

EVALUATION OF POTENTIAL WATER SOURCE LAKES IN CD-NORTH - 2002

Final Report

September 2003



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and

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1200 Timberloch Place
The Woodlands, TX**

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INTRODUCTION

ConocoPhillips Alaska Inc. has been exploring for oil within the Colville Delta North (CD-North) Development Area since the early 1990's (Figure 1). During exploration, rivers and lakes are crossed by ice roads and water is withdrawn from lakes to support both industrial and domestic needs. Additional potential impacts will arise when the area is developed for oil extraction.

Because of the biological sensitivity of this area, the fish and fish habitats in this region of the Colville Delta have been studied since 1991 (Moulton 1993). These earlier surveys revealed that lakes within the delta are relatively deep, averaging almost 15 ft deep. This is unlike lakes in the Prudhoe Bay and Kuparuk oil fields, where lakes are rarely in excess of 7 ft deep. The combination of deep water, which allows successful wintering, and proximity to a major river creates abundant habitat for fish and many species are found in lakes throughout the delta (Moulton 1998).

In order to submit applications for exploration and development permits, information specific to the activity area is required in order to evaluate the biological sensitivity of lakes and river channels in the region. This study was designed to provide physical and biological information on two large lakes that may be used as water sources for the CD-North development. It is anticipated that permit stipulations similar to those imposed on the Alpine water source lakes will be required for lakes used for the same purpose in the CD-North development. The information from this study will provide baseline information to allow comparison of populations after water withdrawal has commenced.

METHODS

Lakes M9313 (also known as lake O7.1) and L9210 (also known as lake P6.3) were sampled from July 10 to 18 by fyke net because the sampling objective was to sample fish with non-lethal gear so that the sampling will not be the cause of any observed changes to the populations.

Fyke nets used during the 2002 sampling had an opening 0.9 m deep by 1.1 m wide, the trap end was 4.9 m long, made of 9.5 mm mesh. The wings (5 m long) and lead (15 m long) were made of 12.7 mm mesh. The nets were emptied daily. Fish were measured and released, with no fish retained for laboratory analysis. Duration of each set was recorded to allow calculation of catch rates. Water chemistry measurements taken in conjunction with the fyke net sampling included water temperature, specific conductance, dissolved oxygen, turbidity and pH.

In 2002, fish greater than 180 mm were tagged to provide information of residence time within the lakes and possibly provide information on population size. Floy FF-94 anchor

tags (monofilament = 1/2 inch, vinyl = 3/4 inch) were applied to broad whitefish and least cisco exceeding 180 mm fork length.

Water chemistry measurements include surface measures of water temperature, specific conductance, dissolved oxygen, pH, and turbidity. Temperature, specific conductance and dissolved oxygen are taken along the edge of each lake with a YSI Model 85 meter. A sample is returned to the field office to measure pH and turbidity. PH is measured with either a Coning pH meter or an Oaktron pH Tester III. Turbidity is measured with an H.F. Scientific DRT15CE turbidity meter

Bathymetric data were collected in 2002 using methods described by MBJ (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 recorded on both lake L9210 and lake M9313. 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 in 1 foot intervals on the aerial photograph of the surveyed lakes. The surface area of the lake and each 1 foot contour was obtained, then 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

Biological Observations

Few fish were caught by fyke net in either sampled lake (Table 2). Only ten least cisco and one round whitefish were caught in lake L9210 during 8 days of sampling, while one least cisco was caught in lake M9313 with a similar level of effort.

Based on previous sampling with gill nets, the two lakes are known to support healthy populations of least cisco (Table 3), but the fyke nets proved to be ineffective. The ineffectiveness of the fyke nets was likely a function of the lake bathymetry. Both lakes have steep shorelines, which limit the locations available for effective fyke net stations. In addition, it is probable that least cisco remained offshore of the shallow areas where the nets were set. Because of the low catch rates, sampling was not conducted during the planned August period. Eight of the 10 least cisco caught in lake L9210 in July were tagged and released (Table 4).

Water Chemistry

Specific conductance was much higher in lake M9313 than in L9210, which is not surprising given the former lake's proximity to the coast (Table 5). Specific conductance in L9210 averaged 261 microS/cm during the July 2002 sampling, while that in M9313 averaged 726. Historical sampling at these two revealed a similar pattern (Table 6), with much of the difference caused by elevated sodium and chloride ions, indicating more exposure to marine water.

