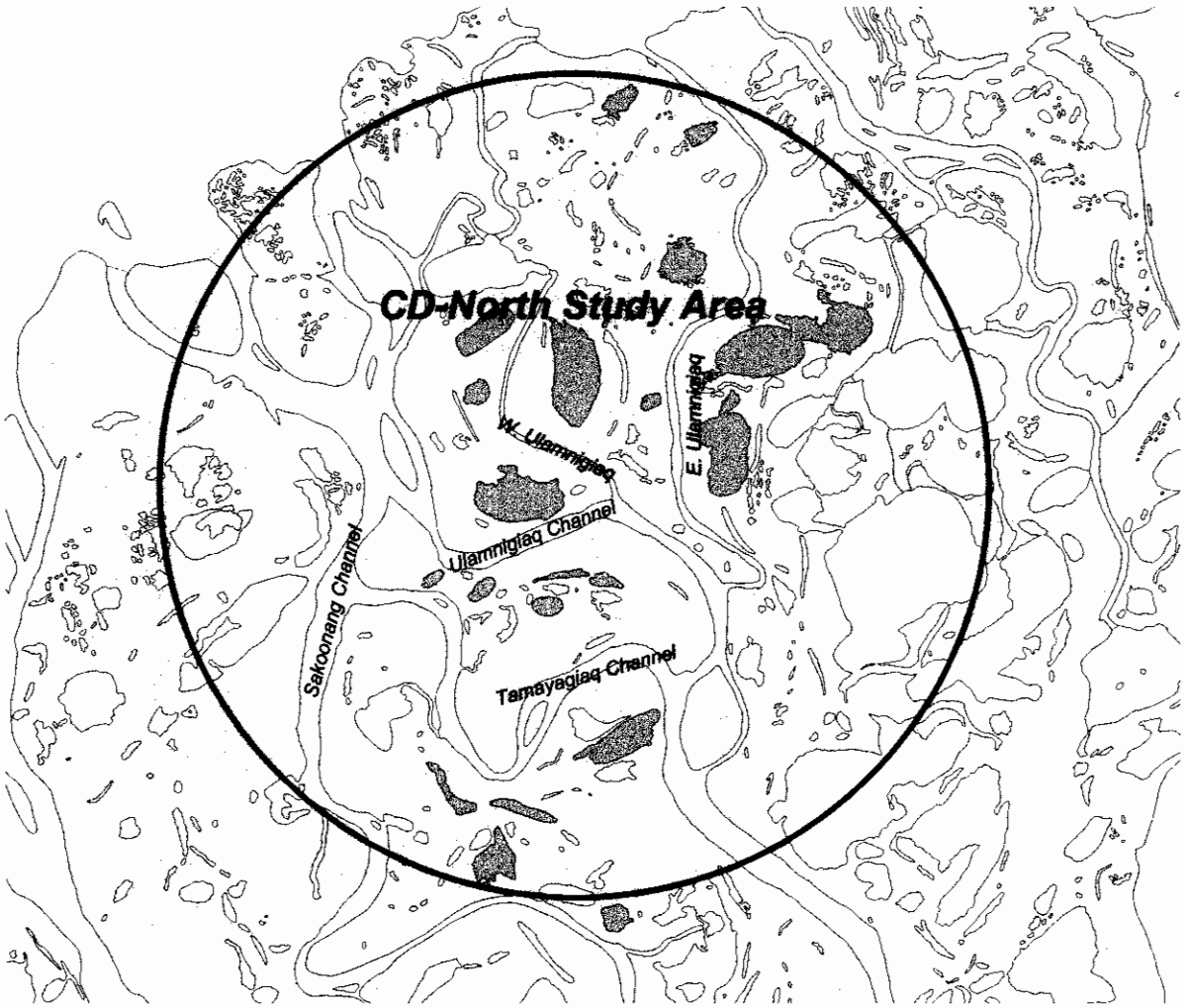
FISH UTILIZATION OF HABITATS IN THE CD-NORTH EXPLORATION AREA, 1999-2000

Final Report

February 2001



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FISH UTILIZATION OF HABITATS IN THE CD-NORTH EXPLORATION AREA, 1999-2000

INTRODUCTION

Phillips Alaska Inc. has been exploring for oil within the CD-North Exploration Area (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 During exploration, rivers and lakes are crossed by ice roads and water is withdrawn from lakes to support both industrial and domestic needs.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 if the area is developed for oil extraction.

During review of applications for exploration and development permits, information will be required on the biological sensitivity of lakes and river channels in the region. The study was designed to provide physical and biological information on lakes and channels to understand their use by various fish species. In addition, results of the survey can be used, in concert with previous surveys within the area, to direct any future investigations that may be needed.

The objectives of the study are to document fish presence and habitat use in lakes and channels in or near the CD-North Exploration Area. Selected lakes include those that may be used to support exploration. Some of the lakes in the areas of interest were sampled in previous years, while others were sampled in 1999 and 2000.

METHODS

FIELD SAMPLING

Lake Sampling

Sampling was conducted at 21 lakes in or near the CD-North exploration area identified by Phillips Alaska (Figure 2). The 1999-2000 field effort continued basic inventory in lakes within the CD-North Development Area that had not previously been surveyed or re-surveyed lakes that had been sampled in the early 1990's. Sampling was with gill nets combined with physical measurements. Lakes were sampled with short-duration gill net sets using a multimesh gill net (120 feet long, six panels of variable mesh, mesh size ranging from 1 to 3.5 inches stretched mesh). These nets have been previously used to collect inventory-level data from lakes throughout the Colville Delta and nearby areas. Sets were kept to a short duration to minimize both entangling waterfowl and fish mortality. Fish captured were measured and released if not severely injured. Duration of each set was recorded to allow calculation of catch rates.

Water chemistry parameters were measured in studied lakes to assess habitat conditions and provide information on the suitability of water for domestic and industrial uses. Water chemistry

measurements included water temperature, specific conductance or salinity, dissolved oxygen, and pH. In many lakes, a water sample was taken and sent to Northern Test Labs for more detailed analysis. Laboratory analysis included determining levels of chloride, sodium, calcium, magnesium, hardness and total dissolved solids (TDS).

Bathymetric data were collected to allow estimating lake volume. Depths were taken with an Eagle SupraPro ID depth sounder. Transect positions were determined by marking the beginning and end locations of 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. Readings were converted to distance measurements and resulting points were plotted on the known location of each transect.

Lake volume is estimated by applying the formula for the volume of a cone to the surface area and maximum depth of each lake. Surface area is obtained from a GIS base map using USGS 1:63,360 scale quads. Maximum depth is the maximum observed depth from the bathymetric transects. The amount allowed for winter water withdrawal is estimated as 15% of the volume of the lake deeper than 7 feet. The volume estimation is a rough estimate, but is currently accepted for a first estimate for a one-time use. For lakes that are proposed for long-term use, volume is estimated based on contour maps of the lake.

River Channel Sampling

During 2000, fyke nets were used to sample 4 delta channels in the CD-North Exploration Area (Figure 3). Previous investigations of the Sakoonang Channel in 1995 and 1996 revealed that minor Colville Delta channels are heavily used by juvenile whitefishes and ciscoes. The year 2000 channel surveys used fyke nets to evaluate if channels between Alpine and CD-North areas serve a similar function.

Sampling in channels was by fyke net so that fish could be released unharmed. Sampling covered mid to late July (July 10-22) to evaluate fish use of channels after spring out-migration was complete, and the end of August (August 18-27) to evaluate in-migration patterns of those fish returning from summer feeding areas in the nearshore Beaufort Sea.

LAKE SUMMARIES

This report uses lake numbering based on the Emergency Response Grid (ERG) used by Alaska Clean Seas, the response organization for the North Slope oilfield region. This numbering system allows the lakes to be quickly located on area maps. The lake number corresponds to the grid within which the lake occurs, along with a sequence number. In most cases, there is only one lake within a grid. Where two or more lakes occur within the same grid, lakes are numbered sequentially beginning from the west and south sides of the grid.

Information contained for each surveyed lake (if measured) includes:

1. A diagram of the lake,
2. Other names utilized for the same lake,
3. Lake location, in latitude/longitude,
4. The USGS quadrangle sheet and the township and range in which the lake is situated
5. Habitat classification,
6. Surface area in acres, obtained from USGS digital maps,
7. Maximum depth in feet,
8. Presence or absence of an outlet,
9. Specific conductance (μS/cm)
10. pH,
11. Calculated lake volume and volume of water permitted for winter withdrawal,
12. Water chemistry measurements,
13. Catch record, including gear used, date sampled, species caught and size range,
14. Where appropriate data exist, the length frequency of dominant species is plotted,
15. The depth distribution based on bathymetric transects that were recorded.

Five different lake types are defined, based primarily on the potential for access by fish. Definitions for the lake types are as follows:

Perched (Frequent Flooding) = Perched lake with an obvious high water channel, likely subject to annual flooding.

Perch (Infrequent Flooding) = Perched lake with no obvious high water channel, likely subject to flooding on an infrequent basis (every five years or more).

Drainage = Drainage Lake, a lake that is part of a defined drainage system, i.e. there is an active connection to a creek.

Oxbow = Oxbow lake, formed from abandoned river channels.

Tundra = Tundra Lake, a thaw lake not within or connected to the Colville Delta, little potential for fish access on a regular basis.

RESULTS AND DISCUSSION

LAKE SAMPLING

Biological Observations

Fish sampling has been conducted in 21 lakes in of near the CD-North exploration area (Table 1). As with most other fish surveys in this region, least cisco dominated the catches in samples obtained by gill net; broad whitefish and arctic cisco were also present (Table 2). Additional species, such as ninespine stickleback and Alaska blackfish are present in many of the lakes, as indicated by sampling with fyke nets or minnow traps, but are not sampled efficiently by gill net.

Fish were caught in 57% of the sampled lakes (12 of 21), which is lower than the delta-wide average of 87%. All 12 fish-bearing lakes contained least cisco, which represented 98% (470 of 478 fish) of the catch by gill net.

Water Chemistry Measurements

Water chemistry parameters measured in the studied lakes are presented Table 3. The most relevant parameters are specific conductance and total dissolved solids (TDS), which reflect the dissolved ion concentration. During freeze-up, ions are excluded from the ice, leading to a build-up in ion concentration in the remaining water. High levels of dissolved solids in late winter can lead to fish mortality, thus rendering the lake unsuitable for wintering. Lakes near the delta front or frequently flooded during coastal storm surges often have higher TDS than lakes further inland or less frequently flooded.

Evaluation of Fish Concerns

Information from fish sampling, depth measurements and water chemistry was used to evaluate each lake regarding its potential to support fish. Obviously, if fish were captured during the gill net sampling, the lake was classified as fish-bearing. The gill net sets were short, however, so the absence of catch does not necessarily mean a lake does not support fish. Lakes also were assessed for their proximity to fish-bearing streams, their depth and water chemistry. Lakes deeper than 7 feet are likely to retain unfrozen water during winter, thus have the potential to overwinter fish. Lakes with high TDS concentrations and that had not produced fish during sampling were classified as non-fish bearing. Deep lakes with low TDS levels are classified as potential fish-bearing lakes, with additional sampling needed if further clarification of the designation is desired. Results of the evaluation are summarized in Table 4. As can be seen, three lakes (N7.1, O8.1 and Q7.1) have high TDS (>1,000 μS/cm) yet contained fish. These results indicate that high TDS by itself is not an absolute indicator suitability. All three lakes are deep (19.1, 28.1 and 18.9 ft), which may reduce the effect of ion concentration during winter. The six lakes classified as non-fish bearing are all less than 15 feet deep.

The 21 lakes in or near the CD-North exploration contain an estimated 344.5 million gallons of water available for winter use under current permitting criteria for one-time withdrawals. The amount available ranges from 0.3 to 70.8 million gallons. Not all lakes are suitable for all uses – for example, lakes with elevated TDS will not be suitable for camp use, but may be acceptable for drilling. The differing levels of ionic concentrations are illustrated in Figure 4.

RIVER CHANNEL SAMPLING

Fyke net sampling was conducted at five stations on four channels (Figure 3). Station FJ-01 at the south end of East Ulamnigiaq Channel was fished for four days then moved north to FJ-03 for the duration of the sampling, so the analysis is primarily based on the remaining four stations. Nomenclature for the channels is based on interviews with Nuiqsut elders. Tamayagiaq and Ulamnigiaq channels are west-flowing forks of Tamayayak Channel identified on USGS topographical maps of the region, and are second-order distributaries similar to Sakoonang Channel. East and West Ulamnigiaq channels are third-order distributaries that branch off Ulamnigiaq Channel and flow generally north.

The total effort of 1,939 net hours in the four channels resulted in a catch of 4,822 fish from 16 species (Table 5). Six species (least cisco, arctic cisco, broad whitefish, humpback whitefish, round whitefish and rainbow smelt) accounted for 83% of the catch. The catch was dominated by juveniles of all species, with few adult fish caught (Figures 5-10). The only mature fish were least cisco captured sporadically through the summer and during the return migration in late summer, and several humpback whitefish and rainbow smelt.

Catch tended to be higher in the third-order distributaries (East and West Ulamnigiaq channels) than in the larger Tamayagiaq and Ulamnigiaq channels (Figure 11, Table 6). When combined with the results reported in Moulton (1997 and 1999), it appears that minor distributary channels and tapped lakes provide the most valuable juvenile rearing habitat in the study area, with major channels supporting lower densities. Juvenile broad whitefish, round whitefish and least cisco appear to be more abundant farther upstream in the Sakoonang Channel near the Alpine Development, while arctic cisco and rainbow smelt are more abundant in channels near the CD-North area (Figure 12, Table 7). Relative numbers of fish rearing in the different habitats, however, are difficult to assess because of differences in fyke net efficiency (a fyke net in a small channel samples a greater percentage of the channel than one in a large channel) and probable inter-annual distributional differences.

Fish distribution in this outer delta region is strongly influenced by wind direction and water level changes. During prolonged east winds, the water level drops as the sea level decreases, and the remaining water becomes fresher. When the wind reduces velocity or reverses to the west, the water level increases and the water becomes cooler and more saline. These changes are reflected in both water temperature and specific conductance, with stations closer to the coast responding sooner than those farther in the delta. Fish respond rapidly to these water changes, with freshwater fish moving downstream during east winds, and retreating upriver when cooler, more brackish

water moves upstream under west winds. Concurrent with these changes in water conditions, salt-tolerant species move upstream with the brackish water, and return down-river under east winds. The result is generally larger and more varied catches when water is moving and smaller catches of fewer species when wind and water conditions are stable.

During the first part of the July sampling period (July 12-15), east winds dominated, water level decreased, and water in Tamayagiaq Channel was quite fresh (specific conductance around 150-165 μS/cm). Station FJ-03, on East Ulamnigiaq Channel, is farther out in the delta as reflected in the higher conductivity. On July 15, the wind switched to the west, with a resulting rise in the water level, increasing conductivity and decreasing temperature (Figure 13). Catches of least cisco, humpback whitefish, and round whitefish on July 16 and 17 reflect the fish movements induced by this switch in wind and water level, as the area became more brackish (Figures 14-16). By July 20, the wind switched back around to the northeast, but the water quality in the channels and fish catches continued to show effects of the west winds. Substantial mixing was still underway, with specific conductance increasing in some channels and decreasing in others. By July 22, water temperature had increased and specific conductance decreased at all stations, and catches of least cisco and humpback whitefish had decreased.

The three chum salmon were juveniles (38, 45, 55 mm), two from Tamayagiaq Channel and one from East Ulamnigiaq Channel. This is the second consecutive year that juvenile chum salmon have been recorded from the Colville Delta. Two chum salmon smolts were caught in 1999 in a tapped lake adjacent to the Alpine Development runway (Moulton 1999).

The results from 2000 are consistent with those reported in Moulton (1997) for the Sakoonang Channel, that is most of the fish within the minor channels were young-of-the-year or juveniles, with few mature fish caught. Fish appeared to be moving downstream towards Harrison Bay during the early summer, with a return migration near the end of August. In mid-summer, few fish remained in the river channel and tapped lakes, with most being young-of-the-year.

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Table 1. Locations of lakes sampled in or near the CD-North exploration area.

ERG Name	Lake Name	Latitiude deg.	Latitiude min.	Longitude deg.	Longitude min.	USGS Topo Sheet	Township/Range	Habitat
M7.2	M9714	70	27.12	150	52.25	Harrison Bay B-2	T13N R5E, Sect. 28	Perched Lake (Frequent Flooding)
N7.1	M9211	70	26.11	150	51.70	Harrison Bay B-2	T13N R5E, Sect. 33	Perched Lake (Infrequent Flooding)
N8.1	L9208	70	26.90	150	50.94	Harrison Bay B-2	T13N R5E, Sect. 28	Perched Lake (Infrequent Flooding)
O6.1	M9713	70	25.42	150	55.63	Harrison Bay B-2	T12N R5E, Sect. 5	Perched Lake (Infrequent Flooding)
O6.2	M9712	70	25.82	150	55.30	Harrison Bay B-2	T12N R5E, Sect. 5	Perched Lake (Infrequent Flooding)
O7.1	M9313	70	25.41	150	53.69	Harrison Bay B-2	T12N R5E, Sect. 4	Perched Lake (Infrequent Flooding)
O7.2	M0019	70	25.23	150	52.43	Harrison Bay B-2	T12N R5E, Sect. 4	Perched Lake (Frequent Flooding)
O7.3	L9903	70	25.20	150	50.60	Harrison Bay B-2	T12N R5E, Sect. 4	Perched Lake (Frequent Flooding?)
O8.1	L9107	70	25.46	150	50.32	Harrison Bay B-2	T12N R5E, Sect. 3	Perched Lake (Infrequent Flooding)
P6.1	L9905	70	24.25	150	57.23	Harrison Bay B-2	T12N R5E, Sect. 7	Perched Lake (Frequent Flooding)
P6.2	L9904	70	24.17	150	56.28	Harrison Bay B-2	T12N R5E, Sect. 8	Perched Lake (Frequent Flooding)
P6.3	L9210	70	24.61	150	55.14	Harrison Bay B-2	T12N R5E, Sect. 8	Perched Lake (Infrequent Flooding)
P6.4	L9908	70	24.16	150	54.70	Harrison Bay B-2	T12N R5E, Sect. 8	Perched Lake (Frequent Flooding?)
P6.5	L9906	70	24.00	150	55.09	Harrison Bay B-2	T12N R5E, Sect. 17	Perched Lake (Frequent Flooding)
P7.1	L9108	70	24.94	150	51.49	Harrison Bay B-2	T12N R5E, Sect. 10	Perched Lake (Infrequent Flooding)
P7.2	L9907	70	24.10	150	53.95	Harrison Bay B-2	T12N R5E, Sect. 9	Perched Lake (Frequent Flooding?)
Q7.1	M9709	70	23.13	150	53.80	Harrison Bay B-2	T12N R5E, Sect. 21	Perched Lake (Infrequent Flooding)
R5.2	M9626	70	22.86	150	57.24	Harrison Bay B-2	T12N R5E, Sect. 19	Perched Lake (Infrequent Flooding)
R6.1	M9522	70	22.19	150	55.21	Harrison Bay B-2	T12N R5E, Sect. 29	Perched Lake (Frequent Flooding)
R6.3	L9281	70	22.43	150	56.56	Harrison Bay B-2	T12N R5E, Sect. 20	Perched Lake (Infrequent Flooding)
R6.4	M9321	70	22.74	150	55.95	Harrison Bay B-2	T12N R5E, Sect. 20	Perched Lake (Infrequent Flooding)

Table 2. Fish caught by gill net sampling in the CD-North exploration area, 1992-2000.

ERG Name	Lake Name	Date	Sampling Duration (hours)	Broad Whitefish	Arctic Cisco	Least Cisco	Total Catch
M7.2	M9714	Aug 8 97	12.0				0
N7.1	M9211	Nov 3 92	26.0		6	8	14
N8.1	L9208	Nov 3 92	30.5				0
O6.1	M9713	Aug 7 97	5.0				0
		Aug 8 97	6.7				0
O6.2	M9712	Aug 7 97	6.0				0
		Aug 8 97	5.8				0
O7.1	M9313	Nov 5 93	20.7			79	79
		Jul 25 00	2.1			4	4
O7.2	M0019	Jul 25 00	7.0				0
O7.3	L9903	Jul 26 00	2.3			3	3
O8.1	L9107	Nov 5 93	22.0			21	21
		Aug 11 97	2.9			6	6
P6.1	L9905	Aug 2 99	2.3				0
P6.2	L9904	Aug 2 99	2.5	1		5	6
P6.3	L9210	Nov 3 92	22.0			50	50
		Jul 26 00	1.4			4	4
P6.4	L9908	Aug 1 99	4.5				0
		Aug 2 99	5.0				0
P6.5	L9906	Aug 2 99	2.2	1		4	5
P7.1	L9108	Nov 5 92	20.0			87	87
		Aug 11 97	4.7			18	18
P7.2	L9907	Aug 1 99	4.7				0
		Aug 2 99	5.0				0
Q7.1	M9709	Aug 2 97	6.5			30	30
R5.2	M9626	Aug 16 96	8.0			2	2
R6.1	M9522	Aug 3 96	11.2			0	0
R6.3	L9281	Nov 5 95	21.0			53	53
R6.4	M9321	Nov 6 95	23.1			96	96

Table 3. Water quality parameters measured at lakes in or near the CD-North exploration area.

ERG Name	Lake Name	Date	Water Temp (deg C)	Dissolved Oxygen (mg/l)	Specific Conductance (mS/cm)	Salinity (ppt)	pH	Chloride (mg/l)	Sodium (mg/l)	Calcium (mg/l)	Magnesium (mg/l)	Hardness (mg/l)	TDS[1] (mg/l)
M7.2	M9714	Aug 08 97	12.4	8.3	17,384	7.6	8.3						(10,050)
N7.1	M9211	Aug 13 97	12.0	9.5	6,545	3.6	8.0						(3,785)
		Nov 01 98						2,210	985	79	153	827	3,740
N8.1	L9208	1992						4,800	1,990	260	161	1,500	9,200
O6.1	M9713	Nov 01 98						1,090	556	49	65	388	1,920
		Jul 22 99	13.0	10.4	3,302		7.9	836	439	38	54	317	1,640
O6.2	M9712	Aug 07 97	12.6	9.2	3,767		7.9						(2,180)
O7.1	M9313	Aug 13 97	12.0	10.9	841		8.3						(488)
		Nov 01 98						259	108	29	22	162	484
		Jul 22 99						224	96	24	20	141	472
		Jul 25 00	10.1	10.3	759		7.9	192	71	21	16	120	370
O7.2	M0019	Jul 25 00	10.7		584		7.9	146	58	15	13	90	296
O7.3	L9903	Jul 26 00	9.9		836		8.0						(486)
O8.1	L9107	Aug 11 97	14.1	11.0	1,867		8.1						(1,081)
		Nov 01 98						572	313	38	24	215	1,080
P6.1	L9905	Aug 02 99	10.3	11.7	5,860	3.2	8.4	1,880	991	69	135	737	3,470
P6.2	L9904	Aug 02 99	9.8	11.8	622		8.1	161	79	18	16	112	354
P6.3	L9210	1992						64	20	10	19	92	190
		Nov 01 98						75	26	21	11	100	189
		Jul 22 99						68	24	21	12	101	200
		Jul 26 00	10.1		243		7.9	45	16	14	8	65	170
P6.4	L9908	Aug 01 99	9.8	11.1	251		7.9	48	18	15	10	77	130
P6.5	L9906	Aug 02 99	10.2	11.9	416		8.0	97	49	15	12	86	238
P7.1	L9108	Aug 11 97	13.1	10.0	1,405		8.1						(815)
		Nov 01 98						427	218	31	29	201	800
P7.2	L9907	Aug 01 99	10.1	11.3	264		8.0	36	16	17	12	89	128
Q7.1	M9709	Jul 22 97	12.3	10.8	7,209	4.0	7.8	2,390	3,230	258	166	1,480	4,254
R5.2	M9626	Aug 16 96	11.0		246								(144)
R6.1	M9522	Aug 03 96	9.5		4,290								(2,482)
R6.3	L9281	1992						90	4	9	11	62	280
		Jul 09 95	12.8		346								(202)
		Nov 04 95	0.0		420								(245)
R6.4	M9321	Jul 16 95	16.0		146								(88)
		Nov 06 95	0.0		230								(135)

[1] TDS values in parenthesis are estimated from specific conductance/TDS relationship calculated from 68 paired observations in delta lakes.

TDS = 0.578*(specific conductance)+2.330 (r^2 = 0.992)

(specific conductance range: 55 to 7,209 µS/cm; TDS range: 18 to 4,254 mg/l)

Table 4. Summary of fish presence and estimated available winter water in lakes in the CD-North exploration area.

ERG Name	GIS Est Acreage	Maximum Depth (ft)	Calculated Volume (mil gals)	15% Vol. >7 ft (mil gals)	Fish Caught[1]	TDS (mg/l)	Fish Concern[2]	Volume Available (mil gals)
M7.2	17.4	14.1	26.3	2.0		10,050	No	26.3
N8.1	14.9	11.0	17.6	1.0		9,200	No	17.6
O6.1	14.5	11.0	17.1	0.9		1,640	No	17.1
O6.2	52.5	8.1	45.7	0.9		2,180	No	45.7
P6.1	7.4	12.4	9.9	0.6		3,470	No	9.9
R6.1	19.9	9.0	19.3	0.6		2,482	No	19.3
O7.2	5.4	10.8	6.2	0.3		296	Y?	0.3
P6.4	9.5	11.3	11.5	0.7		130	Y?	0.7
P7.2	11.2	10.1	12.1	0.6		128	Y?	0.6
N7.1	42.9	19.2	88.6	8.4	ARCS,LSCS	3,740	Yes	8.4
O7.1	128.3	25.1	346.2	37.4	LSCS	370	Yes	37.4
O7.3	8.3	22.9	20.5	2.1	LSCS	486	Yes	2.1
O8.1	208.2	28.1	629.0	70.8	LSCS	1,080	Yes	70.8
P6.2	12.5	25.3	34.1	3.7	BDWF,LSCS	354	Yes	3.7
P6.3	117.1	29.1	366.3	41.7	LSCS	170	Yes	41.7
P6.5	14.7	13.0	20.6	1.4	BDWF,LSCS	238	Yes	1.4
P7.1	112.2	17.1	206.3	18.3	LSCS	800	Yes	18.3
Q7.1	64.6	18.9	131.2	12.4	LSCS	4,254	Yes	12.4
R5.2	20.1	20.3	43.8	4.3	LSCS	144	Yes	4.3
R6.3	43.8	13.5	63.5	4.6	LSCS, BKFH, NSSI	202	Yes	4.6
R6.4	20.8	11.7	26.2	1.6	LSCS, NSSB	88	Yes	1.6

[1] BDWF = broad whitefish, LSCS = least cisco, ARCS = arctic cisco, BKFH = Alaska blackfish, NSSB = ninespine stickleback

[2] Y? indicates that fish were not caught, but characteristics of the lake suggest fish may be present at times.

Table 5. Catches of fish from fyke net sampling in Colville Delta channels in or near the CD-North exploration area, 2000.

Species	July	August	2000 Total
Chum salmon	3	0	3
Broad whitefish	171	153	324
Humpback whitefish	590	245	835
Arctic cisco	154	89	243
Least cisco	667	312	979
Round whitefish	325	114	439
Dolly Varden char	0	2	2
Arctic grayling	12	2	14
Rainbow smelt	1,171	6	1,177
Longnose sucker	32	0	32
Saffron cod	0	3	3
Arctic flounder	5	8	13
Fourhorn sculpin	44	129	173
Slimy sculpin	0	2	2
Threespine stickleback	0	9	9
Ninespine stickleback	421	153	574
Total Effort (hrs)	1,001	938	1,939

Table 6. Catch rates and total catch by species at river channels in the CD-North exploration area, based on fyke net sampling during July and August, 2000.

Catch Rate (fish per day)

	July				August				
	Tamay	Ulam	W. Ulam	E. Ulam	Tamay	Ulam	W. Ulam	E. Ulam	2000
Species	FJ-04	FJ-02	FJ-05	FJ-1&3	FJ-04	FJ-02	FJ-05	FJ-03	Total
Chum salmon	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3
Broad whitefish	1.8	2.0	5.3	7.3	1.5	2.9	3.1	8.2	32.0
Humpback whitefish	5.7	9.9	18.3	22.0	5.9	2.4	4.4	12.4	81.1
Arctic cisco	1.6	5.7	7.9	1.2	0.0	0.8	1.5	6.8	25.6
Least cisco	4.4	23.5	17.8	16.4	5.1	5.2	5.8	15.9	94.1
Round whitefish	5.3	5.5	1.1	14.8	1.7	4.1	1.7	4.1	38.4
Dolly Varden char	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2
Arctic grayling	0.4	0.3	0.1	0.3	0.0	0.2	0.0	0.0	1.3
Rainbow smelt	14.6	9.0	81.8	26.1	0.1	0.0	0.2	0.3	132.1
Longnose sucker	1.6	0.9	0.3	0.3	0.0	0.0	0.0	0.0	3.2
Saffron cod	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.3
Arctic flounder	0.0	0.0	0.0	0.4	0.2	0.1	0.2	0.3	1.2
Fourhorn sculpin	0.2	0.5	0.1	2.5	0.9	4.7	4.8	2.8	16.6
Slimy sculpin	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2
Threespine stickleback	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.7	0.9
Ninespine stickleback	5.9	4.5	15.3	15.0	0.7	3.2	0.8	11.0	56.5
Total CPUE:	41.7	61.8	148.1	106.4	16.2	24.0	23.1	62.8	484.0

Number of Fish

	July				August				2000
	Tamay	Ulam	W. Ulam	E. Ulam	Tamay	Ulam	W. Ulam	E. Ulam	
Species	FJ-04	FJ-02	FJ-05	FJ-1&3	FJ-04	FJ-02	FJ-05	FJ-03	Total
Chum salmon	2	0	0	1	0	0	0	0	3
Broad whitefish	16	23	37	101	15	29	30	79	330
Humpback whitefish	52	117	128	304	58	24	43	120	846
Arctic cisco	15	67	55	17	0	8	15	66	243
Least cisco	40	277	124	226	50	51	57	154	979
Round whitefish	48	65	8	204	17	40	17	40	439
Dolly Varden char	0	0	0	0	0	2	0	0	2
Arctic grayling	4	3	1	4	0	2	0	0	14
Rainbow smelt	133	106	571	361	1	0	2	3	1,177
Longnose sucker	15	11	2	4	0	0	0	0	32
Saffron cod	0	0	0	0	0	1	0	2	3
Arctic flounder	0	0	0	5	2	1	2	3	13
Fourhorn sculpin	2	6	1	35	9	46	47	27	173
Slimy sculpin	0	0	0	0	0	0	2	0	2
Threespine stickleback	0	0	0	0	0	0	2	7	9
Ninespine stickleback	54	53	107	207	7	32	8	106	574
Total Effort (hrs)	219.2	282.8	167.6	331.5	235.9	236.3	234.1	231.9	1,939

Tamay = Tamayagiaq Channel
Ulam = Ulamnigiaq Channel
W. Ulam = West Ulamnigiaq Channel
E. Ulam = East Ulamnigiaq Channel

Table 7. Catch rates by species at river channels in the Colville delta based on fyke net sampling during July and August, 1995-1996 and 2000.

	Sakoonang Channel[1] (1995-1996)			Ulamnigiaq Channel (2000)			Tamayagiaq Channel (2000)			West Ulamnigiaq (2000)			East Ulamnigiaq (2000)		
	Mean	Standard Deviation	No. of Sets	Mean	Standard Deviation	No. of Sets	Mean	Standard Deviation	No. of Sets	Mean	Standard Deviation	No. of Sets	Mean	Standard Deviation	No. of Sets
Broad whitefish	49.0	60.4	51	2.4	2.5	22	2.0	2.5	17	3.9	3.0	17	8.2	9.3	20
Humpback whitefish	6.9	12.2	51	6.4	9.4	22	3.8	6.8	17	9.4	15.3	17	19.1	30.9	20
Round whitefish	14.6	16.5	51	4.8	4.2	22	4.2	3.8	17	1.5	1.7	17	11.5	13.5	20
Least cisco	40.2	51.2	51	15.1	21.7	22	4.2	4.8	17	10.4	13.7	17	17.7	20.2	20
Arctic cisco	0.3	1.2	51	3.5	9.9	22	1.1	1.9	17	4.0	6.6	17	4.2	11.1	20
Arctic grayling	1.2	2.8	51	0.2	0.4	22	0.3	0.6	17	0.1	0.3	17	0.2	0.4	20
Rainbow smelt	1.8	3.9	51	4.8	10.8	22	7.5	16.7	17	30.5	96.9	17	18.0	35.6	20
Dolly Varden Char	0.1	0.2	51	0.1	0.3	22	0.1	0.3	17	0.0	0.0	17	0.0	0.0	20
Burbot	0.4	0.7	51	0.0	0.0	22	0.0	0.0	17	0.0	0.0	17	0.0	0.0	20
Alaska blackfish	0.0	0.2	51	0.0	0.0	22	0.0	0.0	17	0.0	0.0	17	0.0	0.0	20
Longnose sucker	0.7	1.2	51	0.5	1.4	22	0.8	2.2	17	0.1	0.3	17	0.2	0.6	20
Arctic flounder	0.6	1.7	51	0.0	0.2	22	0.1	0.2	17	0.1	0.4	17	0.4	0.8	20
Fourhorn sculpin	2.8	7.9	51	2.4	3.0	22	2.3	3.4	17	2.8	4.2	17	2.9	3.3	20
Slimy sculpin	0.0	0.0	51	0.0	0.0	22	0.0	0.0	17	0.1	0.3	17	0.0	0.0	20
Threespine stickleback	0.0	0.1	51	0.0	0.0	22	0.0	0.0	17	0.1	0.4	17	0.3	0.7	20
Ninespine stickleback	6.2	9.0	51	3.9	3.5	22	4.1	6.5	17	7.8	15.7	17	12.7	18.8	20

[1] Sakoonang Channel sample is based on Station C9501 as described in Moulton (1997).

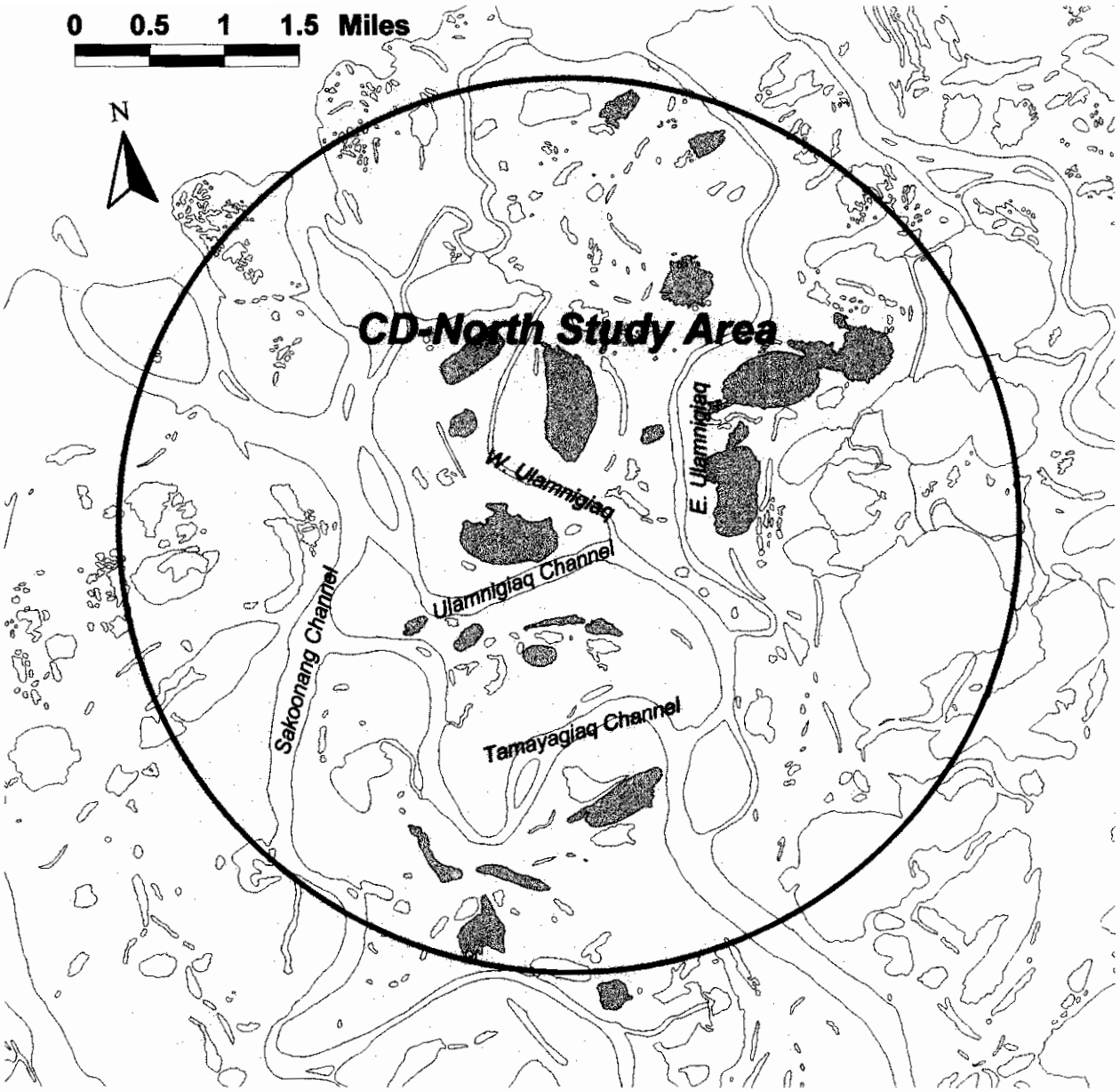


Figure 1. General location of the CD-North exploration area in the Colville Delta, Alaska.

