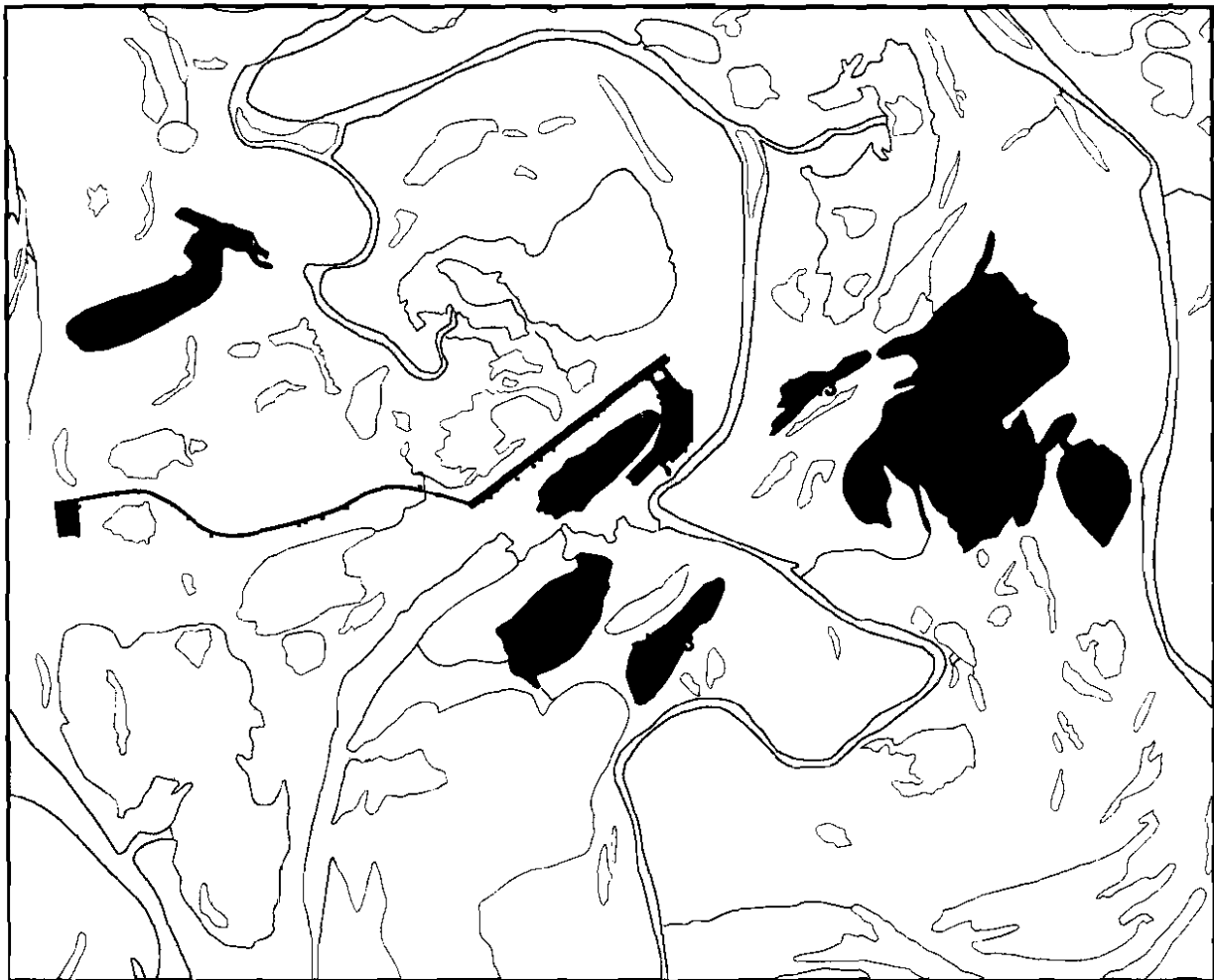


ALPINE DEVELOPMENT PROJECT FISH SURVEY-1998

Final Report

January 1999



Prepared by:

**MJM Research
1012 Shoreland Drive
Lopez Island, WA**

Prepared for:

**ARCO Alaska, Inc.
700 G Street
Anchorage, AK**

ALPINE DEVELOPMENT PROJECT FISH SURVEY-1998

Final Report

January 1999

Prepared by:

Lawrence L. Moulton
MJM Research
1012 Shoreland Drive
Lopez Island, WA

Prepared for:

ARCO Alaska, Inc.
700 G Street
Anchorage, AK

Table of Contents

Introduction	1
Methods	1
Results and Discussion	2
Literature Cited	4
Appendix A. Fish Survey Data Tables	A-1
Appendix B. Lake T7.2 (B8534) Information Packet	B-1
Appendix C. Lake S4.1 (B8533) Information Packet	C-1
Appendix D. Lake T6.1 (L9313) Information Packet	D-1
Appendix E. Lake T7.3 (L9342) Information Packet	E-1
Appendix F. Lake T8.1 (L9283) Information Packet	F-1
Appendix G. Lake U6.1 (L9312) Information Packet	G-1
Appendix H. Lake U6.3 (L9310) Information Packet	H-1

List of Tables

Table 1. Number of fish caught in Lake T7.2 (B8534) in 1998, by species.	5
Table 2. Catch rate by species at each station sampled in lake T7.2 in 1998.	6
Table 3. Estimated volumes for selected Alpine Project Area lakes.	7
Table 4. Number of depth readings by lake.	8
Table 5. Comparison of estimated available winter water based on volume-of-cone method and contour method.	9

List of Figures

Figure 1. Fyke net locations on lake T7.2 (B8534), July 1998.	10
Figure 2. Length frequency of least cisco caught by fyke net in T7.2 (B8534), 1998.	11
Figure 3. Catch rates of least cisco (greater than 50 mm) from fyke net sampling in lake T7.2 during 1998.	12
Figure 4. Catch rates of least cisco (less than 50 mm) from fyke net sampling in lake T7.2 during 1998.	13
Figure 5. Catch rates of Alaska blackfish from fyke net sampling in lake T7.2 during 1998.	14
Figure 6. Catch rates of ninespine stickleback from fyke net sampling in lake T7.2 during 1998.	15
Figure 7. Contour map of lake S4.1 (B8533).	16
Figure 8. Contour map of lake T6.1 (L9313).	17
Figure 9. Contour map of lake T7.2 (B8534).	18
Figure 10. Contour map of lake T7.3 (L9342).	19
Figure 11. Contour map of lake T8.1 (L9283).	20
Figure 12. Contour map of lake U6.1 (L9312).	21
Figure 13. Contour map of lake U6.3 (L9310).	22

ALPINE DEVELOPMENT PROJECT FISH SURVEY-1998

INTRODUCTION

Lake T7.2 (also known as B8534 and L9282) lies within the Alpine Development Area and may be proposed as a water source for the Alpine Development. Previous sampling in the lake has revealed the presence of three fish species: least cisco, Alaska blackfish and ninespine stickleback (Bendock and Burr 1986; Moulton 1998). Least cisco were numerous and appeared to grow slightly slower than the anadromous population found in the Colville River (Moulton 1998).

The objective of the 1998 study was to obtain additional biological information on fish utilizing the littoral zone (nearshore region) of lake T7.2. Bathymetric surveys were also conducted to allow estimating water volumes for the following lakes:

S4.1 (L9315 or B8533)

T6.1 (L9313)

T7.2 (L9282 or B8534)

T7.3 (L9342)

U6.1 (L9312)

T8.1 (L9283)

U6.3 (L9310)

Contour maps were developed from the bathymetric information to estimate lake volumes.

METHODS

The biological survey consisted of biological sampling with fyke nets combined with physical measurements. Fyke nets were fished at five locations within lake T7.2 (Figure 1).

Catches were enumerated by species; fork lengths (in millimeters) were taken for all specimens captured, except ninespine stickleback and slimy sculpin. On some occasions when more than 50 young-of-the-year least cisco were captured, the first 50 were measured and the rest counted and released. Duration of each set was recorded to allow calculation of catch rates. Water quality measurements included water temperature, specific conductance and dissolved oxygen.

Bathymetric data were collected to allow estimating lake volume. Depths taken during summer were read with an Eagle SupraPro ID depth sounder. During winter, depths were measured through the ice with a Polar Vision hand-held sonar unit. Both sonar units were checked against a measuring tape in 24 ft of water and found to be highly accurate. Error was less than 0.1 ft.

Transect positions were determined by marking the beginning and end locations of the transects on

base maps of the lakes. Individual depth measurements were located with a hand-held GPS receiver while traversing the lake with either a boat or float tube. The readings were converted to distance measurements and the resulting points were plotted on the known location of the transect. During winter, the transect was again determined by marking the beginning and end locations of the transects on base maps of the lakes. GPS coordinates of the end points were also recorded. The individual depth readings were a measured distance apart, with the distance between measurements varying with the size of the lake. On large lakes, such as T7.2, the depth measurements were 100 ft apart, while on small lakes, such as T7.3, the depth measurements were 25 ft apart.

Depth measurements were plotted on base maps of each lake. Initial plots of transects obtained during summer appeared erratic because of error caused by U.S. Department of Defense scrambling of the civilian GPS signal. Transects were manually smoothed to better represent the course covered by the boat or float tube. Transects obtained during winter were straight lines, thus smoothing was not necessary.

Contours were drawn around regions containing depths greater than the indicated contour line. The area encompassed by each contour was then obtained from the GIS program used to generate the contour plot. Total estimated volume was obtained by summing the volumes represented by each contour interval. Estimated volumes were calculated as cubic feet and gallons.

RESULTS AND DISCUSSION

Biological Observations

Fyke net sampling conducted between July 16 and 24, 1998 in lake T7.2 produced a catch of 2,856 fish (Table 1). Ninespine stickleback and least cisco were the most abundant species, with Alaska blackfish, burbot and broad whitefish also caught. The broad whitefish was 835 mm total length, which be may the largest ever caught in Alaska. A review of available information failed to produce any other records of broad whitefish in excess of 750 mm.

Least cisco were present as young-of-the-year fish (less than 50 mm) and larger (Figure 2). Since the lake did not receive inflow during spring break-up (Jim Aldrich, Michael Baker Jr. Inc., personal communication, 1998), the young-of-the-year fish most probably indicate successful spawning in the lake.

Least cisco (other than young-of-the-year) were sparsely distributed around the lake, with highest catches at Station B (Table 2, Figure 3). Young-of-the-year least cisco were caught in greatest number at Stations A and E, with none captured at Stations B or C (Figure 4). Alaska blackfish and ninespine stickleback were most abundant at Station B (Figures 5 and 6).

Three of the species, least cisco, Alaska blackfish and ninespine stickleback, had previously been caught in the lake (Bendock and Burr 1986, Moulton 1998). Broad whitefish and burbot caught in 1998 were new records, thus there are now five documented species using the lake.

The biological sampling indicates that fish utilize the shallow region of the lake during summer, with young least cisco often present in large numbers. Some use is localized, particularly by Alaska blackfish and ninespine stickleback, which appear most abundant in heavily vegetated areas. Schools of least cisco, however, likely roam extensively along the shore and can be found at almost

any location.

Winter habitat within the lake is abundant, with an estimated 269 million gallons of water deeper than 7 feet and a maximum depth of 28 feet (Table 3). Least cisco, Alaska blackfish and ninespine stickleback all appear to have reproducing populations in the lake, with broad whitefish and burbot likely using the lake on an opportunistic basis.

Lake Volumes

Lake volumes were estimated for all seven lakes (Table 3). Also included are the volumes deeper than 7 feet and the likely allowable winter withdrawal. The volume deeper than 7 feet represents the likely volume of water present at maximum ice thickness, thus is an estimate of the water available to support wintering fish. The water likely to be allowable for winter withdrawal is 15% of the minimum winter volume. Alaska Department of Fish and Game has been using this 15% guideline to allow winter water use while retaining some measure of protection for wintering fish. If special arrangements are made for a variance from the 15% guideline, the allowable withdrawal will, of course, be different.

Contour maps were generated for each referenced lake (Figures 7 to 13). The contour maps were based on 69 to 304 depth measurements per lake, with the number of measurement somewhat dependent on lake size (Table 4). The maps are best interpretations of available depth information, but because of the wide spacing between transects on some lakes, there are likely to be inaccuracies in the mapped representations.

An appendix containing existing information for each lake is attached.

The amount of water available for withdrawal in the North Slope oil field region has traditionally been estimated by applying the formula for the volume of a cone to the lake surface area and maximum depth. The estimated volumes for the seven lakes were obtained from both cone volume method and contour method to compare the two methods (Table 5). There was considerable variation in the differences estimated between the two methods, with the contour method providing up to 63% more water to 34% less water. On average, the contour method provided about 9% more water than the cone volume method. Assuming that the contour method is the more accurate estimator, relying on the cone volume method for estimating withdrawals from lakes T7.2 and U6.3 would result in 23% and 20% withdrawals of winter volume compared to the desired maximum of 15%. Withdrawals based on the cone volume method from the 5 other lakes would result in actual withdrawals between 9% and 15%.

LITERATURE CITED

Bendock, T.N. and J.M. Burr. 1986. Arctic Area Trout Studies. Federal Aid in Fish Restoration and Anadromous Fish Studies, 1985-1986, Volume 27, Study T-7-1, Alaska Department of Fish and Game, Sport Fish Division, Juneau, AK. 75p.

Moulton, L.L. 1998. Lakes sampled for fish within and near the Colville River delta, Alaska 1979-1998. Report to ARCO Alaska Inc. Bainbridge Island, WA. 513p.

Table 1. Number of fish caught in Lake T7.2 (B8534) in 1998, by species.

Species	Number Caught	Percent	Number Measured
Broad whitefish	1	0.0%	1
Alaska blackfish	16	0.6%	16
Burbot	1	0.0%	1
Least cisco	757	26.5%	480
Ninespine stickleback	2,081	72.9%	0
Total	2,856		498

Table 2. Catch rate by species at each station sampled in lake T7.2 in 1998

Species	Station	Mean CPUE (fish/day)	Standard Deviaton	Number of Sets
Least cisco (>50 mm)	A	2.4	3.0	7
	B	6.3	8.8	7
	C	1.0		1
	D	2.0	2.8	2
	E	0.3	0.5	3
Least cisco (<50 mm)	A	40.8	74.4	7
	B	0.0	0.0	7
	C	0.0		1
	D	13.1	10.1	2
	E	101.7	95.8	3
Alaska blackfish	A	0.0	0.0	7
	B	1.7	1.3	7
	C	0.0		1
	D	0.5	0.7	2
	E	0.0	0.0	3
Ninespine stickleback	A	25.9	12.8	7
	B	241.3	110.8	7
	C	1.0		1
	D	1.5	0.8	2
	E	14.9	23.0	3

Table 3. Estimated volumes for selected Alpine Project Area lakes.

(volume estimates based on contour mapping developed from depth measurements obtained during 1995-1998 Alpine Project Fish Surveys)

ERG Lake Number	Investigator Number	Max. Depth (ft)	Area (acres)	Estimated Volume (million cf)	Estimated Volume (million gals)	Volume below 7 ft (million gals)	15% of Volume below 7 ft (million gals)
S4.1	B8533	25.2	114.5	67.97	508.36	269.37	40.41
T6.1	L9313	12.3	68.9	24.69	184.64	44.93	6.74
T7.2	B8534	28.0	480.4	224.44	1,678.65	711.73	106.76
T7.3	L9342	11.5	25.3	8.98	67.20	13.07	1.96
T8.1	L9283	10.5	74.3	26.84	200.75	45.64	6.85
U6.1	L9312	14.1	99.9	39.84	297.99	94.33	14.15
U6.3	L9310	24.1	60.5	28.27	211.40	84.38	12.66

Table 4. Number of depth readings by lake

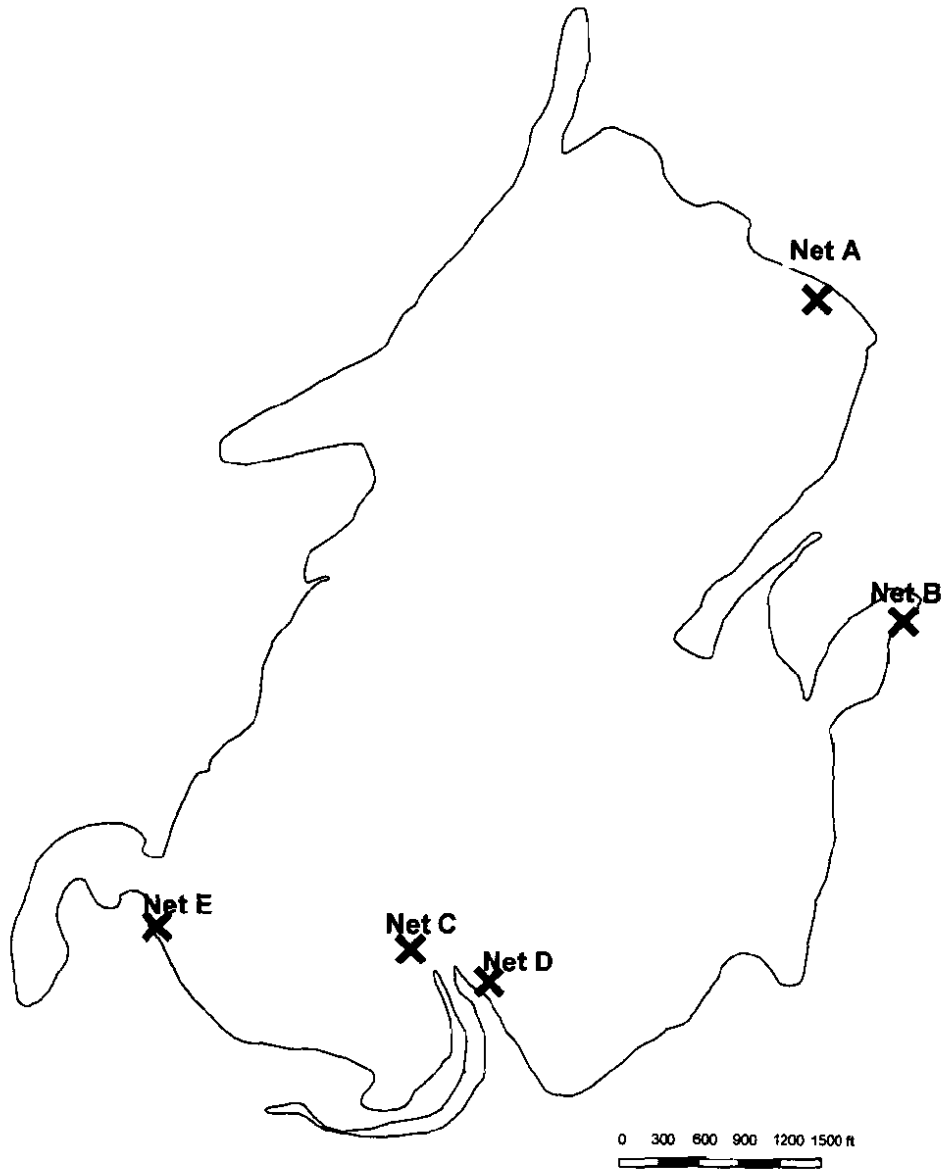
ERG Lake Number	Investigator Number	Number of Readings
S4.1	B8533	166
T6.1	L9313	239
T7.2	B8534	304
T7.3	L9342	76
T8.1	L9283	69
U6.1	L9312	126
U6.3	L9310	137

Table 5. Comparison of estimated available winter water based on volume-of-cone method and contour method.

ERG Lake Number	Investigator Number	Cone Method (million gals.)	Contour Method (million gals.)	Percent Difference
S4.1	B8533	33.61	40.41	+20.2
T6.1	L9313	5.89	6.74	+14.5
T7.2	B8534	162.69	106.76	-34.4
T7.3	L9342	1.95	1.96	+0.3
T8.1	L9283	4.20	6.85	+63.2
U6.1	L9312	11.43	14.15	+23.7
U6.3	L9310	16.70	12.66	-24.2
Mean Difference:				+9.1

Figure 1. Fyke Net Locations on Lake T7.2 (B8534)
July 1998

MJM Research	January 1999
--------------	--------------



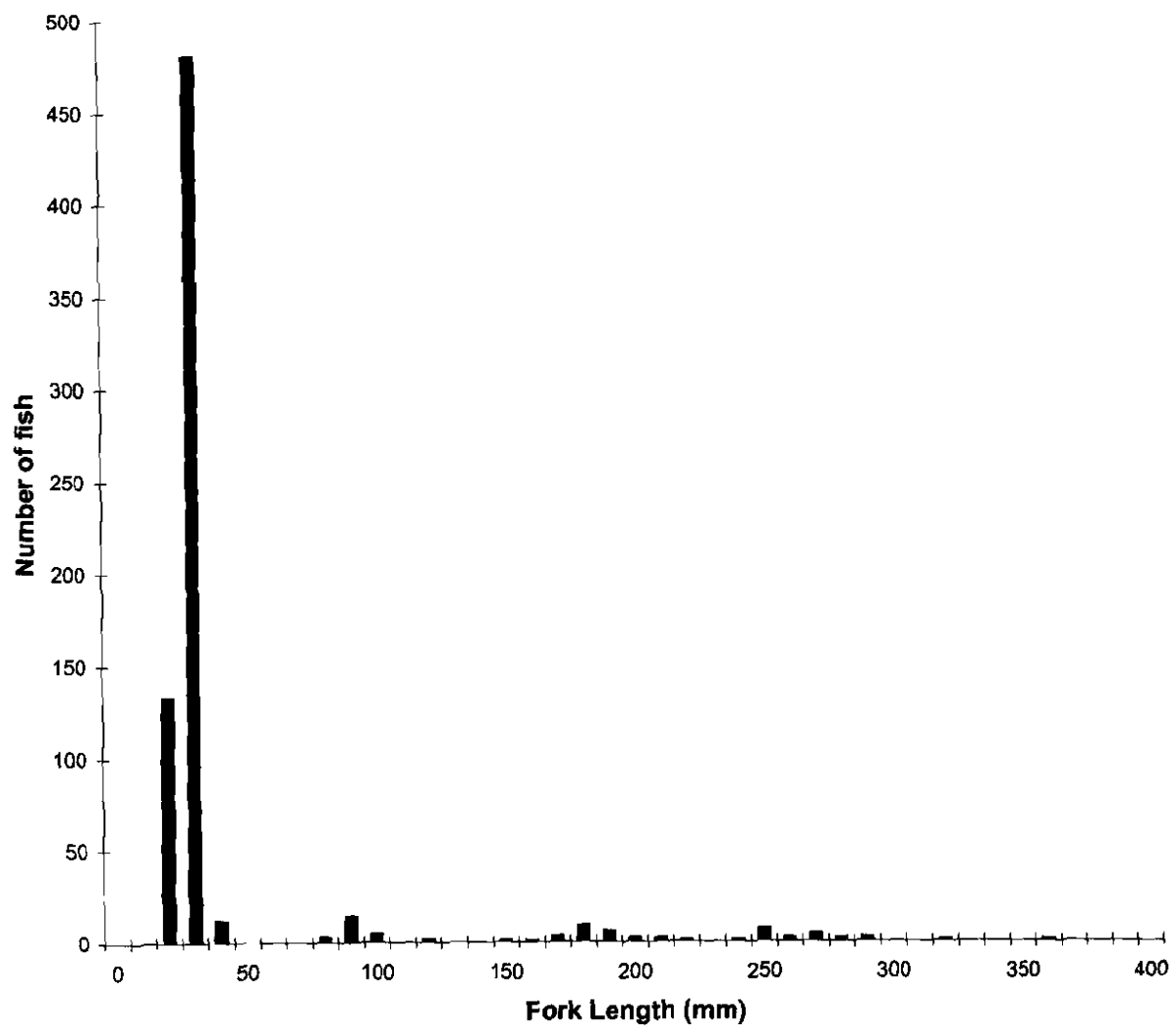


Figure 2. Length frequency of least cisco caught by fyke net in lake T7.2 (B8534), 1998.

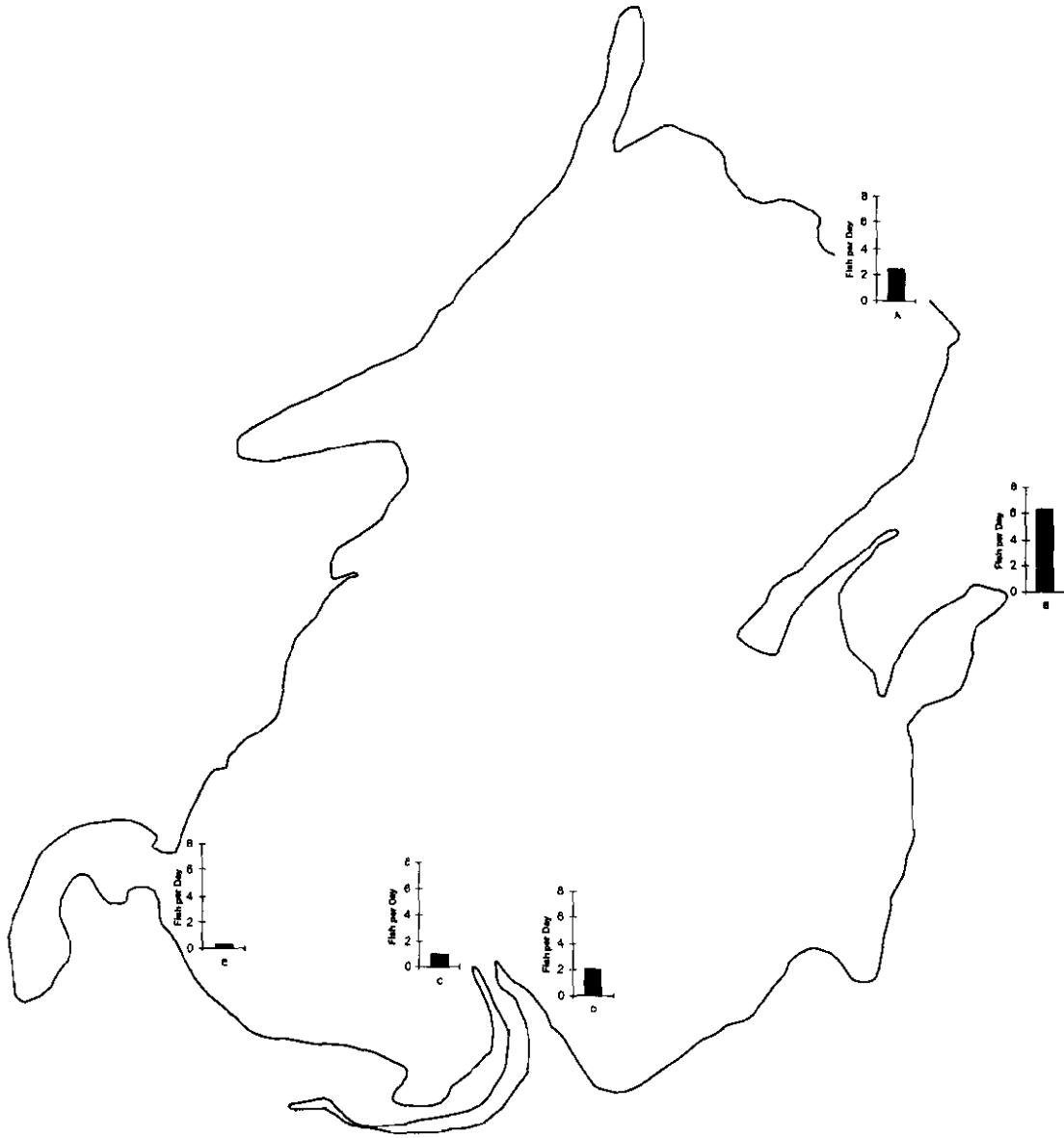


Figure 3. Catch rates of least cisco (greater than 50 mm) from fyke net sampling in lake T7.2 during 1998.

