Perch Lake Water Quality Report 2008

Prepared for
The Perch Lake Cabin Association
&
Perch Lake Watershed Group

Monitoring and Assessment Branch
Stewardship Division
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Acknowledgements

Volunteers are essential to the water quality monitoring program as they provide local knowledge and assist with sample collection and transportation. Special thanks to Walter Gobert for providing transportation onto the lake and recording of data during winter sampling on Perch Lake. Sampling for water quality was conducted by Saskatchewan Watershed Authority staff member Lorelei Benoit.

1.0 Introduction and Background

The purpose of this report is to identify important water quality parameters in Perch Lake, which depart from Saskatchewan Watershed Authority target values and provincial objectives for recreation and the protection of aquatic life (SWA 2007; SE 2006). In addition, this report describes Perch Lake's productivity classification in an effort to enable the reader to understand the 'nature' of the lake, especially during winter months as there is no historical water quality data available for analysis.

1.1 General Description of Perch Lake

Perch Lake has a surface area of 1.4 km^2, 2.2 km in length and 0.68 km in width (calculated based on lake levels on August 14, 1992). Perch Lake has a maximum depth of approximately 10 m and is located 118 km northwest of North Battleford and 12 km northeast of Paradise Hill, Saskatchewan.

Perch Lake is used by both public recreational users and permanent residents. With a total of 58 pre-existing cabins, the development of an additional 48 lakefront properties were proposed from 2006 to 2008 (Pers. Comm. Walter Gobert, Lake Resident). It was the potential increase in both permanent and recreational users that concerned the Perch Lake Cabin Association and was the impetus for the inception of the Perch Lake Watershed Group.

Perch Lake residents and visitors enjoy fishing during summer and winter months. In addition to fishing, summer activities include the use of recreational watercraft. Swimming is uncommon due to macrophyte (shoreline plant) growth during the summer. There are no seasonal campsites at the lake; therefore, public use is comprised of day trips for those without cabins.

Perch Lake is located within the Onion Lake Plain of the Boreal Transition ecoregion, which is characterized by gently to moderately rolling glacial till plain and dominated by surface drainage towards the North Saskatchewan River (Acton et al. 1998). In years with significant outflow, Perch Lake flows west towards the Monnery River and then south to the North Saskatchewan.

1.2 Lake Stewardship & Perch Lake Watershed Group

Perch Lake Watershed Group (PLWG) showed interest in Saskatchewan Watershed Authority's *Lake Stewardship Program* on August 2006, eventually leading to sampling in early 2008. The *Lake Stewardship Program* was intended to support activities and projects focused on increasing public education regarding lake health. Lakes with stewardship groups and volunteers interested in learning more about water quality and aquatic ecology participated in Saskatchewan Watershed Authority's *Lake Stewardship Program.* In addition to providing the advice and resources for stewardship groups, the *Lake Stewardship Program* provided technical support (i.e. sample collection), analytical costs and interpreted water quality measurements for the PLWG. Prior to the termination of the *Lake Stewardship Program* in March 2008, there were two water quality samples taken during the winter of 2008.

The PLWG volunteers are important advocates on behalf of Perch Lake and its upland area. Since March 2008, the group continues to take part in activities and projects which promote education and awareness regarding the aquatic and terrestrial health of Perch Lake. The PLWG aims to inform the public about the water quality of Perch Lake and the ways that human activities can positively or negatively affect its water quality. The group has carried out one of their goals by providing permanent residents with informational packages and newsletters regarding the health of Perch Lake.

The mission of the PLWG is "…to educate our watershed community about healthy living on the water and promote participation from each cabin owner to clean up our shoreline and improve water quality of Perch Lake." The PLWG continues to work towards protecting Perch Lake by proposing a signage project at the boat launch, which is intended to provide boaters and lake users with information on a number of ways to protect the lake. The group has suggested a shoreline cleanup with community volunteers for spring 2009.

2.0 Water Quality Sampling

The objective of water quality sampling in 2008 was to provide background (normal or average) water quality values for Perch Lake. Though water quality sampling through the *Lake Stewardship Program* ceased shortly after sampling was initiated, the background data collected on Perch Lake in 2008 does provide information that can be used to better understand the lake's water quality.

No historical water quality data was found in the government surface water quality database for Perch Lake, Saskatchewan.

2.1 Sampling Frequency, Locations and Water Quality Testing

The standard lake sampling schedule for Saskatchewan Watershed Authority's *Lake Stewardship Program* includes two winter (January to March) and four summer samples (May to October) per year; however, because of program circumstances, only two winter samples were taken on Perch Lake in 2008. Winter sampling dates were February 6 and March 10, 2008. Sampling was conducted at the Perch Lake *Baseline Station* (Figure 1).

