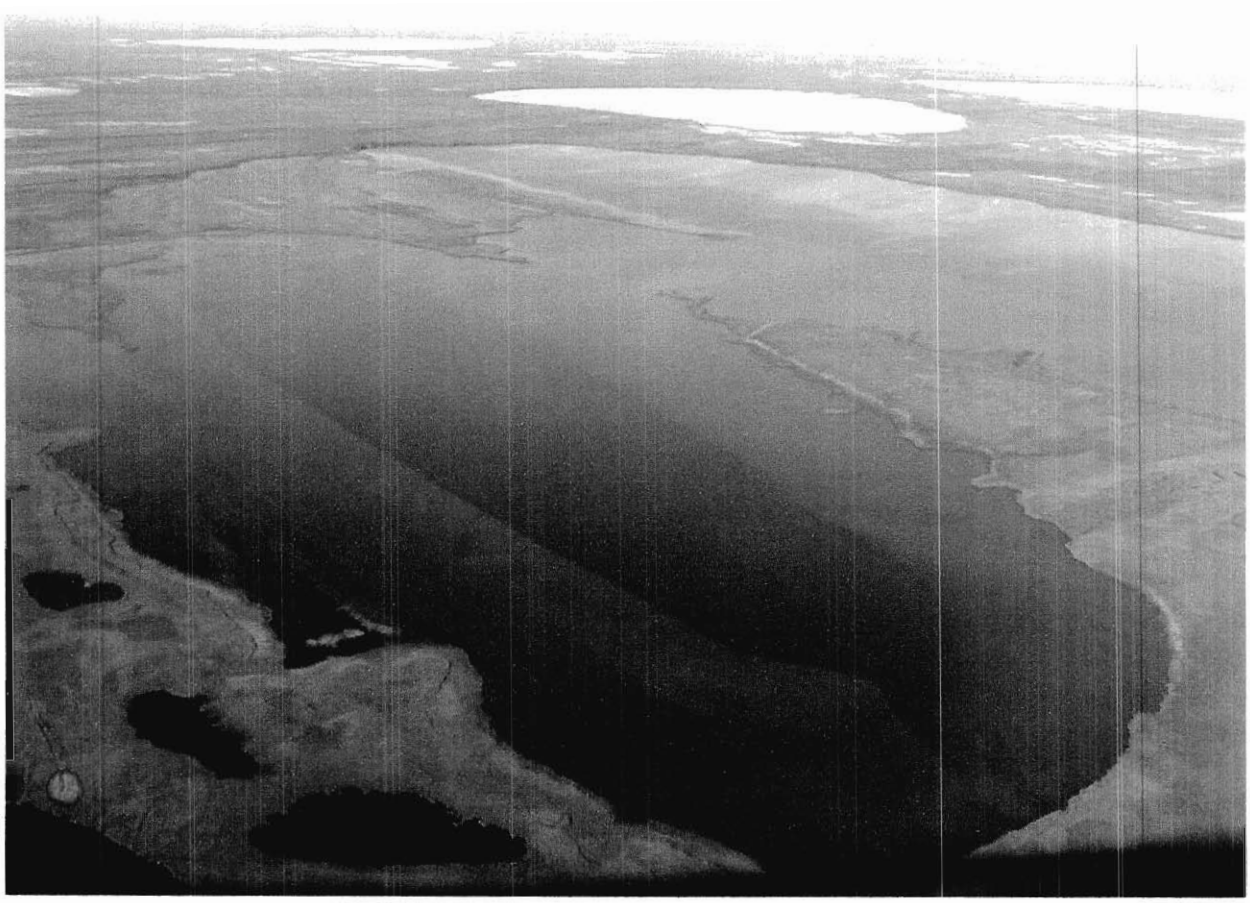
FISH SURVEY OF LAKES ASSOCIATED WITH THE KOKODA EXPLORATION PROSPECT: 2002-2003

Final Data Report

November 2003



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EXECUTIVE SUMMARY

The objectives of the study are to document fish presence and habitat use in eastern NPR-A lakes for lakes that may be used to support exploration activities. The region surveyed during 2002-2003 generally lies between the confluence of Fish and Judy creeks and the southeast corner of Teshekpuk Lake, along a potential ice road to the Kokoda region.

The objectives of the survey were to:

1) inventory fish species in the various lakes within the project study area (sampling area 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 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). The sets were kept to a short duration to minimize the chance for entangling waterfowl and to minimize fish mortality.

In 2002-2003, minnow traps and seines were used to identify smaller fish species that may not be detected by gill nets. The traps were set and retrieved in concert with the gill net sampling. At lakes where bottom contours allowed, a 20 ft seine was pulled through vegetation beds along the lakeshore to detect small fishes.

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 turbidity. A water sample was sent to Northern Test Labs for laboratory determination of chloride, sodium, calcium, magnesium, and hardness (as CaCO3).

Bathymetric data were collected to allow estimating lake volume. The amount allowed for winter water withdrawal when sensitive fish species are present is currently set at 15% of the volume of the lake deeper than 7 feet. When resistant fish species (i.e. ninespine stickleback and Alaska blackfish) are present, the current allocation is 30% of the volume deeper than 5 feet. There is no

withdrawal limit if fish are not present.

The area potentially available for ice aggregate was estimated by calculating the area of the lake shallower than 4 feet, assuming that the ice would grow to at least 4 feet prior to the need for aggregate. If the ice is shallower than 4 feet at the time of ice removal, then the area available will be less

A total of 6 lakes were sampled in 2002 and 30 in 2003 in connection with potential exploration in the Kokoda region of NPR-A. Lake trout, broad whitefish, least cisco and/or Arctic grayling were captured by gill net or observed in 9 of the NPR-A lakes, which is consistent with earlier reports from the region. Ninespine stickleback were also caught or observed in an additional 20 lakes.

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.

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 include lake trout, broad whitefish, least cisco and arctic grayling, while the more resistant species are Alaska blackfish and ninespine stickleback.

Based on the above lake evaluation, 29 lakes were confirmed to contain fish, with 9 containing sensitive species and an additional 20 containing only ninespine stickleback. One additional lake (M0233) likely supports resistant species, but was not sampled for them. Fish were not detected in the remaining 6 lakes.

The analysis indicated that 979.25 million gallons of water are likely to be available for winter use from lakes surveyed during 2002-2003 in association with the Kokoda area and potential ice road. In addition, 6,853 acres are likely to be available for ice chips from lakes surveyed during 2002-2003 in association with the Kokoda area and potential ice road.

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INTRODUCTION

ConocoPhillips 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 for lakes that may be used to support exploration activities. The region surveyed during 2002-2003 generally lies between the confluence of Fish and Judy creeks and the southeast corner of Teshekpuk Lake (Figure 1), along a potential ice road to the Kokoda region.

The objectives of the survey were to:

1) inventory fish species in the various lakes within the project study area (sampling area 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 2002-2003 field effort continued sampling begun in 1999 in the eastern NPR-A Exploration Area. Lakes in the area may be needed as sources of freshwater during oil exploration, for ice road and ice pad construction, as well as for short-term potable water supplies. 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, supplemented with minnow trap sets, seine hauls, and visual observations.

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 2002-2003, minnow traps and seines 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. At lakes where bottom contours allowed, a 20 ft seine was pulled through vegetation beds along the lakeshore to detect small fishes. Where this method was employed, three hauls were made at each lake.

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 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 an Oaktron Acorn Series pH5 meter. Turbidity was measured with an H.F. Scientific DRT15CE turbidity meter. A water sample was sent to Northern Test Labs for laboratory determination of chloride, sodium, calcium, magnesium, and hardness (as CaCO3).

Bathymetric data were collected to allow estimating lake volume. In 2002 and 2003, location and depth were recorded on a Lowrance Model LCX-15MT integrated GPS/depth sounder. Location and depth were recorded at approximately 1-2 second intervals. The study design was to record at least six to eight depth transects on each lake. Lake volume was estimated by contour mapping of depth intervals. Contour maps were prepared by plotting the position and depth data obtained by GPS on GIS basemaps and plotting the contours in 1 or 2 ft intervals on maps of the surveyed lakes. One foot intervals were plotted for lakes where the maximum depth was 10 ft or less, two foot intervals were used on deeper lakes. The surface area of each contour was obtained, then the volume was estimated using the formula for truncated cones:

$V = h/3*(A1+A2+(A1*A2)\ (1/2))$

Where h = vertical depth of the stratum, A1 = area of the upper surface, and A2 = area of the lower surface of the stratum whose volume is to be determined. The volumes of individual strata are summed to obtain the volume of the desired depth intervals.

The amount allowed for winter water withdrawal when sensitive fish species are present is currently set at 15% of the volume of the lake deeper than 7 feet. When resistant fish species (i.e. ninespine stickleback and Alaska blackfish) are present, the current allocation is 30% of the volume deeper than 5 feet. There is no withdrawal limit if fish are not present.

The area potentially available for ice aggregate was estimated by calculating the area of the lake shallower than 4 feet, assuming that the ice would grow to at least 4 feet prior to the need for aggregate. If the ice is shallower than 4 feet at the time of ice removal, then the area available will be less

Lake Summaries

This report uses lake numbering based 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 sampling from 1977-1986
L = Lobdell; water chemistry sampling in 1991-1999
M = Moulton; fish sampling in 1995-2003
MB = Michael Baker Jr., Inc. water chemistry sampling in 2002 and 2003
N = Netsch et al. (1977) NPRA sampling in 1977

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.

Six 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).

Deflation = Deflation lake, a lake formed when sand dunes become revegetated and the basins between the dunes become filled with water. Deflation lakes are typically the deepest coastal plain lakes.

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 6 lakes were sampled in 2002 and 30 in 2003 in connection with potential exploration in the Kokoda region of NPR-A (Table 1, Figure 2). Lake trout, broad whitefish, least cisco and/or Arctic grayling were captured by gill net or observed in 9 of the NPR-A lakes (Table 2), which is consistent with earlier reports from the region (Netsch et al. 1977, McElderry and Craig 1981, Bendock and Burr 1984). Ninespine stickleback were also caught or observed in an additional 20 lakes. Length information is presented for each fish-bearing lake in the Lake Summaries.

Lakes in the Kokoda region and along the potential Kokoda ice road were predominantly deflation

lakes, which are characterized by wide sandy shoals on the west and east sides, where sand dunes have eroded into the lakes (Figure 3). Deep water is often confined to a relatively small portion of the lake surface, as compared to lakes farther east, which tend to deepen rapidly near shore.

Water Chemistry Measurements

Water chemistry parameters measured in the studied lakes are presented Table 3. Mean water temperatures during the survey ranged as follows:

Jul 24 to 27, 2002:	10.1 °C (range: 7.1 to 13.0°C).
Jul 12 to 25, 2003	13.2 °C (range: 9.1 to 14.7°C).

Dissolved oxygen was high, averaging around 95% saturation in both years. The observed frequency of specific conductance and pH values from surveyed lakes are graphed in Figure 5. The generally low specific conductance and low ion concentration indicates little marine influence in most lakes in this region.