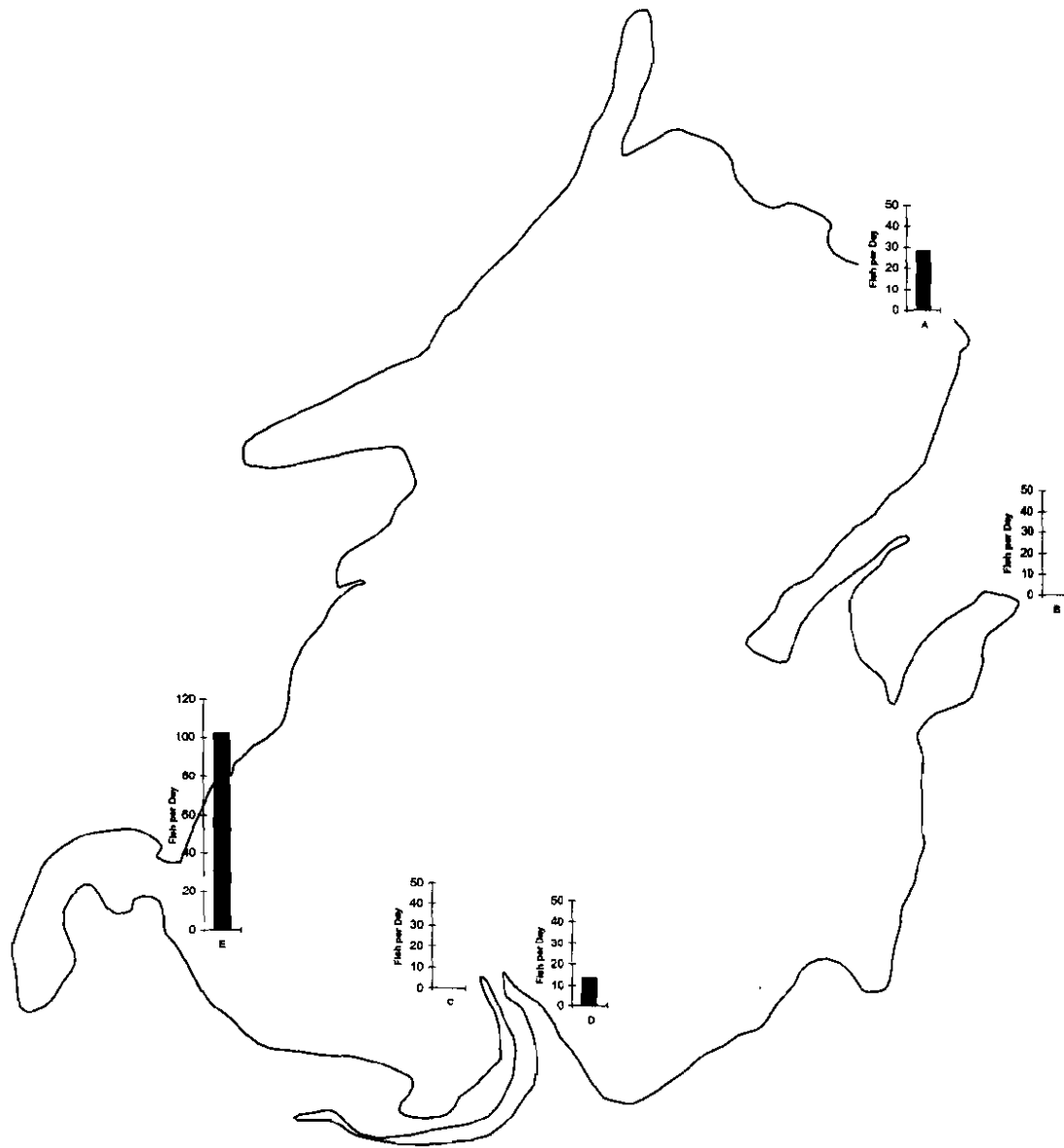


Figure 4. Catch rates of least cisco (less than 50 mm) from fyke net sampling in lake T7.2 during 1998.

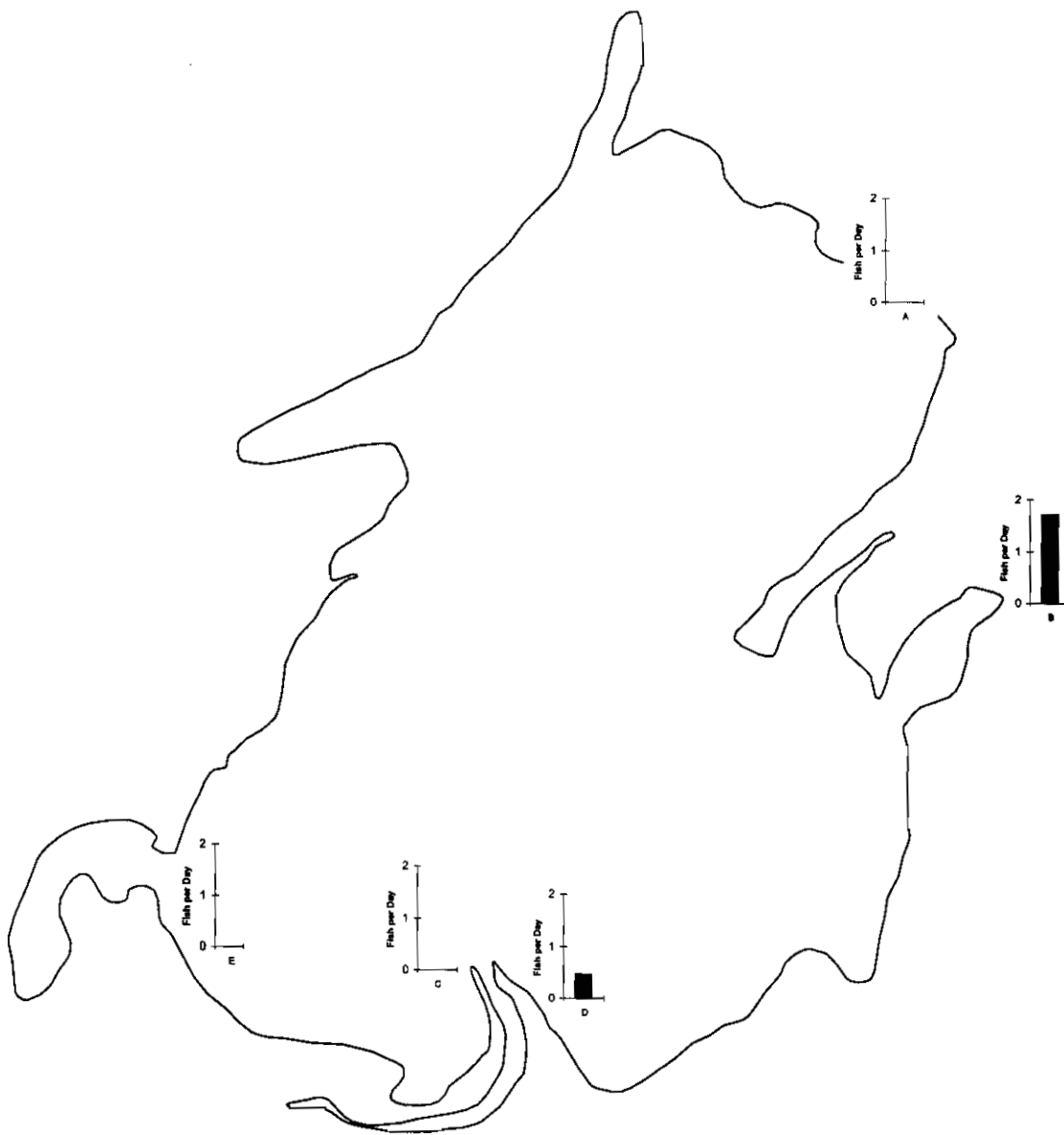


Figure 5. Catch rates of Alaska blackfish from fyke net sampling in lake T7.2 during 1998.

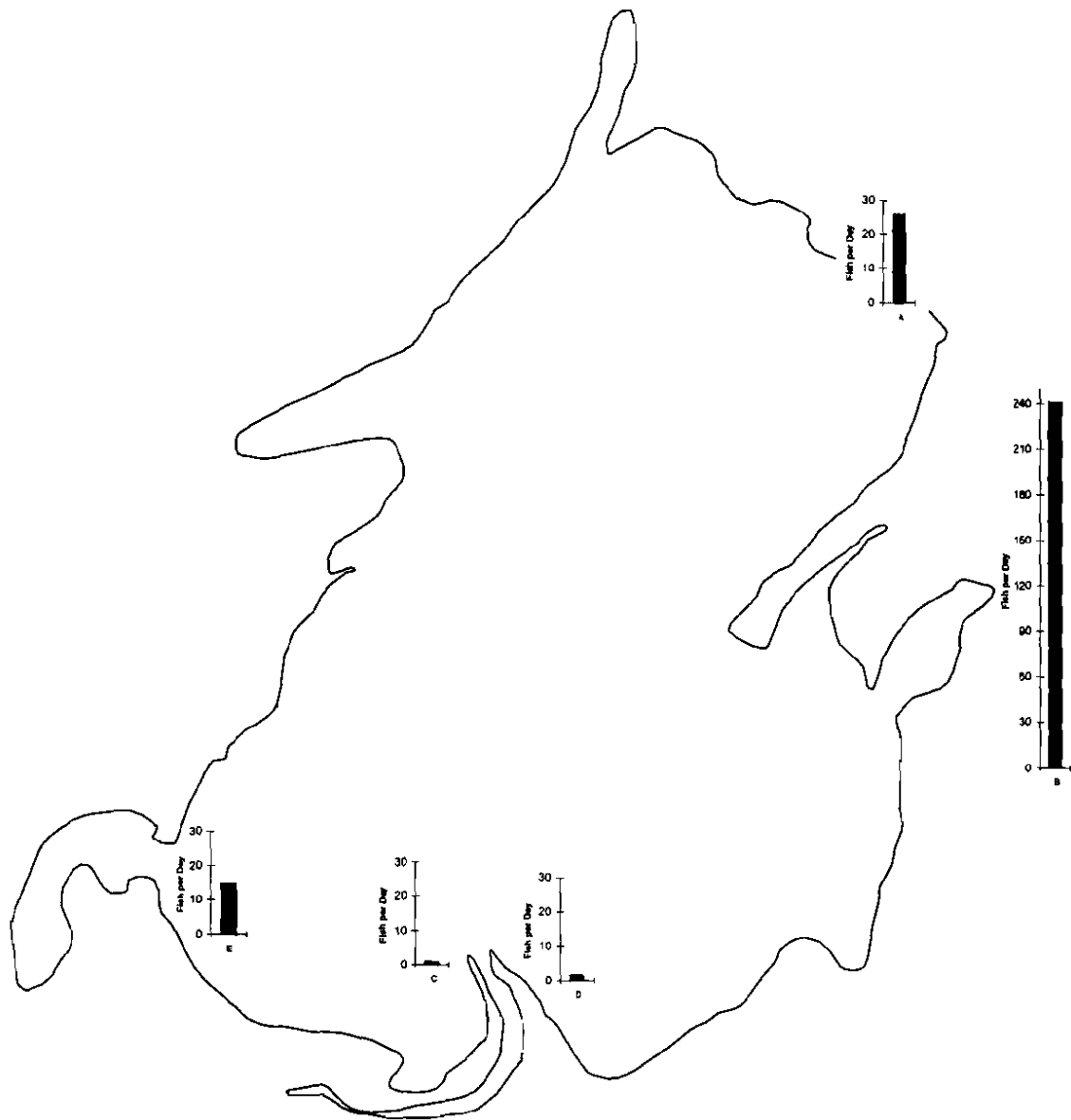


Figure 6. Catch rates of ninespine stickleback from fyke net sampling in lake T7.2 during 1998.

Figure 7. Contour Map of Lake S4.1 (B8533)
contour data from 1995, 1996 and 1998

MJM Research

December 1998

Disclaimer: Contours are approximate interpretations
of available depth information to estimate lake volume,
they should not be used for navigation or design.

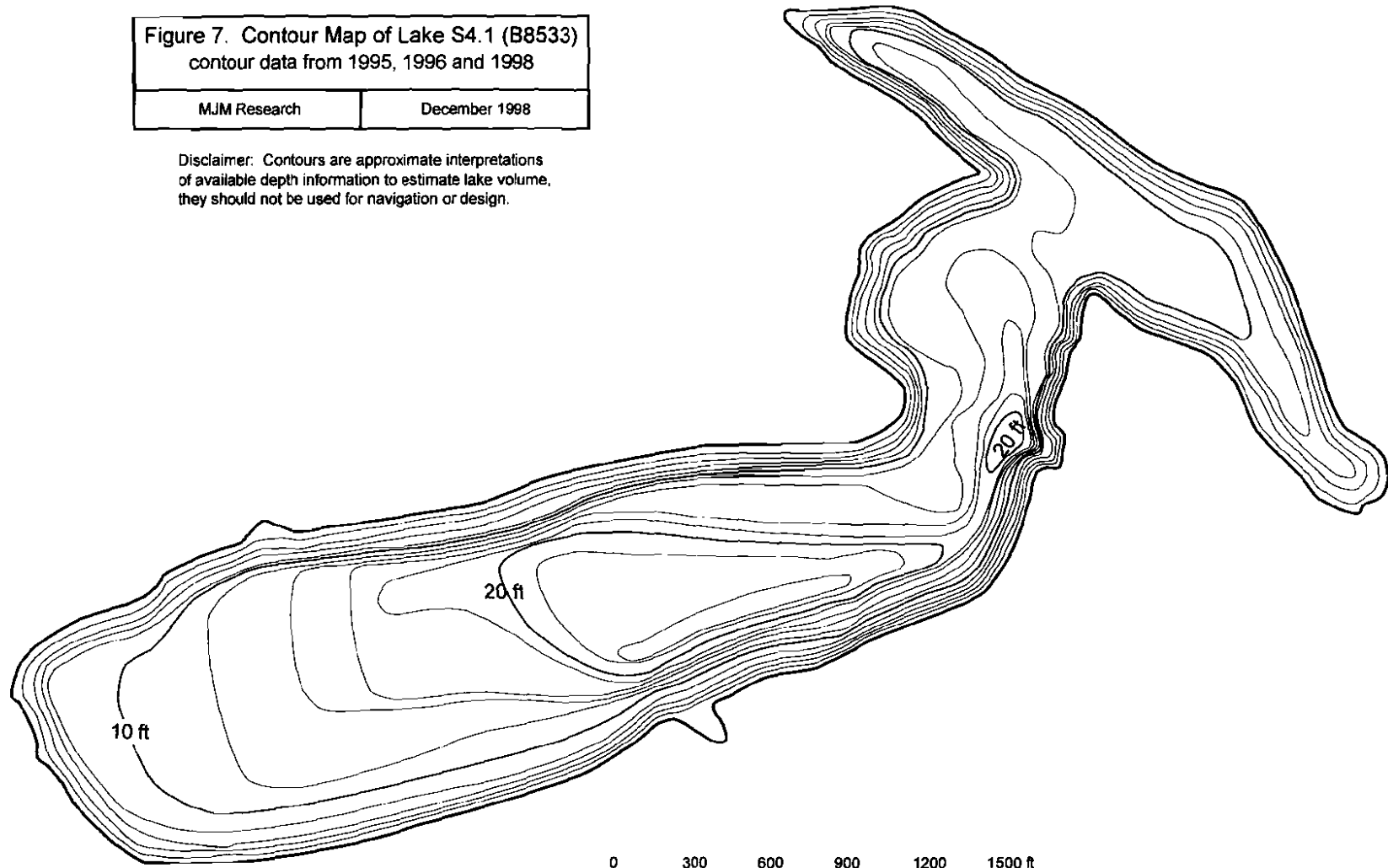


Figure 8. Contour Map of Lake T6.1 (L9313)
contour data from 1995, 1996 and 1998

MJM Research

December 1998

Disclaimer: Contours are approximate interpretations
of available depth information to estimate lake volume,
they should not be used for navigation or design.

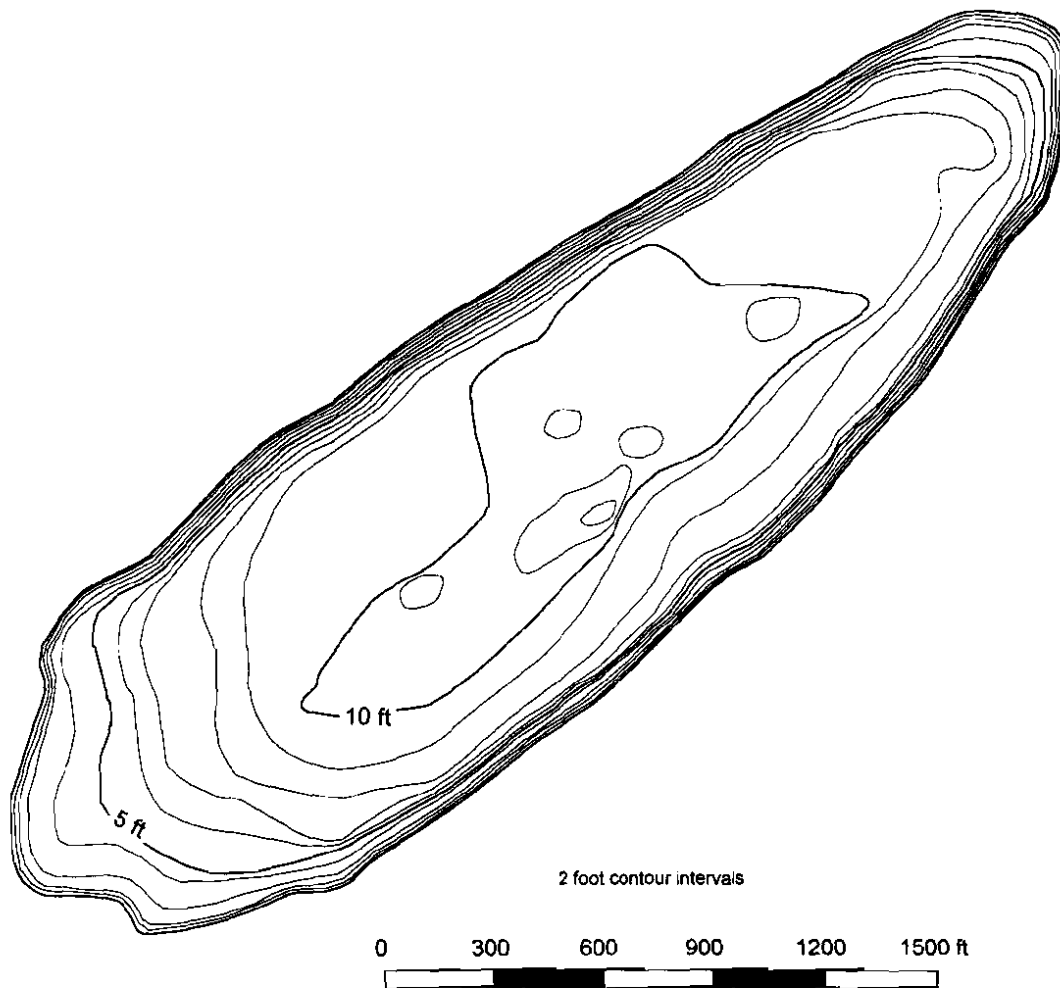


Figure 9. Contour Map of Lake T7.2 (B8534)
contour data from 1995 and 1998

MJM Research	December 1998
--------------	---------------

Disclaimer: Contours are approximate interpretations of available depth information to estimate lake volume, they should not be used for navigation or design.

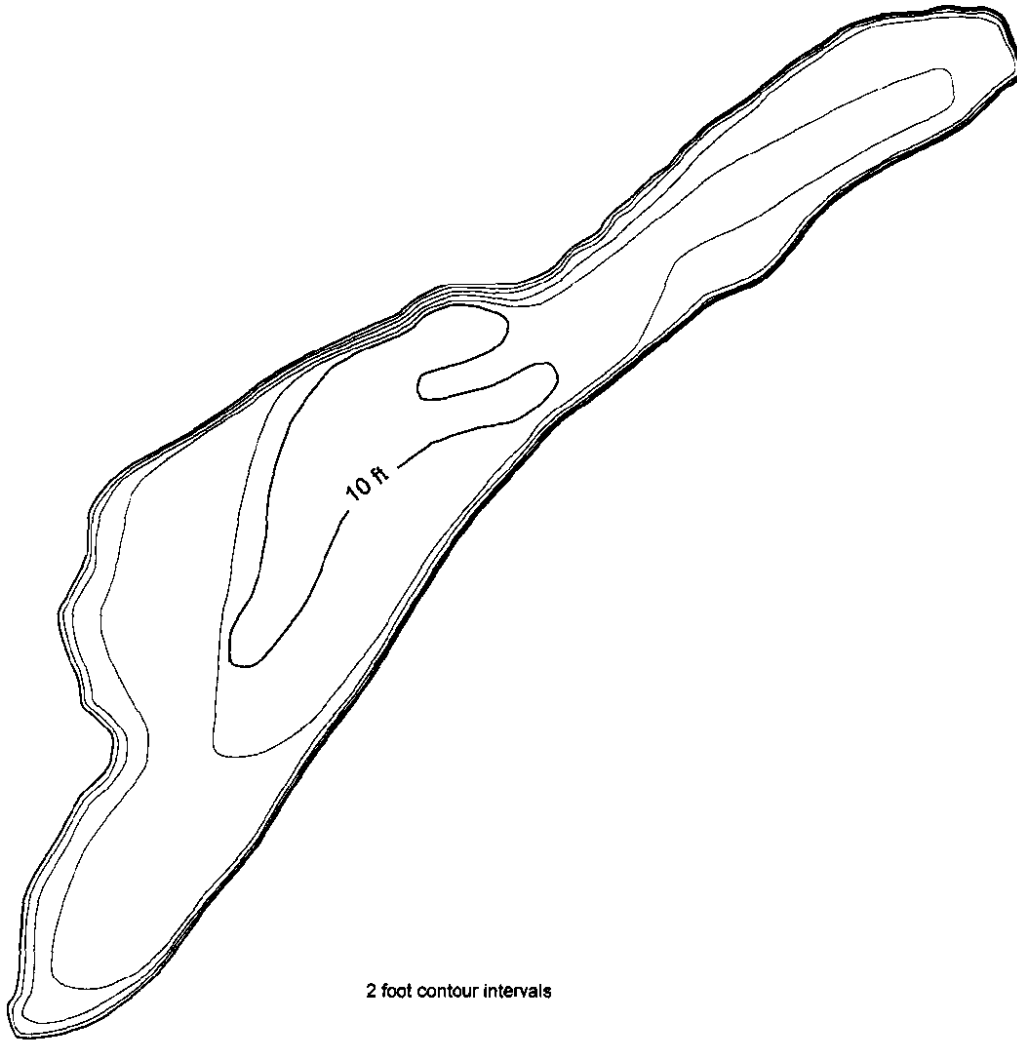


Figure 10. Contour Map of Lake T7.3 (L9342)
contour data from 1995 and 1998

MJM Research

December 1998

Disclaimer: Contours are approximate interpretations
of available depth information to estimate lake volume,
they should not be used for navigation or design.



