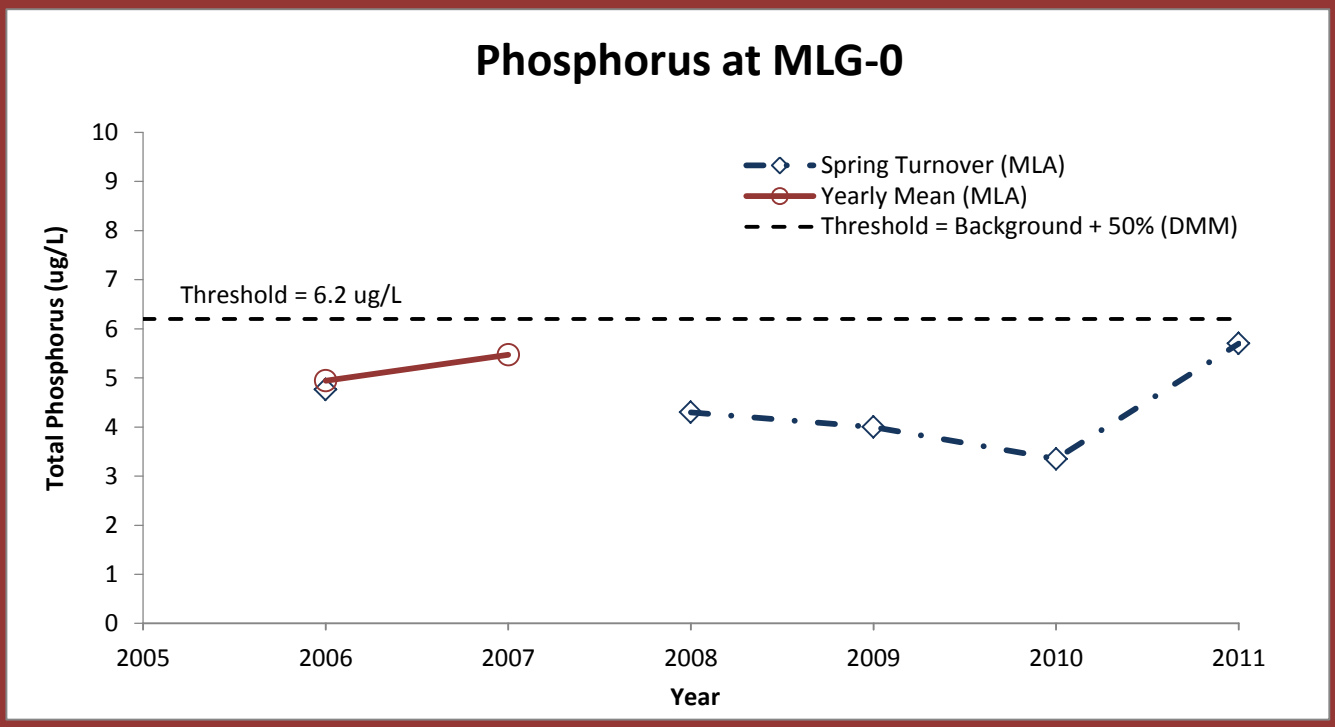
This area has been selected as a long-term monitoring site.

Spring turnover TP was the highest recorded concentration in the sampling history but remain below the DMM threshold value.

Recommendations

Continue sampling spring turnover phosphorus and calcium annually to monitor long-term trends.

(MLG) MUSKOKA LAKES G&CC



Notes:

ROSSEAU NORTH (RSH)

Area Description

The Rosseau North sampling area is within the limits of the village of Rosseau, at the northern end of Lake Rosseau. Drainage from the village enters the lake at the sampling sites, as well as at the mouth of the Shadow River. Two creeks drain into the bay, one through a lacustrine wetland along the western shoreline and the other near Highway 141 to the east. There is a high level of development not only along the shoreline of the lake and Shadow River, but in much of the watershed area in the form of residential and agricultural properties.

Volunteer Recognition

Rosseau North was monitored in 2011 by Peter Martin, **David Peacock**, and Mary Anne Peacock.

2011 Data

RSH-0: TP-Spring turnover = 8.6 µg/L
TP-Yearly mean = 5.6 µg/L
Calcium = 3.47 mg/L
Secchi = 4.6 m
Total coliforms = 3 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

RSH-2: TP-Yearly mean = 9.6 µg/L
Total coliforms = 13 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

RSH-4: TP-Yearly mean = 5.9 µg/L
Total coliforms = 5 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

Trends

Monitoring of Rosseau North started in 2002.

The 2011 spring turnover TP at RSH-0 was higher than 2010 and was greater than the DMM threshold value.

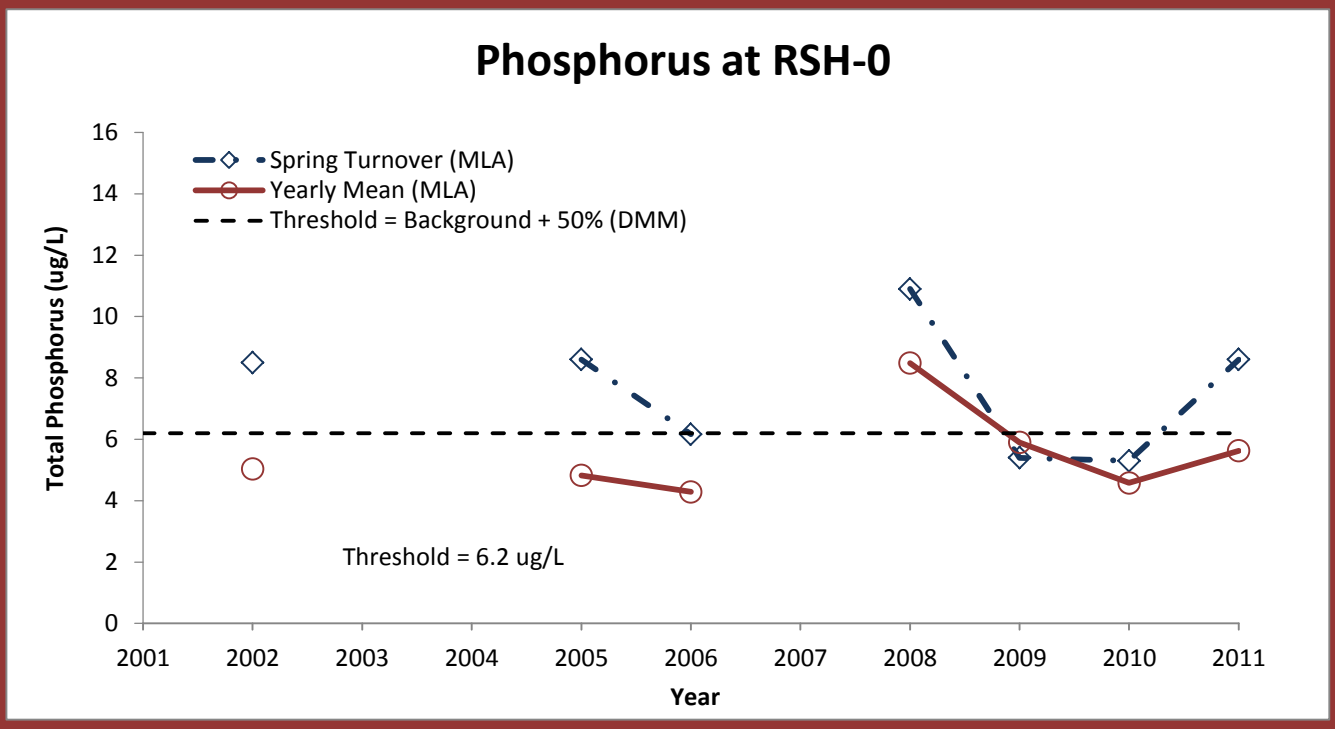
The yearly mean TP at RSH-0 was less than the DMM threshold value

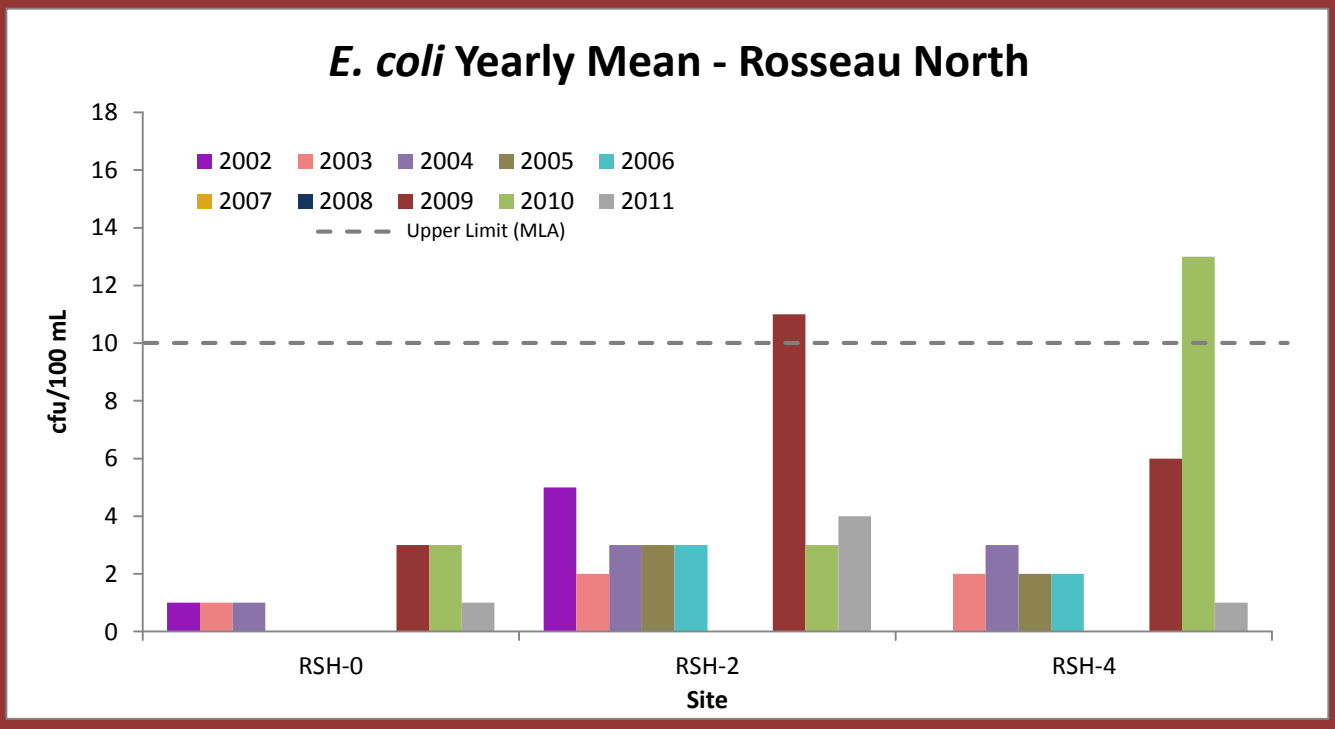
E. coli levels at RSH-0 and RSH-4 were lower than 2010 and all *E. coli* levels were less than the MLA upper limit.

Recommendations

Continue existing sampling protocol in 2012 to monitor long-term trends.

(RSH) ROSSEAU NORTH





ROYAL MUSKOKA ISLAND (RMI)

Area Description

Royal Muskoka Island has one deepwater sampling site located in the central portion of Lake Rosseau. This is a highly developed residential island with many roads and cottages along the shoreline. A large proportion of the interior of the island is cleared or otherwise altered. The eastern shore, opposite RMI-0, is less developed with residences spread out along the shore. Northwest winds and a long fetch would result in significant wave action.

Volunteer Recognition

Royal Muskoka Island was monitored in 2011 by Devon Seybold, Katherine Seybold, Luke Seybold, and Peter Seybold.

2011 Data

RMI-0: TP-Spring turnover = 5.8 µg/L
Calcium = 3.74 mg/L
Secchi = 3.7 m

Trends

Monitoring of Royal Muskoka Island started in 2003.

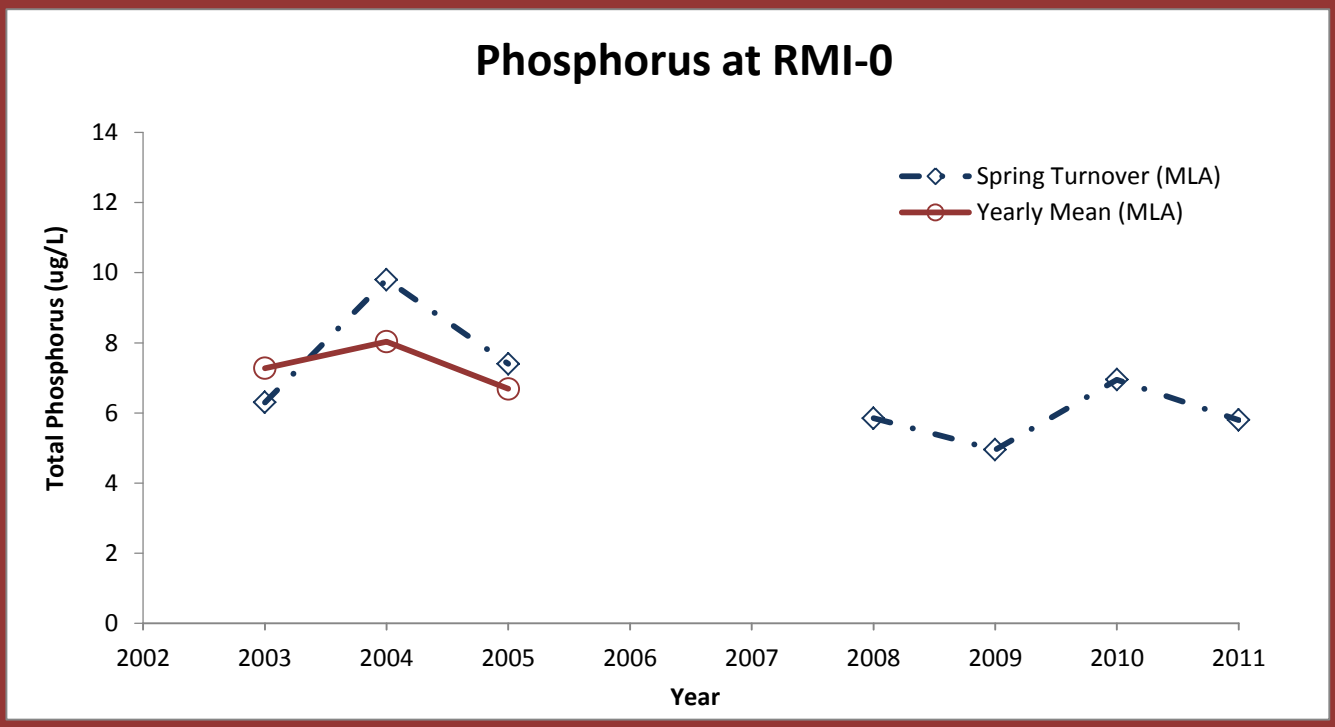
This area has been selected as a long-term monitoring site.

Spring turnover TP is consistent with historical values

Recommendations

Continue sampling spring turnover phosphorus and calcium annually to monitor long-term trends.

(RMI) ROYAL MUSKOKA ISLAND



Notes:

SKELETON BAY (SKB)

Area Description

Skeleton Bay is located in the eastern portion of Lake Rosseau's north basin. It is approximately 1.7 km² in size with a maximum depth of 20 m. Hwy 141 follows the shoreline in the northeast section of the bay, below a steep cliffed area. This bay is fed by six watercourses including the Bent River which drains agricultural lands. Skeleton Bay is classified as moderately sensitive by the DMM.

Volunteer Recognition

Skeleton Bay was monitored in 2011 by James Lacombe, Charles Moffatt, and **David Peacock**.

2011 Data

SKB-0: TP-Spring turnover = 8.0 µg/L
Calcium = 3.74 mg/L
Secchi = 2.8 m

SKB-1: TP-Yearly mean = 12.3 µg/L*

SKB-3: TP-Yearly mean = 5.1 µg/L*

SKB-4: TP-Yearly mean = 12.9 µg/L*

(* based on 1 sampling event)

Trends

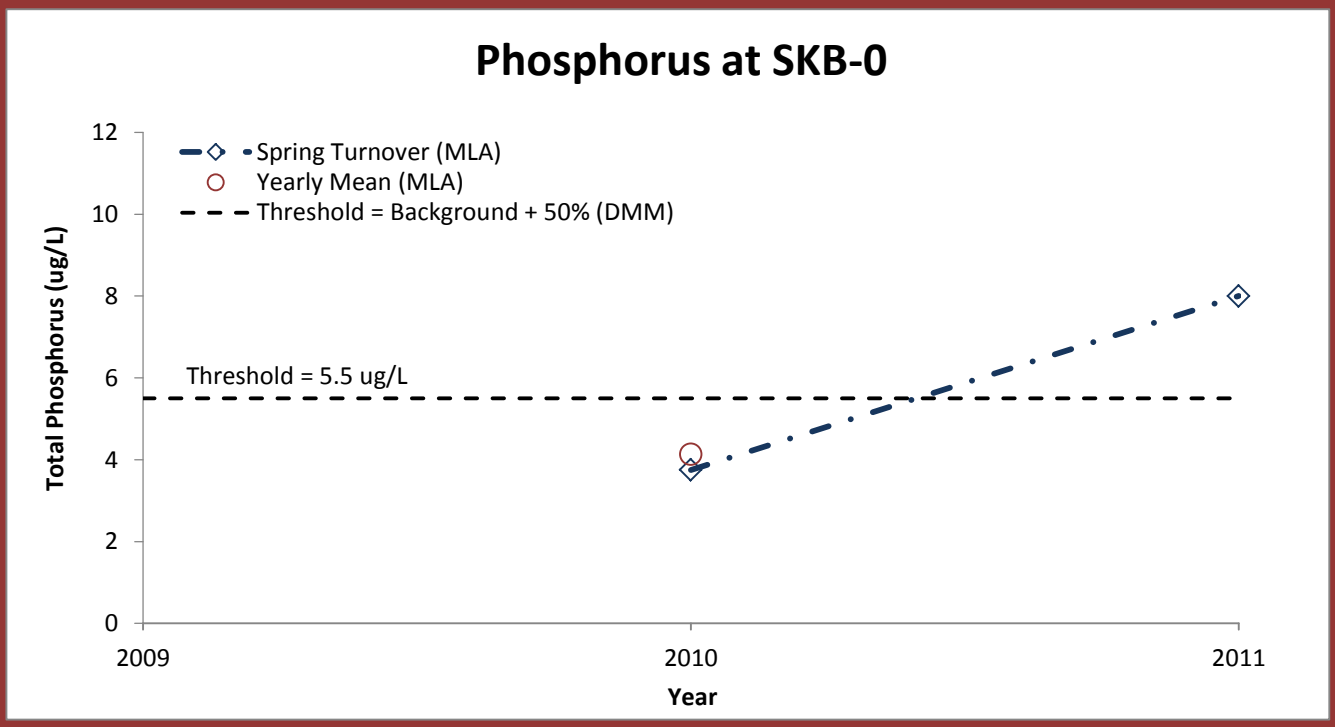
Monitoring of Skeleton Bay started in 2010.

