



BC Lake Stewardship and Monitoring Program

Lajoie Lake 2005 - 2007

*A partnership between the BC Lake Stewardship Society (BCLSS)
and the Ministry of Environment*



The Importance of Lajoie Lake & its Watershed

British Columbians want lakes to provide good water quality, aesthetics, and recreational opportunities. When these features are not apparent in our local lakes, people begin to wonder why. Concerns often include whether the water quality is getting worse, if the lake has been impacted by land development or other human activities, and what conditions will result from more development within the watershed.

The BC Lake Stewardship Society (BCLSS), in collaboration with the Ministry of Environment, has designed a program, entitled *The BC Lake Stewardship and Monitoring Program*, to address these concerns. Through regular water sample collections, we can come to understand a lake's current water quality, identify the preferred uses for a given lake, and monitor water quality changes resulting from land development within the lake's watershed.

There are different levels of lake monitoring and assessment. The level appropriate for a particular lake depends on the funding and human resources available. In some cases, data collected as part of a Level I or II program can point to the need for a more in-depth Level III program. This report gives the three year results of a Level I monitoring program for Lajoie Lake.

The BCLSS can provide communities with both lake-specific monitoring results and educational materials on general lake protection issues. This useful information can help communities play a more active role in the protection of the lake resource. Finally, this program allows government to use its limited resources efficiently with the help of local volunteers and BCLSS.

A **watershed** is defined as the entire area of land that moves the water it receives into a common waterbody. The term watershed is misused when describing only the land immediately around a waterbody or the waterbody itself. The true definition represents a much larger area than most people normally consider.

Watersheds are where much of the hydrologic cycle occurs and play a crucial role in the purification of water. Although no

“new” water is ever made, it is continuously recycled as it moves through watersheds and other hydrologic compartments. The quality of the water resource is largely determined by a watershed's capacity to buffer impacts and absorb pollution.

Every component of a watershed (vegetation, soil, wildlife, etc.) has an important function in maintaining good water quality and a healthy aquatic environment. It is a common misconception that detrimental land use practices will not impact water quality if they are kept away from the area immediately surrounding a waterbody. Poor land use practices in a watershed can eventually impact the water quality of the downstream environment.



Lajoie Lake, also known as Little Gun Lake, is located approximately 90 km northwest of Lillooet in the Thompson-Nicola region. The lake has a surface area of 65.8 ha, perimeter of 2926 m and lies at an elevation of 907 m. The average depth of Lajoie Lake is 12.2 m, while the deepest spot is 23.5 m. The lake contains cutthroat trout, dolly varden, kokanee, peamouth chub, prickly sculpin, rainbow trout and redbside shiner. Kokanee are stocked upstream in Gun

Lake and have recently made their way to Lajoie Lake. They may have a significant negative impact on trout in the lake due to their competition for the same food source and the fact that they will now spawn and their population numbers will increase uncontrolled (Miracle, 2008, pers. comm.). Rainbow trout are stocked in the lake about once a year.

Historically this region was involved in the gold mining industry and Lajoie Lake was first used in the 1930's as a recreation area for the residents of the nearby mining towns of Bralorne and Pioneer. The land around the lake was staked as mining claims by Bralorne and Pioneer residents, who then had use of the property by 'working their claim'. The mining companies logged the shores of Lajoie Lake fairly intensively to provide timbers for the mines, and logging activity is currently active in the watershed.

What's Going on Inside Lajoie Lake?

Temperature

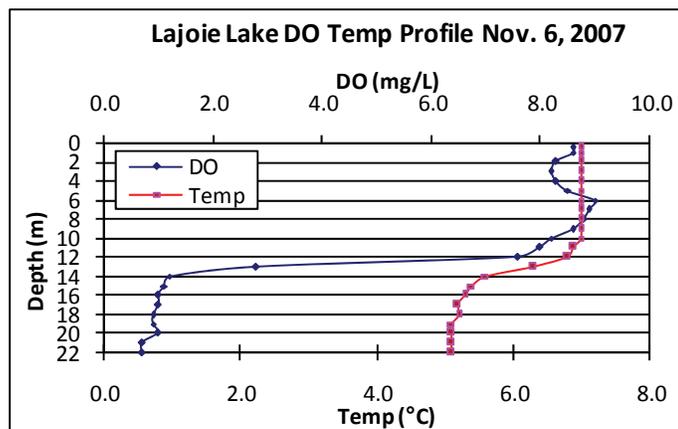
Lakes show a variety of annual temperature patterns based on their location and depth. Most interior lakes, such as Lajoie Lake, form layers (stratify), with the coldest water at the bottom. Because colder water is more dense, it resists mixing into the warmer upper layer for much of the summer. In spring and fall, these lakes usually mix from top to bottom (overturn) as wind energy overcomes the reduced temperature and density differences between surface and bottom waters. In the winter, lakes re-stratify under ice with the densest water (4°C) near the bottom. These lakes, called dimictic because they turn over twice per year, are the most common type of lake in British Columbia. Lajoie Lake is dimictic.

