B.C. Volunteer Lake Monitoring Program

CHARLIE LAKE

(Peace Region)

2003-2005

BRITISH COLUMBIA
The Best Place on Earth
Ministry of Environment

BCLSS

The Importance of Charlie Lake & its Watershed

British Columbians want lakes to provide good water quality, aesthetics and recreational opportunity. When we don't see these features in our local lakes, we want to know why. Is water quality getting worse? Has the lake been polluted by land development? What uses can be made of the lake today? And, what conditions will result from more development within the watershed?

The Ministry of Environment's (MOE) Volunteer Lake Monitoring Program (VLMP), in collaboration with the non-profit B.C. Lake Stewardship Society, is designed to help answer these questions. 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.

Through regular status reports, the VLMP can provide communities with monitoring results specific to their local lake and with educational material on lake protection issues in general. This useful information can help communities play a more active role in the protection of the lake resource. Finally, the VLMP allows government to use its limited resources efficiently thanks to the help of area volunteers and the B.C. Lake Stewardship Society.

Charlie Lake's VLMP program began in 2003 and has been conducted by the Charlie Lake Conservation Society. This group has done numerous activities around their lake, including monitoring for three years under this VLMP program, shoreline clean-ups, watershed initiatives to reduce soil erosion from oil and gas sites, talks with the agriculture industry to help improve stream crossings and enhance riparian strips, community education outreach programs, wetland/waterfowl conservation projects and the development of a strategic watershed plan.

This status report summarizes information derived from this program. Quality of the data has been found to be acceptable. Data quality information is available on request.

A **watershed** is defined as the entire area of land that moves the water it receives to 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. Charlie Lake's watershed is approximately 285km^2 and is shown on the next page.

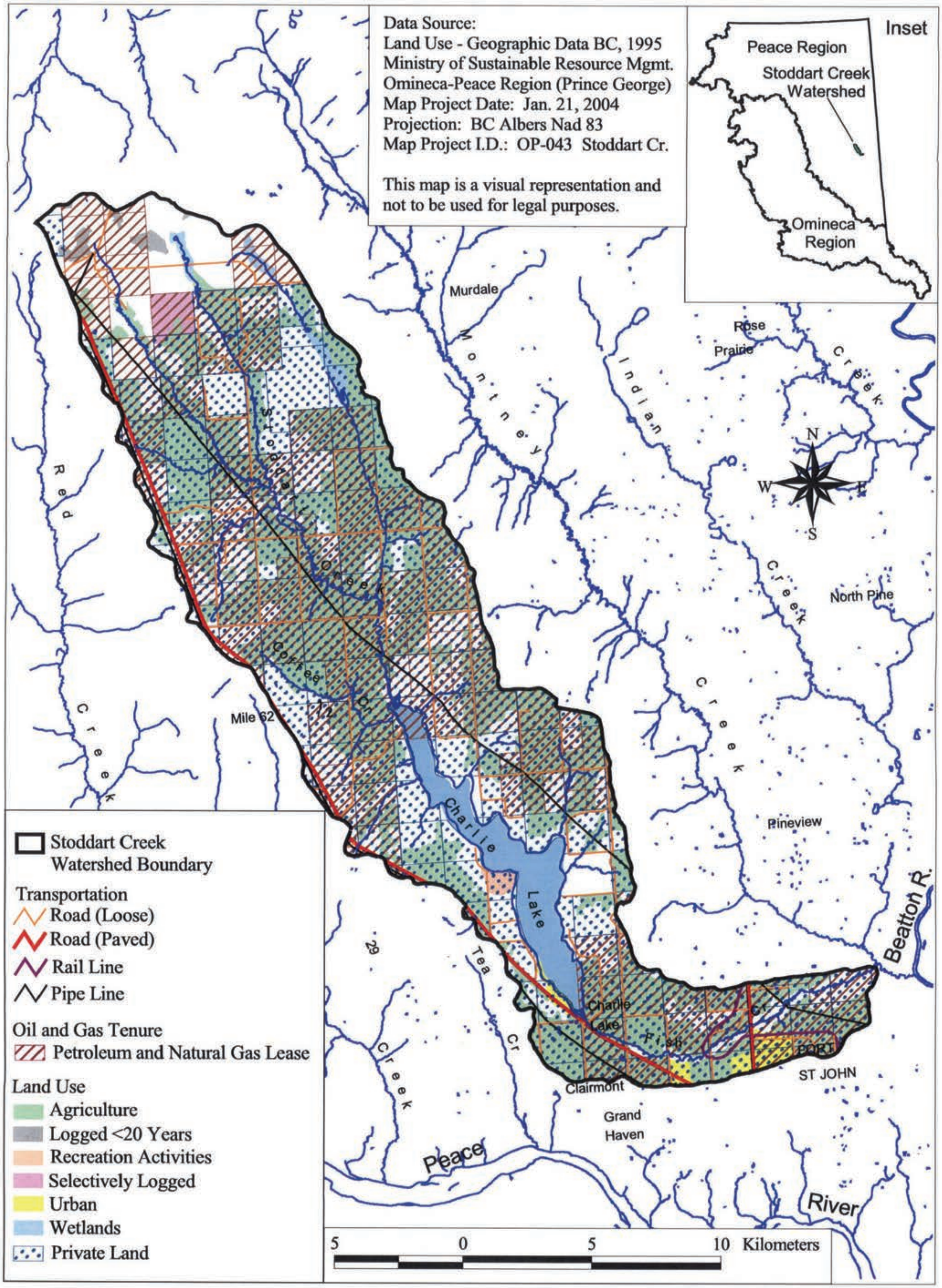
Watersheds are where much of the ongoing hydrological cycle takes place and play a crucial role in the purification of water. The quality of the water resource is largely determined by a watershed's capacity to buffer impacts and absorb pollution. This buffering capacity can be decreased by degrading land use activities.

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 water body. Poor land-use practices anywhere in a watershed can eventually impact the water quality of the down stream 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. 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.

This study is one part of a broader water quality management program being carried out by the Environmental Quality Section in MOE's Omineca-Peace Region. The overall objectives of this program are to monitor water quality so as to identify problems, to determine causes, and to work with local governments, landowners and other interested parties to improve or otherwise protect water quality and aquatic life. The information gained through this study will be applied to the protection of water quality through various means, including education of property and land owners, development of watershed management plans, or the enforcement of provincial and local regulatory controls, where applicable.

