Kawartha Highlands Water Quality Report 2025

For a fifth year in a row, we are pleased to share water quality results from our work in the Kawartha Highlands region. These results add to our growing database (8 years of data now), which represents a substantial source of information on the water quality in the Highlands region. Overall, we find that water quality in our region continues to be very good and to favorably compare with other cottage regions in southern Ontario. In this report, we provide more specific results on multiple aspects of water quality and update you on our progress in building our capacity to better understand water quality in our region.

In addition to the water sampling, we deployed a buoy (see photo to the right) in Catchacoma Lake for about six weeks during early fall 2024. This buoy is self-contained and collects data on a variety of water quality parameters including water temperature and dissolved oxygen at a relatively high frequency (multiple times per hour or more). This short trial in Catchacoma Lake was intended to give us experience deploying, maintaining, and retrieving the buoy. We have plans to deploy buoys for most of the upcoming summer in two lakes as part of doctoral research being conducted by Trent graduate student, Sherryann Prowell. She is studying oxygen dynamics in the Kawartha Highlands lakes and its effects on greenhouse gases and dissolved organic matter..

We would like to hear back from you. Send us a lake science question and we might feature it in a future report. Or email us if you have something else water quality related to discuss whether that's a concern or just a general question. We are happy to share our knowledge of water in the Kawartha Highlands. You can reach us by emailing the Trent Aquatic Research Program at paulfrost@trentu.ca.

This report is produced by the Trent Aquatic Research Program, Trent University, Peterborough, Ontario. Please direct all questions and inquiries about this report to Dr. Paul Frost. Email: paulfrost@trentu.ca

About the Trent Aquatic Research Program

The Trent Aquatic Research Program includes a range of research and monitoring projects on lakes and rivers in southern Ontario. In addition to monitoring water quality, we are involved in projects tracking fish movement in Stoney Lake, studying oxygen dynamics at the bottom of our lakes, and assessing the chemistry of streams draining agricultural catchments in southern Ontario. Our work in the Kawartha Highlands is an important part of this program as it couples our research into water quality trends and lake foodwebs to our goal of collecting and sharing knowledge about the health of our water with shoreline owners, cottagers, and other local stakeholders.

All communications regarding this sampling program should be directed to Dr. Paul Frost (paulfrost@trentu.ca). If you would like us to sample your lake and/or would like to help out with our sampling efforts, send us an email and we will coordinate with you over the summer. We are pleased to be able to continue our water quality program, to share our results, and work together with all of you to complete this important work.

How you can support the Trent Aquatic Research Program?

If you like the limnology and water science presented in this report, please consider supporting the Trent Aquatic Research Program with a donation. The health of our program is connected to your support, which allows us to hire and train students interested in water science. We greatly benefit from indirect and in-kind contributions that allow us to access and sample lakes. Financial contributions from individuals and cottage associates are also especially valuable to us as these funds directly support our program personnel. It is these staff members (students and research associates) that sample lakes, collect and archive high-quality water quality data, and respond quickly to reports of potential water quality issues.

To learn more about our program and how you can donate, visit: https://mycommunity.trentu.ca/tarp. Click on support TARP and choose “Kawartha Lake Monitoring Program” or “TARP Endowment” from the drop down menu. All questions and related inquiries about how to support TARP should be directed to:

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What do we measure?

Our water research program at Trent has access to world-class facilities and highly specialized equipment to study water quality in and between lakes. Below is a partial list of parameters that we measure as part of our program. For information on each of these parameters, please refer to our Primer Report 2021 or send us an email. All of these data (for any lake and any year) that we sampled are available on request. Parameters that are bolded are shown on the following pages for the lakes included in our on-going monitoring activities.