Coastal lakes in BC are more often termed warm monomictic lakes because they turn over once per year. These lakes have temperatures that do not fall below 4°C. Warm monomictic lakes generally do not freeze and circulate freely in the winter at or above 4°C, and stratify only in the summer.

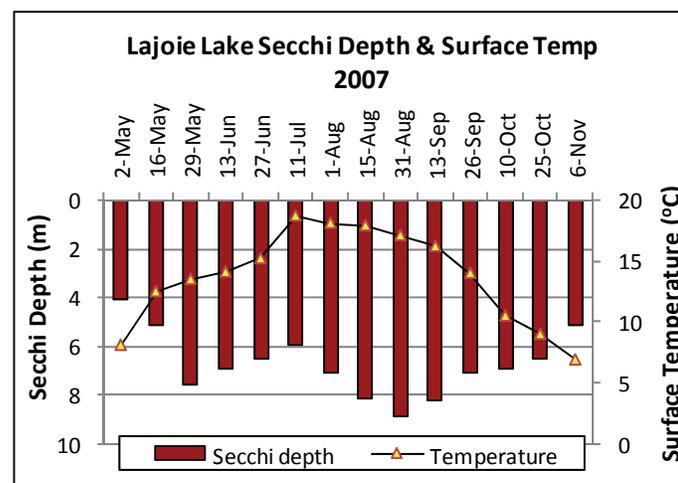
Ice-on and ice-off dates for BC lakes are important data for climate change research. Local residents report that Lajoie Lake freezes every year. By comparing these dates to climate change trends, we can examine how global warming is affecting our lakes. Lajoie Lake volunteers have been reporting ice on and off dates since 2005.

Surface temperature readings serve as an important ecological indicator. By measuring surface temperature, we can record and compare readings from season to season and year to year. Temperature stratification patterns are also very important to water quality. They determine much of the seasonal oxygen, phosphorus, and algal conditions.

Dissolved oxygen (DO) and temperature data was collected from multiple depths in Lajoie Lake in 2006 and 2007. Data collected in all years indicates that the bottom waters have low DO values throughout the sampling season. The top graph displays the DO and temperature profile from Nov. 6, 2007. As the graph shows, the lake is nearing isothermal conditions (same temperature throughout the water column). DO values are low between 14 and 22 m but remain high in the upper waters.



Surface temperature and Secchi depth were measured at one location (see map next page) on Lajoie Lake. The lower graph illustrates the Lajoie Lake Secchi depth and temperature for 2007. The maximum surface temperature was 18.8 °C (July 11th) and the minimum surface temperature was 7 °C (November 6th). The maximum surface temperatures measured in 2005 and 2006 were 19 °C (August 10th), 19.3 °C and (July 5th), respectively. Minimum surface temperatures were 5.5 °C on November 1, 2005 and 7.2 °C on November 5, 2006.



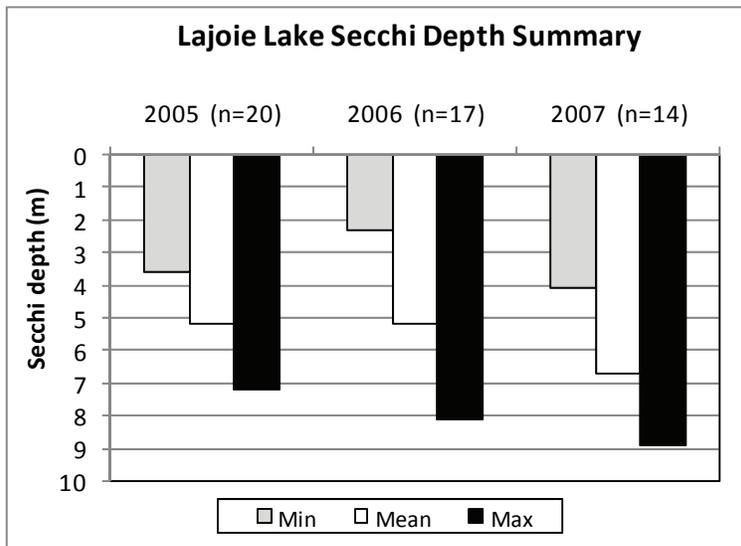
Trophic Status and Water Clarity

The term *trophic status* is used to describe a lake's level of productivity and depends on the amount of nutrients available for plant growth, including tiny floating algae called phytoplankton. Algae are important to the overall ecology of the lake because they are food for zooplankton, which in turn are food for other organisms, including fish. In most lakes, phosphorus is the nutrient in shortest supply and thus acts to limit the production of aquatic life. When in excess, phosphorus accelerates growth and may artificially age a lake. Total phosphorus (TP) in a lake can be greatly influenced by human activities.