Charlie Lake Watershed and Land Use Map



A visual representation of the Charlie Lake/Stoddart Creek watershed. There is some overlap of land use activities.

Charlie Lake is located in the Peace region approximately 9km northwest of Fort St. John, B.C. The lake is roughly 15km long with maximum and mean depths of 15m and 6.4m, respectively. It has a surface area of $18km^2$ and a shoreline perimeter of 38km. Watershed land use activities include agriculture, range/grazing, oil and gas, forestry, recreation and residential development (page 2). The main inflowing tributary to Charlie Lake is Stoddart Creek, with other named tributaries including Coffee Creek and Fish Creek (Lower Stoddart Creek).

Charlie Lake contains the following sport fish: northern pike (*Esox lucius*), burbot (*Lota lota*), walleye (*Stizostedion vitreum*) and yellow perch (*Perca flavescens*). There have been many successful stocking and colonization programs on Charlie Lake, which date back to the early 1930s. There have also been some unsuccessful programs including both rainbow trout and largemouth bass.

The Charlie Lake shoreline is highly developed with two Provincial Parks, one Rotary Park, a golf course and approximately 1500-2000 residents. The main concern among many residents is the high loading of sediment and nutrients from both inflowing tributaries and shoreline practices. This nutrient addition to the lake, which has occurred during the past century, has lead to an increased intensity of both green and blue-green algal blooms (French and Booth, 2004). The main source of these sediments and nutrients is thought to originate from poorly constructed/functioning road crossings, riparian land clearing, livestock access to stream channels, poor water management at oil and gas wellhead sites and roads, domestic waste and foreshore residential development (French and Booth, 2004).

Besides being used for recreational activities, Charlie Lake is also the back up water supply to the City of Fort St. John. It was previously the main source of water for the City, however, the City later moved to a ground water system near the Peace River. During the time the City was using the lake as a water supply, a weir was constructed (1980s) at the lake's outlet to help control water levels.

As previously mentioned, the two main challenges for Charlie Lake are likely the control of phosphorus (nutrient) and sediment loading. Phosphorus loading can promote summer algal blooms and the growth of dense macrophyte mats. There has been some sampling done on inflowing tributaries to Charlie Lake, with tributaries, especially Stoddart Creek, showing some external loading after rain events and spring runoff. However, as will be discussed on page 7 and 8, Charlie Lake also appears to internally load phosphorus, which can be a major source of phosphorus during periods of bottom depth anoxia (no oxygen). The sediment loading is mainly problematic after large rain events and spring runoff when tributaries have a high discharge. This loading might also provide additional aquatic plant rooting habitat, possibly escalating the current weed problem.

Non-Point Source Pollution and Charlie Lake

"Point source" pollution originates from municipal or industrial effluent outfalls. Other pollution sources exist over broader areas and may be hard to isolate as distinct effluents. These are referred to as "non-point" sources of pollution (NPS). Shoreline modification, urban stormwater runoff, onsite septic systems, agriculture and forestry are common contributors to NPS pollution. One of the most detrimental effects of NPS pollution is phosphorus loading to water bodies. The amount of total phosphorus (TP) in a lake can be greatly influenced by human activities. If local soils and vegetation do not retain this phosphorus, it will enter watercourses where it will become available for algal production.

Onsite Septic Systems and Grey Water

Onsite septic systems effectively treat human waste water and wash water (grey water) as long as they are properly located, designed, installed, and **maintained**. When these systems fail they may become significant sources of nutrients and pathogens. Poorly maintained pit privies, used for the disposal of human waste and grey water, can also be significant contributors.

Stormwater Runoff

Lawn and garden fertilizer, sediment eroded from modified shorelines or infill projects, oil and fuel leaks from vehicles and boats, road salt, and litter can all be washed by rain and snowmelt from properties and streets into watercourses. Phosphorus and sediment are of greatest concern, providing nutrients and/or rooting medium for aquatic plants and algae. Pavement prevents water infiltration to soils, collects hydrocarbon contaminants during dry weather and increases direct runoff of these contaminants to lakes during storm events.