Baseline Station: Baseline stations are generally deep, centrally located sites chosen to represent typical water quality conditions in the lake. Certain parameters (i.e. dissolved oxygen and temperature) are recorded at intervals throughout the depth at the site. Baseline stations are typically sampled six times throughout the year with top and bottom samples collected when the water column is not uniformly mixed.

During water quality sampling, several water quality parameters were collected which represent the chemical and biological aspects of Perch Lake's water quality. Parameters of importance include major ions, nutrients, heavy metals, herbicides, bacteria, dissolved oxygen and pH

Used to define the overall water quality of Perch Lake, water quality results from the baseline station were compared to provincial objectives for specific water uses such as irrigation and the protection of aquatic life and target values recommended by the Saskatchewan Watershed Authority (Table 1) [1]. For a complete listing of all parameters tested, see the Data Tables at the end of the document.

Table 1: Objectives and target values established for the assessment of lake water quality

Parameter	Objective
Nutrients	
Total Phosphorus (mg/L)	0.1 [2]
Unionized Ammonia (µg/L)	19* [1]
NO_3-N (mg/L)	2.9 [2]
Metals	
Mercury - Inorganic (µg/L)	0.026 [1]
Aluminium (mg/L)	0.1 [1]
Chromium (µg/L)	1 [1]
Arsenic (µg/L)	5 [1]
Major Ions	
Chloride (mg/L)	100 [1]
Sodium (mg/L)	100 [2]
Sulphate (mg/L)	1000 [1]
Herbicides**	
MCPA (µg/L)	0.025 [1]
2'4-D (µg/L)	4 [1]
Microbiological Water Quality	
E. coli Bacteria (units/100mL)	200 [1]
General Parameters	
Dissolved Oxygen (mg/L)	5.5 [1]
pH (units)	6.5-9.0 [1]
Chlorophyll *a* (µg/L)	50 [2]

*Value calculated based on pH and temperature. **Not sampled

[1] Saskatchewan's Surface Water Quality Objectives, Interim Edition, 2006.

[2] Saskatchewan Watershed Authority target value.

[1] For a more complete explanation regarding the objectives used to assess Perch Lake's water quality, please refer to the "Lake Stewardship Water Quality Guide" online at www.swa.ca.

