

Suitability of Select Lakes for Fish Stocking in the Lac la Biche Region



Prepared for:

**Lac la Biche Fisheries Enhancement Group
in Cooperation with Lakeland County
Lac La Biche, Alberta**

Prepared by:

Jay S. White, M.Sc., P. Biol.
Aquality Environmental Consulting Ltd.
11216 23B Avenue
Edmonton, Alberta
T6J 4Z6

October 2005

1.0 Table of Contents

1.0 TABLE OF CONTENTS	1
2.0 INTRODUCTION	2
3.0 METHODS.....	3
3.1 FIELD COLLECTIONS.....	3
3.2 LABORATORY ANALYSIS.....	4
4.0 RESULTS AND DISCUSSION.....	5
4.1 RESULTS SUMMARY	5
4.2 TOUCHWOOD LAKE	6
4.3 PINEHURST LAKE.....	8
4.4 ELINOR LAKE	9
4.5 CLAUDE LAKE	11
4.6 ANTOINE LAKE.....	11
4.7 LITTLE JOHNSON LAKE (LITTLE CHUMP)	13
4.8 BURNT LAKE	14
4.9 FRENCHMAN LAKE	16
4.10 HORNE LAKE.....	18
4.11 KINUSIO LAKE.....	19
4.12 HYLO LAKE	19
4.13 LAKE MISSAWAWI.....	20
4.14 TOTAL DISSOLVED SOLIDS	20
5.0 RECOMMENDATIONS	22
6.0 REFERENCES CITED.....	24

2.0 Introduction

The popularity of fishing makes it a national pastime in Canada. More than six million Canadians fish recreationally, almost double the number of Canadians that play hockey or golf combined (Canadian Sportfishing Industry Association, 2004). Canadians spent \$6.7 billion on the sport in 2000 (Department of Fisheries and Oceans Canada, 2000). Albertans alone spent \$147.8 million on recreational fishing in 1996 (Federal-Provincial-Territorial Task Force on the Importance of Nature to Canadians 2000).

Over 226,000 recreational fishing licenses were sold in Alberta in 2002, with an estimated 373,000 people fishing (Sustainable Resource Development 2004). However, fishing opportunities in our Province are limited due to the scarcity of suitable fish habitat (Sustainable Resource Development, 2003). Many lakes in the Province are shallow and freeze to the bottom in the winter, or have water temperatures that are too warm for fish in the summer. Both of these scenarios are barriers to fish survival. There are only 800 natural lakes and 300 reservoirs in Alberta that contain sportfish.

The limited number of fishable lakes in Alberta puts immense pressure on recreational fisheries and creates several challenges for managers of the resource, such as over-harvesting. Simply put, the demand for fish greatly exceeds the supply of fish and fish-bearing waterbodies in the Province. As a result, fish populations have declined as a result of over-harvest and habitat alteration (Sustainable Resource Development 2003). To deal with this dilemma, many of Alberta's lakes are managed as catch-and-release, while others have been closed to angling altogether. Anglers in Alberta now travel large distances and into remote areas within the Province to fish. Extensive forestry, oil and gas exploration and other developments have helped to open up many remote waterbodies year-round within the Province to those with all-terrain vehicles.

The Lac la Biche Fisheries Enhancement Group is considering stocking suitable lakes in the Lakeland region to help meet the goals of increasing and improving fish habitat and reducing angling pressure on other lakes in the region. Several lakes in the region have experienced the collapse of fish populations, such as the walleye (*Sander vitreus*) collapse in Lac la Biche in the 1980s. The lakes that the group is considering stocking with sportfish are, with a few exceptions, currently fishless lakes. A stocked fishery may be managed as a put-and-take system. In such a system, fish would be stocked in the spring and removed in the summer by anglers and in the fall by commercial fishermen. This approach can result in both recreational and economic benefits for fishermen. Alberta Sustainable Resource Development has several criteria to determine the suitability of any water body for stocking (Berry and Stenton, 1993).

The purpose of this study was to sample and identify potential fish stocking candidates within the Lac La Biche region. The lakes investigated were: Antoine, Burnt, Claude, Elinor, Frenchman, Hylo, Horne, Kinosiu, Little Johnson (also called Little Chump), Missawawi, Pinehurst, and Touchwood. Water depth, temperature and dissolved oxygen were used as

gross indicators of fish survival, and lakes that were found to be suitable were sampled to verify presence and absence of fish. Other components of fish habitat suitability were not assessed as part of this study. Several lakes were prescreened for their suitability in April and August 2004, and samplings were undertaken in March, June, and August, 2004.

3.0 Methods

3.1 Field Collections

Water quality parameters were sampled on three separate occasions during 2004. Winter samples were collected at the following lakes by first drilling holes through the ice with an 8-inch power auger. Kinosisu Lake was sampled on March 31, 2004, and Elinor, Pinehurst, Antoine, Hylo (Tawakwato), Missawawi, and Touchwood were sampled on April 1, 2004. Summer samples were collected at the following lakes from a small aluminum boat. Claude, and Little Johnson Lake were sampled on June 11, 2004; Frenchman and Horne Lake were sampled on August 2, 2004; and Burnt Lake was sampled on August 3, 2004. The locations of all lakes are shown in Figure 1. All collections were made by Aquality Environmental Consulting Ltd., working with Lakeland County staff.

Dissolved oxygen (DO), temperature (°C), acidity (pH) and total dissolved solids (TDS) were recorded with a Hydrolab 4x datasonde, which was calibrated as required on the mornings of each sampling day. Acid-washed 2L brown Nalgene bottles were used to collect discrete water quality samples at 1m depth intervals at lakes with significant depth (i.e. greater than 6m; Touchwood, Pinehurst, Elinor, Claude and Little Johnson). A stainless steel 1L Kemmerer bottle, or Van Dorn bottle was used to collect water samples at regular intervals for routine chemical analysis.

Three lakes thought to be most suitable based on preliminary results were netted to find whether viable fish populations already existed there. Netting was performed on Sept 21-23, 2004 at Frenchman, Horne and Burnt Lakes. All collections were made by Aquality Environmental Consulting Ltd., working with Lakeland County and Alberta Sustainable Resource Development (ASRD) staff. Two experimental gillnets (Fipec FEX-03) were set at each lake in midmorning and left for approximately 24 hours then picked of captured fish. Nets were set perpendicular to shore at a depth of 2-5 meters, to offer the greatest possibility of catching fish. Two small commercial minnow traps were baited and set at various locations around the lake. Finally, Frenchman Lake and Burnt Lake were seined using nets supplied by ASRD. Horne Lake was not seined as there was no suitable shoreline area around the lake. All live fish captured in gillnets were measured and promptly released, and one dead fish was aged and disposed of according to Alberta Sustainable Resource Development protocols.

3.2 Laboratory Analysis

Water samples were kept on ice and analyzed within 24 hours for TP and TDP at the University of Alberta limnology lab. Total phosphorus (TP) and total dissolved phosphorus (TDP) were digested and analysed by the Bierhuizen and Prepas (1985) potassium persulfate method and measured spectrophotometrically as per APHA (1992). Silica, carbonate, bicarbonate, alkalinity and pH were also analyzed.

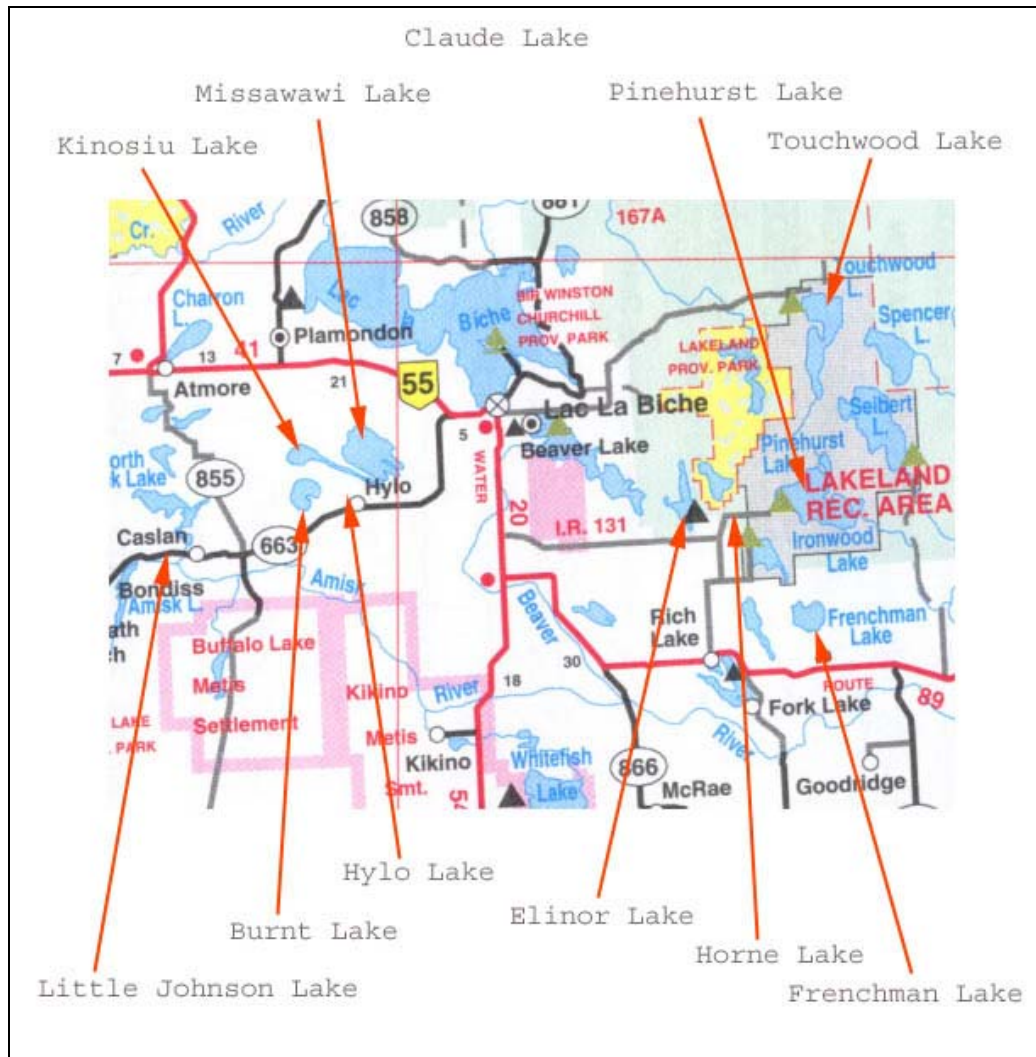


Figure 1: Selected lakes sampled by Aquality and Lakeland County to assess fish stocking suitability. Arrows indicate lakes sampled, or indicate where a lake should appear on the map.

