BC Lake Stewardship and Monitoring Program

Sproat Lake 2005 - 2009

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

BRITISH COLUMBIA
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The Importance of Sproat 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 (MoE), 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 2005 - 2009 results of a Level I program for Sproat 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.

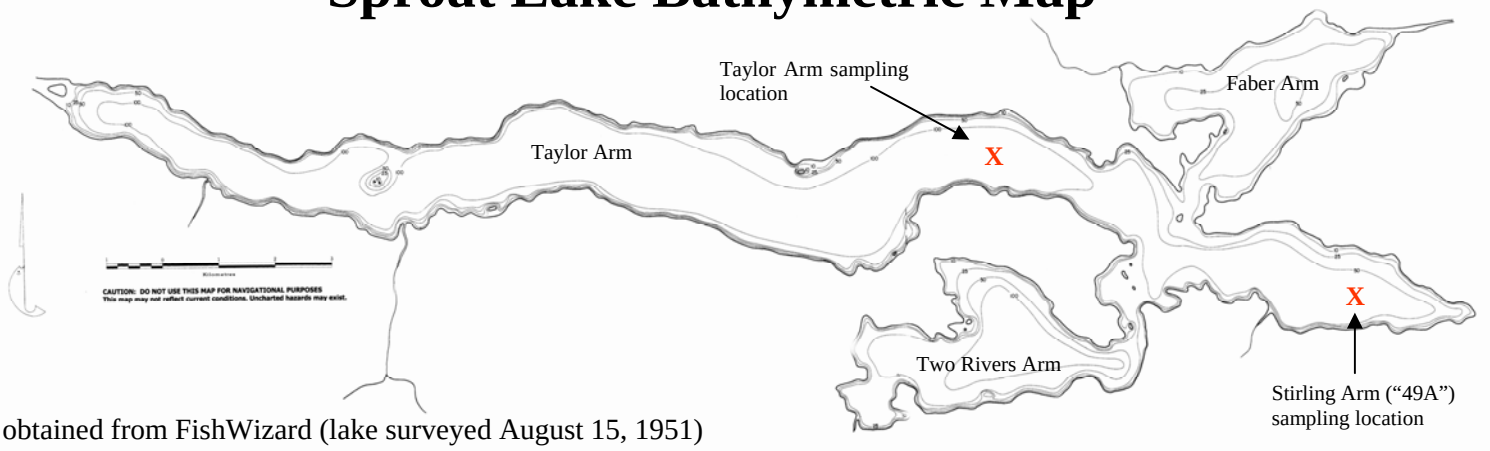
Watersheds are where much of the hydrologic cycle occurs and play a crucial role in the purification of water. Although no "new" water is ever made, it is continuously recycled as it moves through watersheds and other hydrologic compartments. The quality of the water resource is largely determined by 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.

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

Sproat Lake has a surface area of 37.75 km^2, a perimeter of 90.8 km and lies at an elevation of 32 m. The average depth of the lake is 66.5 m, while the deepest spot is 195 m. Located on Central Vancouver Island, Sproat Lake is 10 km west of Port Alberni. The Pacific Rim Highway borders the north shore of the lake. There are many streams that flow into Sproat Lake, with the main inflows being Taylor River (west end of Taylor Arm) and Two Rivers (west end of Two Rivers Arm). Sproat River, the main outflow from the lake, is located at the east end of Faber Arm. There is also a water intake located at the east end of Stirling Arm that currently services Catalyst Paper Corporation, located in Port Alberni. Sproat Lake, through the use of this existing water intake, has been suggested as a future water supply for the Alberni Valley (Cote 2010, Pers. Comm.). In addition, there are karst formations and caves located in the Stirling Arm area that local residents are working toward protecting (Cote 2010, Pers. Comm.). Sproat Lake is not only a popular house boating destination, but is also the home base for the last two remaining (of seven) Martin Mars Waterbombers.

Atlantic, coho, and sockeye salmon, prickly sculpin, cutthroat trout, dolly varden, kokanee, rainbow trout, steelhead and threespine stickleback are present in Sproat Lake. Sproat Lake was stocked periodically since 1921, though it has not been stocked since 2001. (FISS, 2010)

Sproat Lake Bathymetric Map



Map obtained from FishWizard (lake surveyed August 15, 1951)

What's Going on Inside Sproat Lake?

