

**MONITORING OF WATER-SOURCE LAKES IN  
THE ALPINE DEVELOPMENT PROJECT:  
1999-2004**

Final Report

March 2005



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**Prepared for:**

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Anchorage, AK**

and

**Anadarko Petroleum Corp.  
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The Woodlands, TX**

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# **MONITORING OF WATER-SOURCE LAKES IN THE ALPINE DEVELOPMENT PROJECT: 1999-2004**

## **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 (Appendix C). 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 the 2004 catch patterns to those observed in previous years. Results of the 1999 through 2003 monitoring are reported in Moulton (1999, 2000, 2002, 2003, 2004).

## **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 the 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 2003 sampling (Figures 3 and 4). As set forth in the monitoring stipulations, sampling was conducted during two ice-free periods: July 22-28 and August 16-22. 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 2002-2004, 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 2002-2004, 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 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 22-28, 2004 produced a catch of 568 fish from 3 species, while sampling conducted August 16-22 produced 873 fish from 4 species (Table 5). As in previous years, least cisco was again the most numerous species caught in 2004, representing 81% of the non-stickleback catch. The July catch rate of least cisco (102.6 fish per day) was the highest recorded since July catches of 2000 (Figure 8). Catch rates of least cisco in August 2003 decreased from the high catch in 2002, but were greater than those in August 2000 and 2001.

The least cisco in 2000 likely represented many age groups (based on length frequency analysis – Appendix B), because the lengths ranged from 60 to 220 mm. In 2001 and 2002, the captured least cisco were smaller, with age-0 and 1 fish being most abundant (Figure 9). Few larger fish were caught, with only 2 over 190 mm. In 2004, as in 2003, the length frequency indicated representation from a broad range of age groups, with fish ranging from 51 to 248 mm. The catch of age-0 fish in each of the last four years likely indicates successful spawning, although immigration cannot be ruled out.

Catches of fish other than least cisco were low in 2004 when compared to previous years, with Alaska blackfish, slimy sculpin and ninespine stickleback being the only other species caught (Table 4, Figure 8). Catch rates (CPUE) of the detected species were in the range of those measured in recent years. Sixty-seven tagged least cisco were released in 2004 (Table 5). One least cisco released in 2003 was caught after being at large for 386 days (Table 6).

### **Lake L9313 (T6.1)**

**Water Chemistry.** Specific conductance in L9313 in 2004 decreased about 18% from that recorded in 2003, however, there is a strong trend of increasing specific conductance since 1995 (Table 7, 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 flooded annually during spring break-up, while L9312 is only occasionally flooded.

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; included 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 22-28, 2004 and again during August 16-22 produced a combined catch of 582 fish from 6 species (Table 4). Ninespine stickleback, least cisco and broad whitefish were the most abundant species, with Alaska blackfish, humpback whitefish and round whitefish also caught. As was the case in 2001 and 2002, catch rates of least cisco were higher in July than in August (Figure 11).

As in 2002 and 2003, least cisco caught during 2004 included a broader range of sizes than has previously been seen in this lake, and included fish in the adult size range (Figure 12). In 1999 and 2000, catches were composed of juveniles but mature fish had been caught in 2001 and some earlier years. The length distribution of young fish in 2004 indicated that at least four age groups were represented.

In 2004, none of the 38 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. One broad whitefish and 84 least cisco were tagged and released in L9313 during 2004 (Table 5). Four least cisco released in 2004 were recaptured after being at liberty for 23-26 days (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 2004 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, 1999-2004.

Lake Name	Month	1998/1999 (gallons)	1999/2000 (gallons)	2000/2001 (gallons)	2001/2002 (gallons)	2002/2003 (gallons)	2003/2004 (gallons)
L9312							
	June		1,625,100			2,011,700	1,346,800
	July					100	1,309,700
	August					0	1,369,300
	September			495,000		0	1,864,800
	October			1,786,600	Combined w/ Nov.		1,514,800
	November			2,435,320		378,800	2,204,900
	December			2,587,600	6,083,500 <sup>1</sup>	1,483,400	1,680,000
	January			8,840,220	1,798,000	1,841,900	1,468,500
	February	9,100,325		1,911,100	3,137,100	1,626,800	1,402,700
	March	1,847,370		1,781,600	3,180,400	1,503,100	1,511,100
	April		947,100	2,153,200	799,167	1,499,400	1,811,000
	May		1,865,161	1,980,200	3,375,833	2,271,000	1,889,500
	Total Use	10,947,695	4,437,361	23,970,840	12,290,500	12,616,200	19,373,100
	Minimum Winter Volume <sup>2</sup>	100,545,255	100,545,255	100,545,255	100,545,255	100,545,255	100,545,255
	Percent of Minimum Vol.	10.9%	4.4%	23.8%	12.2%	12.5%	19.3%
	Permitted Use <sup>3</sup>	12,600,000	19,000,000	32,360,000	32,360,000	30,000,000	30,000,000
L9313							
	June		1,817,300			411,090	0
	July		2,226,700			1,392,750	29,800
	August					1,902,400	400
	September			2,122,600		1,602,200	100
	October				Combined w/ Nov		160,200
	November					3,438,400	280,400
	December		765,600		378,120 <sup>1</sup>	0	368,000
	January	63,000	1,696,600		362,800	107,600	488,300
	February	126,000	1,039,800		228,000	177,000	571,000
	March		1,550,800		1,355,300	600	300
	April		843,900		238,200	300	113,300
	May				38,182	38,900	912,200
	Total Use	189,000	9,940,700	9,404,700 <sup>4</sup>	2,222,482	9,071,240	2,924,000
	Minimum Winter Volume <sup>2</sup>	19,384,330	19,384,330	19,384,330	19,384,330	19,384,330	19,384,330
	Percent of Minimum Vol.	1.0%	51.3%	48.5%	11.5%	46.8%	15.1%
	Permitted Use <sup>3</sup>	5,600,000	13,400,000	10,340,000	10,340,000	6,000,000	6,000,000

<sup>1</sup> Totals for 4th quarter 2001, not just December.

<sup>2</sup> Volume deeper than 7 feet, based on depth transects obtained during 2002

<sup>3</sup> 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.

<sup>4</sup> 7,282,100 million gallons were used prior to freeze-up

Table 2. Water chemistry parameters measured in conjunction with Alpine Area fish sampling at lake L9312, 1995-2004.

Parameter	Year	July			August				
		Mean	Standard Deviation	No. of Samples	Range	Mean	Standard Deviation	No. of Samples	Range
Water Temperature (°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
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
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
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

Table 3. Variation in specific conductance and minimum winter dissolved oxygen observed at lakes L9312 and L9313 from 1997 to 2004.

<b>Lake</b>	<b>Year</b>	<b>Winter Water Withdrawal (million gals.)</b>	<b>July Specific Conductance<sup>1</sup> (<math>\mu</math>S/cm)</b>	<b>April Specific Conductance<sup>2</sup> (<math>\mu</math>S/cm)</b>	<b>April Minimum Dissolved Oxygen<sup>2</sup> (mg/l)</b>
L9312	1997	(no withdrawal)	83.5	--	--
	1998	(no withdrawal)	--	--	--
	1999	10,947,695	77.2	--	--
	2000	4,437,361	54.8	--	--
	2001	23,970,840	58.6	232.1	3.5
	2002	12,290,500	61.6	155.5	9.5
	2003	12,616,200	71.2	--	--
	2004	19,373,100	66.9	--	--
L9313	1997	(no withdrawal)	126.2	--	--
	1998	(no withdrawal)	--	--	--
	1999	189,000	172.8	--	--
	2000	9,940,700	167.7	--	--
	2001	0	248.6	798.5	2.2
	2002	2,222,482	202.2	988.4	0.05
	2003	9,071,240	295.8	378.7	1.5
	2004	2,924,000	242.0	--	--

<sup>1</sup> Measured at Fyke Net Station

<sup>2</sup> Mean Water Column Value

Table 4. Catches of fish by species from Alpine Area Lakes fyke net sampling, 1999-2004.

Species	July 1999		2000				2001				2002				2003				2004			
	No. of Fish		July		August		July		August		July		August		July		August		July		August	
		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	No. of Fish	CPUE	No. of Fish	CPUE	No. of Fish	CPUE	No. of Fish	CPUE
<b>L9312</b>																						
Least cisco	62	9.0	1,349	192.3	196	28.4	56	8.1	228	29.1	142	17.1	652	91.9	689	102.6	333	49.7	315	45.8	439	63.3
Arctic cisco	0	0.0	0	0.0	5	0.7	0	0.0	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	4	0.6	7	1.0	0	0.0	1	0.1	7	1.0	0	0.0	21	3.1	0	0.0	0	0.0
Humpback whitefish	0	0.0	27	3.8	15	2.2	1	0.1	1	0.1	0	0.0	4	0.6	0	0.0	0	0.0	0	0.0	0	0.0
Round whitefish	24	3.5	7	1.0	17	2.5	5	0.7	4	0.5	15	1.8	4	0.6	2	0.3	0	0.0	0	0.0	0	0.0
Burbot	0	0.0	0	0.0	1	0.1	0	0.0	0	0.0	0	0.0	1	0.1	0	0.0	1	0.1	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	0	0.0	0	0.0	0	0.0	0	0.0
Alaska blackfish	7	1.0	22	3.1	102	14.8	5	0.7	8	1.0	0	0.0	27	3.8	1	0.1	31	4.6	0	0.0	148	21.3
Fourhorn sculpin	0	0.0	0	0.0	0	0.0	0	0.0	1	0.1	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	93	13.5	4	0.6	49	6.3	4	0.5	31	4.4	2	0.3	12	1.8	7	1.0	24	3.5
Ninespine stickleback	184	26.7	729	103.9	368	53.3	89	12.8	75	9.6	44	5.3	46	6.5	65	9.7	17	2.5	246	35.7	262	37.8
Total Catch:	365		2,153		801		167		366		206		772		759		415		568		873	
Number of Species:	6		8		9		7		7		5		8		5		6		3		4	
Net Hours:	165.4		168.3		165.7		166.4		187.8		199.7		170.3		161.2		160.8		165.2		166.4	
<b>L9313</b>																						
Least cisco	975	135.7	0	0.0	5	0.7	48	7.0	5	0.6	342	40.8	62	8.6	243	36.3	152	22.7	88	12.8	576	81.9
Broad whitefish	5	0.7	4	0.6	7	1.0	2	0.3	3	0.4	71	8.5	175	24.4	24	3.6	2	0.3	5	0.7	4	0.6
Humpback whitefish	0	0.0	0	0.0	5	0.7	1	0.1	4	0.5	2	0.2	31	4.3	1	0.1	0	0.0	0	0.0	0	0.0
Round whitefish	2	0.3	0	0.0	0	0.0	0	0.0	0	0.0	2	0.2	0	0.0	1	0.1	3	0.4	1	0.1	0	0.0
Burbot	0	0.0	0	0.0	1	0.1	0	0.0	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	100	14.8	11	1.6	22	2.8	11	1.3	90	12.6	0	0.0	11	1.6	9	1.3	118	16.8
Ninespine stickleback	111	15.5	779	110.2	332	49.3	100	14.6	128	16.2	227	27.1	688	96.0	83	12.4	62	9.2	647	94.1	10,434	1,483.9
Total Catch:	1,102		806		450		162		162		655		1,046		352		230		750		11,132	
Number of Species:	5		3		6		5		5		6		5		5		5		5		4	
Net Hours:	172.4		169.7		161.6		164.2		189.1		201.1		172.0		160.5		160.9		165.0		168.8	

CPUE = fish per 24 hrs of netting

Table 5. 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	
<b>L9312</b>	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	0	4	
	2004	Least cisco	67	0	95	
	<b>L9313</b>	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	

Table 6. Summary of individual tag returns from Alpine water use lakes, 2001-2004.

Lake	Species	Release Length	Tag Code	Release Date	Recapture Date	Days Out
<b>L9312</b>						
	Least cisco	244	MJM021089	7/28/2003	8/17/2004	386
<b>L9313</b>						
	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 7. Water chemistry parameters measured in conjunction with Alpine Area fish sampling at lake L9313, 1995-2004.

Parameter	Year	July			August				
		Mean	Standard Deviation	No. of Samples	Range	Mean	Standard Deviation	No. of Samples	Range
Water Temperature (°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
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
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
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



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

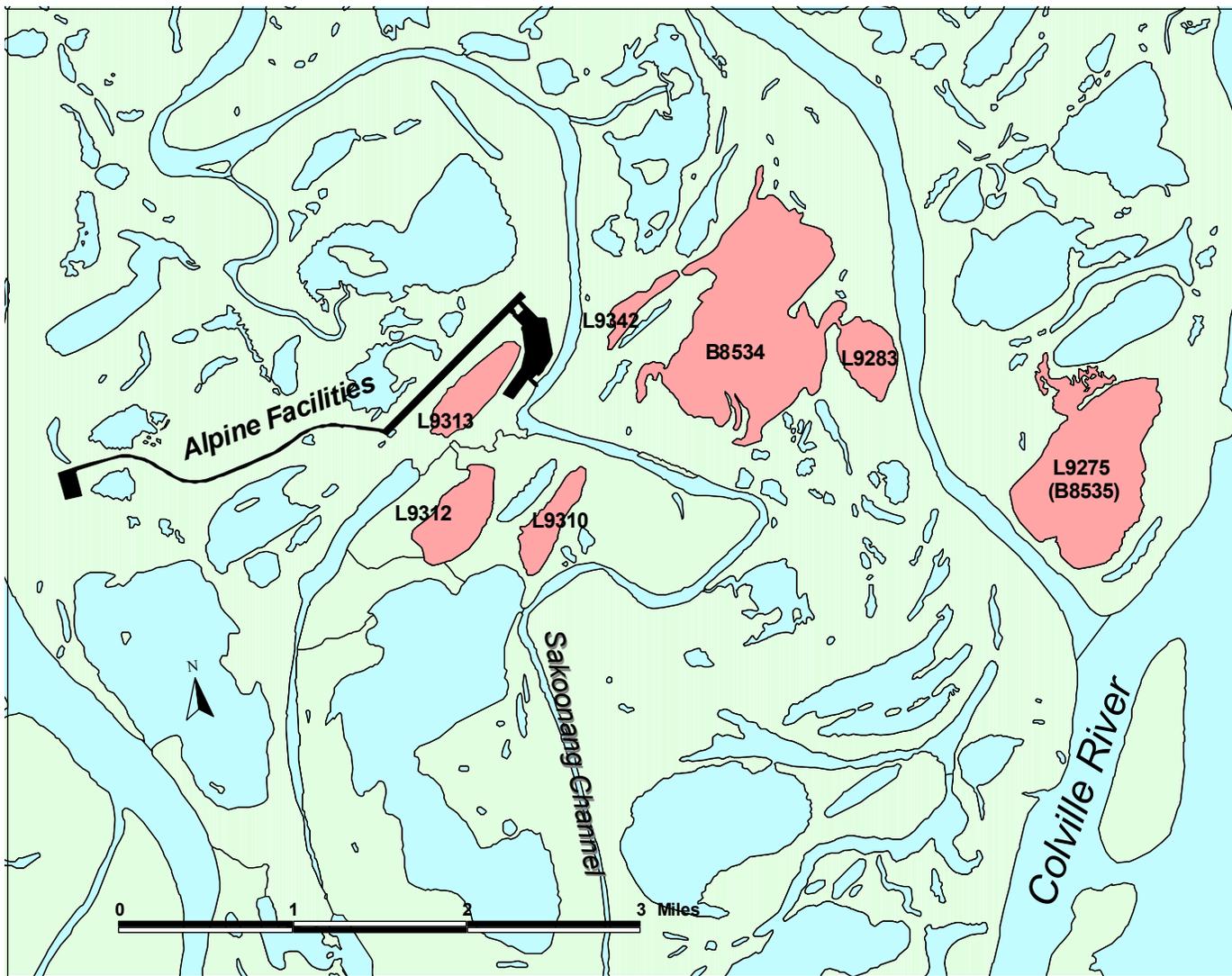


Figure 2. Lakes L9312 and L9313 used as permanent water sources for the Alpine Development.