4.0 Results and Discussion

4.1 Results Summary

A list of site locations and sampling depths appears in Table 1. For all lakes sampled, physical profiles were generated showing dissolved oxygen and temperature. For the deepest lakes (Touchwood, Pinehurst, Elinor, Claude, Antoine and Little Johnson), water chemistry (i.e. nutrients) profiles are also presented. For the shallower lakes, only physical profiles were recorded (Burnt, Frenchman, Horne, Hylo, Kinusio and Missawawi). Due to our inability to locate deep spots for Kinusiu Lake, no physical profile or water chemistry data were collected there.

Table 1: Legal and GPS locations and sampling depths for the lakes sampled in this study. Lakes are presented from deepest to shallowest.

Lake Name	Location		Depth (m)	
	Legal	GPS	Sampled	Max Known
Touchwood Lake (North Basin)	Tp66-68 R9, 10 W4	N 54 50 256 W 111 23 106	25	40
Pinehurst Lake	Tp65, 66 R9, 10 W4	N 54 39 672 W 111 26 663	18	21
Elinor Lake	Tp65, R11, W4	N 54 39 114 W 111 39 671	17.3	-
Claude Lake	Tp67, R13, W4	N 54 47 625 W 111 54 493	13.7	-
Antoine Lake	Tp67, R14, W4	N 54 45 978 W 112 04 881	6	-
Little Johnson Lake	Tp65, R17, W4	N 54 47 626 W 111 54 438	3.9	-
Burnt Lake	Tp66, R16, W4	N 54 41 108 W 112 19 615	3.3	-
Frenchman Lake	Tp64, R10, W4	N 54 31 866 W 111 27 411	3.5	-
Horne Lake	Tp65, R11, W4	N 54 38 056 W 111 33 462	3.3	-
Kinusiu Lake	Tp66, R16, W4	N 54 43 665 W 112 18 038	2.5	-
Hylo Lake	Tp66, R15, W4	N 54 41 395 W 112 12 199	2.1	-
Missawawi Lake	Tp66, R15, W4	N 54 43 449 W 112 11 492	2.1	-

Results are presented in the order of deepest to shallowest lakes. Generally speaking, the smaller, shallower lakes had the lowest dissolved oxygen concentrations, higher temperatures, and highest phosphorus concentrations and would be least suitable for fish survival. We assume that fish would be unable to overwinter in these lakes, and that summer thermal stress would be a threat to fish survival. The shallow lakes (< 3 m) include Burnt, Frenchman, Horne, Hylo, Kinosiu, Little Johnson (Little Chump) and Missawawi Lakes. Better candidates for fish stocking would be the deeper Antoine, Claude, Elinor, Pinehurst and Touchwood Lakes.

4.2 Touchwood Lake

Touchwood Lake was sampled in early April 2004 to a depth of 25m (the maximum length of the HydroLab Sonde's cable). Touchwood is the deepest lake in the region, and one of the deepest in Alberta. The surface was frozen at the sampling time. Water temperatures rose from 0 °C to 2 °C in the first two meters and then to 2.5 °C at 25 m (Figure 2). Dissolved oxygen was 13.5 mg/L at the surface and dropped gradually to 5.5 mg/L at 25 m. pH was neutral, ranging from 8.2 at the surface to 7.5 at 25m. Both total dissolved solids and conductivity remained steady throughout the water column. Total Phosphorus (TP) was 25.7 µg/L at the surface, dropping to approximately 20 µg/L at 12 m before increasing again at 21m, peaking at 32.6 µg/L (Figure 3). Total Dissolved Phosphorus (TDP) concentrations were lowest at the surface (14.2 µg/L) but increased at depth, following the pattern of TP. The major increase for concentrations of both TP and TDP came between 21m and 24m. This pattern was not matched by any other physical parameter sampled, and may suggest that anoxic sediments farther down are releasing phosphorus.

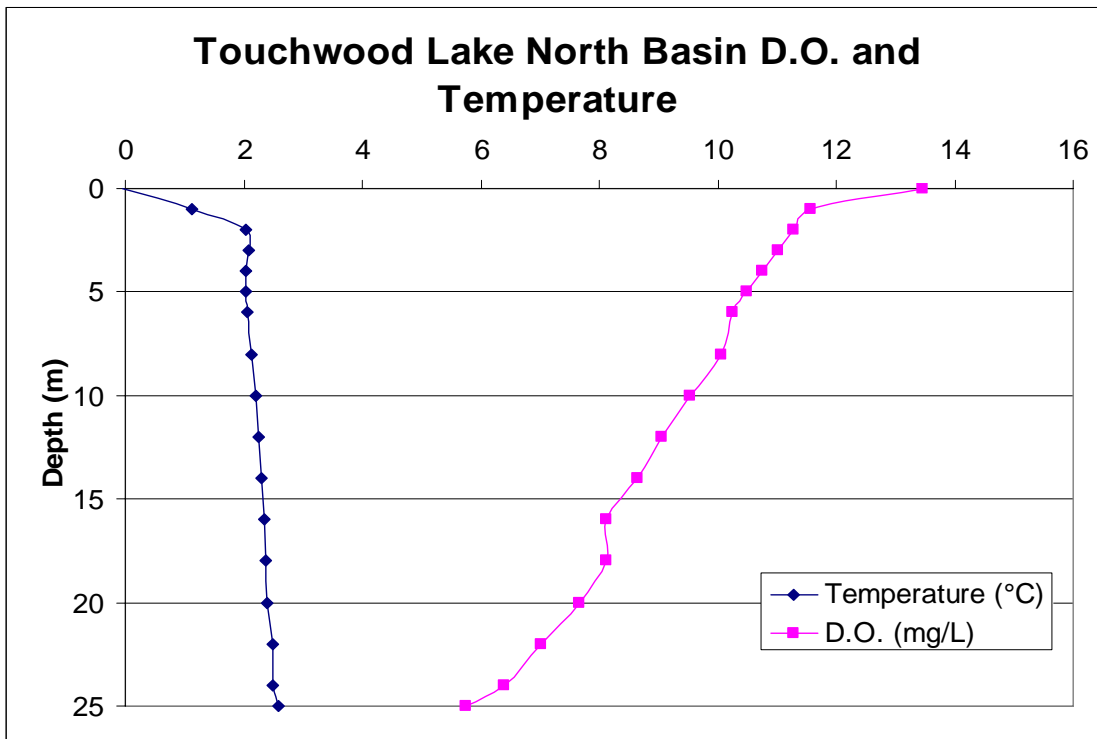


Figure 2: Physical profile data for Touchwood Lake.

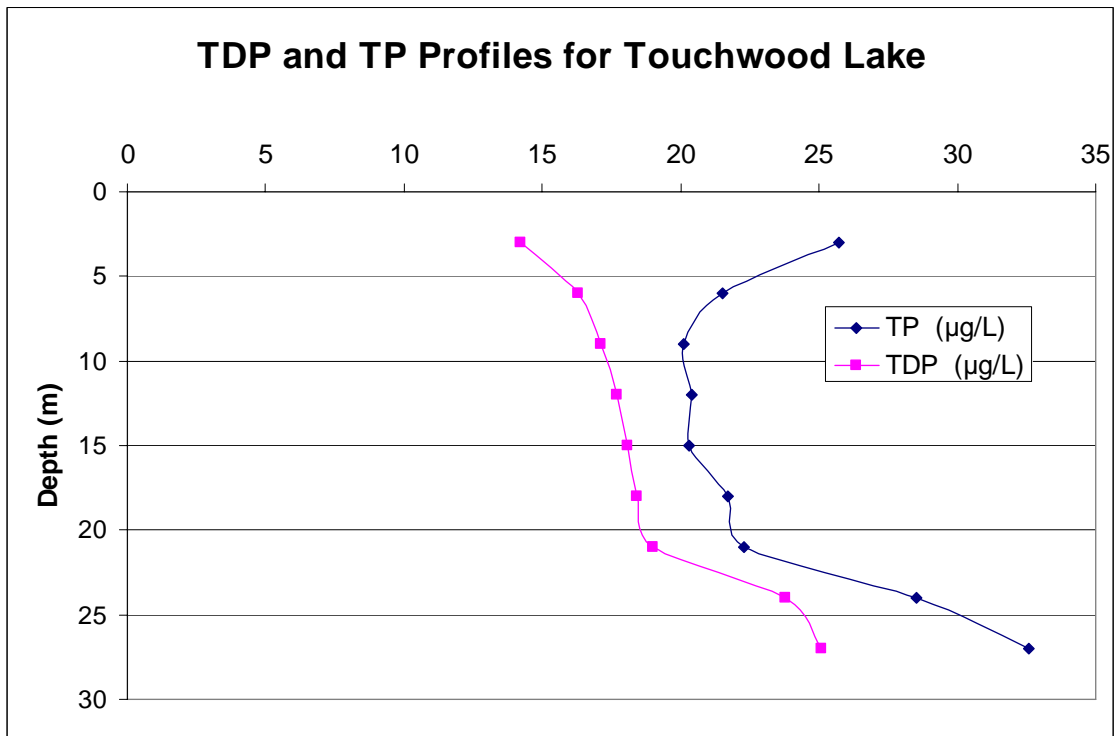


Figure 3: TP and TDP profile for Touchwood Lake

4.3 Pinehurst Lake

Pinehurst Lake was sampled in early April 2004 to a depth of 18 m. Temperature ranged from 0 °C at the surface to 3 °C at the bottom, with the biggest temperature increase happening between 1-2 m (Figure 4). Dissolved oxygen was highest at the surface, dropping slowly for the first 12 m and then quickly dropping to zero by 18m. pH was neutral at 7.5 until the 18 m mark, where it became slightly acidic to the bottom. Both total dissolved solids and conductivity were stable throughout most of the water column. TP was approximately 20 µg/L at the surface, remaining steady to 12m before rising to 53.20 µg/L at 18m (Figure 5). TDP followed an identical pattern, hovering at 15 µg/L in the first 12 m, and increasing to 43.9 µg/L at the bottom, suggesting that anoxic sediments are releasing phosphorus.

