Annual Progress Report

Overwintering Results of Ten Aerated Lakes in the Northwest Boreal Region 1999-2000

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Abstract

Lake aeration is a fishery enhancement technique that is used to maintain dissolved oxygen levels in eutrophic lakes prone to winterkill. Ten stocked lakes that are susceptible to winterkill were aerated in the 1999-2000 (October - April) in the Northwest Boreal Region. These lakes were Cecil Thompson Park Pond, Moonshine Lake, Cummings Lake, Sulphur Lake, Spring Lake, East Dollar Lake, Figure Eight Lake, Swan Lake, Zama Pond and Cutbank Lake. The lakes ranged in size from 2-172 ha and in depth from 3.0-22.0 m. Cutbank Lake has been added to the aeration program this year (November) and is the largest lake Alberta Conservation Association aerates to date, at 172 hectares. The objective of this project is to annually sustain dissolved oxygen levels in these lakes at or above 3.0 mg/l. Maintaining the dissolved oxygen at this level or higher ensures the survival of trout throughout the winter (Fast 1994). The Northwest Boreal Region is now using mechanical surface aeration as the main system for aeration on eight of the ten aerated lakes. At Spring Lake a point release system is still operated, to destratify the water column in the fall and a 1/3-hp Gast compressor aerates Zama Pond. The 1999-2000 aeration program results were successful with all ten lakes overwintering.

Previous year(s) over wintering results and aeration methods can be found in the Annual Progress Reports, Alberta Conservation Association, Northwest Boreal Region (1986-87 to 1998-99).

1.0 Introduction

The objective of the aeration program is to overwinter stocked populations of trout in the Northwest Boreal Region. Other benefits include year round fishing, production of larger fish, and year round use of the recreation areas. Most of these lakes are quite shallow, productive and are subject to prolonged ice and snow cover. Snow depths of > 10 cm does not allow sufficient sunlight to penetrate for photosynthetic activity (Miller, T.G and W.C.Mackay. 1996 draft). The combination of these factors result in what is called a winterkill. Winterkill is the depletion of the stored oxygen in the waterbody after ice cover. Decomposition of aquatic plant matter, under ice aquatic life, including fish populations all contribute to the oxygen decline. Aeration is the process of introducing oxygen into a lake or pond for the purpose of overwintering fish. Only the stocked ponds and lakes that are subject to winterkill are aerated.

Several lake aeration techniques have been used in the Northwest Boreal Region. The Alberta Conservation Association is presently using mechanical surface aeration which has provided the best results of all the aeration techniques used in the Northwest Boreal Region (Miller, T.G and W.C.Mackay. 1996 draft). Oxygen concentrations, water temperature, ice depth and snow depth were recorded on a monthly schedule. Lake aeration is started before freeze up to induce oxygenation throughout the whole lake. The 1999-2000 aeration report details each lakes morphometry, aeration techniques, results and recommendations.

Ten stocked lakes that are susceptible to winterkill were aerated during 1999-2000 (October - April) in the Northwest Boreal Region. These lakes were Cecil Thompson Park Pond, Moonshine Lake, Cummings Lake, Sulphur Lake, Spring Lake, East Dollar Lake, Figure Eight Lake, Swan Lake, Zama Pond and Cutbank Lake (Figure 1). The lakes aerated ranged in size from 2 -172 ha in size and 3.0-22.0 m in depth. Cutbank Lake has been added to the aeration program this year and is the largest lake the Alberta Conservation Association aerates to date, at 172 hectares.

Previous year(s) over wintering results and aeration methods can be found in the Annual Progress Reports, Alberta Conservation Association, Northwest Boreal Region (1986-87 to 1998-99).