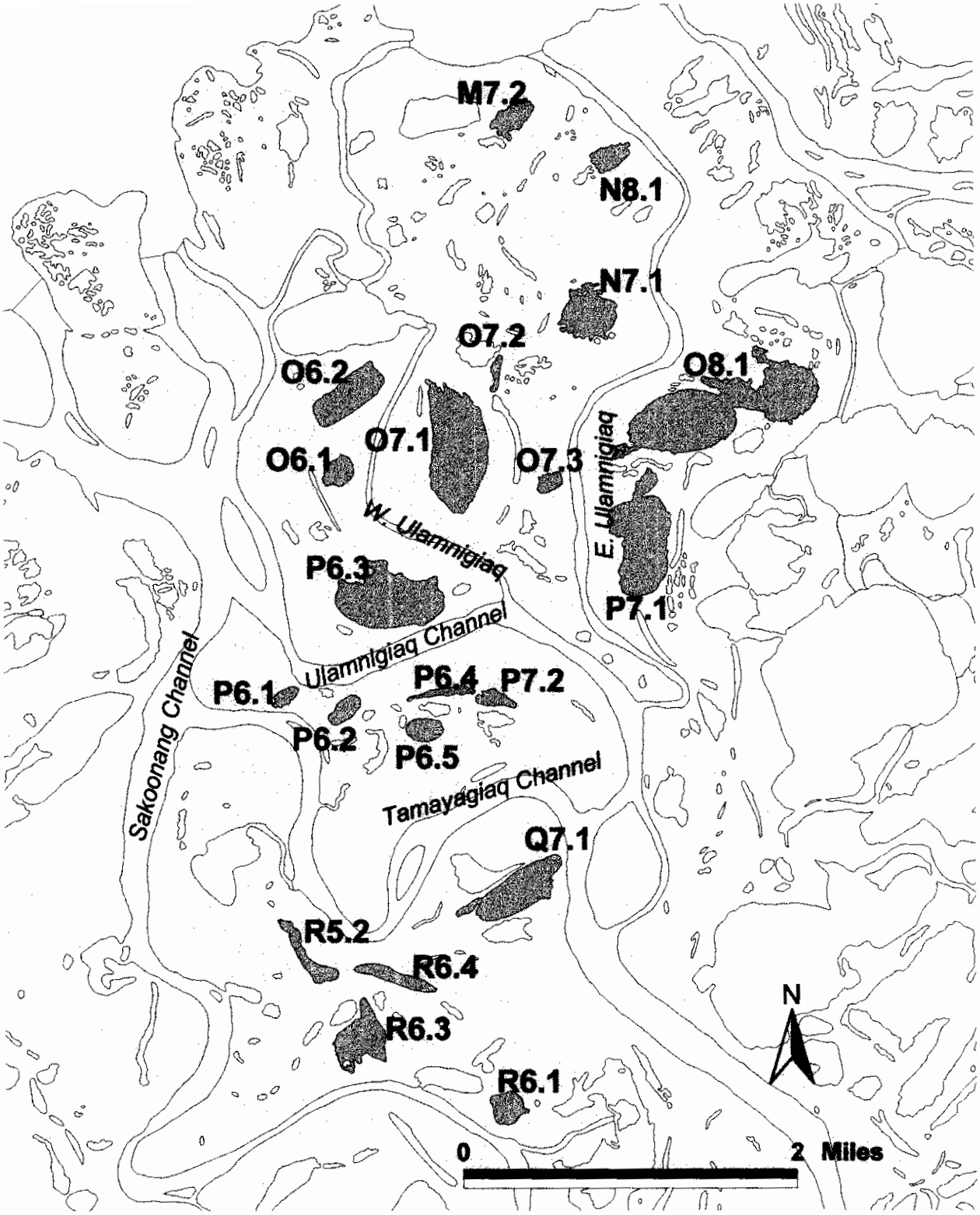


Figure 2. Lakes in or near the CD-North exploration area.

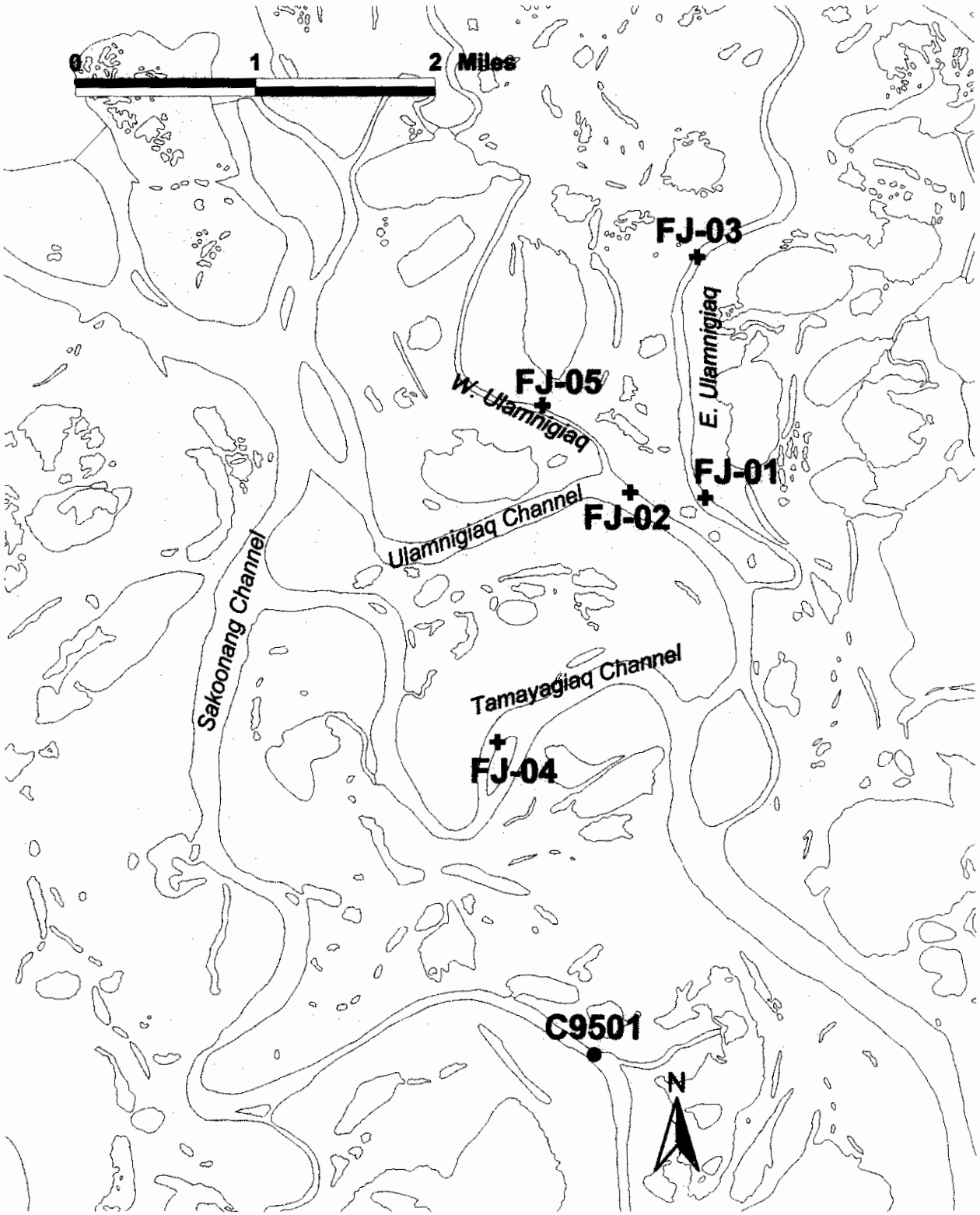


Figure 3. Fyke net locations in the CD-North exploration area during 2000, and Sakoonang Channel net sampled in 1995-1996.

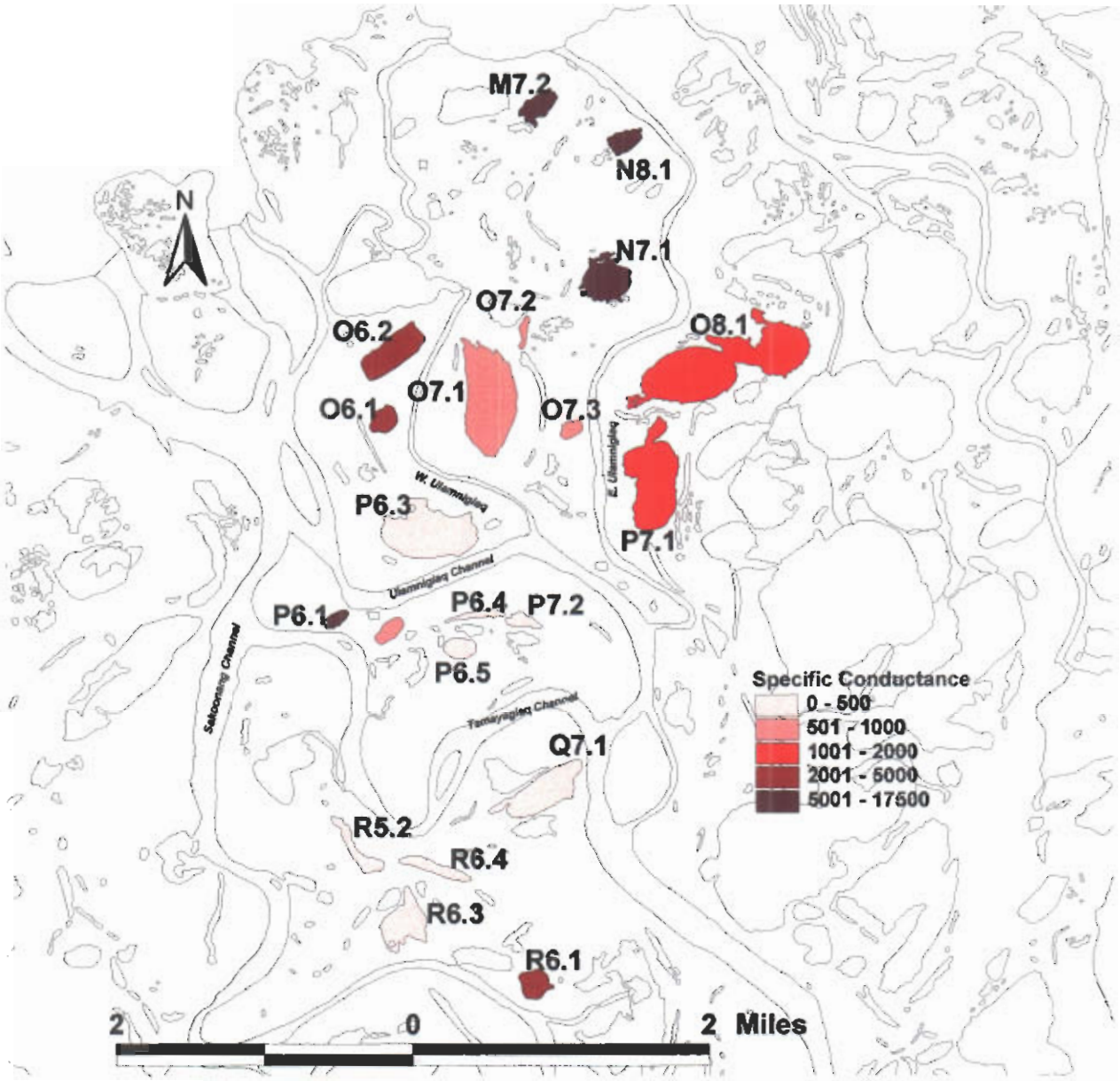


Figure 4. Specific conductance in lakes in or near the CD-North exploration area.

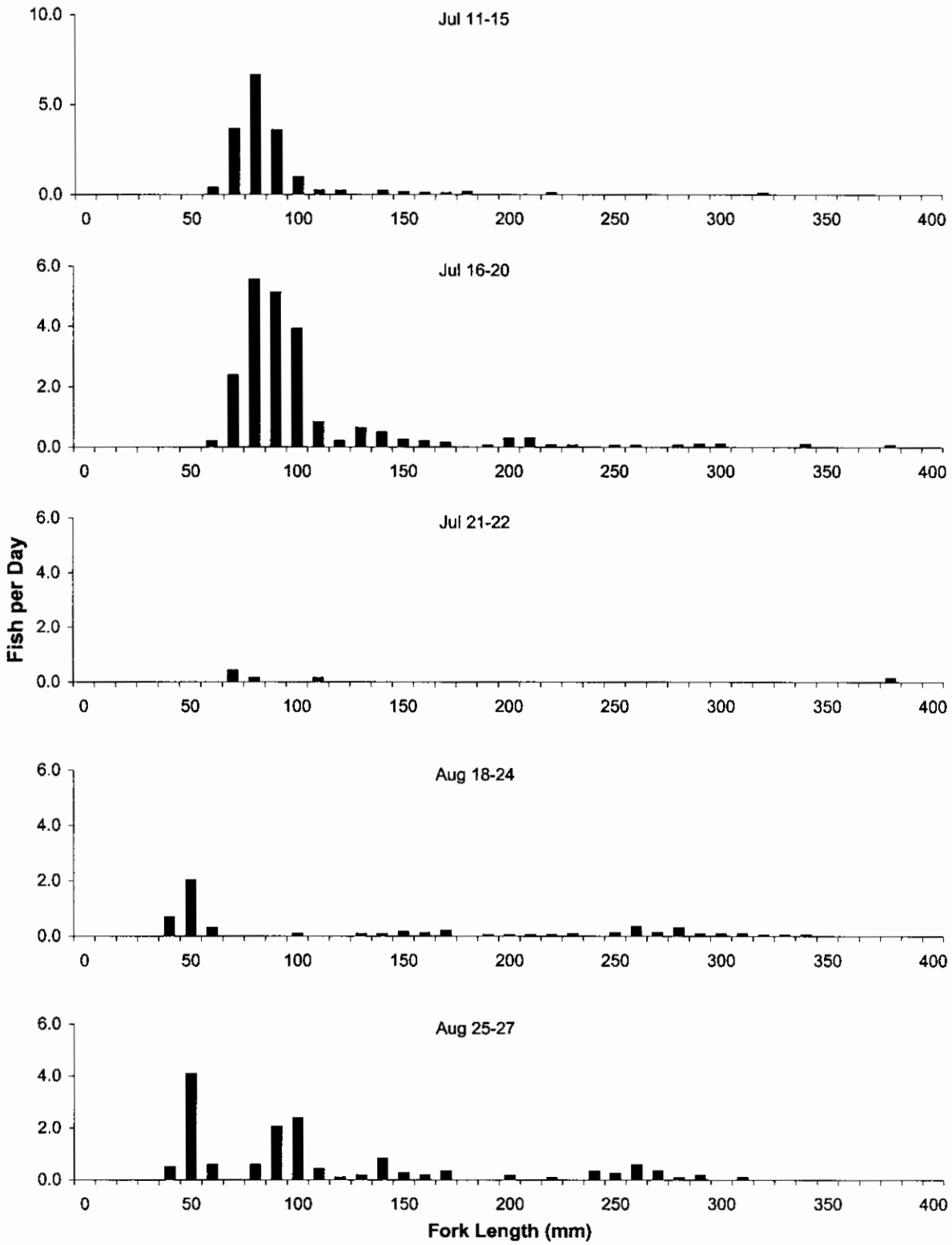


Figure 5. Length frequencies of least cisco caught in the CD-North exploration area by fyke nets, 2000 (least cisco mature at about 250 mm).

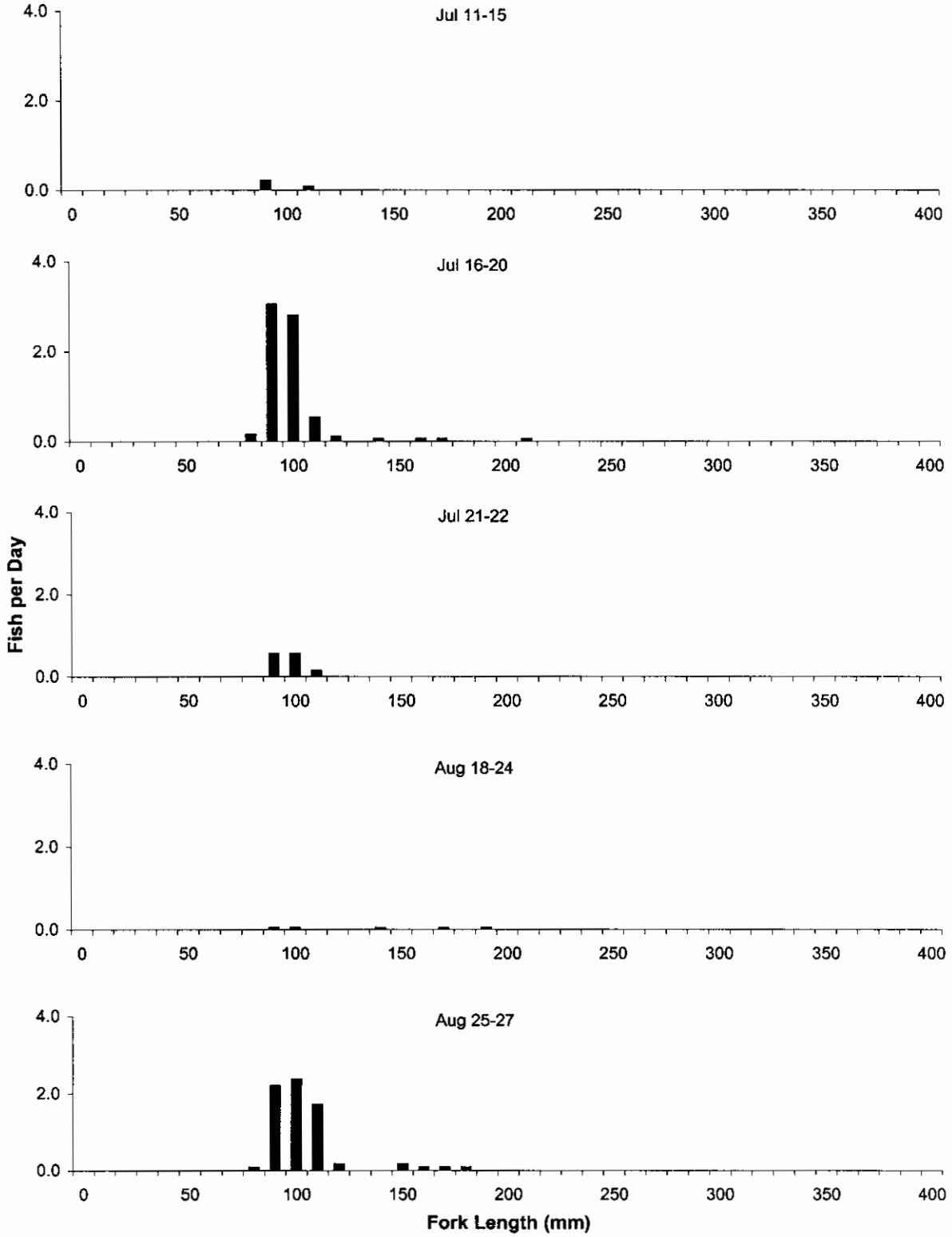


Figure 6. Length frequencies of arctic cisco caught in the CD-North exploration area by fyke nets, 2000 (arctic cisco mature at about 350 mm).

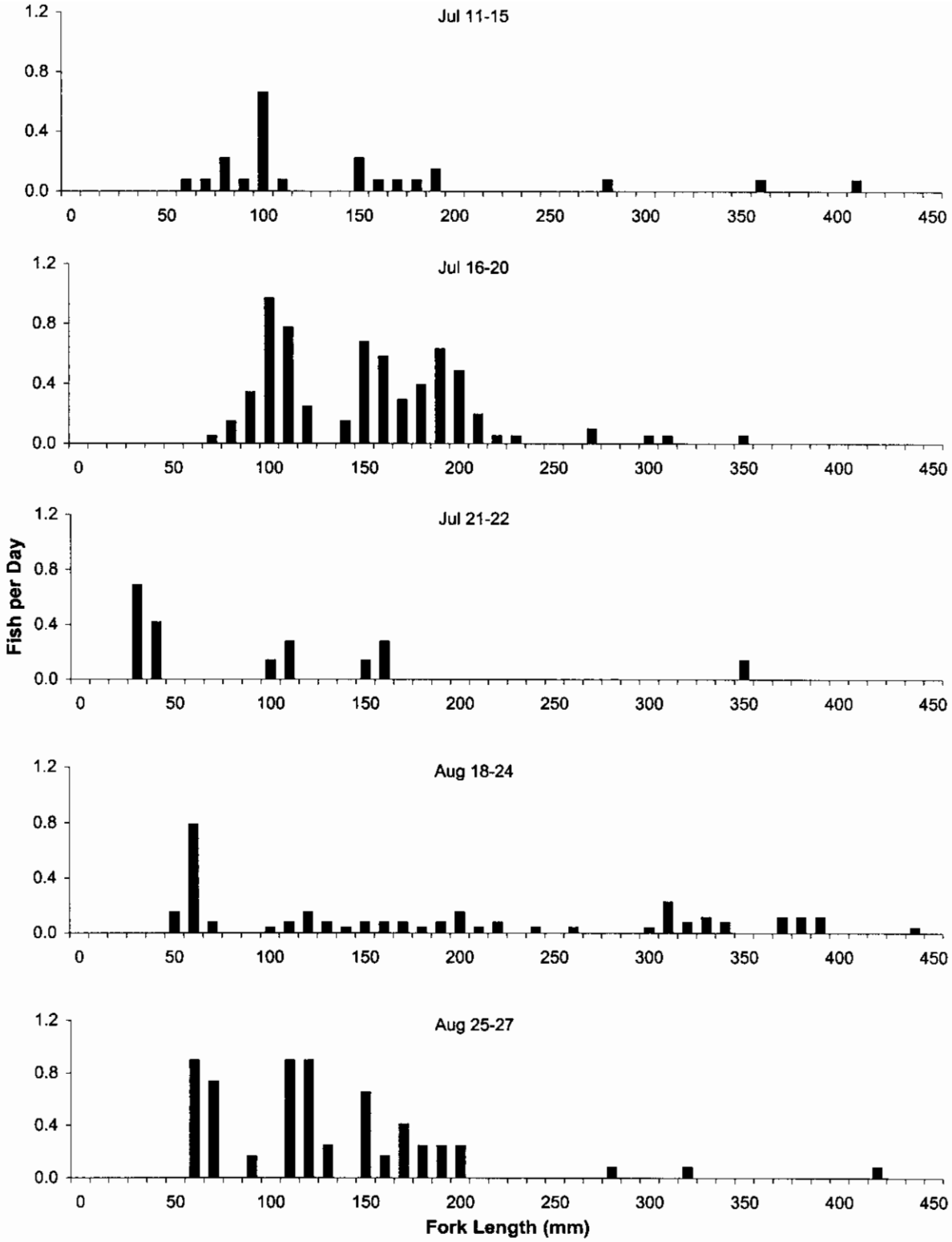


Figure 7. Length frequencies of broad whitefish caught in the CD-North exploration area by fyke nets, 2000 (broad whitefish mature at about 480 mm).

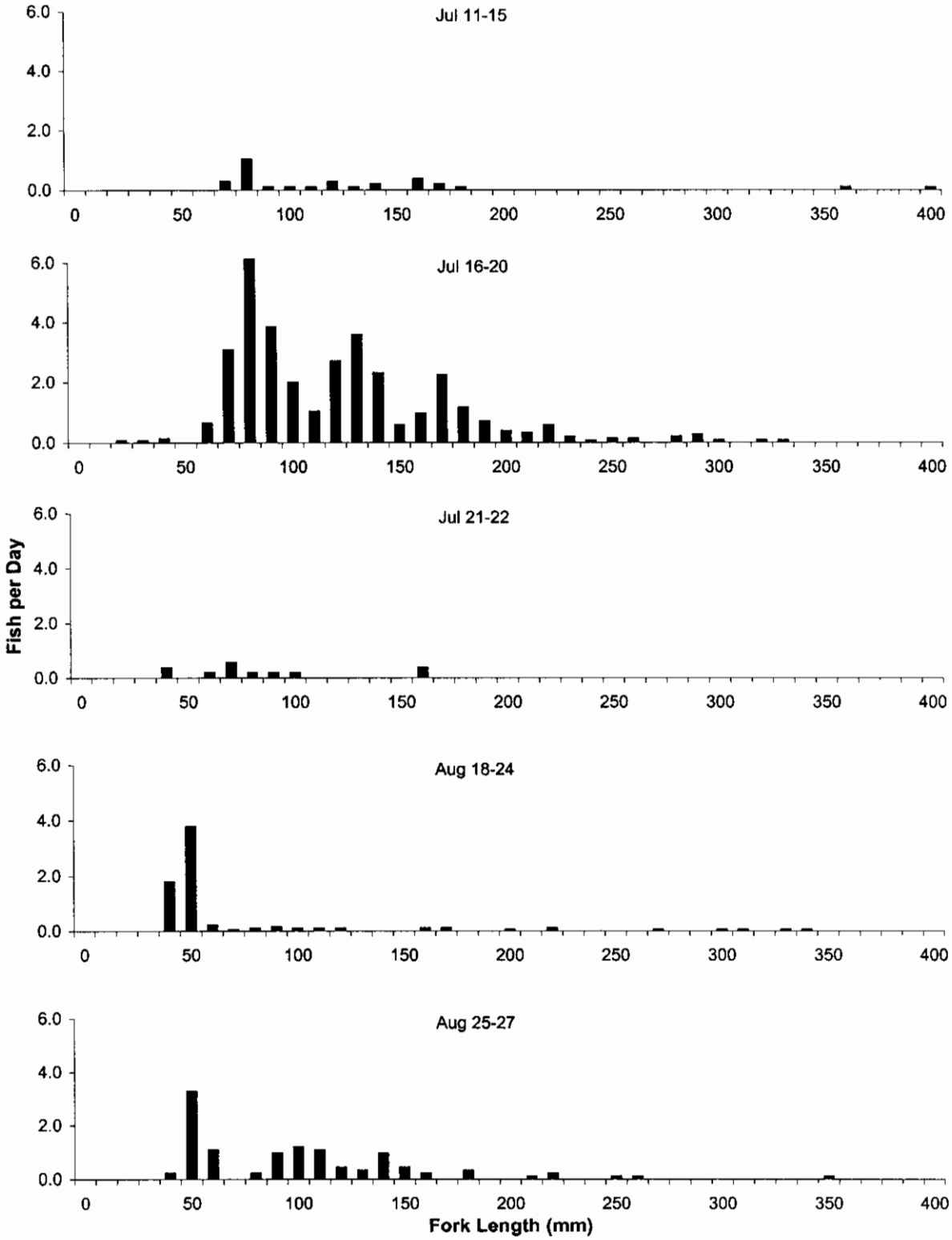


Figure 8. Length frequencies of humpback whitefish caught in the CD-North exploration area fyke nets, 2000 (humpback whitefish mature at about 350 mm).

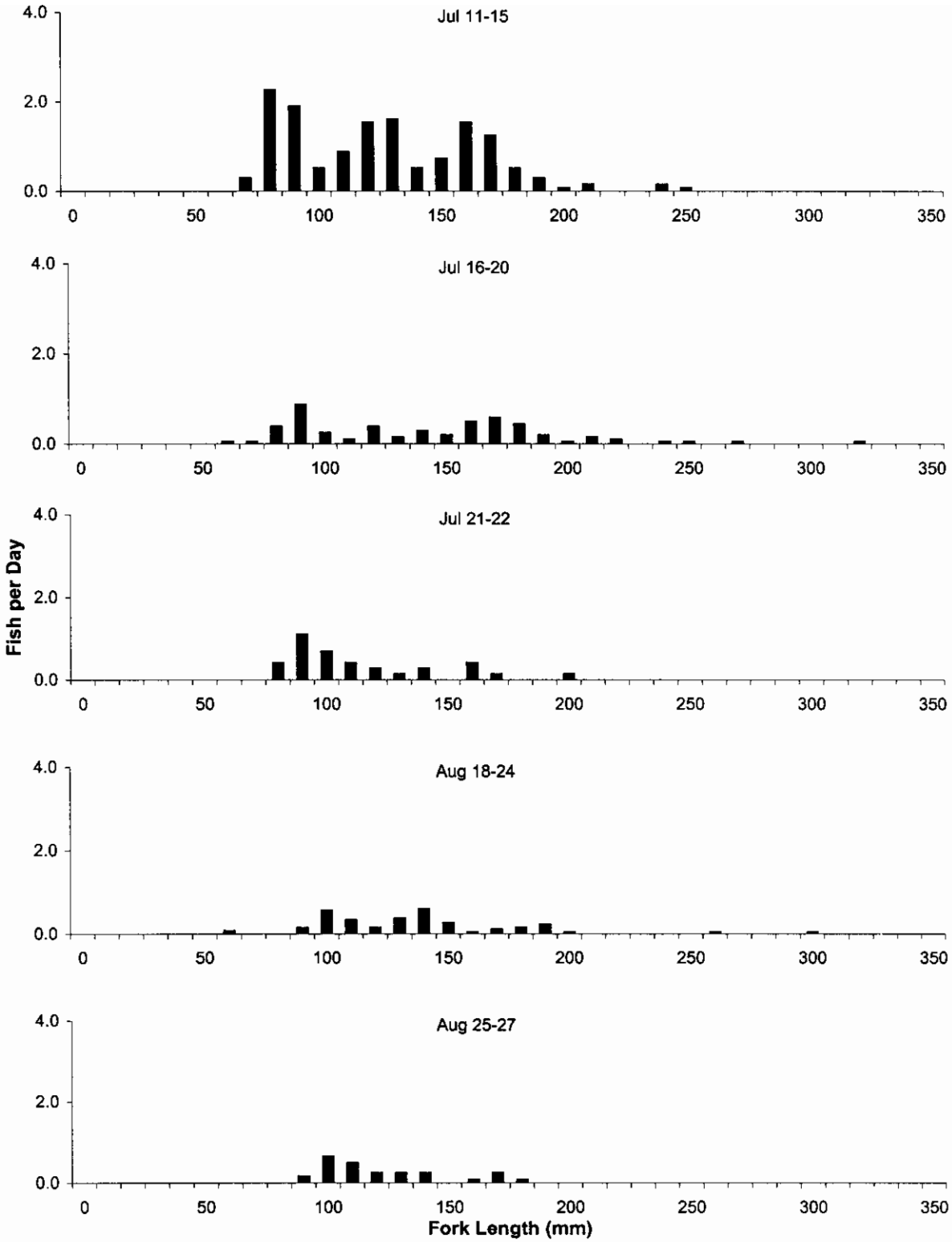


Figure 9. Length frequencies of round whitefish caught in the CD-North exploration area by fyke nets, 2000 (round whitefish mature at about 350 mm).

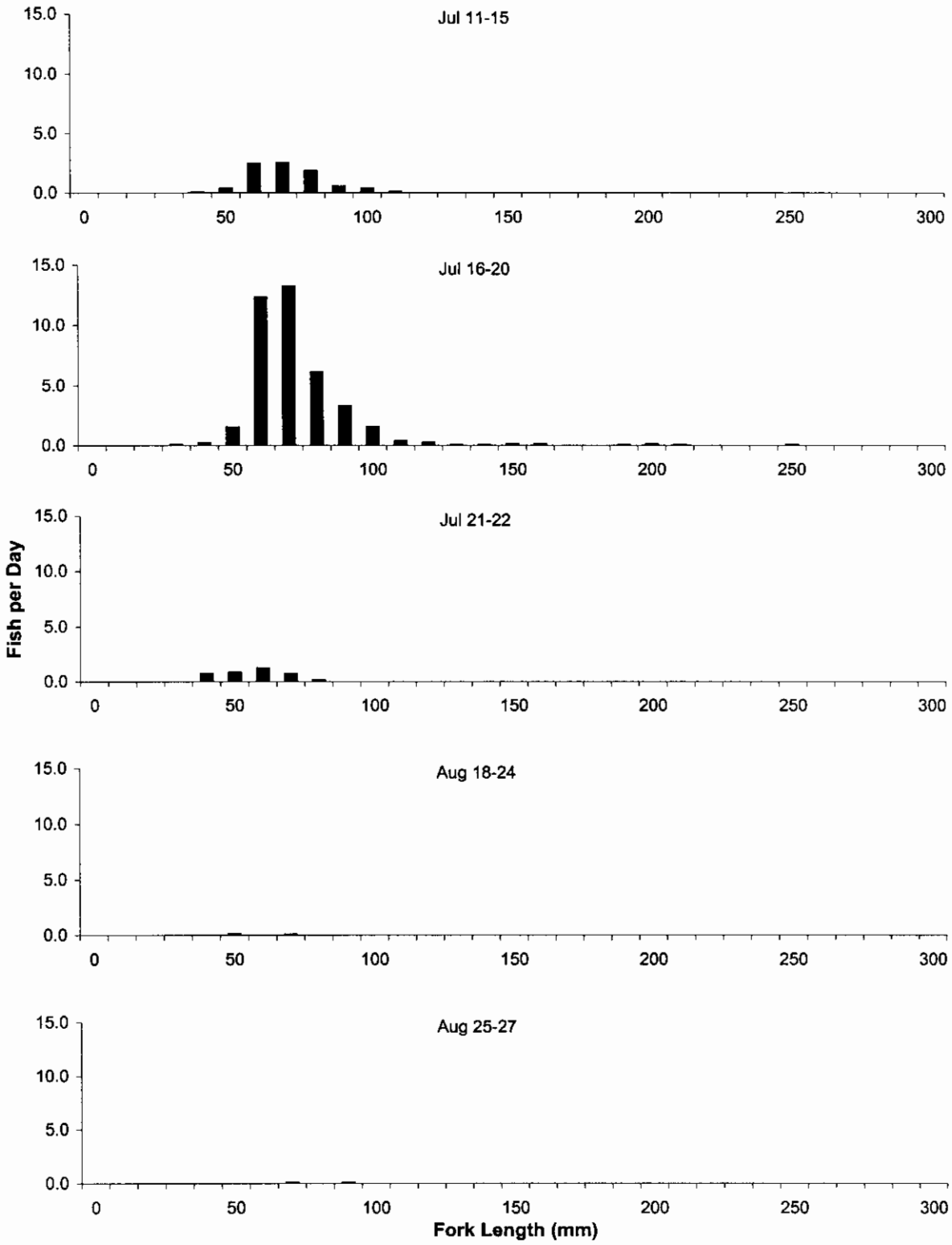
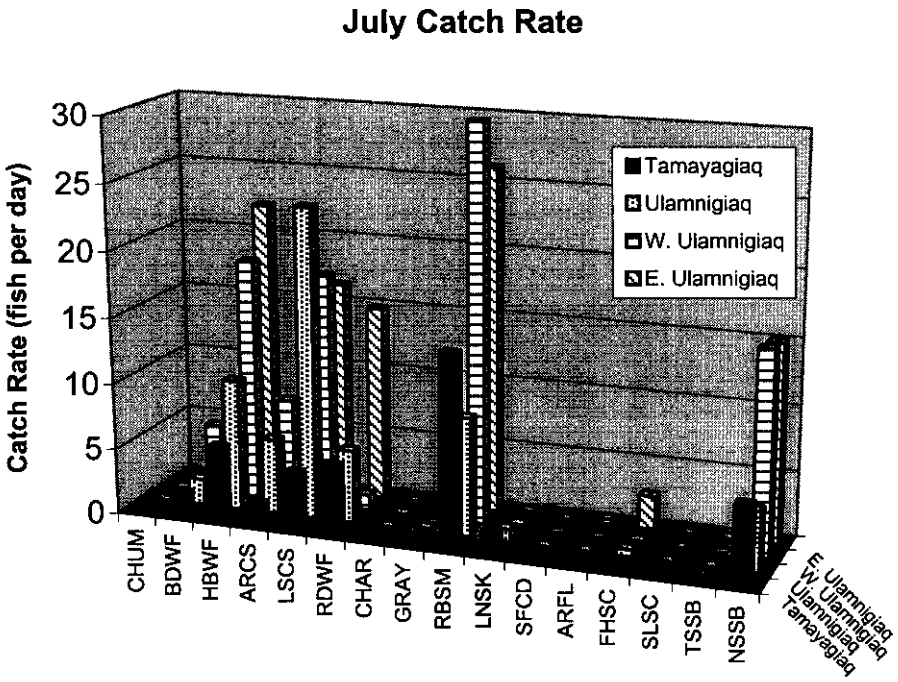


Figure 10. Length frequencies of rainbow smelt caught in the CD-North exploration area by fyke nets, 2000 (rainbow smelt mature at about 200 mm, Haldorson and Craig 1984).



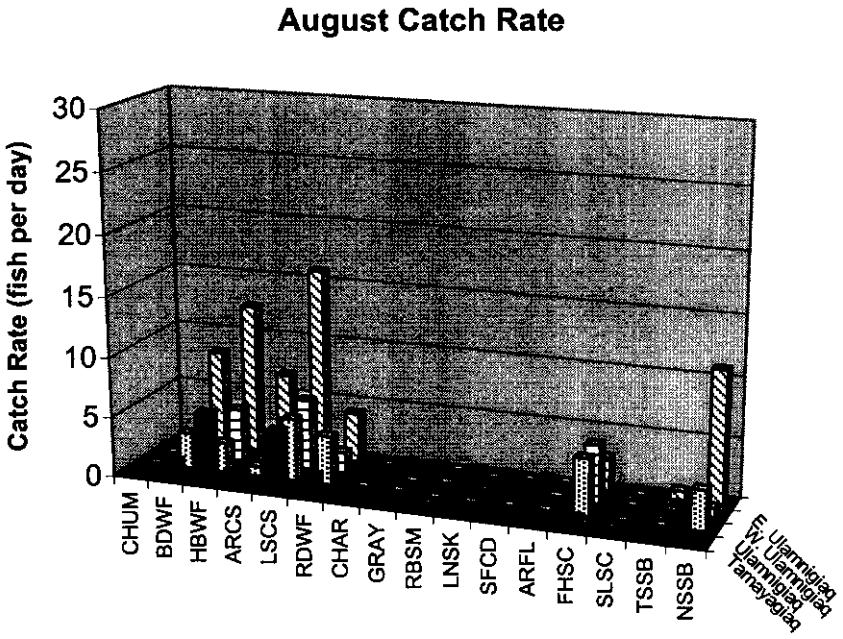


Figure 11. Catch rates by species at river channels in the CD-North exploration area, based on fyke net sampling during July and August, 2000.

CHUM = chum salmon
BDWF = broad whitefish
HBWF = humpback whitefish
ARCS = arctic cisco
LSCS = least cisco
RDWF = round whitefish
CHAR = Dolly Varden
GRAY = arctic grayling
RBSM = rainbow smelt
LNSK = longnose sucker
SFCD = saffron cod
ARFL = arctic flounder
FHSC = fourhorn sculpin
SLSC = slimy sculpin
TSSB = threespine stickleback
NSSB = ninespine stickleback

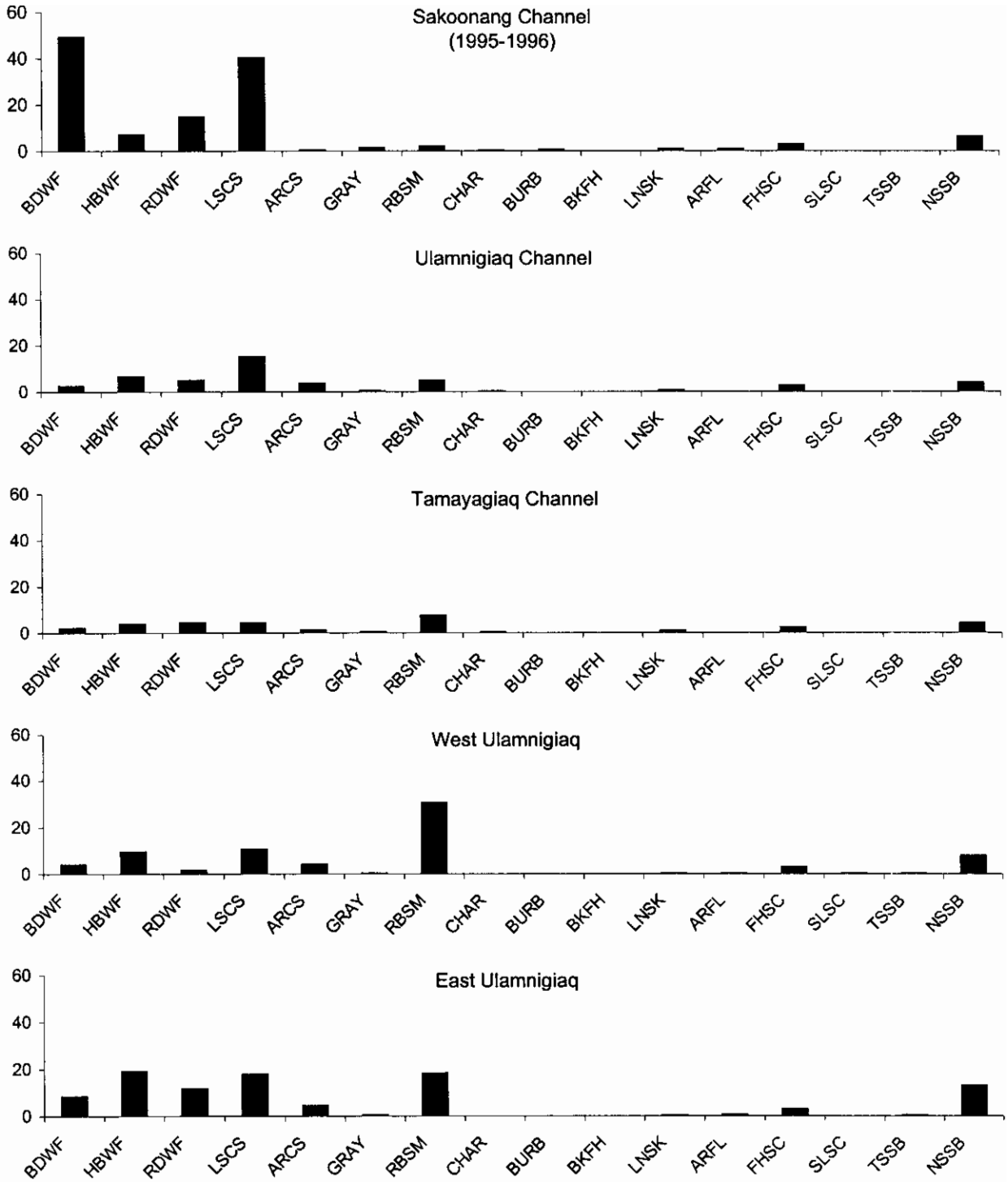


Figure 12. Comparison of catch rates by species at river channels in the CD-North exploration area and Alpine development area based fyke net sampling during July and August, 1995-1996 and 2000.

