Hotel Lake 2024

Year One Report

BC Lake Stewardship Society

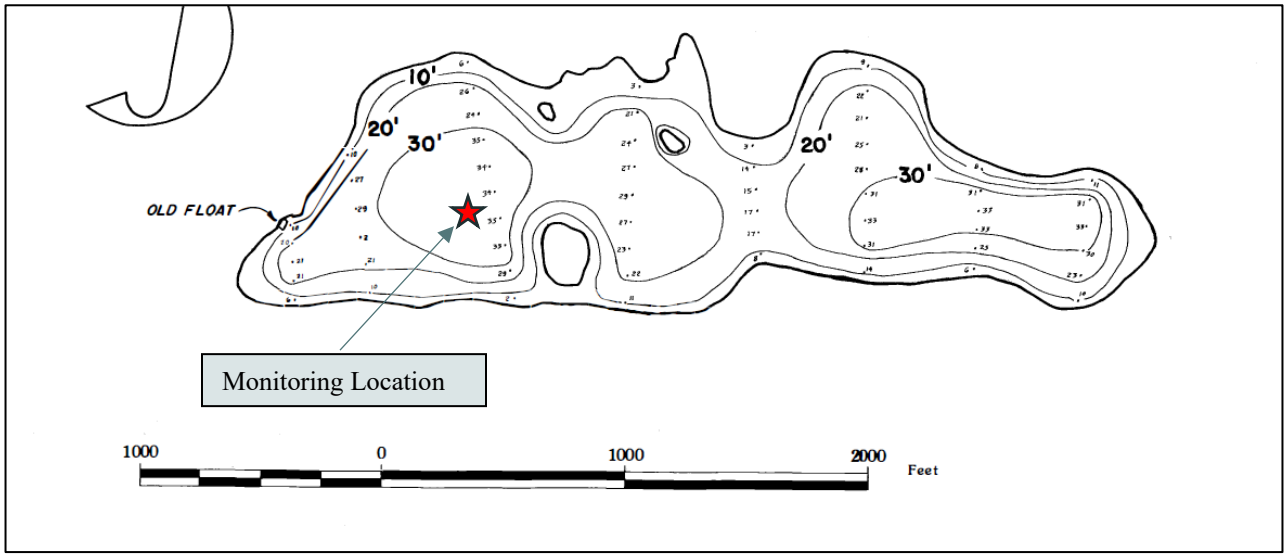
Image obtained from the Hotel Lake Advisory Association website

General Information

This report includes a year one summary of Level 1 BC Lake Stewardship and Monitoring Program (BCLSMP) Data from Hotel Lake collected by volunteers between February 5 and December 8, 2024. The Level 1 program includes seasonal Secchi depth and surface temperature measurements, with the addition of dissolved oxygen and temperature profiles. Conductivity readings were also collected at Hotel Lake by volunteers between May 31 and August 14, 2024.

Hotel Lake is located in the Pender Harbour area on the Sunshine Coast, approximately 50 km northwest of Sechelt, BC. The lake is located at an elevation of 57 m above sea level. The lake has a maximum depth of 10.6 m, an average depth of 5.9 m, and a surface area of 25.22 hectares (BC MOE, 2025). Hotel Lake has been stocked with Cutthroat Trout (*Oncorhynchus clarkii*) since at least

the 1960's (BC MOE, 2025). Other fish species present in Hotel Lake include Peamouth Chub (*Mylocheilus caurinus*), Sculpin (*Cottoideas sp.*), and Threespine Stickleback (*Gasterosteus aculeatus*) (BC MOE, 2025). A bathymetric map of Hotel Lake and approximate monitoring location is included in the figure below. The coordinates of the monitoring site are 49.639333, -124.048833.



Hotel Lake is located within the Ruby Creek watershed, which has a drainage basin area of 6,910 hectares (BC MOE, 2025b). Hotel Lake is a headwater lake, as it is the highest elevation lake in the area (HLAA, 2025). Due to this, the majority of water entering Hotel Lake is through precipitation, groundwater, or a small wetland area at the east end of Hotel Lake (HLAA, 2025). Water from Hotel Lake exits through an outlet on the north side of the lake, which flows downstream to nearby Mixal Lake (HLAA, 2025).

Hotel Lake is used for recreational purposes such as kayaking, swimming, and fishing. It is also part of the North Pender Harbour Water Service Area (NPHWSA). Water from nearby Garden Bay Lake is used for domestic purposes, with Hotel Lake available as a secondary supply in emergency situations (SCRD, 2016). Monitoring at Hotel Lake has been conducted for several years by local volunteers (https://www.hotellakeadvisory.com/library). Lake level readings have been collected since September 2021 by the Hotel Lake Advisory Association (and since the early 2000's by other volunteers) as an indicator of general health of Hotel Lake. Other observations collected by the HLAA include rainfall data, spawning dates, weather patterns, and running times of the outlet of Hotel Lake (HLAA, 2025). Observations from volunteers indicate that the lake level on November 15, 2024 was the highest that has been recorded in the last three years.