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 4.

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 lake trout, 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.

When sensitive fish are present, the amount of water available during winter is limited to 15% of the volume under 7 feet of ice. The water withdrawal criteria are relaxed when only resistant fish

species are present because of the greater tolerance to lower dissolved oxygen and higher concentrations of dissolved solids. In this case, up to 30% of the water volume under 5 feet of ice is allowed for winter withdrawal. For lakes that do not contain fish, there is currently no limit to the amount taken. For practical reasons, the volume available is limited to the volume of unfrozen water under the ice at the time of withdrawal. In most cases, the withdrawal occurs when the ice is 4 feet thick or greater. In order to provide some estimate of water likely to be available, the volume of water under 4 feet of ice is provided.

Based on the above lake evaluation, 29 lakes were confirmed to contain fish, with 9 containing sensitive species and an additional 20 containing only ninespine stickleback (Figure 4). One additional lake (M0233) likely supports resistant species, but was not sampled for them. Fish were not detected in the remaining 6 lakes.

Based on the above analysis, 979.25 million gallons of water are likely to be available for winter use from lakes surveyed during 2002-2003 in association with the Kokoda area and potential ice road.

The area covered by water less than 4 feet deep, and therefore likely to be suitable for removing ice aggregate, was estimated for each lake (Table 5). A map of the potential ice aggregate area for each lake is included in the individual lake summaries. Based on the above analysis, 6,853 acres are likely to be available for ice chips from lakes surveyed during 2002-2003 in association with the Kokoda area and potential ice road.

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. 2003. Fish utilization of lakes in the Upper Fish Creek region of eastern NPR-A: 2002. Report by MJM Research to ConocoPhillips Alaska, Inc. Lopez Island., WA. 87p.

Table 1. Summary of lakes sampled for the Kokoda prospect in 2002-2003.

Lake Name	Latitude (NAD27)	Longitude (NAD27)	Town	Range	Section	Surface Area (acres)	Maximum Depth (feet)	Calculated Volume (mill. gals)
M0229	70.28549	153.17409	11N	5W	17/20/21/28/29	1,031.2	7.7	470.54
M0230	70.27226	153.14708	11N	5W	27/28/33/34	414.1	4.5	not calc.
M0231	70.27486	153.11686	11N	5W	27/34	164.9	9.6	205.48
M0232	70.27204	153.07891	11N	5W	25/26/27/34/35/36	740.8	22.1	943.69
M0233	70.31650	153.10141	11N	5W	10/11	149.2	10.6	151.88
M0234	70.31238	153.12843	11N	5W	10/15	122.2	27.8	225.94
B84058	70.31001	152.93503	11N	4W	8/9/16/17/18/20/21	2,987.0	32.8	3,320.75
B84059A	70.30539	153.08347	11N	5W	11//14/23	514.4	22.2	280.44
B84059B	70.30828	153.07017	11N	5W	11//14/23	455.0	16.1	252.04
B84059C	70.30857	153.03757	11N	5W	12/13/24	1,791.6	40.3	2,390.07
M0301	70.27545	152.07134	11N	1W	26	362.6	9.9	466.61
M0302	70.25754	152.17293	11N	1W	4/5/32/33	58.8	9.4	93.93
M0303	70.26740	152.20501	11N	1W	32	65.5	9.8	123.89
M0304A	70.26801	152.22509	11N	1W	31	77.8	9.2	119.27
M0304B	70.26993	152.24909	11N	1W	30/31	36.0	8.2	43.34
M0305	70.28729	152.19363	11N	1W	16/17/20/21/29	440.1	8.7	665.85
M0306A	70.27827	152.25843	11N	2W	25/30	73.9	7.5	107.99
M0306B	70.27712	152.27401	11N	2W	25	46.1	7.5	67.84
M0307	70.26872	152.28570	11N	2W	25/36	227.3	7.0	48.97
M0308	70.31527	152.42589	11N	2W	8/9/16/17	237.6	10.2	257.56
M0309A	70.30868	152.47590	11N	2W	17/18	301.0	8.6	293.51
M0309B	70.31584	152.45795	11N	2W	8/17	168.8	12.3	171.89
M0310	70.30956	152.54279	11N	3W	13	90.9	11.8	104.47
M0311	70.31259	152.56773	11N	3W	11/14	101.8	13.7	133.88
M0312	70.30996	152.60741	11N	3W	15	21.0	6.7	20.99
M0313	70.31522	152.61432	11N	3W	10/15	58.5	11.9	79.52
M0314	70.33101	152.59358	11N	3W	2/3/10/11	143.3	10.5	205.22
M0315	70.32727	152.62213	11N	3W	3/10	157.7	8.7	185.75
M0316A	70.31356	152.69249	11N	3W	8/17	94.7	15.2	114.75
M0316B	70.31082	152.68031	11N	3W	16/17	46.1	7.6	31.85
M0317	70.31092	152.71202	11N	3W	17	108.3	8.5	133.41
M0318	70.30617	152.76521	11N	3W/4W	13/18	110.7	9.6	164.74
M0319	70.31872	152.81360	11N	4W	11/12	202.4	12.5	278.72
M0320	70.32398	152.99086	11N	4W	7	188.0	20.5	235.11
M0321	70.32621	153.04762	11N	5W	12	78.3	12.3	131.87
M0322	70.31017	153.15995	11N	5W	16	68.7	13.1	63.00
M0323	70.30532	153.17858	11N	5W	16	82.0	9.5	102.13
M0324	70.30036	153.15485	11N	5W	16/21	128.1	9.2	147.26
M0325	70.26848	153.18932	11N	5W	32/33	82.3	16.0	113.01
M0326	70.26342	153.22200	11N	5W	31/32	296.2	9.4	345.04
M0327	70.32888	152.92134	11N	4W	4/9	72.8	7.4	62.47
M0328	70.28334	152.33426	11N	2W	22/23/26/27	241.9	9.0	198.56

Table 2. Catches of fish from lakes sampled for the Kokoda prospect, 2002-2003.

		Gill Nets		Minnow Traps		Seine and Observation	
Lake Name	Sample Date	Set Duration (hours)	Fish Species[1]	Set Duration (hours)	Fish Species[2]	Number of Hauls	Fish Species[2]
M0229	7/27/02	3.0	BDWF, LSCS	0.0		observed	NSSB
M0230	7/27/02	0.0	BDWF, LSCS	0.0		observed	NSSB
M0231	7/26/02	3.5	LSCS	0.0		0	
M0232	7/26/02	0.0	LSCS	0.0		0	
M0233	7/24/02	8.1	None	0.0		0	
M0234	7/25/02	2.4	LSCS	0.0		0	
B84058	7/21/81	?	LKTR,BDWF	0.0		0	NSSB
B84059	7/21/81	?	LKTR,BDWF	0.0		0	NSSB
M0301	7/12/03	10.4	none	7.3	NSSB	0	
M0302	7/12/03	3.0	LSCS	7.5	none	0	
M0303	7/13/03	4.8	none	4.7	none	2	NSSB
M0304A/B	7/15/03	5.4	none	6.0	none	3	none
M0305	7/24/03	6.0	none	6.0	NSSB	0	
M0306A/B	7/15/03	6.0	none	9.0	none	3	none
M0307	7/13/03	5.5	none	6.2	none	3	NSSB
M0308	7/17/03	6.7	none	9.2	none	0	
M0309A/B	7/17/03	6.3	none	9.7	none	2	none
M0310	7/15/03	5.4	none	7.3	none	2	NSSB
M0311	7/16/03	6.1	none	5.0	NSSB	0	
M0312	7/19/03	6.4	none	6.7	none	3	none
M0313	7/19/03	6.3	none	8.0	NSSB	3	none
M0314	7/16/03	6.1	none	8.2	none	4	none
M0315	7/19/03	6.6	none	6.2	none	2	NSSB
M0316	7/25/03	8.5	none	11.4	NSSB	0	
M0317	7/25/03	8.5	none	11.4	NSSB	0	
M0318	7/24/03	5.8	none	3.7	NSSB	0	
M0319	7/24/03	5.5	none	4.0	NSSB	0	
M0320	7/20/03	6.5	none	4.6	NSSB	2	NSSB
M0321	7/23/03	6.9	none	0.0		observed	NSSB
M0322	7/22/03	7.5	none	2.5	NSSB	0	
M0323	7/22/03	6.0	none	7.8	NSSB	0	
M0324	7/21/03	6.2	none	6.7	NSSB	observed	NSSB
M0325	7/14/03	6.5	none	8.3	NSSB	0	
M0326	7/21/03	6.8	none	9.7	NSSB	0	
M0327	7/23/03	11.0	none	0.0		observed	NSSB
M0328	8/1/03	0.0		0.0		observed	GRAY

[1] BDWF = broad whitefish, HBWF = humpback whitefish, LSCS = least cisco, GRAY = arctic grayling, LKTR = lake trout

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

Table 3. Water chemistry parameters measured in conjunction with lake sampling for the Kokoda prospect, 2002-2003.