0 300 600 900 1200 1500 ft

Figure 11. Contour Map of Lake T8.1 (L9283)
contour data from 1995 and 1998

MJM Research	December 1998
--------------	---------------

Disclaimer: Contours are approximate interpretations of available depth information to estimate lake volume, they should not be used for navigation or design

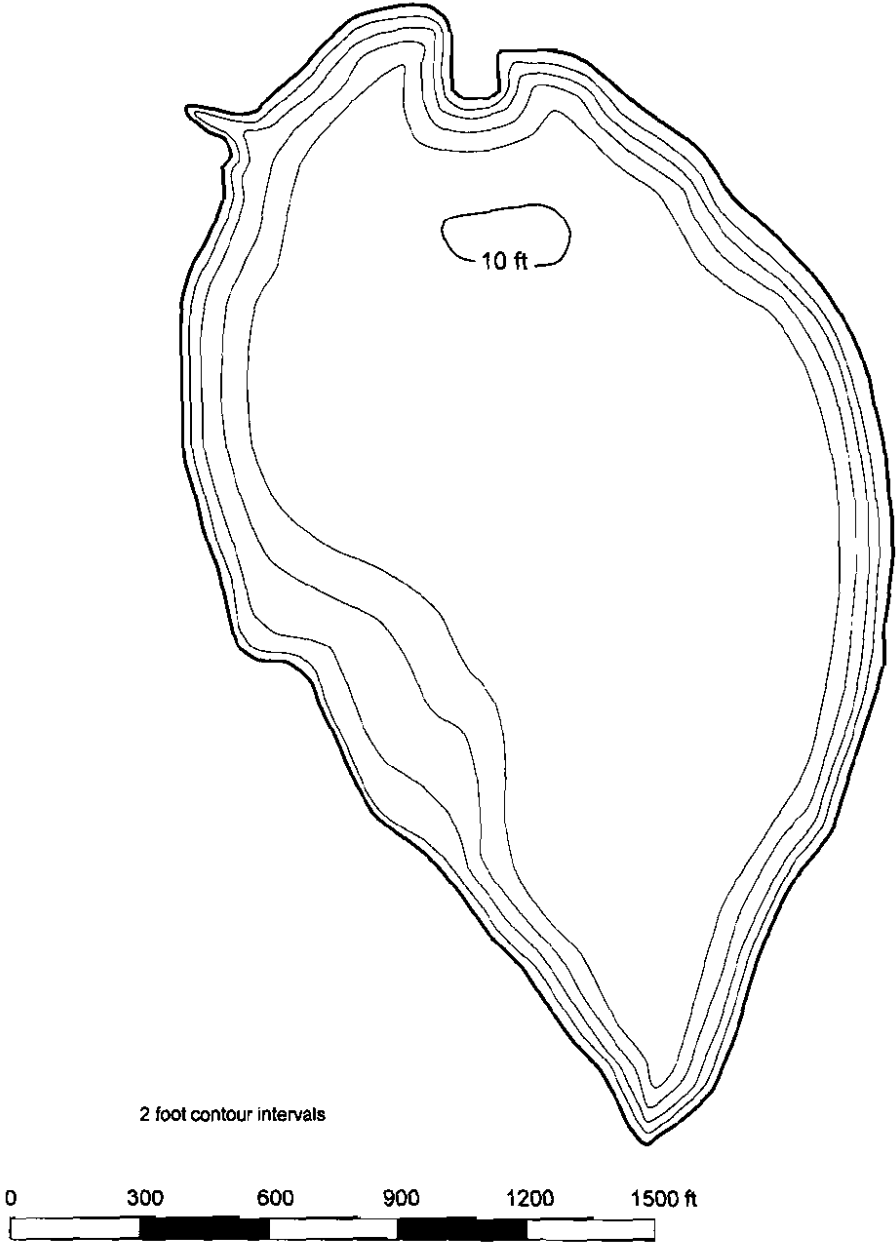
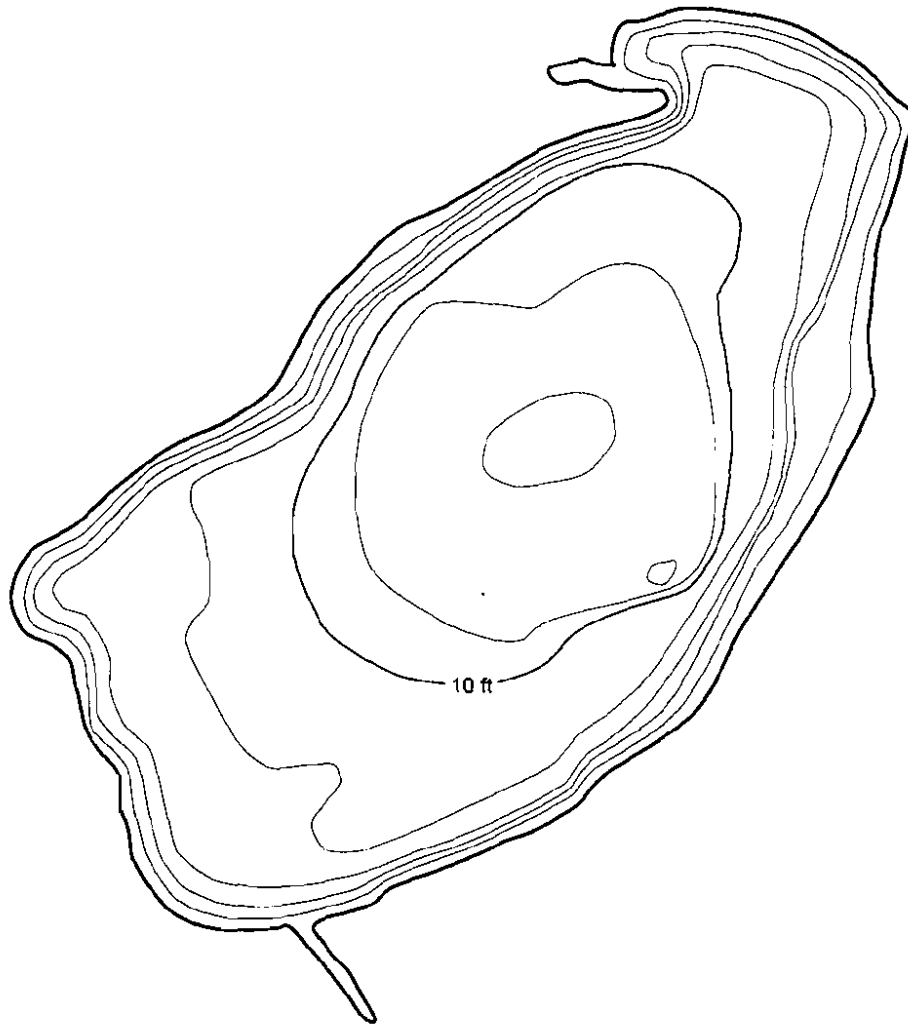


Figure 12. Contour Map of Lake U6.1 (L9312)
depth contours based on 1995, 1997 and 1998 data

MJM Research

December 1998

Disclaimer: Contours are approximate interpretations
of available depth information to estimate lake volume,
they should not be used for navigation or design.



2 foot contour intervals

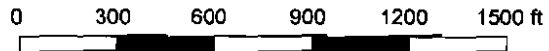
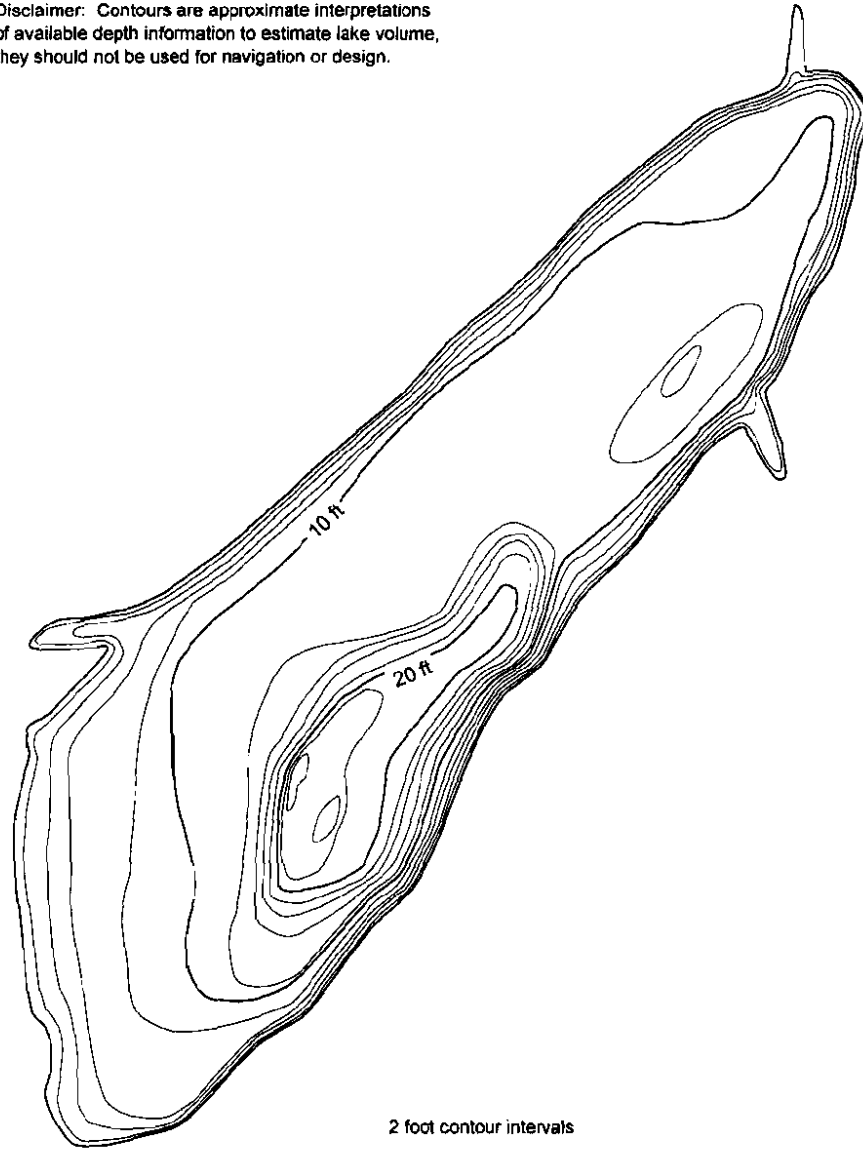


Figure 13. Contour Map of Lake U6.3 (L9310)
contour data from 1995, 1997 and 1998

MJM Research	December 1998
--------------	---------------

Disclaimer: Contours are approximate interpretations of available depth information to estimate lake volume, they should not be used for navigation or design.



Appendix A. Fish Survey Data Tables

Appendix Table A-1. Fyke net effort at lake T7.2 during 1998.

Station	Set Number	Start Date	Start Time	End Date	End Time	Set Duration (hours)
B8534A	98001	7/16/98	15:50	7/17/98	12:35	20.8
	98005	7/17/98	12:35	7/18/98	11:55	23.3
	98008	7/18/98	11:55	7/19/98	12:20	24.4
	98011	7/19/98	12:20	7/20/98	16:00	27.7
	98014	7/20/98	16:00	7/21/98	13:20	21.3
	98017	7/21/98	13:20	7/22/98	12:55	23.6
	98020	7/22/98	12:55	7/24/98	14:10	49.3
B8534B	98002	7/16/98	16:35	7/17/98	11:30	18.9
	98004	7/17/98	11:30	7/18/98	11:30	24.0
	98007	7/18/98	11:30	7/19/98	11:50	24.3
	98010	7/19/98	11:50	7/20/98	15:10	27.3
	98013	7/20/98	15:10	7/21/98	12:55	21.8
	98016	7/21/98	12:55	7/22/98	12:10	23.3
	98019	7/22/98	12:10	7/24/98	13:25	49.3
B8534C	98003	7/17/98	11:05	7/18/98	10:35	23.5
B8534D	98006	7/18/98	11:10	7/19/98	11:20	24.2
	98009	7/19/98	11:20	7/20/98	13:25	26.1
B8534E	98012	7/20/98	14:50	7/21/98	12:10	21.3
	98015	7/21/98	12:10	7/22/98	11:20	23.2
	98018	7/22/98	11:20	7/24/98	18:20	55.0

Appendix Table A-2. Length frequencies of least cisco caught in lake T7.2 by station, 1998.

Fork Length (mm)	Number of fish by Station					Total
	B8534A	B8534B	B8534C	B8534D	B8534E	
20-29	110	0	0	4	19	133
30-39	200	0	0	23	258	481
40-49	8	0	0	1	3	12
50-59	0	0	0	0	0	0
60-69	0	0	0	0	0	0
70-79	0	0	0	0	0	0
80-89	1	2	0	0	0	3
90-99	7	7	0	0	0	14
100-109	4	1	0	0	0	5
110-119	0	0	0	0	0	0
120-129	0	2	0	0	0	2
130-139	0	0	0	0	0	0
140-149	0	0	0	0	0	0
150-159	1	0	0	0	0	1
160-169	1	0	0	0	0	1
170-179	1	2	0	0	0	3
180-189	0	9	0	0	0	9
190-199	1	5	0	0	0	6
200-209	0	2	0	0	0	2
210-219	0	2	0	0	0	2
220-229	0	1	0	0	0	1
230-239	0	0	0	0	0	0
240-249	0	1	0	0	0	1
250-259	1	5	0	1	0	7
260-269	0	1	0	1	0	2
270-279	1	2	0	1	0	4
280-289	0	1	1	0	0	2
290-299	0	1	0	1	0	2
300-309	0	0	0	0	0	0
310-319	0	0	0	0	0	0
320-329	0	1	0	0	0	1
330-339	0	0	0	0	0	0
340-349	0	0	0	0	0	0
350-359	0	0	0	0	0	0
360-369	0	1	0	0	0	1

Appendix Table A-3. Lengths of fish other than least cisco caught in lake T7.2 in 1998.

Species	Fork Length (mm)	Station	Date
Broad whitefish	835 ^a	B8534E	7/24/98
Burbot	840	B8534A	7/24/98
Alaska blackfish	64	B8534B	7/21/98
	73	B8534B	7/24/98
	76	B8534B	7/24/98
	81	B8534B	7/17/98
	83	B8534B	7/22/98
	84	B8534B	7/24/98
	85	B8534B	7/22/98
	86	B8534B	7/20/98
	91	B8534B	7/24/98
	92	B8534B	7/19/98
	92	B8534B	7/22/98
	103	B8534B	7/17/98
	104	B8534B	7/24/98
	107	B8534B	7/24/98
125	B8534B	7/24/98	
76	B8534D	7/20/98	

^a total length

Appendix Table A-4. Water quality parameters measured at study areas during 1998.

Station	Date	Time	Depth (m)	Water Temperature °C	Dissolved Oxygen (mg/l)	Conductivity (µS/cm)	Specific Conductance (µS/cm)
T7.2A (B8534A)	7/17/98	12:55	0.5	13.3	10.5	217	280
	7/18/98	12:10	0.5	13.1	10.2	218	282
	7/19/98	12:30	0.5	13.6	10.3	219	281
	7/20/98	16:20	0.5	14.1	10.3	222	281
	7/21/98	13:25	0.5	14.2	10.3	224	282
	7/22/98	13:10	0.5	14.6	10.2	226	282
	7/24/98	13:40	0.5	12.6	10.4	216	282
T7.2B (B8534B)	7/17/98	11:55	0.5	13.6	10.2	218	279
	7/18/98	11:40	0.5	13.1	10.1	218	282
	7/19/98	12:10	0.5	13.6	10.1	221	282
	7/20/98	15:40	0.5	14.4	10.3	224	282
	7/21/98	13:10	0.5	14.5	10.4	225	282
	7/22/98	12:40	0.5	14.5	10.3	225	282
	7/24/98	14:40	0.5	13.1	9.9	218	283
T7.2C (B8534C)	7/18/98	10:40	0.5	12.3	9.1	215	284
T7.2D (B8534D)	7/19/98	11:35	0.5	13.7	10.3	221	282
	7/20/98	14:00	0.5	14.4	10.7	228	285
T7.2E (B8534E)	7/21/98	12:35	0.5	14.3	9.9	224	282
	7/22/98	11:45	0.5	14.1	10.2	216	273

Appendix Table A-5. Fish catch by station and date at lake T7.2 during 1998.

Station	Start Date	Start Time	End Date	End Time	Duration (hours)	Species	Number Caught	Number Measured
B8534A	7/16/98	15:50	7/17/98	12:35	20.75	LSCS	7	7
						NSSB	22	0
	7/17/98	12:35	7/18/98	11:55	23.33	LSCS	7	7
						NSSB	15	0
	7/18/98	11:55	7/19/98	12:20	24.42	LSCS	2	2
						NSSB	18	0
	7/19/98	12:20	7/20/98	16:00	27.67	LSCS	171	171
						NSSB	31	0
	7/20/98	16:00	7/21/98	13:20	21.33	NSSB	41	0
						7/21/98	13:20	7/22/98
	NSSB	38	0					
	7/22/98	12:55	7/24/98	14:10	49.25	BRBT	1	1
						LSCS	145	59
						NSSB	22	0
	B8534B	7/16/98	16:35	7/17/98	11:30	18.92	BKFB	2
LSCS							2	2
NSSB							125	0
7/17/98		11:30	7/18/98	11:30	24.00	LSCS	2	2
						NSSB	198	0
7/18/98		11:30	7/19/98	11:50	24.33	BKFB	1	1
						LSCS	3	3
						NSSB	480	0
7/19/98		11:50	7/20/98	15:10	27.33	BKFB	1	1
						LSCS	12	12
						NSSB	325	0
7/20/98		15:10	7/21/98	12:55	21.75	BKFB	1	1
						NSSB	199	0
7/21/98		12:55	7/22/98	12:10	23.25	BKFB	3	3
						LSCS	24	24
						NSSB	185	0
7/22/98		12:10	7/24/98	13:25	49.25	BKFB	7	7
						LSCS	3	3
	NSSB					335	0	
B8534C	7/17/98	11:05	7/18/98	10:35	23.50	LSCS	1	1
						NSSB	1	0

Appendix Table A-5. Fish catch by station and date at lake T7.2 during 1998.

Station	Start Date	Start Time	End Date	End Time	Duration (hours)	Species	Number Caught	Number Measured
B8534D	7/18/98	11:10	7/19/98	11:20	24.17	LSCS	10	10
						NSSB	2	0
	7/19/98	11:20	7/20/98	13:25	26.08	BKFH	1	1
						LSCS	22	22
B8534E	7/20/98	14:50	7/21/98	12:10	21.33	LSCS	169	50
						NSSB	3	0
	7/21/98	12:10	7/22/98	11:20	23.17	LSCS	111	50
						NSSB	40	0
	7/22/98	11:20	7/24/98	18:20	55.00	BDWF	1	1
						LSCS	2	0

BDWF = broad whitefish
 BKFH = Alaska blackfish
 BRBT = burbot
 LSCS = least cisco
 NSSB = ninespine stickleback

Appendix Table A-6. Length measurements of fish caught by fyke net in lake T7.2 during 1998.

Station	Species	Date	Fork Length (mm)	Comments	Station	Species	Date	Fork Length (mm)	Comments
B8534A	Burbot	7/24/98	840		B8534A	Least Cisco	7/20/98	27	
	Least Cisco	7/17/98	86					27	
			92					27	
			94					27	
			95					27	
			95					27	
			96					27	
			97					27	
		7/18/98	24					27	
			25					27	
			25					27	
			27					27	
			31					27	
			32					27	
			32					27	
		7/19/98	250					27	
			275					27	
		7/20/98	21					27	
			21					28	
			22					28	
			22					28	
			24					28	
			24					28	
			24					28	
			24					28	
			24					28	
			25					28	
			25					28	
			25					28	
			25					28	
			25					28	
			25					28	
			25					28	
			25					28	
			25					28	
			25					28	
			25					28	
			26					28	
			26					28	
			26					28	
			26					28	
			26					28	
			26					28	
			26					28	
			26					28	
			26					28	
			26					29	
			26					29	
			26					29	
			26					29	
			26					29	
			26					29	

Appendix Table A-6. Length measurements of fish caught by fyke net in lake T7.2 during 1998.

Station	Species	Date	Fork Length (mm)	Comments	Station	Species	Date	Fork Length (mm)	Comments
B8534A	Least Cisco	7/20/98	29		B8534A	Least Cisco	7/20/98	31	
			29					31	
			29					31	
			29					31	
			29					31	
			29					31	
			29					31	
			29					32	
			29					32	
			29					32	
			29					32	
			29					32	
			29					32	
			29					32	
			29					32	
			29					32	
			29					32	
			29					32	
			29					32	
			29					32	
			29					32	
			29					32	
			29					32	
			30					33	
			30					33	
			30					33	
			30					33	
			30					33	
			30					33	
			30					34	
			30					34	
			30					34	
			30					34	
			30					34	
			30					34	
30		34							
30		34							
30		34							
30		34							
30		34							
30		34							
30		35							
30		7/22/98	153						
30			161						
30			178						
30			194						
30		7/24/98	32						
30			33						
30			34						
30			34						
30			34						
30			34						
30			34						
30			34						
30			35						
30			35						
30			35						
30			35						
31			35						
31			35						
31			35						
31			35						
31			35						
31			35						

Appendix Table A-6. Length measurements of fish caught by fyke net in lake T7.2 during 1998.

Station	Species	Date	Fork Length (mm)	Comments	Station	Species	Date	Fork Length (mm)	Comments
B8534A	Least Cisco	7/24/98	36		B8534B	AK Blackfish	7/24/98	76	
			36					84	
			36					91	
			36					104	
			36					107	
			36					125	
			36					129	
			36					183	
			36					85	
			36					208	
			36					280	
			36					214	
			36					299	
			36					364	
			37					90	
			37					180	
			37					180	
			37					183	
			37					183	
			37					190	
			37					209	
			38					242	
			38					255	
			38					268	
			38					285	
			38					329	
			39					82	
			39					90	
			39					96	
			39					96	
39		97	Mortality						
39		97							
39		98							
39		102							
39		179							
40		179							
40		180							
40		185							
99		186							
101		190							
103		190							
103		190							
107		191							
B8534B	AK Blackfish	7/17/98	81		B8534B	Least Cisco	7/17/98	119	
			103					129	
		7/19/98	92				251		
		7/20/98	86				257		
		7/21/98	64				259		
		7/22/98	83				259		
			85				277		
			92				129		
7/24/98	73		187						

Appendix Table A-6. Length measurements of fish caught by fyke net in lake T7.2 during 1998.

Station	Species	Date	Fork Length (mm)	Comments	Station	Species	Date	Fork Length (mm)	Comments
B8534B	Least Cisco	7/24/98	279		B8534E	Least Cisco	7/21/98	31	
B8534C	Least Cisco	7/18/98	280					31	
B8534D	AK Blackfish	7/20/98	76					31	
	Least Cisco	7/19/98	32					32	Mortality
			32					32	
			33	Mortality				32	
			33					32	
			35					32	
			35					32	
			250					33	
B8534D	Least Cisco	7/19/98	268					33	
			270					33	
			299					33	
		7/20/98	20					33	
			25					33	
			25					33	
			28					34	
			32					34	
			32					34	
			32					34	
			33					34	
			33					34	
			34					35	
			34					35	
			34					35	
			34					35	
			34					36	
			35					36	
			35				7/22/98	36	Mortality
			36					36	
			36					40	
			36					28	
			38					30	
			38					31	
			41					31	
B8534E	Broad WF	7/24/98	835 total length					31	
	Least Cisco	7/21/98	26					31	
			27					31	
			29					31	
			29					32	
			29					32	
			30					32	
			30					32	
			30					33	
			30					33	
			31	Mortality				33	
			31					33	
			31					34	
			31					34	
			31					34	
			31					34	
			31					34	

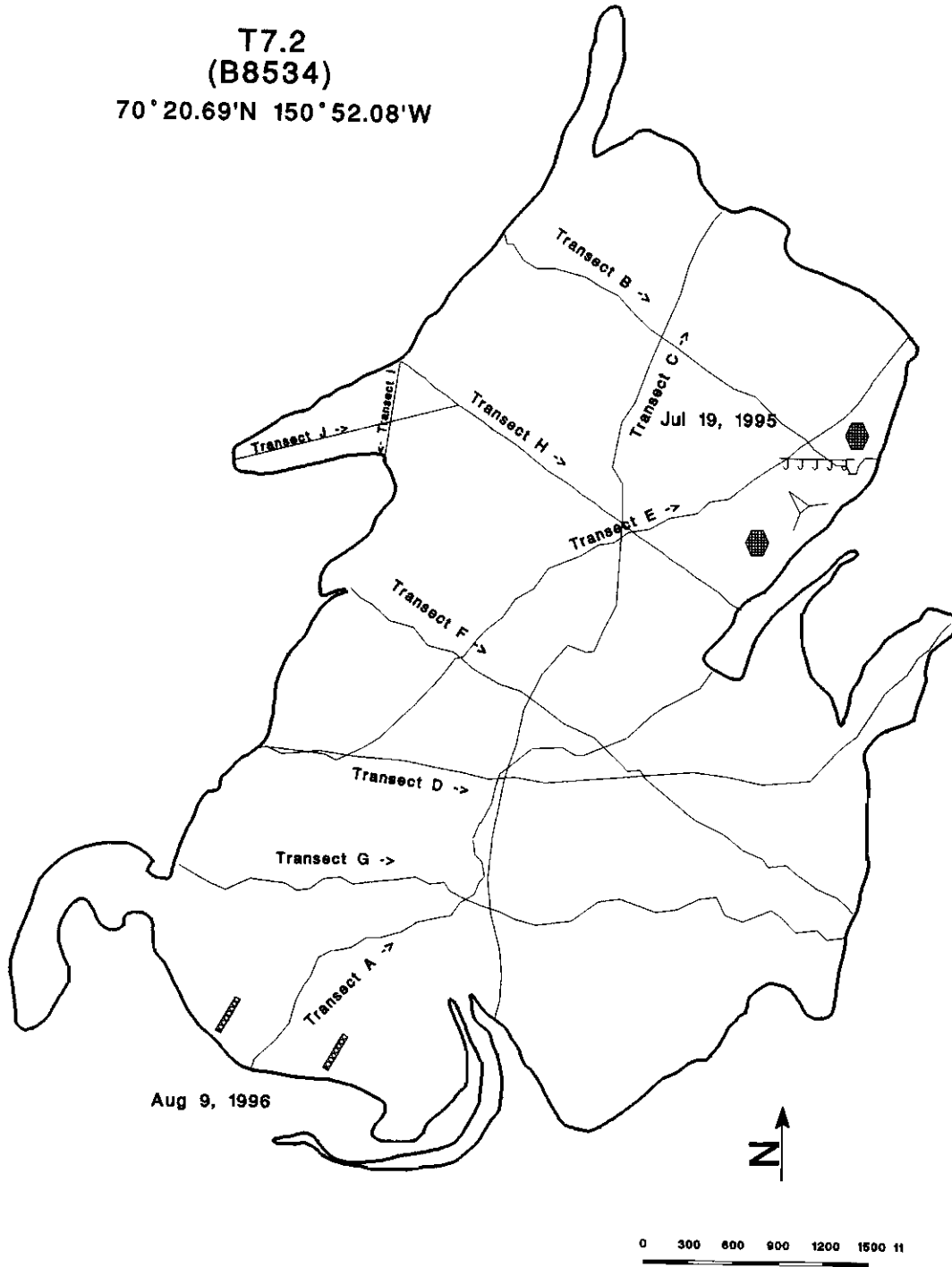
Appendix Table A-6. Length measurements of fish caught by fyke net in lake T7.2 during 1998.