2011 spring turnover TP concentration was higher than in 2010 and was greater than the DMM threshold value.

Recommendations

Continue existing sampling protocol in 2012 to monitor long-term trends. Focus on obtaining more samples for yearly mean TP in 2011.

(SKB) SKELETON BAY



Notes:

TOBIN'S ISLAND (TOB)

Area Description

Tobin's Island is an open bay area in the central part of Lake Rosseau. The surrounding area is moderately developed with cottage/residential properties along the shoreline and much of the inland forest area remaining in a natural state. Two creeks from adjacent wetland areas drain into the lake within this sampling area.

Volunteer Recognition

Tobin's Island was monitored in 2011 by Devon Seybold, Katherine Seybold, Luke Seybold, and Peter Seybold.

2011 Data

TOB-0: TP-Spring turnover = 6.0 µg/L
Calcium = 3.87 mg/L
Secchi = 3.9 m

Trends

Monitoring of Tobin's Island started in 2006.

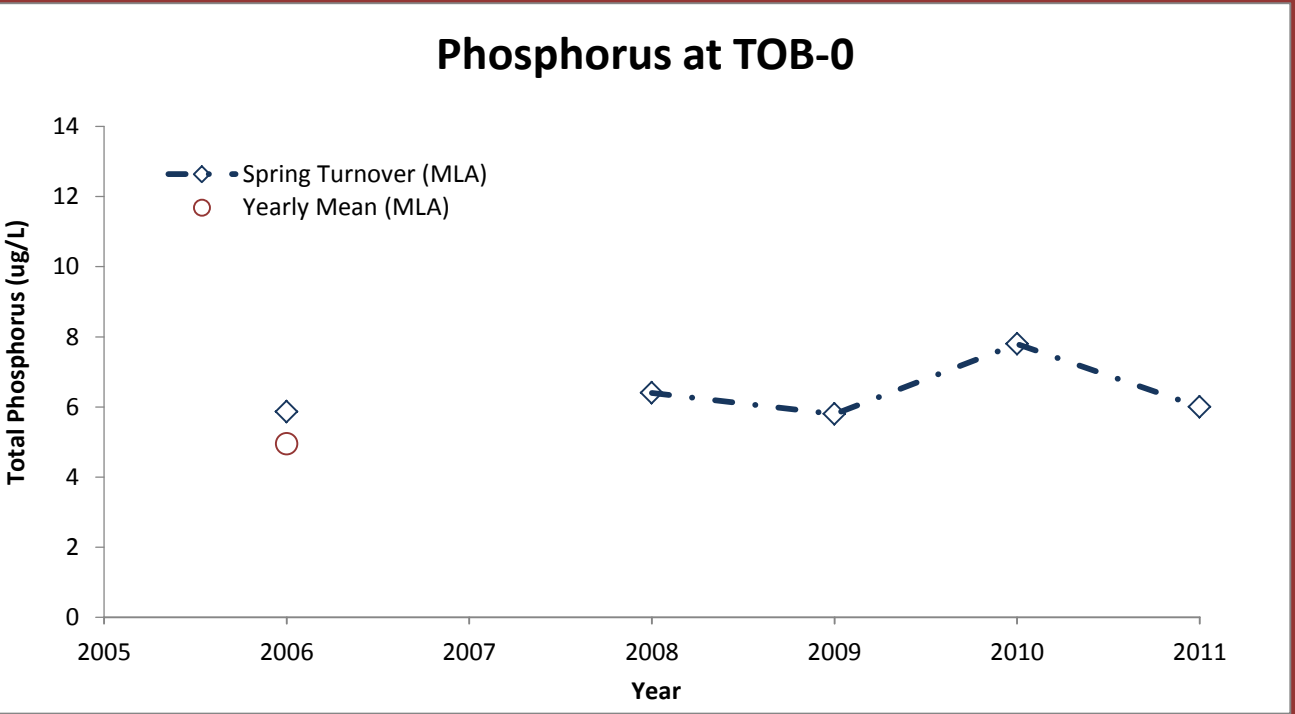
This area has been selected as a long-term monitoring site.

2011 spring turnover TP is consistent with the historic values

Recommendations

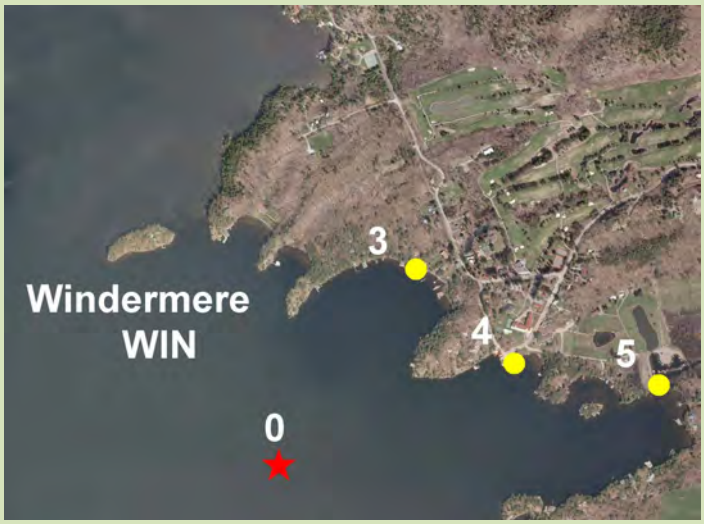
Continue sampling spring turnover phosphorus and calcium annually to monitor long-term trends.

(TOB) TOBIN'S ISLAND



Notes:

WINDERMERE (WIN)



Area Description

The Windermere village area in northern Lake Rosseau is a highly developed resort and residential area. There is a large resort complex, golf course, marina, and many residential properties. In addition, there is a significant amount of agricultural land near the sampling area. Several creeks outlet into this area, one of which flows through farms fields and wetlands and enters the lake at the marina.

Volunteer Recognition

Windermere was monitored in 2011 by Drew Purdy, Cameron Purdy, Devon Seybold, Karin Seybold, **Katherine Seybold**, and Peter Seybold.

2011 Data

WIN-0: TP-Spring turnover = 5.6 µg/L
TP-Yearly mean = 4.5 ug/L
Calcium = 4.05 mg/L
Secchi = 4.7 m

WIN-3: TP-Yearly mean = 4.4 µg/L
Total coliforms = 17 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

WIN-4: TP-Yearly mean = 5.4 µg/L
Total coliforms = 26 cfu/100 mL
Total *E. coli* = 6 cfu/100 mL

WIN-5: TP-Yearly mean = 11.9 µg/L
Total coliforms = 45 cfu/100 mL*
Total *E. coli* = 12 cfu/100 mL*

(* includes one sample with elevated *E. coli* levels; however, no follow-up samples were collected)

Trends

Monitoring at Windermere started in 2003, with the 2011 spring turnover TP and yearly mean TP concentrations being consistent with previously recorded levels.

TP yearly mean concentrations at WIN-5 are elevated when compared to other sites in this area.

2011 *E.coli* levels were less than the MLA upper limit except at site WIN-5.

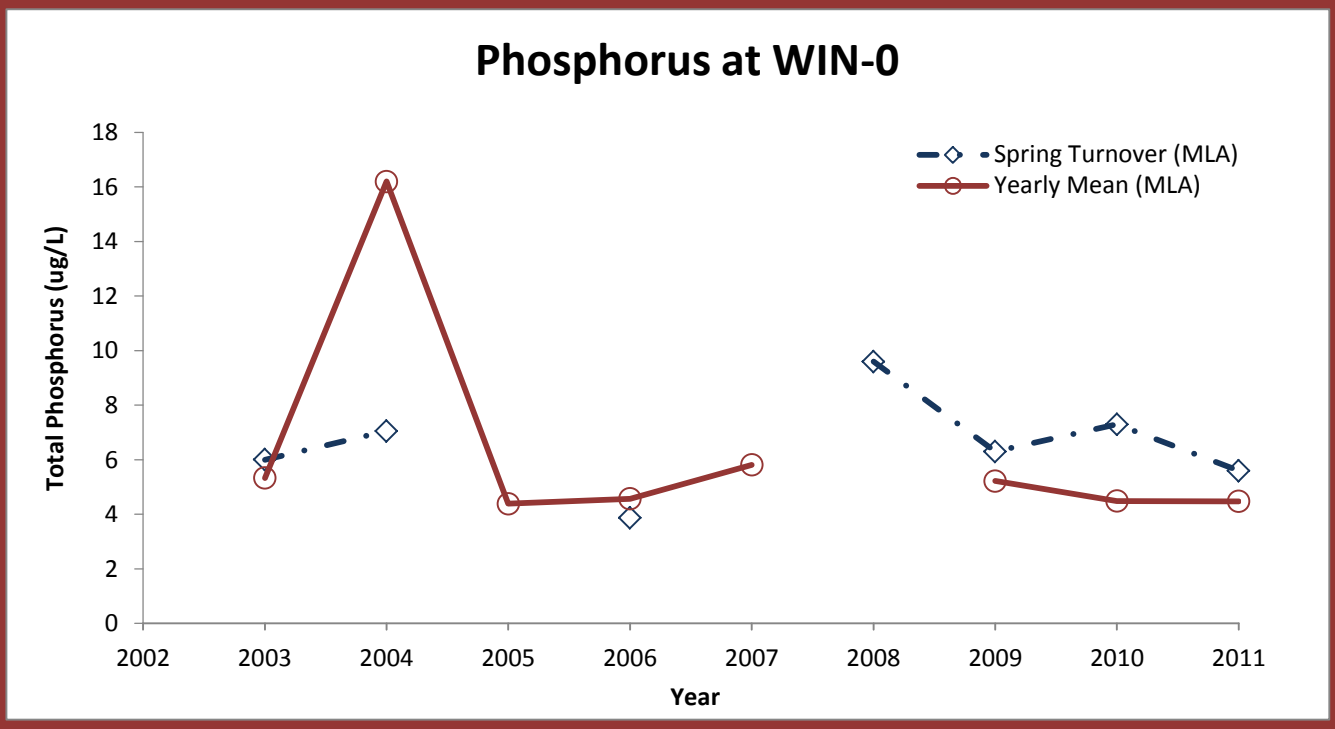
Recommendations

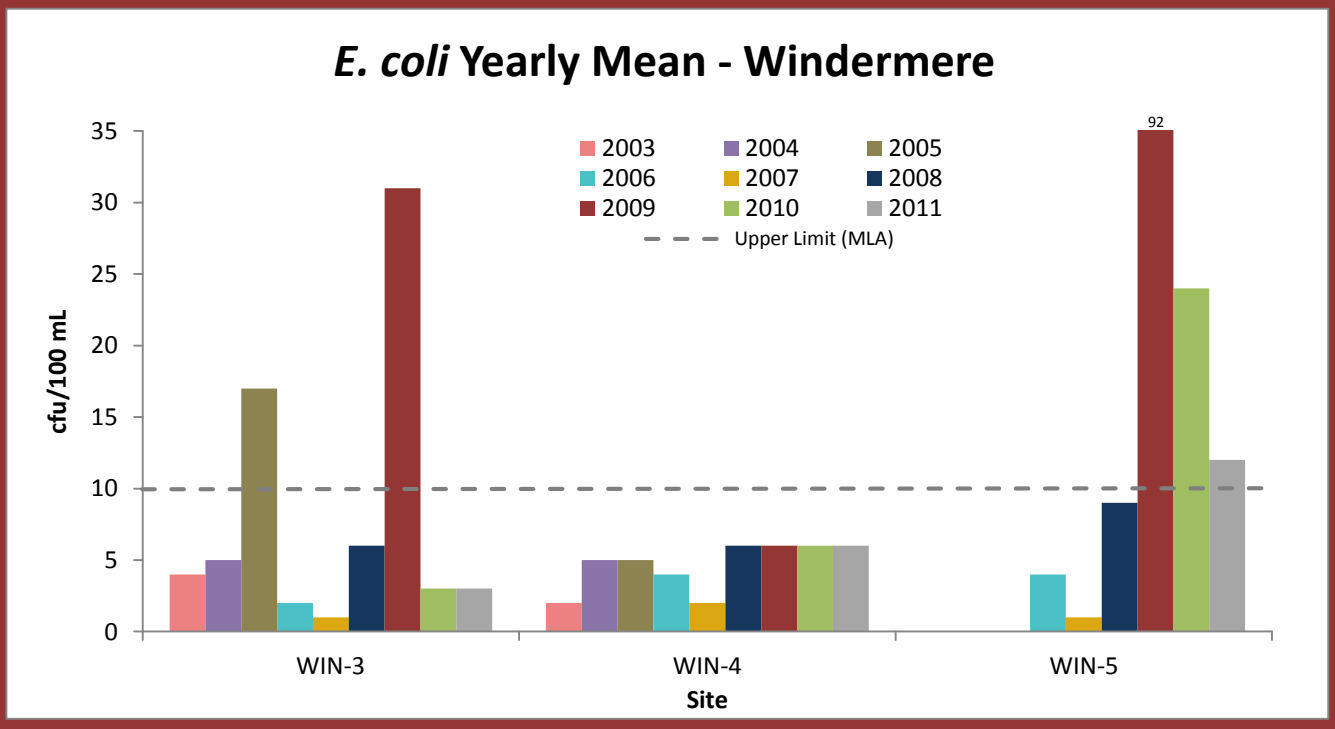
Continue existing sampling protocol to monitor long-term trends.

Ensure that follow-up bacterial samples are collected from sites with elevated *E. coli* levels.

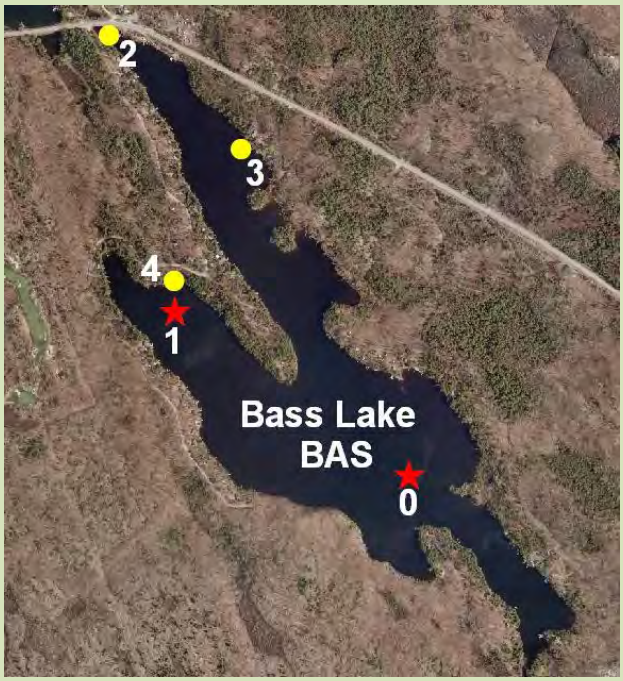
Additional sampling at WIN-5 should be considered.

(WIN) WINDERMERE





BASS LAKE (BAS)



Area Description

Bass Lake is a small, shallow, moderately developed lake located immediately southwest of Lake Joseph. It is 0.96 km^2 in area with a maximum depth of 8 m. Hwy 169 separates this lake from Lake Joseph at the north end. Bass Lake drains wetlands located to the south and water flows into Stills Bay via Stills Falls. Bass Lake has been classified as moderately sensitive by the DMM.

Volunteer Recognition

Bass Lake was monitored in 2011 by **Chris Bodanis**, Bev Turney and Chris Turney.

2011 Data

BAS-0: TP-Spring turnover = 7.5 µg/L
TP-Yearly mean = 7.1 µg/L*
Calcium = 3.38 mg/L
Secchi = 2.9 m

BAS-1: TP-Yearly mean = 7.1 µg/L**
Secchi = 3.0 m

BAS-2: Total coliforms = 27 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

BAS-3: Total coliforms = 31 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

BAS-4: Total coliforms = 31 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

(* based on 5 sampling events)
(** based on 4 sampling events following the spring turnover period)

Trends

Bass Lake was monitored from 2005 to 2007 and in 2010, 2011.

The spring turnover TP value at BAS-0 and the yearly mean TP values at BAS-0 and BAS-1 were below the DMM threshold.

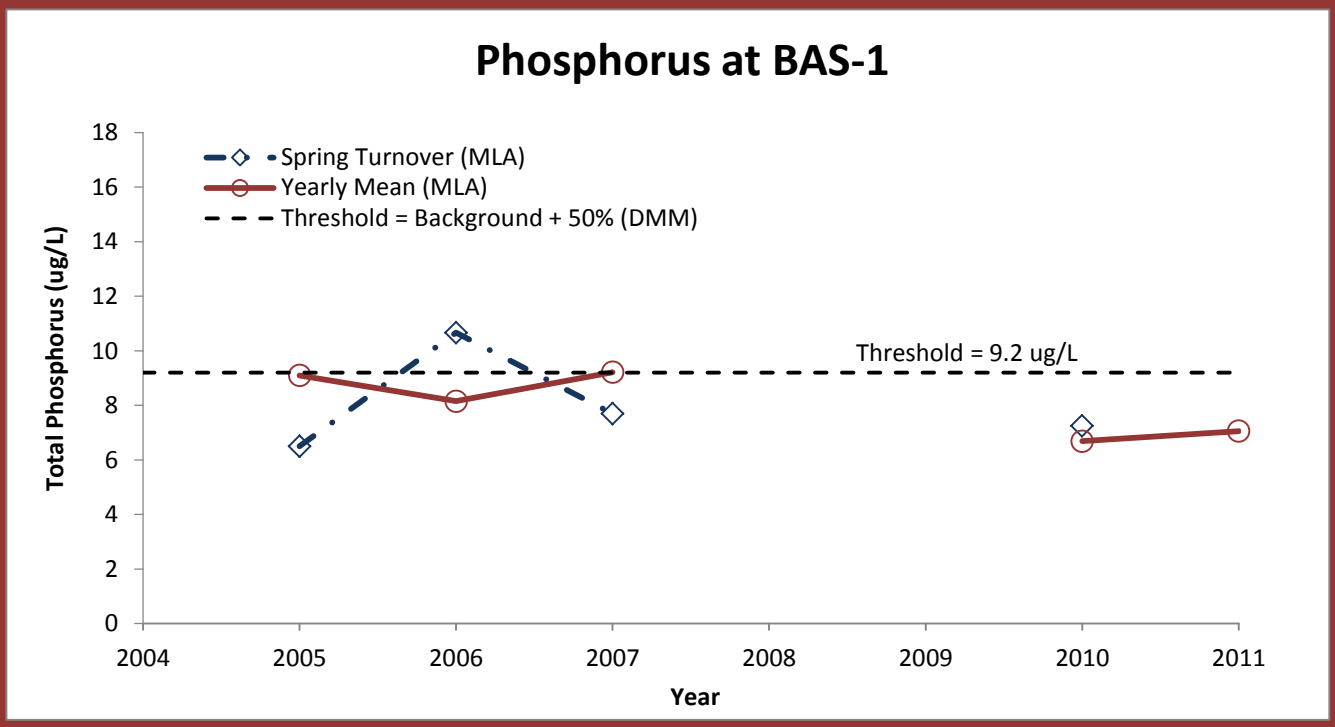
Note: BAS-1 is the new reference site for deep-water phorsphorus and calcium. Spring turnover data was not available for this site.