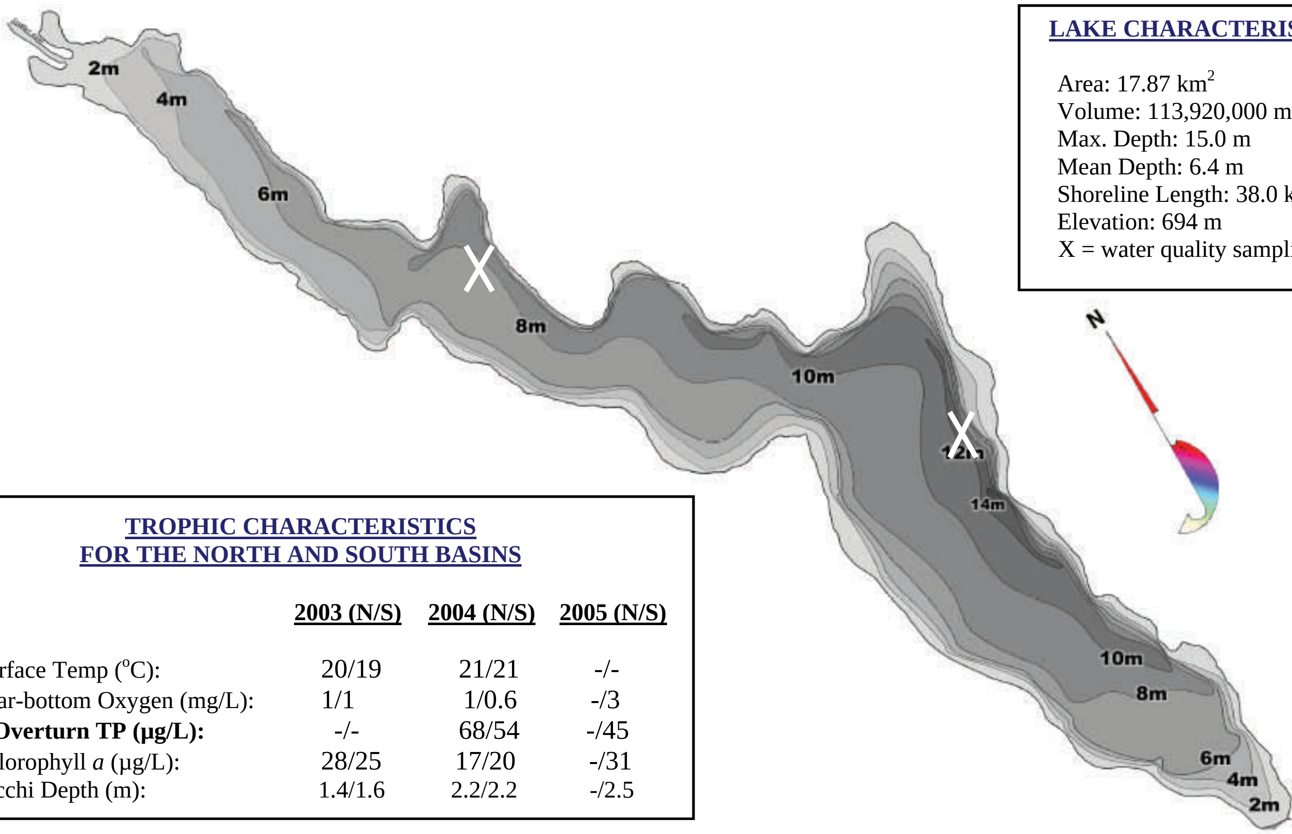
Agriculture

Agriculture includes grain, livestock and mixed farming. These practices can alter water flow and increase sediment and chemical/bacterial/parasite inputs to water bodies.

Boating

Oil and fuel leaks are the main concerns with boat operation on small lakes. With larger boats, sewage and grey water discharges are issues. Other problems include litter, the spread of aquatic plants, and the churning up of bottom sediments and nutrients in shallow water operations.

Charlie Lake Contour Map



LAKE CHARACTERISTICS

Area: 17.87 km^2
Volume: 113,920,000 m^3
Max. Depth: 15.0 m
Mean Depth: 6.4 m
Shoreline Length: 38.0 km
Elevation: 694 m
X = water quality sampling site

TROPHIC CHARACTERISTICS FOR THE NORTH AND SOUTH BASINS

	2003 (N/S)	2004 (N/S)	2005 (N/S)
Max. Surface Temp (^oC):	20/19	21/21	-/-
Min. Near-bottom Oxygen (mg/L):	1/1	1/0.6	-/3
Spring Overturn TP (μg/L):	-/-	68/54	-/45
Avg. Chlorophyll *a* (μg/L):	28/25	17/20	-/31
Avg. Secchi Depth (m):	1.4/1.6	2.2/2.2	-/2.5

What's Going on Inside Charlie Lake?

Temperature

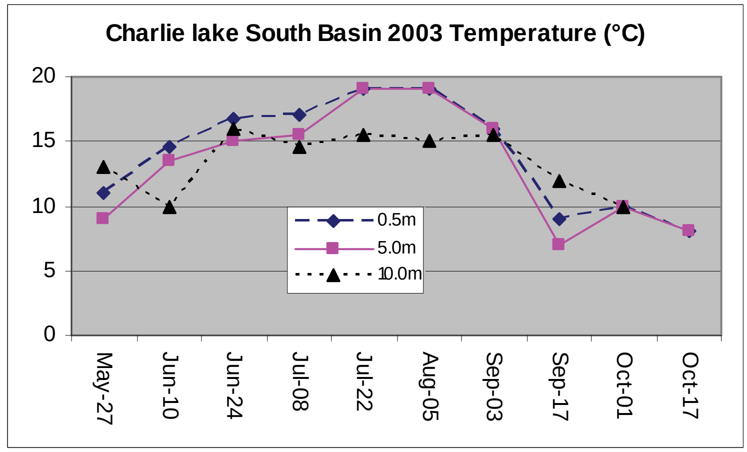
Lakes show a variety of annual temperature patterns based on each lake's location and depth. Most interior lakes form layers (stratify), with the coldest summer water near the bottom. Because cold water is more dense, it resists mixing into the warmer, upper layer for much of the summer. In spring and 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 most dense water (4°C) near the bottom.

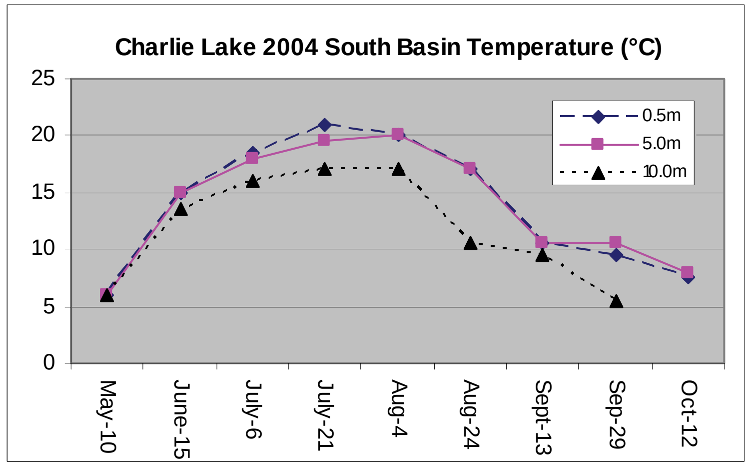
Lakes of only a few metres depth tend to mix throughout the summer or layer only temporarily, depending on wind conditions. In winter, the temperature pattern of these lakes is similar to that of deeper lakes.

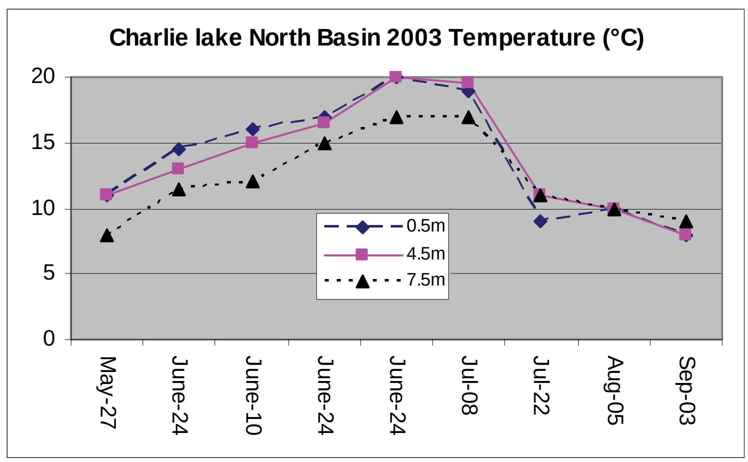
Temperature stratification patterns are very important to lake water quality. They determine much of the seasonal oxygen, phosphorus and algal conditions. When abundant, algae can create problems for most lake users.