Parameter	Units
Specific conductivity	µS/cm
Dissolved oxygen, concentration	mg/L
Dissolved oxygen, percent saturation	**%**
Water temperature	°C
Secchi depth	m
pH	
Total suspended solids	mg/L
Dissolved organic carbon	mg C/L
Absorbance at 280 nm	cm^{-1}
Molar absorptivity at 280 nm	L mol C^{-1} cm^{-1}
Total phosphorus	µg P/L
Total dissolved phosphorus	µg P/L
Particulate phosphorus	µg P/L
Total dissolved nitrogen	µg N/L
Nitrate	µg N/L
Ammonium	µg N/L
Chlorophyll a	µg/L
Dissolved calcium	mg Ca/L

When and where did we sample?

We collect water quality data from about 30 lakes in the Kawartha Highlands region each summer. Many of the lakes we sample every year whereas others, primarily more remote lakes in the Kawartha Highlands Provincial Park, are sampled on a less frequent basis (every 2 or 3 years). In 2024, we sampled lakes listed here on the dates indicated below.

Lake	Date Sampled
Anstruther	August 8, 2024
Beaver	July 25, 2024
Big Cedar	July 18, 2024
Bottle	August 6, 2024
Buzzard	August 7, 2024
Catchacoma	August 1, 2024
Chandos	July 22, 2024
Crystal	July 24, 2024
Eels	July 22, 2024
Galloway	August 14, 2024
Gold	July 25, 2024
Jack	July 22, 2024
Kasshabog	July 19, 2024
Little Turtle	August 13, 2024
Long	July 30, 2024

Lake	Date Sampled
Looncall	July 30, 2024
Loucks	July 30, 2024
Lower Stoney	July 26, 2024
Mississauga	July 25, 2024
North Rathbun	August 8, 2024
Pencil	July 15, 2024
Picard	July 23, 2024
Raccoon	August 1, 2024
Rathbun	August 8, 2024
Salmon	July 23, 2024
Sawmill	August 13, 2024
Sucker	August 6, 2024
Upper Stoney	July 26, 2024
Wolf	July 30, 2024

Chlorophyll a

Lake	Average*	2024
Anstruther	3.11	1.11
Beaver	3.73	4.86
Big Cedar	2.90	1.93
Bottle	4.88	3.10
Buzzard	2.54	1.00
Catchacoma	2.43	0.26
Chandos	2.62	1.22
Crystal	2.01	1.22
Eels	3.33	1.69
Galloway	n.a.	3.32
Gold	2.59	2.30
Jack	2.81	1.56
Kasshabog	2.94	1.79
Little Turtle	3.36	2.76
Long	2.23	0.99
Looncall	3.52	0.91
Loucks	2.94	0.87
Lower Stoney	7.12	4.65
Mississauga	2.83	1.88
North Rathbun	6.69	3.11
Pencil	2.93	2.15
Picard	2.37	1.04
Raccoon	3.80	1.83
Rathbun	2.60	1.24
Salmon	1.61	0.76
Sawmill	4.75	3.70
Sucker	4.19	1.34
Upper Stoney	3.74	3.62
Wolf	3.60	1.03

Background. *Chlorophyll a* (μg/L) is a plant pigment that we measure to estimate algal biomass in the surface waters. Values close to or below 5 μg/L are generally considered good and a sign of low algal biomass.

2024 results. *Chlorophyll a* concentrations continue to be low to very low in most Kawartha Highlands lakes. These values indicate generally good water quality and low algal biomass in our lakes. Also noteworthy is that chlorophyll concentrations were almost universally lower in Kawartha Highland lakes in 2024 compared to 2022 and 2023. While there are generally year to year fluctuations in many limnological parameters, synchronous changes (such as we are seeing with chlorophyll *a*) indicate regional (e.g., weather) drivers of lake algal communities.

*The average was calculated using all of the data we have for each lake between the years of 2015-2024 which for most lakes is 6 or 7 sampling years.