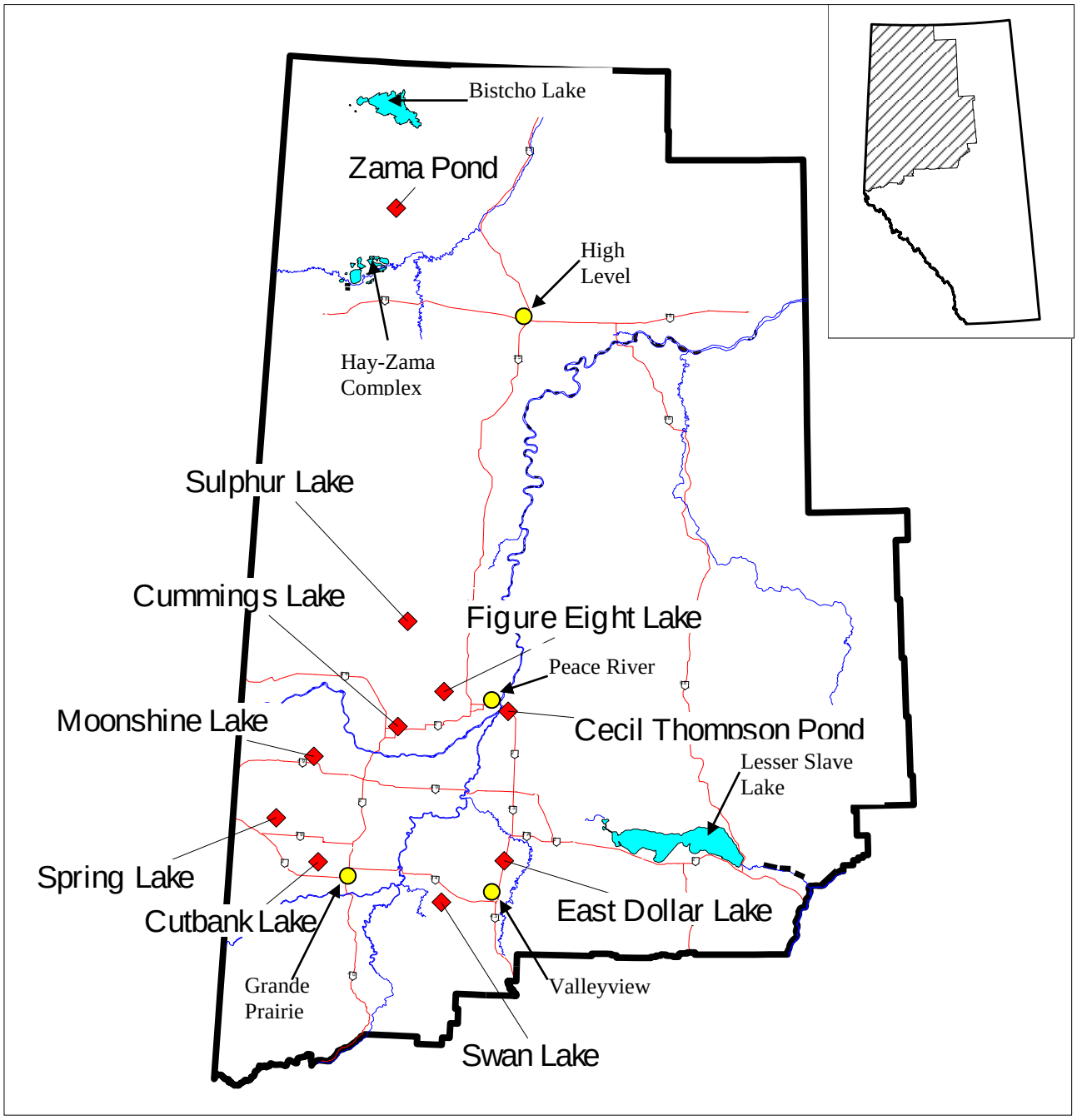

Figure 1. Northwest Boreal Region map of aerated lake locations, 1999 - 2000.

2.0 Study Area

Table 1. All Aerated lakes in the Northwest Boreal Region.

Lake	Location	Size(ha)	Depth (max/mean)	Fish Stocked	Total Years Aerated
C. Thompson Pond	SW 23-83-21-W5	0.81 ha	4.0m	RNTR	6 years
Moonshine Lake	SW 32-79-08-W6	30.8 ha	3.9m/1.6m	RNTR/BNTR	12 years
Cummings Lake	SE 10-82-03-W6	26.9 ha	3.3m/2.0m	RNTR/BKTR*	14 years
Sulphur Lake	NW 07-89-02-W6	53.4 ha	7.6m/3.3m	RNTR/BKTR	11 years
Spring Lake	SE 23-75-11-W6	32.1 ha	22.0m/8.6m	RNTR/BKTR	22 years
East Dollar Lake	NW 08-73-21-W5	5.6 ha	8.0m/4.0m	RNTR/BNTR**	15 years
Figure Eight Lake^	NE 20-84-25-W5	38.6 ha	6.0m/3.0m	RNTR/BNTR***	14 years
Zama Pond	SE 13-117-05-W6	0.5 ha	6.0m/	RNTR	16 years
Swan Lake	70-25 & 26-W5	139.9 ha	5.6m/3.2m	RNTR****	3rd year
Cutbank Lake	NE 23-72-08-W6	172.0 ha	5.0m/2.1m	BKTR	1st year

RNTR - rainbow trout BNTR - brown trout BKTR - brook trout
* BKTR were last stocked in 93-94
** BNTR were stocked in 91-92 and 96-97
*** BNTR were stocked in 96-97
**** 1st stocking since 1993
^ recorded a partial summerkill July 10-12, 98