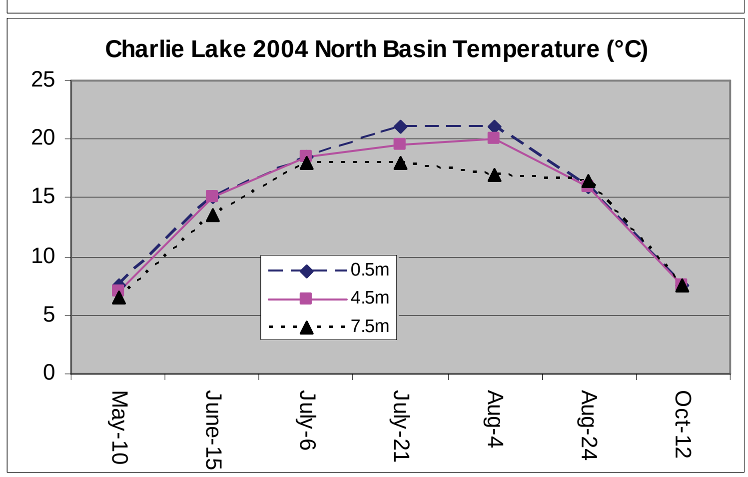
Temperature was measured in both the north and south basin of Charlie Lake between 2003 and 2005. The figures on the next column illustrate representative profiles collected. All three years, in both basins, show the lake beginning to stratify in mid to late May. The south basin held this stratification all three years, generally until the fall turnover event in early to mid September. However, the north basin appeared to de-stratify during August in both 2003 and 2004 (north basin data were not collected in 2005). The main factor for this difference is likely the fact the south basin is over 2m deeper than the north basin. This would allow the north basin deep station to be more susceptible to air temperature and wind change compared to the south basin, and therefore de-stratify more easily. Surface and mid-depth temperature appear to be very similar during July and August of most years, suggesting the lake has a deep thermocline, and is probably very productive in most of the water column.

Maximum water temperatures in the central and north deep stations reached 19/20°C in 2003, 21/21°C in 2004 and the central basin 12°C in 2005. Although the 2003 and 2004 maximum temperatures were similar, the 2005 maximum was much less. After noticing this substantial difference, the field sampling equipment was checked. Upon inspection, it was noted that the alcohol in the thermometer had actually separated, causing values to be recorded 6-7°C cooler than actual temperatures.









What's Going on Inside Charlie Lake?

Dissolved Oxygen

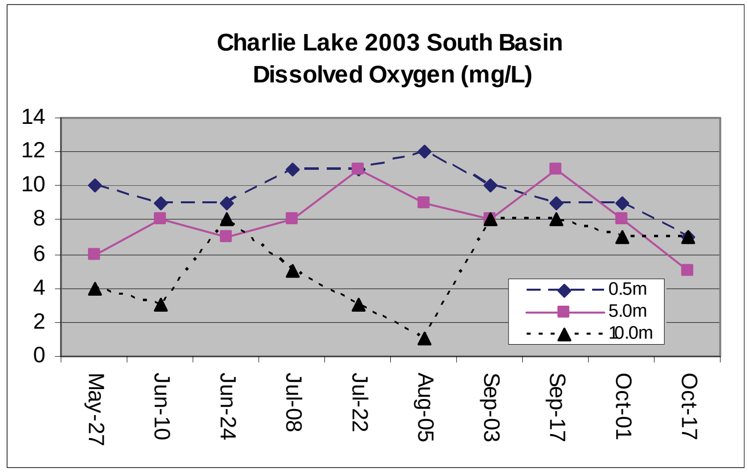
Oxygen is essential to life in lakes. It enters lake water from the air by wind action and plant photosynthesis. Oxygen is consumed by respiration of animals and plants, including the decomposition of dead organisms by bacteria. A great deal can be learned about the health of a lake by studying oxygen patterns and levels.

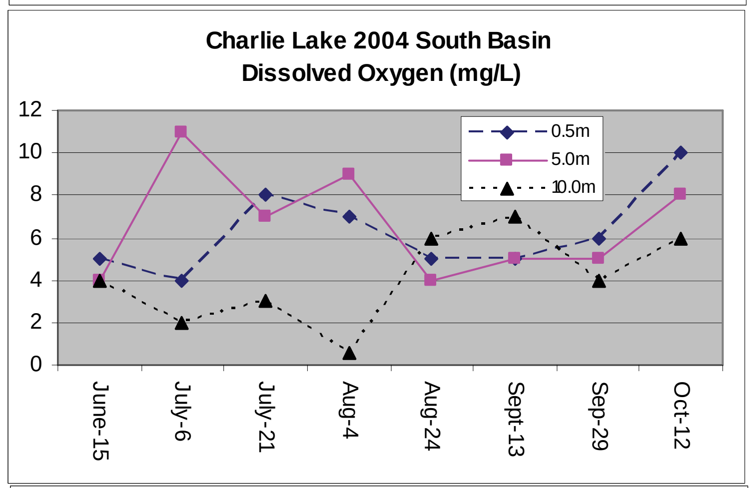
Lakes that are unproductive (oligotrophic) will have sufficient oxygen to support life at all depths through the year. But as lakes become more productive (eutrophic), and increasing quantities of plants and animals respire and decay, more oxygen consumption occurs, especially near the bottom where dead organisms accumulate.

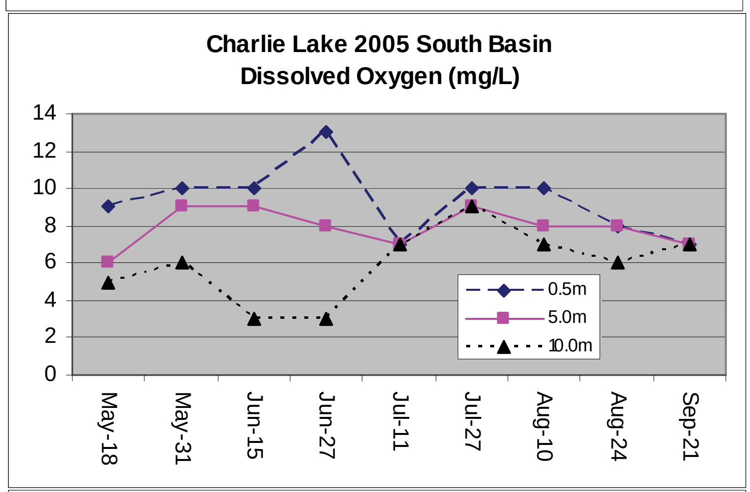
In productive lakes oxygen in the isolated bottom layer may deplete rapidly (often to anoxia), forcing fish to move into the upper layer (fish are stressed when oxygen falls below about 20% saturation). Fish kills can occur when decomposing or respiring algae use up the oxygen. In summer, this can happen on calm nights after an algal bloom, but most fish kills occur during late winter or at initial spring mixing.

