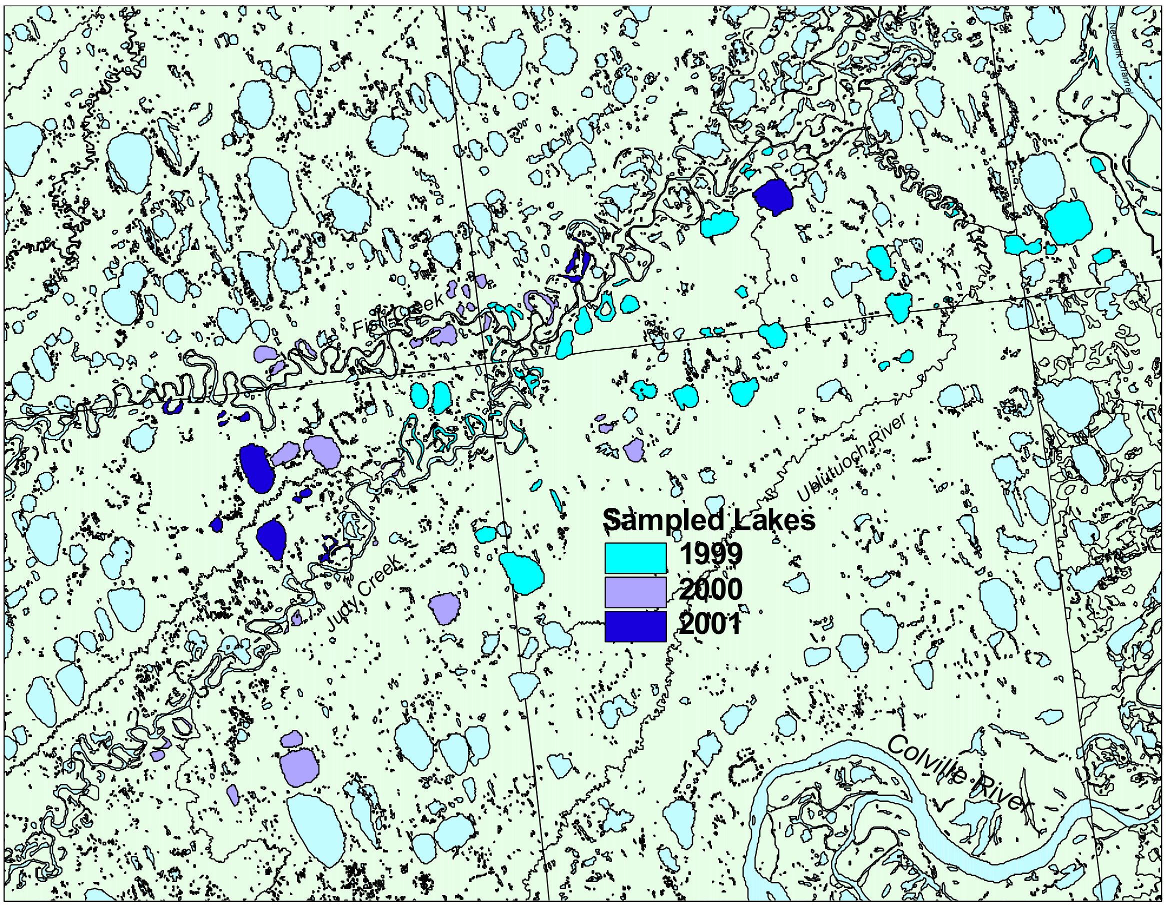
FISH UTILIZATION OF LAKES IN EASTERN NPR-A: 1999-2001

Final Data Report

December 2001



Prepared by:

MJM Research
1012 Shoreland Drive
Lopez Island, WA

Prepared for:

Phillips Alaska, Inc.
700 G Street
Anchorage, AK

FISH UTILIZATION OF LAKES IN EASTERN NPR-A: 1999-2001

Final Data Report

December 2001

MJM Research
1012 Shoreland Drive
Lopez Island, WA 98261

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Index to Lake Summaries

INTRODUCTION

Phillips Alaska Inc. has been exploring for oil within the eastern portion of the National Petroleum Reserve–Alaska (NPR-A) since the winter of 1999/2000. Exploration includes crossing rivers and lakes with ice roads and withdrawal of water from lakes to support both industrial and domestic needs.

During review of exploration, and potentially development, permits, information is required on the biological sensitivity of lakes in the region. The study was designed to provide physical and biological information on these lakes 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 eastern NPR-A lakes. Selected lakes include those that may be used to support exploration. The area surveyed during 1999-2001 lies between the Nechelik Channel of the Colville River and the confluence of Fish and Judy creeks, then continues south along Judy Creek and west along upper Fish Creek (Figure 1).

The 1999-2001 field effort was the first sampling in the eastern NPR-A Exploration Area since 1979 (McElderry and Craig 1981). In that study, the objective was to locate arctic cisco spawning sites in or near the Colville River. Three lakes in NPR-A were sampled, but arctic cisco spawning sites were not located. The sampling identified broad whitefish, least cisco, round whitefish and arctic grayling from the study region. An additional lake was sampled by Netsch et al. (1977), but fish were not caught

The objectives of the survey were to:

1) inventory fish species in the various lakes within the project study areas (sampling areas identified in Figure 1),

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

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

4) measure lake depths to estimate lake volumes, and

5) measure water chemistry parameters to assess suitability of water for potential uses.

The study was confined to lakes within sampling regions identified on Figure 1. The sampling regions are arbitrarily-defined to assist with identifying lake locations. In each year, surveys began after ice melted from the lakes in early July and continued into early August. In summer 2001, lakes investigated were in or near areas in eastern NPR-A scheduled for oil exploration in winter 2001/2002.

The 2001 field effort continued sampling begun in 1999 in the NPR-A Exploration Area (see figures). The NPR-A area lies between the Nechelik Channel of the Colville River and upstream of the confluence of Fish and Judy creeks. Lakes in the area may be needed as sources of freshwater during oil exploration. Permitting decisions on water withdrawal will need to consider potential impacts to fish that depend on an adequate water supply for surviving winter. The inventory of fish and fish habitat provides information for assisting permitting decisions regarding water use and ice road routing. The surveys in lakes consisted of short-duration gill net sampling in July and August.

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

METHODS

The biological survey consisted of sampling with gill nets and minnow traps combined with physical measurements. Lakes were sampled with short-duration gill net sets (typically 4 to 6 hours) 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. The sets were kept to a short duration to minimize the chance for entangling waterfowl and to minimize fish mortality. Since the objective of the gill netting is to document presence/absence, the nets were pulled after fish were detected. Fish captured were measured and released if not severely injured. Duration of each set was recorded to allow calculation of catch rates.

In 2000, minnow traps were used to identify smaller fish species that may not be detected by gill nets. Minnow traps baited with preserved salmon eggs were set in pairs at the edge of surveyed lakes. The traps were set and retrieved in concert with the gill net sampling.

Water chemistry parameters were measured to assess habitat conditions and provide information on the suitability of the water for domestic and industrial uses. Water chemistry measurements included surface measures of water temperature, specific conductance, dissolved oxygen, pH, and in 2001, turbidity. Temperature, specific conductance and dissolved oxygen were *in situ* surface measurements taken along the edge of each lake with a YSI Model 85 meter. A sample was returned to the field office to measure pH and turbidity. PH was measured with either a Coning pH meter or an Oaktron pH Tester III. Turbidity was measured with an H.F. Scientific DRT15CE turbidity meter. At many of the lakes, a water sample was taken and sent to Northern Test Labs for laboratory determination of chloride, sodium, calcium, magnesium, hardness (as $CaCO_3$) and total dissolved solids (TDS).

Bathymetric data were collected to allow estimating lake volume. Depths were taken with an Eagle SupraPro ID depth sounder. Individual depth measurements were located with a hand-held Garmin

III+ GPS receiver while traversing the lake with either a boat or float tube. In 1999-2000, transect positions were determined by marking the beginning and end locations of transects on base maps of the lakes. Readings were converted to distance measurements and the resulting points were plotted on the known location of the transect. In 2001, transect positions were determined by entering the GPS positions into Arcview 3.2 GIS software and plotting the positions on maps of the surveyed lakes.

Lake volume was estimated by applying the formula for the volume of a cone to the surface area and maximum depth of each lake. The surface area was obtained from a GIS base map using USGS 1:63,360 scale quadrangle sheets. The amount allowed for winter water withdrawal was estimated as 15% of the volume of the lake deeper than 7 feet. The volume estimation is a rough estimate, but is currently accepted as an initial 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.

Lake Summaries

When possible, 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, the lakes are numbered sequentially beginning from the west and south sides of the grid. However, the ERG ends just west of the Colville Delta, thus is not useful for most sampling in NPR-A.

For lakes not covered by the ERG, the lake number uses a researcher/year code. The lake number contains several pieces of information, including the code of the sampler and the year of sampling.

Sampler Code:
MC = McElderry and Craig (1981); sampling in 1979
B = Bendock and Burr (1986); sampling in 1985
L = Lobdell; water chemistry sampling in 1991-1999
M = Moulton; fish sampling in 1999
First Two Numerals:
Year of Initial Sampling
(if Moulton sampled a lake previously sampled by McElderry and Craig, then the McElderry and Craig lake number is used)
Last Two Numerals:
Numbers from 1 to 99 used to identify the individual lake sampled within a given year

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. pH,
10. Calculated lake volume and volume of water permitted for winter withdrawal,
11. Water chemistry measurements,
12. Catch record, including gear used, date sampled, species caught and size range,
13. Where appropriate data exist, the length frequency of dominant species is plotted,
14. 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 near a floodplain, but above the water surface elevation of the active channel, with an obvious high water channel. These lakes are likely subject to annual flooding.

Perched (Infrequent Flooding) = Perched lake near a floodplain, but above the water surface elevation of the active channel, with no obvious high water channel. These lakes are 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 a river drainage, little potential for fish access on a regular basis.

RESULTS AND DISCUSSION

Biological Observations

A total of 14 lakes were sampled for the first time in NPR-A in 2001 (Table 1). This brought the total number of lakes sampled to 93 when combined with the 79 lakes sampled in 1999-2000 (Moulton 2000a,b). Sampling in 1999 covered the region from the Colville River to the confluence of Fish and Judy creeks, while the 2000-2001 sampling was west of the confluence of Fish Creek and Judy Creek (Figure 1).

Broad whitefish, least cisco, arctic grayling and Alaska blackfish were the only species captured by gill net in the NPR-A lakes, which was consistent with earlier reports from the region (Netsch et al. 1977, McElderry and Craig 1981, Bendock and Burr 1984). Ninespine stickleback were also caught in minnow traps in 2000. Lakes in the Ublutuoch region along the Colville River consistently produced fish, while those in other regions were less likely to be fish-bearing. Most fish were in lakes along major drainages, such as Fish Creek, Judy Creek and the Ublutuoch River (Figures 2 to 4). A list of fish captured by gill net is presented in Table 2, catches by minnow trap are listed in Table 3. Length information is presented for each fish-bearing lake in the Lake Summaries.

In regions not influenced by the Colville River, only 25% of the surveyed lakes contained fish. In contrast, over 85% of the perched and drainage lakes sampled with similar methods in the Colville Delta supported fish (Moulton 1998). The pattern of fish distribution in the NPR-A lakes appeared to be a function of ready access to fish-bearing streams. This finding is supported by interviews with Nuiqsut elders, who report that lakes connected to larger rivers by small tundra streams support fish populations. Least cisco and broad whitefish, in particular, were found only in lakes near Fish Creek (Figures 5 and 6). One exception to this pattern was lake M9917, which contained arctic grayling. In this case, there may be a seasonal connection to Judy Creek, which was 1.8 miles away (Figure 7).

In contrast to 1999, fish densities in 2000 and 2001 were very low and often non-existent, despite much longer fishing times (Tables 2 and 3). The average duration of sets increased from 5.0 hours in 1999 to 7.9 hours in 2000 and 9.4 hours in 2001. Set time was increased to ensure that the lack of fish was not an artifact of the short set times. It presently appears that in the area surveyed upstream from the confluence of Fish and Judy creeks, fish do not make significant use of lake habitat unless there is an active stream connection. As observed in 1999, fish use of lakes near and downstream of the confluence is quite high for those lakes near the creeks and for those lakes connected to the creeks by streams. Fish have, however, been reported from lakes farther up in the Fish Creek/Judy Creek system. Bendock and Burr (1984) reviewed available data and identified five lakes in the upper portion of the drainages that held least cisco, broad whitefish, humpback whitefish, arctic grayling and lake trout.

Water Chemistry Measurements

Water chemistry parameters measured in the studied lakes are presented Table 4. Mean water temperatures during the three years of survey ranged as follows:

1999 (Jul 9 to Aug 4, 1999):	12.8 ^{o}C (range: 7.4 to 15.3^{o}C)
2000 (Jul 13 to Aug 4, 2000):	11.3 ^{o}C (range: 7.0 to 14.8^{o}C).
2001 (Jul 14 to 23, 2001):	13.0 ^{o}C (range: 8.6 to 16.6^{o}C).

Dissolved oxygen was high, averaging 95.8% saturation in 1999, 96.4% in 2000 and 100% in 2001. The observed frequency of specific conductance and pH values from surveyed lakes are graphed in Figure 8.

Evaluation of Fish Concerns

Information from fish sampling and depth measurements was used to evaluate each lake regarding its potential to support fish. Obviously, if fish were captured during gill net sampling, the lake was classified as fish-bearing. Gill net sets were relatively short, however, so absence of catch does not necessarily mean a lake does not support fish. Lakes also were assessed for their proximity to fish-bearing streams and their depth. Lakes deeper than 7 feet are likely to retain unfrozen water during winter, thus have potential to overwinter fish. Deep lakes that are near fish-bearing streams and are likely to have a connection with the stream at some point during the year are classified as potential fish-bearing lakes, with additional sampling needed if further clarification of the designation is desired. Results of the evaluation are included in Table 5.

Lakes in which fish were verified as present are divided into those lakes containing species sensitive to habitat changes likely to be associated with water withdrawal and those containing species more resistant to such changes. Species sensitive to impacts of water withdrawal (such as reduced dissolved oxygen and increased dissolved solids) include broad whitefish, least cisco and arctic grayling, while the more resistant species are Alaska blackfish and ninespine stickleback. Alaska blackfish are particularly resistant to low dissolved oxygen, being able to breathe atmospheric oxygen (Armstrong 1994). Residents of the Yukon Delta have reported observing Alaska blackfish oriented along cracks in the ice during winter to use oxygen in ponds that have gone anoxic. Ninespine stickleback can also withstand low dissolved oxygen (Lewis et al. 1972), although not the same extent as Alaska blackfish. Ninespine stickleback, however, can withstand higher levels of dissolved solids, and often frequent brackish nearshore waters during summer.

Nuiqsut elders provided Phillips Alaska personnel an evaluation of 23 lakes during tours of the region in fall 1999 (Moulton 2000). For 18 lakes, the evaluation reached in this study was the same as the elders evaluation. For two lakes considered potentially fish-bearing, the elders expressed no fish concern (L9822, M9904). Two lakes initially classified as having no fish concern were identified by the elders as being potentially fish-bearing (M9914 and M9923). These two lakes are large, shallow tundra lakes remote from fish-bearing streams. The elders expressed the opinion that pressure ridges tend to form in winter in such lakes due to cracks in the lake ice that are kept open by shifting currents and that this type of lake will have fish. They indicated that when this phenomenon is observed on any lake of this size, caution should be exercised to avoid affecting fish potentially present. Lake M9923 was re-sampled in 2000 to further evaluate potential fish presence, but again no fish were caught. The shallow depth (6.5 ft), lack of access and lack of catch after sampling for 19.1 hours with gill net and 15.4 hours with minnow trap indicate that the lake does not provide significant fish habitat. It is likely the phenomenon described by the elders is more prevalent in deeper lakes that are likely to provide sufficient winter habitat to allow survival, and in lakes containing a seasonal connection to a stream system.

Based on the above lake evaluation, 33 lakes were confirmed to contain fish, another 17 have potential to be fish-bearing (based on this report and information from Nuiqsut elders), and 43 likely do not represent fish habitat. Of the 33 lakes containing fish, 24 contained sensitive species and 9 contained more resistant species (Figures 2 to 4).

LITERATURE CITED

Armstrong, R.H. 1994. Alaska blackfish. ADF&G's Wildlife Notebook Series. Alaska Dept. Fish and Game. Juneau, AK.

Bendock, T.N. and J. Burr. 1984. Freshwater fish distributions in the Central Arctic Coastal Plain (Ikpikpuk River to Colville River). Alaska Department of Fish and Game, Sport Fish Division, Fairbanks, AK. 52p.

Bendock, T.N. and J.M. Burr. 1986. Arctic Area Trout Studies. Vol 27. T-7-1. Federal Aid in Fish Restoration and Anadromous Fish Studies. Alaska Dept. Fish and Game. Juneau, AK. 75 p.

Lewis, D.B., M. Walkey, and H.J.G. Dartnall. 1972. Some effects of low oxygen tensions on the distribution of the three-spined stickleback Gasterosteus aculeatus L. and the nine-spined stickleback Pungitius pungitius (L). J. Fish. Biol. 4: 103-108.

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

Moulton, L.L. 1994. Colville Delta winter fish habitat study 1991-1993. Report to ARCO Alaska. 40 p. + appendices.

Moulton, L.L. 2000a. Fish utilization of lakes in eastern NPR-A – 1999. Report to ARCO Alaska Inc. Lopez Island, WA. 248 p.

Moulton, L.L. 2000b. Fish utilization of lakes in eastern NPR-A – 1999-2000. Report to ARCO Alaska Inc. Lopez Island, WA. 124 p.

Table 1. Summary of eastern NPR-A lakes sampled during 1999-2001.

Region	Lake	Township/ Range	Habitat[1]	Surface Area (acres)	Max. Depth (feet)	Calculated Volume (mil. gals)
Ublutuoch						
	L9306 (W2.1)	T11 R4E Sect. 22	Perched Lake (FF)	64.0	10.2	70.2
	L9307 (X2.1)	T11N R4E Sect. 28	Tundra Lake	650.0	6.1	426.3
	L9341b (W3.1)	T11N R4E Sect. 23	Perched Lake (FF)	30.0	19.3	62.3
	L9801 (X1.2)	T11N R4E Sect. 32	Tundra Lake	40.1	5.0	21.6
	L9802 (X1.1)	T11N R4E Sect. 31/32	Tundra Lake	221.9	6.0	143.1
	L9807 (Y2.1)	T11N R4E Sect. 34	Tundra Lake	94.1	8.2	83.0
	L9808 (X3.1)	T11N R4E Sect. 27	Drainage Lake	5.0	14.2	7.7
	L9817	T10N R3E Sect. 10	Tundra Lake	74.6	9.0	72.2
	L9818	T10N R3E Sect. 10	Tundra Lake	32.7	4.0	14.1
	L9819	T10N R3E Sect. 34	Tundra Lake	244.5	7.9	207.7
	L9822	T10N R3E Sect. 3	Oxbow Lake	11.6	11.0	13.8
	L9823	T10N R3E Sect. 3	Tundra Lake	5.0	12.0	6.4
	L9824	T11N R3E Sect. 25	Perched Lake (FF)	21.6	11.0	25.5
	L9825	T11N R3E Sect. 24	Perched Lake (FF)	12.3	15.3	20.2
	L9832	T10N R3E Sect. 3	Tundra Lake	242.5	2.8	73.0
	L9901 (X4.2)	T10N R4E Sect. 25	Perched Lake (FF)	16.3	25.0	43.7
	L9902 (X4.1)	T10N R4E Sect. 26	Perched Lake (FF)	15.7	16.6	28.1
	L9914	T11N R3E Sect. 7	Perched Lake (IF?)	24.4	16.0	42.0
	L9915	T11N R3E Sect. 18	Perched Lake (FF?)	24.4	14.4	37.7
	M9912	T10N R2E Sect. 2	Tundra Lake	32.9	7.8	27.6
	M9913	T10N R2E Sect. 2	Tundra Lake	20.0	7.9	17.0
	M9922	T10N R2E Sect. 10-11/14-15	Tundra Lake	190.7	5.3	108.6
	M9923	T10N R2E Sect. 12-13	Tundra Lake	251.7	6.5	175.9
	M9924	T11N R2E Sect. 36	Tundra Lake	47.9	3.4	17.5
	M9925	T10N R3E Sect. 6	Tundra Lake	218.0	3.9	91.4
	M9930	T11N R3E Sect. 18	Tundra Lake	23.4	7.9	19.9
	M0101A	T11N R2E Sect. 29	Oxbow Lake	40.1	12.1	52.2
	M0101B	T11N R2E Sect. 29	Oxbow Lake	63.9	15.2	104.4
	M0102	T11N R2E Sect. 29	Oxbow Lake	44.8	9.5	45.8
	MC7916	T11N R3E Sect. 19	Drainage Lake	418.6	8.0	360.1
	MC7917	T11N R2E Sect. 24	Drainage Lake	293.8	12.6	398.0
Fish Ck Confluence						
	L9916	T11N R1E Sect. 34	Perched (FF?)	169.1	14.3	260.0
	M9901	T10N R1E Sect. 11-14	Oxbow Lake	66.3	16.9	120.5
	M9902	T10N R1E Sect. 12	Tundra Lake	19.9	11.3	24.1
	M9903	T10N R1E Sect. 12	Oxbow Lake?	70.2	22.1	166.8
	M9904	T10N R1E Sect. 1	Perched (FF?)	25.2	9.3	25.2
	M9905	T10N R2E Sect. 6	Tundra Lake?	24.6	11.3	29.9
	M9906	T10N R1E Sect. 10	Tundra Lake	202.9	9.7	211.6
	M9907	T10N R1E Sect. 10-11	Tundra Lake	147.7	9.5	150.9
	M9908	T11N R2E Sect. 28	Perched (FF?)	17.9	9.4	18.1
	M9909	T11N R2E Sect. 33	Oxbow Lake	117.6	16.4	207.3
	M9910	T10N R2E Sect. 6	Perched (FF?)	146.5	9.0	141.8
	M9911	T11N R2E Sect. 33	Perched (IF?)	144.2	15.3	237.2
	M9914	T10N R2E Sect. 9	Tundra Lake	127.4	7.8	106.8
	M9915	T10N R1E Sect. 24	Tundra Lake	30.6	7.1	23.4
	M9916	T10N R2E Sect. 30	Tundra Lake	42.8	3.8	17.5
	M9917	T10N R1E Sect. 26	Tundra Lake	175.1	9.8	184.5
	M9918	T10N R1E Sect. 13	Oxbow Lake	41.5	14.7	65.6
	M9919	T10N R1E Sect. 9-16	Oxbow Lake	106.8	14.9	171.1
	M9920	T10N R1E Sect. 15	Oxbow Lake	96.1	18.0	185.9

Table 1. Summary of eastern NPR-A lakes sampled during 1999-2001.

Region	Lake	Township/ Range	Habitat[1]	Surface Area (acres)	Max. Depth (feet)	Calculated Volume (mil. gals)
	M9921	T11N R2E Sect. 33	Tundra Lake	108.3	4.4	51.3
	M9926	T10N R1E Sect. 1	Oxbow Lake	31.6	8.1	27.5
	M9927	T11N R1E Sect. 35	Perched Lake (?)	14.9	7.4	11.9
	M9928	T11N R1E Sect. 36	Oxbow Lake	111.8	18.5	222.4
	M0001	T11N R1E Sect. 31	Oxbow Lake	48.7	10.6	55.5
	M0002	T11N R1E Sect. 35	Perched (FF?)	20.5	16.0	35.3
	M0003	T11N R1E Sect. 26	Perched (FF?)	19.8	16.0	34.0
	M0005	T11N R1W Sect. 25	Perched (IF?)	122.3	12.1	159.0
	M0006	T11N R1W Sect. 36	Perched (IF?)	122.4	13.3	175.0
	M0007	T10N R1E Sect. 18	Tundra Lake	355.5	10.5	401.3
	M0008	T10N R1W Sect. 13	Tundra Lake	172.4	9.1	168.6
	M0009	T11N R1E Sect. 26	Tundra Lake	48.7	6.6	34.5
	M0010	T11N R1E Sect. 26	Tundra Lake	29.7	8.1	25.9
	M0020	T11N R2E Sect. 30	Oxbow Lake	124.1	16.1	214.8
	M0021	T11N R1E Sect. 35	Oxbow Lake	36.3	17.7	69.1
	M0022	T10N R2E Sect. 17	Tundra Lake	38.0	6.5	26.5
	M0023	T10N R2E Sect. 17	Tundra Lake	16.4	3.9	6.9
	M0024	T10N R2E Sect. 21	Tundra Lake	138.6	7.3	108.8
	M0025	T11N R1E Sect. 26	Tundra Lake	44.2	8.2	39.0
	M0028	T11N R1E Sect. 34	Perched (IF?)	36.4	8.7	34.1
	M0032	T10N R1E Sect. 16	Oxbow Lake	28.6	11.4	35.0
	M0103	T10N R1W Sect. 24	Tundra Lake	32.5	7.8	27.2
	M0104	T10N R1W Sect. 14	Tundra Lake	503.5	6.3	341.1
	M0105	T10N R1W Sect. 26	Tundra Lake	349.6	6.9	259.3
	M0106	T10N R1W Sect. 10	Tundra Lake	12.0	10.7	13.8
	M0107	T10N R1W Sect. 3	Tundra Lake	14.1	10.5	15.9
	M0110	T10N R1W Sect. 22	Tundra Lake	51.4	6.4	35.4
	M0111	T10N R1W Sect. 11	Oxbow Lake	28.0	12.9	38.8
	M0112	T10N R1W Sect. 4	Oxbow Lake	53.4	15.1	86.7
	M0113A	T10N R1E Sect. 30	Oxbow Lake	47.1	14.5	73.4
	M0113B	T10N R1E Sect. 30	Oxbow Lake	13.8	10.2	15.1
	M0114	T10N R1E Sect. 30	Oxbow Lake	16.3	11.7	20.5
	M0130	T10N R1W Sect. 24	Tundra Lake	16.3	3.0	5.3
Judy Creek						
	L9911	T9N/T10N R1E Sect. 1/36	Tundra Lake	540.2	8.0	464.6
	M0011	T10N R1E Sect. 29	Oxbow Lake	8.8	14.1	13.3
	M0012	T9N R1W Sect. 1	Oxbow Lake	42.5	17.9	81.9
	M0013	T9N R1W Sect. 2	Oxbow Lake	8.7	6.1	5.7
	M0014	T9N R1W Sect. 23	Tundra Lake	114.3	8.5	104.4
	M0015	T9N R1W Sect. 26	Tundra Lake	473.4	7.5	381.8
	M0016	T9N R1E Sect. 4	Tundra Lake	300.2	6.2	200.1
	M0017	T9N R1W Sect. 28	Tundra Lake	70.3	3.3	24.9
	M0029	T9N R1W Sect. 20	Perched (FF?)	44.4	12.6	60.2
	M0030	T9N R1W Sect. 20	Oxbow Lake	26.0	8.3	23.2
	M0031	T9N R1W Sect. 17	Oxbow Lake	33.4	11.4	40.9

[1] FF = frequent flooding (every 1 to 5 years); IF = infrequent flooding (less than once every 5 years)

[2] BDWF = broad whitefish, LSCS = least cisco, GRAY = arctic grayling, BKFH = Alaska blackfish, NSSB = ninespine stickleback

[3] No = lake does not represent fish habitat, Yes = fish present during survey, Y? = fish not caught but lake has potential to be fish habitat, Y(elders) = North Slope elders indicate the lake represents potential fish habitat.

Table 2. Catches of fish from NPR-A sampling with gill nets, 1999-2001.

Region	Lake	Date	Duration (hours)	Broad Whitefish	Least Cisco	Arctic Grayling	Alaska Blackfish	Ninespine Stickleback	Total Catch
Ublutuoch									
	L9817	Jul 17 99	7.5						0
	L9818	Jul 17 99	7.1						0
	L9819	Jul 19 99	7.2						0
	L9822	Jul 16 99	6.5						0
	L9823	Jul 16 99	6.3						0
	L9824	Jul 18 99	6.7						0
	L9825	Jul 18 99	6.8		1	13			14
	L9832	Jul 19 99	3.2						0
	L9914	Aug 4 99	2.6						0
	L9915	Jul 27 99	5.7		3				3
	M9912	Jul 12 99	6.3						0
	M9913	Jul 12 99	5.4						0
	M9922	Jul 15 99	6.4						0
		Aug 1 00	20.5						0
	M9923	Jul 17 99	4.0						0
		Aug 1 00	15.1						0
	M9924	Jul 18 99	2.2						0
	M9925	Jul 18 99	6.4						0
	M9930	Jul 27 99	5.7						0
	M0101	Jul 14 01	8.0	1	6				7
	M0102	Jul 14 01	6.8						0
	MC7917	Aug 4 99	4.0		10				10
	W2.1	Aug 3 99	6.7	2	3				5
	W3.1	Jul 22 99	1.4	1	1				2
	X1.1	Jul 19 99	6.2						0
	X1.2	Jul 19 99	6.1						0
	X2.1	Jul 31 99	7.7						0
	X3.1	Aug 4 99	1.8			1			1
	X4.1	Jul 23 99	0.6	1	4				5
	X4.2	Jul 23 99	1.6	2	7				9
	Y2.1	Jul 31 99	5.0						0
Fish Ck Confluence									
	L9916	Jul 14 00	2.9		9				9
	M9901	Jul 9 99	6.8			29			29
	M9902	Jul 9 99	5.9						0
	M9903	Jul 10 99	3.1						0
		Jul 16 99	6.8						0
	M9904	Jul 10 99	3.4						0
	M9905	Jul 10 99	3.9						0
	M9906	Jul 15 99	7.6						0
	M9907	Jul 15 99	8.2						0
	M9908	Jul 11 99	4.9						0
	M9909	Jul 11 99	5.0	2	6				8
	M9910	Jul 11 99	1.2			4			4
	M9911	Jul 17 99	6.3	14	2				16
	M9914	Jul 12 99	2.3						0
	M9915	Jul 13 99	5.5						0
	M9916	Jul 13 99	6.3						0
	M9917	Jul 13 99	8.7			3			3
	M9918	Jul 14 99	6.3		1	1			2

Table 2. Catches of fish from NPR-A sampling with gill nets, 1999-2001.

Region	Lake	Date	Duration (hours)	Broad Whitefish	Least Cisco	Arctic Grayling	Alaska Blackfish	Ninespine Stickleback	Total Catch
	M9919	Jul 14 99	4.9		1				1
	M9920	Jul 14 99	2.8						0
	M9921	Jul 15 99	4.3						0
	M9926	Jul 20 99	5.1						0
	M9927	Jul 20 99	5.2						0
	M9928	Jul 20 99	1.6	3	13				16
	M0001	Jul 12 00	5.1						0
	M0002	Jul 13 00	4.7						0
		Jul 14 00	1.8		1				1
	M0003	Jul 13 00	4.4						0
		Jul 14 00	1.5						0
	M0005	Jul 15 00	6.0					3	3
	M0006	Jul 15 00	6.8				1		1
	M0007	Jul 16 00	8.7						0
	M0008	Jul 16 00	5.2						0
	M0009	Jul 17 00	6.8						0
	M0010	Jul 17 00	8.0						0
	M0020	Jul 27 00	1.8		7				7
	M0021	Jul 27 00	2.7		7				7
	M0022	Jul 29 00	8.8						0
	M0023	Jul 29 00	0.9						0
	M0024	Jul 29 00	10.3						0
	M0025	Jul 31 00	8.0						0
	M0028	Aug 2 00	8.0						0
	M0032	Aug 4 00	8.5						0
	M0103	Jul 15 01	11.9						0
	M0104	Jul 16 01	9.6						0
	M0105	Jul 16 01	9.1						0
	M0106	Jul 17 01	10.0						0
	M0107	Jul 17 01	9.7						0
	M0110	Jul 19 01	7.3						0
	M0111	Jul 19 01	7.9						0
	M0112	Jul 20 01	9.2						0
	M0113	Jul 21 01	10.4						0
	M0114	Jul 23 01	12.6		1				0
Judy Creek									
	L9911	Jul 25 99	4.1						0
	M0011	Jul 19 00	10.8						0
	M0012	Jul 20 00	10.2						0
	M0013	Jul 20 00	10.0						0
	M0014	Jul 21 00	14.3						0
	M0015	Jul 21 00	12.2						0
	M0016	Jul 22 00	12.7						0
	M0017	Jul 24 00	2.2						0
	M0029	Aug 3 00	10.9						0
	M0030	Aug 3 00	11.0						0
	M0031	Aug 3 00	11.1						0

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

Minnow Traps (2 per lake)

NPR-A Region	Lake	Date	Trap Effort (hours)	Ninespine Stickleback	Total Catch
Ublutuoch					
	M9922	8/1/2000	21.35	seen	1
	M9923	8/1/2000	15.42		0
Fish Ck Confluence					
	M0020	7/27/2000	1.92		0
	M0021	7/27/2000	4.00		0
	M0022	7/29/2000	10.00		0
	M0023	7/29/2000	3.00		0
	M0024	7/29/2000	11.17		0
	M0025	7/31/2000	9.50		0
	M0028	8/2/2000	11.17	1	1
	M0032	8/4/2000	31.83		0
Judy Creek					
	M0011	7/19/2000	9.83	19	19
	M0012	7/20/2000	8.50		0
	M0013	7/20/2000	8.50		0
	M0014	7/21/2000	15.33		0
	M0015	7/21/2000	10.50		0
	M0016	7/22/2000	14.00	1	1
	M0017	7/24/2000	5.67		0
	M0029	8/3/2000	12.00	3	3
	M0030	8/3/2000	12.00		0
	M0031	8/3/2000	11.50		0

Table 4. Water chemistry parameters measured in conjunction with NPR-A Area lake sampling, 1999-2001.