Secchi Depth

Lake	Average*	2024
Anstruther	4.48	4.5
Beaver	4.54	6.0
Big Cedar	5.18	6.0
Bottle	2.67	3.0
Buzzard	5.42	5.0
Catchacoma	3.82	4.5
Chandos	5.17	6.5
Crystal	6.25	6.5
Eels	3.94	4.5
Galloway	n.a.	3.3
Gold	5.03	5.0
Jack	5.35	7.0
Kasshabog	4.75	4.5
Little Turtle	4.08	3.5
Long	4.84	3.5
Looncall	4.59	5.8
Loucks	4.29	5.5
Lower Stoney	3.41	4.3
Mississauga	4.59	5.5
North Rathbun	3.24	3.3
Pencil	3.93	4.0
Picard	5.25	6.0
Raccoon	4.08	4.3
Rathbun	4.49	4.0
Salmon	6.95	7.0
Sawmill	3.20	3.0
Sucker	4.54	4.0
Upper Stoney	4.70	4.5
Wolf	4.25	4.5

Background. *Secchi depth* (m) is a measure of water clarity based on how deep you can see a disk dropped into the water. Generally, deeper depth indicates clearer waters and Secchi depths of less than 2 m are generally considered to be of concern.

2024 results. There were no unusual observations for Secchi depth found in summer of 2024. Most lakes were found to have Secchi depths of between 4 and 6 meters with most 2024 depths close to the long term average. Less transparency was found in Bottle and Sawmill lakes (3.0 m) but these values are close to those previously found. More lakes than normal had Secchi depths of 6.0 m or more, which is consistent with very clear water. Overall, Secchi depth measurements from 2024 are indicative of good water quality in the Kawartha Highlands lakes.

*The average was calculated using all of the data we have for each lake between the years of 2015-2024 which for most lakes is 6 or 7 sampling years.

Dissolved Calcium

Lake	Average*	2024
Anstruther	5.4	7.6
Beaver	6.3	6.3
Big Cedar	28.7	27.7
Bottle	3.1	5.8
Buzzard	2.2	2.3
Catchacoma	6.1	6.5
Chandos	21.7	22.3
Crystal	31.2	33.4
Eels	7.6	7.5
Galloway	n.a.	26.7
Gold	5.5	6.8
Jack	24.2	32.5
Kasshabog	8.1	9.9
Little Turtle	6.4	6.7
Long	4.5	5.2
Looncall	7.6	7.6
Loucks	4.3	5.0
Lower Stoney	29.9	35.8
Mississauga	6.4	6.6
North Rathbun	1.8	1.6
Pencil	15.4	15.7
Picard	29.4	31.3
Raccoon	17.9	17.0
Rathbun	1.6	1.6
Salmon	27.6	26.7
Sawmill	2.9	3.2
Sucker	2.9	4.1
Upper Stoney	25.1	25.3
Wolf	5.8	6.6

Background. *Dissolved calcium* (mg/L) is an important nutrient that is connected to whether your lake has hard or soft water. Values lower than 5 mg/L indicate soft water lakes whereas values above 10 mg/L are a sign that your lake has relatively harder water in our area. It has been reported that some lakes are experiencing reduced Ca concentrations in the Muskoka and Haliburton regions. These reductions have led to concerns about effects on zooplankton communities and lake health.

2024 results. As in the past, Kawartha Highlands lakes show a wide range of dissolved calcium concentrations, which likely reflect geological processes in their upstream catchments. Across all the years that we have sampled, we have seen no evidence or trend in decreasing calcium in Kawartha Highlands lakes. There are two lakes (Rathbun and N. Rathbun) which are particularly low (<2.0 mg Ca/L) and several other lakes on the low end (Buzzard, Sawmill, and Sucker). It would be worthwhile to continue to monitor these lakes to see if Ca concentrations are stable in these lakes. Otherwise, low Ca does not appear to be a general issue for Kawartha Highlands lakes.

*The average was calculated using all of the data we have for each lake between the years of 2015-2024 which for most lakes is 6 or 7 sampling years.