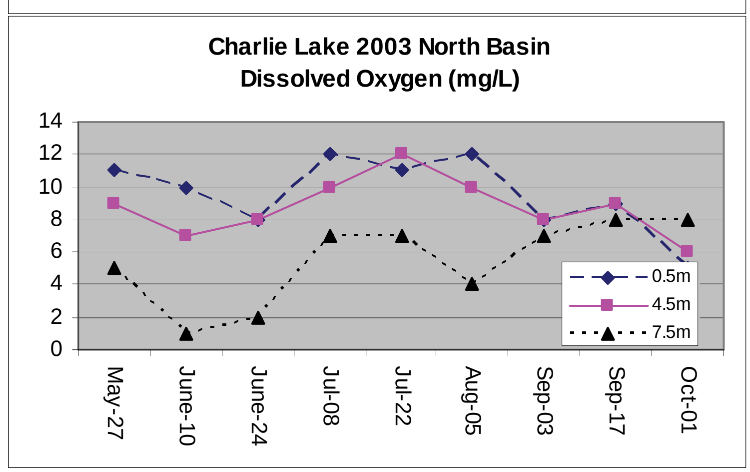
The figures on the next column display representative oxygen patterns for the north and south basins of Charlie Lake from 2003-2005. Somewhat similar patterns were observed between the three years in each respective basin, suggesting comparable annual trends in the lake and consistency in field collection by the volunteers. Surface water oxygen remained near saturation in both basins during most years (the 2004 south basin is the exception), with bottom level oxygen being more dynamic, ranging from <1mg/L up to 9mg/L. This large variation in bottom level oxygen is likely due to several factors such as: changing temperature throughout the summer (dissolved oxygen will decrease with an increase in temperature), the lake holding a stratification (a stratification will prevent the bottom layer (hypolimnion) from being mixed with the surface), wind patterns and water turbulence, the annual variation in phosphorus inputs (this variation will affect the amount of both plant and algae growth, which in turn will effect oxygen levels based on both photosynthesis and respiration rates) and bacterial decomposition.

The 2004 south basin had surface level oxygen between 5 and 7mg/L for an extended period near the end of the summer. This period also coincides with cooling water temperatures, possibly resulting in the mixing of the stratified layers. This mixing may have caused the oxygen poor hypolimnetic waters to be mixed with the surface water, resulting in the observed sag. During this same time period bottom level oxygen increased to near saturation from anoxia, which helps to corroborate this theory. Subsequent to this mixing period, all depths appeared to have oxygen increases, probably applicable to the decreasing water temperatures with the onset of fall.









What's Going on Inside Charlie Lake?

Trophic Status and Phosphorus

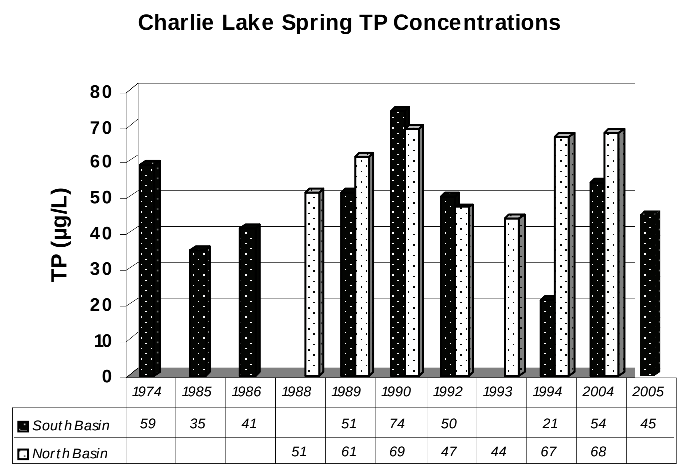
The term "trophic status" is used to describe a lake's level of productivity and depends on the amount of nutrient available for plant growth, including tiny floating algae called phytoplankton. Algae are important to the overall ecology of lakes because they are food for zooplankton, which in turn are 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. As mentioned earlier (page 4), total phosphorus (TP) in a lake can be greatly influenced by human activities.

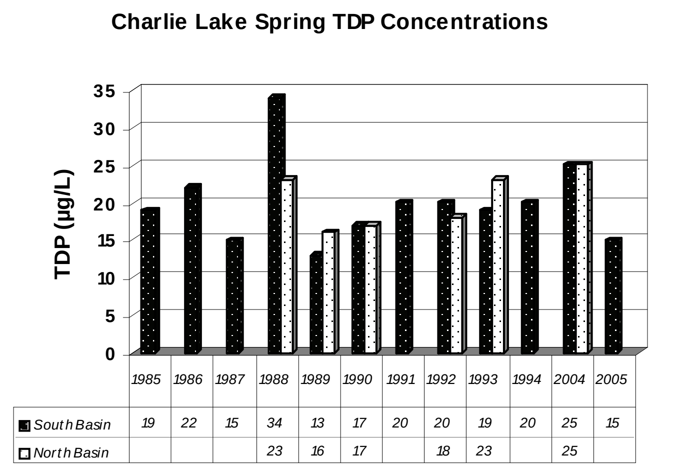
The trophic status of a lake can be determined by measuring productivity. The more productive a lake is the higher the algal growth and therefore the less clear the water becomes. Water clarity is measured using a ***Secchi disc***. Productivity is also determined by measuring nutrient levels and ***chlorophyll*** (the green photosynthetic pigment of algae). Phosphorus concentrations measured during spring overturn can be used to predict summer algae productivity.

Lakes of low productivity are referred to as ***oligotrophic***, meaning they are typically clear water lakes with low nutrient levels (1-10µg/L TP), sparse plant life (0-2µg/L Chl. *a*), and low fish production. Lakes of high productivity are ***eutrophic***. They have abundant plant life (>7µg/L Chl. *a*), including algae, because of higher nutrient levels (>30µg/L TP). Lakes with an intermediate productivity are called ***mesotrophic*** (10-30µg/L TP and 2-7µg/L Chl. *a*) and generally combine the qualities of oligotrophic and eutrophic lakes.