One measure of productivity is water clarity. The more productive a lake, the higher the algal growth and, therefore, the less clear the water becomes. The clarity of the water can be evaluated by using a Secchi disc, a black and white disc that measures the depth of light penetration.

Natural variation and trends in Secchi depth and temperature not only occur between years, but also throughout one season. As temperature increases during the summer months, the Secchi depth decreases. As the temperature of the lake increases, so do some species of algae. Due to the increase in algae, the water clarity decreases. This trend is apparent in the June to August readings on the graph above.

The graph to the right illustrates the minimum, mean and maximum Secchi readings from 2005 to 2007, as well as the number of readings each year (n). The maximum reading for all sampling years, 8.9 m, occurred on August 31st 2007. The lowest Secchi depth measured was 2.3 m (May 2nd 2006). The average Secchi depth measured was 5.2 m (May 2nd 2006). The average Secchi readings for Lajoie Lake were 5.2 m in 2005 & 2006 and 6.7 m in 2007, indicating relatively little change over the sampling years. Based on these Secchi values, Lajoie Lake was exhibiting oligotrophic conditions.



The flushing rate, the rate of water replacement in a lake, is another factor that affects water quality. The flushing rate depends on the amount of inflow and outflow of a lake. Relative to its volume, Lajoie Lake is estimated to have a low flushing rate and, therefore, may be more sensitive to human impact. The higher the flushing rate, the more quickly excess nutrients can be removed from the system.

Land Use and Pollution Sources

Human activities that impact water bodies range from small, widespread and numerous *non-point* sources throughout the watershed to large *point* sources of concentrated pollution (e.g. outfalls, spills, etc.). Undisturbed watersheds have the ability to purify water and repair small amounts of damage from pollution and alteration. However, modifications to the landscape and increased levels of pollution impair this ability.

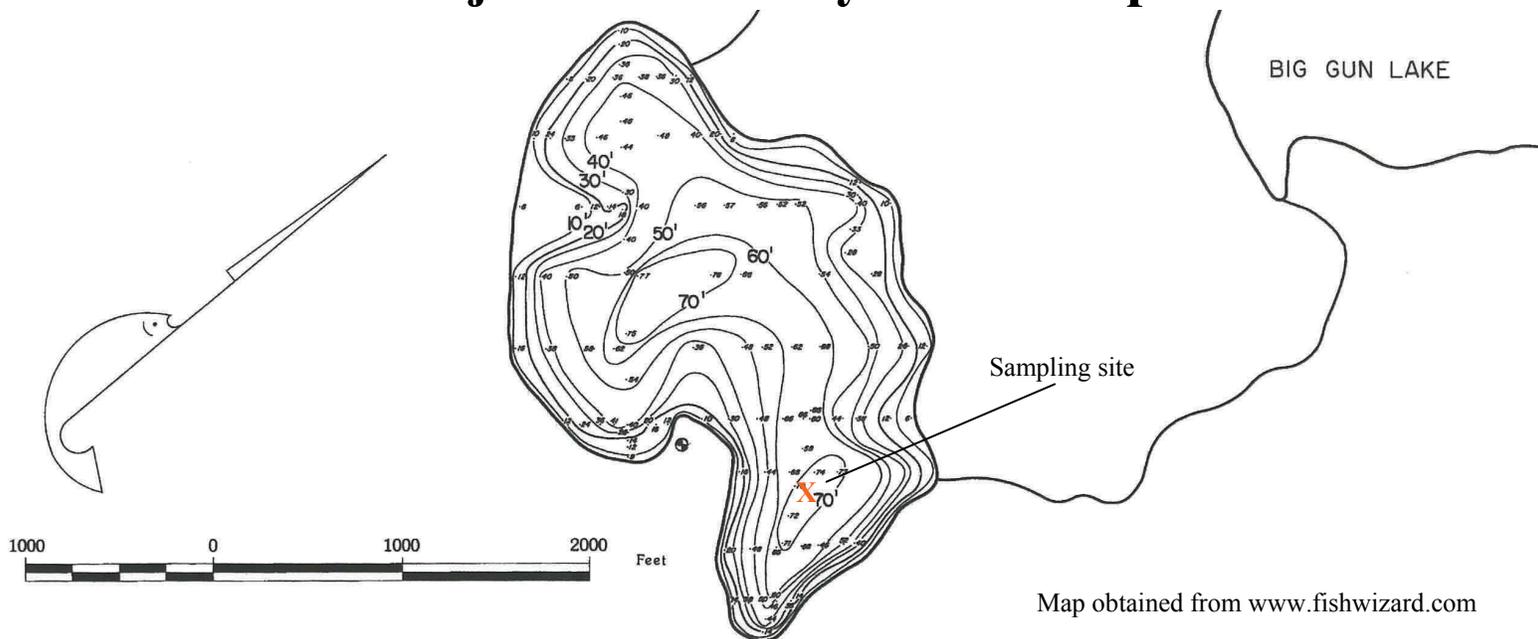
The Ministry of Environment believes the area immediately surrounding Lajoie Lake is likely to have the most influence on the lake's water quality. There is currently logging activity in this area. At this time, there are no obvious land use impacts on water quality in this area, however, a detailed survey has not been conducted. Local residents are encouraged to ensure their septic systems are up to standard and that their land use activities are following good environmental practices. Further information can be found on the following page.