NPR-A Region	Lake	Date	Water Temp. (^{o}C)	Dissolved Oxygen (mg/l)	Dissolved Oxygen Percent Saturation	Specific Conductance (µS/cm)	pH	Turbidity (NTU)	Chloride (mg/l)	Sodium (mg/l)	Calcium (mg/l)	Magnesium (mg/l)	Hardness (mg/l)	TDS (mg/l)
Ublutuoch														
	L9817	7/17/1999	14.9	9.23	92.6	325	7.98							
	L9818	7/17/1999	13.8	9.10	87.9	256	7.92							
	L9819	7/19/1999	12.3	9.11	85.3	177	8.00							
	L9822	7/16/1999	15.1	9.77	96.6	108	7.89		12.1	2.6	8.6	2.2	30.6	44
	L9823	7/16/1999	15.1	9.57	94.9	215	7.76		44.4	8.9	22.4	6.5	82.6	168
	L9824	7/18/1999	13.5	9.14	88.1	56	7.84		5.3	1.7	5.2	1.4	19.0	MDL=35
	L9825	7/18/1999	12.6	9.01	82.4	47	7.86		4.5	1.4	4.4	1.2	15.9	MDL=35
	L9832	7/19/1999	10.9	10.27	93.0	203	7.98							
	L9914	8/4/1999	12.5	11.28	107.8	406	8.42							
	L9915	7/27/1999	7.4	11.50	95.3	191	8.29		20.8	9.5	25.4	3.7	78.9	124
	M9912	7/12/1999	14.3	9.94	95.7	88	7.38		13.9	4.4	8.6	2.2	31.4	59
	M9913	7/12/1999	13.9	9.82	97.0	86	7.37		11.9	3.9	9.2	2.1	32.0	55
	M9922	8/1/2000	10.5			135	7.79		19.9	5.2	14.5	3.3	49.8	88
		7/15/1999	14.3	10.00	95.4	136	7.77		23.8	6.2	16.5	4.1	58.0	92
	M9923	8/1/2000	9.7			225	8.20		18.8	5.4	33.0	4.9	103.0	128
		7/17/1999	14.4	9.71	95.8	253	8.23		24.1	6.8	38.4	6.3	122.0	140
	M9924	7/18/1999	11.7			186	7.58		22.7	10.5	24.8	4.4	77.3	136
	M9925	7/18/1999	12.2			276	8.12		37.8	11.1	40.2	6.2	122.0	194
	M9930	7/27/1999	7.9	11.98	102.3	179	8.26		17.8	7.3	25.2	3.6	77.8	88
	M0101	7/14/2001	8.6	11.84	100.6	121	8.11	1.2	8.4	4.3	18.0	2.9	57.0	70
	M0102	7/14/2001	10.7	10.87	98.3	173	8.34	4.0	14.0	6.8	27.0	4.2	86.0	78
	MC7917	8/4/1999	11.9	10.50	97.2	175	8.02		14.2	5.8	25.4	3.3	76.7	104
	W2.1	1993							25.0	13.0	6.0	2.3	24.0	110
		1998							21.1	9.5	7.3	3.1	31.1	68
		8/3/1999	12.6	11.25	105.3	145	7.97		22.1	13.7	8.6	4.0	38.0	70
	W3.1	7/22/1999	9.0	11.31	97.8	167	7.88		15.0	6.8	7.5	2.8	30.0	67
	X1.1	7/19/1999	11.1	10.05	91.7	172	8.18							
	X1.2	7/19/1999	10.7	9.83	89.3	180	8.13							
	X2.1	7/31/1999	9.0	11.27	97.8	230	8.03							
	X3.1	8/4/1999	12.9	11.33	107.7	153	8.20							
	X4.1	7/23/1999	10.1	11.23	99.8	171	7.95		20.7	11.7	12.4	6.5	57.6	88
	X4.2	7/23/1999	9.2	11.04	96.2	312	8.16		49.1	22.5	19.8	12.6	101.0	154
	Y2.1	7/31/1999	9.0	11.36	98.4	161	7.93		12.9	4.4	20.1	3.7	65.5	96

Table 4. Water chemistry parameters measured in conjunction with NPR-A Area lake sampling, 1999-2001.

NPR-A Region	Lake	Date	Water Temp. (^oC)	Dissolved Oxygen (mg/l)	Dissolved Oxygen Percent Saturation	Specific Conductance (µS/cm)	pH	Turbidity (NTU)	Chloride (mg/l)	Sodium (mg/l)	Calcium (mg/l)	Magnesium (mg/l)	Hardness (mg/l)	TDS (mg/l)
Fish Ck Confluence														
	L9916	7/14/2000	7.0	11.1	92.7	210	8.07		14.5	6.9	27.3	5.2	89.5	106
	M9901	7/9/1999	14.7	9.91	97.9	180	7.66		23.8	4.6	24.7	3.7	79.8	110
	M9902	7/9/1999	14.9	9.57	95.0	294	8.10		18.5	8.6	39.3	7.8	135.0	164
	M9903	7/10/1999	15.2	9.55	95.2	87	8.11		7.9	2.8	9.7	1.9	33.2	55
		7/16/1999	15.3	9.98	100.0	85	7.86							
	M9904	7/10/1999	14.8	9.62	95.3	210	8.04		8.3	3.4	32.0	4.4	98.6	126
	M9905	7/10/1999	15.0	9.41	93.6	85	7.97		7.4	2.6	9.9	1.9	33.0	61
	M9906	7/15/1999	13.0	9.90	94.6	200	8.25		13.8	5.0	26.9	4.0	85.6	112
	M9907	7/15/1999	13.2	9.88	95.5	199	8.30		13.3	5.4	25.4	4.3	84.0	116
	M9908	7/11/1999	14.2	9.90	96.3	318	8.35		28.6	9.0	40.9	7.6	136.0	188
	M9909	7/11/1999	13.7	9.92	95.0	173	8.11		20.5	5.0	18.8	3.8	65.1	98
	M9910	7/11/1999	13.7	10.50	101.1	127	8.10		8.7	3.1	17.2	3.0	54.9	78
	M9911	7/11/1999	14.3	10.26	100.6	146	8.03		9.4	3.6	21.5	2.9	65.7	84
	M9914	7/12/1999	14.2	9.84	95.8	99	7.45		12.1	4.5	10.1	2.4	35.9	74
	M9915	7/13/1999	14.7	9.76	95.7	89	7.58		14.1	4.1	9.0	2.3	32.8	61
	M9916	7/13/1999	13.5	10.15	97.3	147	9.00		17.5	8.0	15.4	3.8	55.0	120
	M9917	7/13/1999	14.6	9.72	95.5	208	8.26		19.3	6.4	27.7	4.3	88.6	138
	M9918	7/14/1999	14.5	9.68	94.9	75	8.04		7.0	2.8	8.5	1.8	29.8	44
	M9919	7/14/1999	14.3	10.11	98.8	106	7.80		10.4	3.7	12.8	2.5	43.2	138
	M9920	7/14/1999	15.3	9.84	98.3	174	8.27		7.7	3.4	25.5	4.0	81.6	114
	M9921	7/15/1999	13.9	10.38	103.0	197	8.02		27.4	8.6	28.3	5.1	91.6	130
	M9926	7/20/1999	12.3	9.67	90.5	167	8.37		9.0	4.5	23.8	5.0	132.0	84
	M9927	7/20/1999	9.6	10.19	82.8	237	8.60		19.8	9.7	29.0	8.8	102.0	136
	M9928	7/20/1999	12.0	9.90	92.0	121	8.04		8.4	4.0	16.4	2.7	52.2	62
	M0001	7/12/2000					7.73		10.3	4.6	16.5	3.0	53.3	90
	M0002	7/13/2000	8.7	11.1	95.9	84	7.25		9.7	3.9	8.5	2.0	29.3	<35
	M0003	7/13/2000	8.7	11.0	94.2	130	7.58		13.5	5.7	15.2	3.0	50.3	84
	M0005	7/15/2000	9.1	10.7	93.5	282	8.06		29.4	12.3	31.4	6.4	105.0	148
	M0006	7/15/2000	9.9	10.6	92.6	223	7.97		21.2	9.7	27.4	5.1	89.4	134
	M0007	7/16/2000	11.4	11.2	105.7	295	8.15		32.0	11.9	35.5	5.5	111.0	164
	M0008	7/16/2000	12.6	10.8	101.3	125	7.83		13.5	5.9	14.1	2.7	46.3	76
	M0009	7/17/2000	12.9	10.5	99.3	69	7.60		7.7	3.1	7.6	1.5	25.0	<35

Table 4. Water chemistry parameters measured in conjunction with NPR-A Area lake sampling, 1999-2001.

NPR-A Region	Lake	Date	Water Temp. (^oC)	Dissolved Oxygen (mg/l)	Dissolved Oxygen Percent Saturation	Specific Conductance (µS/cm)	pH	Turbidity (NTU)	Chloride (mg/l)	Sodium (mg/l)	Calcium (mg/l)	Magnesium (mg/l)	Hardness (mg/l)	TDS (mg/l)
	M0010	7/17/2000	12.2	10.5	97.9	150	8.00		14.2	6.2	17.2	3.7	58.2	88
	M0020	7/27/2000	10.1	10.5	95.4	142	7.91		11.1	4.9	18.4	3.2	59.1	122
	M0021	7/27/2000	11.2			117	7.86		7.6	3.2	16.6	2.6	52.1	102
	M0022	7/29/2000	10.4			96	7.97		11.5	5.1	10.0	2.4	34.8	84
	M0023	7/29/2000	10.3			192	7.88		22.6	9.9	19.0	4.6	66.5	128
	M0024	7/29/2000	10.6	10.9	98.0	107	7.93		14.3	4.8	11.2	2.9	39.9	70
	M0025	7/31/2000	9.9			100			10.7	4.9	10.5	2.6	36.8	66
	M0028	8/2/2000	11.7			119	8.15		10.4	5.0	13.7	3.4	48.2	74
	M0032	8/4/2000	13.6			205	8.22		21.3	8.2	24.6	4.5	79.7	114
	M0103	7/15/2001	10.4	11.3	101.9	271	8.21	1.3	37.0	17.0	34.0	5.9	110.0	170
	M0104	7/16/2001	11.6	10.6	96.7	81	7.91	2.0	8.1	3.9	10.0	1.7	33.0	66
	M0105	7/16/2001	14.3	10.2	101.1	376	8.36	3.0	51.0	23.0	48.0	8.2	150.0	240
	M0106	7/17/2001	12.6	11.1	104.3	69	7.54	1.1	8.4	4.6	7.0	1.8	25.0	76
	M0107	7/17/2001	13.1	10.6	99.1	114	7.85	1.2	14.0	7.8	12.0	2.6	40.0	120
	M0110	7/19/2001	14.4	10.0	97.8	338	8.32	1.7	49.0	22.0	38.0	6.6	120.0	240
	M0111	7/19/2001	14.0	11.4	106.3	540	8.42	1.3	99.0	37.0	52.0	15.0	190.0	350
	M0112	7/20/2001	14.3	10.3	99.2	162	8.02	0.8	19.0	8.9	15.0	3.3	51.0	110
	M0113	7/21/2001	15.2	10.0	97.8	88	8.17	0.7	5.3	2.9	12.0	2.0	39.0	50
	M0114	7/23/2001	16.6	10.0	102.5	158	8.32	1.6	7.0	4.2	25.0	3.2	75.0	90
Judy Creek														
	L9911	7/25/1999	9.2	11.04	95.9	179	8.22		11.9	5.0	27.5	3.8	84.2	118
	M0011	7/19/2000	11.4	10.7	98.2	135	7.96		10.9	5.6	16.5	3.2	54.3	66
	M0012	7/20/2000	11.5	10.7	99.1	208	8.29		19.7	9.9	24.7	4.1	78.6	140
	M0013	7/20/2000	11.1	11.2	103.8	192	8.58		8.2	7.2	28.9	3.5	86.5	136
	M0014	7/22/2000	12.3	10.6	97.5	197	7.79		24.7	9.8	21.8	4.2	71.5	166
	M0015	7/22/2000	14.8	9.8	98.5	204	7.80		23.5	10.1	21.2	3.9	69.0	156
	M0016	7/22/2000	13.2	10.3	96.7	124	7.77		14.8	5.2	14.4	2.8	47.6	72
	M0017	7/24/2000	11.6	7.8	73.0	266	7.61		16.3	8.9	34.2	6.8	133.0	162
	M0029	8/3/2000	13.4			468	8.50		45.9	29.3	39.2	10.6	142.0	254
	M0030	8/3/2000	13.0			198	8.26		20.1	10.0	22.6	4.4	74.5	66
	M0031	8/3/2000	14.0	10.1	97.8	120	7.96		6.9	4.4	16.9	2.3	51.6	56

Table 5. Estimated water volumes available for winter withdrawal from surveyed lakes in eastern NPR-A, 1999-2001.

Region	Lake	Habitat[1]	Surface Area (acres)	Max. Depth (feet)	Calculated Volume (mil. gals)	15% of Winter Volume (mil. gals)	Sensitive Fish Species Caught[2]	Resistant Fish Species Caught[3]	Fish Concern[4]	Available Water (mil. gals)
Ublutuoch										
	L9306 (W2.1)	Perched Lake (FF)	64.0	10.2	70.2	3.3	BDWF,LSCS	none	Yes	3.3
	L9307 (X2.1)	Tundra Lake	650.0	6.1	426.3		none	none	No	426.3
	L9341b (W3.1)	Perched Lake (FF)	30.0	19.3	62.3	6.0	BDWF,LSCS	none	Yes	6.0
	L9801 (X1.2)	Tundra Lake	40.1	5.0	21.6		none	none	No	21.6
	L9802 (X1.1)	Tundra Lake	221.9	6.0	143.1		none	none	No	143.1
	L9807 (Y2.1)	Tundra Lake	94.1	8.2	83.0		none	none	No	83.0
	L9808 (X3.1)	Drainage Lake	5.0	14.2	7.7	0.6	GRAY	none	Yes	0.6
	L9817	Tundra Lake	74.6	9.0	72.2		none	none	No	72.2
	L9818	Tundra Lake	32.7	4.0	14.1		none	none	No	14.1
	L9819	Tundra Lake	244.5	7.9	207.7		none	none	No	207.7
	L9822	Oxbow Lake	11.6	11.0	13.8	0.8	none	none	Y?	0.8
	L9823	Tundra Lake	5.0	12.0	6.4		none	none	No	6.4
	L9824	Perched Lake (FF)	21.6	11.0	25.5	1.4	none	none	Y?	1.4
	L9825	Perched Lake (FF)	12.3	15.3	20.2	1.6	LSCS,GRAY	none	Yes	1.6
	L9832	Tundra Lake	242.5	2.8	73.0		none	none	No	73.0
	L9901 (X4.2)	Perched Lake (FF)	16.3	25.0	43.7	4.7	BDWF,LSCS	none	Yes	4.7
	L9902 (X4.1)	Perched Lake (FF)	15.7	16.6	28.1	2.4	BDWF,LSCS	none	Yes	2.4
	L9914	Perched Lake (IF?)	24.4	16.0	42.0	3.5	none	none	Y?	3.5
	L9915	Perched Lake (FF?)	24.4	14.4	37.7	2.9	LSCS	none	Yes	2.9
	M9912	Tundra Lake	32.9	7.8	27.6		none	none	No	27.6
	M9913	Tundra Lake	20.0	7.9	17.0		none	none	No	17.0
	M9922	Tundra Lake	190.7	5.3	108.6	0.0	none	NSSB (observed)	Yes	0.0
	M9923	Tundra Lake	251.7	6.5	175.9		none	none	Y (elders)	0.0
	M9924	Tundra Lake	47.9	3.4	17.5		none	none	No	17.5
	M9925	Tundra Lake	218.0	3.9	91.4		none	none	No	91.4
	M9930	Tundra Lake	23.4	7.9	19.9		none	none	No	19.9
	M0101A	Oxbow Lake	40.1	12.1	52.2	3.3	BDWF,LSCS	none	Yes	3.3
	M0101B	Oxbow Lake	63.9	15.2	104.4	8.4	LSCS	none	Yes	8.4
	M0102	Oxbow Lake	44.8	9.5	45.8	1.8	none	NSSB (observed)	Yes	1.8
	MC7916	Drainage Lake	418.6	8.0	360.1	6.8	BDWF,LSCS,GRAY	BKFH,NSSB	Yes	6.8
	MC7917	Drainage Lake	293.8	12.6	398.0	26.5	LSCS	none	Yes	26.5
Fish Ck Confluence										
	L9916	Perched (FF?)	169.1	14.3	260.0	19.9	LSCS	none	Yes	19.9
	M9901	Oxbow Lake	66.3	16.9	120.5	10.6	GRAY	none	Yes	10.6

Table 5. Estimated water volumes available for winter withdrawal from surveyed lakes in eastern NPR-A, 1999-2001.

Region	Lake	Habitat[1]	Surface Area (acres)	Max. Depth (feet)	Calculated Volume (mil. gals)	15% of Winter Volume (mil. gals)	Sensitive Fish Species Caught[2]	Resistant Fish Species Caught[3]	Fish Concern[4]	Available Water (mil. gals)
	M9902	Tundra Lake	19.9	11.3	24.1		none	none	No	24.1
	M9903	Oxbow Lake?	70.2	22.1	166.8	17.1	none	none	Y?	17.1
	M9904	Perched (FF?)	25.2	9.3	25.2	0.9	none	none	Y?	0.9
	M9905	Tundra Lake?	24.6	11.3	29.9		none	none	No	29.9
	M9906	Tundra Lake	202.9	9.7	211.6		none	none	No	211.6
	M9907	Tundra Lake	147.7	9.5	150.9		none	none	No	150.9
	M9908	Perched (FF?)	17.9	9.4	18.1	0.7	none	none	Y?	0.7
	M9909	Oxbow Lake	117.6	16.4	207.3	17.8	BDWF,LSCS	none	Yes	17.8
	M9910	Perched (FF?)	146.5	9.0	141.8	4.7	GRAY	none	Yes	4.7
	M9911	Perched (IF?)	144.2	15.3	237.2	19.3	BDWF,LSCS	none	Yes	19.3
	M9914	Tundra Lake	127.4	7.8	106.8	1.6	none	none	Y (elders)	1.6
	M9915	Tundra Lake	30.6	7.1	23.4		none	none	No	23.4
	M9916	Tundra Lake	42.8	3.8	17.5		none	none	No	17.5
	M9917	Tundra Lake	175.1	9.8	184.5	7.9	GRAY	none	Yes	7.9
	M9918	Oxbow Lake	41.5	14.7	65.6	5.2	LSCS,GRAY	none	Yes	5.2
	M9919	Oxbow Lake	106.8	14.9	171.1	13.6	LSCS	none	Yes	13.6
	M9920	Oxbow Lake	96.1	18.0	185.9	17.0	none	none	Y?	17.0
	M9921	Tundra Lake	108.3	4.4	51.3		none	none	No	51.3
	M9926	Oxbow Lake	31.6	8.1	27.5	0.6	none	none	Y?	0.6
	M9927	Perched Lake (?)	14.9	7.4	11.9		none	none	No	11.9
	M9928	Oxbow Lake	111.8	18.5	222.4	20.7	BDWF,LSCS	none	Yes	20.7
	M0001	Oxbow Lake	48.7	10.6	55.5	2.8	none	none	Y?	2.8
	M0002	Perched (FF?)	20.5	16.0	35.3	3.0	LSCS	none	Yes	3.0
	M0003	Perched (FF?)	19.8	16.0	34.0	2.9	none	none	Y?	2.9
	M0005	Perched (IF?)	122.3	12.1	159.0	10.1	none	NSSB	Yes	10.1
	M0006	Perched (IF?)	122.4	13.3	175.0	12.4	none	BKFH	Yes	12.4
	M0007	Tundra Lake	355.5	10.5	401.3		none	none	No	401.3
	M0008	Tundra Lake	172.4	9.1	168.6		none	none	No	168.6
	M0009	Tundra Lake	48.7	6.6	34.5		none	none	No	34.5
	M0010	Tundra Lake	29.7	8.1	25.9		none	none	No	25.9
	M0020	Oxbow Lake	124.1	16.1	214.8	18.2	LSCS	none	Yes	18.2
	M0021	Oxbow Lake	36.3	17.7	69.1	6.3	LSCS	none	Yes	6.3
	M0022	Tundra Lake	38.0	6.5	26.5		none	none	No	26.5
	M0023	Tundra Lake	16.4	3.9	6.9		none	none	No	6.9
	M0024	Tundra Lake	138.6	7.3	108.8		none	none	No	108.8
	M0025	Tundra Lake	44.2	8.2	39.0		none	none	No	39.0

Table 5. Estimated water volumes available for winter withdrawal from surveyed lakes in eastern NPR-A, 1999-2001.

Region	Lake	Habitat[1]	Surface Area (acres)	Max. Depth (feet)	Calculated Volume (mil. gals)	15% of Winter Volume (mil. gals)	Sensitive Fish Species Caught[2]	Resistant Fish Species Caught[3]	Fish Concern[4]	Available Water (mil. gals)
	M0028	Perched (IF?)	36.4	8.7	34.1	1.0	none	NSSB	Yes	1.0
	M0032	Oxbow Lake	28.6	11.4	35.0	2.0	none	none	Y?	2.0
	M0103	Tundra Lake	32.5	7.8	27.2		none	none	No	27.2
	M0104	Tundra Lake	503.5	6.3	341.1		none	none	No	341.1
	M0105	Tundra Lake	349.6	6.9	259.3		none	none	No	259.3
	M0106	Tundra Lake	12.0	10.7	13.8		none	none	No	13.8
	M0107	Tundra Lake	14.1	10.5	15.9		none	none	No	15.9
	M0110	Tundra Lake	51.4	6.4	35.4		none	none	No	35.4
	M0111	Oxbow Lake	28.0	12.9	38.8	2.7	none	none	Y?	2.7
	M0112	Oxbow Lake	53.4	15.1	86.7	7.0	none	none	Y?	7.0
	M0113A	Oxbow Lake	47.1	14.5	73.4	5.7	none	NSSB (observed)	Yes	5.7
	M0113B	Oxbow Lake	13.8	10.2	15.1	0.7	none	NSSB (observed)	Yes	0.7
	M0114	Oxbow Lake	16.3	11.7	20.5	1.2	LSCS	none	Yes	1.2
	M0130	Tundra Lake	16.3	3.0	5.3		none	none	No	5.3
Judy Creek										
	L9911	Tundra Lake	540.2	8.0	464.6		none	none	No	464.6
	M0011	Oxbow Lake	8.8	14.1	13.3	1.0	none	NSSB	Yes	1.0
	M0012	Oxbow Lake	42.5	17.9	81.9	7.5	none	none	Y?	7.5
	M0013	Oxbow Lake	8.7	6.1	5.7		none	none	No	5.7
	M0014	Tundra Lake	114.3	8.5	104.4		none	none	No	104.4
	M0015	Tundra Lake	473.4	7.5	381.8		none	none	No	381.8
	M0016	Tundra Lake	300.2	6.2	200.1	0.0	none	NSSB	Yes	0.0
	M0017	Tundra Lake	70.3	3.3	24.9		none	none	No	24.9
	M0029	Perched (FF?)	44.4	12.6	60.2	4.0	none	NSSB	Yes	4.0
	M0030	Oxbow Lake	26.0	8.3	23.2	0.5	none	none	No	23.2
	M0031	Oxbow Lake	33.4	11.4	40.9	2.4	none	none	Y?	2.4

[1] FF = frequent flooding (every 1 to 5 years); IF = infrequent flooding (less than once every 5 years)

[2] BDWF = broad whitefish, LSCS = least cisco, GRAY = arctic grayling

[3] BKFH = Alaska blackfish, NSSB = ninespine stickleback

[4] No = lake does not represent fish habitat, Yes = fish present during survey, Y? = fish not caught but lake has potential to be fish habitat, Y(elders) = North Slope elders indicate the lake represents potential fish habitat.

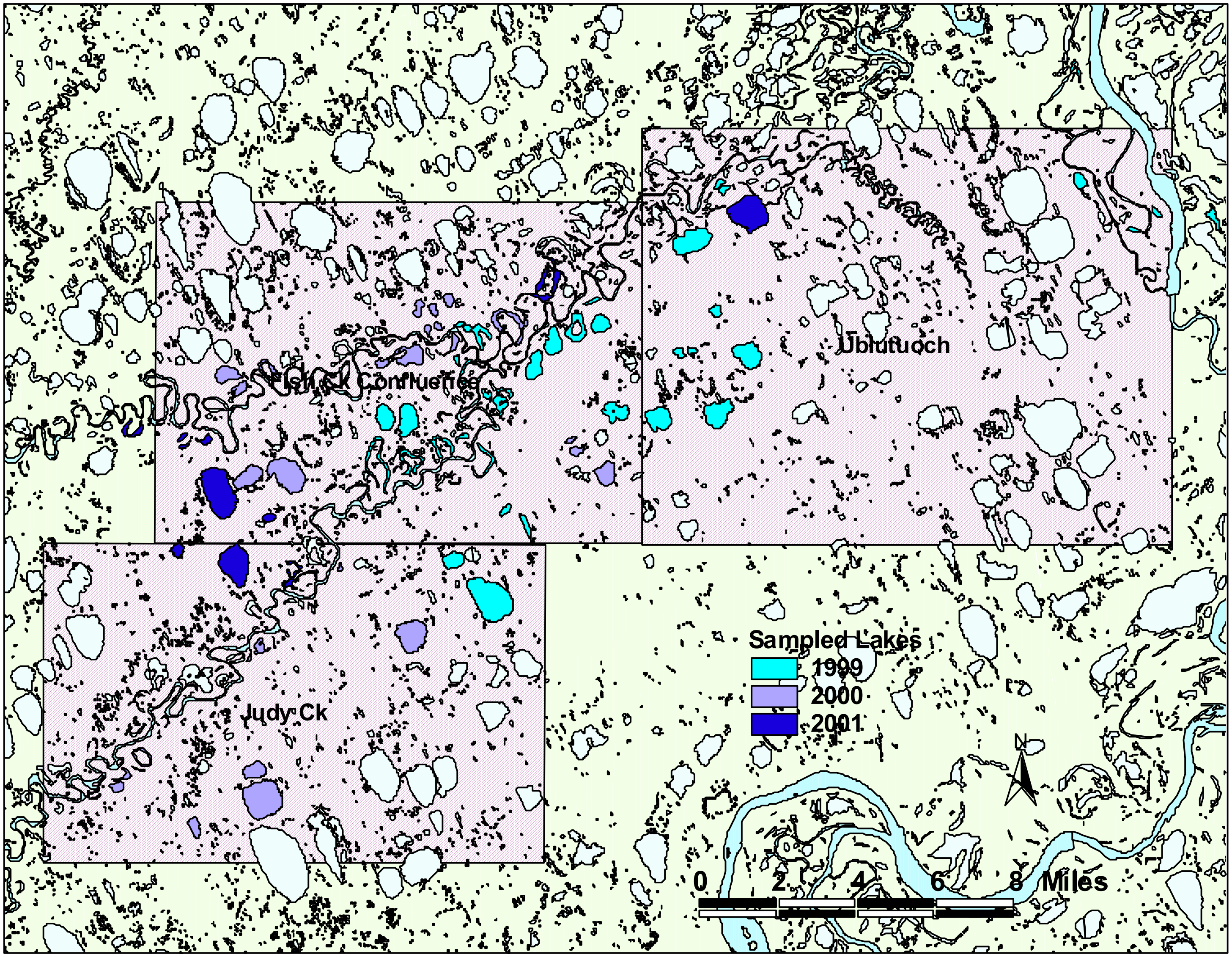


Figure 1. Regions of eastern NPRA sampled for fish during 1999-2001 summer field seasons.

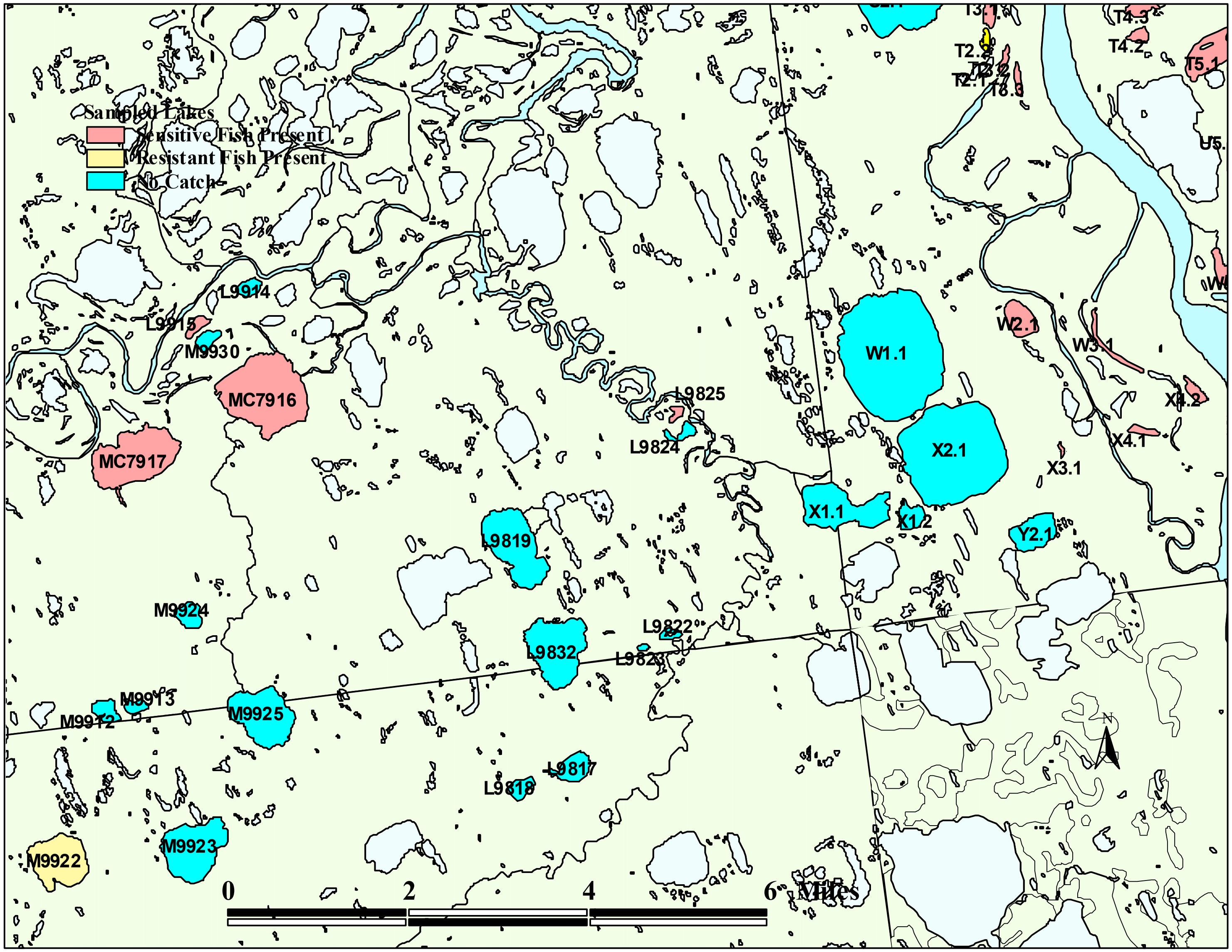


Figure 2. Lakes sampled for fish in the Ublutuoch region during 1999-2001.