Lake Volumes

Lake L9210 (P6.3) is a 134.7 acre lake with a maximum depth of 29.1 feet. The total lake volume was estimated to be 452.4 million gallons. The amount allowed for water withdrawal when sensitive fish species are present is currently set at 15% of the minimum winter volume. The minimum winter volume is defined as the amount of water deeper than 7 feet because during severe winters, lake ice can be 6.5 to 7 feet thick. Lake L9210 supports least cisco and round whitefish, so the 15% criterion is in effect for this lake, and approximately 28.2 million gallons are available for annual use (Table 7). This revised estimate is a 3.9 million gallon increase over the previous estimate of 24.3 million available gallons based on less intensive depth measurements (Moulton 2002).

Lake M9313 (O7.1) is a 140.2 acre lake with a maximum depth of 25.1 feet. The total lake volume was estimated to be 415.1 million gallons. Lake M9313 supports least cisco, so the 15% criterion applies for this lake as well. Approximately 19.0 million gallons are available for annual use (Table 7). This estimate is a decrease of 0.7 million gallons over the previous estimate of 19.7 million available gallons based on less intensive depth measurements (Moulton 2002).

Literature Cited

- Moulton, L.L. 1993. Colville Delta Winter Fish Habitat Study 1991-1992. Report by MJM Research to ARCO Alaska Inc. Bainbridge Island, WA. 19 p. + appendices.
- Moulton, L.L. 1998. Lakes sampled for fish within and near the Colville River delta, Alaska 1979-1998. Report by MJM Research to ARCO Alaska Inc. Bainbridge Island, WA. 513p.
- Moulton, L.L. 2002. Fish habitats in the CD-North exploration area, 1999-2001. Report by MJM Research to Phillips Alaska, Inc. Lopez Island, WA. 38p.

Table 1. Fyke net stations occupied in CD-North during 2002.
(latitude and longitude based on NAD27 datum)

Station	Latitude	Longitude
L9210	70.41528	150.92374
M9313	70.42933	150.89827

Table 2. Catches of fish from fyke net sampling in CD-North lakes during July 10-18, 2002.

Species	L9210	M9313
Least cisco	10	1
Round whitefish	1	0
Alaska blackfish	7	0
Ninespine stickleback	807	951
Total Effort (hrs)	185.6	186.6

Table 3. Fish caught by gill net sampling in the CD-North study area, 1992-2000.

Lake	Date	Sampling Duration (hours)	Least Cisco
L9210	Nov 3 92	22.0	50
	Jul 26 00	1.4	4
M9313	Nov 5 93	20.7	79
	Jul 25 00	2.1	4

Table 4. Tag releases in the Colville Delta-North study area, by station and species, 2002.

Station	Release Date	Species	Release Length	Tag Code
L9210	7/12/2002	Least cisco	286	MJM020128
L9210	7/13/2002	Least cisco	260	MJM020130
L9210	7/13/2002	Least cisco	193	MJM020136
L9210	7/13/2002	Least cisco	234	MJM020137
L9210	7/13/2002	Least cisco	297	MJM020138
L9210	7/13/2002	Least cisco	195	MJM020139
L9210	7/13/2002	Least cisco	200	MJM020302
L9210	7/13/2002	Least cisco	192	MJM020303

Table 5. Water chemistry measured at CD-North fyke net sampling sites, 2002.

Station	Date	Temp (°C)	Dissolved Oxygen		Specific Conductance (microS/cm)	pH	Turbidity (NTU)
			(mg/l)	(%)			
L9210	7/10/2002	10.5	10.97	98.2	255		
	7/11/2002	10.4	11.32	101.3	255	7.80	1.2
	7/12/2002	8.6	11.23	96.7	255	7.86	1.8
	7/13/2002	8.2	11.32	96.1	255	7.62	1.5
	7/14/2002	10.1	11.78	104.5	258	7.89	1.1
	7/15/2002	12.5	10.53	99.4	261	7.91	1.1
	7/16/2002	14.7	10.28	100.2	262	7.89	1.1
	7/17/2002	16.8	9.24	95.6	263	7.94	1.3
	7/18/2002	16.5	9.44	97.8	281	7.79	0.9
M9313	7/10/2002	8.9	10.86	93.6	723	7.41	0.9
	7/11/2002	9.5	10.40	91.5	723	7.75	0.8
	7/12/2002	9.0	11.82	98.8	741	7.93	0.8
	7/13/2002	8.6	11.56	99.5	708	7.51	0.7
	7/14/2002	9.2	12.01	104.8	704	7.77	0.9
	7/15/2002	10.2	11.53	103.0	716	7.70	1.0
	7/16/2002	12.5	10.89	102.7	723	7.75	0.9
	7/17/2002	14.0	10.69	100.0	729	7.91	0.9
	7/18/2002	14.9	10.49	99.2	764	7.72	0.9