BDWF = broad whitefish	ARCS = arctic cisco	BURB = burbot	FHSC = fourhorn sculpin
HBWF = humpback whitefish	GRAY = arctic grayling	BKFH = Alaska blackfish	SLSC = slimy sculpin
RDWF = round whitefish	RBSM = rainbow smelt	LNSK = longnose sucker	TSSB = threespine stickleback
LSCS = least cisco	CHAR = Dolly Varden	ARFL = arctic flounder	NSSB = ninespine stickleback

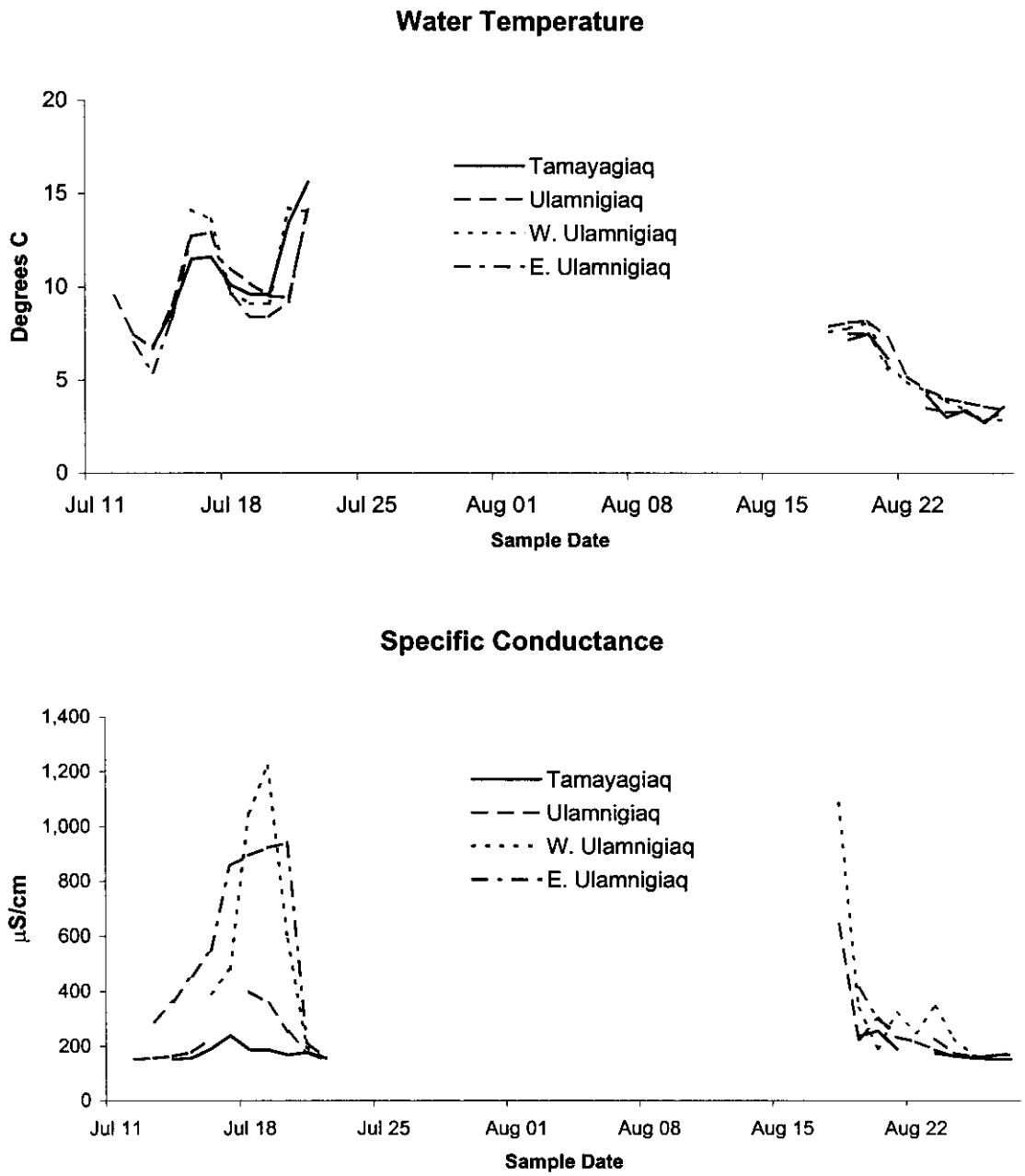


Figure 13. Water temperature and specific conductance at fyke net stations sampled in the CD-North exploration area during 2000.

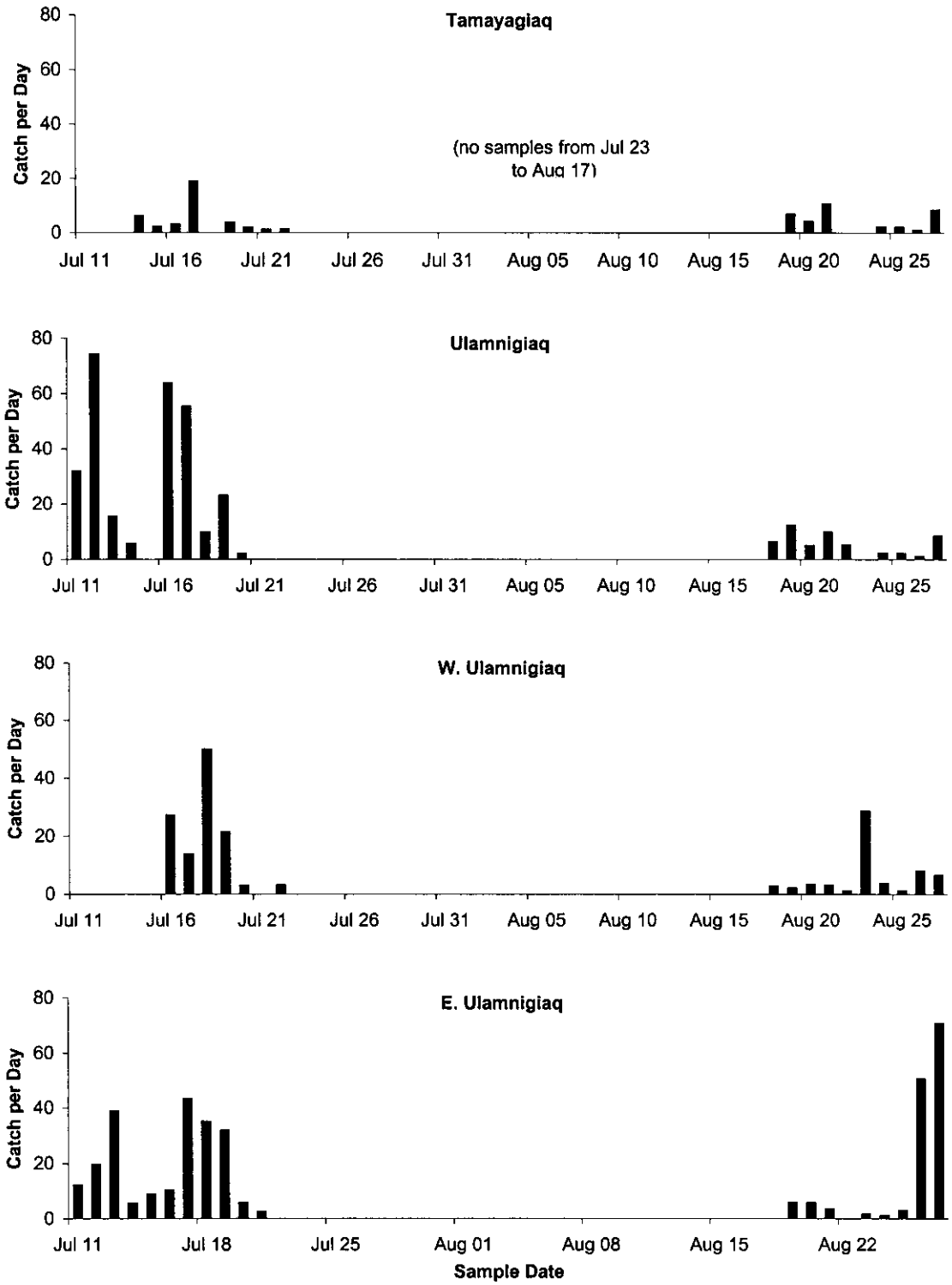


Figure 14. Daily catch rate of least cisco at CD-North study area fyke net stations, 2000.

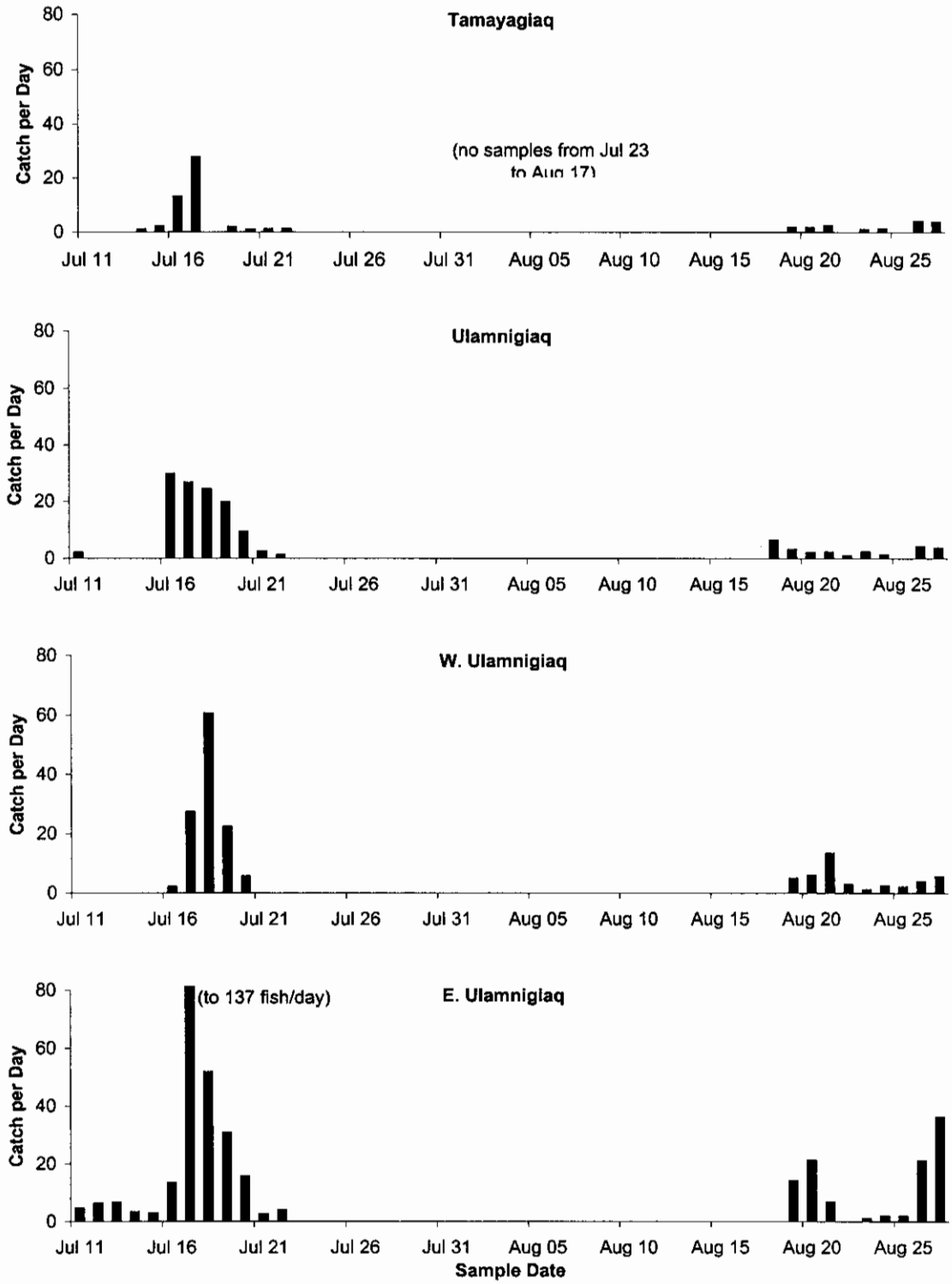


Figure 15. Daily catch rate of humpback whitefish at CD-North study area fyke net stations, 2

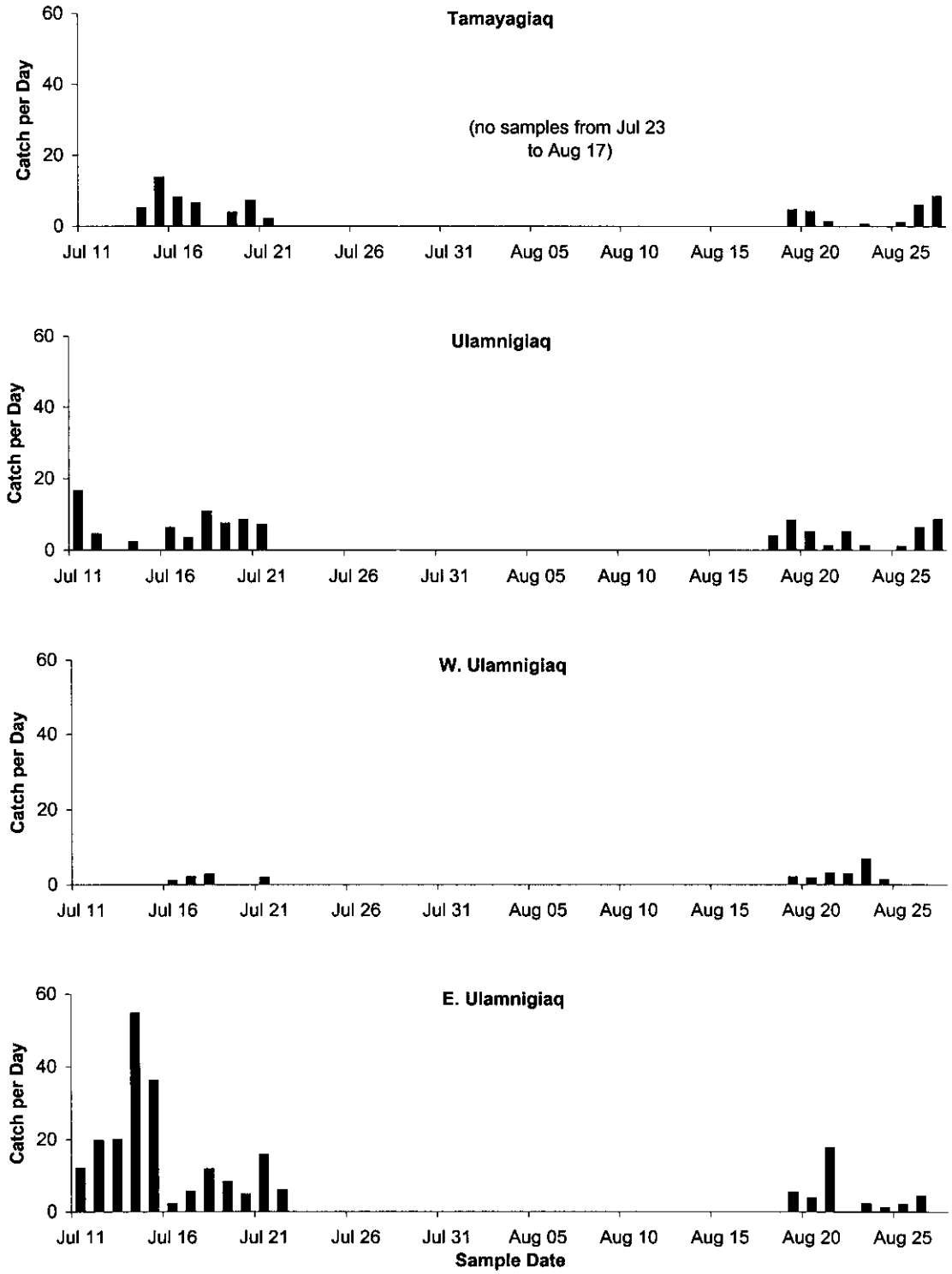
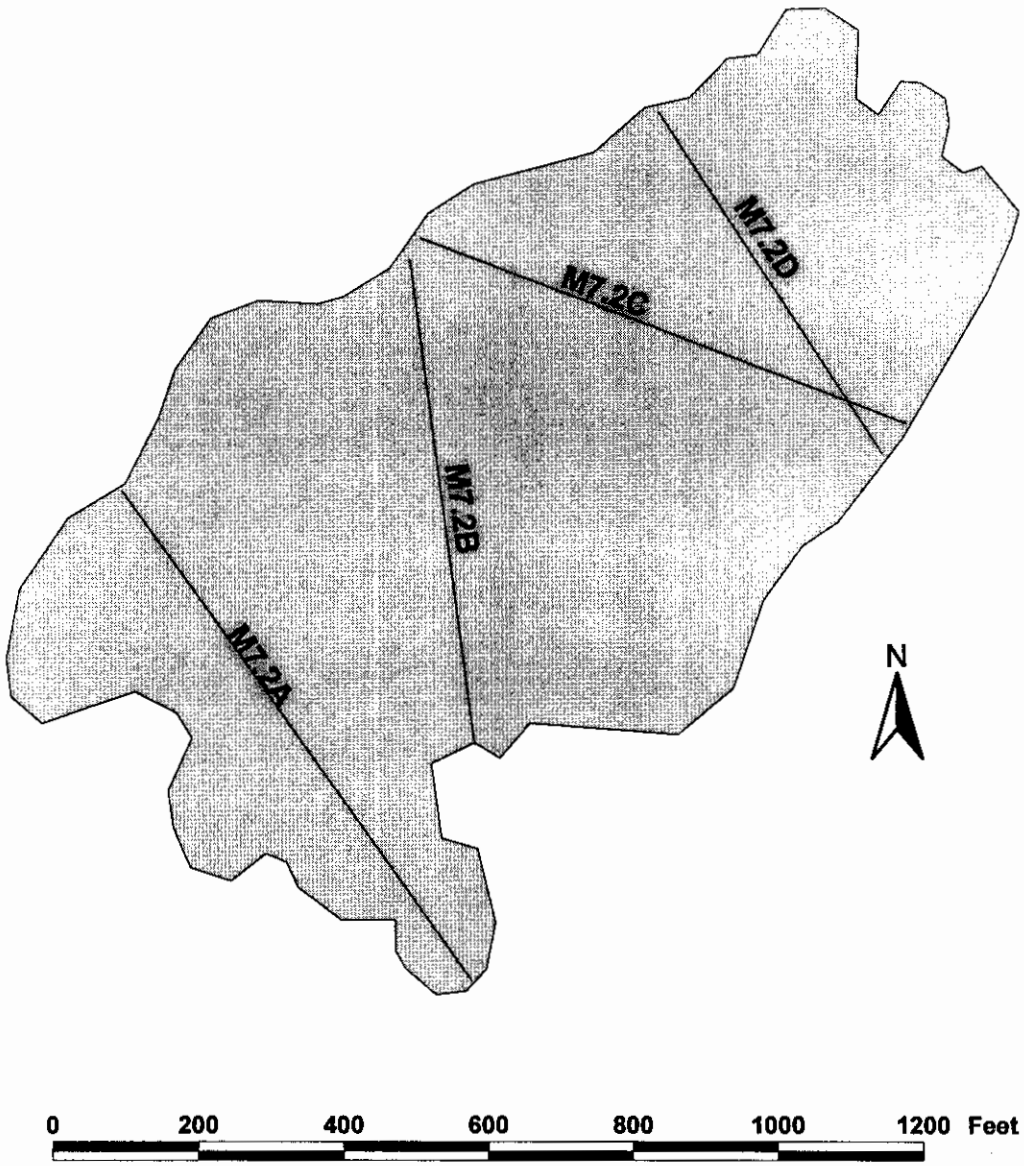


Figure 16. Daily catch rate of round whitefish at CD-North study area fyke net stations, 2000.

LAKE SUMMARIES

M7.2

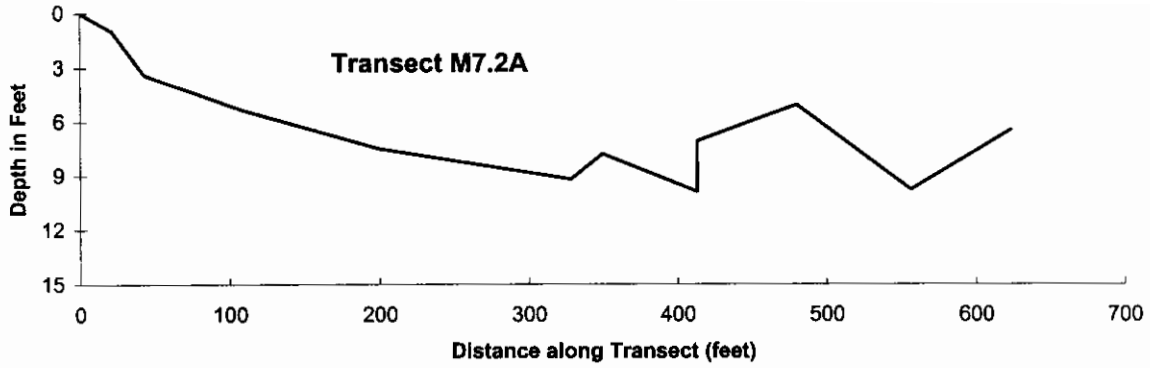


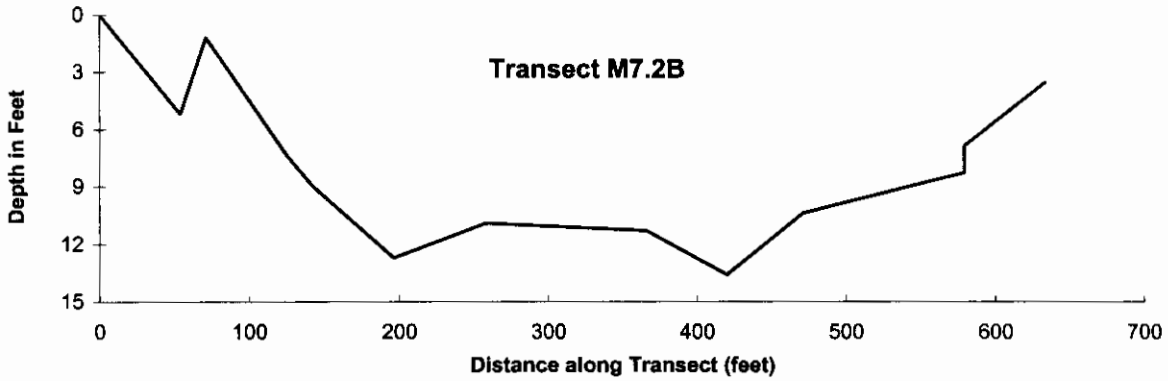
Lake M7.2

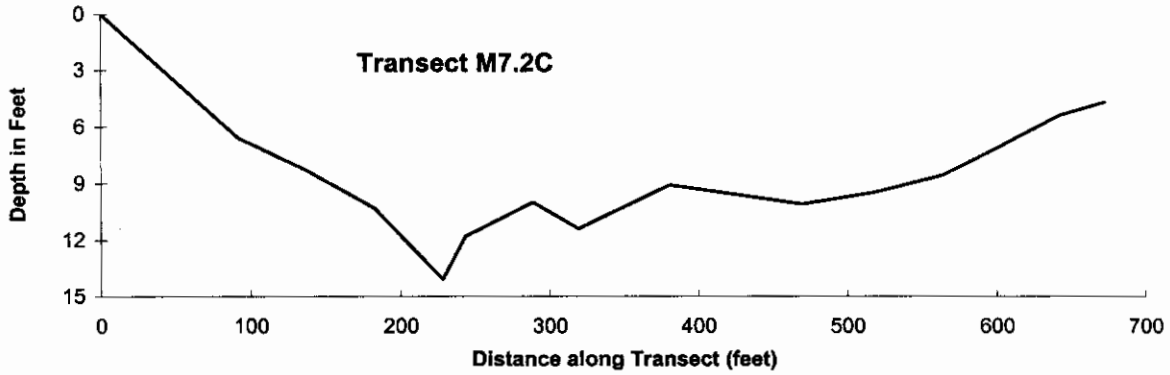
Other Names:	M9714
Location:	70°27.12'N 150°52.25'W
USGS Quad Sheet:	Harrison Bay B-2: T13N R5E, Sect 28
Habitat:	Perched Lake (Frequent Flooding)
Area:	17 acres
Maximum Depth:	14.1 feet
Active Outlet:	No
Spec. Conductance:	17,384 µS/cm
Salinity:	7.6 ppt
pH:	8.3
Calculated Volume:	26.3 million gallons
Permittable Volume:	No fish concern

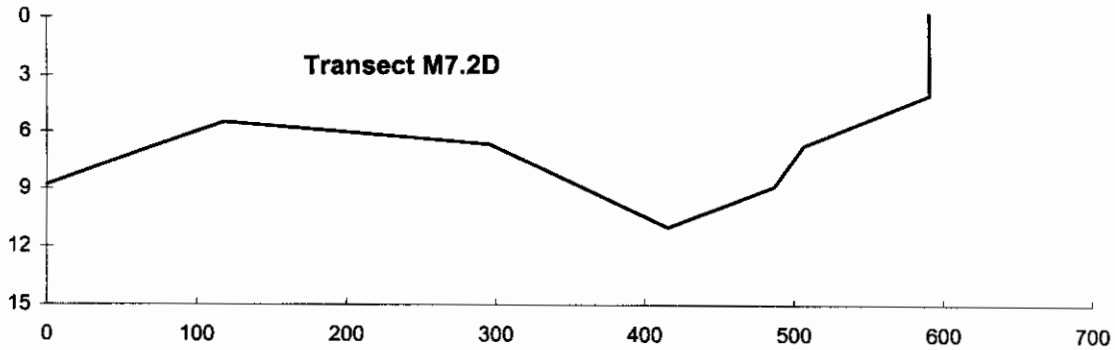
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gillnet	Aug 8 97	12.0	None	0
Minnow Trap	Aug 8 97	11.9	None	0









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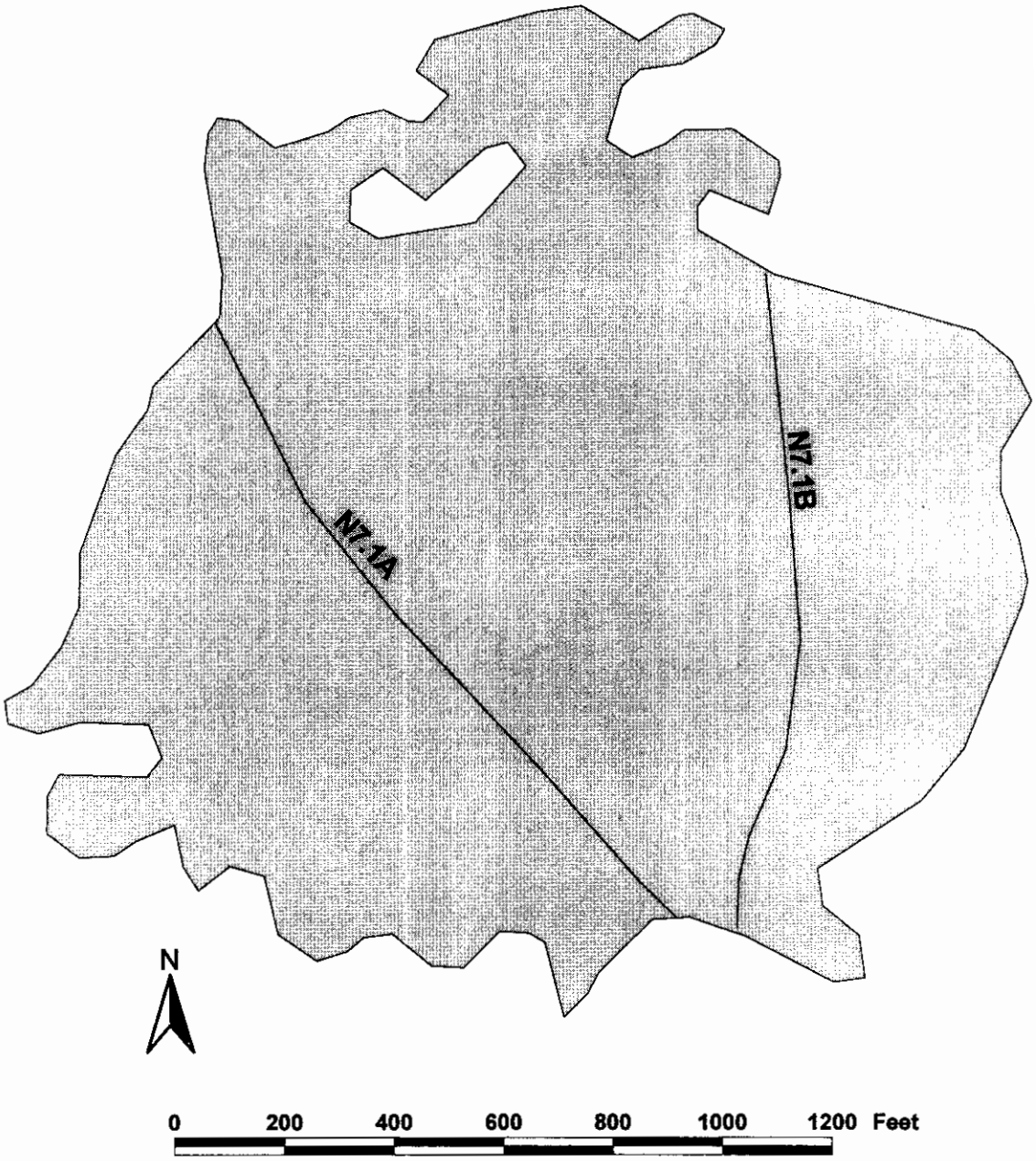
N7.1



Lake N7.1

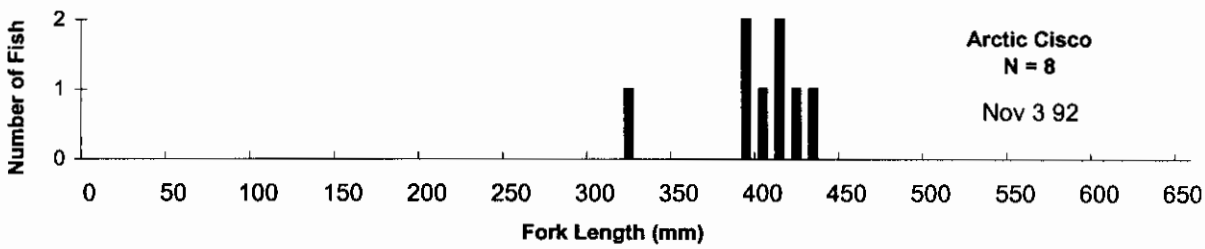
Other Names:	M9211
Location:	70°26.11'N 150°51.70'W
USGS Quad Sheet:	Harrison Bay B-2: T13N R5E, Sect 33
Habitat:	Perched Lake (Infrequent Flooding)
Area:	43 acres
Maximum Depth:	19.2 feet
Active Outlet:	No
Spec. Conductance:	6,545 µS/cm
pH:	8.0
Calculated Volume:	88.6 million gallons
Permittable Volume:	8.4 million gallons

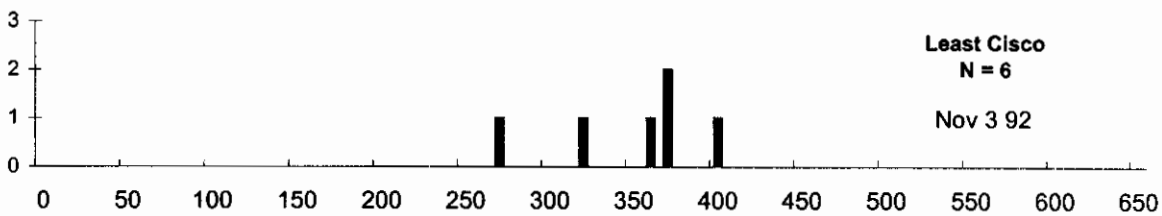
Water Quality:

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)
1998	2,210	985	153	79	827	3,740

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Nov 3 92	26.0	Least cisco	6	275-403
			Arctic cisco	8	320-430





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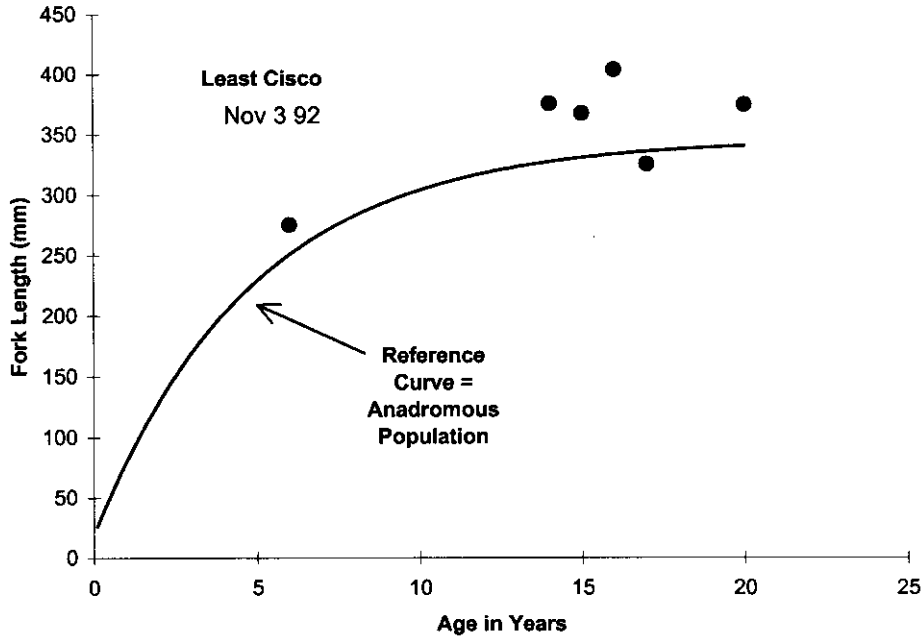

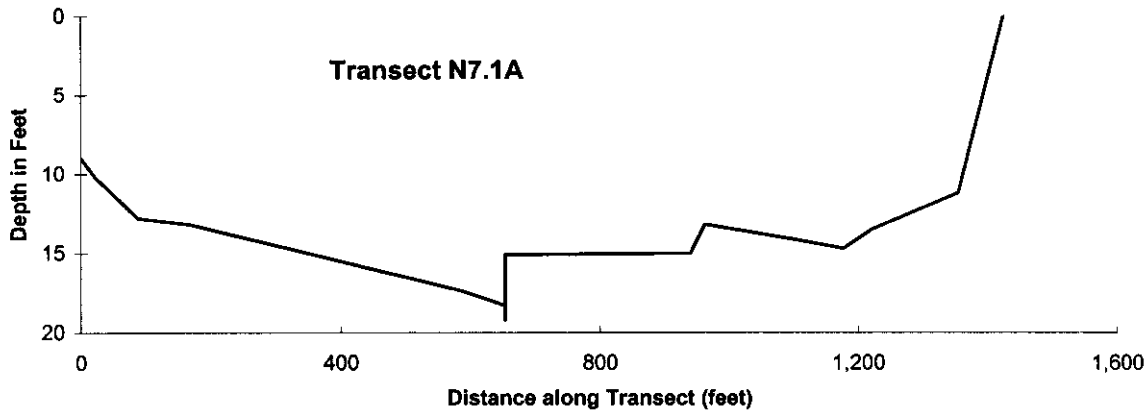

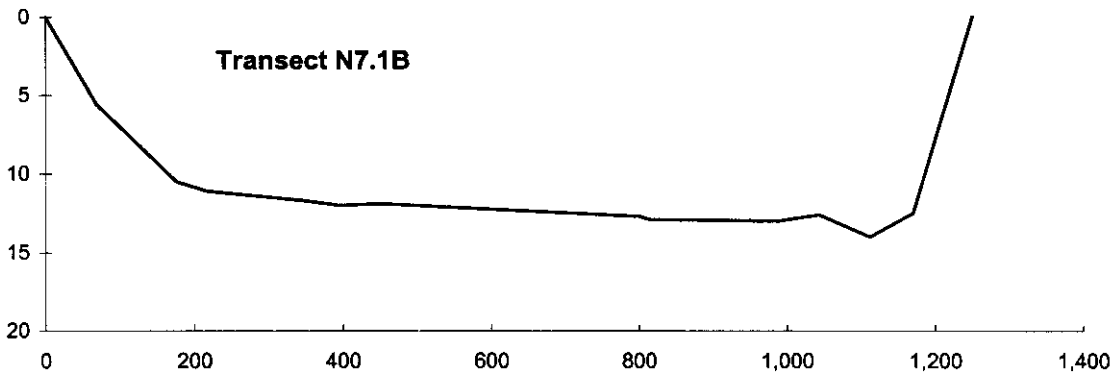

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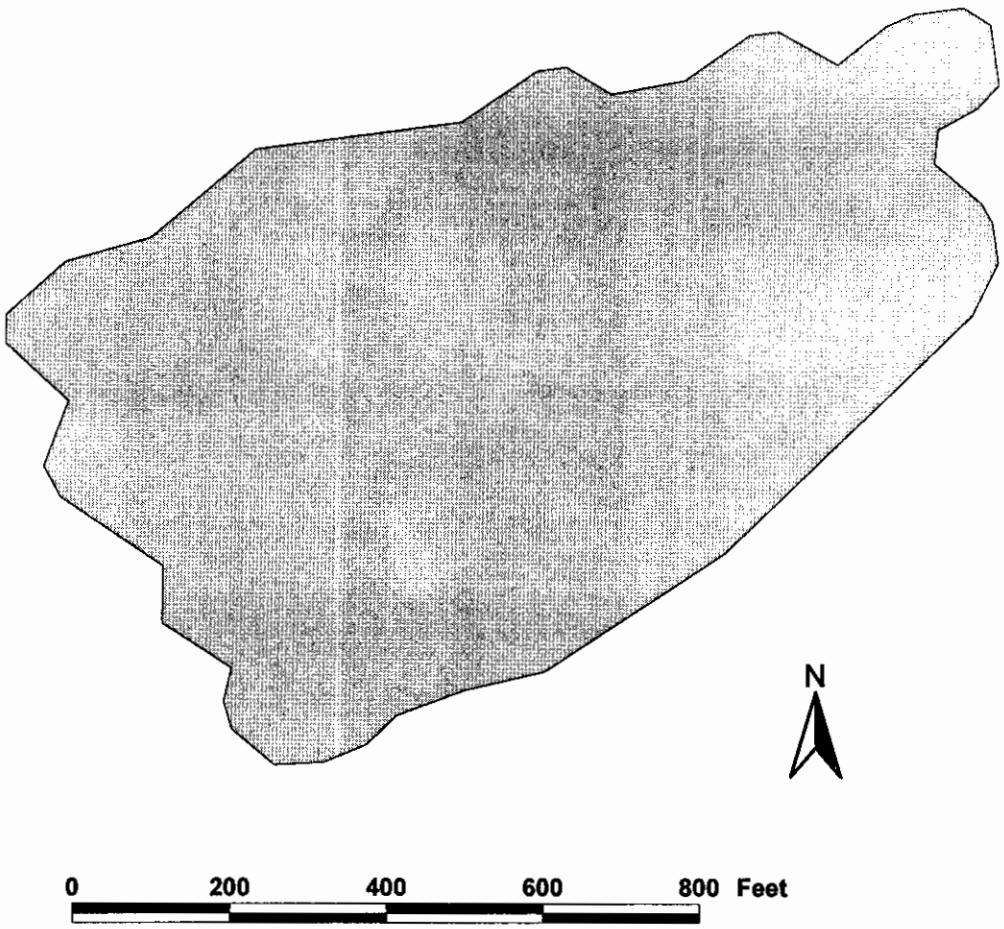
N8.1