Total Phosphorus

Lake	Average*	2024
Anstruther	4.64	6.3
Beaver	6.29	7.8
Big Cedar	6.01	5.2
Bottle	8.94	8.2
Buzzard	5.68	5.9
Catchacoma	5.65	9.1
Chandos	6.67	5.8
Crystal	6.64	6.3
Eels	5.96	8.2
Galloway	n.a.	16.0
Gold	6.06	6.5
Jack	4.88	4.8
Kasshabog	4.77	4.0
Little Turtle	6.90	14.2
Long	6.68	7.6
Looncall	6.40	20.5
Loucks	5.60	14.4
Lower Stoney	14.66	19.8
Mississauga	5.31	3.7
North Rathbun	10.15	8.0
Pencil	6.16	6.9
Picard	5.64	3.9
Raccoon	5.48	6.1
Rathbun	7.24	10.1
Salmon	5.78	3.3
Sawmill	9.00	20.1
Sucker	6.47	12.1
Upper Stoney	7.89	9.3
Wolf	6.41	11.7

Background. *Total phosphorus* (μg/L) is an important water quality parameter as phosphorus is a growth-limiting nutrient that limits the proliferation of algal biomass in the Kawartha Highlands (see page 12).

2024 results. Most Kawartha Highlands lakes show total phosphorus (TP) concentrations below 10 μg/L as has been the case since we began monitoring in 2015. Many lakes had higher TP concentrations in 2024 with some lakes well above the long-term average. Despite this year to year variation, we see no emerging trends and no apparent long term changes in total phosphorus in Kawartha Highlands lakes. While higher TP concentrations are concerning, the lack of effect on chlorophyll or on Secchi depths suggests that that these higher phosphorus values did not translate into higher algal growth. Nonetheless, this is an area that we will be closely watching in the upcoming summer.

*The average was calculated using all of the data we have for each lake between the years of 2015-2024 which for most lakes is 6 or 7 sampling years.

Specific Conductivity

Lake	Average*	2024
Anstruther	34.0	36.0
Beaver	48.8	49.4
Big Cedar	192.7	191.7
Bottle	21.6	22.7
Buzzard	18.2	19.0
Catchacoma	48.9	49.3
Chandos	146.2	151.2
Crystal	187.3	188.4
Eels	49.7	50.1
Galloway	n.a.	224.0
Gold	38.5	39.2
Jack	143.9	148.8
Kasshabog	86.5	90.4
Little Turtle	43.8	44.0
Long	31.5	35.9
Looncall	50.2	43.9
Loucks	30.4	27.2
Lower Stoney	208.1	223.8
Mississauga	46.1	47.3
North Rathbun	15.4	15.5
Pencil	95.5	98.5
Picard	220.6	229.7
Raccoon	112.7	117.2
Rathbun	13.2	13.9
Salmon	171.1	171.4
Sawmill	20.1	21.3
Sucker	21.9	21.8
Upper Stoney	183.0	178.5
Wolf	43.1	60.9

Background. *Specific conductivity* (µS/cm) is a measure of electrical conductance through water. This tells us about the hardness of water with more mineral-rich water having more ions and higher conductivity. Conductivity generally increases when rocks dissolve into groundwater. For Kawartha Highland lakes, this is generally reflective of the relative contribution of rainwater and of certain geological features in each lake's catchment. These ions are not especially biologically reactive and so this number doesn't vary much seasonally or year to year.

2024 results. Specific conductivity varied widely among Kawartha Highland lakes in 2024 with few/small differences from the long-term mean. There is also no clear spatial pattern (e.g., north to south) in specific conductivity with lakes having higher values located very close to lakes with lower values. Resolving the source of this spatial variation remains a topic of interest as it reflects a combination of weather, hydrological, and geological variables.

*The average was calculated using all of the data we have for each lake between the years of 2015-2024 which for most lakes is 6 or 7 sampling years.