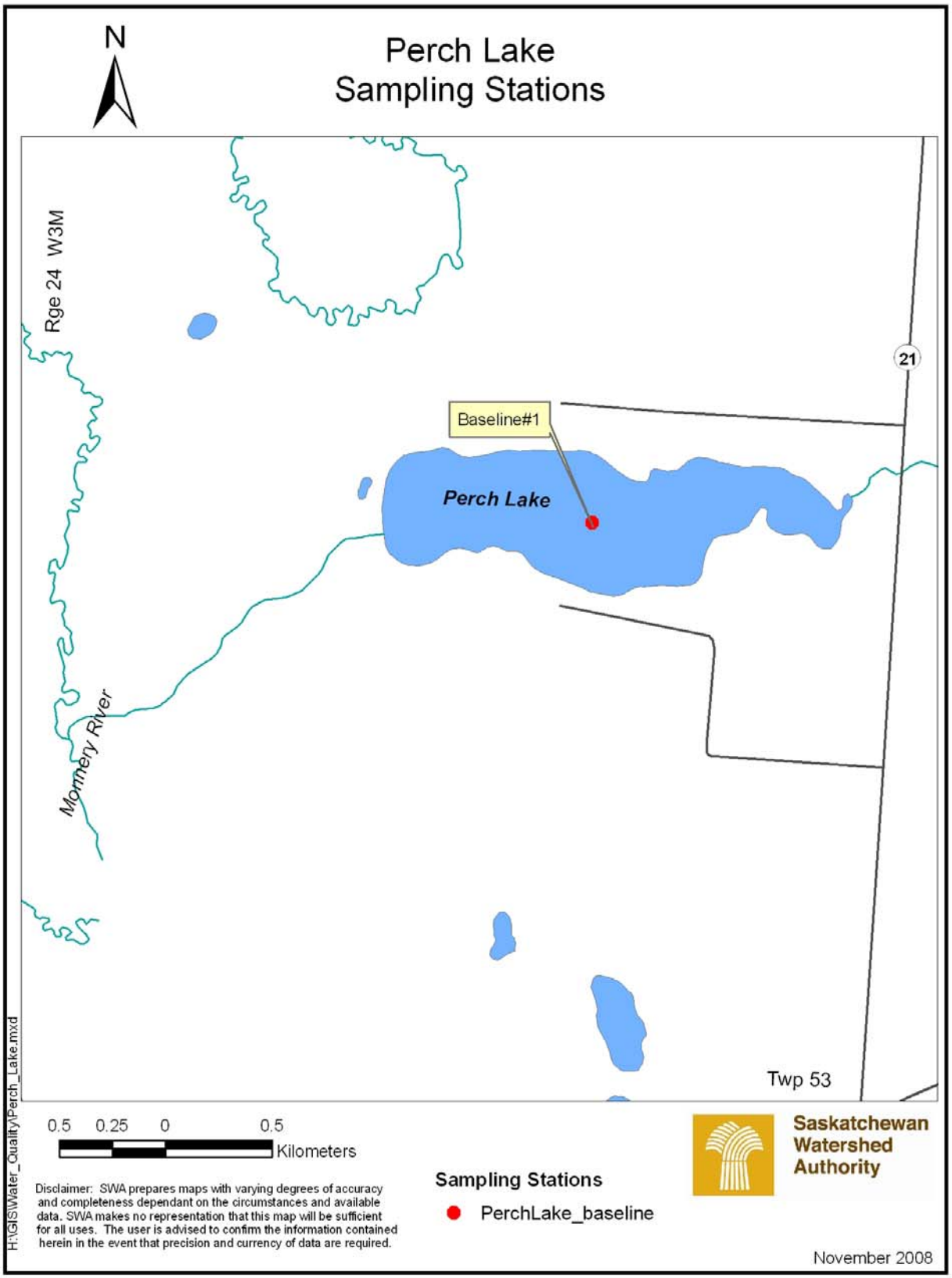

Figure 1: Map of Perch Lake 2008 baseline station

3.0 Water Quality Results and Discussion

3.1 Baseline Station Summary

Perch Lake's baseline station shows excursions in four out of 15 parameters compared to objectives or target values. Parameters which did not meet the objectives and target values include: dissolved oxygen, sodium, ammonia and arsenic. Excursions in these particular parameters indicate that these deviations may not be due to human influences, but rather to natural processes which may not impair the ecology of Perch Lake.

3.2 Parameters with WQI Objectives

Nutrients

Nutrients are essential for the growth and survival of all organisms. As a result of their importance, key nutrients including phosphorus, ammonia, and nitrogen were monitored as part of the *Lake Stewardship Program*.

Total Phosphorus
The amount of nutrients in a lake influence how much and what types of life it supports. In aquatic systems nutrients come from a variety of sources including: human activities, natural weathering, inflow, and internal sources (e.g. release from sediment at the lake bottom). Increased nutrients can lead to a variety of problems including increased algal growth; however, it is important to note that total phosphorus is variable and may change seasonally. Total phosphorus ranged from Perch Lake was 0.02 mg/L to 0.03 mg/L within the water column on both sampling occasions.

Ammonia
Ammonia is an important nutrient found naturally in lakes throughout Saskatchewan. Ammonia is largely derived from the decomposition of organic matter and exists in two forms, unionized and ionized. The relative proportion of each form is dependent on pH and temperature (Trussell, 1972). At certain concentrations, unionized ammonia can be harmful to aquatic life such as fish.

Perch Lake's decreasing dissolved oxygen (see General Parameters, Dissolved Oxygen) with increasing depth may be a contributing factor leading to a slight increase in ammonia concentration at the lake bottom (Wetzel 2001). An increased concentration of ammonia may therefore result in increased levels of unionized ammonia, which is noted in the exceeded ammonia objective in February's bottom sample and throughout the water column during winter 2008.

Nitrate
Nitrate and nitrite are forms of nitrogen. Nitrogen is an essential plant nutrient, which can contribute to either algal or macrophyte growth. In Perch Lake nitrate concentrations were below the Saskatchewan Watershed Authority objective of 2.9 mg/L.

Metals

Arsenic, chromium, mercury and aluminium are natural elements found in soil and bedrock. They may enter surface water through natural rock weathering, discharge of industrial wastewater, agricultural pollution, and dissolution in rain, snow, or groundwater. It is difficult to trace the source of metals in surface water since there are many natural and human sources. Given that Saskatchewan is rich in many minerals, it is not unusual to find these metals in surface water.