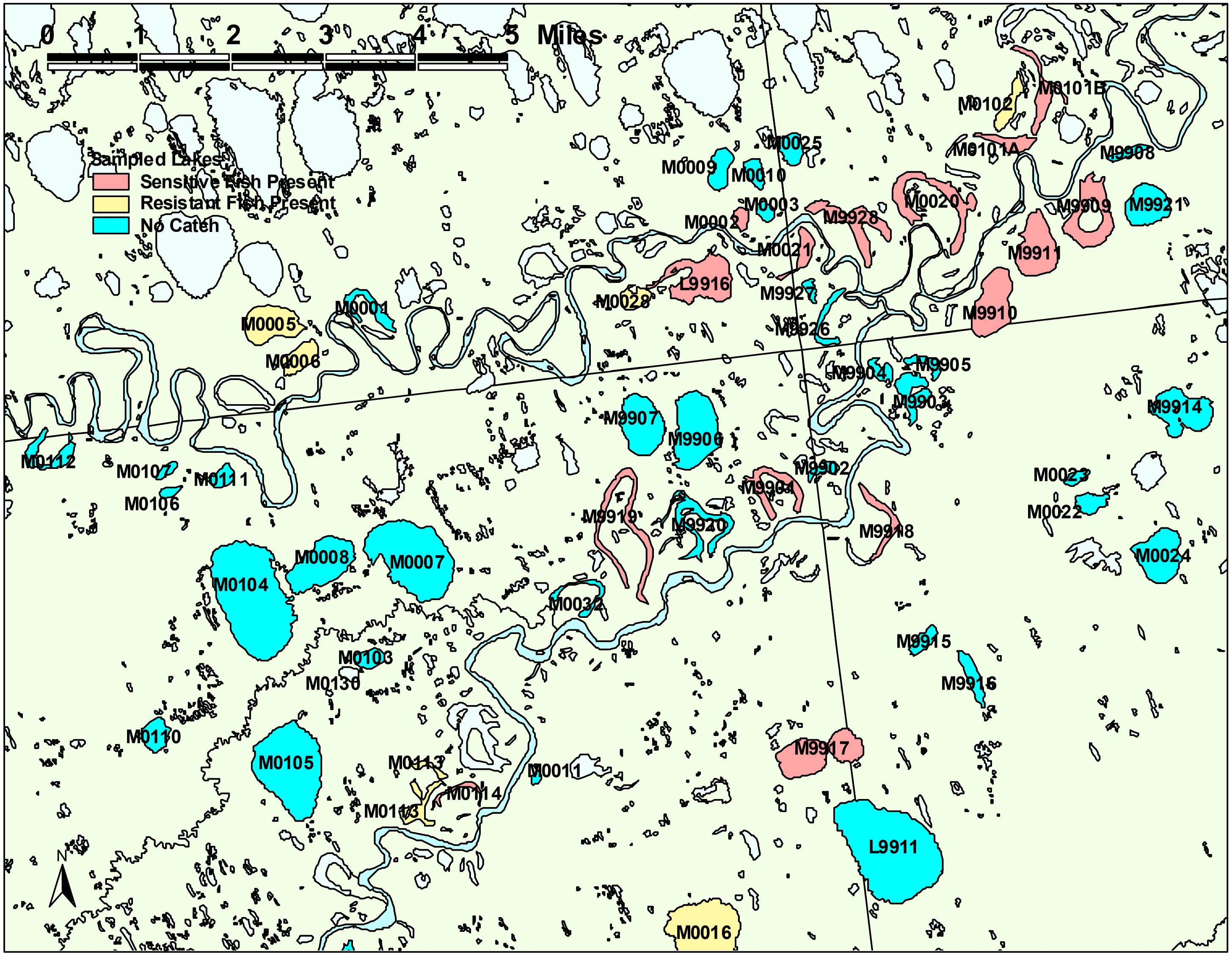


Figure 3. Lakes sampled for fish in the Fish Creek Confluence region during 1999-2001.

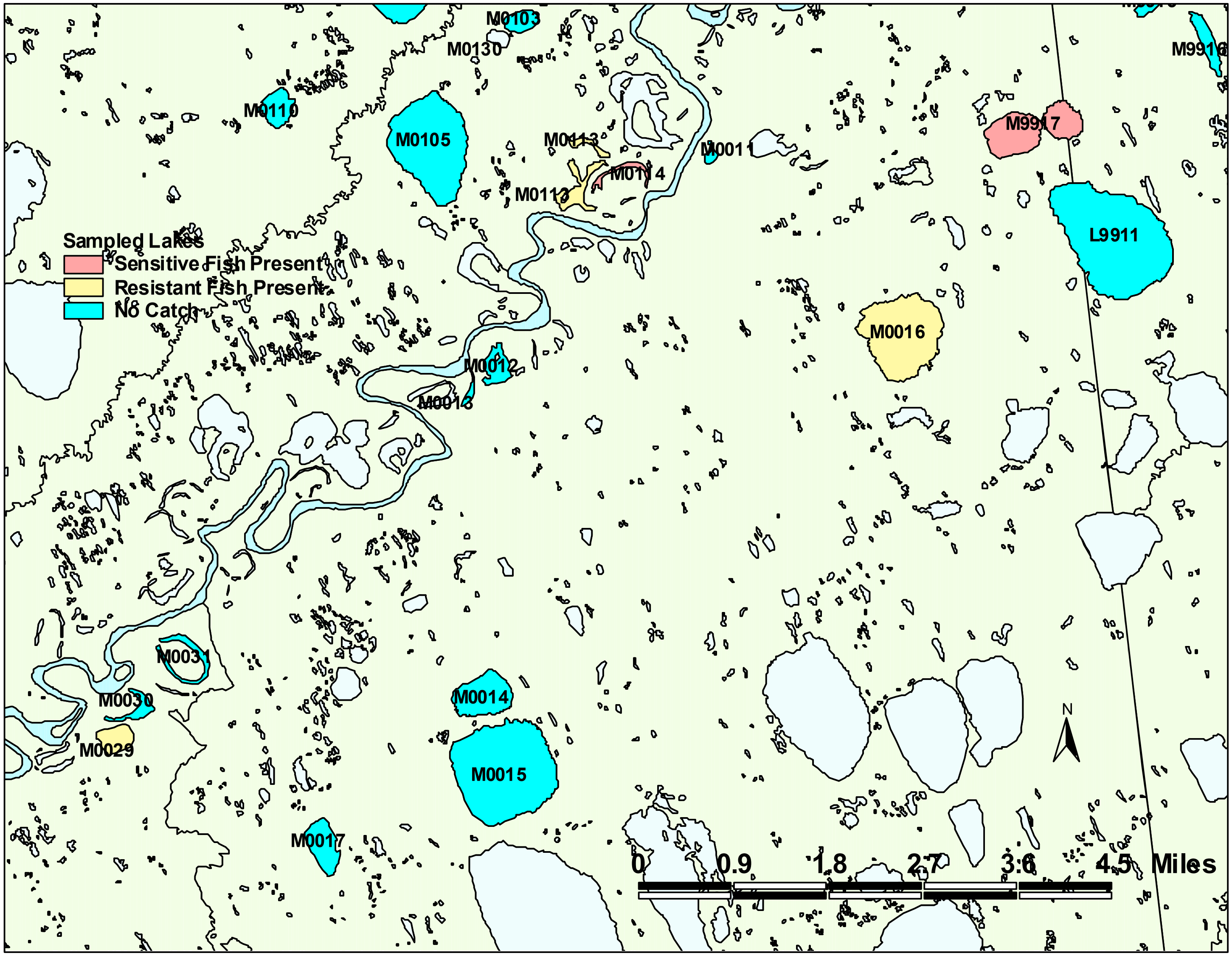


Figure 4. Lakes sampled for fish in the Judy Creek region during 1999-2001.

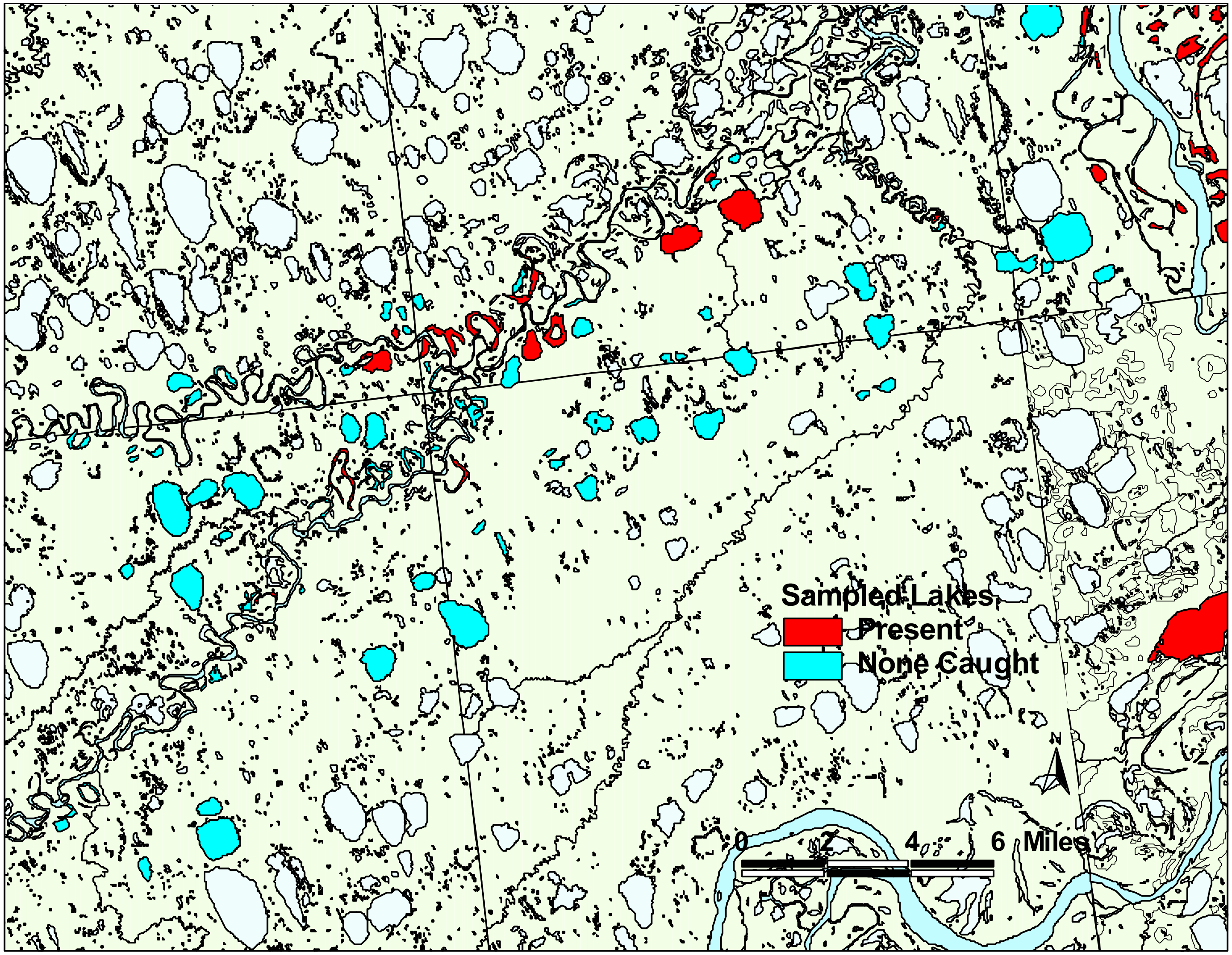


Figure 5. Distribution of least cisco in lakes sampled west of the Ublutuoch River during 1999-2001 summer field seasons.

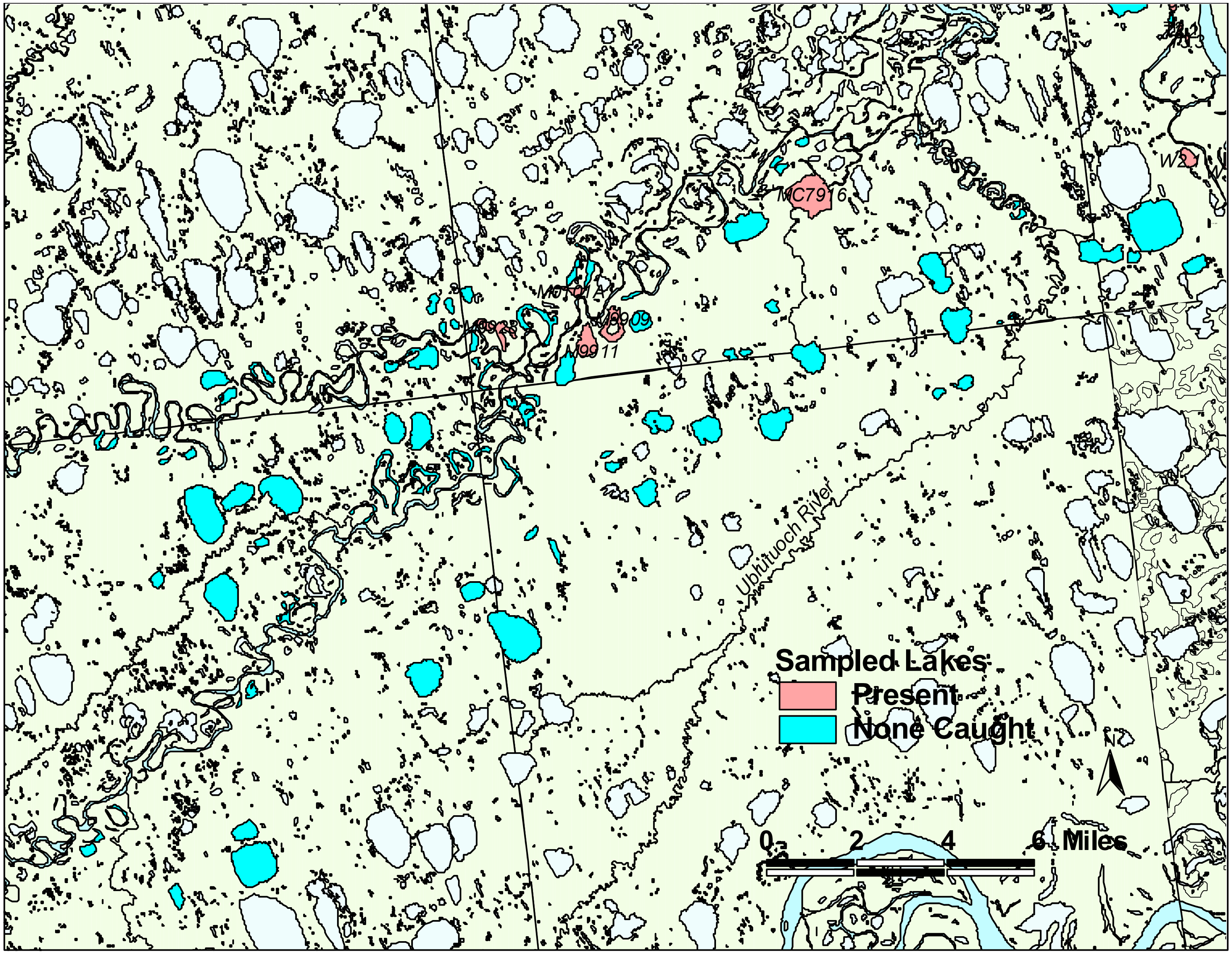


Figure 6. Distribution of broad whitefish in lakes sampled west of the Ublutuoch River during 1999-2001 summer field seasons.

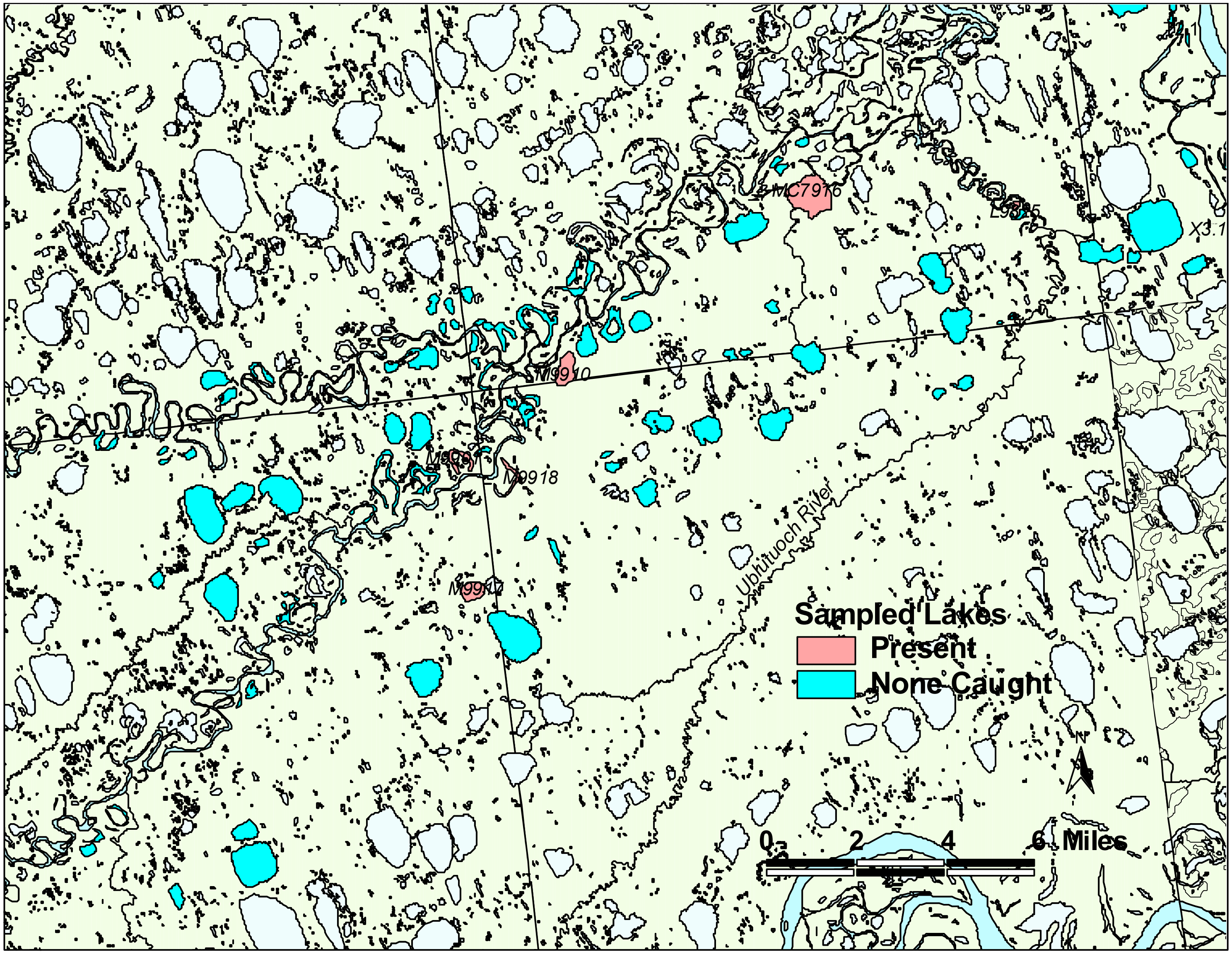
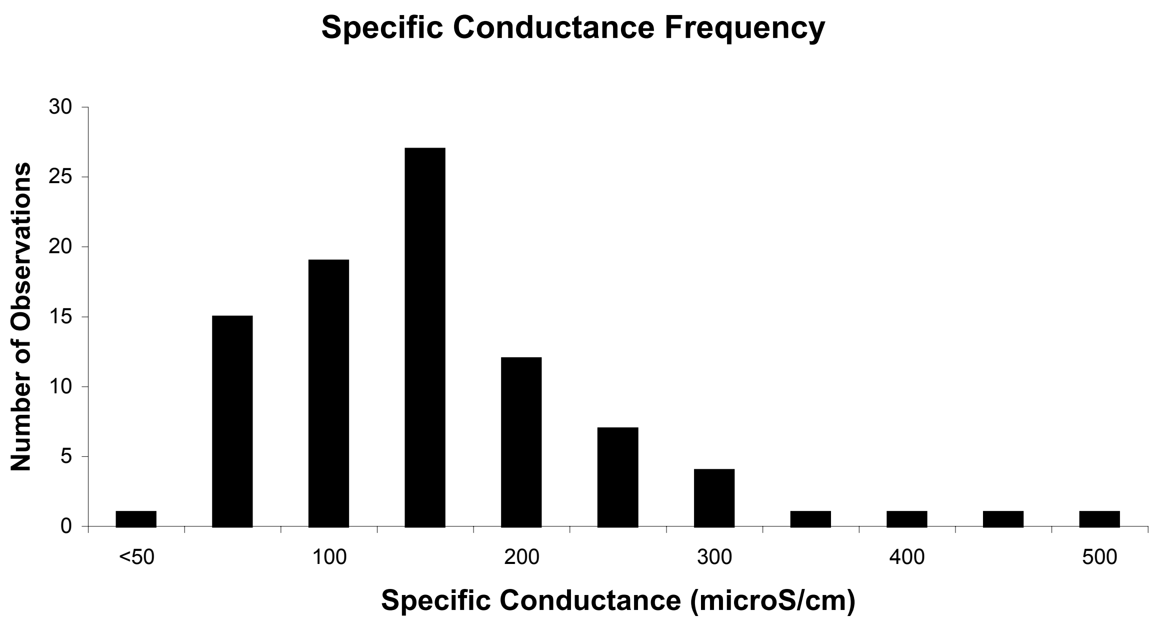


Figure 7. Distribution of arctic grayling in lakes sampled west of the Ublutuoch River during 1999-2001 summer field seasons.



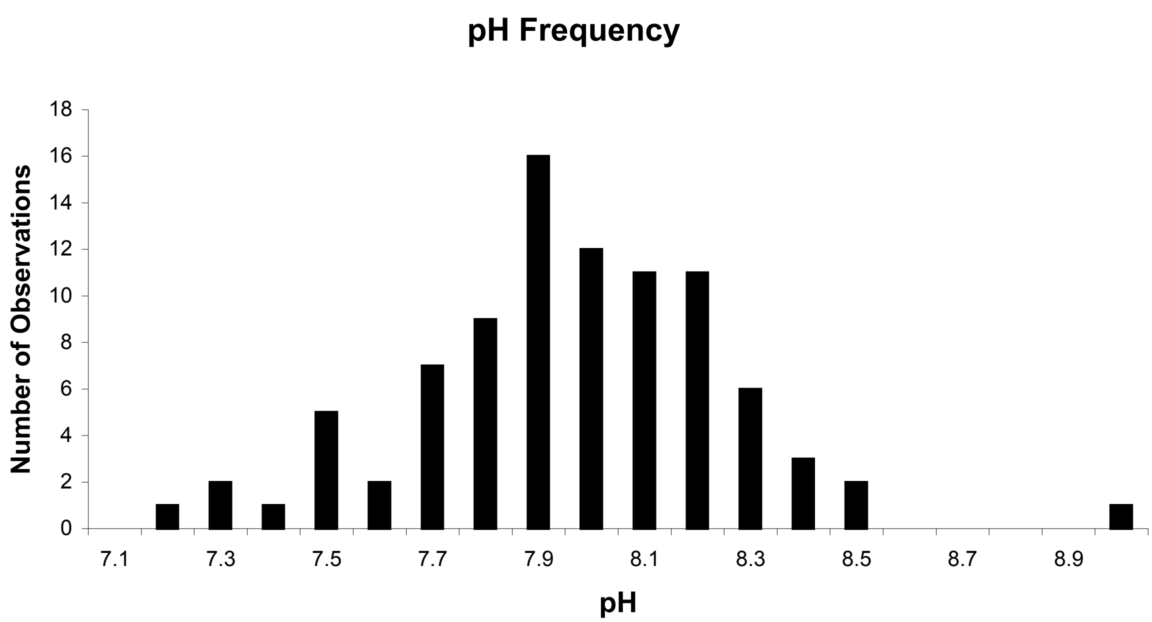
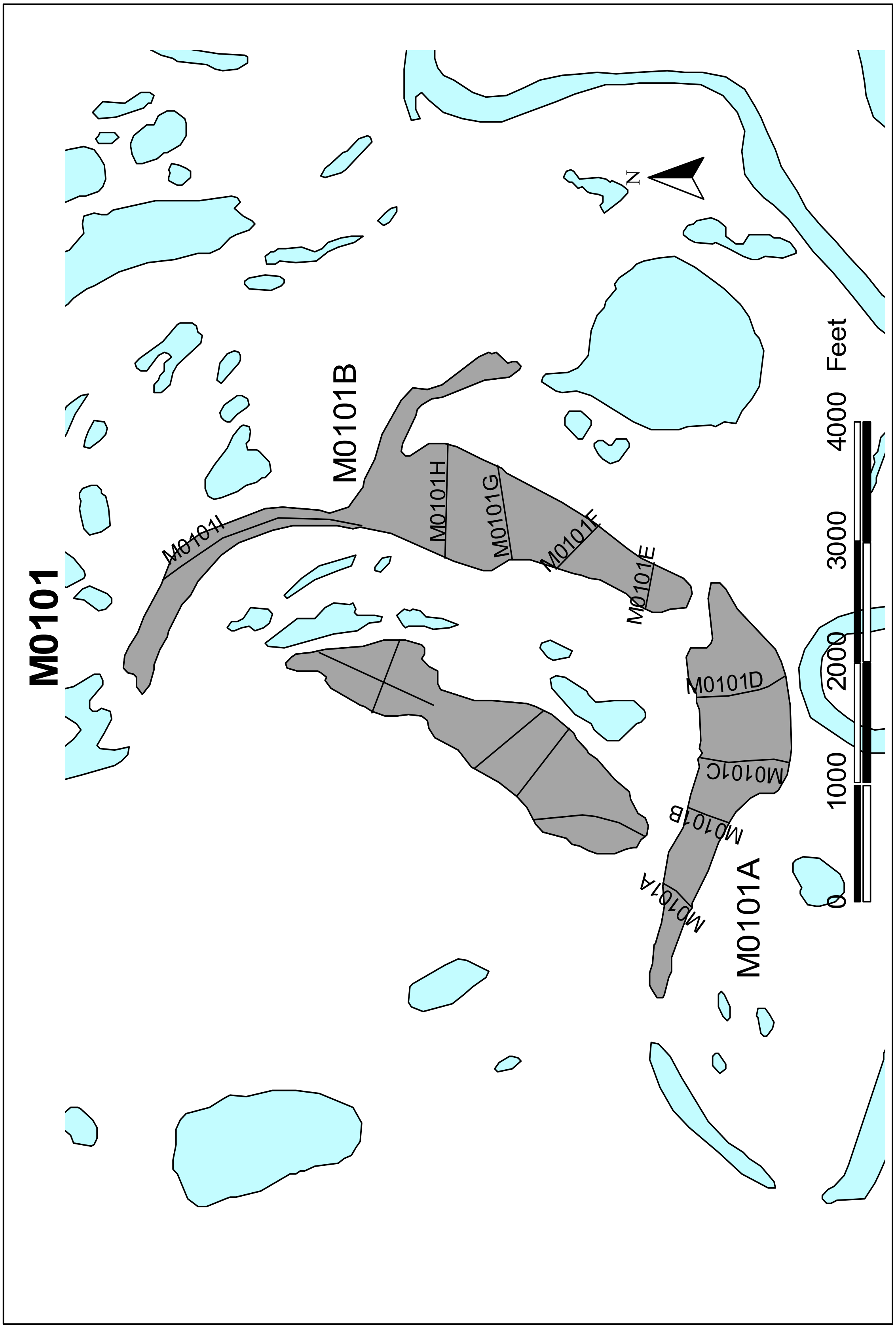


Figure 8 Frequency distribution of specific conductance and pH measurements taken during summer from 89 lakes in eastern NPRA, 1999-2001.