Station	Species	Date	Fork Length (mm)	Comments
B8534E	Least Cisco	7/22/98	34	
			34	
			34	
			34	
			34	
			34	
			35	
			35	
			35	
			35	
			35	
			35	
			36	
			36	
			36	
			36	
			36	
			36	
			36	
			36	
			36	
			36	
			36	
			36	
			36	
			37	
			37	
			37	
			37	
			37	
			38	
			39	

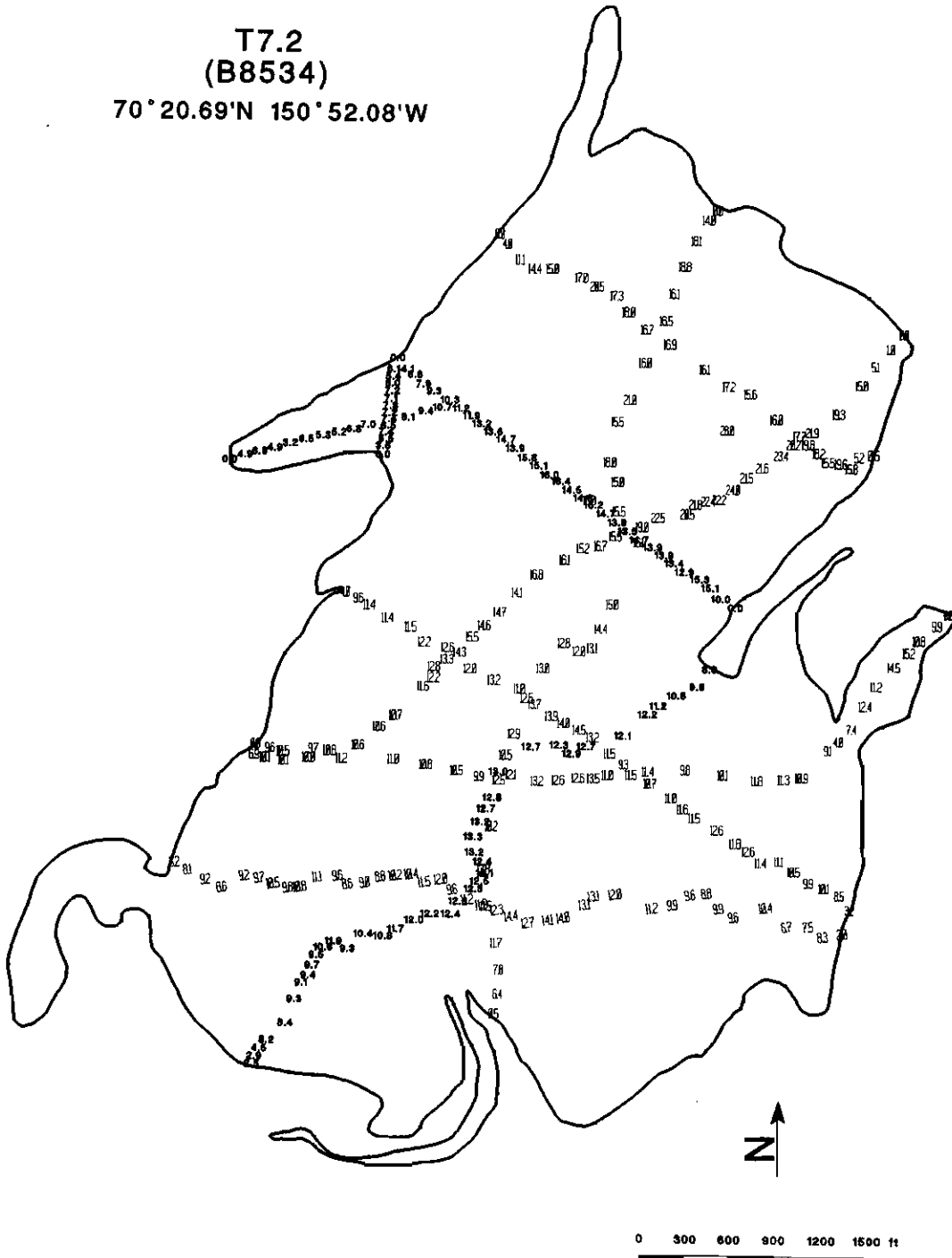
Appendix B

Lake T7.2 Data Packet

T7.2
(B8534)
70°20.69'N 150°52.08'W



T7.2
(B8534)
70°20.69'N 150°52.08'W



Lake T7.2

Other Names: B8534; L9282
Location: 70°20.69'N 150°52.08'W
USGS Quad Sheet: Harrison Bay B-2: T12N R5E, Sect 33
Habitat: Perched Lake (Frequent Flooding)
Area: 480 acres
Maximum Depth: 18.0 feet
Active Outlet: No
Spec. Conductance: 204 µS/cm (1985)
 276 µS/cm (1995)
 282 µS/cm (1998)
pH: 8.5 (1985)
Calculated Volume: 1,678.7 million gallons (based on depth contours)
Permittable Volume: 106.8 million gallons

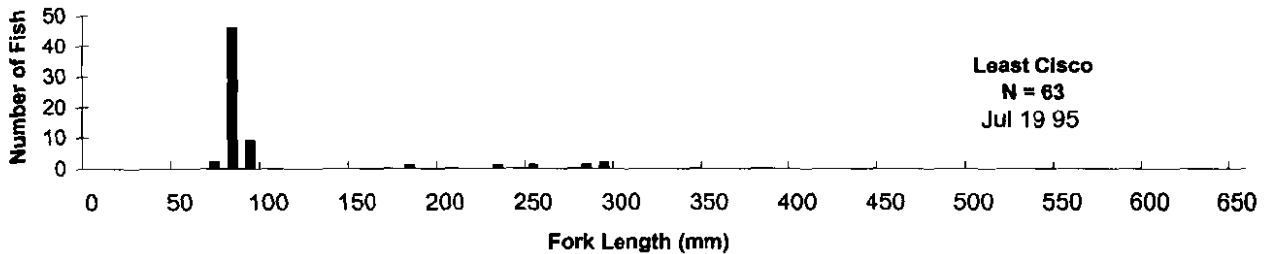
Water Quality:

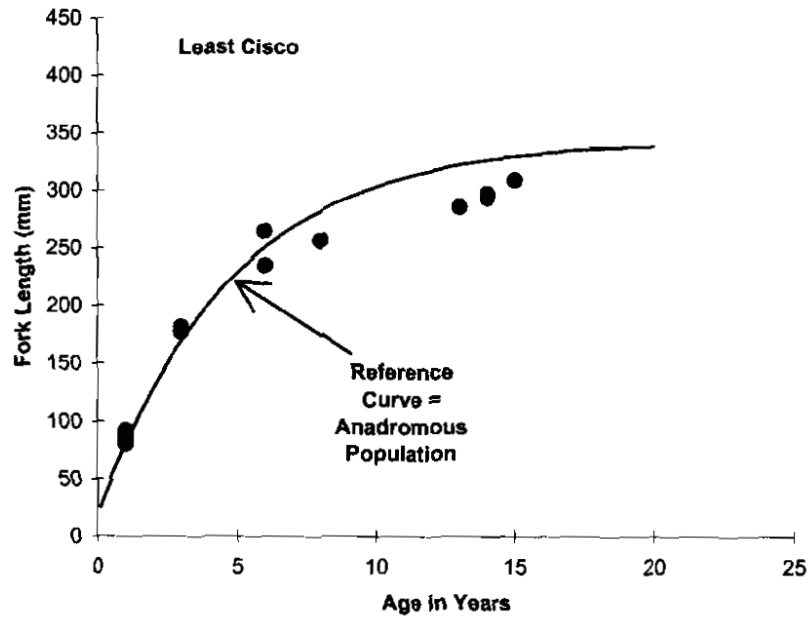
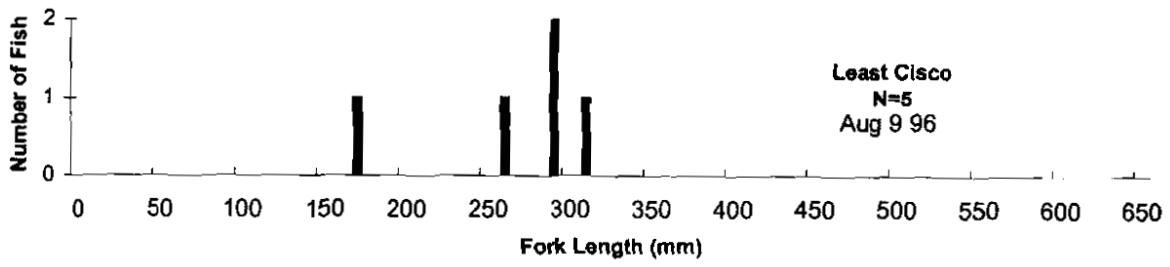
Year of Test	Chloride (mg/l)	Sodium (mg/l)	Magnesium (mg/l)	Calcium (mg/l)	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Source
1985					103		Bendock & Burr 1986
1992	43	1.5	10.6	19	91	240	J. Lobdell

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Jul 16-19, 1985	~24	Least cisco	0.28/hr	
Fyke Net	Jul 19 95	20.5	Least cisco	63	78-298
			Alaska blackfish	1	
			9spine stickleback	840	
Minnow Trap	Jul 19 95	40.5	Alaska blackfish	1	
Set Line	Jul 19 95	20.1	None	0	
Gill Net	Aug 9 96	10.1	Least cisco	6	178-310

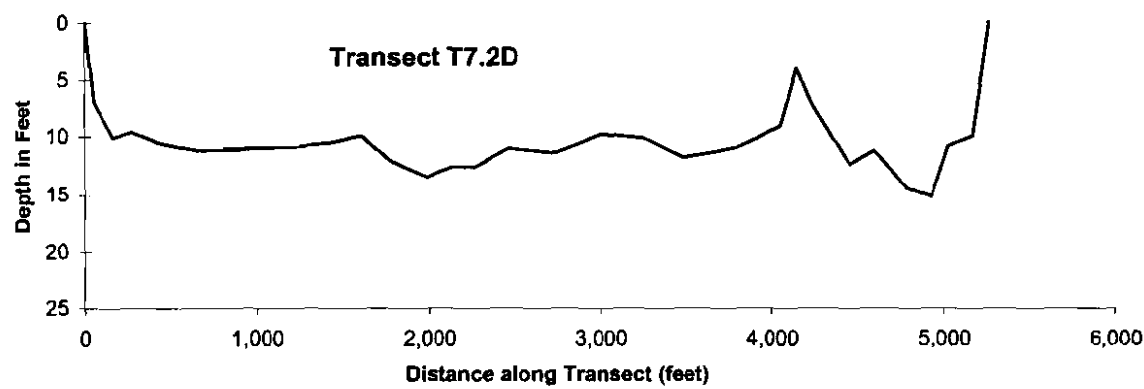
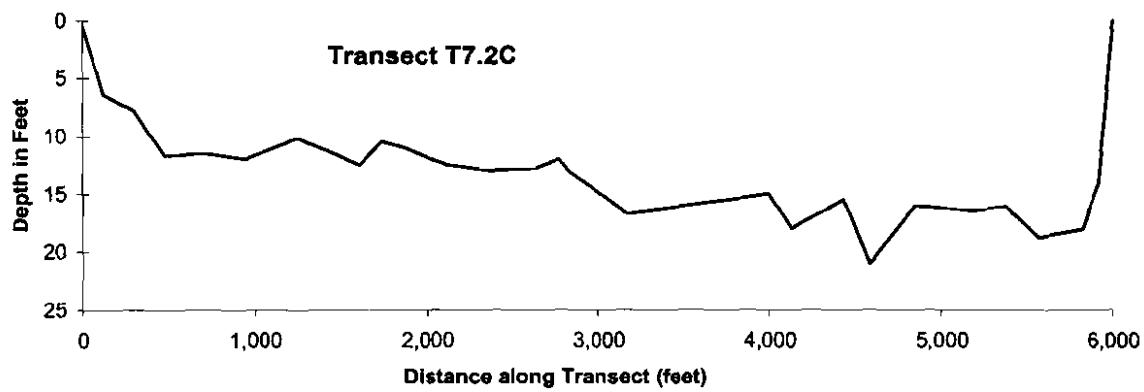
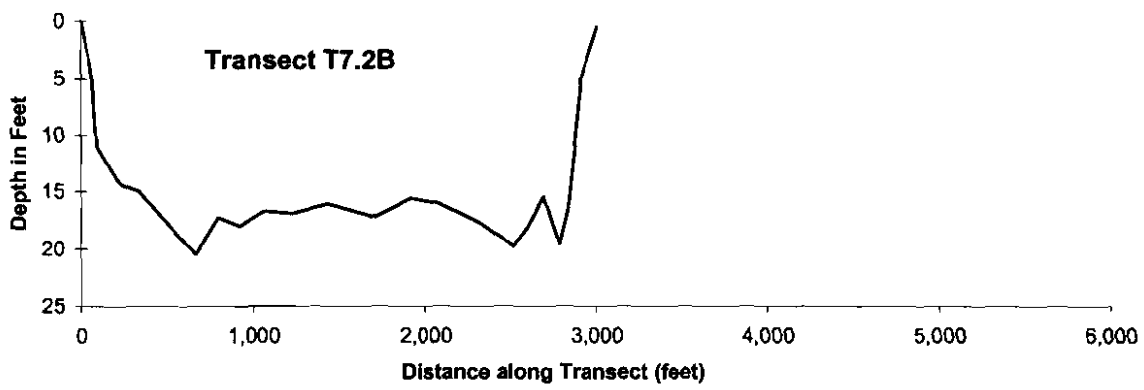
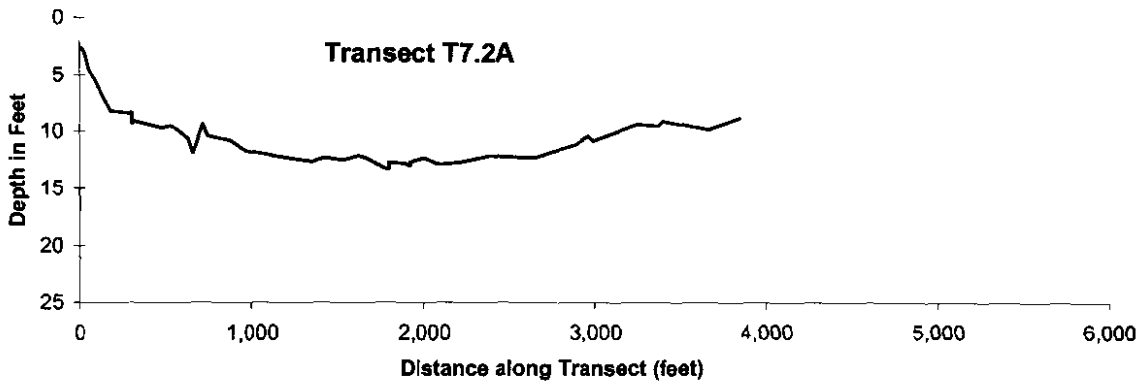
Source of 1985 data: Bendock and Burr 1986

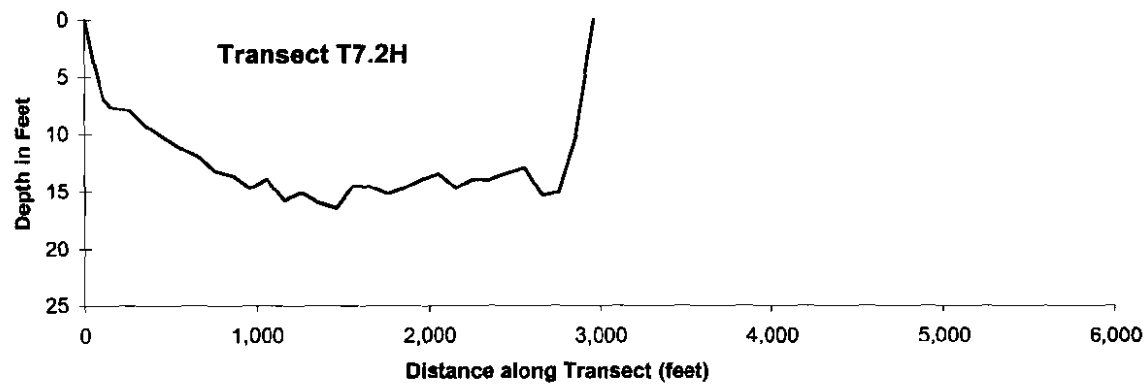
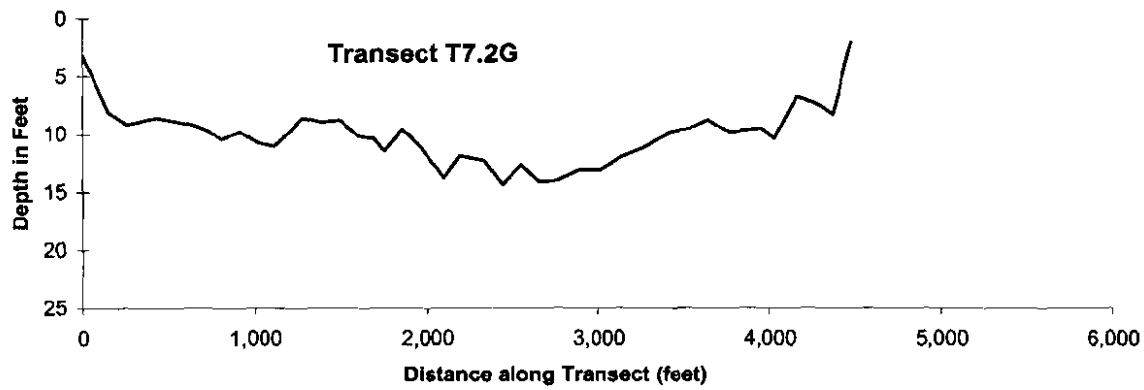
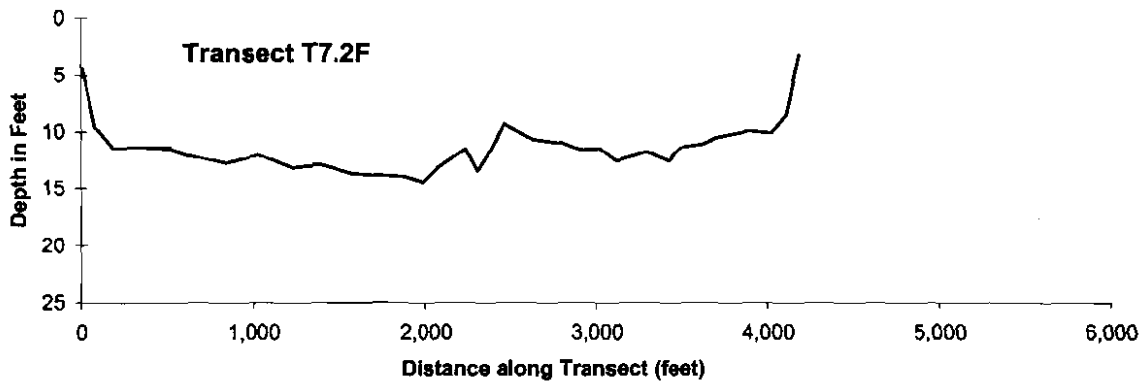
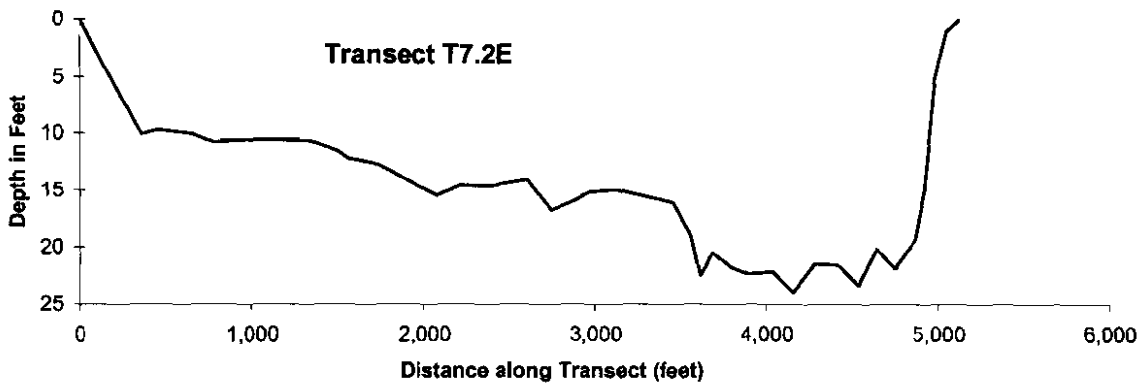


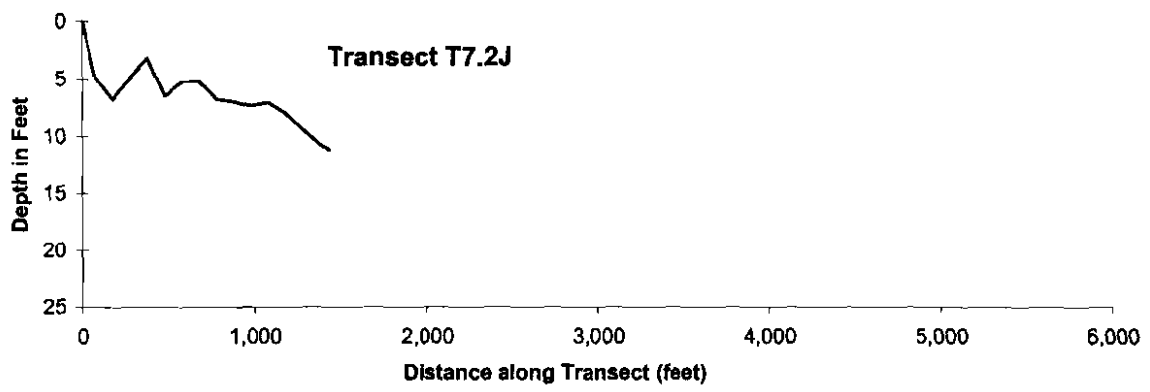
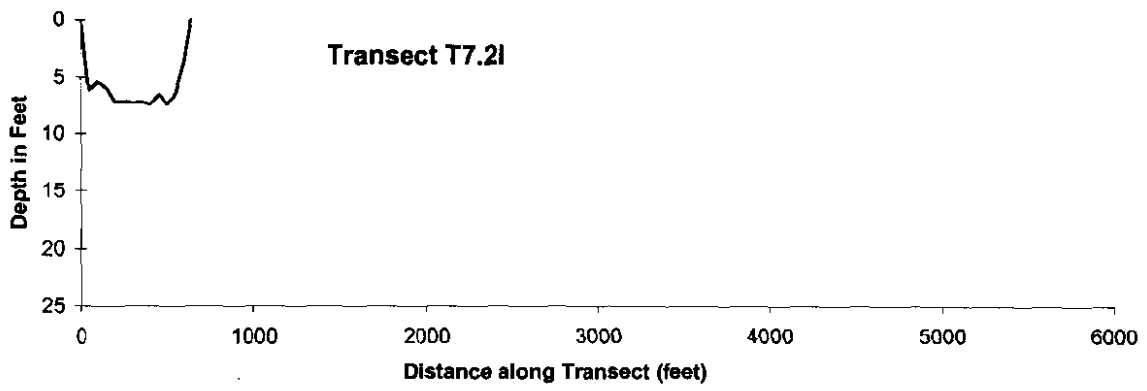


Depths obtained at lake T7.2 on November 2, 1998 at transects H, I and J.