Quality Assurance and Quality Control

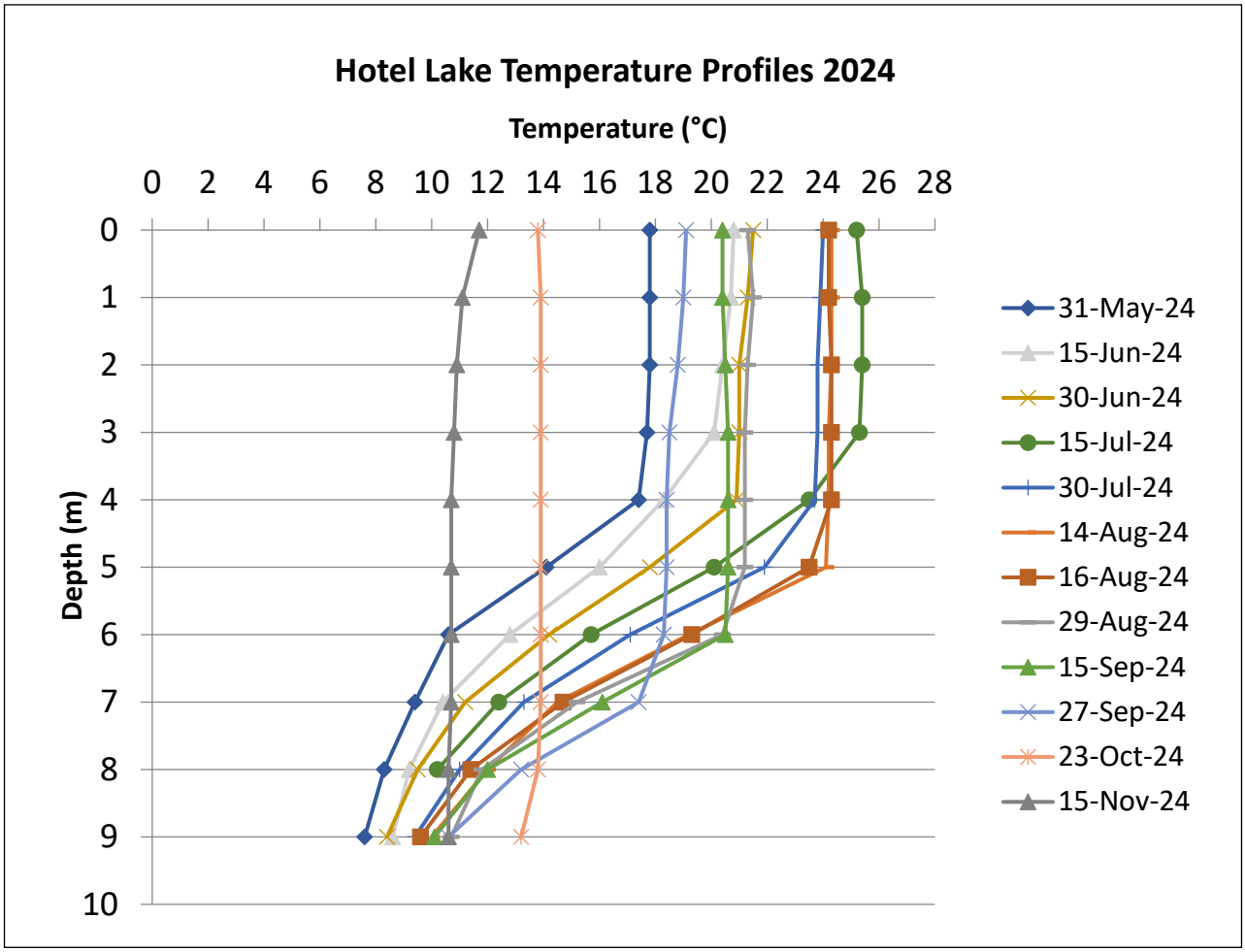
BCLSS Director Marge Sydney checked in with the volunteers from the Hotel Lake on June 28, 2024. Results of the check-in can be found in the attached appendix.

What's Going on Inside Hotel Lake?

Lake Mixing

Why Measure Temperature? Measuring temperature throughout the water column and overtime allows us to understand a lake's specific thermal structure. It allows us to predict the patterns of other variables (e.g., dissolved oxygen and phosphorus) that play a key role in lake productivity and recreational water quality. It is also an important measurement to better understand how lakes throughout BC respond to climate change. By measuring temperature throughout the water column, we may be able to detect changes in the time of lake turnover, changes to the depth of the thermocline, warming surface waters, and other impacts.

Temperature stratification (i.e., vertical water column layering) patterns are very important to lake water quality as they can determine much of the seasonal oxygen, nutrient, and biological conditions. Temperature profiles were collected at the Hotel Lake Deep Site from May 31 to November 15, 2024 and are shown below.