Table 6. Water quality parameters measured at lakes in the CD-North study area.

Lake	Date	Water Temp (°C)	Dissolved Oxygen (mg/l)	Specific Conductance (microS/cm)	pH	Magnesium (mg/l)	Calcium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Hardness (mg/l)	TDS ¹ (mg/l)
L9210	Jun 14 05					19	10	20	64	92	190
	Nov 01 98					11	21	26	75	100	189
	Jul 22 99					12	21	24	68	101	200
	Jul 26 00	10.1		243	7.89	8	14	16	45	65	170
M9313	Aug 13 97	12.0	10.9	841	8.26						(488)
	Nov 01 98					22	29	108	259	162	484
	Jul 22 99					20	24	96	224	141	472
	Jul 25 00	10.1	10.3	759	7.86	16	21	71	192	120	370

∩ ¹ TDS values in parenthesis are estimated from specific conductance/TDS relationship calculated from 68 paired observations in delta lakes.
 $TDS = 0.578 * (\text{specific conductance}) + 2.330$ ($r^2 = 0.992$)
 (specific conductance range: 55 to 7,209 $\mu\text{S}/\text{cm}$; TDS range: 18 to 4,254 mg/l)

Table 7. Summary of fish presence and estimated available winter water in lakes in the CD-North study area.

Name	Aerial Photo Acreage	Maximum Depth (ft)	Calculated Volume (mil gals)	15% Vol. >7 ft (mil gals)	Fish Caught ¹	Fish Concern ²	Volume Available (mil gals)
L9210	134.7	29.1	452.4	28.2	LSCS, RDWF BKFH, NSSB	Yes	28.2
M9313	140.2	25.1	415.1	19.0	LSCS, NSSB	Yes	19.0

¹ LSCS = least cisco, RDWF = round whitefish
 BKFH = Alaska blackfish, NSSB = ninespine stickleback



Figure 1. Lakes sampled in CD-North area during 2002 in relation to the Alpine Development, Colville Delta, Alaska.