3.0 Methods

3.1 Point release system set up and operation

A point release diffuser consists of 3.8 - 5.1 cm PVC tubing glued together in an "X" shape. The diffuser has four, 1.2m arms with 6.35- mm holes, drilled at 25.4-mm intervals (Figure 2). The air is forced through a length of hose, 3.8 cm in diameter, lying along the bottom of the lake. The hose is weighted down with bricks and re-bar secured to the hose by quick ties. A compressor unit on shore, forces air into the hose and out through the point release diffuser. A brick is attached to the bottom of the diffuser to prevent it from floating to the surface when in operation. A buoy with a flag attached to the point release keeps it level as well as indicating the location of the aeration system. Each flag/buoy indicates one point release. Spring Lake is the only water body that the point release system is still being used (Table 2).

3.2 Mechanical surface aerator set-up and operation

The aerator fits into the middle of a square float. The float is anchored at the four corners with small diameter nylon rope and a brick attached at the end of each rope. This keeps the aerator in position and from spinning around. The waterproof cord/cable sits on the bottom of the lake and runs out along the bottom of the lake and up to the float. The cord is secured to the float and attaches to the aerator. The motor is submerged and the prop is approximately 7.6-10.1 cm underneath the surface of the water. When operating, the prop throws water up against an inverted bell causing the water to spray up and out in a circular fountain back into the lake. The contact between the water and the inverted bell, breaks up the water into small droplets and falls back into the lake. See Figure 3 for a diagram of a mechanical surface aerator. Maintenance is minimal on these aerators. They are installed and turned on at the beginning of the aeration season (late October) and operates until mid-April. The number and size of mechanical surface aerators vary from lake to lake (Table 2).

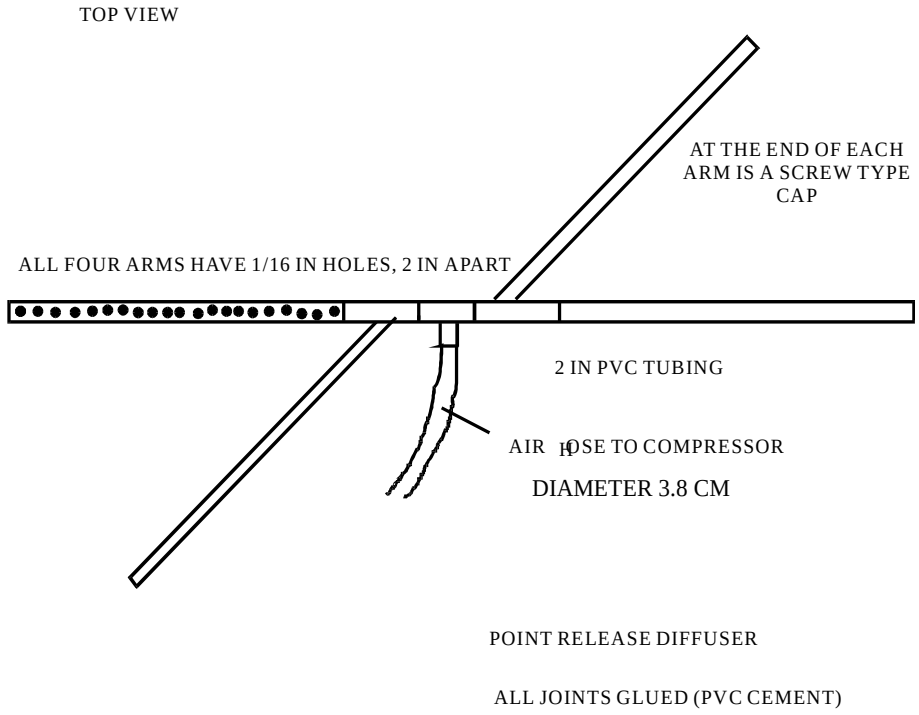

Figure 2. Diagram of a Point Release Pod.