Lake	Date	Water Temp (°C)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (%)	Specific Conductance (microS/cm)	pH	Turbidity (NTU)	Ions[1] Ca^+ (mg/l)	Ions[1] Mg^+ (mg/l)	Ions[1] Na^+ (mg/l	Ions[1] Cl^- (mg/l)	Total Hardness [CaCO3] (mg/l)
M0229	7/27/02	7.1	10.9	91.0	203.8	7.46	1.4	24	2.8	7.0	17.0	71
M0230	not sampled, too shallow							31	3.2	4.9	11.4	92
M0231	7/26/02	9.1	11.3	98.5	203.8	7.47	1.8	30	2.7	4.8	10.3	85
M0232	7/26/02	10.4	11.0	99.2	195.5	7.54	1.3	19	2.1	4.4	9.6	56
M0233	7/24/02	13.0	9.9	93.3	143.6	7.40	0.6	21	2.2	3.8	7.7	62
M0234	7/25/02	10.8	9.9	90.2	165.3	7.69	0.9	24	2.4	4.2	8.6	70
B84058	7/20/03	14.7	10.1	98.7	138.1	7.99	1.3	19	2.2	4.2	8.1	57
B84059	7/20/03	15.3	10.1	100.0	134.5	7.99	1.5	19	2.2	4.1	8.1	56
M0301	7/12/03	13.3	10.0	96.4	245.7	8.27	1.3	30	5.4	9.0	24.0	97
M0302	7/12/03	15.4	9.9	99.2	276.3	8.22	1.0	22	5.5	22.0	39.0	77
M0303	7/13/03	13.2	9.9	94.9	103.8	7.92	1.9	11	1.9	4.8	11.0	36
M0304A/B	7/15/03	10.4	11.0	100.3	96.1	7.69	1.2	10	1.8	3.7	10.0	32
M0305	7/24/03	13.9	10.5	100.1	141.1	7.95	3.4	18	2.8	6.4	15.0	56
M0306A/B	7/15/03	10.4	40.5	94.9	106.9	7.69	0.5	11	1.8	5.8	11.0	36
M0307	7/14/03	13.6	10.2	98.1	120.4	7.91	0.7	14	2.2	5.9	13.0	43
M0308	7/17/03	8.7	11.1	95.4	188.0	8.23	0.6	27	2.8	5.6	11.0	79
M0309A/B	7/17/03	9.8	11.4	100.7	194.2	8.24	0.6	28	2.8	5.2	11.0	82
M0310	7/15/03	10.6	11.2	100.2	218.8	8.27	0.4	31	3.5	6.8	14.0	92
M0311	7/16/03	9.6	11.2	97.8	137.4	7.96	0.5	19	2.1	3.9	8.1	56
M0312	7/19/03	13.7	10.4	100.0	127.7	8.14	0.4	18	2.2	3.3	5.8	55
M0313	7/19/03	13.3	10.6	99.9	154.7	8.09	0.5	21	2.6	5.2	10.0	62
M0314	7/16/03	10.1	11.1	98.7	140.3	8.10	0.7	21	2.1	3.5	6.6	61
M0315	7/19/03	12.3	10.7	99.4	209.1	8.29	0.6	31	3.5	5.9	11.0	93
M0316	7/25/03	11.5	10.4	95.6	128.0	7.93	1.0	18	2.2	4.6	9.0	54
M0317	7/25/03	9.6	10.7	93.5	169.3	8.00	1.1	26	2.6	4.7	9.4	75
M0318	7/24/03	13.8	9.7	93.6	134.2	7.86	1.3	19	2.4	4.7	9.6	57
M0319	7/24/03	13.3	9.8	93.8	156.6	8.15	0.7	25	2.3	3.8	7.3	72
M0320	7/20/03	18.7	NM	NM	193.5	8.32	2.1	30	2.7	4.2	7.2	87
M0321	7/23/03	14.2	9.8	95.0	62.9	7.78	0.6	9	1.0	1.9	3.3	27
M0322	7/22/03	15.5	NM	NM	124.5	8.13	0.8	19	2.1	2.7	4.7	57
M0323	7/22/03	16.0	NM	NM	111.8	8.03	0.7	15	1.9	3.2	6.1	46
M0324	7/21/03	19.0	NM	NM	198.7	8.34	0.9	32	3.1	4.6	8.1	91
M0325	7/14/03	12.6	10.4	98.0	131.6	8.04	1.3	19	2.0	3.0	5.6	57
M0326	7/21/03	16.2	NM	NM	176.1	8.22	3.8	27	2.5	2.7	6.7	77
M0327	7/23/03	14.2	10.1	100.5	139.3	8.23	0.5	22	2.2	3.4	5.8	64
M0328	8/1/03	NM	NM	NM	NM	NM	NM	30	3.4	5.7	12.0	88

[1] NM = not measured, meter malfunction

[1] Ions:

Ca^+ = Calcium
Mg^+ = Magnesium
NA^+ = Sodium
Cl^- = Chloride

Table 5. Estimated area available for removing ice aggregate, based on the area covered by water shallower than 4 feet, for lakes surveyed for the Kokoda prospect, 2002-2003.

Lake Name	Surface Area (acres)	Maximum Depth (feet)	Acres covered by Water shallower than 4 feet
M0229	1,031.2	7.7	862.6
M0230	414.1	4.5	414.1
M0231	164.9	9.6	82.1
M0232	740.8	22.1	540.3
M0233	149.2	10.6	96.1
M0234	122.2	27.8	82.0
B84058	2,987.0	32.8	1296.6
B84059A	514.4	22.2	328.2
B84059B	455.0	16.1	221.1
B84059C	1,791.6	40.3	640.1
M0301	362.6	9.9	176.4
M0302	58.8	9.4	16.9
M0303	65.5	9.8	16.0
M0304A	77.8	9.2	23.0
M0304B	36.0	8.2	19.7
M0305	440.1	8.7	142.0
M0306A	73.9	7.5	4.5
M0306B	46.1	7.5	37.8
M0307	227.3	7.0	65.9
M0308	237.6	10.2	142.8
M0309A	301.0	8.6	182.0
M0309B	168.8	12.3	124.3
M0310	90.9	11.8	55.9
M0311	101.8	13.7	63.4
M0312	21.0	6.7	10.9
M0313	58.5	11.9	28.8
M0314	143.3	10.5	55.6
M0315	157.7	8.7	81.4
M0316A	94.7	15.2	63.4
M0316B	46.1	7.6	35.0
M0317	108.3	8.5	49.6
M0318	110.7	9.6	43.4
M0319	202.4	12.5	93.0
M0320	188.0	20.5	113.6
M0321	78.3	12.3	36.1
M0322	68.7	13.1	44.8
M0323	82.0	9.5	46.0
M0324	128.1	9.2	76.9
M0325	82.3	16.0	39.1
M0326	296.2	9.4	167.4
M0327	72.8	7.4	46.2
M0328	241.9	9.0	188.5

Table 4. Estimated water volumes available for winter withdrawal from surveyed lakes near the Kokoda prospect, 2002-2003.

(requested water based on 15% of winter volume deeper than 7 ft when sensitive species are present, 30% of winter volume deeper than 5 ft when resistant or no fish are likely to be present).

Lake	Surface Area (acres)	Max. Depth (feet)	Calculated Volume (mil. gals)	Volume Under 4ft of Ice (mil. gals)	30% of 5 ft Winter Volume (mil. gals)	15% of 7 ft Winter Volume (mil. gals)	Sensitive Fish Species Present1	Resistant Fish Species Present2	Requested Water (mil. gals)
M0229	1,031.2	7.7	470.54			0.02	BDWF, LSCS	not sampled	0.02
M0230	414.1	4.5	not calc.			0.00	BDWF, LSCS	not sampled	ice chips
M0231	164.9	9.6	205.48			0.10	LSCS	not sampled	0.10
M0232	740.8	22.1	943.69			24.43	LSCS	not sampled	24.43
M0233	149.2	10.6	151.88		10.28	1.39	none	not sampled	10.28
M0234	122.2	27.8	225.94			14.88	LSCS	not sampled	14.88
B84058	2,987.0	32.8	3,320.75	1787.07	442.84	180.53	LKTR,BDWF	NSSB	180.53
B84059A	514.4	22.2	280.44	46.08	8.57	2.00	LKTR,BDWF	NSSB	2.00
B84059B	455.0	16.1	252.04	27.34	4.57	0.54	LKTR,BDWF	NSSB	0.54
B84059C	1,791.6	40.3	2,390.07	1763.94	456.16	196.33	LKTR,BDWF	NSSB	196.33
M0301	362.6	9.9	466.61	126.69	20.69	0.37	none	NSSB	20.69
M0302	58.8	9.4	93.93	47.21	12.80	3.27	LSCS	none	3.27
M0303	65.5	9.8	123.89	49.31	10.17	1.46	none	NSSB	10.17
M0304A	77.8	9.2	119.27	34.86	5.70	0.17	none	none	34.86
M0304B	36.0	8.2	43.34	5.92	0.50	0.01	none	none	5.92
M0305	440.1	8.7	665.85	189.48	28.88	0.65	none	NSSB	28.88
M0306A	73.9	7.5	107.99	25.50	3.15	0.00	none	none	25.50
M0306B	46.1	7.5	67.84	15.13	1.57	0.01	none	none	15.13
M0307	227.3	7.0	48.97	48.97	3.31	0.00	none	NSSB	3.31
M0308	237.6	10.2	257.56	87.69	17.14	0.88	none	none	87.69
M0309A	301.0	8.6	293.51	97.59	19.35	1.70	none	none	97.59
M0309B	168.8	12.3	171.89	7.06	9.50	1.98	none	none	7.06
M0310	90.9	11.8	104.47	1.59	4.67	0.78	none	NSSB	4.67
M0311	101.8	13.7	133.88	55.72	10.33	2.62	none	NSSB	10.33
M0312	21.0	6.7	20.99	2.39	0.15	0.00	none	none	2.39
M0313	58.5	11.9	79.52	3.19	3.99	0.76	none	none	3.19
M0314	143.3	10.5	205.22	62.41	11.35	1.28	none	none	62.41
M0315	157.7	8.7	185.75	49.75	7.86	0.11	none	NSSB	7.86
M0316A	94.7	15.2	114.75	48.79	11.25	2.60	none	NSSB	11.25
M0316B	46.1	7.6	31.85	3.28	0.16	0.01	none	NSSB	0.16
M0317	108.3	8.5	133.41	33.22	4.82	0.17	none	NSSB	4.82
M0318	110.7	9.6	164.74	49.83	9.20	0.97	none	NSSB	9.20
M0319	202.4	12.5	278.72	101.21	20.32	2.10	none	NSSB	20.32
M0320	188.0	20.5	235.11	87.15	15.45	3.73	none	NSSB	15.45
M0321	78.3	12.3	131.87	56.17	12.91	3.25	none	NSSB	12.91
M0322	68.7	13.1	63.00	17.30	3.14	0.40	none	NSSB	3.14
M0323	82.0	9.5	102.13	61.46	7.04	0.94	none	NSSB	7.04
M0324	128.1	9.2	147.26	87.64	10.14	1.15	none	NSSB	10.14
M0325	82.3	16.0	113.01	32.26	5.29	0.90	none	NSSB	5.29
M0326	296.2	9.4	345.04	90.33	15.69	0.75	none	NSSB	15.69
M0327	72.8	7.4	62.47	13.51	1.60	0.01	none	NSSB	1.60
M0328	241.9	9.0	198.56	59.54	12.94	2.22	GRAY	none	2.22

[1] Sensitive species include lake trout, grayling, whitefishes, char, burbot, slimy sculpin, etc.

