2000 NORTH SLOPE FISH SURVEY

Preliminary Summary of Eastern NPR-A and Alpine Results

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TABLES AND FIGURES

INTRODUCTION

Phillips Alaska desires to continue gathering pre-development data on fish inhabiting lakes and streams in and around the eastern NPR-A region and the Colville River delta (Figure 1). The information gathered during the 2000 Fish Survey will be used to support requests for permits and assist with designing, siting and scheduling of facilities and activities.

Previous surveys in the region have shown that many lakes across the region contain an abundance and diversity of fish species (McElderry and Craig 1980, Bendock and Burr 1986, Moulton 1994, 1996). Lakes deep enough to retain water through the winter usually contain fish, for example only 2 of 75 lakes sampled within the delta between 1991 and 1995 did not produce fish. The fish fauna is dominated by ciscoes and whitefish (Coregonus sp.), with least cisco, broad whitefish and humpback whitefish typically representing a majority of the catch. Other species commonly encountered include round whitefish, ninespine stickleback, burbot, Alaska blackfish, fourhorn sculpin and rainbow smelt. The dominant species, least cisco, has a variety of growth forms that are readily distinguishable (Moulton 1994, 1996) and may represent 1) adaptation to varying lake productivity or 2) different dispersal episodes.

Study Objectives

The objectives of the survey were to:

1) conduct an inventory of fish species in the various lakes and streams within the project study areas (sampling areas identified on Figures 1 and 2),

2) obtain information on relative abundance of species in different water bodies sampled, especially from lakes that may be proposed for water withdrawal during exploration and field development,

3) obtain basic descriptive population data for the species captured,

4) obtain bathymetric (i.e. depth) data to estimate lake volumes, and

5) obtain water quality measurements to assess suitability of water for potential uses.

Approach

Habitats Sampled

The study was confined to lakes and streams within sampling areas identified on Figure 1. Many of the lakes in these areas have water depths in excess of 7 feet, thus may provide habitat suitable for year-round use by fish. Several streams also exist in the study areas and may provide areas for seasonal use. The study began after ice melted from the lakes in early July and continued into early

August.

Areas investigated include:

1) areas in eastern NPR-A scheduled for oil exploration in 2000/2001,

2) lakes with special study needs in the Alpine Development Area.

Eastern NPRA Area

Fish Survey. The 2000 field effort continued sampling begun in 1999 in the NPRA Exploration Area (see figures). The NPRA area lies between the Nechelik Channel of the Colville River and the vicinity of the confluence of Fish and Judy creeks. Lakes in the area may be desirable sources of freshwater during oil exploration. Water withdrawal will need to consider potential impacts to fish that depend on an adequate water supply for surviving winter. Streams in the area may be crossed by ice roads during winter. An understanding of winter dynamics in these streams will be needed to minimize effects to fish. The inventory of fish and fish habitat will provide information for assisting permitting decisions regarding water use and ice road routing. In addition, streams in the area will likely be crossed by ice roads, so an understanding of potential overwintering areas is also desirable.

The surveys in lakes consisted of short-duration gill net sampling in July and August.

Bathymetic and Water Quality Data. Bathymetric and water quality data were collected in conjunction with fish sampling. The bathymetric information allows estimating lake volumes. Water quality parameters measured include water temperature, specific conductance, dissolved oxygen, and pH.

Alpine Lake Studies

Fish Populations. Lakes L9313 and L9312 were sampled during 2000. These lakes are used as camp water sources for the Alpine Development. Both lakes support populations of fish that are harvested for subsistence or form important links in regional food chains. The Alaska Department of Fish and Game (ADF&G) permit for water withdrawal requires that the fish populations be monitored twice during the ice-free season for 3 years after project start-up to assess the viability of the populations.

In 1999, sites suitable for monitoring with fyke nets were identified and initial information on the fish populations was obtained. The sampling during 2000 provides the first information on the populations after one winter of water withdrawal

Water Quality Data. Water quality parameters measured include water temperature, specific conductance, dissolved oxygen, and pH.

METHODS

Gear Utilized

The sampling strategy was to use gill nets in perched lakes that were sampled for the first time and fyke nets in lakes that were subjected to long-term monitoring. Gill nets used were those used in previous surveys in the region (120 feet long, six panels of variable mesh, mesh size ranging from 1 to 3.5 inches stretched mesh). Data gathered in 1995-1997 indicate that fyke nets are relatively inefficient in perched lakes within the delta, particularly for sampling least cisco and broad whitefish. In order to avoid entangling waterfowl in the gill nets, the strategy was to have each gill net set limited to 4-6 hours duration and have a person tend each net to ensure waterfowl do not approach the net. The person monitored the net continuously for the duration of the set.

Fyke nets were those employed during previous Colville Delta fish studies, with a 3x4 ft frame (3/8" mesh in body), 25 ft wings, and 50 ft lead (3/4" mesh in wings and lead).

Biological and Physical Data

Data collected include catch rate and size data for each species captured in each set made. Associated data include beginning and end time of each set, type of gear utilized, water temperature, conductivity or salinity, and any relevant observations. Fish were counted by species and measured to the nearest millimeter fork length. Prior to measuring samples from fyke nets, the fish were anesthetized in MS-222, and after measuring they were allowed to recover in a holding pen prior to release.

Depth surveys were be made of the lakes and channels surveyed to assess the potential for winter survival.

Analysis

Data analysis included a description of the catch from each sample site, with the associated population data. Fish catches were presented as catch per effort to reveal differences in relative abundance. The information was presented by sample site and by habitat type.

Historical data from previous sampling in the Colville Delta and other nearby areas, such as Dease Inlet, Teshekpuk Lake and the Prudhoe Bay region, are used for comparative assessment of the findings.

