MONITORING OF WATER-SOURCE LAKES IN THE ALPINE DEVELOPMENT PROJECT: 1999-2005

Final Report

December 2005

Prepared by:

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Lopez Island, WA

Prepared for:

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and

Anadarko Petroleum Corp.
1201 Lake Robbins Dr
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Table of Contents

List of Tables

List of Figures

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INTRODUCTION

Two lakes, designated L9312 (or U6.1) and L9313 (or T6.1), provide the permanent water supply for the Alpine development (Figures 1 and 2). Two naming conventions are used to identify the lakes in the Colville Delta region – one name conveys information on initial sampling and the investigator responsible for the sampling, the other name conveys information on location within the North Slope Emergency Response grid (Moulton 1998).

A series of permits have been issued by Alaska Department of Fish and Game (ADF&G) that allow water withdrawal from the lakes under restrictions intended to protect fish residing within the lakes. These permits have been modified as information on the lakes has improved and as project needs have changed. A permit stipulation added to the March 30, 1999 amendments was that each lake would be monitored for fish presence at least twice during the ice-free season for a period of three years. On September 1, 2000, an additional modification specified that the fish monitoring be continued for a minimum of 5 years. This stipulation was fulfilled by the 2003 sampling and subsequent report (Moulton 2004).

Fish populations in the lakes had been surveyed prior to issuance of water withdrawal permits, beginning in 1995 with baseline studies specific to the Alpine Development (Moulton 1997). Both of the water-source lakes support fish, with eleven species identified from L9312 and seven identified from L9313 (Moulton 1999, 2000).

In 2004, UAF initiated studies on the effects of water withdrawal on water chemistry in Lake L9312. Objectives of this study were to provide information on fish using the lakes to assist the assessment of water withdrawal and compare 2005 catch patterns to those observed in previous years. Results of the 1999 through 2004 monitoring are reported in Moulton (1999, 2000, 2002, 2003, 2004, 2005).

METHODS

Monitoring of the water-source lakes consisted of sampling with fyke nets combined with physical measurements. Sampling was by fyke net because the objective was to sample fish with non-lethal gear so that the sampling would not be the cause of any observed changes to the populations. In past years, beginning in 1995, a variety of gear types were tested to evaluate fish populations in delta lakes (see Appendix B-1 for a list of gear used and resulting catches). Based on those catches, it was decided to use only fyke nets because they sampled the entire range of species and allowed live release of captured fish.

Net locations identified in 1999 as the most appropriate monitoring sites (Moulton 1999) were re-occupied for the 2000 through 2005 sampling (Figures 3 and 4). As set forth in the monitoring stipulations, sampling was conducted during two ice-free periods: July 18-28 and August 18-23. These two time periods have been sampled every year since 2000. Fish were measured and released, with no fish retained for laboratory analysis. Duration of each set was recorded in order to calculate catch rates.

In 2001, Floy FD-68B anchor tags (monofilament = 5/8 inch, vinyl = 1 1/8 inch) were applied to broad whitefish and least cisco exceeding 250 mm fork length to obtain information on residence time within the lake and potentially allow for estimating population size. In 2002-2005, we changed to smaller Floy FF-94 anchor tags (monofilament = 1/2 inch, vinyl = 3/4 inch), which were applied to broad whitefish, round whitefish, and least cisco exceeding 180 mm fork length. The switch to smaller tags in 2002-2005, and thus smaller tagged fish, was made to increase the number of tagged fish.

Water chemistry measurements obtained at the two lakes included surface measures of water temperature, specific conductance, dissolved oxygen, pH, and turbidity. Temperature, specific conductance and dissolved oxygen were *in situ* measurements taken within 15 cm (6 inches) of the surface at the fyke net station in each lake with a YSI Model 85 meter. A sample was returned to the field office to measure pH and turbidity. PH was measured with either a Corning pH meter or an Oaktron pH Tester III. Turbidity was measured with an H.F. Scientific DRT15CE turbidity meter.

Bathymetric data were collected in 2002 using methods described by Michael Baker Jr. (2003) to provide a consistent approach to estimating water volumes. In 2002, location and depth were recorded on a Lowrance Model LCX-15MT integrated GPS/depth sounder. Location and depth were recorded at approximately 1-2 second intervals. Ten transects were run on Lake L9312 and 14 were recorded on Lake L9313. Lake volume was estimated by contour mapping of depth intervals. Contour maps were prepared by plotting the position and depth data obtained by GPS on geo-referenced aerial photography obtained June 30, 1999. Contours were plotted on the aerial photograph of the surveyed lakes. The surface area of each contour was obtained, and the volume was estimated using the formula for truncated cones:

$V = h/3*(A1+A2+(A1*A2) (1/2))$

Where h = vertical depth of the stratum, A1 = area of the upper surface, and A2 = area of the lower surface of the stratum whose volume is to be determined. The volumes of individual strata are summed to obtain the volume of the desired depth intervals.

RESULTS AND DISCUSSION

History of Water Withdrawal

Lake L9312 is a 111-acre lake containing approximately 323 million gallons of water (earlier reports use a surface area of 100 acres based on USGS base maps – the 111 acres is based on digitizing the surface area from June 1999 aerial photography). An estimated 100.5 million gallons is deeper than the maximum ice thickness of 7 feet; this volume is considered the minimum winter volume available to wintering fish. As a result, 30 million gallons of water are currently available for use. Over 31% of the lake volume is deeper than 7 feet (Figure 5).

Lake L9313 is a 78-acre lake containing approximately 174 million gallons of water (earlier reports use a surface area of 69 acres based on USGS base maps – the 78 acres is based on digitizing the surface area from June 1999 aerial photography). An estimated 19.4 million gallons is deeper than the maximum ice thickness of 7 feet; this volume is considered the minimum winter volume available to wintering fish. At present, 6 million gallons of water are available for use. About 11% of the lake volume is deeper than 7 feet (Figure 6).

Water use has varied considerably in the two lakes over the last three winters as permit conditions have been modified (Table 1). The initial water use permits that designated the lakes as permanent water sources, issued March 30, 1999, allowed 15% of the estimated minimum winter volume to be removed. The volume allowed for removal was increased to 30% of the minimum winter volume on January 27, 2000. This increase was made because the lakes were to serve as the permanent water supply for the Alpine facilities and the previous criterion imposed a severe constraint on the project.

During summer 2000, staff gauges were installed in the lakes to allow direct measure of the water surface elevation. Both lakes were flooded during break-up 2000 and the water surface elevations observed after the lakes stabilized were set as benchmarks to monitor water use. Water withdrawals were to cease when the water surface elevation reached 7.0 ft in L9312 and 5.8 ft in L9313. The permitted removals were also amended to reflect new estimates of lake volumes.

In L9312, 87% of the permitted withdrawal was used in winter 1998/1999, while only 15% was used in 1999/2000. Use exceeded 81% of the permitted withdrawal in 2000/2001, but was only 44% of the permitted amount in 2001/2002. To date, the withdrawals represent between 3% and 26% of the minimum winter volume.

In L9313, only 3% of the permitted withdrawal volume was used in 1998/1999, with 74% used in 1999/2000. No water was used from L9313 in winter 2000/2001 because the water surface elevation fell below the permitted level (5.8 ft) prior to ice formation in the fall, even though only 2.1 million gallons had been used after break-up. Investigation of the apparent loss of water determined that the low staff gauge reading was caused by frost-induced movement of the staff gauge, not loss of water from the lake. For 2001/2002, about 21% of the permitted withdrawal was used. To date, the withdrawals represent between 1% and 51% of the minimum winter volume. In

three years water use was near 50% of the minimum winter volume.

Lake L9312 (U6.1)

Water Chemistry. Water chemistry parameters measured in association with fish sampling since 1995 are summarized in Table 2. Flooding during break-up in 2000 appeared to decrease specific conductance, as there was a 29% decrease between July 1999 and July 2000. Specific conductance in L9312 during July increased slightly (7%) between 2000 and 2001. The lake was apparently not flooded during the 2001. MBJ (2002) report that the lake was fully recharged by overflow from the Sakoonang Channel in 2002. Specific conductance has shown a relatively stable trend since 2000 (Figure 7). The low value, averaging 66 microSiemens/cm, indicates the lake is primarily snow melt with little influence from the river.

Biological Observations. Fyke net sampling conducted July 19-28, 2005 produced a catch of 252 fish from 4 species, while sampling conducted August 18-23 produced 357 fish from 3 species (Table 4). As in previous years, least cisco was the most numerous species caught in 2005, representing 87% of the non-stickleback catch. The July catch rate of least cisco during 2005 (17.9 fish per day) ranked fourth highest since July 1999 (Figure 8). Catch rates of least cisco in August 2005 were the lowest yet observed during August sampling.

The least cisco in 2000 likely represented many age groups (based on length frequency analysis – Appendix B), because the lengths ranged from 29 to 242 mm. In 2001 and 2002, the captured least cisco were smaller, with age-0 and 1 fish being most abundant (Figure 9). In 2005, the low catch rate appeared to be caused by low abundance of small fish. The abundance of fish between 180-200 mm was similar to that seen in previous years, but relatively few fish less than 150 mm were caught.

Catches of fish other than least cisco were low in 2005 when compared to previous years, with round whitefish, Alaska blackfish, slimy sculpin and ninespine stickleback being the only other species caught (Table 4, Figure 8). Catch rates (CPUE) of the detected species, although low, were in the range of those measured in recent years.

Ninety-four tagged least cisco were released in 2005, along with 1 broad whitefish and 2 round whitefish (Table 6). One least cisco released in 2004 was caught after being at large for 370 days, and one round whitefish released in 2003 was caught after 728 days (Table 7). In addition, one least cisco and one round whitefish tagged in July 2005 were recaptured later the same week.

Lake L9313 (T6.1)

Water Chemistry. Specific conductance in L9313 in 2005 decreased about 6% from that recorded in 2004, however, there is a strong trend of increasing specific conductance since 1995 (Table 8, Figure 8). The high levels of dissolved solids compared to Lake L9312 are likely related to more

frequent influence from the river because of the lower elevation. L9313 is normally flooded annually during spring break-up, while L9312 is only occasionally flooded. Break-up during 2005 was unusual in that Lake L9313 was not flooded for the first time since break-up monitoring began in 1995. The lake appeared to fully re-charge from snow melt and summer rainfall (M. Alexander, pers. comm.. 2005).

There was evidence of oxygen depression in L9313 during winters 2000/2001, 2001/2002 and 2002/2003 (Table 3). Dissolved oxygen reached levels during April 2002 that are lethal to fish (0.0-0.1 mg/l). Water removal during winter 2001/2002 from the lake was about 13% of the volume deeper than 7 feet – removals of this magnitude are not expected to affect dissolved oxygen. Low oxygen levels were also observed in this lake in 2000/2001 (2.0-2.5 mg/l on April 18, 2001) when there was no water removal. This lake appears prone to natural oxygen depletion during late winter, possibly related to the shallowness of the lake, as 96% of the lake is shallower than 7 feet.

In April and May 2003, a special effort was made to examine the distribution of oxygen levels at various locations around the lake (Wolf 2003a,b, attached as Appendix D). Water chemistry measurements were taken at eight sites roughly along the longitudinal axis of the lake. On April 28, there was some variation in the distribution of dissolved oxygen, ranging from less than 1.0 mg/l at four stations, to near 3.5-4.0 mg/l at two stations in the northeastern portion of the lake. By May 9, dissolved oxygen was less than 2.0 at five stations, and between 2-3 mg/l at the other three stations.

Biological Observations. Fyke net sampling conducted July 18-28, 2005 and again during August 18-23 produced a combined catch of 993 fish from 3 species (Table 5). Ninespine stickleback, least cisco and Alaska blackfish were the only species caught during 2005. For the first time since 2000, least cisco were not caught in July (Figure 11).

Least cisco caught during August 2005 were mostly small fish, ages 0 and 1 (Figure 12). Only 2 fish greater than 110 mm were caught and none reached the 180 mm size criterion for tagging.

In 2005, none of the 123 fish tagged in previous years were recaptured. One of 4 least cisco tagged in 2001 was recaptured during 2002. This individual was released on July 22, 2001 and recaptured on the same day in 2002. This recapture is direct evidence that at least some fish survived low dissolved oxygen levels recorded in April 2002. No fish were tagged and released in L9313 during 2005 (Table 6).

Sampling in Lake L9313 prior to 1999 indicated few fish resided in the lake (Appendix Table B-1), with ninespine stickleback and low densities of least cisco and Alaska blackfish present. The high catches of age-2 and 3 least cisco in 1999 and their subsequent disappearance, along with the highly variable length distribution, likely indicate that fish enter and leave the lake annually during high water. At present, it is unclear whether or not the young least cisco caught in this lake from 2001 to 2005 represent successful spawning or immigration from the river.

Sampling during July is conducted during 24-hours of daylight, while sampling in late August

includes periods of darkness at night. The catches in late August in both L9312 and L9313 may reflect this difference in daylight pattern. The pattern of daily catch indicates that both slimy sculpin and Alaska blackfish were more active at night (Figures 10 and 13). The few burbot (which avoid light when possible) caught in the lakes have also been caught during August.

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Table 1. Water withdrawal at Alpine Development lakes from freeze-up to break-up, 1999-2005 (values in millions of gallons).

Lake Name	Month	1998/1999 (mil. gal.)	1999/2000 (mil. gal.)	2000/2001 (mil. gal.)	2001/2002 (mil. gal.)	2002/2003 (mil. gal.)	2003/2004 (mil. gal.)	2004/2005 (mil. gal.)
L9312								
	June		1.63			2.01	1.35	1.76
	July					0.00	1.31	1.85
	August					0	1.37	1.75
	September			0.50		0	1.86	1.69
	October			1.79	Combined w/ Nov.		1.51	2.16
	November			2.44		0.38	2.20	2.04
	December			2.59	6.08[1]	1.48	1.68	1.47
	January			8.84	1.80	1.84	1.47	1.59
	February	9.10		1.91	3.14	1.63	1.40	1.58
	March	1.85		1.78	3.18	1.50	1.51	2.23
	April		0.95	2.15	0.80	1.50	1.81	2.02
	May		1.87	1.98	3.38	2.27	1.89	1.91
	Total Use	10.95	4.44	23.97	12.29	12.62	19.37	22.04
	Min. Winter Vol.[2]	100.55	100.55	100.55	100.55	100.55	100.55	100.55
	Percent of Min. Vol.	10.9%	4.4%	23.8%	12.2%	12.5%	19.3%	21.9%
	Permitted Use[3]	12.60	19.00	32.36	32.36	30.00	30.00	30.00
L9313								
	June		1.82			0.41	0.00	0.74
	July		2.23			1.39	0.03	0.07
	August					1.90	0.00	0.00
	September			2.12		1.60	0.00	0.00
	October				Combined w/ Nov		0.16	0.59
	November					3.44	0.28	0.78
	December		0.77		3.78[1]	0.00	0.37	0.89
	January	0.06	1.70		0.36	0.11	0.49	0.00
	February	0.13	1.04		0.23	0.18	0.57	0.02
	March		1.55		1.36	0.00	0.00	0.00
	April		0.84		0.24	0.00	0.11	0.30
	May				0.04	0.04	0.91	0.00
	Total Use	0.19	9.94	2.12	2.22	9.07	2.92	3.39
	Min. Winter Vol.[2]	19.38	19.38	19.38	19.38	19.38	19.38	19.38
	Percent of Min. Vol.	1.0%	51.3%	11.0%	11.5%	46.8%	15.1%	17.5%
	Permitted Use[3]	5.60	13.40	10.34	10.34	6.00	6.00	6.00

[1] Totals for 4th quarter 2001, not just December.

[2] Volume deeper than 7 feet, based on depth transects obtained during 2002

[3] These permitted use levels were used by ConocoPhillips Alaska, Inc. (formerly ARCO Alaska) for tracking purposes, some of these levels are less than permitted levels found in the ADF&G permits.

[4] 7.282 million gallons were used prior to freeze-up

Table 2. Water chemistry parameters measured in conjunction with Alpine Area fish sampling at lake L9312, 1995-2005.

		July				August			
Parameter	**Year**	**Mean**	**Standard Deviation**	**No. of Samples**	**Range**	**Mean**	**Standard Deviation**	**No. of Samples**	**Range**
Water Temperature (^{o}C)									
	1995	13.4	--	1	13.4			0	
	1997	8.3	0.7	5	7.7-9.5			0	
	1999	10.4	1.9	7	8.6-13.5			0	
	2000	10.7	0.8	6	10.0-12.1	7.6	0.6	6	6.6-8.5
	2001	14.2	1.0	7	13.1-15.9	6.0	1.1	6	5.2-8.1
	2002	12.1	2.0	8	9.9-15.4	7.1	1.3	6	5.5-8.7
	2003	12.6	3.5	7	7.0-17.5	6.4	0.6	8	5.5-7.2
	2004	13.8	1.3	7	11.7-15.0	14.2	1.6	8	11.7-17.1
	2005	10.5	0.9	8	9.4-11.7	10.1	0.5	6	9.3-10.7
Dissolved Oxygen (mg/l)									
	1997	11.5	0.7	5	10.5-12.4			0	
	1999	11.4	0.1	2	11.4-11.5			0	
	2000	10.9	0.1	4	10.8-10.9			0	
	2001	9.7	0.3	7	9.0-10.0	11.2	0.9	6	9.8-12.3
	2002	10.4	0.6	8	9.5-11.4	11.8	0.4	6	11.2-12.3
	2003	10.2	0.5	7	9.5-10.9	12.2	0.2	8	11.8-12.5
	2004	10.1	0.6	7	9.4-10.8	10.4	0.5	8	9.8-11.3
	2005	11.5	0.4	8	11.04-12.16	11.3	0.4	6	10.78-11.83
Specific Conductance (µS/cm)									
	1995	60.0	--	1	60.0			0	
	1997	83.5	0.5	5	82.7-83.9			0	
	1999	77.2	1.5	7	76.2-79.5			0	
	2000	54.8	0.2	6	54.5-55.2	55.7	0.4	6	55-56.3
	2001	58.6	0.7	7	57.1-59.2	60.9	0.8	6	60.2-62.0
	2002	61.6	0.5	8	61.1-62.4	62.2	0.3	5	61.8-62.7
	2003	71.2	0.8	7	70.0-72.3	67.9	1.6	8	66.8-70.4
	2004	66.9	0.4	7	66.4-67.5	68.4	0.5	8	67.5-68.9
	2005	63.2	0.6	8	62.4-63.9	67.2	4.7	6	65.1-76.8
Turbidity (NTU)									
	2000	8.6	1.4	4	7.5-10.5	4.4	0.9	4	3.9-5.7
	2001	1.9	0.7	6	1.3-3.0	2.3	1.4	6	1.2-4.7
	2002	1.0	0.3	6	0.7-1.5	2.3	1.2	7	1.5-4.9
	2003	7.6	7.1	6	0.7-18.0	1.0	0.2	8	0.8-1.4
	2004	0.6	0.5	7	0.4-1.7	0.8	0.1	8	0.6-1.0
	2005	0.7	0.3	9	0.5-1.57	0.9	0.2	6	0.68-1.27

Table 3. Variation in specific conductance and minimum winter dissolved oxygen observed at lakes L9312 and L9313 from 1997 to 2005.

Lake	Year	Winter Water Withdrawal (million gals.)	July Specific Conductance[1] (μS/cm)	April Specific Conductance[2] (μS/cm)	April Minimum Dissolved Oxygen[2] (mg/l)
L9312	1997	(no withdrawal)	83.5	--	--
	1998	(no withdrawal)	--	--	--
	1999	10.95	77.2	--	--
	2000	4.44	54.8	--	--
	2001	23.97	58.6	232.1	3.5
	2002	12.29	61.6	155.5	9.5
	2003	12.62	71.2	--	--
	2004	19.37	66.9	--	--
	2005	22.04	63.2	--	--
L9313					
	1997	(no withdrawal)	126.2	--	--
	1998	(no withdrawal)	--	--	--
	1999	0.19	172.8	--	--
	2000	9.94	167.7	--	--
	2001	0.00	248.6	798.5	2.2
	2002	2.22	202.2	988.4	0.05
	2003	9.07	295.8	378.7	1.5
	2004	2.92	242.0	--	--
	2005	3.39	228.0	--	--

[1] Measured at Fyke Net Station

[2] Mean Water Column Value

Table 4. Catches of fish by species from Lake L9312 fyke net sampling, 1999-2005.

	1999 July		2000 July		2001 July		2002 July		2003 July		2004 July		2005 July	
Species	No. of Fish	CPUE	No. of Fish	CPUE	No. of Fish	CPUE	No. of Fish	CPUE	No. of Fish	CPUE	No. of Fish	CPUE	No. of Fish	CPUE
Least cisco	62	9.0	1,349	192.3	56	8.1	142	17.1	689	102.6	315	45.8	177	17.9
Arctic cisco	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Broad whitefish	5	0.7	5	0.7	7	1.0	1	0.1	0	0.0	0	0.0	1	0.1
Humpback whitefish	0	0.0	27	3.8	1	0.1	0	0.0	0	0.0	0	0.0	0	0.0
Round whitefish	24	3.5	7	1.0	5	0.7	15	1.8	2	0.3	0	0.0	2	0.2
Burbot	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Longnose sucker	0	0.0	1	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Alaska blackfish	7	1.0	22	3.1	5	0.7	0	0.0	1	0.1	0	0.0	0	0.0
Fourhorn sculpin	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Slimy sculpin	83	12.0	13	1.9	4	0.6	4	0.5	2	0.3	7	1.0	5	0.5
Ninespine stickleback	184	26.7	729	103.9	89	12.8	44	5.3	65	9.7	246	35.7	67	6.8
Total Catch:	365		2,153		167		206		759		568		252	
Number of Species:	6		8		7		5		5		3		5	
Net Hours:	165.4		168.3		166.4		199.7		161.2		165.2		237.3	

	August	August		August		August		August		August		August	
Species		No. of Fish	CPUE	No. of Fish	CPUE	No. of Fish	CPUE	No. of Fish	CPUE	No. of Fish	CPUE	No. of Fish	CPUE
Least cisco	August	196	28.4	228	29.1	652	91.9	333	49.7	439	63.3	42	7.0
Arctic cisco	not sampled in	5	0.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Broad whitefish	1999	4	0.6	0	0.0	7	1.0	21	3.1	0	0.0	0	0.0
Humpback whitefish		15	2.2	1	0.1	4	0.6	0	0.0	0	0.0	0	0.0
Round whitefish		17	2.5	4	0.5	4	0.6	0	0.0	0	0.0	0	0.0
Burbot		1	0.1	0	0.0	1	0.1	1	0.1	0	0.0	0	0.0
Longnose sucker		0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Alaska blackfish		102	14.8	8	1.0	27	3.8	31	4.6	148	21.3	20	3.3
Fourhorn sculpin		0	0.0	1	0.1	0	0.0	0	0.0	0	0.0	0	0.0
Slimy sculpin		93	13.5	49	6.3	31	4.4	12	1.8	24	3.5	4	0.7
Ninespine stickleback		368	53.3	75	9.6	46	6.5	17	2.5	262	37.8	291	48.2
Total Catch:		801		366		772		415		873		357	
Number of Species:		9		7		8		6		4		3	
Net Hours:		165.7		187.8		170.3		160.8		166.4		144.8	

Table 5. Catches of fish by species from Lake L9313 fyke net sampling, 1999-2005.