Lake sediments can themselves be a major source of phosphorus. If deep-water oxygen becomes depleted, a chemical shift occurs in bottom sediments. This shift causes sediment to release phosphorus to overlying waters. This "internal loading" of phosphorus can be natural but is often the result of phosphorus pollution. Lakes displaying internal loading have elevated algal levels and generally lack recreational appeal.

Charlie Lake spring TP levels in both the north and south basin had averages greater than 30µg/L in 2003 through 2005, suggesting eutrophy. Furthermore, as displayed in the historical spring TP figure, most data collected between 1974 and 2005 show eutrophy. It is of note that although the spring TP concentration is often used to predict summer productivity levels, it is often difficult to do so when the lake exhibits internal phosphorus loading. This loading, which is dependant on the bottom level dissolved oxygen concentration, can influence algal productivity when bio-available (ortho) phosphorus is released. Charlie Lake usually exhibits internal loading for at least a month each summer.





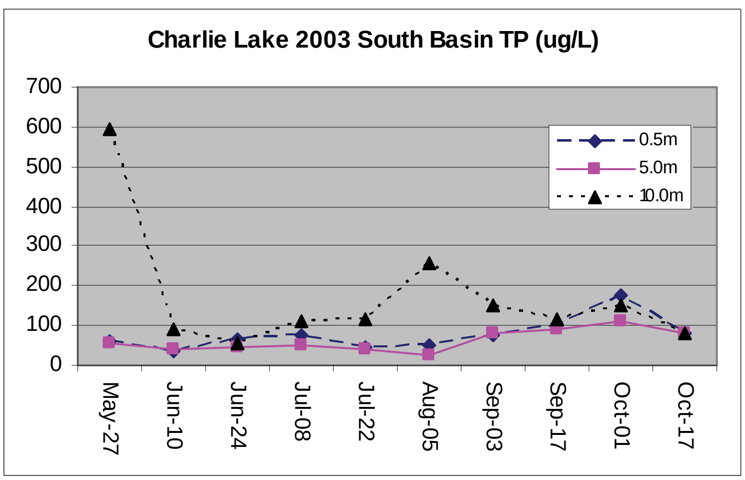
Most samples collected during the 20 year multi-basin record suggest that annual spring TP concentrations are highly variable. Some years show the south basin to have higher concentrations, while some years do not. This high variation in spring TP is probably attributable to changing rates of internal phosphorus loading, which will be affected by annual ice on/ice off dates, the amount of algae and vegetation growth throughout the summer and the bottom depth oxygen levels. This variation might also be influenced by external TP loading rates, which will be determined by the amount of spring runoff entering tributaries and land use practices throughout the watershed. As seen in the TDP graph, which is not influenced by particulate phosphorus, concentrations have been much less variable, although appear to have steadily increased from 1989 to 2004.

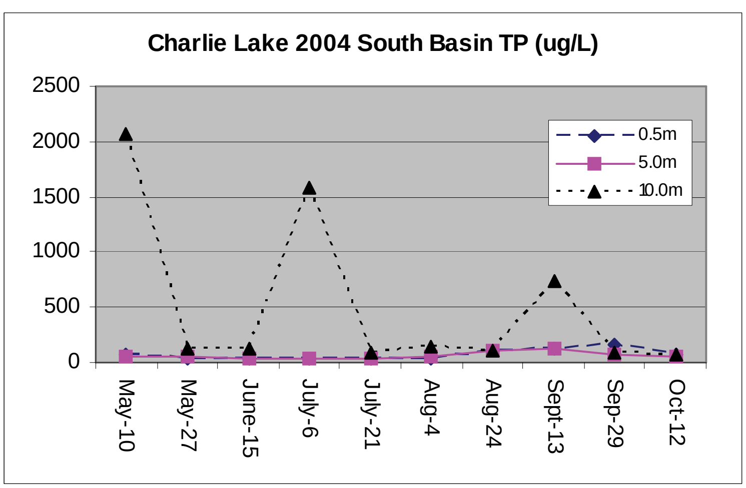
Total phosphorus trends had some similarities between 2003 and 2005, with surface and mid-depth levels remaining relatively stable from spring through fall, and bottom level concentrations increasing sporadically throughout the summer. As seen in the south basin 2003 and 2004 graphs, large TP spikes were observed during May, which coincides with both spring runoff and large algal blooms. This spike might be the result of both phosphorus bound sediment settling out from nearby, high flowing tributaries, and/or resulting from organic settling of algal material. The August 2003 spike in

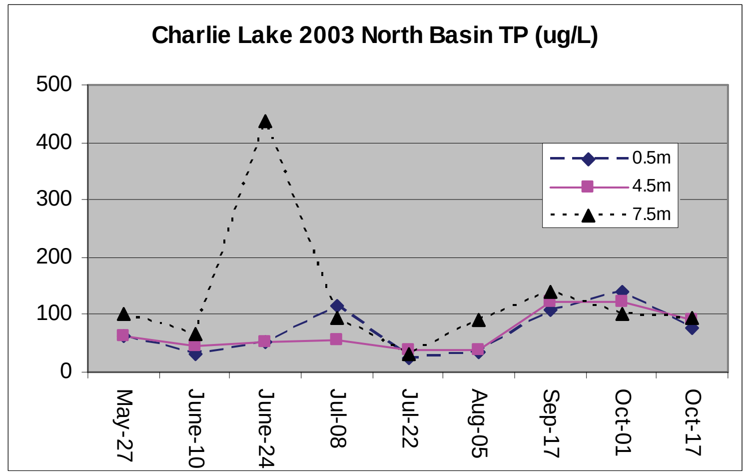
What's Going on Inside Charlie Lake?