Lake volume estimates for one-time withdrawals are made by calculating the volume of a cone

using the lake area for the base and the maximum observed depth for the height. The estimated area for each lake is obtained from a GIS base map. For lakes where there is a fish concern, a correction is made to ensure that fish can survive the winter. The maximum depth is reduced by 7 feet prior to making the volume calculation to account for the expected maximum ice thickness during winter - 15% of the this revised estimate is then available for withdrawal.

SUMMARY OF RESULTS

NPR-A Lakes

A total of 28 lakes were sampled for the first time in NPR-A in 2000 (Table 1). Two lakes surveyed in 1999 were re-visited. Much of the sampling was upstream of the confluence of Fish Creek and Judy Creek, with much of the sampling in lakes along each of the streams. In contrast to 1999, fish densities were very low and often non-existent, despite much longer fishing times (Tables 2 and 3). It seems clear that upstream from the confluence of these creeks, fish do not make significant use of lake habitat. As observed in 1999, fish use of lakes near and downstream of the confluence is quite high for those lakes near the creeks and for those lakes connected to the creeks by streams. Water chemistry parameters measured in 2000 are provided in Table 4.

Alpine Lakes Studies

Water use from lake L9313 during winter 1999/2000 was 5.9 million gallons, or 85% of the permitted withdrawal. In lake L9312, only 2.8 million gallons was used, or about 15% of the permitted use (Table 5).

Fyke nets were fished in lakes L9312 and L9313 from July 22 to 29, and again from August 16-22. In lake L9312, we caught 2,954 fish from 10 species, compared to 365 fish from 6 species in 1999 (Table 6). Fishing effort was twice as great in 2000, which accounts for some of the difference, but there was a dramatic increase in the number of least cisco in 2000. Humpback whitefish, Alaska blackfish and ninespine stickleback were also more numerous in 2000.

In lake L9313 we caught 1,256 fish from 6 species in 2000, compared to 1,102 from 5 species in 1999. Compared to last year, there was a noticeable lack of least cisco in L9313, and substantial increase of Alaska blackfish and ninespine stickleback (Table 6).

Length frequency data for each lake are included (Tables 7 and 8). For both L9312 and L9313, much of the increase in Alaska blackfish catch was from high catches during August, when the sun had moved below the horizon and there were periods of darkness at night. It is likely the reduced light accounted for the high Alaska blackfish catch during August.

Additional bathymetry and water chemistry data were obtained to better understand the physical and chemical dynamics of the lakes (Table 9).

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McElderry, H.I. and P.C. Craig. 1981. A fish survey in the lower Colville River drainage with an analysis of spawning use by Arctic and least cisco. Appendix 2. Final Report, Simpson Lagoon (Part 4, Fish). In: Environmental Assessment of the Alaskan Continental Shelf, Final Reports (Vol. 7). BLM/NOAA OCSEAP, Boulder, Colorado. p. 657 678.

