

BC Lake Stewardship and Monitoring Program

Cowichan Lake 2004 - 2007

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



The Importance of Cowichan 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 four year results of a Level I program for Cowichan 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 the 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.

Cowichan Lake is located 31 km west of Duncan, in the Cowichan Valley, on Vancouver Island. The Cowichan Lake region includes the villages of Honeymoon Bay, Youbou, Marble Bay, Caycuse, Mesachie Lake and the town of Lake Cowichan.

Lake Cowichan has approximately 3000 residents and there are estimated to be another 3000 in the surrounding communities. Cowichan Lake has been described as 'in transition' between a forest management area to a residential and recreational area; and is facing development pressure.

Cowichan Lake is one of the largest bodies of freshwater on Vancouver Island and has a surface area of 6,204 ha, a perimeter of 113 km and lies at an elevation of 164 m. The average depth of the lake is 50.1 m, while the deepest spot is 152 m. Cowichan Lake is a deep lake framed by steep mountains, resulting in rocky steep shoreline areas that provide little cover for fish species. The lake contains anadromous bull trout, atlantic salmon, brook trout, brown catfish, brown trout, Chinook, chum and coho salmon, cutthroat and rainbow trout, dolly varden, kokanee, and western brook lamprey.

What's Going on Inside Cowichan Lake?

Temperature

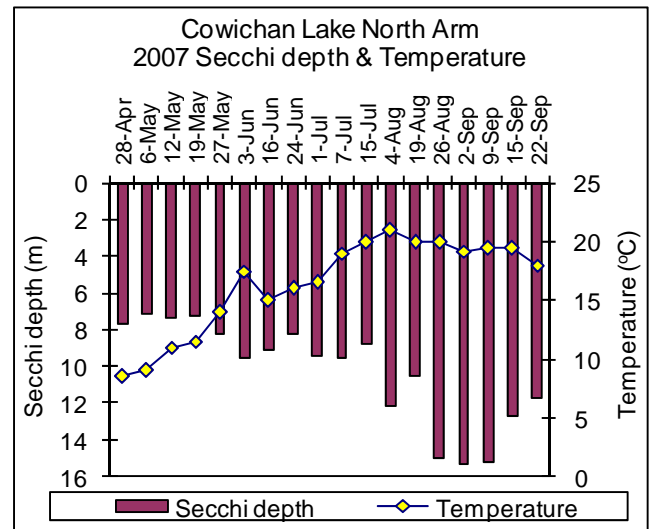
Lakes show a variety of annual temperature patterns based on their location and depth. Most interior lakes form layers (stratify), with the coldest water at the bottom. Because colder water is more dense, it resists mixing into the warmer upper layer for much of the summer. In spring and fall, these 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 are called dimictic lakes because they turn over twice per year. They are the most common type of lake in British Columbia.

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. Cowichan Lake is classified as a warm monomictic lake.

Ice-on and ice-off dates for BC lakes are important data for climate change research. By comparing these dates to climate change trends, we can examine how global warming is affecting our lakes. Local residents report that Cowichan Lake rarely freezes.

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. Surface temperature helps to determine much of the seasonal oxygen, phosphorus, and algal conditions.

Temperature and Secchi depth (water clarity) were measured at the North and South Arms (see map on page 3) of Cowichan Lake in 2005. Only the North arm was sampled in 2004, 2006, and 2007. The adjacent graph illustrates the 2007 Secchi and temperature data from the North Arm. The maximum surface temperature was 21°C (Aug 4th) and the minimum surface temperature was 8.5°C (April 28th). The maximum surface temperatures measured in 2004, 2005 and 2006 were 24°C (July 31st), 23.5°C (Aug 7th), and 21.25°C (July 22nd), respectively. Minimum surface temperatures were 17.5°C (Sept 25th), 12.5°C (May 21st), 11.5°C (May 13th), in 2004, 2005 and 2006, respectively.



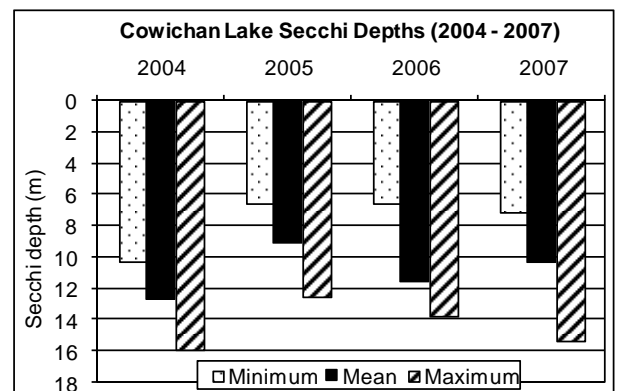
Trophic Status and Water Clarity

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 disk, an 8 inch diameter black and white disk 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. In general, as temperatures increase during the summer months, 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 can decrease. This general trend is not apparent in the 2007 data. Continued monitoring of the lake will provide a better interpretation of data.

The adjacent graph illustrates the minimum, mean and maximum Secchi readings from 2004 to 2007, as well as the number of readings for each year (n). The maximum reading for all sampling years, 16 m, occurred on August 14, 2004. The lowest Secchi depth measured was 6.5 m in both 2005 (May 21st) and 2006 (May 20th). The average Secchi readings for Cowichan Lake ranged from 9.1 m (2005) to 12.7 m (2004).