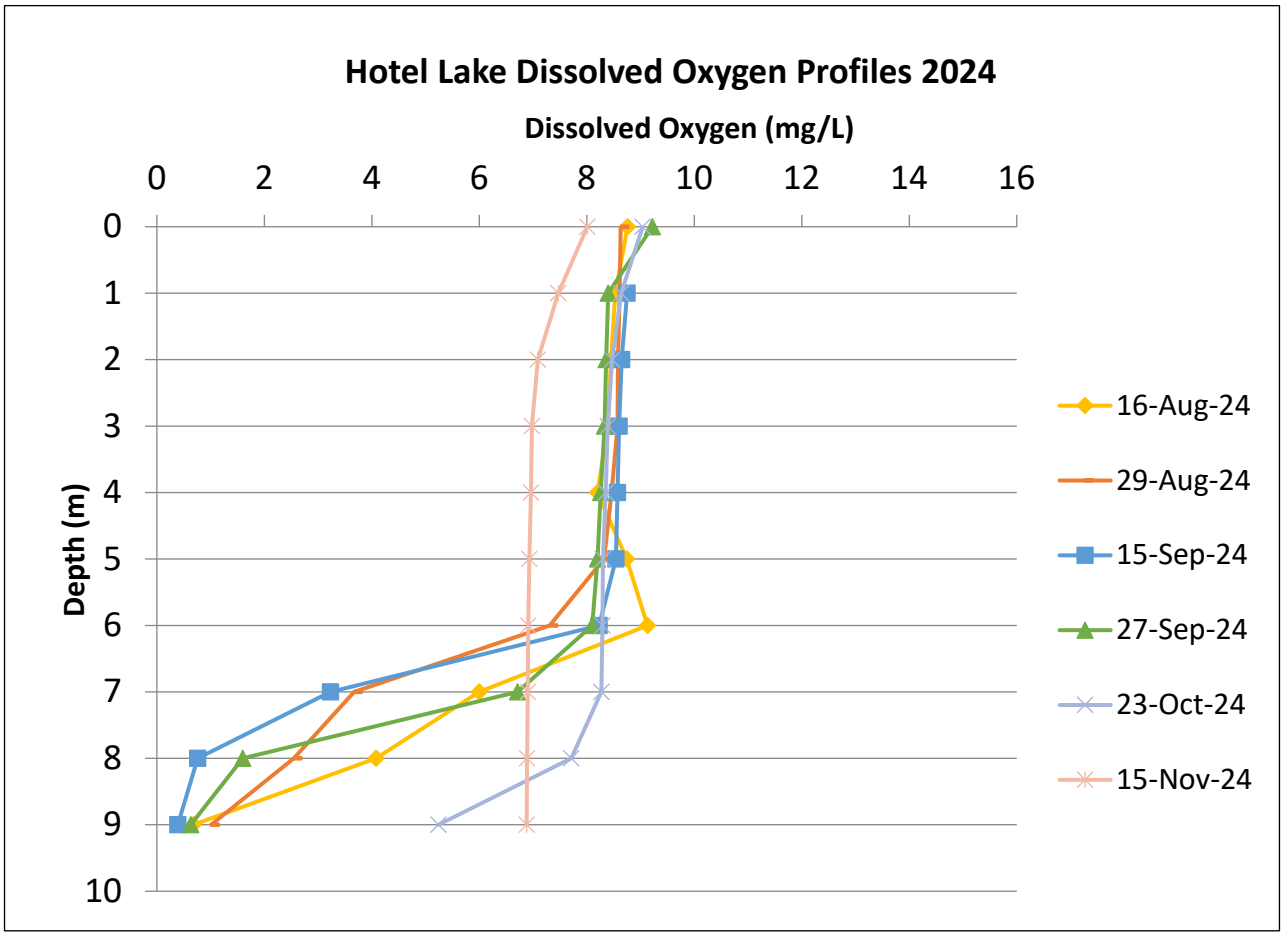
The lake was stratified from May 31 to September 15 and was lightly stratified on September 27. There appears to be a wide thermocline between 4 m and 8 m. The lake had uniform temperatures in the October 23 and November 15 profiles, indicating that late summer overturn took place between 27 September and 23 October and oxygen was replenished to lower depths by 15 November with some residual DO depletion still evident on 23 October. For future years of monitoring, it is recommended that monitoring begin in April to capture the onset of lake stratification.

What is Dissolved Oxygen?

Dissolved oxygen (DO) is the amount of O_2 molecules that are dissolved into the water. The amount of O_2 that is dissolved in a lake depends on several factors including the mixing that occurs during the overturn of a lake, the amount of wind action a lake experiences, the temperature of the lake, the number of plants that photosynthesize in the lake, and daily fluctuation patterns.

Why Measure Dissolved Oxygen? DO and temperature are measured from the surface to the bottom of the lake which is called a profile. The profile is done by measuring DO and temperature every

meter from the surface to 1 m above the lake bottom. By developing an understanding of what DO and temperature look like from the surface to the bottom of the lake, more insight can be gained concerning the health of the lake. With climate warming, it is becoming increasingly important to document DO and temperature profiles for lakes in order to better predict locations and time periods that may experience increased or decreased DO concentrations in relation to changing temperatures. More information on DO and temperature profiles can also assist lake managers with understanding how sensitive a lake is to change due to climate warming. DO profiles were collected at the Deep Site on Hotel Lake from August 16 to November 15, 2024, and are shown below.