	1999 July		2000 July		2001 July		2002 July		2003 July		2004 July		2005 July	
Species	No. of Fish	CPUE	No. of Fish	CPUE	No. of Fish	CPUE	No. of Fish	CPUE	No. of Fish	CPUE	No. of Fish	CPUE	No. of Fish	CPUE
Least cisco	975	135.7	0	0.0	48	7.0	342	40.8	243	36.3	88	12.8	0	0.0
Broad whitefish	5	0.7	4	0.6	2	0.3	71	8.5	24	3.6	5	0.7	0	0.0
Humpback whitefish	0	0.0	0	0.0	1	0.1	2	0.2	1	0.1	0	0.0	0	0.0
Round whitefish	2	0.3	0	0.0	0	0.0	2	0.2	1	0.1	1	0.1	0	0.0
Burbot	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Alaska blackfish	9	1.3	23	3.3	11	1.6	11	1.3	0	0.0	9	1.3	44	4.4
Ninespine stickleback	111	15.5	779	110.2	100	14.6	227	27.1	83	12.4	647	94.1	721	72.2
Total Catch:	1,102		806		162		655		352		750			
Number of Species:	5		3		5		6		5		5			
Net Hours:	172.4		169.7		164.2		201.1		160.5		165.0		239.7	

	August		August		August		August		August		August		August	
Species	No. of Fish	CPUE	No. of Fish	CPUE	No. of Fish	CPUE	No. of Fish	CPUE	No. of Fish	CPUE	No. of Fish	CPUE	No. of Fish	CPUE
Least cisco	August		5	0.7	5	0.6	62	8.6	152	22.7	576	81.9	73	12.0
Broad whitefish	not sampled in		7	1.0	3	0.4	175	24.4	2	0.3	4	0.6	0	0.0
Humpback whitefish	1999		5	0.7	4	0.5	31	4.3	0	0.0	0	0.0	0	0.0
Round whitefish			0	0.0	0	0.0	0	0.0	3	0.4	0	0.0	0	0.0
Burbot			1	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Alaska blackfish			100	14.8	22	2.8	90	12.6	11	1.6	118	16.8	21	3.5
Ninespine stickleback			332	49.3	128	16.2	688	96.0	62	9.2	10,434	1,483.9	134	22.1
Total Catch:			450		162		1,046		230		11,132			
Number of Species:			6		5		5		5		4			
Net Hours:			161.6		189.1		172.0		160.9		168.8		145.5	

CPUE = fish per 24 hrs of netting

Table 6. Number of tagged fish released and recaptured in Alpine water use lakes.

Lake	Year	Species	Tags Released	Tags Recaptured	No. of Fish >180 mm Caught
L9312	2001	Broad whitefish	5	0	5
	2002	Broad whitefish	2	0	2
		Humpback whitefish	2	0	2
		Least cisco	2	0	2
		Round whitefish	5	0	5
	2003	Broad whitefish	3	0	3
		Least cisco	110	1	114
		Round whitefish	4	1	4
	2004	Least cisco	67	1	95
	2005	Broad whitefish	1	0	1
		Least cisco	94	1	99
		Round whitefish	2	1	2
L9313	2001	Broad whitefish	1	0	1
		Least cisco	4	1	1
	2002	Broad whitefish	18	1	1
		Least cisco	6	2	8
	2003	Broad whitefish	1	0	1
		Humpback whitefish	1	0	1
		Least cisco	7	1	7
	2004	Broad whitefish	1	0	1
		Least cisco	84	4	179
	2005	None	0	0	0

Table 7. Summary of individual tag returns from Alpine water use lakes, 2001-2005.

Lake	Species	Release Length	Tag Code	Release Date	Recapture Date	Days Out
L9312						
	Least cisco	244	MJM021089	7/28/2003	8/17/2004	386
		193	MJM022629	7/20/2005	7/26/2005	6
		208	MJM021690	7/22/2004	7/27/2005	370
	Round whitefish	266	MJM020943	7/23/2003	7/20/2005	728
		318	MJM020943	7/20/2005	7/25/2005	5
L9313						
	Broad whitefish	235	MJM020505	8/23/2002	8/26/2002	3
	Least cisco	255	MJM0100243	7/22/2001	7/22/2002	365
		188	MJM020475	7/22/2002	7/23/2002	1
		190	MJM020475	7/23/2002	8/26/2002	34
		389	MJM021039	7/23/2003	8/17/2003	25
		193	MJM021715	7/25/2004	8/20/2004	26
		190	MJM021719	7/25/2004	8/20/2004	26
		201	MJM021733	7/26/2004	8/20/2004	25
		193	MJM021763	7/28/2004	8/20/2004	23

Table 8. Water chemistry parameters measured in conjunction with Alpine Area fish sampling at lake L9313, 1995-2005.

		July				August			
Parameter	**Year**	**Mean**	**Standard Deviation**	**No. of Samples**	**Range**	**Mean**	**Standard Deviation**	**No. of Samples**	**Range**
Water Temperature (^{o}C)									
	1995	13.1	--	1	13.1			0	
	1997	8.0	0.4	5	7.7-8.6			0	
	1999	10.2	1.9	7	8.3-12.7			0	
	2000	10.6	0.4	5	10.3-11.2	7.7	0.5	6	6.9-8.5
	2001	14.2	0.9	7	13.2-15.6	5.8	0.7	6	5.0-7.0
	2002	12.3	2.0	8	10.6-15.7	7.2	1.7	7	5.3-9.4
	2003	13.1	3.0	7	7.8-16.1	6.4	0.3	8	6.0-6.8
	2004	14.1	1.4	7	11.7-15.6	14.3	1.7	8	11.5-17.0
	2005	11.0	0.8	10	9.6-12.4	9.5	0.4	6	9.1-10.3
Dissolved Oxygen (mg/l)									
	1997	11.4	0.4	6	11.0-12.2			0	
	1999	12.0	0.5	2	11.6-12.3			0	
	2000	11.0	0.2	3	10.9-11.2			0	
	2001	9.5	0.4	7	9.1-10.2	11.2	1.2	6	10.1-12.9
	2002	10.5	0.8	8	9.3-11.5	11.7	0.4	7	11.1-12.2
	2003	10.2	0.5	7	9.8-10.4	12.2	0.3	8	11.8-12.8
	2004	10.1	0.7	7	9.2-10.9	10.6	0.9	8	9.7-12.5
	2005	11.1	0.4	10	10.52-11.73	11.3	0.5	6	10.64-11.79
Specific Conductance (µS/cm)									
	1995	107.0	--	1	107.0				
	1997	126.2	2.0	5	123.3-128.5				
	1999	172.8	3.3	7	170.2-177.9				
	2000	167.7	1.1	5	166.7-169.2	174.1	2.5	6	170.3-176.5
	2001	248.6	4.0	7	244.9-257.3	255.6	4.2	6	253.0-263.9
	2002	202.2	1.9	8	200.6-206.6	208.9	1.8	7	207.7-213.0
	2003	295.8	0.6	7	295.3-296.8	291.6	7.7	8	285.3-305.6
	2004	242.0	1.3	7	240.5-243.5	250.7	0.9	8	249.5-252.0
	2005	228.8	2.2	10	225.7-232.5	238.6	0.4	6	237.8-239.0
Turbidity (NTU)									
	2000	3.4	0.2	4	3.3-3.6	8.4	4.5	4	5.5-15.0
	2001	2.9	1.6	7	1.5-6.4	2.4	1.7	6	1.4-5.8
	2002	1.7	1.5	8	0.9-5.3	2.8	0.7	7	1.7-3.7
	2003	3.3	2.9	6	0.8-8.6	1.2	0.5	8	0.7-2.2
	2004	0.6	0.2	7	0.4-0.8	1.0	0.2	8	0.8-1.2
	2005	0.6	0.3	11	0.37-1.1	0.9	0.2	6	0.64-1.26

Figure 1. Location of the Alpine Development in the Colville River delta.

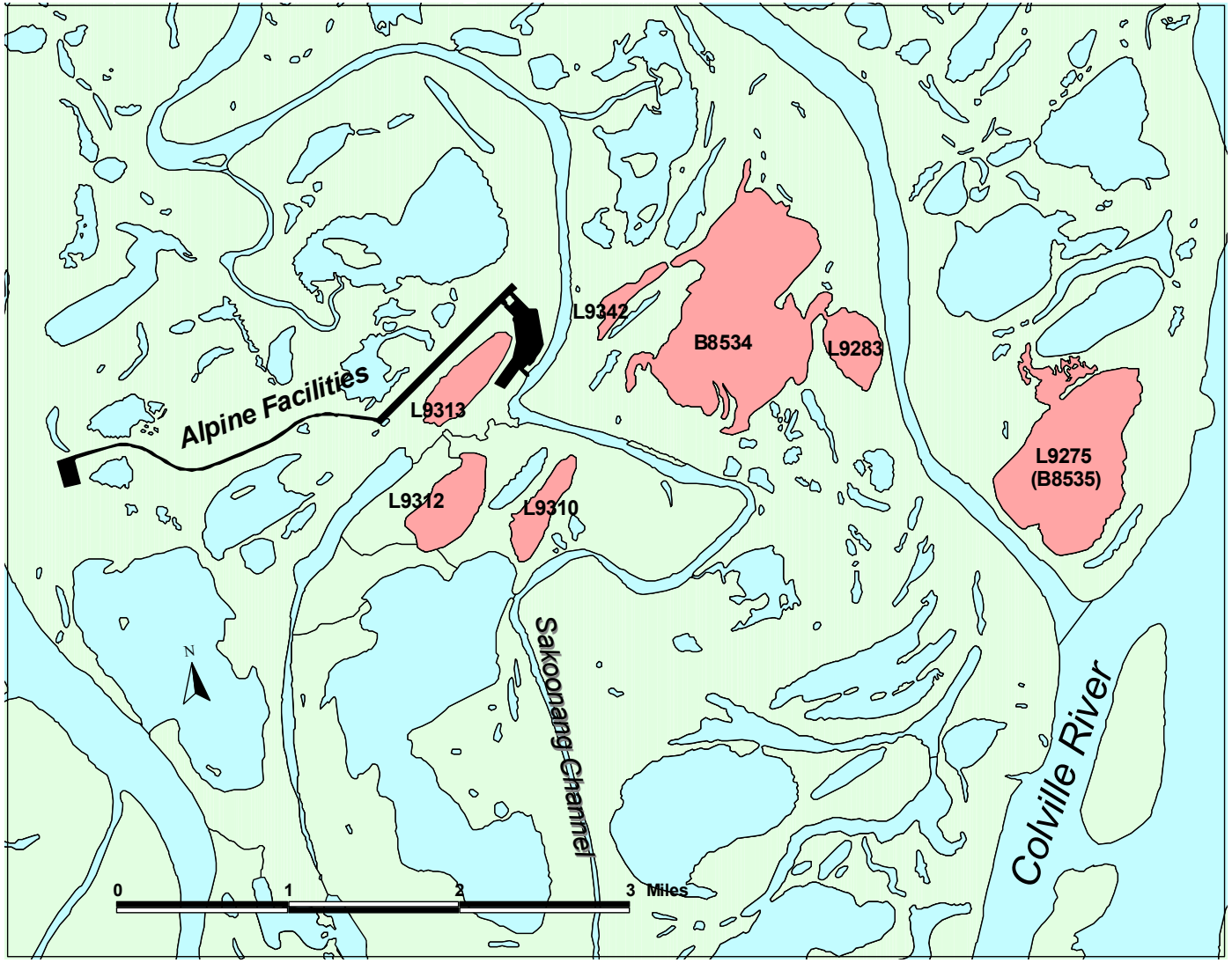

Figure 2. Lakes L9312 and L9313 used as permanent water sources for the Alpine Development.

Figure 3. Fyke net station used for long-term monitoring in lake L9312.

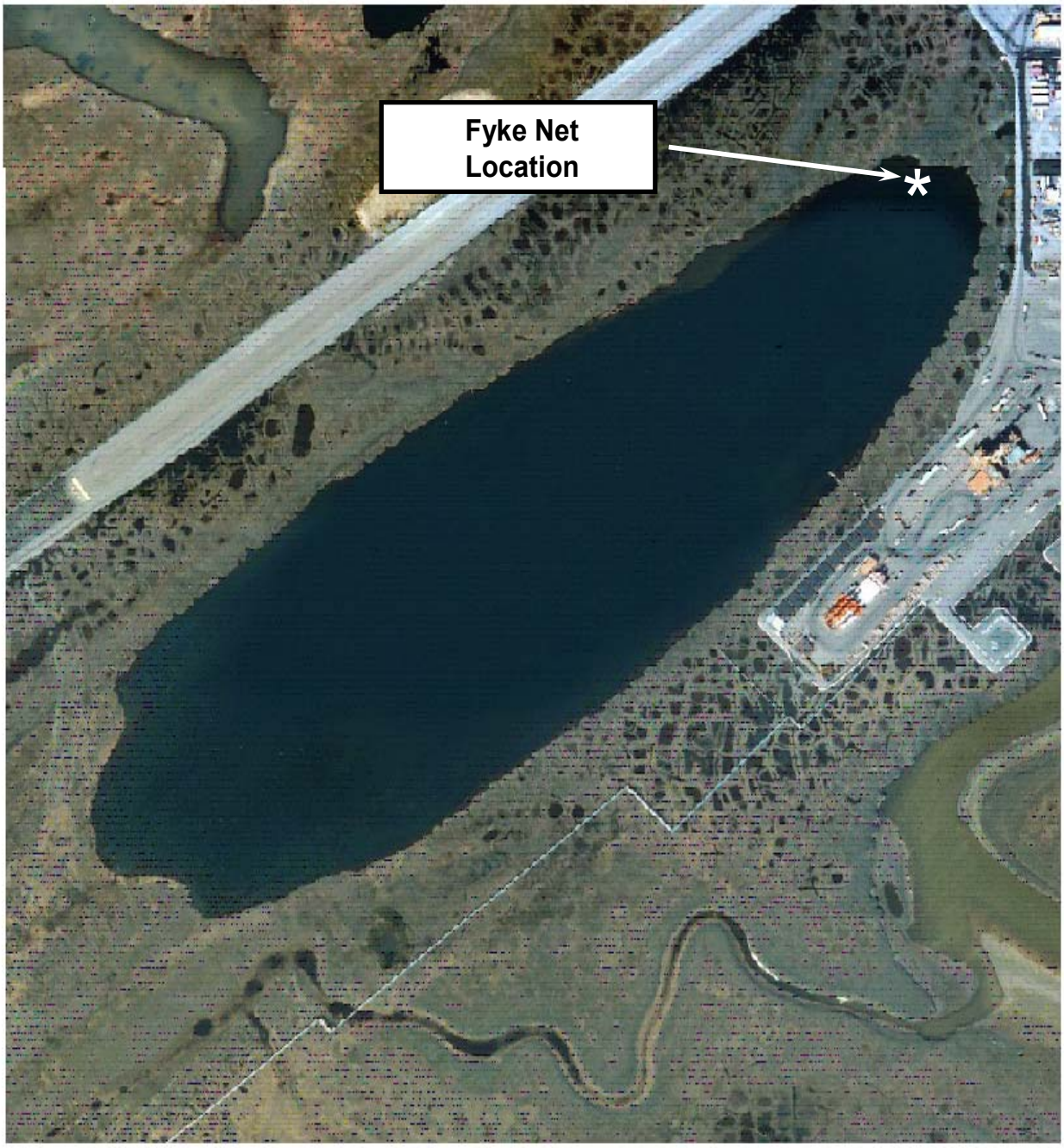

Figure 4. Fyke net station used for long-term monitoring in lake L9313.

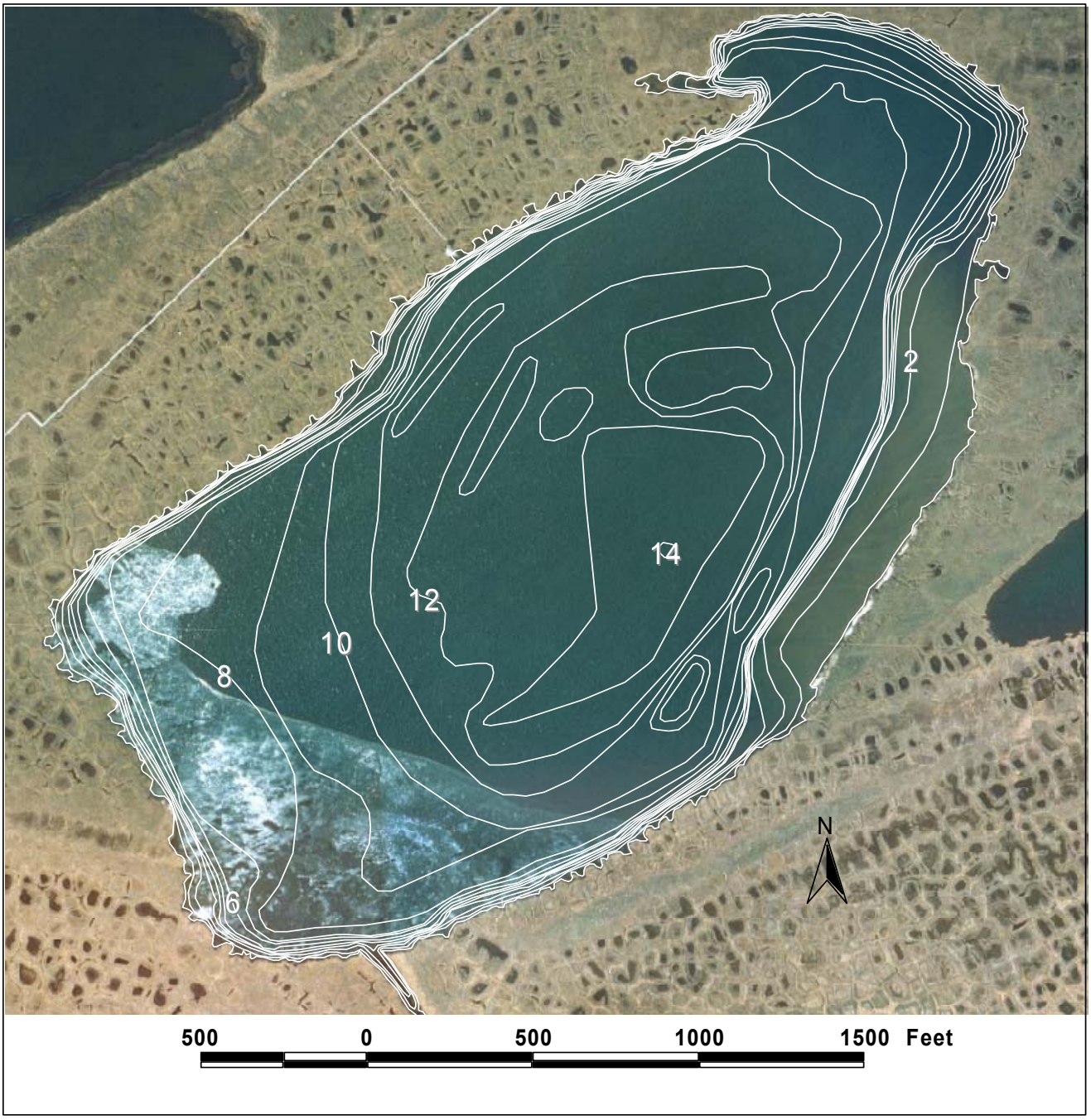

Figure 5. Bathymetric contours (in 1 foot intervals) for lake L9312 based on depth survey of July 28, 2002.

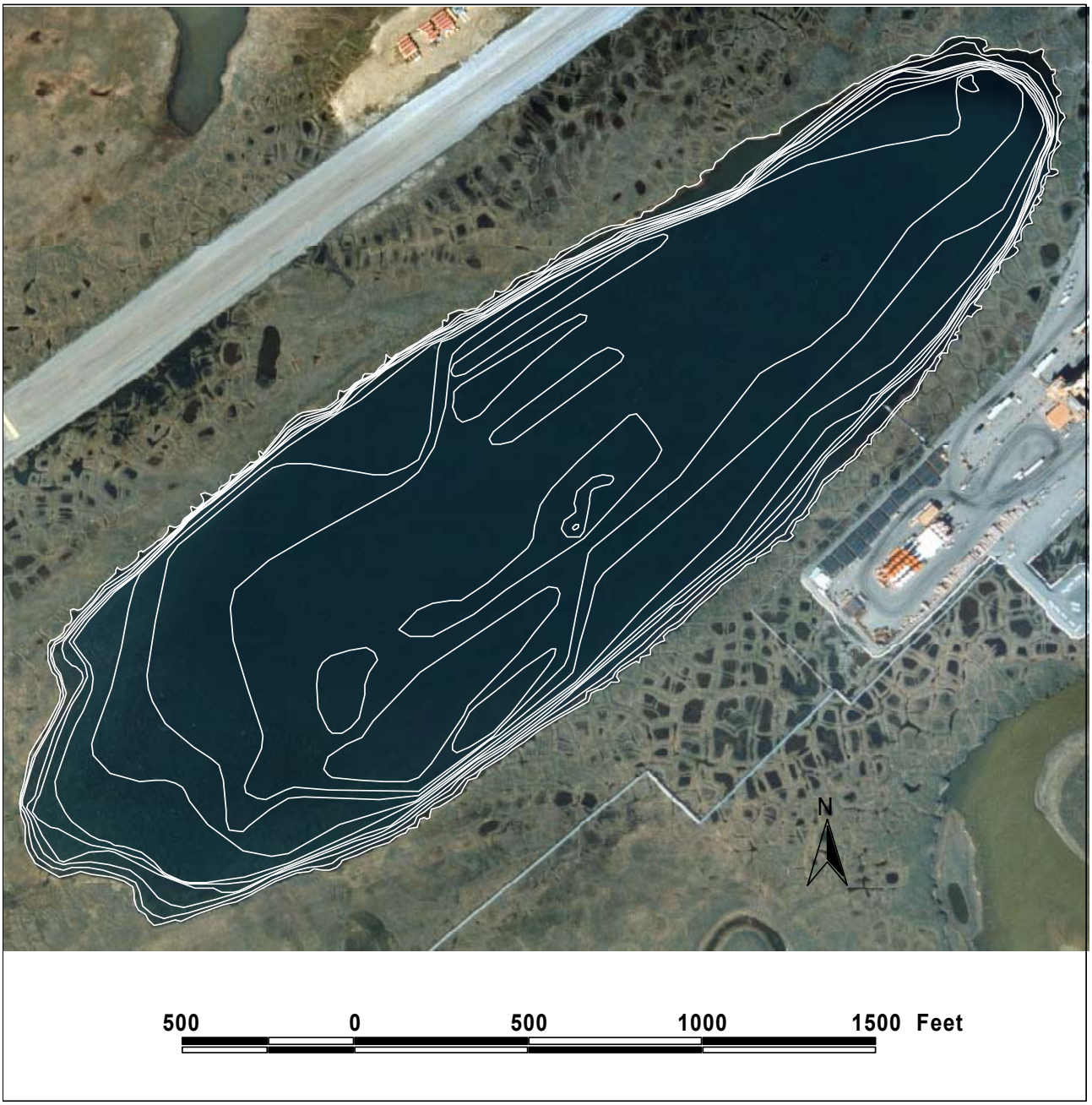

Figure 6. Bathymetric contours (in 1 foot intervals) for lake L9313 based on depth survey of July 28, 2002.