T7.2H		T7.2I		T7.2J	
Distance (ft)	Depth (ft)	Distance (ft)	Depth (ft)	Distance (ft)	Depth (ft)
0	0.0	0	0.0	0	0.0
60	4.1	50	6.1	80	4.9
110	6.8	100	5.4	180	6.8
160	7.6	150	6.0	280	4.9
260	7.9	200	7.2	380	3.2
360	9.3	250	7.1	480	6.5
460	10.3	300	7.3	580	5.3
560	11.2	350	7.2	680	5.2
660	11.9	400	7.4	780	6.8
760	13.2	450	6.5	880	7.0
860	13.6	500	7.4	980	7.4
960	14.7	550	6.5	1,080	7.1
1,060	13.9	600	3.6	1,180	8.0
1,160	15.8	640	0.0	1,280	9.4
1,260	15.1			1,380	10.7
1,360	16.0			1,430	11.2
1,460	16.4				
1,560	14.5				
1,660	14.6				
1,760	15.2				
1,860	14.7				
1,960	13.9				
2,060	13.5				
2,160	14.7				
2,260	13.9				
2,360	13.9				
2,460	13.4				
2,560	12.9				
2,660	15.3				
2,760	15.1				
2,860	10.0				
2,960	0.0				

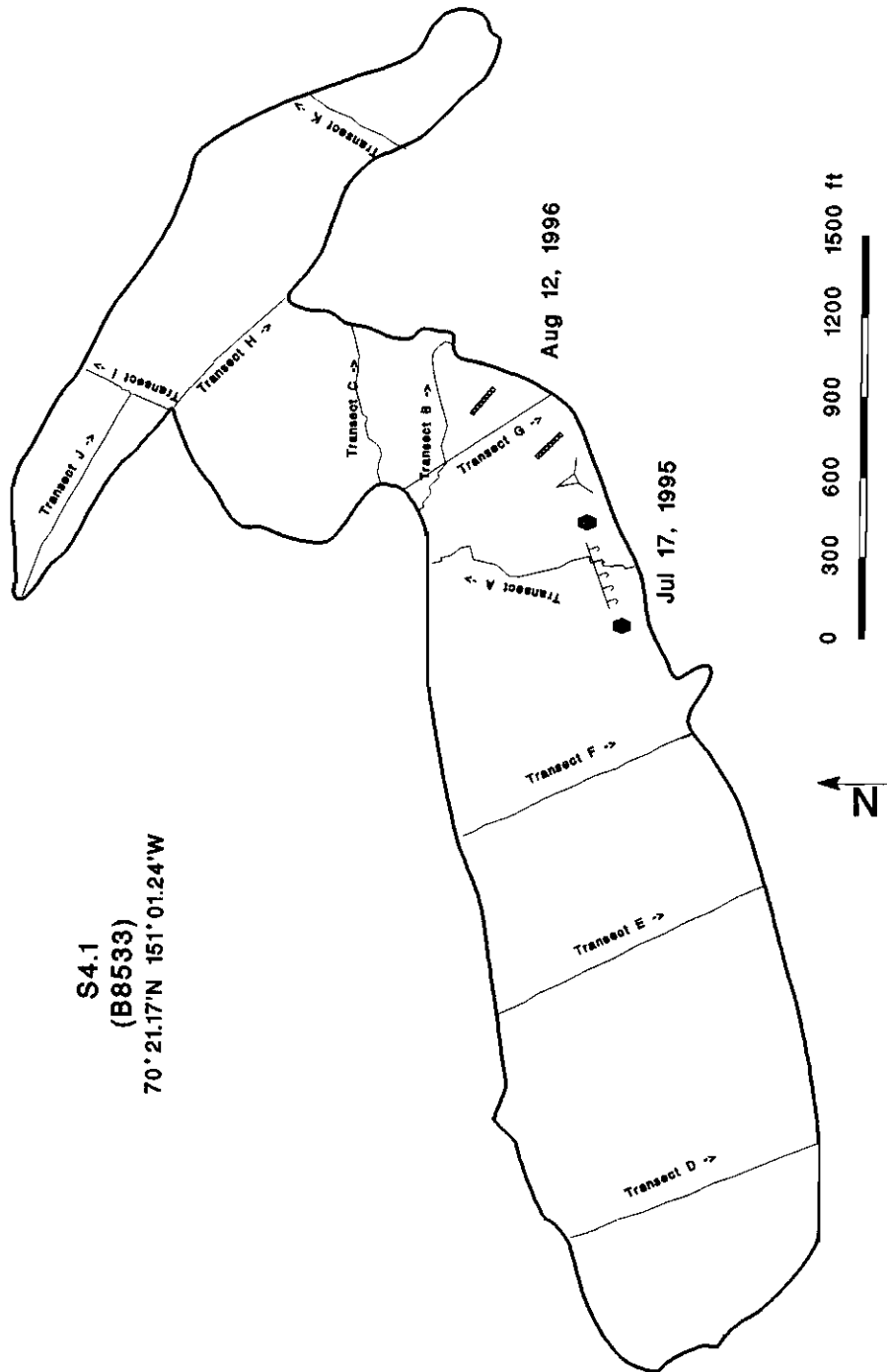


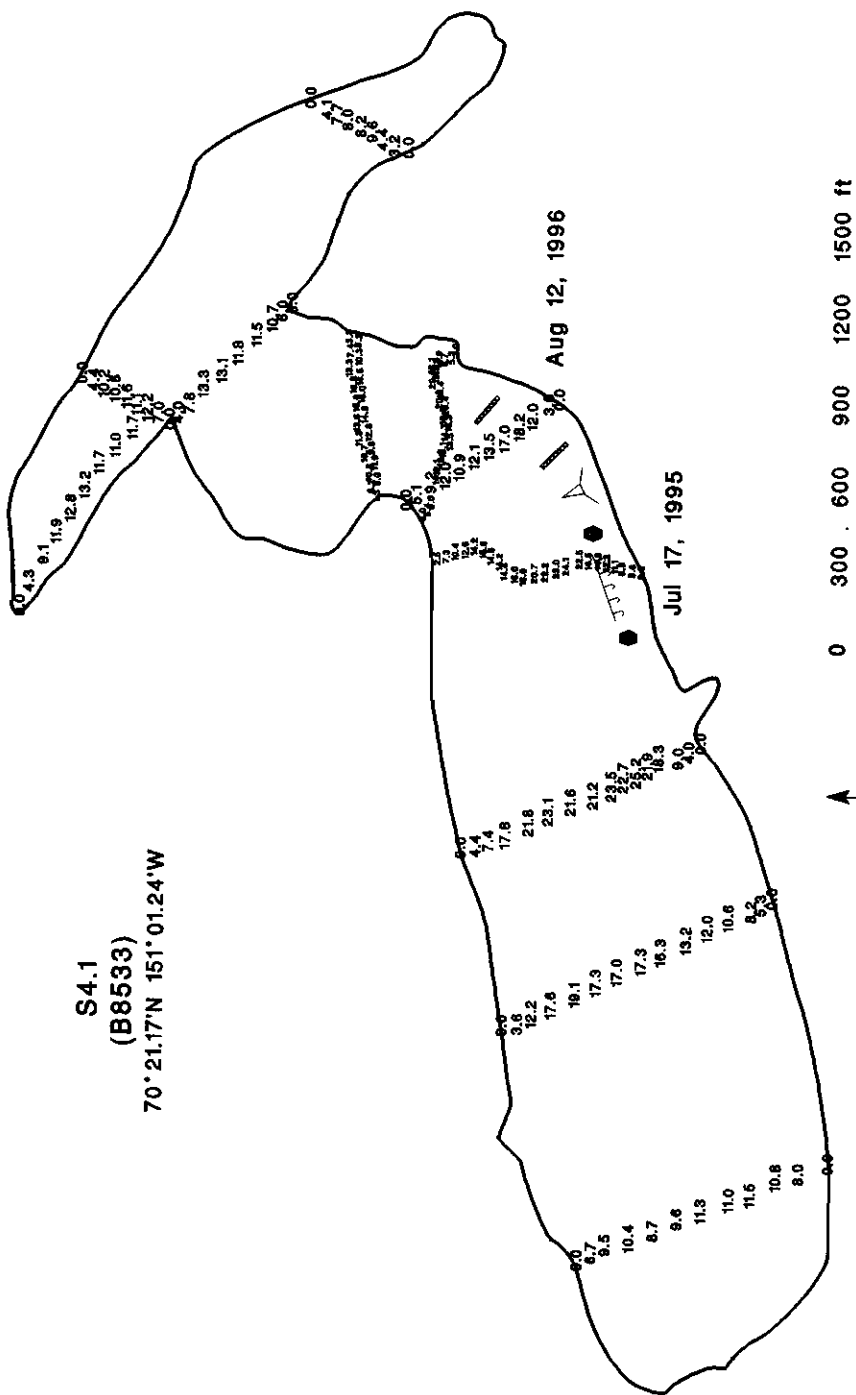




Appendix C
Lake S4.1 Data Packet

S4.1
(B8533)
70°21.17'N 151°01.24'W





Lake S4.1

Other Names: B8533; L9315
Location: 70°21.17'N 151°01.24'W
USGS Quad Sheet: Harrison Bay B-2: T12N R4E, Sect 36
Habitat: Perched Lake (Infrequent Flooding)
Area: 114 acres
Maximum Depth: 24.1 feet
Active Outlet: No
Spec. Conductance: 230 μ S/cm (1985)
 166 μ S/cm (1995)
pH: 7.5 (1985)
Calculated Volume: 508.4 million gallons
Permittable Volume: 40.4 million gallons

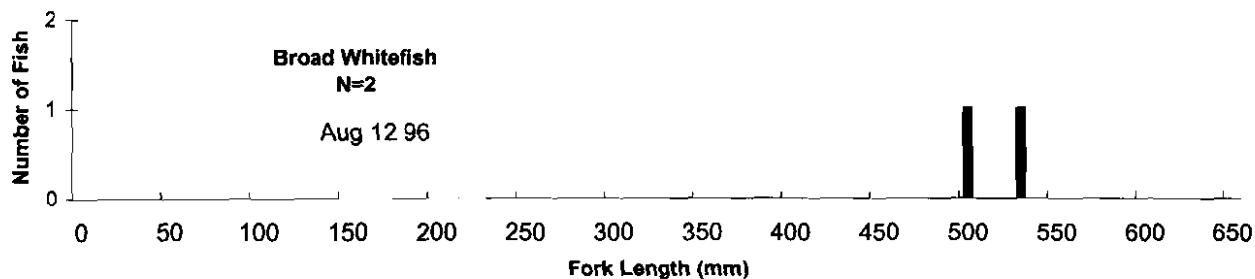
Water Quality:

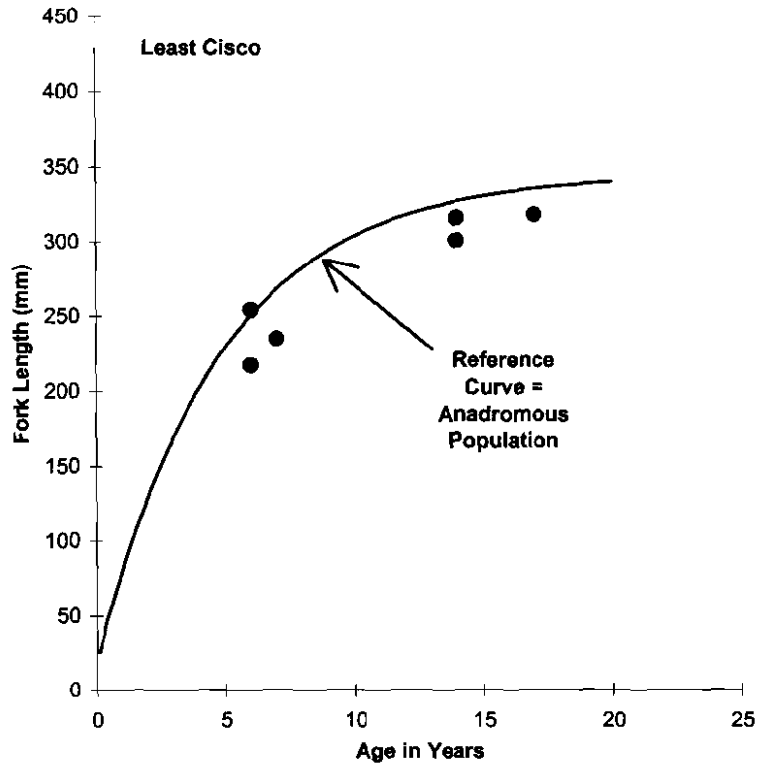
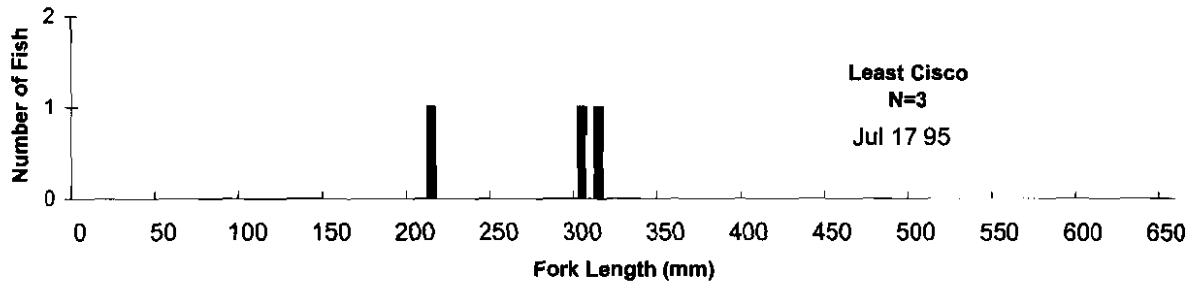
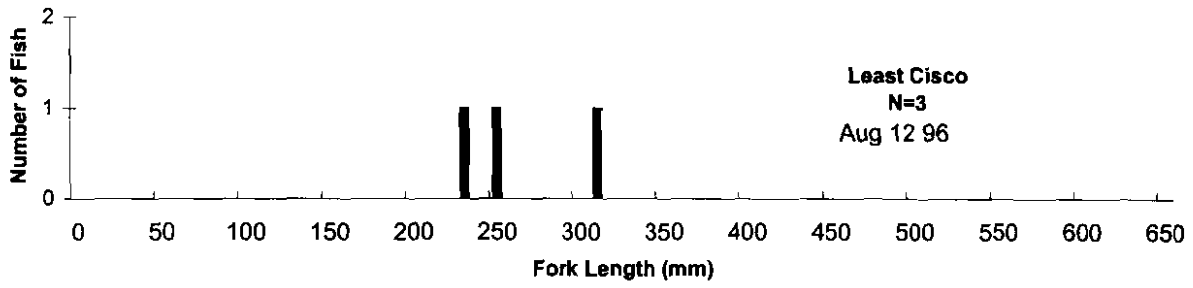
Year of Test	Chloride (mg/l)	Sodium (mg/l)	Magnesium (mg/l)	Calcium (mg/l)	Total Hardness [CaCO ₃] (mg/l)	Total Dissolved Solids (mg/l)	Source
1985					51		Bendock & Burr 1986
1993	19	11.0	2.4	4.7	22	46	J. Lobdell

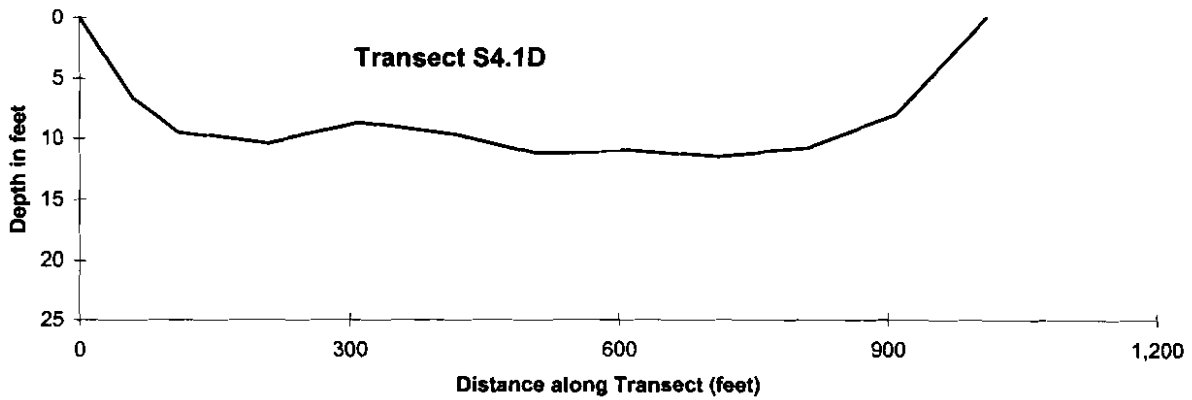
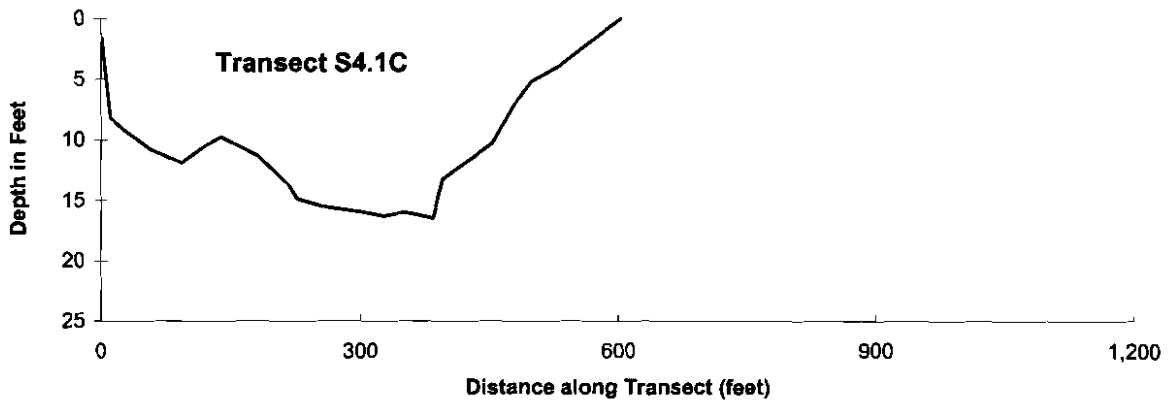
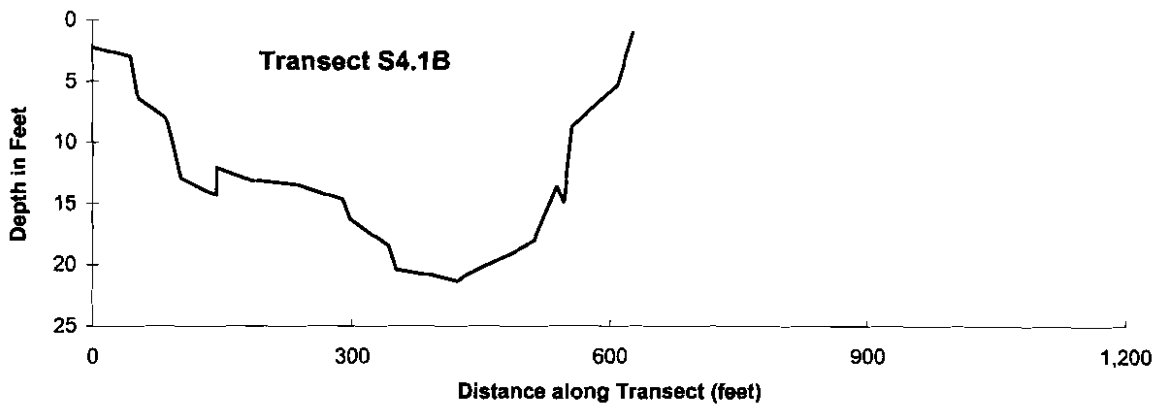
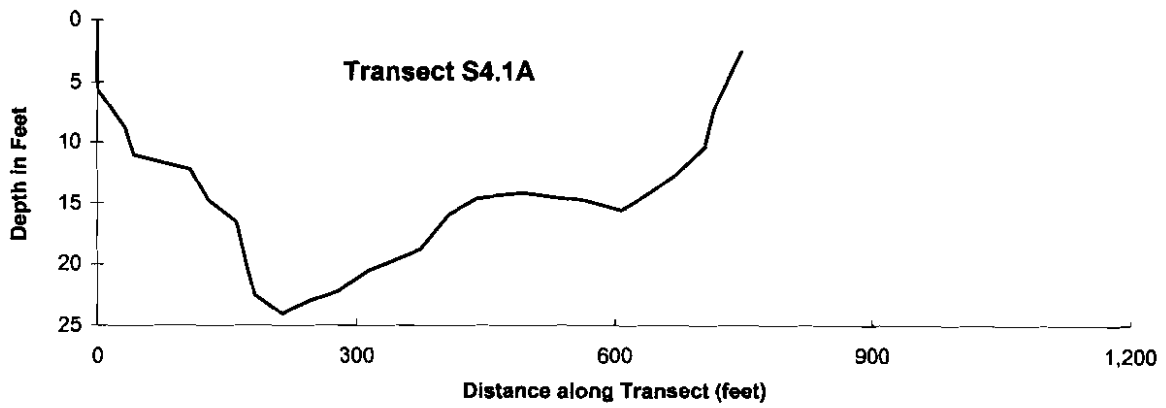
Catch Record:

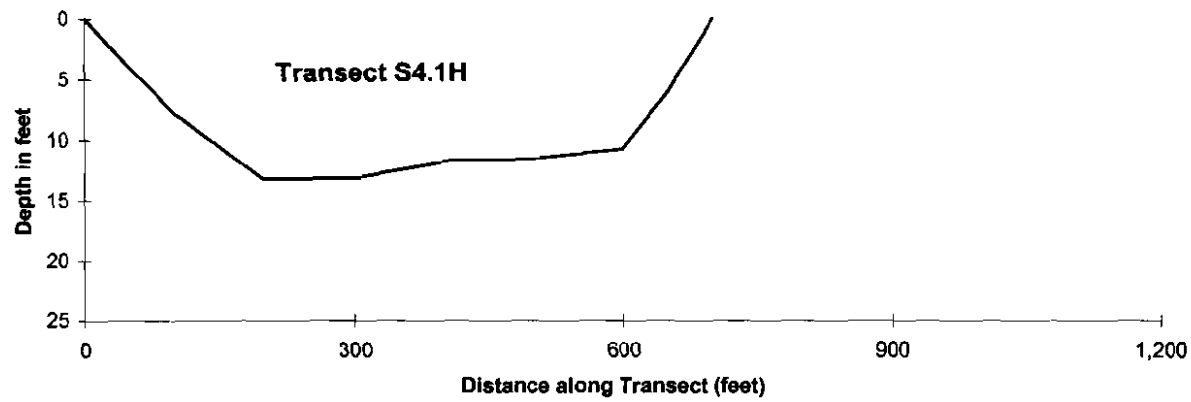
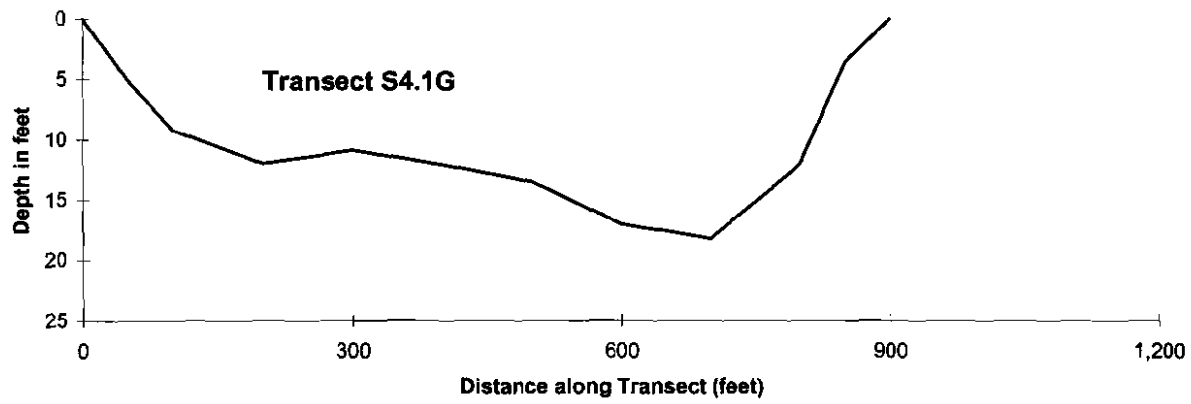
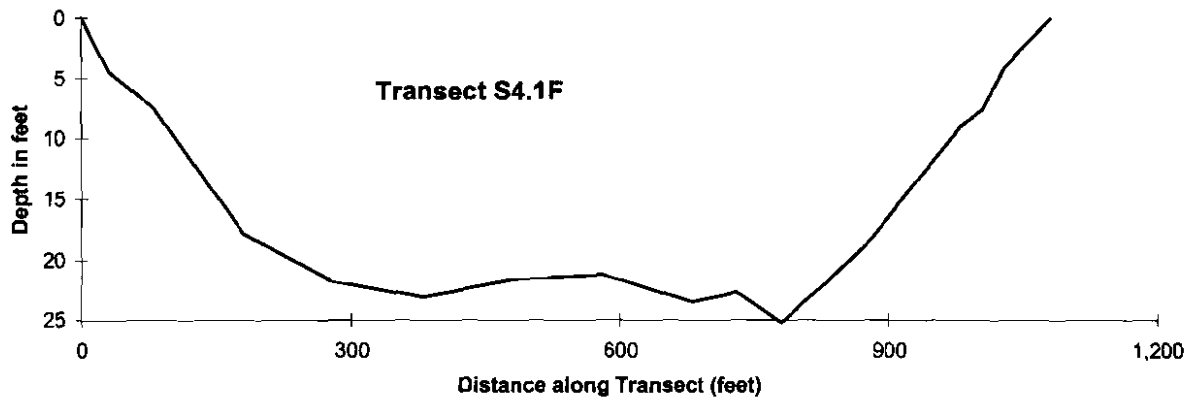
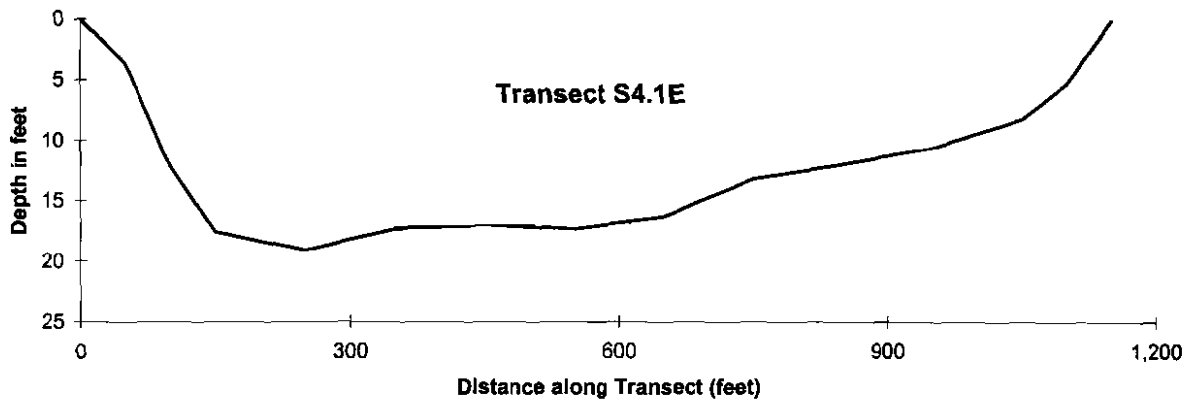
Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Jul 16-19, 1985	~24	Broad whitefish	?	
			Least cisco	?	
Fyke Net	Jul 17 95	23.7	Least cisco	3	217-318
			9spine stickleback	1,680	
Minnow Trap	Jul 17 95	48.3	9spine stickleback	1	
Set Line	Jul 17 95	23.8	None	0	
Gill Net	Aug 12 96	11.7	Broad whitefish	2	507-534
			Least cisco	3	235-316
			Round whitefish	4	304-421