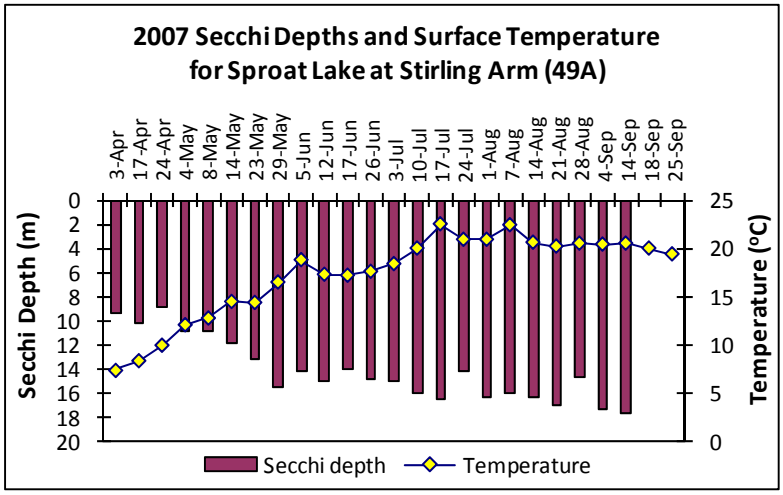
Temperature

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. Sproat Lake is classified as a warm monomictic lake.

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. By comparing these dates to climate change trends, we can examine how global warming is affecting our lakes. Volunteers report that Sproat Lake does not freeze.

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.



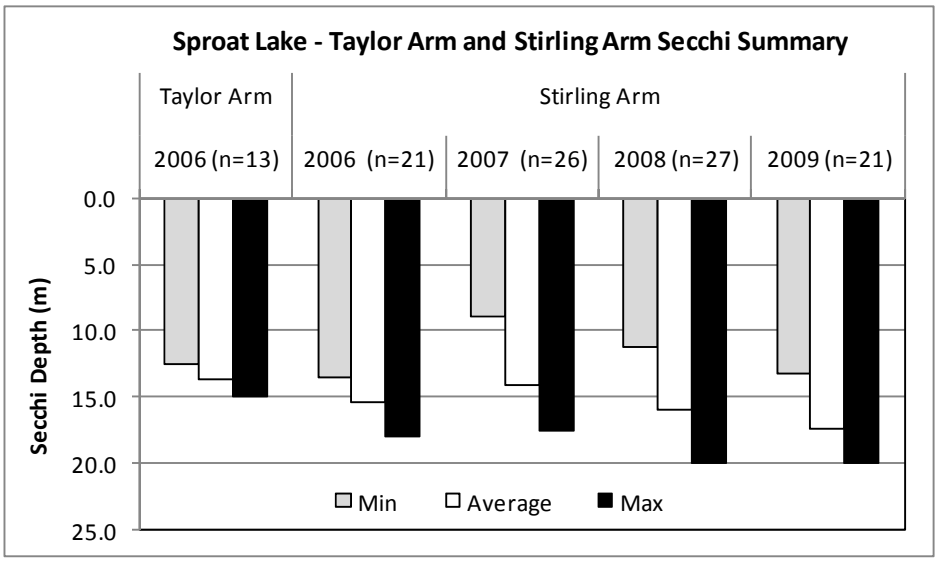
Temperature and Secchi depth (water clarity) were measured at the Taylor Arm site from 2005 to 2007, as well as the Stirling Arm (49A) site from 2006 to 2009. Only one year of data collected at Taylor Arm met the minimum requirement of 12 samples per season (2006). The adjacent graph illustrates the 2007 Secchi and temperature data from Stirling Arm on Sproat Lake. The maximum surface temperature was 22.5°C (July 17th) and the minimum surface temperature was 7.4°C (April 3rd). The maximum surface water temperatures measured in 2006, 2008 and 2009 were 22.9°C (Aug. 29th), 23.3°C (Aug. 13th), and 27°C (July 28th), respectively. Minimum surface temperatures were 14.9°C (May 16th), 7.4°C (April 22nd) and 15°C (Oct. 15th), in 2006, 2008 and 2009, respectively. Usually the lowest surface temperature readings occur shortly after ice-off and during spring overturn. Since temperature readings in 2006 and 2009 did not begin until May 16 and June 4, respectively, the minimum temperatures for 2006 and 2009 do not reflect the low surface temperatures that would occur in early spring months.

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.

Lakes of low productivity are referred to as ***oligotrophic***, meaning they are typically clear water lakes with low nutrient levels, sparse plant life and low fish production. Lakes of high productivity are ***eutrophic***. They have abundant plant life because of higher nutrient levels. Lakes with an intermediate productivity are called ***mesotrophic*** and generally combine the qualities of oligotrophic and eutrophic lakes.