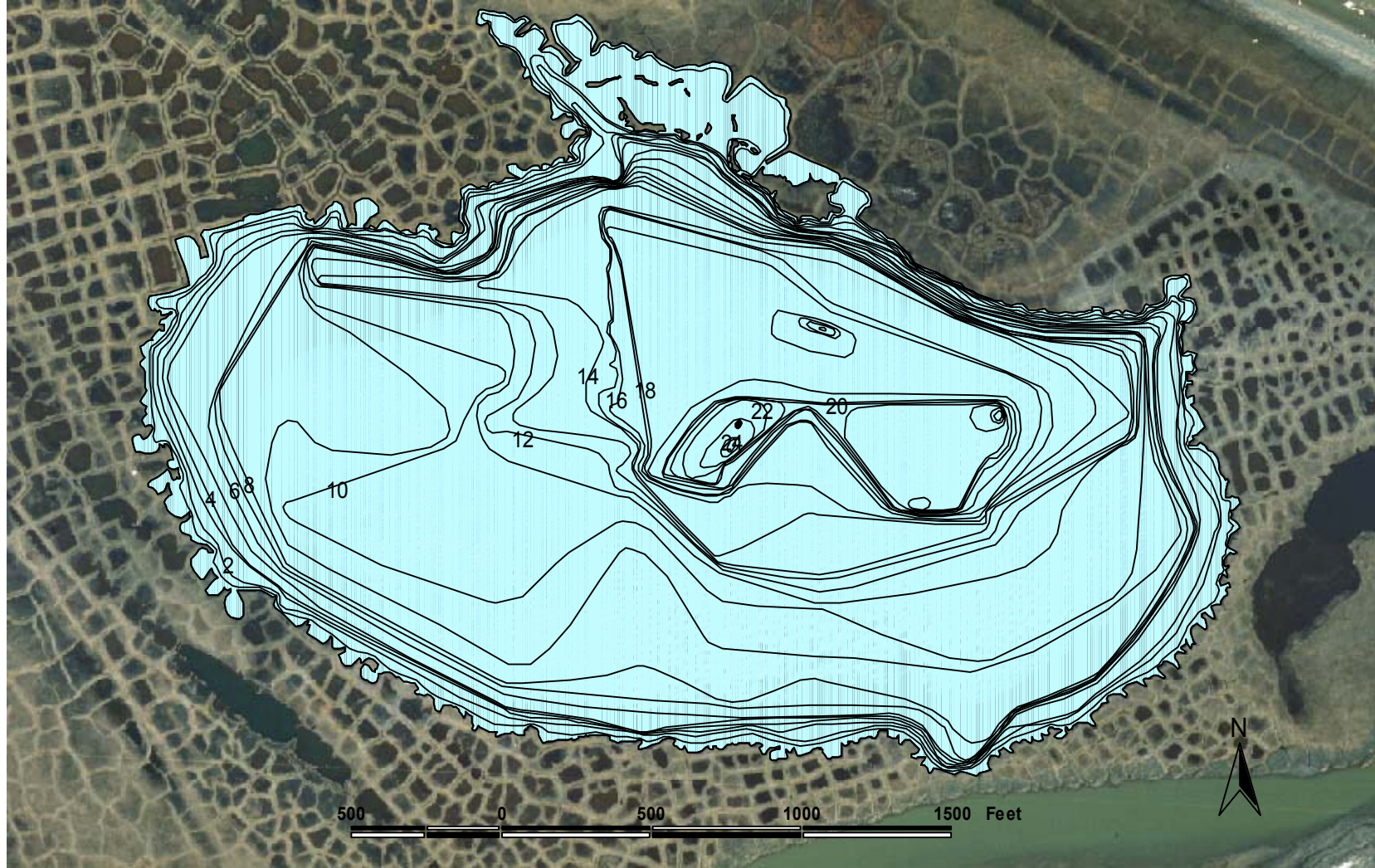


Figure 2. Depth contours of lake L9210, based on transects surveyed on September 1, 2002 (depth intervals in 1 foot increments).