Arsenic

Arsenic is an element common in Saskatchewan's ground and surface water. The arsenic objective set for the protection of aquatic life in surface water is 5 µg/L (SE 2006). Perch Lake exceeded the objective on both winter sampling occasions (values were 7.1 µg/L and 7.3 µg/L). The arsenic concentration in Perch Lake is similar to a third of the lakes tested through the *Lake Stewardship Program* (Figure 2)

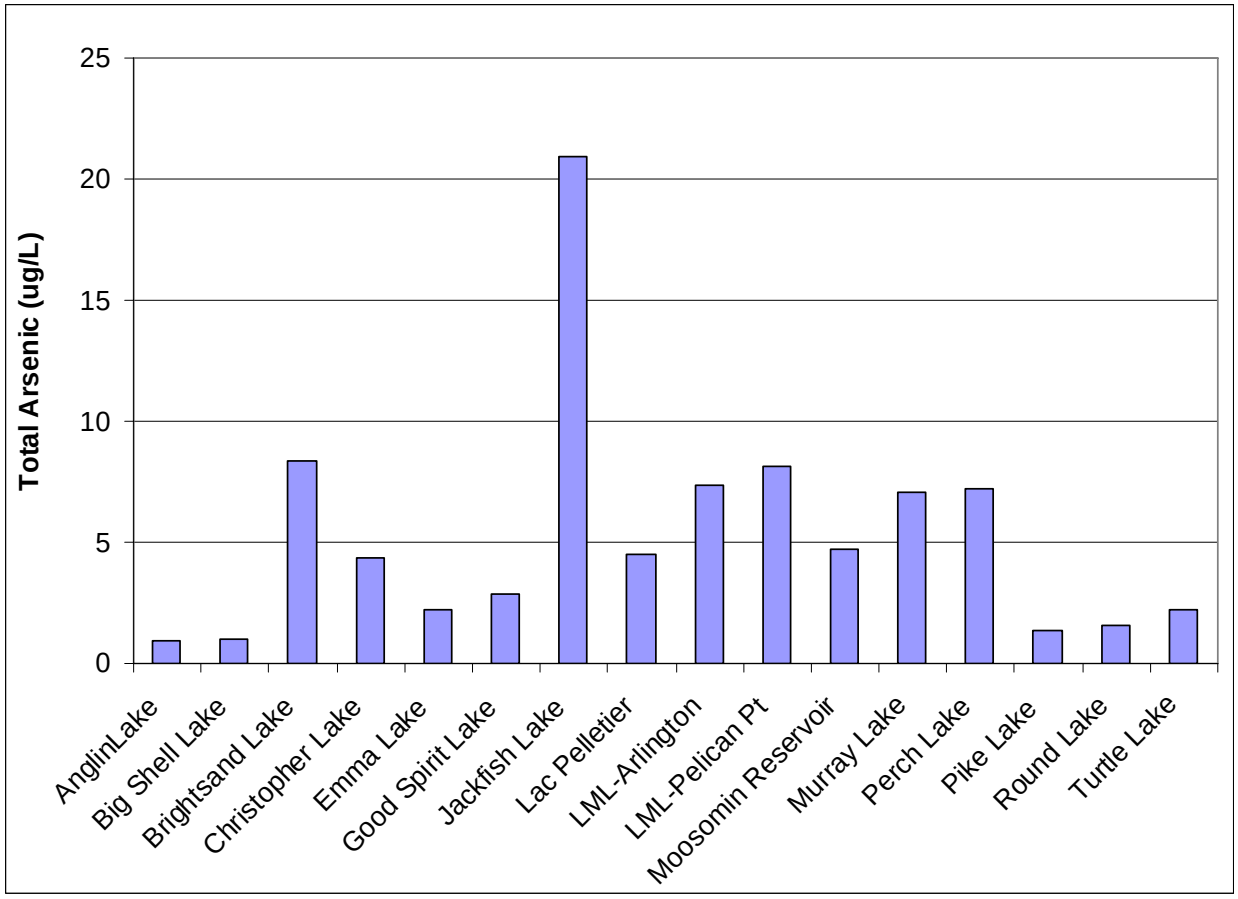

Figure 2: Average concentration of arsenic in lakes tested through the *Lake Stewardship Program*. Note: LML= Last Mountain Lake.

Aluminum

Occurring naturally in the environment, aluminum can remain bound to soil under neutral or slightly basic conditions (Wetzel 2001). Given the absence of local industrial sources of aluminum, levels appear natural and were below detection <0.005 mg/L (or <5µg/L).

Chromium

In the absence of major industry, chromium values are present in small amounts in the natural environment. For this reason the objective for the protection of aquatic life is <1 µg/L in surface water such as lakes. Perch lake had levels of chromium below detection with both samples resulting in values <0.001 mg/L (or <1 µg/L).

Mercury

Having gathered much attention for it ability to bioaccumulate in aquatic organisms such as fish, mercury can be found naturally within the water column; however levels found in the water column have very little relationship to that found in biological organisms. Mercury levels in Perch Lake's water did not exceeded water quality objectives. On both sampling occasions in 2008, results were below lab detection.