[2] Resistant species are Alaska blackfish (BKFH) and ninespine stickleback (NSSB)

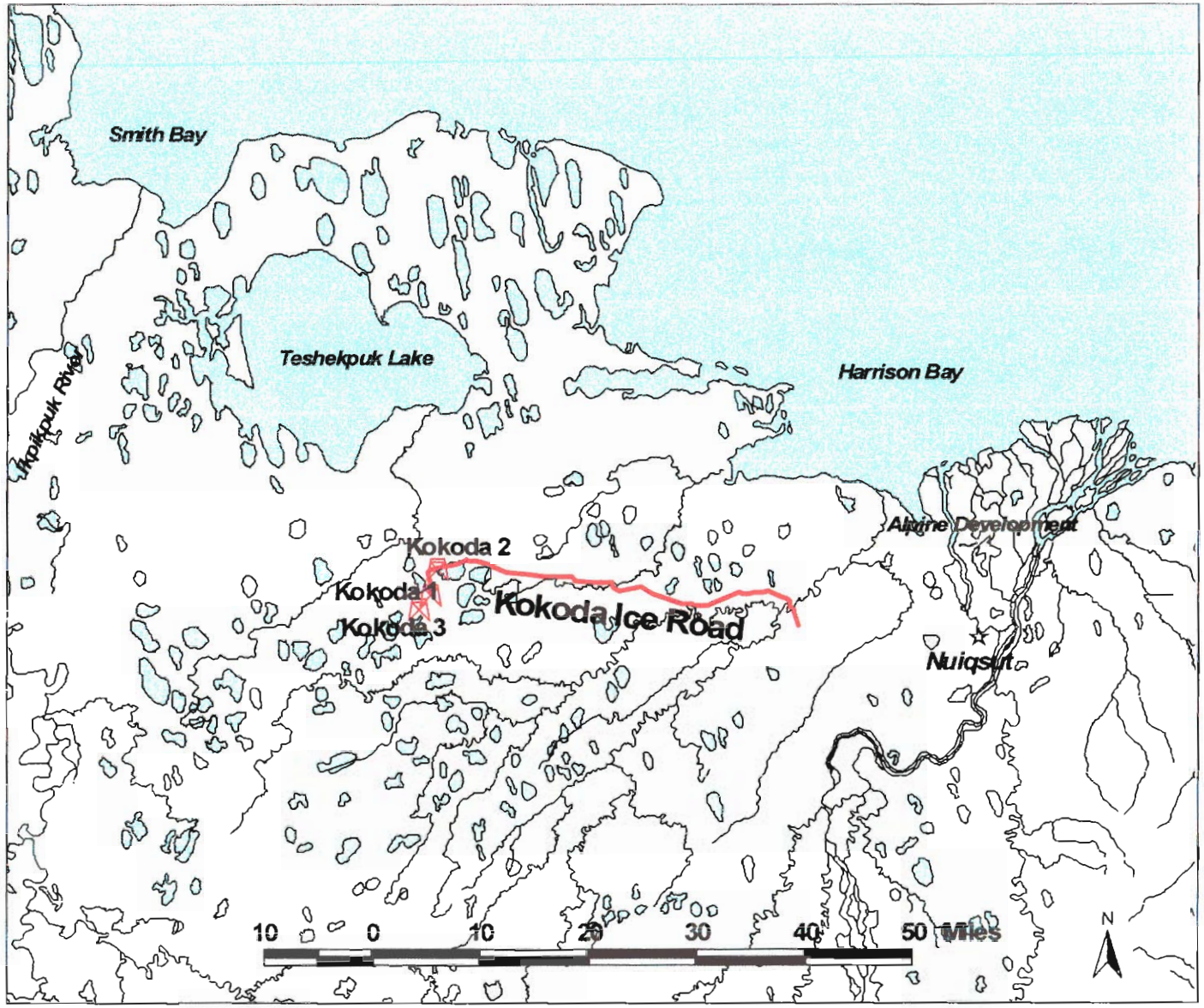


Figure 1. Kokoda exploration area and potential ice road.

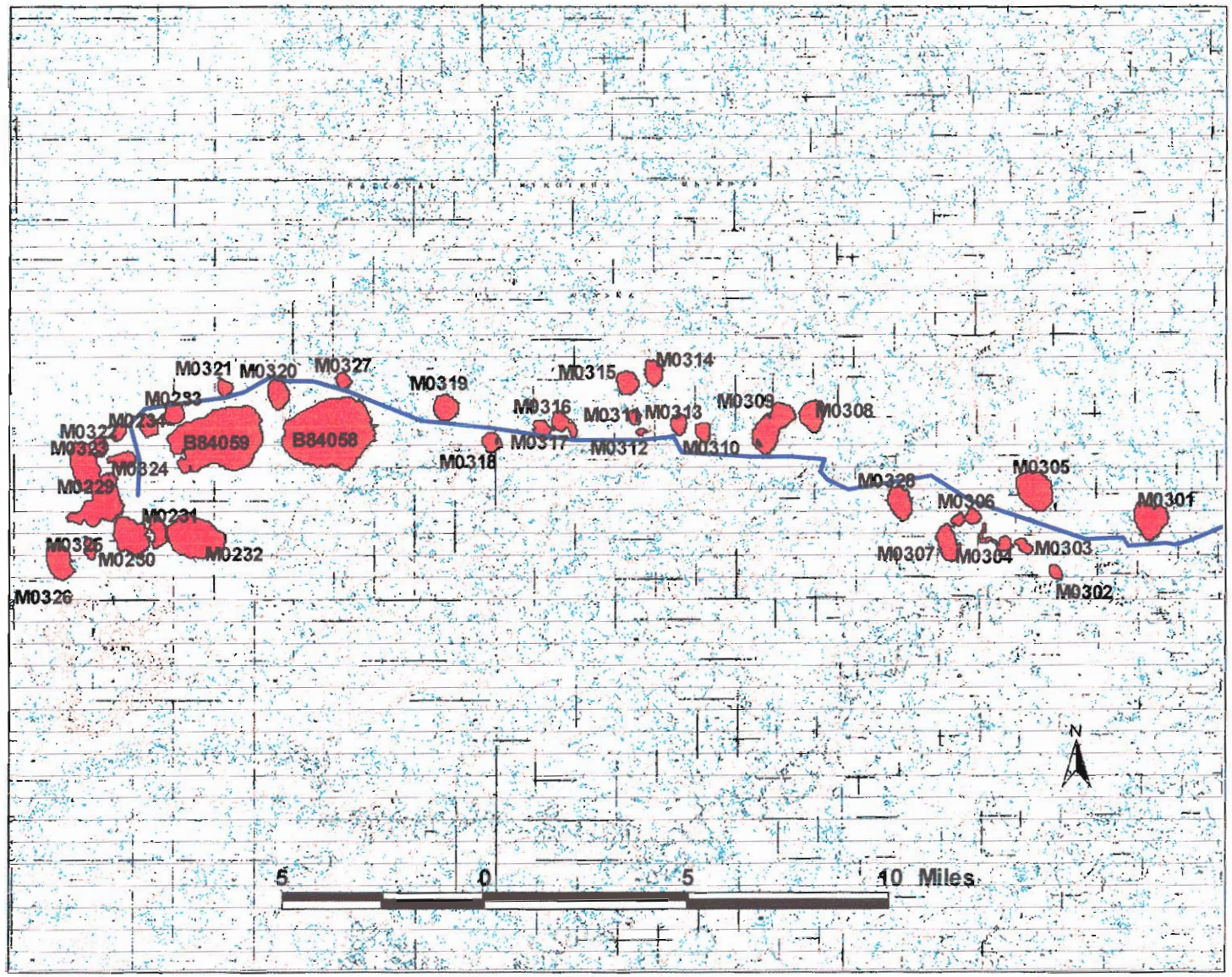


Figure 2. Lakes sampled for fish in the Kokoda Study Area during 2002-2003.

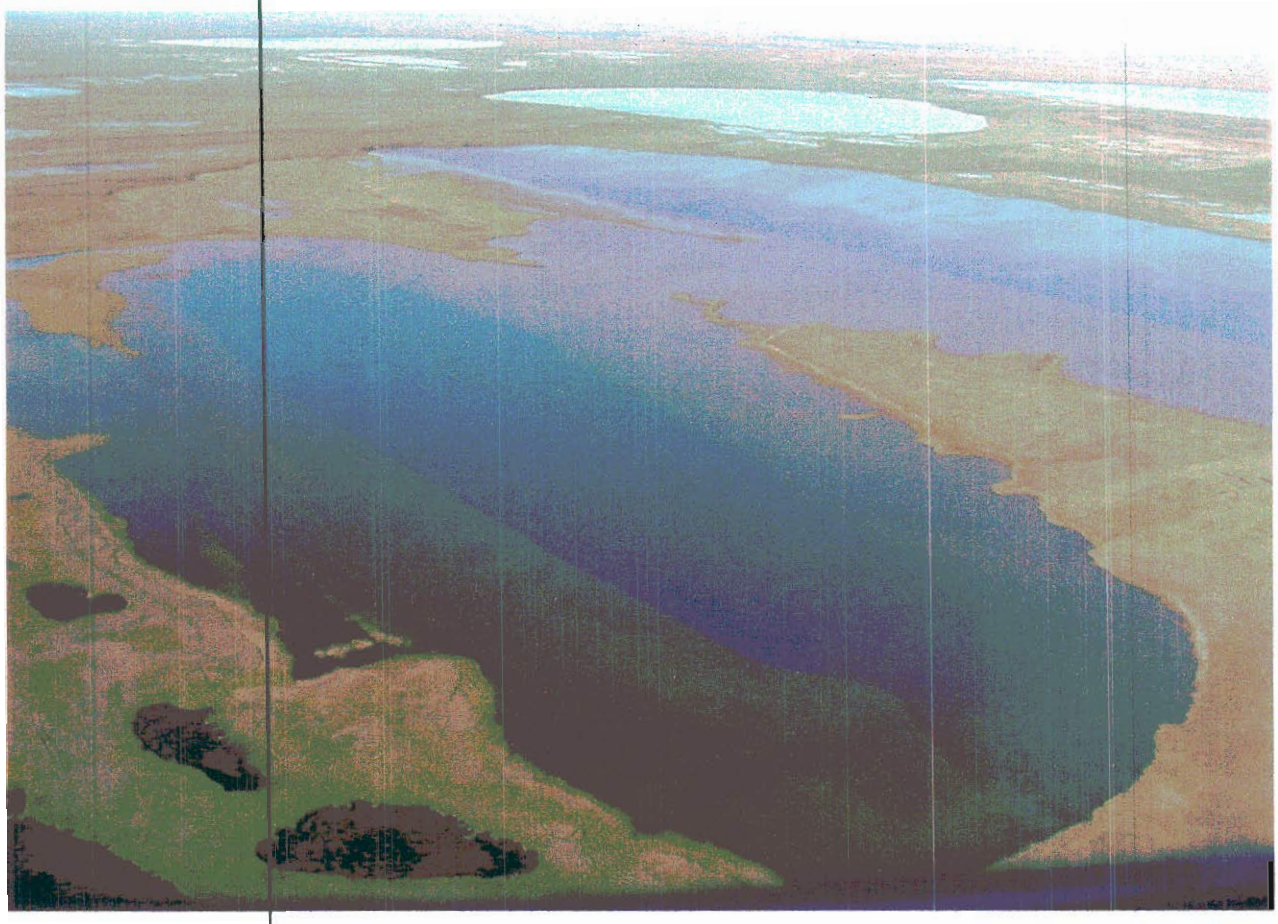


Figure 3. Typical lake in the Kokoda Study Area, showing wide sandy shoals along the lake margin and deep area restricted to the center of the lake.