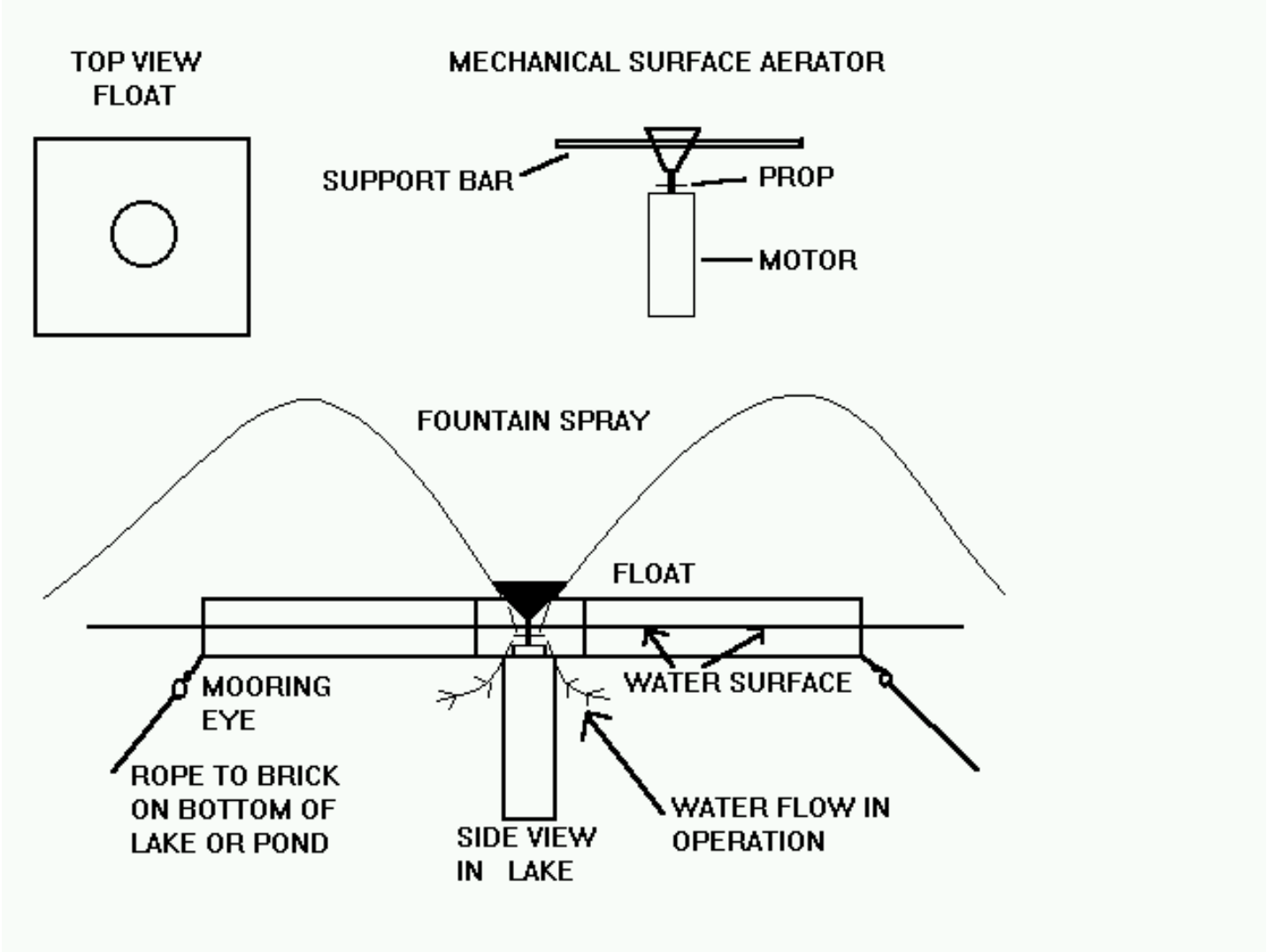

Figure 3. Diagram of a Mechanical Surface Aerator.

3.3 Oxygen sampling methods

In the 1999-2000 aeration season (October – April), an Oxyguard Handy Mark 2 digital meter was used to sample the oxygen levels. It has a liquid crystal display, a 10m waterproof cord and probe. The meter/probe displays percent of saturation, mg/l and temperature. The probe is lowered to the appropriate depth where mg/l (milligrams per litre) and temperature readings are measured, while the probe is moved up and down in the water column. The percent of saturation is used to calibrate the meter before field use. Occasional maintenance of the Oxyguard unit is required. This involves replacing the electrolyte and membrane, then re-calibrating the unit, including the changing of the power cell (battery) when battery power is low.

Oxygen sampling is completed once a month. This has changed from previous years, when oxygen sampling was performed every second week. The surface aerators are very efficient allowing oxygen sampling to occur monthly. During the sampling day, aeration units are checked for maintenance and repairs. The number of sampling locations varies from lake to lake, as do the sampling depths. One or two HACH Kits are used along with another Oxyguard to double-check the Oxyguard meter, three times a year. Once in the fall before aeration begins, December, and again in February-March. If the readings between the two methods are within one ppm (part per million) or mg/l, then the meter is working correctly.