Major Ions

Major ions are charged particles dissolved in water. Many metals and minerals are also present in ionic form, but the major ions of importance for the purpose of this document include chloride, sodium, and sulphate. Processes like erosion, runoff, evaporation and human activity can contribute to dissolved ions in the water. The sum of all ions (including some not described here) is represented by a value called total dissolved solids (see Specific Conductivity).

Chloride

Not typically exceeding in Saskatchewan lakes tested through the *Lake Stewardship Program*, the objective for the protection of aquatic life is 100 mg/L. During the winter 2008, chloride concentrations in Perch Lake had maximum values of 58.9 mg/L at the surface to 64 mg/L near the lake bottom.

Sodium

Sodium is one of the many ions that make up the ionic composition of the water. Saskatchewan Watershed Authority suggests a target value for sodium of 100 mg/L; however, there are many different acceptable levels of sodium depending on the use of the water (i.e. irrigation or livestock watering). The sodium levels in Perch Lake exceeded the target with values from 201 mg/L to 206 mg/L.

Sulphate

Typically representing the largest proportion of dissolved sulphur in a lake (dependant on pH and redox potential), sulphate has an objective of 1000 mg/L for the protection of agricultural uses (Wetzel 2001; CCME 2006). Sulphate concentrations in Perch Lake had values from 177.2 mg/L to 178.0 mg/L in surface samples taken during the winter 2008.

Microbiological

Escherichia coli

Escherichia coli (*E. coli*) is a species of bacteria found in the lower intestines of animals and humans. *Escherichia coli* species are commonly detected in surface water because humans, pets, livestock, birds and wild animals come into contact with the water. The recreational guideline for *E.coli* states that "The geometric mean of at least five samples taken during a period not to exceed 30 days should not exceed 2000 *E. coli* per litre" (Saskatchewan Environment 2006).

Though our method of testing did not meet the methodological requirements as mentioned above, both samples from Perch Lake baseline were below the objective for *E.coli* in recreational waters (10 counts/100mL). Regardless of the origin, it is always helpful for humans to take steps to minimize contamination (i.e. proper septic tank maintenance and keeping pets out of the water).

General Parameters

Surface water quality parameters measured at the baseline station include five general measurements which contribute to a better understanding of Perch Lake's water quality. These five parameters include chlorophyll *a*, specific conductivity/total dissolved solids (TDS), turbidity, pH, dissolved oxygen (DO) and temperature.

Chlorophyll *a*

Chlorophyll *a* is the primary pigment that plants and algae use to convert sunlight into energy for growth. By determining the amount of chlorophyll *a* you can estimate the algal biomass. Saskatchewan Watershed Authority set a target value for chlorophyll *a* at 50 mg/L. The range for chlorophyll *a* for winter sampling in Perch Lake is from <0.02 mg/L to 1.7 mg/L. It is important to note that chlorophyll *a* in winter conditions under the ice is expected to be low and is not reflective of concentrations during summer months.

Specific Conductivity and Total Dissolved Solids

Influenced by geology and soil composition, conductivity is a measure of water's ability to conduct an electrical current, which is dependent on the concentration of dissolved ions in solution. Specific conductivity is calculated using the conductivity of the water which is a function of ion concentration and the water temperature. This field measurement provides an estimate of salinity which is more accurately represented by laboratory results for TDS (total of all dissolved ions in the water). In March 2008, specific conductivity values in Perch Lake were 1,285 µS/cm to 1,363 µS/cm. TDS values in Perch Lake in February and March 2008 were 1,095 mg/L and 1,126 mg/L respectively. Perch Lake during winter months is classed as sub-saline (Last et al. 2005).

Turbidity

Turbidity is a measure of water clarity. A reduction in water clarity may be caused by both dissolved and suspended solids in the water, including sediment (e.g. during lake overturn) and plankton (small plants and animals). Common sources of turbidity include shoreline erosion (because of ice scour or wave action from wind or boat traffic), waste discharge, urban runoff,

algal growth, sediment disruption from human activities or bottom feeding organisms. An increase in turbidity decreases light penetration because the particles floating in the water either absorb or scatter the light (Wetzel 2001). For recreational purposes, the surface water objective for turbidity is less than 50 NTU. Turbidity is low (meaning good light penetration and clarity is good) at the baseline station in Perch Lake which can be expected during winter months. Values ranged between 0.55 NTU and 4.8 NTU.

pH

pH is an important water quality parameter that affects chemical and biological reactions within lakes. Affecting many other parameters, extremes in pH or rapid changes in pH can impact aquatic life. The pH of Perch Lake ranged from 8.8 to 9.19 which are not values unusual for our lakes here in Saskatchewan though throughout the entire province, lakes demonstrate a variety of pH levels (basic to acidic).