Dissolved Oxygen

Lake	DO % saturation	DO Conc. (mg/L)
Anstruther	68.1	11.89
Beaver	29.1	4.97
Big Cedar	22.8	3.69
Bottle	40.1	6.83
Buzzard	5.78	1.01
Catchacoma	79.3	13.90
Chandos	38.9	6.86
Crystal	57.2	9.84
Eels	42.0	7.47
Galloway	67.1	8.48
Gold	75.5	13.26
Jack	57.1	9.89
Kasshabog	19.5	3.41
Little Turtle	5.69	1.01
Long	48.9	8.48
Looncall	5.35	0.90
Loucks	21.9	3.78
Lower Stoney	27.9	3.53
Mississauga	81.1	13.96
North Rathbun	5.09	0.88
Pencil	51.8	9.09
Picard	8.94	1.61
Raccoon	4.74	0.82
Rathbun	68.8	12.32
Salmon	18.4	3.25
Sawmill	8.71	1.33
Sucker	29.3	5.12
Upper Stoney	37.1	6.16
Wolf	19.6	2.42

Background. *Dissolved oxygen* is the amount of O_2 found dissolved in the water. Concentrations shown here are from measurements about 1 m from the lake floor. Also provided is the % saturation value, which if less than 20% indicates sustained O_2 consumption in the lake's hypolimnion.

2024 results. Dissolved oxygen concentrations at the bottom of Kawartha Highlands lakes varies a lot from lake to lake. Lower values are generally found in shallower and darker lakes. Very low values in the lake's bottom waters are not necessarily a sign of lake impairment but can be problematic for populations of some fish species (e.g., lake trout). Very low DO was found in Buzzard, Little Turtle, Looncall, Picard, Raccoon, and Sawnmill lakes in 2024.

These values are from the 2024 sampling of the Kawartha Highlands lakes.

News from the Program

One of the goals of the Trent Aquatic Research Program is share the knowledge we gain from studying lakes and rivers. This sharing includes through our websites and outlets like this report to the general public. We also publish in scientific publications with articles intended for a more technical audience. Here are some of our recent more technical scientific products from the program.

Recent Publications

King, S.S., P.C. Frost, S.B. Watson and M.A. Xenopoulos. 2023. Transitions in dissolved organic phosphorus and dissolved organic carbon across a freshwater estuary gradient. Journal of Geophysical Research: Biogeosciences 128: e2023JG007601

Rice, M.J., C.L.C. Jones, C.W.E. Starke and P.C. Frost. 2021. Calcium stress in *Daphnia pulicaria* and exposure to predator-derived cues: Making a bad situation worse? Freshwater Science 40: 449-462.

Rohde, E., N.J. Pearce, J. Young and M.A. Xenopoulos. 2022. Applying early warning indicators to predict critical transitions in a lake undergoing multiple changes. Ecological Applications *32*: e2685.

Stevens, C.M., P.C Frost, N.J.T. Pearce, J.D. Kelley, A. Zastepa, A.T. Fisk and M.A. Xenopoulos. 2025. Limnological data derived from high frequency monitoring buoys are asynchronous in a large lake. PLoS ONE 20: e0314582. (https://doi.org/10.1371/journal.pone.0314582)

Conference Presentations (Years 2024-25)

Cook, S. and P.C. Frost. 2025. Variable sensitivity of growth rate to calcium limitation among populations of Daphnia pulicaria from the Kawartha Highland Lakes. Society of Canadian Aquatic Sciences. Hamilton, Ontario.