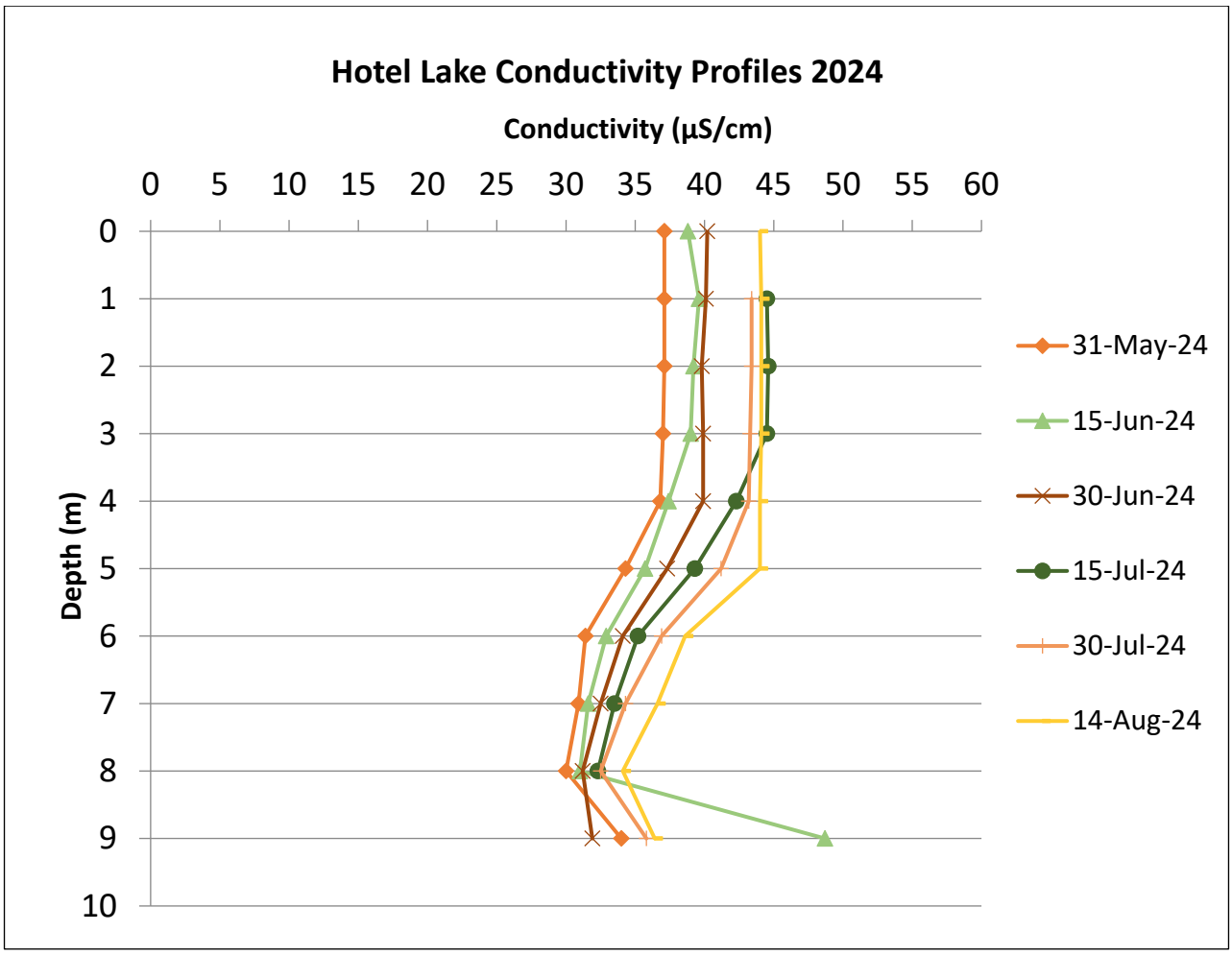
DO profiles for Hotel Lake show that oxygen was replenished to lower depths in the fall after the 23 October sampling event. Dissolved oxygen depletion and anoxic conditions are evident in lower depths in the late summer between August 16 and September 15, with DO concentrations as low as 0.39 mg/L on September 15, 2024.

Volunteers at Hotel Lake were able to obtain a YSI to measure DO in August 2024, therefore, DO measurements were only collected in the late summer and fall in 2024. For future monitoring, it is

recommended that DO measurements be collected starting in April to capture the spring and early summer DO profiles.

Conductivity

Conductivity is a measure of how easily electricity flows through water. This is related to the concentrations of ions present in the water, which are made up of dissolved salts and other inorganic materials. As the concentration of ions increases in water, the conductivity also increases. Conductivity is also affected by temperature, with higher conductivity observed at higher temperatures. Conductivity is a helpful measure of water quality in a lake. Significant changes to baseline conductivity can indicate a source of pollution or other disturbance. Conductivity measurements were conducted at Hotel Lake every two weeks between May 31 and August 14. Conductivity profiles are shown in the graph below.