Lake N8.1

Other Names: L9208; M9210
Location: 70°26.90'N 150°50.94'W
USGS Quad Sheet: Harrison Bay B-2: T13N R5E, Sect 28
Habitat: Perched Lake (Infrequent Flooding)
Area: 15 acres
Maximum Depth: 11 feet
Active Outlet: No
Calculated Volume: 17.6 million gallons
Permittable Volume: No fish concern

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	4,800	1,990	260	161	1,500	9,200	J. Lobdell

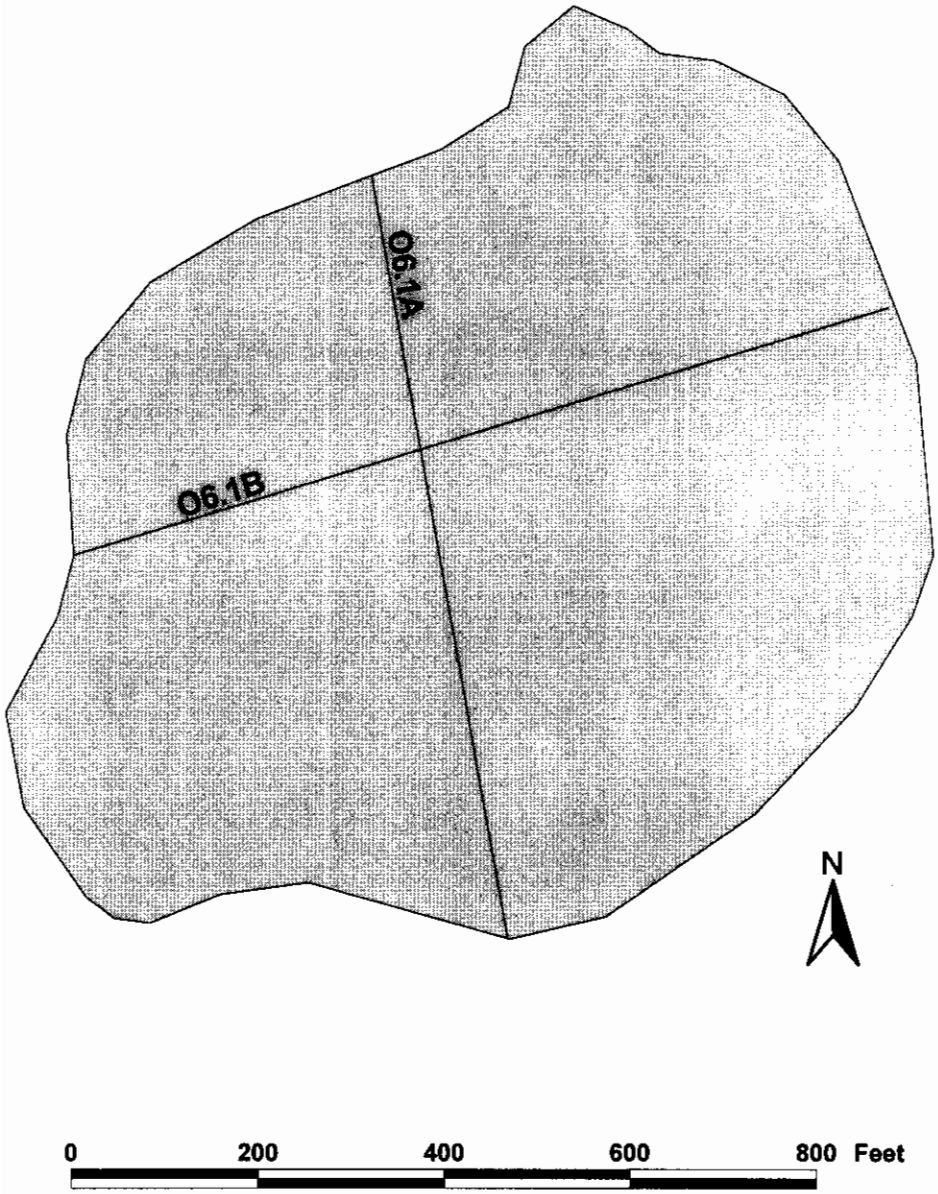
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Nov 3 92	30.5	None	0

Salinity Profile:

Date	Depth (m)	Salinity (ppt)
Nov 3 92	0.5	3.9
	1.0	3.9
	1.5	3.9
	2.0	4.0
	2.5	4.0
	3.0	4.0
	3.5	5.5

O6.1



Lake O6.1

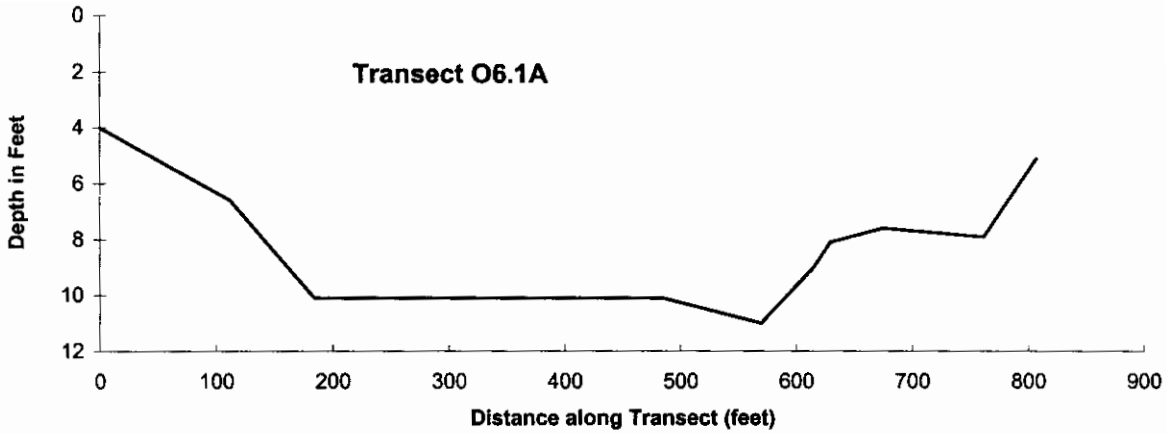
Other Names:	M9713
Location:	70°25.42'N 150°55.63'W
USGS Quad Sheet:	Harrison Bay B-2: T12N R5E, Sect 5
Habitat:	Perched Lake (Infrequent Flooding)
Area:	14 acres
Maximum Depth:	11.0 feet
Active Outlet:	No
Spec. Conductance:	3,302 µS/cm
pH:	7.9
Calculated Volume:	17.1 million gallons
Permittable Volume:	No fish concern

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)
1998	1,090	556	65	49	388	1,920
1999	836	439	38	54	317	1,640

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Aug 7 97	5.0	None	0
	Aug 8 97	6.7	None	0


Transect O6.1A
Depth in Feet
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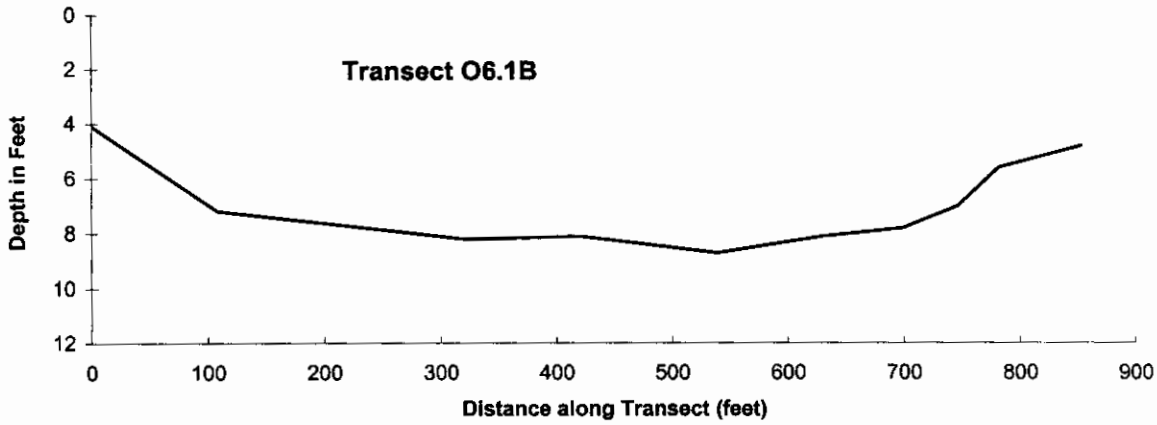
2
4
6
8
10
12
0
100
200
300
400
500
600
700
800
900
Distance along Transect (feet)


Transect O6.1B
Depth in Feet
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0
100
200
300
400
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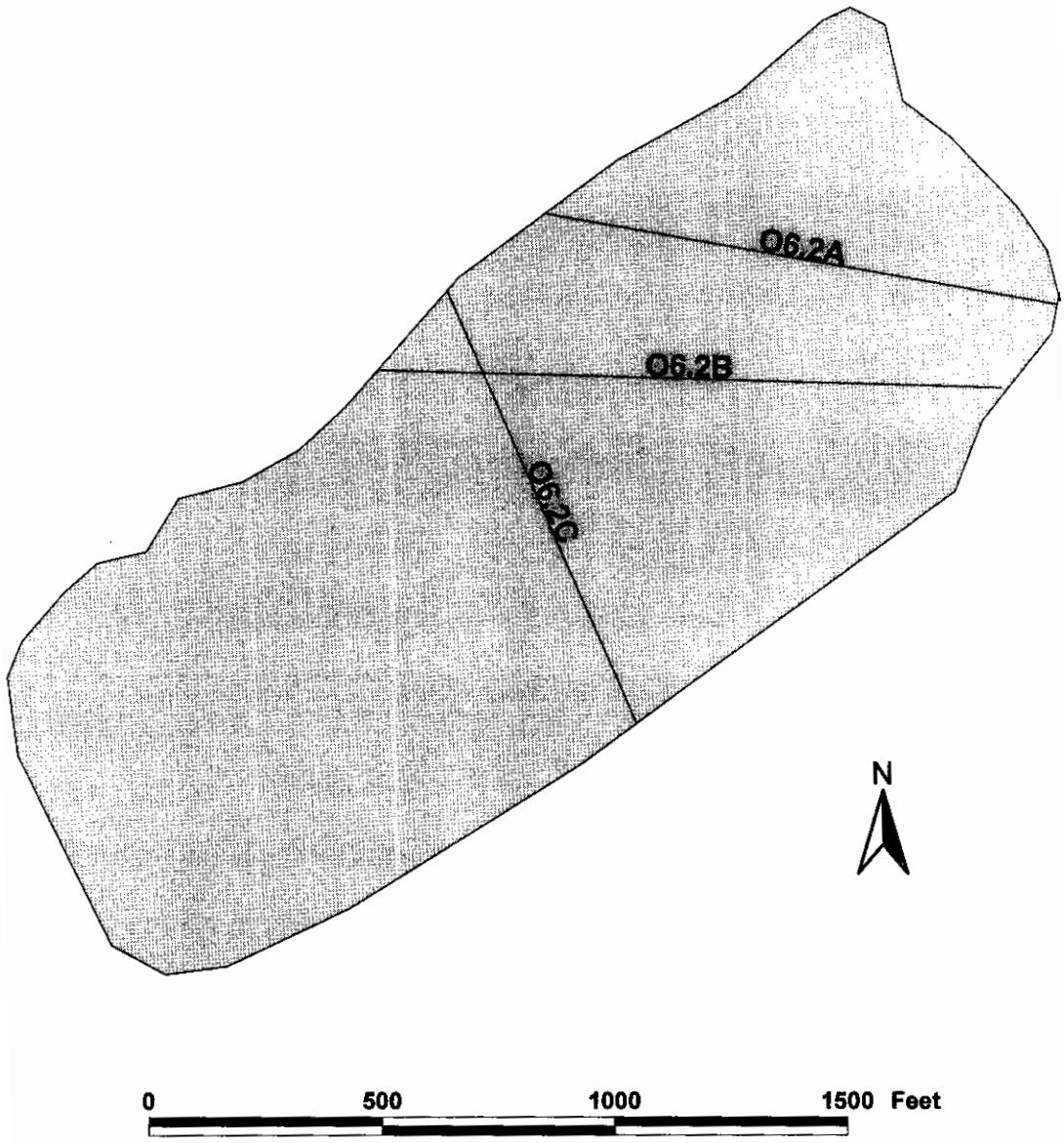
600
700
800
900
Distance along Transect (feet)

O6.2

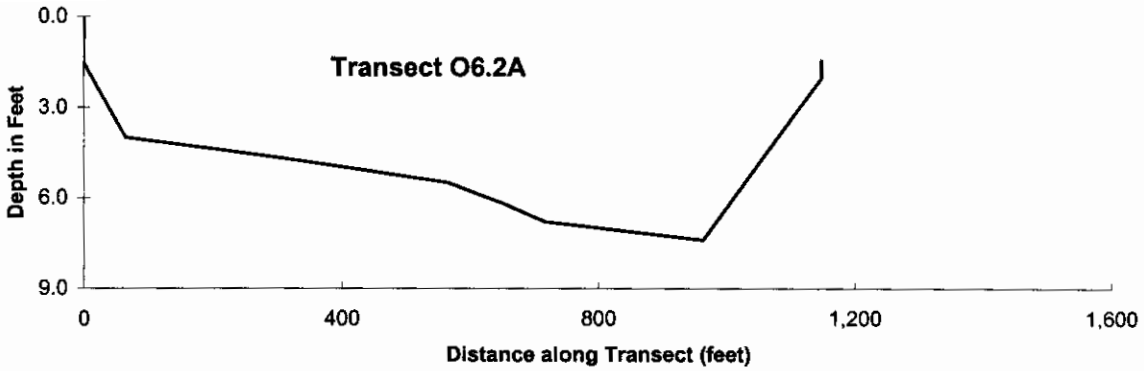


Lake O6.2

Other Names:	M9712
Location:	70°25.82'N 150°55.30'W
USGS Quad Sheet:	Harrison Bay B-2: T12N R5E, Sect 5
Habitat:	Perched Lake (Infrequent Flooding)
Area:	53 acres
Maximum Depth:	8.1 feet
Active Outlet:	No
Spec. Conductance:	3,767 µS/cm
pH:	7.9
Calculated Volume:	45.7 million gallons
Permittable Volume:	No fish concern

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Aug 7 97	6.0	None	0
	Aug 8 97	5.8	None	0


Transect O6.2A
Depth in Feet
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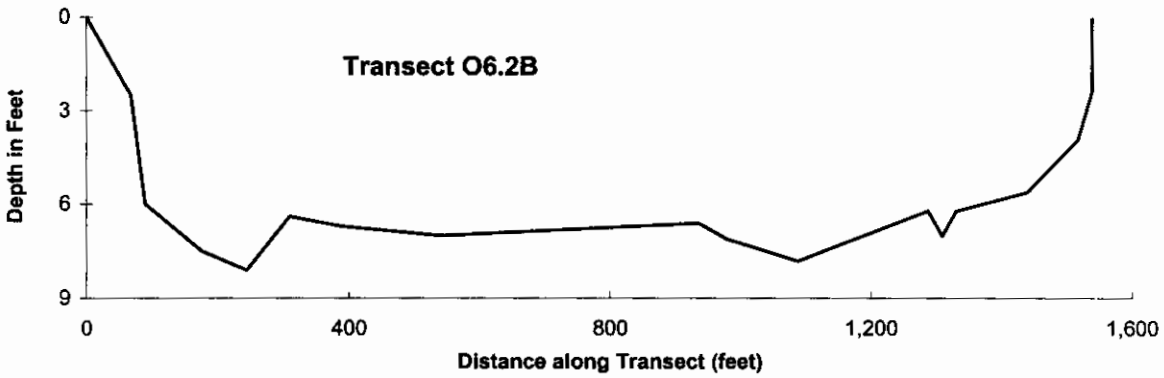
6.0
9.0
0
400
800
1,200
1,600
Distance along Transect (feet)


Transect O6.2B
Depth in Feet
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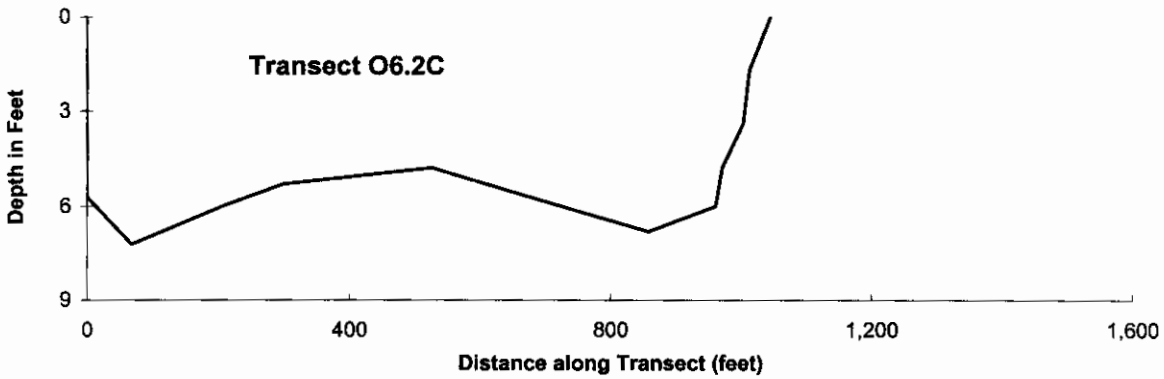
6
9
0
400
800
1,200
1,600
Distance along Transect (feet)


Transect O6.2C
Depth in Feet
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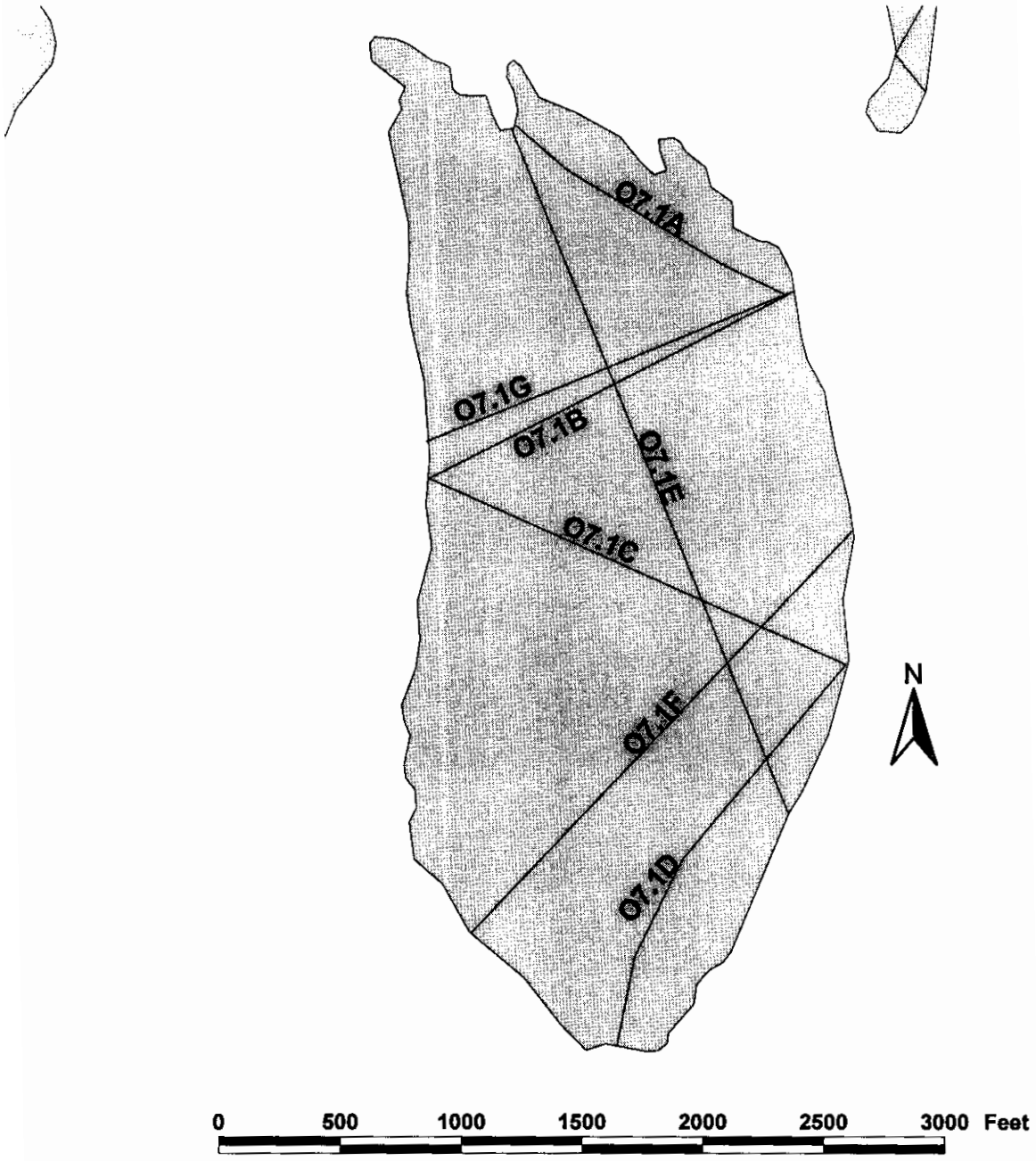
3
6
9
0
400
800
1,200
1,600
Distance along Transect (feet)

O7.1


O7.1A
O7.1G
O7.1B
O7.1E
O7.1C
O7.1F
O7.1D
N
0
500
1000
1500
2000
2500
3000
Feet

Lake O7.1

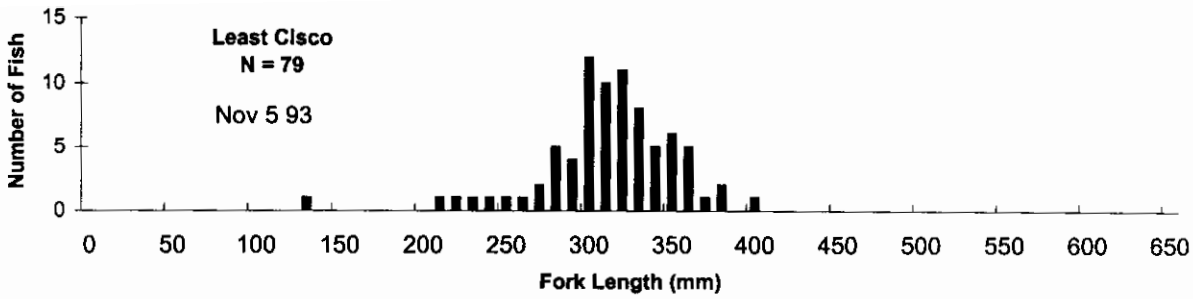
Other Names:	M9313	
Location:	70°25.41'N 150°53.69'W	
USGS Quad Sheet:	Harrison Bay B-2: T12N R5E, Sect 4	
Habitat:	Perched Lake (Infrequent Flooding)	
Area:	128 acres	
Maximum Depth:	25.1 feet	
Active Outlet:	No	
Spec. Conductance:	839 µS/cm	(1998)
	759 µS/cm	(2000)
pH:	8.3	(1998)
	7.9	(2000)
Calculated Volume:	346.2 million gallons	
Permittable Volume:	37.4 million gallons	

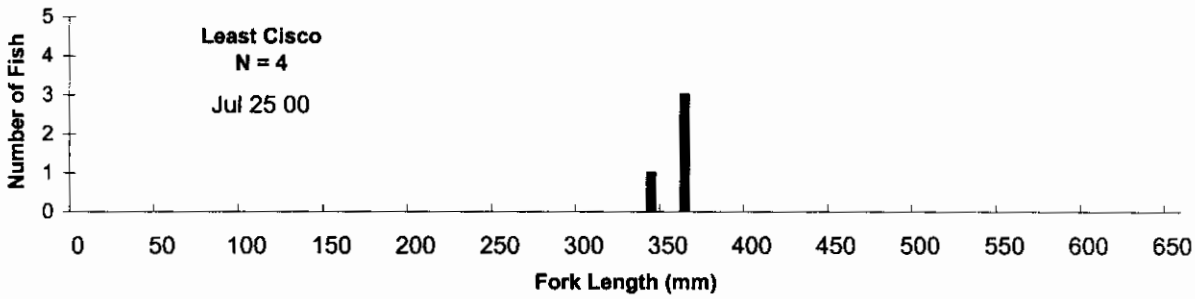
Water Quality:

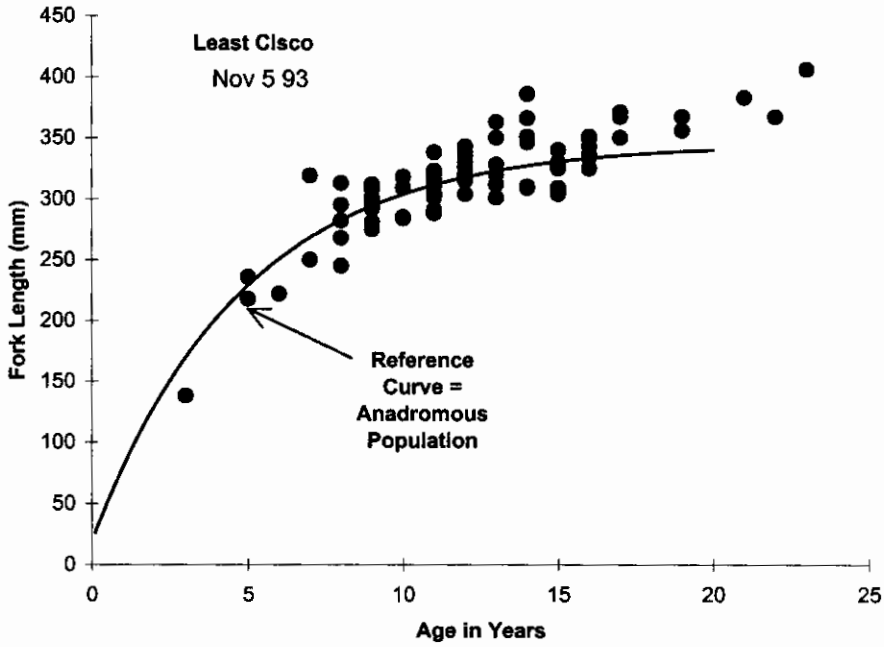
Year of Test	Chloride (mg/l)	Sodium (mg/l)	Magnesium (mg/l)	Calcium (mg/l	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Source
1998	259	108	29	22	162	484	J. Lobdell
1999	224	96	24	20	141	472	J. Lobdell
2000	192	71	21	16	120	370	this study

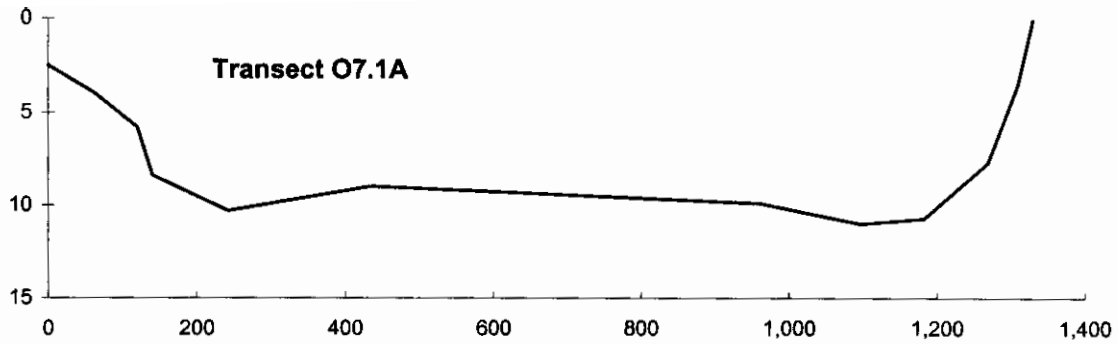
Catch Record:

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		


Least Cisco
N = 79
Nov 5 93
Number of Fish
Fork Length (mm)


Least Cisco
N = 4
Jul 25 00
Number of Fish
Fork Length (mm)


Least Cisco
Nov 5 93
Reference Curve = Anadromous Population
Fork Length (mm)
Age in Years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400
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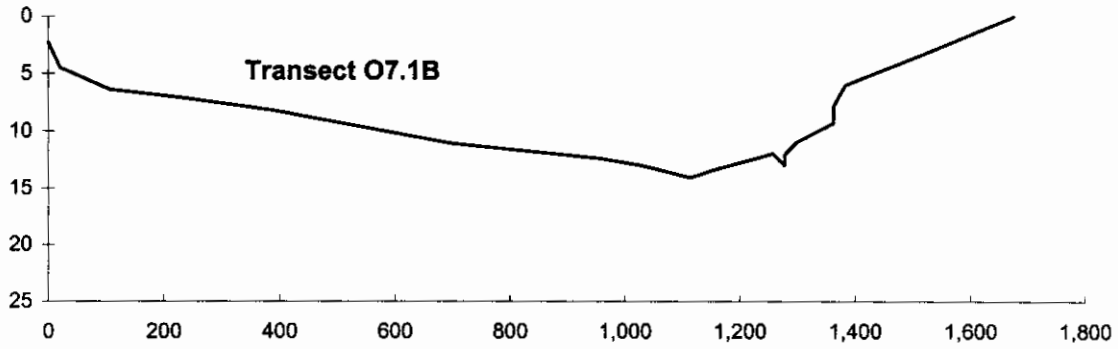
1,400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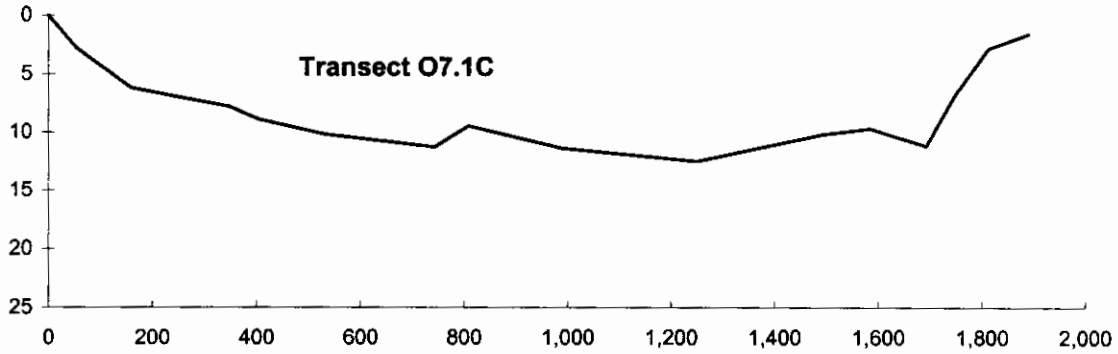
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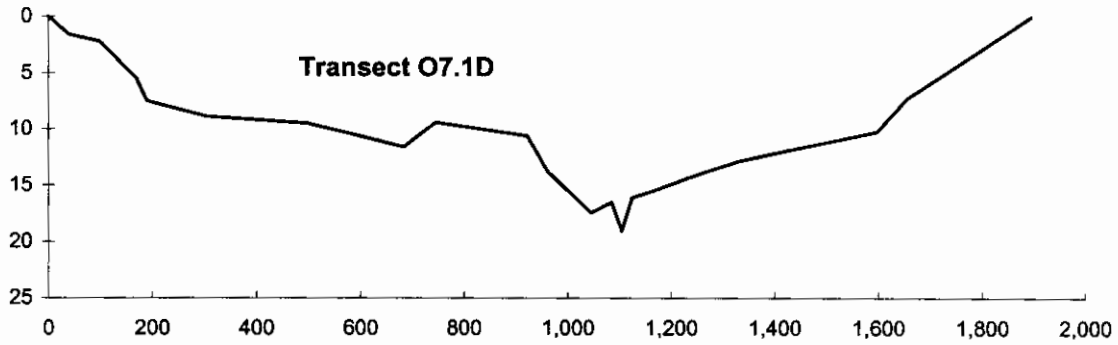
1,800
2,000


Transect O7.1D
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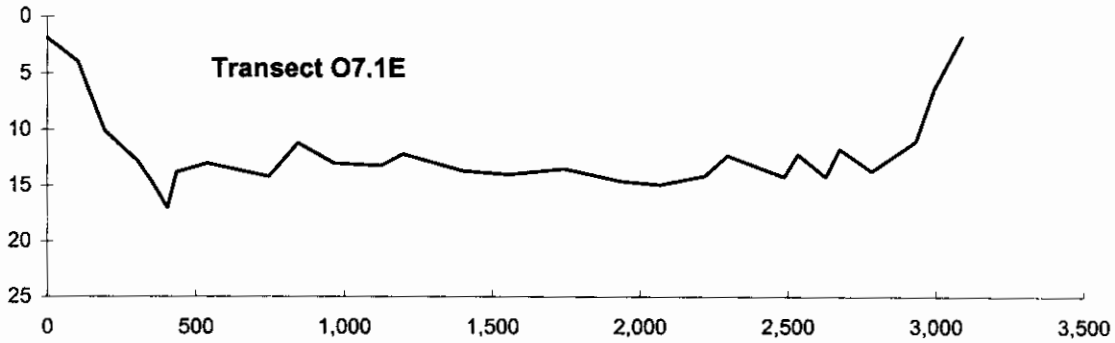
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2,000
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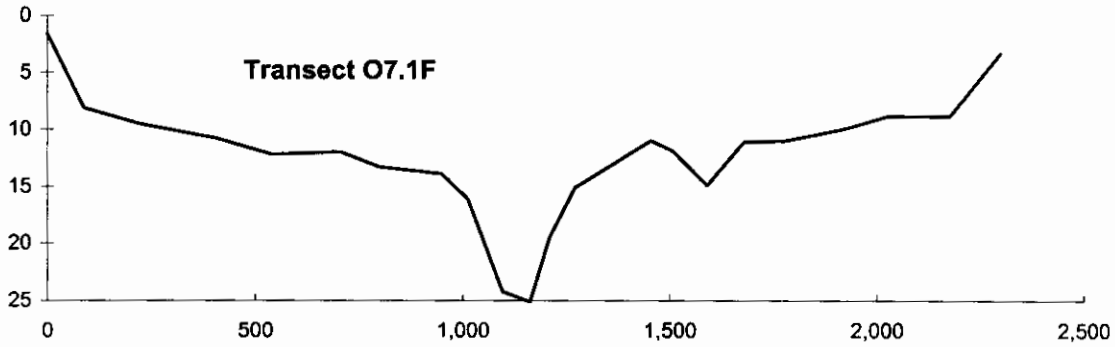
3,000
3,500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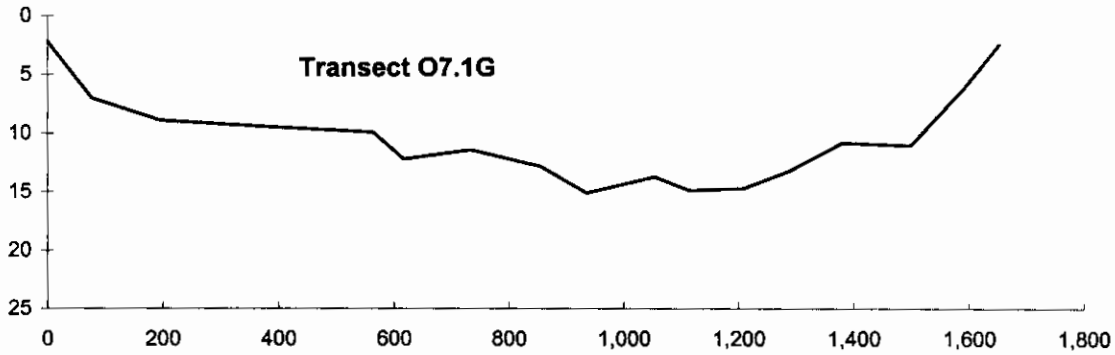
1,500
2,000
2,500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600
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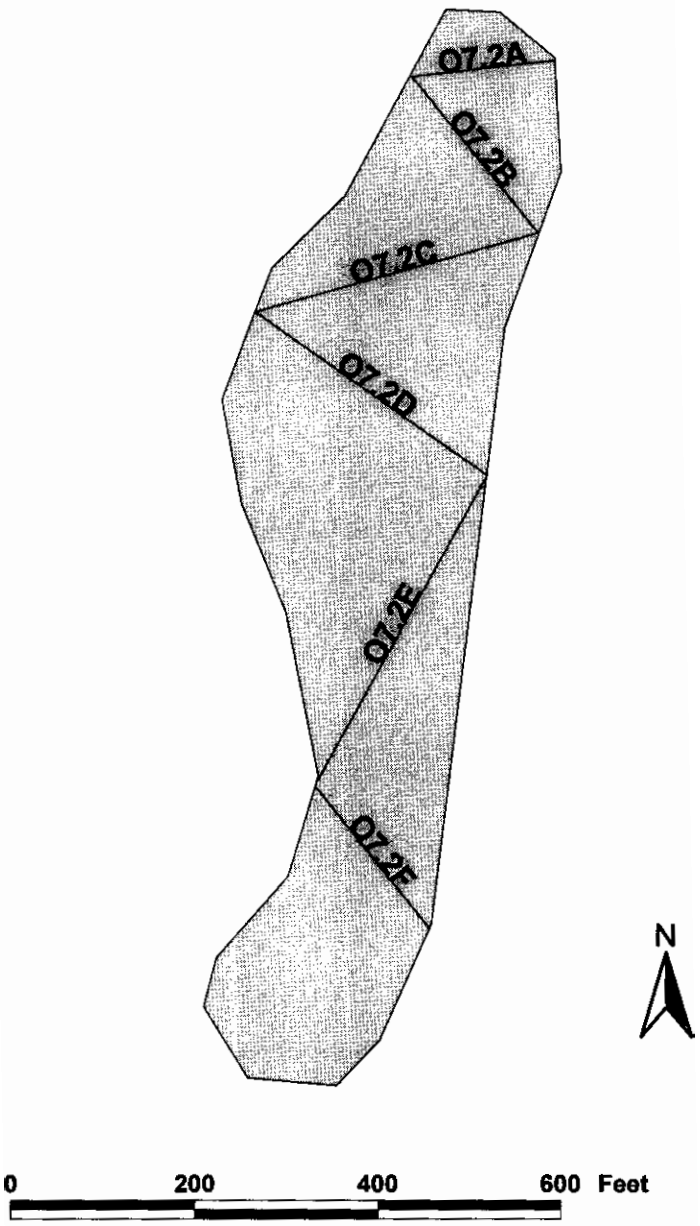
1,200
1,400
1,600
1,800