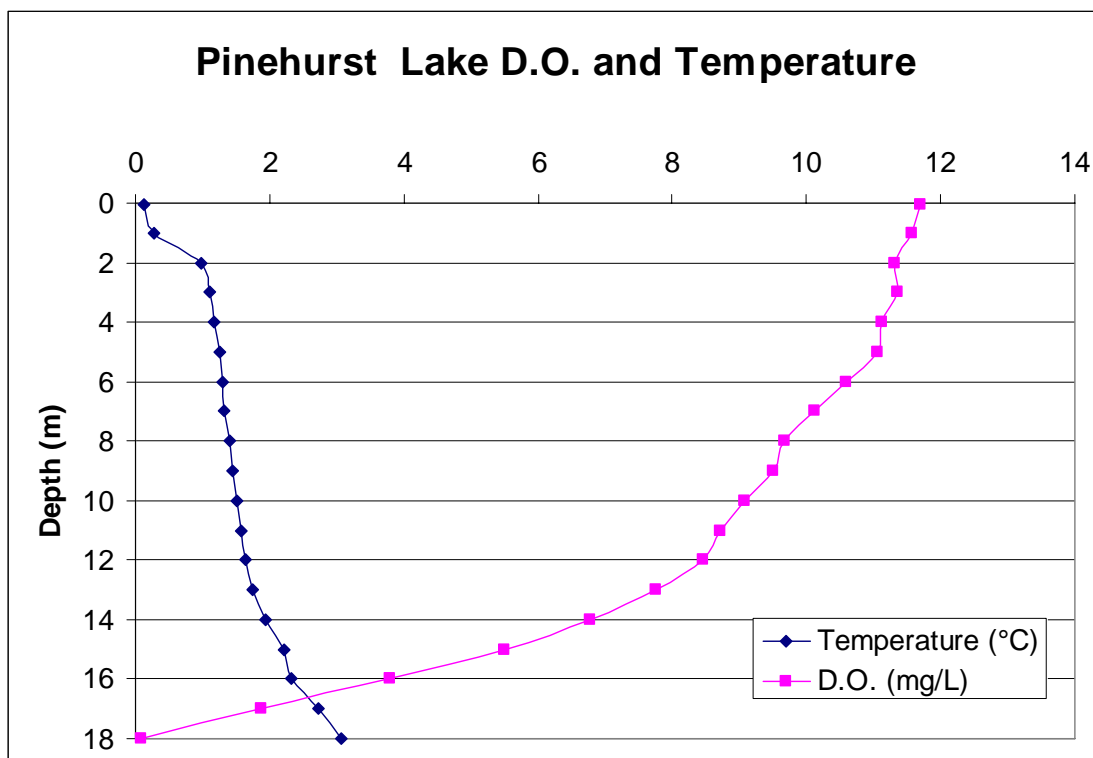


Figure 4: Physical profile data for Pinehurst Lake.

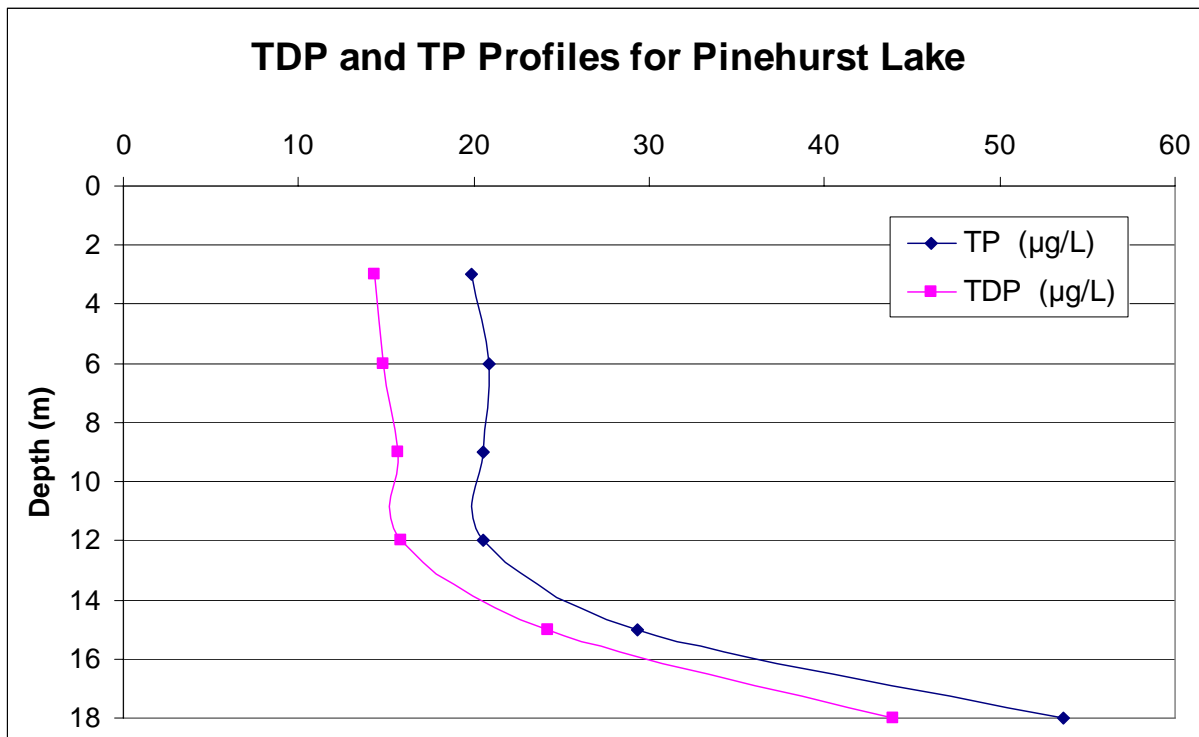


Figure 5: TP and TDP profile for Pinehurst Lake.

4.4 Elinor Lake

Elinor Lake was sampled in early April 2004, while still frozen. Bottom depth at the sampling location was 17.5 m. Temperature at the surface was 0°C and rose quickly to approximately 4 °C at 3m, warming to only 4.5 °C at the bottom (Figure 6). Dissolved oxygen was highest at the surface, with a concentration of 10 mg/L but dropped sharply, reaching 1.5 mg/L at 6m before stabilizing at 0.75 mg/L at 12 m to the bottom. pH was fairly constant, with the water being slightly alkaline. The slight drop between 16 m and 17.5 m is likely due to the sampling probe disturbing sediment at the bottom of the lake. This conclusion is supported by the sharp increase in total dissolved solids and conductivity in the same depth range. TP was 21.9 µg/L at 3m, increasing to 34.3 µg/L at 9m, dipping slightly with concentrations of 33.5 µg/L at 15m (Figure 7). TDP followed a similar pattern, starting at 11.5 µg/L, peaking at 23.1 µg/L at 12m, and dipping to 21.9 µg/L at 15m. Sufficient oxygen at depth may be keeping phosphorus bound to the bottom sediments.

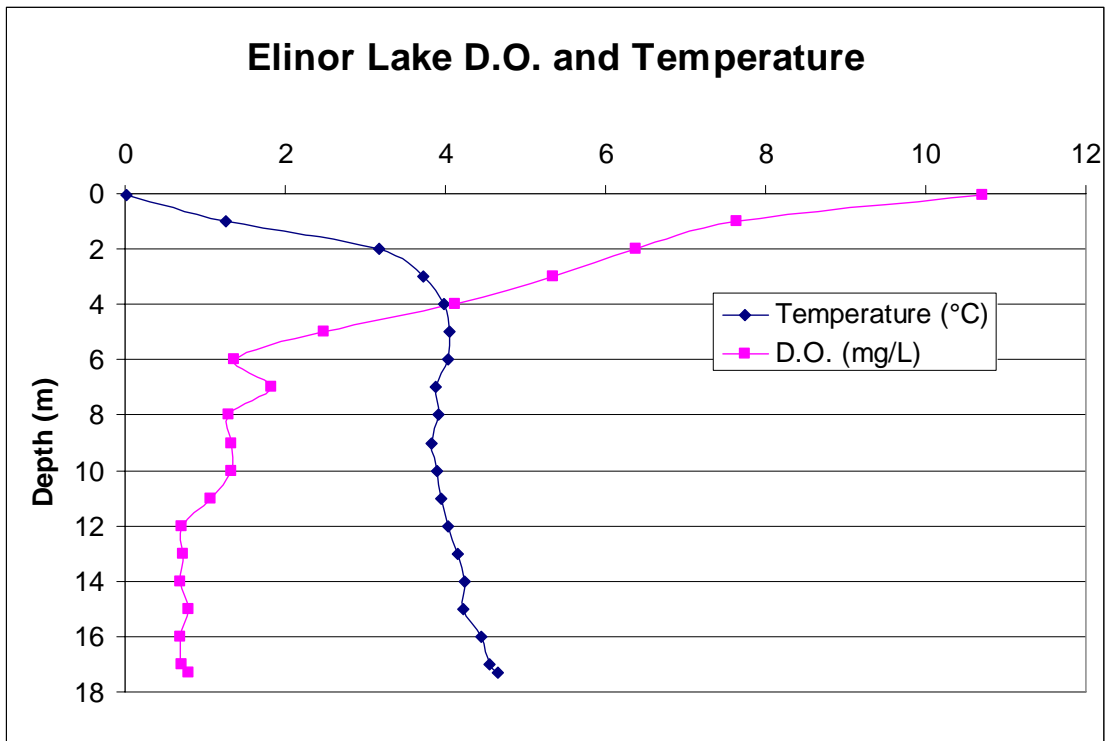


Figure 6: Physical profile data for Elinor Lake.