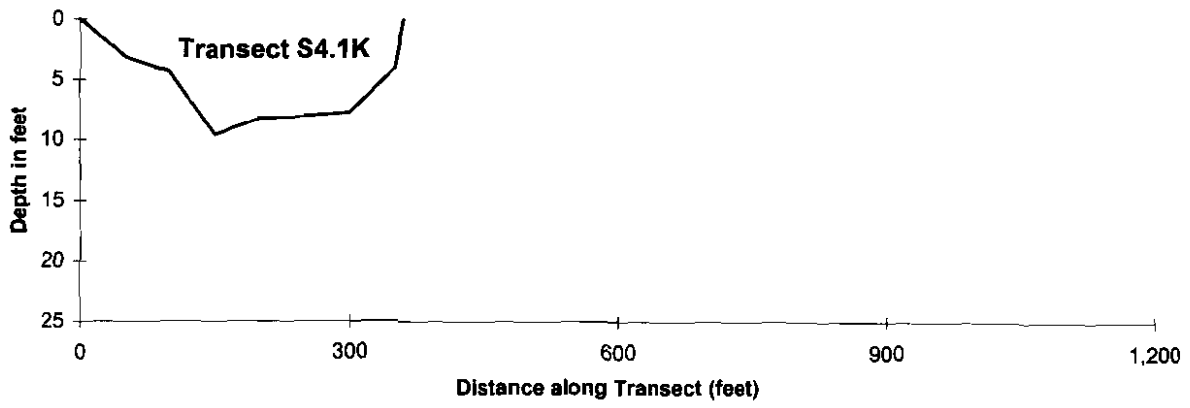
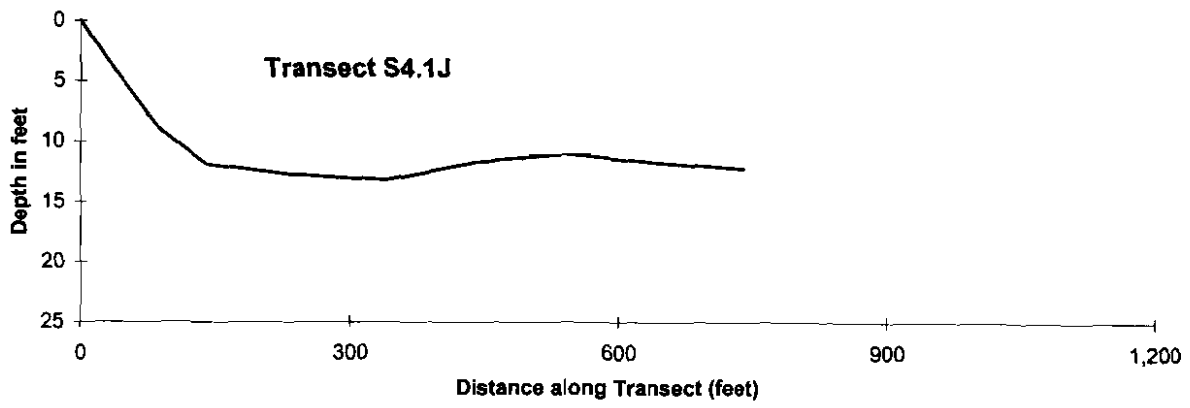
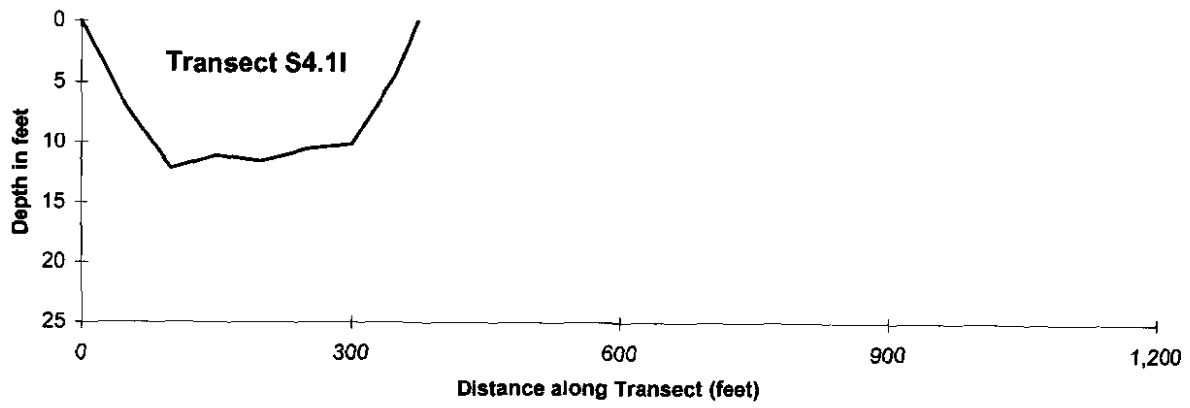
Source of 1985 data: Bendock and Burr 1986





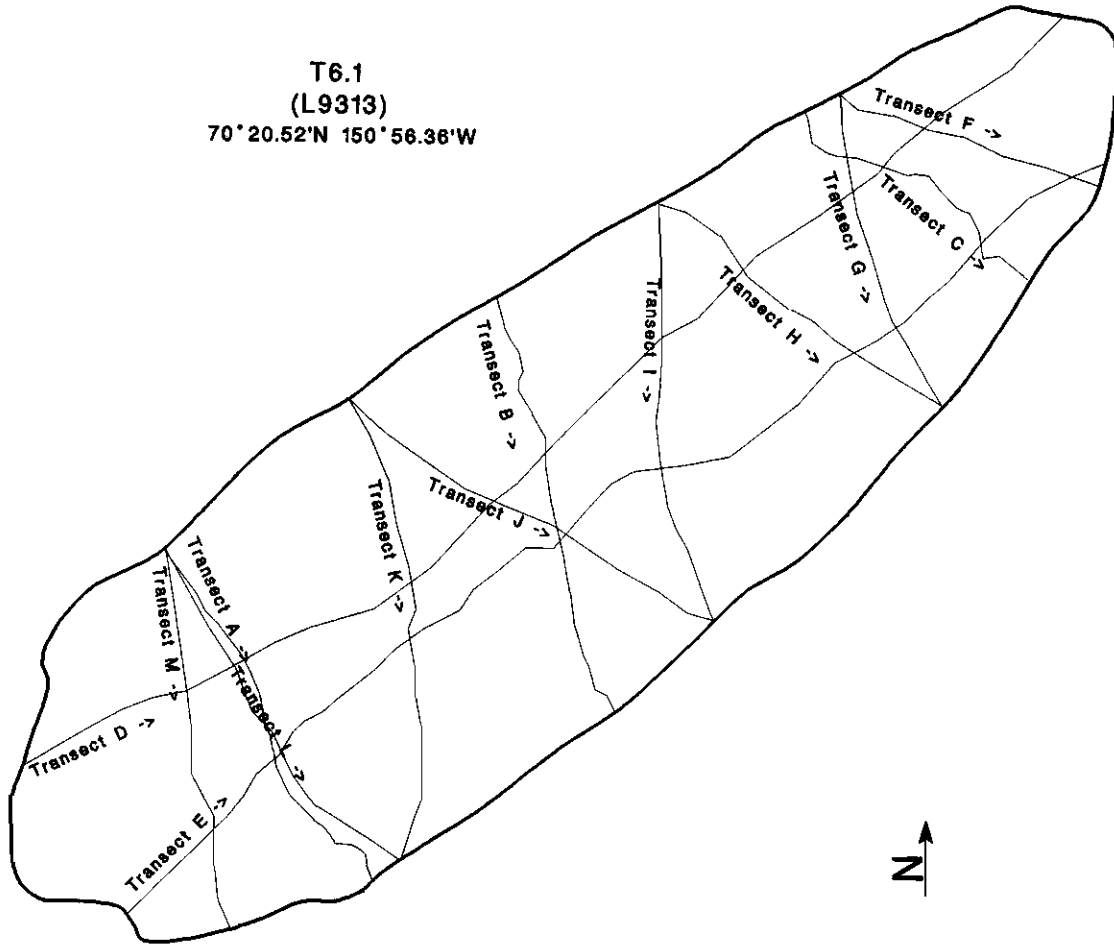




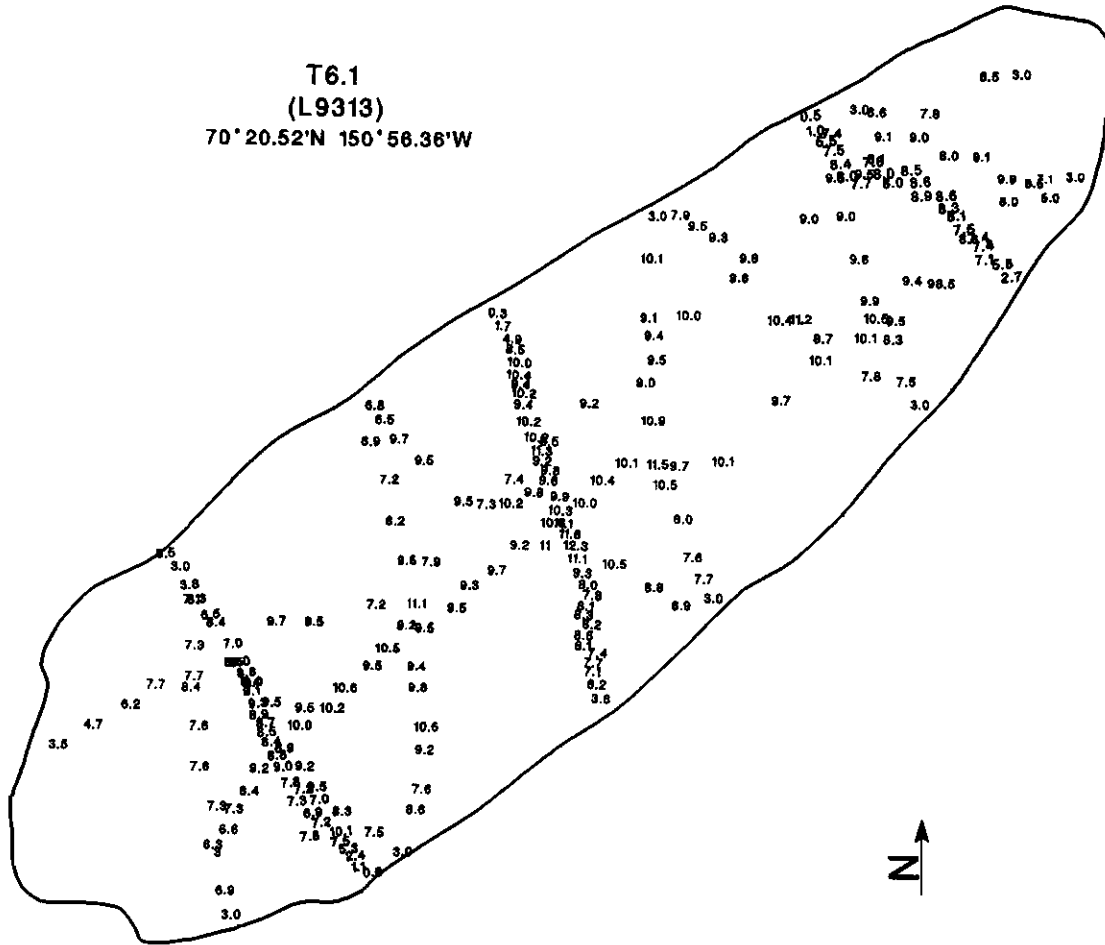


Appendix D
Lake T6.1 Data Packet

T6.1
(L9313)
70°20.52'N 150°56.36'W



T6.1
(L9313)
70° 20.52'N 150° 56.36'W



Lake T6.1

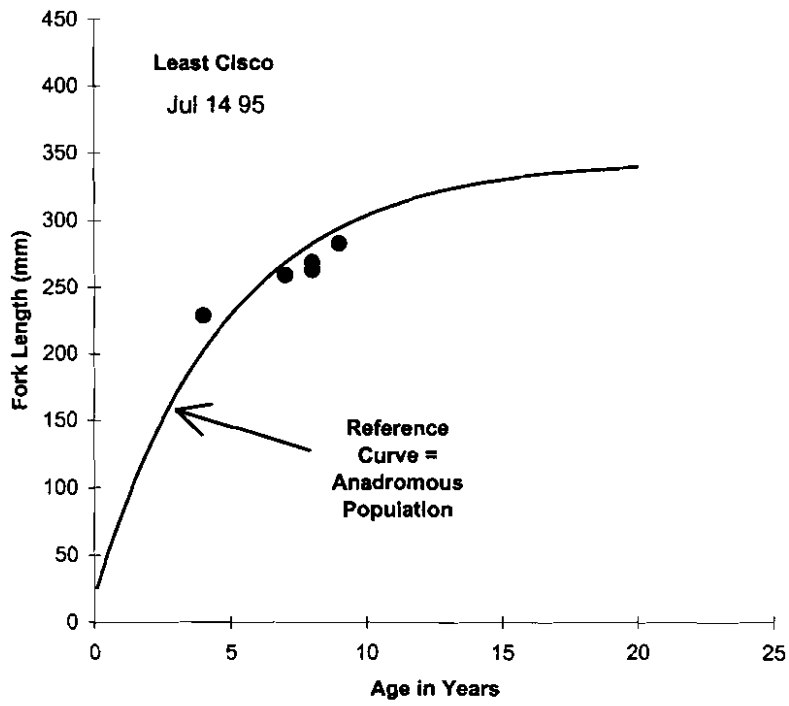
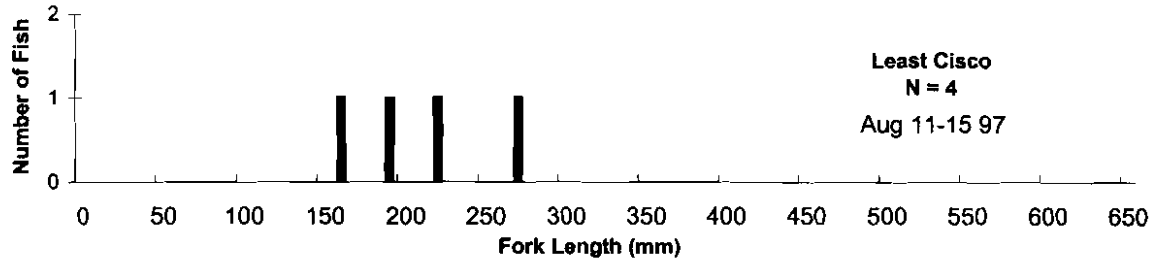
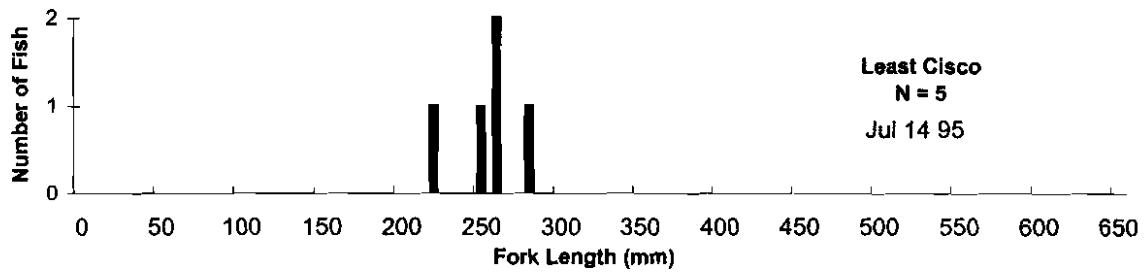
Other Names: L9313
Location: 70°20.52'N 150°56.36'W
USGS Quad Sheet: Harrison Bay B-2: T11N R5E, Sect 5
Habitat: Perched Lake (Infrequent Flooding)
Area: 69 acres
Maximum Depth: 12.3 feet
Active Outlet: No
Spec. Conductance: 107 μ S/cm
pH: 7.7
Calculated Volume: 184.6 million gallons (based on depth contours)
Permittable Volume: 6.7 million gallons

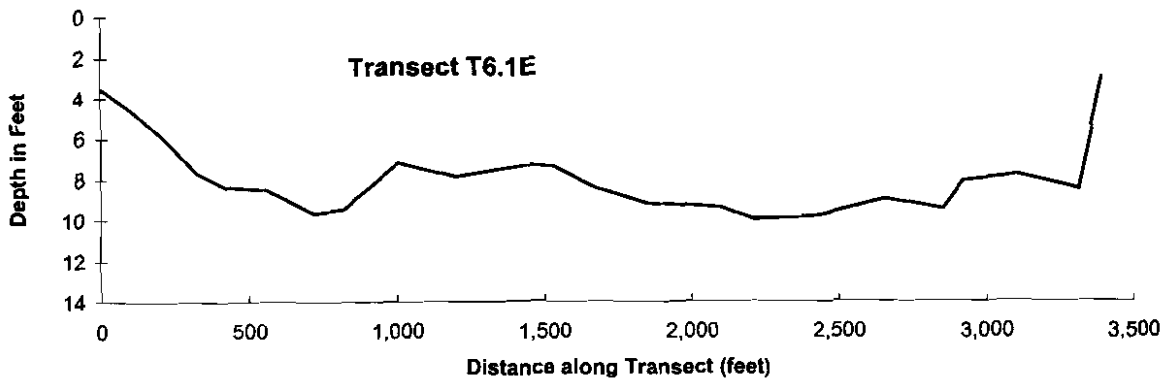
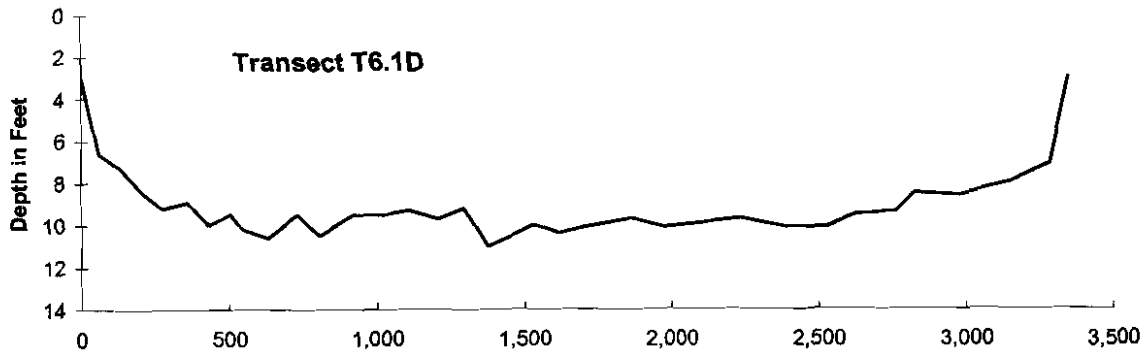
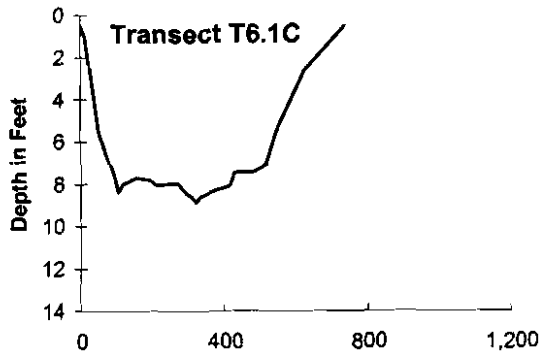
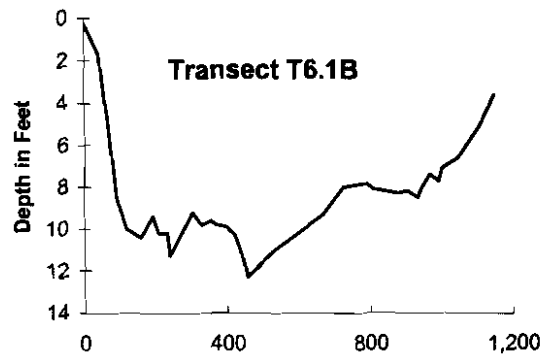
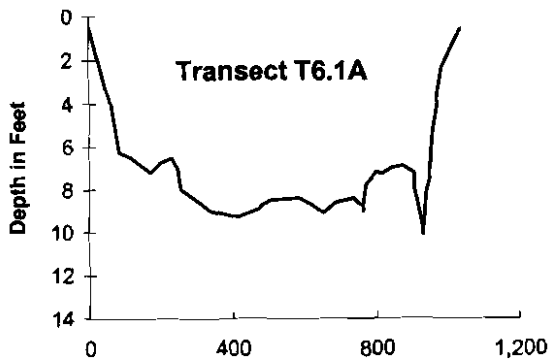
Water Quality:

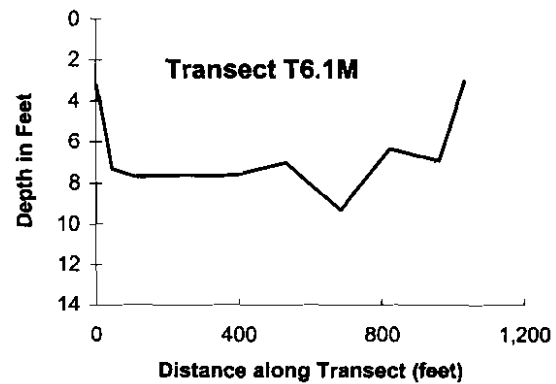
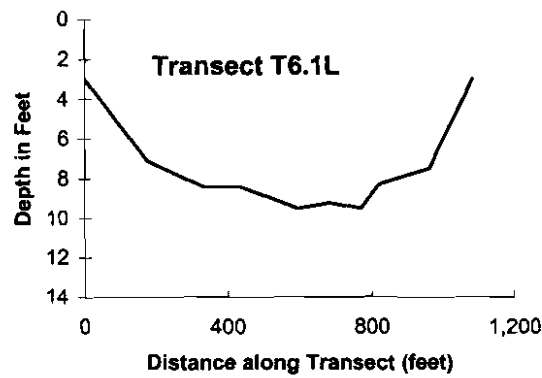
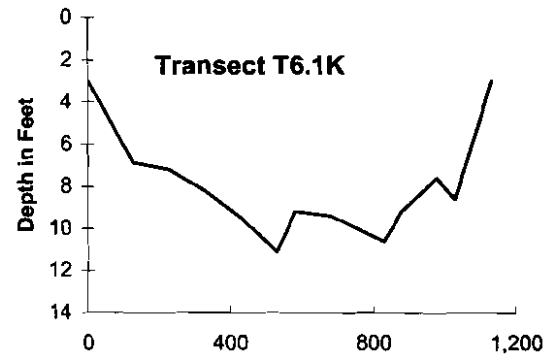
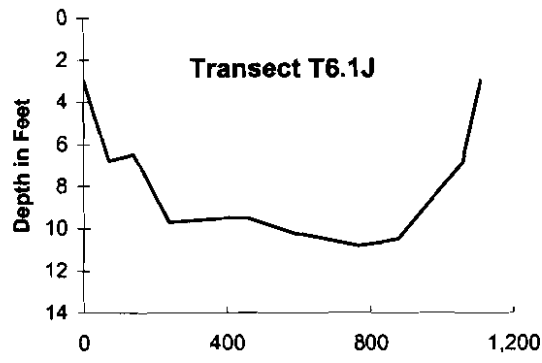
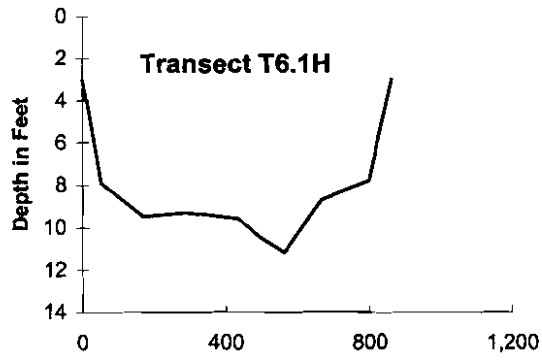
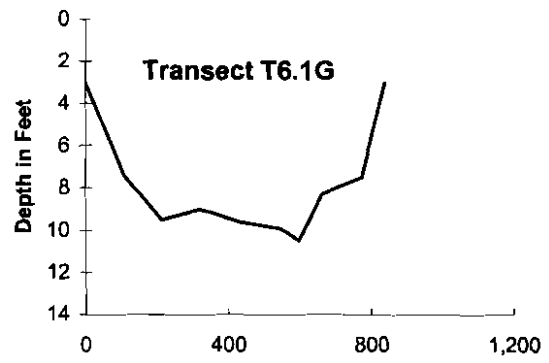
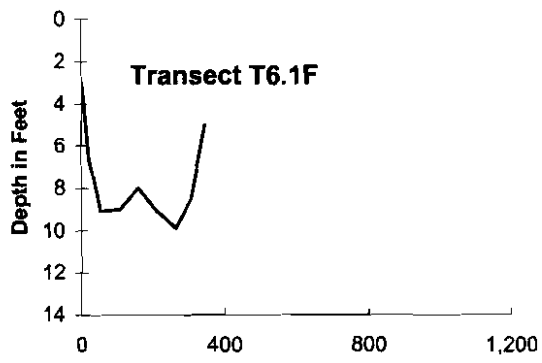
Year of Test	Chloride (mg/l)	Sodium (mg/l)	Magnesium (mg/l)	Calcium (mg/l)	Total Hardness [CaCO ₃] (mg/l)	Total Dissolved Solids (mg/l)	Source
1993	19	9.3	3.1	8	33	54	J. Lobbell

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Fyke Net	Jul 14 95	23.3	Least cisco	5	229-283
			Alaska blackfish	6	42-90
			9spine stickleback	63	
Fyke Net	Jul 26 95	20.7	9spine stickleback	9	
Minnow Trap	Jul 15 95	43.2	9spine stickleback	9	
Set Line	Jul 15 95	21.6	None	0	
Set Line	Jul 16 95	24.3	None	0	
Gill Net	Nov 1 95	20.6	None	0	
Gill Net	Aug 8 96	9.1	None	0	
Fyke Net	Aug 11-15 97	91.2	Least cisco	4	167-276
			Alaska blackfish	12	79
			Slimy sculpin	1	