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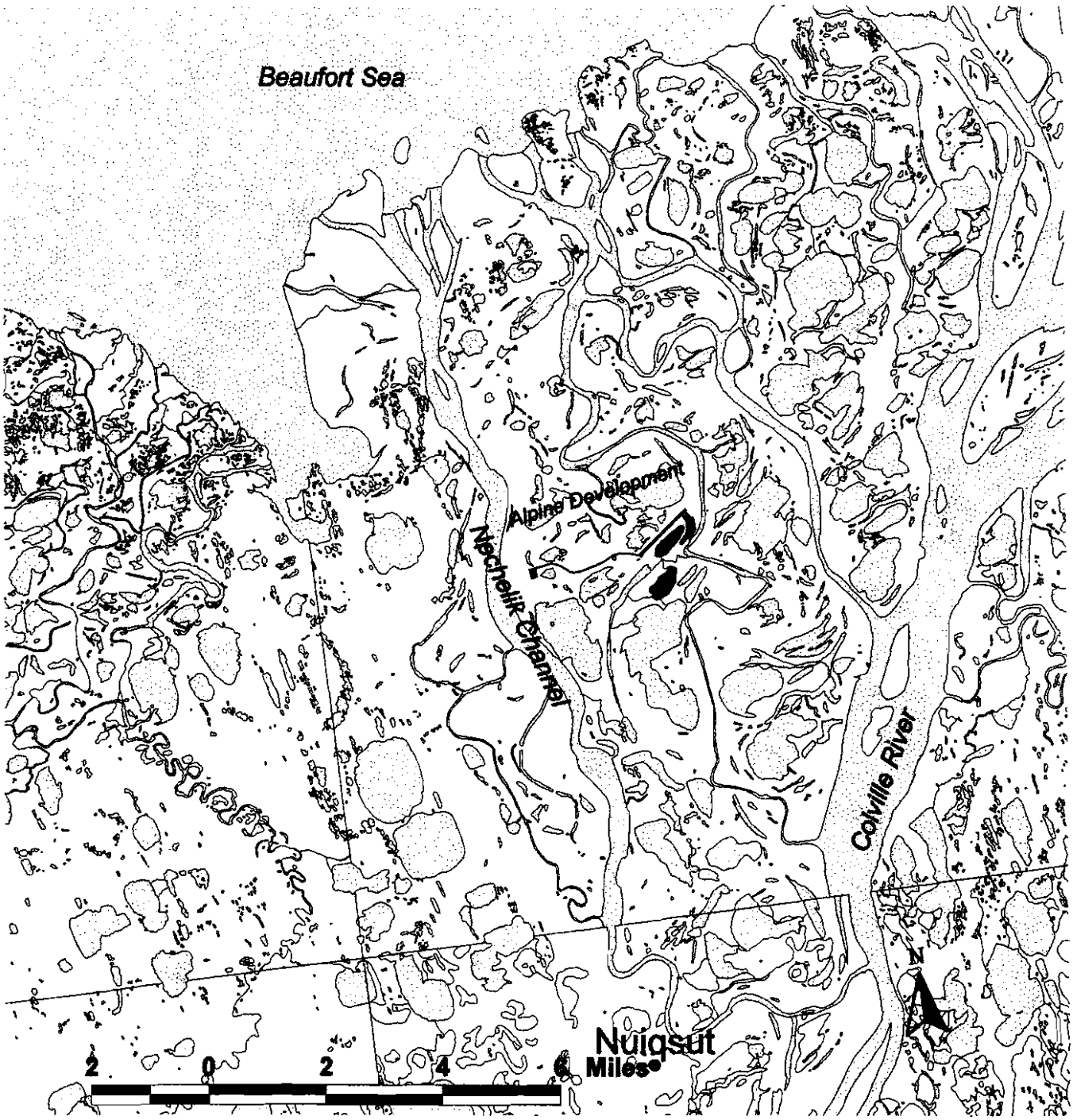
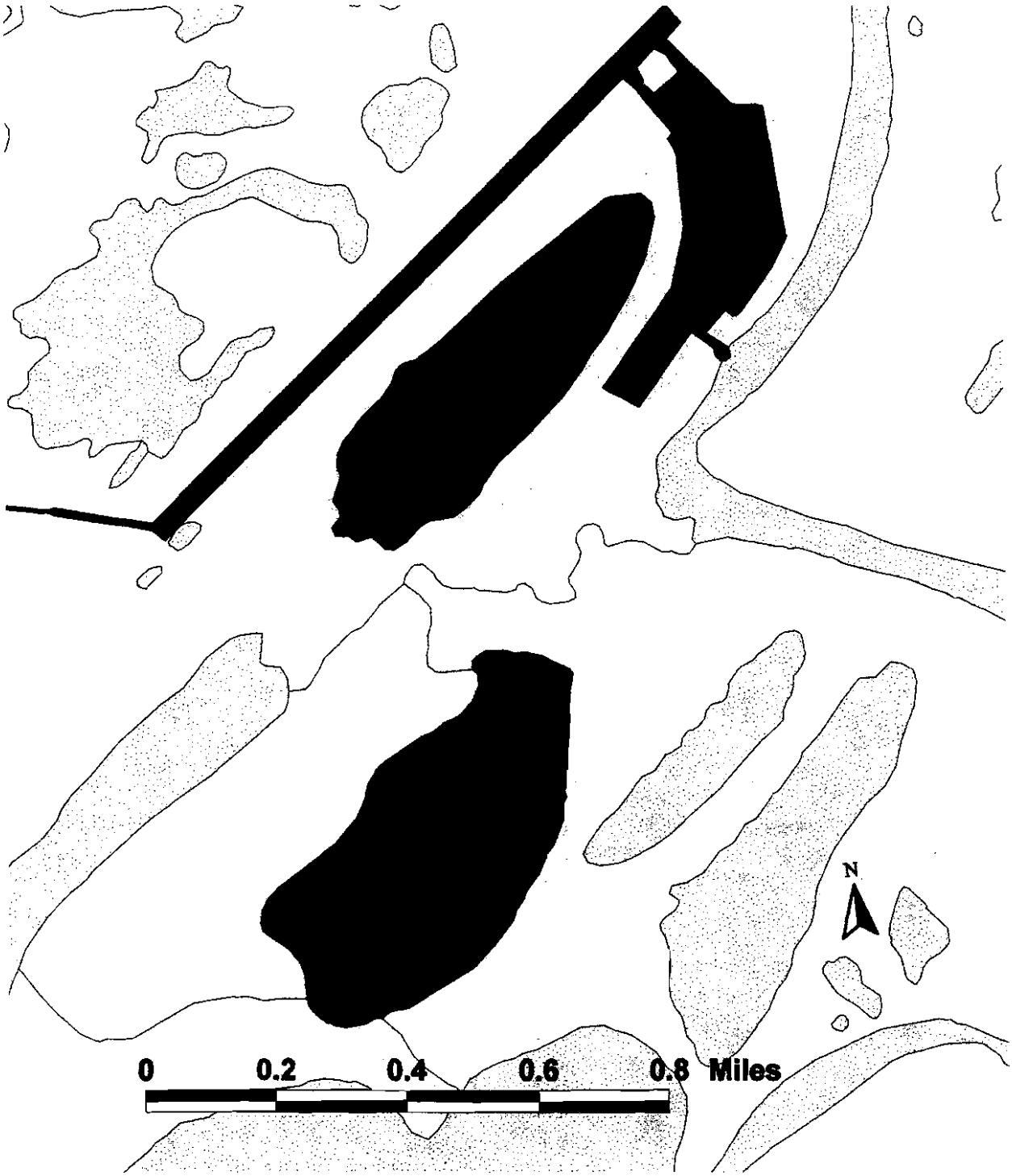
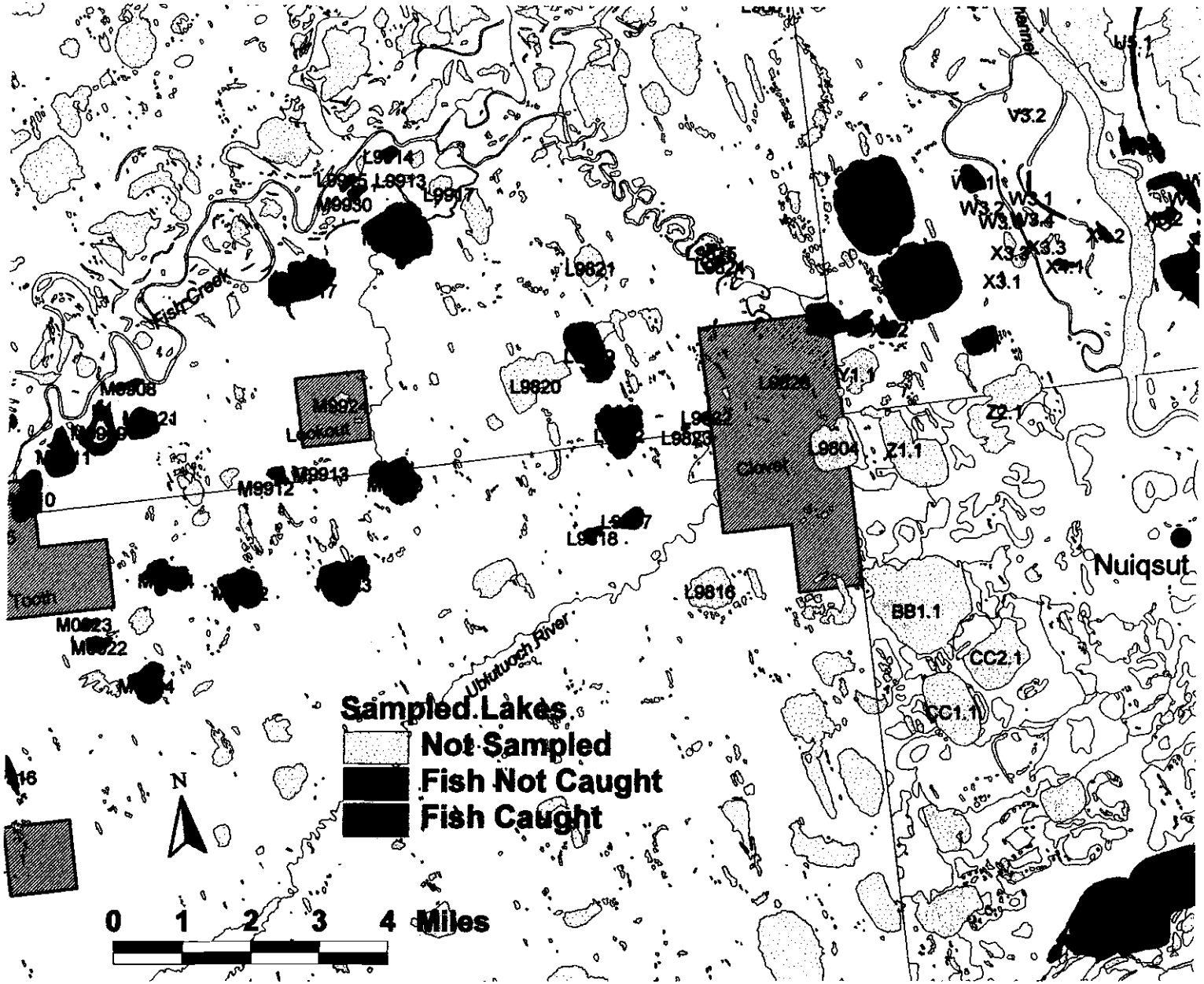