O7.2



Lake O7.2

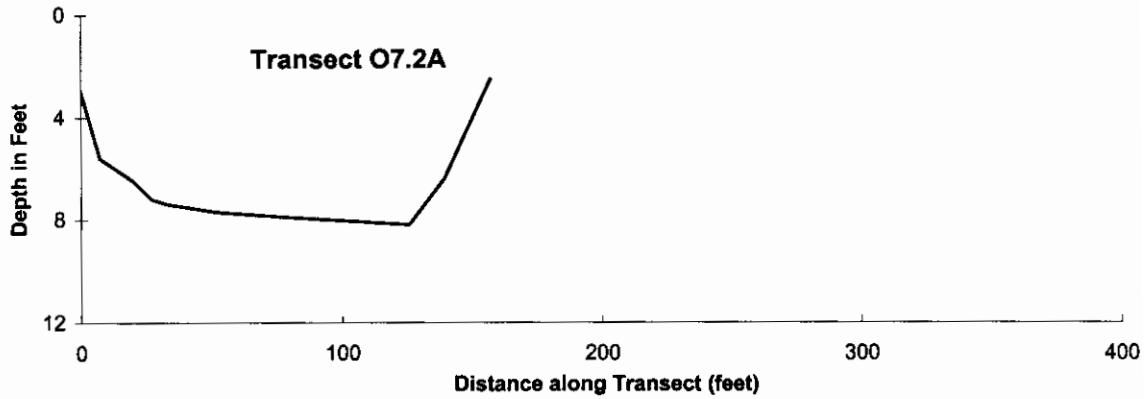
Other Names:	M0019
Location:	70°25.85N 150°53.30W
USGS Quad Sheet:	Harrison Bay B-2: Northern Border of Section 4 of T12N R5E
Habitat:	
Area:	5 acres
Maximum Depth:	10.8 feet
Active Outlet:	
Spec. Conductance:	584 µS/cm
pH:	7.88
Calculated Volume:	6.2 million gallons
Permittable Volume:	0.3 million gallons

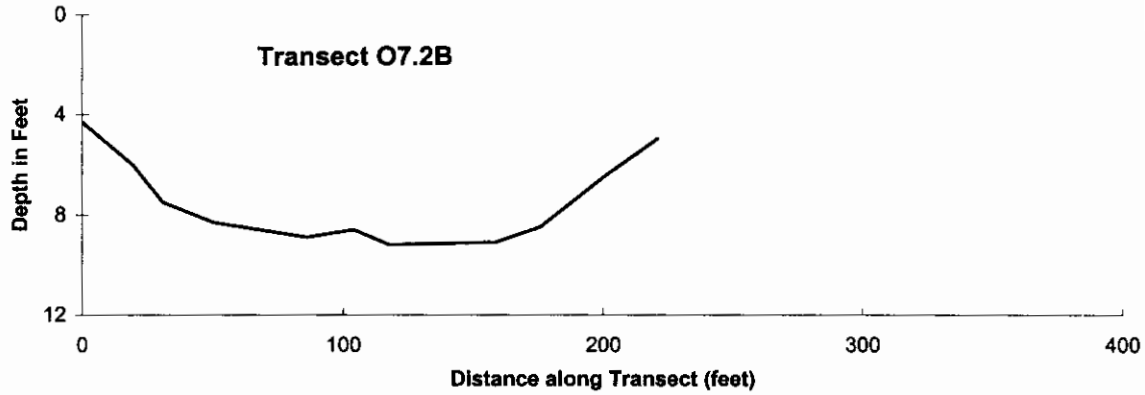
Water Quality:

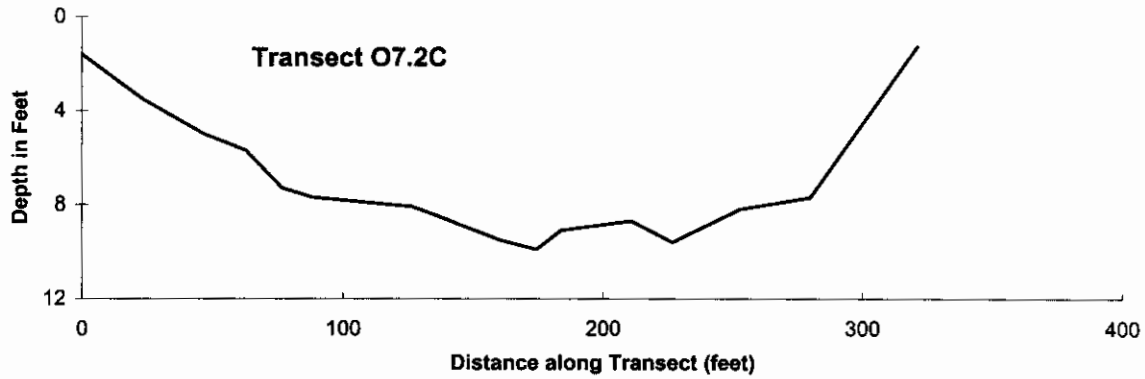
Year of Test	Chloride (mg/l)	Sodium (mg/l)	Calcium (mg/l)	Magnesium (mg/l	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Source
2000	146.0	57.8	15.1	12.8	90	296	this study

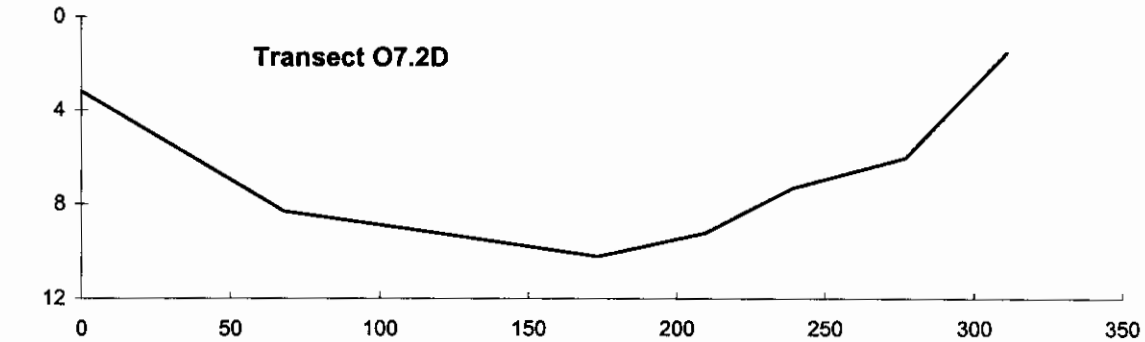
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 25 00	7.0	None	0
Minnow Traps	Jul 25 00	9.8	None	0

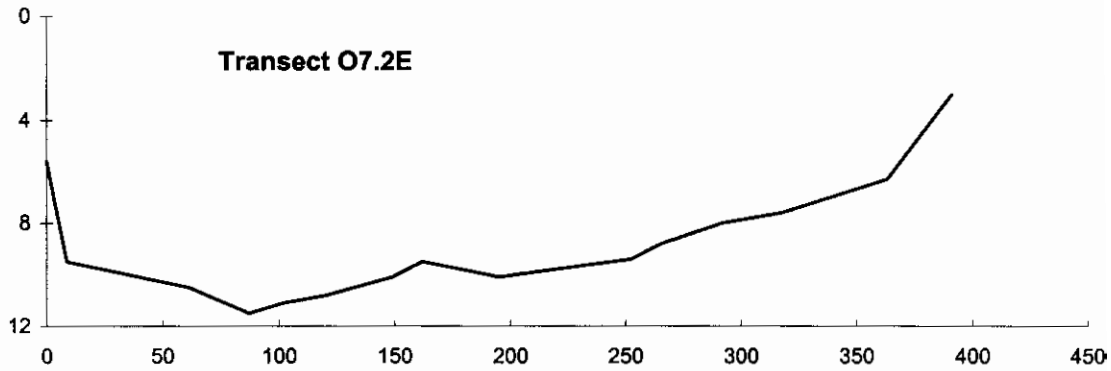








last revised 2/14/01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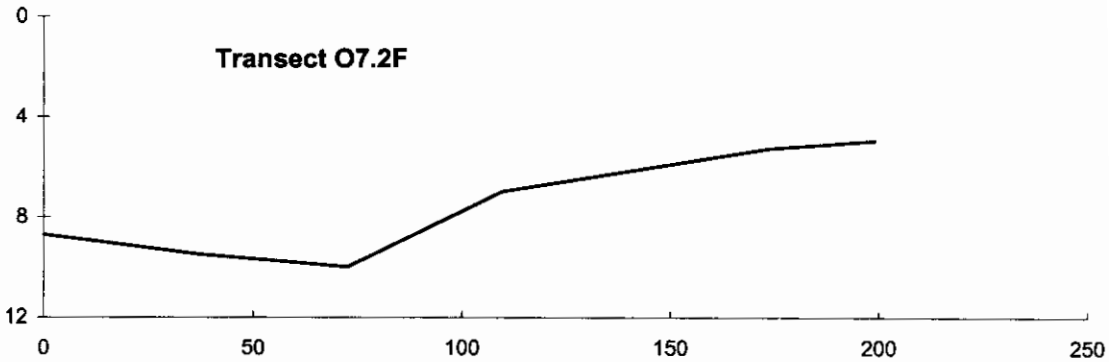
4
8
12
0
50
100
150
200
250
300
350
400
450


Transect O7.2F
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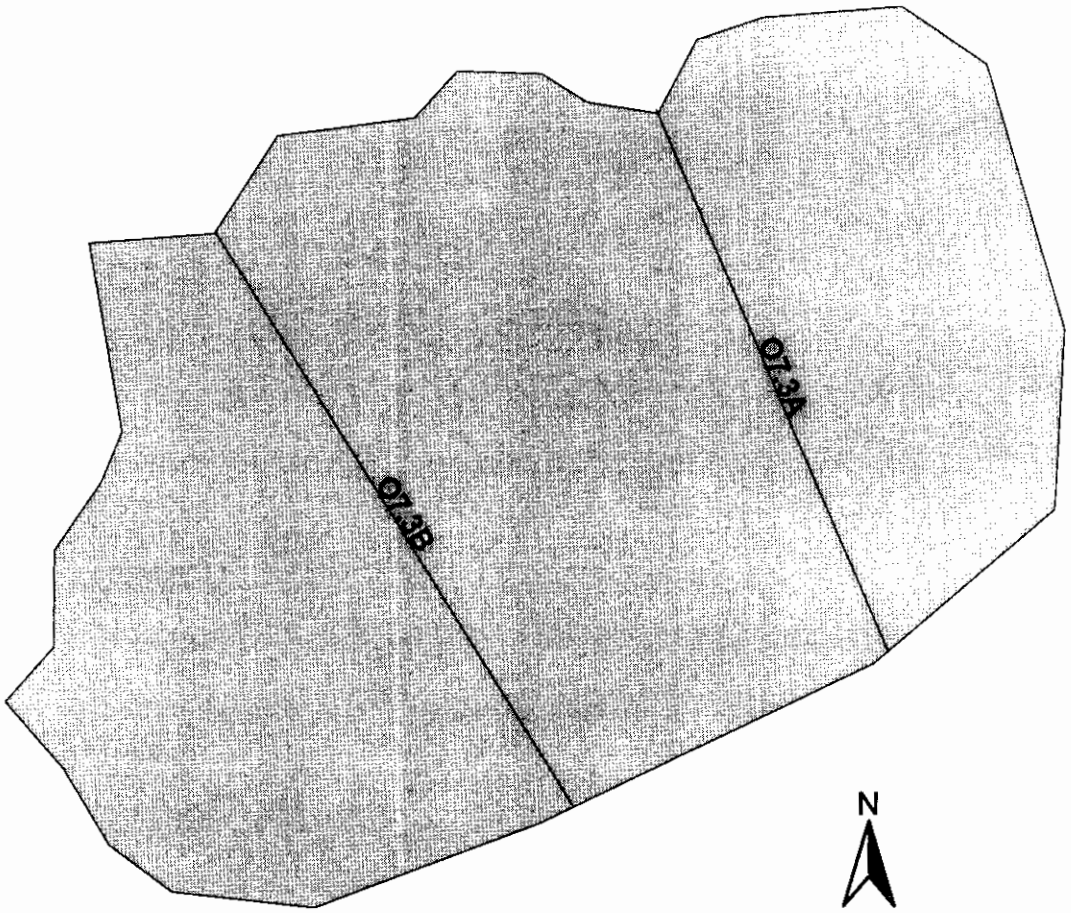
8
12
0
50
100
150
200
250

O7.3



0 100 200 300 400 500 Feet

Lake O7.3

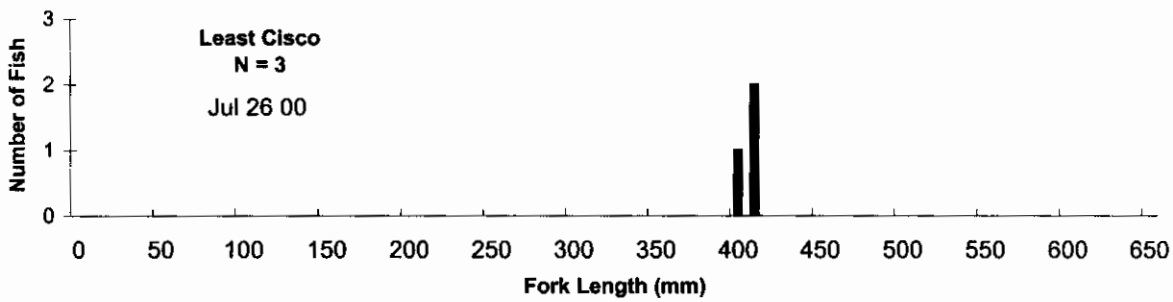
Other Names:	L9903
Location:	70°25.20N 150°50.60W
USGS Quad Sheet:	Harrison Bay B-2: Section 4 of T12N R5E
Habitat:	
Area:	8 acres
Maximum Depth:	22.9 feet
Active Outlet:	
Spec. Conductance:	836 µS/cm
pH:	7.96
Calculated Volume:	20.5 million gallons
Permittable Volume:	2.1 million gallons

Water Quality:

Year of Test	Chloride (mg/l)	Sodium (mg/l)	Calcium (mg/l)	Magnesium (mg/l	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Source

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Jul 26 00	2.3	Least cisco	3	402-415
Minnow Traps	Jul 26 00	4.5	None	0	



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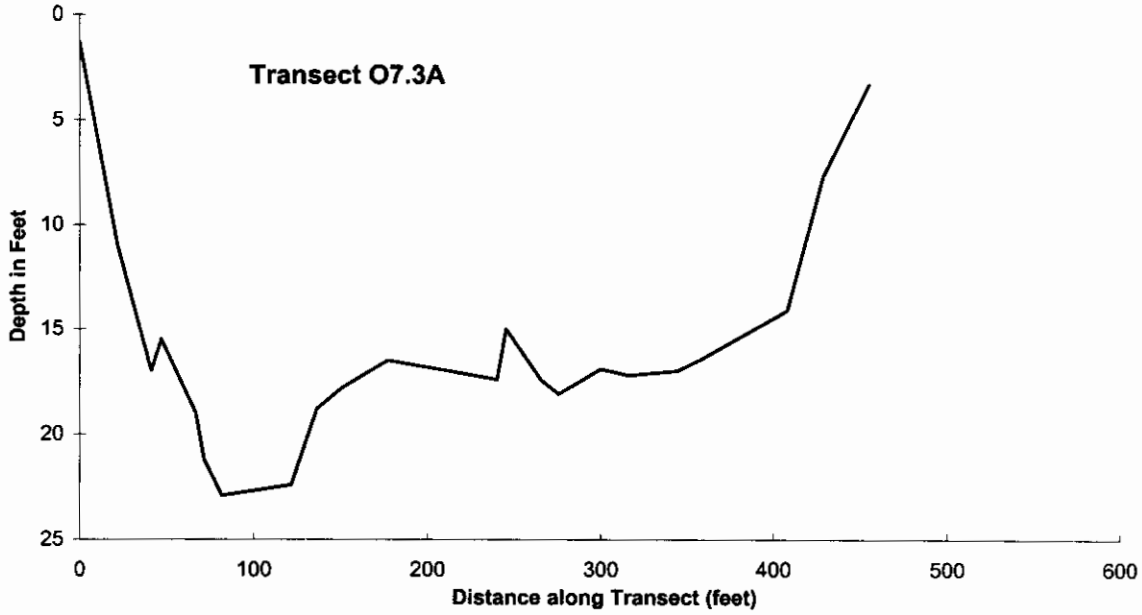
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Depth in Feet
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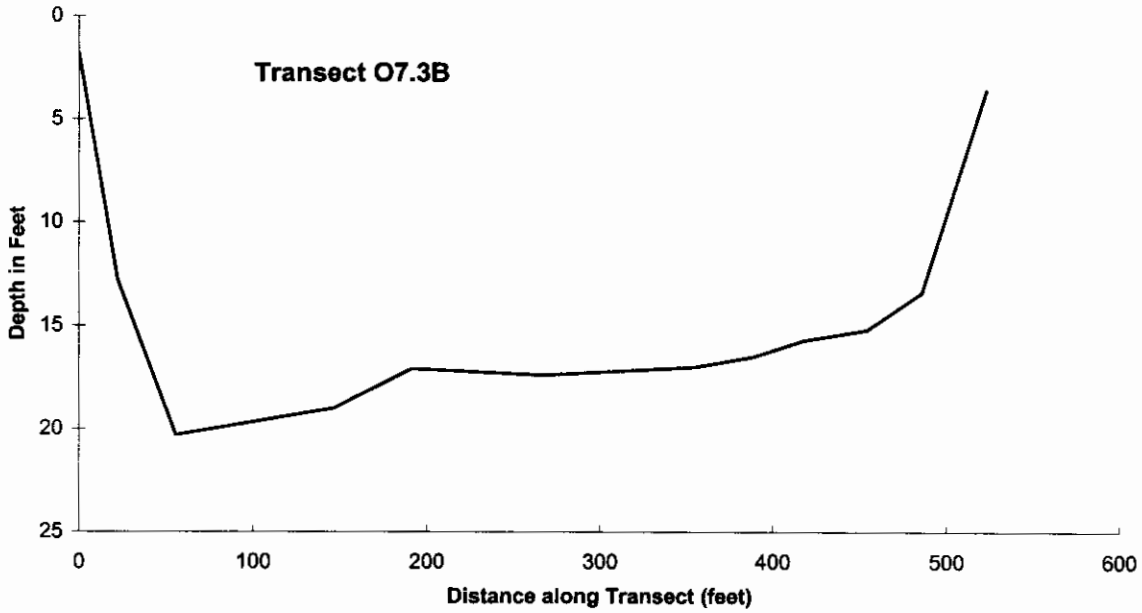
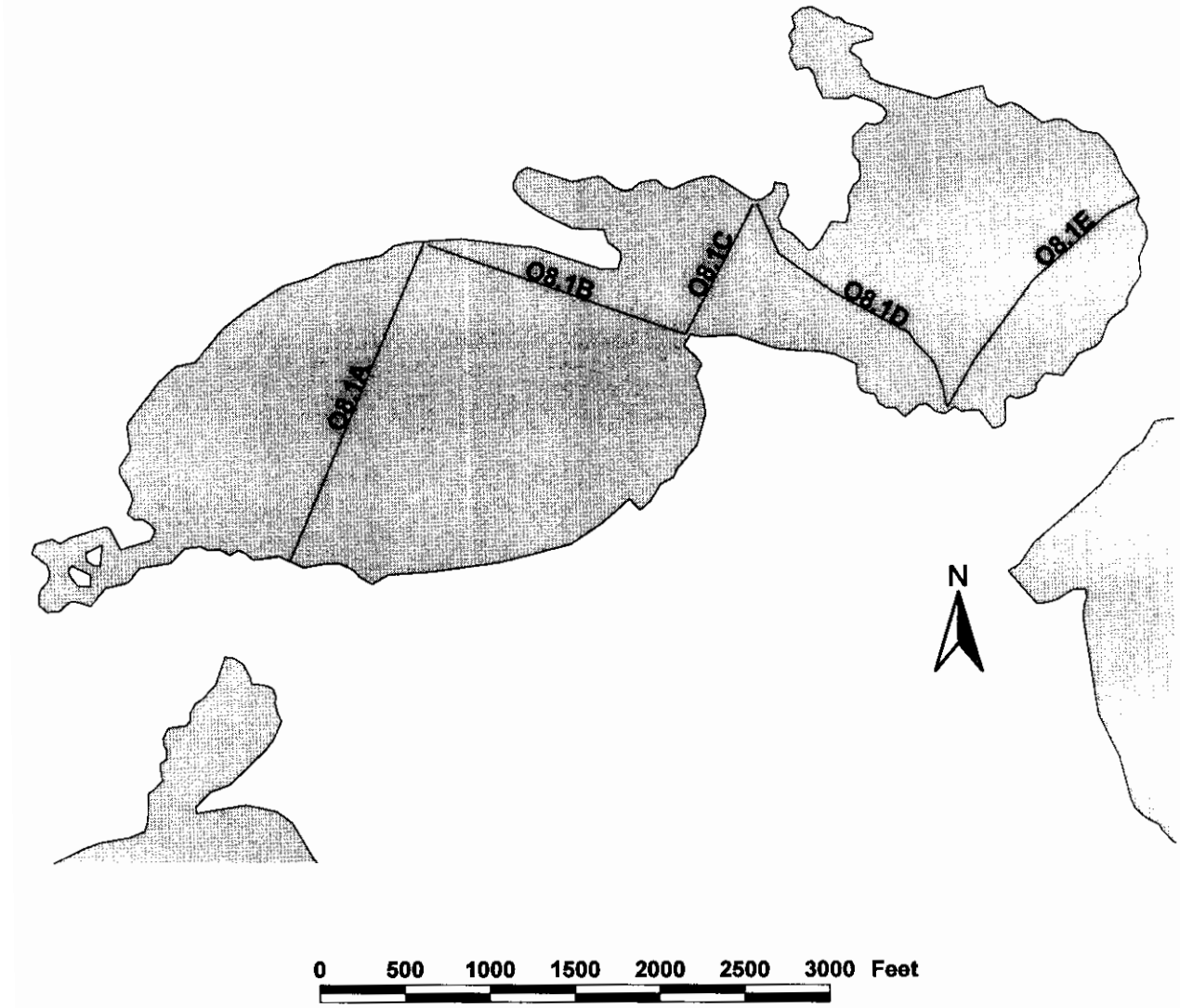
10
15
20
25
0
100
200
300
400
500
600
Distance along Transect (feet)


Transect O7.3B
Depth in Feet
0
5
10
15
20
25
0
100
200
300
400
500
600
Distance along Transect (feet)

O8.1



Lake O8.1

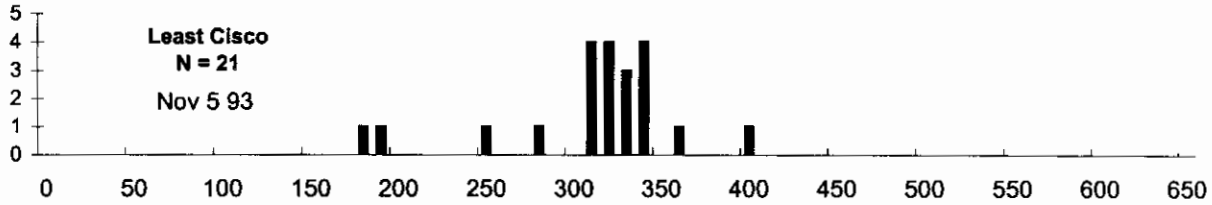
Other Names:	L9107; M9312
Location:	70°25.46'N 150°50.32'W
USGS Quad Sheet:	Harrison Bay B-2: T12N R5E, Sect 3
Habitat:	Perched Lake (Infrequent Flooding)
Area:	208 acres
Maximum Depth:	28.1 feet
Active Outlet:	No
Spec. Conductance:	1,867 µS/cm
pH:	8.1
Calculated Volume:	629.0 million gallons
Permittable Volume:	70.8 million gallons

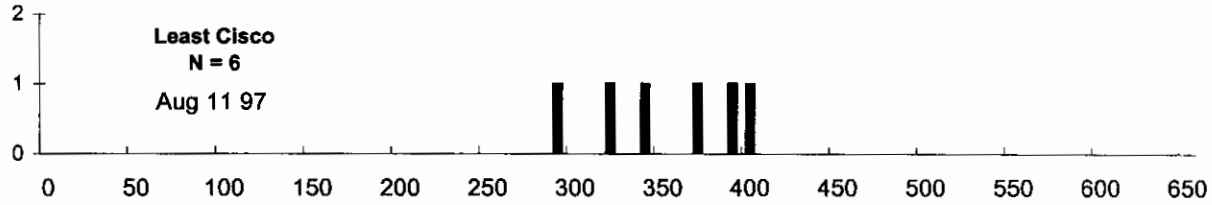
Water Quality:

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
1991	420	250	30	20	174	840	J. Lobdell
1998	572	313	38	24	215	1,080	

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Nov 5 93	22.0	Least cisco	21	188-400
Minnow Trap	Nov 5 93	22.0	None	0	
Gill Net	Aug 11 97	2.9	Least cisco	6	298-400
Minnow Trap	Aug 11 97	12.0	None	0	





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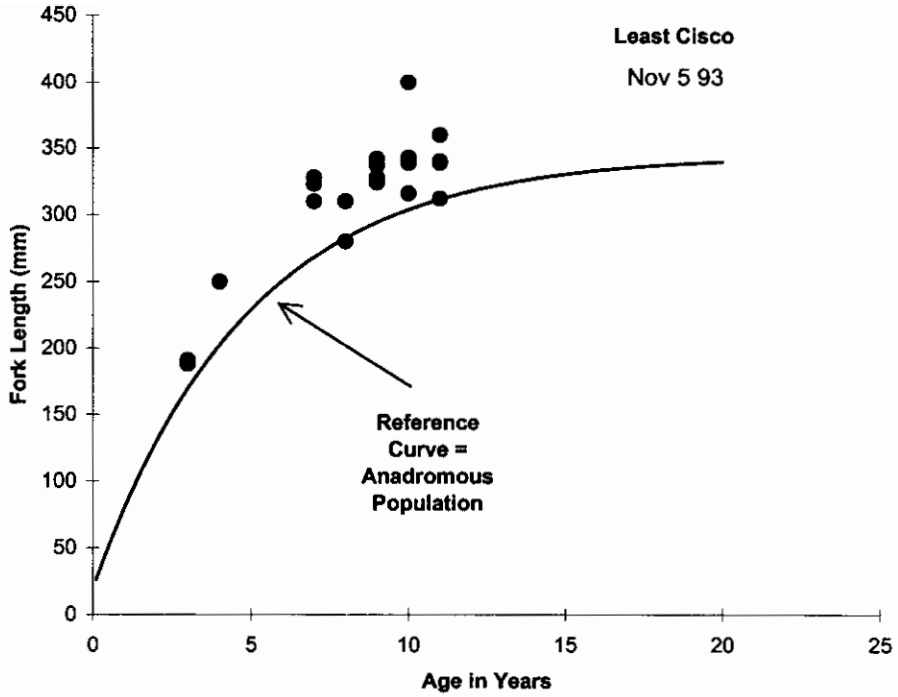

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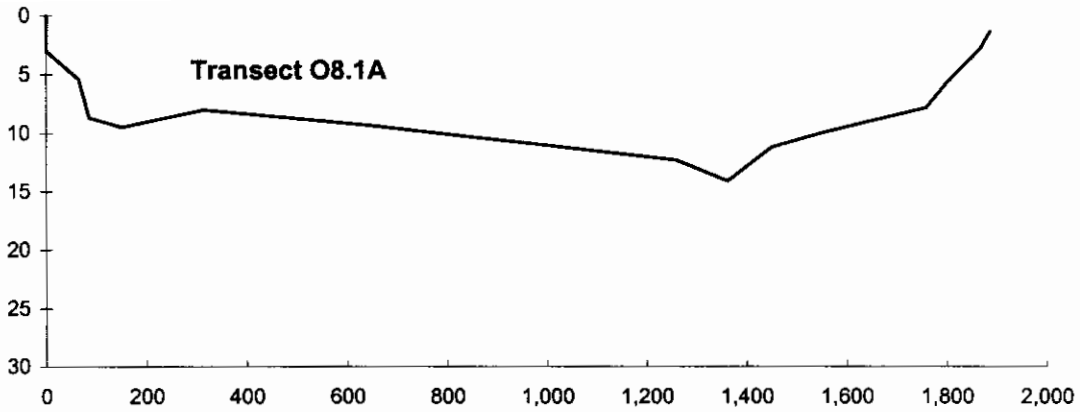
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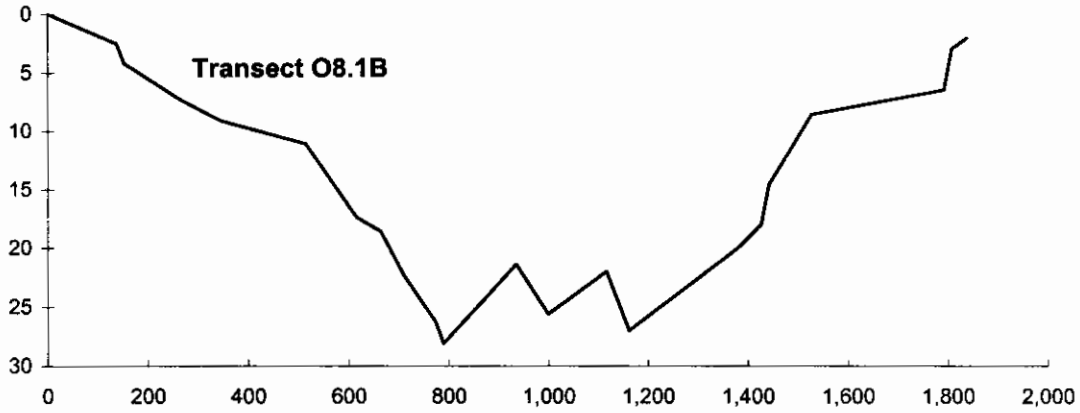
2,000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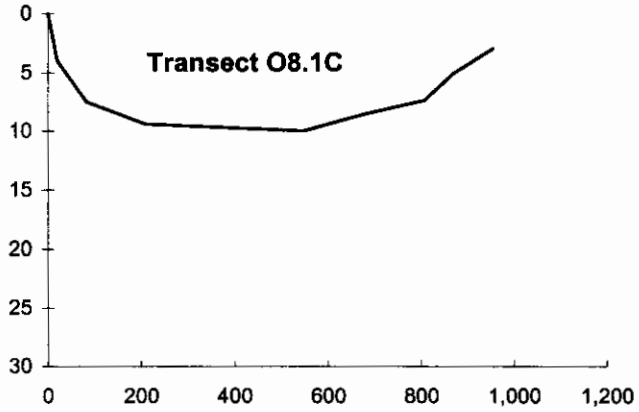
2,000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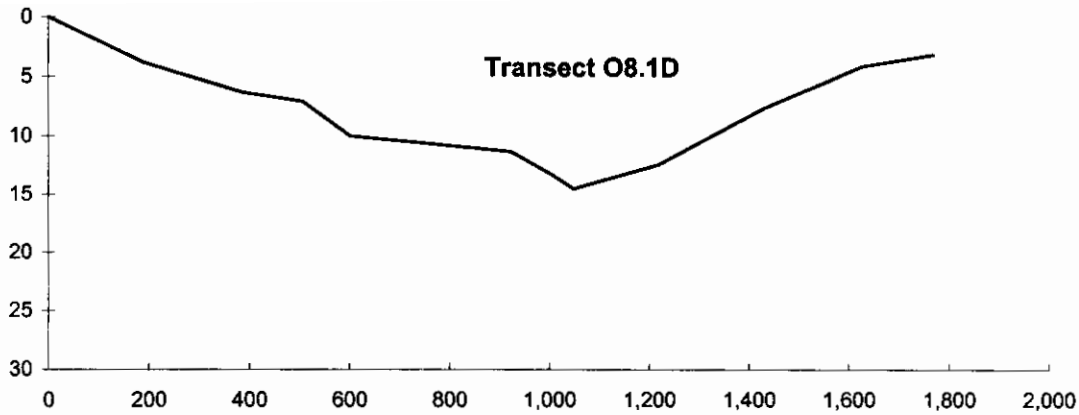
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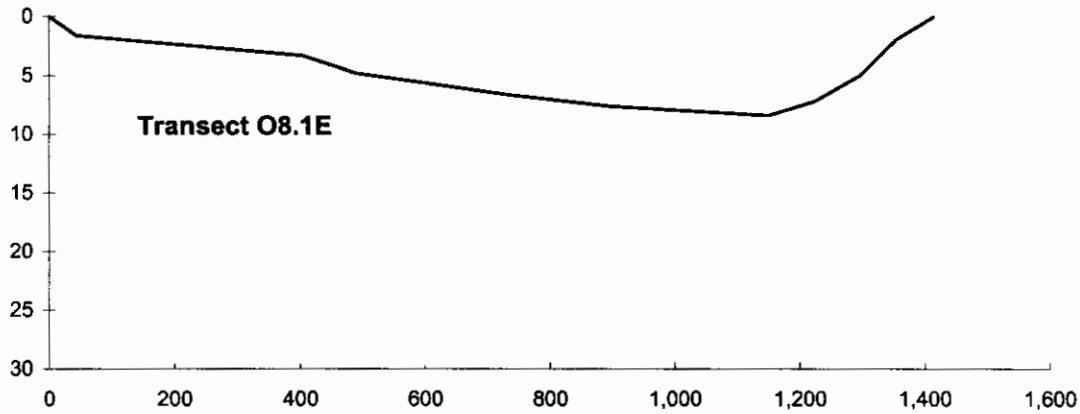
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200
400
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1,200
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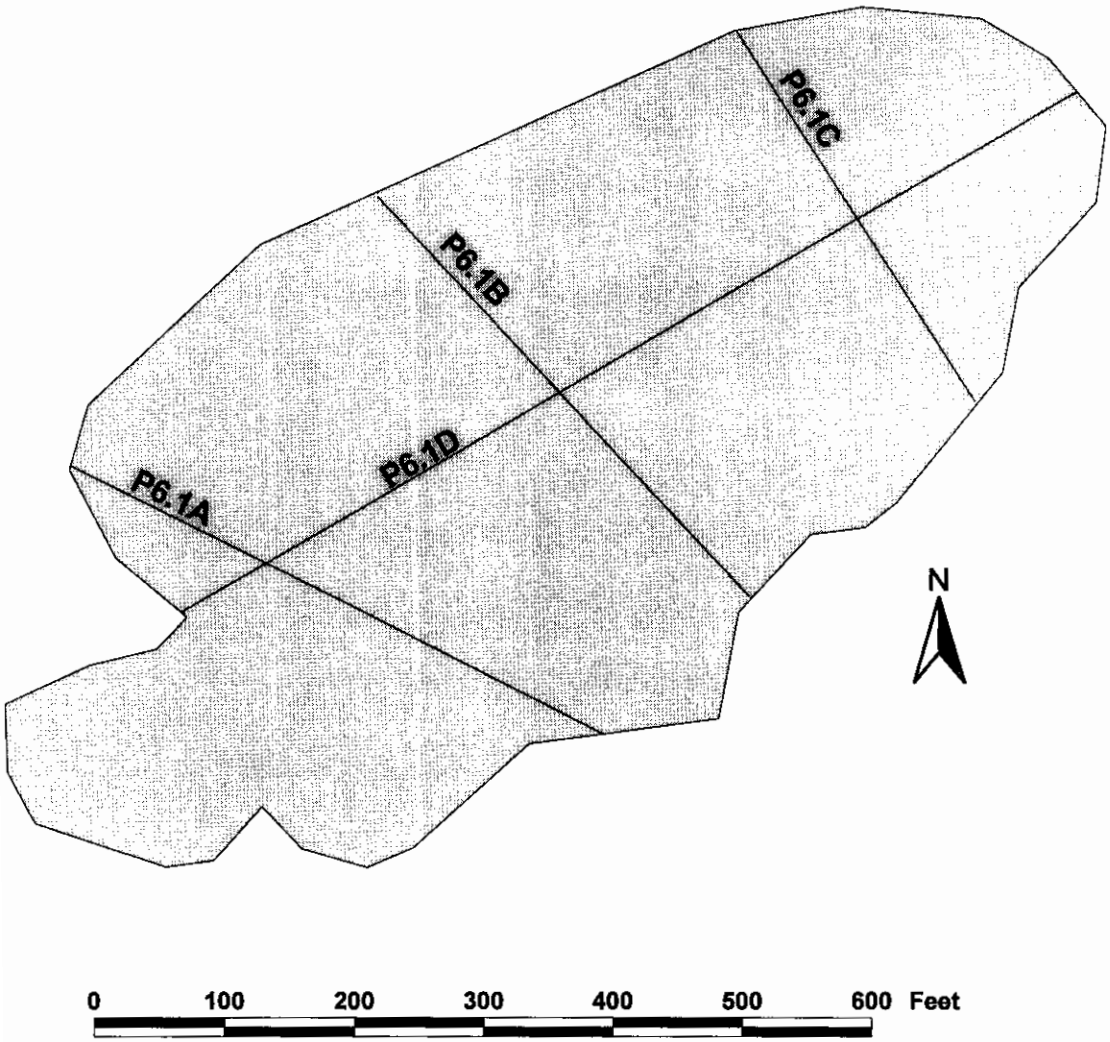
1,600

P6.1



Lake P6.1

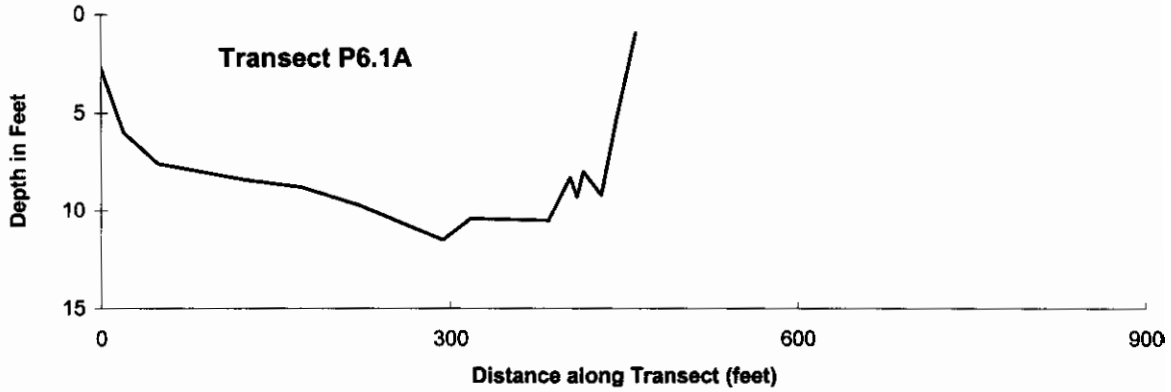
Other Names:	L9905
Location:	70°24.25'N 150°57.23'W
USGS Quad Sheet:	Harrison Bay B-2: T12N R5E Sect. 7
Habitat:	Perched Lake (Frequent Flooding)
Area:	7 acres
Maximum Depth:	12.4 feet
Active Outlet:	
Spec. Conductance:	5,860 µS/cm
pH:	8.4
Calculated Volume:	9.9 million gallons
Permittable Volume:	0.6 million gallons