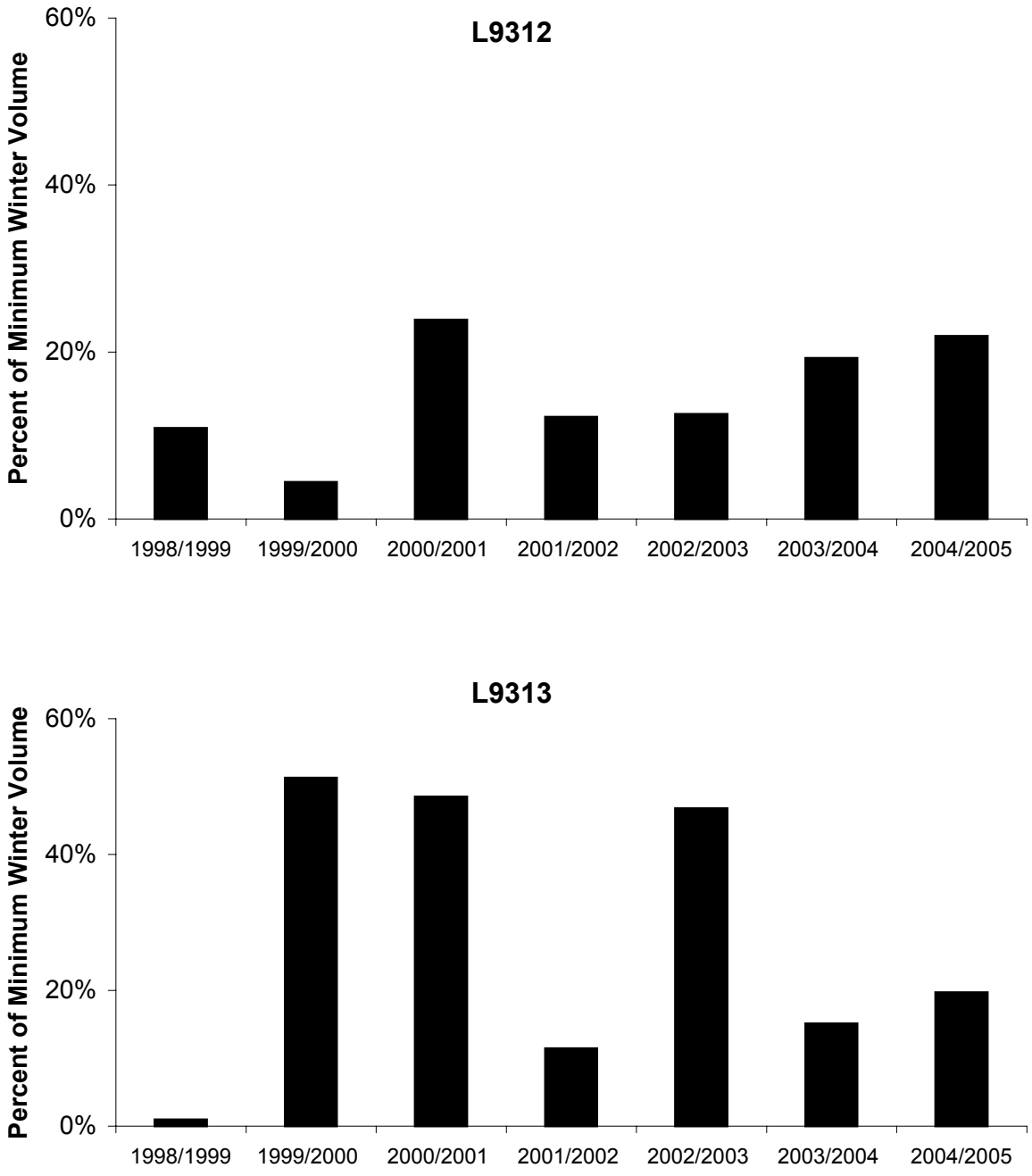

Figure 7. Percent of minimum winter water volume withdrawn from lakes L9312 and L9313 from 1998 to 2005.

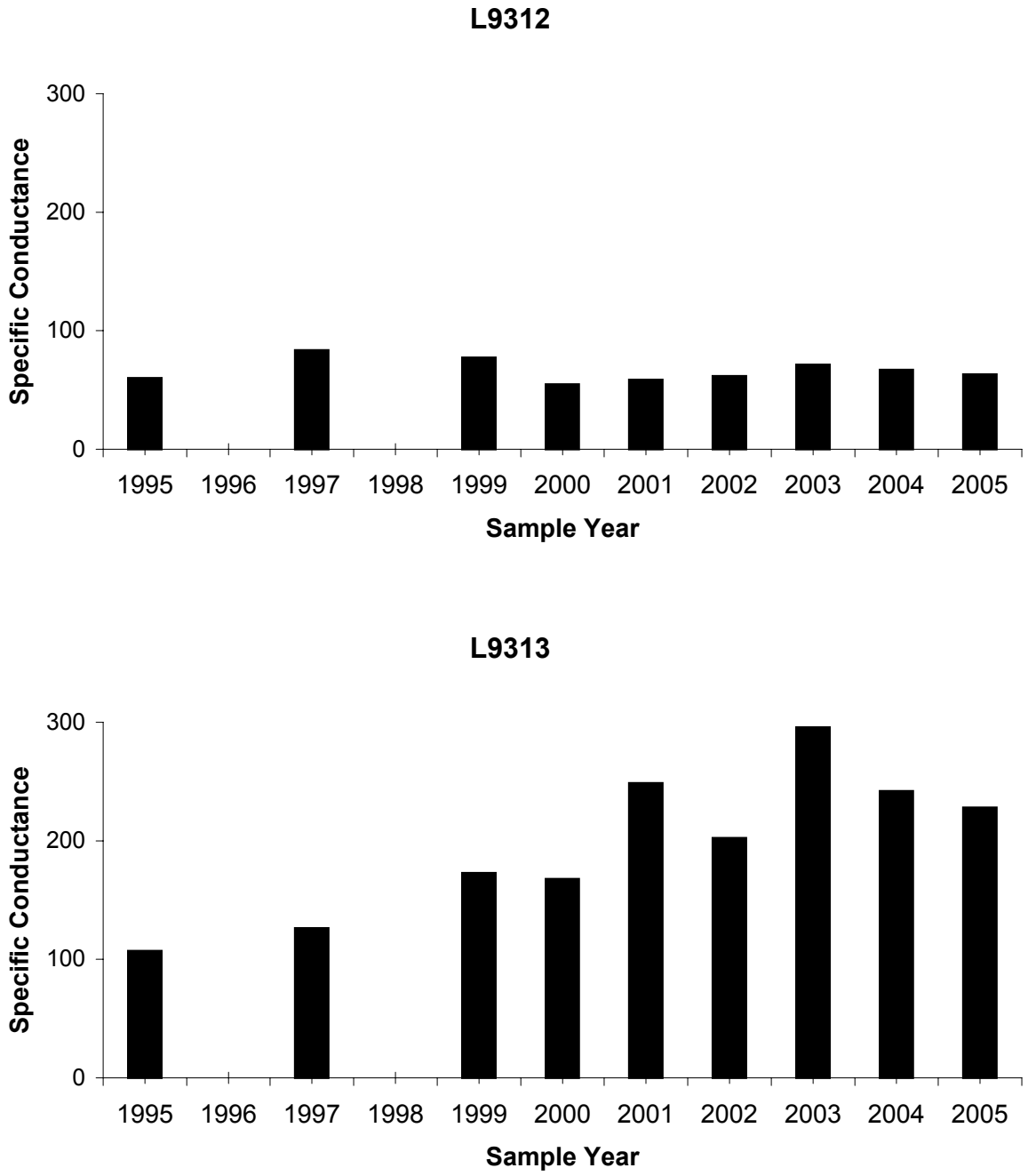

Figure 8. Specific conductance during July (in microS/cm) at two water source lakes in the Alpine Development Area, 1995-2005.

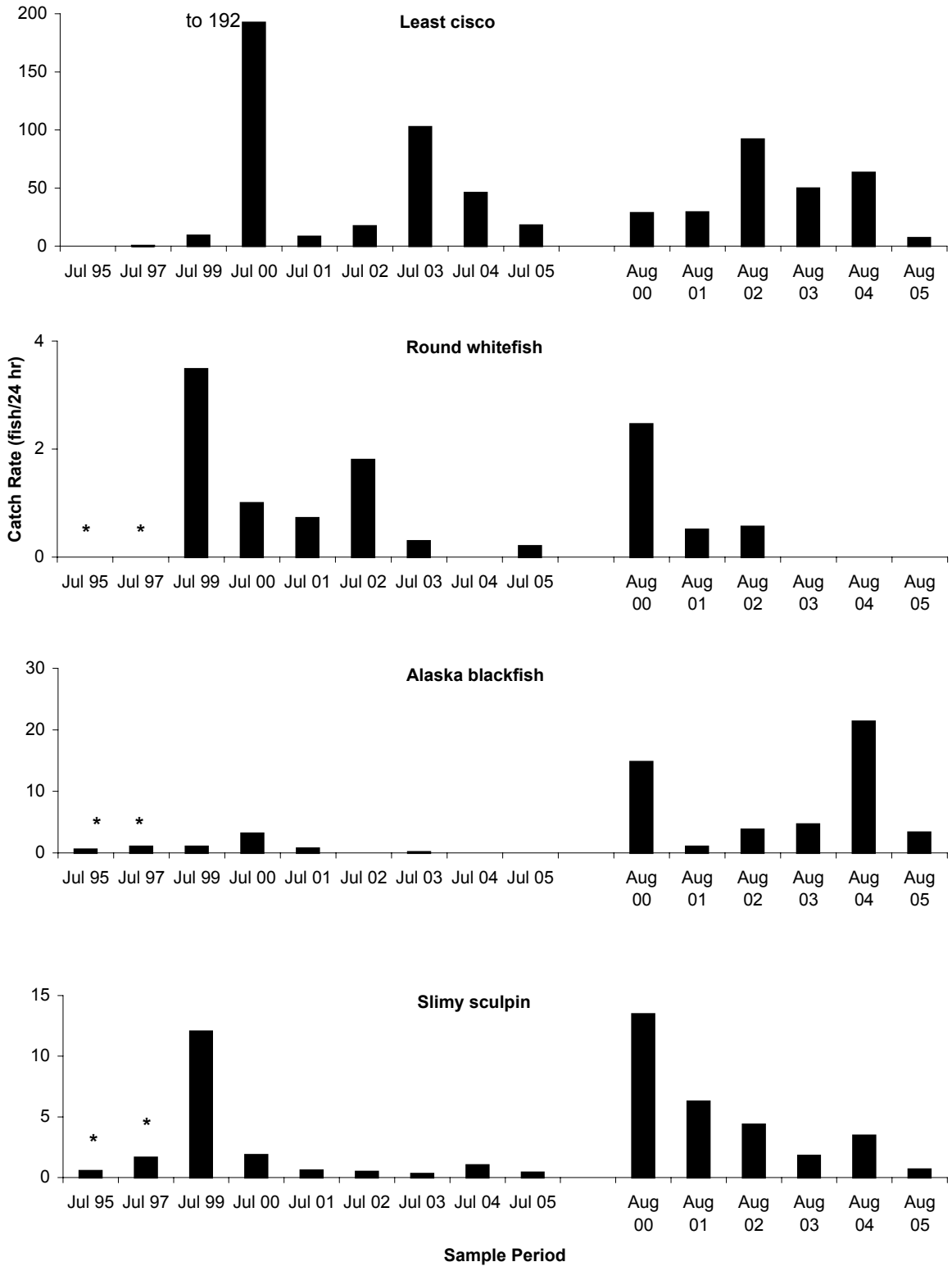

Figure 9. Mean catch rates of selected species in lake L9312, Alpine Development Area, 1995-2005 (* = nets fished in 1995 and 1997 were at different locations).

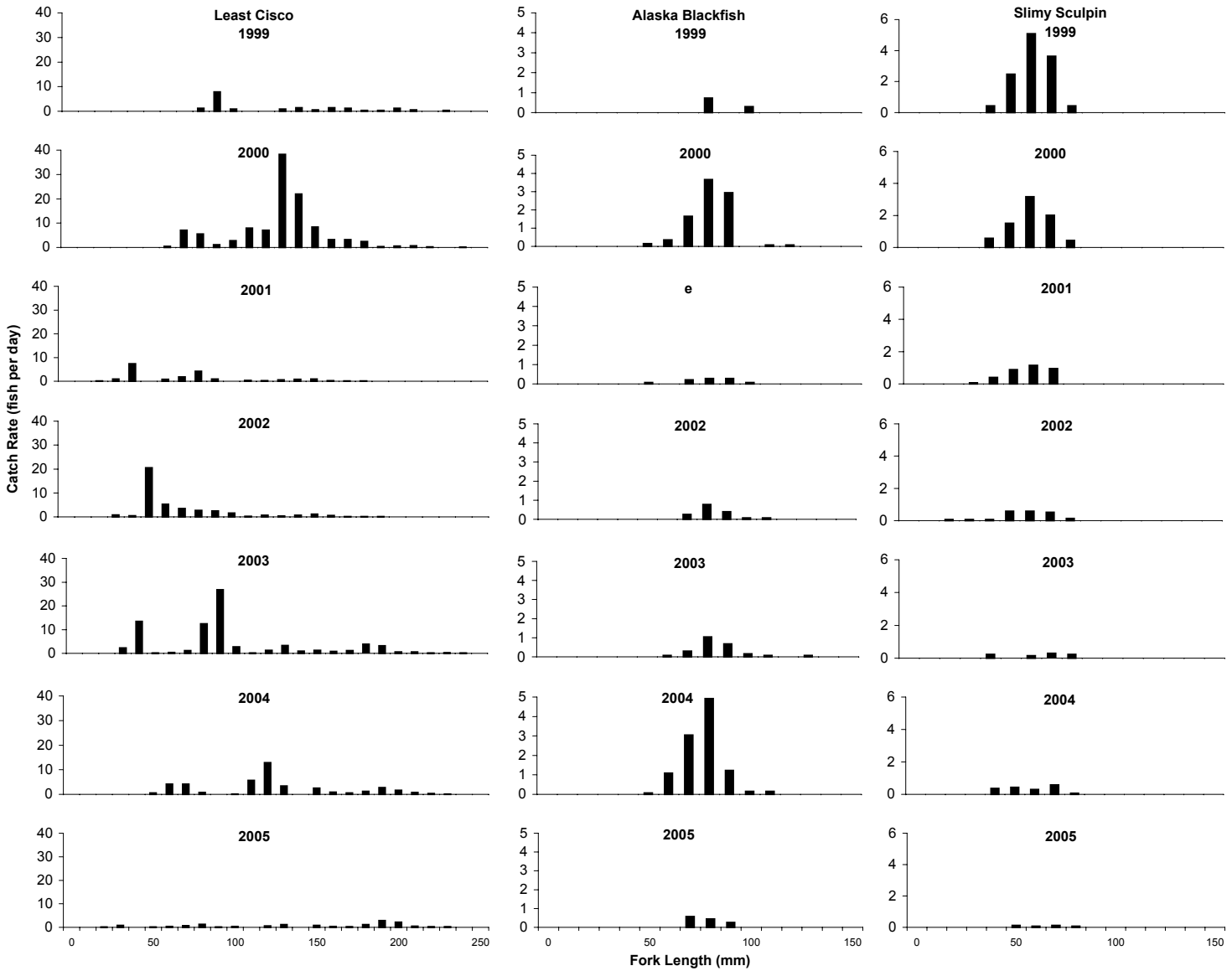

Figure 10. Length frequencies of least cisco, Alaska blackfish and slimy sculpin in lake L9312 during 1999-2005 sampling with fyke nets.

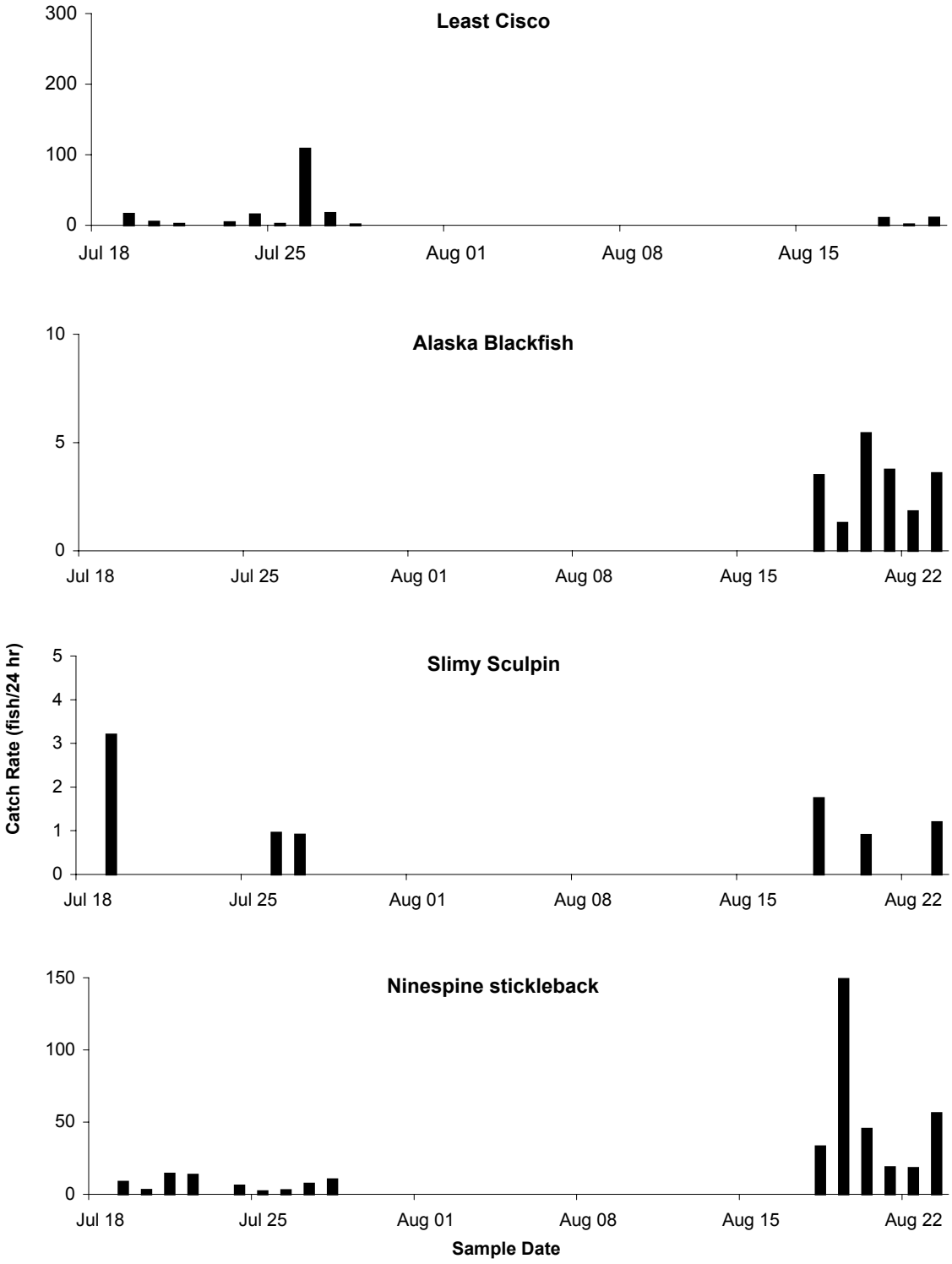

Figure 11. Daily pattern of catch for dominant species in lake L9312 during 2005 fyke net sampling (catches in fish per day).

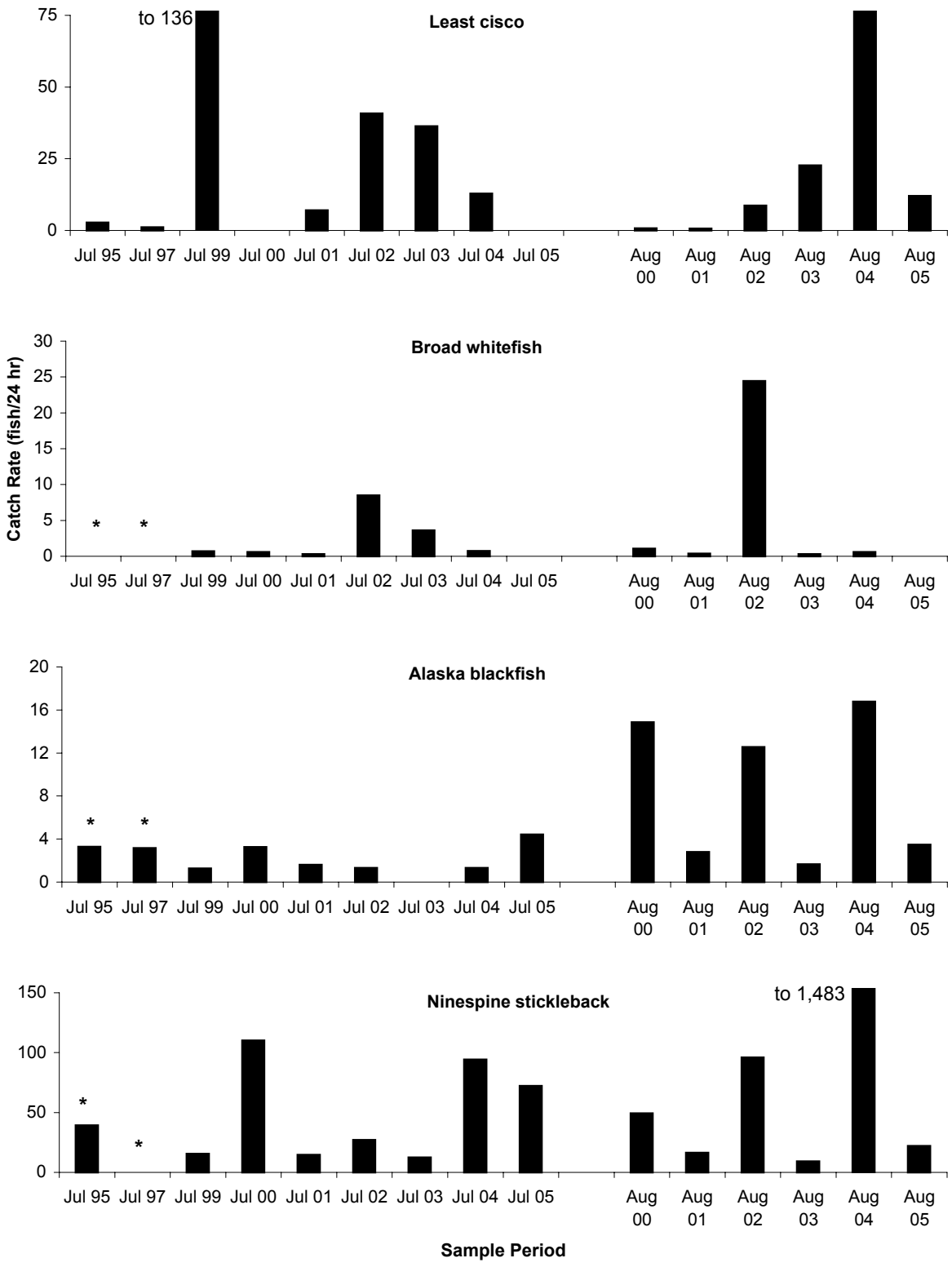

Figure 12. Mean catch rates of selected species in lake L9313, Alpine Development Area, 1995-2005 (* = nets fished in 1995 and 1997 were at different locations).