Dissolved Oxygen & Temperature

Dissolved oxygen concentrations are variable depending on time, weather, and temperature. Dissolved oxygen affects both chemical processes and biological organisms within the lake. For example, certain fish species are sensitive to low levels of dissolved oxygen and may experience stress or death due to low levels of oxygen in the water. The objective is 5.5 mg/L of dissolved oxygen for the protection of aquatic life. Profile measurements for dissolved oxygen in Perch Lake indicate that it is not well oxygenated throughout the late winter months (February and March). Though it is not monitored on a yearly basis, the Ministry of the Environment has found that the lake often experiences winterkill due to low oxygen levels during the winter, with the last large even occurring in 1992 (MOE 1996).

Low dissolved oxygen during the winter months is common in Saskatchewan lakes. This drop in oxygen is due to the low oxygen exchange with the atmosphere and the presence of bacteria on the lake bottom which utilize the oxygen in the process of decomposition. In February 2008, the dissolved oxygen was below the objective at a depth of 5 m resulting in 13 percent of the lake volume below the objective (see Figure 3a). However, by March 2008, the dissolved oxygen was below the objective throughout 100 percent of the water column. From 6 m depth to lake bottom, the concentrations of dissolved oxygen continued to decrease from 3 mg/L to 0.1 mg/L (Figure 3b).

Temperature profiles throughout depth are measured because of the direct/indirect influence it has on other parameters such as dissolved oxygen and specific conductivity. For example, temperature can influence the spatial distribution of fish (i.e. cold water vs. warm water species) and plant growth. Ranging seasonally, temperature values observed at the baselines in Perch Lake during the winter varied from 0.8°C to 3.1°C (Figure 3a & 3b).

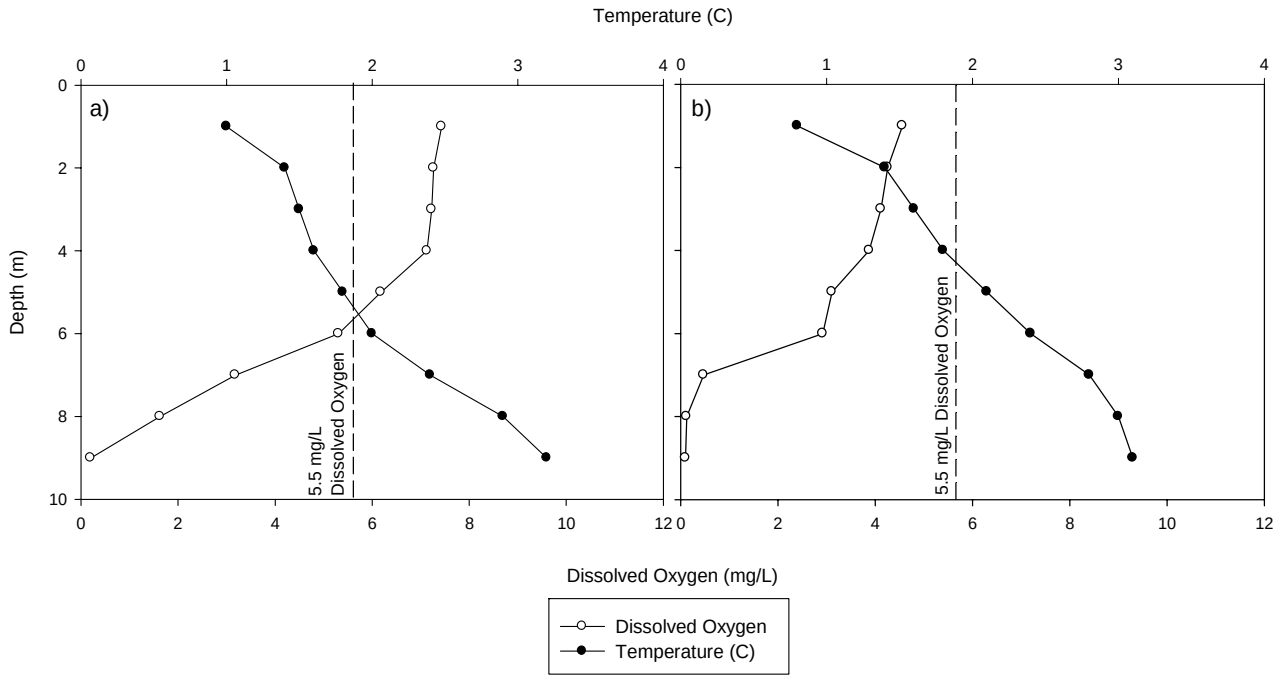

Figure 3: **Profile of dissolved oxygen and temperature on February 6th (a) and March 10th (b), 2008. Vertical line indicates the 5.5 mg/L dissolved oxygen Surface Water Quality Objective for the protection of aquatic life (SE 2006).**

3.3 Lake Productivity

Lakes are often categorized according to how productive they are, which can be estimated by how much algae (chlorophyll *a*) is present in the water during the summer. Because our sampling occurred during the winter, we used two alternative ways of assessing the productivity of Perch Lake.