Should Further Monitoring be Done on Lajoie Lake?

The data collected during the Level 1 monitoring program suggests Lajoie Lake is oligotrophic. Average Secchi values collected over the three years appear to be stable. The Ministry of Environment will begin a 3 year, overturn water chemistry sampling (Level 2) program in 2009 to confirm the trophic status of the lake. Volunteers are encouraged to continue monitoring Secchi depth and temperature as it will allow for early detection of a change in water quality.

As previously mentioned, local volunteer monitors are recording ice-on and ice-off dates which will be valuable for long term climate change studies.

Lajoie Lake Bathymetric Map



Map obtained from www.fishwizard.com

Tips to Keep Lajoie Lake Healthy

Onsite Sewage Systems

- Inspect your system yearly, and have the septic tank pumped every 2 to 5 years by a septic service company. Regular pumping is cheaper than having to rebuild a drain-field.
- Use phosphate-free soaps and detergents.
- Do not put toxic chemicals (paints, varnishes, thinners, waste oils, photographic solutions, or pesticides) down the drain because they can kill the bacteria at work in your onsite sewage system and can contaminate water-bodies.
- Conserve water: run the washing machine and dishwasher only when full and use only low-flow shower-heads and toilets.

Yard Maintenance, Landscaping and Gardening

- Minimize the disturbance of shoreline areas by maintaining natural vegetation cover.
- Minimize high-maintenance grassed areas.
- Replant lakeside grassed areas with native vegetation. Do not import fine fill.
- Use paving stones instead of pavement.
- Stop or limit the use of fertilizers and pesticides.
- Do not use fertilizers in areas where the potential for water contamination is high, such as sandy soils, steep slopes, or compacted soils.
- Do not apply fertilizers or pesticides before or during rain due to the likelihood of runoff.
- Hand pull weeds rather than using herbicides.
- Use natural insecticides such as diatomaceous earth. Prune infested vegetation and use natural predators to keep pests in check. Pesticides can kill beneficial and desirable insects, such as ladybugs, as well as pests.
- Compost yard and kitchen waste and use it to boost your garden's health as an alternative to chemical fertilizers.

Boating

- Do not throw trash overboard or use lakes or other water bodies as toilets.
- Use biodegradable, phosphate-free cleaners instead of harmful chemicals
- Conduct major maintenance chores on land.
- Keep motors well maintained and tuned to prevent fuel and lubricant leaks.
- Use absorbent bilge pads for minor leaks or spills.
- Recycle used lubricating oil and left over paints.
- Check for and remove all aquatic plant fragments from boats and trailers before entering or leaving a lake.
- Do not use metal drums in dock construction. They rust, sink and become unwanted debris. Use blue or pink closed-cell extruded polystyrene billets or washed plastic barrel floats. All floats should be labelled with the owner's name, phone number and confirmation that barrels have been properly maintained.

Who to Contact for More Information

Ministry of Environment

1259 Dalhousie Drive
Kamloops, BC V2C 5Z5

Phone: 250.371.6200

Fax: 250.828.4000

Gun Lake Ratepayers Association:

Contact: Irene Calbick

Summer: General Delivery
Gold Bridge, BC V0K 1P0

Winter: #408 - 7138 Collier Street
Burnaby, BC V5E 0A2

The BC Lake Stewardship Society

#203 - 1889 Springfield Rd.
Kelowna, BC V1Y 5V5

Phone: 250.717.1212

Toll free: 1.877.BC LAKES

Fax: 250.717.1226

Email: info@bclss.org

Website: www.bclss.org

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Volunteer Monitoring by:

Heather and John Leighton

Data Compiling by:

Carolyn Johns (BCLSS)

Technical Review by:

Marge Sidney (MoE)

Report Produced by:

Carolyn Johns

BC Lake Stewardship Society

Photo Credit:

Heather and John Leighton

Bathymetric Map Credit:

Fish Wizard (www.fishwizard.com)

References

Maricle, S. 2008. Fish Technician, Ministry of Environment, Kamloops, BC. Email, 8 December 2008.