4.0 Results

All ten aerated lakes were successfully overwintered during the 1999 - 2000 aeration season. Individual lake results follow. Water levels were lower than the previous year affecting oxygen-sampling depths in some lakes. All the aeration systems are installed and operated from October to mid-April each year, except for Spring Lake which operated for approximately a 7 days. Table 2 provides details for consecutive successful overwintering years for each of the aerated lakes.

Table 2. Aerated lakes recent successive overwintering years.

Lake	Successive Years Overwintering
C. Thompson Pond	94-95 to 99-00, **6** yrs
Moonshine Lake	94-95 to 99-00, **6** yrs
Cummings Lake	93-94 to 99-00, **7** yrs
Sulphur Lake	91-92 to 99-00, **9** yrs
Spring Lake	78-79 to 99-00, **22** yrs
East Dollar Lake	85-86 to 99-00, **15** yrs
Figure Eight Lake	91-92 to 99-00, **9** yrs
Zama Pond	88-89 to 99-00, **12** yrs
Swan Lake	97-98 to 99-00, **3** yrs
Cutbank Lake	1999-2000, **1** yr

4.1 Cecil Thompson Park Pond

A 1/6th-hp Otterbine successfully overwintered Cecil Thompson Park Pond (Figure 4). Low water levels reduced the depth of the pond thereby reducing the number of depths sampled, compared to past years.

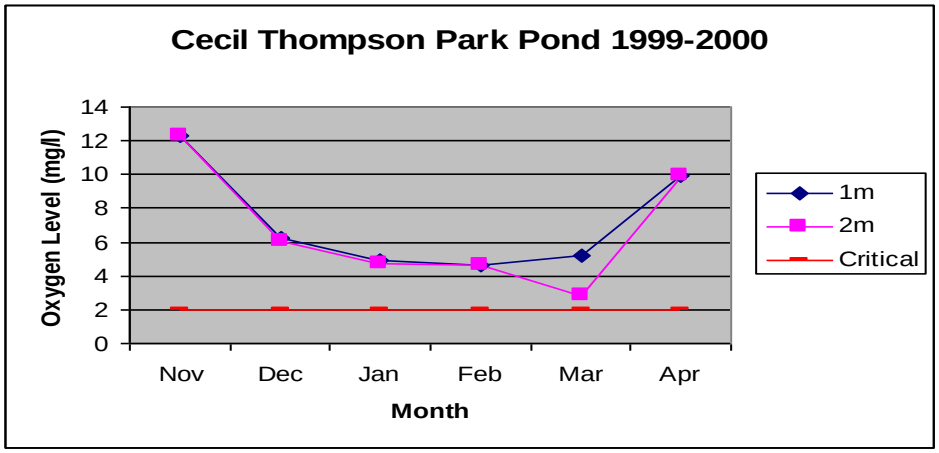

Figure 4. Oxygen concentrations in Cecil Thompson Park Pond, 1999-2000.

4.2 Moonshine Lake

A 1-hp surface aerator was operated for the 1999-2000 season. Oxygen data was not recorded in November. Moonshine Lake overwintered (Figure 5).

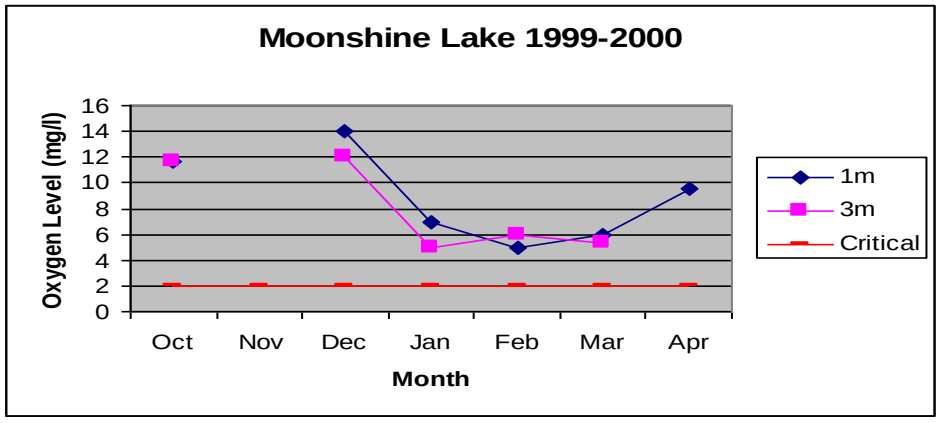

Figure 5. Oxygen concentrations in Moonshine Lake, 1999-2000.