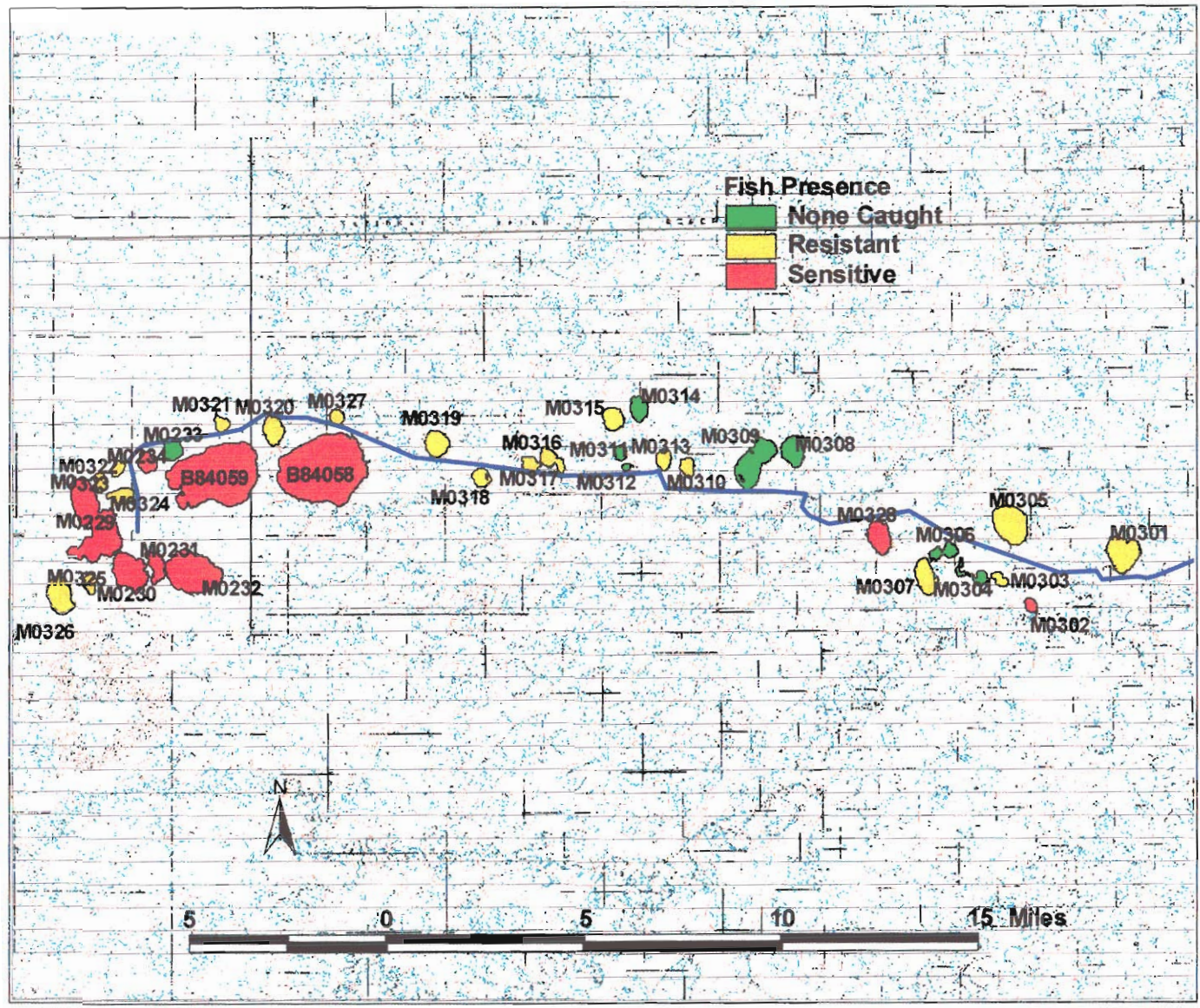
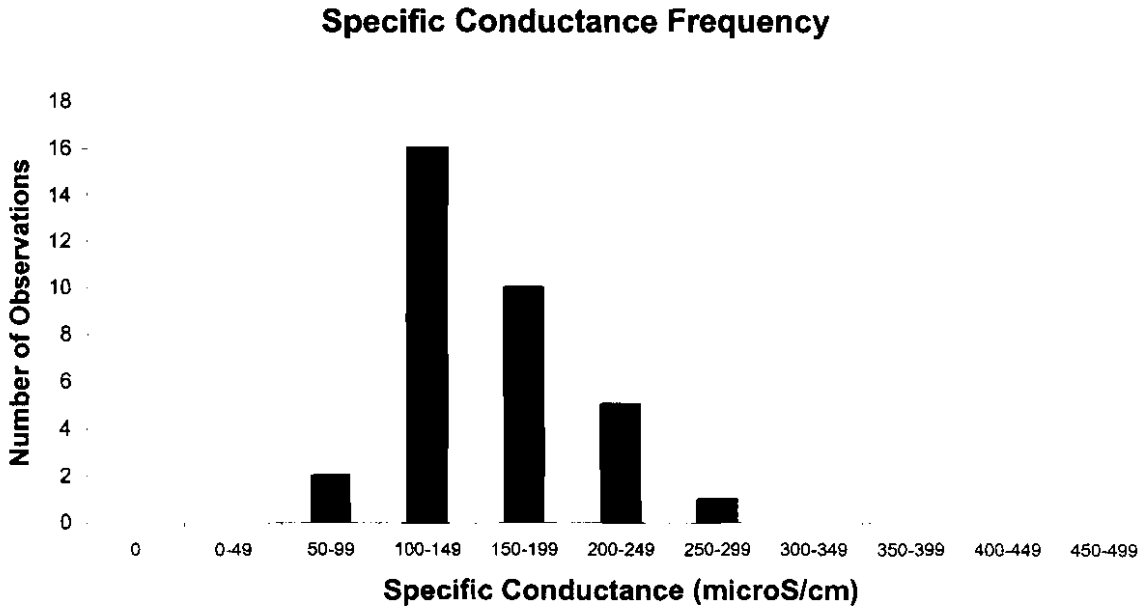


Figure 4. Distribution of sensitive and resistant fish species in lakes sampled in the Kokoda Study Area during 2002-2003 summer field seasons.



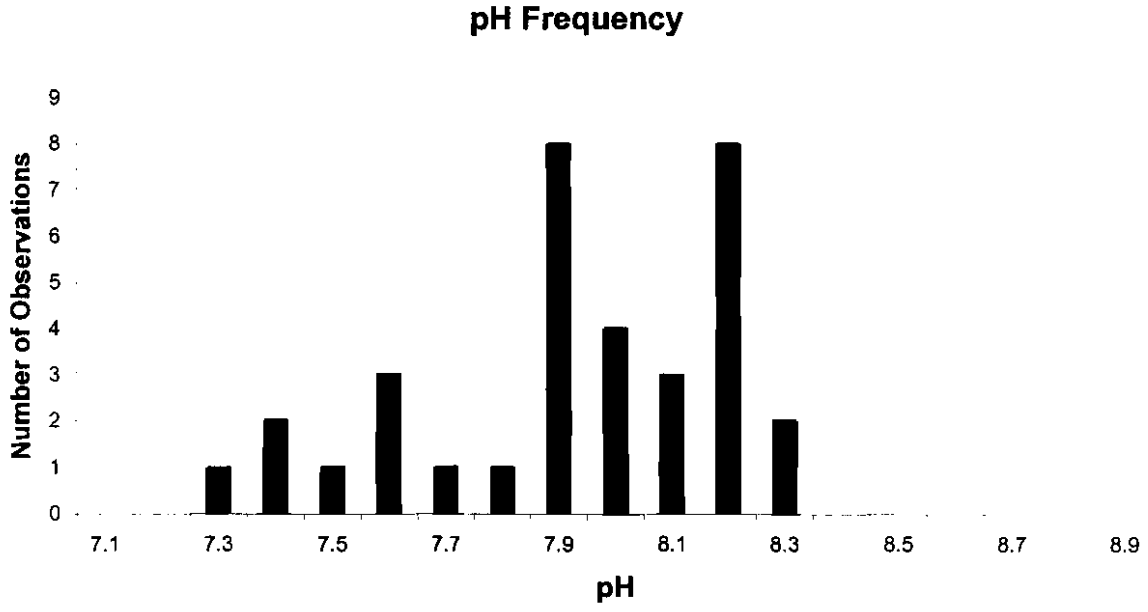
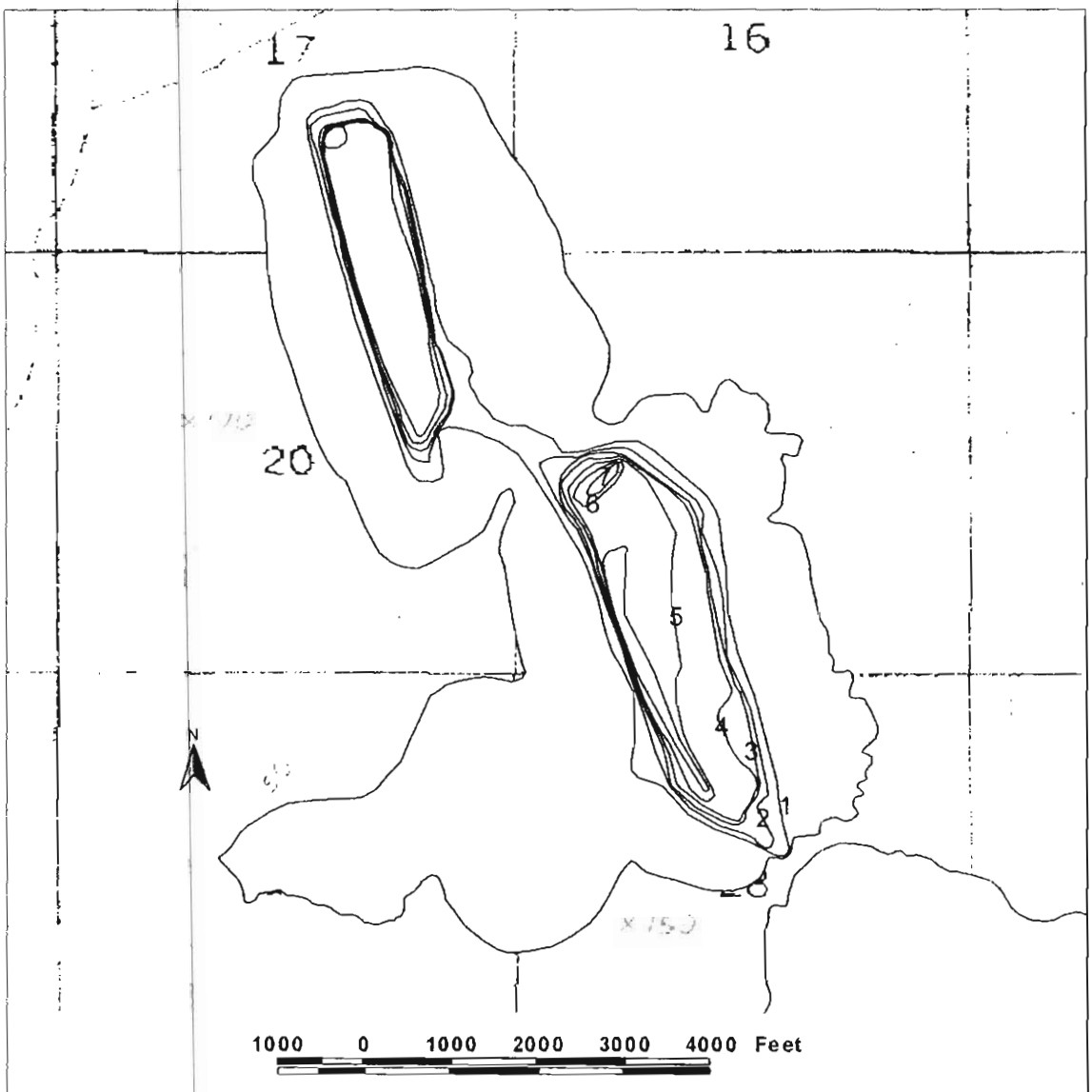


Figure 5. Frequency distribution of specific conductance and pH measurements taken during summer from 34 lakes associated with the Kokoda prospect, 2002-2003.