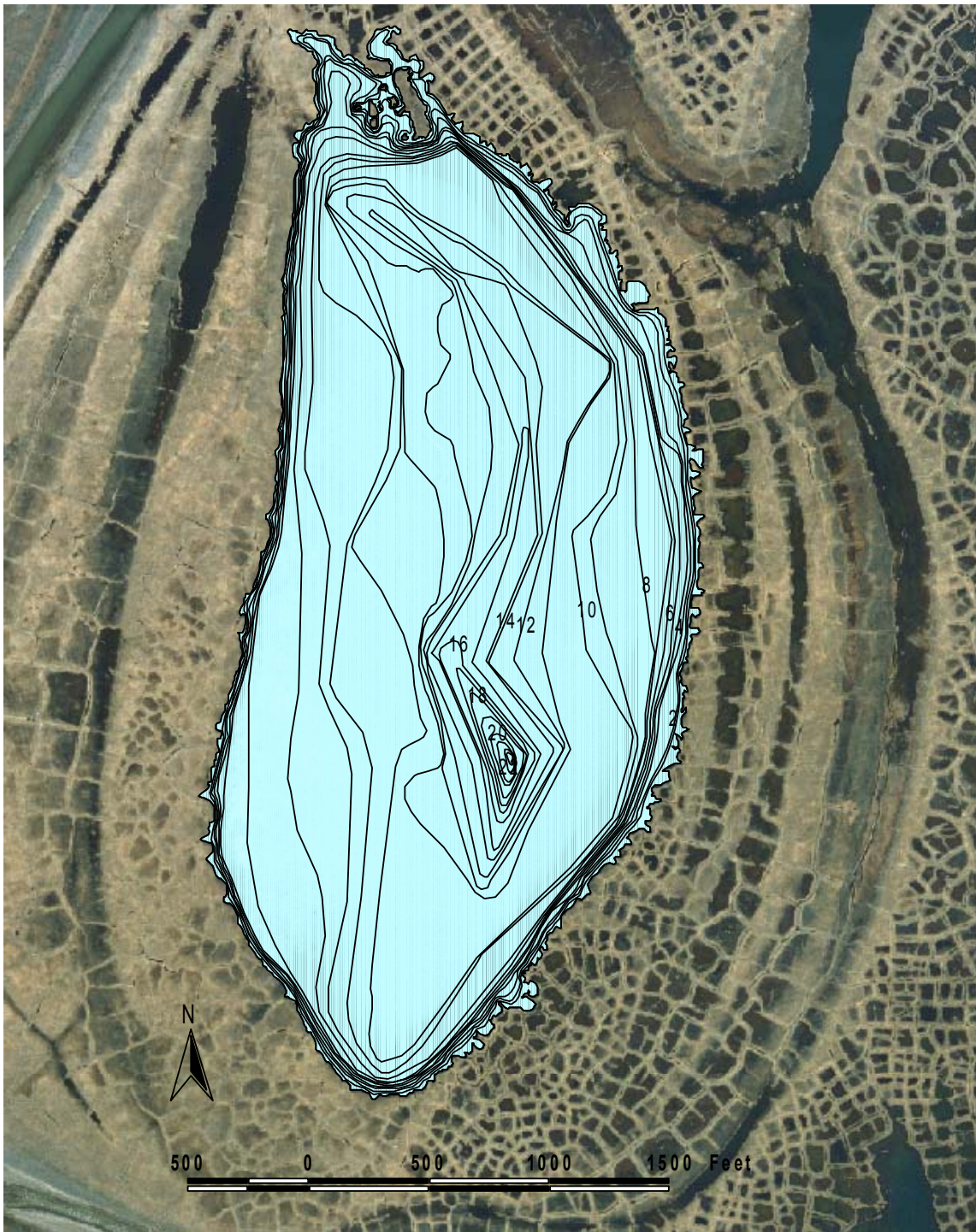


Figure 3. Depth contours of lake M9313, based on transects surveyed on September 1, 2002 (depth intervals in 1 foot increments).