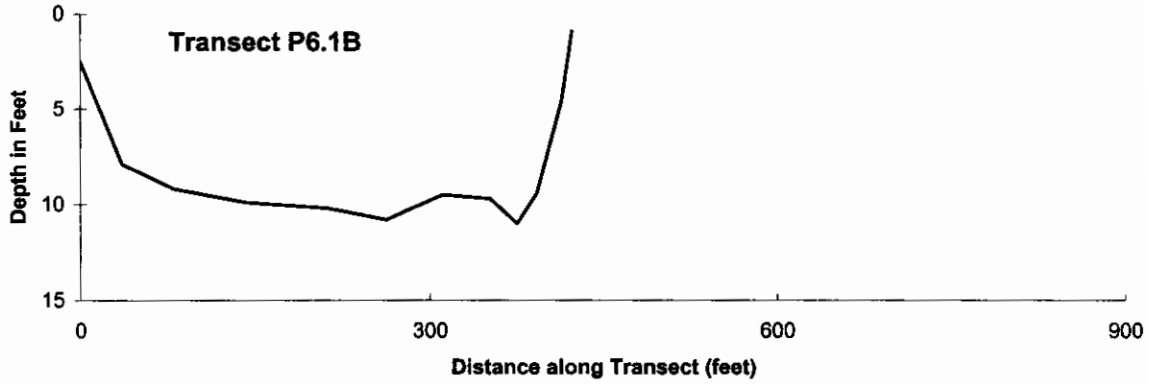
Water Quality:

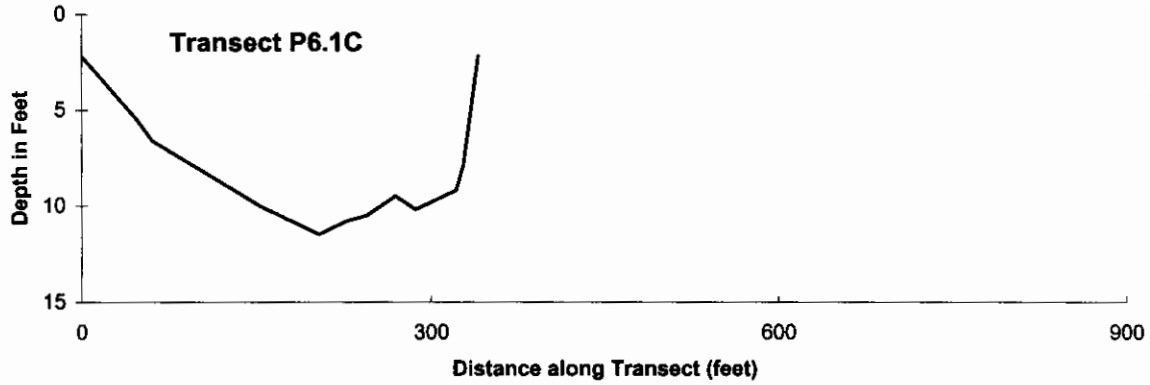
Year of Test	Chloride (mg/l)	Sodium (mg/l)	Calcium (mg/l)	Magnesium (mg/l	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Source
1999	1,880	991	69	135	737	3,470	J. Lobdell

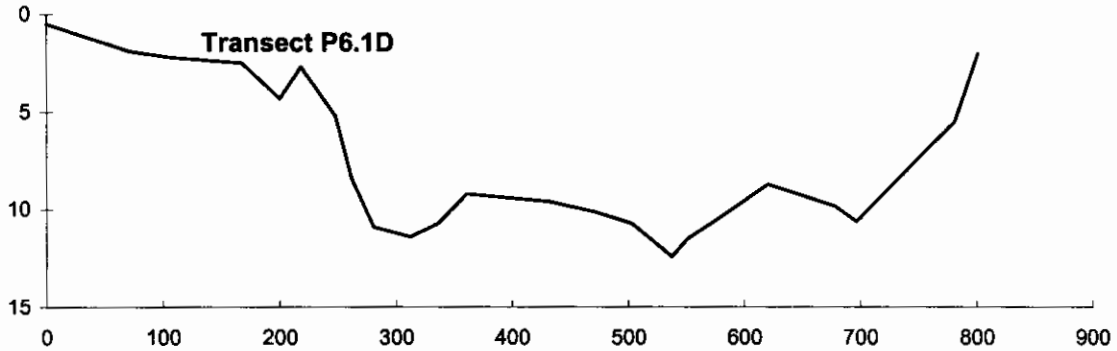
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Aug 2 99	2.3	None	0



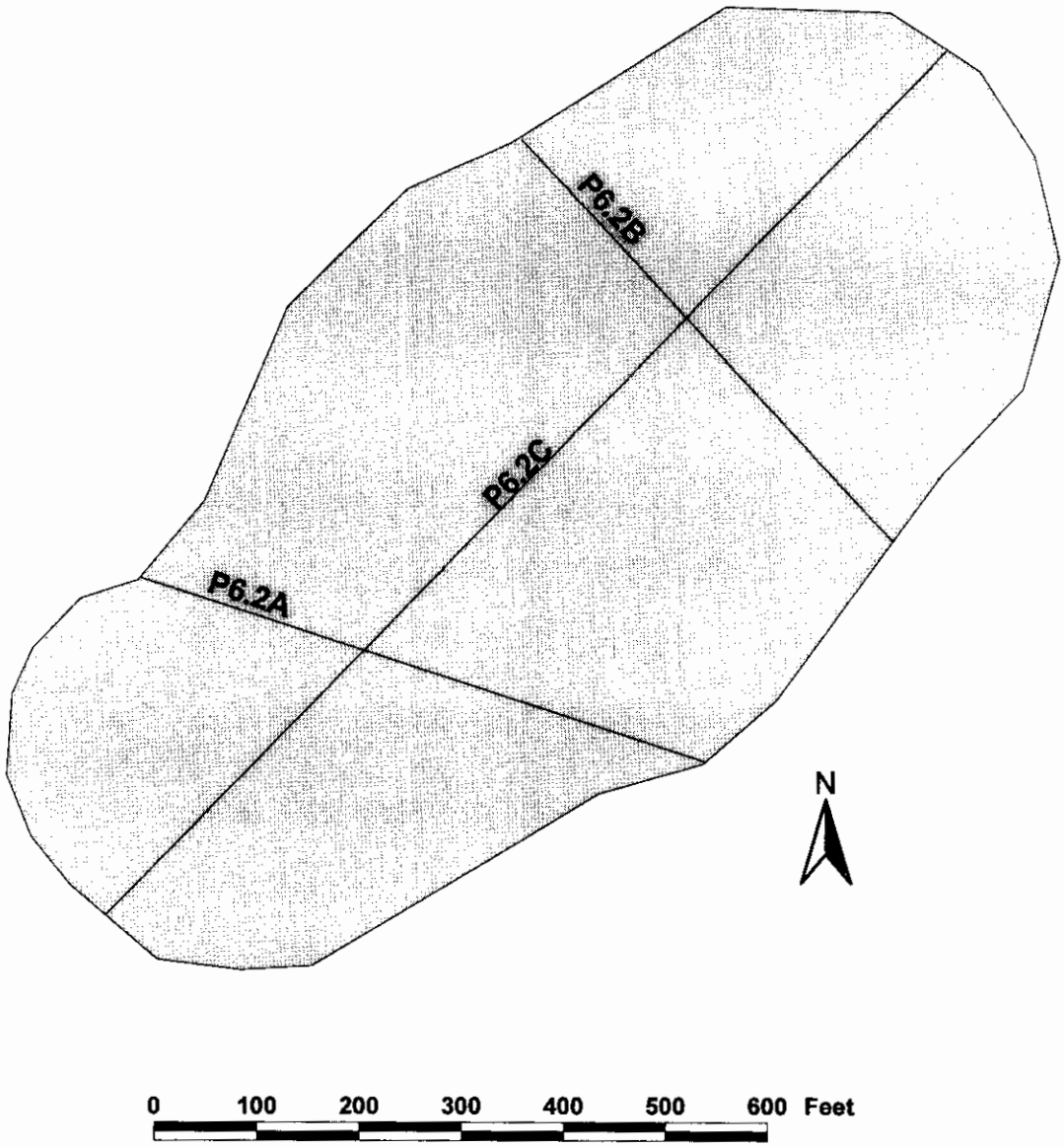






last revised 2/14/01

P6.2



Lake P6.2

Other Names:	L9904
Location:	70°24.17'N 150°56.28'W
USGS Quad Sheet:	Harrison Bay B-2: T12N R5E Sect. 8
Habitat:	Perched Lake (Frequent Flooding)
Area:	13 acres
Maximum Depth:	25.3 feet
Active Outlet:	
Spec. Conductance:	622 µS/cm
pH:	8.1
Calculated Volume:	34.1 million gallons
Permittable Volume:	3.7 million gallons

Water Quality:

Year of Test	Chloride (mg/l)	Sodium (mg/l)	Calcium (mg/l)	Magnesium (mg/l	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Source
1999	161	79	18	16	112	354	J. Lobdell

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Aug 2 99	2.5	Broad whitefish	1	505
			Least cisco	5	307-353

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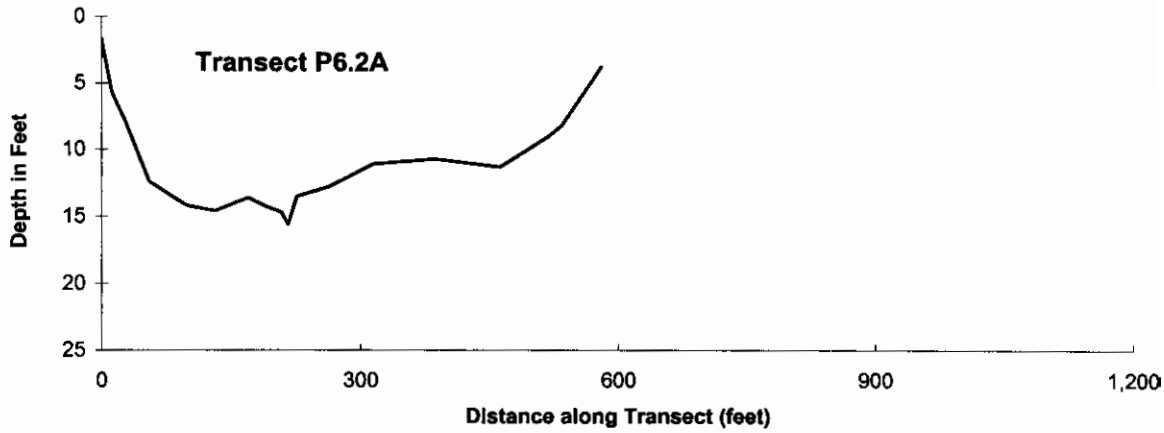
Transect P6.2A
Depth in Feet
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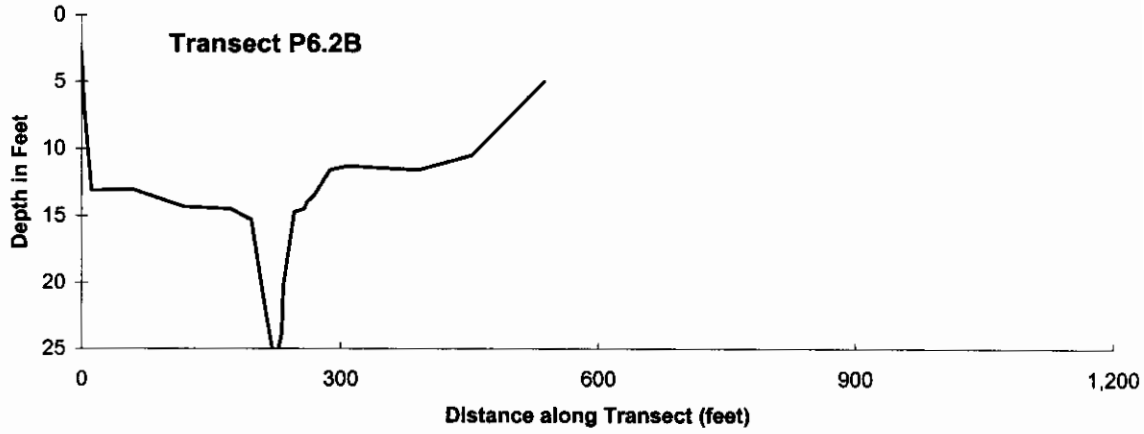
5
10
15
20
25
0
300
600
900
1,200
Distance along Transect (feet)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Depth in Feet
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15
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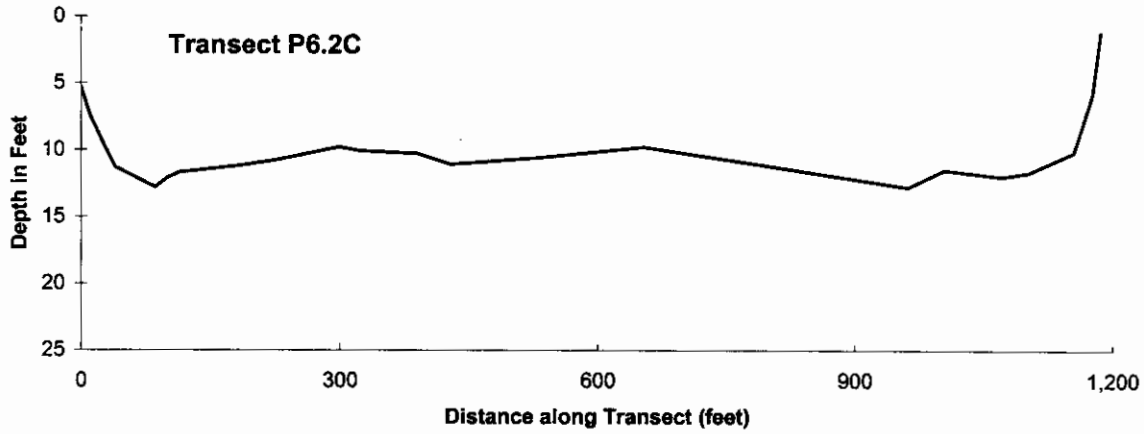
25
0
300
600
900
1,200
Distance along Transect (feet)


Transect P6.2C
Depth in Feet
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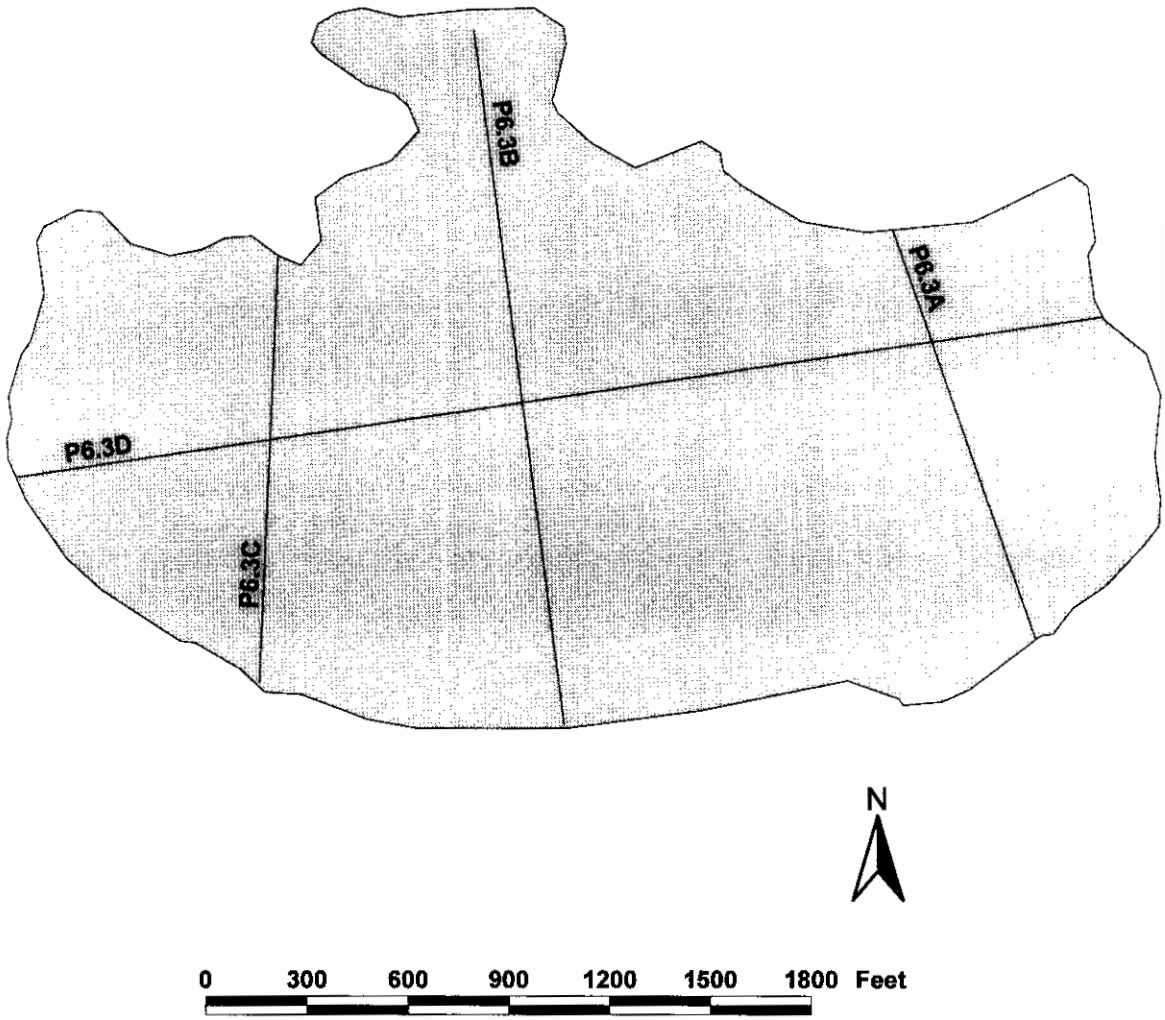
10
15
20
25
0
300
600
900
1,200
Distance along Transect (feet)

P6.3



Lake P6.3

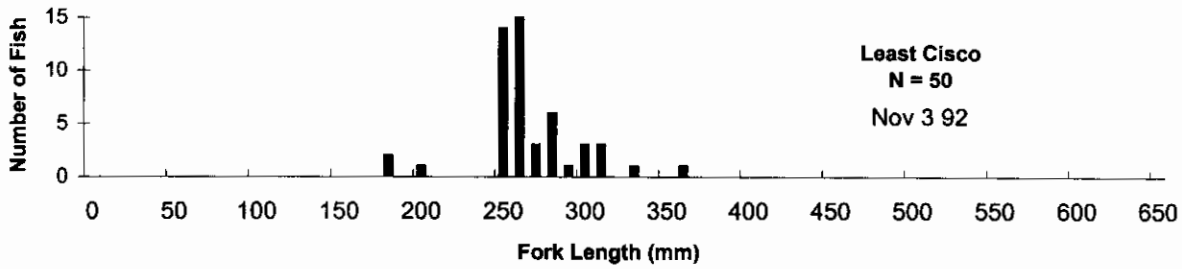
Other Names:	L9210; M9213
Location:	70°24.61'N 150°55.14'W
USGS Quad Sheet:	Harrison Bay B-2: T12N R5E, Sect 8
Habitat:	Perched Lake (Infrequent Flooding)
Area:	117 acres
Maximum Depth:	29.1 feet
Active Outlet:	No
Spec. Conductance:	243 µS/cm
pH:	7.9
Calculated Volume:	366.3 million gallons
Permittable Volume:	41.7 million gallons

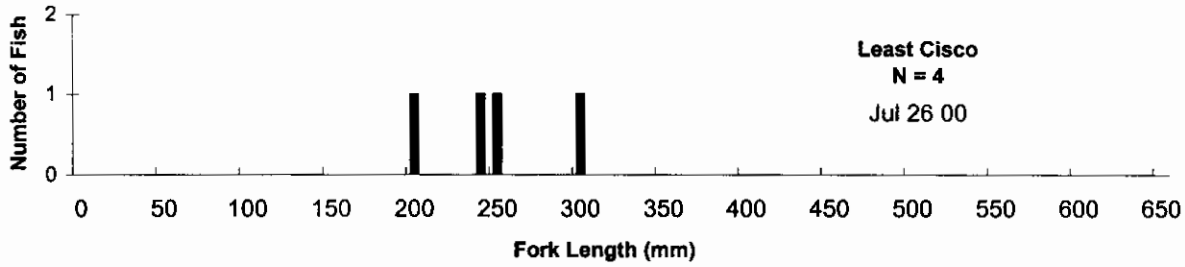
Water Quality:

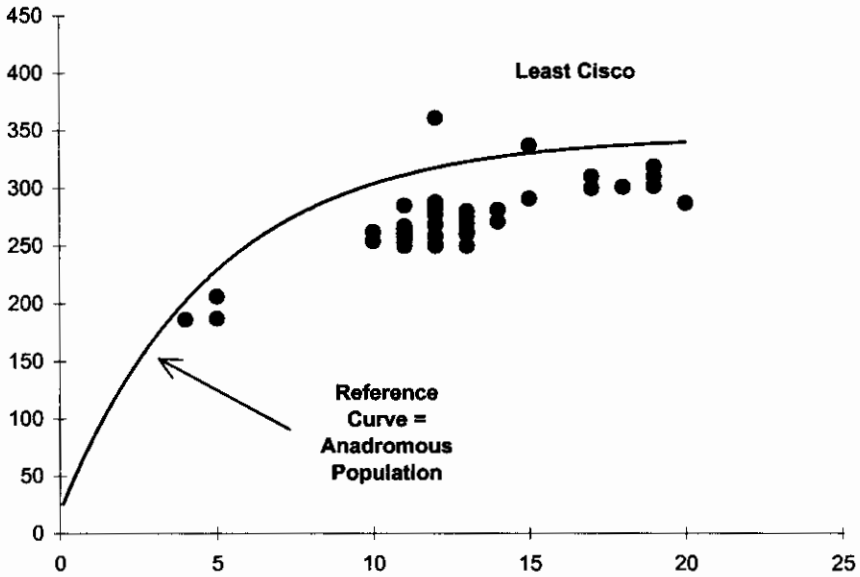
Year of Test	Chloride (mg/l)	Sodium (mg/l)	Magnesium (mg/l)	Calcium (mg/l	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Source
1992	64.0	20.0	10.0	19.0	92	190	J. Lobdell
1998	74.8	25.8	21.2	11.4	100	189	this study
1999	67.7	24.2	21.0	11.7	101	200	this study
2000	45.1	16.0	13.7	7.5	65	170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







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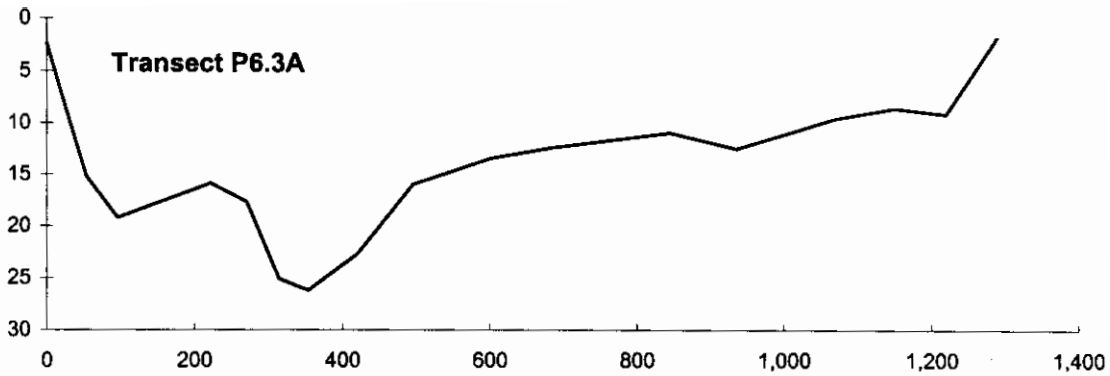
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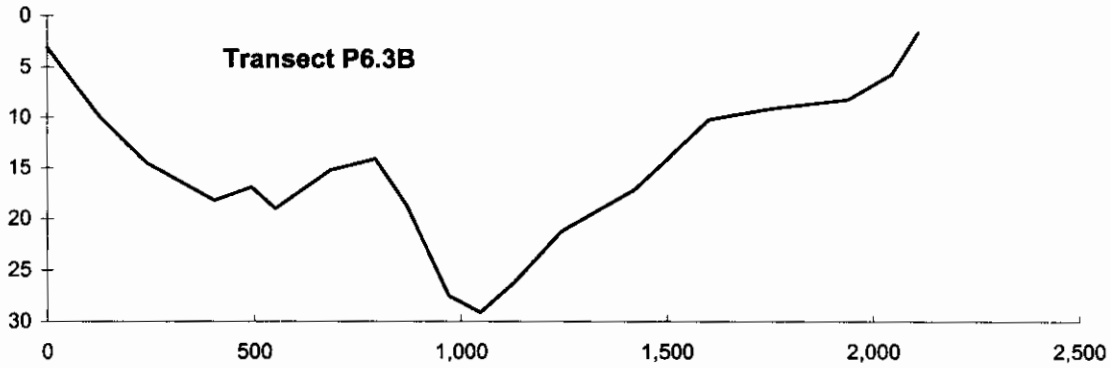
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25
30
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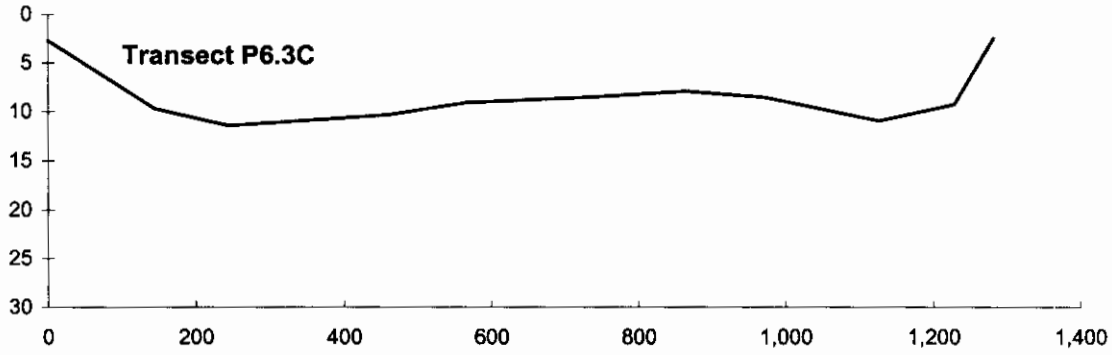
1,000
1,500
2,000
2,500


Transect P6.3C
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5
10
15
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25
30
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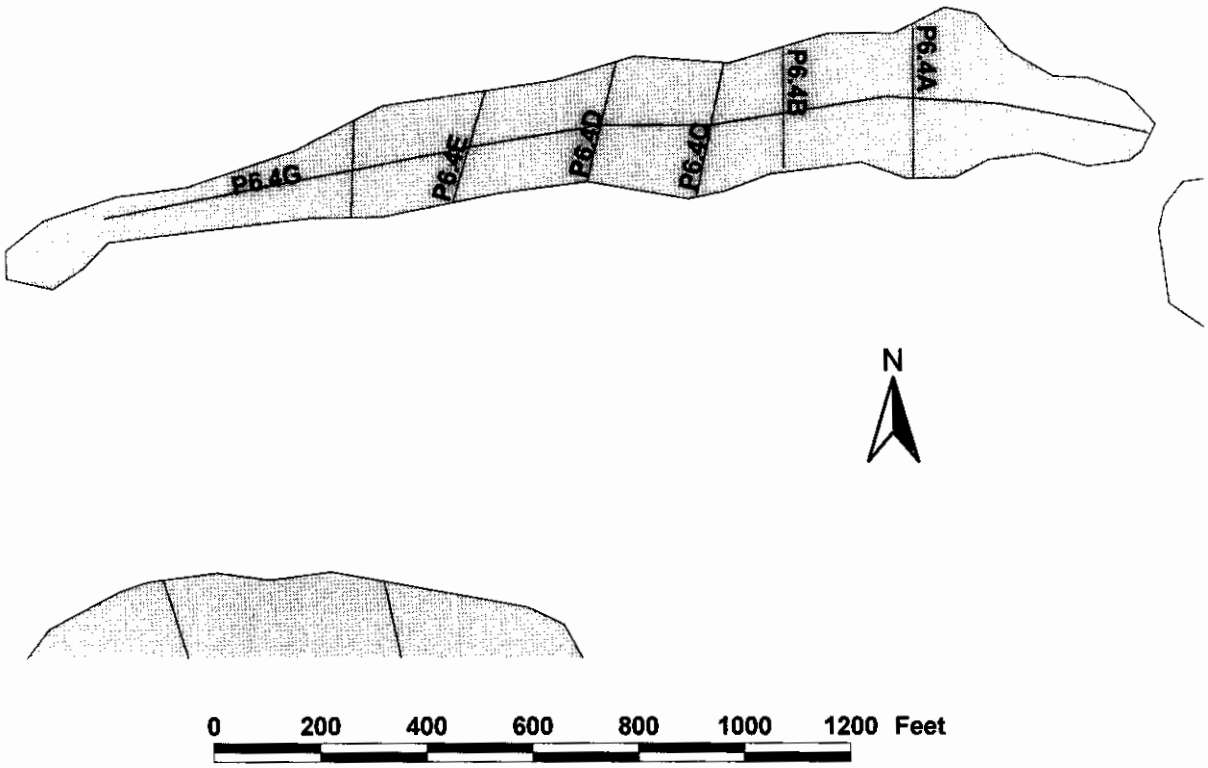
200
400
600
800
1,000
1,200
1,400


Transect P6.3D
0
5
10
15
20
25
30
0
500
1,000
1,500
2,000
2,500
3,000
3,500

P6.4


P6.4G
P6.4E
P6.4D
P6.4C
P6.4B
P6.4A
N
0
200
400
600
800
1000
1200
Feet

Lake P6.4

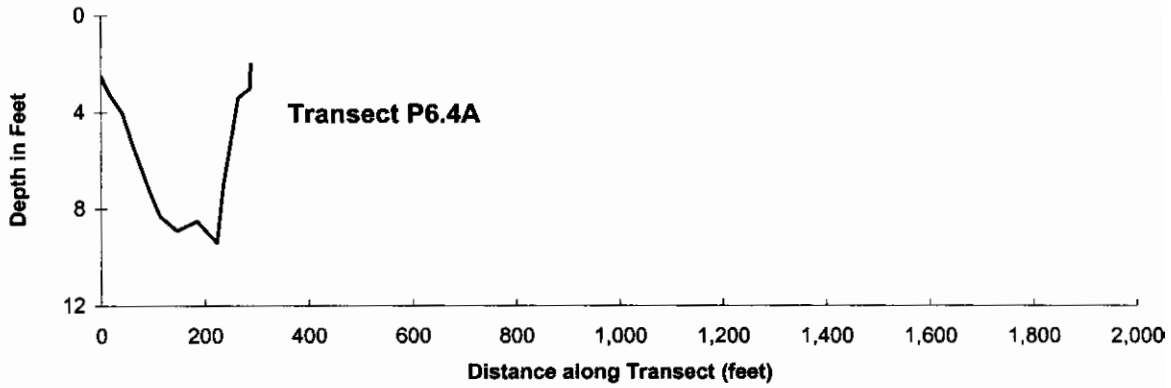
Other Names:	L9908
Location:	70°24.17'N 150°54.56'W
USGS Quad Sheet:	Harrison Bay B-2: T12N R5E Sect. 8
Habitat:	Perched Lake (Frequent Flooding?)
Area:	9 acres
Maximum Depth:	11.3 feet
Active Outlet:	
Spec. Conductance:	251 µS/cm
pH:	7.9
Calculated Volume:	1.5 million gallons
Permittable Volume:	0.7 million gallons

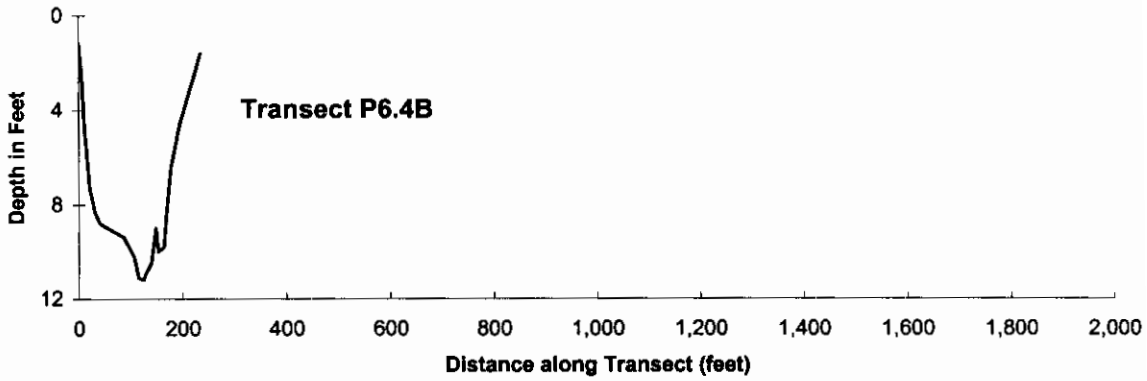
Water Quality:

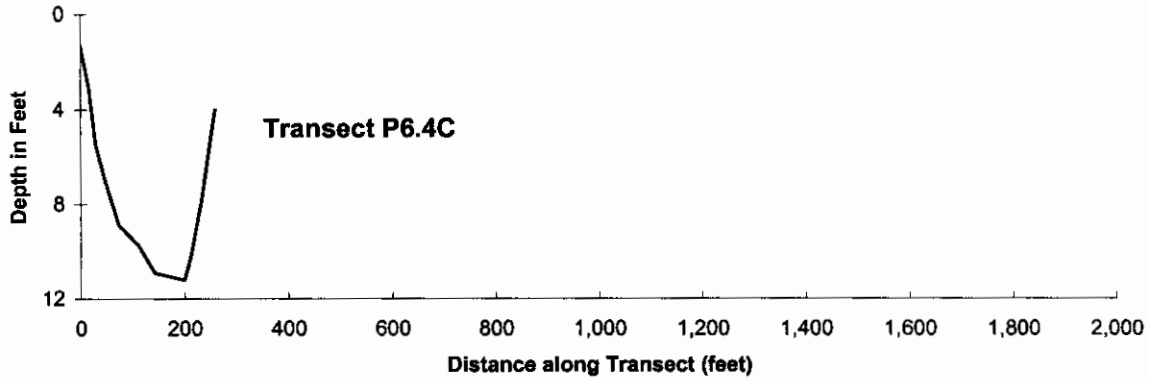
Year of Test	Chloride (mg/l)	Sodium (mg/l)	Calcium (mg/l)	Magnesium (mg/l	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Source
1999	47.7	18.1	15.2	9.6	77.2	130.0	this study

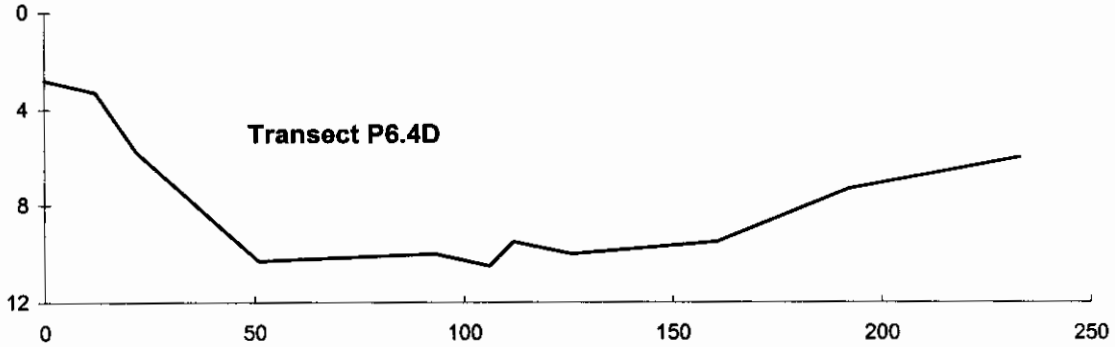
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Aug 1 99	4.5	None	0
	Aug 2 99	5.0	None	0

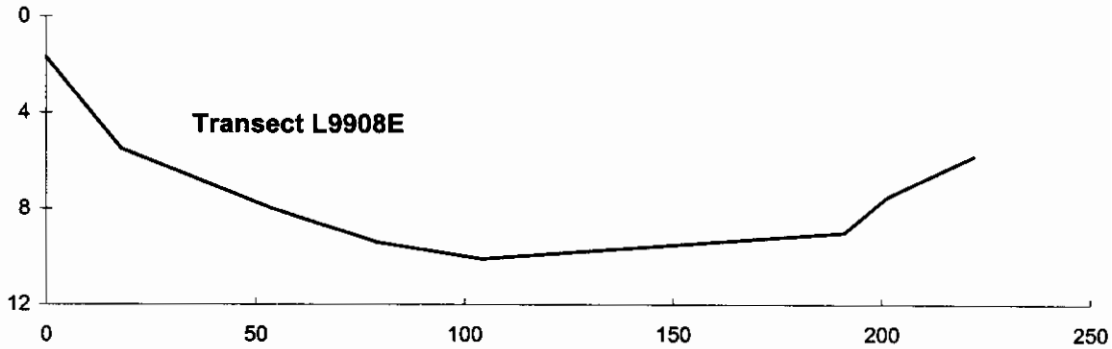








last revised 2/14/01


Transect L9908E
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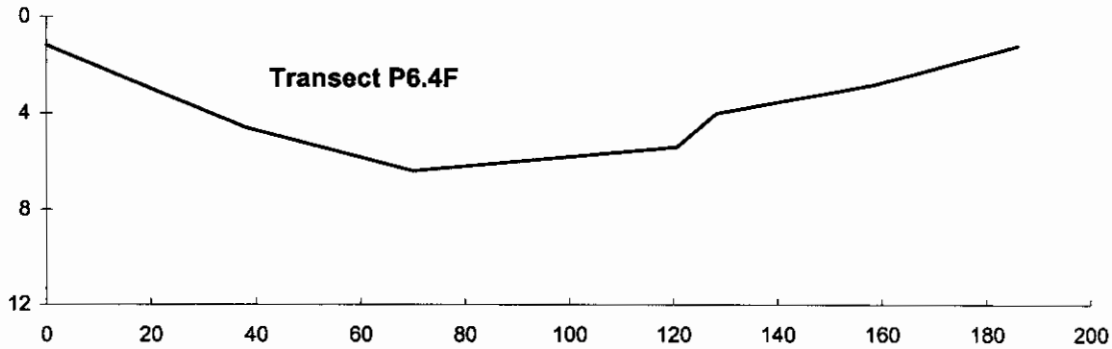
4
8
12
0
50
100
150
200
250