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

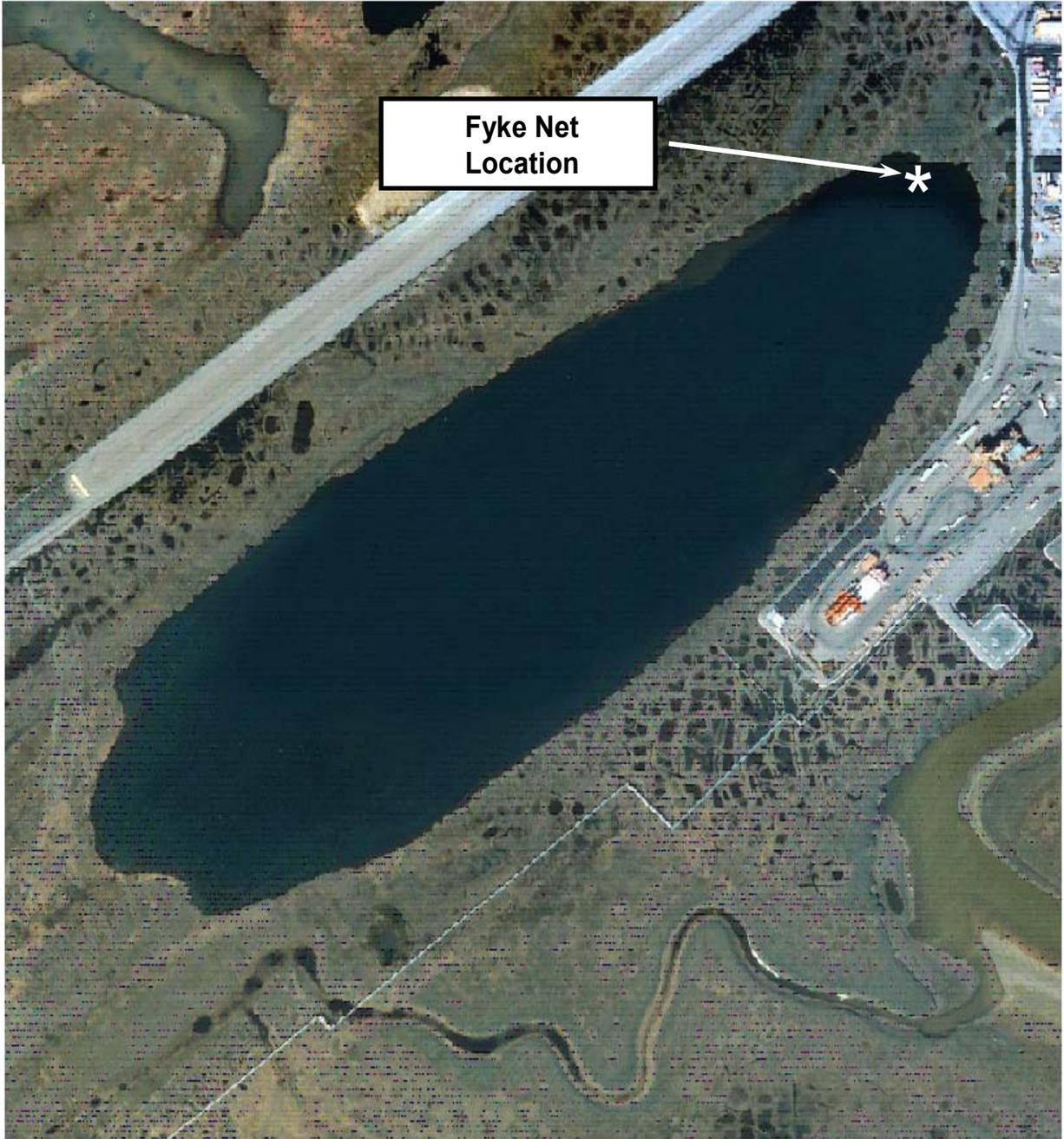
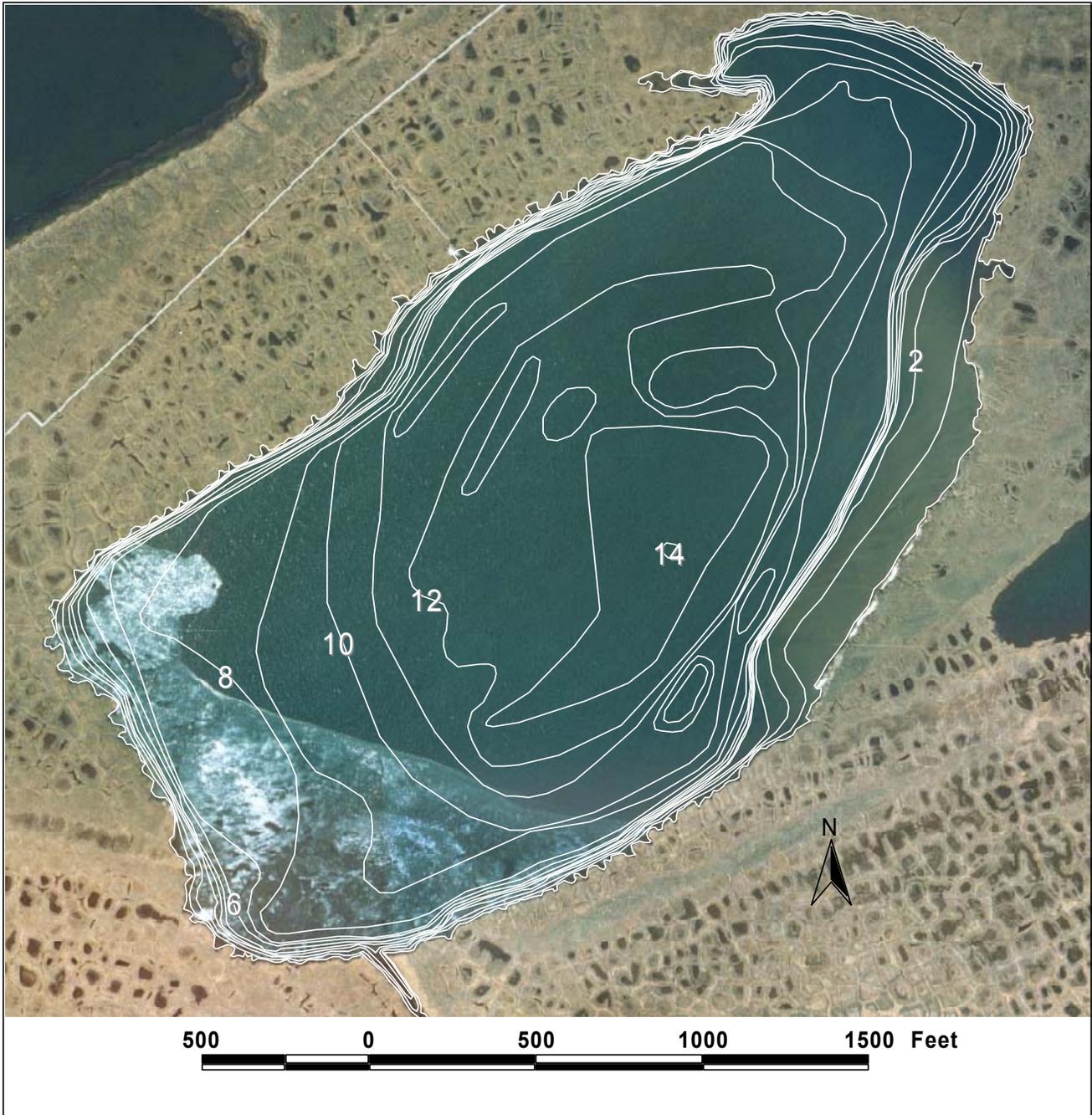
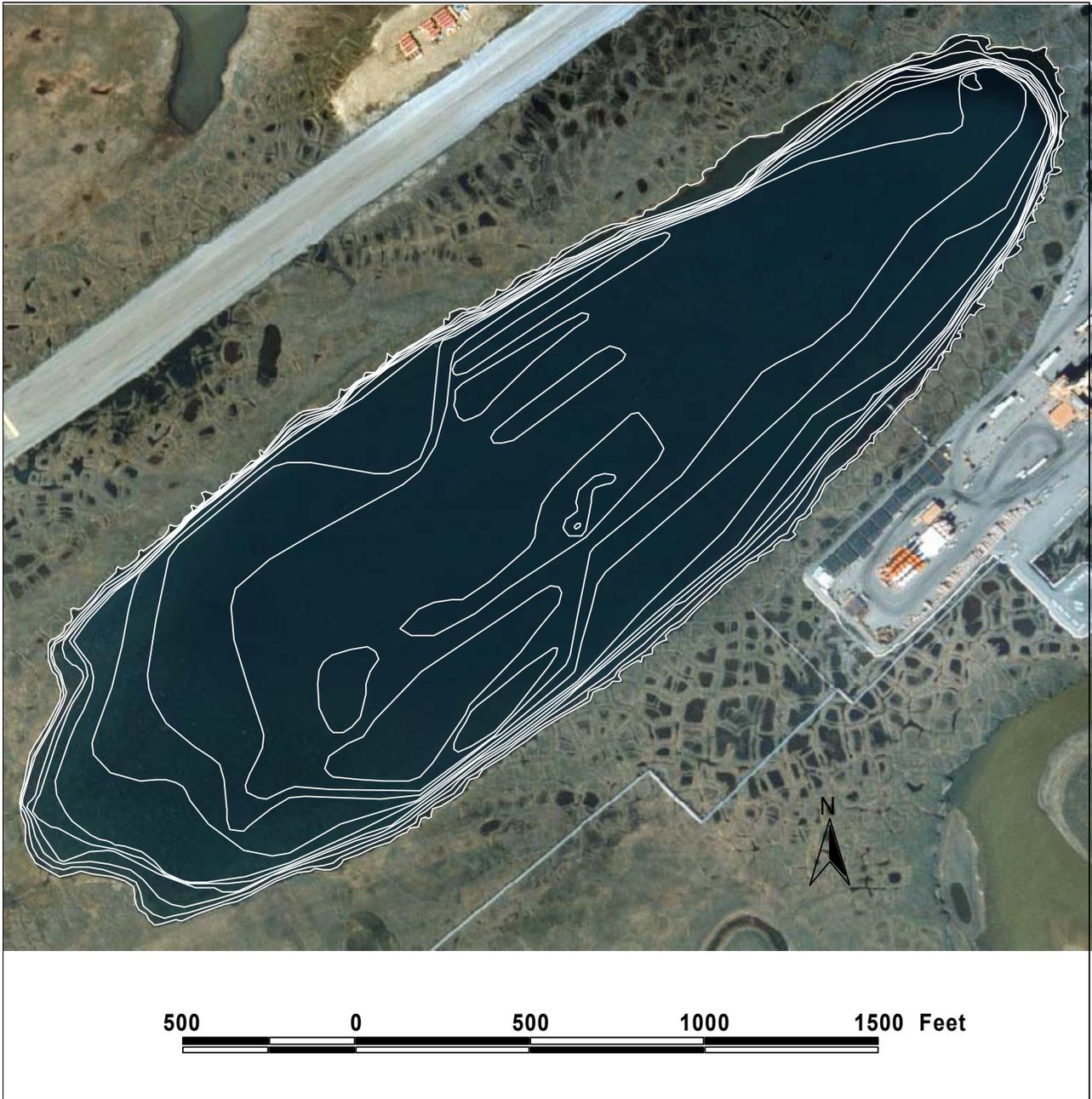


Figure 4. Fyke net station used for long-term monitoring in lake L9313.



**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.**

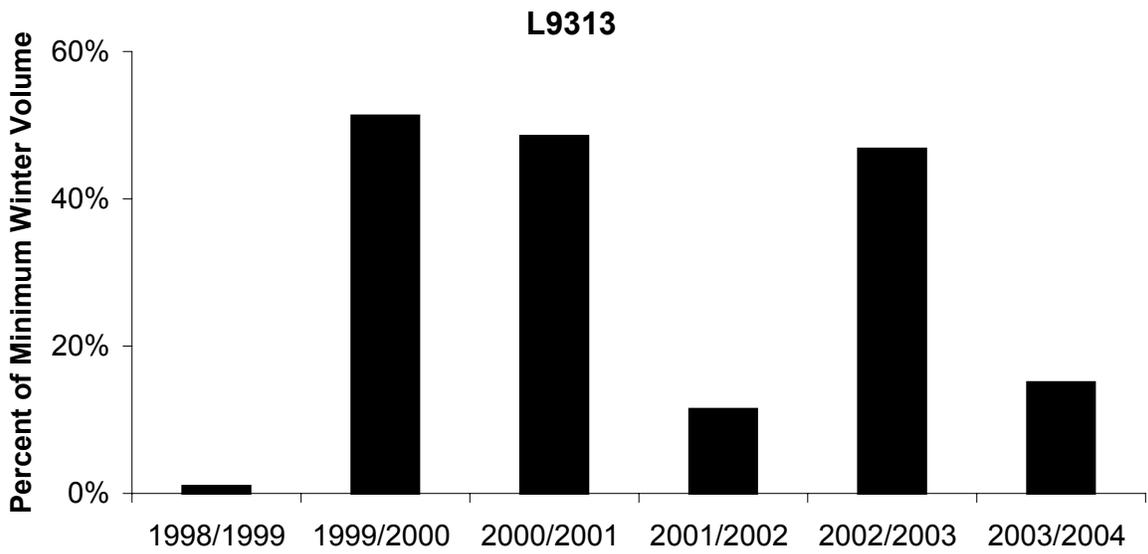
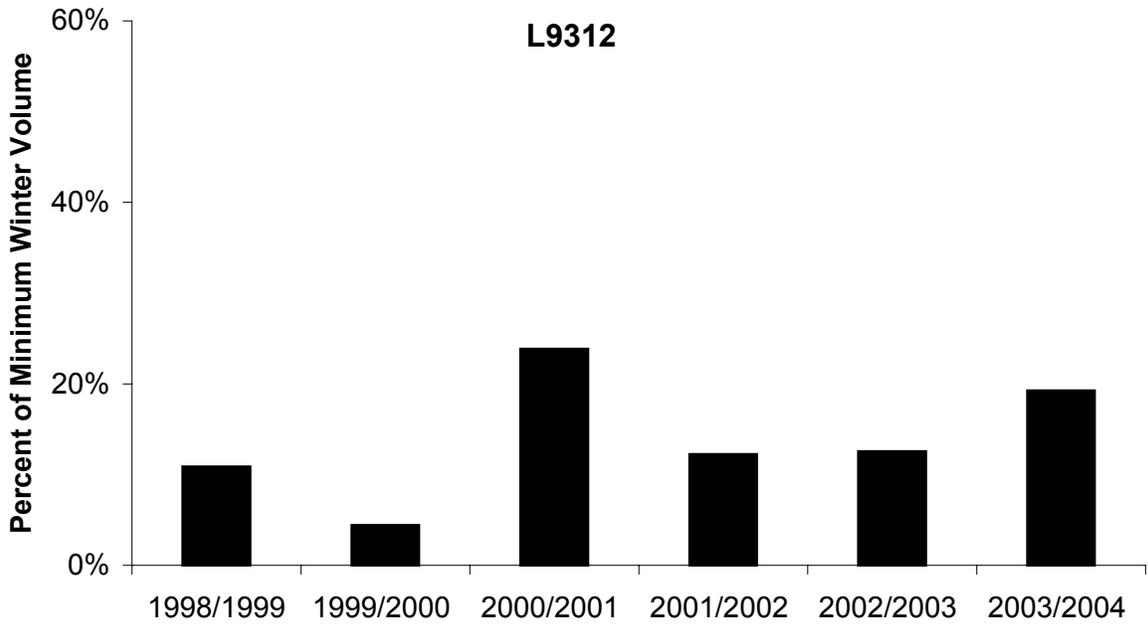


Figure 7. Percent of minimum winter water volume withdrawn from lakes L9312 and L9313 from 1998 to 2004.