Lake Summaries



Depth contours of M0229, based on transects surveyed on July 27, 2002 (depth intervals in 1 foot increments).

Lake M0229

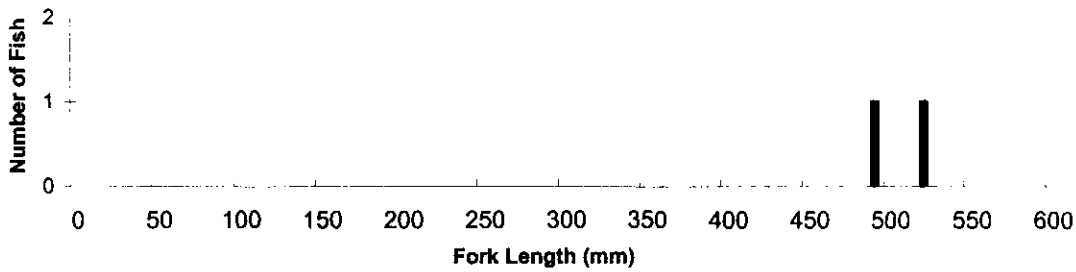
Other Names:
Location: 70.28549°N 153.17409°W
USGS Quad Sheet: Teshekpuk B-1: T11N R5W Sec. 17/20/21/28/29
Habitat: Drainage Lake
Area: 1,031.2 acres
Maximum Depth: 7.7 feet
Active Outlet: Yes
Calculated Volume: 470.54 million gallons
Permittable Volume: 0.02 million gallons
Potential Aggregate: 862.6 acres (water depth 4 ft or less)

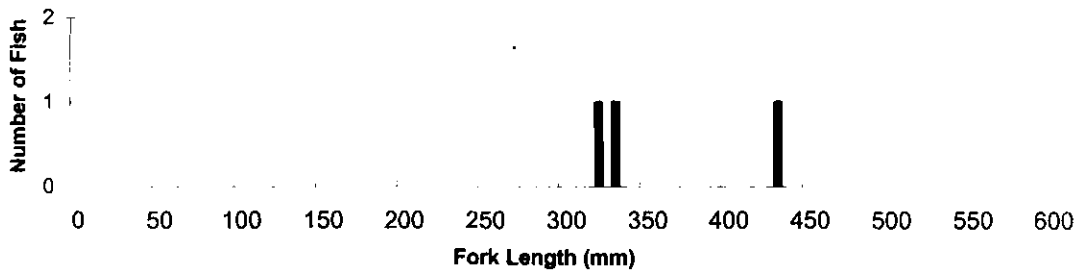
Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2002	23.9	2.8	7.0	17.0	71	204	1.4	7.46	This Study

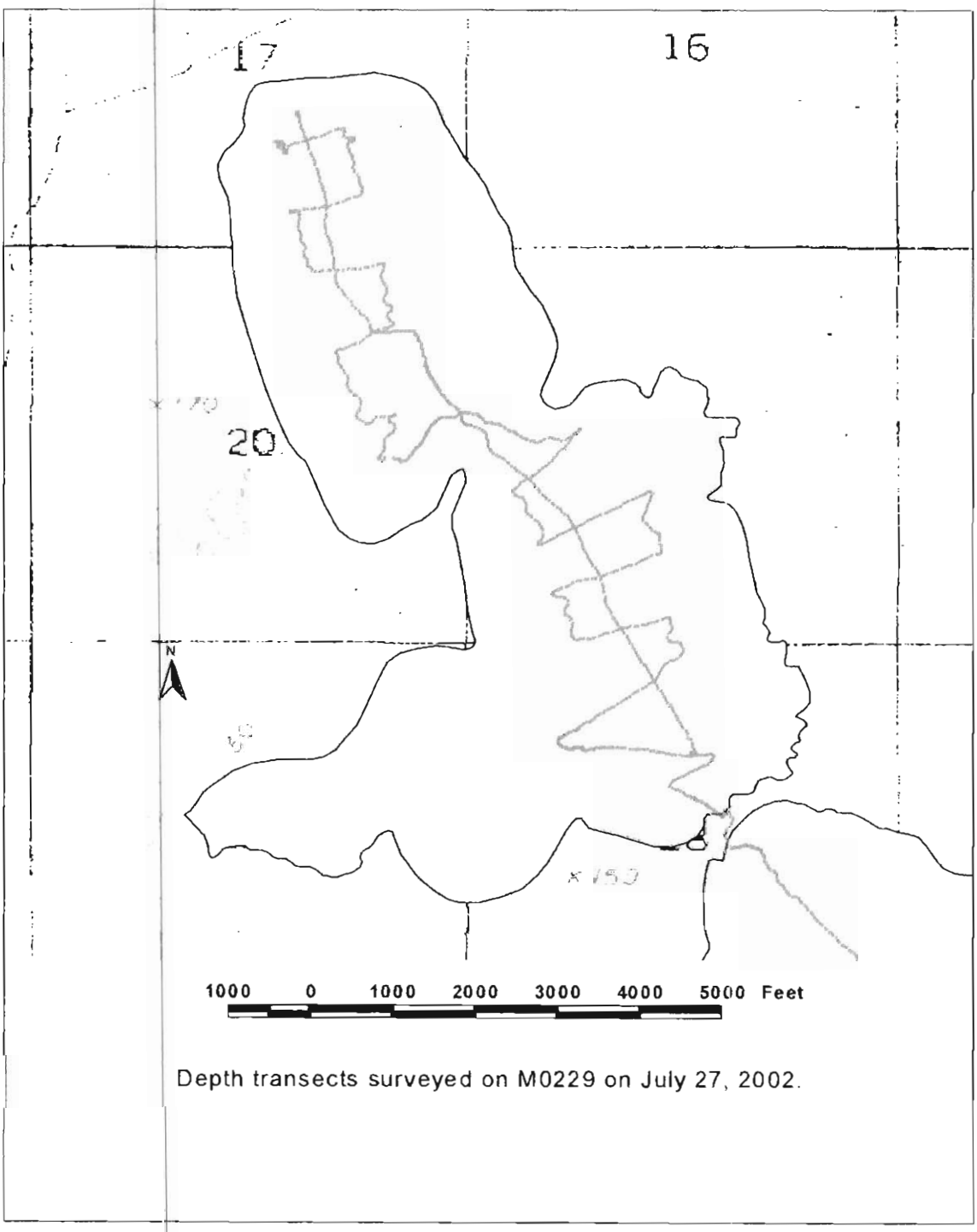
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Jul 27 02	3.0	Broad whitefish	3	495-524
			Least cisco	3	321-438

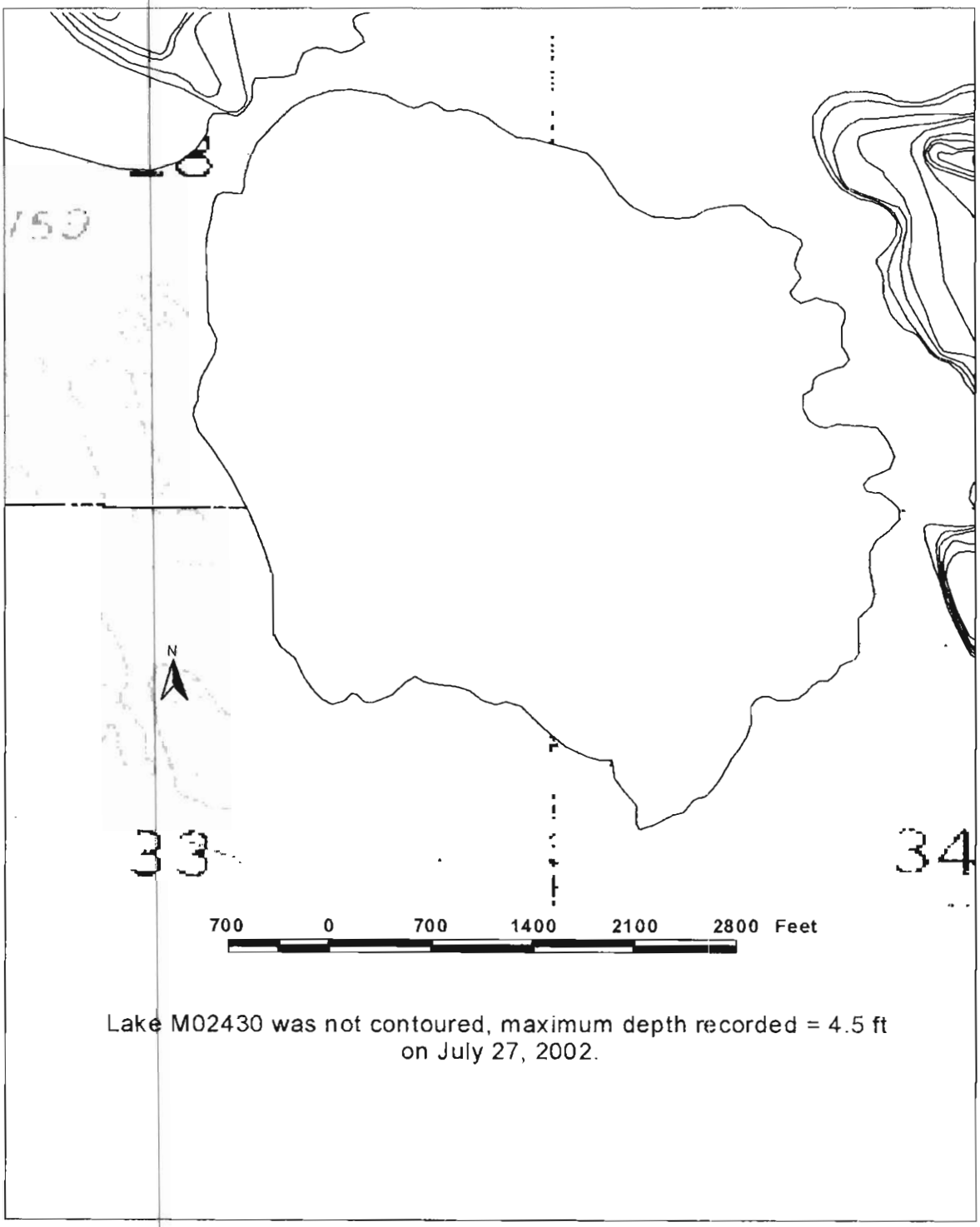




Regions of lake M0229 less than 4 ft deep (shaded), and likely to be available for ice chips, based on transects surveyed on July 27, 2002.