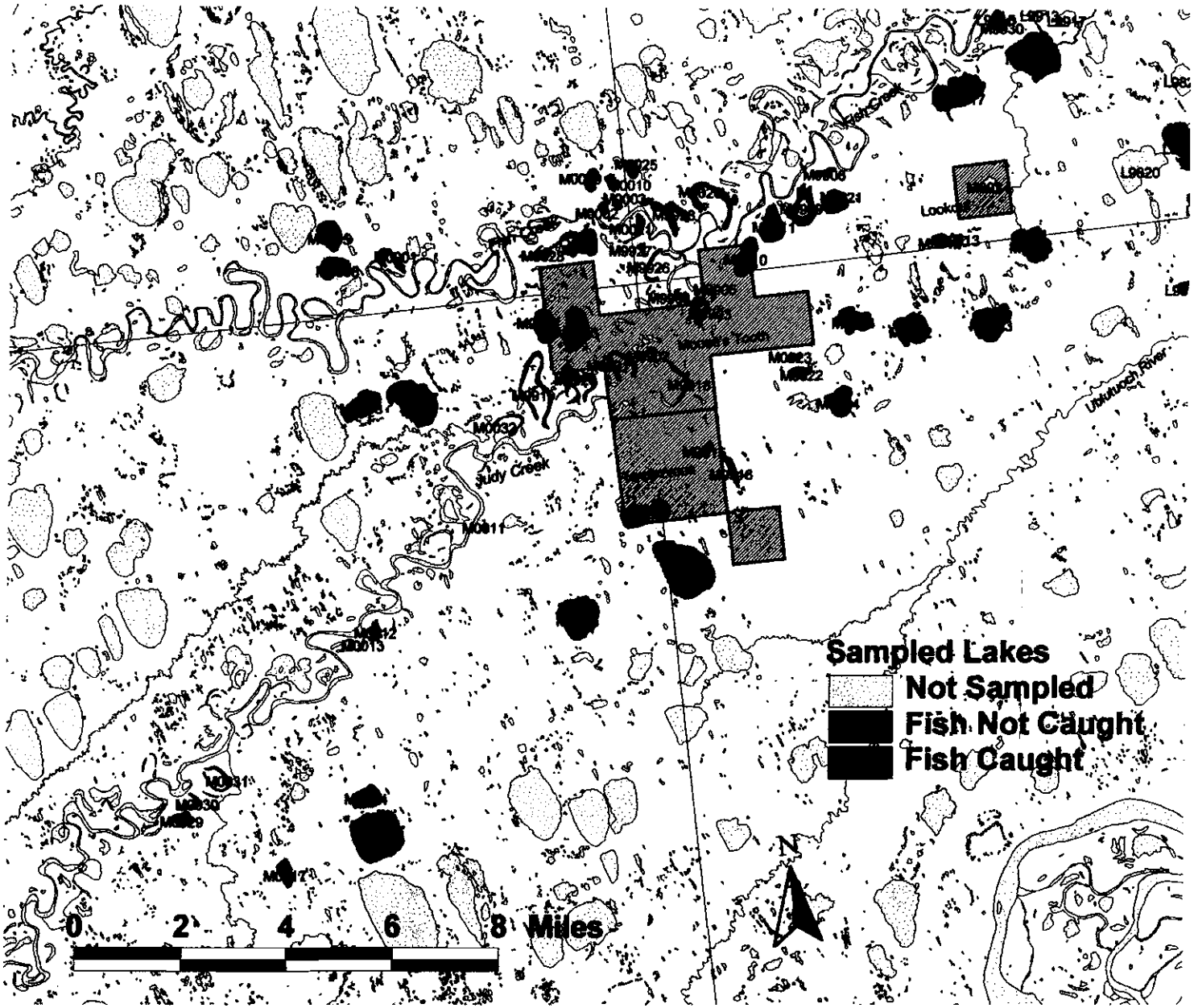
Location of Alpine Development permanent water-use lakes.