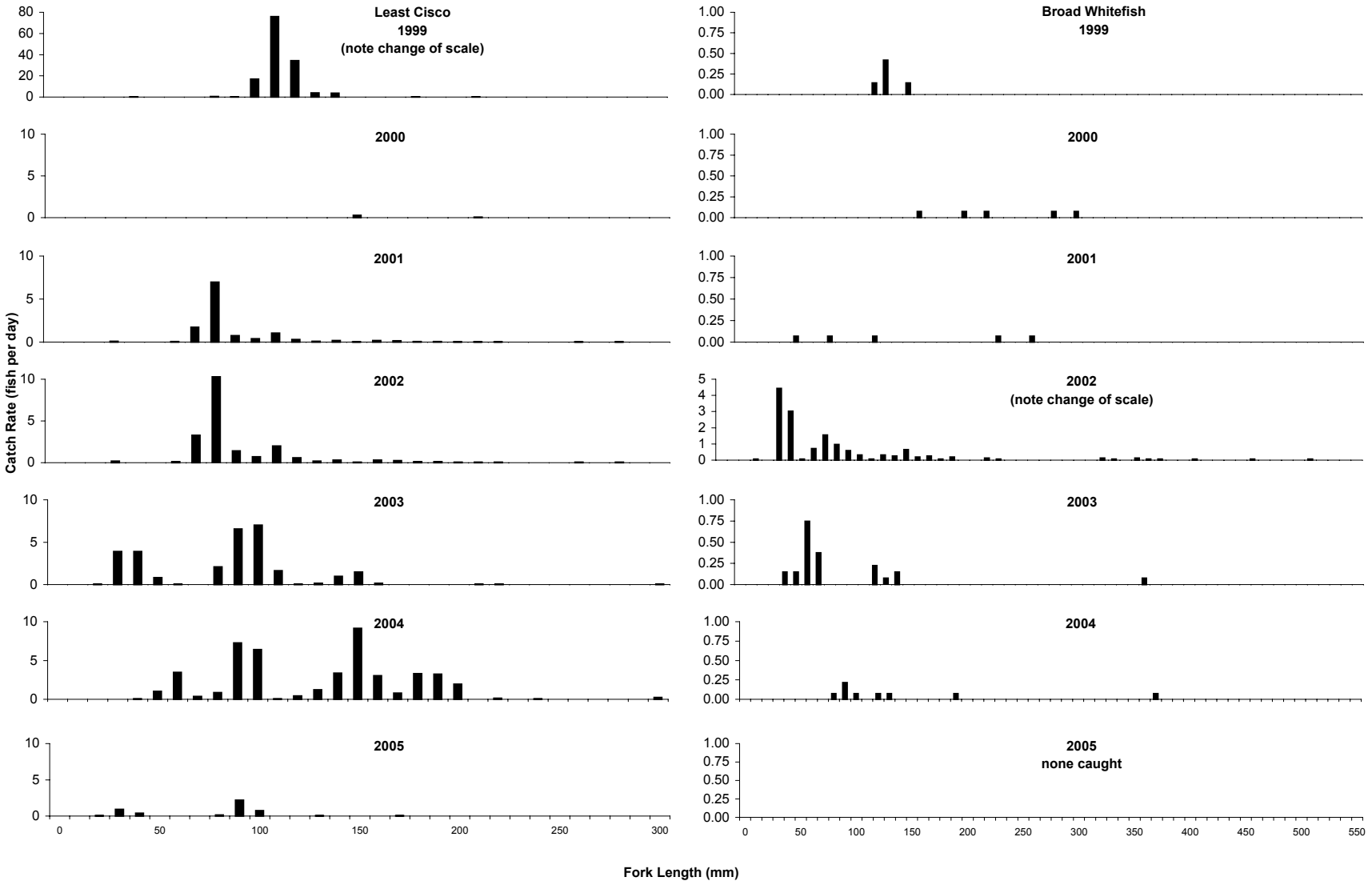

Figure 13. Length frequencies of least cisco and broad whitefish in lake L9313 during 1999-2005 sampling with fyke nets.

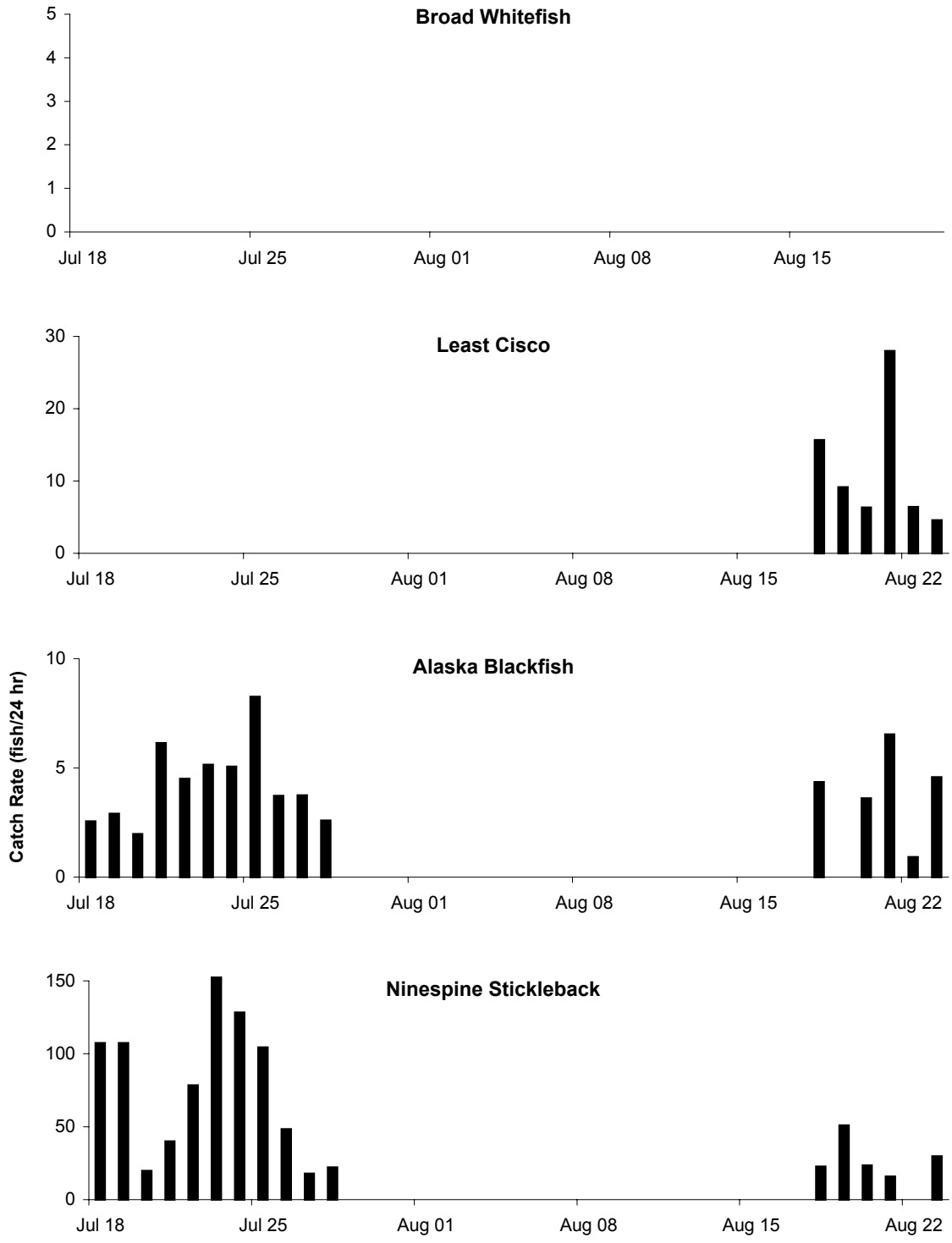

Figure 14. Daily pattern of catch for dominant species in lake L9313 during 2005 fyke net sampling (catches in fish per day).

APPENDIX A
Water Chemistry from Alpine Area Lakes
1995 to 2003

Appendix Table A-1. Water chemistry measurements for lake L9310, 1995 - 2002.

Date	Sample Depth (ft)	Water Temp (^{o}C)	Dissolved Oxygen (mg/l)	Specific Conductance (microS/cm)	pH	Turbidity (NTU)	Total Depth (ft)	Ice Thickness (ft)	Source
7/12/1995	surface	13.0		186					MJM Research
11/2/1995	surface	0.0		176			12.0	1.1	MJM Research
	1.6	0.1		176			12.0	1.1	MJM Research
	3.3	0.2		176			12.0	1.1	MJM Research
	4.9	0.5		178			12.0	1.1	MJM Research
	6.6	0.5		182			12.0	1.1	MJM Research
	8.2	0.8		182			12.0	1.1	MJM Research
	9.8	1.2		182			12.0	1.1	MJM Research
	11.5	1.9		201			12.0	1.1	MJM Research
7/9/1997	surface	8.7	11.9	126	7.9				MJM Research
7/11/1997	surface	7.4	11.6	127					MJM Research
7/13/1997	surface	8.1	9.7	128					MJM Research
7/14/1997	surface	8.0	11.3	127					MJM Research
7/15/1997	surface	10.0	11.8	128					MJM Research
8/3/1997	surface	14.2	10.5	129	8.1				MJM Research
2/8/2001	6.0	1.3	9.7	347	8.1	0	23.1	4.8	URS
	12.0	1.6	8.2	347	8.2	0	23.1	4.8	URS
	18.0	1.8	6.7	339	7.9	0	23.1	4.8	URS
2/21/2001	12.0	1.8	6.3	325	7.3	0	25.0*	5.1	URS
	16.0	1.9	6.0	299	7.3	1	25.0*	5.1	URS
	22.0	1.4	4.7	251	6.9	3	25.0*	5.1	URS
3/7/2001	6.5	1.9	7.9	353	7.2	0	24.3	5.3	URS
	12.0	2.3	6.1	346	7.0	0	24.3	5.3	URS
	18.0	2.3	5.8	350	6.7	0	24.3	5.3	URS
3/20/2001	7.0	2.6	7.4	367	7.2	0	24.9	5.7	URS
	15.5	2.7	7.8	364	7.0	0	24.9	5.7	URS
	23.5	3.2	7.5	362	6.8	0	24.9	5.7	URS
4/3/2001	12.0	2.9	9.0	377	7.2	0	22.7	6.0	URS
	18.0	3.0	8.2	376	7.1	0	22.7	6.0	URS
	22.0	3.1	8.7	375	6.7	0	22.7	6.0	URS
4/19/2001	16.0	4.4	10.3	359	7.0	0	25.2	6.2	URS
	18.0	5.2	9.3	349	6.8	0	25.2	6.2	URS
	22.0	5.7	10.4	341	6.5	0	25.2	6.2	URS
4/28/2001	10.0	4.2	10.1	373	7.7	0	23.6	6.1	URS
	14.0	4.2	8.7	375	7.7	0	23.6	6.1	URS
	18.0	4.1	8.9	378	7.8	0	23.6	6.1	URS
7/31/2001	surface	10.8	9.9	157	7.9	0.83			MJM Research
	3.3	10.8	9.7	145	7.8	1.2			MJM Research
	6.6	10.9	9.5	142	7.9	0.64			MJM Research
	10.8	10.9	9.4	142	7.9	1.1			MJM Research

Appendix Table A-1. Water chemistry measurements for lake L9310, 1995 - 2002.

Date	Sample Depth (ft)	Water Temp (^{o}C)	Dissolved Oxygen (mg/l)	Specific Conductance (microS/cm)	pH	Turbidity (NTU)	Total Depth (ft)	Ice Thickness (ft)	Source
1/16/2002	5.0	11.3	0.4	210	7.7	0.5	20.9	4.00	MBJ 2002
	8.0	10.7	0.8	210	7.6	0.5	20.9	4.00	MBJ 2002
	11.0	9.5	1.6	222	7.6	0.5	20.9	4.0	MBJ 2002
	14.0	8.1	1.8	229	7.5	0.6	20.9	4.0	MBJ 2002
	17.0	6.1	2.0	242	7.5	0.9	20.9	4.0	MBJ 2002
	19.0	4.8	2.1	254	7.4	1.1	20.9	4.0	MBJ 2002
2/9/2002	6.0	0.5	10.2	451	7.6	0.7	21.4	5.0	MBJ 2002
	9.0	1.2	9.1	334	7.5	0.7	21.4	5.0	MBJ 2002
	12.0	1.6	8.5	320	7.4	0.8	21.4	5.0	MBJ 2002
	15.0	1.9	7.5	313	7.3	1.4	21.4	5.0	MBJ 2002
	18.0	2.0	5.4	310	7.2	1.8	21.4	5.0	MBJ 2002
	20.0	2.1	1.0	311	7.1	1.9	21.4	5.0	MBJ 2002
3/11/2002	6.5	2.5	9.1	352	7.2	0.8	18.5	5.6	MBJ 2002
	9.5	2.6	8.1	348	7.2	0.8	18.5	5.6	MBJ 2002
	12.5	2.4	7.1	345	7.1	0.8	18.5	5.6	MBJ 2002
	15.5	2.5	6.5	351	7.2	1.38	18.5	5.6	MBJ 2002
4/6/2002	7.5	1.3	7.9	660	7.8	0.7	21.1	6.3	MBJ 2002
	10.5	1.6	7.3	653	7.7	0.8	21.1	6.3	MBJ 2002
	13.5	1.9	6.4	637	7.6	0.9	21.1	6.3	MBJ 2002
	16.5	2.3	5.8	625	7.6	0.7	21.1	6.3	MBJ 2002
	19.5	2.3	5.3	639	7.6	0.8	21.1	6.3	MBJ 2002
8/14/2002	5.0	9.6	10.7	159	8.4	0.4	20.2		MBJ 2002
	8.0	9.4	11.1	160	8.6	0.5	20.2		MBJ 2002
	11.0	9.4	11.0	161	8.7	0.6	20.2		MBJ 2002
	14.0	9.4	10.9	161	8.7	0.5	20.2		MBJ 2002
	17.0	9.3	10.9	160	8.6	1.4	20.2		MBJ 2002
	19.0	9.3	10.8	160	8.7	0.5	20.2		MBJ 2002

* denotes soft lake bottom observed during field measurement

Appendix Table A-2. Water chemistry measurements for lake L9312, 1995 to 2005.

Date	Sample Depth (ft)	Water Temp (^{o}C)	Dissolved Oxygen (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Total Depth (ft)	Ice Thickness (ft)	Source
7/13/1995	surface	13.4		60					MJM Research
11/2/1995	surface	0.0		136			12.0	1.0	MJM Research
	1.6	0.0		138			12.0	1.0	MJM Research
	3.3	0.5		132			12.0	1.0	MJM Research
	4.9	0.5		132			12.0	1.0	MJM Research
	6.6	0.8		132			12.0	1.0	MJM Research
	8.2	1.1		131			12.0	1.0	MJM Research
	9.8	1.7		132			12.0	1.0	MJM Research
	11.5	1.8		135			12.0	1.0	MJM Research
7/9/1997	surface	8.1	11.9	83		7.9			MJM Research
7/10/1997	surface	7.7	11.6	84		7.7			MJM Research
7/13/1997	surface	8.2	10.5	84					MJM Research
7/14/1997	surface	7.8	11.2	83					MJM Research
7/15/1997	surface	9.5	12.4	84					MJM Research
8/3/1997	surface	13.4	10.6	85		8.2			MJM Research
7/28/1999	surface	8.9	11.4	76					MJM Research
7/29/1999	surface	8.6	11.5	80					MJM Research
7/30/1999	surface	8.8		76					MJM Research
7/31/1999	surface	9.5		76					MJM Research
8/1/1999	surface	11.4		76					MJM Research
8/2/1999	surface	13.5		79					MJM Research
8/3/1999	surface	12.0		76					MJM Research
7/23/2000	surface					7.9			MJM Research
7/24/2000	surface	12.1		55					MJM Research
7/25/2000	surface	10.5	10.9	55					MJM Research
7/26/2000	surface	10.2	10.9	55					MJM Research
7/27/2000	surface	10.0	10.8	55					MJM Research
7/28/2000	surface	10.0		55					MJM Research
7/29/2000	surface	11.2	10.9	55					MJM Research
8/16/2000	surface	8.5		56					MJM Research
8/17/2000	surface	7.4		56					MJM Research
8/18/2000	surface	7.6		55					MJM Research
8/19/2000	surface	7.9		56					MJM Research
8/20/2000	surface	7.5		56					MJM Research
8/21/2000	surface	6.6		56					MJM Research
7/21/2000	surface	10.4	11.1	53	10.5				MJM Research
	4.9	10.0	11.2	53	7.6				MJM Research
	8.2	9.8	11.1	53	7.5				MJM Research
	11.5	9.6	11.1	53	8.6				MJM Research

Appendix Table A-2. Water chemistry measurements for lake L9312, 1995 to 2005.

Date	Sample Depth (ft)	Water Temp (^{o}C)	Dissolved Oxygen (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Total Depth (ft)	Ice Thickness (ft)	Source
8/15/2000	surface	6.2	11.6	55	4.0				MJM Research
	4.9	6.0	11.7	55	4.1				MJM Research
	8.2	5.9	11.9	55	3.9				MJM Research
	11.5	5.9	11.7	55	5.7				MJM Research
2/8/2001	6.0	0.9	10.9	180	0	8.5	14.9	4.8	URS
	12.0	2.4	1.5	269	0	8.0	14.9	4.8	URS
2/21/2001	6.0	1.2	12.5	161	0	7.3	14.2*	5.1	URS
	8.0	2.2	10.8	149	0	7.3	14.2*	5.1	URS
	12.0	2.9	3.0	118	0	6.5	14.2*	5.1	URS
3/7/2001	6.5	1.4	11.2	178	0	7.4	14.1	5.4	URS
	9.5	2.4	7.8	181	0	7.8	14.1	5.4	URS
	13.0	3.0	4.4	162	0	6.9	14.1	5.4	URS
3/20/2001	7.0	2.3	11.0	169	0	7.3	14.8	5.7	URS
	10.0	3.0	7.5	193	0	7.6	14.8	5.7	URS
	13.5	3.2	2.5	152	0	6.3	14.8	5.7	URS
4/3/2001	8.0	3.0	10.2	186	0	7.0	14.4	6.1	URS
	10.0	3.5	7.0	185	0	6.8	14.4	6.1	URS
	12.0	3.7	6.8	184	0	6.7	14.4	6.1	URS
4/18/2001	12.0	4.3	5.7	208	0	7.1	14.6	6.4	URS
	13.0	4.2	3.3	252	0	6.8	14.6	6.4	URS
	14.0	4.2	1.6	236	0	7.0	14.6	6.4	URS
4/28/2001	8.0	4.3	10.6	195	0	7.8	15.4	6.2	URS
	10.0	4.5	11.2	197	0	7.8	15.4	6.2	URS
	12.0	4.5	11.1	197	0	7.8	15.4	6.2	URS
7/22/2001	surface	15.0	9.9	57	1.52	8.1			MJM Research
7/23/2001	surface	15.9	9.0	59	3.02	8.2			MJM Research
7/24/2001	surface	13.6	9.6	59	2.02	7.7			MJM Research
7/25/2001	surface	13.1	9.8	59	1.28	8.0			MJM Research
7/26/2001	surface	13.3	9.5	59	2	8.0			MJM Research
7/27/2001	surface	14.3	9.9	59					MJM Research
7/28/2001	surface	14.1	10.0	58	1.3	7.8			MJM Research
7/28/2001	surface	13.3	8.6	59	1.1	7.8			MJM Research
	3.3	13.4	8.7	59	1.1	7.8			MJM Research
	6.6	13.4	8.5	59	1.2	7.7			MJM Research
	10.8	13.4	8.5	59	1.7	7.6			MJM Research

Appendix Table A-2. Water chemistry measurements for lake L9312, 1995 to 2005.