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 20 cm diameter 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. 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 Sproat Lake during any of the sampling years. Continued monitoring, with a minimum of 12 readings evenly spaced throughout the sampling season, will provide a better interpretation of data.

The graph above illustrates the minimum, average and maximum Secchi readings from 2006 in Taylor Arm and 2006 to 2009 in Stirling Arm, as well as the number of readings for each year (n). The maximum reading for all sampling years in Stirling Arm, 20.0 m, occurred on September 11th and 17th 2008, and September 15th and 22nd 2009. The lowest Secchi depth measured was 8.9 m on April 24th, 2007 in Stirling Arm. The average Secchi readings for Sproat Lake were 13.7 m (2006) in Taylor Arm, and 15.3 m (2006), 14.2 m (2007), 16.0 m (2008) and 17.4 m (2009) in Stirling Arm. One reason the minimum Secchi readings of Stirling Arm in 2006 and 2009 are slightly higher than 2007 and 2008 may be because sampling began later on in the season and early spring readings were missed. Based on the graph above, Sproat Lake is exhibiting oligotrophic conditions (Nordin, 1985).

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 Sproat Lake is 8 years (Ashley 2010, Pers. Comm.).

Land Use and Pollution Sources

The main land use in the Sproat Lake area is forestry. There are also three Provincial Parks, as well as private campgrounds and "spontaneous camping areas" on Sproat Lake (Cote 2010, Pers. Comm.). Volunteers report that only 50% of lakeshore residences are considered full time (Cote 2010, Pers. Comm.). Sproat Lake is not only popular with steelhead and rainbow trout fishermen, but with recreational boaters, including house boaters. There are four designated houseboat overnight areas: northwest and southwest shores of Taylor Arm, north shore of Two Rivers Arm, and a section along the south east shore of Two Rivers Arm (Wilson 2010, Email Comm.). There are also three ecologically sensitive areas: the western tips of both Taylor Arm and Two Rivers Arm, and the eastern tip of Faber Arm (Wilson 2010, Pers. Comm.).

The Ministry of Environment conducted water quality sampling in 2006 (Epps, 2006), and found that Sproat Lake is low in nutrients and bacteriological contamination. Although these findings indicate excellent water quality, local residents are encouraged to ensure their septic systems are up to standard and that their land use activities are following good environmental practices. Recreational users of the lake are also encouraged to ensure their boats and equipment are properly maintained. Further information on keeping Sproat Lake healthy can be found on the following page.

Should Further Monitoring Be Done on Sproat Lake?

The data collected by BCLSS volunteers on Sproat Lake from 2006 to 2009 indicates that the water quality has remained relatively stable over the sampling years. Based on data collected at the Stirling Arm site, Sproat Lake is exhibiting oligotrophic conditions, which is supported by Secchi and phosphorus results from both *The "Living With Our Lake" Project* (Sproat Lake Stewardship Society, 1998), as well as the data collected by the Ministry of Environment in 2006, as discussed above. However, based on the size and shape of the lake, it would be beneficial to sample the other arms of the lake more thoroughly in order to determine the overall trophic status of the lake.

If volunteers are willing to continue monitoring Sproat Lake, the data could help identify early warning signs should there be a deterioration in water quality. If possible, a deep-site sampling location in Two Rivers Arm and Faber Arm could also be added to the sampling program.

Tips to Keep Sproat Lake Healthy

Yard Maintenance, Landscaping and Gardening

- Minimize the disturbance of shoreline areas by maintaining natural vegetation cover.
- Minimize high-maintenance grassed areas.
- Reduce your use of fertilizers and pesticides.
- 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, as water contamination from runoff may occur. Use compost to fertilize gardens instead of commercial fertilizers, and hand pull weeds if necessary.

Boating and Recreation

- Do not throw trash overboard or use lakes or other water bodies as toilets.
- Use biodegradable, phosphate-free cleaners instead of harmful chemicals when cleaning your boat.
- 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.
- Conduct major maintenance chores on land.

Onsite Sewage Systems

- Make sure that your system meets local requirements before installing, repairing, or upgrading an onsite sewage system.
- 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 drainfield.
- 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.
- Use biodegradable household cleaners instead of bleach or other hazardous products (which will kill the good bacteria in your system).
- Don't overwater the drainfield or allow roof or perimeter drains to run onto the drainfield.

Left: Martin Mars water bomber landing on Sproat Lake.

Who to Contact for More Information

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Sproat Lake Community Association

http://sproatlakecommunityassociation.ca/

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Acknowledgements

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Fish Wizard (www.fishwizard.com)