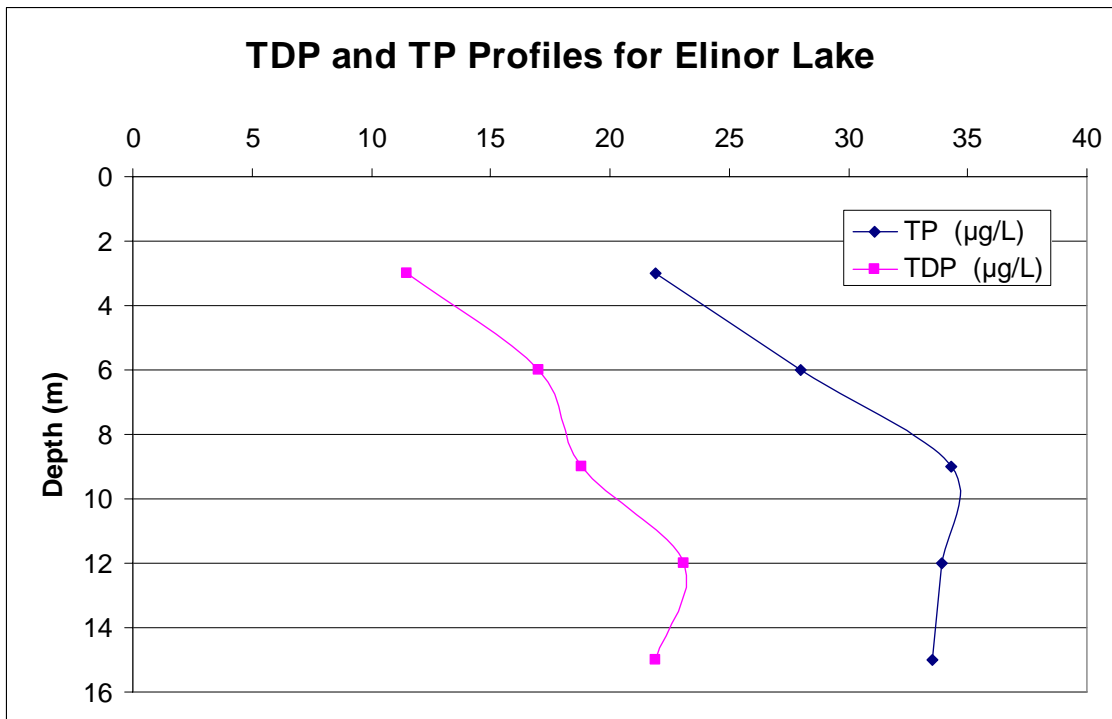


Figure 7: TP and TDP profile for Elinor Lake.

4.5 Claude Lake

Claude Lake was sampled in mid June 2004 to a depth of 14 m. Temperature ranged from 22 °C at the surface to just below 6 °C at the bottom with two thermoclines between at 0 m-4 m and another at 6m (Figure 8). Dissolved oxygen ranged from a little below 10 mg/L at 0.5 m to less than 0.5 mg/L in the bottom quarter of the water column. pH varied substantially, ranging from approximately 7 at the surface and bottom, but peaking at 9 between 0.5 m and 5 m. Both conductivity and total dissolved solids increased, with the biggest increase coming in the final meter of the water column between 13 m and 14 m. Nutrient samples were not taken at Claude Lake.

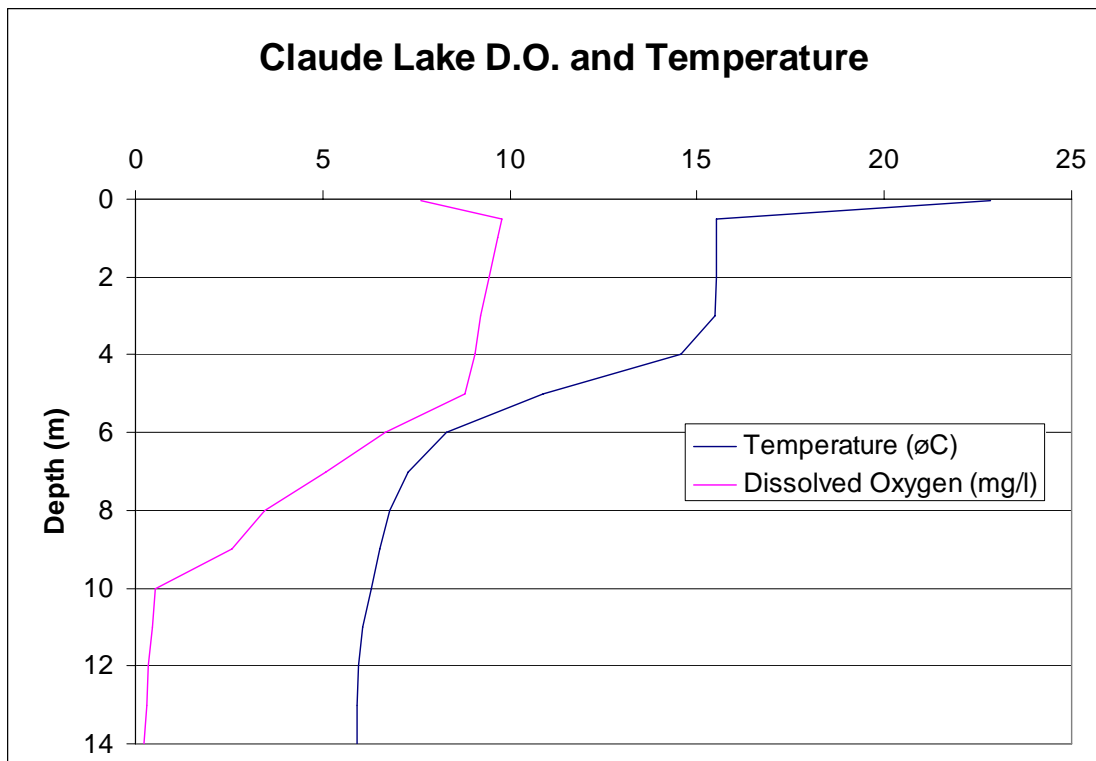


Figure 8: Physical profile data for Claude Lake.

4.6 Antoine Lake

Antoine Lake was sampled in early April 2004 while still frozen. Sampling occurred from surface to a depth of 6 m. Temperature rose gradually from 0 °C at the surface, reaching 4.6 °C at the bottom (Figure 9). Dissolved oxygen dropped sharply from 5.5 mg/L at the surface to about 0.75 mg/L at 3 m in depth, where it remained constant to the bottom. pH was neutral, ranging from 7.7 to 7.2 at the bottom. Both total dissolved solids and conductivity remained constant throughout the water column. TP in Antoine lake was very high, 88.4 µg/L at the surface rising to 185.10 µg/L at 6m (Figure 10). TDP followed the same pattern, with concentration of 47.1 µg/L at the surface, rising to 152.6 µg/L at 6m.

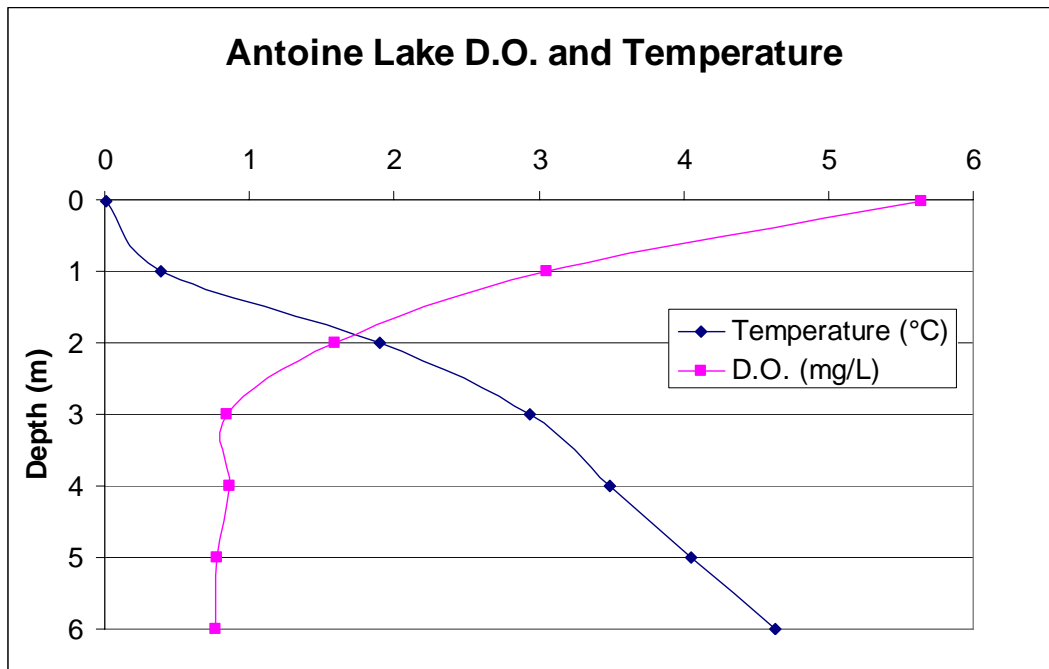


Figure 9: Physical profile data for Antoine Lake.