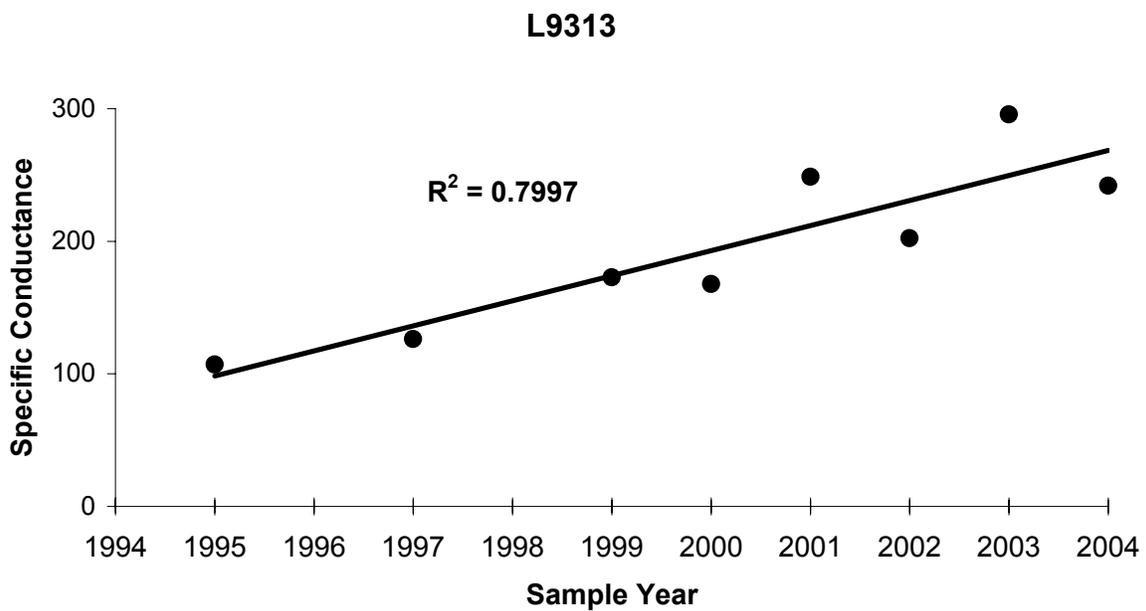
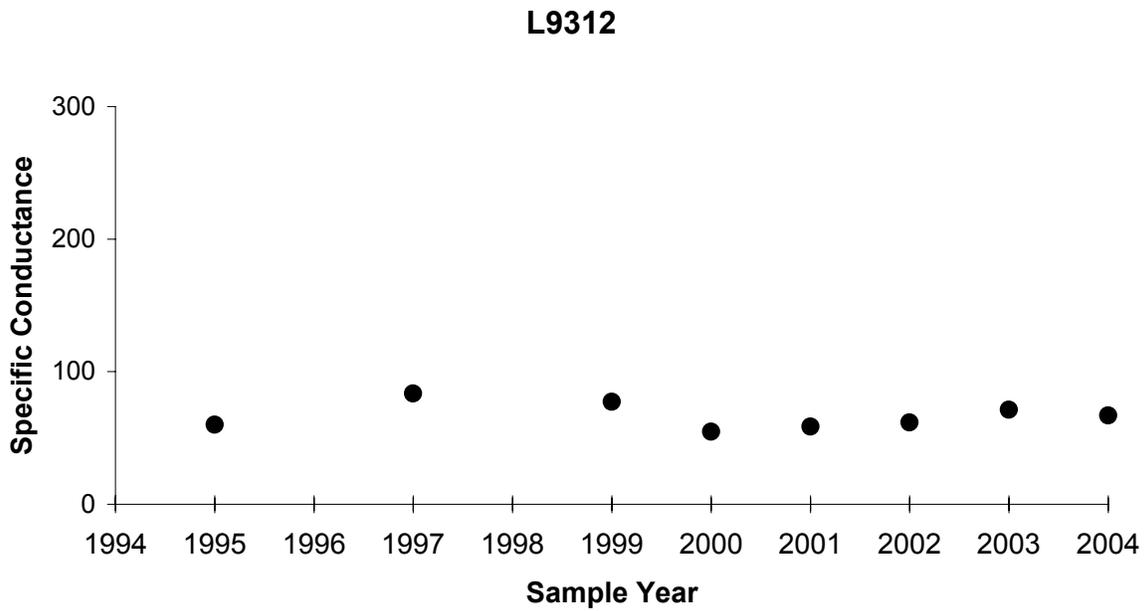


Figure 8. Specific conductance during July (in microS/cm) at two water source lakes in the Alpine Development Area, 1995-2004.

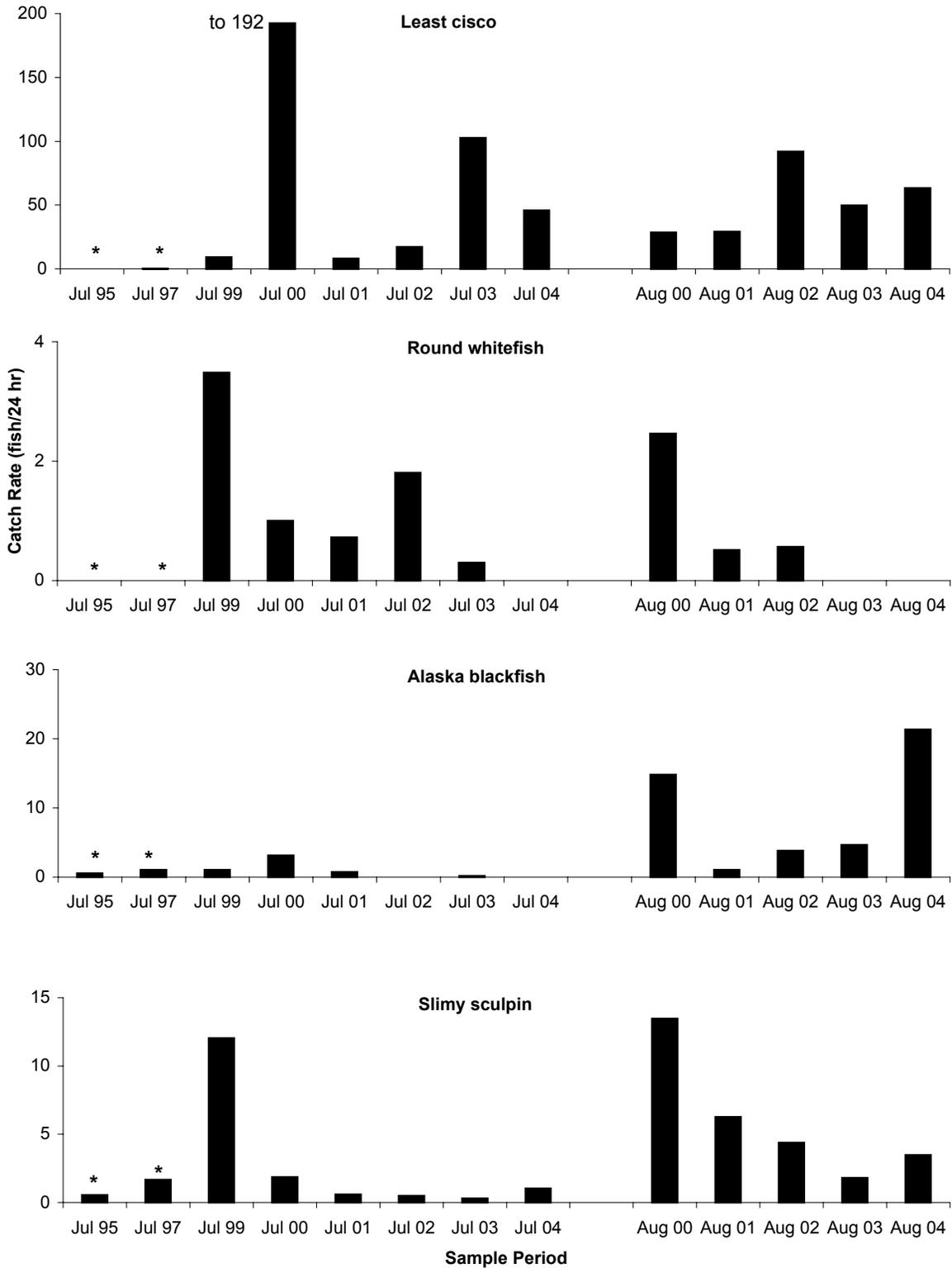


Figure 9. Mean catch rates of selected species in lake L9312, Alpine Development Area, 1995-2004 (\* = nets fished in 1995 and 1997 were at different locations).

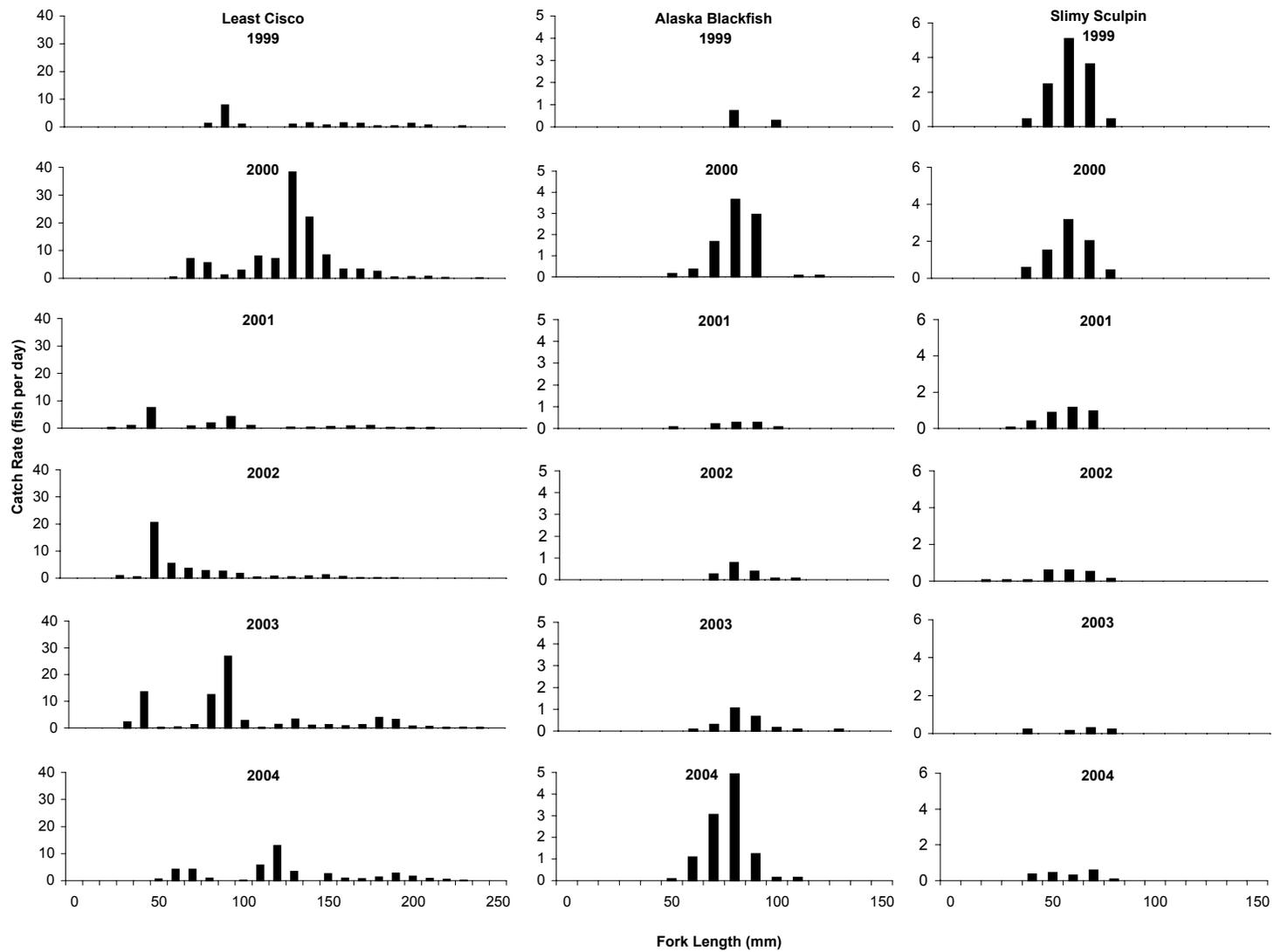


Figure 10. Length frequencies of least cisco, Alaska blackfish and slimy sculpin in lake L9312 during 1999-2004 sampling with fyke nets.

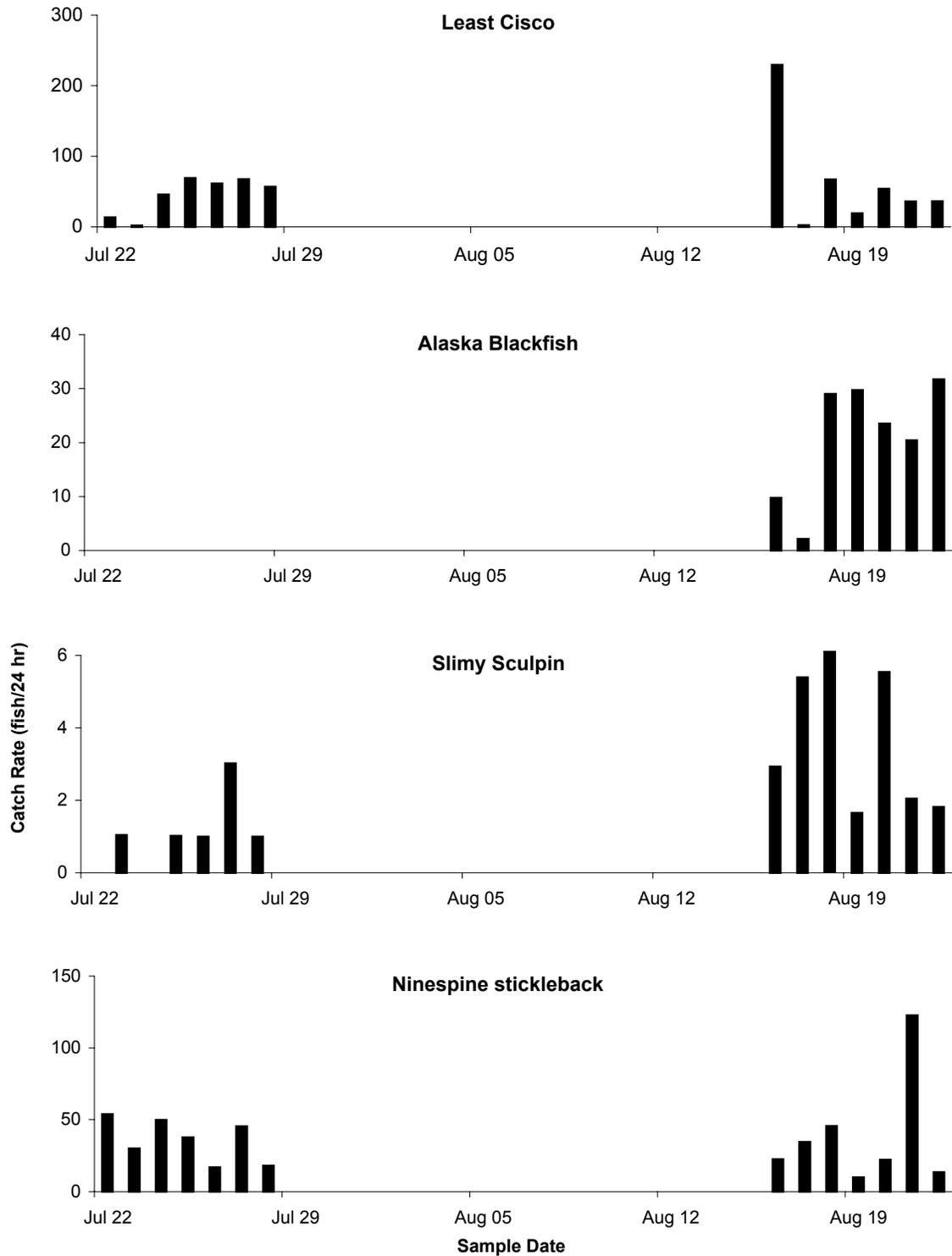


Figure 11. Daily pattern of catch for dominant species in lake L9312 during 2004 fyke net sampling (catches in fish per day).