4.3 Cummings Lake

Two aerators, a 1-hp and a 2-hp, were operated continuously for the 1999-2000 aeration season. Another low water year and large amounts of weed growth were a concern. Figure 6 indicates overwintering success.

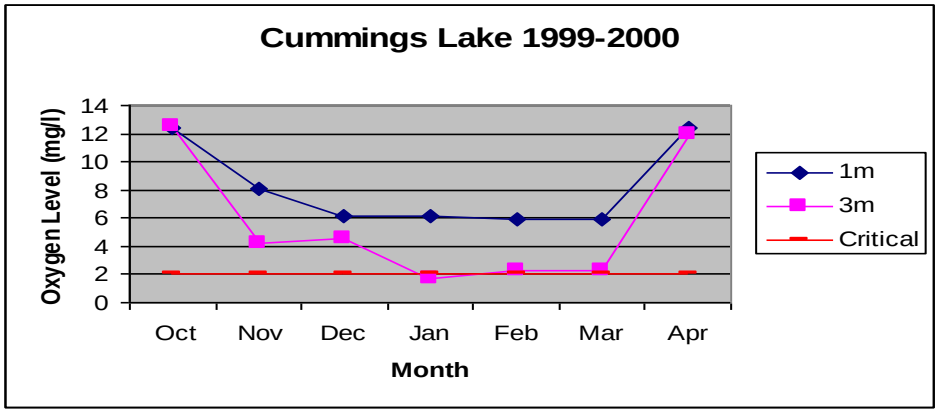

Figure 6. Oxygen concentrations in Cummings Lake, 1999-2000.

4.4 Sulphur Lake

Maintenance requirements (oil changes, greasing, and belt inspections) were performed on a weekly schedule by a contracted mechanic, Phil McGregor. The Sulphur Lake aeration system operated most of the year except from February 5-14 (alternator) and mid-March (exhaust). 4, 1-hp surface aerators are operated annually through a Kubota diesel generator and a power distribution panel. Sulphur Lake overwintered (Figure 7).

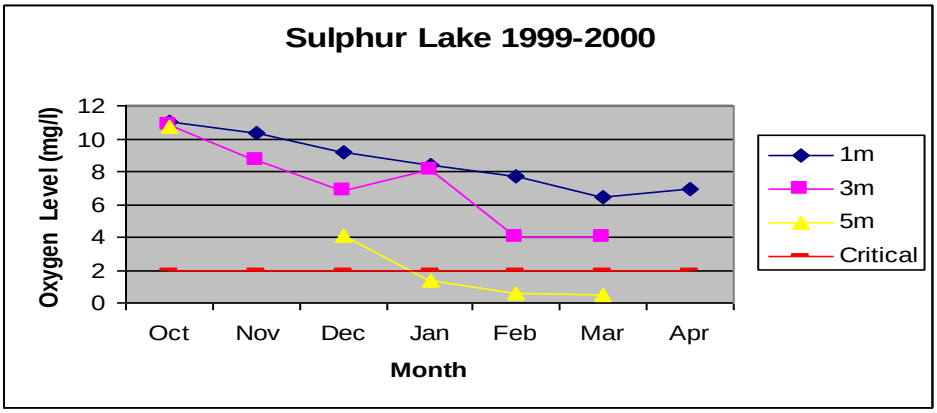

Figure 7. Oxygen concentrations in Sulphur Lake, 1999-2000.

4.5 Spring Lake

Spring Lake was not mechanically destratified this year as the fall was very windy and destratification occurred naturally. Figure 8 data indicates oxygen levels in October, late December, and late March.

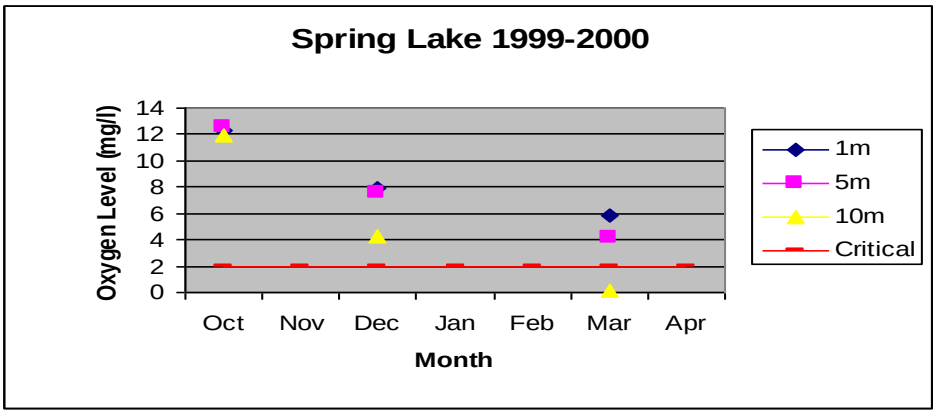

Figure 8. Oxygen concentrations in Spring Lake, 1999-2000.