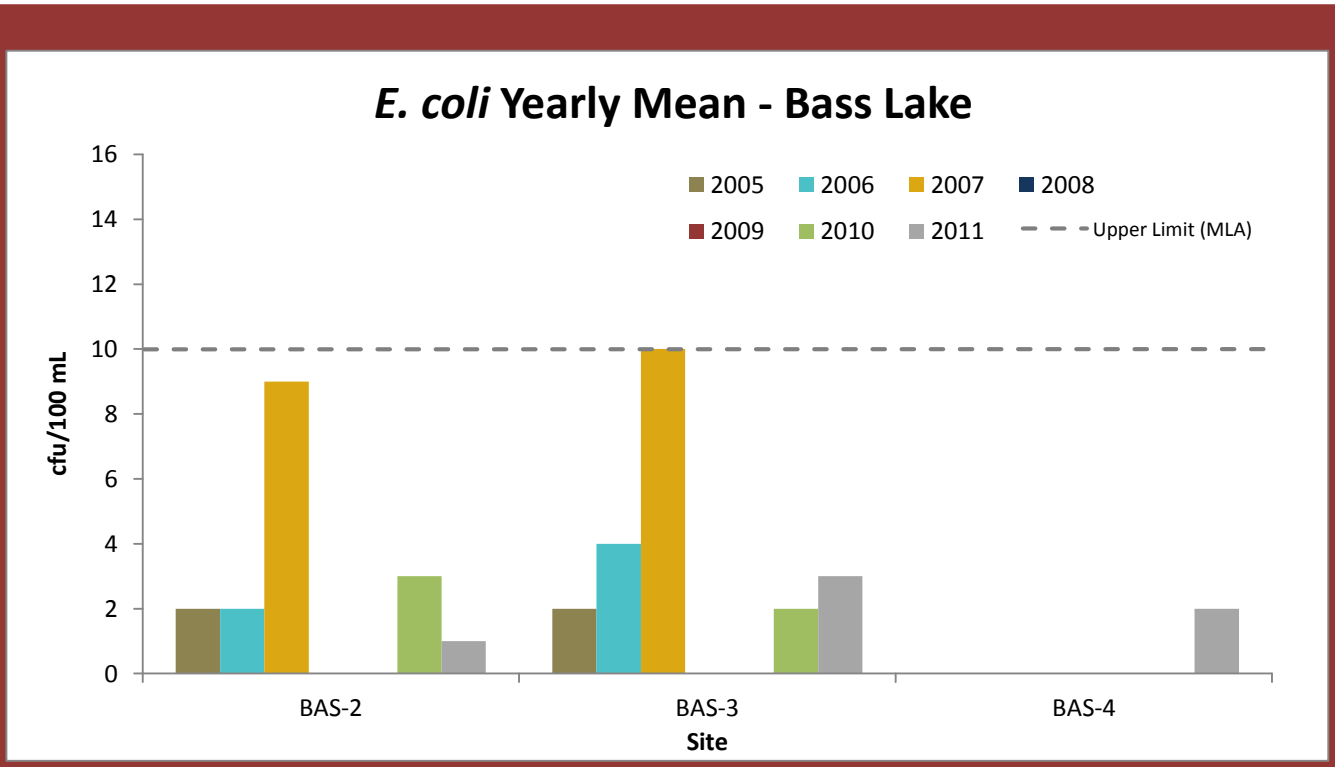
E. coli levels at all sites were less than the MLA upper limit.

Recommendations

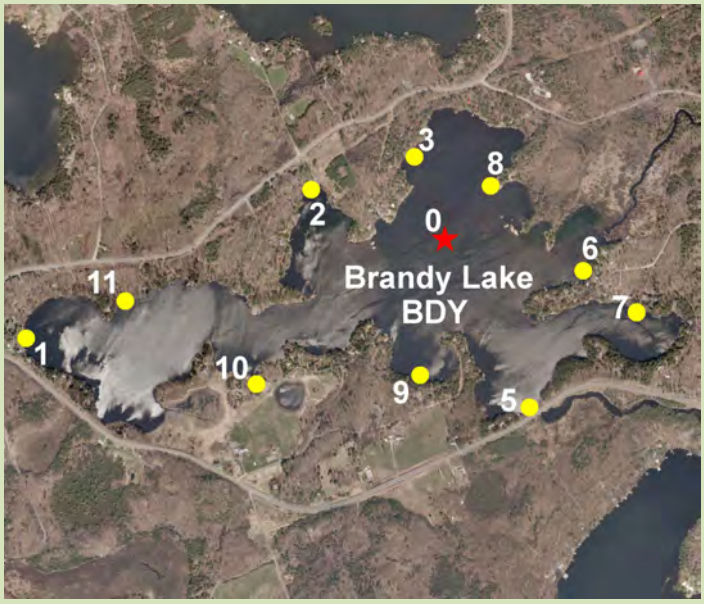
Continue existing sampling protocol to monitor long-term trends.

Consider changing *E. coli* sampling sites in 2012 since levels at present sites are below the MLA upper limit.


Phosphorus at BAS-1
Spring Turnover (MLA)
Yearly Mean (MLA)
Threshold = Background + 50% (DMM)
Threshold = 9.2 ug/L
Total Phosphorus (ug/L)
0
2
4
6
8
10
12
14
16
18
2004
2005
2006
2007
2008
2009
2010
2011
Year


E. coli Yearly Mean - Bass Lake
2005
2006
2007
2008
2009
2010
2011
Upper Limit (MLA)
cfu/100 mL
0
2
4
6
8
10
12
14
16
BAS-2
BAS-3
BAS-4
Site

BRANDY LAKE (BDY)



Area Description

The shoreline of Brandy Lake is moderately developed with many residences and access roads. A large number of the properties maintain a natural shoreline but, there is close to 10% un-buffered lawn. Approximately 40% of the lake shoreline is natural wetland. In the eastern portion of the lake, there is a large wetland with a creek outlet. A second creek is located to the southeast. Brandy Lake is a dystrophic, or "tea-coloured" lake, which is naturally rich in carbon.

Volunteer Recognition

Brandy Lake was monitored in 2011 by Bob Hogg, Tony Mathia, **Donna & Peter Sale**, and Gary Simmonds.

2011 Data (* includes one sample with elevated *E. coli* levels and two follow-up samples)

BDY-0: TP-Spring turnover = 17.8 µg/L
Calcium = 3.46 mg/L
Secchi = 1.4 m

BDY-1: Total coliforms = 29 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

BDY-2: Total coliforms = 47 cfu/100 mL
Total *E. coli* = 7 cfu/100 mL

BDY-3: Total coliforms = 85 cfu/100 mL
Total *E. coli* = 14 cfu/100 mL

BDY-5: Total coliforms = 18 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

BDY-6: Total coliforms = 97 cfu/100 mL*
Total *E. coli* = 51 cfu/100 mL*

BDY-7: Total coliforms = 21 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

BDY-8: Total coliforms = 56 cfu/100 mL
Total *E. coli* = 6 cfu/100 mL

BDY-9: Total coliforms = 14 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

BDY-10: Total coliforms = 38 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

BDY-11: Total coliforms = 76 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

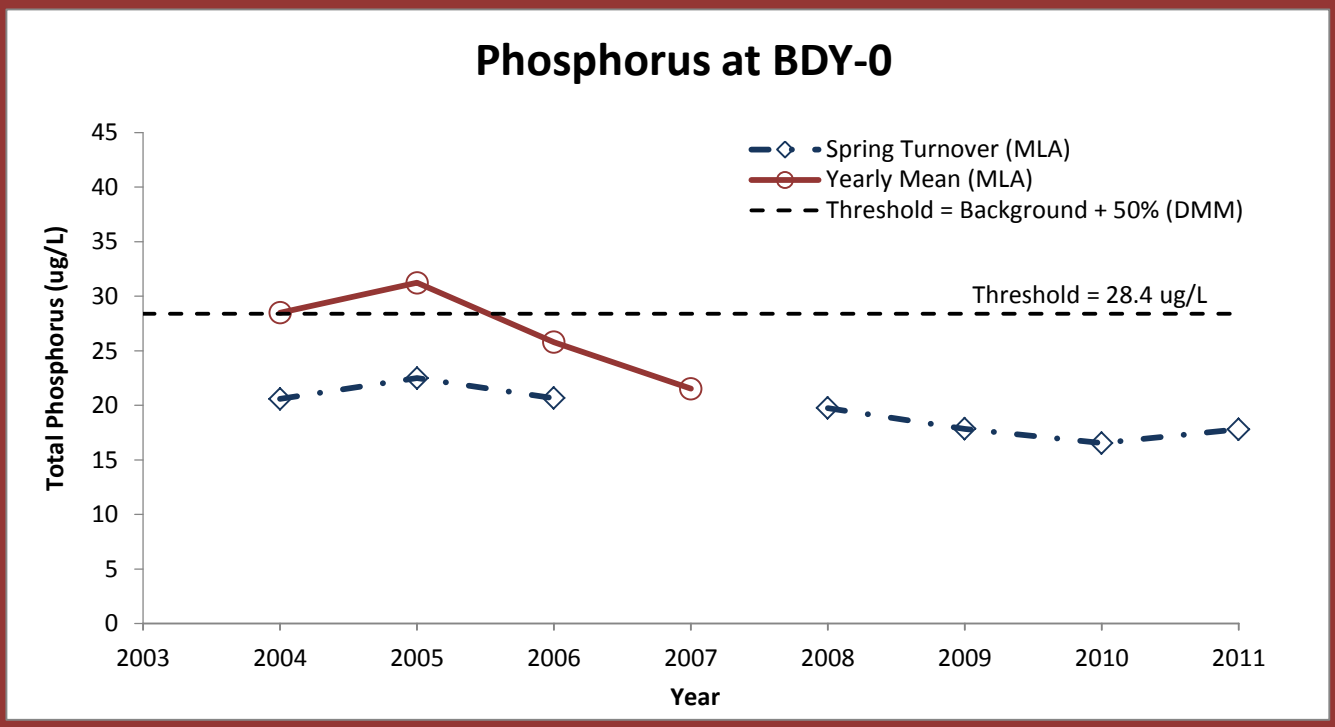
Trends and Recommendations

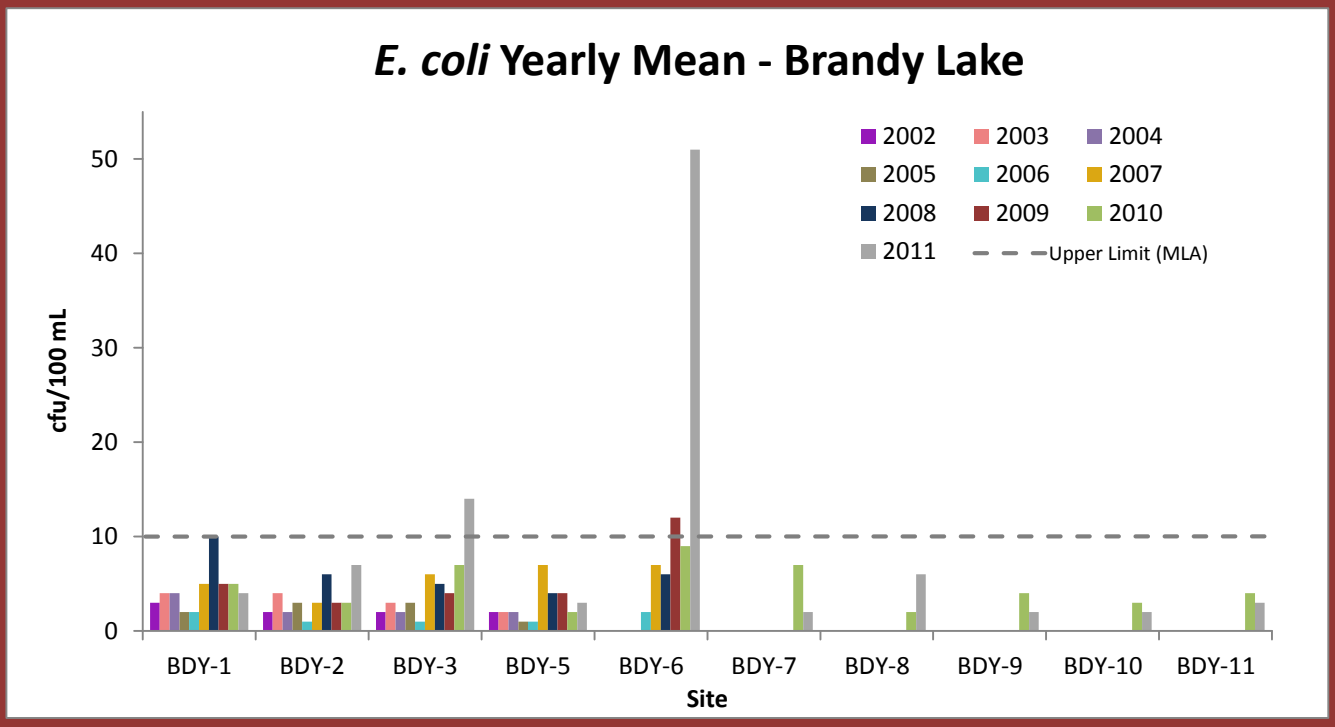
Monitoring of Brandy Lake started in 2004 and should continue in 2012 following existing sampling protocol to monitor long-term trends.

The 2011 spring turnover TP at BDY-0 was consistent with historical values and was less than the DMM threshold value.

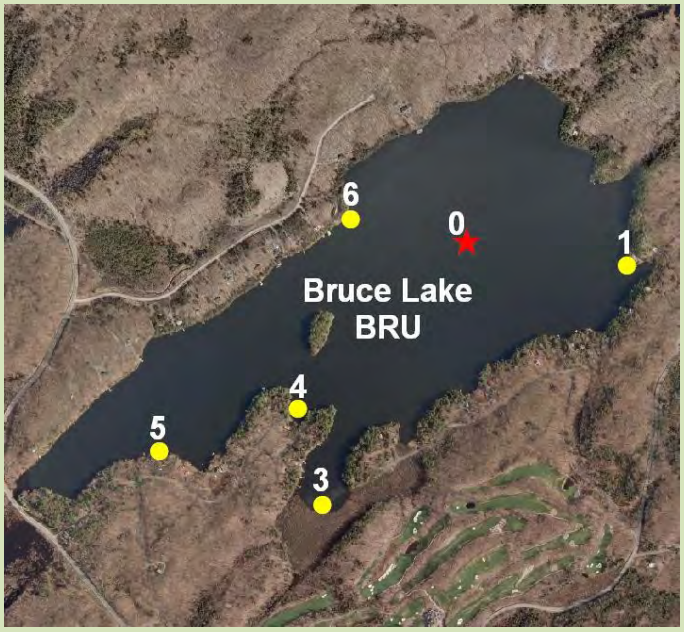
2011 *E.coli* levels were less than the MLA upper limit with the exception of BDY-6.

(BDY) BRANDY LAKE





BRUCE LAKE (BRU)



Area Description

Bruce Lake is located east of Hwy 632, between Lake Joseph and Lake Rosseau. It is relatively small in size at 1.0 km^2 and has a maximum depth of 6 m. Approximately 25% of the catchment area for this lake is made up of wetlands. The lake is moderately developed and there is a golf course located immediately to the south. Bruce Lake is classified as moderately sensitive by the DMM.

Volunteer Recognition

Bruce Lake was monitored in 2011 by **Paul Hutchinson**, Craig Maslin, Cynthia Mercanti, and Karen Weber.

2011 Data (* includes one sample with elevated *E. coli* levels and one additional sample collected in late August)

BRU-0: TP-Spring turnover = 9.5 µg/L
TP-Yearly mean = 7.4 µg/L
Calcium = 3.70 mg/L
Secchi = 4.1 m
Total coliforms = 14 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

BRU-1: TP-Yearly mean = 7.1 µg/L
Total coliforms = 109 cfu/100 mL*
Total *E. coli* = 6 cfu/100 mL*

BRU-3: TP-Yearly mean = 8.2 µg/L
Total coliforms = 60 cfu/100 mL
Total *E. coli* = 11 cfu/100 mL

BRU-4: TP-Yearly mean = 7.7 µg/L
Total coliforms = 60 cfu/100 mL*
Total *E. coli* = 10 cfu/100 mL*

BRU-5: TP-Yearly mean = 7.6 µg/L
Total coliforms = 18 cfu/100 mL
Total *E. coli* = 5 cfu/100 mL

BRU-6: TP-Yearly mean = 8.5 µg/L
Total coliforms = 31 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

Trends

Monitoring of Bruce Lake started in 2010.

The 2011 spring turnover TP at BRU-0 was slightly higher than in 2010, but below the DMM threshold. Nearshore yearly mean TP values were slightly lower than in 2010.