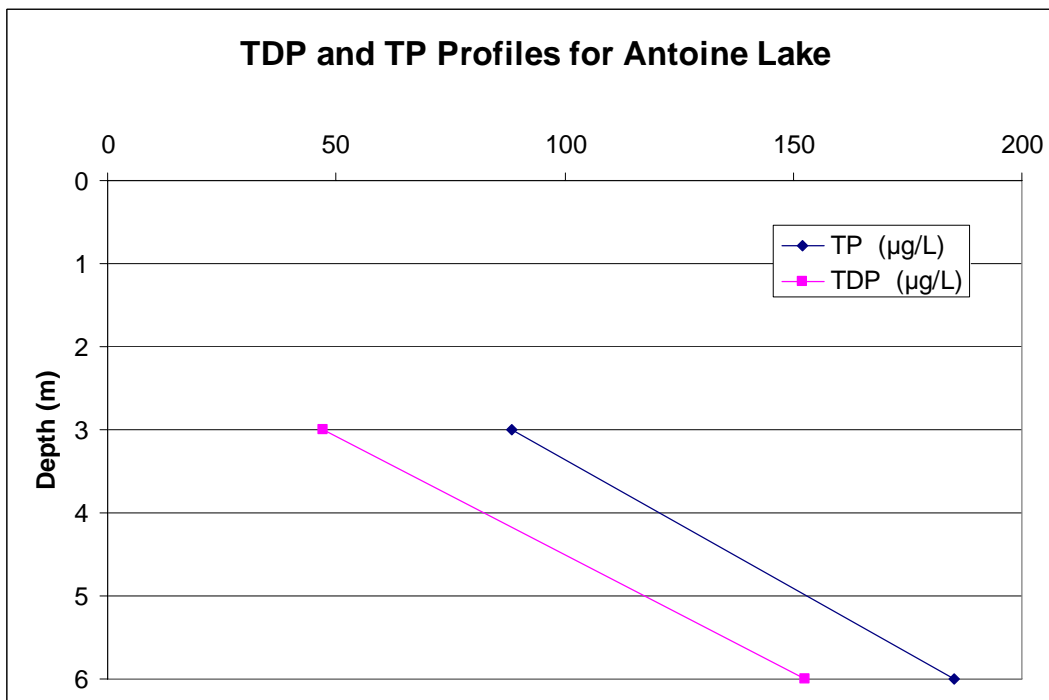


Figure 10: TP and TDP profile for Antoine Lake.

4.7 Little Johnson Lake (Little Chump)

Little Johnson Lake was sampled to a bottom depth of approximately 3.8 m in mid June 2004. Temperature remained between 16.5 °C and 15.5 °C throughout the water column (Figure 11). Patterns for pH and dissolved oxygen were fairly constant from the surface down to 3m, then dropping sharply from there to the bottom. Conductivity and total dissolved solids rose sharply at 3m from 0.2 g/l to 0.24 g/l for TDS and from 0.31 ms/m to 0.34 ms/m for conductivity. TP concentrations stayed stable throughout the water column, starting at 27.8 µg/L at 1m of depth and hovering at that mark until the bottom (Figure 12). TDP concentrations followed the same pattern, starting at 12.1 µg/L at 1m, suggesting that this shallow lake is well mixed.

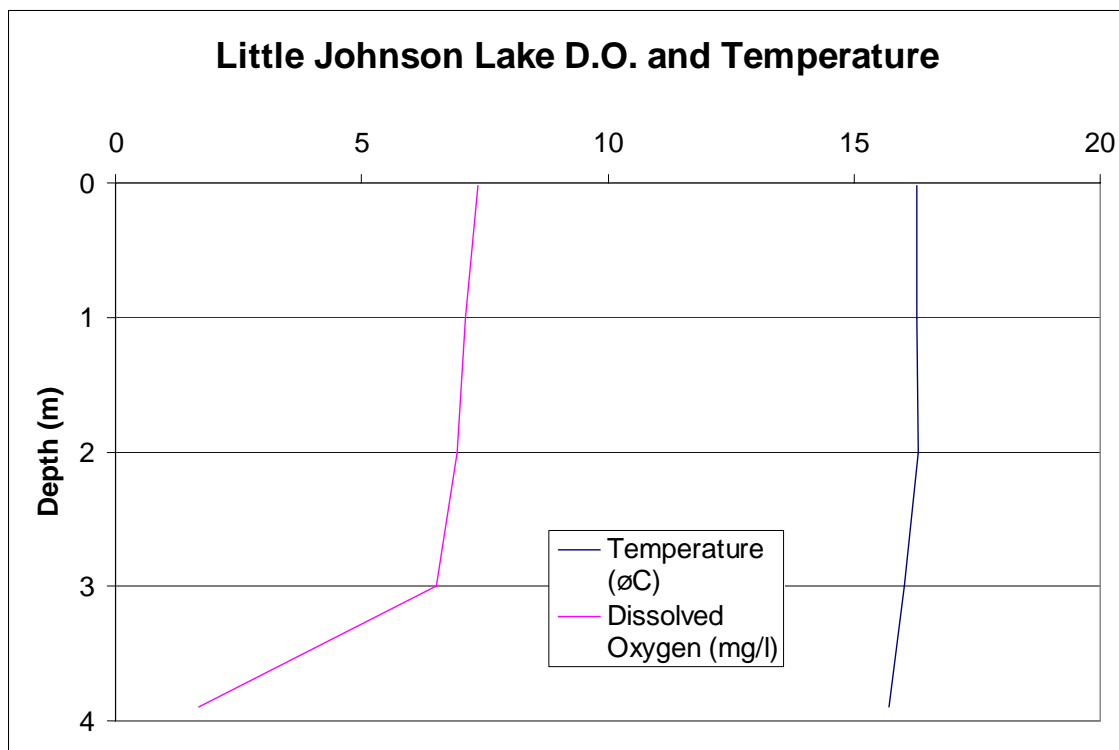


Figure 11: Physical profile data for Little Johnson Lake.

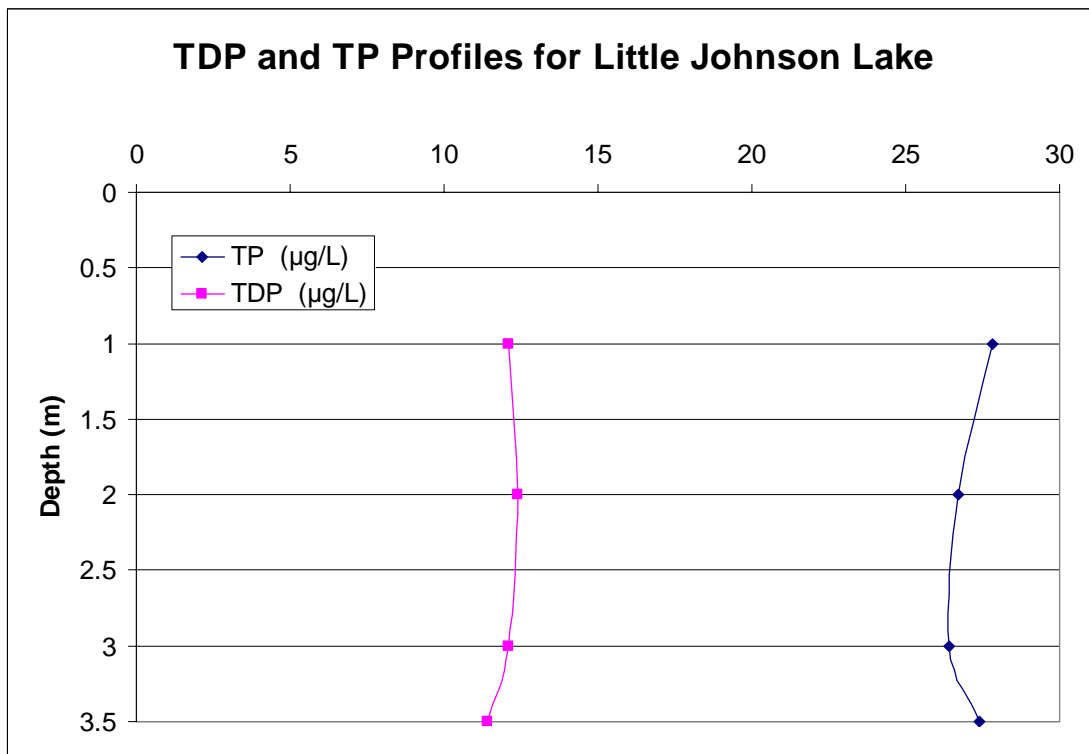


Figure 12: TP and TDP profile for Little Johnson Lake.

4.8 Burnt Lake

Physical Profile

Burnt Lake was sampled on August 3, 2004 for physical parameters and water chemistry. Depth at the sampling location was 3.32 meters. Dissolved oxygen concentrations were high, 10.13 mg/L at the surface, and remained fairly stable for the first three meters of depth. Dissolved oxygen dropped to 8.09 mg/L at the bottom, most likely due to the probe disturbing anoxic sediments at the bottom of the lake (Figure 13). pH behaved in a similar fashion, staying constant at approximately 9.42 down to 3 m of depth, then dropping to 8.49 at the bottom. Temperature remained constant throughout the water column starting at 20.83 °C at the surface and dropping to 20.43 °C at the bottom. TP and TDP were 33.7 and 9.0 µg/L, respectively at 1m in depth and did not increase significantly as depth increased suggesting this lake was well mixed (Figure 14).

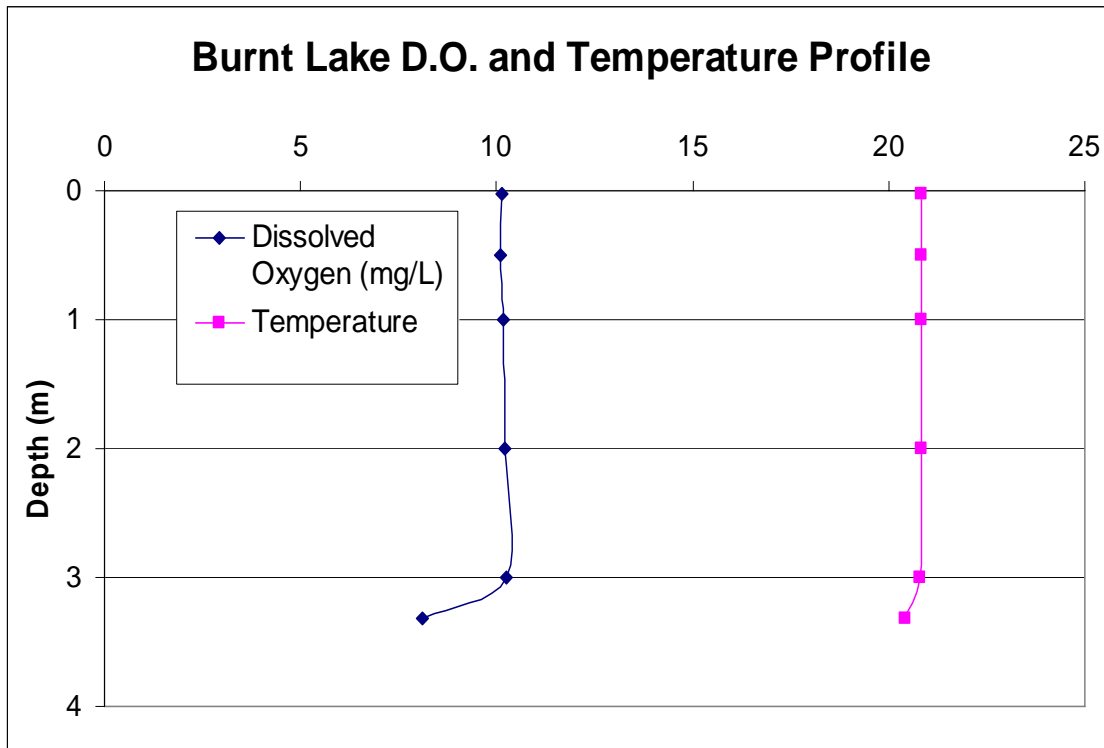


Figure 13: Physical profile data for Burnt Lake.