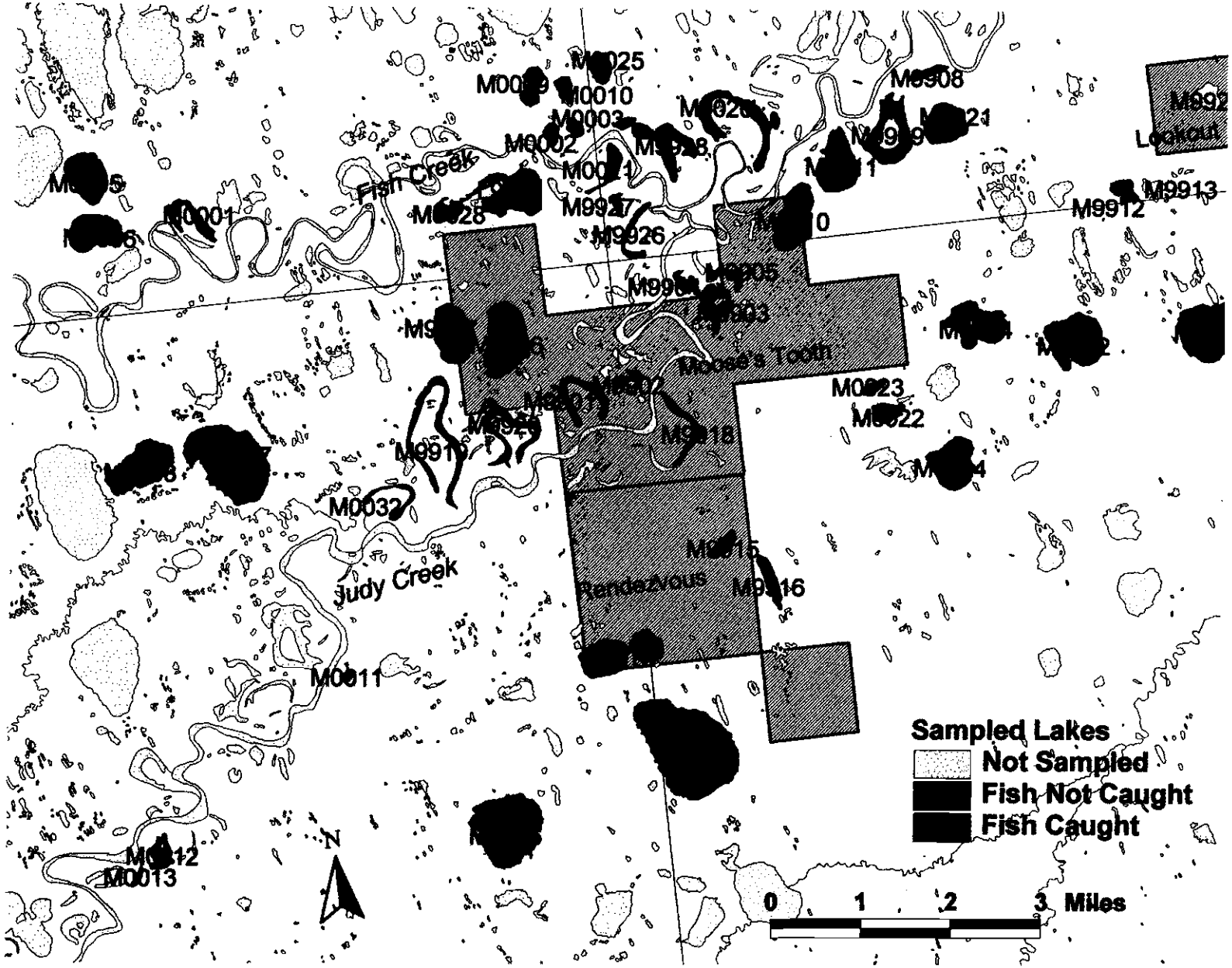
Lakes L9312 and L9313 combine to represent the permanent water source for the Alpine Development.



Fish distribution in lakes between Fish Creek and the Colville River, based on sampling in 1999 and 2000.



Distribution of fish in lakes near the confluence of Fish and Judy creeks based on sampling with gill nets in 1999 and 2000.



Close-up of fish distribution in lakes near the confluence of Fish and Judy creeks, based on sampling in 1999 and 2000.

Table 1. Summary of eastern NPR-A lake data obtained during 2000.