APPENDIX A
Lake Summaries for Potential Water source Lakes
Sampled in 2002

A-2

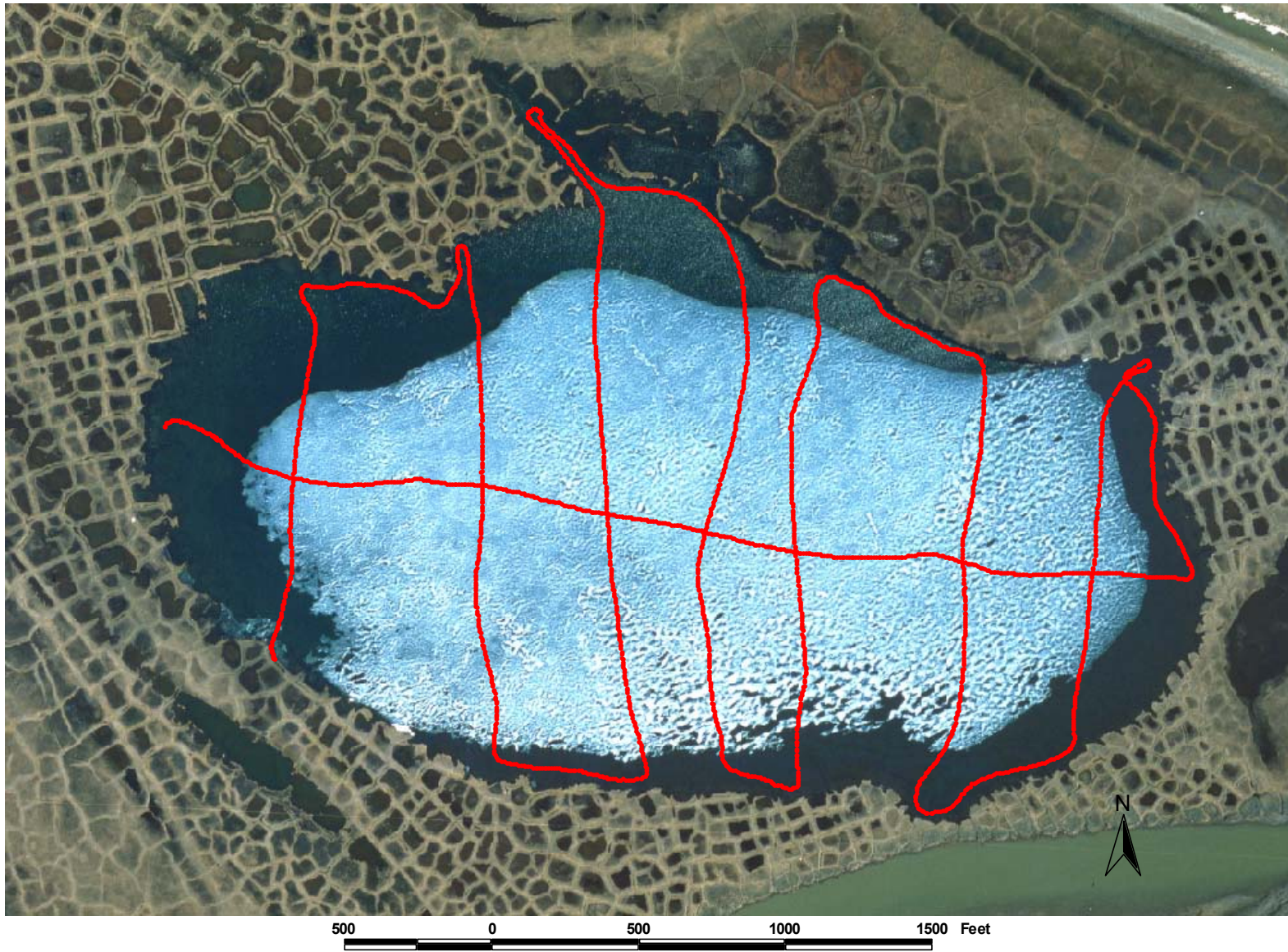


Figure A-1. Depth transects surveyed on lake L9210 on September 1, 2002.

Lake L9210

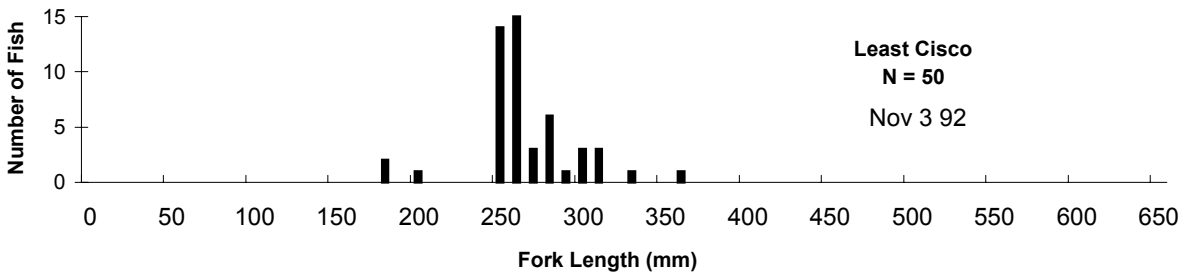
Other Names: P6.3; M9213
Location: 70°24.61'N 150°55.14'W
USGS Quad Sheet: Harrison Bay B-2: T12N R5E, Sect 8
Habitat: Perched Lake (Infrequent Flooding)
Area: 135 acres
Maximum Depth: 29.1 feet
Active Outlet: No
Calculated Volume: 452.4 million gallons
Permittable Volume: 28.2 million gallons