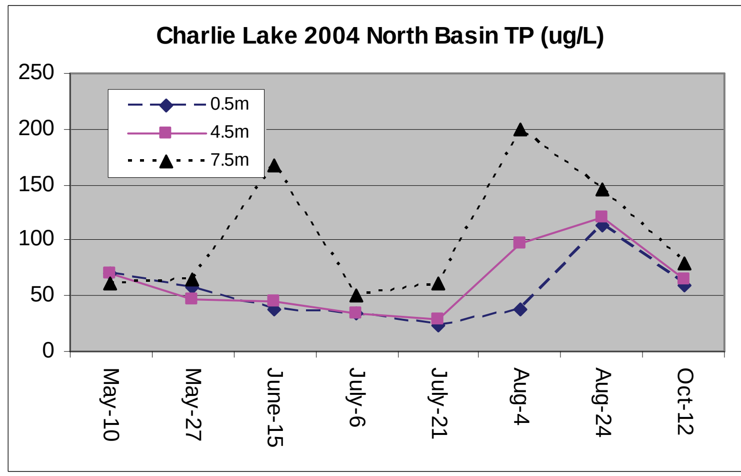
the south basin coincides with both a peak release of ortho-phosphorus from bottom sediments, as well as an algal bloom. However, the ortho-phosphorus component of the TP spike is still relatively low (~20%), suggesting the remaining TP is probably attributable to organic settling or sediment. The large spike in July 2004 south basin TP occurs concurrently with a very strong three day precipitation event, which may have caused nearby inflowing tributaries to contribute phosphorus bound sediment. A very large spike in the June 2005 surface water TP coincided with both a peak in ortho-phosphorus release from bottom sediments and a very large algal bloom.

North basin TP data was collected in 2003 and 2004 (data was not collected in 2005 due to budget constraints), which showed similar patterns between the two years. The one exception was the large bottom depth spike on June 24th, 2003. This spike does not seem to correlate with any other sampled parameters, leaving the interpretation of it unknown. The large spike on June 15th, 2004 is explained by a heavy precipitation event, possibly combined with some organic settling. Both years showed a small spike in August/September, which coincided with both a large ortho-phosphorus spike and an algal bloom.









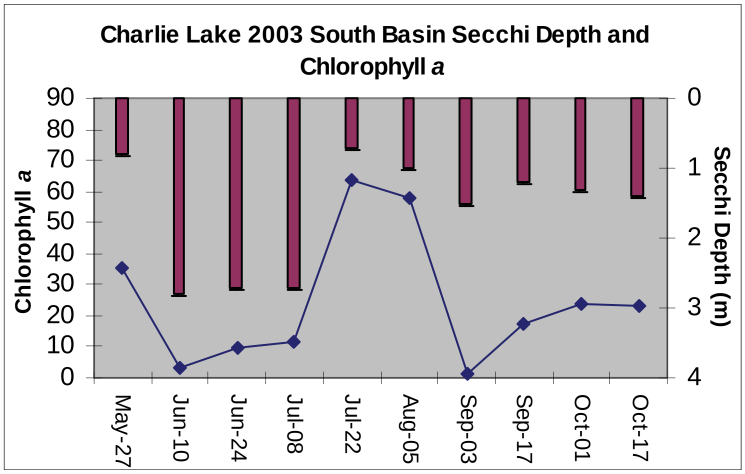
Chlorophyll *a* data, seen in the graphs for both the north and south basins on the next page, show somewhat similar trends between 2003 and 2005, with a two year summer average of 21.3µg/L in the south basin and a three year summer average of 25.3µg/L in the north basin. The data suggests the north basin to be slightly more productive compared to the south basin; however, when comparing just the two years, rather than the third year for the north basin, the numbers are much closer. The north basin 2003 and 2004 chlorophyll *a* average is 22.5µg/L.

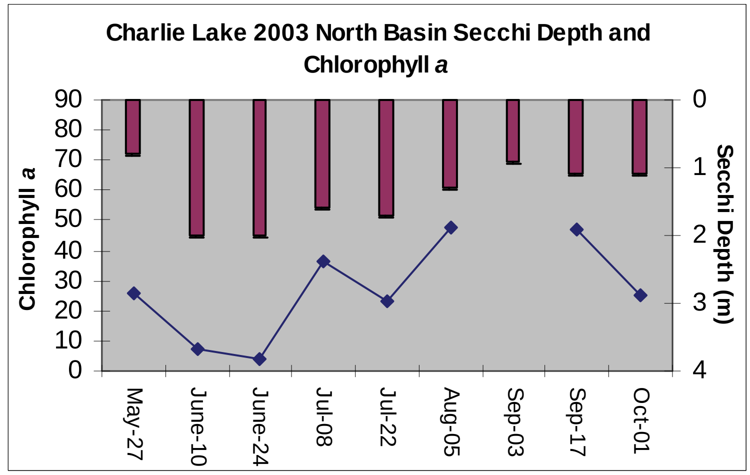
Although the chlorophyll *a* data appears to be highly variable, there are some discernable trends. More specifically, there appear to be spikes in chlorophyll *a* during the spring, mid-summer and fall. This is consistent with what French and Carmichael (1999) found during their summary of historical data on Charlie Lake. They described the first bloom, which generally occurs during the spring, as a Chrysophyte (golden-brown algae) and dinophyte (dinoflagellate) bloom. The second, mid-summer bloom, was characterized as an open-water Chlorophyte (green algae) bloom. The third bloom, typically occurring in the fall, is usually a Cyanophyte (blue-green algae) bloom.

Water visibility, which is measured by Secchi disc (seen in the same figure), can be used as an indicator for summer chlorophyll *a* concentrations. Secchi appeared to be a relatively good indicator of chlorophyll *a* during this program, suggesting that future measurements of just secchi is a possible cost saving measure compared to chlorophyll *a*.

Household Tips to Keep Charlie Lake Healthy

The south basin had a two year secchi average of 1.9m while the north basin had a three year summer average of 2.0m. Although average depths differed between the years of study, both basins showed similar depths in each respective year. There was an increasing average depth in Secchi in each of the three years, suggesting water quality, as measured by clarity, improved from 2003-2005.