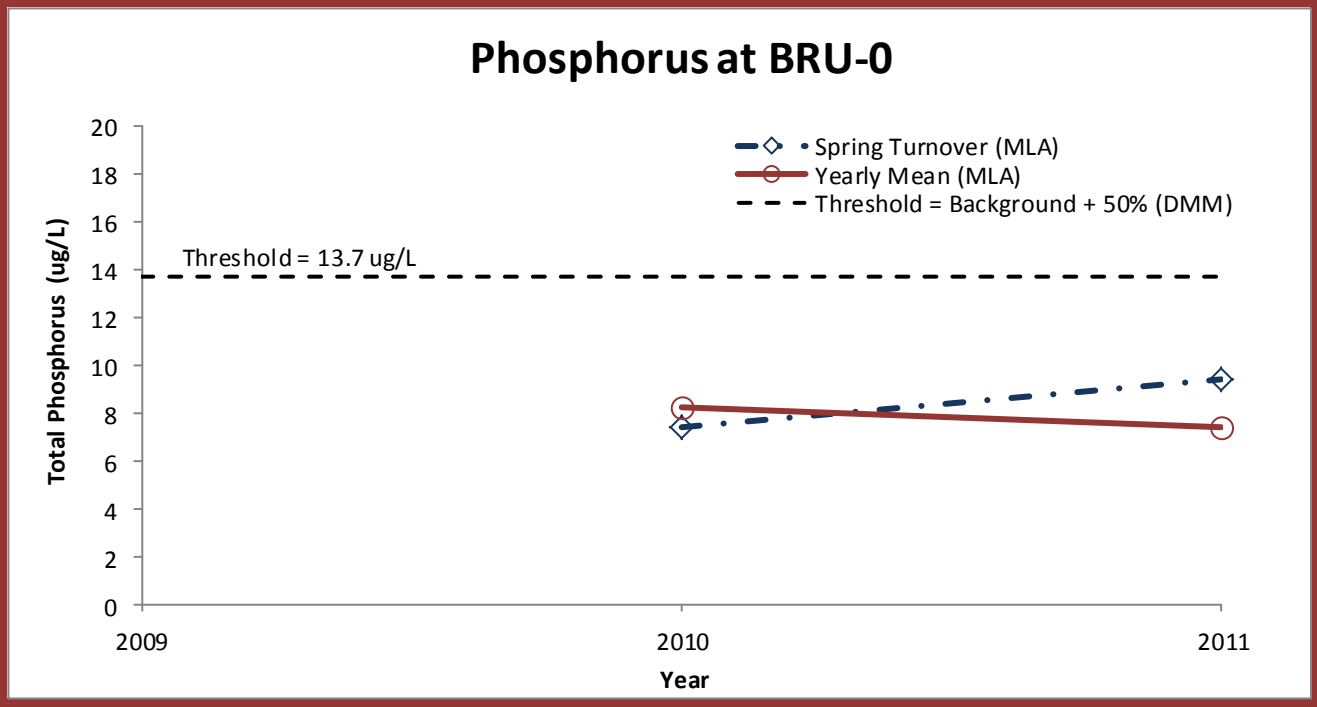
2011 *E.coli* levels were less than the MLA upper limit except at site BRU-3.

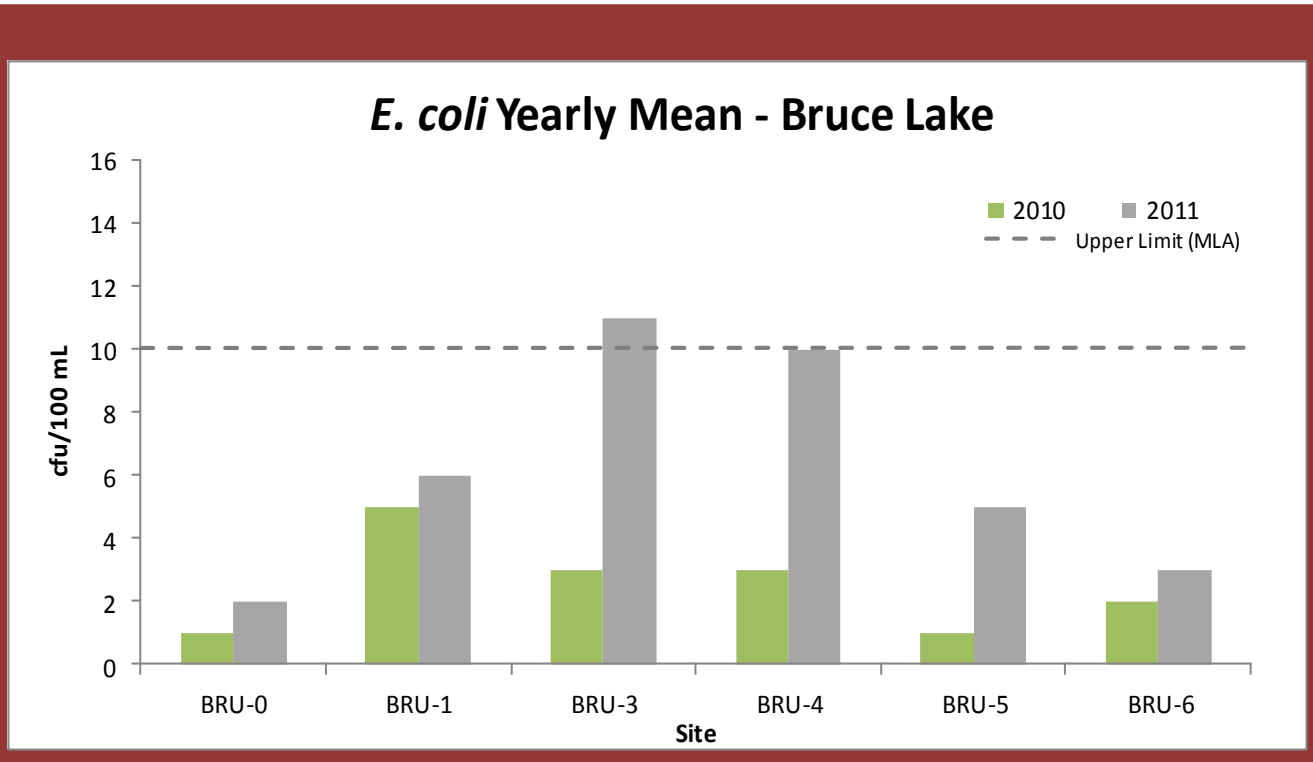
Comments

Continue existing sampling protocol to monitor long-term trends.

Ensure that follow-up bacterial samples are collected from sites with elevated *E. coli* levels.

(BRU) BRUCE LAKE





CLEAR LAKE (CLR)

Area Description

Clear Lake, also called Torrance Lake, is a moderately developed lake with much of the shoreline area converted into residential lots. It is also adjacent to highway 169. This lake is 152 ha in size, has a maximum depth of 16 m and has a very small watershed. There is limited inflow and outflow of water on this lake. Clear Lake has been classified as moderately sensitive and over threshold by the DMM.

Volunteer Recognition

Clear Lake was monitored in 2011 by **Bob & Sharon Cleverdon**.

2011 Data

CLR-0: TP-Spring turnover = 7.4.µg/L
TP-Yearly mean = 5.5 µg/L
Calcium = 3.69 mg/L
Secchi = 7.2 m

CLR-1: TP-Yearly mean = 6.0 µg/L
Total coliforms = 31 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

CLR-2: TP-Yearly mean = 6.0 µg/L
Total coliforms = 87 cfu/100 mL
Total *E. coli* = 2 cfu /100 mL

CLR-3: TP-Yearly mean = 5.6 µg/L
Total coliforms = 42 cfu /100 mL
Total *E. coli* = 3 cfu /100 mL

CLR-4: TP-Yearly mean = 6.0 µg/L
Total coliforms = 20 cfu /100 mL
Total *E. coli* = 2 cfu /100 mL

Trends

Monitoring of Clear Lake started in 2006.

The 2011 spring turnover TP and yearly mean TP values at CLR-0 were similar to those observed in 2010. Both concentrations remained above the DMM threshold. Nearshore yearly mean TP values were consistent with those observed in 2010.

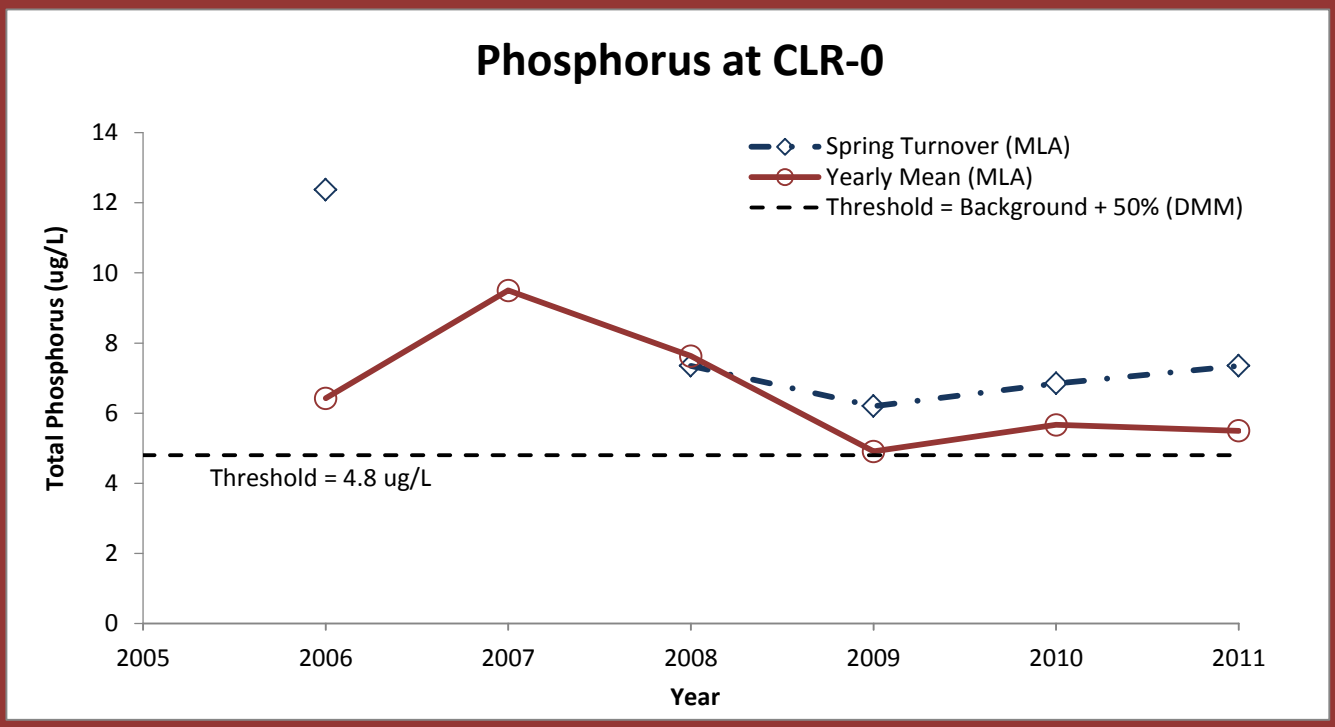
2011 *E.coli* levels were all less than the MLA upper limit.

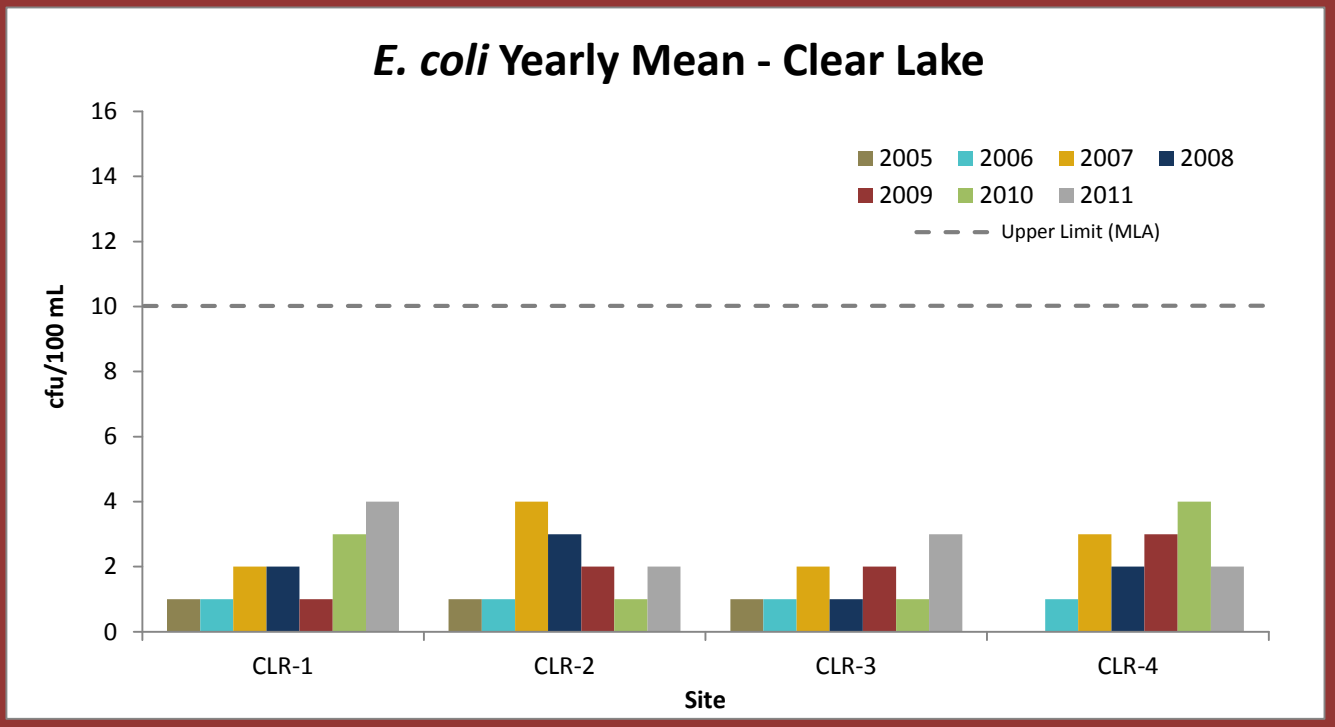
Recommendations

Continue existing sampling protocol to monitor long-term trends.

6+ years have not indicated a bacterial issue; consider reduced monitoring or site changes.

(CLR) CLEAR LAKE





INDIAN RIVER (IND)

Area Description

The Indian River flows from Lake Rosseau, through Port Carling and into Mirror Lake and Lake Muskoka. This highly developed area receives stormwater from the Port Carling urban centre. It also has high boat traffic, a locks system, marinas and many commercial and residential properties. A large lacustrine wetland is located adjacent to the river.

Volunteer Recognition

Indian River was monitored in 2011 by **Susan Carson**, Margaret Hewgill, Dianne Turnbull, and Ian Turnbull.

2011 Data

IND-0: TP-Spring turnover = 8.3 µg/L
TP-Yearly mean = 6.1 µg/L
Calcium = 3.72 mg/L
Secchi = 4.2 m
Total coliforms = 9 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

IND-1: Total coliforms = 16 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

IND-2: Total coliforms = 69 cfu/100 mL*
Total *E. coli* = 15 cfu/100 mL*

IND-3: Total coliforms = 31 cfu/100 mL
Total *E. coli* = 6 cfu/100 mL

IND-4: Total coliforms = 67 cfu/100 mL
Total *E. coli* = 6 cfu/100 mL

(* includes one sample with elevated *E. coli* levels; however, no follow-up samples were collected)

Trends

Monitoring of the Indian River started in 2002.

2011 spring turnover TP at IND-0 was within the historic range but was the highest recorded concentration in recent years.

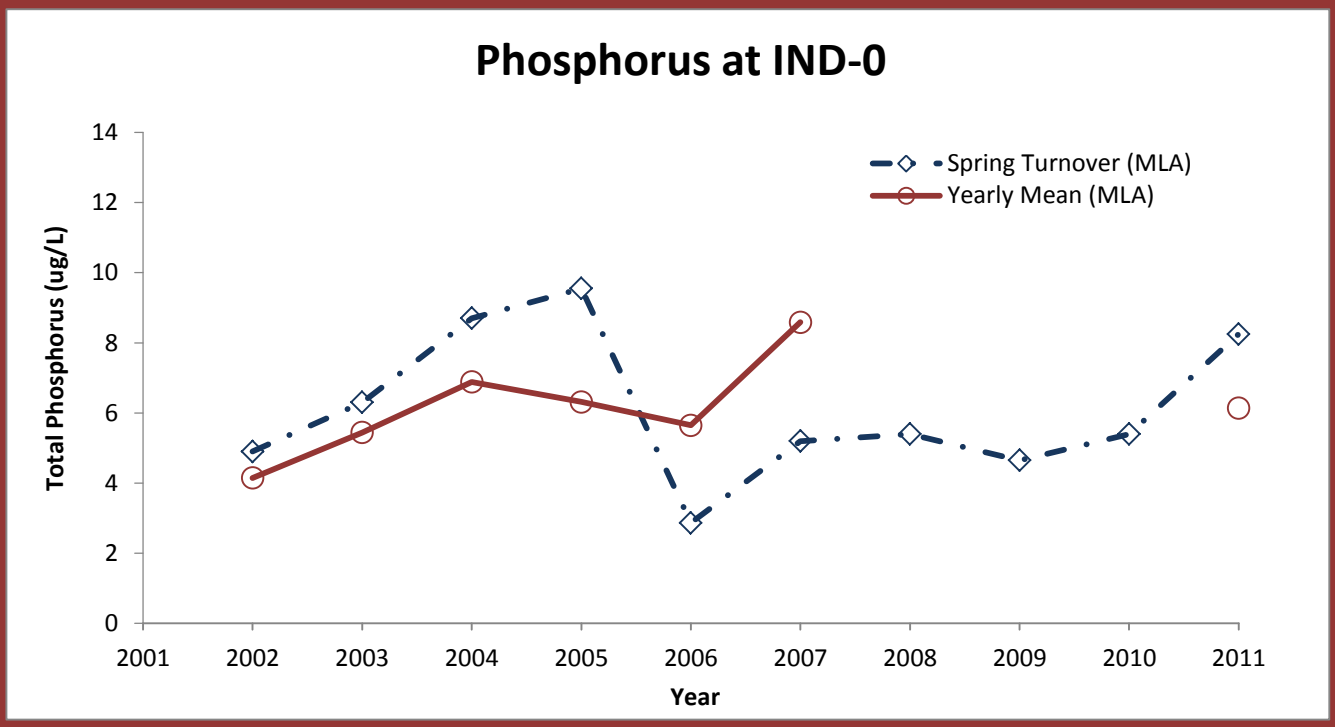
E. coli levels at IND-1, IND-3 and IND-4 were less than the MLA upper limit.