Conductivity at Hotel Lake was fairly consistent throughout the monitoring period, with values ranging from 30 µs/cm on May 31, 2024 to 48.7 µs/cm on June 15, 2024. The value of 48.7 µs/cm,

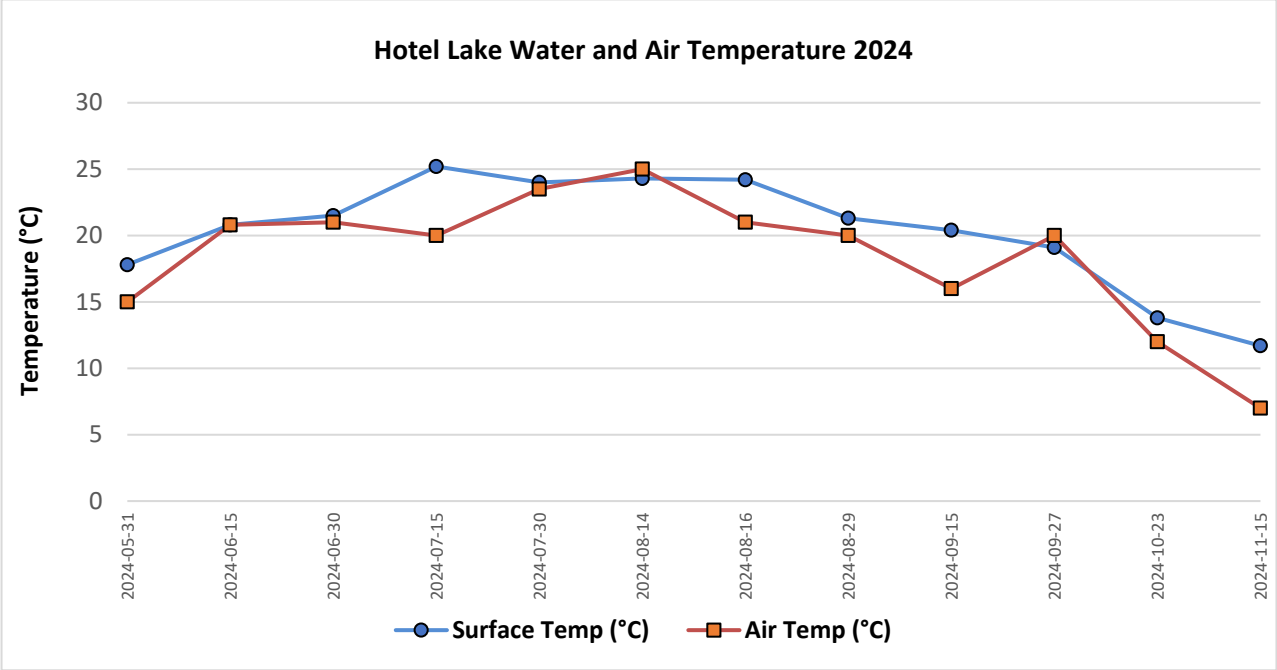
collected on June 15, was outside of the normal range observed at that depth, which could indicate a false reading due to equipment error. Conductivity increased throughout the monitoring period, likely due to warmer temperatures observed throughout the season. There was also a slight decrease in conductivity observed at lower depths, correlating with decreased temperatures.

Surface Temperature

Why Measure Surface Temperature?

Measuring temperature over time allows us to understand a lake's specific thermal structure. Temperature measurement also provides important information on the health of the biological community by indicating when and where the temperature tolerances of fish and other animals or plants may be exceeded. Surface temperature monitoring is important to provide background conditions and therefore identify trends that may be present. Surface temperature also helps to determine much of the seasonal oxygen, phosphorus, and algal conditions.

Surface temperature readings were collected by volunteers throughout the 2024 season. The surface temperature summary below shows surface water temperature and air temperature from May 31 to November 15, 2024.



The maximum surface water temperature reading was 25.2°C (July 15) and the minimum was 11.7°C (November 15). The average surface temperature reading from May to November was 20.3°C. The

maximum air temperature recorded was 25°C (August 14) and the minimum was 7°C (November 15). The average air temperature between May to November 2024 was 18.4°C.