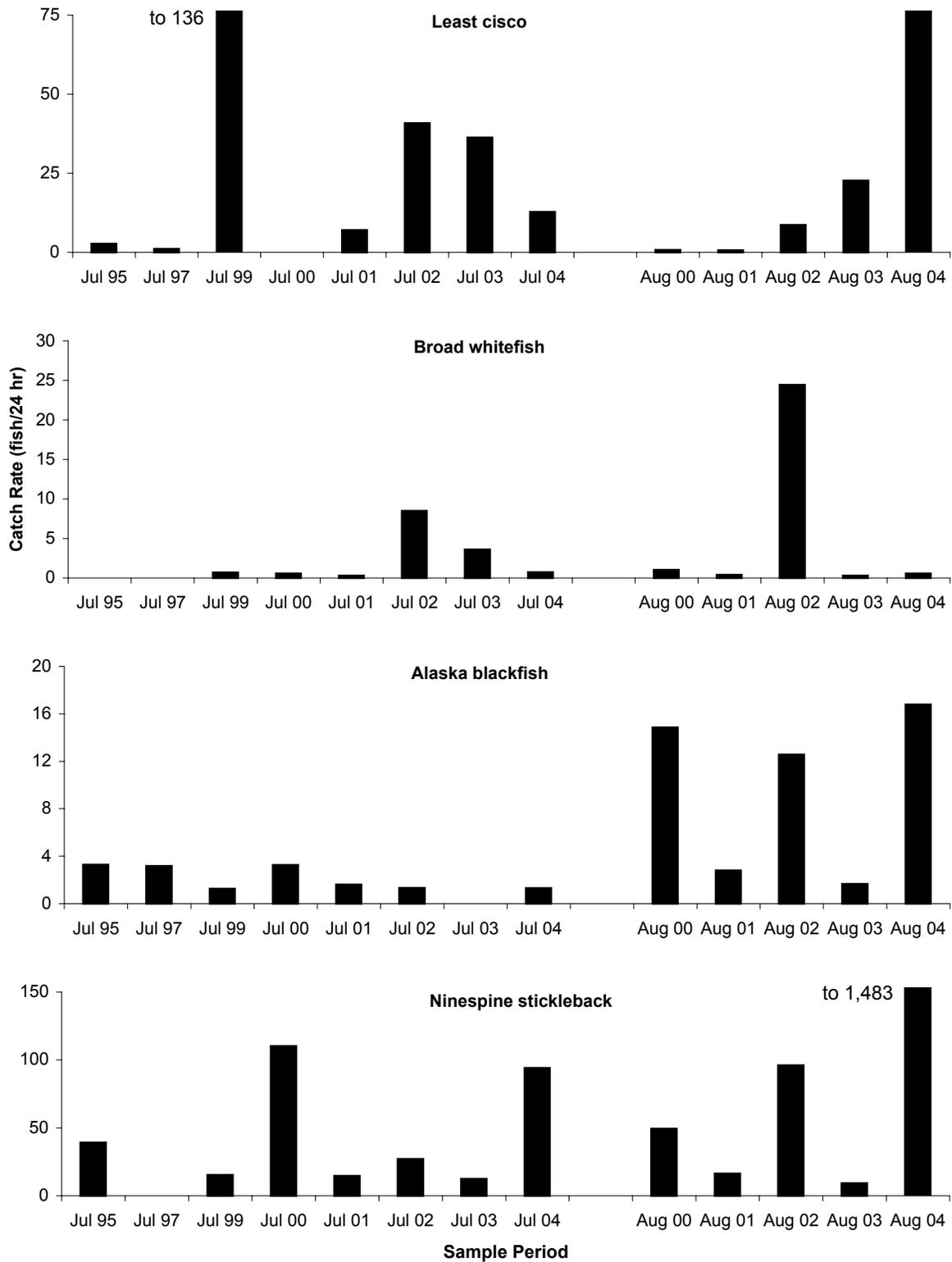


Figure 12. Mean catch rates of selected species in lake L9313, Alpine Development Area, 1995-2004 (\* = nets fished in 1995 and 1997 were at different locations).

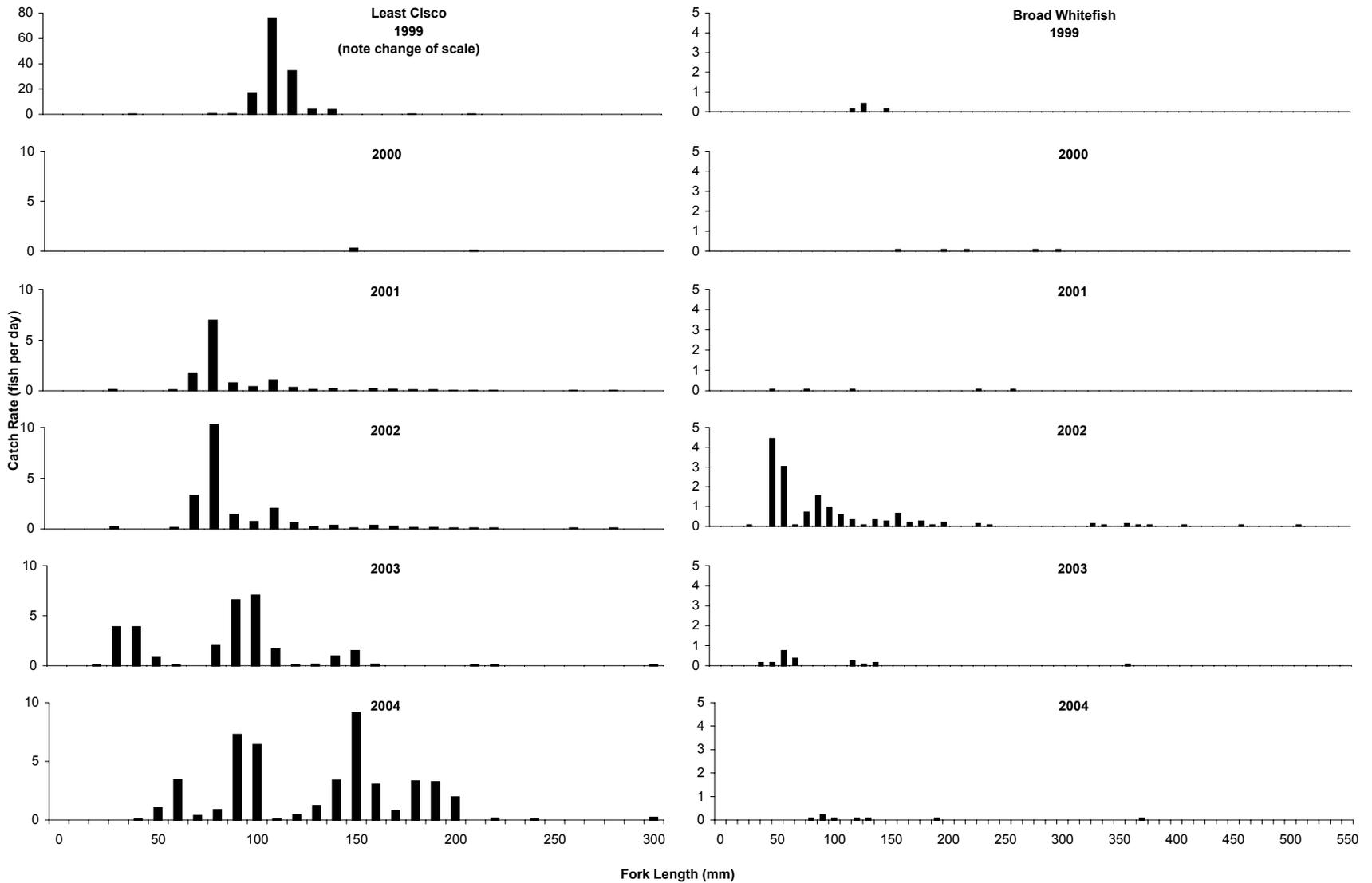


Figure 13. Length frequencies of least cisco and broad whitefish in lake L9313 during 1999-2004 sampling with fyke nets.

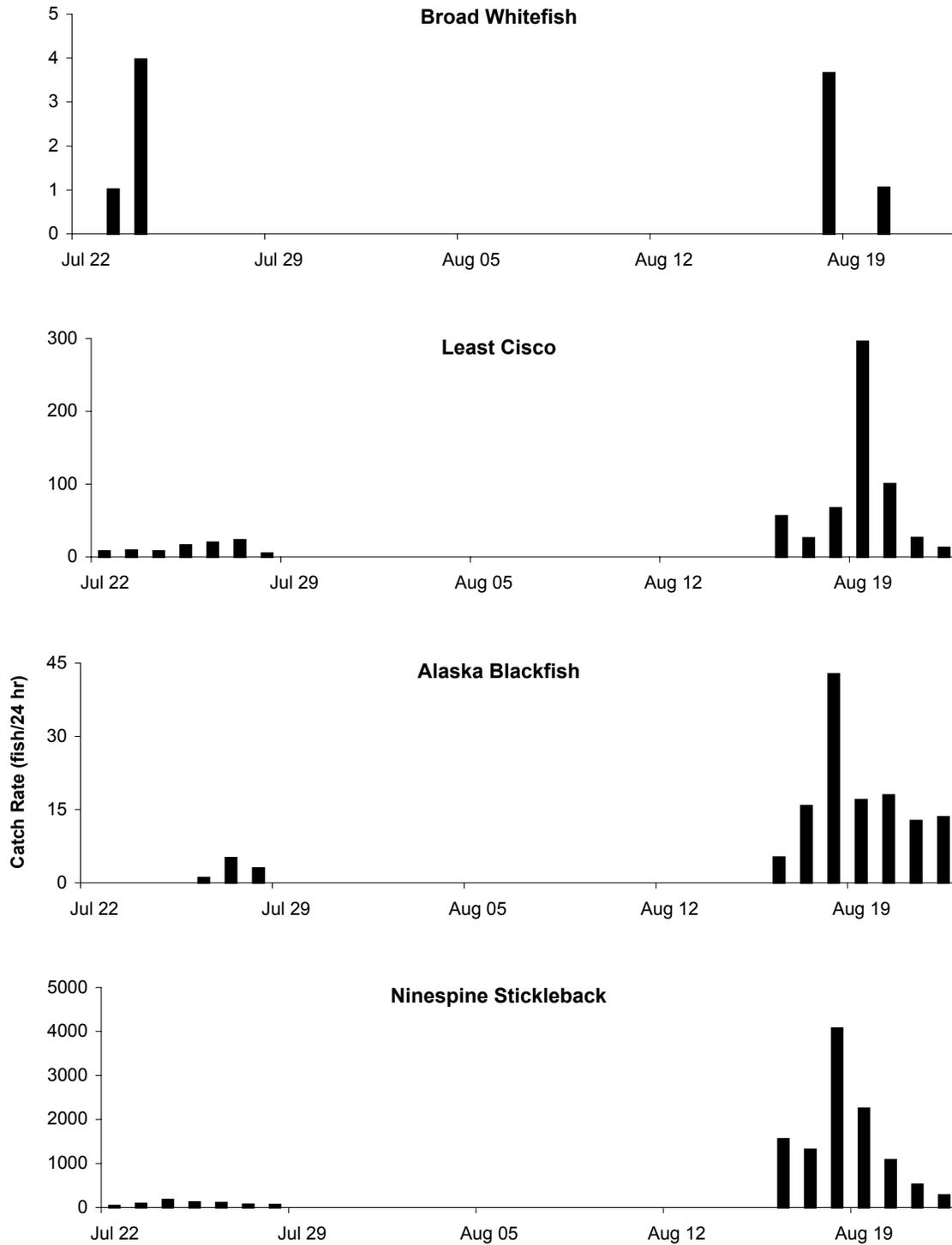


Figure 14. Daily pattern of catch for dominant species in lake L9313 during 2004 fyke net sampling (catches in fish per day).

**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 (°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 (°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 2003.

Date	Sample Depth (ft)	Water Temp (°C)	Dissolved Oxygen (mg/l)	Specific Conductance (microS/cm)	pH	Turbidity (NTU)	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 2003.

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

Appendix Table A-2. Water chemistry measurements for lake L9312, 1995 to 2003.

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

Appendix Table A-2. Water chemistry measurements for lake L9312, 1995 to 2003.

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

\* denotes soft lake bottom observed during field measurement

Appendix Table A-3. Water chemistry measurements for lake L9313, 1995-2003.

Date	Sample Depth (ft)	Water Temp (°C)	Dissolved Oxygen (mg/l)	Specific Conductance (microS/cm)	pH	Turbidity (NTU)	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, 1995-2003.

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

Appendix Table A-3. Water chemistry measurements for lake L9313, 1995-2003.

Date	Sample Depth (ft)	Water Temp (°C)	Dissolved Oxygen (mg/l)	Specific Conductance (microS/cm)	pH	Turbidity (NTU)	Total Depth (ft)	Ice Thickness (ft)	Source
1/16/2002	4.7	0.6	10.8	573	8.2	0.6	9.4	3.7	MBJ 2002
	7.7	1.9	9.5	623	7.5	0.6	9.4	3.7	MBJ 2002
2/9/2002	5.3	1.1	7.1	764	7.1	1.1	9.5	4.4	MBJ 2002
	8.3	2.1	6.0	723	7.1	1.1	9.5	4.4	MBJ 2002
3/12/2002	6	1.7	3.8	805	6.3	1.1	9.5	5.4	MBJ 2002
	9	2.2	2.8	836	6.3	1.2	9.5	5.4	MBJ 2002
4/7/2002	6.8	1.4	0.1	910	6.9	0.9	9.4	5.8	MBJ 2002
	8.0	2.1	0.0	1066	6.9	0.9	9.4	5.8	MBJ 2002
5/11/2002	7.0	3.1	4.0	894	7.3	13.9	9.5	5.9	MBJ 2002
7/22/2002	surface	15.7	9.3	201	7.5	1.1			MJM Research
7/23/2002	surface	14.4	9.5	202	7.4	0.9			MJM Research
7/24/2002	surface	13.7	10.2	201	7.5	5.3			MJM Research
7/25/2002	surface	11.6	10.1	202	7.5	1.5			MJM Research
7/26/2002	surface	10.6	10.8	202	7.6	1.3			MJM Research
7/27/2002	surface	10.9	11.1	202	7.5	1.0			MJM Research
7/28/2002	surface	10.6	11.1	207	7.7	1.0			MJM Research
7/29/2002	surface	11.0	11.5	203	8.2	1.4			MJM Research
8/3/2002	surface	15.3	10.0	176	8.2	0.9			MJM Research
	3.3	15.2	9.9	176	8.1	0.9			MJM Research
	6.6	15.1	9.9	176	8.1	0.9			MJM Research
	9.8	15.1	9.7	176	8.1	0.7			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	7.9	3.1			MJM Research
8/22/2002	surface	5.5	11.6	208	7.6	3.7			MJM Research
8/23/2002	surface	6.4	11.5	208	7.6	2.8			MJM Research
8/24/2002	surface	6.4	11.8	213	7.5	3.1			MJM Research
8/25/2002	surface	8.1	11.9	208	7.6	2.9			MJM Research
8/26/2002	surface	9.2	11.1	209	7.6	1.7			MJM Research
8/27/2002	surface	9.4	12.2	209	7.7	2.2			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, 1995-2003.