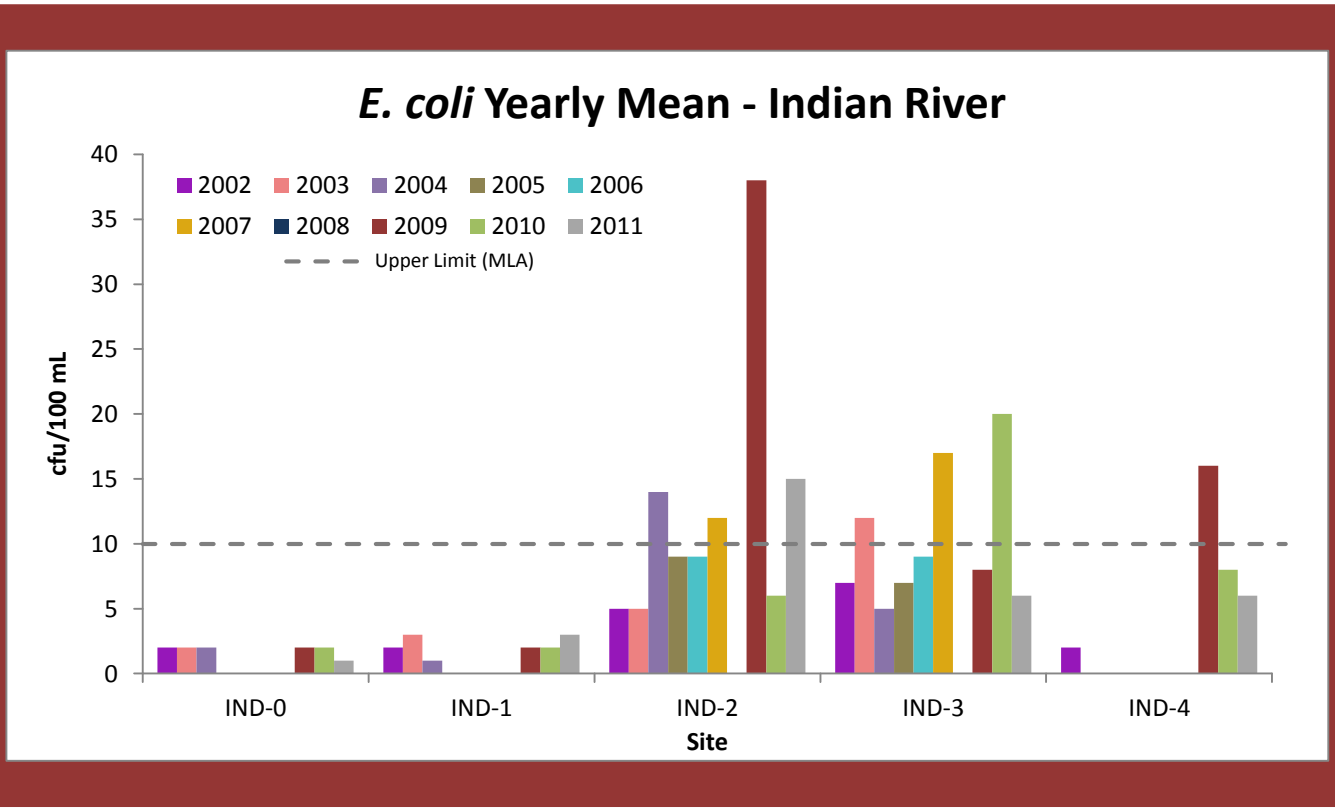
Recommendations

Continue existing sampling protocol in 2012 to monitor long-term trends.

Ensure that follow-up bacterial samples are collected from sites with elevated *E. coli* levels.

(IND) INDIAN RIVER





JOSEPH RIVER (JOR)

Area Description

Joseph River is the water body connecting Lake Joseph and Lake Rosseau The river is 1.37 km² in size and up to 8 m deep. Direction of flow is from Lake Joseph into Lake Rosseau. A marina, a bridge crossing for Peninsula Road and two wetlands are located adjacent to the channel. This area receives significant boat traffic as the main navigable waterway between the two large lakes. The Joseph River is classified as moderately sensitive by the DMM.

Volunteer Recognition

Joseph River was monitored in 2011 by **Beth Guy**.

2011 Data

JOR-0: TP-Spring turnover = 7.2 µg/L
TP-Yearly mean = 7.6 µg/L
Calcium = 3.86 mg/L
Secchi = 3.5 m

JOR-1: TP-Yearly mean = 7.5 µg/L

JOR-2: TP-Yearly mean = 5.9 µg/L

Trends

Monitoring of Joseph River started in 2005.

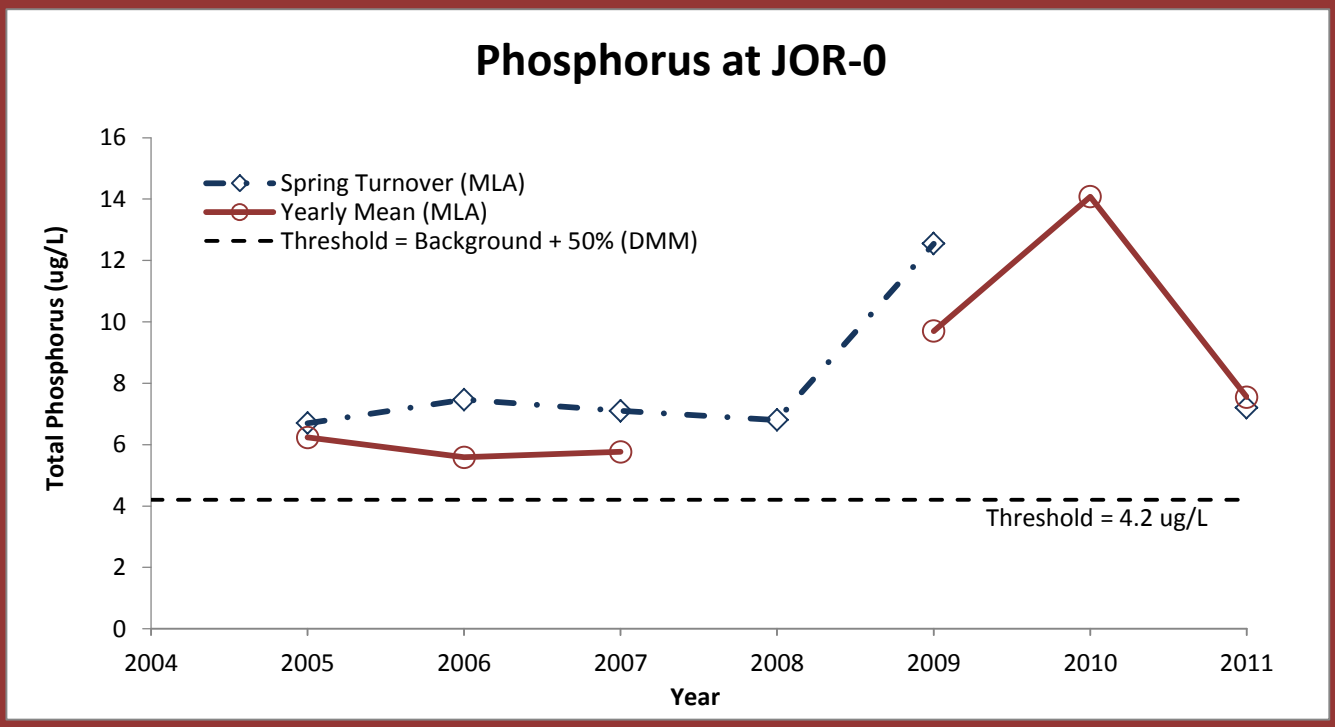
The 2011 spring turnover TP at JOR-0 was within the historic range and was greater than the DMM threshold value.

The 2011 yearly mean TP at JOR-0 was consistent with the historic values.

Recommendations

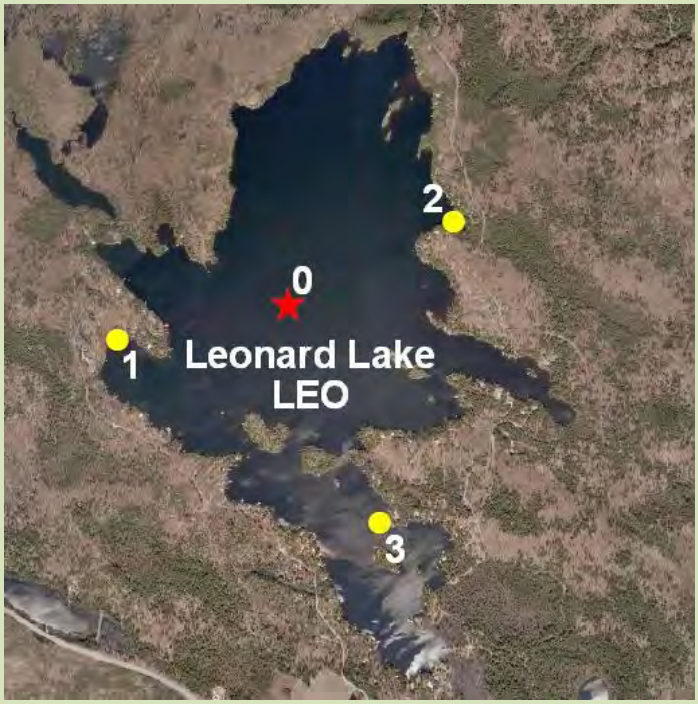
Continue existing sampling protocol in 2012 to monitor long-term trends.

(JOR) JOSEPH RIVER



Notes:

LEONARD LAKE (LEO)



Area Description

Leonard Lake is a medium sized lake at 1.52 km² in size and has a maximum depth of 16 m. This lake is moderately developed with primarily residential properties. Immediate shoreline alteration is limited to 9% but backlot clearing and forest thinning is found in 77% of properties. There is limited inflow and outflow of water on this lake, and few wetlands in the vicinity. Leonard Lake is classified as moderately sensitive and over-threshold by the DMM.

Volunteer Recognition

Leonard Lake was monitored in 2011 by **Betty Isbister**, Cole Roberts, **Gordon Roberts**, and Doug Wallace.

2011 Data

LEO-0: TP-Spring turnover = 6.6 µg/L
TP-Yearly mean = 5.2 µg/L
Calcium = 2.25 mg/L
Secchi = 4.3 m

LEO-1: Total coliforms = 43 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

LEO-2: Total coliforms = 60 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

LEO-3: Total coliforms = 280 cfu/100 mL
Total *E. coli* = 30 cfu/100 mL

Trends

Monitoring of Leonard Lake started in 2008.

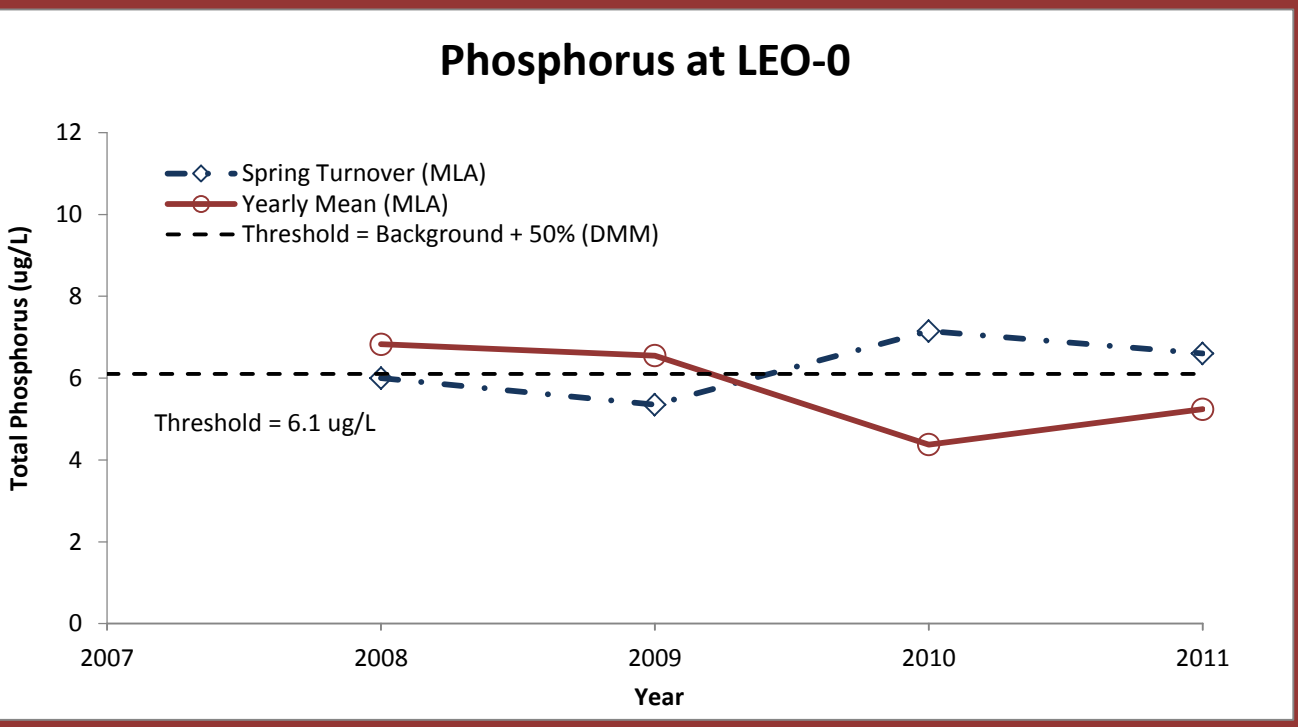
The 2011 spring turnover TP and yearly mean TP concentrations are consistent with historical values, although the spring turnover TP concentration was greater than the DMM threshold value.

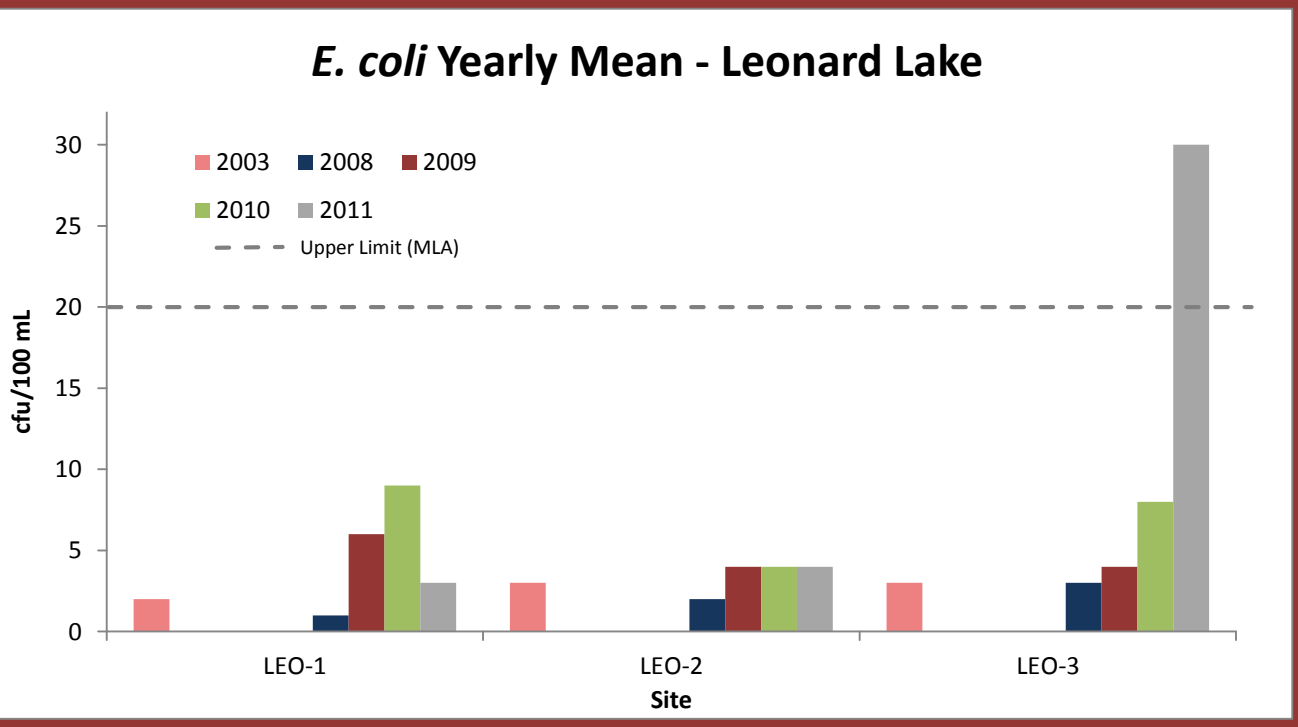
E. coli levels at LEO-3 was the highest ever recorded in the sampling history and was above the MLA upper limit.

Recommendations

Continue existing sampling protocol in 2012 to monitor long-term trends.

(LEO) LEONARD LAKE





MIRROR LAKE (MIR)

Area Description

Mirror Lake is essentially a widening of the Indian River as it flows between Lake Rosseau to the north and Lake Muskoka to the south. The lake is approximately 0.46 km² in area, with a maximum depth of 8 m. Two small creeks outlet into the lake near sampling sites MIR-1 and MIR-2. Much of the lake is within the Town of Port Carling and receives drainage from the urban area. Mirror Lake has a small watershed, approximately 0.97 km², and is classified as moderately sensitive and over-threshold by the DMM.

Volunteer Recognition

Mirror Lake was monitored in 2011 by **Susan Carson**, Carly Spence, Jenn Spence, Rick Spence, and Sandy Tozer Spence.

2011 Data

MIR-0: TP-Spring turnover = 6.4 µg/L
TP-Yearly mean = 6.9 µg/L
Calcium = 3.77 mg/L
Secchi = 2.5 m

MIR-1: TP-Yearly mean = 6.7 µg/L*
Total coliforms = 39 cfu/100 mL
Total *E. coli* = 11 cfu/100 mL

MIR-2: TP-Yearly mean = 8.6 µg/L**
Total coliforms = 90 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

MIR-3: TP-Yearly mean = 8.4 µg/L$^{\pm}$
Total coliforms = 27 cfu/100 mL
Total *E. coli* = 5 cfu/100 mL

(* based on 1 sampling event)
(** based on 2 sampling events)
($^{\pm}$ based on 3 sampling events)

Trends

Monitoring of Mirror Lake started in 2007.