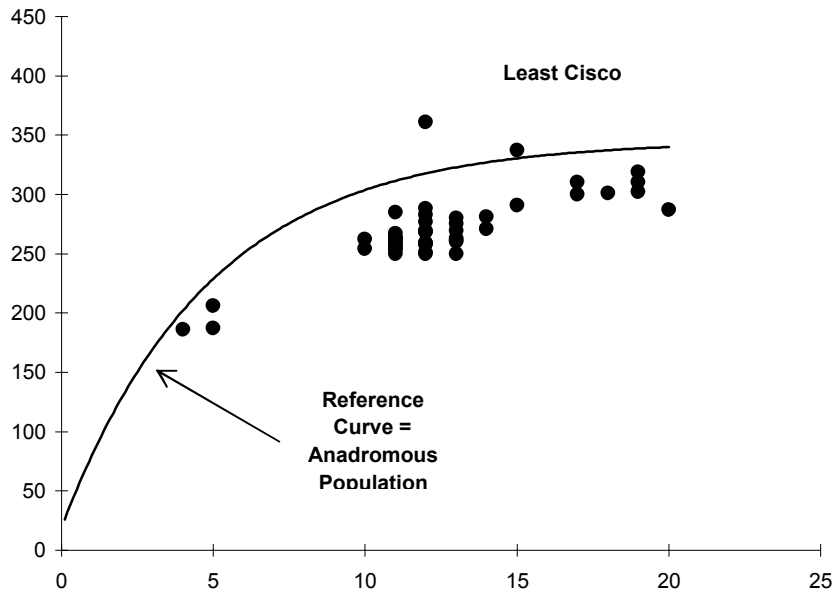
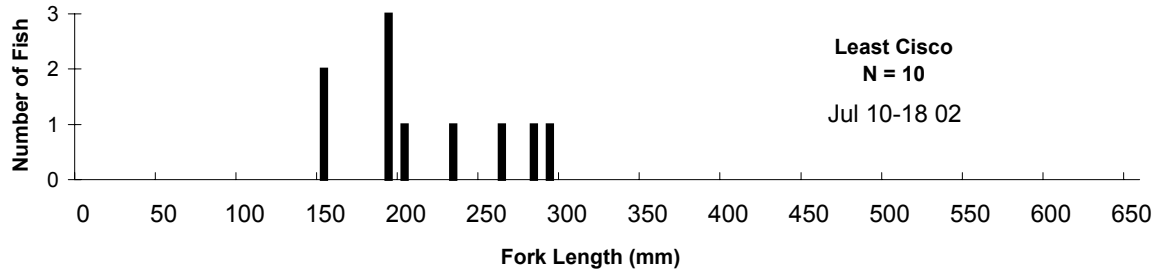
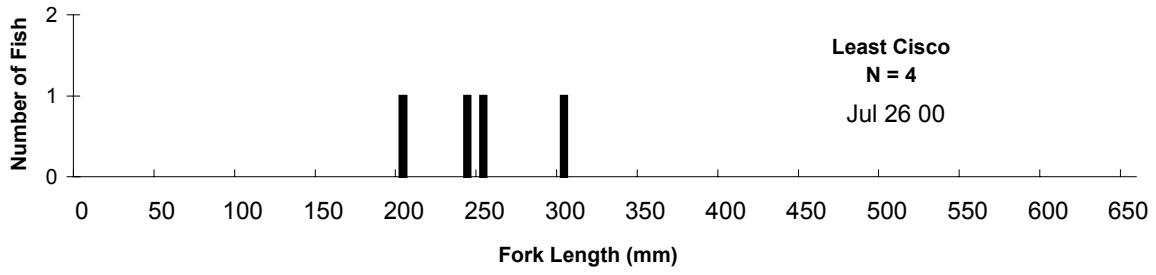
Water Chemistry:

Year of Test	Magnesium (mg/l)	Calcium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
1992	10.0	19.0	20.0	64.0	92	190				J. Lobdell
1998	21.2	11.4	25.8	74.8	100	189				J. Lobdell
1999	21.0	11.7	24.2	67.7	101	200				this study
2000	13.7	7.5	16.0	45.1	65	170	243		7.89	this study
2002							292	3.4	7.86	this study

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Nov 3 92	22.0	Least cisco	50	186-361
	Jul 26 00	1.4	Least cisco	4	200-309
Minnow Traps	Jul 26 00	5.0	None		
Fyke Net	Jul 10-18, 03	185.6	Least cisco	10	151-286
			Round whitefish	1	208
			Alaska blackfish	7	53-79
			9spine stickleback	807	