Lake Summaries


M0101
M0101B
M0101I
M0101H
M0101G
M0101F
M0101E
M0101D
M0101C
M0101B
M0101A
M0101A
N
0
1000
2000
3000
4000
Feet

Lake M0101

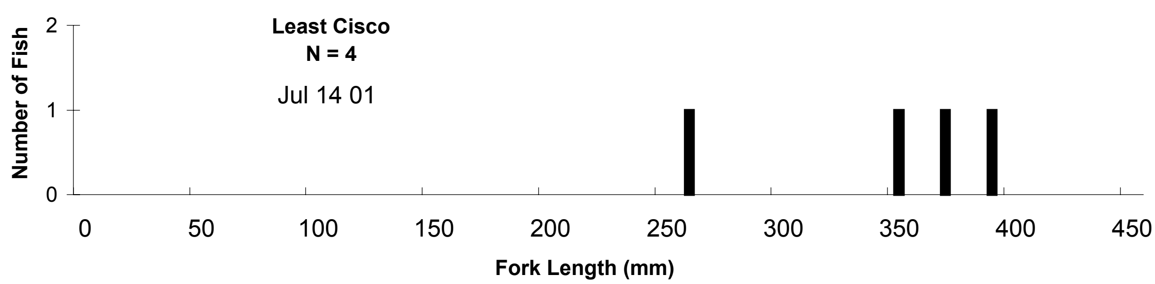
Other Names:		
Location:	70° 16' 42.5"N 151° 40' 59.0"W	
USGS Quad Sheet:	T11N R2E, Section 29	
	M0101A	M0101B
Habitat:	Oxbow Lake	Oxbow Lake
Area:	40 acres	64 acres
Maximum Depth:	12.1 feet	15.2 feet
Active Outlet:		
Turbidity:	1.2 NTU	
Spec. Conductance:	121 μS/cm	
pH:	8.1	
Calculated Volume:	52.2 million gallons	104.4 million gallons
Permittable Volume:	3.3 million gallons	8.4 million gallons

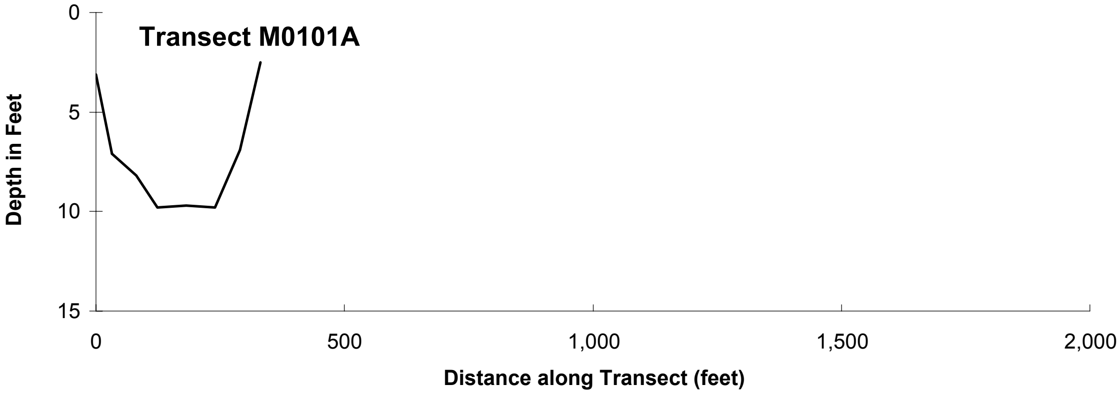
Water Quality:

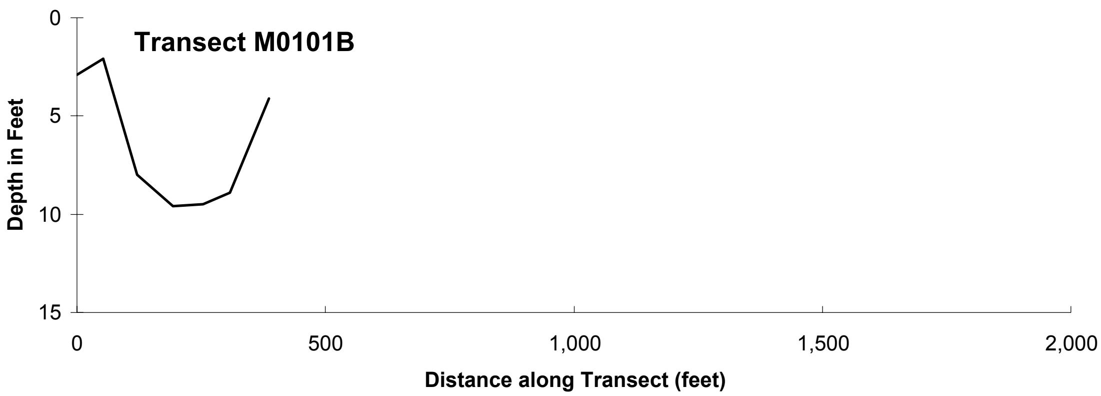
Year of Test	Chloride (mg/l)	Sodium (mg/l)	Calcium (mg/l)	Magnesium (mg/l	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Source
2001	8.4	4.3	18.0	2.9	57	70	this study

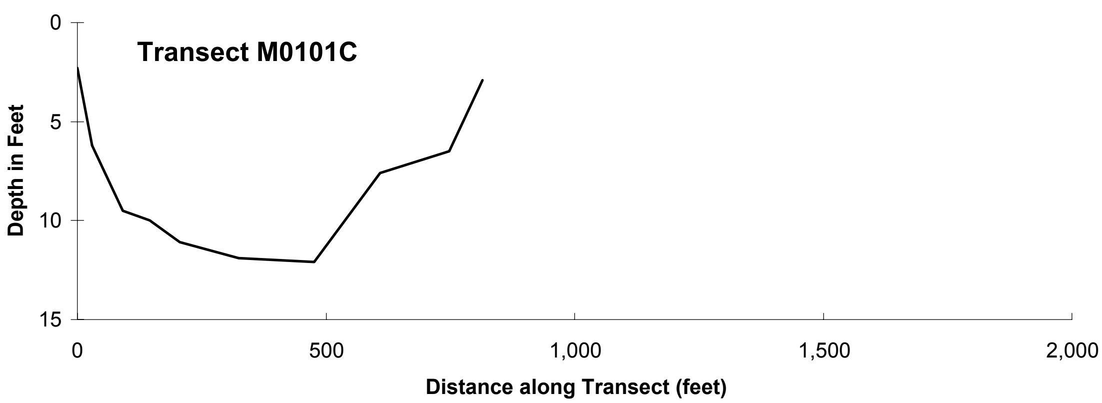
Catch Record:

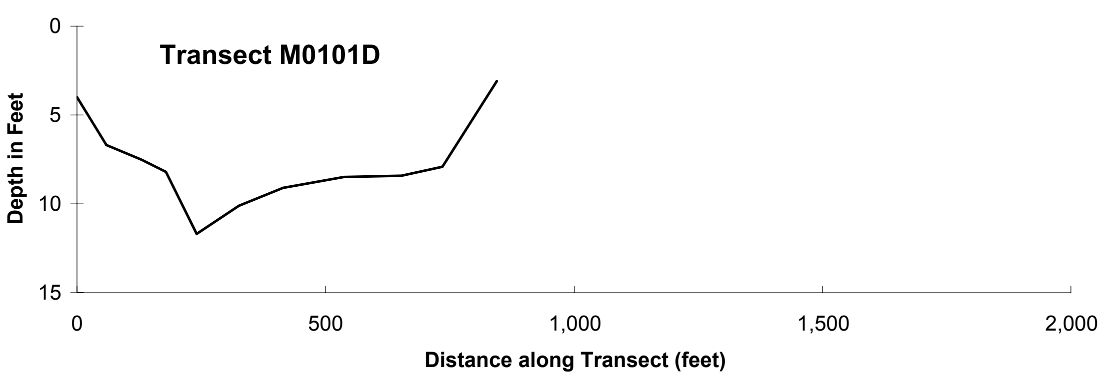
Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Jul 14 01	8.0	Broad whitefish	1	
			Least cisco	5	263-398

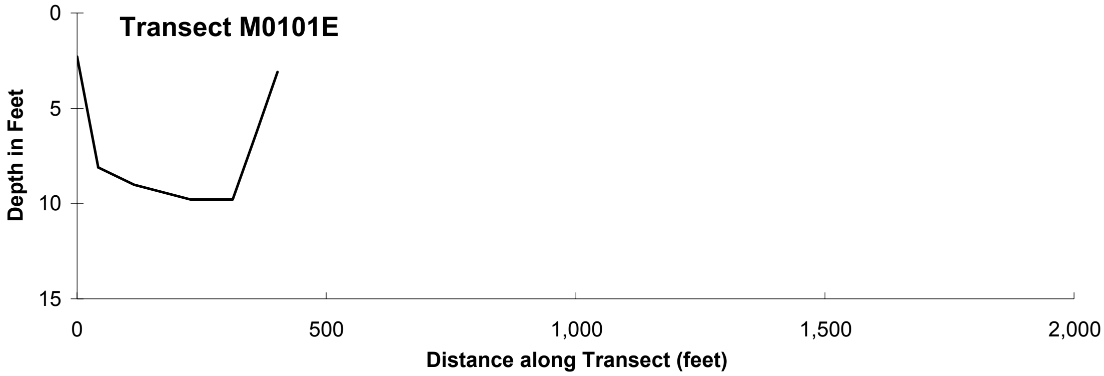


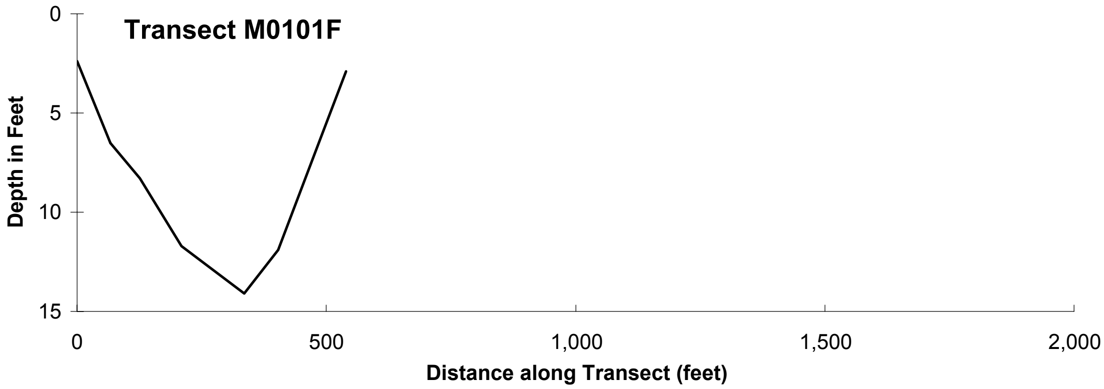

Transect M0101A
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)

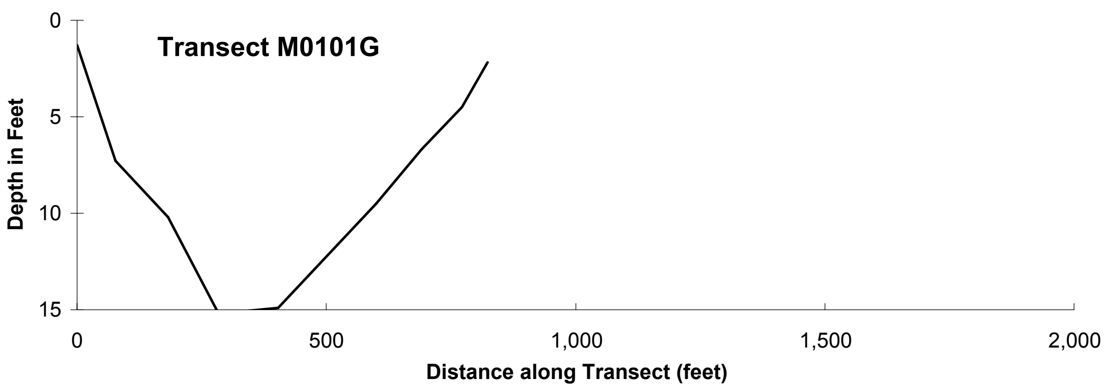

Transect M0101B
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)

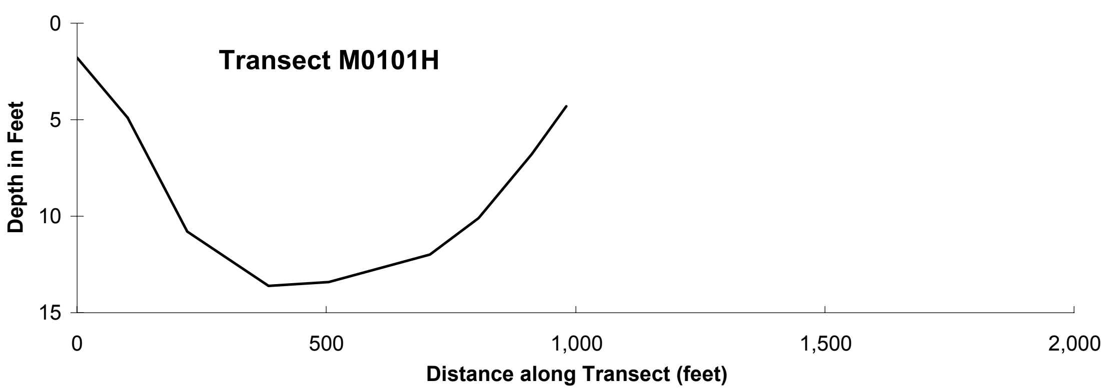

Transect M0101C
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)

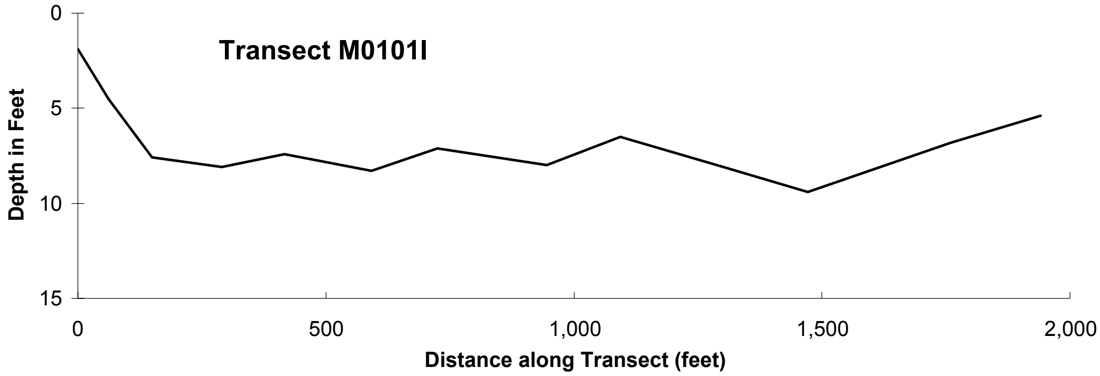

Transect M0101D
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)

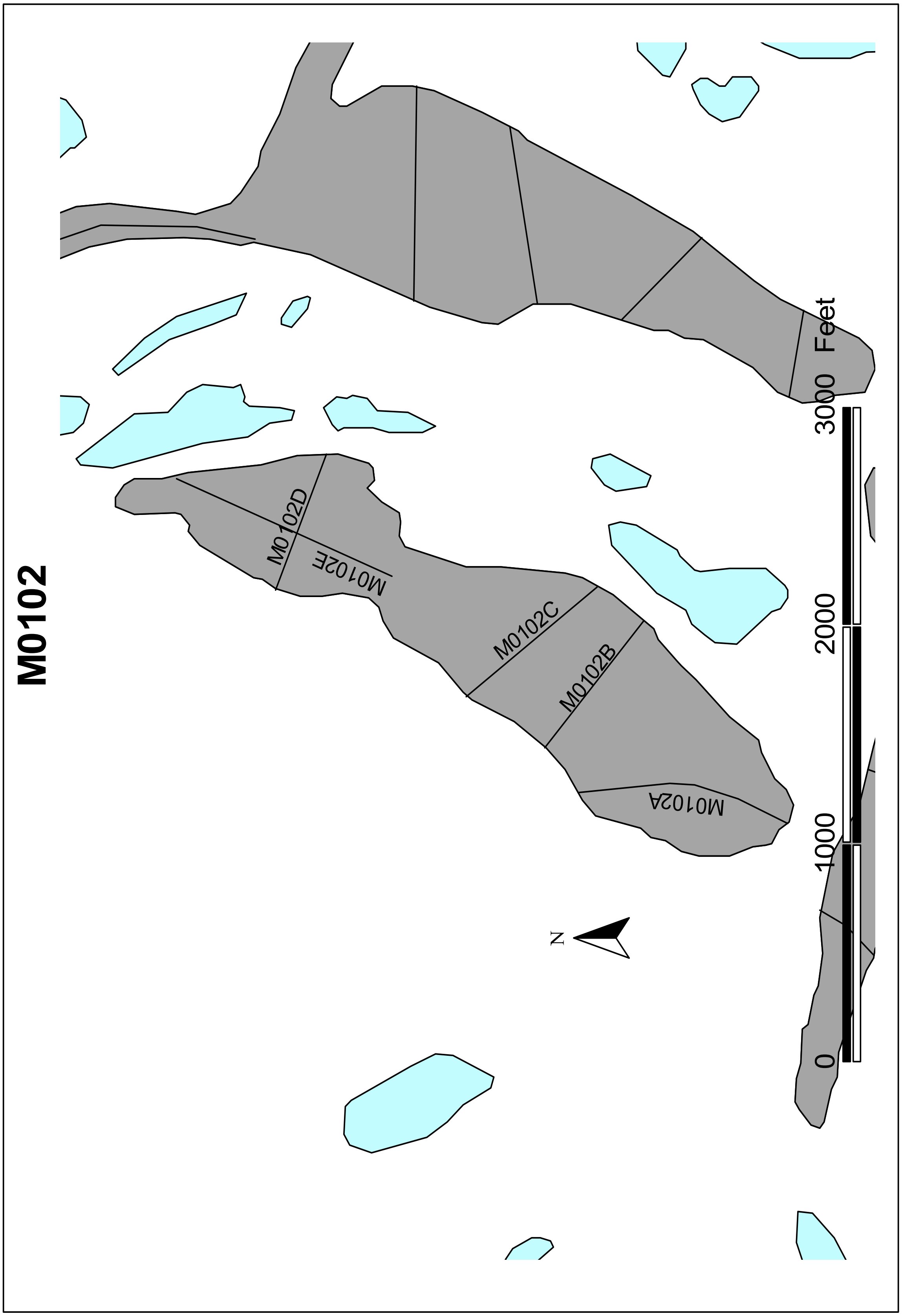

Transect M0101E
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)


Transect M0101F
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)


Transect M0101G
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)


Transect M0101H
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)


Transect M0101I
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)


M0102
M0102D
M0102E
M0102C
M0102B
M0102A
N
0
1000
2000
3000
Feet

Lake M0102

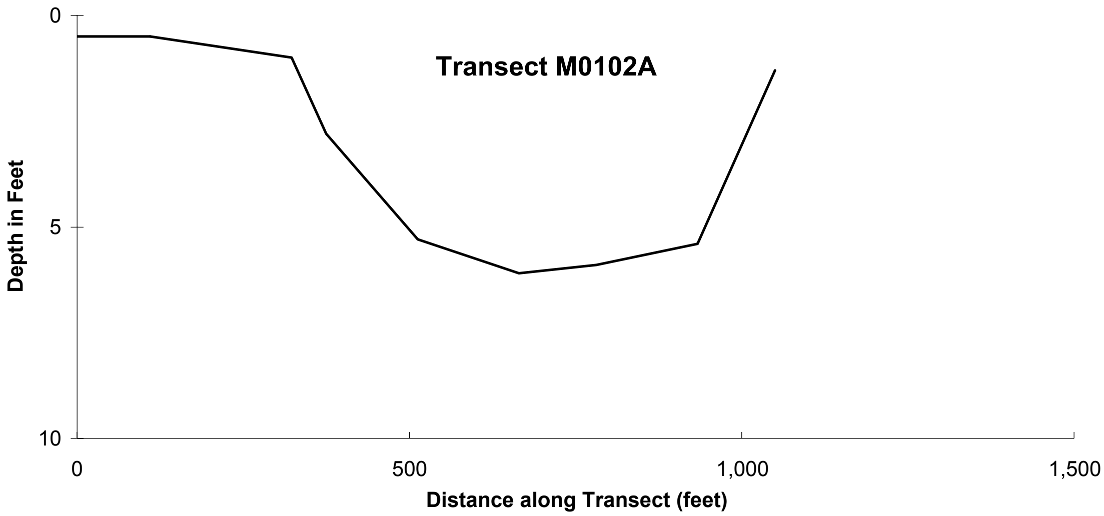
Other Names:	
Location:	70° 16' 42.5"N 151° 40' 59.0"W
USGS Quad Sheet:	T11N R2E, Section 29
Habitat:	Oxbow Lake
Area:	45 acres
Maximum Depth:	9.5 feet
Active Outlet:	
Turbidity:	4.0 NTU
Spec. Conductance:	173 µS/cm
pH:	8.3
Calculated Volume:	45.8 million gallons
Permittable Volume:	1.8 million gallons

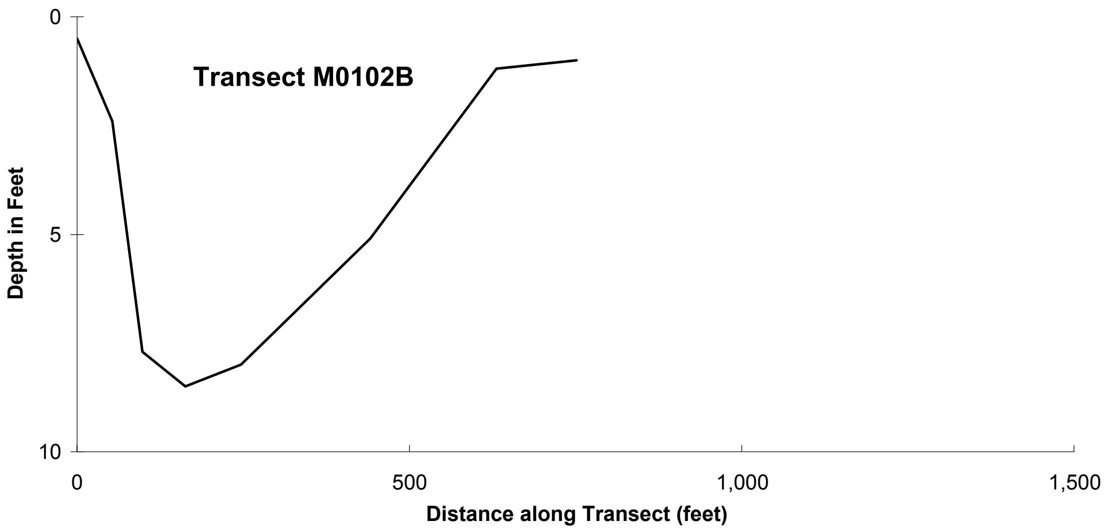
Water Quality:

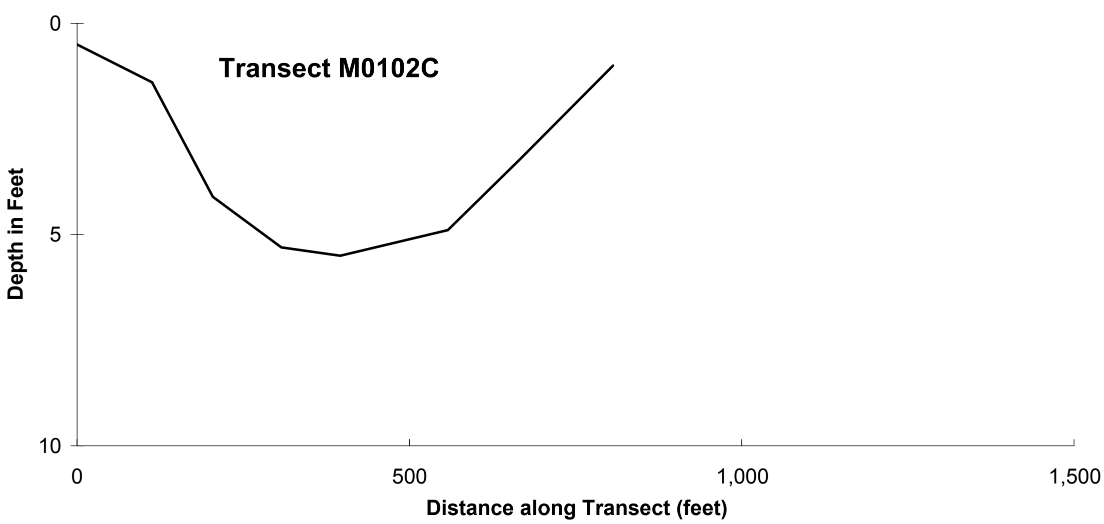
Year of Test	Chloride (mg/l)	Sodium (mg/l)	Calcium (mg/l)	Magnesium (mg/l	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Source
2001	14.0	6.8	27.0	4.2	86	78	this study

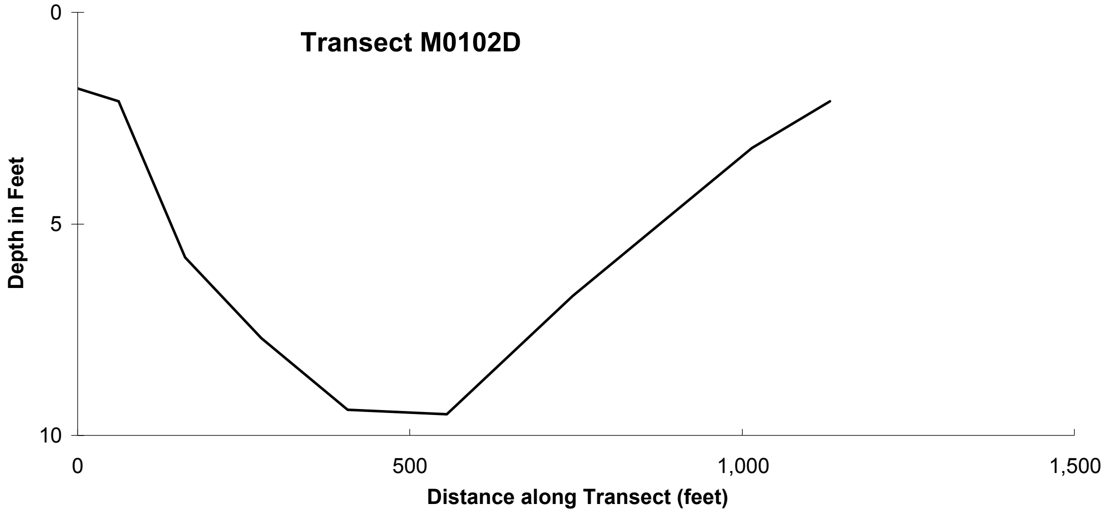
Catch Record:

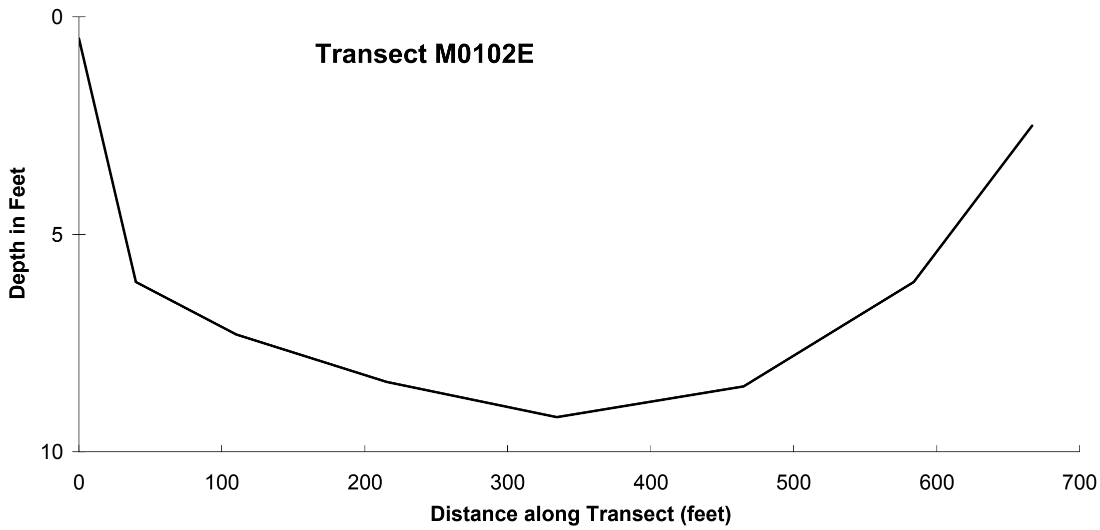
Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 14 01	6.8	None	0
			(Ninespine stickleback observed)	

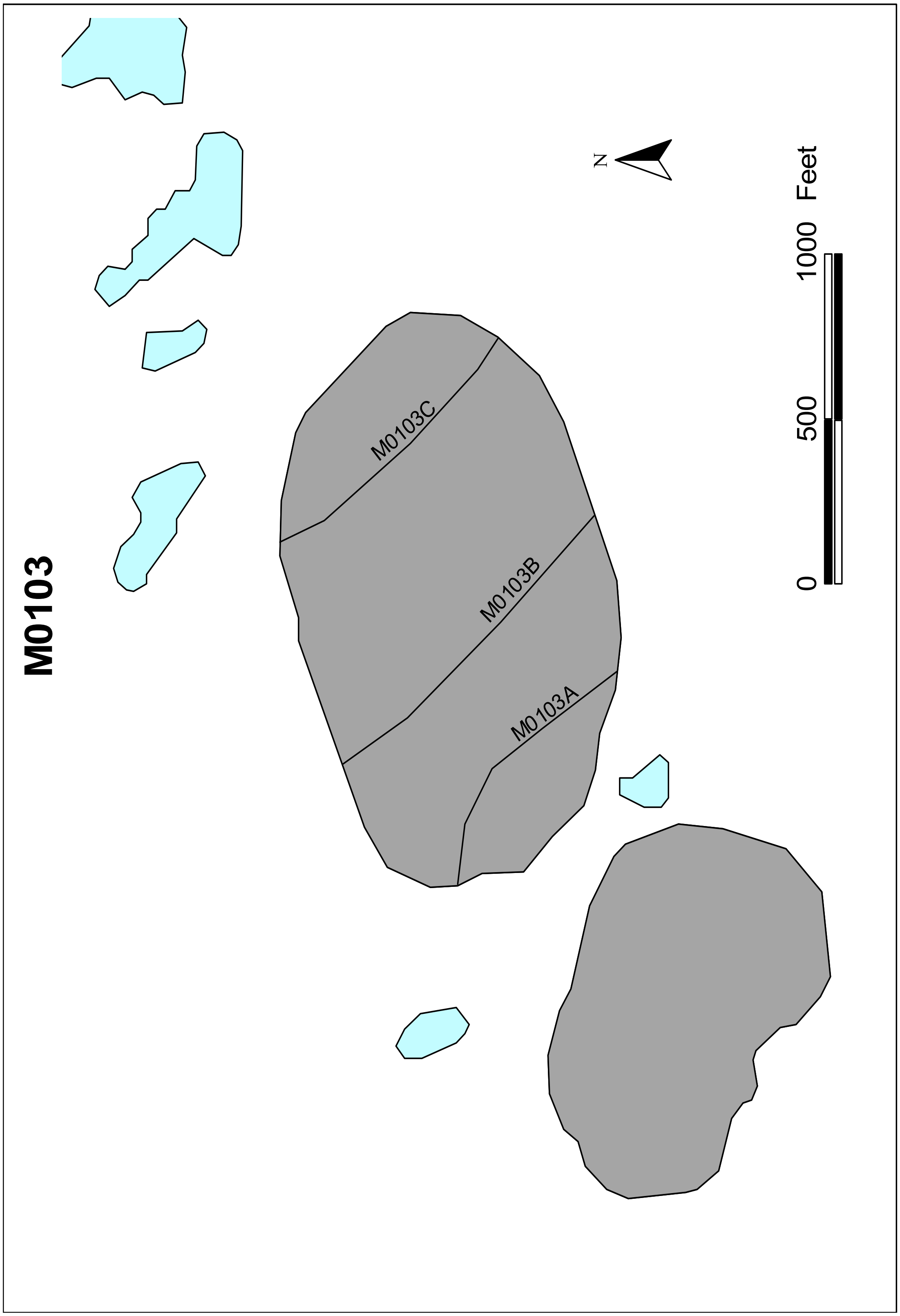

Transect M0102A
Depth in Feet
0
5
10
0
500
1,000
1,500
Distance along Transect (feet)


Transect M0102B
Depth in Feet
0
5
10
0
500
1,000
1,500
Distance along Transect (feet)


Transect M0102C
Depth in Feet
0
5
10
0
500
1,000
1,500
Distance along Transect (feet)


Transect M0102D
Depth in Feet
0
5
10
0
500
1,000
1,500
Distance along Transect (feet)


Transect M0102E
Depth in Feet
0
5
10
0
100
200
300
400
500
600
700
Distance along Transect (feet)



M0103
M0103C
M0103B
M0103A
N
0
500
1000
Feet

Lake M0103

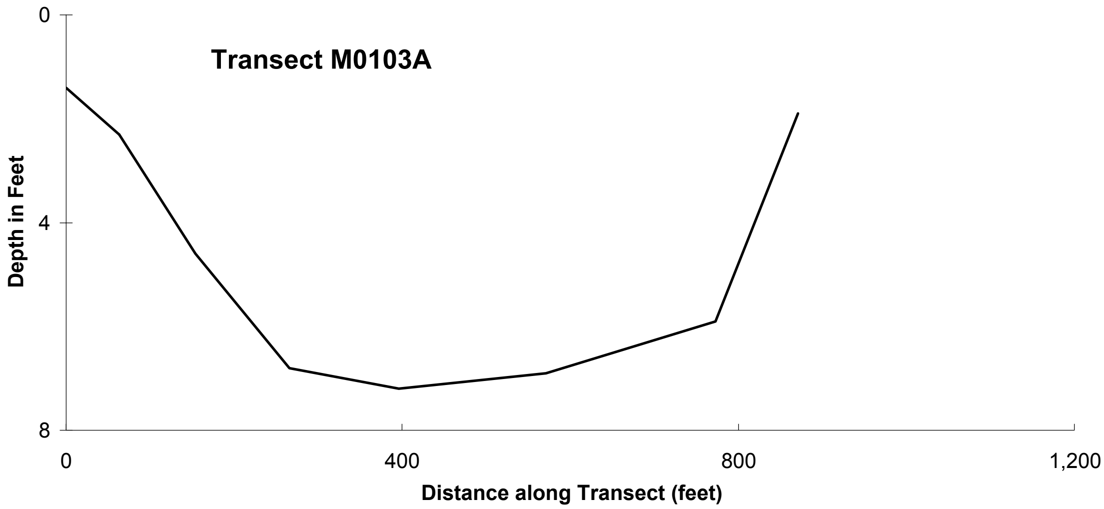
Other Names:	
Location:	70° 16' 42.5"N 151° 40' 59.0"W
USGS Quad Sheet:	T10N R1W, Section 24
Habitat:	Tundra Lake
Area:	32 acres
Maximum Depth:	7.8 feet
Active Outlet:	
Turbidity:	1.3 NTU
Spec. Conductance:	271 μS/cm
pH:	8.21
Calculated Volume:	27.2 million gallons
Permittable Volume:	No fish concern

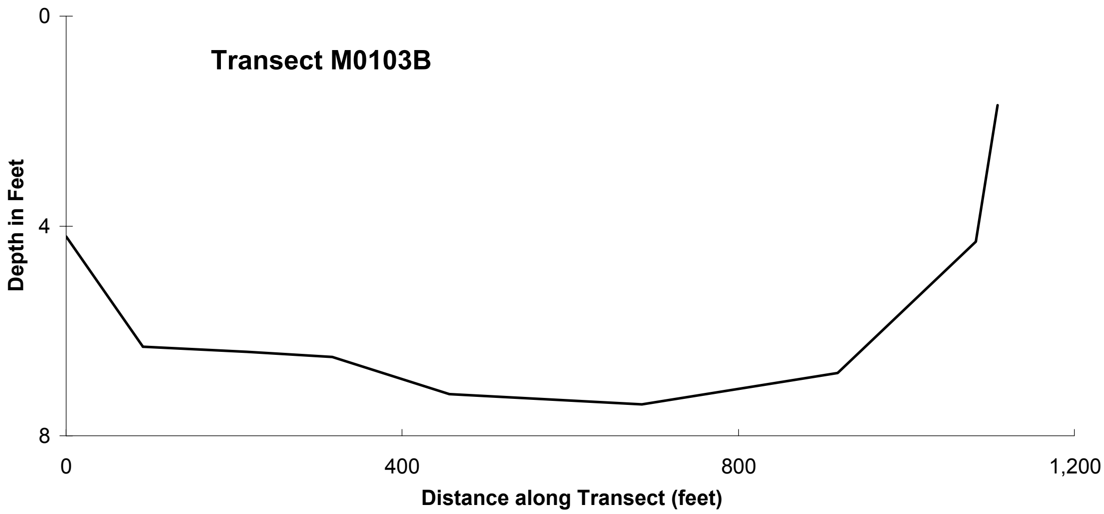
Water Quality:

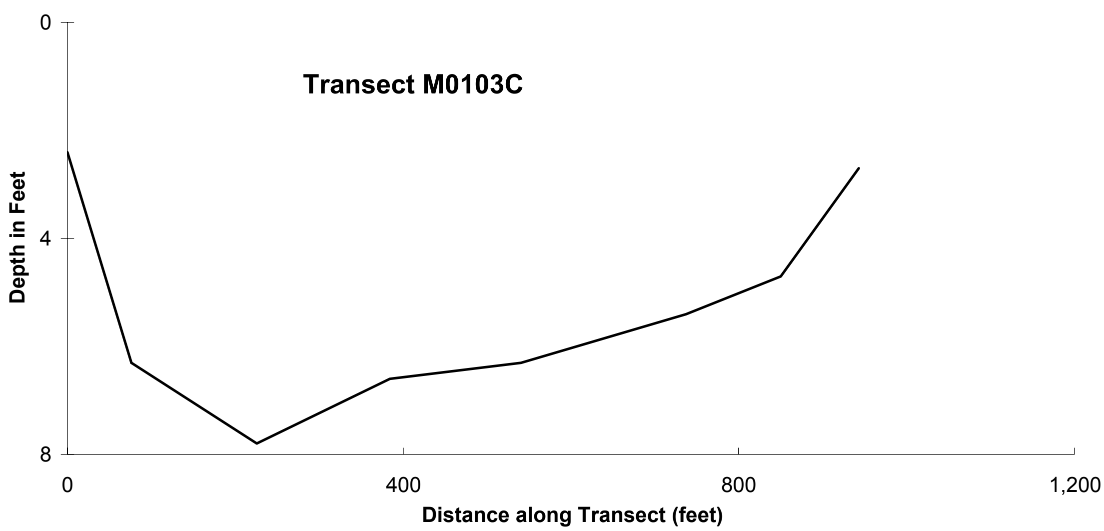
Year of Test	Chloride (mg/l)	Sodium (mg/l)	Calcium (mg/l)	Magnesium (mg/l	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Source
2001	37.0	17.0	34.0	5.9	110	170	this study

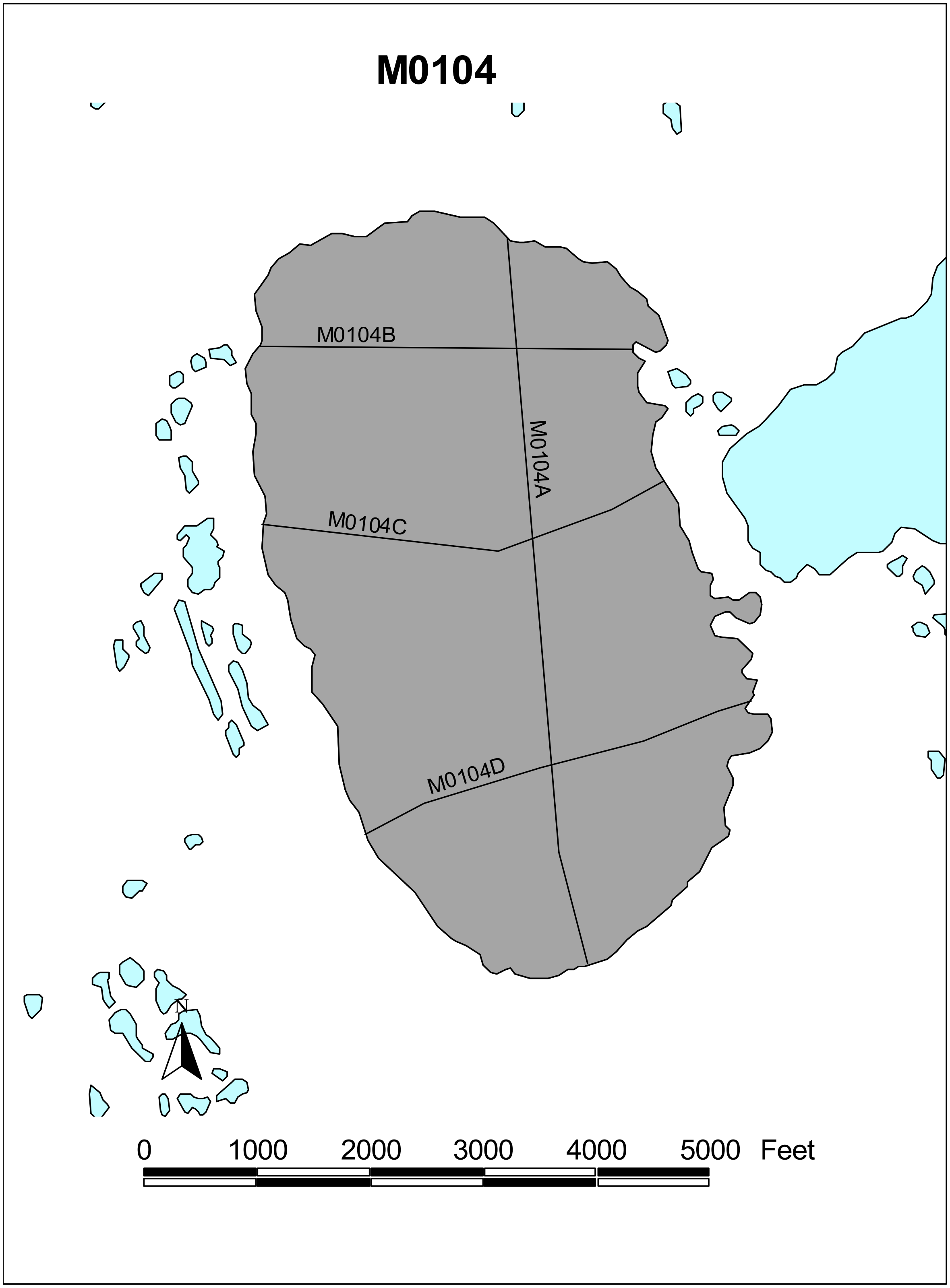
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 15 01	11.9	None	0


Transect M0103A
Depth in Feet
0
4
8
0
400
800
1,200
Distance along Transect (feet)


Transect M0103B
Depth in Feet
0
4
8
0
400
800
1,200
Distance along Transect (feet)


Transect M0103C
Depth in Feet
0
4
8
0
400
800
1,200
Distance along Transect (feet)


M0104
M0104B
M0104A
M0104C
M0104D
N
0
1000
2000
3000
4000
5000
Feet

Lake M0104

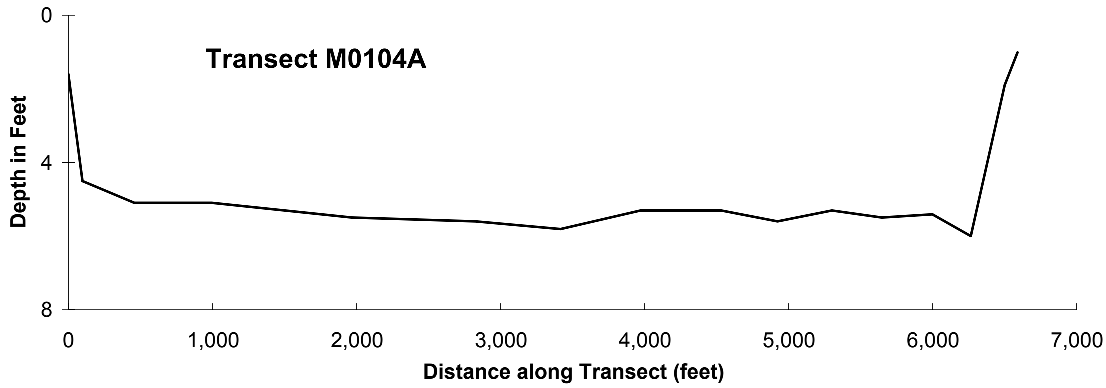
Other Names:	
Location:	70° 16' 42.5"N 151° 40' 59.0"W
USGS Quad Sheet:	T10N R1W, Section 14
Habitat:	Tundra Lake
Area:	504 acres
Maximum Depth:	6.3 feet
Active Outlet:	
Turbidity:	2.0 NTU
Spec. Conductance	81 μS/cm
pH:	7.9
Calculated Volume:	341.1 million gallons
Permittable Volume	No fish concern

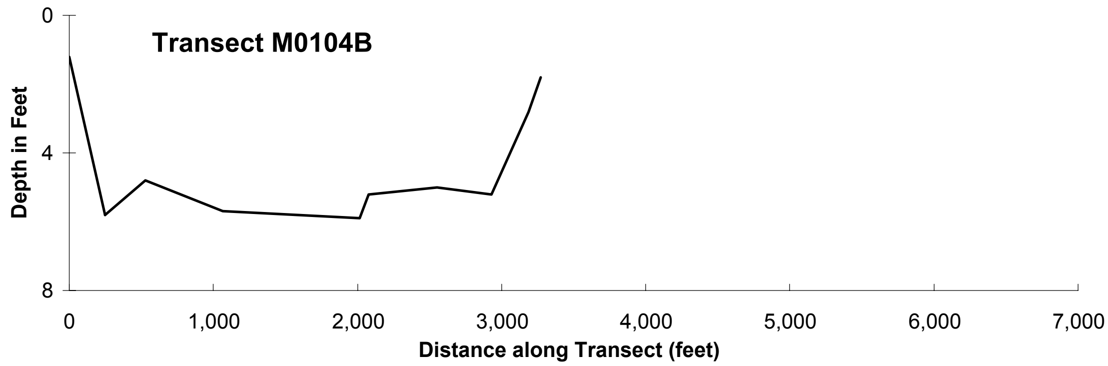
Water Quality:

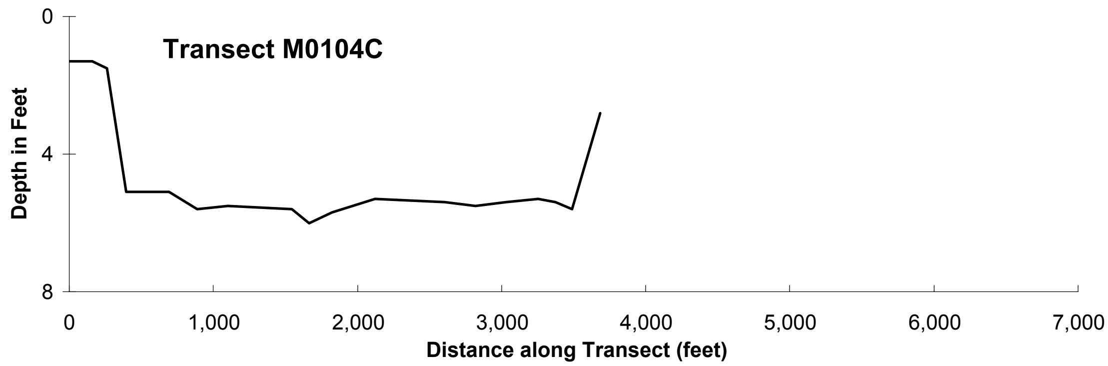
Year of Test	Chloride (mg/l)	Sodium (mg/l)	Calcium (mg/l)	Magnesium (mg/l	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Source
2001	8.1	3.9	10.0	1.7	33	66	this study

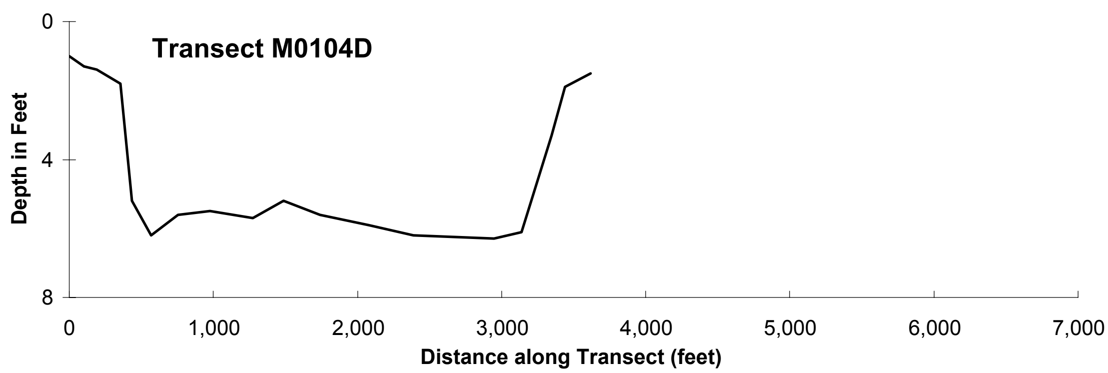
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 16 01	9.6	None	0

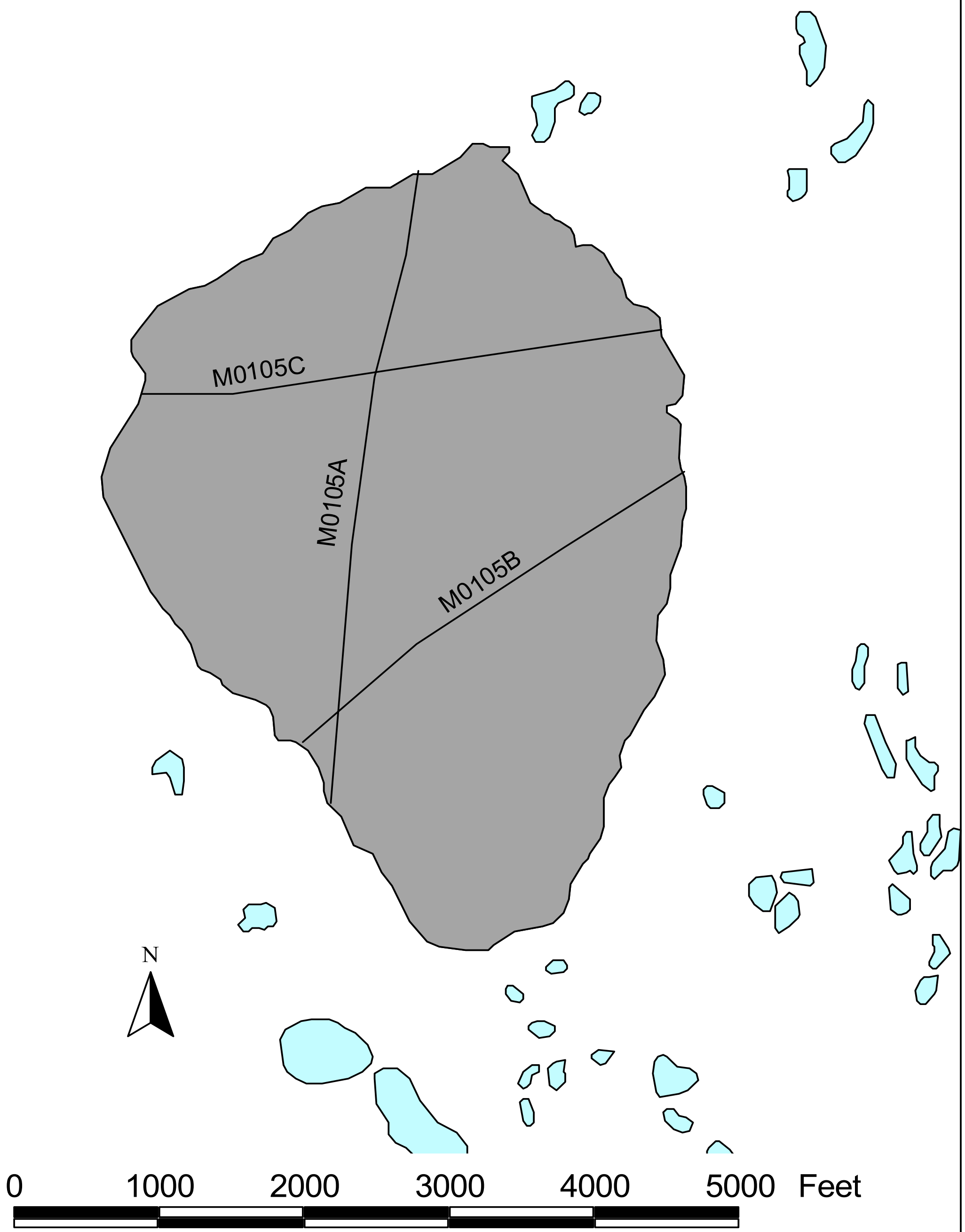

Transect M0104A
Depth in Feet
0
4
8
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
Distance along Transect (feet)


Transect M0104B
Depth in Feet
0
4
8
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
Distance along Transect (feet)


Transect M0104C
Depth in Feet
0
4
8
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
Distance along Transect (feet)


Transect M0104D
Depth in Feet
0
4
8
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
Distance along Transect (feet)

M0105



Lake M0105

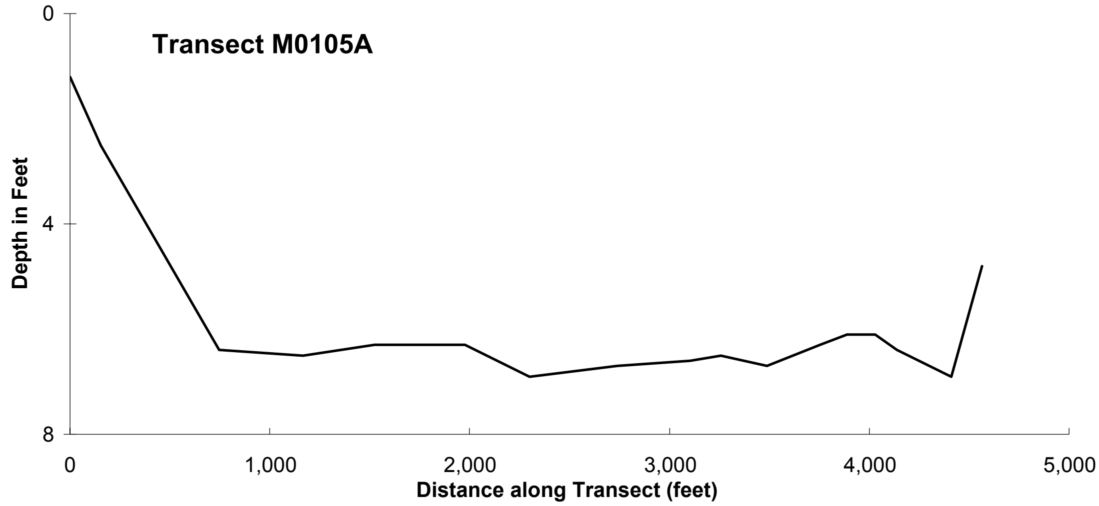
Other Names:	
Location:	70° 16' 42.5"N 151° 40' 59.0"W
USGS Quad Sheet:	T10N R1W, Section 26
Habitat:	Tundra Lake
Area:	350 acres
Maximum Depth:	6.9 feet
Active Outlet:	
Turbidity:	3.0 NTU
Spec. Conductance:	376 µS/cm
pH:	8.4
Calculated Volume:	259.3 million gallons
Permittable Volume:	No fish concern

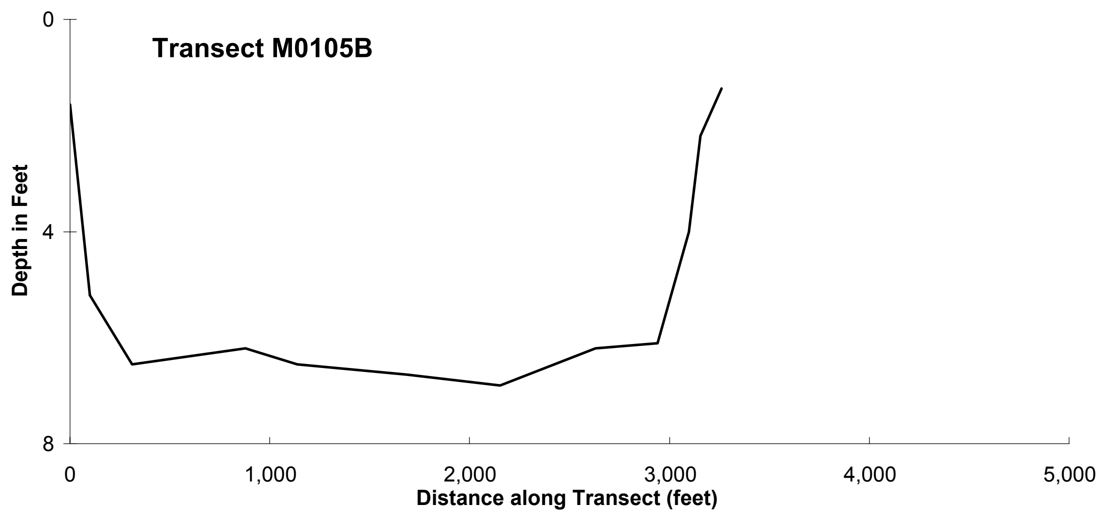
Water Quality:

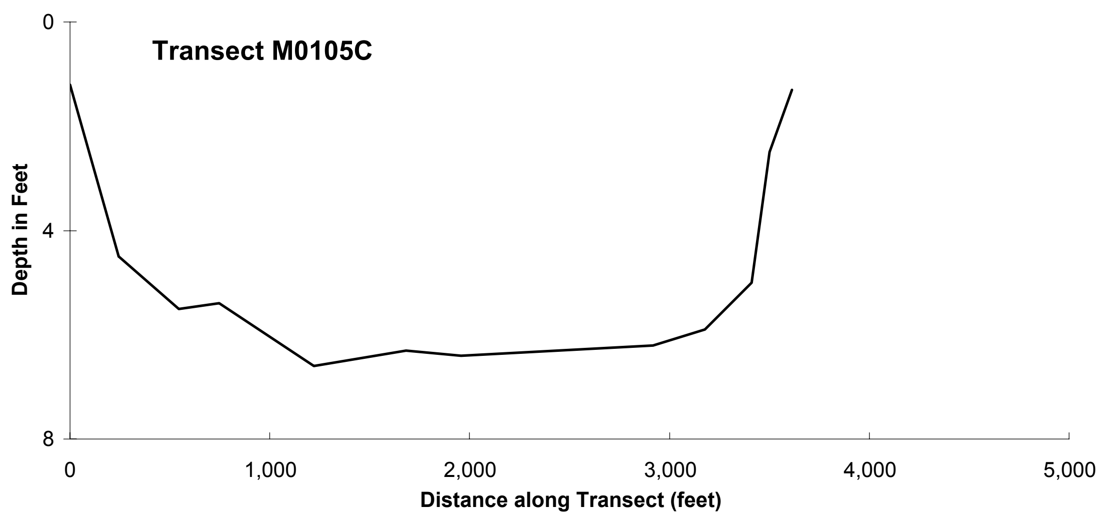
Year of Test	Chloride (mg/l)	Sodium (mg/l)	Calcium (mg/l)	Magnesium (mg/l	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Source
2001	51.0	23.0	48.0	8.2	150	240	this study

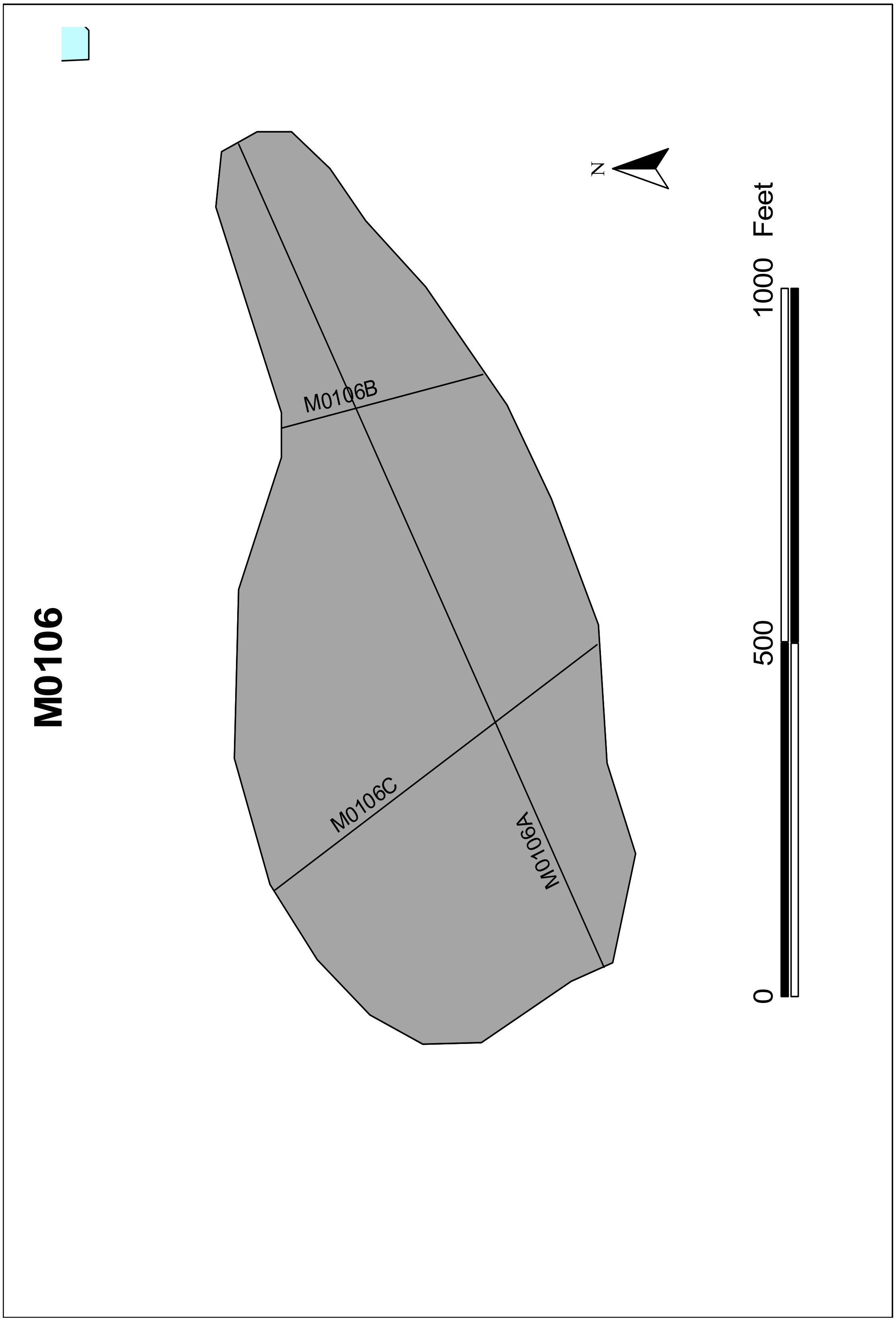
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 16 01	9.1	None	0


Transect M0105A
Depth in Feet
0
4
8
0
1,000
2,000
3,000
4,000
5,000
Distance along Transect (feet)


Transect M0105B
Depth in Feet
0
4
8
0
1,000
2,000
3,000
4,000
5,000
Distance along Transect (feet)


Transect M0105C
Depth in Feet
0
4
8
0
1,000
2,000
3,000
4,000
5,000
Distance along Transect (feet)


M0106
M0106A
M0106B
M0106C
N
0
500
1000
Feet

Lake M0106

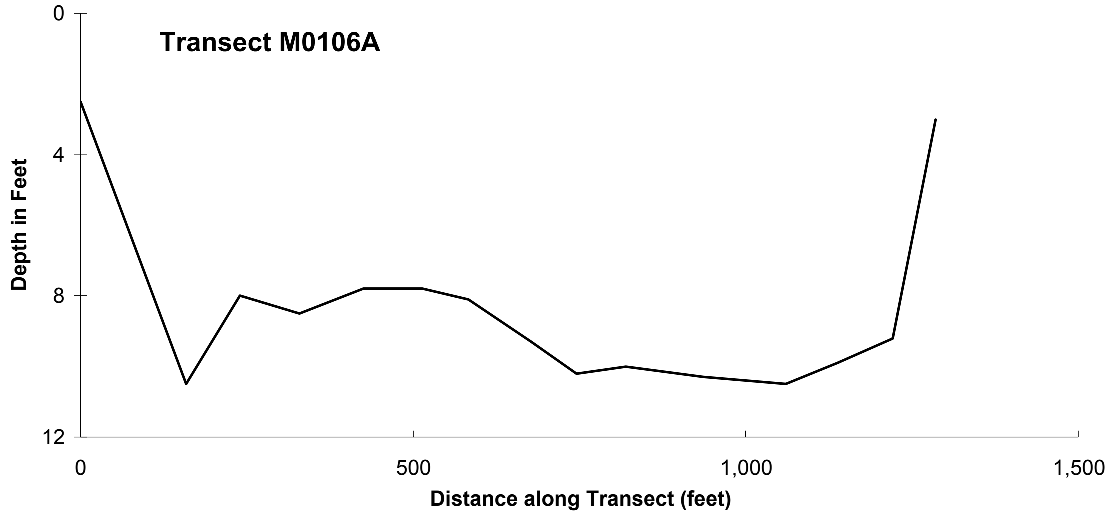
Other Names:
Location: 70° 16' 42.5"N 151° 40' 59.0"W
USGS Quad Sheet: T10N R1W, Section 10
Habitat: Tundra Lake
Area: 12 acres
Maximum Depth: 10.7 feet
Active Outlet:
Turbidity: 1.1 NTU
Spec. Conductance: 69 µS/cm
pH: 7.5
Calculated Volume: 13.8 million gallons
Permittable Volume: No fish concern

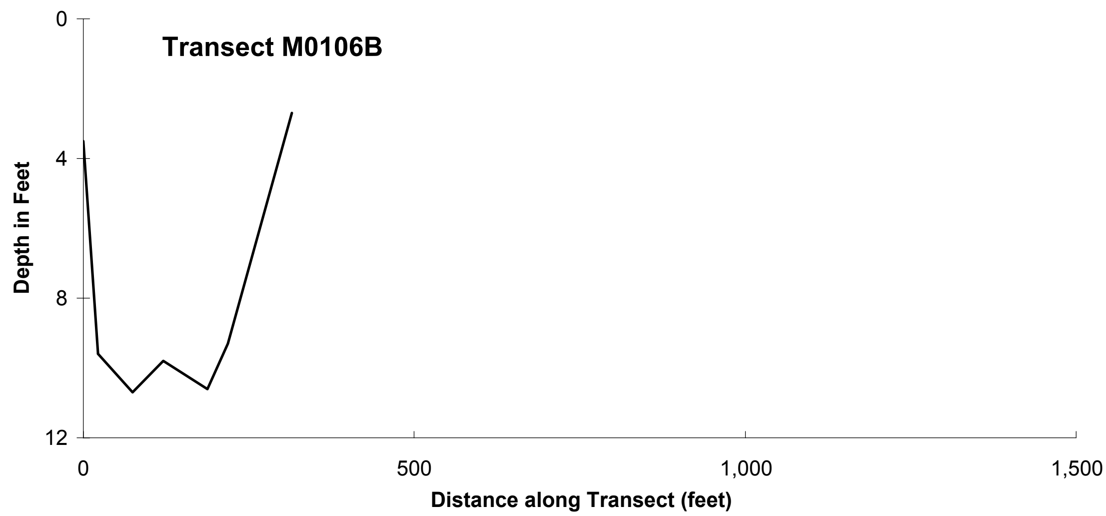
Water Quality:

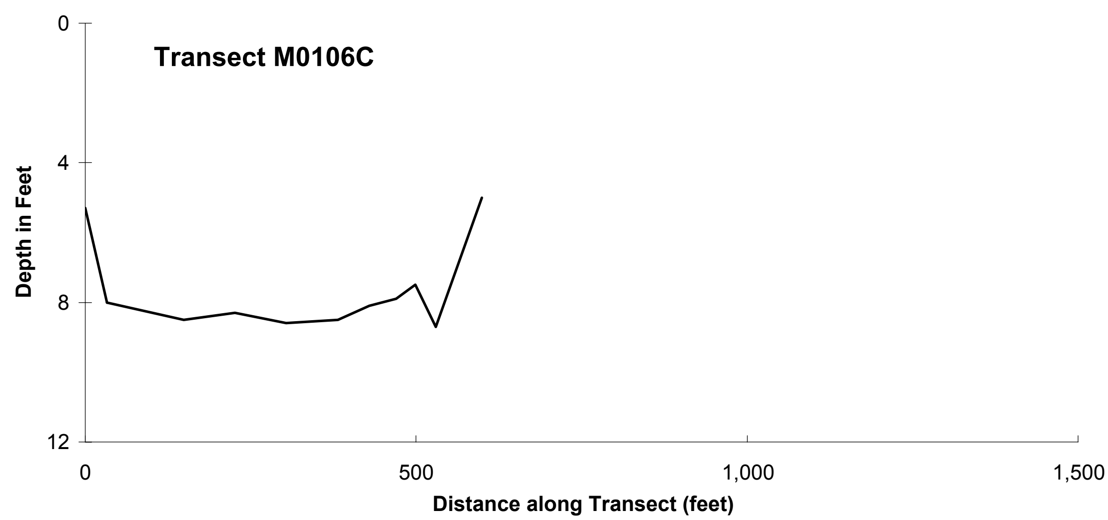
Year of Test	Chloride (mg/l)	Sodium (mg/l)	Calcium (mg/l)	Magnesium (mg/l	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Source
2001	8.4	4.6	7.0	1.8	25	76	this study

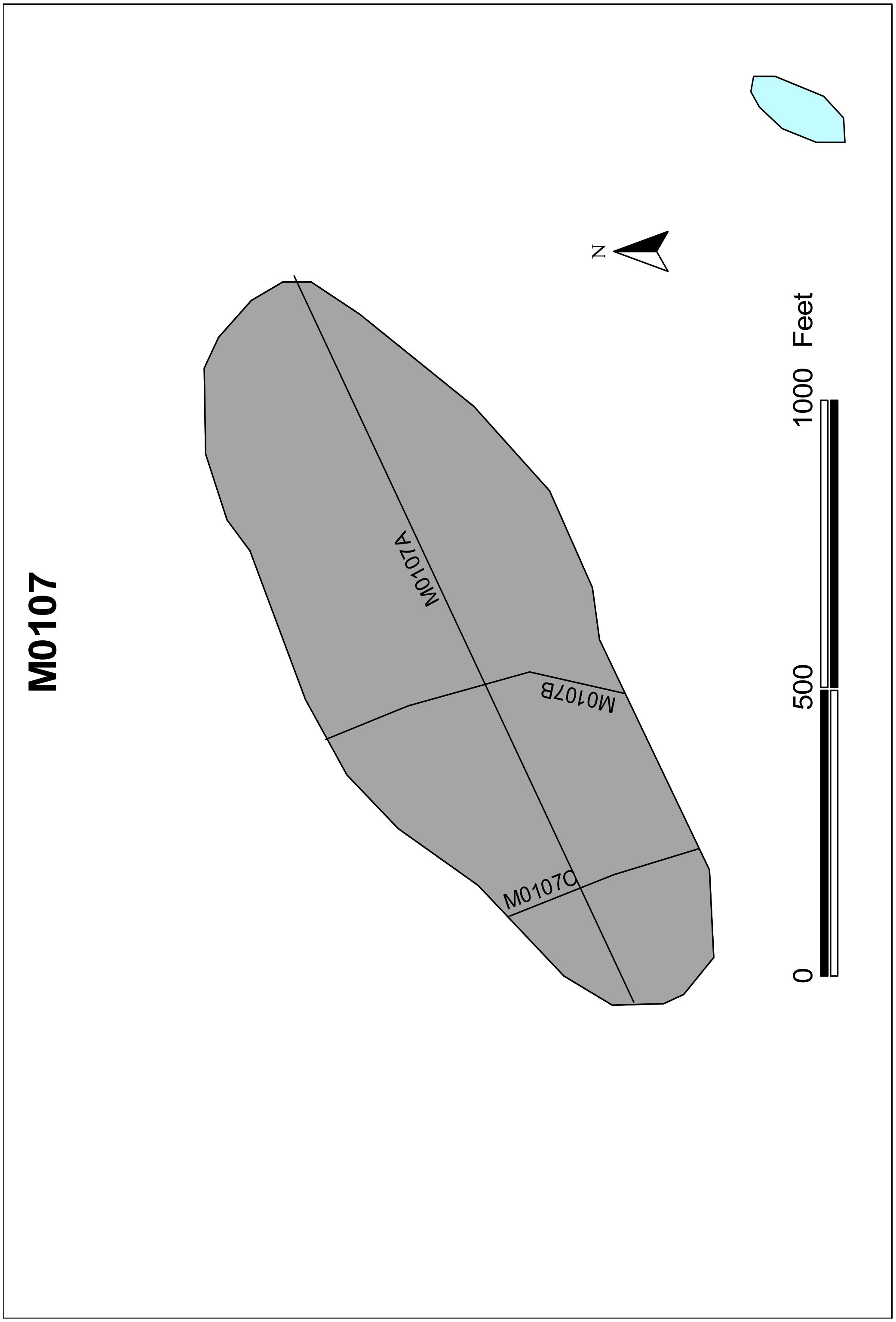
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 17 01	10.0	None	0


Transect M0106A
Depth in Feet
0
4
8
12
0
500
1,000
1,500
Distance along Transect (feet)


Transect M0106B
Depth in Feet
0
4
8
12
0
500
1,000
1,500
Distance along Transect (feet)


Transect M0106C
Depth in Feet
0
4
8
12
0
500
1,000
1,500
Distance along Transect (feet)


M0107
M0107A
M0107B
M0107C
N
0
500
1000
Feet

Lake M0107

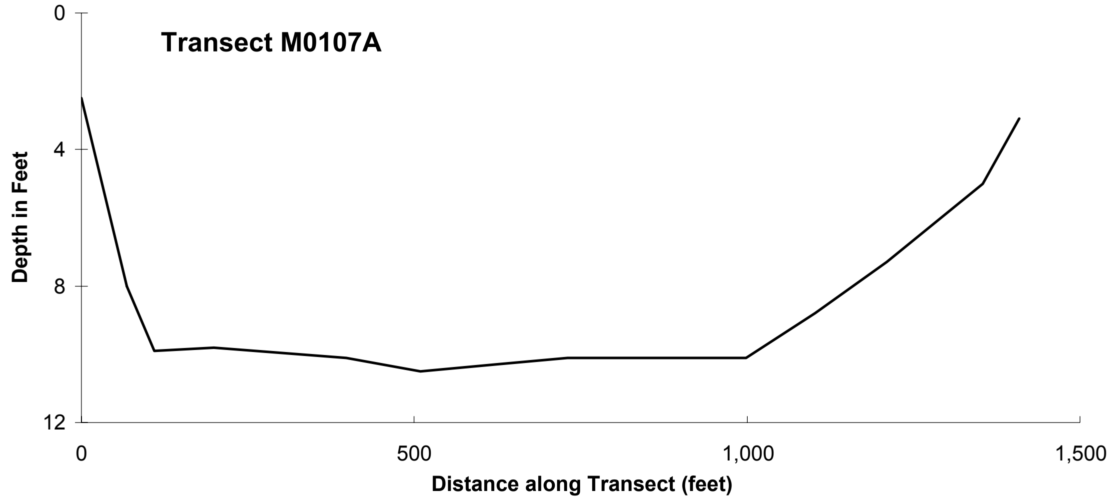
Other Names:	
Location:	70° 16' 42.5"N 151° 40' 59.0"W
USGS Quad Sheet:	T10N R1W, Section 3
Habitat:	Tundra Lake
Area:	14 acres
Maximum Depth:	10.5 feet
Active Outlet:	
Turbidity:	1.2 NTU
Spec. Conductance:	114 μS/cm
pH:	7.85
Calculated Volume:	15.9 million gallons
Permittable Volume:	No fish concern

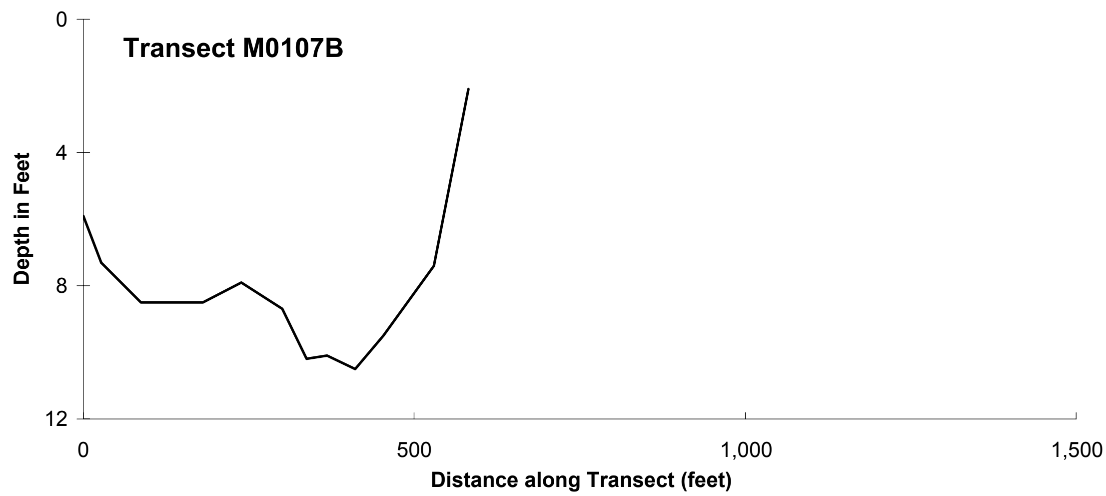
Water Quality:

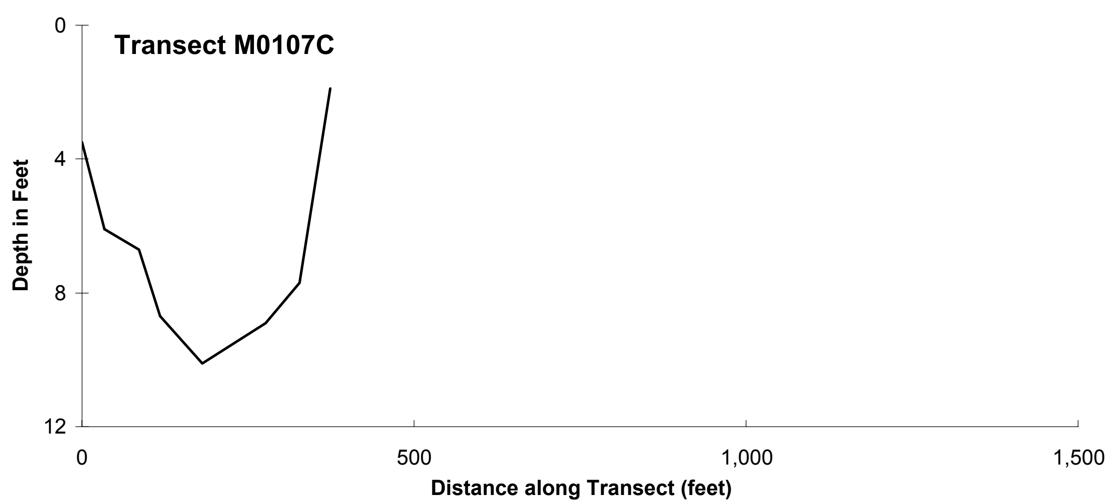
Year of Test	Chloride (mg/l)	Sodium (mg/l)	Calcium (mg/l)	Magnesium (mg/l	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Source
2001	14.0	7.8	12.0	2.6	40	120	this study

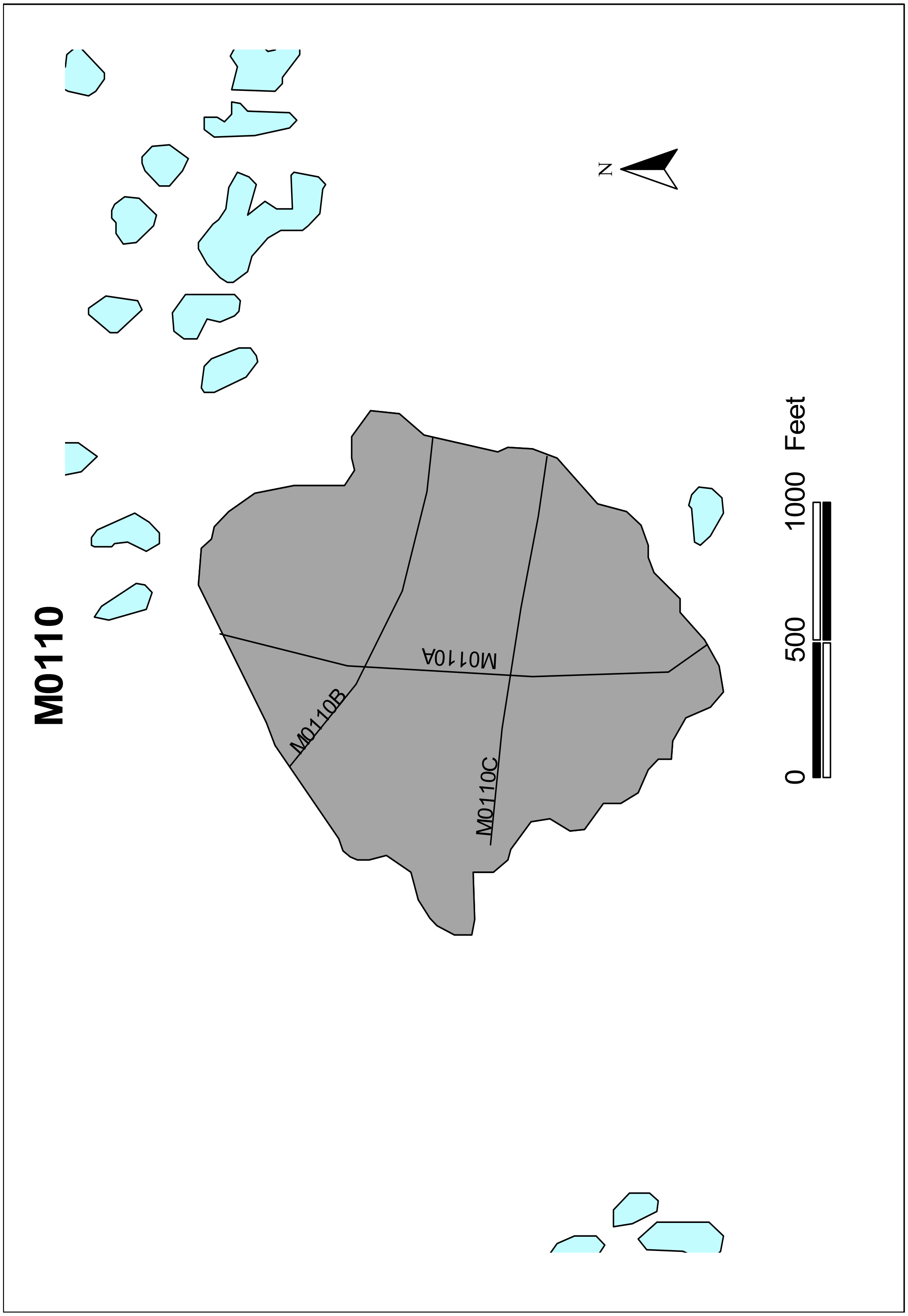
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 17 01	9.7	None	0


Transcect M0107A
Depth in Feet
Distance along Transect (feet)
0
4
8
12
0
500
1,000
1,500


Transect M0107B
Depth in Feet
Distance along Transect (feet)
0
4
8
12
0
500
1,000
1,500


Transect M0107C
Depth in Feet
Distance along Transect (feet)
0
4
8
12
0
500
1,000
1,500


M0110
M0110A
M0110B
M0110C
N
0
500
1000
Feet

Lake M0110

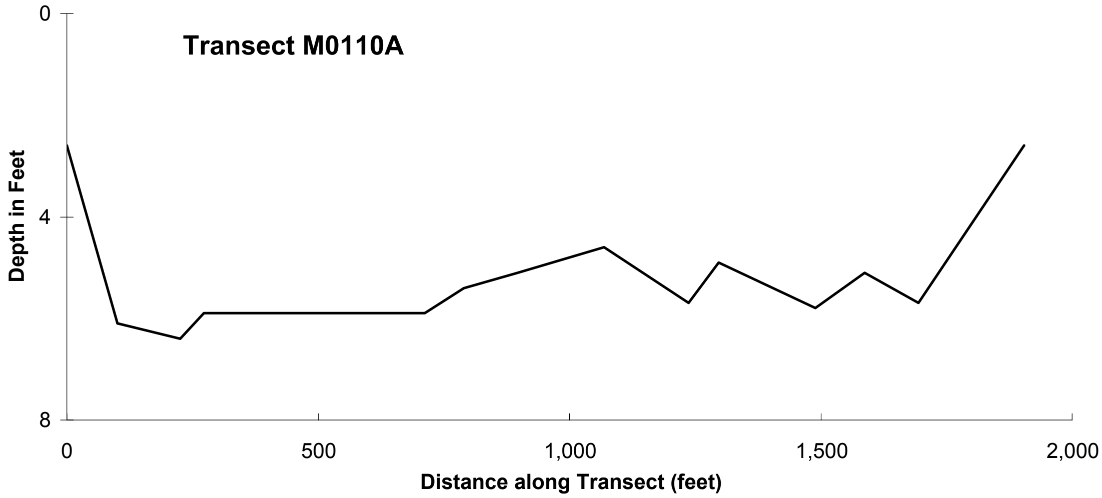
Other Names:
Location: 70° 16' 42.5"N 151° 40' 59.0"W
USGS Quad Sheet: T10N R1W, Section 22
Habitat: Tundra Lake
Area: 51 acres
Maximum Depth: 6.4 feet
Active Outlet:
Turbidity: 1.7 NTU
Spec. Conductance: 338 μS/cm
pH: 8.32
Calculated Volume: 35.4 million gallons
Permittable Volume: No fish concern

Water Quality:

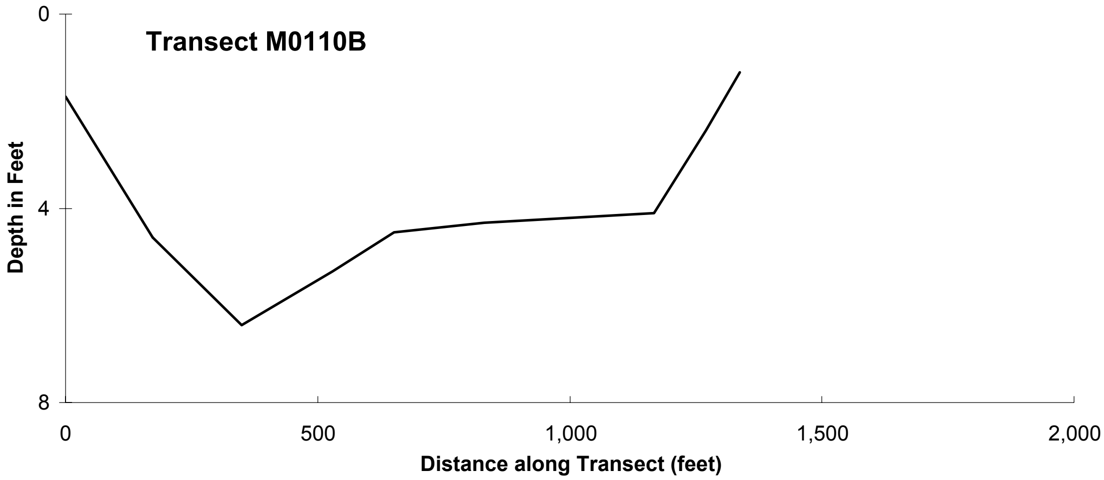
Year of Test	Chloride (mg/l)	Sodium (mg/l)	Calcium (mg/l)	Magnesium (mg/l	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Source
2001	49.0	22.0	38.0	6.6	120	240	this study

Catch Record:

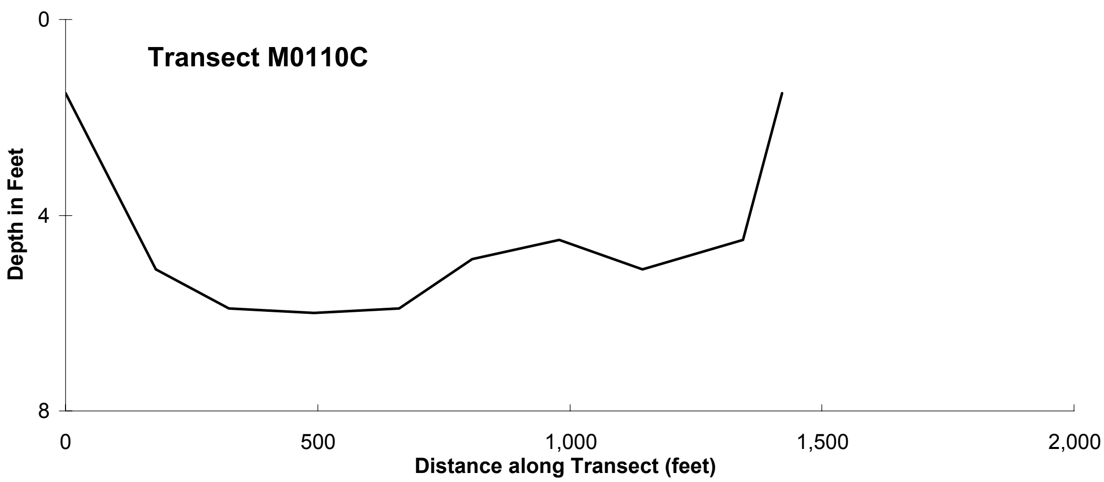
Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 19 01	7.3	None	0



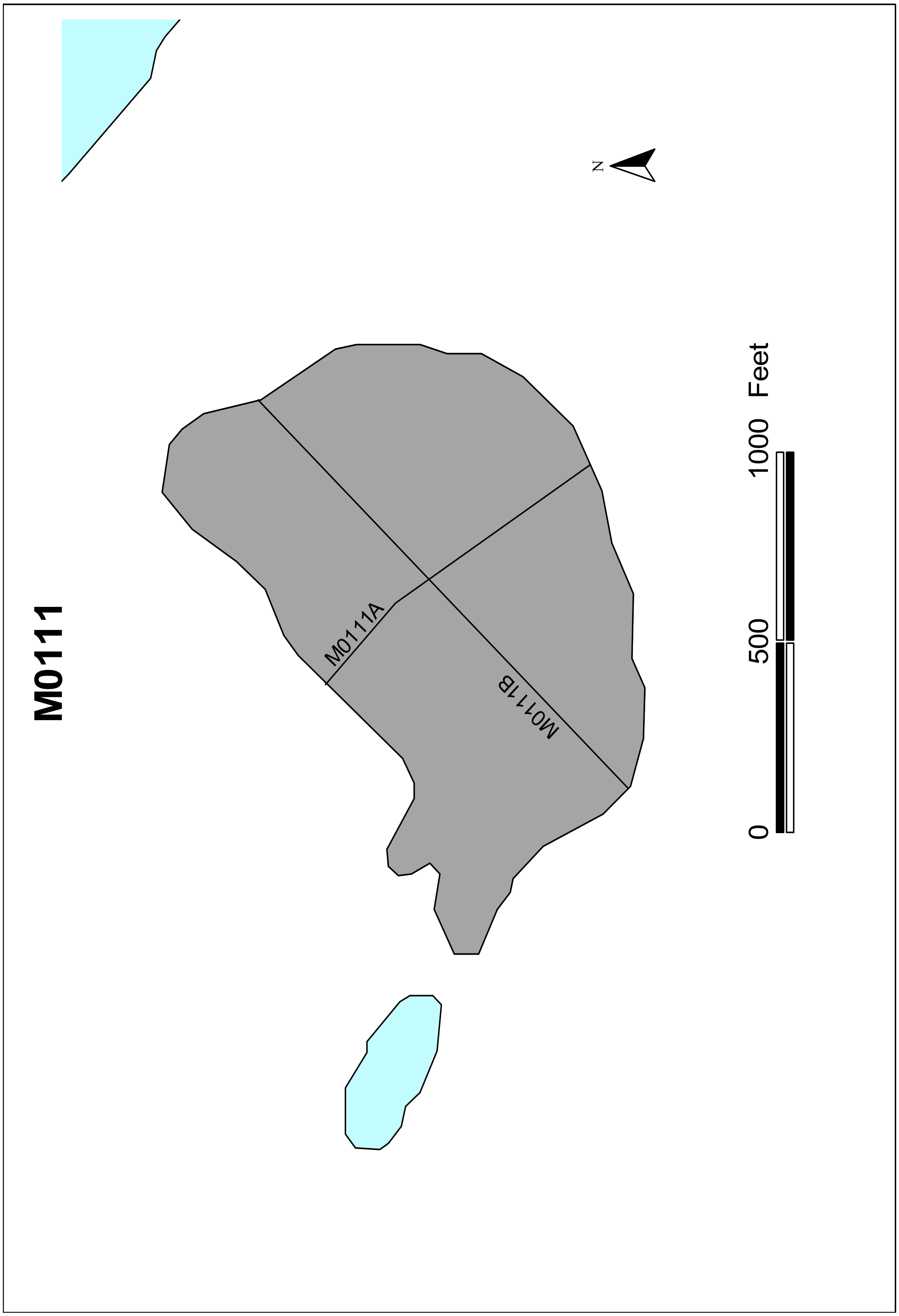
Transect M0110A
Depth in Feet
0
4
8
0
500
1,000
1,500
2,000
Distance along Transect (feet)



Transect M0110B
Depth in Feet
0
4
8
0
500
1,000
1,500
2,000
Distance along Transect (feet)



Transect M0110C
Depth in Feet
0
4
8
0
500
1,000
1,500
2,000
Distance along Transect (feet)


M0111
M0111A
M0111B
N
0
500
1000
Feet

Lake M0111

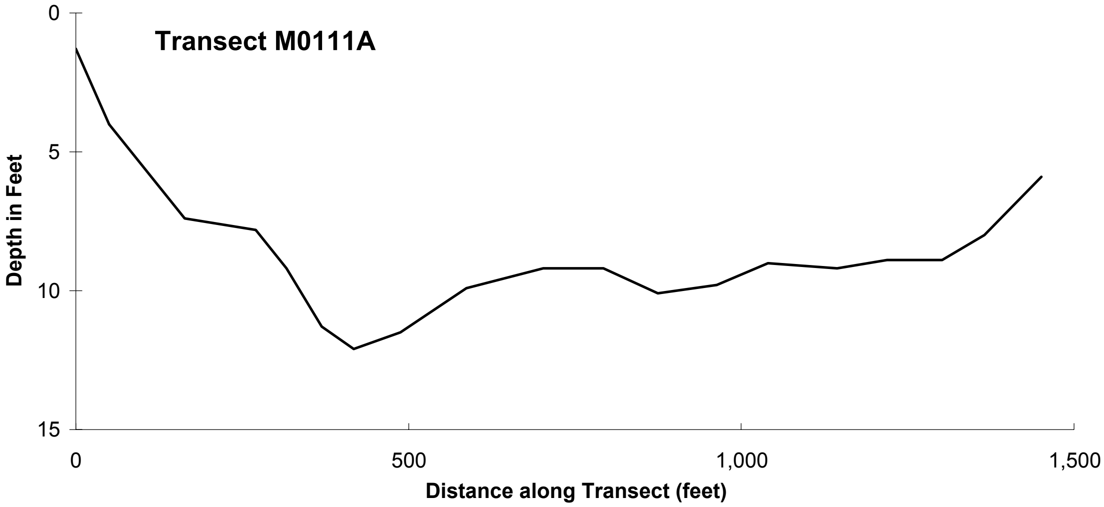
Other Names:	
Location:	70^o 16' 42.5"N 151^o 40' 59.0"W
USGS Quad Sheet:	T10N R1W, Section 11
Habitat:	Oxbow Lake
Area:	28 acres
Maximum Depth:	12.9 feet
Active Outlet:	
Turbidity:	1.3 NTU
Spec. Conductance:	540 µS/cm
pH:	8.4
Calculated Volume:	38.8 million gallons
Permittable Volume:	2.7 million gallons

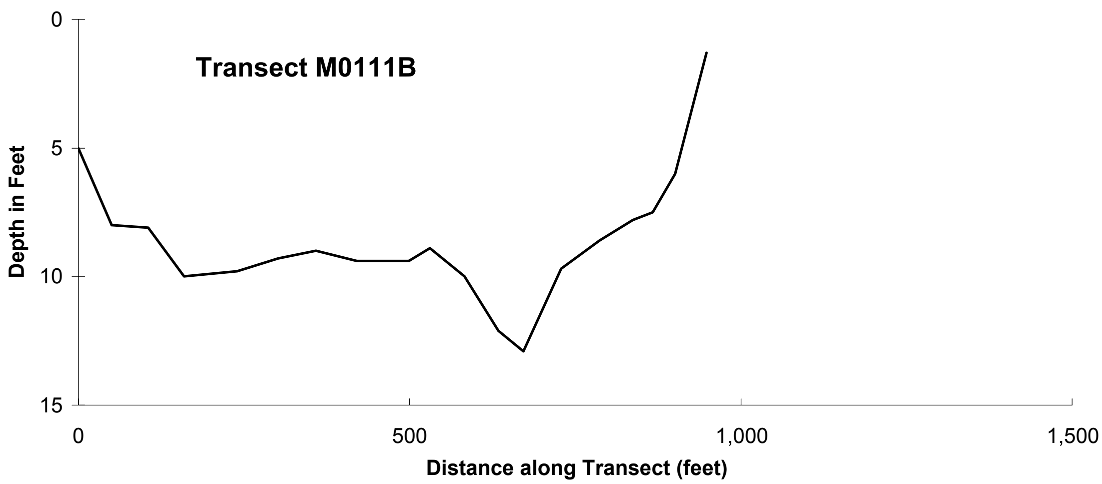
Water Quality:

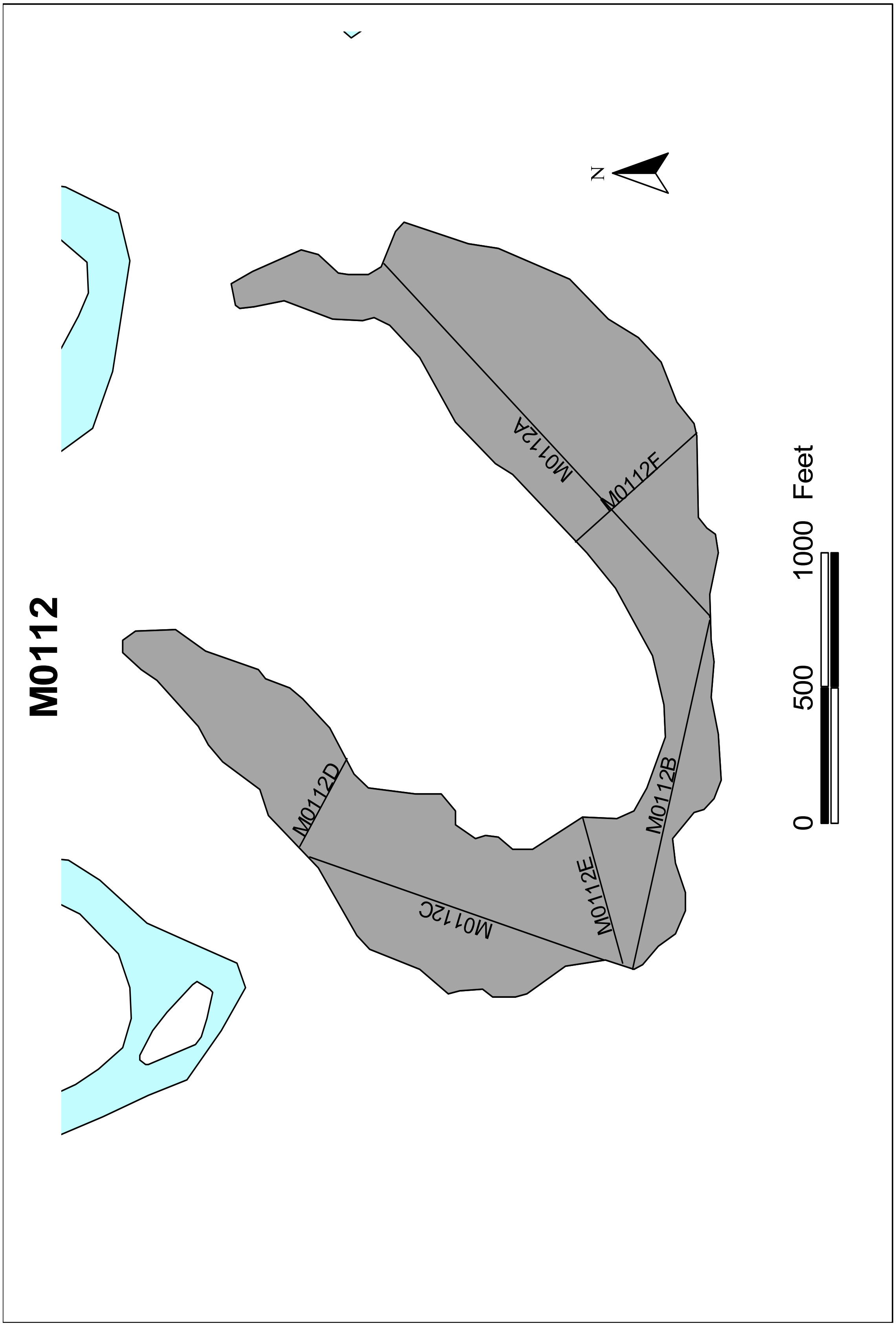
Year of Test	Chloride (mg/l)	Sodium (mg/l)	Calcium (mg/l)	Magnesium (mg/l	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Source
2001	99.0	37.0	52.0	15.0	190	350	this study