Date	Sample Depth (ft)	Water Temp (^{o}C)	Dissolved Oxygen (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Total Depth (ft)	Ice Thickness (ft)	Source
8/17/2001	surface	8.1	11.1	62	3.3	8.2			MJM Research
8/19/2001	surface	6.2	11.0	60	1.2	7.8			MJM Research
8/20/2001	surface	5.4	10.7	60	1.6	7.8			MJM Research
8/21/2001	surface	5.3	12.2	61	1.2	7.9			MJM Research
8/22/2001	surface	6.0	12.3	60	1.6	7.8			MJM Research
8/23/2001	surface	5.2	9.8	62	4.7	7.6			MJM Research
8/24/2001	surface				0.8	7.8			MJM Research
8/25/2001	surface	4.7	13.2	58	0.5	7.9			MJM Research
	3.3	4.7	13.2	58	0.7	7.9			MJM Research
	6.6	4.7	13.1	58	1	7.9			MJM Research
	10.8	4.7	13.0	58	0.5	7.9			MJM Research
1/16/2002	4	0.4	16.0	151	0.3	7.6	11.40	3.10	MBJ 2002
	7	1.5	14.2	134	0.5	7.6	11.40	3.10	MBJ 2002
	10	2.5	9.8	126	0.4	7.5	11.40	3.10	MBJ 2002
2/9/2002	5	0.6	15.9	152	1.2	7.5	11.40	3.9	MBJ 2002
	8	1.6	15.5	150	1.5	7.5	11.40	3.9	MBJ 2002
	10	2.3	13.7	145	2.1	7.2	11.40	3.9	MBJ 2002
3/11/2002	5	1.3	15.4	185	2.0	7.3	11.5	4.7	MBJ 2002
	8	2.1	14.3	171	1.6	7.3	11.5	4.7	MBJ 2002
	10	2.6	10.0	164	1.8	7.2	11.5	4.7	MBJ 2002
4/6/2002	6.5	2.0	9.7	159	0.6	6.9	11.7	5.4	MBJ 2002
	9.5	2.9	9.3	152	0.6	7.1	11.7	5.4	MBJ 2002
7/22/2002	surface	15.4	9.5	61					MJM Research
7/23/2002	surface	14.0	9.8	61	0.7	7.5			MJM Research
7/24/2002	surface	13.5	9.9	62		7.3			MJM Research
7/25/2002	surface	10.9	10.3	62	1.5	7.6			MJM Research
7/26/2002	surface	10.8	10.6	61	0.9	7.7			MJM Research
7/27/2002	surface	10.7	10.8	62	1.0	7.8			MJM Research
7/28/2002	surface	9.9	10.8	62	0.8	7.8			MJM Research
7/29/2002	surface	11.2	11.4	61	1.1	8.3			MJM Research
8/7/2002	surface	9.7	10.9	63	1.1	8.1			MJM Research
	3.3	9.7	10.8	63	1.3	8.1			MJM Research
	6.6	9.7	10.8	63	1.2	8.1			MJM Research
	9.8	9.7	10.7	63	1.2	8.1			MJM Research
8/14/2002	4	9.4	11.3	68	1.1	8.2	11.9		MBJ 2002
	7	9.3	11.3	70	1.3	8.0	11.9		MBJ 2002
	10	9.3	11.2	71	1.2	7.8	11.9		MBJ 2002

Appendix Table A-2. Water chemistry measurements for lake L9312, 1995 to 2005.

Date	Sample Depth (ft)	Water Temp (^{o}C)	Dissolved Oxygen (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Total Depth (ft)	Ice Thickness (ft)	Source
8/21/2002	surface	5.6	12.0	62	4.9	7.7			MJM Research
8/22/2002	surface	5.5	11.5	62	2.5	7.4			MJM Research
8/23/2002	surface	7.0	12.2	62	2.2	7.6			MJM Research
8/24/2002	surface				1.5	7.4			MJM Research
8/25/2002	surface	7.4	11.2	62	1.7	7.4			MJM Research
8/26/2002	surface	8.1	11.6	63	1.8	7.3			MJM Research
8/27/2002	surface	8.7	12.3	62	1.5	7.4			MJM Research
7/21/2003	surface	17.5	9.5	72					MJM Research
7/22/2003	surface	14.9	10.5	70	0.7	8.1			MJM Research
7/23/2003	surface	14.0	10.3	71	2.3	7.8			MJM Research
7/24/2003	surface	13.7	10.1	71	1.5	7.6			MJM Research
7/25/2003	surface	11.1	9.9	72	18.0	7.3			MJM Research
7/26/2003	surface	9.7	10.5	72	10.5	7.4			MJM Research
7/28/2003	surface	7.0	10.9	71	12.5	7.5			MJM Research
8/15/2003	surface	7.2	12.1	67	0.9	7.8			MJM Research
8/16/2003	surface	7.0	11.8	70	1.4	7.5			MJM Research
8/17/2003	surface	6.5	12.0	67	0.8	7.6			MJM Research
8/18/2003	surface	6.8	12.4	71	1.0	7.6			MJM Research
8/19/2003	surface	6.5	12.2	67	0.9	7.6			MJM Research
8/20/2003	surface	6.1	12.1	67	0.9	7.6			MJM Research
8/21/2003	surface	5.9	12.2	67	1.2	7.6			MJM Research
8/22/2003	surface	5.5	12.5	68	0.8	7.6			MJM Research
7/22/2004	surface	11.7	10.4	66	1.7	7.7			MJM Research
7/23/2004	surface	12.4	10.8	67	0.4	7.9			MJM Research
7/24/2004	surface	14.8	10.6	67	0.4	7.7			MJM Research
7/25/2004	surface	13.9	10.5	67	0.5	7.7			MJM Research
7/26/2004	surface	15.0	9.4	67	0.4	7.6			MJM Research
7/27/2004	surface	15.0	9.6	67	0.5	7.7			MJM Research
7/28/2004	surface	13.7	9.6	67	0.6	7.6			MJM Research
8/16/2004	surface	13.5	11.3	68	0.6	7.3			MJM Research
8/17/2004	surface	15.2	10.9	68	0.8	7.7			MJM Research
8/18/2004	surface	17.1	10.5	69	0.7	7.5			MJM Research
8/19/2004	surface	15.0	10.6	68	0.7	7.7			MJM Research
8/20/2004	surface	14.5	10.0	68	1.0	7.8			MJM Research
8/21/2004	surface	13.6	9.8	69	0.8	7.6			MJM Research
8/22/2004	surface	13.0	9.9	69	0.8	7.6			MJM Research
8/23/2004	surface	11.7	10.0	69	0.9	7.7			MJM Research
7/19/2005	surface	9.4	11.5	63	0.7	7.7			MJM Research
7/20/2005	surface				0.7	7.7			MJM Research
7/21/2005	surface	10.0	12.2	63	0.6	7.7			MJM Research

Appendix Table A-2. Water chemistry measurements for lake L9312, 1995 to 2005.

Date	Sample Depth (ft)	Water Temp (^{o}C)	Dissolved Oxygen (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Total Depth (ft)	Ice Thickness (ft)	Source
7/22/2005	surface	10.8	12.0	63	0.6	7.8			MJM Research
7/23/2005	surface	11.6	11.3	62	0.8	7.7			MJM Research
7/25/2005	surface	11.7	11.7	63	1.6	7.8			MJM Research
7/26/2005	surface	10.7	11.3	64	0.5	7.7			MJM Research
7/27/2005	surface	10.3	11.1	64	0.6	7.8			MJM Research
7/28/2005	surface	9.5	11.0	64	0.7	7.8			MJM Research
8/18/2005	surface	10.7	10.8	77	0.9	7.7			MJM Research
8/19/2005	surface	9.3	11.0	65	0.9	7.7			MJM Research
8/20/2005	surface	10.2	11.2	65	0.8	7.8			MJM Research
8/21/2005	surface	9.8	11.6	65	0.7	7.8			MJM Research
8/22/2005	surface	10.7	11.3	65	1.1	7.8			MJM Research
8/23/2005	surface	10.0	11.8	65	1.3	7.7			MJM Research

* denotes soft lake bottom observed during field measurement

Appendix Table A-3. Water chemistry measurements for lake L9313, 1995-2005.

Date	Sample Depth (ft)	Water Temp (^{o}C)	Dissolved Oxygen (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Total Depth (ft)	Ice Thickness (ft)	Source
7/13/1995	surface	13.1		107					MJM Research
10/31/1995	surface	0.0		189			8.5	1.0	MJM Research
	1.6	0.1		189			8.5	1.0	MJM Research
	3.3	0.2		188			8.5	1.0	MJM Research
	4.9	0.4		187			8.5	1.0	MJM Research
	6.6	0.9		182			8.5	1.0	MJM Research
	8.2	1.0		170			8.5	1.0	MJM Research
7/9/1997	surface	7.9	11.2	123		7.7			MJM Research
7/10/1997	surface	7.7	11.6	127		7.7			MJM Research
7/11/1997	surface	8.6	11.6	125					MJM Research
7/13/1997	surface	8.1	11.1	128					MJM Research
7/14/1997	surface	7.7	11.0	127					MJM Research
7/15/1997	surface	9.4	12.2	127					MJM Research
7/28/1999	surface	8.8	12.3	172		7.8			MJM Research
7/29/1999	surface	8.3	11.6	178					MJM Research
7/30/1999	surface	8.6		170					MJM Research
7/31/1999	surface	9.4		171					MJM Research
8/1/1999	surface	11.4		171					MJM Research
8/2/1999	surface	12.5		177					MJM Research
8/3/1999	surface	12.7		171					MJM Research
7/23/2000	surface					8.0			MJM Research
7/25/2000	surface	11.2	10.9	167					MJM Research
7/26/2000	surface	10.6	11.2	167					MJM Research
7/27/2000	surface	10.3		169					MJM Research
7/28/2000	surface	10.3	11.1	167					MJM Research
7/29/2000	surface	10.6		169					MJM Research
8/16/2000	surface	8.5		172					MJM Research
8/17/2000	surface	7.5		170					MJM Research
8/18/2000	surface	7.6		175					MJM Research
8/19/2000	surface	8.0		175					MJM Research
8/20/2000	surface	7.5		177					MJM Research
8/21/2000	surface	6.9		175					MJM Research
7/18/2000	surface	11.2	10.6	162	3.6				MJM Research
	4.9	11.1	10.5	162	3.3				MJM Research
	8.2	10.8	10.8	163	3.3				MJM Research
	11.5	10.8	10.9	163	3.5				MJM Research
8/15/2000	surface	6.6	12.3	170	5.5				MJM Research
	4.9	5.9	12.4	171	5.7				MJM Research
	8.2	5.7	12.6	171	15.0				MJM Research
	11.5	5.7	12.5	171	7.5				MJM Research

Appendix Table A-3. Water chemistry measurements for lake L9313, 1995-2005.

Date	Sample Depth (ft)	Water Temp (^{o}C)	Dissolved Oxygen (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Total Depth (ft)	Ice Thickness (ft)	Source
2/8/2001	6.0	0.8	7.8	491	0	7.9	9.5	4.6	URS
2/21/2001	6.0	2.5	5.7	561	0	6.4	9.4*	5.0	URS
	7.5	2.0	5.5	580	1	6.5	9.4*	5.0	URS
	8.0	2.2	5.3	579	3	6.6	9.4*	5.0	URS
3/7/2001	6.5	1.0	4.0	519	0	6.9	9.6	5.2	URS
	8.5	0.8	4.1	517	0	6.9	9.6	5.2	URS
3/20/2001	6.5	1.1	4.0	408	0	9.0	9.6	5.5	URS
	8.5	2.1	3.8	549	0	8.7	9.6	5.5	URS
4/3/2001	6.0	1.3	3.3	634	56	7.0	9.5	5.8	URS
	8.0	2.6	3.9	526	128	6.7	9.5	5.8	URS
4/18/2201	7.5	2.5	2.5	842	0	7.1	9.6	6.1	URS
	8.0	3.6	2.1	785	0	7.0	9.6	6.1	URS
	9.5	4.1	2.0	769	0	6.8	9.6	6.1	URS
4/28/2001	7.0	2.4	3.8	623	0	7.2	9.6	6.1	URS
	8.0	2.7	3.4	671	0	7.3	9.6	6.1	URS
7/22/2001	surface	15.5	9.3	245	3.2	8.1			MJM Research
7/23/2001	surface	15.6	9.1	247	6.4	8.0			MJM Research
7/24/2001	surface	14.1	9.1	247	2.8	7.7			MJM Research
7/25/2001	surface	13.2	9.2	249	1.9	7.9			MJM Research
7/26/2001	surface	13.5	10.2	257	1.5	8.0			MJM Research
7/27/2001	surface	14.1	9.7	247	2.3	7.9			MJM Research
7/28/2001	surface	13.7	9.7	248	2.5	7.9			MJM Research
7/25/2001	surface	13.2	9.2	249	1.7	8.0			MJM Research
	3.3	13.6	9.5	247	1.4	8.0			MJM Research
	6.6	13.6	9.5	247	1.3	8.0			MJM Research
	10.8	13.7	10.0	247	4.6	7.9			MJM Research
8/17/2001	surface	7.0	10.2	255	1.8	7.8			MJM Research
8/19/2001	surface	6.0	10.1	255	1.4	7.7			MJM Research
8/20/2001	surface	5.4	11.3	254	2.4	8.0			MJM Research
8/21/2001	surface	5.5	12.4	253	1.6	7.8			MJM Research
8/22/2001	surface	5.7	12.9	253	1.5	7.7			MJM Research
8/23/2001	surface	5.0	10.1	264	5.8	7.9			MJM Research
8/24/2001	surface				1.4	7.8			MJM Research
8/25/2001	surface	4.4	12.6	249	0.7	8.0			MJM Research
	3.3	4.4	12.6	249	0.7	8.0			MJM Research
	6.6	4.5	12.5	248	1	8.0			MJM Research
	10.8	4.5	12.4	248	2	8.0			MJM Research

Appendix Table A-3. Water chemistry measurements for lake L9313, 1995-2005.

Date	Sample Depth (ft)	Water Temp (^{o}C)	Dissolved Oxygen (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Total Depth (ft)	Ice Thickness (ft)	Source
1/16/2002	4.7	0.6	10.8	573	0.6	8.2	9.4	3.7	MBJ 2002
	7.7	1.9	9.5	623	0.6	7.5	9.4	3.7	MBJ 2002
2/9/2002	5.3	1.1	7.1	764	1.1	7.1	9.5	4.4	MBJ 2002
	8.3	2.1	6.0	723	1.1	7.1	9.5	4.4	MBJ 2002
3/12/2002	6	1.7	3.8	805	1.1	6.3	9.5	5.4	MBJ 2002
	9	2.2	2.8	836	1.2	6.3	9.5	5.4	MBJ 2002
4/7/2002	6.8	1.4	0.1	910	0.9	6.9	9.4	5.8	MBJ 2002
	8.0	2.1	0.0	1066	0.9	6.9	9.4	5.8	MBJ 2002
5/11/2002	7.0	3.1	4.0	894	13.9	7.3	9.5	5.9	MBJ 2002
7/22/2002	surface	15.7	9.3	201	1.1	7.5			MJM Research
7/23/2002	surface	14.4	9.5	202	0.9	7.4			MJM Research
7/24/2002	surface	13.7	10.2	201	5.3	7.5			MJM Research
7/25/2002	surface	11.6	10.1	202	1.5	7.5			MJM Research
7/26/2002	surface	10.6	10.8	202	1.3	7.6			MJM Research
7/27/2002	surface	10.9	11.1	202	1.0	7.5			MJM Research
7/28/2002	surface	10.6	11.1	207	1.0	7.7			MJM Research
7/29/2002	surface	11.0	11.5	203	1.4	8.2			MJM Research
8/3/2002	surface	15.3	10.0	176	0.9	8.2			MJM Research
	3.3	15.2	9.9	176	0.9	8.1			MJM Research
	6.6	15.1	9.9	176	0.9	8.1			MJM Research
	9.8	15.1	9.7	176	0.7	8.1			MJM Research
8/14/2002	4.7	9.5	11.4	241	1.0		9.5		MBJ 2002
	7.7	9.4	11.4	244	1.6		9.5		MBJ 2002
8/21/2002	surface	5.3	11.8	208	3.1	7.9			MJM Research
8/22/2002	surface	5.5	11.6	208	3.7	7.6			MJM Research
8/23/2002	surface	6.4	11.5	208	2.8	7.6			MJM Research
8/24/2002	surface	6.4	11.8	213	3.1	7.5			MJM Research
8/25/2002	surface	8.1	11.9	208	2.9	7.6			MJM Research
8/26/2002	surface	9.2	11.1	209	1.7	7.6			MJM Research
8/27/2002	surface	9.4	12.2	209	2.2	7.7			MJM Research
4/28/2003	4.5	1.5	0.3	390		7.4	8.8	4.2	MBJ 2003
4/28/2003	7.5	1.9	0.1	420		7.0	8.8	4.2	MBJ 2003
4/28/2003	5.0	0.8	2.7	280		6.7	6.2	4.6	MBJ 2003
4/28/2003	5.0	1.0	0.9	310		6.5	8.8	4.8	MBJ 2003
4/28/2003	8.0	1.0	0.5	400		6.1	8.8	4.8	MBJ 2003
4/28/2003	5.0	2.0	0.6	430		6.6	8.2	4.9	MBJ 2003
4/28/2003	8.0	2.0	0.9	400		6.2	8.2	4.9	MBJ 2003
4/28/2003	4.5	2.0	0.8	390		6.6	8.1	4.2	MBJ 2003
4/28/2003	7.5	2.0	0.6	390		6.6	8.1	4.2	MBJ 2003

Appendix Table A-3. Water chemistry measurements for lake L9313, 1995-2005.

Date	Sample Depth (ft)	Water Temp (^{o}C)	Dissolved Oxygen (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Total Depth (ft)	Ice Thickness (ft)	Source
5/9/2003	4.5	1.0	0.6	300		7.9	9.2	4.3	MBJ 2003
5/9/2003	7.5	2.0	0.1	300		7.3	9.2	4.3	MBJ 2003
5/9/2003	5.0	2.0	2.6	300		7.3	6.7	4.4	MBJ 2003
5/9/2003	5.0	3.0	1.1	400		7.3	9.4	4.9	MBJ 2003
5/9/2003	8.0	3.0	0.9	400		6.9	9.4	4.9	MBJ 2003
5/9/2003	5.5	2.0	2.3	300		7.1	8.8	5.1	MBJ 2003
5/9/2003	8.5	2.0	2.2	400		6.8	8.8	5.1	MBJ 2003
5/9/2003	5.0	2.0	1.5	300		6.8	8.4	4.3	MBJ 2003
5/9/2003	8.0	2.0	0.0	300		6.4	8.4	4.3	MBJ 2003
5/9/2003	5.0	2.0	1.5	410		6.8	9.2	4.7	MBJ 2003
5/9/2003	8.0	2.0	0.0	410		6.2	9.2	4.7	MBJ 2003
5/9/2003	5.0	2.0	1.8	420		6.5	9.0	4.7	MBJ 2003
5/9/2003	8.0	2.0	1.6	430		6.3	9.0	4.7	MBJ 2003
5/9/2003	5.0	1.0	2.9	290		6.7	8.6	4.6	MBJ 2003
5/9/2003	8.0	2.0	2.3	400		6.5	8.6	4.6	MBJ 2003
7/21/2003	surface	16.1	10.4	295					MJM Research
7/22/2003	surface	15.7	10.0	296	0.8	8.0			MJM Research
7/23/2003	surface	14.6	9.9	295	1.4	8.0			MJM Research
7/24/2003	surface	14.3	9.9	295	1.7	7.7			MJM Research
7/25/2003	surface	12.2	9.8	296	3.9	7.7			MJM Research
7/26/2003	surface	11.1	10.4	295	3.4	7.8			MJM Research
7/28/2003	surface	7.8	11.3	297	8.6	7.7			MJM Research
8/15/2003	surface	6.8	12.4	285	2.2	7.7			MJM Research
8/16/2003	surface	6.7	11.8	301	1.5	7.7			MJM Research
8/17/2003	surface	6.5	11.8	285	1.2	7.7			MJM Research
8/18/2003	surface	6.6	12.1	306	1.1	7.7			MJM Research
8/19/2003	surface	6.3	12.2	287	0.9	7.7			MJM Research
8/20/2003	surface	6.3	12.3	289	1.3	7.7			MJM Research
8/21/2003	surface	6.0	12.3	292	0.9	7.7			MJM Research
8/22/2003	surface	6.2	12.8	287	0.7	7.7			MJM Research
7/22/2004	surface	11.7	10.5	240	0.7	7.8			MJM Research
7/23/2004	surface	12.8	10.9	241	0.7	8.0			MJM Research
7/24/2004	surface	14.6	10.9	241	0.4	7.9			MJM Research
7/25/2004	surface	14.5	10.5	242	0.8	8.0			MJM Research
7/26/2004	surface	15.4	9.5	243	0.4	7.8			MJM Research
7/27/2004	surface	15.6	9.4	243	0.5	7.6			MJM Research
7/28/2004	surface	13.9	9.2	244	0.7	7.9			MJM Research
8/16/2004	surface	13.7	10.4	251	0.8	7.7			MJM Research
8/17/2004	surface	15.9	11.0	249	1.1	8.0			MJM Research
8/18/2004	surface	17.0	10.9	250	1.0	7.9			MJM Research
8/19/2004	surface	15.2	12.5	250	1.1	7.9			MJM Research
8/20/2004	surface	14.5	9.7	250	1.2	7.9			MJM Research
8/21/2004	surface	13.3	10.2	251	0.8	7.8			MJM Research

Appendix Table A-3. Water chemistry measurements for lake L9313, 1995-2005.

Date	Sample Depth (ft)	Water Temp (^{o}C)	Dissolved Oxygen (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Total Depth (ft)	Ice Thickness (ft)	Source
8/22/2004	surface	13.1	10.4	252	0.9	7.9			MJM Research
8/23/2004	surface	11.5	10.1	252	0.8	7.8			MJM Research
7/18/2005	surface	10.9	11.0	226	0.4	7.9			MJM Research
7/19/2005	surface	9.6	10.9	227	0.6	8.0			MJM Research
7/20/2005	surface				0.6	7.9			MJM Research
7/21/2005	surface	10.3	11.7	229	0.5	8.0			MJM Research
7/22/2005	surface	11.1	11.7	227	0.4	8.0			MJM Research
7/23/2005	surface	11.6	11.4	228	0.5	8.1			MJM Research
7/24/2005	surface	12.0	11.1	228	1.1	8.2			MJM Research
7/25/2005	surface	12.4	11.1	230	0.5	8.1			MJM Research
7/26/2005	surface	11.1	10.7	230	1.1	7.9			MJM Research
7/27/2005	surface	10.9	10.5	232	0.5	8.1			MJM Research
7/28/2005	surface	10.5	11.0	232	0.8	8.0			MJM Research
8/18/2005	surface	10.3	10.6	238	0.8	8.0			MJM Research
8/19/2005	surface	9.5	10.9	239	1.3	7.9			MJM Research
8/20/2005	surface	9.4	11.4	239	0.8	8.1			MJM Research
8/21/2005	surface	9.1	11.8	239	0.7	8.1			MJM Research
8/22/2005	surface	9.6	11.8	238	0.6	8.1			MJM Research
8/23/2005	surface	9.3	11.5	239	0.9	8.1			MJM Research

* denotes soft lake bottom observed during field measurement

Appendix Table A-4. Water chemistry measurements for lake B8534/L9282, 1995-2002.