Though Secchi depth and surface temperature measurements were taken in 2004, sampling did not start until later in the season resulting in fewer sample dates. This later start date may explain the higher minimum, average and maximum values for 2004 as compared to subsequent sampling years. The 2005, 2006 & 2007 data met the minimum sampling requirements (12 readings spread between spring and fall) and all three years clearly show the oligotrophic status of the lake.

The flushing rate, another factor that affects water quality, is the rate of water replacement in a lake and depends on the amount of inflow and outflow of a lake. The higher the flushing rate, the more quickly excess nutrients can be removed from the system. The flushing rate for Cowichan Lake is 2.2 years. The short flushing period and high mean lake depth (50.1 m) indicates Cowichan Lake has a relatively high capacity to assimilate additional nutrients.

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.

Land use activities at Cowichan Lake include logging activity on private forest lands and the accelerated development of lakeshore property. The following concerns regarding riparian and shoreline habitats have been expressed by local residents as a result of these land uses.

- Over 80 named creeks support Cowichan Lake as historically one of the richest salmon rearing habitats (further information on this can be obtained from either the BCLSS or the Friends of Miracle Creek - see pg. 4 for contact info).
- On-going concerns of active logging in a designated watershed.
- Property values rapidly escalating while property owners and developers apply pressure on land use.
- Lakeshore property owner's rights and increasing land values promote high land use expectations at the expense of lakeshore riparian areas.
- Inability to enforce shoreline riparian protection regulations.
- Overlapping land use jurisdictions: Forestry, Property Owners, Recreational Users and Environmental Protection.

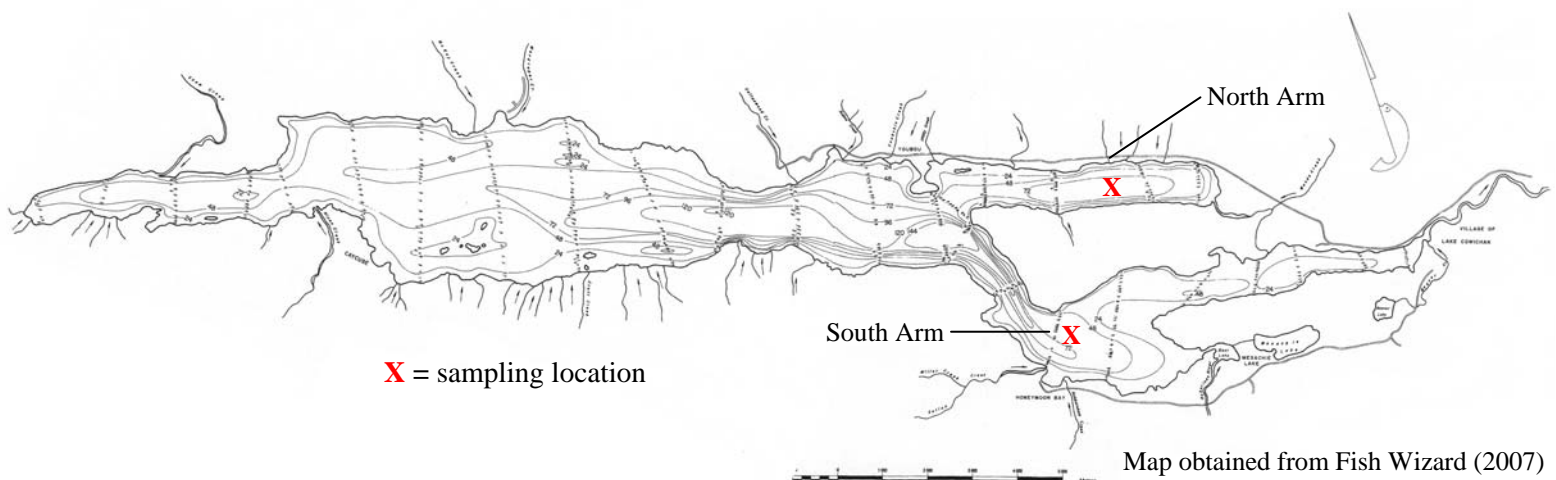
Local residents are encouraged to ensure their septic systems are up to standard and that their land use activities are following good environmental practices. Further information on keeping Cowichan Lake healthy can be found on the following page.

Should Further Monitoring be Done on Cowichan Lake?

The data collected on Cowichan Lake from 2004 to 2007 indicates that the water quality has remained relatively stable over the sampling years. Based on these four years of Secchi measurements alone it appears that Cowichan Lake is oligotrophic. Local volunteer monitors are continuing to monitor Secchi depth and surface temperature.

All residents and land developers within the watershed are advised to continue to practice good land management so that nutrient migration to the lake and its tributaries are minimized..

Cowichan Lake Bathymetric Map



Tips to Keep Cowichan 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 waterbodies.
- Conserve water: run the washing machine and dishwasher only when full and use only low-flow showerheads 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 - Nanaimo

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BC Lake Stewardship Society

Photo Credit:

Flickr (<http://www.flickr.com>)

Bathymetric Map:

Fish Wizard (www.fishwizard.com)