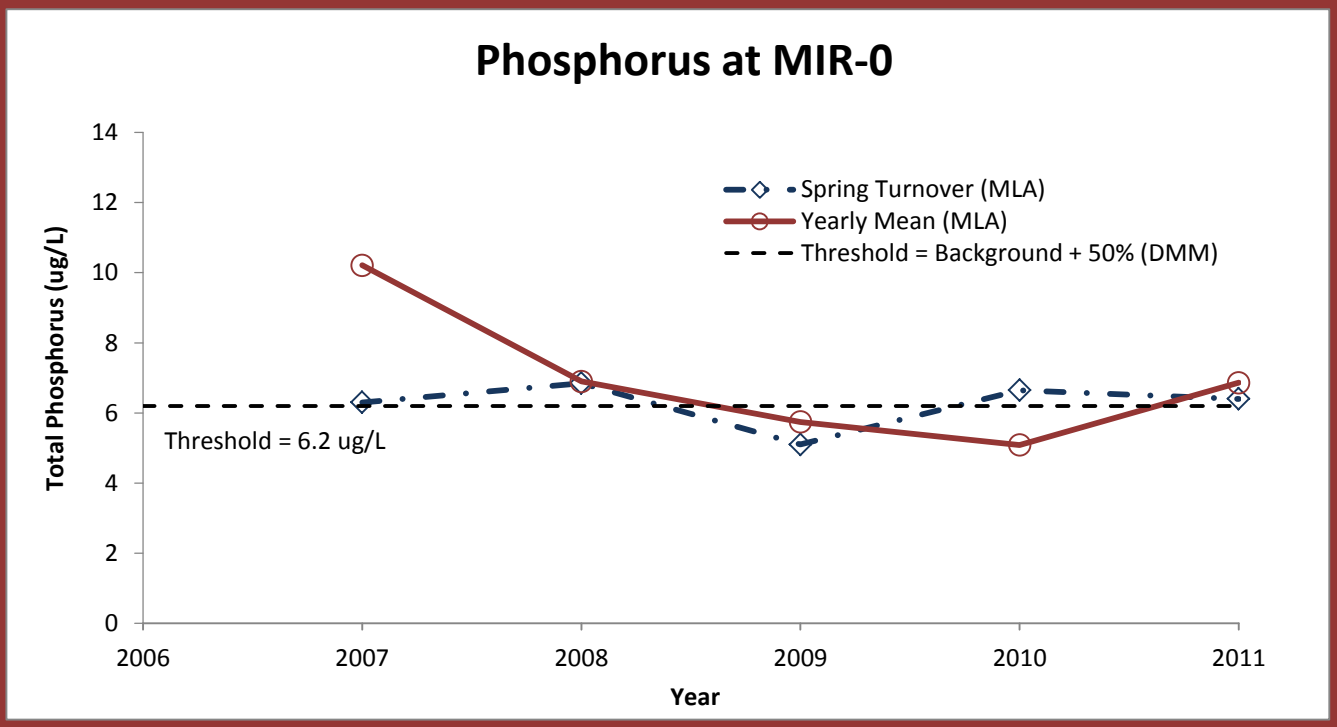
The 2011 spring turnover TP and yearly mean TP concentrations are consistent with historical values with nearly all having been greater than the DMM threshold.

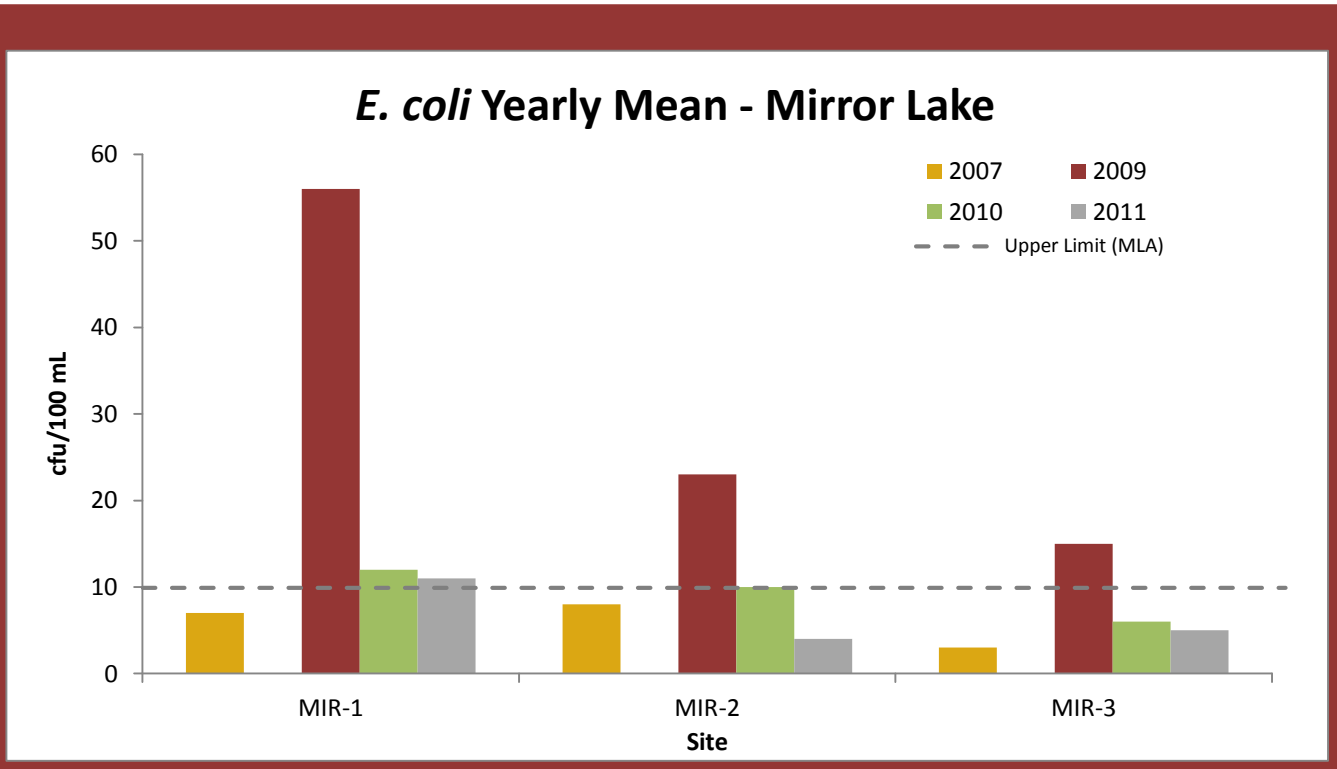
2011 *E. coli* levels were all less than the MLA upper limit with the exception of MIR-1.

Recommendations

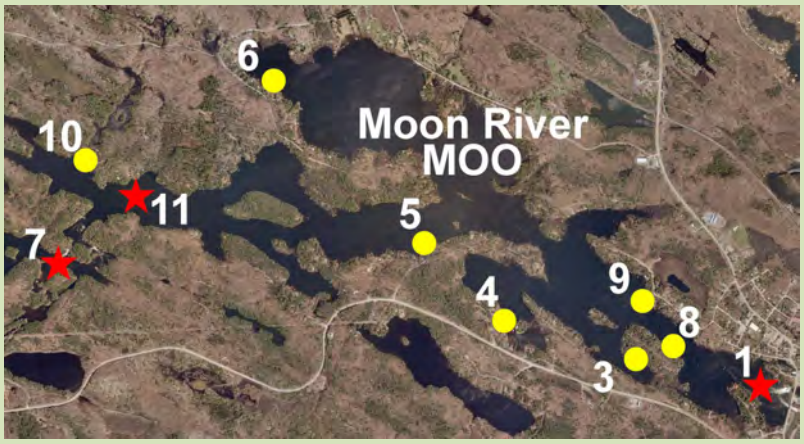
Continue existing sampling protocol in 2012 to monitor long-term trends. Focus on obtaining more samples for yearly mean TP in 2012.

(MIR) MIRROR LAKE





MOON RIVER (MOO)



Area Description

The Moon River is the main outlet of the Muskoka Watershed, flowing from Lake Muskoka to Georgian Bay. The river receives overland drainage from the Town of Bala and its urban area, including many roads and the developed shoreline. Approximately 12 creeks outlet into this sampling area, several draining wetlands.

Volunteer Recognition

Moon River was monitored in 2011 by Simon Dwyer, Tara Murphy, Victoria Murphy, Anne Polewski, **Bruno Polewski**, and Bill Purkis.

2011 Data

MOO-1: TP-Spring turnover = 7.4 µg/L
TP-Yearly mean = 6.1 µg/L
Calcium = 3.39 mg/L
Total coliforms = 9 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

MOO-3: TP-Yearly mean = 5.6 µg/L*
Total coliforms = 15 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

MOO-4: TP-Yearly mean = 7.0 µg/L**
Total coliforms = 27 cfu/100 mL
Total *E. coli* = 7 cfu/100 mL

MOO-5: TP-Yearly mean = 5.9 µg/L**
Total coliforms = 12 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

MOO-6: TP-Yearly mean = 6.3 µg/L**
Total coliforms = 52 cfu/100 mL
Total *E. coli* = 8 cfu/100 mL

MOO-7: TP-Yearly mean = 5.6 µg/L**
Total coliforms = 18 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL
Secchi = 3.4 m$^{\pm}$

MOO-8: TP-Yearly mean = 5.2 µg/L**
Total coliforms = 25 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

MOO-9: TP-Yearly mean = 5.3 µg/L**
Total coliforms = 11 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

MOO-10: TP-Yearly mean = 6.6 µg/L
Total coliforms = 15 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

MOO-11: TP-Yearly mean = 5.1 µg/L*
Total coliforms = 5 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL
Secchi = 3.2 m

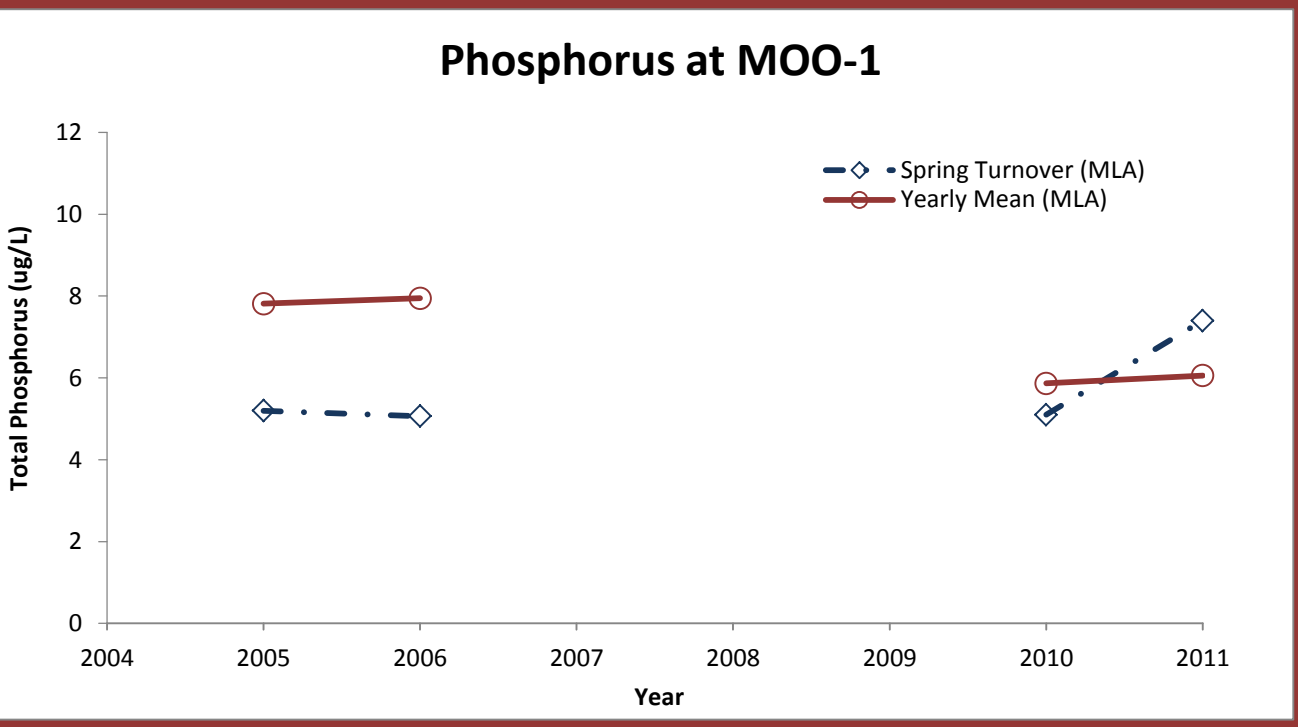
(* based on 3 sampling events; ** based on 2 sampling events; $^{\pm}$ based on 3 measurements)

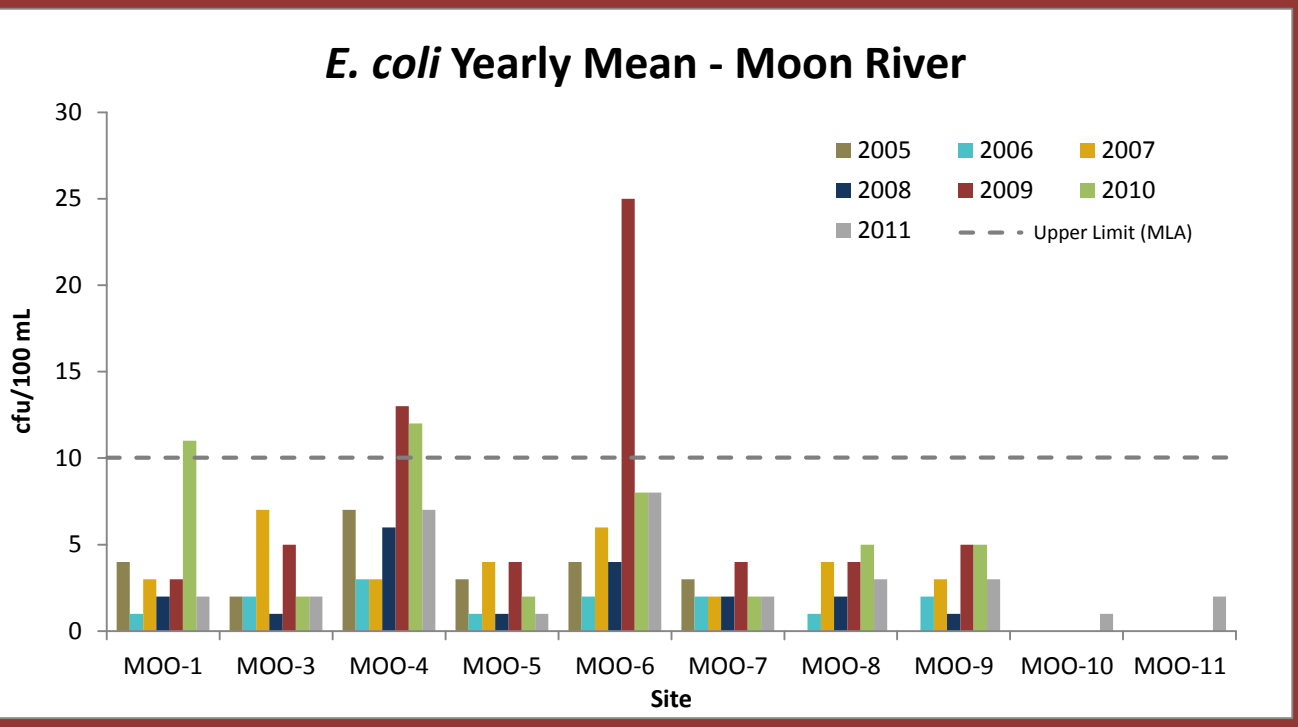
Trends and Recommendations

Monitoring of Moon River started in 2005 and should continue in 2012 following existing sampling protocol to monitor long-term terms.

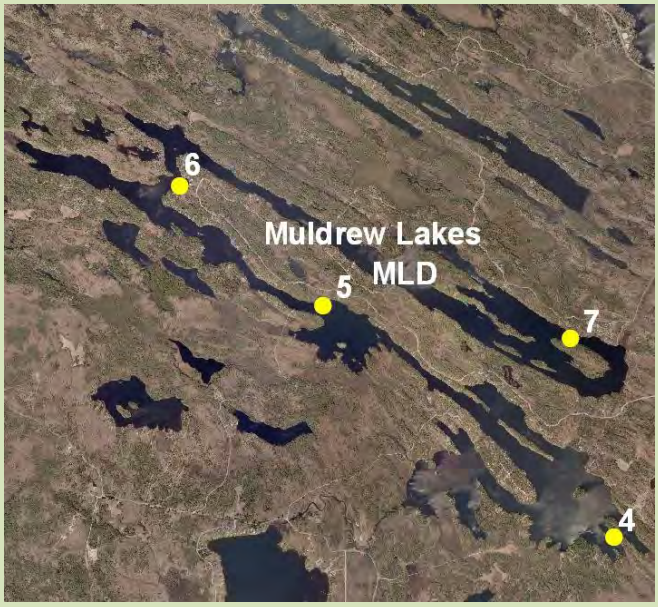
2011 spring turnover TP and yearly mean TP concentrations are consistent with historical values.

(MOO) MOON RIVER





MULDREW LAKES (MLD)



Volunteer Recognition

Muldrew Lakes was monitored in 2011 by **Janet Allen**, **Lola Bratty**, **Michael Foster**, and John Twist.

Area Description

North and South Muldrew Lakes are oriented northwest to southeast, formed as a result of glacial retreat. North Muldrew Lake is approximately 1.52 km² in size, a maximum of 16 m deep and is considered moderately sensitive by the DMM. Several creeks and five wetland areas drain into the lake. There is a large resort area along the eastern shoreline and considerable residential development, most retaining a natural shoreline. South Muldrew Lake is approximately 2.7 km² in area, with a maximum depth of 18 m, and is also classified as moderately sensitive. South Muldrew Lake has less shoreline development than North Muldrew Lake, likely due to the extent of adjacent wetlands. Approximately ten wetland areas drain into the eastern portion of South Muldrew Lake.

2011 Data

MLD-4: Total coliforms = 67 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

MLD-5: Total coliforms = 38 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

MLD-6: Total coliforms = 62 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

MLD-7: Total coliforms = 50 cfu/100 mL
Total *E. coli* = 6 cfu/100 mL

Trends

Monitoring of the Muldrew Lakes started in 2006.