Date	Sample Depth (ft)	Water Temp (^{o}C)	Dissolved Oxygen (mg/l)	Specific Conductance (microS/cm)	pH	Turbidity (NTU)	Total Depth (ft)	Ice Thickness (ft)	Source
7/18/1995	surface	15.3		276					MJM Research
7/17/1998	surface	13.3	10.5	280					MJM Research
7/17/1998	surface	13.6	10.2	279					MJM Research
7/18/1998	surface	13.1	10.2	282					MJM Research
7/18/1998	surface	13.1	10.1	282					MJM Research
7/18/1998	surface	12.3	9.1	284					MJM Research
7/19/1998	surface	13.6	10.3	281					MJM Research
7/19/1998	surface	13.6	10.1	282					MJM Research
7/19/1998	surface	13.7	10.3	282					MJM Research
7/20/1998	surface	14.1	10.3	281					MJM Research
7/20/1998	surface	14.4	10.3	282					MJM Research
7/20/1998	surface	14.4	10.7	285					MJM Research
7/21/1998	surface	14.2	10.3	282					MJM Research
7/21/1998	surface	14.5	10.4	282					MJM Research
7/21/1998	surface	14.3	9.9	282					MJM Research
7/22/1998	surface	14.6	10.2	282					MJM Research
7/22/1998	surface	14.5	10.3	282					MJM Research
7/22/1998	surface	14.1	10.2	273					MJM Research
7/24/1998	surface	12.6	10.4	282					MJM Research
7/24/1998	surface	13.1	9.9	283					MJM Research
2/8/2001	6.0	1.0	11.4	777	8.4	0	23.6	4.9	URS
	12.0	1.7	10.2	726	8.3	0	23.6	4.9	URS
	18.0	2.2	9.9	696	8.2	0	23.6	4.9	URS
3/7/2001	6.5	1.4	8.2	754	7.5	0	24.6	5.4	URS
	12.0	2.1	8.3	722	7.4	0	24.6	5.4	URS
	18.0	2.6	7.1	706	7.1	10*	24.6	5.4	URS
4/3/2001	12.0	2.5	8.7	786	7.5	0	23.8	5.9	URS
	18.0	2.5	8.7	814	7.3	0	23.8	5.9	URS
	22.0	2.6	8.7	813	6.9	0	23.8	5.9	URS
4/28/2001	12.0	4.3	9.7	759	8.2	0	23.7	6.2	URS
	18.0	4.0	9.9	808	8.0	0	23.7	6.2	URS
	22.0	3.9	9.7	811	7.6	0	23.7	6.2	URS
8/5/2001	surface	7.8	10.7	286	8.2	2.8			MJM Research
1/16/2002	4.8	0.5	9.1	464	7.9	1.4	21.0	3.8	MBJ 2002
	7.8	1.0	8.2	447	7.8	0.7	21.0	3.8	MBJ 2002
	10.8	1.2	10.0	462	7.8	0.5	21.0	3.8	MBJ 2002
	13.8	1.8	10.4	546	7.7	0.4	21.0	3.8	MBJ 2002
	16.8	2.0	9.0	572	7.6	0.6	21.0	3.8	MBJ 2002
	19.8	2.3	7.3	570	7.8	0.6	21.0	3.8	MBJ 2002

Appendix Table A-4. Water chemistry measurements for lake B8534/L9282, 1995-2002.

Date	Sample Depth (ft)	Water Temp (^{o}C)	Dissolved Oxygen (mg/l)	Specific Conductance (microS/cm)	pH	Turbidity (NTU)	Total Depth (ft)	Ice Thickness (ft)	Source
2/8/2002	5.0	1.0	11.8	646	7.7	0.5	21.0	4.9	MBJ 2002
	8.0	1.0	10.8	665	7.6	0.5	21.0	4.9	MBJ 2002
	11.0	2.0	10.6	642	7.6	0.5	21.0	4.9	MBJ 2002
	14.0	2.0	10.7	642	7.6	0.7	21.0	4.9	MBJ 2002
	17.0	2.0	10.8	642	7.6	0.9	21.0	4.9	MBJ 2002
	20.0	2.0	10.1	642	7.7	0.8	21.0	4.9	MBJ 2002
3/11/2002	6.0	1.0	9.4	763	7.4	1.4	21.1	5.4	MBJ 2002
	9.0	1.1	9.1	756	7.3	1.9	21.1	5.4	MBJ 2002
	12.0	1.5	8.8	740	7.3	0.9	21.1	5.4	MBJ 2002
	15.0	1.7	8.3	733	7.3	1.0	21.1	5.4	MBJ 2002
	18.0	1.9	8.2	719	7.2	1.0	21.1	5.4	MBJ 2002
4/6/2002	7.0	1.3	7.9	660	7.8	0.7	21.0	5.8	MBJ 2002
	10.0	1.6	7.3	653	7.7	0.8	21.0	5.8	MBJ 2002
	13.0	1.9	6.4	637	7.6	0.9	21.0	5.8	MBJ 2002
	16.0	2.3	5.8	625	7.6	0.7	21.0	5.8	MBJ 2002
	19.0	2.3	5.3	639	7.6	0.8	21.0	5.8	MBJ 2002
5/11/2002	7.0	2.0	10.4	553	6.9	3.5	20.8	6.0	MBJ 2002
	10.0	2.6	9.1	699	7.1	1.2	20.8	6.0	MBJ 2002
	13.0	2.8	7.4	712	7.1	0.7	20.8	6.0	MBJ 2002
	16.0	2.9	6.6	709	7.1	0.6	20.8	6.0	MBJ 2002
	19.0	2.7	5.7	732	7.2	1.1	20.8	6.0	MBJ 2002
8/14/2002	5.0	8.9	10.7	331	8.7	0.6			MBJ 2002
	8.0	8.9	10.6	331	8.8	0.8			MBJ 2002
	11.0	8.8	10.6	332	8.8	0.7			MBJ 2002
	14.0	8.8	10.6	332	8.8	0.6			MBJ 2002
	17.0	8.8	10.6	332	8.9	0.9			MBJ 2002
	20.0	8.8	10.5	332	8.9	0.6			MBJ 2002

Appendix Table A-5. Water chemistry measurements for lake L9283, 1995-2002.

Date	Sample Depth (ft)	Water Temp (^{o}C)	Dissolved Oxygen (mg/l)	Specific Conductance (microS/cm)	pH	Turbidity (NTU)	Total Depth (ft)	Ice Thickness (ft)	Source
7/18/1995	surface	16.8		234					MJM Research
2/8/2001	6.0	0.5	7.8	1,043	7.8	0	8.5	4.8	URS
3/7/2001	6.5	1.1	3.9	999	6.9	0	8.6	5.4	URS
3/7/2001	7.0	1.4	3.9	950	6.5	0	8.6	5.4	URS
4/3/2001	7.5	1.9	2.7	1,238	7.0	0	9.0	6.1	URS
4/28/2001	7.0	1.1	4.4	1,078	7.1	0	8.9	6.4	URS
4/28/2001	8.0	1.8	4.0	1,033	8.1	0	8.9	6.4	URS
8/5/2001	surface	7.1	11.1	333	8.1	1.7			MJM Research
1/16/2002	5.0	0.5	12.9	838	6.9	1.2	9.0	4.0	MBJ 2002
	8.0	0.9	12.1	850	7.2	0.8	9.0	4.0	MBJ 2002
2/8/2002	6.0	1.0	7.9	831	7.5	0.8	8.7	5.1	MBJ 2002
	7.0	1.0	8.7	812	7.5	1.0	8.7	5.1	MBJ 2002
3/11/2002	7.0	1.0	9.8	1,008	7.7	3.4	9.0	6.1	MBJ 2002
	8.0	2.0	10.2	945	7.5	6.0	9.0	6.1	MBJ 2002
4/6/2002	7.3	0.6	2.2	1,199	7.4	1.4	9.0	6.3	MBJ 2002
5/11/2002	7.7	2.3	1.7	1,253	7.2	2.1	9.1	6.7	MBJ 2002
8/14/2002	5.0	8.1	11.1	310	8.5	0.8	8.9		MBJ 2002
	8.0	8.0	11.0	312	8.5	0.9	8.9		MBJ 2002

Appendix Table A-6. Water chemistry measurements for lake L9275, 2001-2002.

Date	Sample Depth (ft)	Water Temp (^{o}C)	Dissolved Oxygen (mg/l)	Specific Conductance (microS/cm)	pH	Turbidity (NTU)	Total Depth (ft)	Ice Thickness (ft)	Source
2/8/2001	8.0	2.2	13.4	519	7.1	0	16.1	4.8	URS
	12.0	2.1	10.1	525	7.2	0	16.1	4.8	URS
3/7/2001	6.5	1.8	9.2	449	7.6	0	16.2	5.4	URS
	10.0	2.2	9.3	381	7.4	0	16.2	5.4	URS
	15.0	3.1	5.4	309	6.9	0	16.2	5.4	URS
4/3/2001	8.0	2.8	11.3	547	7.7	0	16.2	6.0	URS
	12.0	3.3	11.2	547	7.5	0	16.2	6.0	URS
	16.0	3.5	10.9	562	6.5	0	16.2	6.0	URS
4/28/2001	8.0	4.4	10.9	529	8.3	0	16.1	6.2	URS
	10.0	4.7	11.1	523	8.3	0	16.1	6.2	URS
	14.0	4.9	12.5	497	8.3	0	16.1	6.2	URS
8/5/2001	surface	7.1	11.4	210	8.1	2.4			MJM Research
1/15/2002	4.8	1.0	14.4	419	8.4	0.8	12.5	3.8	MBJ 2002
	7.8	1.4	14.4	402	8.7	0.6	12.5	3.8	MBJ 2002
	10.8	1.9	13.6	395	8.8	0.4	12.5	3.8	MBJ 2002
2/8/2002	5.2	1.0	12.6	499	7.6	0.6	12.5	4.2	MBJ 2002
	8.2	2.0	12.4	464	7.4	0.6	12.5	4.2	MBJ 2002
	11.2	2.0	12.0	464	7.5	0.6	12.5	4.2	MBJ 2002
3/11/2002	5.0	0.6	11.6	569	7.2	1.3	12.8	5.0	MBJ 2002
	8.0	1.3	11.6	541	7.6	0.9	12.8	5.0	MBJ 2002
	11.0	1.9	11.4	501	7.8	0.9	12.8	5.0	MBJ 2002
4/6/2002	6.5	1.3	9.5	493	6.9	0.7	12.7	5.4	MBJ 2002
	9.5	1.9	8.4	474	7.0	0.6	12.7	5.4	MBJ 2002
	11.0	2.2	8.5	464	7.2	0.6	12.7	5.4	MBJ 2002
8/13/2002	5.0	8.9	11.3	241	9.0	0.6	12.5		MBJ 2002
	8.5	8.9	11.4	241	9.0	0.5	12.5		MBJ 2002
	11.0	8.9	11.4	241	8.9	0.5	12.5		MBJ 2002

Appendix Table A-7. Water chemistry measurements for lake L9342, 1995-2002.

Date	Sample Depth (ft)	Water Temp (^{o}C)	Dissolved Oxygen (mg/l)	Specific Conductance (microS/cm)	pH	Turbidity (NTU)	Total Depth (ft)	Ice Thickness (ft)	Source
7/12/1995	surface	12.7		84					MJM Research
11/2/1995	surface	0.2		186		0.0	8.9	1.1	MJM Research
11/2/1995	surface	0.3		185		0.5	8.9	1.1	MJM Research
11/2/1995	3.3	0.5		184		1.0	8.9	1.1	MJM Research
11/2/1995	4.9	0.7		183		1.5	8.9	1.1	MJM Research
11/2/1995	6.6	1.0		183		2.0	8.9	1.1	MJM Research
11/2/1995	8.2	1.1		184		2.5	8.9	1.1	MJM Research
									MJM Research
4/17/2000	8.2	2.1	5.5	315			11.5	6.5	MJM Research
4/18/2000	8.2	1.8	4.8	339			9.0	6.5	MJM Research
4/18/2000	6.6	0.8	5.3	342			6.8	6.5	MJM Research
4/18/2000	6.0	0.8	5.5	325			6.2	6.0	MJM Research
4/18/2000	6.6	0.8	5.8	338			6.7	6.5	MJM Research
4/19/2000	8.2	2.4	4.7	340			9.1	6.5	MJM Research
4/19/2000	8.2	2.8	4.8	335			11.3	6.5	MJM Research
4/19/2000	8.2	2.2	5.2	337			10.0	6.5	MJM Research
4/19/2000	6.6	0.4	5.0	357			7.5	6.5	MJM Research
4/19/2000	5.7	0.1	5.6	297			6.0	5.8	MJM Research
2/8/2001	5.0	1.5	8.3	348	8.3	0.0	12.8	4.8	URS
2/8/2001	11.0	3.0	5.2	355	8.0	1.0	12.8	4.8	URS
3/7/2001	6.5	1.8	7.9	359	7.0	0.0	12.7	5.3	URS
3/7/2001	11.0	2.8	8.0	335	7.0	0.0	12.7	5.3	URS
4/3/2001	8.0	2.4	8.9	292	7.1	0.0	13.3	6.0	URS
4/3/2001	12.0	3.5	9.3	227	6.9	0.0	13.3	6.0	URS
4/28/2001	8.0	3.0	6.5	448	7.4	0.0	13.2	6.2	URS
4/28/2001	12.0	4.3	6.0	417	7.5	0.0	13.2	6.2	URS
7/31/2001	surface	10.7	9.9	123	7.7	1.1			MJM Research
7/31/2001	3.3	10.6	10.1	117	7.7	1.8			MJM Research
7/31/2001	6.6	10.6	10.2	115	7.7	0.8			MJM Research
7/31/2001	10.8	10.6	9.7	114	7.7	0.8			MJM Research
1/16/2002	5.0	0.6	10.0	275	7.7	0.4	11.3	4.0	MBJ 2002
	8.0	1.4	9.6	262	7.5	0.3	11.3	4.0	MBJ 2002
	10.0	1.9	8.1	270	7.2	0.4	11.3	4.0	MBJ 2002
2/9/2002	5.7	1.3	10.0	322	6.5	0.7	11.3	4.7	MBJ 2002
	8.7	1.9	9.3	306	6.7	0.6	11.3	4.7	MBJ 2002
	10.0	2.4	7.2	299	6.8	0.9	11.3	4.7	MBJ 2002
3/11/2002	6.5	1.1	8.5	383	6.2	1.4	10.8	5.5	MBJ 2002
	9.5	2.1	8.1	361	6.4	1.6	10.8	5.5	MBJ 2002

Appendix Table A-7. Water chemistry measurements for lake L9342, 1995-2002.

Date	Sample Depth (ft)	Water Temp (^{o}C)	Dissolved Oxygen (mg/l)	Specific Conductance (microS/cm)	pH	Turbidity (NTU)	Total Depth (ft)	Ice Thickness (ft)	Source
4/6/2002	7.0	1.8	5.7	345	7.6	0.5	11.2	6.0	MBJ 2002
	10.0	2.4	4.5	348	7.4	0.4	11.2	6.0	MBJ 2002
5/11/2002	7.2	2.4	6.8	317	6.3	5.0	11.2	6.2	MBJ 2002
	10.2	3.2	6.3	411	6.3	1.6	11.2	6.2	MBJ 2002
8/14/2002	5.0	8.9	11.0	130	8.3	0.8	11.8		MBJ 2002
	8.0	8.8	10.9	132	8.3	0.5	11.8		MBJ 2002
	10.0	8.8	10.8	132	8.4	0.4	11.8		MBJ 2002

Appendix Table A-8. Historical measurements of ion concentrations at lakes in the Alpine region.

Lake	Year of Test	Chloride (mg/l)	Sodium (mg/l)	Magnesium (mg/l)	Calcium (mg/l	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Source
L9310	1993	10	4.8	3.7	11	43	130	J. Lobdell
L9312	1993	8	4.5	2.1	7.2	27	150	J. Lobdell
L9313	1993	19	9.3	3.1	8	33	54	J. Lobdell
B8534	1985					103		Bendock & Burr 1986
(L9282)	1992	43	1.5	10.6	19	91	240	J. Lobdell
L9283	1992	2.8	1.8	3.2	29	86	110	J. Lobdell
L9275	1985					103		Bendock & Burr 1986
	1992	13	6.2	9.8	22	95	140	J. Lobdell
L9342	1993	14	5.3	3.2	7.4	32	87	J. Lobdell

Appendix Table A-9. Water chemistry profiles measured in conjunction with Alpine Area sampling at lakes L9312 and L9313 during 2000-2003.

L9312

Date	Depth (m)	Water Temp. (oC)	Dissolved Oxygen (mg/l)	Dissolved Oxygen Percent Saturation	Specific Conductance (µS/cm)	Turbidity (NTU)
8/15/2000	surface	6.2	11.6	93.8	55.1	4.0
	1.5	6.0	11.7	93.7	55.1	4.1
	2.5	5.9	11.9	95.3	55.1	3.9
	3.5	5.9	11.7	94.3	55.1	5.7
7/21/2000	surface	10.4	11.1	100.2	53.3	10.5
	1.5	10.0	11.2	98.8	53.4	7.6
	2.5	9.8	11.1	98.5	53.4	7.5
	3.5	9.6	11.1	98.3	53.4	8.6
7/28/2001	surface	13.3	8.6	83.1	59	1.1
	1.0	13.4	8.7	83.2	59	1.1
	2.0	13.4	8.5	81.5	59	1.2
	3.0	13.4	8.5	81.3	59	1.7
8/25/2001	surface	4.7	13.2	102.3	58	0.5
	1.0	4.7	13.2	102.1	58	0.7
	2.0	4.7	13.1	101.4	58	1.0
	3.0	4.7	13.0	101.2	58	0.5
8/7/2002	surface	9.7	10.9	96.1	63	1.1
	1.0	9.7	10.8	95.1	63	1.3
	2.0	9.7	10.8	94.8	63	1.2
	3.0	9.7	10.7	94.6	63	1.2
8/14/2002	1.2	9.4	11.3		68	1.1
	2.1	9.3	11.3		70	1.3
	3.0	9.3	11.2		71	1.2
8/1/2003	surface	8.4	11.9	70.0	8	1.2
	1.0	8.4	11.9	69.8	8	1.2
	2.0	8.4	11.9	69.8	8	1.4
	3.0	8.4	11.9	69.8	8	1.3
8/21/2003	surface	5.9	12.2	66.9	8	1.3
	1.0	5.9	12.3	67.2	8	1.2
	2.0	5.9	12.4	66.8	8	1.2
	3.0	5.9	12.3	66.9	8	1.0

L9313

Date	Depth (m)	Water Temp. (oC)	Dissolved Oxygen (mg/l)	Dissolved Oxygen Percent Saturation	Specific Conductance (µS/cm)	Turbidity (NTU)
7/18/2000	surface	11.2	10.6	96.8	161.8	3.6
	1.5	11.1	10.5	96.4	162.2	3.3
	2.5	10.8	10.8	98.0	162.6	3.3
	3.5	10.8	10.9	98.1	162.7	3.5
8/15/2000	surface	6.6	12.3	99.8	170.4	5.5
	1.5	5.9	12.4	98.0	171.1	5.7
	2.5	5.7	12.6	100.4	171.3	15.0
	3.5	5.7	12.5	100.3	171.4	7.5
7/25/2001	surface	13.2	9.2	87.0	249	1.7
	1.0	13.6	9.5	91.2	247	1.4
	2.0	13.6	9.5	91.7	247	1.3
	3.0	13.7	10.0	94.5	247	4.6
8/25/2001	surface	4.4	12.6	97.4	249	0.7
	1.0	4.4	12.6	97.0	249	0.7
	2.0	4.5	12.5	97.0	248	1.0
	3.0	4.5	12.4	96.2	248	2.0
8/3/2002	surface	15.3	10.0	99.3	176	0.9
	1.0	15.2	9.9	98.9	176	0.9
	2.0	15.1	9.9	98.6	176	0.9
	3.0	15.1	9.7	97.7	176	0.7
8/14/2002	1.4	9.5	11.4		241	1.0
	2.3	9.4	11.4		244	1.6
8/1/2003	surface	8.5	11.9	296.1	8	1.4
	1.0	8.5	11.8	295.8	8	1.5
	2.0	8.5	11.9	295.7	8	1.4
	3.0	8.5	12.0	295.7	8	1.7
8/22/2003	surface	6.2	12.8	286.9	8	0.7
	1.0	6.0	12.9	285.8	8	1.0
	2.0	6.0	13.3	285.8	8	2.2
	3.0	6.0	13.2	285.8	8	2.9

APPENDIX B
Catch Data from lakes L9312 and L9313
For 1995 to 2003

Appendix Table B-1. Results of fish sampling in lakes L9312 and L9313 prior to 1999.

Lake	Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
L9312	Fyke Net	Jul 14, 1995	23.9	Alaska blackfish	1	
				Slimy sculpin	1	
				Ninespine stickleback	10	
		Jul 26, 1995	20.0	Broad whitefish	1	428
				Ninespine stickleback	2	
		Jul 11-15 1997	116.6	Least cisco	1	56
				Alaska blackfish	5	70
				Slimy sculpin	8	38-84
				Ninespine stickleback	57	
	Gill Net	Nov 2, 1995	21.7	Least cisco	62	116-303
				Broad whitefish	5	334-470
	Minnow Trap	Jul 14, 1995	48.6	Slimy sculpin	2	
				Ninespine stickleback	1	
	Set Line	Jul 14, 1995	23.5	None	0	
L9313	Fyke Net	Jul 14, 1995	23.3	Least cisco	5	229-283
				Alaska blackfish	6	42-90
				Ninespine stickleback	63	
		Jul 26, 1995	20.7	Ninespine stickleback	9	
		Jul 11-15 1997	91.2	Least cisco	4	167-276
				Alaska blackfish	12	79
				Slimy sculpin	1	
	Gill Net	Nov 1, 1995	20.6	None	0	
		Aug 8, 1996	9.1	None	0	
	Minnow Trap	Jul 15, 1995	43.2	Ninespine stickleback	9	
	Set Line	Jul 15, 1995	21.6	None	0	
		Jul 16, 1995	24.3	None	0	

Appendix Table B-2. Catches of fish from Alpine Area Lakes fyke net sampling, 1999.

Species	Net A Jul 29	Net A Jul 30	Net A Jul 31	Net B Aug 1	Net B Aug 2	Net B Aug 3	Net B Aug 4	Net A Total	Net B Total
L9312									
Least cisco	0	2	0	40	9	5	6	2	60
Broad whitefish	0	0	0	0	0	1	4	0	5
Humpback whitefish	0	0	0	0	0	0	0	0	0
Round whitefish	11	1	0	4	3	2	3	12	12
Alaska blackfish	0	0	0	0	1	5	1	0	7
Slimy sculpin	0	2	2	32	28	6	13	4	79
Ninespine stickleback	3	4	13	28	46	53	37	20	164
Effort (hours):	20.3	24.2	24.0	25.3	26.1	19.3	26.3	68.4	97.0
L9313									
Least cisco	0	1	1	339	11	623	0	1	974
Broad whitefish	0	0	0	4	0	1	0	0	5
Humpback whitefish	0	0	0	1	0	1	0	0	2
Round whitefish	0	0	0	1	0	1	0	0	2
Alaska blackfish	0	1	3	1	1	0	3	1	8
Slimy sculpin	0	0	0	0	0	0	0	0	0
Ninespine stickleback	7	8	6	5	43	20	22	15	96
Effort (hours):	26.8	24.2	24.1	25.3	26.0	19.3	26.7	51.1	121.3

Appendix Table B-3. Catches of fish from Alpine Area Lakes fyke net sampling, 2000.