The first method of classifying Perch Lake's productivity was to assess the nutrient concentrations including total phosphorus and total nitrogen which both suggest that Perch Lake is productive (mesotrophic to eutrophic). Supporting the classification of meso-eutrophic, the total phosphorus level (during winter 2008) in Perch Lake was from 0.02 mg/L – 0.03 mg/L (Wetzel 2001). The term meso-eutrophic implies that Perch Lake has medium-high concentration nutrients available for organisms such as algae to grow.

A second way to assess productivity is to calculate how rapidly oxygen is depleted throughout the water column. Using the dissolved oxygen concentrations throughout the profile of Perch Lake and lake volume at each depth, we can determine the oxygen consumption which took place between February and March 2008. With approximately 400 mg/m^2/day of dissolved oxygen used during this period, trophic status for Perch Lake is classed again as being meso-eutrophic (Nurnberg 1996). This classification based on lake depletion is the same as the classification based on nutrients.

Lakes with high productivity tend towards oxygen depletion during times of decreased oxygen production/exchange and when increased amounts of oxygen are used by bacteria at the lake bottom. As the winter progresses, more oxygen is used and not regenerated, eventually causing the winter lake oxygen levels to drop below acceptable levels for fish. Though this doesn't occur every year, Perch Lake certainly has the natural potential to do so.

4.0 Recommendations

Perch Lake was sampled through the *Lake Stewardship Program* for the winter of 2008, completing two winter samples in February and March. The information collected thus far provides lake users, residents, managers and other interested parties with an increased understanding of Perch Lake's water quality. To determine seasonal patterns in Perch Lake's water quality and realize the natural chemical and biological characteristics of the lake, additional sampling throughout the open water season would be necessary.

Saskatchewan Watershed Authority encourages the PLWG to continue educating themselves and other lake users about the water quality of Perch Lake and how to protect it. To maintain the water quality of Perch Lake, it is recommended that recreational users and upland stakeholders (including cabin owners) minimize nutrient additions to the lake. Fertilizer use and disruption of natural vegetation and shoreline should be kept to a minimum. Enhancement of shoreline buffer zones to slow erosion and slow the flow of surface runoff to Perch Lake will help reduce the amount of nutrients and other contaminants entering the lake.

The Saskatchewan Watershed Authority encourages the continuation of public education and outreach by the *Perch Lake Watershed Stewards* to teach lake users and stakeholders to follow healthy shoreline living practices such as those outlined in *On the Living Edge – Your Handbook for Waterfront Living* (Kipp & Gallaway 2003).

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Data Tables

2008

Perch Lake Baseline 2008 - Profiles				
Date (d/m/y)	**Depth (m)**	**Dissolved Oxygen (mg/L)**	**Water Temperature (ºC)**	**Specific Conductivity (µS/cm)**
06/02/08	1	7.43	1.0	1,285
	2	7.27	1.4	1,287
	3	7.23	1.5	1,285
	4	7.13	1.6	1,287
	5	6.18	1.8	1,286
	6	5.31	2.0	1,289
	7	3.18	2.4	1,286
	8	1.63	2.9	1,284
	9	0.20	3.2	1,292
	10	0.23	3.1	1,300
10/03/08	1	4.56	0.8	1,356
	2	4.26	1.4	1,358
	3	4.12	1.6	1,354
	4	3.88	1.8	1,356
	5	3.11	2.1	1,347
	6	2.92	2.4	1,348
	7	0.47	2.8	1,346
	8	0.12	3.0	1,363
	9	0.10	3.1	1,355