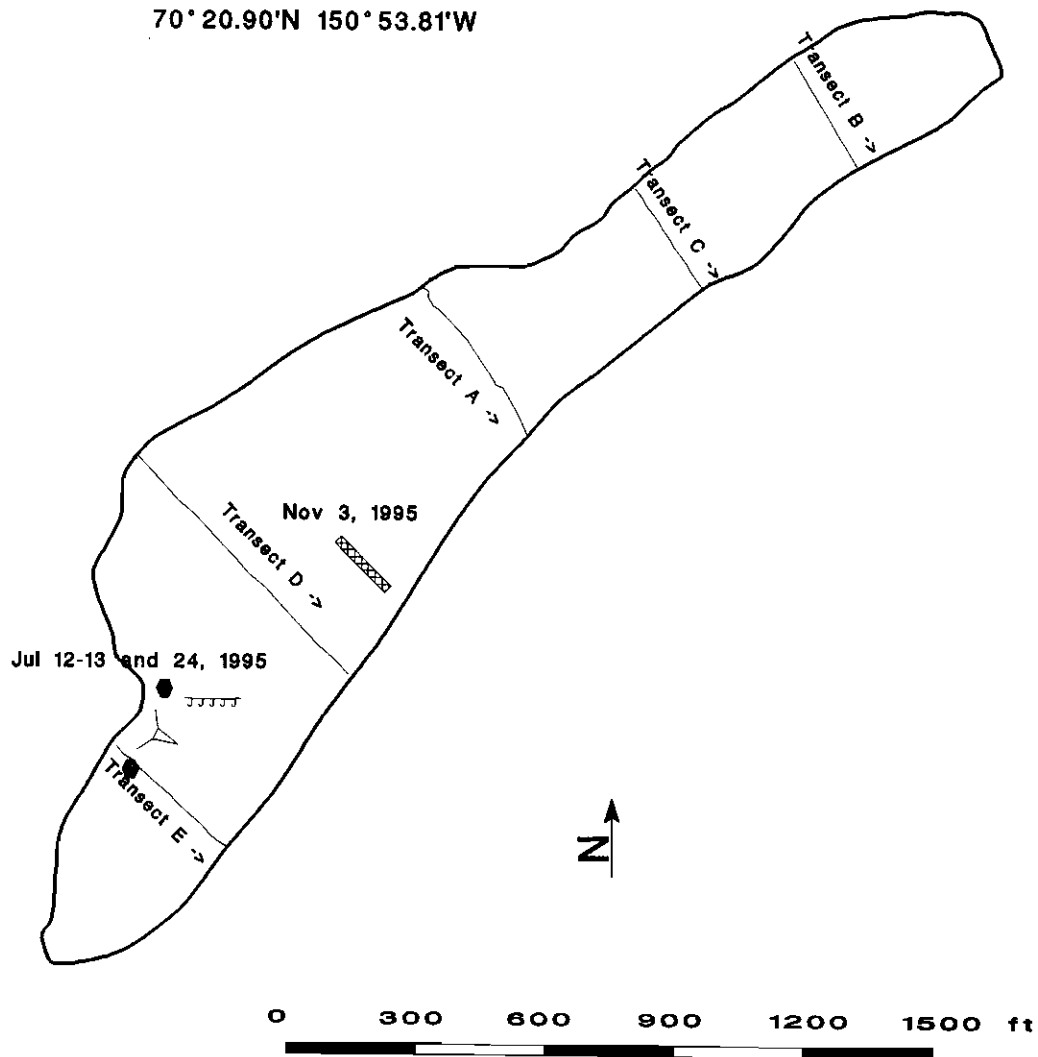






Appendix E
Lake T7.3 Data Packet

T7.3
(L9342)
70° 20.90'N 150° 53.81'W



Lake T7.3

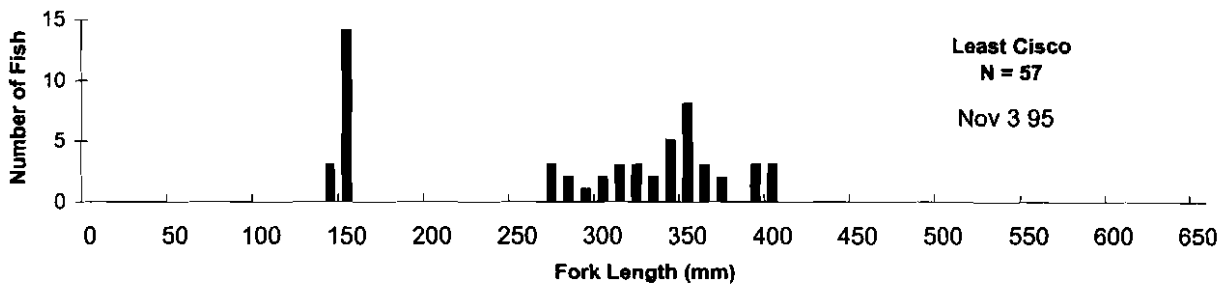
Other Names: L9342
Location: 70°20.90'N 150°53.81'W
USGS Quad Sheet: Harrison Bay B-2: T12N R5E, Sect 33
Habitat: Perched Lake (Infrequent Flooding)
Area: 25 acres
Maximum Depth: 11.8 feet
Active Outlet: No
Spec. Conductance: 84 μ S/cm
Calculated Volume: 67.2 million gallons
Permittable Volume: 2.0 million gallons

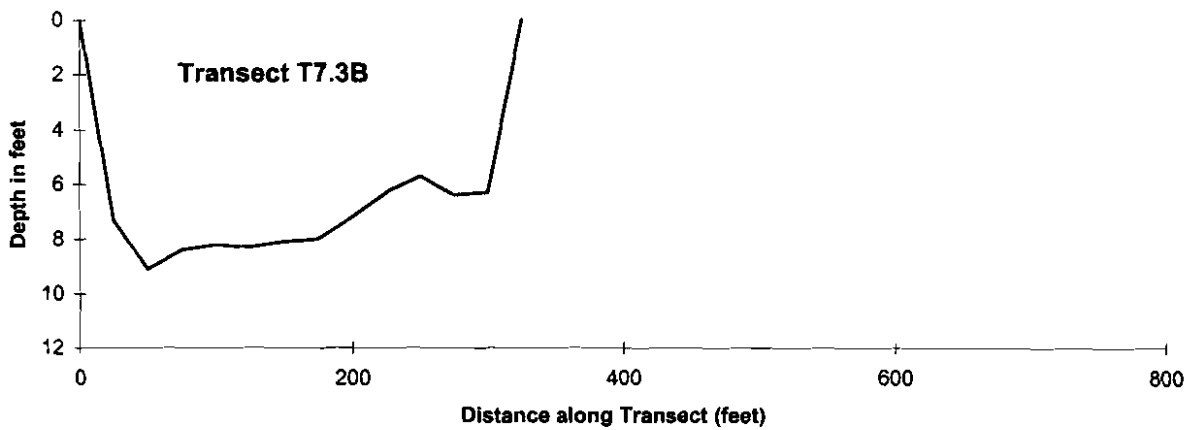
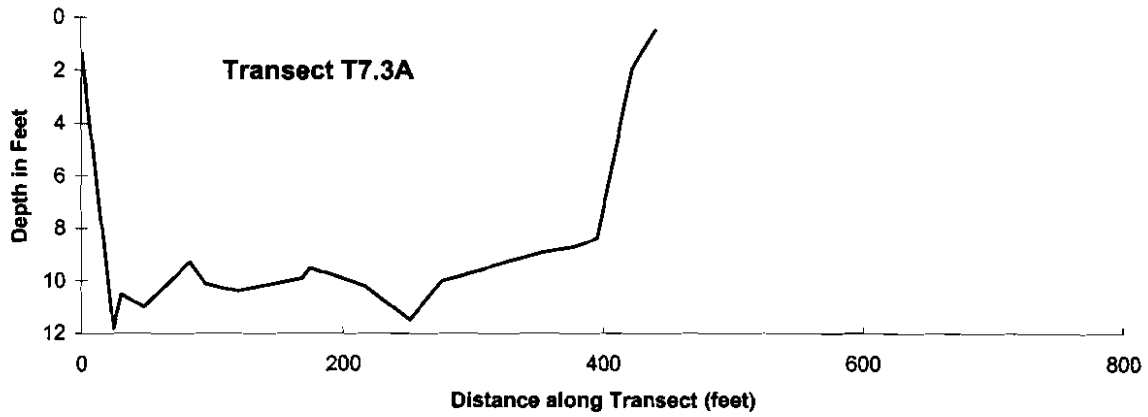
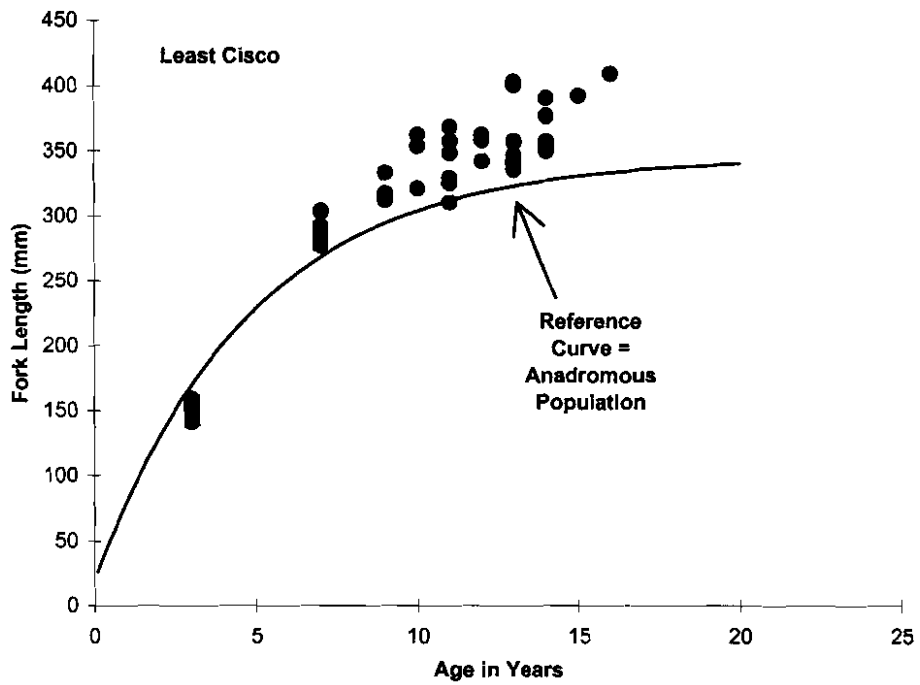
Water Quality:

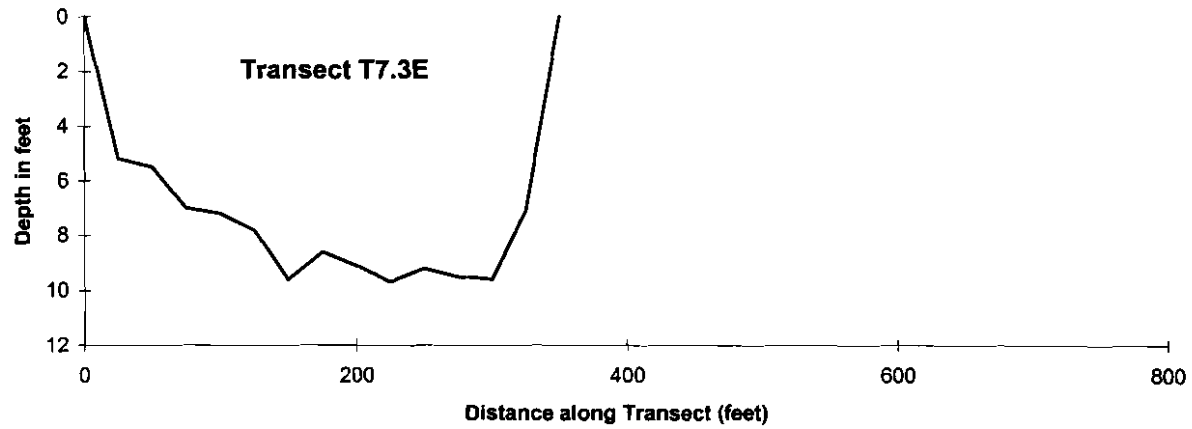
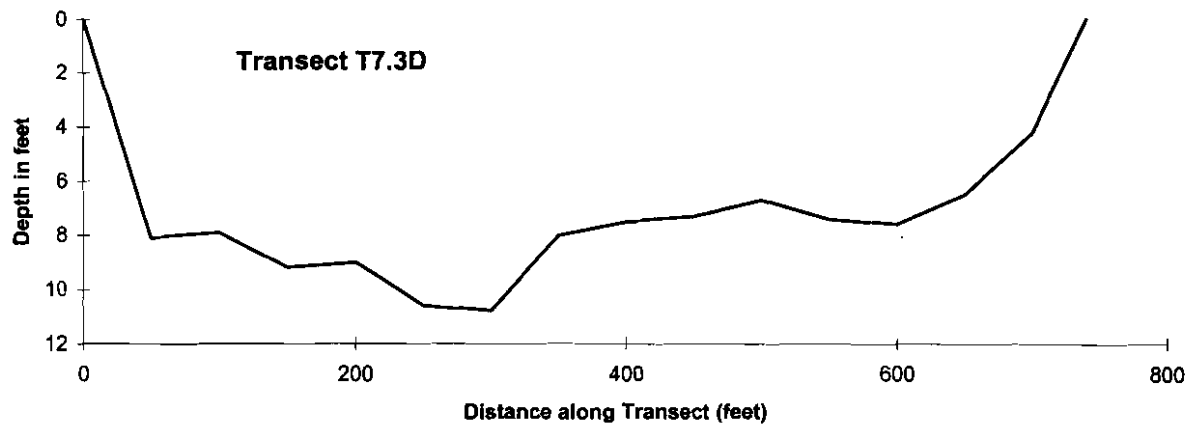
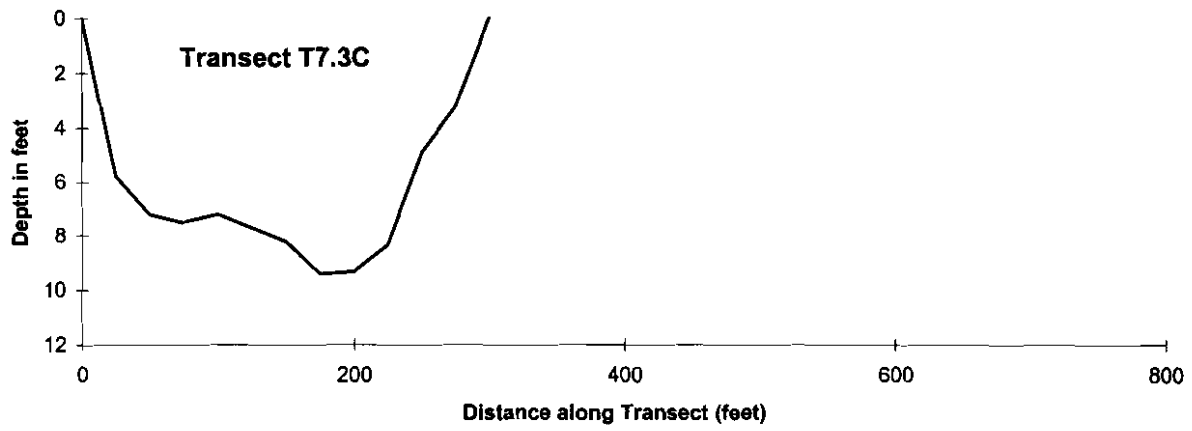
Year of Test	Chloride (mg/l)	Sodium (mg/l)	Magnesium (mg/l)	Calcium (mg/l)	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Source
1993	14	5.3	3.2	7.4	32	87	J. Lobdell

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Fyke Net	Jul 12 95	19.9	None	0	
Fyke Net	Jul 13 95	23.2	9spine stickleback	860	
Fyke Net	Jul 24 95	18.5	Least cisco 9spine stickleback	1 68	141
Minnow Trap	Jul 18 95	41.2	9spine stickleback	6	
Set Line	Jul 18 95	19.9	None	0	
Gill Net	Nov 3 95	23.7	Least cisco Alaska blackfish	57 1	277-409

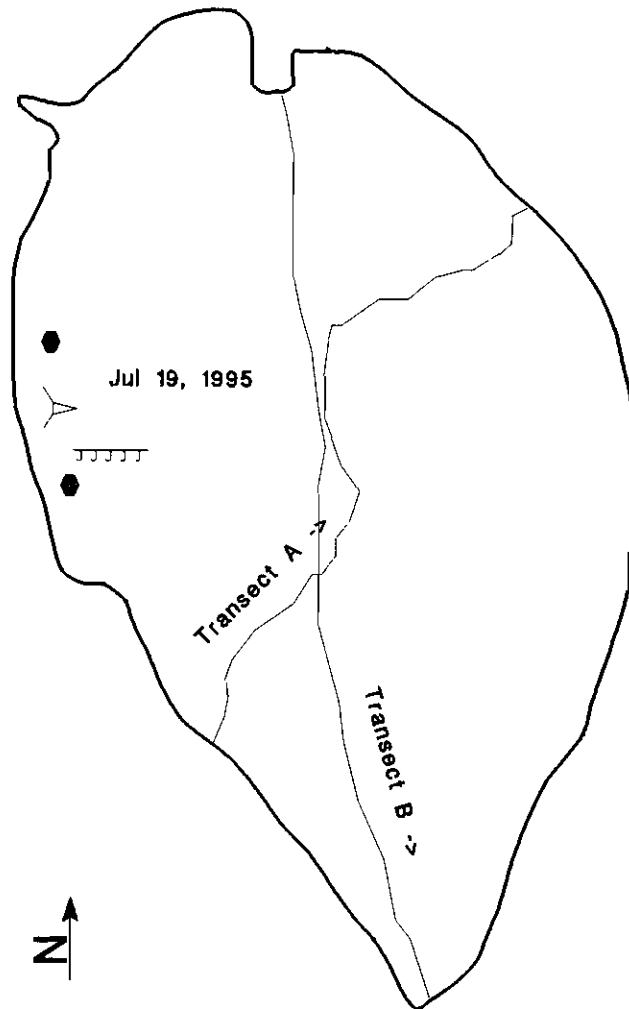




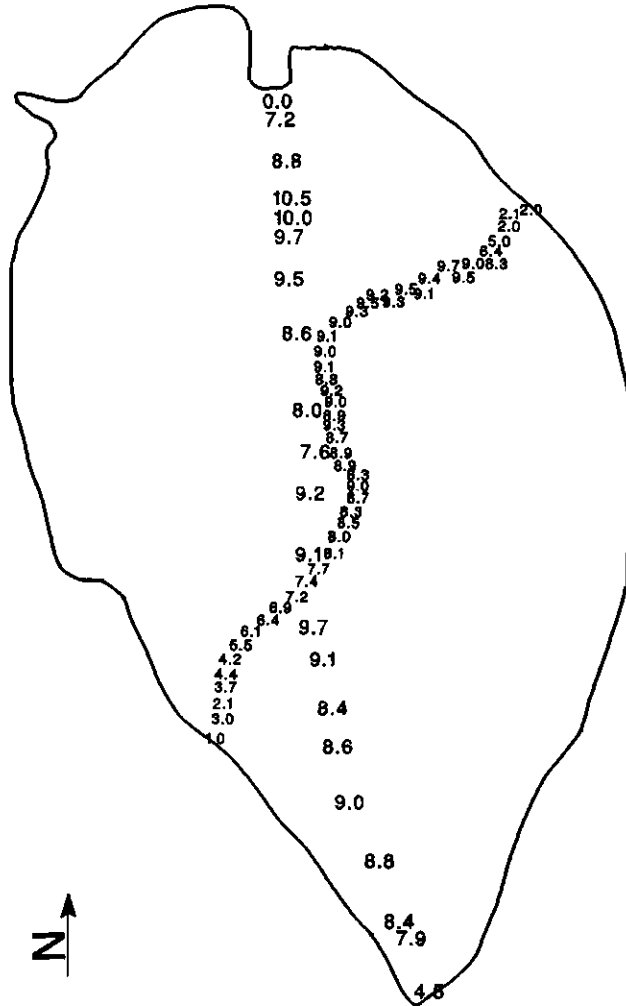


Appendix F
Lake T8.1 Data Packet

T8.1
(L9283)
70° 20.42'N 150° 50.45'W



T8.1
(L9283)
70° 20.42'N 150° 50.45'W



0 300 600 900 1200 1500 ft

Lake T8.1

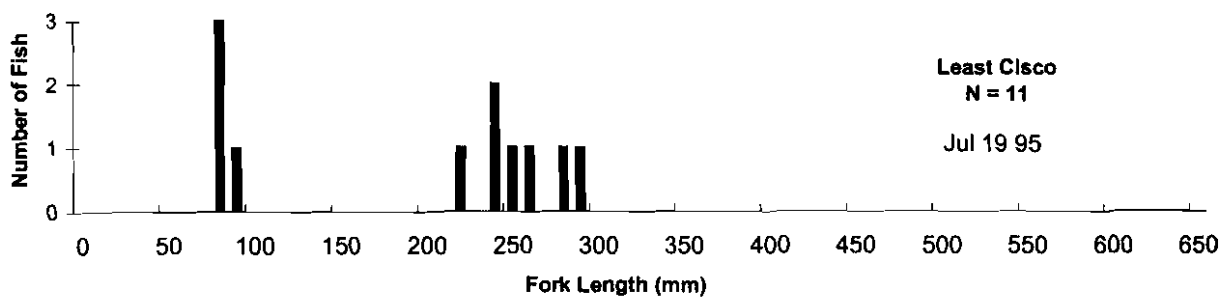
Other Names: L9283
Location: 70°20.42'N 150°50.45'W
USGS Quad Sheet: Harrison Bay B-2: T11N R5E, Sect 3
Habitat: Perched Lake (Frequent Flooding)
Area: 74 acres
Maximum Depth: 9.5 feet
Active Outlet: No
Spec. Conductance: 234 μ S/cm
Calculated Volume: 200.8 million gallons
Permittable Volume: 6.9 million gallons

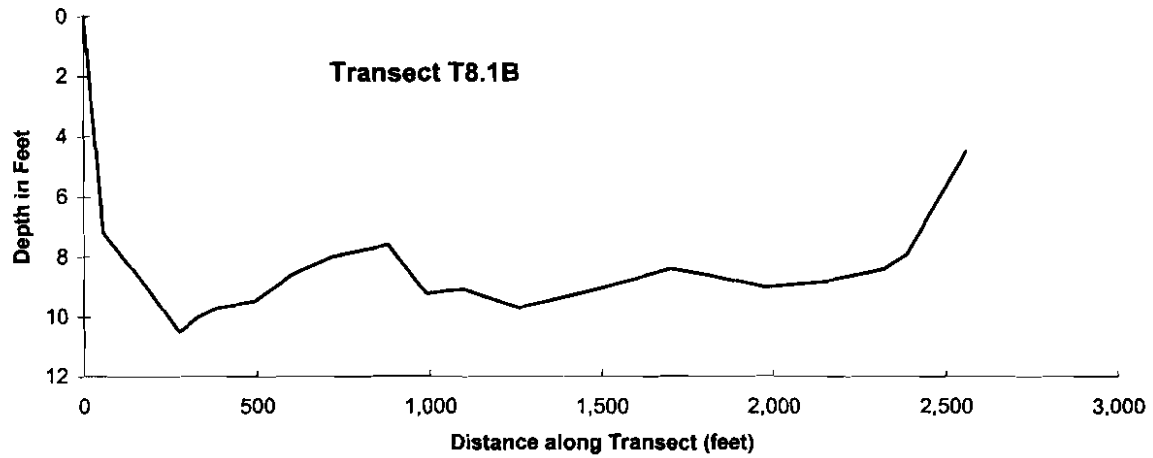
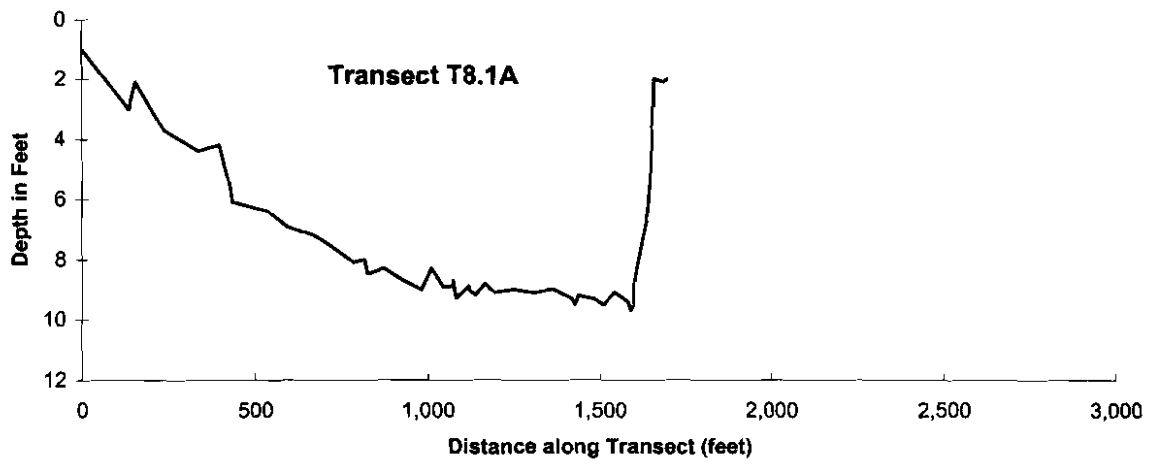
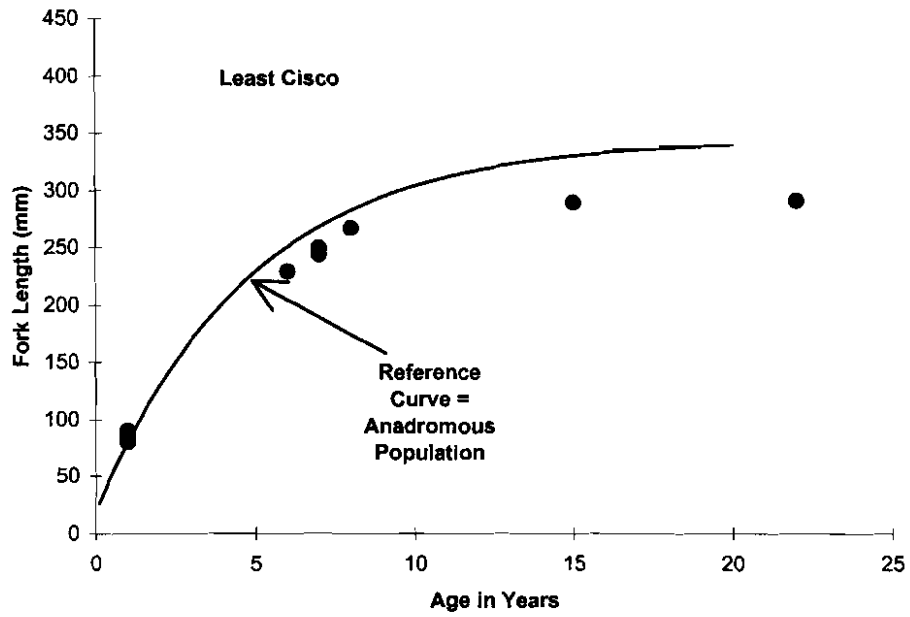
Water Quality:

Year of Test	Chloride (mg/l)	Sodium (mg/l)	Magnesium (mg/l)	Calcium (mg/l)	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Source
1992	2.8	1.8	3.2	29	86	110	J. Lobdell

Catch Record:

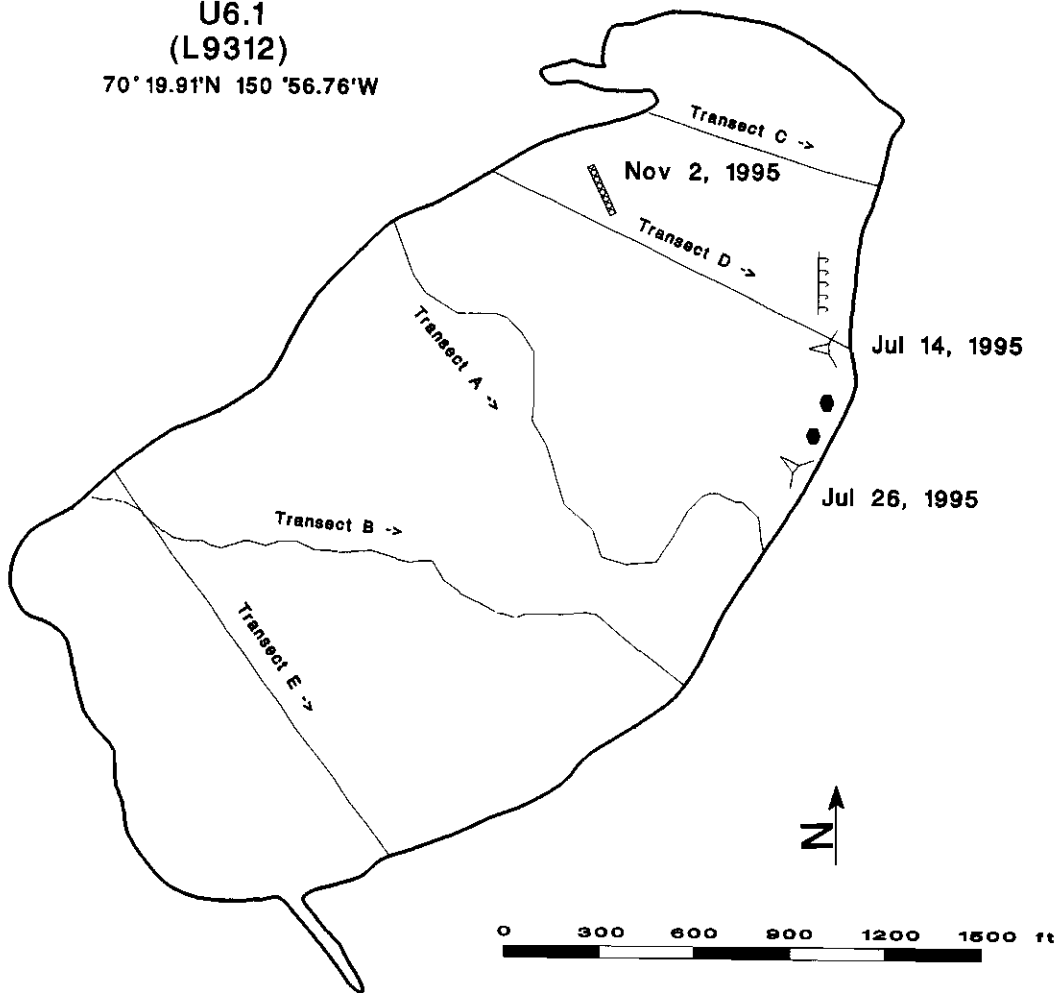
Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Fyke Net	Jul 19 95	20.9	Least cisco	11	80-291
			Alaska blackfish	2	
Minnow Trap	Jul 19 95	41.6	9spine stickleback	45	
Set Line	Jul 19 95	20.8	None	0	



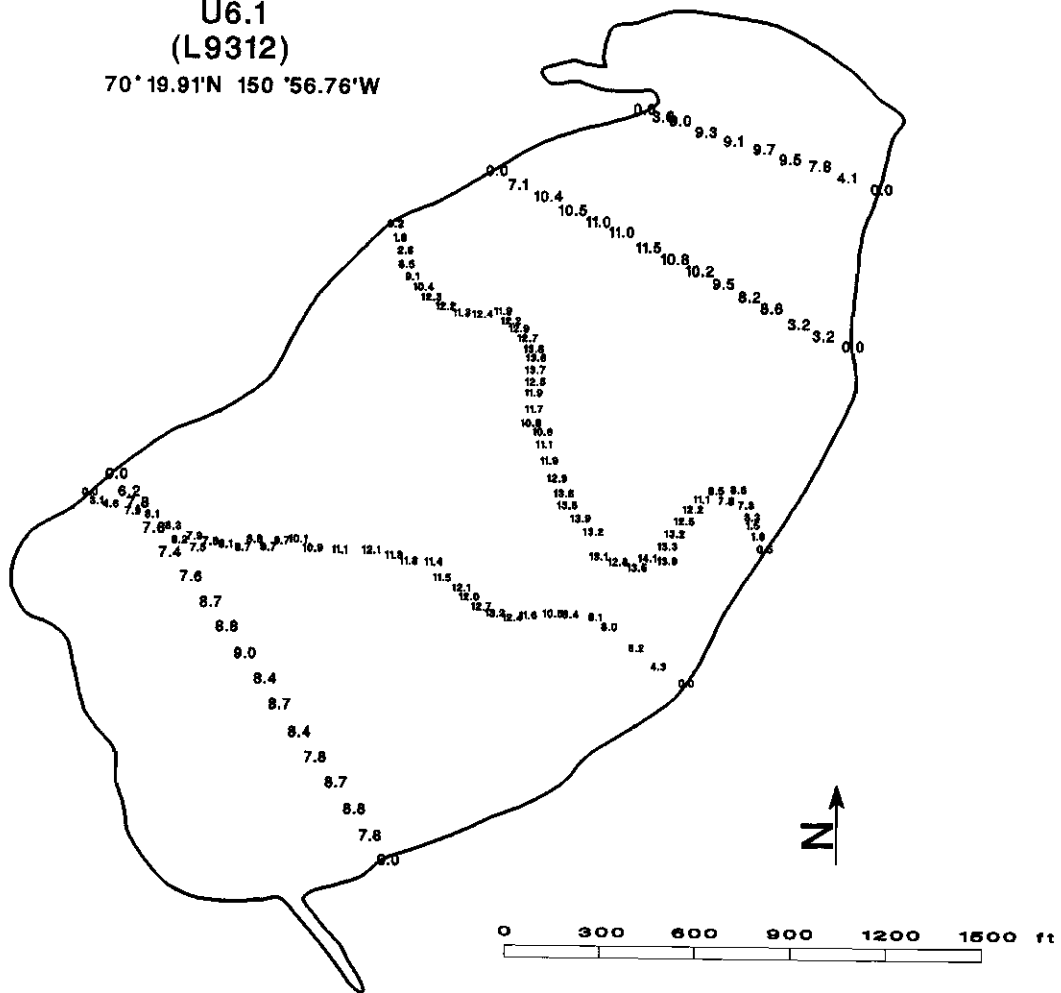


Appendix G
Lake U6.1 Data Packet

U6.1
(L9312)
70° 19.91'N 150° 56.76'W



U6.1
(L9312)
70° 19.91'N 150° 56.76'W



Lake U6.1

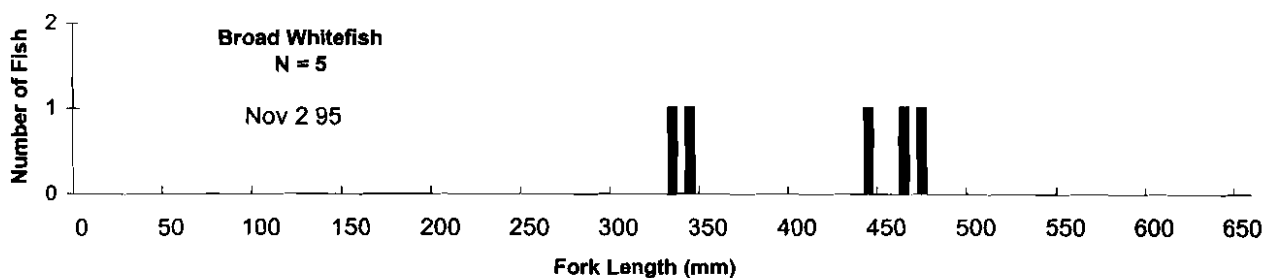
Other Names: L9312
Location: 70°19.91'N 150°56.76'W
USGS Quad Sheet: Harrison Bay B-2: T11N R5E, Sect 5
Habitat: Perched Lake (Infrequent Flooding)
Area: 100 acres
Maximum Depth: 14.1 feet
Active Outlet: No
Spec. Conductance: 60 µS/cm
pH: 7.7-8.2
Calculated Volume: 298.0 million gallons
Permittable Volume: 14.2 million gallons

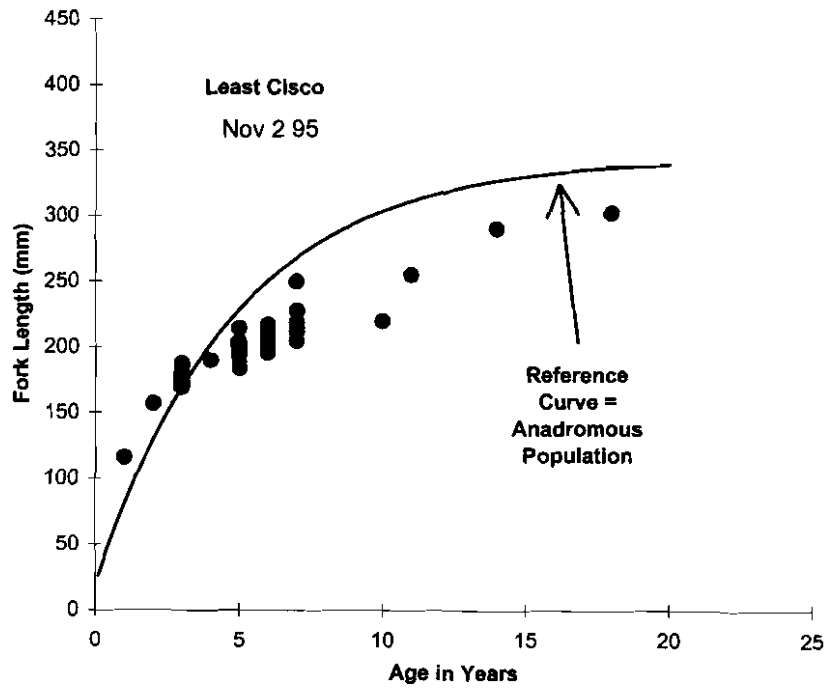
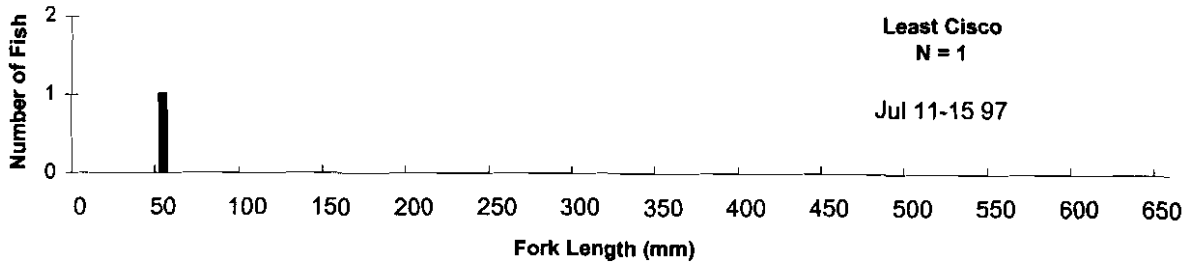
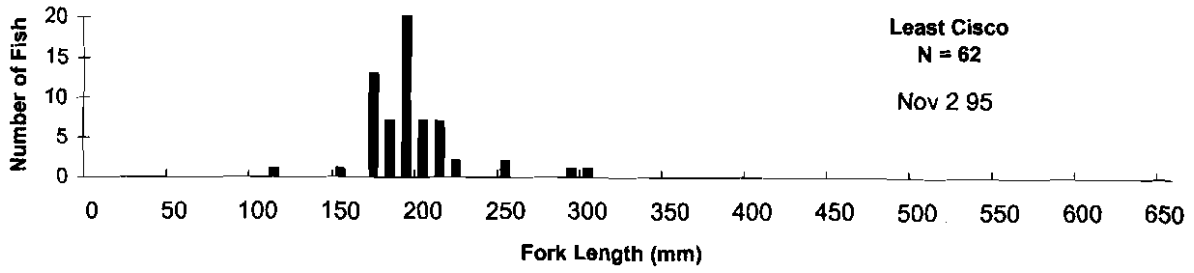
Water Quality:

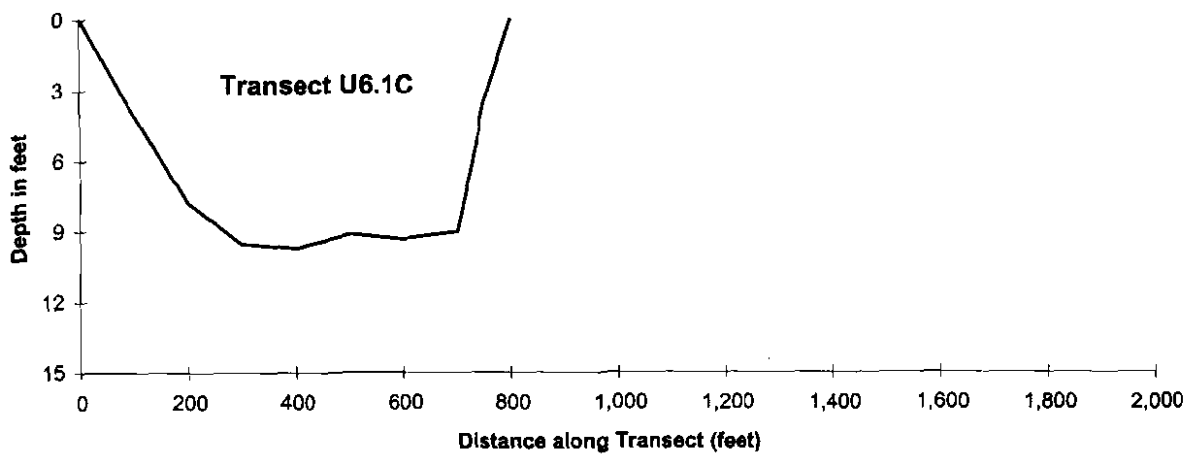
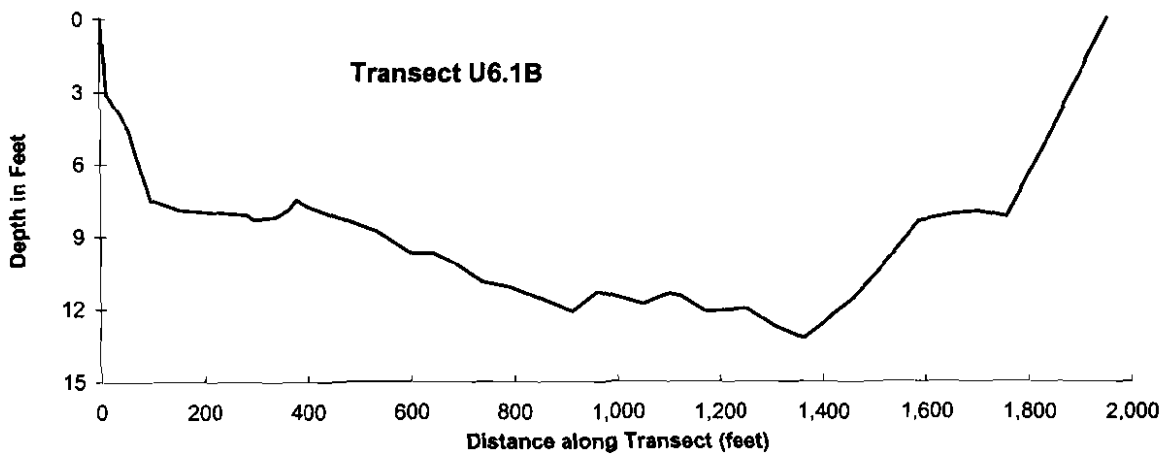
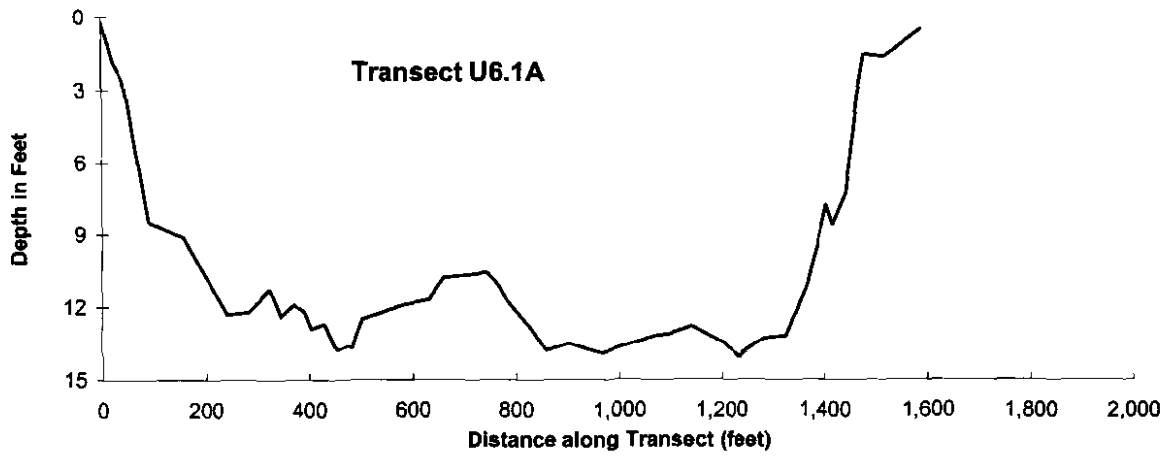
Year of Test	Chloride (mg/l)	Sodium (mg/l)	Magnesium (mg/l)	Calcium (mg/l)	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Source
1993	8	4.5	2.1	7.2	27	150	J. Lobdell

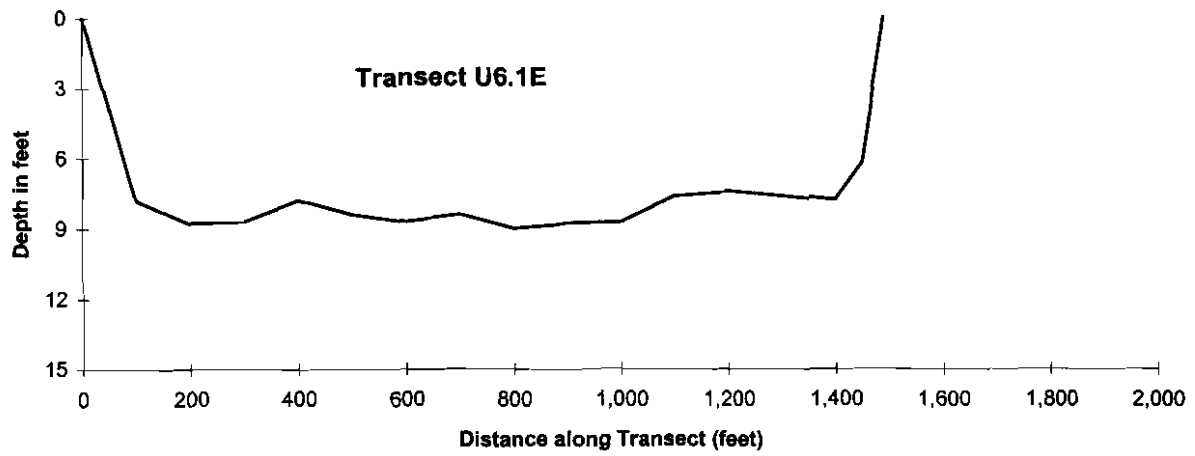
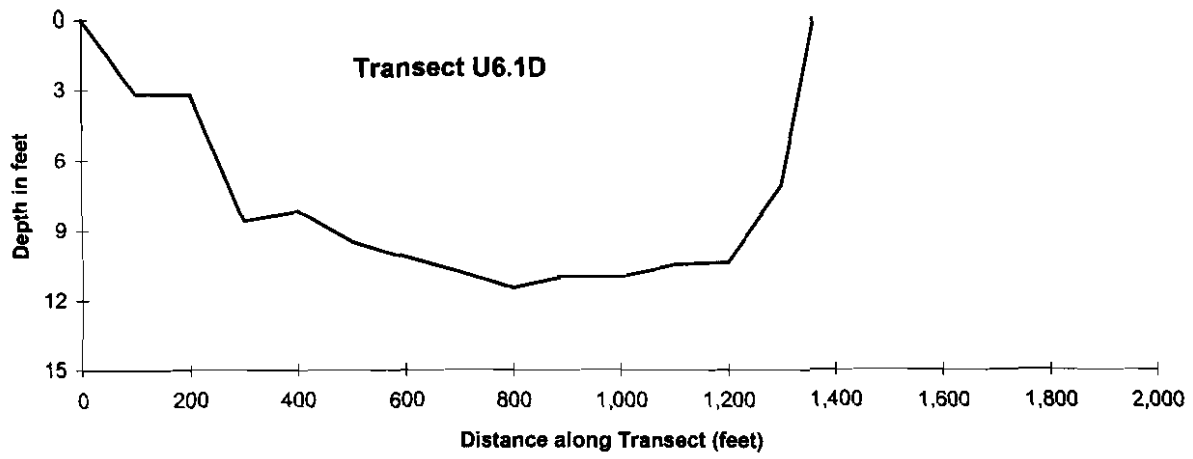
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Fyke Net	Jul 14 95	23.9	Alaska blackfish	1	
			Slimy sculpin	1	
			9spine stickleback	10	
Fyke Net	Jul 26 95	20.0	Broad whitefish	1	428
			9spine stickleback	2	
Minnow Trap	Jul 14 95	48.6	Slimy sculpin	2	
			9spine stickleback	1	
Set Line	Jul 14 95	23.5	None	0	
Gill Net	Nov 2 95	21.7	Least cisco	62	116-303
			Broad whitefish	5	334-470
Fyke Net	Jul 11-15 97	116.6	Least cisco	1	56
			Alaska blackfish	5	70
			Slimy sculpin	8	38-84
			9spine stickleback	57	



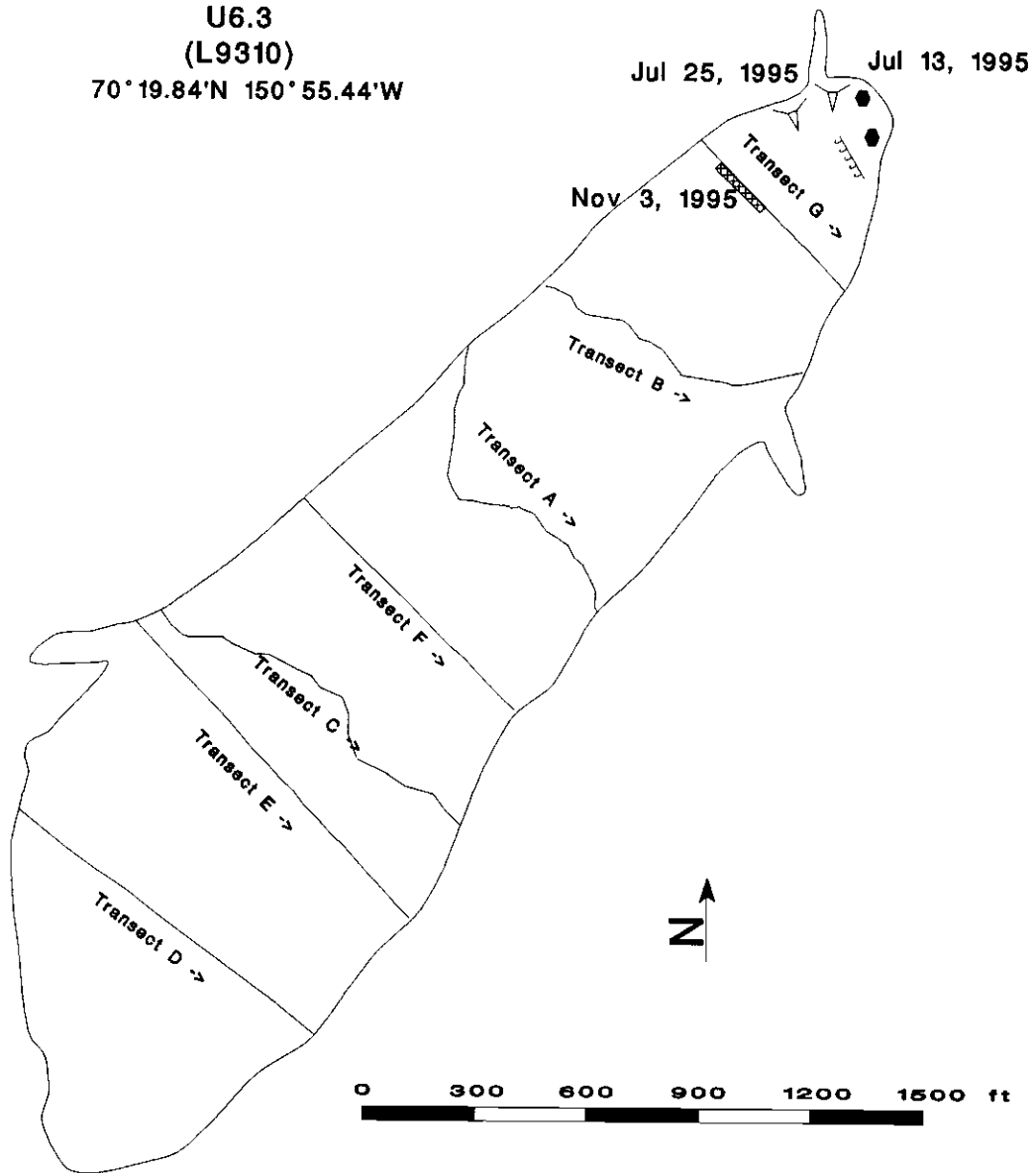






Appendix H
Lake U6.3 Data Packet

U6.3
(L9310)
70°19.84'N 150°55.44'W



Lake U6.3

Other Names: L9310
Location: 70°19.84'N 150°55.44'W
USGS Quad Sheet: Harrison Bay B-2: T11N R5E, Sect 5
Habitat: Perched Lake (Infrequent Flooding)
Area: 61 acres
Maximum Depth: 23.5 feet
Active Outlet: No
Spec. Conductance: 126 μ S/cm
pH: 7.9-8.1
Calculated Volume: 211.4 million gallons
Permittable Volume: 12.7 million gallons

Water Quality:

Year of Test	Chloride (mg/l)	Sodium (mg/l)	Magnesium (mg/l)	Calcium (mg/l)	Total Hardness [CaCO ₃] (mg/l)	Total Dissolved Solids (mg/l)	Source
1993	10	4.8	3.7	11	43	130	J. Loddell

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Fyke Net	Jul 13 95	18.3	Alaska blackfish	1	
			Slimy sculpin	3	
			9spine stickleback	130	
Fyke Net	Jul 25 95	20.3	Least cisco	1	317
			Alaska blackfish	1	
			9spine stickleback	41	
Minnow Trap	Jul 13 95	37.4	None	0	
Set Line	Jul 13 95	18.1	None	0	
Gill Net	Nov 3 95	22.7	Least cisco	26	132-380
			Broad whitefish	2	457-594
Fyke Net	Jul 12-15 97	94.6	Least cisco	1	283
			Alaska blackfish	2	108
			Slimy sculpin	6	52-74
			9spine stickleback	37	
Gill Net	Jul 14 97	4.9	Broad whitefish	2	437-576
			Least cisco	5	298-446