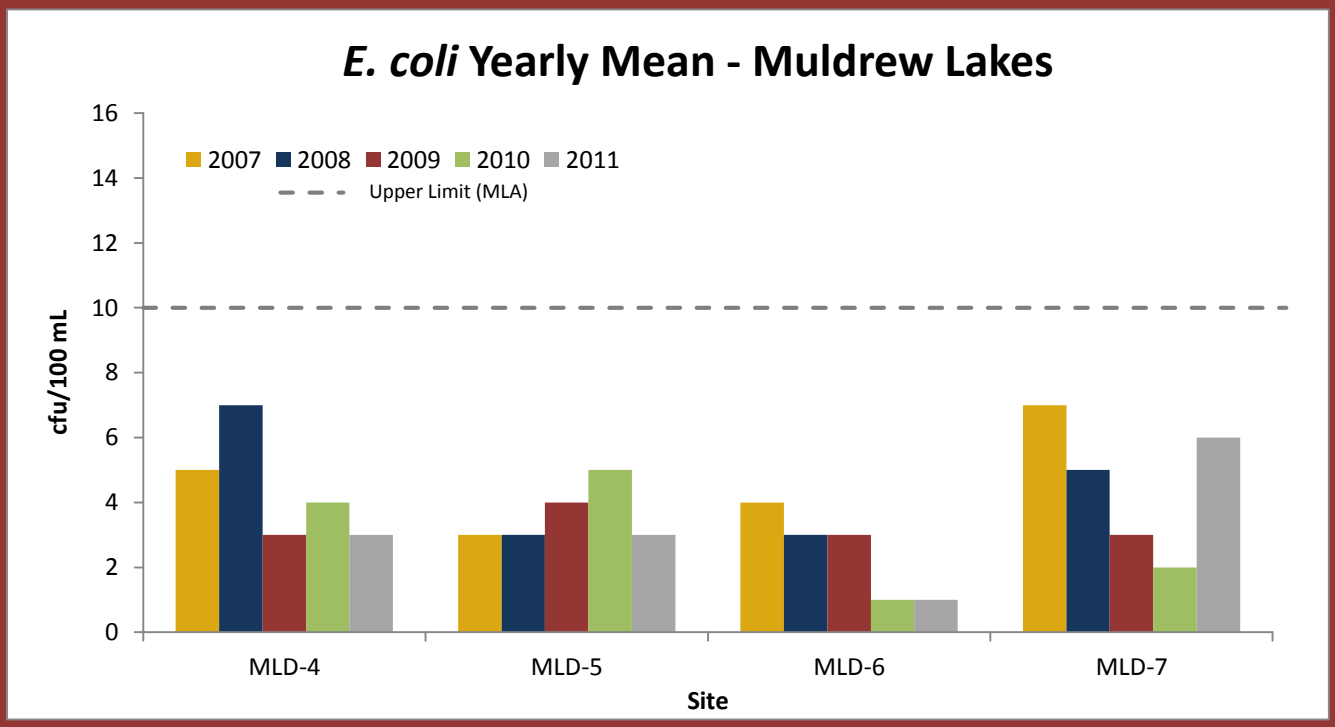
2011 *E. coli* levels at MLD-4 and MLD-5 were lower than 2010 levels.

All 2011 *E. coli* levels were less than the MLA upper limit.

Recommendations

Continue existing sampling protocol in 2012 to monitor long-term trends.

(MLD) MULDREW LAKES



Notes:

MUSKOKA RIVER (MRV)

Area Description

This sample area includes the most downstream reach of the Muskoka River where it flows from the Town of Bracebridge to Alport Bay, Lake Muskoka. This area is highly developed on both banks, and includes the Bracebridge urban area, large agricultural fields, and extensive residential properties along the entire reach of shoreline. Roads are located along both sides of the river for most of the reach length. Several creeks outlet into the river through this area, and there are limited wetland areas adjacent to the river.

Volunteer Recognition

Muskoka River was monitored in 2011 by Debbie Hastings, Jamie Hastings, and **John Wood**.

2011 Data

MRV-2: TP-Yearly mean = 8.1 µg/L
Secchi = 5.1 m
Total coliforms = 106 cfu/100 mL
Total *E. coli* = 19 cfu/100 mL

MRV-3: TP-Yearly mean = 6.9 µg/L
Secchi = 6.0 m
Total coliforms = 100 cfu/100 mL
Total *E. coli* = 5 cfu/100 mL

MRV-4: TP-Yearly mean = 7.6 µg/L
Sechhi = 5.2 m
Total coliforms = 116 cfu/100 mL
Total *E. coli* = 17 cfu/100 mL

MRV-5: TP-Yearly mean = 16.9 µg/L
Total coliforms = 179 cfu/100 mL
Total *E. coli* = 13 cfu/100 mL

MRV-6: TP-Yearly mean = 25.1 µg/L
Total coliforms = 396 cfu/100 mL
Total *E. coli* = 18 cfu/100 mL

Trends

Monitoring of Muskoka River started in 2003.

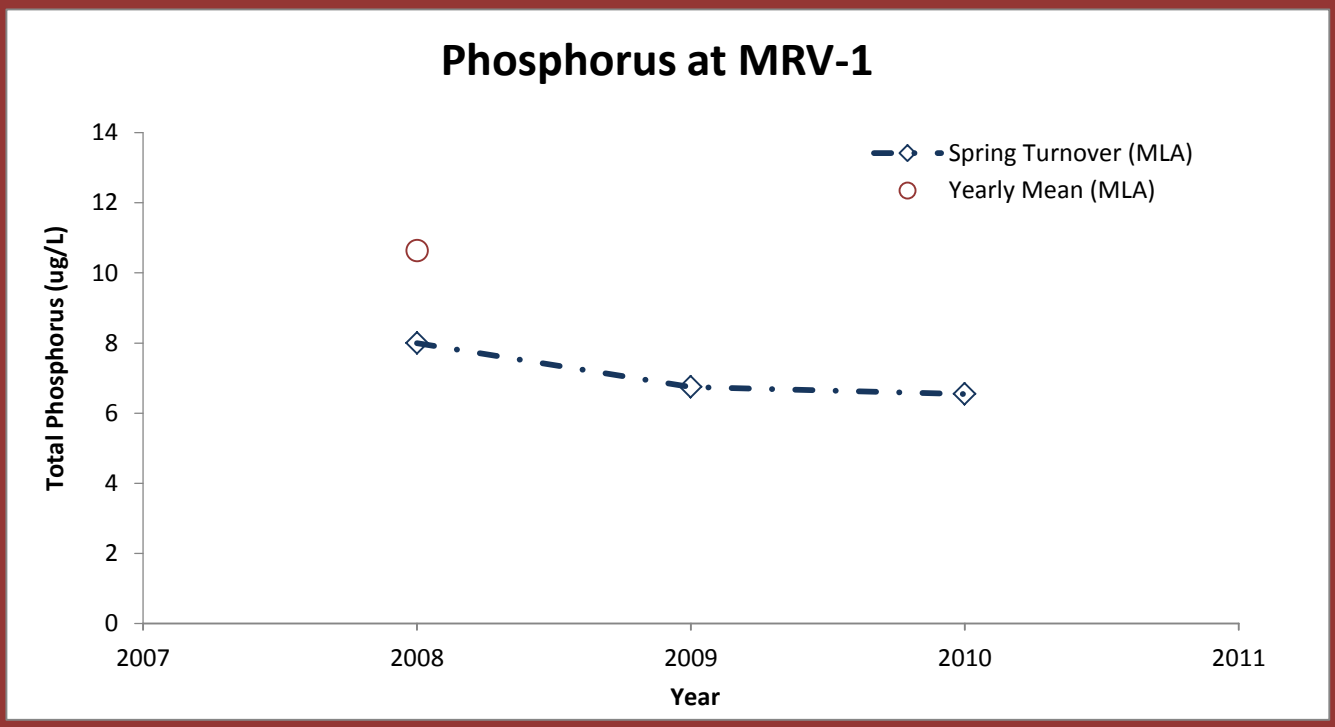
MRV-6 is a newly established site located within Beaver Creek to monitor upstream conditions. The yearly mean TP value at MRV-6 was the highest among all sites monitored.

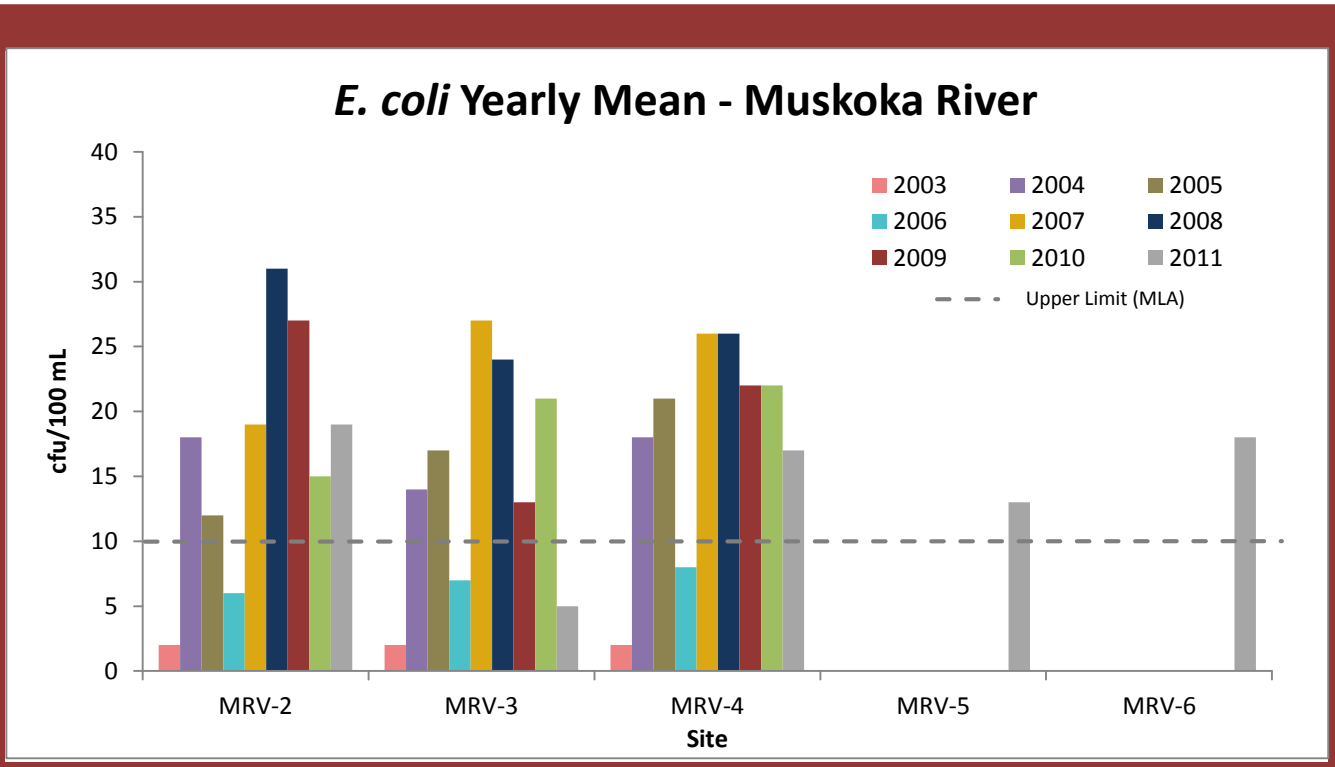
E. coli values were above the MLA upper limit at all sites except MRV-3.

Recommendations

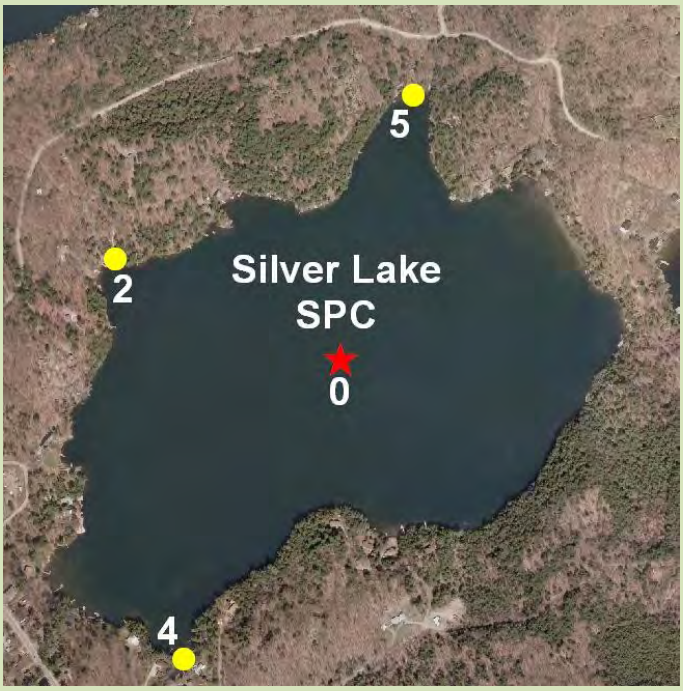
Continue existing sampling protocol to monitor long-term trends.

(MRV) MUSKOKA RIVER





SILVER LAKE (SPC)



Area Description

Silver Lake is immediately adjacent to Port Carling, with 0.57 km² in surface area and a maximum depth of 14 m. This lake has a moderate amount of shoreline residential development with alteration in the form of lawns and thinned forest occurring over approximately 50% of the upland area. The riparian area is well buffered with 90% of the immediate shoreline in a natural state. The southwestern portion of this lake receives drainage from part of the Port Carling urban area. There is limited flow into the lake with one identified outlet in the south. Silver Lake is classified as moderately sensitive by the DMM.

Volunteer Recognition

Silver Lake was monitored in 2011 by **Perry Bowker**.

2011 Data

SPC-0: TP-Spring turnover = 14.8 µg/L
TP-Yearly mean = 8.1 µg/L
Calcium = 5.85 mg/L
Secchi = 5.7 m

SPC-2: Total coliforms = 49 cfu/100 mL
Total *E. coli* = 10 cfu/100 mL

SPC-4: Total coliforms = 42 cfu/100 mL
Total *E. coli* = 17 cfu/100 mL

SPC-5: Total coliforms = 24 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

Recommendations

Continue existing sampling protocol to monitor long-term trends.

Trends

Monitoring of Silver Lake started in 2004.

2011 spring turnover TP at SPC-0 was higher than in 2010 and was greater than the DMM threshold value.

The yearly mean TP at SPC-0 was more consistent with the historic values and was also greater than the DMM threshold value.

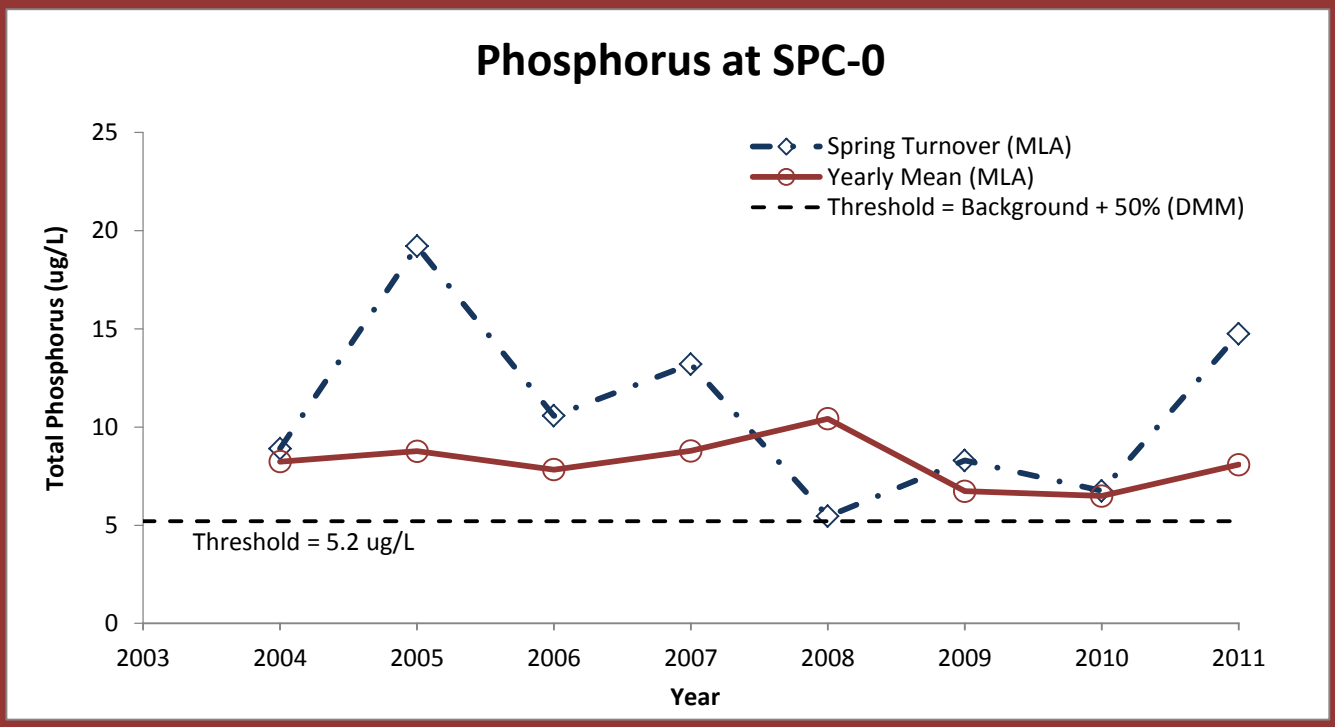
Calcium concentration in Silver Lake is one of the highest recorded values for 2011.