Exploration Area	Lake	Location :		Umiat Meridian Section	Township	Range	GIS Est Acreage	Max Depth (ft)	Estimated Vol (mil gals)	15% AK 7' Voll (mil gals)	Confirmed Fish **	Fish Concern?
S. Spark 1	M0022	SE 1/4 OF	NE 1/4	17	10N	2E	38.0	6.5	26.5		No	No
	M0023	NW 1/4 OF	NE 1/4	17	10N	2E	16.4	3.9	6.9		No	No
	M0024	ALL OF	NW 1/4	21	10N	2E	138.6	7.3	108.8		No	No
Spark 2	M0002	NE 1/4 OF	NW 1/4	35	T11N	1E	20.5	16.0	35.3	**3.0**	LSCS	Yes
	M0003	SE 1/4 OF	SW 1/4	26	11N	1E	19.8	16.0	34.0	**2.9**	No	Y?
	L9916	ALL OF	SE 1/4	34	11N	1E	169.1	14.3	260.0	**19.9**	LSCS	Yes
	M0009	W 1/2 OF	W 1/2	26	11N	1E	48.7	6.6	34.5		No	No
	M0010	E 1/2 OF	W 1/2	26	11N	1E	29.7	8.1	25.9		No	No
	M0020	SW 1/4 OF	SW 1/4	30	11N	2E	124.1	16.1	214.8	**18.2**	LSCS	Yes
	M0021	E 1/2 OF	NE 1/4	35	11N	1E	36.3	17.7	69.1	**6.3**	LSCS	Yes
	M0025	NE 1/4 OF	NE 1/4	26	11N	1E	44.2	8.2	39.0		No	No
Spark 5	M0001	ALL OF	W 1/2	31	11N	1E	48.7	10.6	55.5	**2.8**	No	Y?
	M0005	SW 1/4 OF	SW 1/4	25	11N	1W	122.3	12.1	159.0	**10.1**	NSSB	N?
	M0006	NW 1/4 OF	SW 1/4	36	11N	1W	122.4	13.3	175.0	**12.4**	BKFH	N?
	M0007	ALL OF	NW 1/4	18	10N	1E	355.5	10.5	401.3		No	No
	M0008	ALL OF	NW 1/4	13	10N	1W	172.4	9.1	168.6		No	No
	M0028	W 1/2 OF	SW 1/4	34	11N	1E	36.4	8.7	34.1		NSSB	No
	M0032	ALL OF	SW 1/4	16	10N	1E	28.6	11.4	35.0	**2.0**	No	Y?
Hunter	M0011	NE 1/4 OF	SW 1/4	29	10N	1E	8.8	14.1	13.3		No	N?
	M0012	W 1/2 OF	W 1/2	1	9N	1W	42.5	17.9	81.9		No	N?
	M0013	NE 1/4 OF	SE 1/4	2	9N	1W	8.7	6.1	5.7		No	No
	M0014	CENTER OF	SEC.	23	9N	1W	114.3	8.5	104.4		No	No
	M0015	ALL OF	NE 1/4	26	9N	1W	473.4	7.5	381.8		No	No
	M0016	ALL OF	SE 1/4	4	9N	1E	300.2	6.2	200.1		NSSB	No
	M0017	E 1/2 OF	SE 1/4	28	9N	1W	70.3	3.3	24.9		No	No
	M0029	NW 1/4 OF	SW 1/4	20	9N	1W	44.4	12.6	60.2		NSSB	N?
	M0030	SE 1/4 OF	NW 1/4	20	9N	1W	26.0	8.3	23.2		No	N?
	M0031	ALL OF	SE 1/4	17	9N	1W	33.4	11.4	40.9		No	N?

* The 15% AK Volume is the volume of water that may be extracted from fish-bearing lakes. For those lakes without fish, the column "Calculated Volume" applies.
** All lakes with a "Y" in this column must be treated as fish-bearing: i.e., use the 15% AK Vol column for allowable water withdrawl volumes.
While ninespine stickleback and Alaska blackfish may be present, they are not sensitive to impacts associated with lake withdrawals.

Table 2. Catches of fish from NPR-A sampling with gill nets, 2000.

Gill Nets

NPR-A Region	Lake	Date	Maximum Depth (feet)	Gill Net Effort (hours)	Fish Species	Number Caught
Spark 1	M9922	8/1/00	5.3	20.50	None	
	M9923	8/1/00	6.5	15.08	None	
S. Spark 1	M0022	7/29/00	6.5	8.83	None	
	M0023	7/29/00	3.9	0.90	None	
	M0024	7/29/00	7.3	10.33	None	
Spark 2	L9916	7/14/00	14.3	2.87	Least cisco	9
	M0002	7/13/00	16.0	4.75	None	
		7/14/00		1.75	Least cisco	1
	M0003	7/13/00	16.0	4.42	None	
		7/14/00		1.50	None	
	M0009	7/17/00	6.6	6.83	None	
	M0010	7/17/00	8.1	8.00	None	
	M0020	7/27/00	16.1	1.75	Least cisco	7
	M0021	7/27/00	17.7	2.75	Least cisco	7
	M0025	7/31/00	8.2	8.00	None	
Spark 5	M0001	7/12/00	10.6	5.08	None	
	M0005	7/15/00	12.1	6.00	Ninespine stickleback	3
	M0006	7/15/00	13.3	6.83	Alaska blackfish	1
	M0007	7/16/00	10.5	8.67	None	
	M0008	7/16/00	9.1	5.17	None	
	M0028	8/2/00	8.7	8.00	None	
Hunter	M0011	7/19/00	14.1	10.83	None	
	M0012	7/20/00	17.9	10.17	None	
	M0013	7/20/00	6.1	10.00	None	
	M0014	7/21/00	8.5	14.33	None	
	M0015	7/21/00	7.5	12.17	None	
	M0016	7/22/00	6.2	12.67	None	
	M0017	7/24/00	3.3	2.17	None	
	M0029	8/3/00	12.6	10.92	None	
	M0030	8/3/00	8.3	11.00	None	
	M0031	8/3/00	11.4	11.08	None	
	M0032	8/4/00	11.4	8.50	None	

Table 3. Catches of fish from NPR-A sampling with minnow traps, 2000.