Species	Jul 23	Jul 24	Jul 25	Jul 26	Jul 27	Jul 28	Jul 29	July Total	Aug 16	Aug 17	Aug 18	Aug 19	Aug 20	Aug 21	Aug 22	Aug Total
L9312																
Broad whitefish	3	0	0	0	2	0	0	5	1	1	0	1	1	0	0	4
Humpback whitefish	3	6	6	3	4	3	2	27	8	4	1	1	1	0	0	15
Arctic cisco	0	0	0	0	0	0	0	0	0	0	1	3	1	0	0	5
Least cisco	196	680	380	32	17	14	30	1,349	25	47	45	17	35	12	15	196
Round whitefish	0	3	1	1	1	0	1	7	3	5	6	0	0	0	3	17
Burbot	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Longnose sucker	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Alaska blackfish	4	3	5	4	3	2	1	22	17	12	15	4	17	18	19	102
Slimy sculpin	1	0	0	5	3	2	2	13	9	30	10	6	7	21	10	93
Ninespine stickleback	292	115	67	53	65	50	87	729	43	146	75	31	20	24	29	368
Net Hours:	18.0	27.4	24.3	25.4	23.7	22.8	26.7	168.3	27.4	18.1	24.2	27.0	27.0	21.2	20.8	165.7
L9313																
Broad whitefish	4	0	0	0	0	0	0	4	1	1	1	2	0	0	2	7
Humpback whitefish	0	0	0	0	0	0	0	0	4	0	0	0	1	0	0	5
Least cisco	0	0	0	0	0	0	0	0	2	0	1	1	0	0	1	5
Round whitefish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Burbot	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Alaska blackfish	2	10	5	1	0	2	3	23	10	15	20	13	10	13	19	100
Ninespine stickleback	256	200	116	44	53	45	65	779	49	133	41	32	27	26	24	332
Net Hours:	17.7	31.0	24.3	23.3	24.0	23.9	25.4	169.7	23.5	17.9	29.7	23.2	27.0	21.2	19.1	161.6

Appendix Table B-4. Catches of fish from Alpine Area Lakes fyke net sampling, 2001.

	Jul 22	Jul 23	Jul 24	Jul 25	Jul 26	Jul 27	Jul 28	July Total	Aug 17	Aug 18	Aug 19	Aug 20	Aug 21	Aug 22	Aug 23	Aug 24	August Total
L9312																	
Broad whitefish	0	5	1	0	1	0	0	7	0		0	0	0	0	0	0	0
Humpback whitefish	0	0	1	0	0	0	0	1	0		1	0	0	0	0	0	1
Arctic cisco	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0
Least cisco	8	28	16	1	0	1	2	56	24		64	8	2	65	53	12	228
Round whitefish	1	1	0	1	1	0	1	5	1		1	2	0	0	0	0	4
Burbot	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0
Longnose sucker	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0
Alaska blackfish	0	4	0	0	0	0	1	5	0		1	2	1	2	2	0	8
Fourhorn sculpin	0	0	0	0	0	0	0	0	0		0	0	0	0	0	1	1
Slimy sculpin	0	1	1	1	0	0	1	4	6		14	4	2	11	10	2	49
Ninespine stickleback	16	28	15	3	6	12	9	89	20		18	8	6	8	4	11	75
Effort (hrs)	24.8	24.5	20.5	24.4	27.3	24.0	21.0	166.4	22.9		46.6	21.1	24.1	23.0	23.4	26.8	187.8
L9313																	
Broad whitefish	0	1	0	0	0	0	1	2	0		0	1	0	0	0	2	3
Humpback whitefish	0	0	0	0	0	1	0	1	0		1	1	0	0	2	0	4
Least cisco	28	2	2	0	0	8	8	48	0		2	2	0	1	0	0	5
Round whitefish	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0
Burbot	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0
Alaska blackfish	4	2	0	3	0	2	0	11	4		4	3	3	5	1	2	22
Ninespine stickleback	22	7	12	27	17	12	3	100	15		41	37	6	4	15	10	128
Effort (hrs)	25.9	26.4	20.4	24.1	21.9	22.2	23.3	164.2	18.3		53.0	21.2	23.9	23.4	22.9	26.3	189.1

Appendix Table B-5. Catches of fish from Alpine Area Lakes fyke net sampling, 2002.

	Jul 22	Jul 23	Jul 24	Jul 25	Jul 26	Jul 27	Jul 28	Jul 29	July Total	Aug 21	Aug 22	Aug 23	Aug 24	Aug 25	Aug 26	Aug 27	August Total
L9312																	
Broad whitefish	0	0	0	0	0	1	0	0	1	2	4	1	9	2	19	2	39
Humpback whitefish	0	0	0	0	0	0	0	0	0	2	1	1	4	8	16	32	64
Arctic cisco	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Least cisco	0	54	65	15	4	1	0	3	142	2	5	308	25	2	34	276	652
Round whitefish	2	1	0	2	0	10	0	0	15	27	54	106	1	1	1	1	191
Burbot	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
Longnose sucker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alaska blackfish	0	0	0	0	0	0	0	0	0	0	1	1	3	4	12	7	28
Fourhorn sculpin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Slimy sculpin	0	1	0	0	0	0	0	3	4	3	4	1	5	4	7	7	31
Ninespine stickleback	0	10	9	4	2	3	5	11	44	3	8	14	10	95	7	4	141
Effort (hrs)	27.1	26.5	24.6	19.8	29.3	25.4	16.0	31.0	199.7	28.6	19.8	25.6	23.5	24.1	23.7	25.0	170.3
L9313																	
Broad whitefish	31	10	11	19					71	1	18	22	20	22	46	46	175
Humpback whitefish	1			1					2	28		1		2			31
Least cisco	113	105	44	37	41		1	1	342	4	9	5	4	3	31	6	62
Round whitefish		1		1					2								0
Burbot									0								0
Alaska blackfish	2	1	3	1	2	1	1		11	5	9	5	8	10	21	32	90
Ninespine stickleback	59	58	40	7	11	11	12	29	227	25	21	137		78	363	64	688
Effort (hrs)	28.1	24.6	24.4	22.0	29.3	22.4	22.9	27.4	201.1	30.0	19.7	26.2	23.1	23.8	23.9	25.4	172.0

Appendix Table B-6. Catches of fish from Alpine Area Lakes fyke net sampling, 2003.

	Jul 22	Jul 23	Jul 24	Jul 25	Jul 26	Jul 27	Jul 28	July Total	Aug 16	Aug 17	Aug 18	Aug 19	Aug 20	Aug 21	Aug 22	August Total
L9312																
Broad whitefish	0	0	0	0	0	0	0	0	18	0	0	0	1	2	0	21
Humpback whitefish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arctic cisco	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Least cisco	101	101	380	89	3	0	15	689	57	35	13	9	21	47	151	333
Round whitefish	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0
Burbot	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Longnose sucker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alaska blackfish	0	1	0	0	0	0	0	1	1	2	4	0	3	1	20	31
Fourhorn sculpin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Slimy sculpin	0	1	0	0	0	0	1	2	0	0	4	0	2	3	3	12
Ninespine stickleback	7	20	12	16	6	0	4	65	3	10	2	0	0	0	2	17
Effort (hrs)	18.3	25.6	24.4	22.5	24.8	0.0	45.6	161.2	22.9	22.9	26.0	20.1	22.0	22.4	24.4	160.8
L9313																
Broad whitefish	8	2	2	1	8	0	3	24	0	1	0	0	1	0	0	2
Humpback whitefish	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Least cisco	110	23	7	0	91	0	12	243	11	12	12	90	13	2	12	152
Round whitefish	1	0	0	0	0	0	0	1	0	1	0	0	1	0	1	3
Burbot	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alaska blackfish	0	0	0	0	0	0	0	0	3	0	0	2	0	5	1	11
Ninespine stickleback	40	21	11	4	7	0	0	83	9	15	0	15	0	0	23	62
Effort (hrs)	19.1	25.7	23.9	22.1	24.6	0.0	45.1	160.5	21.8	23.1	20.9	24.6	22.3	23.8	24.6	160.9

Appendix Table B-7. Catches of fish from Alpine Area Lakes fyke net sampling, 2004.

	Jul 22	Jul 23	Jul 24	Jul 25	Jul 26	Jul 27	Jul 28	July Total	Aug 17	Aug 18	Aug 19	Aug 20	Aug 21	Aug 22	Aug 23	August Total
L9312																
Broad whitefish								0								0
Humpback whitefish								0								0
Arctic cisco								0								0
Least cisco	12	2	47	68	62	67	57	315	235	2	65	23	39	35	40	439
Round whitefish								0								0
Burbot								0								0
Longnose sucker								0								0
Alaska blackfish								0	10	2	28	36	17	20	35	148
Fourhorn sculpin								0								0
Slimy sculpin		1		1	1	3	1	7	3	5	6	2	4	2	2	24
Ninespine stickleback	49	29	51	37	17	45	18	246	23	32	44	12	16	120	15	262
Effort (hrs)	21.9	23.1	24.6	23.6	24.2	23.8	24.0	165.2	24.6	22.3	23.2	29.1	17.3	23.5	26.5	166.4
L9313																
Broad whitefish		1	4					5			3		1			4
Humpback whitefish								0								0
Least cisco	7	9	8	16	20	23	5	88	65	23	55	296	95	27	15	576
Round whitefish			1					1								0
Burbot								0								0
Alaska blackfish					1	5	3	9	6	14	35	17	17	13	16	118
Ninespine stickleback	32	87	175	115	104	69	65	647	1,801	1,168	3,334	2,247	1,020	532	332	10,434
Effort (hrs)	21.1	23.7	24.2	23.8	24.3	23.7	24.2	165.0	27.8	21.3	19.7	24.0	22.7	24.7	28.6	168.8

Appendix Table B-8. Catches of fish from Alpine Area Lakes fyke net sampling, 2005.

	Jul 18	Jul 19	Jul 20	Jul 21	Jul 22	Jul 23	Jul 24	Jul 25	Jul 26	Jul 27	Jul 28	July Total	Aug 18	Aug 19	Aug 20	Aug 21	Aug 22	Aug 23	August Total
L9312																			
Broad whitefish								1				1							0
Humpback whitefish												0							0
Arctic cisco												0							0
Least cisco		15	5	2		4	15	2	114	19	1	177	12	1	12	8	5	4	42
Round whitefish			1					1				2							0
Burbot												0							0
Longnose sucker												0							0
Alaska blackfish												0	4	1	6	4	2	3	20
Fourhorn sculpin												0							0
Slimy sculpin		3							1	1		5	2		1			1	4
Ninespine stickleback		8	3	14	15		6	2	3	8	8	67	38	116	50	20	20	47	291
Effort (hrs)		22.5	24.2	23.6	26.8	23.3	23.7	23.2	25.2	26.3	18.5	237.3	27.5	18.7	26.5	25.7	26.3	20.1	144.8
L9313																			
Broad whitefish												0							0
Humpback whitefish												0							0
Least cisco												0	18	7	7	30	7	4	73
Round whitefish												0							0
Burbot												0							0
Alaska blackfish	3	3	2	6	5	5	5	8	4	4	2	44	5		4	7	1	4	21
Ninespine stickleback	126	111	20	39	87	148	127	101	52	19	17	721	26	39	26	17		26	134
Effort (hrs)	28.2	24.8	24.3	23.5	26.7	23.3	23.8	23.3	25.8	25.7	18.5	239.7	27.6	18.4	26.6	25.8	26.2	21.0	145.5

Appendix Table B-9. Tagged fish released in Alpine lakes L9312 and L9313 during 2001.

Lake	Species	Release Date	Release Length	Tag Code
L9312				
	Broad whitefisl	7/23/2001	400	MJM010250
		7/23/2001	362	MJM010426
		7/23/2001	320	MJM010427
		7/24/2001	486	MJM010432
L9313				
	Least cisco	7/23/2001	295	MJM010428
		7/24/2001	262	MJM010433
		8/22/2001	306	MJM011332
	Broad whitefisl	8/20/2001	270	MJM011338

Appendix Table B-10 Tagged fish released in Alpine lakes L9312 and L9313 during 2002

Lake	Species	Release Date	Release Length	Tag Code	Recapture Date	Days Out
L9312						
	Broad whitefish	8/23/2002	285	MJM020503		
		8/24/2002	326	MJM020509		
	Humpback whitefish	8/22/2002	349	MJM020527		
		8/23/2002	350	MJM020502		
	Least cisco	7/22/2002	196	MJM020469		
		8/24/2002	352	MJM020507		
	Round whitefish	7/22/2002	264	MJM020470		
		7/25/2002	247	MJM020480		
		7/25/2002	281	MJM020482		
		8/25/2002	311	MJM020510		
		8/26/2002	282	MJM020561		
L9313						
	Broad whitefish	7/22/2002	240	MJM020473		
		7/22/2002	200	MJM020474		
		7/22/2002	181	MJM020476		
		7/22/2002	197	MJM020477		
		8/22/2002	386	MJM020528		
		8/22/2002	330	MJM020530		
		8/22/2002	375	MJM020531		
		8/22/2002	366	MJM020533		
		8/22/2002	340	MJM020534		
		8/23/2002	235	MJM020505	8/26/2002	3
		8/23/2002	331	MJM020506		
		8/25/2002	418	MJM020560		
		8/26/2002	200	MJM020537		
		8/26/2002	186	MJM020538		
		8/26/2002	515	MJM020562		
		8/26/2002	365	MJM020564		
		8/26/2002	189	MJM020565		
		8/27/2002	468	MJM020540		
	Least cisco	7/22/2001	281	MJM010243	7/22/2002	365
		7/22/2002	186	MJM020471		
		7/22/2002	215	MJM020472		
		7/22/2002	188	MJM020475	8/26/2002	35
		8/23/2002	250	MJM020504		
		8/26/2002	181	MJM020536		
		8/27/2002	369	MJM020539		

Appendix Table B-11. Tagged fish released in Alpine lakes L9312 and L9313 during 2003

Lake	Species	Release Date	Release Length	Tag Code	Recapture Date	Days Out
L9312						
	Broad whitefish	8/20/2003	355	MJM021101		
		8/21/2003	345	MJM021102		
		8/21/2003	360	MJM021103		
	Least cisco	7/23/2003	184	MJM020656		
		7/23/2003	192	MJM020658		
		7/22/2003	185	MJM020666		
		7/22/2003	188	MJM020667		
		7/22/2003	186	MJM020668		
		7/22/2003	189	MJM020669		
		7/22/2003	182	MJM020670		
		7/22/2003	209	MJM020672		
		7/23/2003	193	MJM020676		
		7/23/2003	184	MJM020677		
		7/23/2003	187	MJM020679		
		7/23/2003	181	MJM020680		
		7/23/2003	180	MJM020681		
		7/23/2003	183	MJM020682		
		7/23/2003	181	MJM020684		
		7/23/2003	192	MJM020685		
		7/23/2003	185	MJM020687		
		7/23/2003	186	MJM020691		
		7/23/2003	193	MJM020693		
		7/23/2003	217	MJM020694		
		7/23/2003	195	MJM020695		
		7/23/2003	185	MJM020697		
		7/23/2003	183	MJM020699		
		7/23/2003	190	MJM020700		
		7/23/2003	183	MJM020711		
		7/23/2003	193	MJM020712		
		7/23/2003	211	MJM020715		
		7/23/2003	190	MJM020719		
		7/23/2003	181	MJM020720		
		7/23/2003	188	MJM020721		
		7/23/2003	195	MJM020724		
		7/23/2003	196	MJM020725		
		7/23/2003	195	MJM020933		
		7/23/2003	192	MJM020936		
		7/23/2003	185	MJM020937		
		7/23/2003	210	MJM020940		

Appendix Table B-11 Tagged fish released in Alpine lakes L9312 and L9313 during 200 3

Lake	Species	Release Date	Release Length	Tag Code	Recapture Date	Days Out
L9312						
	Least cisco	7/23/2003	198	MJM020941		
		7/23/2003	182	MJM020942		
		7/23/2003	187	MJM020944		
		7/23/2003	192	MJM020945		
		7/23/2003	185	MJM020946		
		7/23/2003	192	MJM020947		
		7/23/2003	181	MJM020949		
		7/23/2003	195	MJM020950		
		7/23/2003	189	MJM020952		
		7/23/2003	185	MJM020954		
		7/23/2003	190	MJM020957		
		7/23/2003	189	MJM020959		
		7/23/2003	190	MJM020962		
		7/23/2003	190	MJM020964		
		7/23/2003	186	MJM020966		
		7/23/2003	186	MJM020967		
		7/23/2003	191	MJM020971		
		7/23/2003	198	MJM020972		
		7/23/2003	186	MJM020975		
		7/23/2003	232	MJM021004		
		7/23/2003	188	MJM021005		
		7/23/2003	190	MJM021006		
		7/23/2003	193	MJM021007		
		7/23/2003	180	MJM021008		
		7/23/2003	185	MJM021010		
		7/23/2003	189	MJM021011		
		7/23/2003	186	MJM021012		
		7/23/2003	186	MJM021013		
		7/23/2003	190	MJM021015		
		7/23/2003	190	MJM021017		
		7/23/2003	190	MJM021018		
		7/23/2003	212	MJM021020		
		7/23/2003	195	MJM021021		
		7/23/2003	184	MJM021022		
		7/23/2003	190	MJM021026		
		7/23/2003	185	MJM021027		
		7/23/2003	180	MJM021028		
		7/23/2003	202	MJM021030		
		7/23/2003	185	MJM021031		

Appendix Table B-11. Tagged fish released in Alpine lakes L9312 and L9313 during 2003

Lake	Species	Release Date	Release Length	Tag Code	Recapture Date	Days Out
L9312						
	Least cisco	7/23/2003	189	MJM021033		
		7/23/2003	188	MJM021035		
		7/25/2003	190	MJM021051		
		7/25/2003	186	MJM021052		
		7/25/2003	218	MJM021053		
		7/25/2003	195	MJM021054		
		7/25/2003	204	MJM021055		
		7/25/2003	185	MJM021056		
		7/24/2003	188	MJM021067		
		7/24/2003	197	MJM021068		
		7/24/2003	206	MJM021069		
		7/24/2003	190	MJM021070		
		7/24/2003	190	MJM021071		
		7/24/2003	188	MJM021072		
		7/24/2003	189	MJM021073		
		7/28/2003	184	MJM021083		
		7/28/2003	194	MJM021084		
		7/28/2003	199	MJM021085		
		7/28/2003	211	MJM021086		
		7/28/2003	194	MJM021087		
		7/28/2003	194	MJM021088		
		7/28/2003	244	MJM021089		
		7/26/2003	183	MJM021097		
		8/22/2003	238	MJM021104		
		8/16/2003	193	MJM021207		
		8/16/2003	194	MJM021208		
		8/16/2003	186	MJM021209		
		8/16/2003	206	MJM021210		
		8/17/2003	189	MJM021212		
		8/16/2003	212	MJM021213		
		8/18/2003	203	MJM021220		
		8/19/2003	194	MJM021221		
		8/19/2003	200	MJM021222		
		8/19/2003	201	MJM021223		
		8/19/2003	225	MJM021225		
	Round whitefish	7/22/2003	312	MJM020673		
		7/22/2003	350	MJM020674		
		7/23/2003	303	MJM020723		
		7/23/2003	266	MJM020943		

Appendix Table B-11. Tagged fish released in Alpine lakes L9312 and L9313 during 2003

Lake	Species	Release Date	Release Length	Tag Code	Recapture Date	Days Out
L9313						
	Broad whitefish	7/23/2003	399	MJM021037		
	Humpback whitefish	7/24/2003	356	MJM021066		
	Least cisco	7/24/2003	356	MJM021066		
		7/23/2003	389	MJM021039	8/17/2003	25
		7/23/2003	226	MJM021040		
		7/23/2003	211	MJM021041		
		8/22/2003	319	MJM021105		
		8/17/2003	320	MJM021217		
		8/17/2003	327	MJM021218		
		8/19/2003	308	MJM021224		

Appendix Table B-12. Tagged fish released in Alpine lakes L9312 and L9313 during 2004

Lake	Species	Release Date	Release Length	Tag Code	Recapture Date	Days Out
L9312						
	Least cisco	7/22/2004	215	MJM021689		
		7/22/2004	208	MJM021690		
		7/22/2004	195	MJM021691		
		7/22/2004	222	MJM021692		
		7/22/2004	206	MJM021694		
		7/22/2004	217	MJM021696		
		7/22/2004	206	MJM021697		
		7/24/2004	191	MJM021701		
		7/24/2004	201	MJM021702		
		7/24/2004	193	MJM021703		
		7/24/2004	195	MJM021705		
		7/24/2004	199	MJM021706		
		7/24/2004	197	MJM021707		
		7/24/2004	221	MJM021708		
		7/24/2004	193	MJM021709		
		7/24/2004	192	MJM021710		
		7/24/2004	197	MJM021711		
		7/24/2004	190	MJM021712		
		7/24/2004	190	MJM021893		
		7/24/2004	198	MJM021894		
		7/24/2004	225	MJM021895		
		7/24/2004	214	MJM021896		
		7/24/2004	189	MJM021897		
		7/24/2004	208	MJM021898		
		7/24/2004	218	MJM021899		
		7/24/2004	198	MJM021900		
		7/25/2004	191	MJM021725		
		7/25/2004	205	MJM021728		
		7/25/2004	203	MJM021729		
		7/25/2004	187	MJM021730		
		7/26/2004	192	MJM021742		
		7/26/2004	186	MJM021743		
		7/27/2004	180	MJM021749		
		7/27/2004	202	MJM021750		
		7/27/2004	206	MJM021751		
		7/27/2004	185	MJM021752		
		7/27/2004	188	MJM021753		
		7/27/2004	213	MJM021754		
		7/27/2004	224	MJM021755		
		7/27/2004	206	MJM021756		

Appendix Table B-12. Tagged fish released in Alpine lakes L9312 and L9313 during 2004.

Lake	Species	Release Date	Release Length	Tag Code	Recapture Date	Days Out
L9312						
	Least cisco	7/27/2004	202	MJM021757		
		7/27/2004	186	MJM021758		
		7/27/2004	209	MJM021759		
		7/28/2004	204	MJM021765		
		7/28/2004	190	MJM021766		
		7/28/2004	193	MJM021767		
		7/28/2004	194	MJM021768		
		7/28/2004	223	MJM021769		
		7/28/2004	189	MJM021770		
		7/28/2004	197	MJM021771		
		7/28/2004	182	MJM021773		
		7/28/2004	190	MJM021774		
		7/28/2004	192	MJM021775		
		7/28/2004	196	MJM021976		
		7/28/2004	187	MJM021977		
		7/28/2004	188	MJM021978		
		7/28/2003	248	MJM021089	8/17/2004	386
		8/19/2004	198	MJM021808		
		8/19/2004	193	MJM021809		
		8/19/2004	212	MJM021810		
		8/20/2004	219	MJM021846		
		8/21/2004	194	MJM021848		
		8/22/2004	199	MJM021849		
		8/22/2004	181	MJM021851		
		8/22/2004	205	MJM021852		
		8/23/2004	186	MJM021855		
		8/23/2004	200	MJM021856		
		8/23/2004	236	MJM021857		
L9313						
	Broad whitefish	8/19/2004	229	MJM021947		
	Least cisco	7/22/2004	183	MJM021650		
		7/25/2004	328	MJM021713		
		7/25/2004	187	MJM021714		
		7/25/2004	193	MJM021715	8/20/2004	26
		7/25/2004	188	MJM021716		
		7/25/2004	185	MJM021718		
		7/25/2004	190	MJM021719	8/20/2004	26
		7/25/2004	197	MJM021720		

Appendix Table B-12. Tagged fish released in Alpine lakes L9312 and L9313 during 2004.