Water Clarity

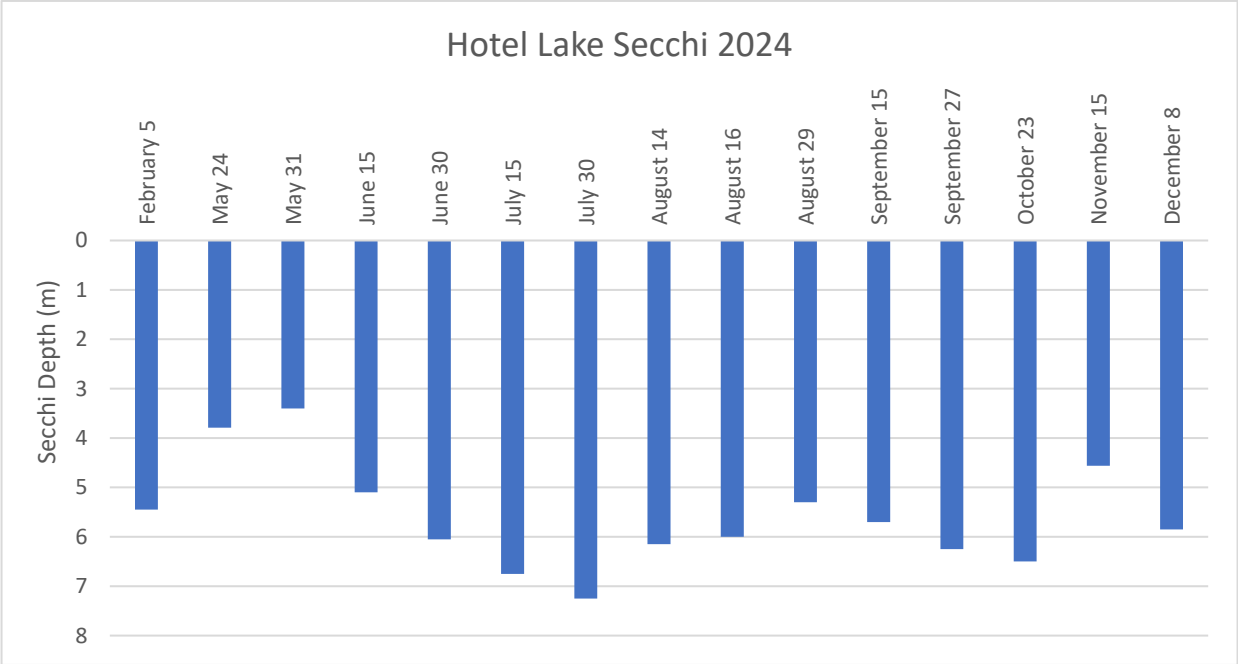
What is a Secchi Disk?

The Secchi disk typically used in lakes is a 20 cm disk with alternating black and white quadrants. It is attached to a tape measure and lowered into the water until the observer can no longer see it. The depth of disappearance, called the Secchi depth, is a measure of the transparency of the water.

Why Measure Water Clarity?

Transparency (clarity) is a good indicator of the impacts from human activity on the land surrounding the water body. If transparency is measured through the season and from year to year, trends can be observed. It can serve as an early warning that activities on the land are affecting water quality. The clarity of the water impacts the amount of light penetration and in turn can affect photosynthesis and the distribution of organisms. Clarity decreases as colour, algae, or suspended sediment increases. The colouration could be due to staining which is largely from the decay of plant material. Algal growth is promoted by nutrient inputs, mainly phosphorus. Suspended sediments can increase as a result of increased runoff from urban or agricultural environments. Glacial sediments can also impact water clarity as the fine glacial silts remain suspended in the waterbody.

The graph below shows the Secchi readings collected by volunteers between February 5 to December 8, 2024. The minimum data requirement of 12 readings over the sampling season was met and the spread of measurements was evenly distributed from spring through late summer. During some site visits (July 15, July 30, August 14, and August 16), windy conditions made it difficult to collect accurate readings from the side of the boat. In this instance, volunteers collected Secchi readings in the water using a face mask. In instances where two Secchi readings are available, the reading using the face mask in the water was used.



The maximum reading was 7.25 m on July 30 and the minimum was 3.4 m on May 31. The average Secchi depth was 5.6 m in 2024.

Keeping Hotel Lake healthy

- Minimize the disturbance of shoreline areas by maintaining natural vegetation cover.

Monitoring Recommendations

- It is recommended that calibration and monitoring procedures are periodically reviewed throughout the monitoring period. Please see the appendix of this report for calibration procedures.
- Observations made by volunteers are very helpful for interpreting data. It is recommended to continue to record any applicable field observations throughout the monitoring season (i.e. algae and its colouration, dead fish, weather events etc.). Photographs of observations can also be valuable.
- Beginning monitoring in early April (weather and safety dependent) and continuing monitoring until complete overturn is caught in the fall (uniform temperature and DO from top to bottom) would be very valuable for tracking any changes to Hotel Lake's stratification pattern over time. There is strong evidence that climate change is exacerbating existing issues in lakes and creating issues where issues didn't exist, whether expected or unexpected. This will make the management of BC's water resources more challenging.

One climate change impact already observed in many northern hemisphere lakes is reduced oxygen concentrations and earlier onset and longer periods of stratification, which will make internal nutrient loading more problematic (Woolway et al., 2020). This is one reason why collecting temperature and dissolved oxygen profiles that capture spring and fall overturn is so important for BC Lakes.

- Hotel Lake was accepted into the Level 3 BC Lake Stewardship and Monitoring Program for 2025. This program will provide valuable baseline information for Hotel Lake which will expand the current monitoring program to include biweekly sampling of phosphorus and chlorophyll-a.

Ice on / Ice off data

Why Collect Ice-On and Ice-Off Data?