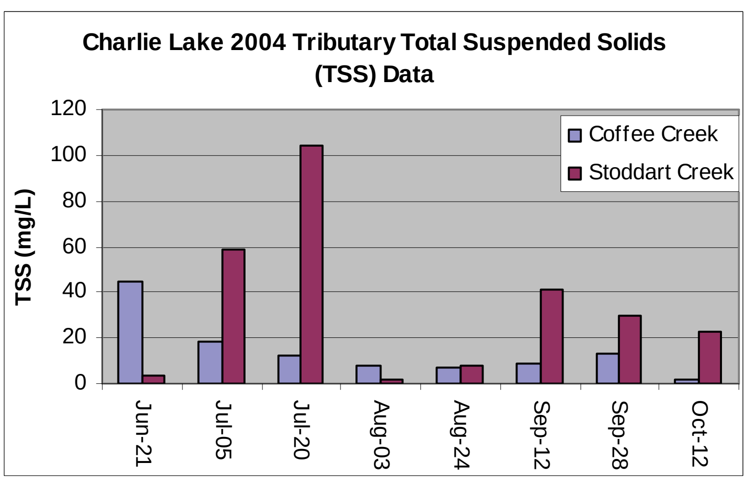


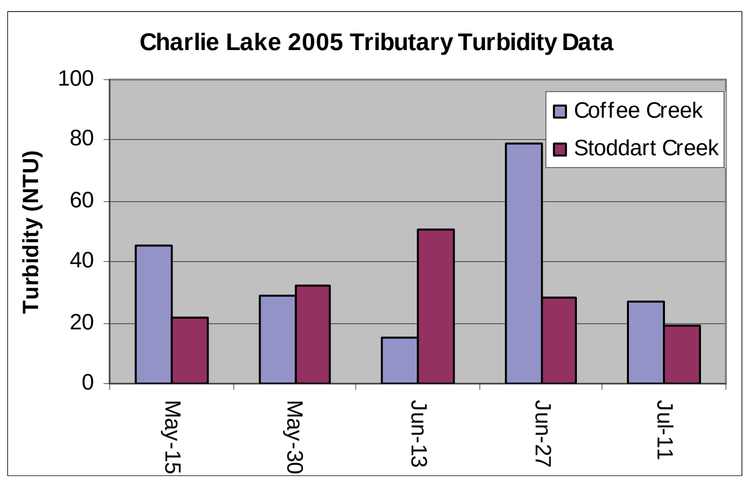
Charlie Lake Tributary Data

As part of the three year lake program on Charlie Lake, the two main tributaries flowing into the lake's north end were sampled to help supplement lake data, as well to evaluate nutrient and sediment loading impacts. In 2003 and 2004 total suspended solids (TSS) data was collected from both Stoddart and Coffee creeks. In 2005 turbidity data was collected.

Results suggest that Stoddart Creek had higher TSS concentrations than Coffee Creek, and that concentrations were highest during early summer and early fall. Although TSS appeared to increase during some rain events, it did not increase during all events. Rather, many TSS spikes were sporadic, possibly related more to watershed disturbance than to flow conditions.

Turbidity data collected in 2005 suggests that both streams have increased turbidity after precipitation events (large storms preceded that June 13th and June 27th samples), however, Coffee Creek appears to have a quicker response time, probably due to its smaller watershed size.





SUMMARY

Recent VLMP water quality results confirm that Charlie Lake is eutrophic. Data collected from this program suggest that Charlie Lake receives TP inputs from external sources, especially during spring runoff and heavy rain events. This agrees with French and Booth (2004), who suggest large amounts of sediment are entering Charlie Lake via poor agricultural and oil & gas practices. Furthermore, dissolved oxygen and phosphorus data suggest that Charlie Lake internally loads, usually for about a month each summer. This internal loading releases bio-available ortho-phosphorus, which appears to be quickly taken up by algae, as seen in the chlorophyll *a* data. French and Booth's 2004 study outline and suggest many actions that can be taken by these industries that should help reduce loading impacts to Charlie Lake and its watershed. Given the amount of ongoing development in the region, better land use practices and remedial action in areas with large clearings should be undertaken if the watershed condition is to improve. As seen in the historical phosphorus data outlined on page 7, TDP concentrations appear to be increasing, especially since 1989.

Regardless, all residents and land developers within the watershed are encouraged to practice good land management such that nutrient and/or sediment addition to the lake and its tributaries is minimized.

Household Tips to Keep Charlie Lake Healthy

Yard Maintenance, Landscaping & 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.
- Don't 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 lady bugs, as well as pests.
- Compost yard and kitchen waste and use it to boost your garden's health as an alternative to chemical fertilizers.

Agriculture

- Locate confined animal facilities away from waterbodies. Divert incoming and treat outgoing runoff from these facilities.
- Limit the use of fertilizers and pesticides.
- Construct adequate manure storage facilities.
- Do not spread manure during wet weather, on frozen ground, in low-lying areas prone to flooding, within 3 m of ditches, 5 m of streams, 30 m of wells, or on land where runoff is likely to occur.
- Install barrier fencing to prevent livestock from grazing on streambanks.
- If livestock cross streams, provide gravelled or hardened access points.
- Provide alternate watering systems, such as troughs, dugouts, or nose pumps for livestock.
- Maintain or create a buffer zone of vegetation along a streambank, river or lakeshore and avoid planting crops right up to the edge of a waterbody.

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.
- Don't 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.

Auto Maintenance

- Use a drop cloth if you fix problems yourself.
- Recycle used motor oil, antifreeze, and batteries.
- Use phosphate-free biodegradable products to clean your car. Wash your car over gravel or grassy areas, but not over sewage systems.

Boating

- Do not throw trash overboard or use lakes or other waterbodies as toilets.
- Use biodegradable, phosphate-free cleaners instead of harmful chemicals.
- Conduct major maintenance chores on land.
- Use 4 stroke engines, which are less polluting than 2 stroke engines, whenever possible. Use an electric motor where practical.
- Keep motors well maintained and tuned to prevent fuel and lubricant leaks.
- Use absorbent bilge pads to soak up minor oil and fuel 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 Styrofoam or washed plastic barrel floats. All floats should be labeled with the owner's name, phone number and confirmation that barrels have been properly emptied and washed.

Who to Contact for More Information

Public Feedback Welcomed

Ministry of Environment
Contact: Bruce Carmichael or James Jacklin
3rd Floor, 1011-4th Ave
Prince George, BC, V2L 3H9
Ph: (250)-565-6455 or (250)-565-4403
Email: Bruce.Carmichael@gov.bc.ca
James.Jacklin@gov.bc.ca

Charlie Lake Conservation Society
Contact: info@charlielakeconservationsociety.ca
Website: www.charlielakeconservationsociety.ca

Peace River Regional District
Contact: Bruce Simard,
Manager of Developmental Services
P.O. Box 810
Dawson Creek, BC, V1G 4H8
Ph: 1-800-670-7773
Fax: (250)-692-3305
Email: bsimard@pris.bc.ca

The B.C. Lake Stewardship Society
Contact:
#4 552 West Ave,
Kelowna, BC, V1Y 4Z4
Ph: 1-877-BC-LAKES
Fax: (250)-717-1226
Email: BCLSS@hotmail.com
Website: www.bclss.org

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