Date	Sample Depth (ft)	Water Temp (°C)	Dissolved Oxygen (mg/l)	Specific Conductance (microS/cm)	pH	Turbidity (NTU)	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	8.0	0.8			MJM Research
7/23/2003	surface	14.6	9.9	295	8.0	1.4			MJM Research
7/24/2003	surface	14.3	9.9	295	7.7	1.7			MJM Research
7/25/2003	surface	12.2	9.8	296	7.7	3.9			MJM Research
7/26/2003	surface	11.1	10.4	295	7.8	3.4			MJM Research
7/28/2003	surface	7.8	11.3	297	7.7	8.6			MJM Research
8/15/2003	surface	6.8	12.4	285	7.7	2.2			MJM Research
8/16/2003	surface	6.7	11.8	301	7.7	1.5			MJM Research
8/17/2003	surface	6.5	11.8	285	7.7	1.2			MJM Research
8/18/2003	surface	6.6	12.1	306	7.7	1.1			MJM Research
8/19/2003	surface	6.3	12.2	287	7.7	0.9			MJM Research
8/20/2003	surface	6.3	12.3	289	7.7	1.3			MJM Research
8/21/2003	surface	6.0	12.3	292	7.7	0.9			MJM Research
8/22/2003	surface	6.2	12.8	287	7.7	0.7			MJM Research
7/22/2004	surface	11.7	10.5	240	7.8	0.7			MJM Research
7/23/2004	surface	12.8	10.9	241	8.0	0.7			MJM Research
7/24/2004	surface	14.6	10.9	241	7.9	0.4			MJM Research
7/25/2004	surface	14.5	10.5	242	8.0	0.8			MJM Research
7/26/2004	surface	15.4	9.5	243	7.8	0.4			MJM Research
7/27/2004	surface	15.6	9.4	243	7.6	0.5			MJM Research
7/28/2004	surface	13.9	9.2	244	7.9	0.7			MJM Research
8/16/2004	surface	13.7	10.4	251	7.7	0.8			MJM Research
8/17/2004	surface	15.9	11.0	249	8.0	1.1			MJM Research
8/18/2004	surface	17.0	10.9	250	7.9	1.0			MJM Research
8/19/2004	surface	15.2	12.5	250	7.9	1.1			MJM Research
8/20/2004	surface	14.5	9.7	250	7.9	1.2			MJM Research
8/21/2004	surface	13.3	10.2	251	7.8	0.8			MJM Research
8/22/2004	surface	13.1	10.4	252	7.9	0.9			MJM Research
8/23/2004	surface	11.5	10.1	252	7.8	0.8			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 (°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 (°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 (°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 (°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 (°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
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 (°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 [CaCO <sub>3</sub> ] (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 (L9282)	1985					103		Bendock & Burr 1986
	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							L9313						
Date	Depth (m)	Water Temp. (oC)	Dissolved Oxygen		Specific		Date	Depth (m)	Water Temp. (oC)	Dissolved Oxygen		Specific	
			(mg/l)	Percent Saturation	(µS/cm)	Turbidity (NTU)				(mg/l)	Percent Saturation	(µS/cm)	Turbidity (NTU)
8/15/2000	surface	6.2	11.6	93.8	55.1	4.0	7/18/2000	surface	11.2	10.6	96.8	161.8	3.6
	1.5	6.0	11.7	93.7	55.1	4.1		1.5	11.1	10.5	96.4	162.2	3.3
	2.5	5.9	11.9	95.3	55.1	3.9		2.5	10.8	10.8	98.0	162.6	3.3
	3.5	5.9	11.7	94.3	55.1	5.7		3.5	10.8	10.9	98.1	162.7	3.5
7/21/2000	surface	10.4	11.1	100.2	53.3	10.5	8/15/2000	surface	6.6	12.3	99.8	170.4	5.5
	1.5	10.0	11.2	98.8	53.4	7.6		1.5	5.9	12.4	98.0	171.1	5.7
	2.5	9.8	11.1	98.5	53.4	7.5		2.5	5.7	12.6	100.4	171.3	15.0
	3.5	9.6	11.1	98.3	53.4	8.6		3.5	5.7	12.5	100.3	171.4	7.5
7/28/2001	surface	13.3	8.6	83.1	59	1.1	7/25/2001	surface	13.2	9.2	87.0	249	1.7
	1.0	13.4	8.7	83.2	59	1.1		1.0	13.6	9.5	91.2	247	1.4
	2.0	13.4	8.5	81.5	59	1.2		2.0	13.6	9.5	91.7	247	1.3
	3.0	13.4	8.5	81.3	59	1.7		3.0	13.7	10.0	94.5	247	4.6
8/25/2001	surface	4.7	13.2	102.3	58	0.5	8/25/2001	surface	4.4	12.6	97.4	249	0.7
	1.0	4.7	13.2	102.1	58	0.7		1.0	4.4	12.6	97.0	249	0.7
	2.0	4.7	13.1	101.4	58	1.0		2.0	4.5	12.5	97.0	248	1.0
	3.0	4.7	13.0	101.2	58	0.5		3.0	4.5	12.4	96.2	248	2.0
8/7/2002	surface	9.7	10.9	96.1	63	1.1	8/3/2002	surface	15.3	10.0	99.3	176	0.9
	1.0	9.7	10.8	95.1	63	1.3		1.0	15.2	9.9	98.9	176	0.9
	2.0	9.7	10.8	94.8	63	1.2		2.0	15.1	9.9	98.6	176	0.9
	3.0	9.7	10.7	94.6	63	1.2		3.0	15.1	9.7	97.7	176	0.7
8/14/2002	1.2	9.4	11.3		68	1.1	8/14/2002	1.4	9.5	11.4		241	1.0
	2.1	9.3	11.3		70	1.3		2.3	9.4	11.4		244	1.6
	3.0	9.3	11.2		71	1.2							
8/1/2003	surface	8.4	11.9	70.0	8	1.2	8/1/2003	surface	8.5	11.9	296.1	8	1.4
	1.0	8.4	11.9	69.8	8	1.2		1.0	8.5	11.8	295.8	8	1.5
	2.0	8.4	11.9	69.8	8	1.4		2.0	8.5	11.9	295.7	8	1.4
	3.0	8.4	11.9	69.8	8	1.3		3.0	8.5	12.0	295.7	8	1.7
8/21/2003	surface	5.9	12.2	66.9	8	1.3	8/22/2003	surface	6.2	12.8	286.9	8	0.7
	1.0	5.9	12.3	67.2	8	1.2		1.0	6.0	12.9	285.8	8	1.0
	2.0	5.9	12.4	66.8	8	1.2		2.0	6.0	13.3	285.8	8	2.2
	3.0	5.9	12.3	66.9	8	1.0		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)
<b>L9312</b>	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		
<b>L9313</b>	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.

<b>Species</b>	<b>Net A Jul 29</b>	<b>Net A Jul 30</b>	<b>Net A Jul 31</b>	<b>Net B Aug 1</b>	<b>Net B Aug 2</b>	<b>Net B Aug 3</b>	<b>Net B Aug 4</b>	<b>Net A Total</b>	<b>Net B Total</b>
<b>L9312</b>									
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
<b>L9313</b>									
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	July							Total	Aug							Total
	Jul 23	Jul 24	Jul 25	Jul 26	Jul 27	Jul 28	Jul 29		Aug 16	Aug 17	Aug 18	Aug 19	Aug 20	Aug 21	Aug 22	
<b>L9312</b>																
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
<b>L9313</b>																
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

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

	July								August								
	Jul 22	Jul 23	Jul 24	Jul 25	Jul 26	Jul 27	Jul 28	Total	Aug 17	Aug 18	Aug 19	Aug 20	Aug 21	Aug 22	Aug 23	Aug 24	Total
<b>L9312</b>																	
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
<b>L9313</b>																	
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.

	July									August							
	Jul 22	Jul 23	Jul 24	Jul 25	Jul 26	Jul 27	Jul 28	Jul 29	Total	Aug 21	Aug 22	Aug 23	Aug 24	Aug 25	Aug 26	Aug 27	Total
<b>L9312</b>																	
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
<b>L9313</b>																	
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

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

	July								August							
	Jul 22	Jul 23	Jul 24	Jul 25	Jul 26	Jul 27	Jul 28	Total	Aug 16	Aug 17	Aug 18	Aug 19	Aug 20	Aug 21	Aug 22	Total
<b>L9312</b>																
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
<b>L9313</b>																
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

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

	July								August									
	Jul 22	Jul 23	Jul 24	Jul 25	Jul 26	Jul 27	Jul 28	Total	Aug 17	Aug 18	Aug 19	Aug 20	Aug 21	Aug 22	Aug 23	Total		
<b>L9312</b>																		
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		
<b>L9313</b>																		
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. Tagged fish released in Alpine lakes L9312 and L9313 during 2001.

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

Appendix Table B-9. Tagged fish released in Alpine lakes L9312 and L9313 during 2002.

Lake	Species	Release Date	Release Length	Tag Code	Recapture Date	Days Out
<b>L9312</b>						
	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		
<b>L9313</b>						
	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-10. Tagged fish released in Alpine lakes L9312 and L9313 during 2003

Lake	Species	Release Date	Release Length	Tag Code	Recapture Date	Days Out
<b>L9312</b>	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-10. Tagged fish released in Alpine lakes L9312 and L9313 during 2003

Lake	Species	Release Date	Release Length	Tag Code	Recapture Date	Days Out
<b>L9312</b>						
	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-10. Tagged fish released in Alpine lakes L9312 and L9313 during 2003

Lake	Species	Release Date	Release Length	Tag Code	Recapture Date	Days Out
<b>L9312</b>						
	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-10. Tagged fish released in Alpine lakes L9312 and L9313 during 2003

Lake	Species	Release Date	Release Length	Tag Code	Recapture Date	Days Out
<b>L9313</b>						
	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-11. Tagged fish released in Alpine lakes L9312 and L9313 during 2004.

Lake	Species	Release Date	Release Length	Tag Code	Recapture Date	Days Out
<b>L9312</b>						
	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-11. Tagged fish released in Alpine lakes L9312 and L9313 during 2004.

Lake	Species	Release Date	Release Length	Tag Code	Recapture Date	Days Out
<b>L9312</b>						
	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		
<b>L9313</b>						
	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-11. Tagged fish released in Alpine lakes L9312 and L9313 during 2004.

Lake	Species	Release Date	Release Length	Tag Code	Recapture Date	Days Out
<b>L9312</b>						
	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-11. Tagged fish released in Alpine lakes L9312 and L9313 during 2004.

Lake	Species	Release Date	Release Length	Tag Code	Recapture Date	Days Out
<b>L9313</b>						
	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 C**  
**Length Frequency Data from lakes L9312 and L9313**  
**2004**

Appendix Table C-1. Length frequencies of least cisco caught by fyke net in the Alpine study area, 2004.

Fork L9312 Length (mm)	Jul								Aug							
	Jul 22	Jul 23	Jul 24	Jul 25	Jul 26	Jul 27	Jul 28	Total	Aug 17	Aug 18	Aug 19	Aug 20	Aug 21	Aug 22	Aug 23	Total
0								0								0
10								0								0
20								0								0
30								0								0
40								0								0
50			5	2				7								0
60	2		2	27	23	2		56	1							1
70	1	1		8	15	28	1	54	3							3
80							1	1	6		2			1	1	10
90								0								0
100								0			1	1				2
110			6	5	4		5	20	35		12	3	5		3	58
120			1	16	6	1	2	26	51	2	38	12	23	2	24	152
130				1		1	4	6	18		4	4	3	8	3	40
140			1	2	5	1	3	0	6		2		1	1		0
150	1			2	4	3	7	17	1		3	2	3	2	6	17
160	1	1	2	1	2	1	1	9	1		1		1			3
170			2		1	1		4	2				2			4
180			1	1	1	4	5	12	3					1	1	5
190	1		12	1	1		7	22	11		2		1	1		15
200	3		2	2		5	1	13	7					1	1	9
210	2		2			1		5	3		1	1				5
220	1		2			1	1	5								0
230								0							1	1
240								0	3							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
<b>Total:</b>	12	2	38	68	62	49	38	257	151	2	66	23	39	17	40	325

Appendix Table C-1. Length frequencies of least cisco caught by fyke net in the Alpine study area, 2004.

Fork	L9313								Aug								
	Length (mm)	Jul 22	Jul 23	Jul 24	Jul 25	Jul 26	Jul 27	Jul 28	Total	Aug 17	Aug 18	Aug 19	Aug 20	Aug 21	Aug 22	Aug 23	Total
0								0									0
10								0									0
20								0									0
30								0									0
40								0						1			1
50								0						13	1		14
60								0					2	36	2	8	48
70	1					2	1	4								1	1
80	1	5		1			1	8					1	1	2		4
90		2					1	3	15	5	6	29	32	11			98
100								0	4	4	13	51	5	9	3		89
110								0								1	1
120								0				3	2	1			6
130			2			1	3	6	2		4	2	3				11
140	3			3		4	4	0	1	5	3	23	15				47
150	1			3	1	1	5	11	17	4	8	62	23	1	1		116
160					1	1	3	5	1		7	23	5			1	37
170				1	2			3				6	2				8
180	1				3	2	1	7	4		4	31					39
190				1	5	8	1	2	11	4	6	6	1				28
200						1	2	3	8	1	3	12					24
210								0									0
220					2			2									0
230								0									0
240								0					1				1
250								0									0
260								0									0
270								0									0
280								0									0
290								0									0
300							1	1				1					1
310								0		2							2
320					1			2									0
330								0									0
340								0									0
350							1	0									0
360								0									0
370								0									0
380								0									0
390								0									0
400								0									0
Total:	7	9	8	16	20	23	5	73	65	23	55	252	139	27	15		576

Appendix Table C-2. Length frequencies of broad whitefish caught by fyke net in the Alpine study area, 2004.

Fork Length (mm)	L9313			Aug		
	Jul 23	Jul 24	Jul Total	Aug 19	Aug 21	Total
30			0			0
40			0			0
50			0			0
60			0			0
70			0			0
80			0			0
90			0			0
100			0			0
110			0		1	1
120		3	3			0
130	1		1			0
140			0			0
150			0	1		1
160			0	1		1
170			0			0
180			0			0
190			0			0
200			0			0
210			0			0
220			0	1		1
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		1	1			0
410			0			0
420			0			0
430			0			0
440			0			0
450			0			0
460			0			0
470			0			0
480			0			0
490			0			0
500			0			0
510			0			0
520			0			0
530			0			0
540			0			0
550			0			0
Total:	1	4	5	3	1	4

Appendix Table C-3. Length frequencies of round whitefish caught by fyke net in the Alpine study area, 2004.

Fork	L9313
Length	Jul 24
(mm)	
0	
10	
20	
30	
40	
50	
60	
70	
80	
90	
100	
110	
120	
130	
140	
150	
160	1
170	
180	
190	
200	
210	
220	
230	
240	
250	
260	
270	
280	
290	
300	
310	
320	
330	
340	
350	
360	
370	
380	
390	
400	
Total:	1

Appendix Table C-4. Length frequencies of Alaska blackfish caught by fyke net in the Alpine study area, 2004.

Fork Length (mm)	L9312								L9313				L9313							
								Aug				Jul								Aug
	Aug 17	Aug 18	Aug 19	Aug 20	Aug 21	Aug 22	Aug 23	Total	Jul 26	Jul 27	Jul 28	Total	Aug 17	Aug 18	Aug 19	Aug 20	Aug 21	Aug 22	Aug 23	Total
0								0				0								0
10								0				0								0
20								0				0								0
30								0				0								0
40								0				0								0
50						1		1				0			1		1			2
60	1		4	3	2	2	3	15		2		2	2	4	7	3	5	1	3	25
70	2	1	9	9	6	7	8	42			3	3		1	11	6	5	5	3	31
80	4	1	12	19	6	8	18	68	1	2		3	3	2	11	4	3	2	5	30
90	2		3	4	2	1	5	17		1		1		1	7	3	3	5	3	25
100				1		1		2				0			2			2	1	5
110					1		1	2				0					1			1
120								0				0							1	1
130								0				0			1					1
140								0				0								0
150								0				0								0
160								0				0								0
170								0				0								0
180								0				0								0
190	1							1				0								0
200								0				0								0
<b>Total:</b>	10	2	28	36	17	20	35	148	1	5	3	9	6	14	35	17	20	13	16	121

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Appendix Table C-5. Length frequencies of slimy sculpin caught by fyke net in the Alpine study area, 2004.

Fork <b>L9312</b>														
Length (mm)	Jul						Aug							
	Jul 23	Jul 25	Jul 26	Jul 27	Jul 28	Total	Aug 17	Aug 18	Aug 19	Aug 20	Aug 21	Aug 22	Aug 23	Total
0						0								0
10						0								0
20						0								0
30						0								0
40		1		1		2		2		2		1		5
50	1		1			2		1		2		3		6
60					1	1	2		1	1	1		1	4
70					1	1	2	3	1	1	1		1	8
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
<b>Total:</b>	1	1	1	3	1	7	3	5	6	2	4	2	2	24

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



# Project Note

**Baker**

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 (°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	Conductivity (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.