4.6 East Dollar Lake

East Dollar Lake overwintered without any aeration between December 7, 1999 and February 8, 2000 as the 1-hp aerator was shutdown due to the super cooling of the lake. After February 8th, the ½ hp unit was installed and the oxygen levels were sufficient to over winter the lake. The ½ hp aerator will be the unit operated on East Dollar Lake from now on. (Figure 9).

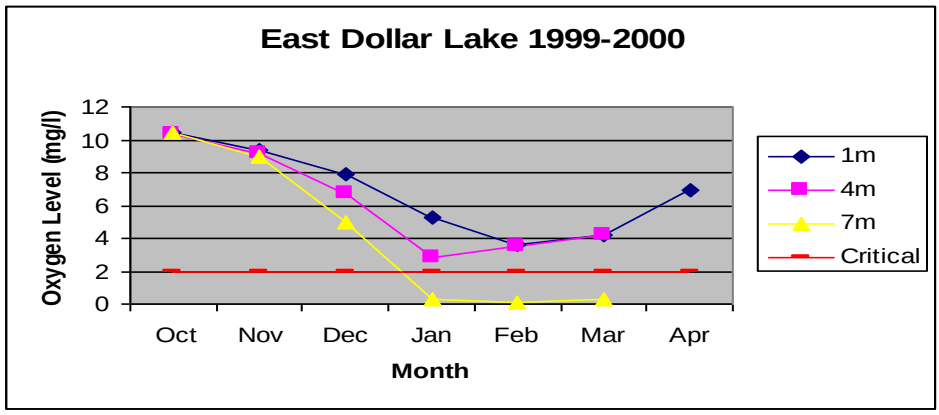

Figure 9. Oxygen concentrations in East Dollar Lake, 1999-2000.

4.7 Figure Eight Lake

Figure Eight Lake was aerated with 3, 1-hp surface aerators. Figure 10 shows three aerators will overwinter this waterbody.

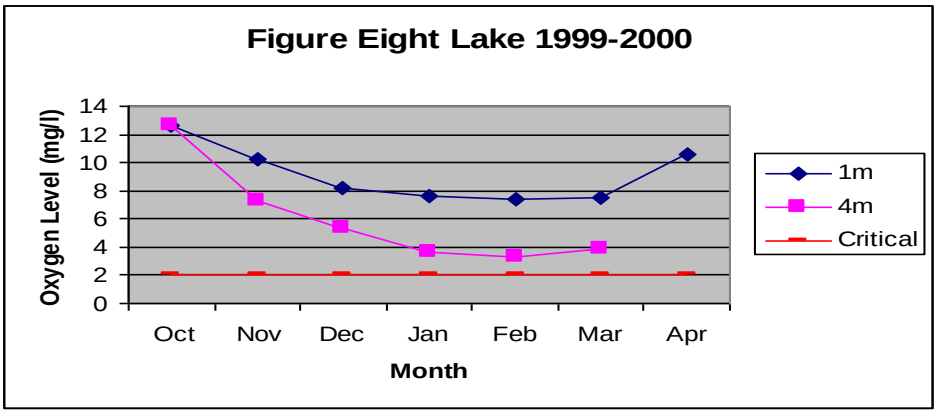

Figure 10. Oxygen concentrations in Figure Eight Lake, 1999-2000.

4.8 Swan Lake

Swan Lake was aerated for the third year. The lake overwintered using 7, 1-hp aerators (Figure 11). Swan Lake was not expected to overwinter as well as in past years due to the lower water levels compared to last season.

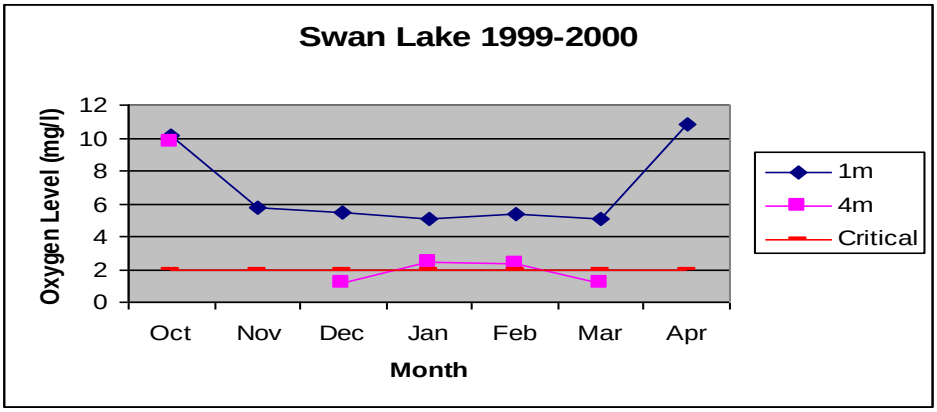

Figure 11. Oxygen concentrations in Swan Lake, 1999-2000.