Not all lakes freeze in the winter – Hotel Lake being one example, but for those that do, Ice-on and Ice-Off data contributes to a better scientific understanding of climate change. By analyzing citizen records, scientists have found that the freeze-thaw cycles of northern water bodies are changing. Observations of ice-on and off dates for BC Lakes can be submitted online through the BC Ice Reporting Tool (https://arcg.is/qy1e5). This data is important for interpreting seasonal data and for tracking climate change impacts on BC lakes.

Summary

The volunteers at Hotel Lake have begun to establish a great data set for the lake from 2024 BCLSMP monitoring, as well as previous monitoring conducted by volunteers for the past several years. Local volunteers are encouraged to continue to record Secchi and surface temperature readings, and dissolved oxygen and temperature profiles for a minimum of two more years, with an emphasis on collecting evenly spaced readings throughout the monitoring season. Hotel Lake was accepted into the BCLSS Level 3 program in 2025. Following the completion of monitoring associated with the Level 3 program, a final report will be prepared. This volunteer collected data is important for long term records and can help identify early warning signs should there be a deterioration in water quality from its current state. Local volunteer monitors are also encouraged to continue recording ice-on and ice-off dates (if applicable) for long term climate change records.

References

BC Ministry of Environment [BC MOE 2025a]. 2025. Habitat Wizard Lakes Report. Accessed March 10, 2025. https://maps.gov.bc.ca/ess/hm/habwiz/

BC Ministry of Environment [BC MOE 2025b]. 2025.iMapBC Freshwater Atlas. Accessed March 10, 2025. https://maps.gov.bc.ca/ess/hm/imap4m/

Hotel Lake Advisory Association [HLAA]. 2025. Hotel Lake Advisory Association Website. Accessed March 10, 2025. https://www.hotellakeadvisory.com/watershed.

Sunshine Coast Regional District [SCRD]. 2016. Drinking Water Systems: Sunshine Coast Water Systems. https://www.scrd.ca/wp-content/uploads/2022/12/2016-SCRD-Water-Quality-Report.pdf

Woolway, R.I., M. Kraemer, J.D. Lenters, C. J. Merchant, C. M. O'Reilly and S. Sharma. 2020. Global lake responses to climate change. Nature Reviews Earth & Environment volume 1, p388–403.

Appendix

Hotel Lake QC Check Form – June 28, 2024

BC LAKE STEWARDSHIP SOCIETY
Box 110, 5505 Jacobson Road
Big Lake Ranch BC, V0L 1G0
Phone: 604-474-2441 Toll free: 1.877 BC LAKES
Email: info@bclss.org Web: www.bclss.org

Level 1 Field Sampling Quality Control Check (Online)

Date: June 28, 2024 Time: 11:50

Auditor: M Sidney

Sampler Name(s): Brian Croft

Lake: Hotel Site: Deep spot

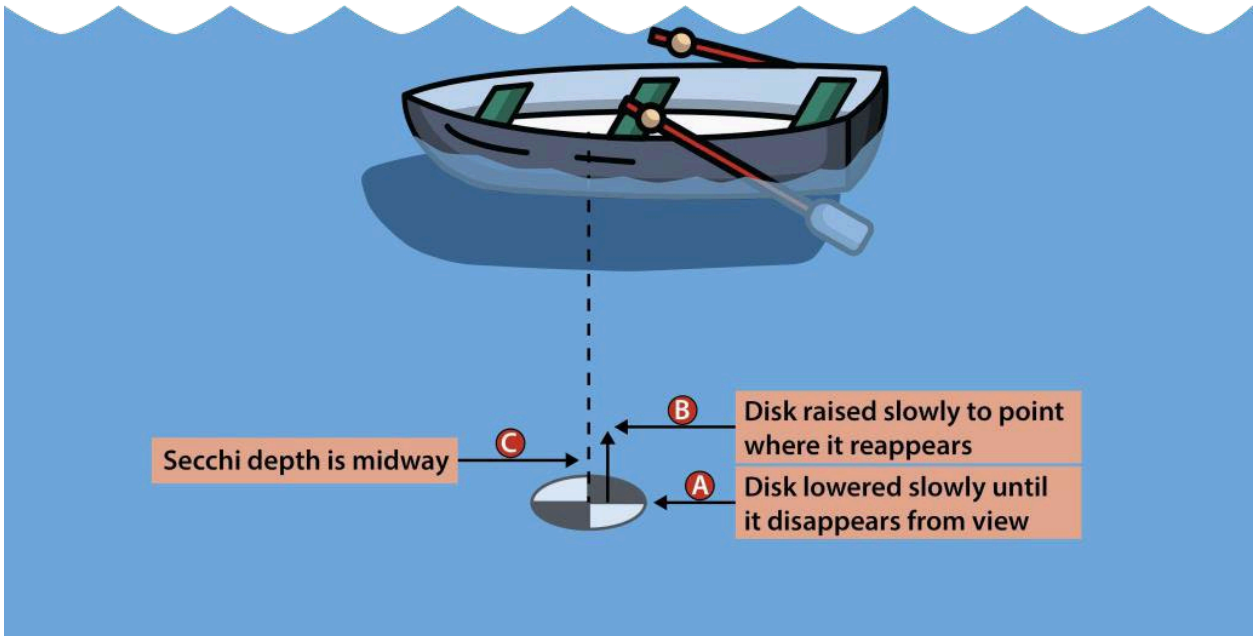
Safety:	**Y/N**	**Comments**
Safety waiver signed?		
Check that weather is safe?	Y	
Follow a check in procedure/go with partner?	Y	
Monitor at same time each week?	N	Tries to go out mid and end of the month
Anchor at deep site?	Y	
Secchi:		
Measuring between 10 a.m.–2 p.m.?	Y	
Sunglasses off?	Y	
Measure from shady side of the boat?	Y	Uses 2 methods as often the lake has a chop. The regular method over the side of the boat and a snorkel mask (more accurate)
Lower Secchi - is it straight down/vertical?	Y	
Average of the two measurements?	Y	
Is Secchi reading accurate?	Y/N	The reading with the snorkel is but not so much the regular method
Is Secchi depth recorded to nearest 0.01 m?	Y	
Other:	**Y/N**	**Comments**
Temperature - read thermometer immediately?	Y/N	Takes the temperature reading from the Temp/Cond meter
Discuss the frequency and timing of monitoring – weekly preferred but minimum of 12 readings spaced evenly from spring to fall (biweekly). If the volunteer misses one on a biweekly	Y	Goes out as often as possible