Depth transects surveyed on M0229 on July 27, 2002.



Lake M02430 was not contoured, maximum depth recorded = 4.5 ft on July 27, 2002.

Lake M0230

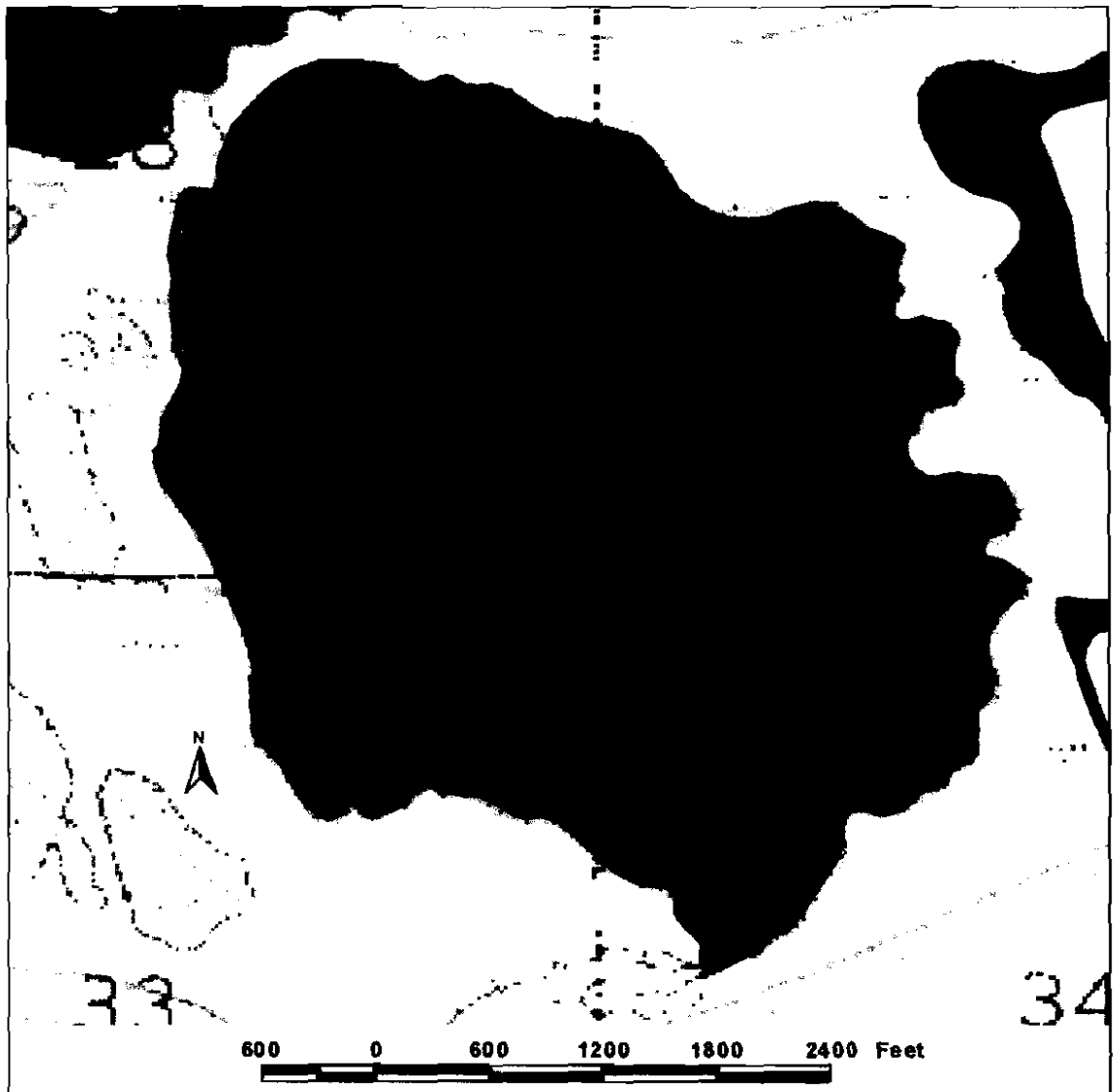
Other Names:
Location: 70.27226°N 153.14708°W
USGS Quad Sheet: Teshekpuk B-1: T11N R5W Sec. 27/28/33/34
Habitat: Drainage Lake
Area: 414.1 acres
Maximum Depth: 4.5 feet
Active Outlet: Yes
Calculated Volume: not calc.
Permittable Volume: ice chips
Potential Aggregate: 414.1 acres (water depth 4 ft or less)

Water Chemistry:

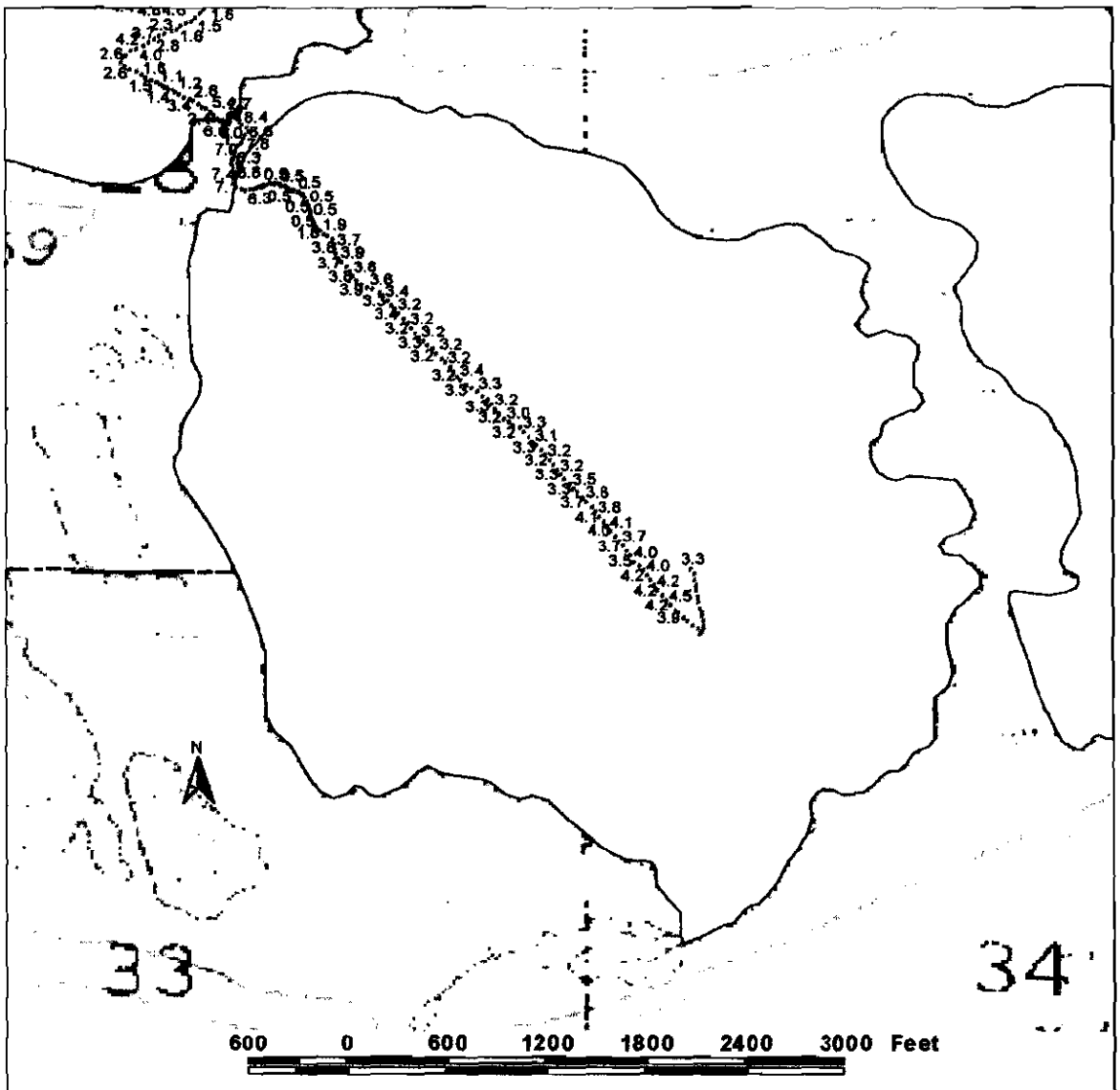
Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2002	31.5	3.2	4.9	11.4	92				This Study

Catch Record:

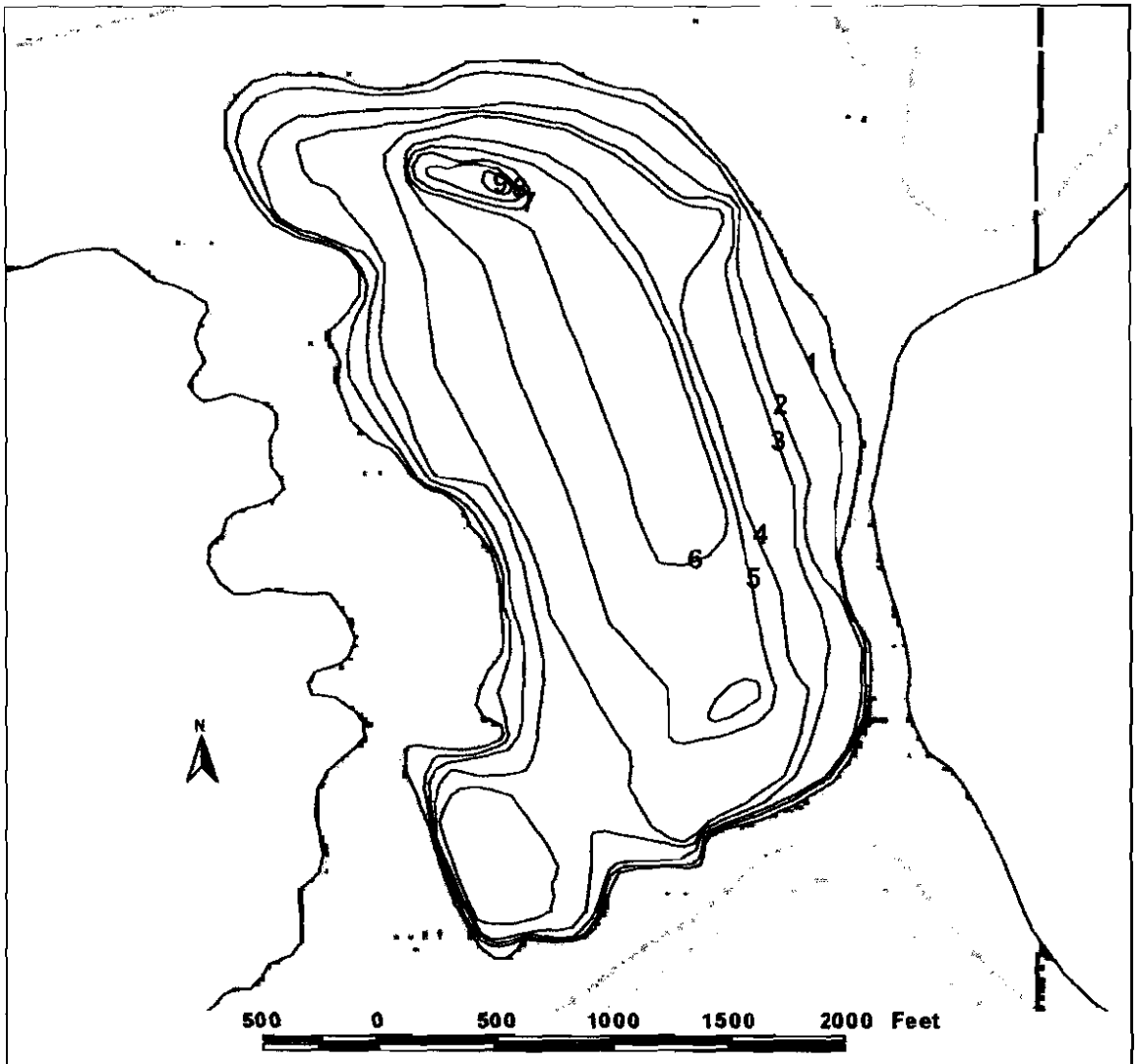
Gear	Date	Effort (hours)	Species	Number Caught
not sampled, connected to M0229				



Regions of lake M0230 less than 4 ft deep (shaded), and likely to be available for ice chips, based on transects surveyed on July 27, 2002.