Transect P6.4F
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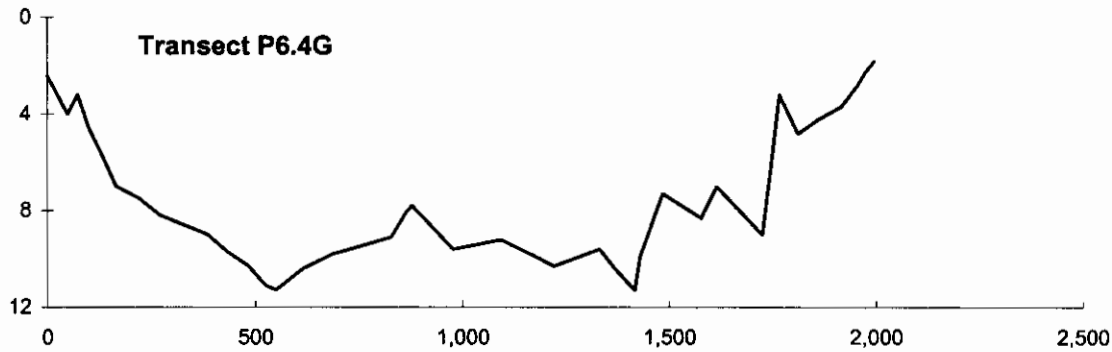
8
12
0
20
40
60
80
100
120
140
160
180
200


Transect P6.4G
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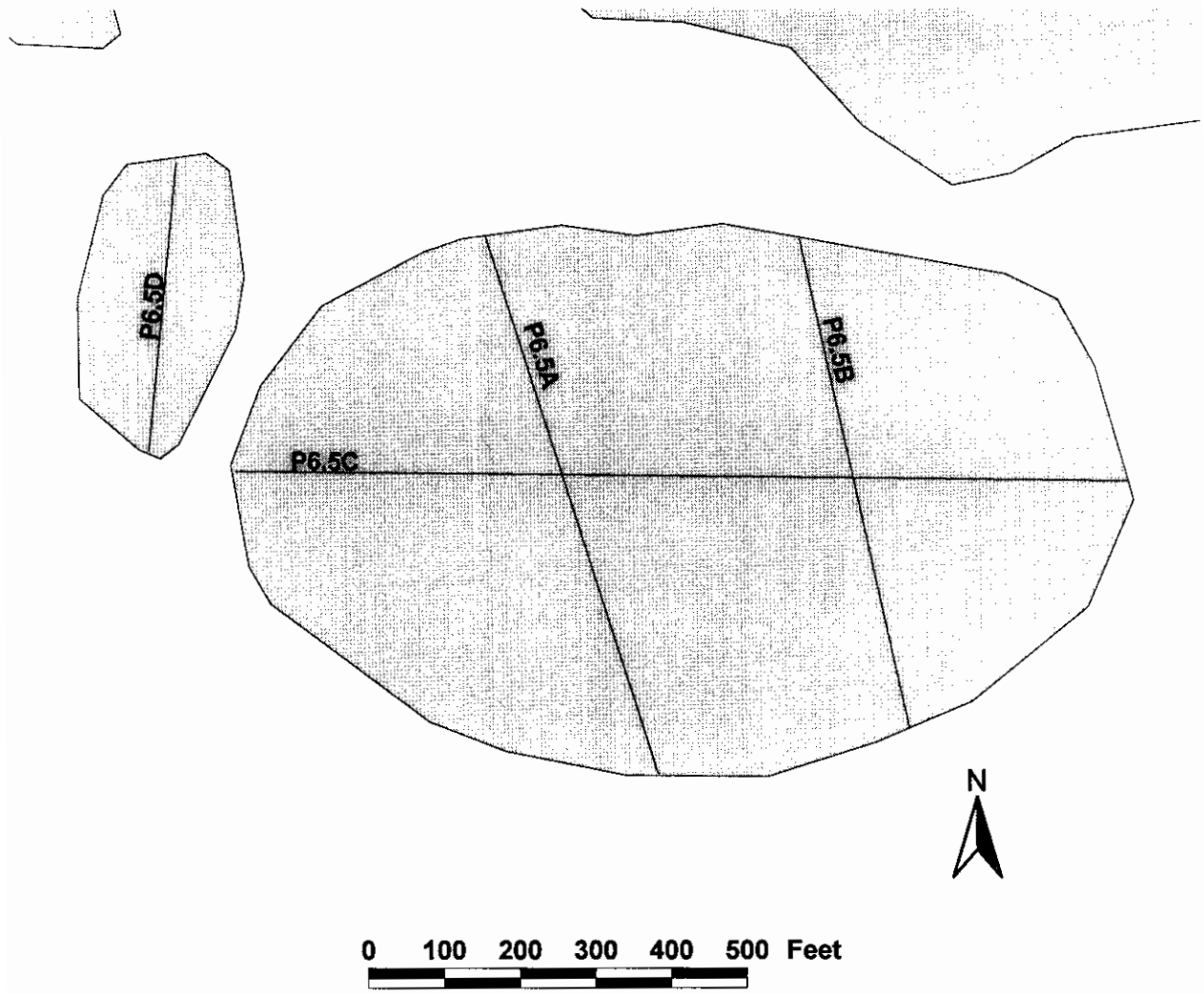
4
8
12
0
500
1,000
1,500
2,000
2,500

P6.5



Lake P6.5

Other Names:	L9906
Location:	70°24.00'N 150°55.09'W
USGS Quad Sheet:	Harrison Bay B-2: T12N R5E Sect. 17
Habitat:	Perched Lake (Frequent Flooding)
Area:	15 acres
Maximum Depth:	13 feet
Active Outlet:	
Spec. Conductance:	416 µS/cm
pH:	8.0
Calculated Volume:	20.6 million gallons
Permittable Volume:	1.4 million gallons

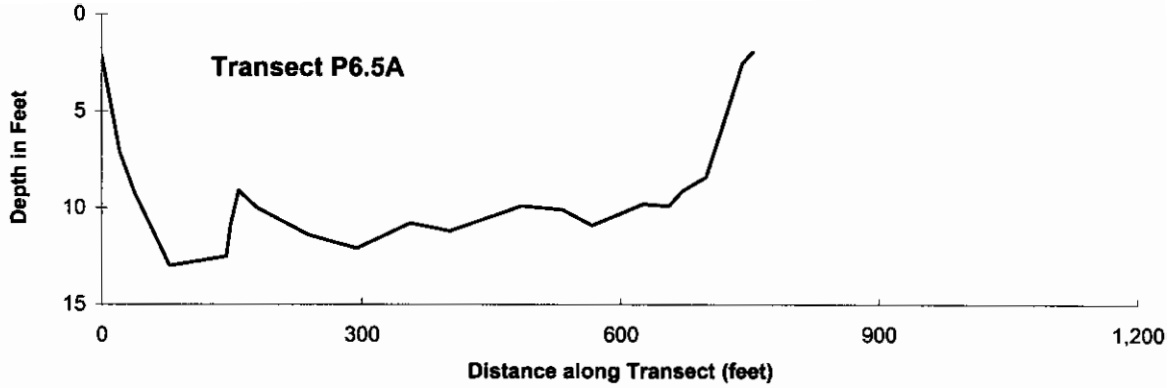
Water Quality:

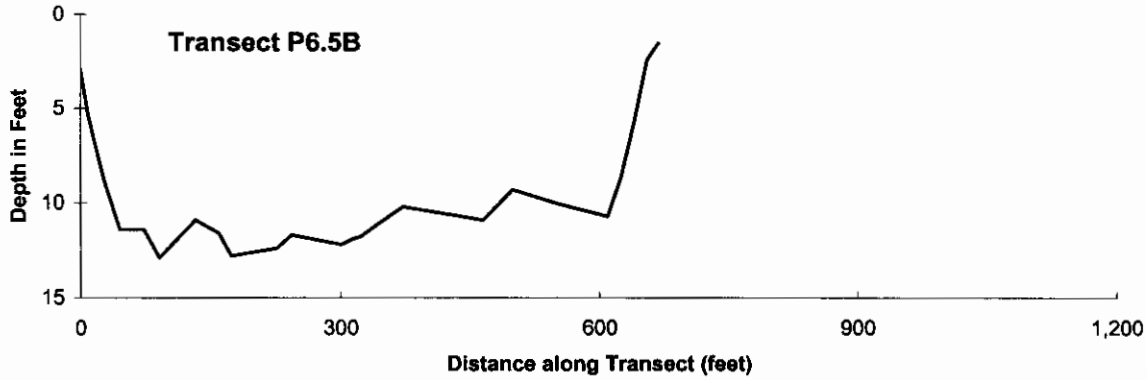
Year of Test	Chloride (mg/l)	Sodium (mg/l)	Calcium (mg/l)	Magnesium (mg/l	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Source
1999	97.4	48.8	14.5	12.1	85.9	238.0	this study

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Aug 2 99	2.2	Broad whitefish	1	553
			Least cisco	4	351-406

last revised 2/14/01


Transect P6.5A
Depth in Feet
0
5
10
15
0
300
600
900
1,200
Distance along Transect (feet)


Transect P6.5B
Depth in Feet
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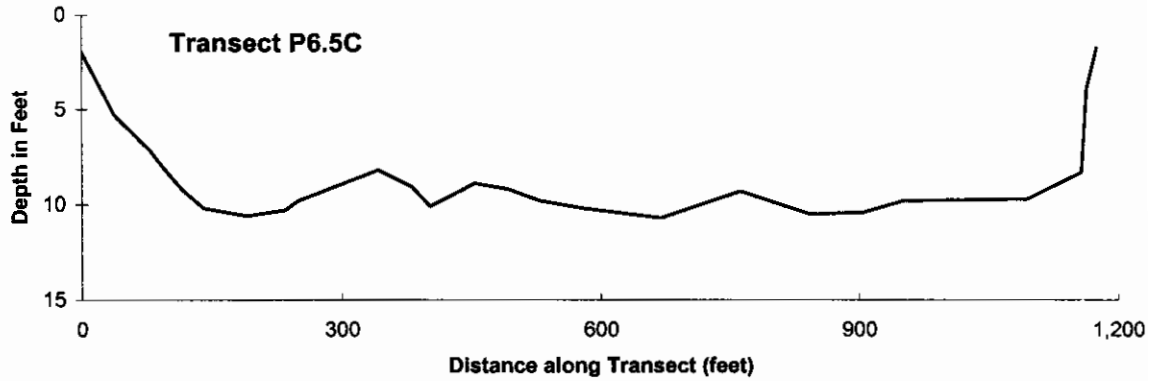
5
10
15
0
300
600
900
1,200
Distance along Transect (feet)


Transect P6.5C
Depth in Feet
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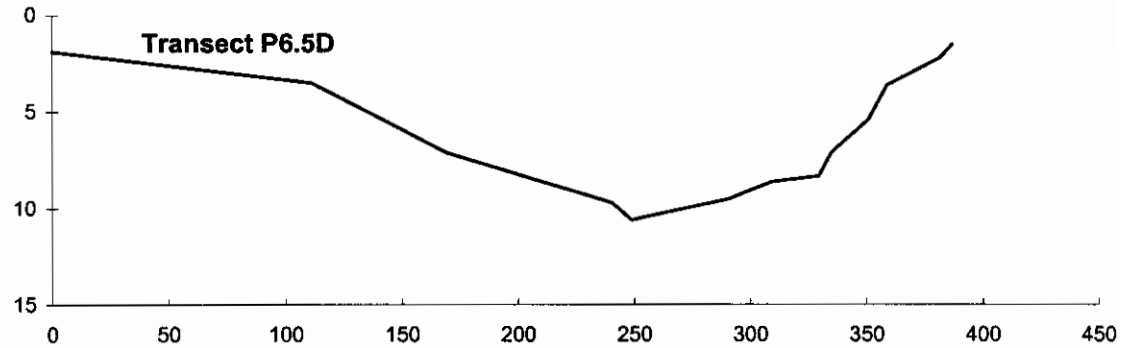
5
10
15
0
300
600
900
1,200
Distance along Transect (feet)


Transect P6.5D
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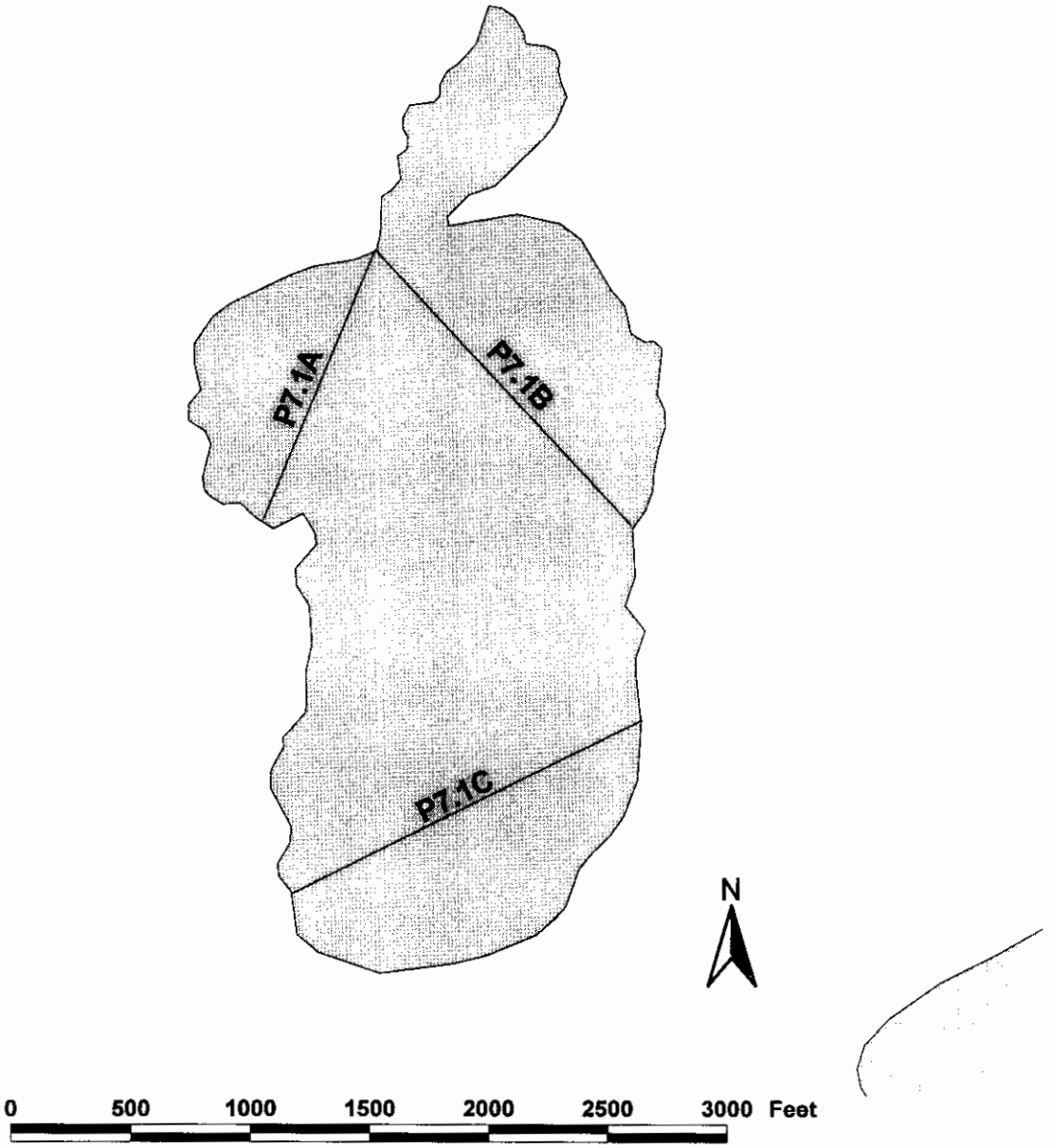
50
100
150
200
250
300
350
400
450

P7.1



Lake P7.1

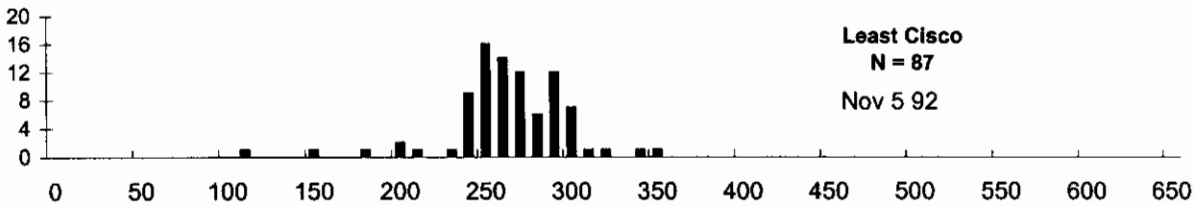
Other Names:	L9108; M9212
Location:	70°24.94'N 150°51.49'W
USGS Quad Sheet:	Harrison Bay B-2: T12N R5E, Sect 10
Habitat:	Perched Lake (Infrequent Flooding)
Area:	112 acres
Maximum Depth:	17.1 feet
Active Outlet:	No
Spec. Conductance:	1,405 µS/cm
pH:	8.1
Calculated Volume:	206.3 million gallons
Permittable Volume:	18.3 million gallons

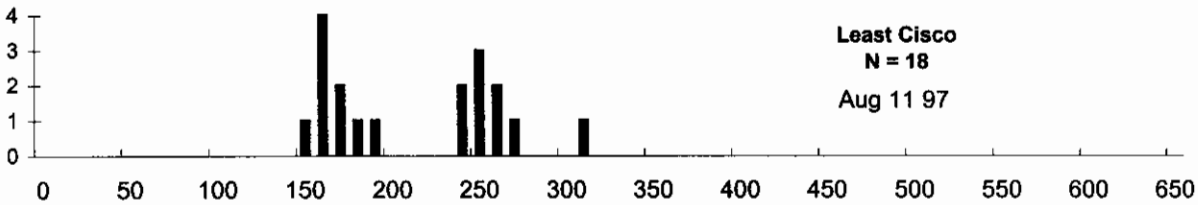
Water Quality:

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
1991	360	200.0	26	23	164	700	J. Lobdell
1998	427	218.0	31.1	29.2	201	800	

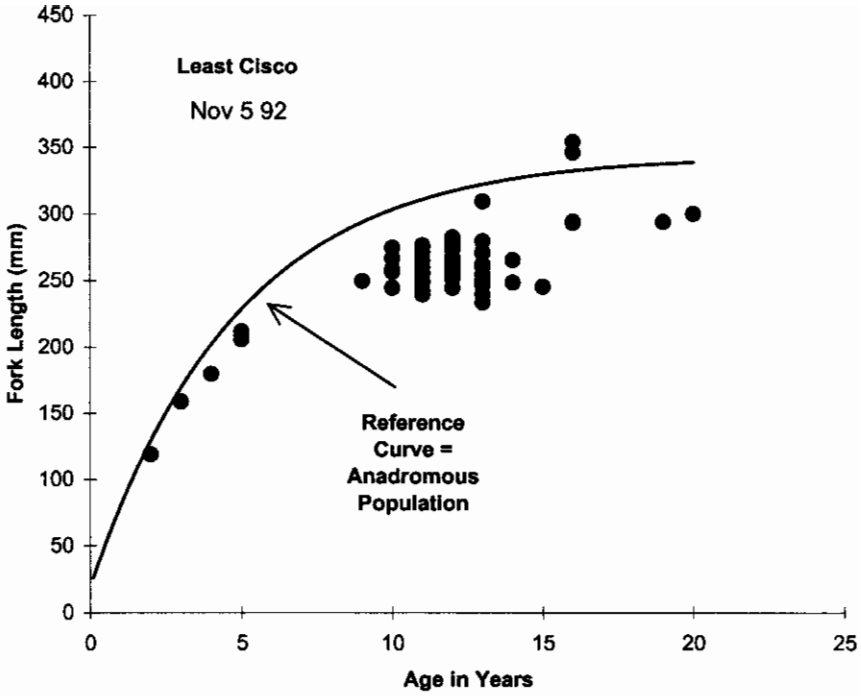
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Nov 5 92	20.0	Least cisco	87	119-355
Gill Net	Aug 11 97	4.7	Least cisco	18	158-316
Minnow Trap	Aug 11 97	12.7	None	0	

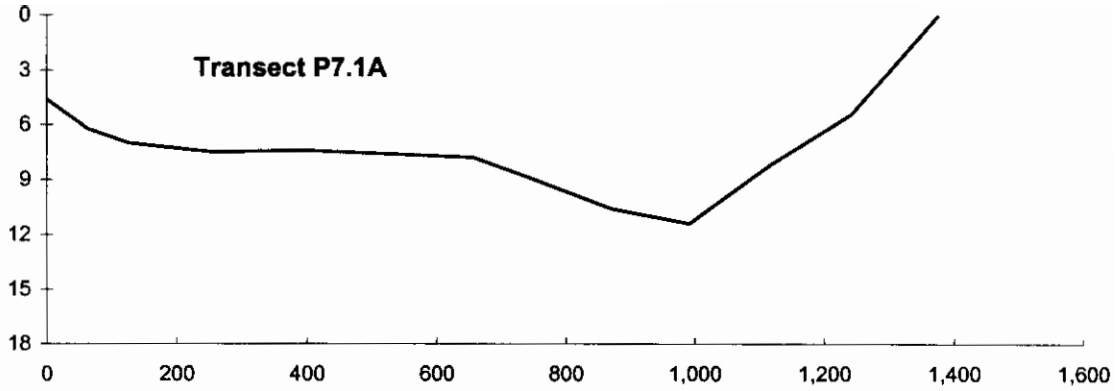




last revised 2/14/01



last revised 2/14/01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800
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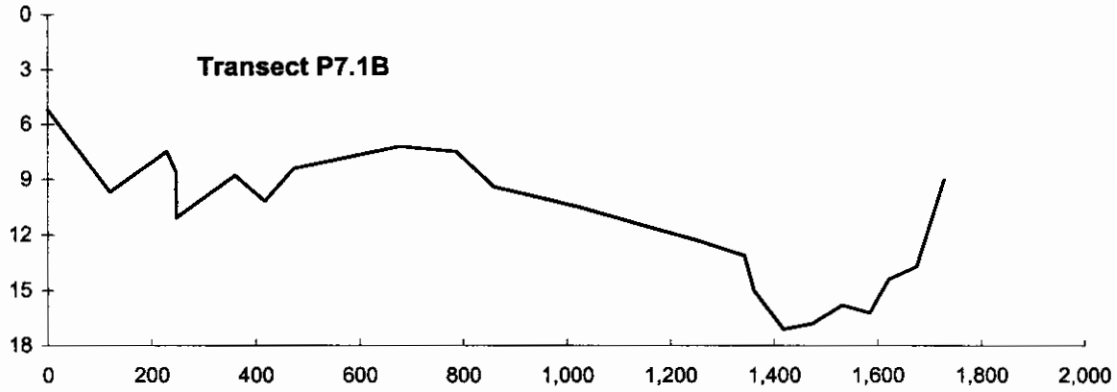
1,600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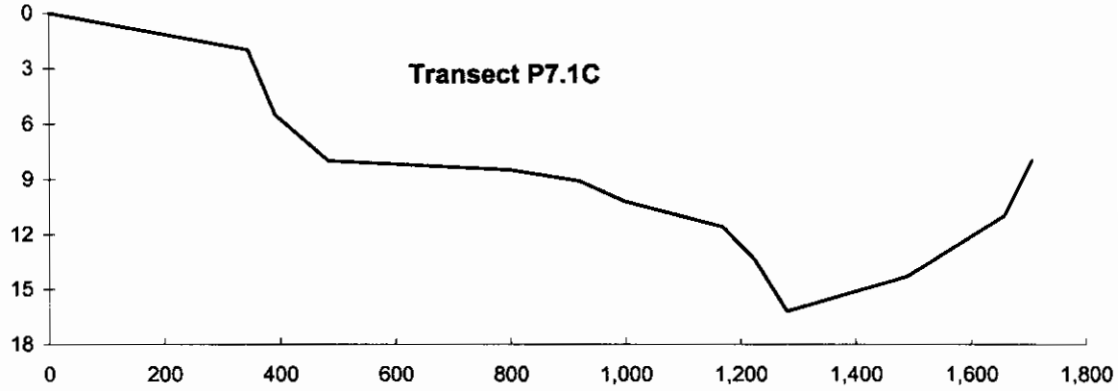
1,800
2,000


Transect P7.1C
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800
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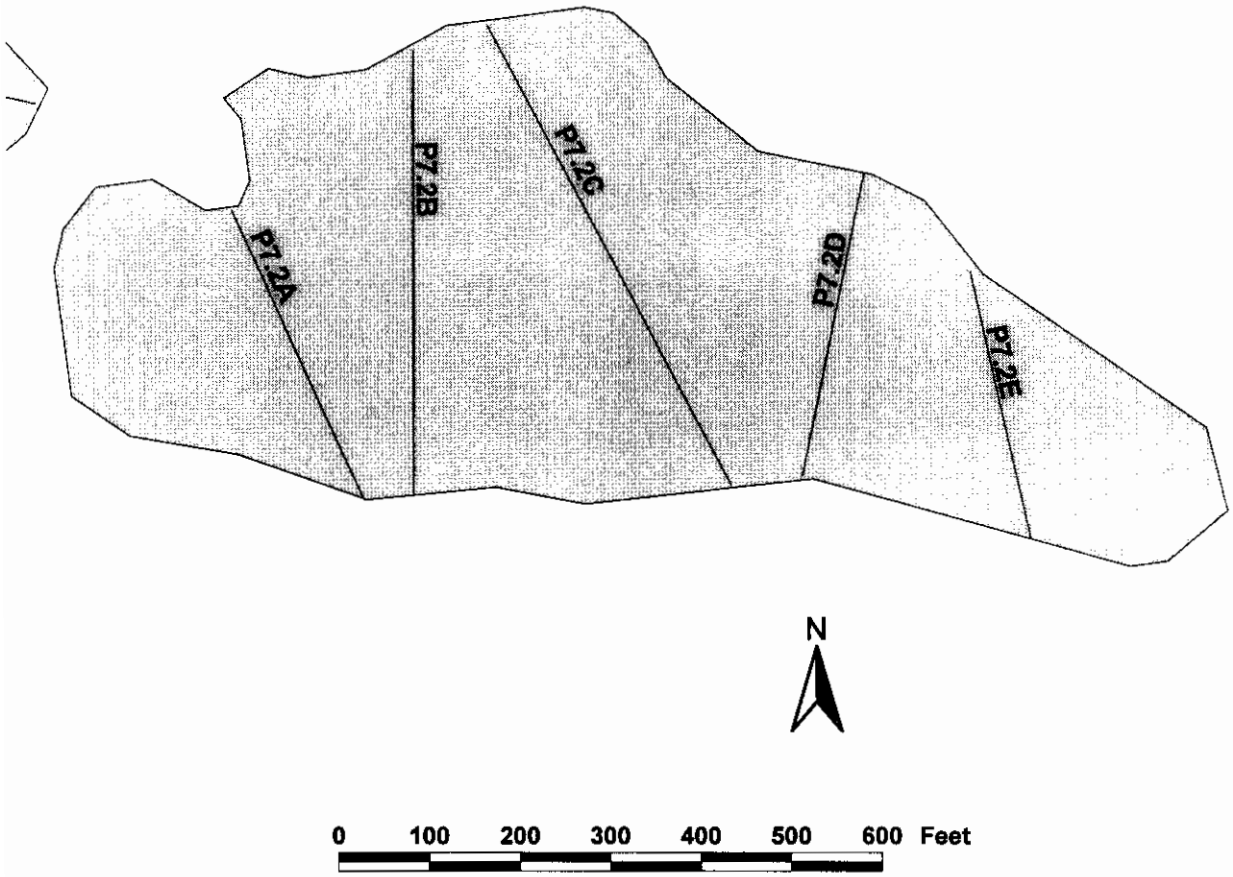
1,600
1,800

P7.2



Lake P7.2

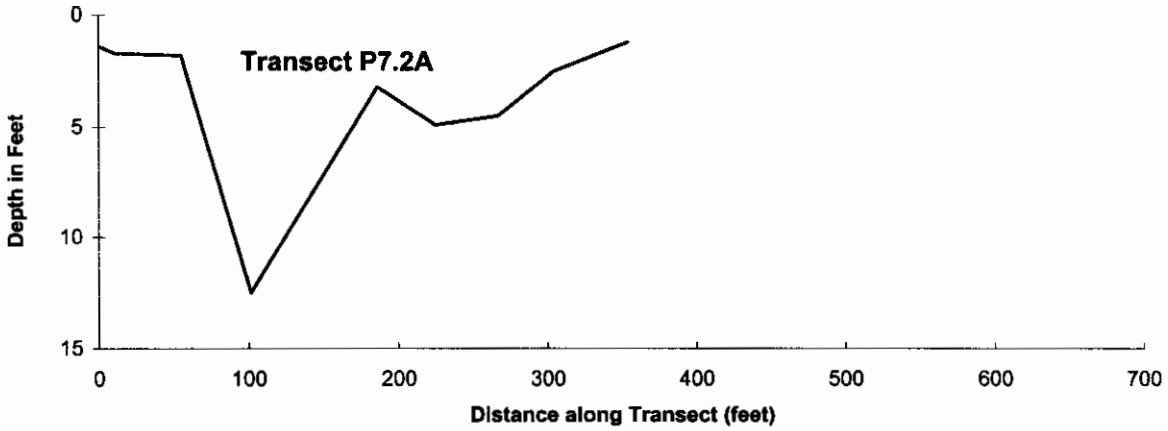
Other Names:	L9907
Location:	70°24.10'N 150°53.95'W
USGS Quad Sheet:	Harrison Bay B-2: T12N R5E Sect. 9
Habitat:	Perched Lake (Frequent Flooding?)
Area:	11 acres
Maximum Depth:	10.1 feet
Active Outlet:	
Spec. Conductance:	264 µS/cm
pH:	8.0
Calculated Volume:	12.1 million gallons
Permittable Volume:	0.6 million gallons

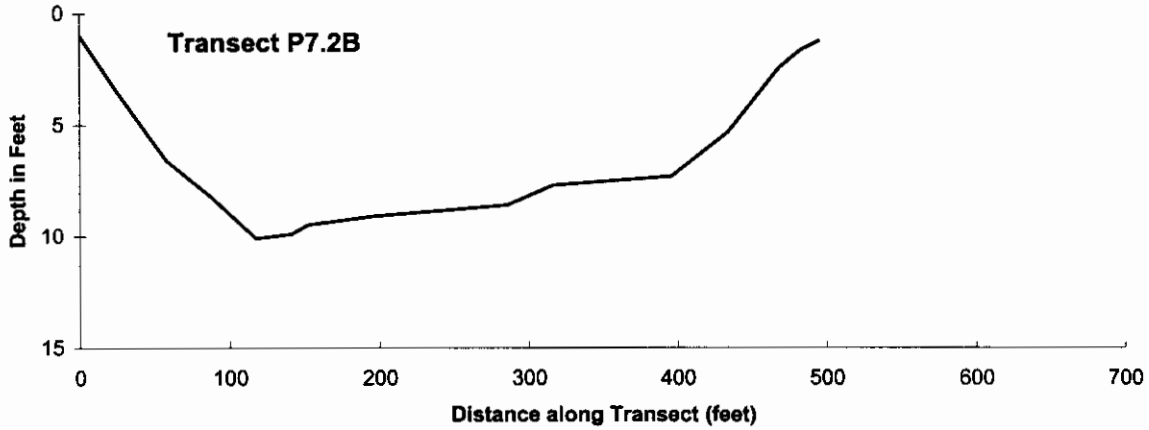
Water Quality:

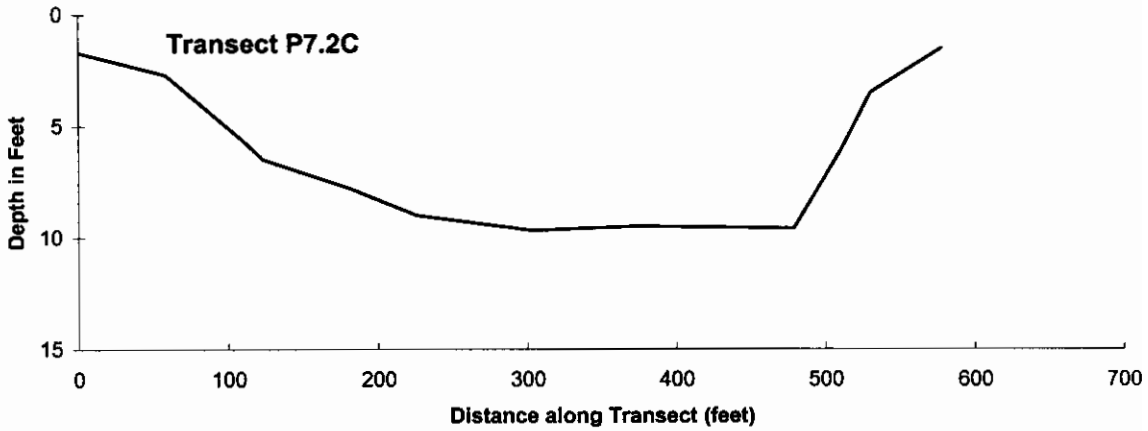
Year of Test	Chloride (mg/l)	Sodium (mg/l)	Calcium (mg/l)	Magnesium (mg/l	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Source
1999	36.2	16.2	16.7	11.5	89.1	128.0	this study

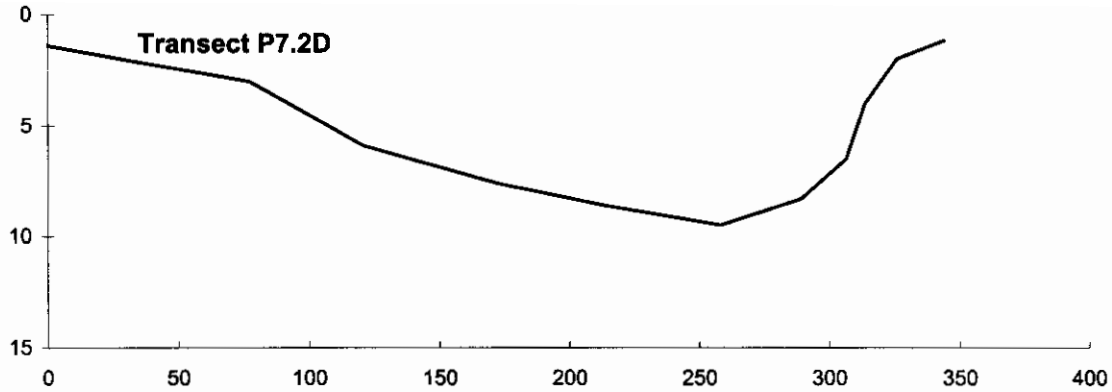
Catch Record:

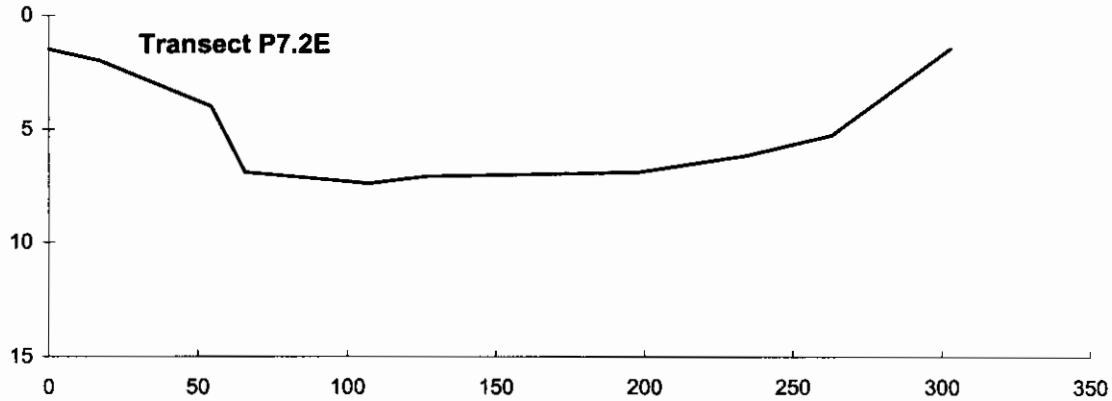
Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Aug 1 99	4.7	None	0
	Aug 2 99	5.0	None	0


Transect P7.2A
Depth in Feet
0
5
10
15
0
100
200
300
400
500
600
700
Distance along Transect (feet)

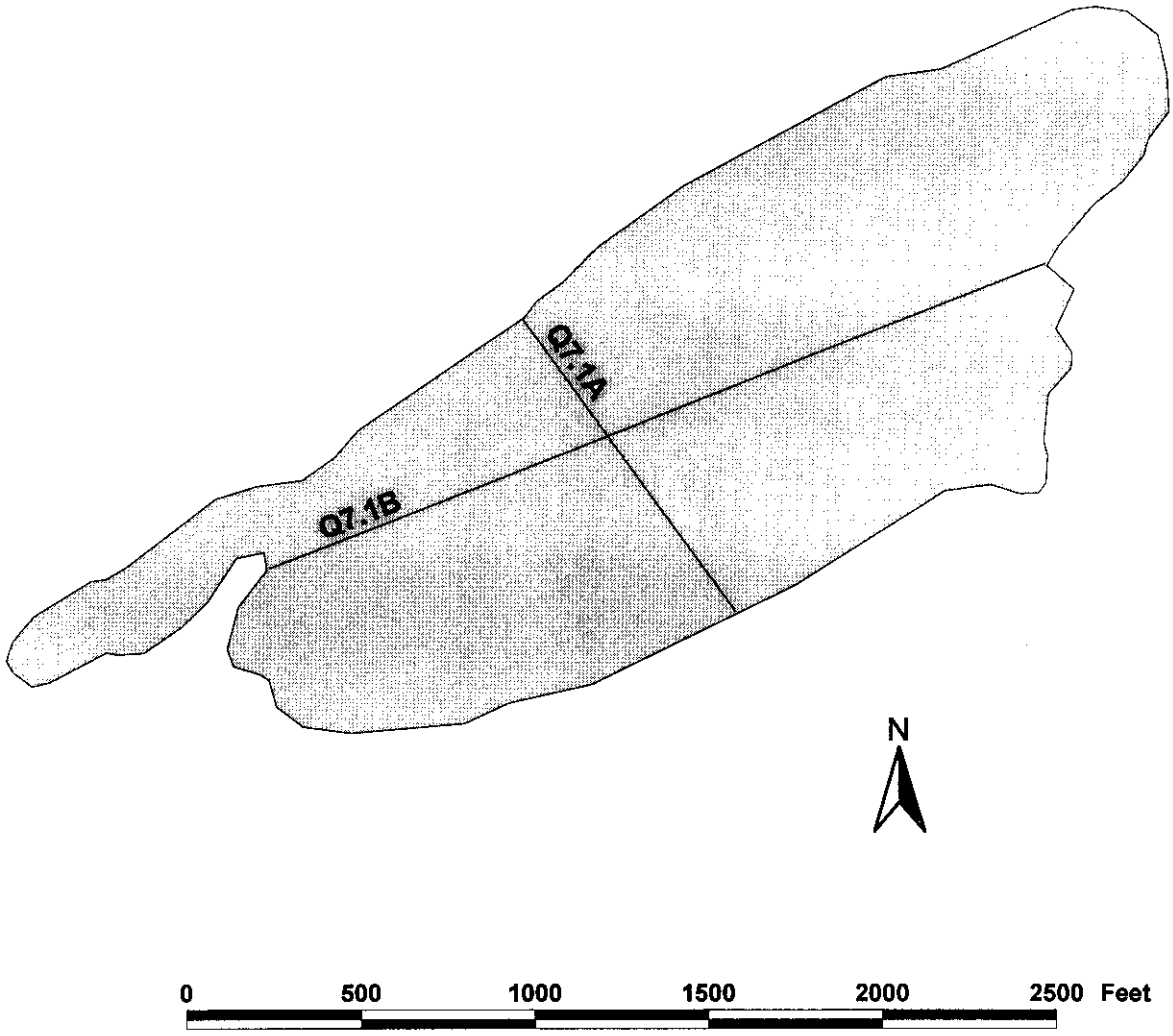

Transect P7.2B
Depth in Feet
0
5
10
15
0
100
200
300
400
500
600
700
Distance along Transect (feet)