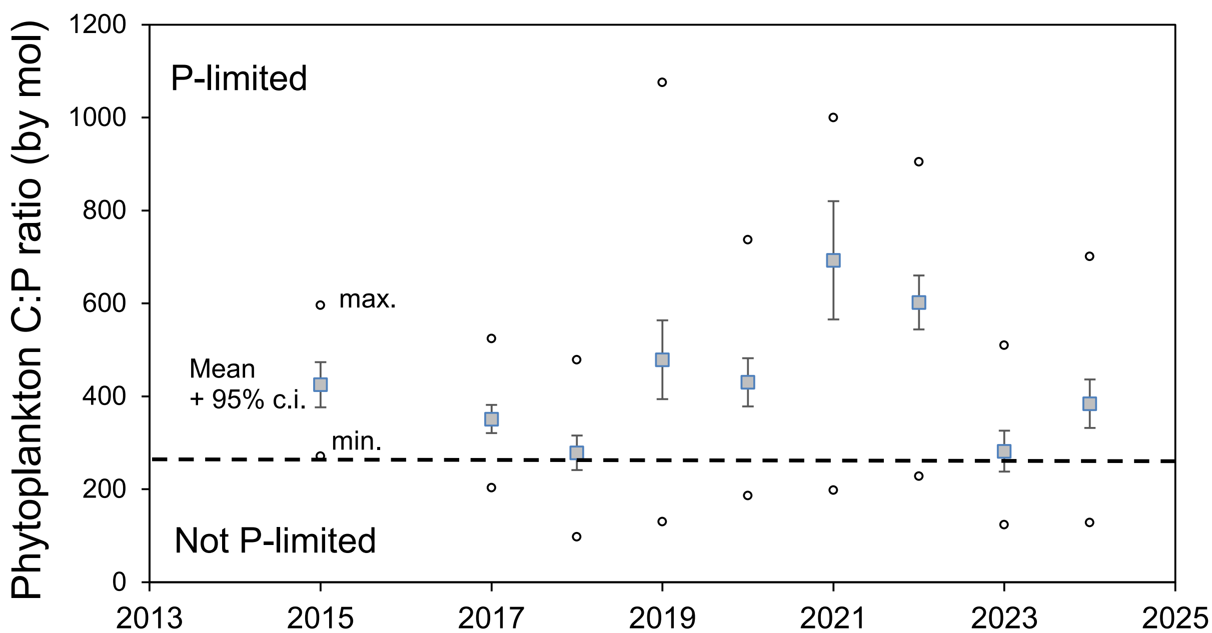
Denga M.I., N.J.T. Pearce, P.C. Frost and M.A. Xenopoulos. 2024. The influence of lake morphometry on hypolimnetic oxygen demand and deep-water oxygen. Association for the Sciences of Limnology and Oceanography. Madison, WI.

Doughty, K.D., C.L.C. Jones, N.J.T. Pearce and P.C. Frost. 2023. Low O_2 in the hypolimnion: Does it affect phytoplankton communities? Society of Canadian Aquatic Sciences, Annual Meeting, Montreal, QC.

Prowell, S., J. Kelley, M. Denga, N. Pearce, P.C. Frost and M.A. Xenopoulos. 2024. Changes in dissolved organic matter composition with hypoxia in freshwater lakes. American Geophysical Union, Washington, D.C.

Assessing nutrient limitation in lake phytoplankton

How do we know if algae in your lake are limited by phosphorus or by some other resource (like light or nitrogen)? Lake ecologists have thought up numerous approaches to determine what the primary limiting resource for phytoplankton because the answer to this question helps guide decisions about how to control excessive algal growth and maintain good water quality. One commonly used approach to diagnose the nutrient in shortest supply is to look at the ratio of carbon to phosphorus (C:P) in phytoplankton cells. Previous work has shown that C:P ratios above 200 or 300 indicates P-deficiency and are good evidence that phytoplankton communities are starved for phosphorus. The average C:P ratio of phytoplankton in Kawartha Highland lakes (across all years) is 436, which is easily in the P-limited range. Looking at the numbers through time, there are yearly differences in C:P ratios (see figure below) and, in any one year, we find some lakes have higher values than others. So while our lakes appear to have phytoplankton that are strongly and perpetually P-limited (a good sign), there remains a need to figure what is the source of this spatial and temporal variation.



Phytoplankton carbon:phosphorus ratios (C:P ratios) in Kawartha Highland lakes over the years 2015-2024. Values above the dotted line indicate moderate to strong P-limitation of phytoplankton communities. Shown are means with 95% confidence intervals for all lakes sampled each year.