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 19 01	7.9	None	0


Transect M0111A
Depth in Feet
0
5
10
15
0
500
1,000
1,500
Distance along Transect (feet)


Transect M0111B
Depth in Feet
0
5
10
15
0
500
1,000
1,500
Distance along Transect (feet)


M0112
M0112A
M0112B
M0112C
M0112D
M0112E
M0112F
N
0
500
1000
Feet

Lake M0112

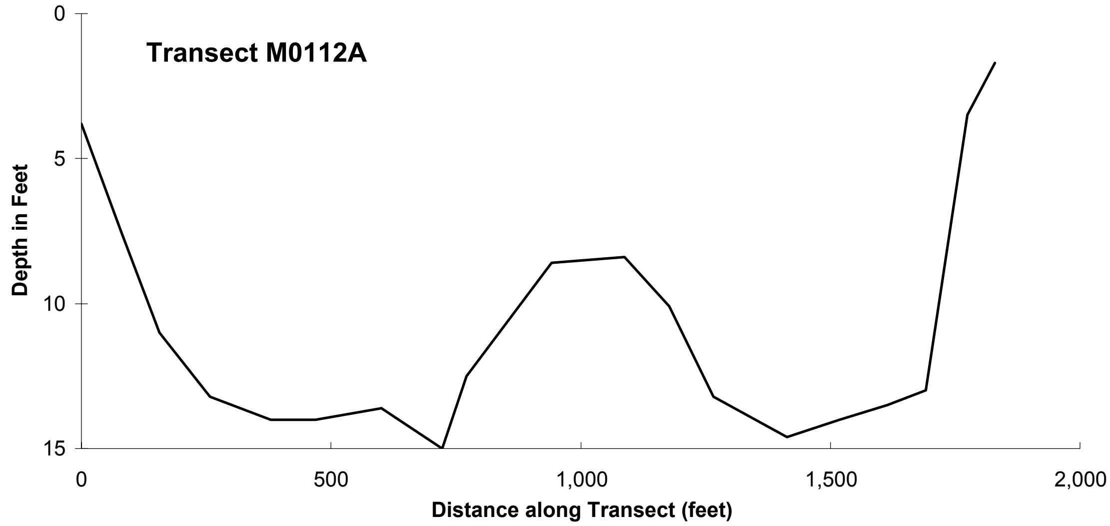
Other Names:	
Location:	70^o 16' 42.5"N 151^o 40' 59.0"W
USGS Quad Sheet:	T10N R1W, Section 4
Habitat:	Oxbow Lake
Area:	53 acres
Maximum Depth:	15.1 feet
Active Outlet:	
Turbidity:	0.8 NTU
Spec. Conductance:	162 µS/cm
pH:	8.0
Calculated Volume:	86.7 million gallons
Permittable Volume:	7.0 million gallons

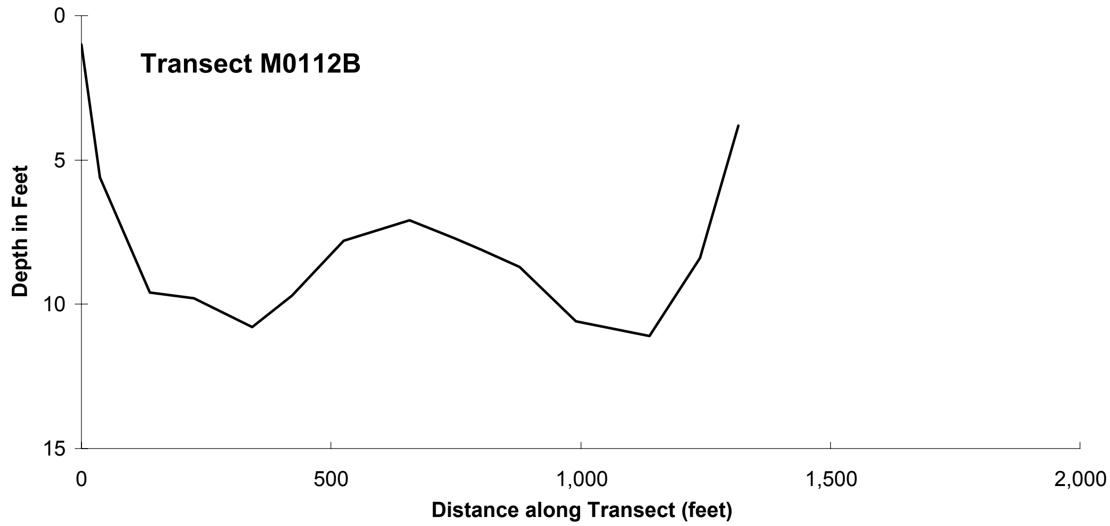
Water Quality:

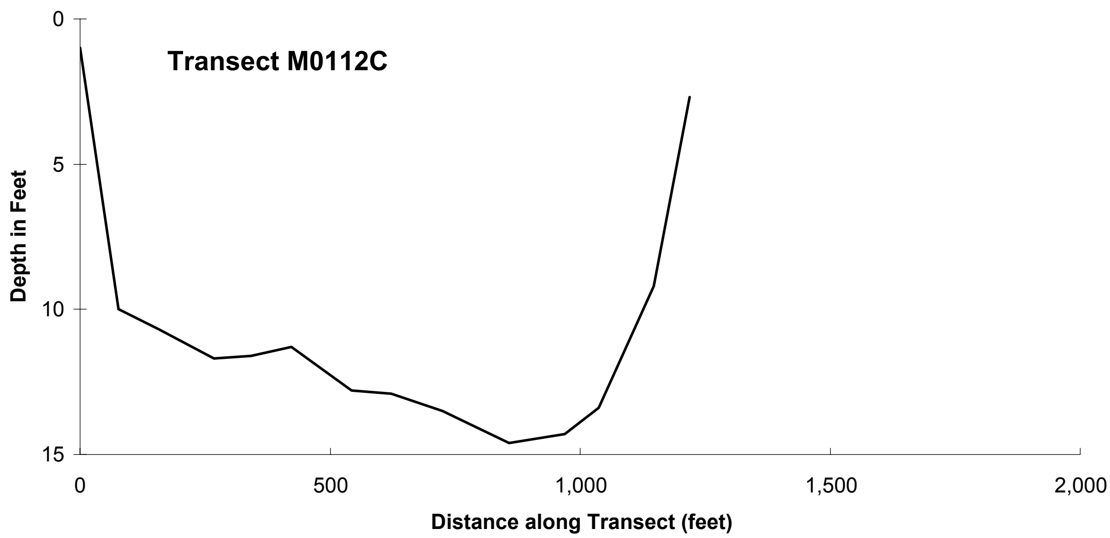
Year of Test	Chloride (mg/l)	Sodium (mg/l)	Calcium (mg/l)	Magnesium (mg/l	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Source
2001	19.0	8.9	15.0	3.3	51	110	this study

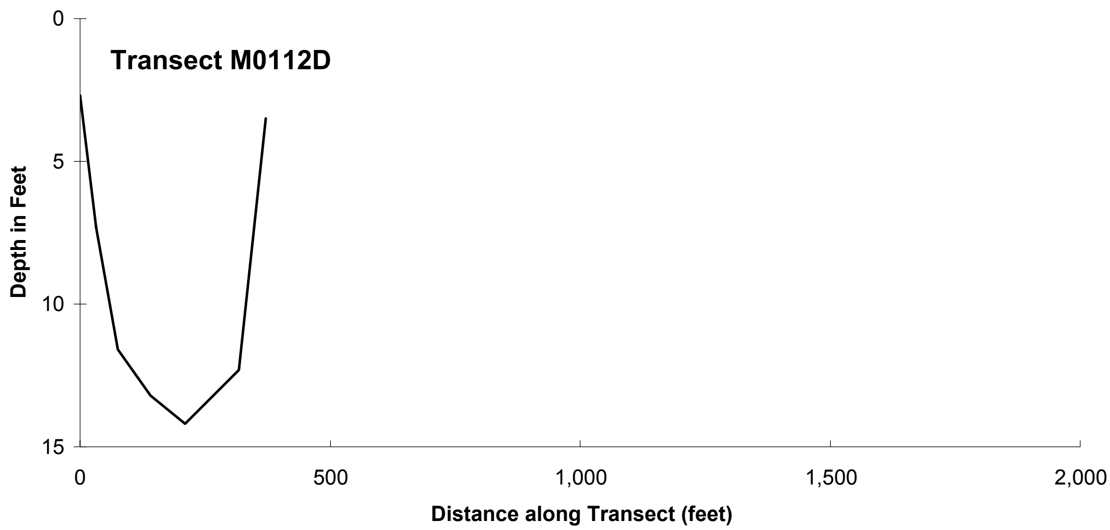
Catch Record:

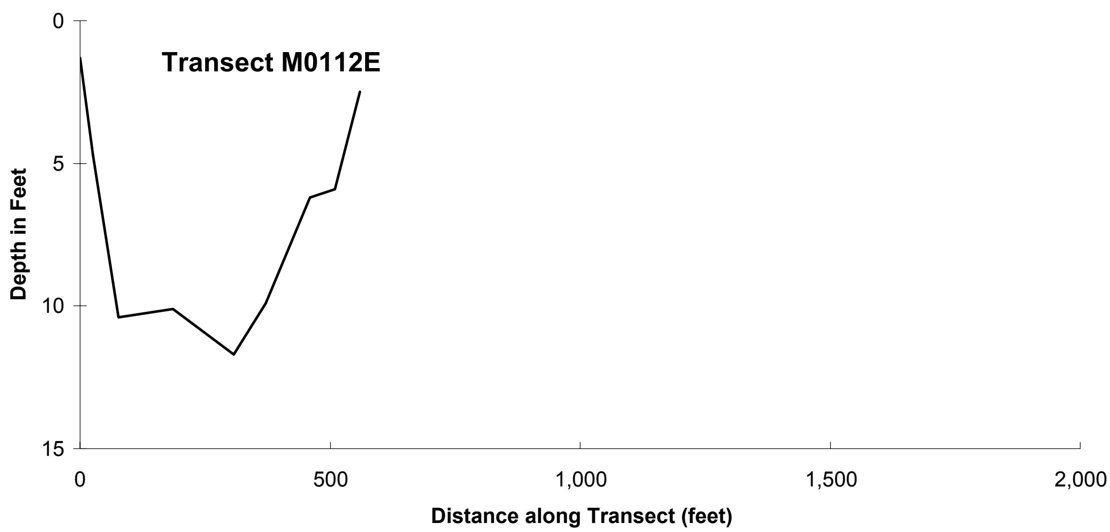
Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 20 01	9.2	None	0

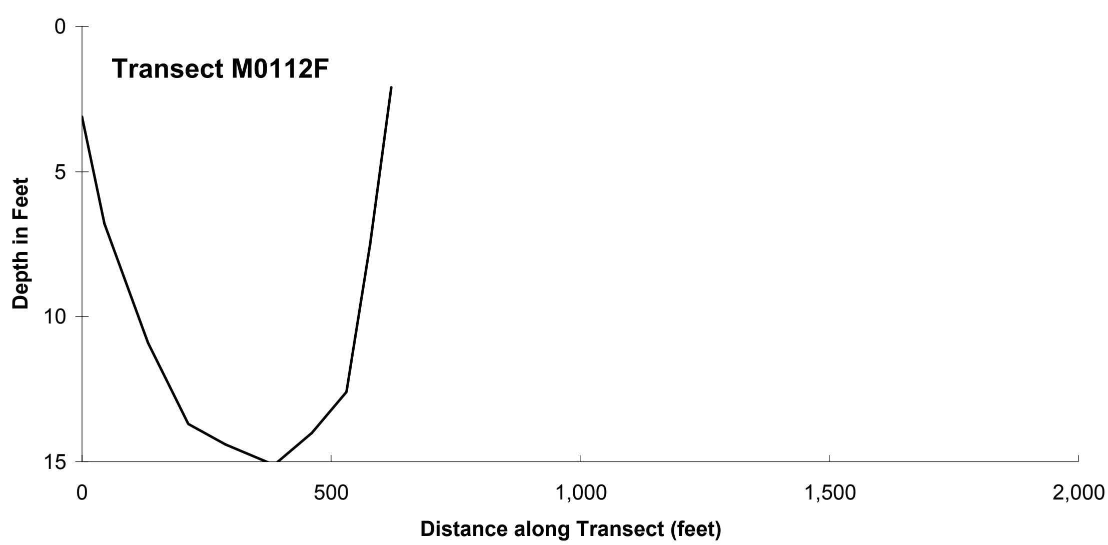

Transect M0112A
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)

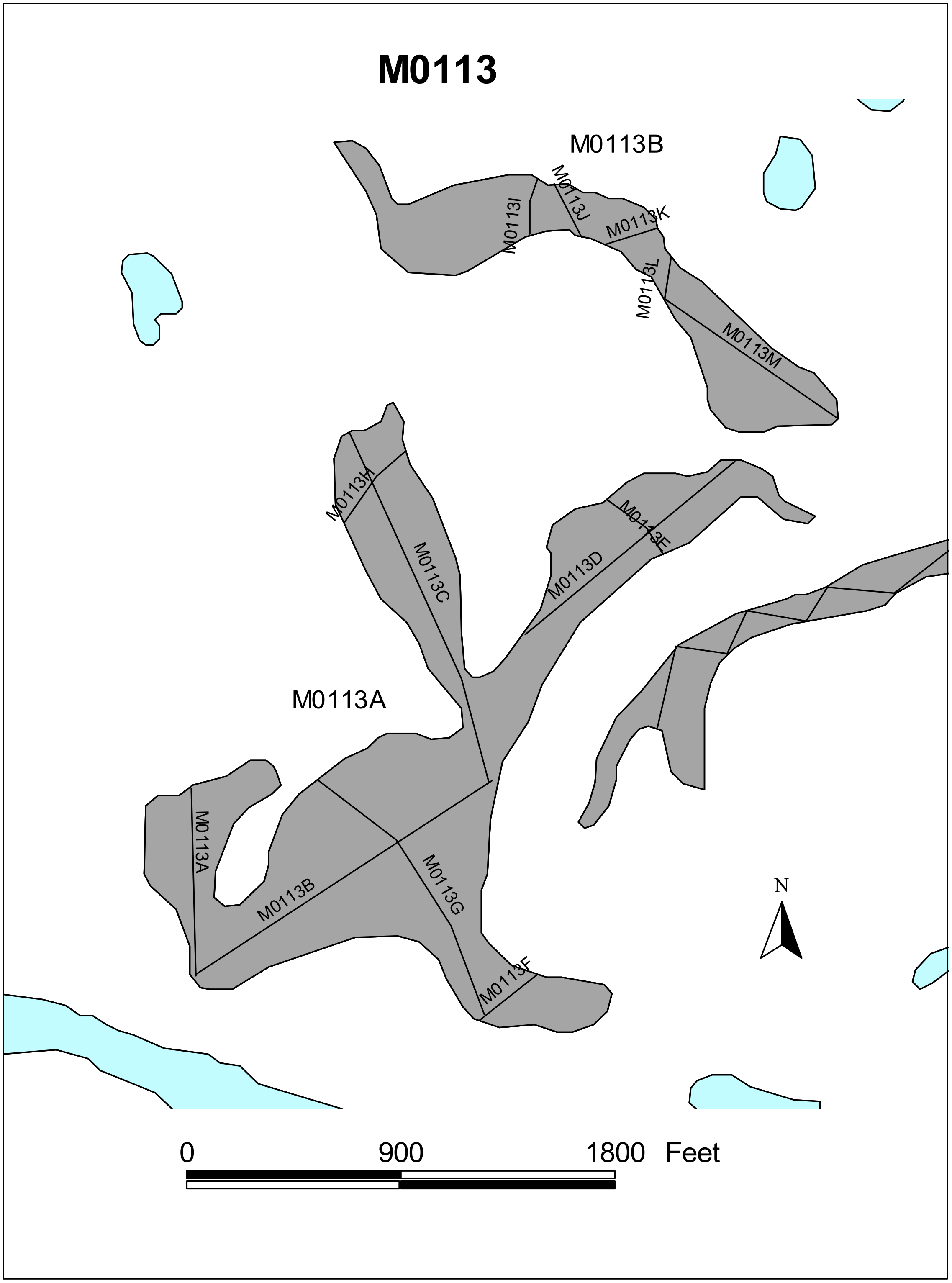

Transect M0112B
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)


Transect M0112C
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)


Transect M0112D
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)


Transect M0112E
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)


Transect M0112F
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)


M0113
M0113B
M0113I
M0113J
M0113K
M0113L
M0113M
M0113H
M0113C
M0113E
M0113D
M0113A
M0113A
M0113B
M0113G
M0113F
N
0
900
1800 Feet

Lake M0113

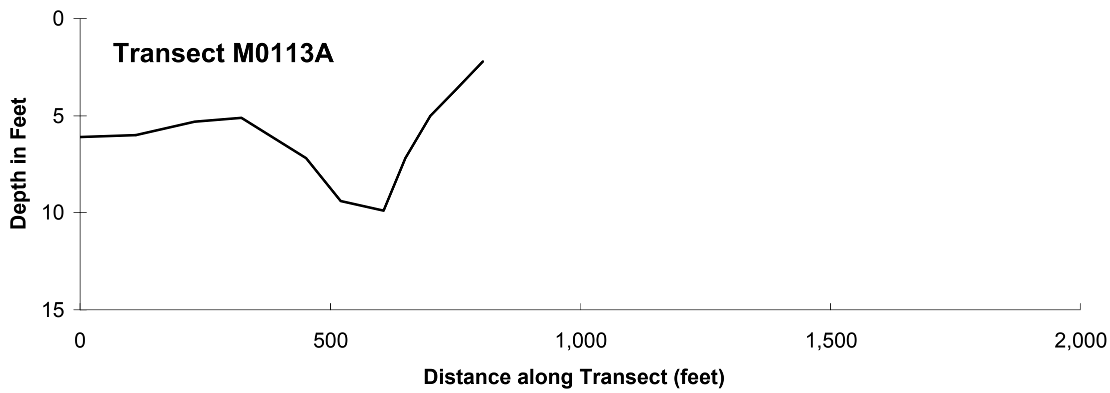
Other Names:				
Location:	70° 16' 42.5"N 151° 40' 59.0"W			
USGS Quad Sheet:	T10N R1E, Section 30			
	M0113A		M0113B	
Habitat:	Oxbow Lake		Oxbow Lake	
Area:	47	acres	14	acres
Maximum Depth:	14.5	feet	10.2	feet
Active Outlet:				
Turbidity:	0.7	NTU		
Spec. Conductance:	88	µS/cm		
pH:	8.2			
Calculated Volume:	73.4	million gallons	15.1	million gallons
Permittable Volume:	5.7	million gallons	0.7	million gallons

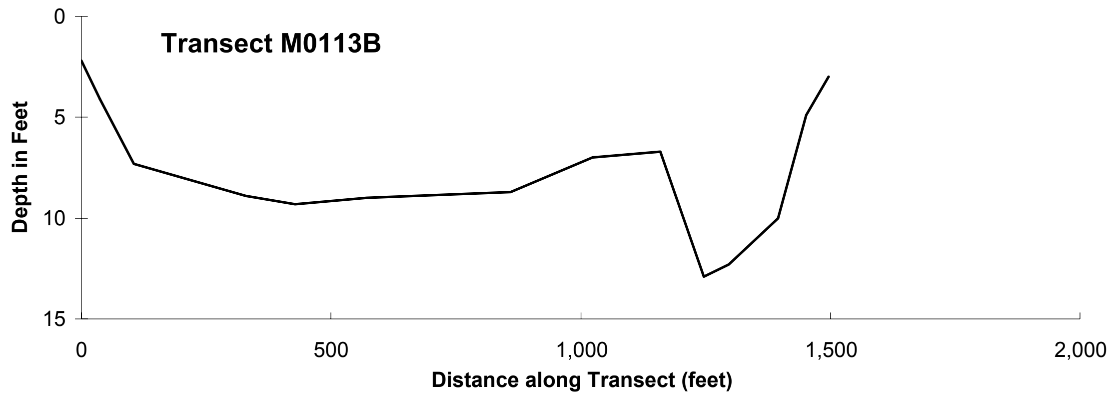
Water Quality:

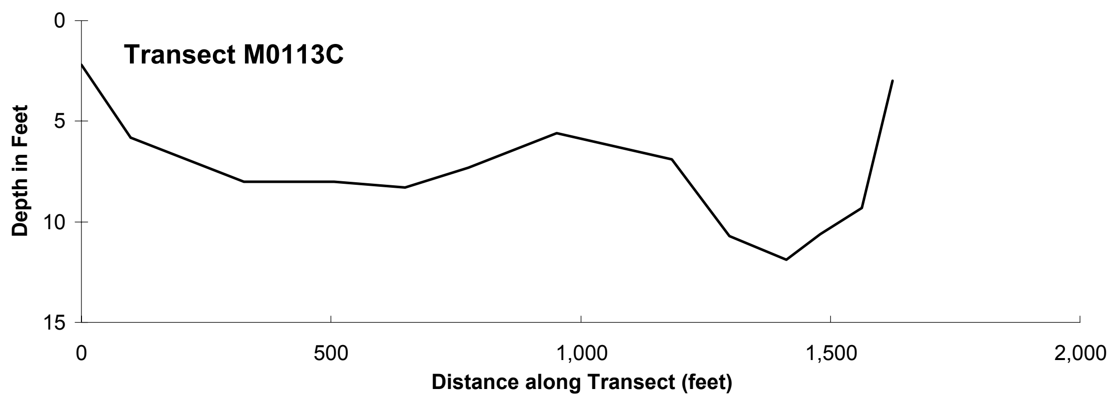
Year of Test	Chloride (mg/l)	Sodium (mg/l)	Calcium (mg/l)	Magnesium (mg/l	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Source
2001	5.3	2.9	12.0	2.0	39	50	this study

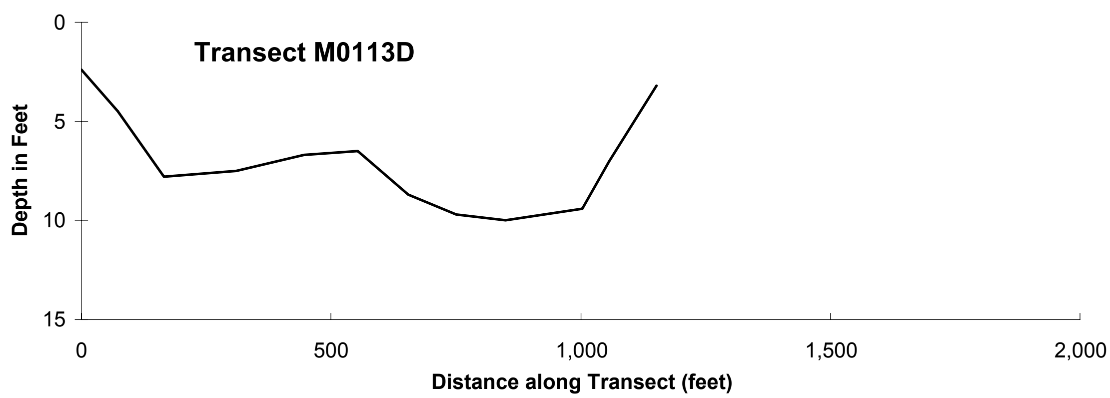
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 21 01	10.4	None	0
			(Ninespine stickleback observed)	

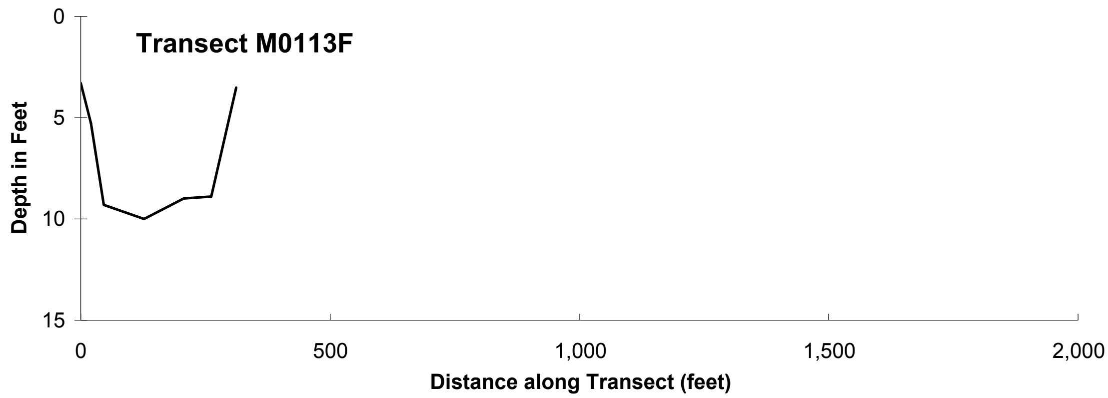

Transect M0113A
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)

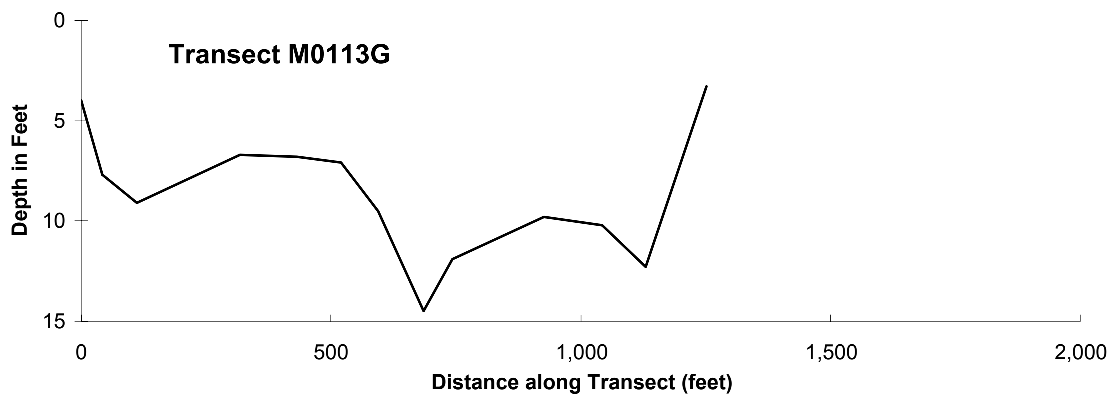

Transect M0113B
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)

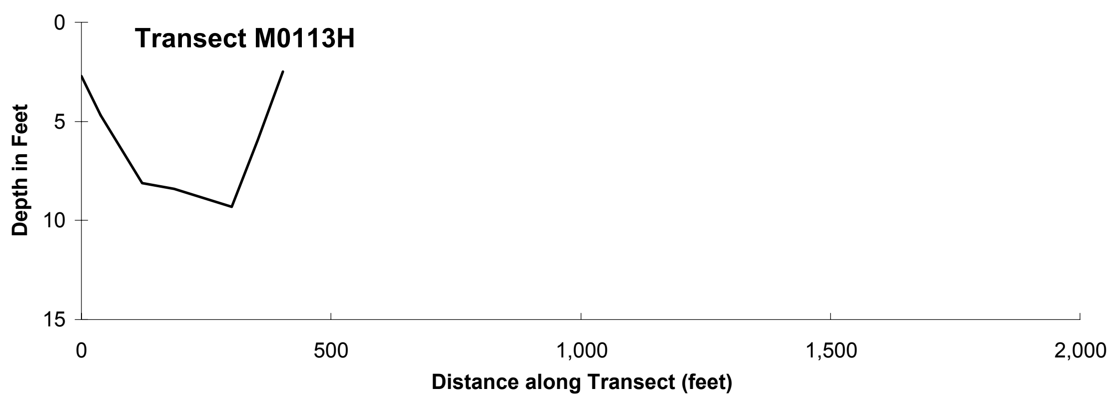

Transect M0113C
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)

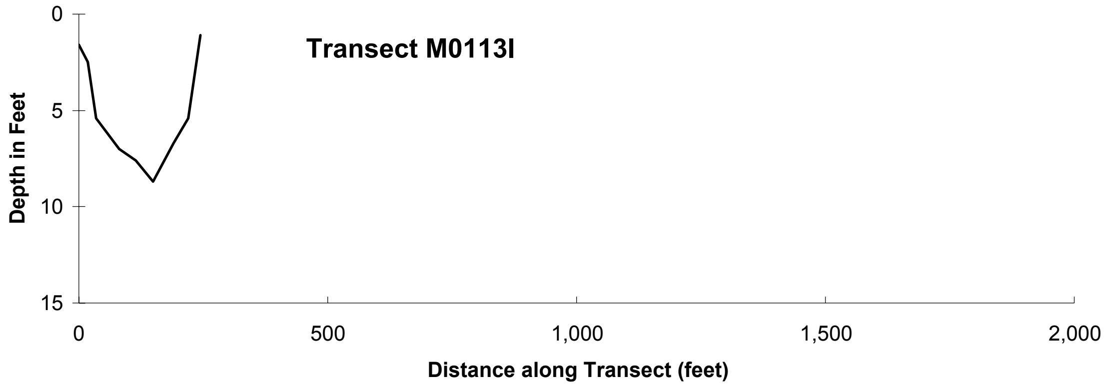

Transect M0113D
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)

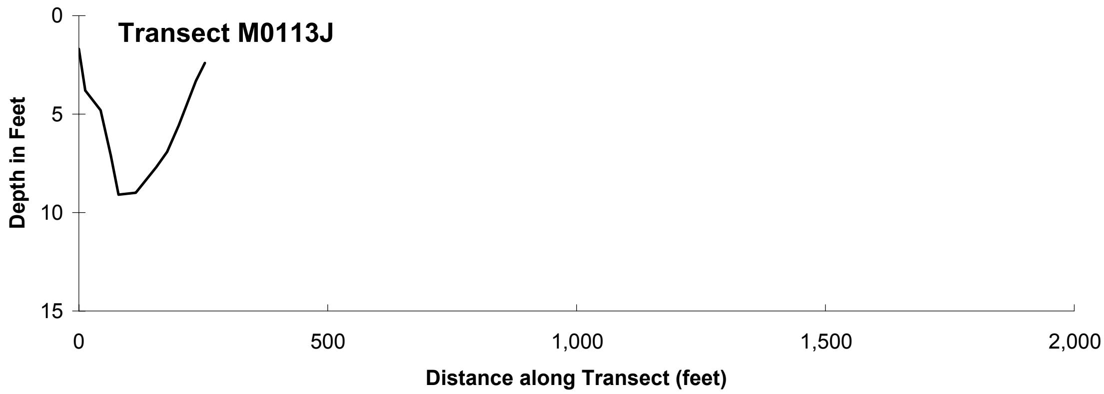

Transect M0113E
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)