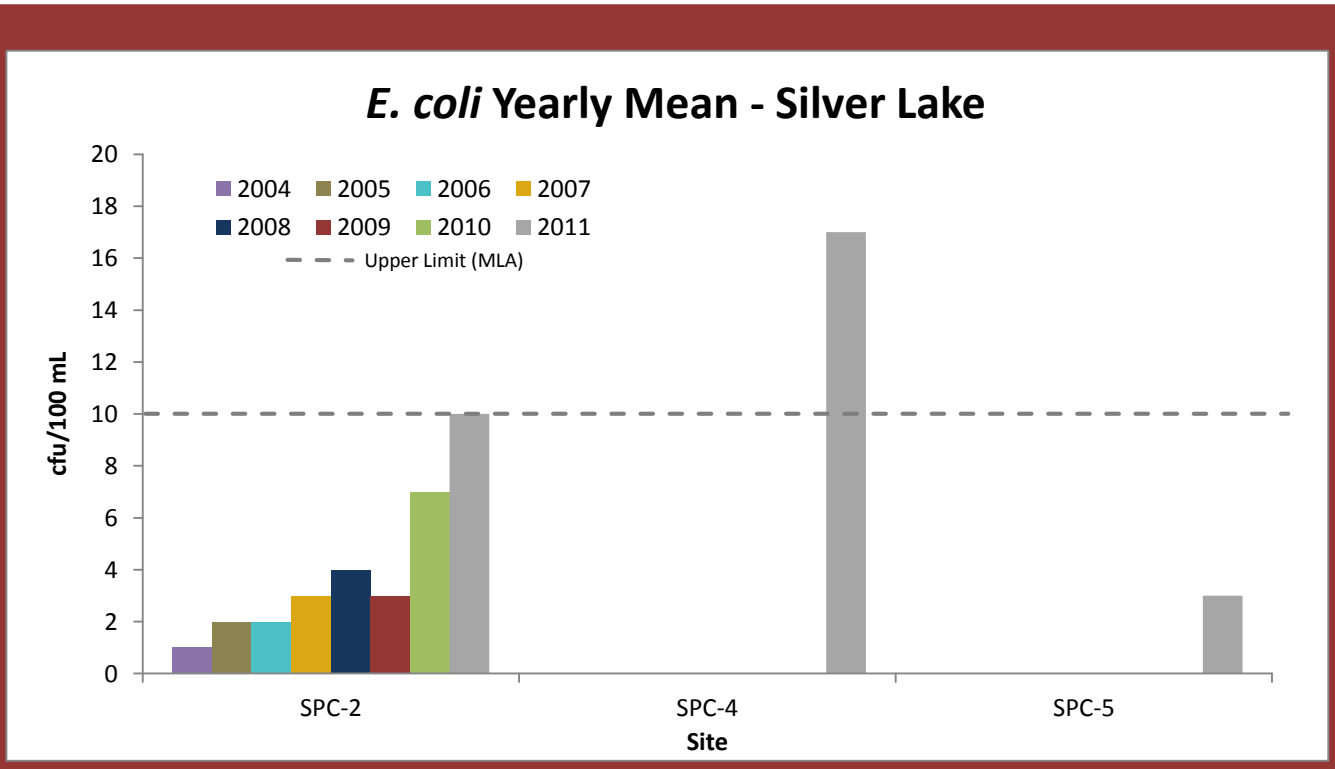
SPC-4 and SPC-5 are newly established sites located in high use areas..

E. coli levels at SPC-4 were higher than the MLA upper limit, whereas *E. coli* levels at SPC-5 were lower than the MLA upper limit.

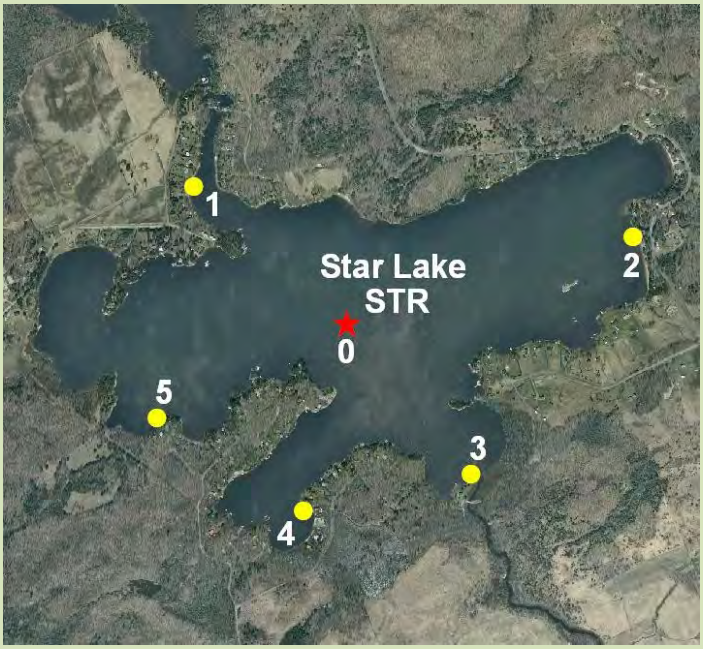
E. coli levels at SPC-2 were at the MLA upper limit.

(SPC) SILVER LAKE





STAR LAKE (STR)



Area Description

Star Lake is located in the Township of Seguin and is approximately 158 ha in area with a maximum depth of 23 m. This lake has a moderate to high level of shoreline development in the form of residential properties. Many of these properties maintain natural riparian vegetation along their shorelines, but some have extensive clearings and lawns. There is a large agricultural area adjacent to the northwestern shore and several roads located in close proximity to the lake. This lake has several inflow and outflow creeks, with limited wetland areas in the upper watershed.

Volunteer Recognition

Star Lake was monitored in 2011 by **Karen Gillies**, Daniel Thurner, Emm Thurner, Lauren Thurner, and Willie Thurner.

2011 Data

STR-0: TP-Spring turnover = 9.7 µg/L
TP-Yearly mean = 9.4 µg/L
Calcium = 2.65 mg/L
Secchi = 2.5 m

STR-1: Total coliforms = 94 cfu/100 mL
Total *E. coli* = 6 cfu/100 mL

STR-2: Total coliforms = 63 cfu/100 mL
Total *E. coli* = 13 cfu/100 mL

STR-3: Total coliforms = 129 cfu/100 mL
Total *E. coli* = 17 cfu/100 mL

STR-4: Total coliforms = 96 cfu/100 mL
Total *E. coli* = 11 cfu/100 mL

STR-5: Total coliforms = 166 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

Trends

Monitoring of Star Lake started in 2007.

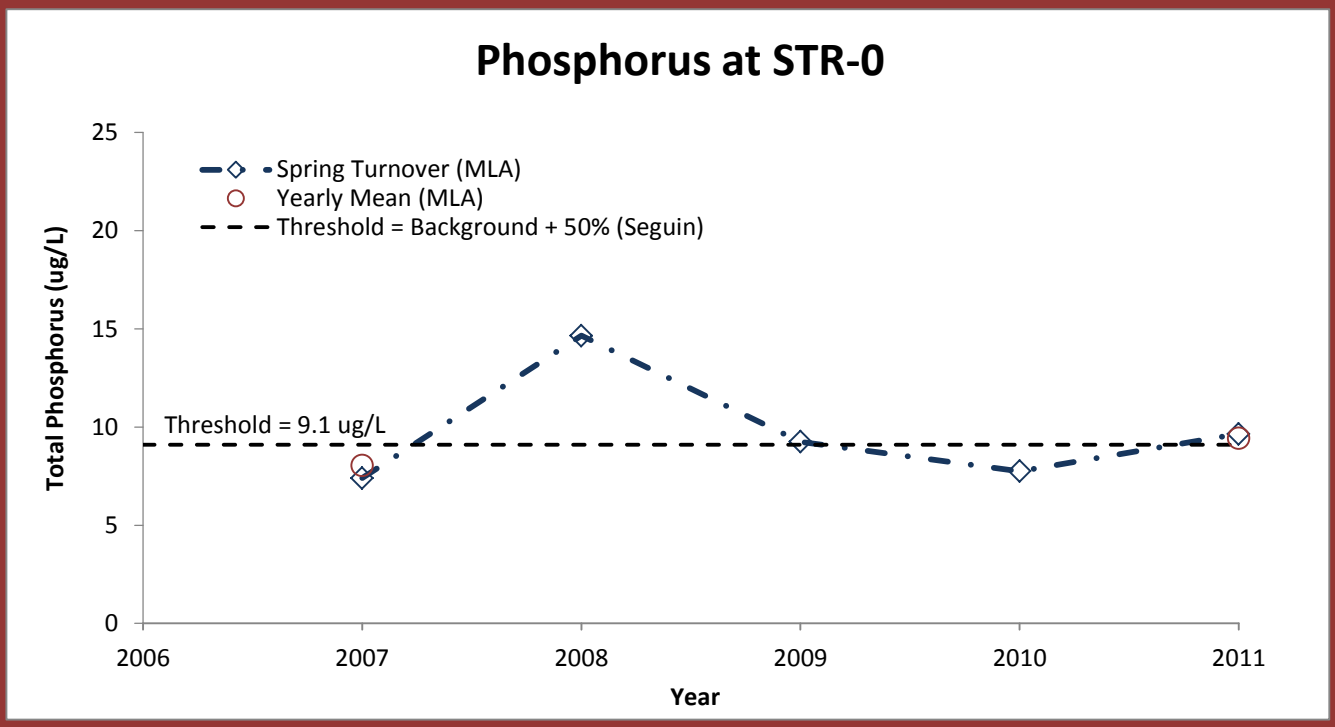
The spring turnover TP at STR-0 is consistent with the historical data and is greater than the DMM threshold.

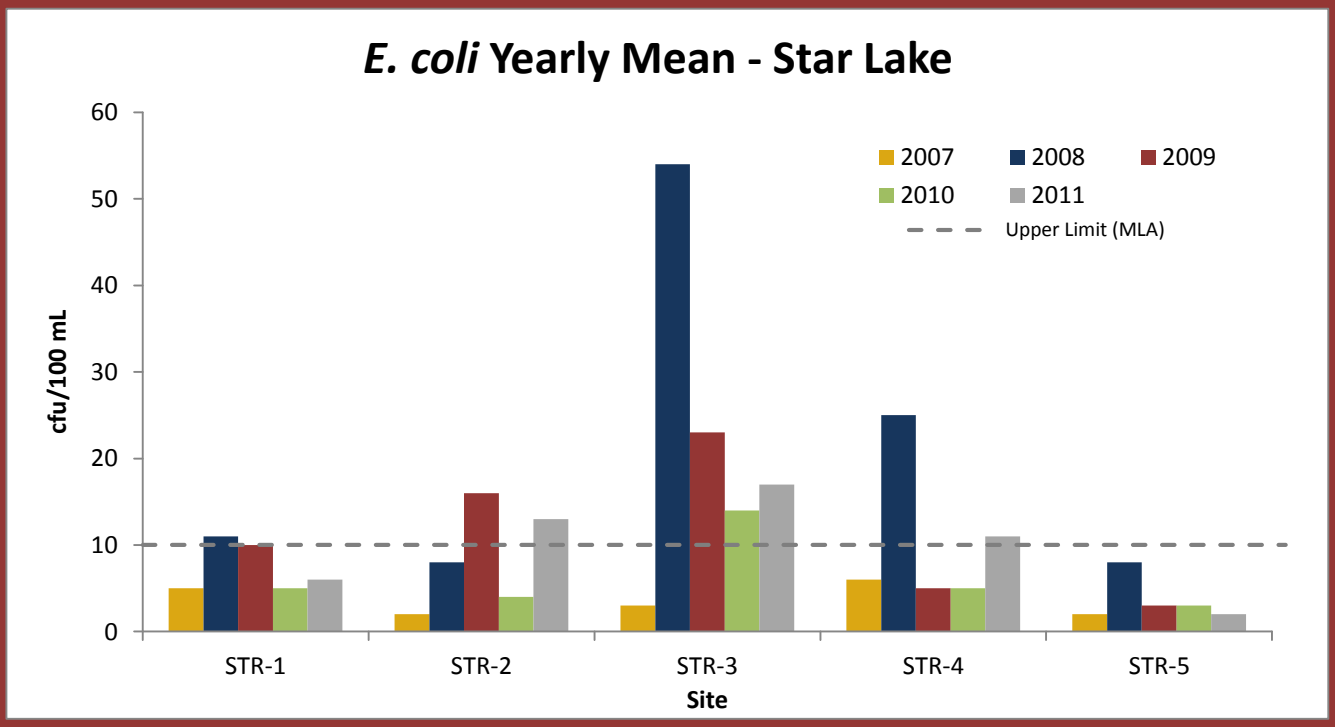
2011 *E. coli* levels at STR-5 were lower than 2010. *E. coli* levels at STR-1 and STR-5 were lower than the MLA upper limit.

Recommendations

Continue sampling spring turnover phosphorus and calcium annually to monitor long-term trends.

(STR) STAR LAKE





SUCKER LAKE (SUC)

Area Description

Sucker Lake is a medium-sized lake that drains into Lake Rosseau, in the Township of Seguin. This lake has low shoreline development intensity, and the riparian area is well vegetated. There are several creeks that drain into the lake, including those with wetland areas. A few roads are constructed in close proximity to the shoreline, including District Road 632 connecting Rosseau and Minett

Volunteer Recognition

Sucker Lake was monitored in 2011 by **Greg Clarkson**, Gail Haber, and Randy Haber.

2011 Data

SUC-0: TP-Spring turnover = 6.6 µg/L
TP-Yearly mean = 5.6 µg/L
Calcium = 2.06 mg/L
Secchi = 3.5 m

Trends

Monitoring of Sucker Lake started in 2009.

SUC-0 has been selected as a long-term monitoring site.

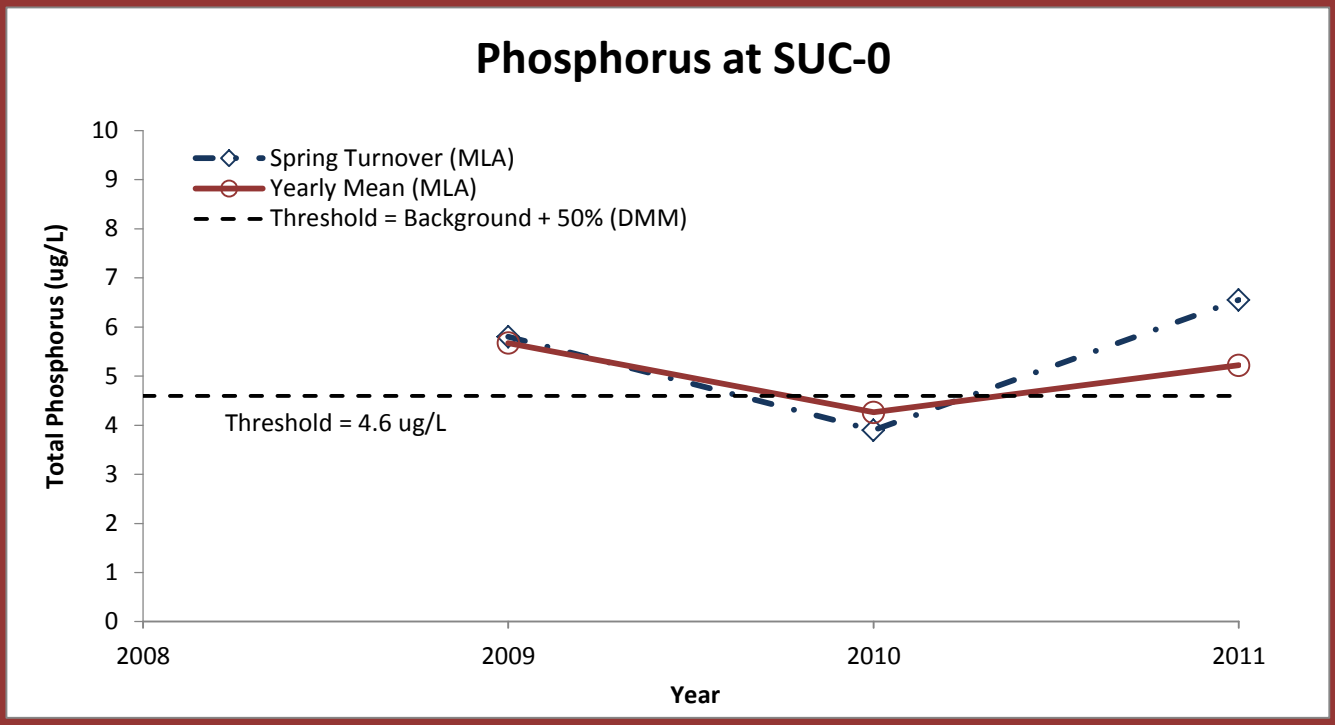
The 2011 spring turnover and yearly mean TP values at SUC-0 were higher than in 2010 and greater than the DMM threshold value.

Calcium concentration in Sucker Lake is one of the lowest recorded values for 2011.

Recommendations

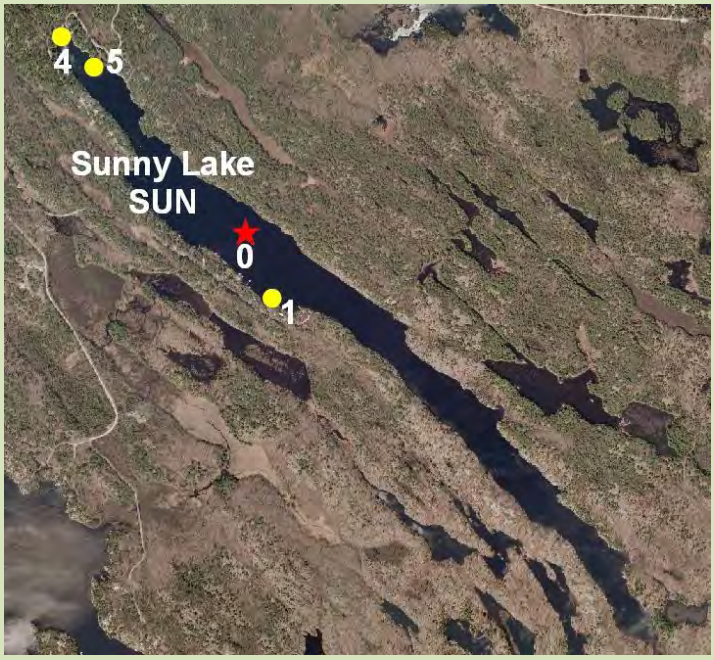
Continue existing sampling protocol to monitor long-term trends.

(SUC) SUCKER LAKE



Notes:

SUNNY LAKE (SUN)



Area Description

Sunny Lake is a long, narrow lake located east of the Town of Gravenhurst, formed as a result of glacial retreat. The lake is approximately 0.5 km² in area, has a maximum depth of 14 m and is part of the Sparrow Lake watershed. The north end of the lake is moderately developed whereas the south end is largely undeveloped. Sunny Lake is classified as moderately sensitive by the DMM.

Volunteer Recognition

Sunny Lake was monitored in 2011 by Norm Grimberg, Drew Kivell, and **Gord Sinclair**.

2011 Data

SUN-0: TP-Spring turnover = 10.2 µg/L
TP-Yearly mean = 9.1 µg/L
Calcium = 2.47 mg/L
Secchi = 3.4 m

SUN-1: Total coliforms = 197 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

SUN-4: Total coliforms = 49 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

SUN-5: Total coliforms = 38 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

Trends

Monitoring of Sunny Lake started in 2008.

The 2011 spring turnover TP and yearly mean TP at SUN-0 are consistent with the historical values and is less than the DMM threshold value.

E. coli levels at SUN-1 and SUN-5 were lower than 2010 levels, while levels at SUN-4 were the same in 2010 and 2011. All 2011 *E. coli* levels were less than the MLA upper limit.

Recommendations

Continue existing sampling protocol in 2012 to monitor long-term trends.

(SUN) SUNNY LAKE