Transect P7.2C
Depth in Feet
0
5
10
15
0
100
200
300
400
500
600
700
Distance along Transect (feet)


Transect P7.2D
0
5
10
15
0
50
100
150
200
250
300
350
400


Transect P7.2E
0
5
10
15
0
50
100
150
200
250
300
350

Q7.1

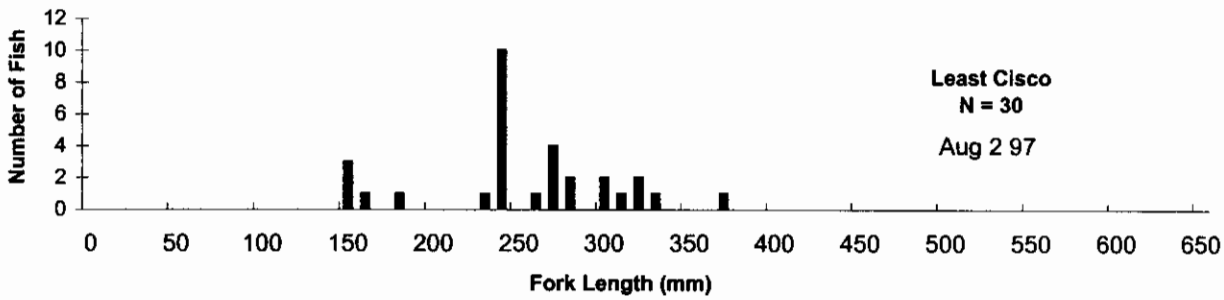


Lake Q7.1

Other Names:	M9709
Location:	70°23.13'N 150°53.80'W
USGS Quad Sheet:	Harrison Bay B-2: T12N R5E, Sect 21
Habitat:	Perched Lake (Infrequent Flooding)
Area:	65 acres
Maximum Depth:	18.9 feet
Active Outlet:	No
Spec. Conductance:	302 µS/cm
pH:	7.8
Calculated Volume:	131.2 million gallons
Permittable Volume:	12.4 million gallons

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gillnet	Aug 2 97	6.5	Least cisco	30	153-371
Minnow Trap	Aug 2 97	12.3	None	0	



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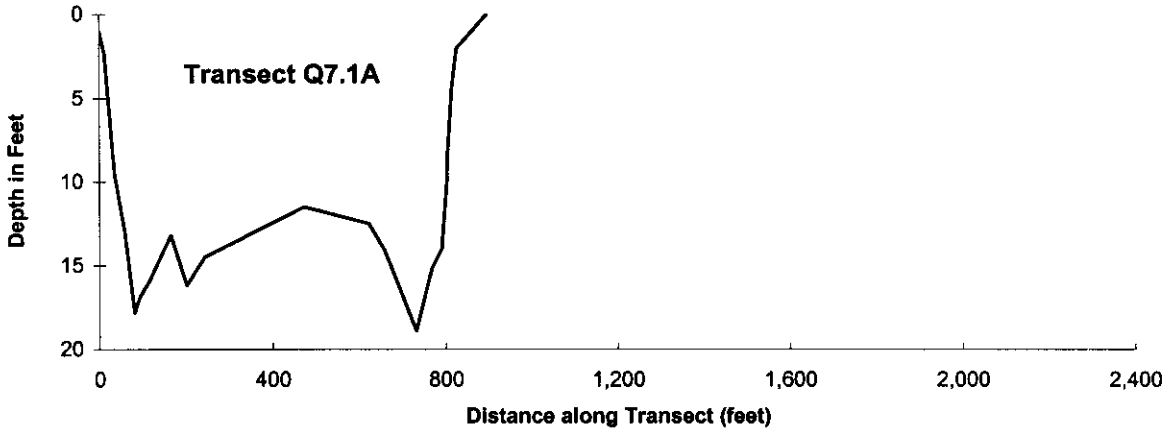
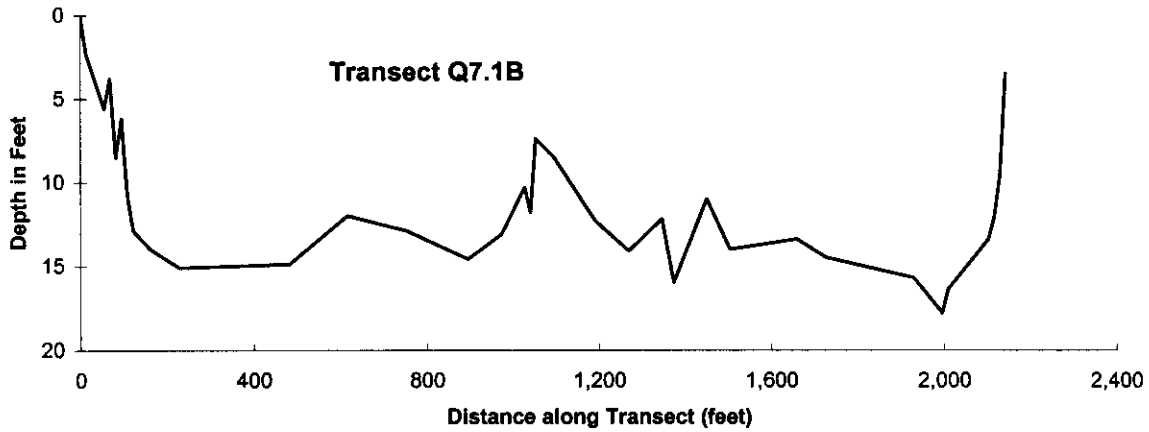
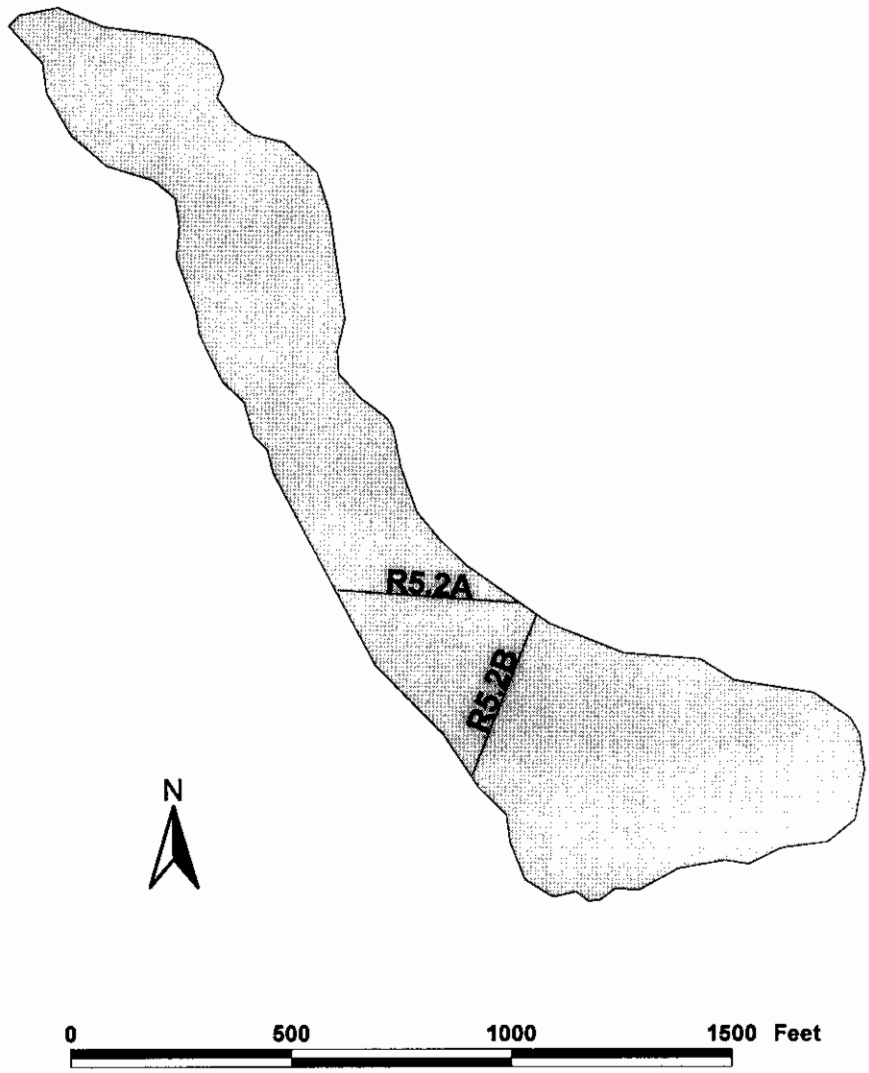

Transect Q7.1A
Depth in Feet
0
5
10
15
20
0
400
800
1,200
1,600
2,000
2,400
Distance along Transect (feet)


Transect Q7.1B
Depth in Feet
0
5
10
15
20
0
400
800
1,200
1,600
2,000
2,400
Distance along Transect (feet)

R5.2

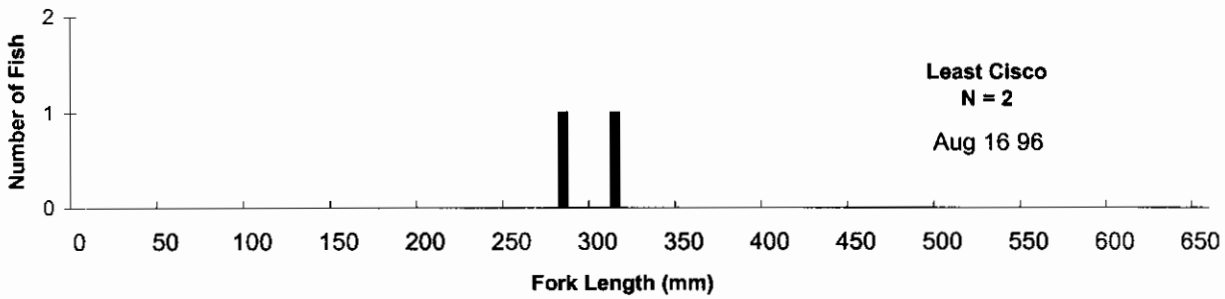


Lake R5.2

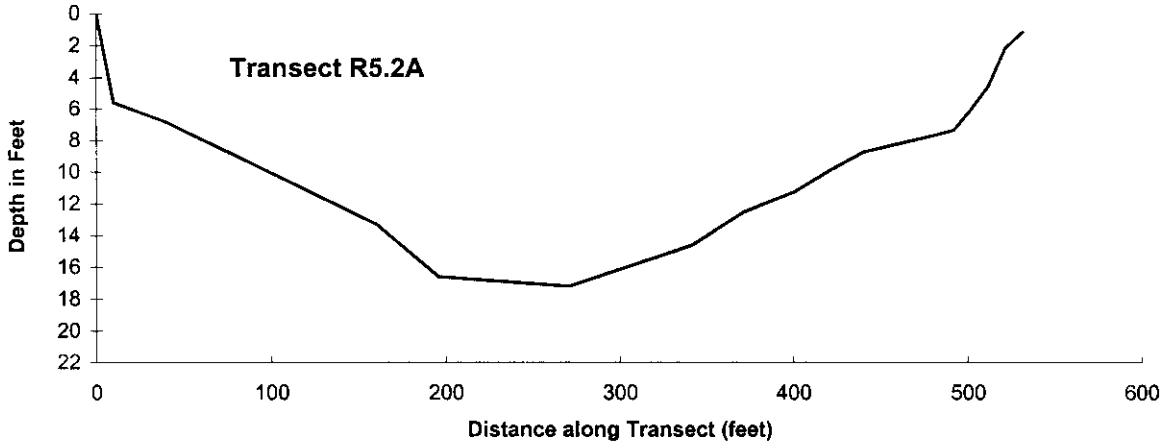
Other Names:	M9626
Location:	70°22.86'N 150°57.24'W
USGS Quad Sheet:	Harrison Bay B-2: T12N R5E, Sect 19
Habitat:	Perched Lake (Infrequent Flooding)
Area:	20 acres
Maximum Depth:	20.3 feet
Active Outlet:	No
Spec. Conductance:	246 µS/cm
Calculated Volume:	43.8 million gallons
Permittable Volume:	4.3 million gallons

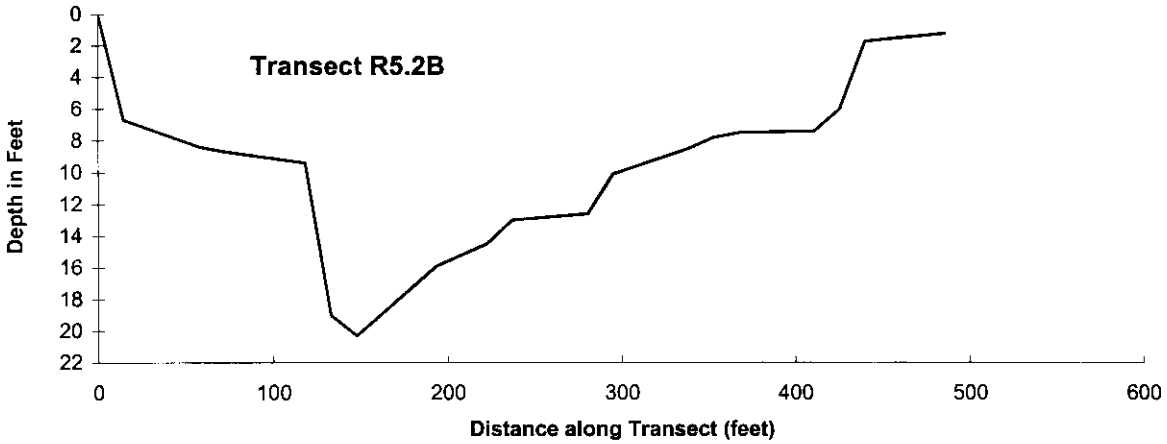
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Aug 16 96	8.0	Least cisco	2	280, 312

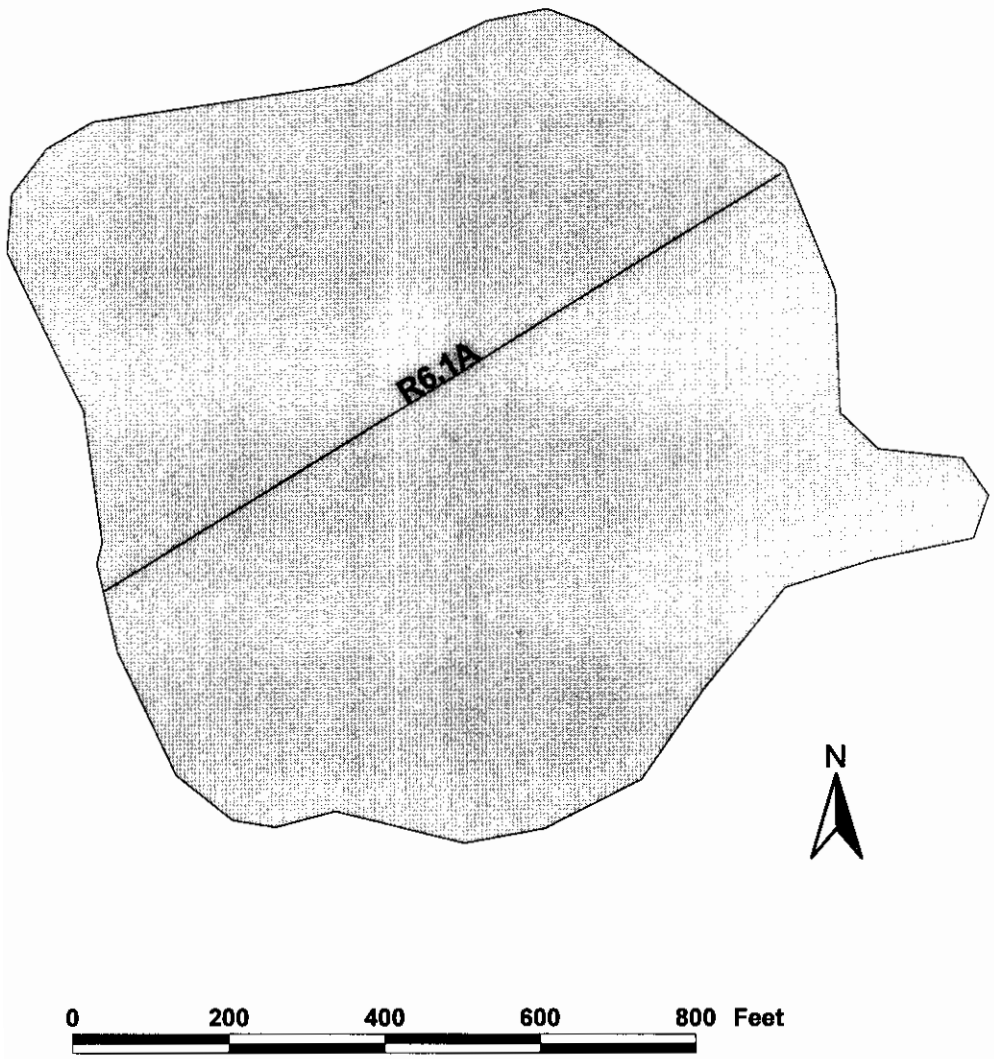


last revised 2/14/01


Transect R5.2A
Depth in Feet
0
2
4
6
8
10
12
14
16
18
20
22
0
100
200
300
400
500
600
Distance along Transect (feet)


Transect R5.2B
Depth in Feet
0
2
4
6
8
10
12
14
16
18
20
22
0
100
200
300
400
500
600
Distance along Transect (feet)

R6.1

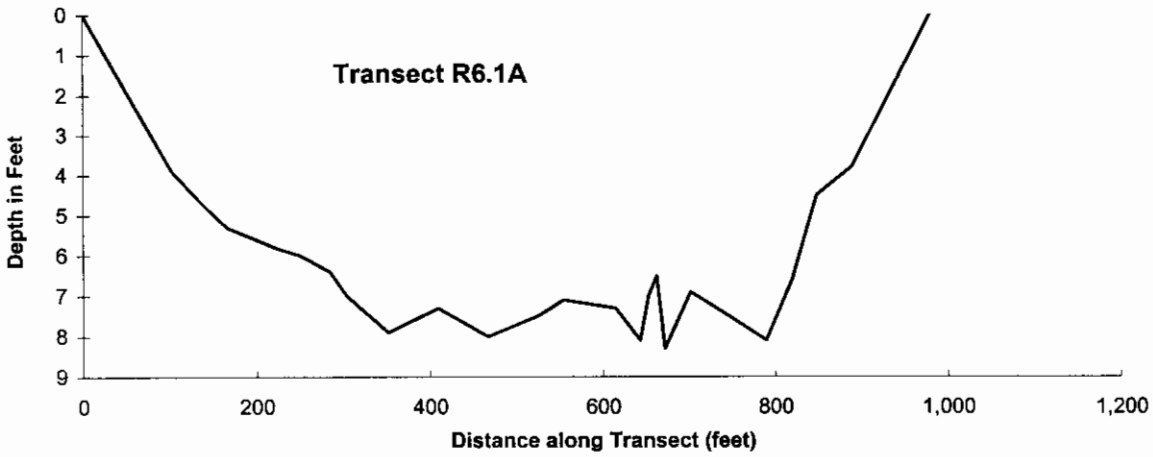


Lake R6.1

Other Names:	M9522
Location:	70°22.19'N 150°55.21'W
USGS Quad Sheet:	Harrison Bay B-2: T12N R5E, Sect 29
Habitat:	Perched Lake (Frequent Flooding)
Area:	20 acres
Maximum Depth:	9.0 feet
Active Outlet:	No
Spec. Conductance:	4,290 µS/cm
Calculated Volume:	19.3 million gallons
Permittable Volume:	No fish concern

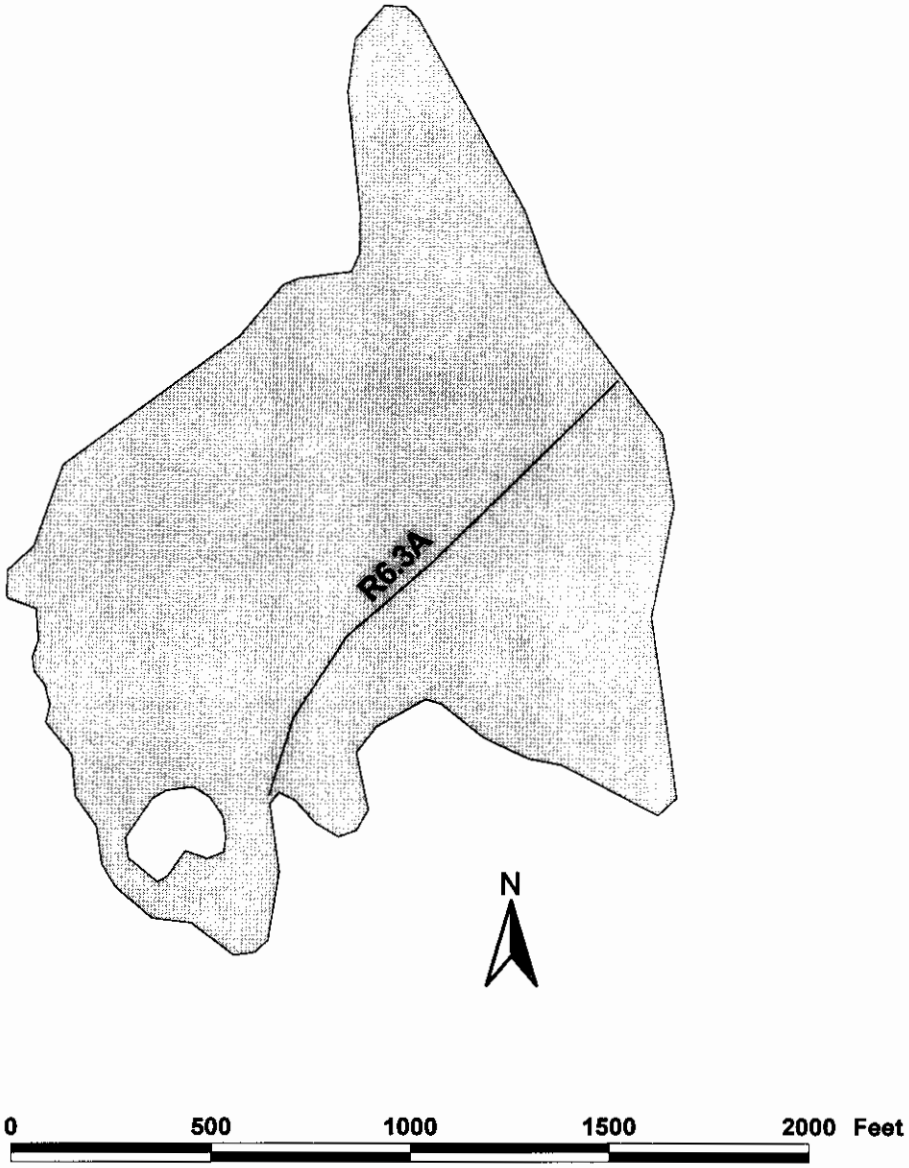
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Aug 3 96	11.2	None	0



last revised 2/14/01

R6.3



Lake R6.3

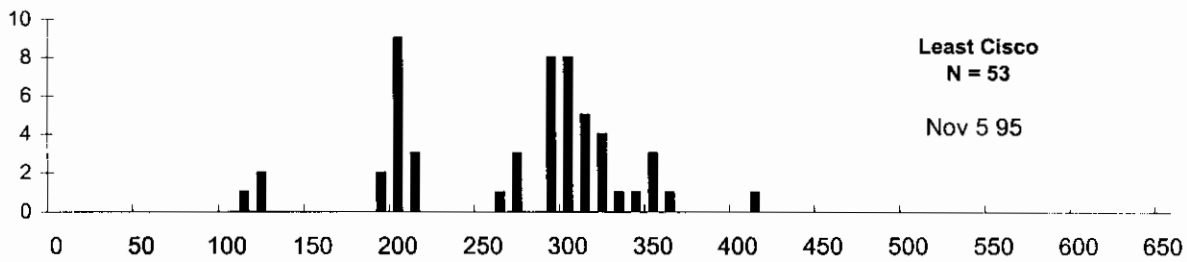
Other Names:	L9281
Location:	70°22.43'N 150°56.56'W
USGS Quad Sheet:	Harrison Bay B-2: T12N R5E, Sect 20
Habitat:	Perched Lake (Infrequent Flooding)
Area:	44 acres
Maximum Depth:	13.5 feet
Active Outlet:	No
Spec. Conductance:	346 µS/cm
Calculated Volume:	63.5 million gallons
Permittable Volume:	4.6 million 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	90	3.6	8.5	11	62	280	J. Lobdell

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Fyke Net	Jul 11 95	25.6	9spine stickleback	560	
Fyke Net	Jul 27 95	21.0	9spine stickleback	4	
Fyke Net	Jul 28 95	21.1	9spine stickleback	5	
Minnow Trap	Jul 11 95	42.4	Alaska blackfish	1	
			9spine stickleback	1	
Set Line	Jul 11 95	26.3	None	0	
Gill Net	Nov 5 95	21.0	Least cisco	53	116-417
			Alaska blackfish	2	100, 100



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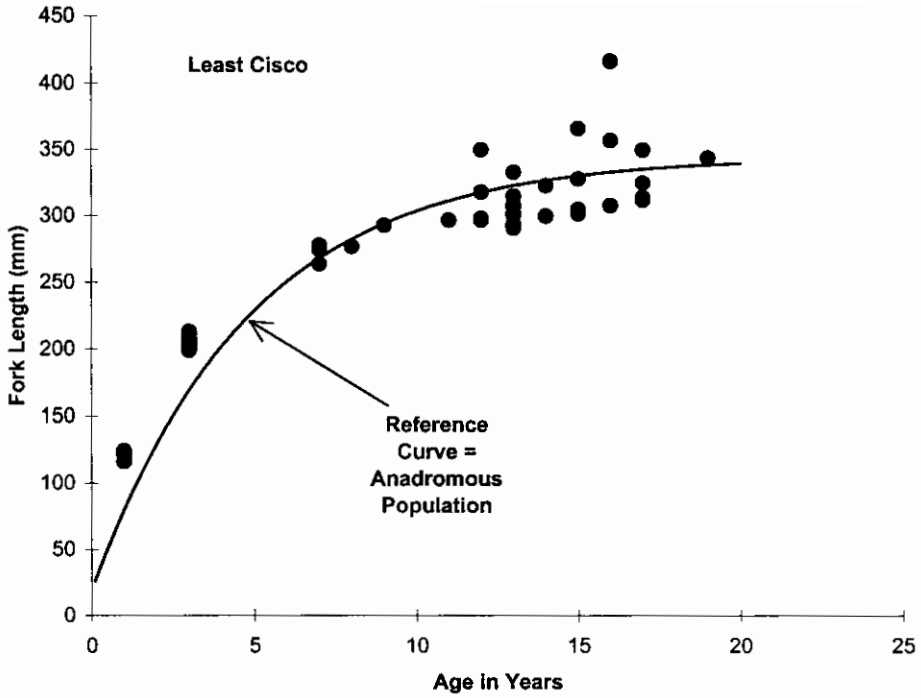
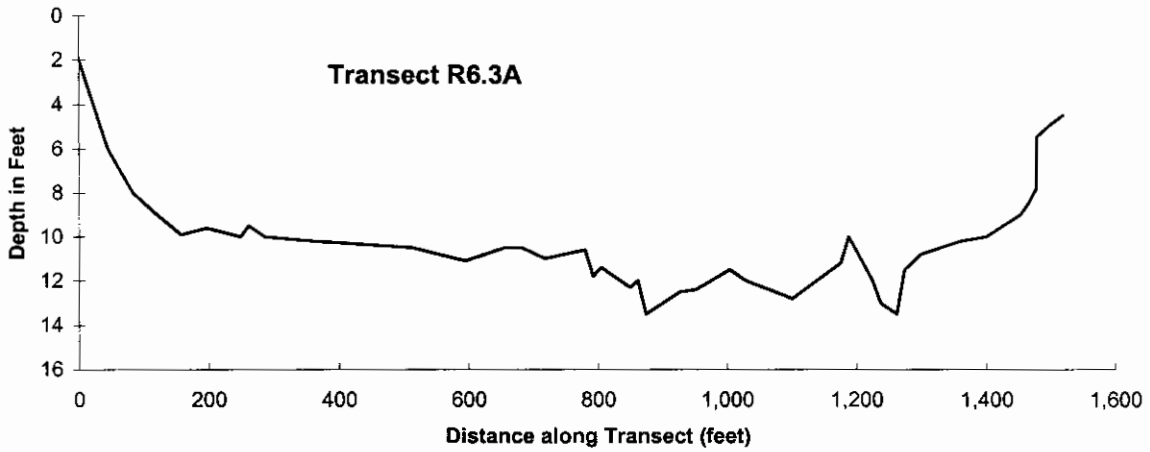
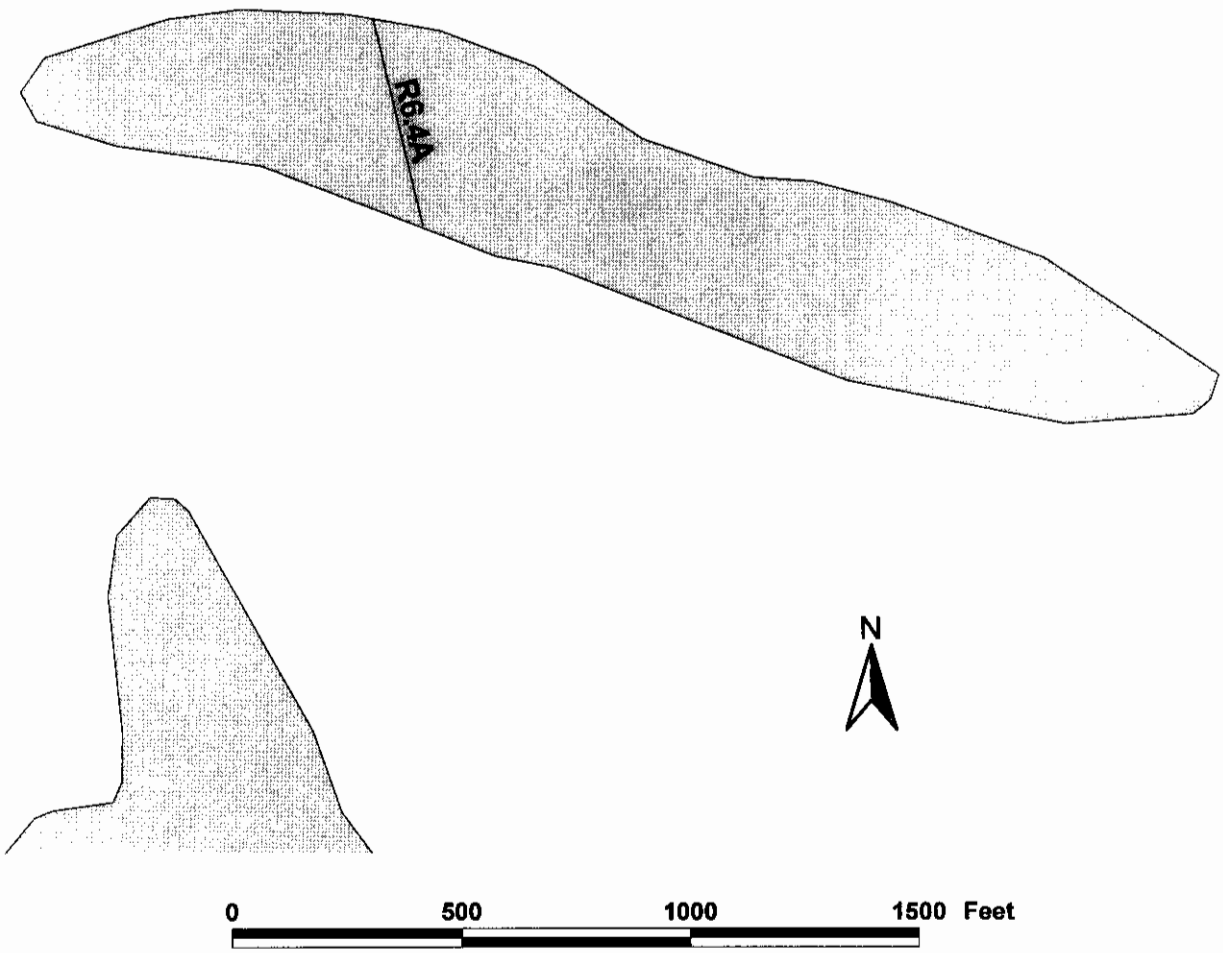

Least Cisco
Fork Length (mm)
Age in Years
Reference Curve = Anadromous Population
0
50
100
150
200
250
300
350
400
450
0
5
10
15
20
25


Transect R6.3A
Depth in Feet
Distance along Transect (feet)
0
2
4
6
8
10
12
14
16
0
200
400
600
800
1,000
1,200
1,400
1,600

R6.4

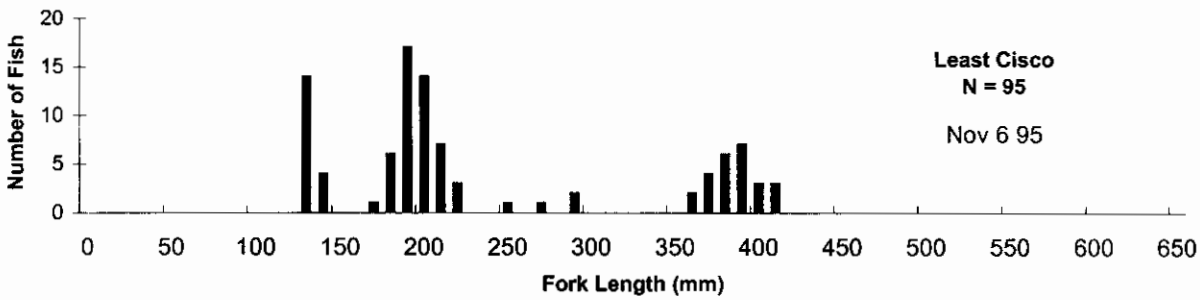


Lake R6.4

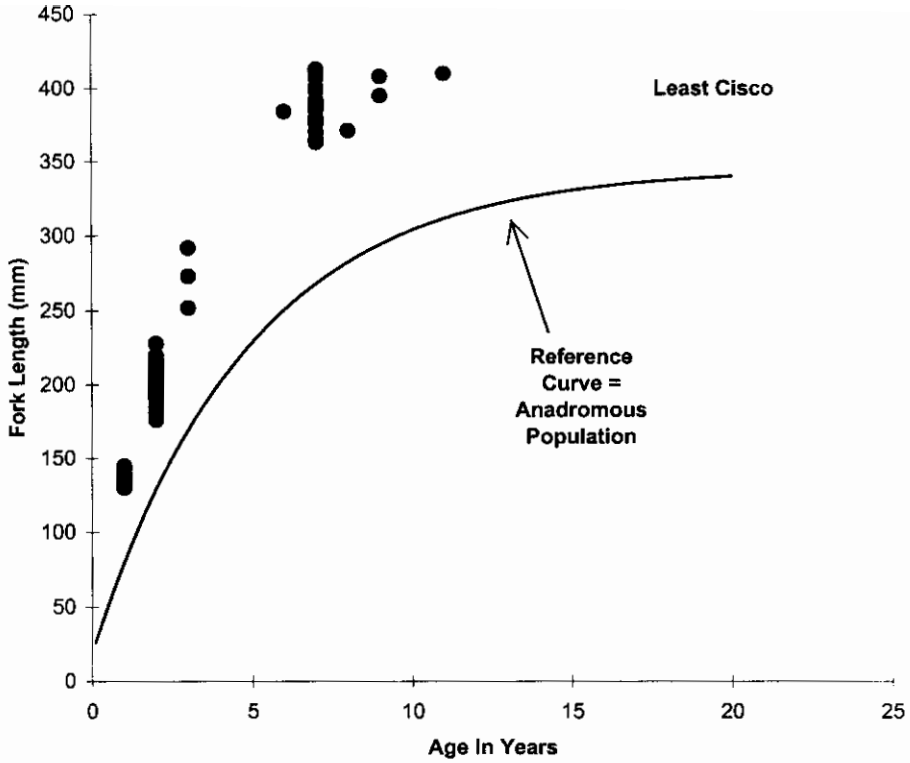
Other Names:	M9321
Location:	70°22.74'N 150°55.95'W
USGS Quad Sheet:	Harrison Bay B-2: T12N R5E, Sect 20
Habitat:	Perched Lake (Infrequent Flooding)
Area:	21 acres
Maximum Depth:	11.7 feet
Active Outlet:	No
Spec. Conductance:	146 µS/cm
Calculated Volume:	26.2 million gallons
Permittable Volume:	1.6 million gallons

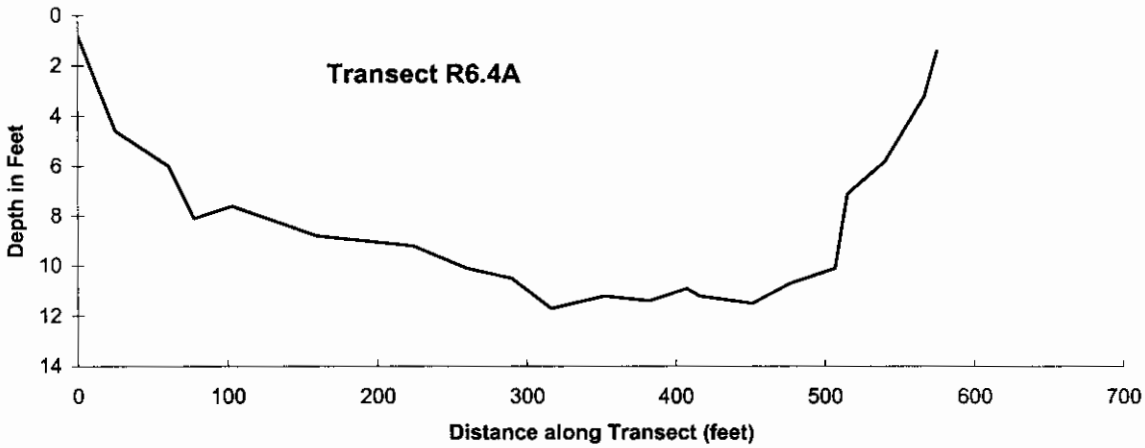
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Fyke Net	Jul 17 95	21.4	9spine stickleback	220	
Minnow Trap	Jul 17 95	44.3	None	0	
Set Line	Jul 17 95	22.1	None	0	
Gill Net	Nov 6 95	23.1	Least cisco	96	130-413



last revised 2/14/01


Least Cisco
Reference Curve = Anadromous Population
Fork Length (mm)
Age In Years
0
50
100
150
200
250
300
350
400
450
0
5
10
15
20
25


Transect R6.4A
Depth in Feet
Distance along Transect (feet)
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2
4
6
8
10
12
14
0
100
200
300
400
500
600
700