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





# 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 (°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	Conductivity (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.

D-6

**APPENDIX E**  
**Water Use Permits for lakes**  
**L9312 and L9313**

Appendix Table E-1. Permits issued by Alaska Dept of Fish and Game regarding water withdrawal from Alpine Development water-source lakes L9312 and L9313.

Lake	ADF&G Permit	Amendment Number	Date Issued	Authorized Withdrawal (million gals.)
L9312				
	FG97-III-0280		December 15, 1997	11.43
	FG99-III-0051		March 30, 1999	19.00
	FG99-III-0051	1	January 27, 2000	19.00
	FG99-III-0051	2	April 7, 2000	19.00
	FG99-III-0051	3	September 1, 2000	32.36
	FG99-III-0051	4	August 9, 2002	32.36
	FG99-III-0051	5	February 14, 2003	30.00
L9313				
	FG97-III-0190		December 13, 1997	7.80
	FG97-III-0190	1	March 30, 1999	13.40
	FG97-III-0190	2	April 7, 2000	13.40
	FG97-III-0190	3	September 1, 2000	10.34
	FG97-III-0190	4	August 9, 2002	10.34
	FG97-III-0190	5	February 14, 2003	6.00

## FISH HABITAT PERMIT (FG99-III-0051)

ISSUED: March 30, 1999  
EXPIRES: Upon Abandonment of Lake L93-12  
as a Water Source

William M. Fowler, Senior Permit Coordinator  
Alpine Development Project  
ARCO Alaska, Inc.  
P.O. Box 100360  
Anchorage, AK 99510-0360

Dear Mr. Fowler:

RE: Water Withdrawal/Intake Structure and Winter Ice Road Access; Lake L93-12; Colville River Delta (Stream No. 330-00-10700-0910); SIDAK9703-03OG; Colville River 18 (2-960874)

The Alaska Department of Fish and Game (ADF&G) originally authorized winter water removal from Lake L93-12 (U6.1) under Fish Habitat Permit FG97-III-0280. Stipulation #1 of FG97-III-0280 read as follows:

Summer water use is prohibited.

Note: Summer water use can be authorized with a permit amendment request from ARCO Alaska Inc. which includes the following information: access to and from the lake for equipment and transfer of water, location of pump/fuel, water removal rate and quantity, specifications for a screened intake to minimize fish entrainment/impingement, and monitoring of water surface elevations.

Lake L93-12 (U6.1) has now been designated as a permanent water source to support Alpine oilfield development. Information needed for summer water use was provided in your letter, with attachments, dated February 18, 1999.

Pursuant to AS 16.05.870(b), the Alaska Department of Fish and Game (ADF&G) is issuing a new permit (FG99-III-0051) for water withdrawal and placement of intake structures in Lake L93-12 (U6.1). ARCO Alaska Inc. requested authorization to remove up to 30 percent of the under-ice water volume from Lake L93-12 (U6.1). Based on revised calculations and additional data on water depth compiled by Dr. Larry Moulton (Alpine Development Area Lakes Contour Maps and Volume Estimates, December 1998) this would provide up to 19.0 million gallons (winter withdrawal) from Lake L93-12 (U6.1). The calculated drawdown in Lake L93-12 (U6.1) would be 8.4 inches if the 19.0 million gallons of water were removed.

ARCO Alaska Inc. included the final design drawings and specifications for the water intake structures for Lake L93-12 (U6.1). Lake L93-12 (U6.1) will have two intakes, each capable of supplying 100 percent of demand. Intake lines will be routed to a pile-supported valve house located on the lakeshore. The intake drum screen is sized to

limit screen face velocity to 0.1 foot/second through 0.04-inch (1 mm) wide screen slots. Each screen drum is sized to a maximum pumping rate of about 170 gallons per minute. The plans and specifications for the water intake system submitted with your letter of February 18, 1999, satisfy Stipulation #1 of Fish Habitat Permit FG97-III-0280 and are approved under the new permit (FG99-III-0051).

Construction plans for the placement of the intake structures and water lines in Lake L93-12 (U6.1) also were provided to the ADF&G in your February 18, 1999, letter. All construction will be carried out from ice pads or from the ice surface of the lake. The proposed design and construction plan does not require excavation of the shoreline for placement of the intake lines. The construction plan as submitted along with provisions for site rehabilitation, if needed, is approved.

Your proposed summer and winter water use from Lake L93-12 (U6.1) may have adverse effects on anadromous fish or their habitat, but should not obstruct the free passage of fish. In accordance with AS 16.05.870(d), project approval is hereby given subject to the following stipulations:

- (1) Winter water use from Lake L93-12 (U6.1) is limited to 15% of the total water volume below 7 feet (normal depth of ice cover).
- (2) Quantity of water taken from Lake L93-12 (U6.1) shall be monitored and gallons removed shall be reported quarterly to the Alaska Department of Natural Resources with a copy to the ADF&G.
- (3) ARCO Alaska Inc. shall monitor the water surface elevation of Lake L93-12 (U6.1). Water surface elevations shall be taken immediately after ice breakup and at least once a week for three weeks following breakup. Water surface elevations also shall be taken once each month until freezeup.
- (4) ARCO Alaska Inc. shall monitor water quality (dissolved oxygen, conductivity, turbidity) in Lake L93-12 (U6.1) in late winter and twice during the ice-free season. During the ice-free season, water quality samples shall be taken at 1 m intervals.
- (5) ARCO Alaska Inc. shall sample, with appropriate gear type, for fish presence in Lake L93-12 (U6.1) at least twice during the ice-free season.
- (6) ARCO Alaska Inc. shall submit, during the ice-free season, monthly reports containing data collected as required in Stipulations 3 through 5.

NOTE: The monitoring requirements identified in Stipulations 3 through 6 shall be followed for at least three years. Based on results of the first three years of data collection, the need for and frequency of monitoring will be assessed and the need for continuation will be determined.

The permittee is responsible for the actions of contractors, agents, or other persons who perform work to accomplish the approved plan. For any activity that significantly deviates from the approved plan, the permittee shall notify the ADF&G and obtain written approval in the form of a permit amendment before beginning the activity. Any action taken by the permittee, or an agent of the permittee, that increases the project's overall

scope or that negates, alters, or minimizes the intent or effectiveness of any stipulation contained in this permit will be deemed a significant deviation from the approved plan. The final determination as to the significance of any deviation and the need for a permit amendment is the responsibility of the ADF&G. Therefore, it is recommended that the ADF&G be consulted immediately when a deviation from the approved plan is being considered.

This letter constitutes a permit issued under the authority of AS 16.05.870. This permit must be available to the on site field supervisor during the permitted activity. Please be advised that this approval does not relieve you of the responsibility of securing other permits, state, federal or local.

Pursuant to 6 AAC 80.010(b), the conditions of this permit are consistent with the Standards of the Alaska Coastal Management Program and the North Slope Borough Coastal District Program.

In addition to the penalties provided by law, this permit may be terminated or revoked for failure to comply with its provisions or failure to comply with applicable statutes and regulations. The department reserves the right to require mitigation measures to correct disruption to fish and game created by the project and which were a direct result of the failure to comply with this permit or any applicable law.

The recipient of this permit (the permittee) shall indemnify, save harmless, and defend the department, its agents and its employees from any and all claims, actions or liabilities for injuries or damages sustained by any person or property arising directly or indirectly from permitted activities or the permittee's performance under this permit. However, this provision has no effect if, and only if, the sole proximate cause of the injury is the department's negligence.

This permit decision may be appealed in accordance with the provisions of AS 44.62.330--44.62.630.

Sincerely,

Robert G. Bosworth, Deputy Commissioner

BY: Alvin G. Ott, Regional Supervisor  
Habitat and Restoration Division  
Alaska Department of Fish and Game

cc: Nancy Welch, ADNR, Fairbanks  
Gene Pavia, DGC, Juneau  
Phillip Martin, USFWS, Fairbanks  
Lloyd Fanter, ACOE, Anchorage  
Sverre Pedersen, ADF&G, Fairbanks  
William Britt, SPCO, Anchorage  
Ted Rockwell, EPA, Anchorage  
Steve Geddes, ARCO, Anchorage  
Mayord Gorden Brown/Leonard Lampe, Village of Nuiqsut

Jim Haynes, ADNR, Anchorage  
Brad Fristoe, ADEC, Fairbanks  
Jon Dunham, NSB, Barrow  
Charles Swanton, ADF&G, Fairbanks  
Bill Morris, ADF&G, Fairbanks  
Jeanne Hanson, NMFS, Anchorage  
Bruce St. Pierre/Chris Brown, AAI, Kuparuk

Bill Fowler  
(FG99-III-0051)

4

3/30/99

Joe Nukapigak/Laston Chinn, Kuukpik Corp.  
Tom Mortensen, Nuiqsut Constructors, Anchorage

AGO/ago

# STATE OF ALASKA

## DEPARTMENT OF FISH AND GAME

HABITAT & RESTORATION DIVISION

TONY KNOWLES, GOVERNOR

1300 COLLEGE ROAD  
FAIRBANKS, ALASKA 99701-1599  
PHONE: (907) 459-7289  
FAX: (907) 456-3091

### FISH HABITAT PERMIT (FG99-III-0051)

#### AMENDMENT #1

ISSUED: January 27, 2000

EXPIRES: Upon Abandonment of Lake L93-12  
as a Water Source

William M. Fowler, Senior Permit Coordinator  
Alpine Development Project  
ARCO Alaska, Inc.  
P.O. Box 100360  
Anchorage, AK 99510-0360

Dear Mr. Fowler:

RE: Water Withdrawal/Intake Structure and Winter Ice Road Access; Lake L93-12;  
Colville River Delta (Stream No. 330-00-10700-0910); SIDAK9703-03OG;  
Colville River 18 (2-960874)

The Alaska Department of Fish and Game (ADF&G) has received and reviewed your request to increase the quantity of water removed from Lake L93-12 (U6.1) during winter. Your letter dated January 19, 2000, requested approval to allow for withdrawal of up to 30% of the under-ice water volume. In support of the request to remove up to 30% of the under-ice water volume, you provided data (water surface elevations, water surface and volume change during summer 1999, past water use, etc.) specific to the Lake L93-12 (U6.1). The intent of monitoring water surface elevations, water volumes removed, and recharge is to ensure that adequate water remains during winter to ensure the proper protection of fish resources. Data presented in the attachments to your January 19, 2000, letter constitutes our baseline data set for Lake L93-12 (U6.1). Fish Habitat Permit FG99-III-0051 is hereby amended to authorize removal of up to 30% on the under-ice volume of water. The exact amount of water to be removed will be adjusted annually based on the water use, recharge, and the water surface elevation in fall just prior to freezeup. All terms and conditions of the original permit remain in effect.

This permit decision may be appealed in accordance with the provisions of AS 44.62.330--44.62.630.

Sincerely,

Robert G. Bosworth, Deputy Commissioner



BY: Alvin G. Ott, Regional Supervisor  
Habitat and Restoration Division  
Alaska Department of Fish and Game

cc: Nancy Welch, ADNR, Fairbanks  
Glenn Gray, DGC, Juneau  
Larry Bright, USFWS, Fairbanks  
Lloyd Fanter, ACOE, Anchorage  
Sverre Pedersen, ADF&G, Fairbanks  
William Britt, SPCO, Anchorage  
Ted Rockwell, EPA, Anchorage  
Steve Geddes, AAI, Anchorage  
Riki Lebman, SPCO/DGC, Anchorage  
Mayor Gordon Brown/Leonard Lampe, Village of Nuiqsut  
Joe Nukapigak/Lanston Chinn, Kuukpik Corp.  
Mike Stahl, ARCO, Anchorage

Jim Haynes, ADNR, Anchorage  
Gary Schultz, ADNR, Fairbanks  
Gordon Brower, NSB, Barrow  
Charles Swanton, ADF&G, Fairbanks  
Jack Winters, ADF&G, Fairbanks  
Jeanne Hanson, NMFS, Anchorage  
Bruce St. Pierre/Leigh Gooding, AAI, Kuparuk  
Kellie Westphal, ADNR, Anchorage  
Stan Pavlas, ARCO, Anchorage

AGO/ago

# STATE OF ALASKA

## DEPARTMENT OF FISH AND GAME

HABITAT & RESTORATION DIVISION

TONY KNOWLES, GOVERNOR

1300 COLLEGE ROAD  
FAIRBANKS, ALASKA 99701-1599  
PHONE: (907) 459-7289  
FAX: (907) 456-3091

### FISH HABITAT PERMIT (FG99-III-0051)

#### AMENDMENT #2

ISSUED: April 7, 2000  
EXPIRES: Upon Abandonment of Lake L93-12  
as a Water Source

William M. Fowler, Senior Permit Coordinator  
Alpine Development Project  
ARCO Alaska, Inc.  
P.O. Box 100360  
Anchorage, AK 99510-0360

Dear Mr. Fowler:

RE: Water Withdrawal/Intake Structure and Winter Ice Road Access; Lake L93-12;  
Colville River Delta (Stream No. 330-00-10700-0910); SIDAK9703-03OG;  
Colville River 18 (2-960874)

The Alaska Department of Fish and Game (ADF&G) has received and reviewed your remedial plan for water intake pipeline settlement at Lake L93-12. Affected sections of the water pipelines will be elevated and placed on VSMS. Concrete saddles will be removed and disturbed areas revegetated and stabilized as needed. Plans call for work to begin this winter with completion by the summer of 2001. A complete description of the project was contained in your letter, with attachments, dated April 7, 2000. Fish Habitat Permit FG99-III-0051 is hereby amended to cover remedial work to stabilize the water pipelines and tundra.

This permit decision may be appealed in accordance with the provisions of AS 44.62.330--44.62.630.

Sincerely,

Robert G. Bosworth, Deputy Commissioner



BY: Alvin G. Ott, Regional Supervisor  
Habitat and Restoration Division  
Alaska Department of Fish and Game

Bill Fowler  
(FG99-III-0051, Amendment #2)

4/7/00

cc: Nancy Welch, ADNR, Fairbanks  
Riki Lebman, SPCO/DGC, Anchorage  
Larry Bright, USFWS, Fairbanks  
Lloyd Fanter, ACOE, Anchorage  
Sverre Pedersen, ADF&G, Fairbanks  
William Britt, SPCO, Anchorage  
Ted Rockwell, EPA, Anchorage  
Mike Joyce, AAI, Anchorage  
Steve Geddes, AAI, Anchorage  
Mike Stahl, ARCO, Anchorage  
Mayor Gordon Brown/Leonard Lampe, Village of Nuiqsut  
Joe Nukapigak/Lanston Chinn, Kuukpik Corp.