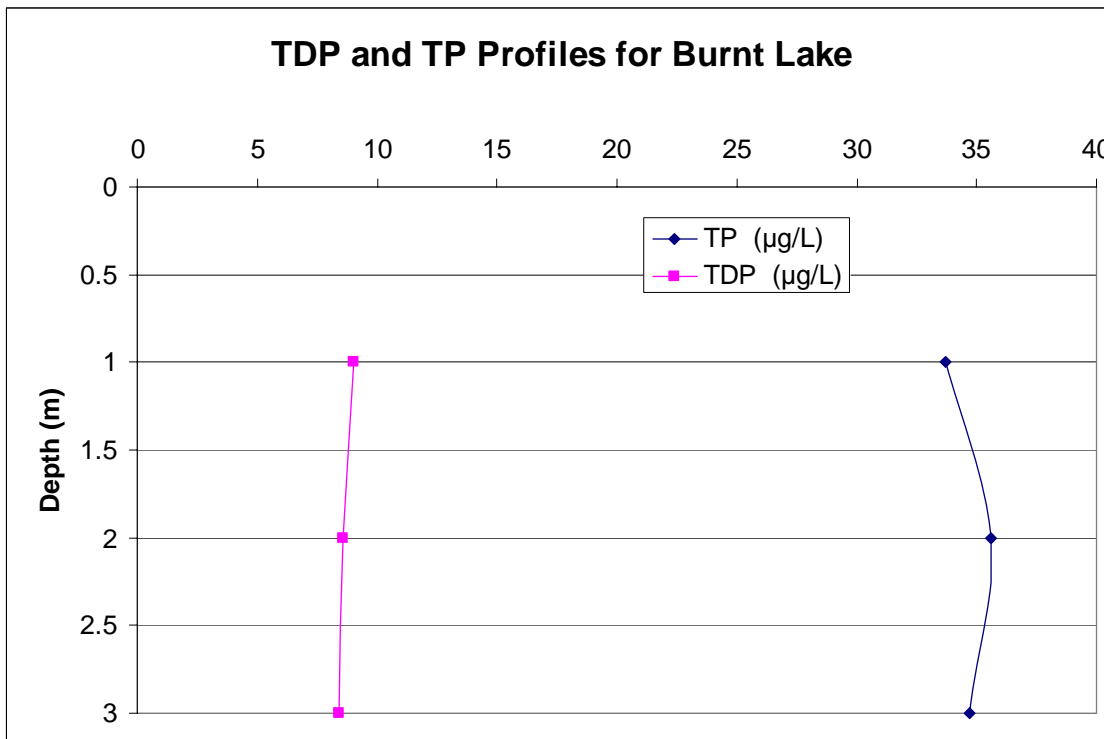


Figure 14: TP and TDP profile for Burnt Lake.

Fish Sampling

Three large Northern Pike (*Esox lucius*), were caught in the gillnet, two of which were still alive when caught. Both live fish were released as quickly as possible without measurement, and the dead Northern Pike was sampled for total length, age (using cleithrum), maturity and stomach contents. The sample was a mature female, total length of 720 mm, with no stomach contents and was aged at six years (Mackay protocol). Seine netting captured several stickleback, freshwater shrimp (*Gammarus spp.*), and other small freshwater invertebrates. Minnow trap captures were similar to those in the seine nets. No other fish were caught.

4.9 Frenchman Lake

Physical Profile

Frenchman Lake was sampled in summer 2004 during the August long weekend for physical parameters and water chemistry. Depth at the sampling location was 3.5 m. Dissolved oxygen was approximately 7.5 mg/L near the surface, peaking at 8.25 mg/L at 2 m before concentrations decreased (Figure 15). Dissolved oxygen at the bottom was 1.25 mg/L. pH was fairly constant through the water column, remaining at approximately 8.8 before dropping near the bottom. Temperature was 22 °C at the surface of the water column, dropping approximately 1 °C between 0.5m and 1m. From that point temperature dropped slowly, until the bottom where it reached 18.76 °C. TP and TDP were consistently 30 and 10 ug/L, respectively, throughout the water column (Figure 16).

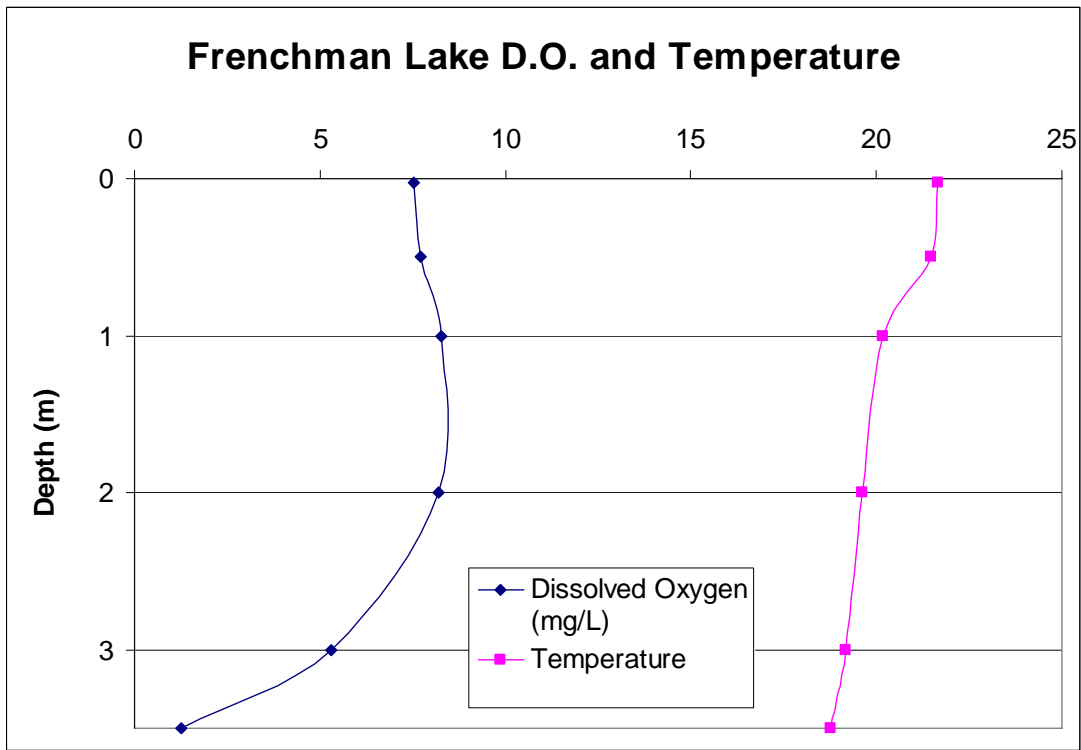


Figure 15: Physical profile data for Frenchman Lake

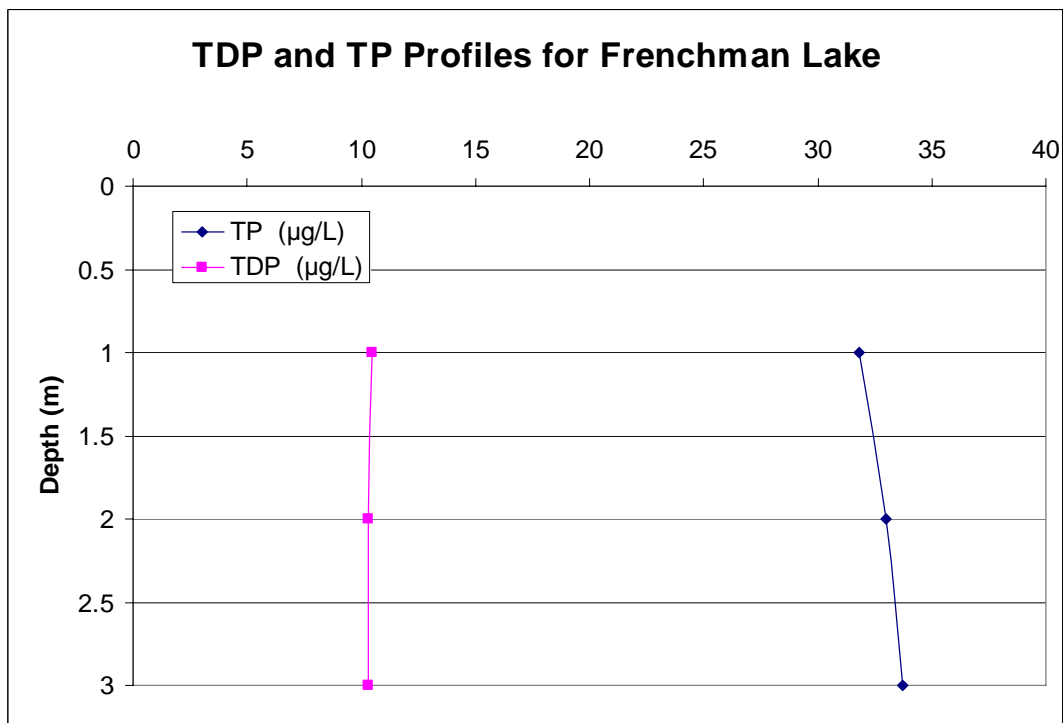


Figure 16: TP and TDP profile for Frenchman Lake.