Perch Lake Baseline 2008 - Surface		
Parameters	**February 6**	**March 10**
Nutrients (mg/L)		
Dissolved Organic Carbon	22.1	21.6
Nitrate, as Nitrogen	<0.04	<0.04
Ammonia, as Nitrogen	0.20	0.33
Total Kjeldahl Nitrogen	1.7	1.8
Total Phosphorous	0.02	0.02
Ortho-Phosphate, as P	<0.02	<0.02
Solids (mg/L)		
Suspended, Fixed	<1	1
Suspended, Volatile	<1	1
Suspended, Total	1	2
Bacteria (orgs/100 mL)		
E. Coli	<10	<10
Total Coliform	<10	<10
Major Ions (mg/L)		
Alkalinity, Total	501	506
Alkalinity, Phenol	50.0	44.9
Bicarbonate	489	508
Calcium	24	25
Carbonate	60	54
Chloride	59.5	64.0
Hardness, Total	323	338
Magnesium	64	67
Potassium	19	20
Sodium	201	206
Sulphate	178.0	182.4
Total Dissolved Solids	1,095	1,126
Other		
Chlorophyll *a* (µg/L)	<0.20	0.59
Conductivity (µS/cm)	1,341	1,370
pH (pH units)	9.0	8.9
Turbidity (NTU)	1.00	0.80
Biochemical Oxygen Demand (mg/L)	<2	<2
Chemical Oxygen Demand (mg/L)	51.9	56.2
Field Data		
Time Sampled	9:50	11:00
Air Temperature (ºC)	-10	-4
pH (pH units)	9.19	9.29
Secchi Disk (meters)	0	na
Turbidity (NTU)	0.93	0.55
Wind Speed (km/hr)	>30.0	4.5
Cloud Cover (%)	100	0
Ice Depth (cm)	0.45	50

Perch Lake Baseline 2008 - Bottom		
Parameters	**February 6**	**March 10**
Nutrients (mg/L)		
Dissolved Organic Carbon	21.6	21.2
Nitrate, as Nitrogen	<0.04	<0.04
Ammonia, as Nitrogen	0.52	0.58
Total Kjeldahl Nitrogen	2.0	2.0
Total Phosphorous	0.03	0.03
Ortho-Phosphate, as P	<0.02	<0.02
Solids (mg/L)		
Suspended, Fixed	<1	1
Suspended, Volatile	2	1
Suspended, Total	2	2
Bacteria (orgs/100 mL)		
E. Coli	<10	<10
Total Coliform	41	<10
Major Ions (mg/L)		
Alkalinity, Total	495	500
Alkalinity, Phenol	38.0	30.5
Bicarbonate	511	536
Calcium	24	25
Carbonate	54	37
Chloride	58.9	63.0
Hardness, Total	323	330
Magnesium	64	65
Potassium	19	20
Sodium	199	201
Sulphate	177.2	178.4
Total Dissolved Solids	1,099	1,125
Other		
Chlorophyll *a* (µg/L)	1.70	0.59
Conductivity (µS/cm)	1,338	1,368
pH (pH units)	8.8	8.8
Turbidity (NTU)	4.8	2.5
Biochemical Oxygen Demand (mg/L)	<2	<2
Chemical Oxygen Demand (mg/L)	50.5	57.6

Perch Lake Baseline 2008 - Surface Metal Parameters		
	February 6	**March 10**
Metals (mg/L)		
Mercury (µg/L)	<0.05	<0.05
Aluminium	<0.005	<0.005
Arsenic (µg/L)	7.3	7.1
Barium	0.027	0.028
Beryllium	<0.001	<0.001
Boron	0.36	0.37
Cadmium	<0.001	<0.001
Chromium	<0.001	<0.001
Cobalt	<0.001	<0.001
Copper	<0.001	0.002
Iron	0.004	0.004
Lead	<0.002	<0.002
Manganese	0.006	0.006
Molybdenum	<0.001	0.004
Nickel	<0.001	<0.001
Silicon, Soluble	0.48	0.66
Silver	<0.001	<0.001
Strontium	0.10	0.11
Titanium	<0.001	<0.001
Vanadium	<0.001	<0.001
Zinc	<0.005	<0.005
Zirconium	<0.001	<0.001

Perch Lake Baseline 2008 - Bottom Metal Parameters		
	February 6	**March 10**
Metals (mg/L)		
Mercury (µg/L)	<0.05	<0.05
Aluminium	<0.005	<0.005
Arsenic (µg/L)	7.3	7.1
Barium	0.027	0.030
Beryllium	<0.001	<0.001
Boron	0.36	0.37
Cadmium	<0.001	<0.001
Chromium	<0.001	<0.001
Cobalt	<0.001	<0.001
Copper	<0.001	<0.001
Iron	0.004	0.010
Lead	<0.002	<0.002
Manganese	0.006	0.053
Molybdenum	<0.001	0.003
Nickel	<0.001	<0.001
Silicon, Soluble	0.48	1.10
Silver	<0.001	<0.001
Strontium	0.10	0.11
Titanium	<0.001	<0.001
Vanadium	<0.001	<0.001
Zinc	<0.005	<0.005
Zirconium	<0.001	<0.001