Jim Haynes, ADNR, Anchorage  
Gary Schultz, ADNR, Fairbanks  
Gordon Brower, NSB, Barrow  
Charles Swanton, ADF&G, Fairbanks  
Jack Winters, ADF&G, Fairbanks  
Jeanne Hanson, NMFS, Anchorage  
Leigh Gooding/Sally Rothwell, AAI, Kuparuk  
Bill Morris, ADF&G, Fairbanks  
Bob Hale, AAI, Anchorage  
Stan Pavlas, ARCO, Anchorage

AGO/ago

# STATE OF ALASKA

## DEPARTMENT OF FISH AND GAME

HABITAT & RESTORATION DIVISION

TONY KNOWLES, GOVERNOR

1300 COLLEGE ROAD  
FAIRBANKS, ALASKA 99701-1599  
PHONE: (907) 459-7289  
FAX: (907) 456-3091

### FISH HABITAT PERMIT (FG99-III-0051) AMENDMENT #3

ISSUED: September 1, 2000  
EXPIRES: Upon Abandonment of Lake L93-12  
as a Water Source

Mike Stahl, Senior Permit Coordinator  
Alpine Development Project  
Phillips Alaska, Inc.  
P.O. Box 100360  
Anchorage, AK 99510-0360

Dear Mr. Stahl:

RE: Water Withdrawal/Intake Structure and Winter Ice Road Access; Lake L93-12;  
Colville River Delta (Stream No. 330-00-10700-0910); SIDAK9703-030G;  
Colville River 18 (2-960874)

The Alaska Department of Fish and Game (ADF&G) has received your request to reset the water volume available for use effective 29 June 2000, and increase the permissible withdrawal volume of water in accordance with the lake-full water elevation achieved during break-up 2000. The ADF&G also received water surface elevation data obtained after break-up and lake water elevation stabilization had occurred. Phillips Alaska, Inc. has also provided updated volume calculations for Lake L93-12 (U6.1). Fish Habitat Permit FG99-III-0051 is hereby amended to reset the permissible water withdrawal volume effective 29 June 2000 and increase the withdrawal volume to 32.36 million gallons, with the following stipulations:

- 1) Annual permissible water volumes will be reset each year after break-up; a water-use year will be considered to extend from break-up to break-up regardless of elapsed time in days.
- 2) The permissible water withdrawal volume is increased in accordance with the new, lake-full, water surface elevation and volume to 32.36 million gallons.
  - a. This volume represents 30% of the under-ice water volume, assuming 7 feet of ice cover, at the recharged water surface elevation and volume.
  - b. At no point shall water withdrawal, evaporation, drainage, or any other event, or combination of events, exceed this volume of water unless a recharge event or events occur(s) during the open water season.

- c. Water surface elevation at the staff gage in Lake L93-12 should never fall below 7.0 feet, if this occurs water use must stop or the lake must be recharged.
- 3) Monitoring of fish, water, and water quality as described in the original permit stipulations 2 through 6 shall be continued for a minimum of 5 years to help assess potential impacts to anadromous fish and/or their habitat.
- 4) A method for lake recharge in the event natural flooding does not occur must be implemented in order to continue water withdrawal of 30% of the under-ice water volume.

All conditions and stipulations not specifically addressed in this permit amendment remain in effect.

This permit amendment may be appealed in accordance with the provisions of AS 44.62.330 – 44.62.630.

Sincerely,

Robert G. Bosworth, Deputy Commissioner



BY: Alvin G. Ott  
Habitat and Restoration Division  
Alaska Department of Fish and Game

cc: Nancy Welch, ADNR, Fairbanks  
Riki Lebman, SPCO/DGC, Anchorage  
Lloyd Fanter, ACOE, Anchorage  
Sverre Pedersen, ADF&G, Fairbanks  
William Britt, SPCO, Anchorage  
Bill Morris, ADF&G, Fairbanks  
Ted Rockwell, EPA, Anchorage  
Gary Schultz/Leon Lynch, ADNR, Fairbanks  
Thomas Manson/Shannon Donnelly, Phillips, Alpine  
Mayor Gordon Brown/Leonard Lampe, Village of Nuiqsut  
Joe Nukapigak/Lanston Chinn, Kuukpik Corp.

Steve Schmitz, ADNR, Anchorage  
Larry Bright, USFWS, Fairbanks  
Gordon Brower, NSB, Barrow  
Charles Swanton, ADF&G, Fairbanks  
Jack Winters, ADF&G, Fairbanks  
Jeanne Hanson, NMFS, Anchorage  
Pete McGee, ADEC, Fairbanks  
Kellie Westphal, ADNR, Anchorage

AGO/wam

# STATE OF ALASKA

TONY KNOWLES, GOVERNOR

## DEPARTMENT OF FISH AND GAME

HABITAT & RESTORATION DIVISION

1300 COLLEGE ROAD  
FAIRBANKS, ALASKA 99701-1599  
PHONE: (907) 459-7289  
FAX: (907) 456-3091

### FISH HABITAT PERMIT (FG99-III-0051)

#### AMENDMENT #4

ISSUED: August 9, 2002  
EXPIRES: Upon Abandonment of Lake L93-12  
as a Water Source

Bruce St. Pierre, Senior Permit Coordinator  
Alpine Development Project  
ARCO Alaska, Inc.  
P.O. Box 100360  
Anchorage, AK 99510-0360

Dear Mr. St. Pierre:

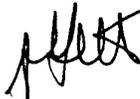
RE: Water Withdrawal/Intake Structure and Winter Ice Road Access; Lake L93-12;  
Colville River Delta (Stream No. 330-00-10700-0910); SIDAK9703-03OG;  
Colville River 18 (2-960874)

The Alaska Department of Fish and Game (ADF&G) has received your request to reset the water volume available for use effective June 12, 2002. Lake L93-12 fully recharged during spring breakup 2002. Data demonstrating recharge of Lake L93-12 and the stabilization period were provided with your July 18, 2002, letter. Fish Habitat Permit FG99-III-0051 is hereby amended to reset the permittable water withdrawal volume effective June 12, 2002 – water withdrawal volume set at 32.36 million gallons. All terms and conditions of Amendment #3 (issued September 1, 2000) remain in effect.

This permit amendment may be appealed in accordance with the provisions of AS 44.62.330 – 44.62.630.

Sincerely,

Robert G. Bosworth, Deputy Commissioner



BY: Alvin G. Ott, Regional Supervisor  
Habitat and Restoration Division  
Alaska Department of Fish and Game

Bruce St. Pierre  
(FG99-III-0051, Amendment #4)

2

August 9, 2002

cc: Leonard Lampe, Nuiqsut  
Eli Nukapigak, Nuiqsut  
Bill Tegoseak/James Patkotak, Barrow

Thomas Napageak, Nuiqsut  
Isaac Nukapigak, Nuiqsut

ecc: Harry Bader, ADNR, Fairbanks  
Gordon Brower, NSB, Barrow  
Glenn Gray, DGC, Juneau  
Kaye Laughlin, DGC, Anchorage  
Leon Lynch, ADNR, Fairbanks  
Ted Rockwell, EPA, Anchorage  
Gary Schultz, ADNR, Fairbanks  
Louise Smith, USFWS, Fairbanks  
Kellie Westphal, ADNR, Anchorage  
Jack Winters, ADF&G, Fairbanks

Larry Bright, USFWS, Fairbanks  
Joy Earp, ACOE, Anchorage  
Kanady/Manson, PHILLIPS, Alpine  
Bill Morris, ADF&G, Fairbanks  
Sverre Pedersen, ADF&G, Fairbanks  
Steve Schmitz, ADNR, Anchorage  
Dick Shideler, ADF&G, Fairbanks  
Charles Swanton, ADF&G, Fairbanks

Mr. Bruce St. Pierre  
FG99-III-0051 Amd. #5

February 14, 2003

# STATE OF ALASKA

**DEPARTMENT OF FISH AND GAME**  
*DIVISION OF HABITAT AND RESTORATION*

**FRANK MURKOWSKI, GOVERNOR**

1300 COLLEGE RD.  
FAIRBANKS, AK 99701  
PHONE: (907) 459-7289  
FAX: (907) 456-3091

**FISH HABITAT PERMIT (FG99-III-0051)  
AMENDMENT #5**

ISSUED: February 14, 2003  
EXPIRES: Upon Abandonment of Lake L93-12  
as a Water Source

Bruce St. Pierre, Senior Permit Coordinator  
Alpine Development Project  
Phillips Alaska, Inc.  
P.O. Box 100360  
Anchorage, AK 99510-0360

Dear Mr. St. Pierre:

RE: Water Withdrawal/Intake Structure and Winter Ice Road Access; Lake L93-12;  
Colville River Delta (Stream No. 330-00-10700-0910); SIDAK9703-030G;  
Colville River 18 (2-960874); LAS 23889

The Alaska Department of Fish and Game (ADF&G) has received and reviewed your application for a permanent water right for the waters contained in Lake L9312 in the Colville River Delta and for an amendment to Fish Habitat Permit FG99-III-0051. In support of your request, refined bathymetric maps and volume estimates were included for review. The refined data indicates that there is less water available below the ice during winter than previously estimated. Fish Habitat Permit FG99-III-0051 is hereby amended to authorize the removal of up to 30 million gallons (92.04 acre-feet) of water per water year (break-up to break-up regardless of date) with the following stipulation:

- 1) The permanent staff gage must be recalibrated to reflect the new bathymetry of the lake bottom and minimum lake water surface elevation must be established. The minimum lake water surface elevation will be that elevation corresponding with the withdrawal of 30 million gallons less the change in elevation attributable to evaporation of 1.5 mm of water per day. If the water



TONY KNOWLES, GOVERNOR

**DEPARTMENT OF FISH AND GAME**

*HABITAT & RESTORATION DIVISION*

1300 COLLEGE ROAD  
FAIRBANKS, ALASKA 99701-1599  
PHONE: (907) 456-7289  
FAX: (907) 456-3091

**FISH HABITAT PERMIT (FG97-III-0190)**

ISSUED: December 13, 1997  
EXPIRES: Upon Abandonment of Lake L93-13  
as a Water Source

Mark J. Schindler, Director  
Colville Permits and Compliance  
ARCO Alaska Inc.  
P.O. Box 100360  
Anchorage, AK 99510-1215

Dear Mr. Schindler:

RE: Water Withdrawal/Intake Structure and Winter Ice Road Access; Lake L93-13;  
Colville River Delta (Stream No. 330-00-10700-0910); SIDAK9703-03OG;  
Colville River 18 (2-960874)

Pursuant to AS 16.05.670(b), the Alaska Department of Fish and Game (ADF&G) has received and reviewed your proposal to develop the Alpine oilfield. Water sources for project startup, ice road construction and maintenance, development drilling, and operations were identified in the revised Environmental Evaluation Document dated September 1997 and the Michael Baker memorandum (Alpine Temporary Water Source Lakes) from Ms. Brooks dated October 15, 1997. About 42 to 65 million gallons will be used for ice road construction each year during Phase I and II, but only every three to five years during Phase III, and 10 million gallons will be used for the HDD crossing of the Colville River. Start-up development drilling will require 42,000 to 63,000 gallons per day. A pumphouse will be placed in Lake L93-13 and water moved via a pipeline to Alpine Pad 1.

Waters in the Colville River Delta supports both resident and anadromous fish species. Lake L93-13 is a perched lake with infrequent flooding that supports least cisco, ninespine stickleback, and Alaskan blackfish (Moulton 1997). Waters in the delta have been specified as being important for the migration, spawning, or rearing of anadromous fishes in accordance with AS 16.05.670(a). Lake L93-13 is located near Alpine Pad 1. Some inflow to Lake L93-13 was noted in June 1997 and the maximum depth found was 12.3 feet by Moulton (1997). Three cross sections for depth in Lake L93-13 were taken by Moulton (1997). Your proposed water use from this lake may have adverse effects on anadromous fish or their habitat, but should not obstruct the free passage of fish. In accordance with AS 16.05.670(d), project approval is hereby given subject to the following stipulations:

- (1) ARCO Alaska Inc. shall identify the total quantity of water needed from Lake L93-13 summer (June 15 to September 30) and winter (October 1 to June 15).

(Note: Since Lake L93-13 is the primary water source for development drilling and operations, the department will consider removal of water in excess of the winter criteria developed for waters in the Colville River delta. Based on Moulton's cross sections, we estimate total winter water available under the ice is about 7.6 million gallons using the 15% criteria.

- (2) ARCO Alaska Inc. shall provide to the department information on rate of water removal and provisions used to minimize the impingement or entrainment of fish. Design drawings for the pumphouse, water intake structure, screening, etc. shall be submitted to the department for review and approval.
- (3) ARCO Alaska Inc. shall report the quantity of water used from Lake L93-13 for the winter and summer time period to the Alaska Department of Natural Resources with a copy sent to the ADF&G.
- (4) Water surface elevation in Lake L93-13 shall be monitored to determine if drawdown over time occurs. Water surface elevations taken shall be submitted to the department. If natural recharge is not adequate to maintain an adequate water volume for industrial use and to ensure the proper protection of fish, then ARCO Alaska Inc. shall prepare and submit a plan for recharging Lake L93-13 to the department for review and approval.

The permittee is responsible for the actions of contractors, agents, or other persons who perform work to accomplish the approved plan. For any activity that significantly deviates from the approved plan, the permittee shall notify the ADF&G and obtain written approval in the form of a permit amendment before beginning the activity. Any action taken by the permittee, or an agent of the permittee, that increases the project's overall scope or that negates, alters, or minimizes the intent or effectiveness of any stipulation contained in this permit will be deemed a significant deviation from the approved plan. The final determination as to the significance of any deviation and the need for a permit amendment is the responsibility of the ADF&G. Therefore, it is recommended that the ADF&G be consulted immediately when a deviation from the approved plan is being considered.

This letter constitutes a permit issued under the authority of AS 16.05.670. This permit must be available to the on site field supervisor during the permitted activity. Please be advised that this approval does not relieve you of the responsibility of securing other permits, state, federal or local.

Pursuant to 6 AAC 80.010(b), the conditions of this permit are consistent with the Standards of the Alaska Coastal Management Program and the North Slope Borough Coastal District Program.

In addition to the penalties provided by law, this permit may be terminated or revoked for failure to comply with its provisions or failure to comply with applicable statutes and regulations. The department reserves the right to require mitigation measures to

Mark J. Schindler  
(FG97-III-0190)

3

December 13, 1997

correct disruption to fish and game created by the project and which were a direct result of the failure to comply with this permit or any applicable law.

The recipient of this permit (the permittee) shall indemnify, save harmless, and defend the department, its agents and its employees from any and all claims, actions or liabilities for injuries or damages sustained by any person or property arising directly or indirectly from permitted activities or the permittee's performance under this permit. However, this provision has no effect if, and only if, the sole proximate cause of the injury is the department's negligence.

This permit decision may be appealed in accordance with the provisions of AS 44.62.330—44.62.630.

Sincerely,

Robert G. Bosworth, Deputy Commissioner



BY: Alvin G. Ott, Regional Supervisor  
Habitat and Restoration Division  
Alaska Department of Fish and Game

Moulton, L.L. 1997. Lakes sampled for fish in and near the Colville River delta, Alaska 1979-1996. Prepared by MJM Research for ARCO Alaska, Inc. pp 2-365.

Moulton, L.L. 1997. Daily reports from 1997 summer field data collection distributed to ADF&G by e-mail.

cc: Nancy Welch, ADNR, Fairbanks  
Glenn Gray, DGC, Juneau  
Phillip Martin, USFWS, Fairbanks  
Lloyd Fanter, ACOE, Anchorage  
Terry Haynes, ADF&G, Fairbanks  
William Britt, SPCO, Anchorage  
Ted Rockwell, EPA, Anchorage  
Mayor Gordon Brown/Leonard Lampe, Village of Nuiqsut  
Joe Nukapigak/Laston Chinn, Kuukpik Corp.  
Jim Haynes, ADNR, Anchorage  
Brad Fristoe, ADEC, Fairbanks  
Jon Dunham, NSB, Barrow  
Fred Andersen, ADF&G, Fairbanks  
Carl Hemming, ADF&G, Fairbanks  
Jeanne Hanson, NMFS, Anchorage  
Larry/Chris Brown, AAI, Kuparuk

AGO/agg

## FISH HABITAT PERMIT (FG97-III-0190 - AMENDMENT #1)

ISSUED: March 30, 1999  
EXPIRES: Upon Abandonment of Lake L93-13  
as a Water Source

William M. Fowler, Senior Permit Coordinator  
Alpine Development Project  
ARCO Alaska, Inc.  
P.O. Box 100360  
Anchorage, AK 99510-0360

Dear Mr. Fowler:

RE: Water Withdrawal/Intake Structure and Winter Ice Road Access; Lake L93-13;  
Colville River Delta (Stream No. 330-00-10700-0910); SIDAK9703-03OG;  
Colville River 18 (2-960874)

Pursuant to AS 16.05.870(b), the Alaska Department of Fish and Game (ADF&G) has received and reviewed your request to amend Fish Habitat Permit FG97-III-0190 (letter dated February 18, 1999, with attachments). ARCO Alaska Inc. requests authorization to remove up to 30 percent of the under-ice water volume from Lake L93-13 (T6.1). Based on revised calculations and additional data on water depth compiled by Dr. Larry Moulton (Alpine Development Area Lakes Contour Maps and Volume Estimates, December 1998) this would provide up to 13.4 million gallons (winter withdrawal) from Lake L93-13 (T6.1). The calculated drawdown in Lake L93-13 (T6.1) would be 7.2 inches if the 13.4 million gallons of water were removed.