Fish Sampling

No fish were caught in either of the gillnets. Several seines at various beaches around the lake collected several stickleback, freshwater shrimp (*Gammarus spp.*), water beetles and a species of unidentified red worm. Minnow trap captures were similar to those in the seine nets. No sport fish were caught.

4.10 Horne Lake

Physical Profile

Horne Lake was sampled during the August long weekend in the summer of 2004 for physical parameters and water chemistry. Depth at the profile location was 3.33 m. Dissolved oxygen concentrations stayed fairly stable through the first three meters of the water column, starting at 8.86 mg/L dropping to 8.04 mg/L at three meters (Figure 17). Dissolved oxygen dropped sharply at the bottom, registering at 5.75 mg/L. pH stayed constant throughout the water column, hovering between 8.74 and 8.32. Temperature also remained constant, starting at 22.23 °C at the surface and dropping to 20.35 °C at the bottom, with the sharpest drop occurring between 1 and 2 m. From that point temperature dropped slowly, until the bottom where it reached 18.76 °C. TDP was consistent at 9 ug/L throughout the water column, while TP increased from 40 ug/L at the surface to 46 ug/L at 3m depth (Figure 18).

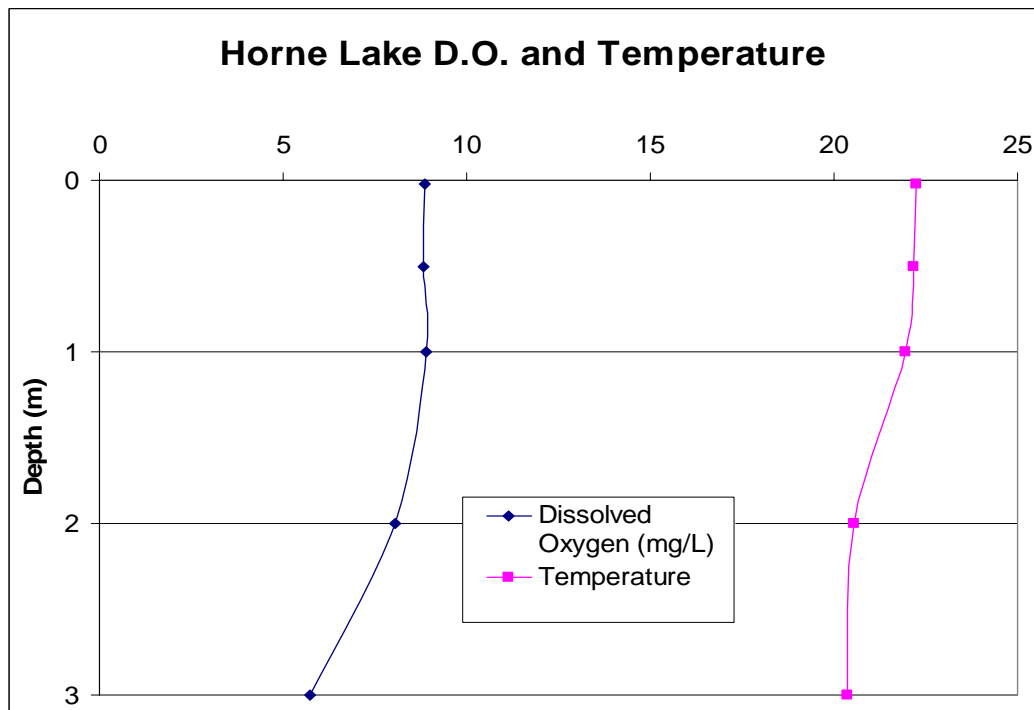


Figure 17: Physical profile data for Horne Lake.

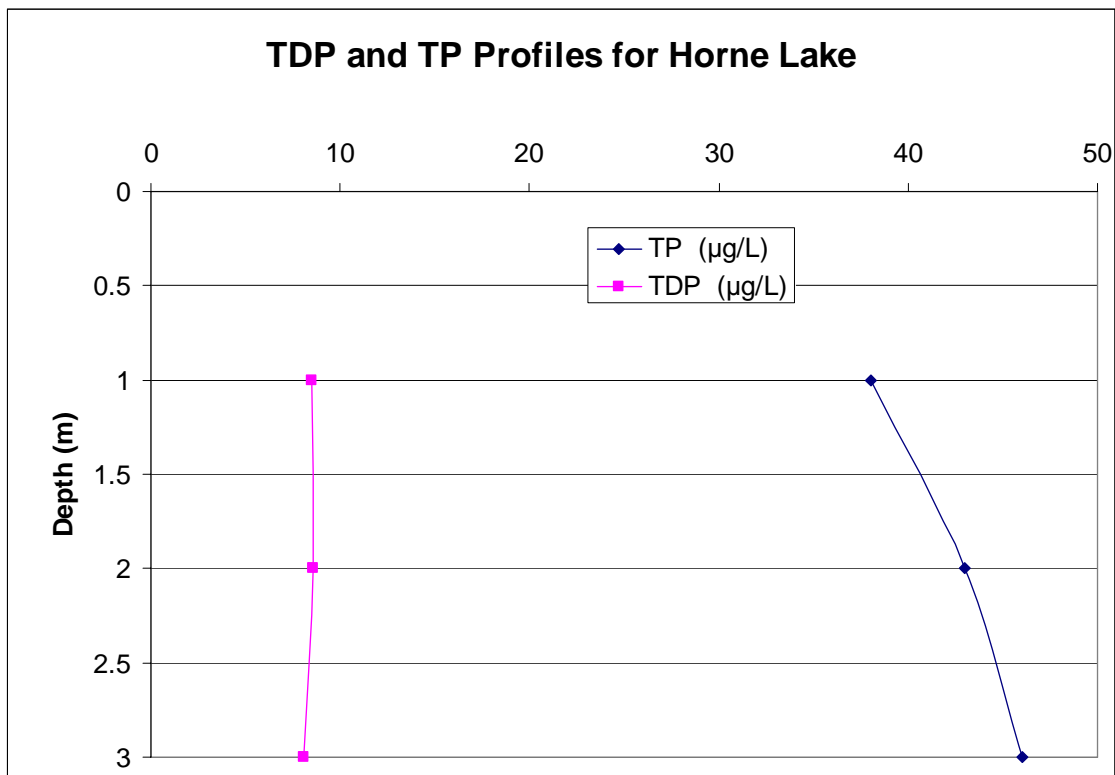


Figure 18: TP and TDP profile for Horne Lake.

Fish Sampling

No fish were caught in the gillnets. Minnow traps captured several stickleback, freshwater shrimp (*Gammarus spp.*), and some small insects. No sport fish were caught. Seining was not possible due to the boggy nature of the shore.

4.11 Kinusio Lake

Two holes were drilled through the ice at Kinusio Lake, and water depths of 1.5m and 2.5m were observed. Kinusio Lake was not sampled for water chemistry or profiles, as the dissolved oxygen concentrations at these sites were less than 4 mg/L at 1 m depth, and less than 1 mg/L at 2.5m depth, less than the minimum required level for most sport fish survival.

4.12 Hylo Lake

Hylo lake was sampled in early April 2004 while still frozen. Bottom depth at the sampling location was 2.1 m. Temperature rose steadily from 0.8 °C at the surface to 4.3 °C at the bottom of the lake. Dissolved oxygen dropped sharply from a high of 15 mg/L at the surface to approximately 1.2 mg/L at the 1 m mark, and remained constant to the bottom. Total dissolved

solids and conductivity remained constant. Due to low dissolved oxygen levels, Hylo Lake was not considered fit for fish overwintering and was not sampled for nutrients.

4.13 Lake Missawawi

Lake Missawawi was sampled in early April 2004. The depth at the sampling location was 2.1 m. Temperature rose steadily from 0°C at the surface, reaching 3 °C at the bottom. Dissolved oxygen was highest at the surface, with reading of 2.5 mg/L, dropping to 1 mg/L at the 1 m mark. pH was slightly alkaline, ranging from 8 to 7.2. Both total dissolved solids and conductivity remained constant.

4.14 Total dissolved solids

Since some lakes were sampled in the early spring before breakup of the ice cover, results for Total Dissolved Solids cannot be compared between these lakes and those sampled during the open water season. Average Total Dissolved Solid concentrations were highest in Hylo Lake in the winter and Frenchman Lake in the summer. Table 2 summarizes average TDS results.

In most cases, TDS remained constant with depth increasing depth until reaching the bottom meter of water. This is presumably due to the probes interaction with bottom sediments which increases TDS concentrations (Figures 19 and 20). The exceptions to this overall rule were Elinor Lake and Hylo Lake, both sampled in the winter. Elinor Lake had recorded TDS levels at the surface of 2148 Parts Per Million (PPM) which increased to over 2600 PPM at 1m in depth, remaining at that level until the bottom meter of water. Hylo Lake also had a marked increase in TDS in the first meter of water, jumping from 5052 PPM to 5341 PPM from the surface to 1m in depth.