Minnow Traps (2 per lake)

NPR-A Region	Lake	Date	Maximum Depth (feet)	Trap Effort (hours)	Fish Species	Number Caught
Spark 1	M9922	8/1/00	5.3	21.35	Ninespine stickleback	seen
	M9923	8/1/00	6.5	108.42	None	
S. Spark 1	M0022	7/29/00	6.5	10.00	None	
	M0023	7/29/00	3.9	3.00	None	
	M0024	7/29/00	7.3	11.17	None	
Spark 2	M0020	7/27/00	16.1	1.92	None	
	M0021	7/27/00	17.7	4.00	None	
	M0025	7/31/00	8.2	9.50	None	
Spark 5	M0028	8/2/00	8.7	9.50	Ninespine stickleback	1
Hunter	M0011	7/19/00	14.1	9.83	Ninespine stickleback	19
	M0012	7/20/00	17.9	8.50	None	
	M0013	7/20/00	6.1	8.50	None	
	M0014	7/21/00	8.5	15.33	None	
	M0015	7/21/00	7.5	10.50	None	
	M0016	7/22/00	6.2	14.00	Ninespine stickleback	1
	M0017	7/24/00	3.3	5.67	None	
	M0029	8/3/00	12.6	12.00	Ninespine stickleback	3
	M0030	8/3/00	8.3	12.00	None	
	M0031	8/3/00	11.4	11.50	None	
	M0032	8/4/00	11.4	35.50	None	

Table 4. Water chemistry parameters measured in conjunction with NPR-A Area lake sampling.

NPR-A Area	Lake	Date	Time	Water Temp. (°C)	Dissolved Oxygen (mg/l)	Dissolved Oxygen Percent Saturation	Specific Conductance (mS/cm)	pH	Chloride (mg/l)	Sodium (mg/l)	Calcium (mg/l)	Magnesium (mg/l)	Hardness (mg/l)	TDS (mg/l)
Spark 1	M9922	8/1/00	10:15	10.5			134.5	7.79	19.9	5.2	14.5	3.3	49.8	88
	M9923	8/1/00	9:45	9.7			225.1	8.20	18.8	5.4	33.0	4.9	103.0	128
S. Spark 1	M0022	7/29/00	10:22	10.4			96.2	7.97	11.5	5.1	10.0	2.4	34.8	84
	M0023	7/29/00	10:09	10.3			191.8	7.88	22.6	9.9	19.0	4.6	66.5	128
	M0024	7/29/00	10:55	10.6	10.9	98.0	107.2	7.93	14.3	4.8	11.2	2.9	39.9	70
Spark 2	L9916	7/14/00	9:10	7.0	11.1	92.7	210.4	8.07	14.5	6.9	27.3	5.2	89.5	106
	M0002	7/13/00	10:45	8.7	11.1	95.9	83.5	7.25	9.7	3.9	8.5	2.0	29.3	<35
	M0003	7/13/00	11:05	8.7	11.0	94.2	130.3	7.58	13.5	5.7	15.2	3.0	50.3	84
	M0009	7/17/00	9:20	12.9	10.5	99.3	69.4	7.60	7.7	3.1	7.6	1.5	25.0	<35
	M0010	7/17/00	12:00	12.2	10.5	97.9	150.4	8.00	14.2	6.2	17.2	3.7	58.2	88
	M0020	7/27/00	8:25	10.1	10.5	95.4	141.6	7.91	11.1	4.9	18.4	3.2	59.1	122
	M0021	7/27/00	10:20	11.2			117.0	7.86	7.6	3.2	16.6	2.6	52.1	102
	M0025	7/31/00	14:15	9.9			99.7		10.7	4.9	10.5	2.6	36.8	66
Spark 5	M0005	7/15/00	8:55	9.1	10.7	93.5	281.9	8.06	29.4	12.3	31.4	6.4	105.0	148
	M0006	7/15/00	10:35	9.9	10.6	92.6	223.4	7.97	21.2	9.7	27.4	5.1	89.4	134
	M0007	7/16/00	9:30	11.4	11.2	105.7	294.9	8.15	32.0	11.9	35.5	5.5	111.0	164
	M0008	7/16/00	12:00	12.6	10.8	101.3	124.7	7.83	13.5	5.9	14.1	2.7	46.3	76
	M0001	7/12/00	12:15					7.73	10.3	4.6	16.5	3.0	53.3	90
	M0028	8/2/00	9:45	11.7			119.4	8.15	10.4	5.0	13.7	3.4	48.2	74
	M0032	8/4/00	11:10	13.6			204.9	8.22	21.3	8.2	24.6	4.5	79.7	114
Hunter	M0011	7/19/00	10:55	11.4	10.7	98.2	135.0	7.96	10.9	5.6	16.5	3.2	54.3	66
	M0012	7/20/00	14:00	11.5	10.7	99.1	208.0	8.29	19.7	9.9	24.7	4.1	78.6	140
	M0013	7/20/00	14:15	11.1	11.2	103.8	192.2	8.58	8.2	7.2	28.9	3.5	86.5	136
	M0014	7/22/00	8:35	12.3	10.6	97.5	197.0	7.79	24.7	9.8	21.8	4.2	71.5	166
	M0015	7/22/00	8:48	14.8	9.8	98.5	203.5	7.80	23.5	10.1	21.2	3.9	69.0	156
	M0016	7/22/00	9:00	13.2	10.3	96.7	123.9	7.77	14.8	5.2	14.4	2.8	47.6	72

M0017	7/24/00	9:50	11.6	7.8	73.0	265.5	7.61	16.3	8.9	34.2	6.8	133.0	162
M0029	8/3/00	10:30	13.4			468.3	8.50	45.9	29.3	39.2	10.6	142.0	254
M0030	8/3/00	10:40	13.0			198.1	8.26	20.1	10.0	22.6	4.4	74.5	66
M0031	8/3/00	10:00	14.0	10.1	97.8	120.1	7.96	6.9	4.4	16.9	2.3	51.6	56

Table 5. Water withdrawal at Alpine Development lakes prior to break-up, 2000.