Lake	Species	Release Date	Release Length	Tag Code	Recapture Date	Days Out
L9312						
	Least cisco	7/25/2004	222	MJM021721		
		7/25/2004	223	MJM021722		
		7/25/2004	194	MJM021723		
		7/25/2004	191	MJM021724		
		7/26/2004	181	MJM021731		
		7/26/2004	192	MJM021732		
		7/26/2004	201	MJM021733	8/20/2004	25
		7/26/2004	195	MJM021734		
		7/26/2004	188	MJM021735		
		7/26/2004	195	MJM021736		
		7/26/2004	197	MJM021737		
		7/26/2004	194	MJM021738		
		7/26/2004	195	MJM021739		
		7/26/2004	196	MJM021740		
		7/26/2004	196	MJM021741		
		7/27/2004	201	MJM021744		
		7/27/2004	190	MJM021745		
		7/27/2004	200	MJM021746		
		7/27/2004	189	MJM021747		
		7/27/2004	304	MJM021748		
		7/28/2004	322	MJM021760		
		7/28/2004	308	MJM021761		
		7/28/2004	195	MJM021762		
		7/28/2004	193	MJM021763	8/20/2004	23
		7/28/2004	345	MJM021764		
		8/17/2004	312	MJM0101805		
		8/17/2004	310	MJM0101806		
		8/19/2004	205	MJM021801		
		8/19/2004	187	MJM021802		
		8/19/2004	199	MJM021803		
		8/19/2004	199	MJM021804		
		8/19/2004	197	MJM021805		
		8/19/2004	188	MJM021806		
		8/19/2004	309	MJM021807		
		8/19/2004	191	MJM021943		
		8/19/2004	195	MJM021944		
		8/19/2004	201	MJM021945		
		8/19/2004	201	MJM021946		
		8/19/2004	184	MJM021948		
		8/19/2004	181	MJM021949		

Appendix Table B-12. Tagged fish released in Alpine lakes L9312 and L9313 during 2004

Lake	Species	Release Date	Release Length	Tag Code	Recapture Date	Days Out
L9313						
	Least cisco	8/19/2004	195	MJM021950		
		8/20/2004	188	MJM021811		
		8/20/2004	195	MJM021812		
		8/20/2004	198	MJM021813		
		8/20/2004	195	MJM021814		
		8/20/2004	188	MJM021815		
		8/20/2004	195	MJM021816		
		8/20/2004	181	MJM021817		
		8/20/2004	195	MJM021818		
		8/20/2004	198	MJM021819		
		8/20/2004	197	MJM021820		
		8/20/2004	196	MJM021821		
		8/20/2004	197	MJM021822		
		8/20/2004	198	MJM021823		
		8/20/2004	204	MJM021824		
		8/20/2004	191	MJM021825		
		8/20/2004	187	MJM021826		
		8/20/2004	194	MJM021827		
		8/20/2004	188	MJM021828		
		8/20/2004	199	MJM021829		
		8/20/2004	200	MJM021830		
		8/20/2004	198	MJM021831		
		8/20/2004	188	MJM021832		
		8/20/2004	206	MJM021833		
		8/20/2004	188	MJM021834		
		8/20/2004	195	MJM021835		
		8/20/2004	200	MJM021836		
		8/20/2004	200	MJM021837		
		8/20/2004	201	MJM021838		
		8/20/2004	204	MJM021839		
		8/20/2004	204	MJM021840		
		8/20/2004	242	MJM021841		
		8/20/2004	200	MJM021842		
		8/20/2004	203	MJM021843		
		8/20/2004	201	MJM021844		
		8/21/2004	191	MJM021847		

Appendix Table B-13. Tagged fish released in Alpine lakes L9312 and L9313 during 2005.

Lake	Species	Release Date	Release Length	Tag Code	Recapture Date	Days Out
L9312						
	Broad whitefish	7/25/2005	520	MJM023013		
	Least cisco	7/19/2005	219	MJM022387		
		7/19/2005	221	MJM022388		
		7/19/2005	230	MJM022392		
		7/19/2005	207	MJM022393		
		7/20/2005	193	MJM022629	7/26/2005	6
		7/20/2005	215	MJM022630		
		7/20/2005	189	MJM022631		
		7/21/2005	220	MJM022655		
		7/23/2005	205	MJM022703		
		7/23/2005	193	MJM022704		
		7/23/2005	205	MJM022705		
		7/24/2005	242	MJM022730		
		7/24/2005	237	MJM022731		
		7/24/2005	180	MJM022732		
		7/24/2005	200	MJM022733		
		7/24/2005	182	MJM022734		
		7/24/2005	220	MJM022735		
		7/24/2005	203	MJM022736		
		7/24/2005	201	MJM022737		
		7/24/2005	231	MJM022738		
		7/24/2005	194	MJM022739		
		7/24/2005	205	MJM022741		
		7/24/2005	201	MJM022742		
		7/25/2005	198	MJM023014		
		7/26/2005	193	MJM023029		
		7/26/2005	199	MJM023030		
		7/26/2005	200	MJM023031		
		7/26/2005	192	MJM023032		
		7/26/2005	199	MJM023033		
		7/26/2005	194	MJM023034		
		7/26/2005	185	MJM023035		
		7/26/2005	192	MJM023036		
		7/26/2005	211	MJM023037		
		7/26/2005	197	MJM023038		
		7/26/2005	190	MJM023039		
		7/26/2005	207	MJM023040		
		7/26/2005	200	MJM023041		
		7/26/2005	183	MJM023042		

Appendix Table B-13. Tagged fish released in Alpine lakes L9312 and L9313 during 2005.

Lake	Species	Release Date	Release Length	Tag Code	Recapture Date	Days Out
L9312						
	Least cisco	7/26/2005	191	MJM023043		
		7/26/2005	187	MJM023044		
		7/26/2005	191	MJM023045		
		7/26/2005	186	MJM023046		
		7/26/2005	180	MJM023047		
		7/26/2005	197	MJM023048		
		7/26/2005	200	MJM023049		
		7/26/2005	212	MJM023050		
		7/26/2005	198	MJM023051		
		7/26/2005	195	MJM023052		
		7/26/2005	190	MJM023053		
		7/26/2005	200	MJM023054		
		7/26/2005	185	MJM023055		
		7/26/2005	187	MJM023056		
		7/26/2005	196	MJM023057		
		7/26/2005	200	MJM023058		
		7/26/2005	186	MJM023059		
		7/26/2005	205	MJM023060		
		7/26/2005	182	MJM023061		
		7/26/2005	206	MJM023062		
		7/26/2005	192	MJM023063		
		7/26/2005	214	MJM023064		
		7/26/2005	202	MJM023065		
		7/26/2005	203	MJM023066		
		7/26/2005	191	MJM023067		
		7/26/2005	203	MJM023068		
		7/26/2005	209	MJM023069		
		7/26/2005	207	MJM023070		
		7/26/2005	191	MJM023071		
		7/26/2005	182	MJM023073		
		7/26/2005	198	MJM023074		
		7/26/2005	195	MJM023075		
		7/26/2005	190	MJM023076		
		7/26/2005	186	MJM023077		
		7/26/2005	189	MJM023078		
		7/26/2005	190	MJM023079		
		7/26/2005	192	MJM023081		
		7/26/2005	193	MJM023082		
		7/26/2005	189	MJM023083		
		7/26/2005	210	MJM023084		

Appendix Table B-13. Tagged fish released in Alpine lakes L9312 and L9313 during 2005.

Lake	Species	Release Date	Release Length	Tag Code	Recapture Date	Days Out
L9312						
	Least cisco	7/26/2005	202	MJM023085		
		7/26/2005	194	MJM023086		
		7/26/2005	190	MJM023087		
		7/26/2005	200	MJM023088		
		7/26/2005	180	MJM023089		
		7/26/2005	201	MJM023090		
		7/26/2005	203	MJM023091		
		7/26/2005	200	MJM023092		
		7/26/2005	190	MJM023093		
		7/26/2005	196	MJM023094		
		7/26/2005	204	MJM023095		
		7/26/2005	205	MJM023096		
		7/26/2005	190	MJM023097		
		7/26/2005	195	MJM023098		
		7/26/2005	197	MJM023099		
		7/26/2005	193	MJM023100		
		7/22/2004	208	MJM021690	7/27/2005	370
		7/27/2005	201	MJM023224		
		7/27/2005	199	MJM023225		
		7/27/2005	192	MJM023226		
		7/27/2005	183	MJM023227		
		7/27/2005	196	MJM023228		
		7/27/2005	194	MJM023229		
		7/27/2005	200	MJM023230		
		7/27/2005	210	MJM023231		
		7/27/2005	185	MJM023232		
		7/27/2005	199	MJM023233		
		7/27/2005	214	MJM023234		
		7/27/2005	203	MJM023235		
		7/28/2005	206	MJM023240		
		8/22/2005	223	MJM023272		
	Round whitefish	7/23/2003	266	MJM020943	7/20/2005	728
		7/20/2005	318	MJM020943	7/25/2005	5
L9313	no fish large enough to be tagged were caught in lake L9313 in 2005					

APPENDIX C
Length Frequency Data from lakes L9312 and L9313
2005

Appendix Table C-1. Length frequencies of least cisco caught by fyke net in the Alpine study area, 2005.

Fork Length (mm)	**L9312** Jul 19	Jul 20	Jul 21	Jul 22	Jul 23	Jul 24	Jul 25	Jul 26	Jul 27	Jul 28	Jul Total
0											0
10											0
20											0
30											0
40											0
50		1									1
60	5										5
70	5										5
80	1										1
90		1									1
100											0
110											0
120								7	1		8
130						1		15	2		18
140								2			0
150					1	1		9	1		12
160			1			1		4			6
170								2	2		4
180		1				2		14	2		19
190		1			1	1	1	36	5		45
200	1				2	5	1	21	4	1	35
210	1	1						4	2		8
220	1		1			1					3
230	1					2					3
240						1					0
250											0
260											0
270											0
280											0
290											0
300											0
310											0
320											0
330											0
340											0
350											0
360											0
370											0
380											0
390											0
400											0
Total:	15	5	2	0	4	15	2	114	19	1	174

Appendix Table C-1. Length frequencies of least cisco caught by fyke net in the Alpine study area, 2005.

Fork Length (mm)	L9312 Aug 18	Aug 19	Aug 20	Aug 21	Aug 22	Aug 23	Aug Total	L9313 Aug 18	Aug 19	Aug 20	Aug 21	Aug 22	Aug 23	Aug Total
0							0							0
10							0							0
20	1						1	1						1
30	11		1		1		13	11			1	2	1	15
40							0	3			1	2		6
50							0							0
60							0							0
70	2		2	1	1		6							0
80	2	1	5	6	2	3	19				2			2
90						1	1	1	5	5	19	2	3	35
100	1		4				5		2	2	7	1		12
110							0							0
120				1			1							0
130							0	1						1
140							0							0
150							0							0
160							0							0
170							0	1						1
180							0							0
190							0							0
200							0							0
210							0							0
220					1		1							0
230							0							0
240							0							0
250							0							0
260							0							0
270							0							0
280							0							0
290							0							0
300							0							0
310							0							0
320							0							0
330							0							0
340							0							0
350							0							0
360							0							0
370							0							0
380							0							0
390							0							0
400							0							0
Total:	17	1	12	8	5	4	47	18	7	7	30	7	4	73

Appendix Table C-2. Length frequencies of broad whitefish caught by fyke net in the Alpine study area, 2005.

Fork Length (mm)	**L9313** Jul 25
30	
40	
50	
60	
70	
80	
90	
100	
110	
120	
130	
140	
150	
160	
170	
180	
190	
200	
210	
220	
230	
240	
250	
260	
270	
280	
290	
300	
310	
320	
330	
340	
350	
360	
370	
380	
390	
400	
410	
420	
430	
440	
450	
460	
470	
480	
490	
500	
510	
520	1
530	
540	
550	
Total:	1

Appendix Table C-3. Length frequencies of round whitefish caught by fyke net in the Alpine study area, 2005.

Fork Length (mm)	**L9312** Jul 20	Jul 25
0		
10		
20		
30		
40		
50		
60		
70		
80		
90		
100		
110		
120		
130		
140		
150		
160		
170		
180		
190		
200		
210		
220		
230		
240		
250		
260		
270		
280		
290		
300		
310	1	1
320		
330		
340		
350		
360		
370		
380		
390		
400		
Total:	1	1

Appendix Table C-4. Length frequencies of Alaska blackfish caught by fyke net in the Alpine study area, 2005.

Fork Length (mm)	**L9312** Aug 18	Aug 19	Aug 20	Aug 21	Aug 22	Aug 23	Aug Total
0							0
10							0
20							0
30							0
40							0
50							0
60							0
70	3		4	1		1	9
80	1	1	2	1	2		7
90				2		2	4
100							0
110							0
120							0
130							0
Total:	4	1	6	4	2	3	20

Fork Length (mm)	**L9313** Jul 19	Jul 20	Jul 21	Jul 22	Jul 23	Jul 24	Jul 25	Jul 26	Jul 27	Jul 28	Jul Total	**L9313** Aug 18	Aug 19	Aug 20	Aug 21	Aug 22	Aug 23	Aug Total
0											0							0
10											0							0
20											0							0
30											0							0
40			1								1							0
50				1		1			2		4				2			2
60	1		1	1	2	1	1		1		8						1	1
70	1		2	1	1	1	2	3		2	13			1	2		1	4
80	1		1	1		1	3		1		8	1	2	2	1		2	8
90		2	1	1	1	1	2	2			10	2		1	1			4
100					1						1	1			1	1		3
110											0	1						1
120											0							0
130											0							0
Total:	3	2	6	5	5	5	8	5	4	2	45	5	2	4	7	1	4	23

Appendix Table C-5. Length frequencies of slimy sculpin caught by fyke net in the Alpine study area, 2005.

Fork Length (mm)	**L9312** Jul 26	Jul 27	Jul Total	Aug 18	Aug 20	Aug 23	Aug Total
0			0				0
10			0				0
20			0				0
30			0				0
40			0				0
50			0	1	1		2
60	1		1				0
70	1		1	1			1
80			0			1	1
90			0				0
100			0				0
110			0				0
120			0				0
130			0				0
140			0				0
150			0				0
160			0				0
170			0				0
180			0				0
190			0				0
200			0				0
Total:	2	0	2	2	1	1	4

APPENDIX D
Winter Water Chemistry in Lake L9313
during April-May, 2003

Project Note

To: Caryn Rea	Date: May 2, 2003
From: Jon Wolf	Project: 2003 Alpine Lake L9313 Monitoring
Subject: April 28, 2003 Monitoring Event	

On April 28, 2003, Jon Wolf conducted the first of two in situ water quality monitoring events at Alpine lake L9313. The monitoring event was carried out with the assistance of Mr. Jack Tipleman of LCMF surveyors. Access to the lake was provided by LCMF tracked vehicle. Weather on the day of sampling was ideal. Temperatures were in the low 20s and there was little or no wind.

Sampling location selection was based solely on depth. Locations selected represented points where water depths were such that sufficient under-ice free water would be available. Each sampling point was recorded using a hand-held global positioning system (GPS) unit referenced to North American Datum of 1927 (NAD27).

At each sampling location, a two-cycle power auger was used to drill a six-inch sampling hole through the ice. Total depth was measured using a weighted tag line. Freeboard, the distance from the top of ice to the water surface in the sample hole, was measured using a pocket rod. Ice thickness was determined using a pole with a wire hook on the end. The pole was lowered into the hole until the hook found the underside of the ice. The pole was then withdrawn and the pocket rod used to measure the resultant ice thickness as marked along the pole. All measurements were made to the nearest tenth-foot and were referenced to the water surface.

A Horiba U-10 in situ water quality meter was used to measure the following in situ water parameters:

- Temperature in degrees Celsius (^{o}C)
- pH in standard units
- Conductivity in millisiemens per centimeter (mS/cm)
- Dissolved oxygen in milligrams per liter (mg/L)
- Salinity in milligrams per liter (mg/L)

In situ samples were collected at approximately 1-meter (3-foot) intervals between the bottom of the ice and the bottom of the lake.

Baker

2003 Alpine Lake L9313 Monitoring Program
In-Situ Water Quality Parameters

Sample Date: April 28, 2003

Sample Location	Sample Time	Sample Location Coordinates (NAD27)	Total Depth (ft)	Ice Thickness (ft)	Free-board (ft)	In-Situ Sample Depth (ft)	Temp. (°C)	pH	Conduc-tivity (mS/cm)	Salinity (%)	Dissolved Oxygen (mg/L)
L9313	11:05	N70°20'29.3" W150°56'20.2"	8.8	4.2	0.2	4.5	1.5	7.4	0.4	0.0	0.3
						7.5	1.9	7.0	0.4	0.0	0.1
L9313a	11:25	N70°20'22.5" W150°56'47.7"	6.2	4.6	0.2	5.0	0.8	6.7	0.3	0.0	2.7
L9313b	11:35	N70°20'32.3" W150°56'20.3"	8.8	4.8	0.4	5.0	1.0	6.5	0.3	0.0	0.9
						8.0	1.0	6.1	0.4	0.0	0.5
L9313c	12:00	N70°20'25.0" W150°56'36.7"	8.2	4.9	0.3	5.0	2.0	6.6	0.4	0.0	0.6
						8.0	2.0	6.2	0.4	0.0	0.9
L9313d	12:15	N70°20'31.5" W150°56'03.8"	8.1	4.2	0.3	4.5	2.0	6.6	0.4	0.0	0.8
						7.5	2.0	6.6	0.4	0.0	0.6
L9313e	12:25	N70°20'35.5" W150°55'59.0"	8.8	4.7	0.3	5.0	2.0	6.6	0.4	0.0	2.1
						8.0	2.0	6.5	0.4	0.0	0.0
L9313f	12:35	N70°20'39.2" W150°55'48.0"	8.6	4.8	0.3	5.0	2.0	6.5	0.4	0.0	3.5
						8.0	2.0	6.2	0.4	0.0	2.8
L9313g	12:45	N70°20'40.1" W150°55'40.6"	8.2	4.5	0.3	5.0	1.0	6.5	0.3	0.00	4.0
						8.0	2.0	6.4	0.3	0.00	2.8

Notes:

1 - Total depth is measured from the water surface to the lake bottom.

2 - Freeboard is the distance from the top of ice to the water surface.

3 - Sample depth is measured from the water surface.

ConocoPhillips

2003 Alpine Lake L9313 Monitoring Program
April 28, 2003 Monitoring Locations

0 250 500 Feet

N

Baker

Prepared by Michael Baker Jr. Inc. May 2, 2003

Project Note

To: Caryn Rea	Date: May 9, 2003
From: Jon Wolf	Project: 2003 Alpine Lake L9313 Monitoring
Subject: May 9, 2003 Monitoring Event	

On May 9, 2003, Mike Cox and Jim Meckel conducted the second of two in situ water quality monitoring events at Alpine lake L9313. The monitoring event was carried out with the assistance of Mr. Jack Tipleman of LCMF surveyors. Access to the lake was provided by LCMF tracked vehicle. Weather on the day of sampling was ideal. Temperatures were in the low 20s and wind was from the east at approximately 10 miles per hour.

Locations monitored during this event were within 5 feet of the locations monitored during the April 28, 2003 monitoring event (see April 28, 2003 report for sampling locations).

At each sampling location, a two-cycle power auger was used to drill a six-inch sampling hole through the ice. Total depth was measured using a weighted tag line. Freeboard, the distance from the top of ice to the water surface in the sample hole, was measured using a pocket rod. Ice thickness was determined using a pole with a wire hook on the end. The pole was lowered into the hole until the hook found the underside of the ice. The pole was then withdrawn and the pocket rod used to measure the resultant ice thickness as marked along the pole. All measurements were made to the nearest tenth-foot and were referenced to the water surface.

A Horiba U-10 in situ water quality meter was used to measure the following in situ water parameters:

- Temperature in degrees Celsius (^{o}C)
- pH in standard units
- Conductivity in millisiemens per centimeter (mS/cm)
- Dissolved oxygen in milligrams per liter (mg/L)
- Salinity in milligrams per liter (mg/L)

In situ samples were collected at 3-foot intervals between the bottom of the ice and the bottom of the lake.

Project Note

2003 Alpine Lake L9313 Monitoring Program

In-Situ Water Quality Parameters

May 9, 2003

Sample Location	Sample Time	Sample Location Coordinates (NAD27)	Total Depth (ft)	Ice Thickness (ft)	Free-board (ft)	In-Situ Sample Depth (ft)	Temp. (°C)	pH	Conduc-tivity (mS/cm)	Salinity (%)	Dissolved Oxygen (mg/L)
L9313	13:07	N70°20'29.3" W150°56'20.2"	9.2	4.3	0.1	4.5	1.0	7.9	0.3	0.0	0.6
						7.5	2.0	7.3	0.3	0.0	0.1
L9313a	13:28	N70°20'22.5" W150°56'47.7"	6.7	4.4	0.1	5.0	2.0	7.3	0.3	0.0	2.6
L9313b	14:00	N70°20'32.3" W150°56'20.3"	9.4	4.9	0.4	5.0	3.0	7.3	0.4	0.0	1.1
						8.0	3.0	6.9	0.4	0.0	0.9
L9313c	14:10	N70°20'25.0" W150°56'36.7"	8.8	5.1	0.3	5.5	2.0	7.1	0.3	0.0	2.3
						8.5	2.0	6.8	0.4	0.0	2.2
L9313d	14:20	N70°20'31.5" W150°56'03.8"	8.4	4.3	0.3	5.0	2.0	6.8	0.3	0.0	1.5
						8.0	2.0	6.4	0.3	0.0	0.0
L9313e	14:35	N70°20'35.5" W150°55'59.0"	9.2	4.7	0.4	5.0	2.0	6.8	0.4	0.0	1.5
						8.0	2.0	6.2	0.4	0.0	0.0
L9313f	14:45	N70°20'39.2" W150°55'48.0"	9.0	4.7	0.3	5.0	2.0	6.5	0.4	0.0	1.8
						8.0	2.0	6.3	0.4	0.0	1.6
L9313g	14:50	N70°20'40.1" W150°55'40.6"	8.6	4.6	0.3	5.0	1.0	6.7	0.3	0.00	2.9
						8.0	2.0	6.5	0.4	0.00	2.3

Notes:

1 - Total depth is measured from the water surface to the lake bottom.

2 - Freeboard is the distance from the top of ice to the water surface.

3 - Sample depth is measured from the water surface.