schedule, they should do it the following week so as not to have a one month gap between readings. Also, remind volunteers that they can monitor +/- a day in subsequent weeks i.e., if week 1 is Wed, then the next week can be Tues or Thurs if they can't get out Wed, and so on.		
If applicable- Dissolved Oxygen (ProSolo):		
Is the DO meter calibrated before taking measurements?		
Is the DO meter calibrated correctly? (no water on ODO sensor cap or temperature sensor, no seal around probe, wait 10 minutes)		
Is the sensor cap in good condition?		
Measurements taken every meter?		
Sensor stored correctly (sponge is moist, if sensor dries out, it is rehydrated for >8 hours and recalibrated before use)		
If applicable- Dissolved Oxygen (550A):		
Is the DO meter calibrated before taking measurements?		
Is the DO meter calibrated correctly? (recorded altitude of region, allow device to warm-up for 15-20 mins, ensure sponge is wet in calibration chamber)		
Is the membrane in good condition? (buildup of oxidized material around anode removed correctly and regularly)		
Has the membrane been changed in the past 6 weeks?		
Measurements taken every meter?		
Is there a flow over the membrane cap when taking measurements (i.e., is a flow being creating by moving the cable)?		

Additional Comments:

Brian borrowed a DO/Cond YSI meter. Would really like to borrow a BCLSS DO/Temp YSI meter. This group has very accurate lake level data going back to 2000, some of which was used in Court – to do with lake vulnerability. The case was decided in the lake's favour and led to the cessation of water being drawn for development and domestic use except for emergencies. They would like to make this material available to the BCLSS as another repository so it isn't lost. Brian takes secchi readings 2 ways; the regular way over the side of a boat and also using a snorkel, due to the lake often being windy and not able to get accurate readings the regular way. He records both values and notes which is which. The group is very dedicated and also records a lot of other data about wildlife – birds, beaver activity, spawning dates, video of peamouth chub and a lot of snorkel work with gopro footage.

Proper Secchi Reading Procedure



YSI ProSolo Field Guide

Reminders

- Calibrate the instrument at the lake level before every sampling event.
- Ensure probe is kept in a moist environment.
- Anchor at sampling site.
- Record DO readings in mg/L.

Calibration

- Wet sponge or place a small amount of water in the calibration cup.
- Make sure there are no water droplets on the sensor cap.
- Attach probe guard and carefully slide into calibration cup ensuring a seal is not created.
- Turn instrument on and wait ~10 minutes.
- Push the *Cal* key, select *ODO* then select *DO%*.
- Observe the measurement readings for stability (white line shows no change for 40 seconds).
- Select *Accept Calibration*.

Contact Information

Contact our office for assistance:

- Phone: **1-877-BCLAKES**
- Email: **info@bclss.org**

For more information, consult the instrument's user manual.

How to Take a DO and T Profile

- Lower probe over the side of the boat.
- Lower the probe until the sensor is submerged just below the surface of the water (the "0 m" reading).
- Take measurements every 1 m until probe is 1 m above lake sediment.
- Allow readings to stabilize before lowering probe.

Probe Maintenance

- Clean sensor using water and lint-free cloth to avoid scratching.
- Replace the cap every 12 to 24 months.
- If sensor cap is left dry for longer than 8 hours, it must be rehydrated by soaking it in tap water for 24 hours. Recalibrate after soaking.

Storage

At the end of the sampling season, prepare your instrument for long-term storage through the winter.

- Remove the batteries and clean away any corrosion.
- Clean the instrument following the procedures in the instrument's manual.
- The sensor should never be stored dry. Ensure the sponge is wet or the calibration cup is filled with water and check that it remains moist throughout the winter.