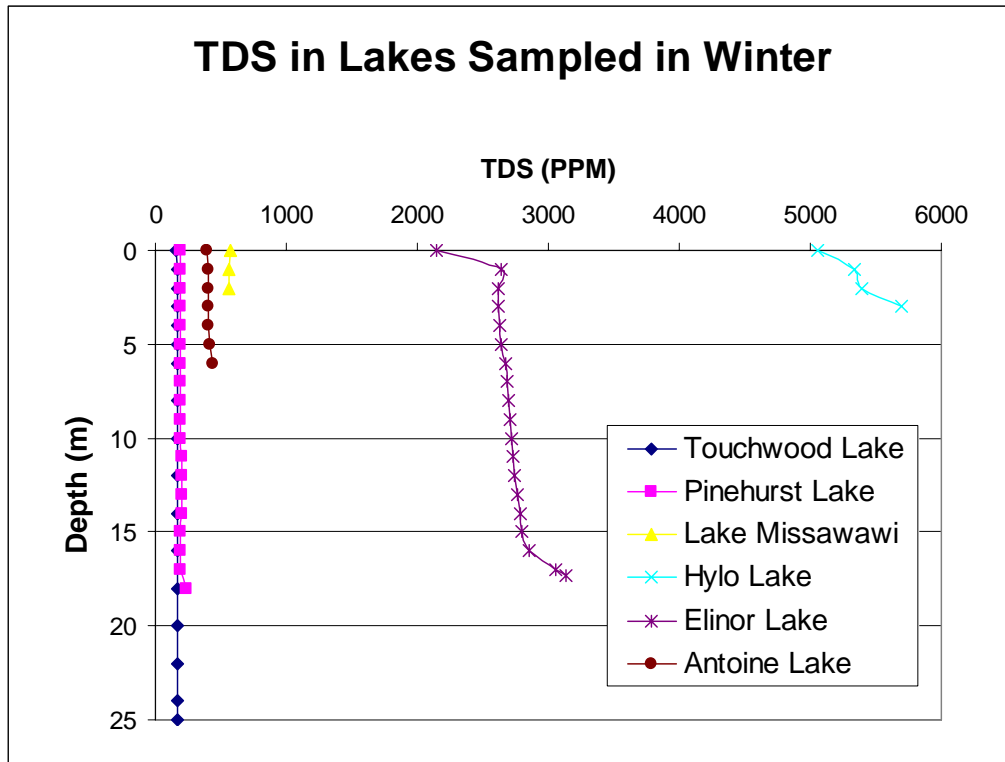


Figure 19: Water column TDS for lakes sampled during winter ice cover.

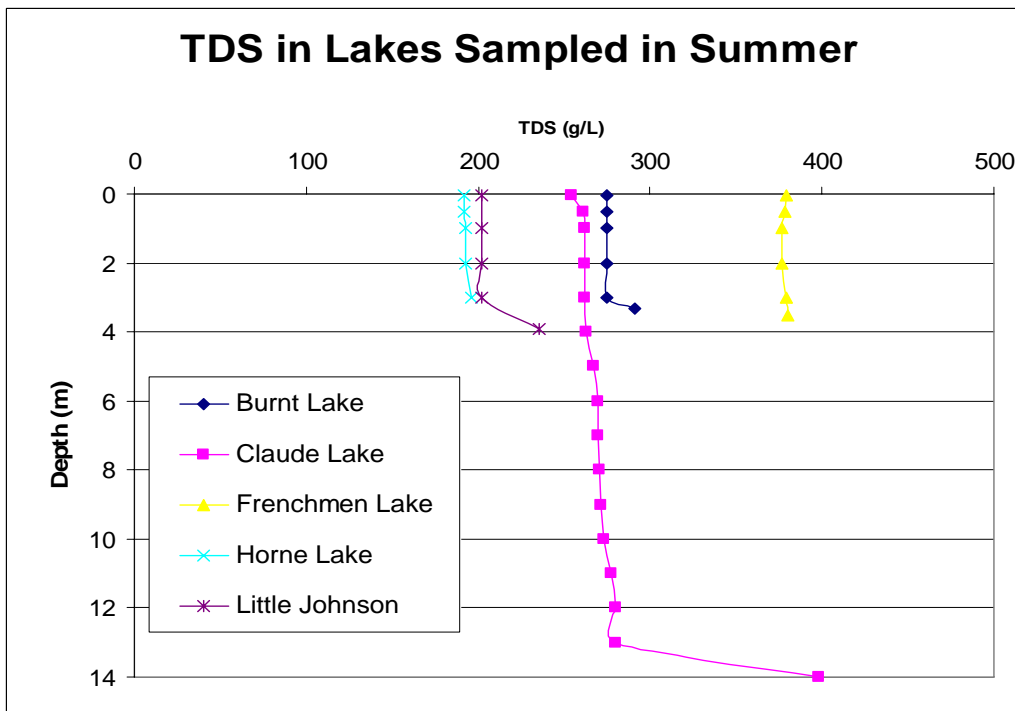


Figure 20: Water column TDS for lakes sampled during the open water season.

Table 2: Average Total Dissolved Solids (PPM) for all lakes studied in the Lakeland County fish stocking suitability study.

Winter	TDS (PPM)	Summer	TDS (PPM)
Touchwood	169	Claude	276
Pinehurst	197	Frenchman	378
Elinor	2718	Burnt	277
Antoine	411	Horne	193
Hylo	5371	Little Johnson	209
Missawawi	565		

4.15 Altitude

The Alberta Trout Stocking Guidelines identify altitude as one of their decision making tools for lake stocking. The altitude of a lake directly affects maximum dissolved oxygen levels, and therefore fish survival. The Lac la Biche airport runway is situated at 1884 ft above sea level (<http://www.world-airport-codes.com/canada/lac-biche-3897.html>). Since the actual altitude above sea level for each of the lakes in this study was unavailable to us, we believe it is safe to assume that all lakes in the Lac la Biche region are located at approximately 1884 ft above sea level. This altitude is well below the Alberta Trout Stocking Guidelines reduced stocking altitude of 3500 ft above sea level.

5.0 Recommendations

Using depth, temperature and dissolved oxygen as indicators of fish stocking suitability, we have developed a ranked listing of lakes most suitable fish stocking in the Lac La Biche region. These lakes are: Touchwood, Pinehurst, Elinor, Claude and Antoine. The next steps will be to determine the target stocking species and assess not only the specific habitat requirements to ensure their survival (i.e. aquatic vegetation, cover, substrate and food availability); but also their reproductive capabilities; associated risk of negative impacts; and evaluate public accessibility to the lake. These lakes have been ranked to provide for winter survival, but the rankings may change if stocked fish are only required to survive throughout the summer months only. Under the latter scenario, then winter ice cover, temperature and dissolved oxygen concentrations would not be of concern. This may be the case if a take-and-put stocking strategy using commercial fishing to remove fish at the end of summer were to be employed. If

this is the case, the remaining lakes (Little Johnson, Burnt, Frenchman, Horne, Kinosiu, Hylton and Missawami) may still be useful for fish stocking.

Claude Lake would make an ideal candidate lake for lake stocking, as it experienced a total winter kill of its native fish population during the winter of 2003-2004. During the summer of 2004, the Lac la Biche Fisheries Enhancement Group, in conjunction with ASRD, AQUALITY Environmental Consulting Ltd. and Lakeland County partnered in a fish restocking program at Claude Lake. Over 9,000 Yellow Perch (*Perca flavescens*) were captured from Lac la Biche, and transported the short distance to Claude Lake where they were released. A similar stocking effort should continue for several summers to ensure the success of the program. A basic monitoring program should also be undertaken, to ensure that Claude Lake remains a viable place for fish to live. Furthermore, efforts should be taken to reduce the chance of another winterkill at Claude Lake in the future. As it is known that Claude Lake experiences periodic die-offs due to low oxygen levels, an aeration system could be installed to ensure higher oxygen levels.

Thinking beyond the immediate challenge presented by Claude Lake there are several other marginal lakes that could support viable fish populations with minor environmental modifications. These lakes include, but are not limited to Horne Lake, Little Johnson Lake, Antoine Lake and Burnt Lake. As these lakes are shallow, there is a concern is that during winter ice cover dissolved oxygen levels would drop below the levels necessary for fish survival. On these lakes, aeration using bubblers would be an ideal solution to enhancing the survival of fish. In order to save on operating costs, the bubbler system could be operated exclusively during the winter, when oxygen levels are at their lowest and the risk to fish survival is greatest. Systems such as these could be installed in partnership and maintained in partnership with local industry, who might be interested in such a visible and positive partnership with the Fisheries Enhancement Group.

Alberta Sustainable Resource Development (ASRD) regulates all activities related to fish stocking in the Province under the Fisheries (Alberta) Act. In addition, ASRD has published a framework for decision-making for fish stocking that should be followed in implementing any stocking strategy (Berry and Stenton, 1993). As well, there is a National code on introductions and transfers of aquatic organisms (Task Group on Introductions and Transfers, 2003). A proposal following the above documents must be submitted to ASRD and be approved prior to any fish stocking projects commence.

6.0 References Cited

- APHA. 1992. Standard Methods for the Examination of Water and Wastewater, 17th Edition. American Public Health Association, American Water Works Association and Water Pollution Control Federation, Washington, D.C.
- Berry, D.K. and C.E. Stenton. 1993. A decision-making process for the evaluation of fish introductions in Alberta. Alberta Environment, Fisheries Management Branch. Edmonton. 29 p.
- Bierhuizen, J.F.H., and E.E. Prepas 1985. Relationship between nutrients, dominant ions, and phytoplankton standing crop in prairie saline lakes. *Can. J. Fish. Aquat. Sci.* 42:1588 -1594.
- Canadian Sportfishing Industry Association. 2004. Statistics compiled by the Canadian Sportfishing Industry Association April 24, 2004. Peterborough, Ontario.
- Department of Fisheries and Oceans Canada. 2000. Statistics compiled by the Department of Fisheries and Oceans Canada for the Year 2000. Winnipeg, Manitoba.
- Federal-Provincial-Territorial Task Force on the Importance of Nature to Canadians. 2000. The importance of nature to Canadians: The economic significance of nature-related activities. Environment Canada. 56 p.
- Mackay, W.C., G.R. Ash, and H.J. Norris, editors. 1990. Fish ageing methods for Alberta. R.L. & L. Environmental Services in association with Alberta Fish and Wildlife Division and the University of Alberta, Edmonton.
- Sustainable Resource Development. 2003. A fish conservation strategy for Alberta: 2000/2005. Fisheries Management-Fish and Wildlife Division.
- Sustainable Resource Development. 2004. Ministry of Sustainable Resource Development 2001/2002 Annual Report. Alberta Government.
- Task Group on Introductions and Transfers. 2003. National code on introductions and transfers of aquatic organisms. Fisheries and Oceans Canada, Saskatchewan. September 2003.