Lake Name	Month (1999/2000)	Monthly Use (gallons)
L9312	February	0
	March	0
	April	947,100
	May	1,865,161
	Permitted Use	19,000,000
	Total Use	2,812,261
L9313	December	765,600
	January	1,696,600
	February	1,039,800
	March	1,550,800
	April	843,900
	May	0
	Permitted Use	6,940,000
	Total Use	5,896,700

Table 6. Catches of fish from Alpine Area Lakes L9312 and L9312 sampling with fyke nets, 2000.

	1999	2000		
Species	**Total**	**July**	**Aug**	**Total**
L9312				
Broad whitefish	5	5	4	9
Humpback whitefish	0	27	15	42
Arctic cisco	0	0	5	5
Least cisco	62	1,349	196	1,545
Round whitefish	24	7	17	24
Burbot	0	0	1	1
Longnose sucker	0	1	0	1
Alaska blackfish	7	22	102	124
Slimy sculpin	83	13	93	106
Ninespine stickleback	184	729	368	1,097
Net Hours:	165.4	168.3	165.7	334.0
L9313				
Broad whitefish	5	4	7	11
Humpback whitefish	0	0	5	5
Least cisco	975	0	5	5
Round whitefish	2	0	0	0
Burbot	0	0	1	1
Alaska blackfish	9	23	100	123
Ninespine stickleback	111	779	332	1,111
Net Hours:	172.4	169.7	161.6	331.3

Table 7. Length frequencies of fish caught in lake L9312 by fyke net during 1999 and 2000.

Fork Length (mm)	Least cisco			Broad Whitefish			Round Whitefish			Alaska blackfish			Slimy sculpin		
	1999	July 2000	August 2000	1999	July 2000	August 2000	1999	July 2000	August 2000	1999	July 2000	August 2000	1999	July 2000	August 2000
30															
40													3	6	2
50											1	1	17	2	19
60		5	1					1			2	3	35	2	42
70		95	3								5	18	25	2	26
80	4	39	38					2	4	5	10	41	3	2	4
90	27	2	14						1		4	37			
100	3	36	3						1	2					
110		90	20									1			
120		87	11			1	3		1			1			
130	3	502	30				4								
140	5	271	34	1			9								
150	2	99	17				1								
160	5	35	9		1		3	1	1						
170	4	40	5	1											
180	1	27	6			1			1						
190	1	5					1		2						
200	4	5	2				1		2						
210	2	6	3						1						
220		3					1								
230	1						1	1							
240		2				1		1							
250									1						
260				1					1						
270															
280								1	1						
290															
300															
310															
320															
330															
340															
350															
360				1											
370					1										
380															
390					1										
400															
410						1									
420															
430															
440															
450															

460																
470				1												
480					2											
Total:	62	1,349	196	5	5	4	24	7	17	7	22	102	83	14	93	

Table 8. Length frequencies of fish caught in lake L9313 by fyke net during 1999 and 2000.

Fork Length (mm)	Least cisco		Broad whitefish			Humpback whitefish			Alaska blackfish		
		August		July	August		July	August		July	August
	1999	2000	1999	2000	2000	1999	2000	2000	1999	2000	2000
0											
10											
20											
30											
40	1							3			
50								2			1
60										7	5
70									4	11	33
80	3								1	5	30
90	3					2			3		19
100	122										6
110	546								1		3
120	246		1								
130	27		3								2
140	26										
150		4	1								1
160					1						
170								1			
180	1							1			
190											
200					1						
210	1	1						1			
220					1						
230											
240											
250											
260											
270											
280					1						
290											
300					1						
310											
320					1						
330											
340											
350											
360											
370											
380											
390											
400											
410				1							
Total:	975	5	5	1	6	2	3	5	9	23	100

Table 9. Water chemistry parameters measured in conjunction with Alpine Area lake sampling, 2000.

Lake	Date	Time	Depth (m)	Water Temp. (oC)	Dissolved Oxygen (mg/l)	Dissolved Oxygen Percent Saturation	Specific Conductance (mS/cm)	Turbidity (NTU)	pH
L9312	7/21/00	11:30	0.5	10.4	11.1	100.2	53.3	10.5	
			1.5	10.0	11.2	98.8	53.4	7.6	
			2.5	9.8	11.1	98.5	53.4	7.5	
			3.5	9.6	11.1	98.3	53.4	8.6	
L9312	8/15/00	12:17	0.5	6.2	11.6	93.8	55.1	4.0	
			1.5	6.0	11.7	93.7	55.1	4.1	
			2.5	5.9	11.9	95.3	55.1	3.9	
			3.5	5.9	11.7	94.3	55.1	5.7	
L9313	7/18/00	14:55	0.5	11.2	10.6	96.8	161.8	3.6	
			1.5	11.1	10.5	96.4	162.2	3.3	
			2.5	10.8	10.8	98.0	162.6	3.3	
			3.5	10.8	10.9	98.1	162.7	3.5	
L9313	8/15/00	12:17	0.5	6.6	12.3	99.8	170.4	5.5	
			1.5	5.9	12.4	98.0	171.1	5.7	
			2.5	5.7	12.6	100.4	171.3	15.0	
			3.5	5.7	12.5	100.3	171.4	7.5	
L9312	7/23/00								7.85
L9313	7/23/00								7.98