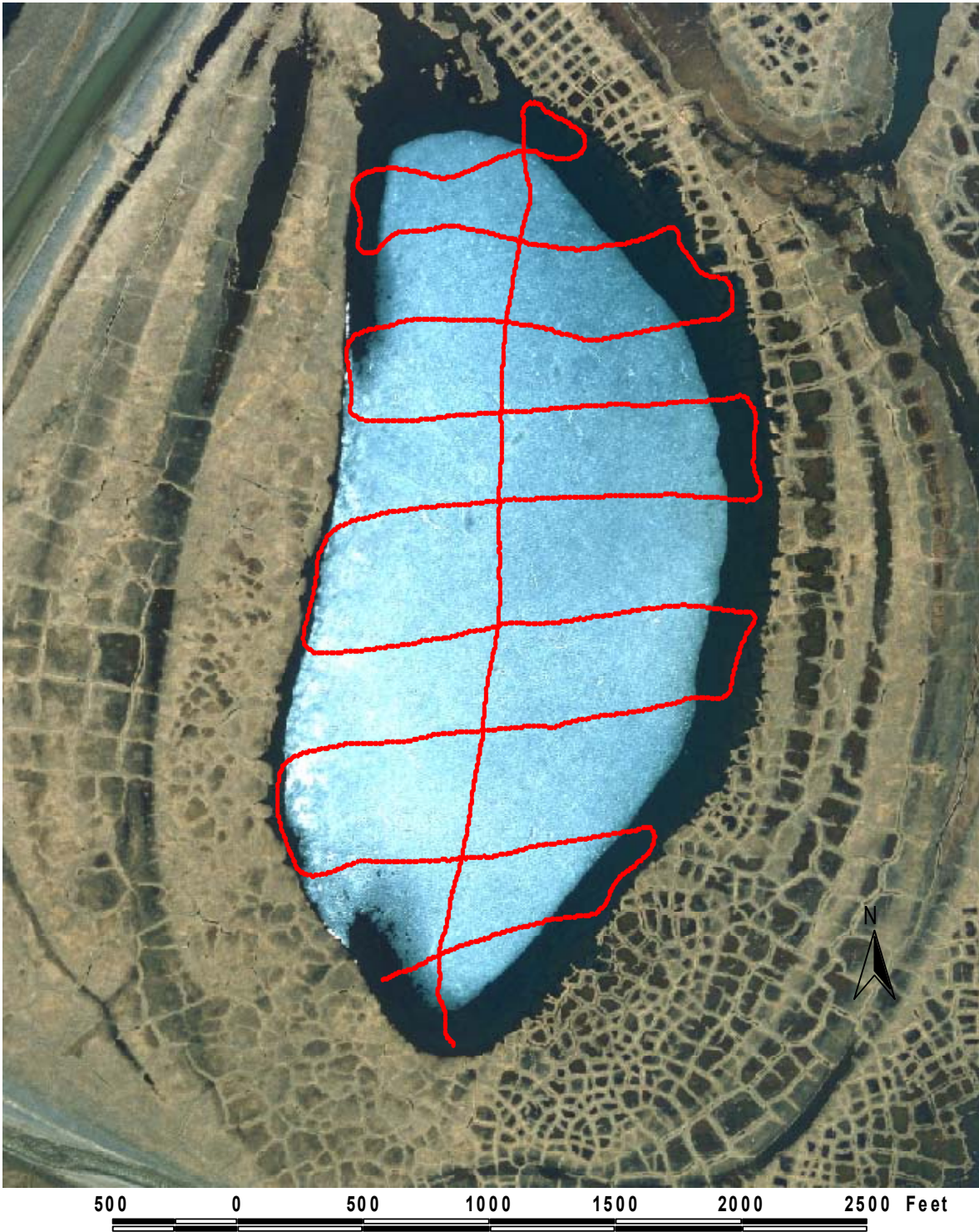


Figure A-2. Depth transects surveyed on lake M9313 on September 1, 2002.

Lake M9313

Other Names: O7.1
Location: 70°25.41'N 150°53.69'W
USGS Quad Sheet: Harrison Bay B-2: T12N R5E, Sect 4
Habitat: Perched Lake (Infrequent Flooding)
Area: 140 acres
Maximum Depth: 25.1 feet
Active Outlet: No
Calculated Volume: 415.1 million gallons
Permittable Volume: 19.0 million gallons

Water Chemistry:

Year of Test	Magnesium (mg/l)	Calcium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
1998	28.8	21.9	108.0	259.0	162	484	839		8.3	J. Lobdell
1999	24.4	19.5	95.9	224.0	141	472				J. Lobdell
2000	21.2	16.4	71.3	192.0	120	370	759		7.86	this study
2002							726	0.9	7.72	this study

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Nov 5 93	20.7	Least cisco	79	138-406
	Jul 25 00	2.1	Least cisco	4	344-369
Minnow Trap	Nov 5 93	20.7	None	0	
	Jul 25 00	6.3	None	0	
Fyke Net	Jul 10-18, 03	186.6	Least cisco	1	171
			9spine stickleback	951	