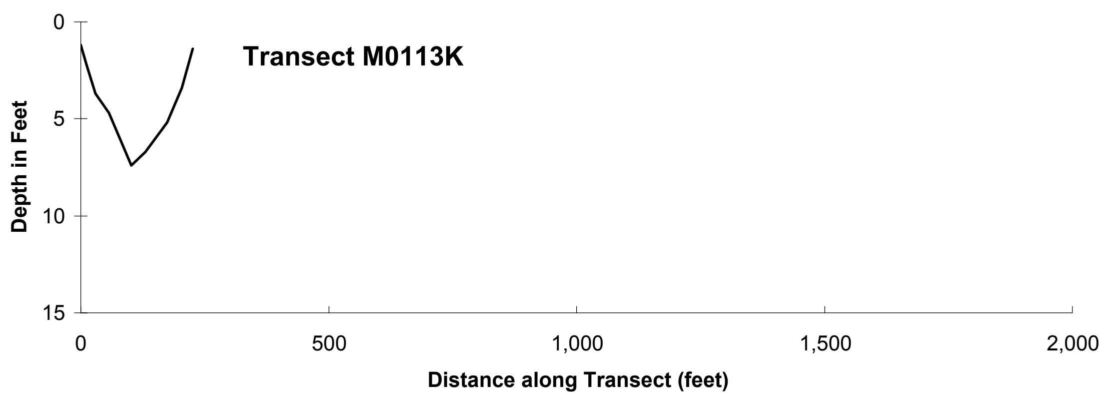

Transect M0113F
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)

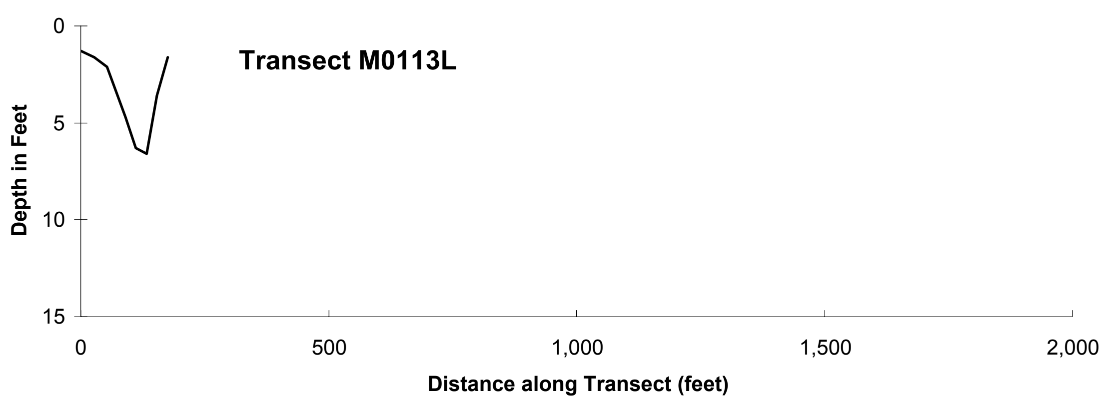

Transect M0113G
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)

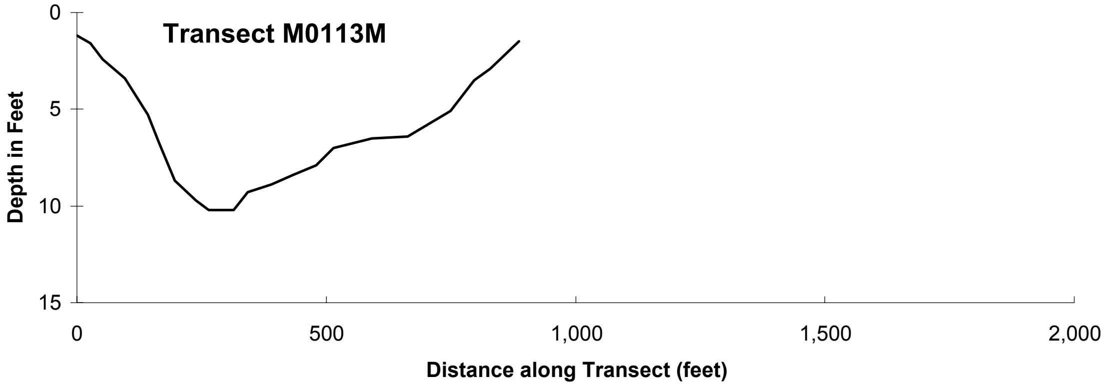

Transect M0113H
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)


Transect M0113I
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)

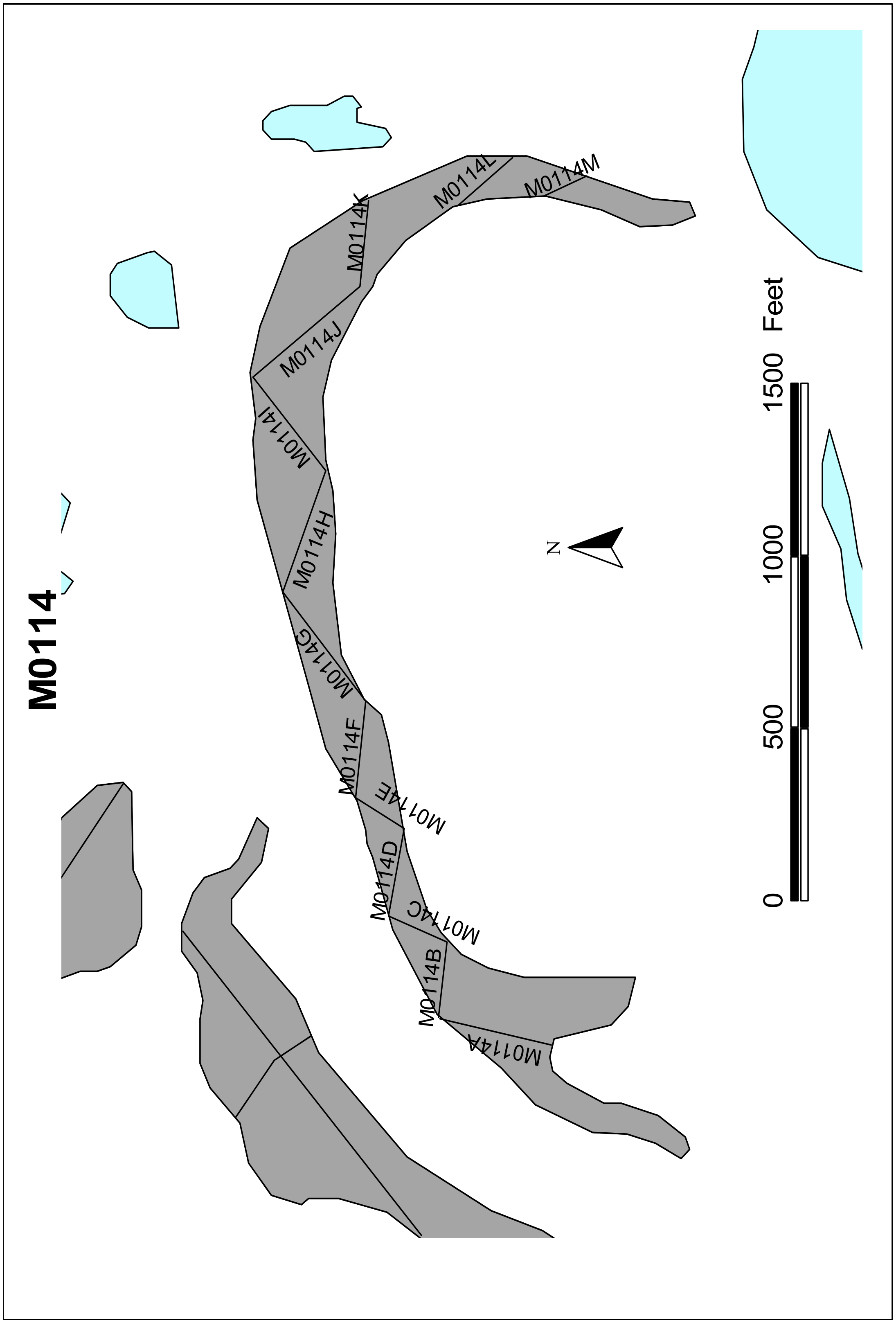

Transect M0113J
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)


Transect M0113K
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)


Transect M0113L
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)



Transect M0113M
Depth in Feet
0
5
10
15
0
500
1,000
1,500
2,000
Distance along Transect (feet)


M0114
M0114A
M0114B
M0114C
M0114D
M0114E
M0114F
M0114G
M0114H
M0114I
M0114J
M0114K
M0114L
M0114M
N
0
500
1000
1500
Feet

Lake M0114

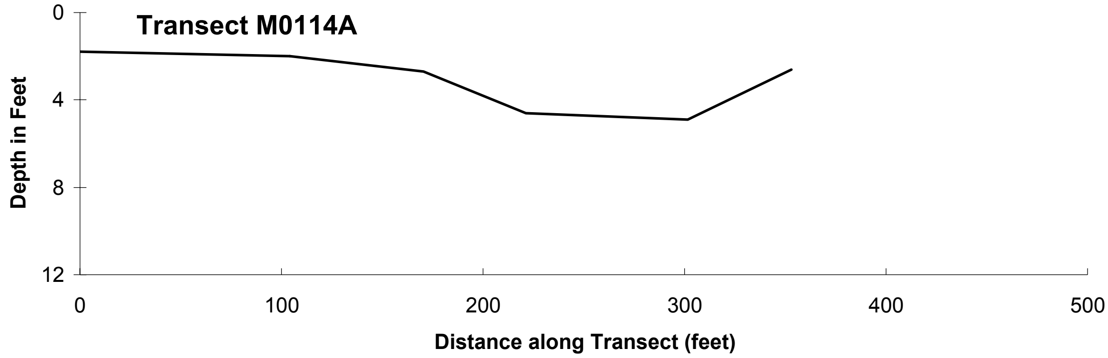
Other Names:	
Location:	70° 16' 42.5"N 151° 40' 59.0"W
USGS Quad Sheet:	T10N R1E, Section 30
Habitat:	Oxbow Lake
Area:	16 acres
Maximum Depth:	11.7 feet
Active Outlet:	
Turbidity:	1.6 NTU
Spec. Conductance:	158 μS/cm
pH:	8.3
Calculated Volume:	20.5 million gallons
Permittable Volume:	1.2 million gallons

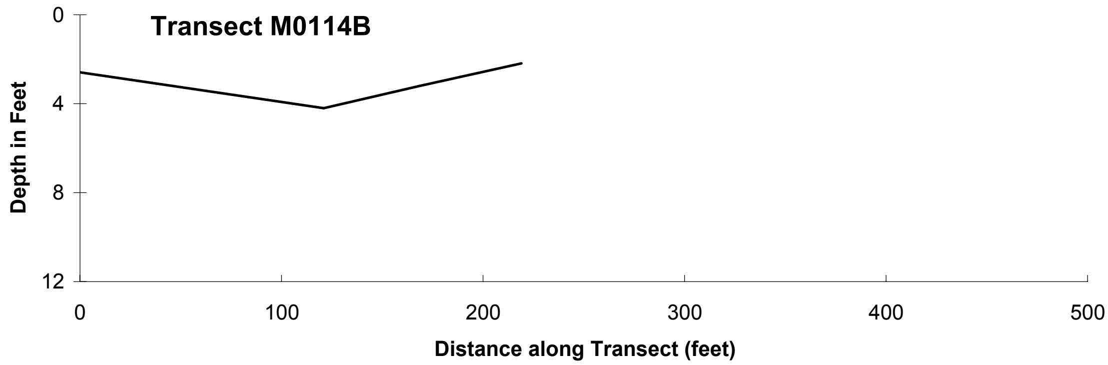
Water Quality:

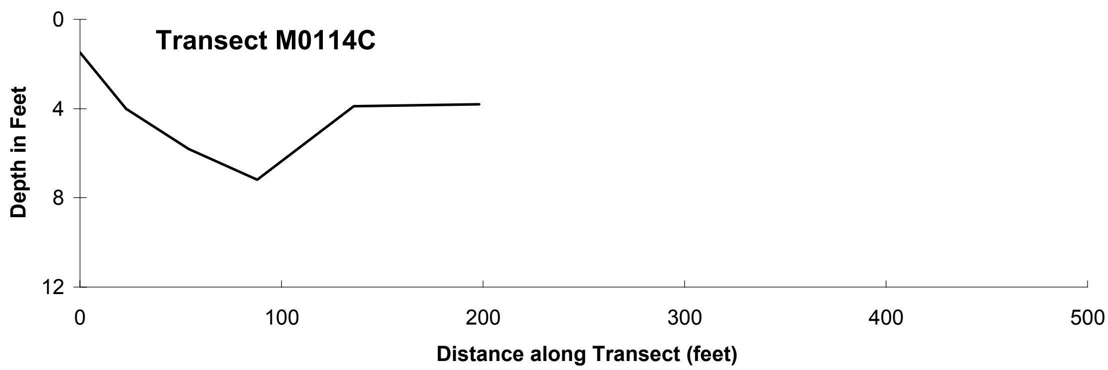
Year of Test	Chloride (mg/l)	Sodium (mg/l)	Calcium (mg/l)	Magnesium (mg/l	Total Hardness [CaCO3] (mg/l)	Total Dissolved Solids (mg/l)	Source
2001	7.0	4.2	25.0	3.2	75	90	this study

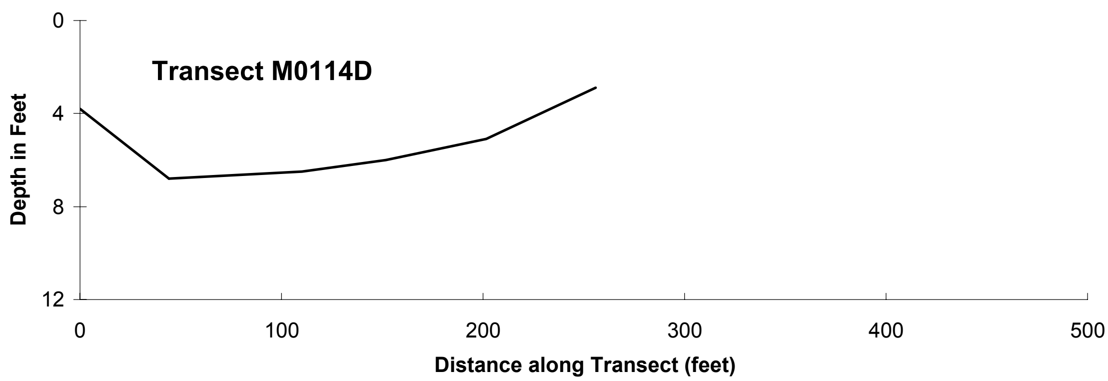
Catch Record:

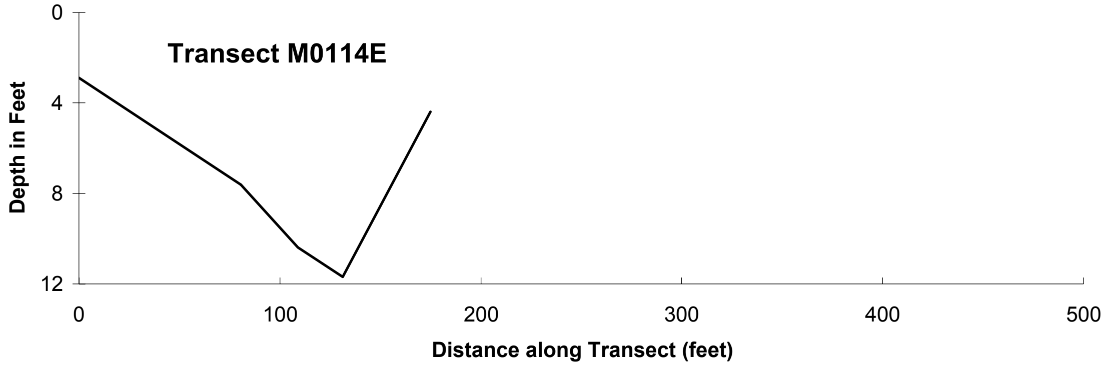
Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Jul 23 01	12.6	Least cisco	1	255

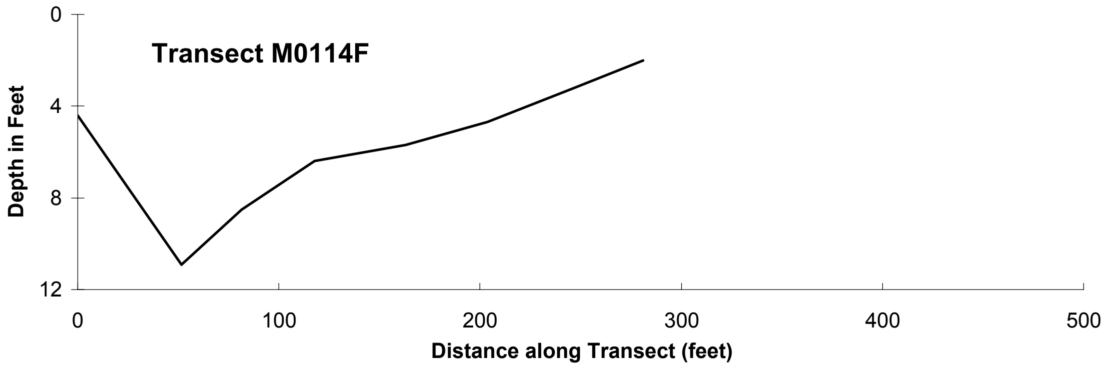

Transect M0114A
Depth in Feet
0
4
8
12
0
100
200
300
400
500
Distance along Transect (feet)

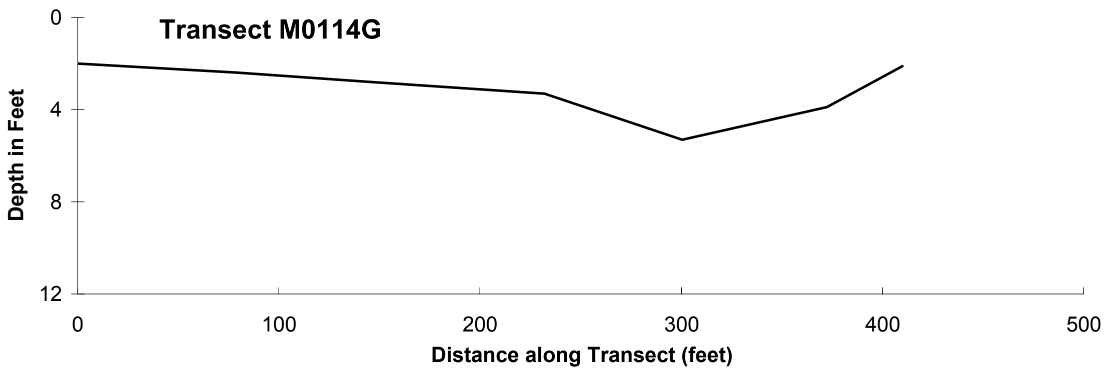

Transect M0114B
Depth in Feet
0
4
8
12
0
100
200
300
400
500
Distance along Transect (feet)

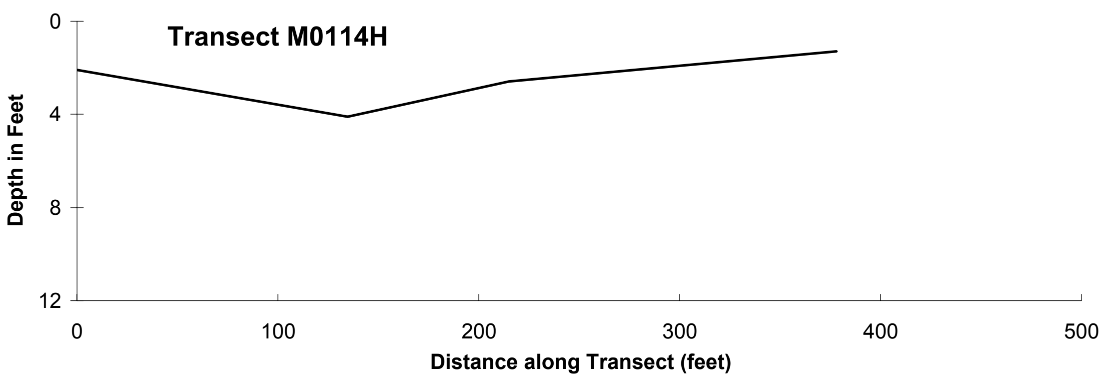

Transect M0114C
Depth in Feet
0
4
8
12
0
100
200
300
400
500
Distance along Transect (feet)

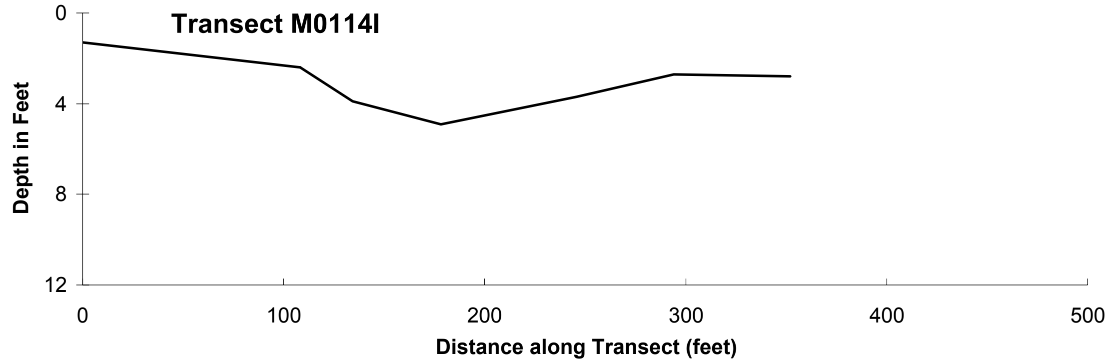

Transect M0114D
Depth in Feet
0
4
8
12
0
100
200
300
400
500
Distance along Transect (feet)

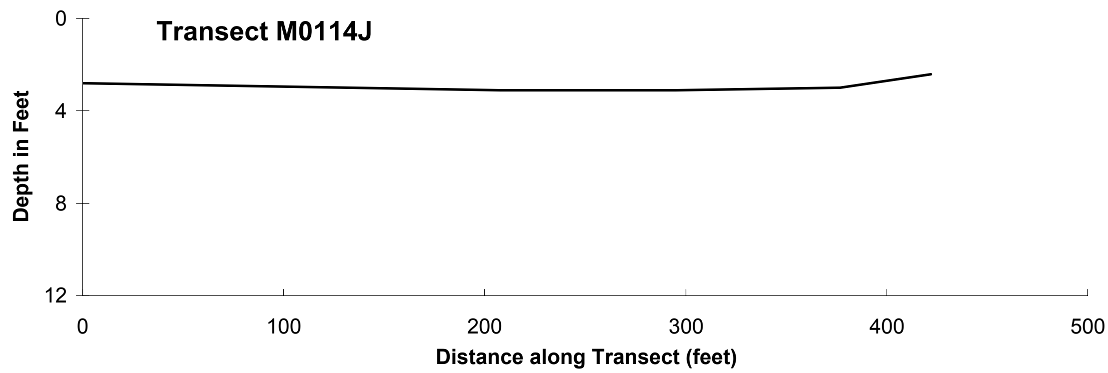

Transect M0114E
Depth in Feet
0
4
8
12
0
100
200
300
400
500
Distance along Transect (feet)

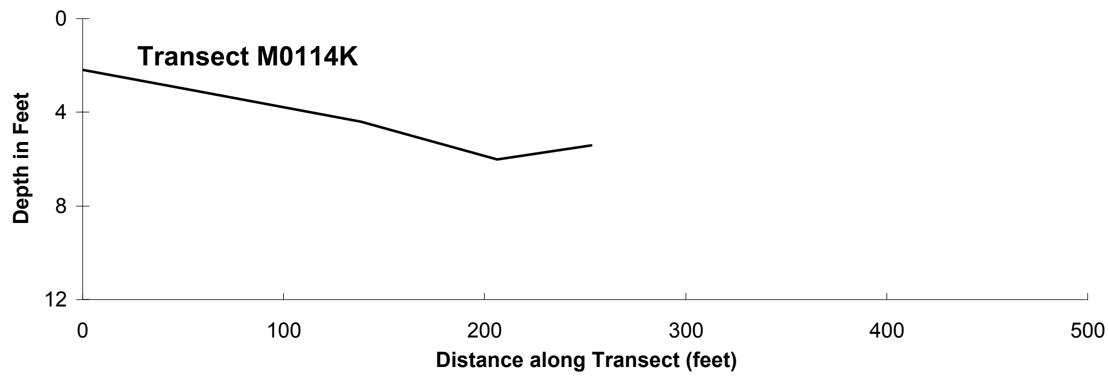

Transect M0114F
Depth in Feet
0
4
8
12
0
100
200
300
400
500
Distance along Transect (feet)

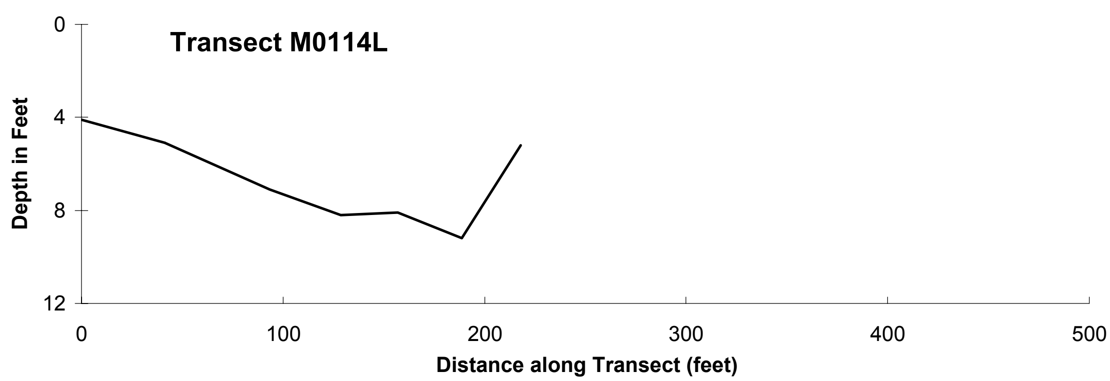

Transect M0114G
Depth in Feet
0
4
8
12
0
100
200
300
400
500
Distance along Transect (feet)

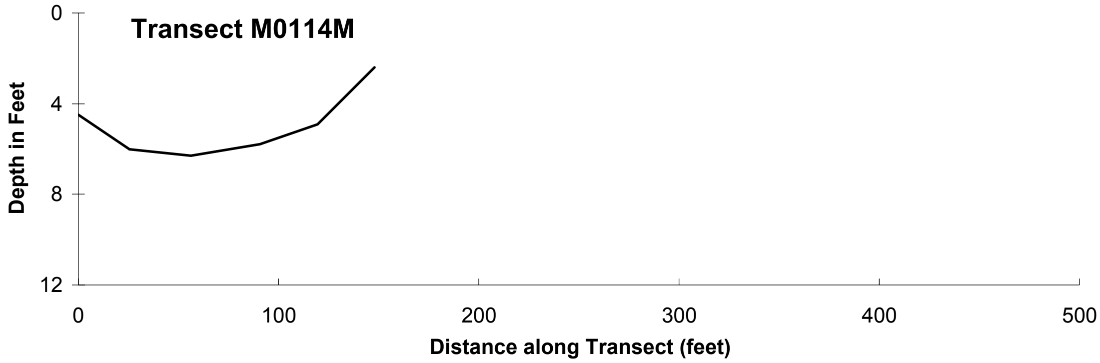

Transect M0114H
Depth in Feet
0
4
8
12
0
100
200
300
400
500
Distance along Transect (feet)


Transect M0114I
Depth in Feet
0
4
8
12
0
100
200
300
400
500
Distance along Transect (feet)

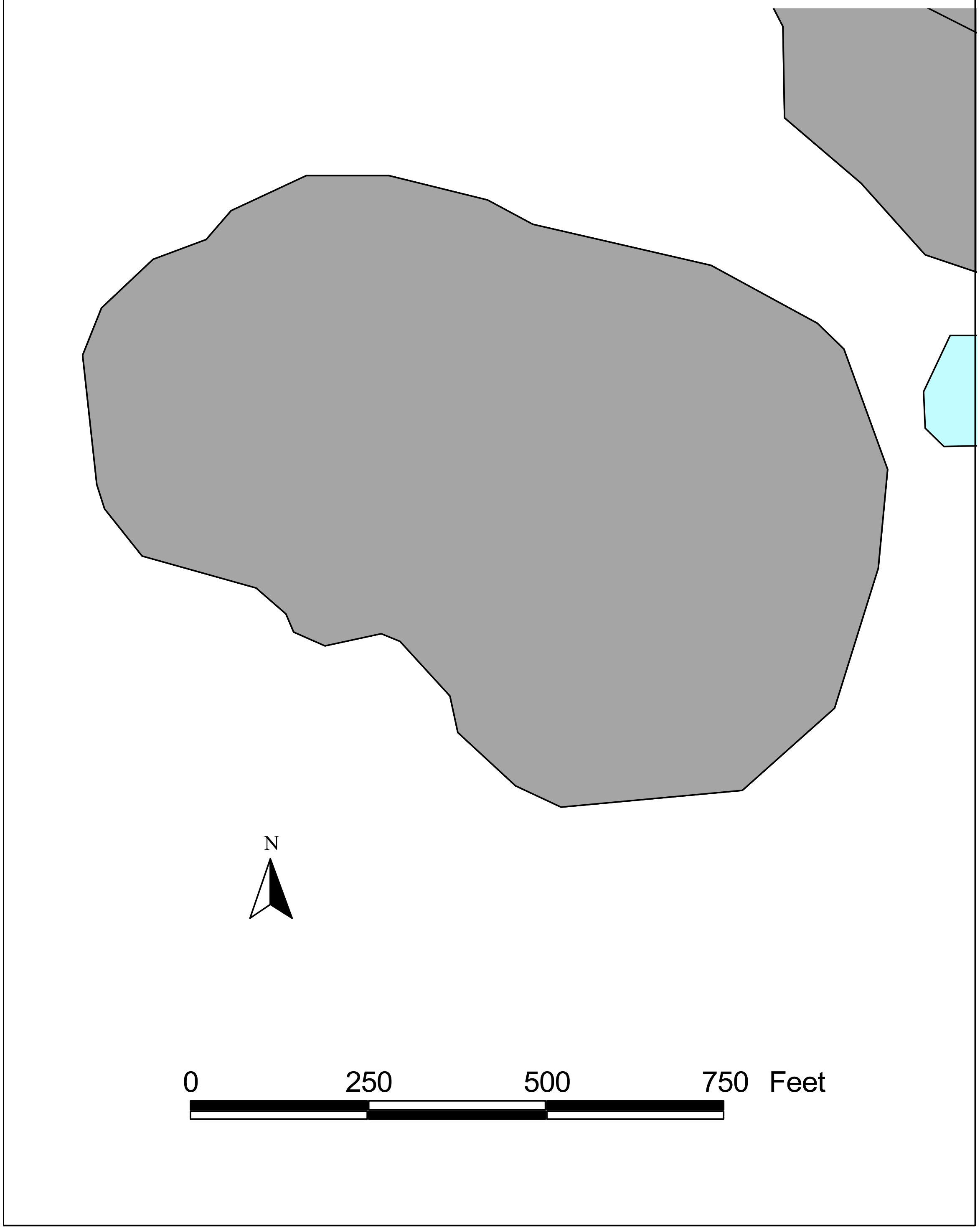

Transect M0114J
Depth in Feet
0
4
8
12
0
100
200
300
400
500
Distance along Transect (feet)


Transect M0114K
Depth in Feet
0
4
8
12
0
100
200
300
400
500
Distance along Transect (feet)


Transect M0114L
Depth in Feet
0
4
8
12
0
100
200
300
400
500
Distance along Transect (feet)


Transect M0114M
Depth in Feet
0
4
8
12
0
100
200
300
400
500
Distance along Transect (feet)

M0130



Lake M0130

Other Names:	
Location:	70° 16' 42.5"N 151° 40' 59.0"W
USGS Quad Sheet:	T10N R1W, Section 24
Habitat:	Tundra Lake
Area:	16 acres
Maximum Depth:	3 feet
Active Outlet:	
Turbidity:	
Spec. Conductance:	
pH:	
Calculated Volume:	5.3 million gallons
Permittable Volume:	No fish concern