4.9 Cutbank Lake

This was the first year of aeration on Cutbank Lake. The aeration systems were installed on November 21st. Ten, 1-hp surface aerators were operated until April 8 when the systems were removed. Figure 12 indicates a rapid drop in oxygen levels throughout the aerated months. Additional aerators may be needed to overwinter Cutbank if a harsh winter occurs.

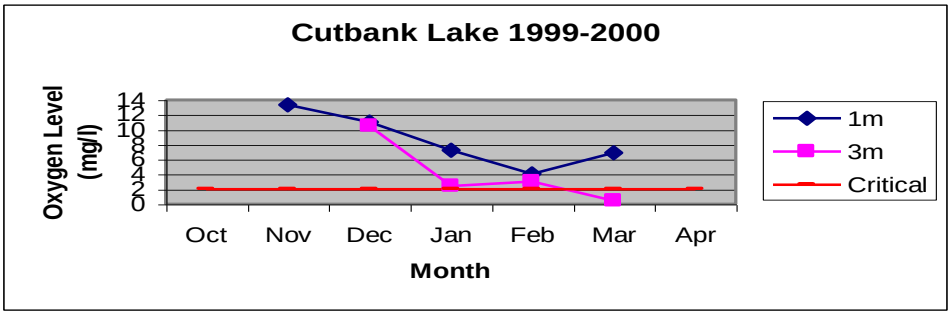

Figure 12. Oxygen concentrations in Cutbank Lake, 1999-2000.

4.10 Zama Pond

Zama Pond is a dugout measuring 76.21m X 36.58 m. Approximately 0.5 ha in size, with a maximum depth is 9.15 m. The pond was built in 1984 to provide more angling opportunity in the area. Natural Resources Service Fisheries Technician Don Schroeder samples oxygen levels once a year, between February and March. Oxygen data was not recorded this year.

5.0 Summary

The 1999-2000 aeration program successfully overwintered all ten lakes. All the aeration systems were removed by April 12, 2000. Cutbank Lake the largest of the aerated lakes, at 172 ha (425 ac), was successfully overwintered with 10, 1-hp surface aerators. 1999 - 2000 was Cutbank Lakes first year of aeration. Swan Lake was successfully aerated again with 7, 1-hp aerators. East Dollar Lake overwintered without any aeration between December 7, 1999 and February 8, 2000 as the 1-hp aerator was shutdown due to the super cooling of the lake. After February 8th, the ½ -hp unit was installed and the oxygen levels were sufficient to over winter the lake. The ½-hp unit will be used on East Dollar Lake in the future. Figure Eight Lake will continue to be aerated with 3, 1-hp aerators. Sulphur Lake aeration system operated most of the year except from February 5-14 (alternator) and mid-March (exhaust). Moonshine Lake had a 1-hp unit operating all season with no problems occurring. At Cummings Lake, two surface aerators (1-hp and 2-hp) were operated from the beginning of the season as low water and large amounts of weed growth were a concern for overwintering success. Spring Lake was not mechanically destratified this year as the fall was very windy and destratification occurred naturally. Cecil Thompson Park Pond and Zama Pond aeration systems operated without any problems.

Previous year(s) over wintering results and aeration methods can be found in the Annual Progress Reports, Alberta Conservation Association, Northwest Boreal Region (1986-87 to 1998-99).

6.0 Recommendations

- Additional aerators will need to be purchased to replace any aerators that malfunction throughout the 2000-2001 aeration season.
- New and additional signage will be constructed and installed in the 2000-2001-aeration season.
- Remove the point release pods, hoses and compressors from Cummings Lake and the experiment point release left over from T.Miller's work, 1994-97, in Moonshine Lake. Leave the original point release units in at Moonshine and Figure Eight lakes for possible aeration during the summer months, if necessary.

7.0 Literature Cited

Fast, 1994. Reviews in Fisheries Science. 2 (1): pg 23-77.

Miller, T.G and W.C.Mackay, 1996 draft. A comparison of mechanical surface aeration and point release air injection used to prevent winterkill in Alberta. Second annual progress report on winter lake aeration. Department of Biological Sciences, University of Alberta. 64pgs.