ARCO Alaska Inc. included the final design drawings and specifications for the water intake structures for Lake L93-13 (T6.1). Lake L93-13 (T6.1) will have two intakes, each capable of supplying 100 percent of demand. Intake lines will be routed to a pile-supported valve house located on the lakeshore. The intake drum screen is sized to limit screen face velocity to 0.1 foot/second through 0.04-inch (1 mm) wide screen slots. Each screen drum is sized to a maximum pumping rate of about 170 gallons per minute. The plans and specifications for the water intake system submitted with your letter of February 18, 1999, satisfy Stipulation #2 of Fish Habitat Permit FG97-III-0190 and are approved.

Construction plans for the placement of the intake structures and water lines in Lake L93-13 (T6.1) also were provided to the ADF&G in your February 18, 1999, letter. All construction will be carried out from ice pads or from the ice surface of the lake. The proposed design and construction plan does not require excavation of the shoreline for placement of the intake lines. The construction plan as submitted along with provisions for site rehabilitation, if needed, is approved.

The original permit (FG97-III-0190) issued on December 13, 1997, stated that the ADF&G would consider a winter water removal in excess of 15 percent. Based on supplement information submitted by ARCO Alaska Inc. (February 18, 1999, letter with attachments) and the commitment to develop a plan for recharge of Lake L93-13 (T6.1), the department hereby amends Fish Habitat Permit FG97-III-0190 to authorize removal of up to 30 percent of the under-ice water, subject to the following additional terms and conditions:

- (1) ARCO Alaska Inc. shall monitor the water surface elevation of Lake L93-13 (T6.1). Water surface elevations shall be taken immediately after ice breakup and at least once a week for three weeks following breakup. Water surface elevations also shall be taken once each month until freezeup.
- (2) ARCO Alaska Inc. shall monitor water quality (dissolved oxygen, conductivity, turbidity) in Lake L93-13 (T6.1) in late winter and twice during the ice-free season. During the ice-free season, water quality samples shall be taken at 1 m intervals.
- (3) ARCO Alaska Inc. shall sample, with appropriate gear type, for fish presence in Lake L93-13 (T6.1) at least twice during the ice-free season.
- (4) ARCO Alaska Inc. shall submit, during the ice-free season, monthly reports containing data collected as required in Stipulations 1 through 3.

NOTE: The monitoring requirements identified in Stipulations 1 through 4 shall be followed for at least three years. Based on results of the first three years of data collection, the need for and frequency of monitoring will be assessed and the need for continuation will be determined.

All terms and conditions of the original permit remain in effect.

Sincerely,

Robert G. Bosworth, Deputy Commissioner

BY: Alvin G. Ott, Regional Supervisor  
Habitat and Restoration Division  
Alaska Department of Fish and Game

cc: Nancy Welch, ADNR, Fairbanks  
Gene Pavia, DGC, Juneau  
Phillip Martin, USFWS, Fairbanks  
Lloyd Fanter, ACOE, Anchorage  
Sverre Pedersen, ADF&G, Fairbanks  
William Britt, SPCO, Anchorage  
Ted Rockwell, EPA, Anchorage  
Steve Geddes, ARCO, Anchorage  
Mayor Gorden Brown/Leonard Lampe, Village of Nuiqsut  
Joe Nukapigak/Laston Chinn, Kuukpik Corp.  
Tom Mortensen, Nuiqsut Constructors, Anchorage

Jim Haynes, ADNR, Anchorage  
Brad Fristoe, ADEC, Fairbanks  
Jon Dunham, NSB, Barrow  
Charles Swanton, ADF&G, Fairbanks  
Bill Morris, ADF&G, Fairbanks  
Jeanne Hanson, NMFS, Anchorage  
Bruce St. Pierre/Chris Brown, AAI, Kuparuk

Bill Fowler  
(FG97-III-0190, Amendment #1)

3

3/30/99

AGO/ago

# STATE OF ALASKA

## DEPARTMENT OF FISH AND GAME

HABITAT & RESTORATION DIVISION

TONY KNOWLES, GOVERNOR

1300 COLLEGE ROAD  
FAIRBANKS, ALASKA 99701-1599  
PHONE: (907) 459-7289  
FAX: (907) 456-3091

### FISH HABITAT PERMIT (FG97-III-0190 - AMENDMENT #2)

ISSUED: April 7, 2000  
EXPIRES: Upon Abandonment of Lake L93-13  
as a Water Source

William M. Fowler, Senior Permit Coordinator  
Alpine Development Project  
ARCO Alaska, Inc.  
P.O. Box 100360  
Anchorage, AK 99510-0360

Dear Mr. Fowler:

RE: Water Withdrawal/Intake Structure and Winter Ice Road Access; Lake L93-13;  
Colville River Delta (Stream No. 330-00-10700-0910); SIDAK9703-03OG;  
Colville River 18 (2-960874)

The Alaska Department of Fish and Game (ADF&G) has received and reviewed your remedial plan for water intake pipeline settlement at Lake L93-13. Affected sections of the water pipelines will be elevated and placed on VSMs. Concrete saddles will be removed and disturbed areas revegetated and stabilized as needed. Plans call for work to begin this winter with completion by the summer of 2001. A complete description of the project was contained in your letter, with attachments, dated April 7, 2000. Fish Habitat Permit FG97-III-0190 is hereby amended to cover remedial work to stabilize the water pipelines and tundra.

This permit decision may be appealed in accordance with the provisions of AS 44.62.330--44.62.630.

Sincerely,

Robert G. Bosworth, Deputy Commissioner



BY: Alvin G. Ott, Regional Supervisor  
Habitat and Restoration Division  
Alaska Department of Fish and Game

Bill Fowler  
(FG97-III-0190, Amendment #2)

2

4/7/00

cc: Nancy Welch, ADNR, Fairbanks  
Riki Lebman, SPCO/DGC, Anchorage  
Larry Bright, USFWS, Fairbanks  
Lloyd Fanter, ACOE, Anchorage  
Sverre Pedersen, ADF&G, Fairbanks  
William Britt, SPCO, Anchorage  
Ted Rockwell, EPA, Anchorage  
Mike Joyce, AAI, Anchorage  
Steve Geddes, AAI, Anchorage  
Mike Stahl, ARCO, Anchorage  
Mayor Gordon Brown/Leonard Lampe, Village of Nuiqsut  
Joe Nukapigak/Lanston Chinn, Kuukpik Corp.

Jim Haynes, ADNR, Anchorage  
Gary Schultz, ADNR, Fairbanks  
Gordon Brower, NSB, Barrow  
Charles Swanton, ADF&G, Fairbanks  
Jack Winters, ADF&G, Fairbanks  
Jeanne Hanson, NMFS, Anchorage  
Leigh Gooding/Sally Rothwell, AAI, Kuparuk  
Bill Morris, ADF&G, Fairbanks  
Bob Hale, AAI, Anchorage  
Stan Pavlas, ARCO, Anchorage

AGO/ago

# STATE OF ALASKA

TONY KNOWLES, GOVERNOR

## DEPARTMENT OF FISH AND GAME

HABITAT & RESTORATION DIVISION

1300 COLLEGE ROAD  
FAIRBANKS, ALASKA 99701-1599  
PHONE: (907) 459-7289  
FAX: (907) 456-3091

### FISH HABITAT PERMIT (FG97-III-0190) AMENDMENT #3

ISSUED: September 1, 2000  
EXPIRES: Upon Abandonment of Lake L93-13  
as a Water Source

Mike Stahl, Senior Permit Coordinator  
Alpine Development Project  
Phillips Alaska, Inc.  
P.O. Box 100360  
Anchorage, AK 99510-0360

Dear Mr. Stahl:

RE: Water Withdrawal/Intake Structure and Winter Ice Road Access; Lake L93-13;  
Colville River Delta (Stream No. 330-00-10700-0910); SIDAK9703-030G;  
Colville River 18 (2-960874)

The Alaska Department of Fish and Game (ADF&G) has received your request to reset the water volume available for use effective 29 June 2000, and increase the permittable withdrawal volume of water in accordance with the lake-full water elevation achieved during break-up 2000. The ADF&G also received water surface elevation data obtained after break-up and lake water elevation stabilization had occurred. Phillips Alaska, Inc. has also provided updated volume calculations for Lake L93-13 (T6.1). Fish Habitat Permit FG97-III-0190 is hereby amended to reset the permittable water withdrawal volume effective 29 June 2000 and increase the withdrawal volume to 10.34 million gallons, with the following stipulations:

- 1) Annual permittable water volumes will be reset each year after break-up; a water-use year will be considered to extend from break-up to break-up regardless of elapsed time in days.
- 2) The permittable water withdrawal volume is increased in accordance with the new, lake-full, water surface elevation and volume to 10.34 million gallons.
  - a. This volume represents 30% of the under-ice water volume, assuming 7 feet of ice cover, at the recharged water surface elevation and volume.
  - b. At no point shall water withdrawal, evaporation, drainage, or any other event, or combination of events, exceed this volume of water unless a recharge event or events occur(s) during the open water season.
  - c. Water surface elevation at the staff gage in Lake L93-13 should never fall below 5.8 feet, if this occurs water use must stop or the lake must be recharged.

- 3) Monitoring of fish, water, and water quality as described in the original permit and amendment #1 stipulations 1 through 4 shall be continued for a minimum of 5 years to help assess potential impacts to anadromous fish and/or their habitat.
- 4) A method for lake recharge in the event natural flooding does not occur must be implemented in order to continue water withdrawal of 30% of the under-ice water volume.

All conditions and stipulations not specifically addressed in this permit amendment remain in effect.

This permit amendment may be appealed in accordance with the provisions of AS 44.62.330 – 44.62.630.

Sincerely,

Robert G. Bosworth, Deputy Commissioner



BY: Alvin G. Ott  
Habitat and Restoration Division  
Alaska Department of Fish and Game

cc: Nancy Welch, ADNR, Fairbanks  
Riki Lebman, SPCO/DGC, Anchorage  
Lloyd Fanter, ACOE, Anchorage  
Sverre Pedersen, ADF&G, Fairbanks  
William Britt, SPCO, Anchorage  
Bill Morris, ADF&G, Fairbanks  
Ted Rockwell, EPA, Anchorage  
Gary Schultz/Leon Lynch, ADNR, Fairbanks  
Thomas Manson/Shannon Donnelly, Phillips, Alpine  
Mayor Gordon Brown/Leonard Lampe, Village of Nuiqsut  
Joe Nukapigak/Lanston Chinn, Kuukpik Corp.

Steve Schmitz, ADNR, Anchorage  
Larry Bright, USFWS, Fairbanks  
Gordon Brower, NSB, Barrow  
Charles Swanton, ADF&G, Fairbanks  
Jack Winters, ADF&G, Fairbanks  
Jeanne Hanson, NMFS, Anchorage  
Pete McGee, ADEC, Fairbanks  
Kellie Westphal, ADNR, Anchorage

AGO/wam

# STATE OF ALASKA

TONY KNOWLES, GOVERNOR

## DEPARTMENT OF FISH AND GAME

HABITAT & RESTORATION DIVISION

1300 COLLEGE ROAD  
FAIRBANKS, ALASKA 99701-1599  
PHONE: (907) 459-7289  
FAX: (907) 456-3091

### FISH HABITAT PERMIT (FG97-III-0190)

#### AMENDMENT #4

ISSUED: August 9, 2002

EXPIRES: Upon Abandonment of Lake L93-13  
as a Water Source

Bruce St. Pierre, Senior Permit Coordinator  
Alpine Development Project  
PHILLIPS Alaska, Inc.  
P.O. Box 100360  
Anchorage, AK 99510-0360

Dear Mr. St. Pierre:

RE: Water Withdrawal/Intake Structure and Winter Ice Road Access; Lake L93-13;  
Colville River Delta (Stream No. 330-00-10700-0910); SIDAK9703-03OG;  
Colville River 18 (2-960874)

The Alaska Department of Fish and Game (ADF&G) has received your request to reset the water volume available for use effective June 12, 2002. Lake L93-13 fully recharged during spring breakup 2002. Data demonstrating recharge of Lake L93-13 and the stabilization period were provided with your July 18, 2002, letter. Fish Habitat Permit FG97-III-0190 is hereby amended to reset the permittable water withdrawal volume effective June 12, 2002 – water withdrawal volume set at 10.34 million gallons. All terms and conditions of Amendment #3 (issued September 1, 2000) remain in effect.

This permit amendment may be appealed in accordance with the provisions of AS 44.62.330 – 44.62.630.

Sincerely,

Robert G. Bosworth, Deputy Commissioner



BY: Alvin G. Ott, Regional Supervisor  
Habitat and Restoration Division  
Alaska Department of Fish and Game

Bruce St. Pierre  
(FG97-III-0190, Amendment #4)

2

August 9, 2002

cc: Leonard Lampe, Nuiqsut  
Eli Nukapigak, Nuiqsut  
Bill Tegoseak/James Patkotak, Barrow

Thomas Napageak, Nuiqsut  
isaac Nukapigak, Nuiqsut

ecc: Harry Bader, ADNR, Fairbanks  
Gordon Brower, NSB, Barrow  
Glenn Gray, DGC, Juneau  
Kaye Laughlin, DGC, Anchorage  
Leon Lynch, ADNR, Fairbanks  
Ted Rockwell, EPA, Anchorage  
Gary Schultz, ADNR, Fairbanks  
Louise Smith, USFWS, Fairbanks  
Kellie Westphal, ADNR, Anchorage  
Jack Winters, ADF&G, Fairbanks

Larry Bright, USFWS, Fairbanks  
Joy Earp, ACOE, Anchorage  
Kanady/Manson, PHILLIPS, Alpine  
Bill Morris, ADF&G, Fairbanks  
Sverre Pedersen, ADF&G, Fairbanks  
Steve Schmitz, ADNR, Anchorage  
Dick Shideler, ADF&G, Fairbanks  
Charles Swanton, ADF&G, Fairbanks

AGO/ago

Mr. Bruce St. Pierre  
FG97-III-0190

February 14, 2003

# STATE OF ALASKA

**DEPARTMENT OF FISH AND GAME**  
*DIVISION OF HABITAT AND RESTORATION*

**FRANK MURKOWSKI, GOVERNOR**

1300 COLLEGE RD.  
FAIRBANKS, AK 99701  
PHONE: (907) 459-7289  
FAX: (907) 456-3091

**FISH HABITAT PERMIT (FG97-III-0190)  
AMENDMENT #5**

ISSUED: February 14, 2003  
EXPIRES: Upon Abandonment of Lake L93-13  
as a Water Source

Bruce St. Pierre, Senior Permit Coordinator  
Alpine Development Project  
Phillips Alaska, Inc.  
P.O. Box 100360  
Anchorage, AK 99510-0360

Dear Mr. Stahl:

RE: Water Withdrawal/Intake Structure and Winter Ice Road Access; Lake L93-13;  
Colville River Delta (Stream No. 330-00-10700-0910); SIDAK9703-030G;  
Colville River 18 (2-960874); LAS 23895

The Alaska Department of Fish and Game (ADF&G) has received and reviewed your application for a permanent water right for the waters contained in Lake L9313 in the Colville River Delta and for an amendment to Fish Habitat Permit FG97-III-0190. In support of your request, refined bathymetric maps and volume estimates were included for review. The refined data indicates that there is considerably less water available below the ice during winter than previously estimated. Fish Habitat Permit FG97-III-0190 is hereby amended to authorize the removal of up to 6 million gallons (18.408 acre-feet) of water per water year (break-up to break-up regardless of date) with the following stipulation:

- 1) The permanent staff gage must be recalibrated to reflect the new bathymetry of the lake bottom and minimum lake water surface elevation must be established. The minimum lake water surface elevation will be that elevation corresponding with the withdrawal of 6 million gallons less the change in elevation attributable to evaporation of 1.4 mm of water per day. If the water