Depth transects surveyed on M0230 on July 27, 2002 (depths in feet).



Depth contours of M0231, based on transects surveyed on July 26, 2002 (depth intervals in 1 foot increments).

Lake M0231

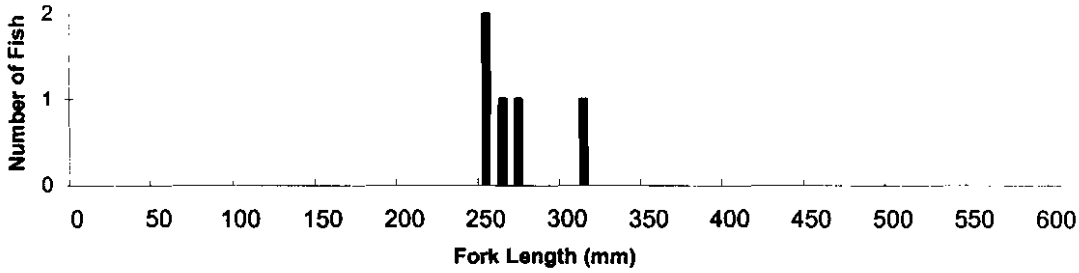
Other Names:
Location: 70.27486°N 153.11686°W
USGS Quad Sheet: Teshekpuk B-1: T11N R5W Sec. 27/34
Habitat: Drainage Lake
Area: 164.9 acres
Maximum Depth: 9.6 feet
Active Outlet: Yes
Calculated Volume: 205.48 million gallons
Permittable Volume: 0.10 million gallons
Potential Aggregate: 82.1 acres (water depth 4 ft or less)

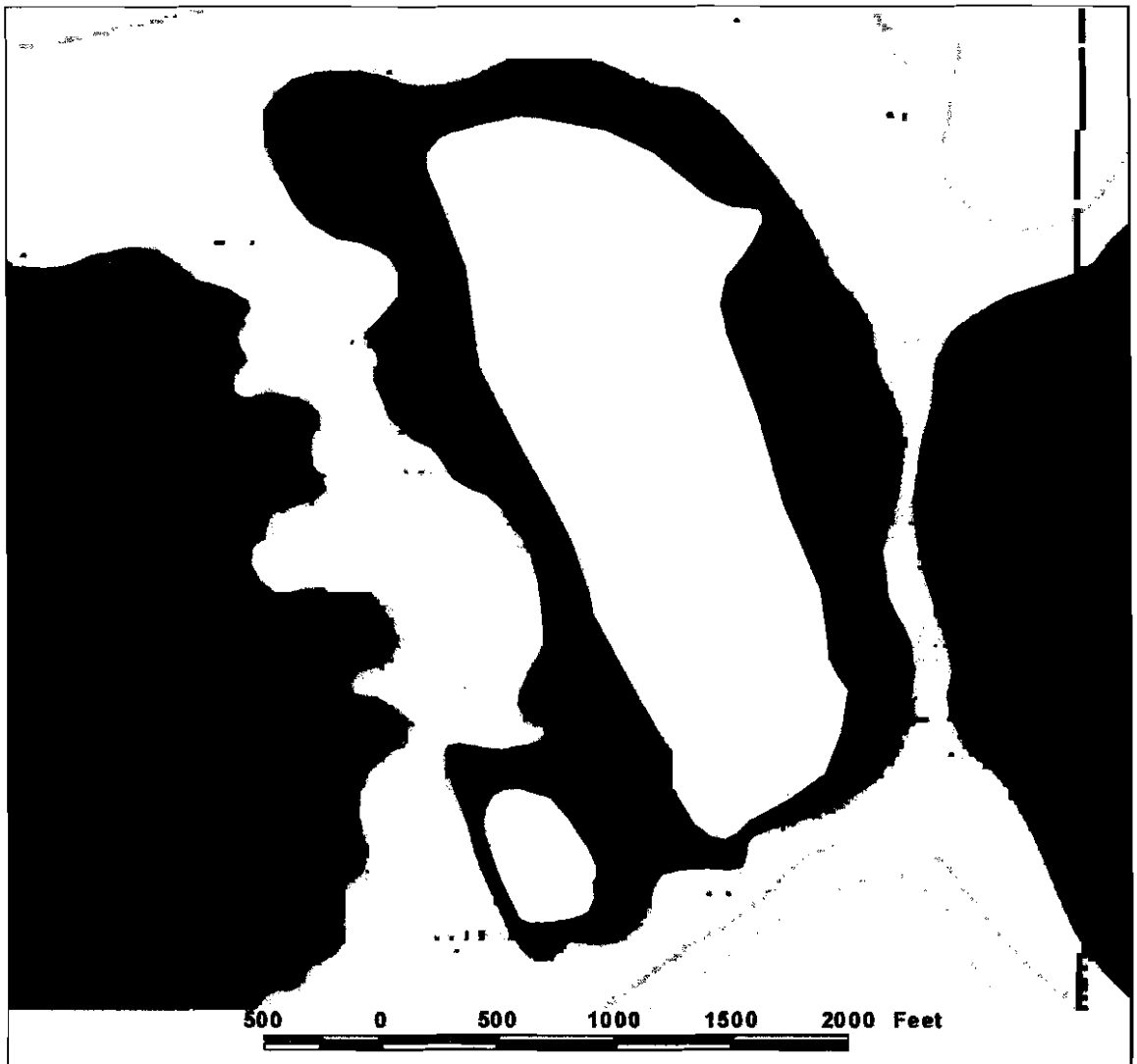
Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2002	29.7	2.7	4.8	10.3	85	204	1.8	7.47	This Study

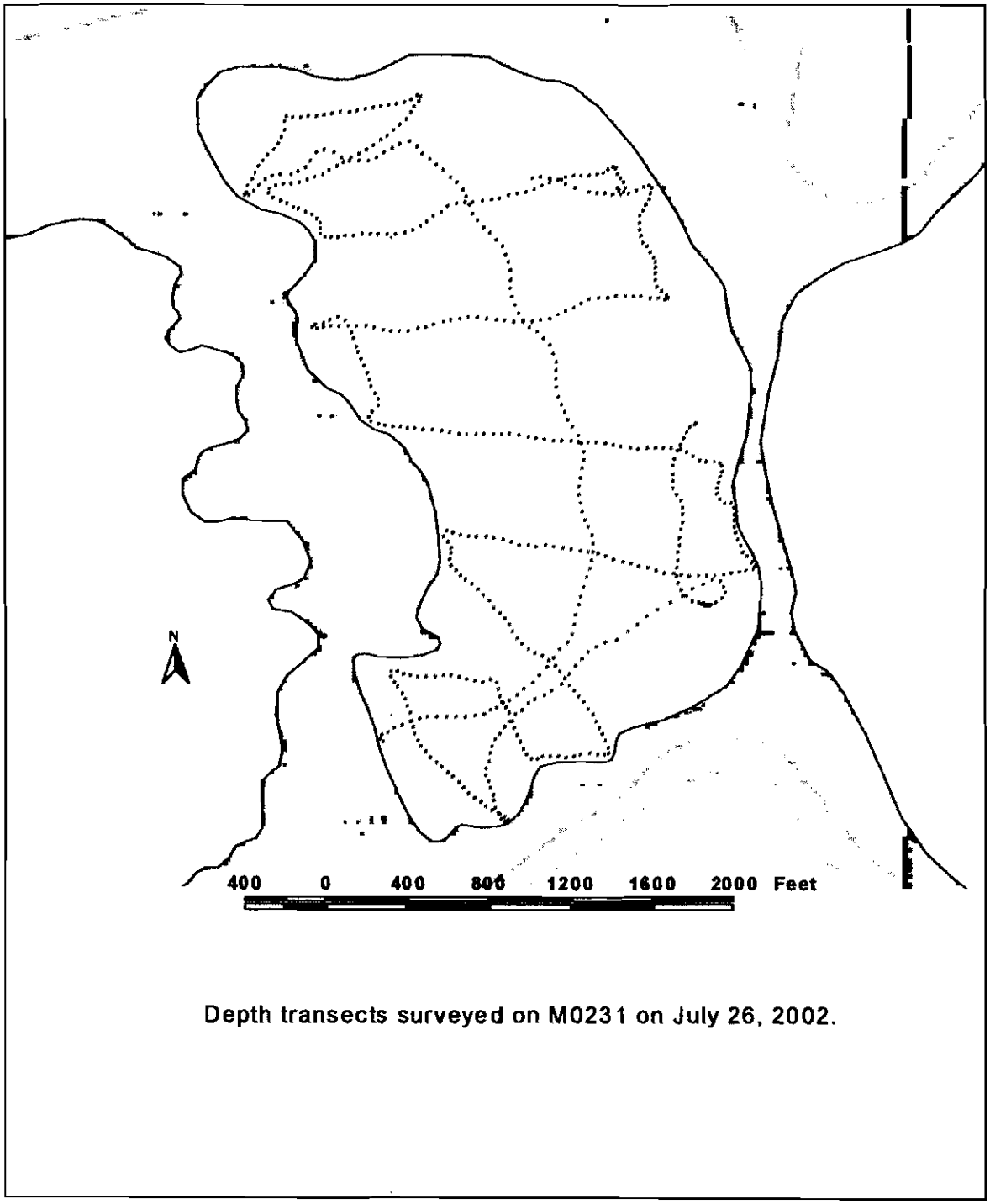
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Jul 26 02	3.5	Least cisco	5	251-312

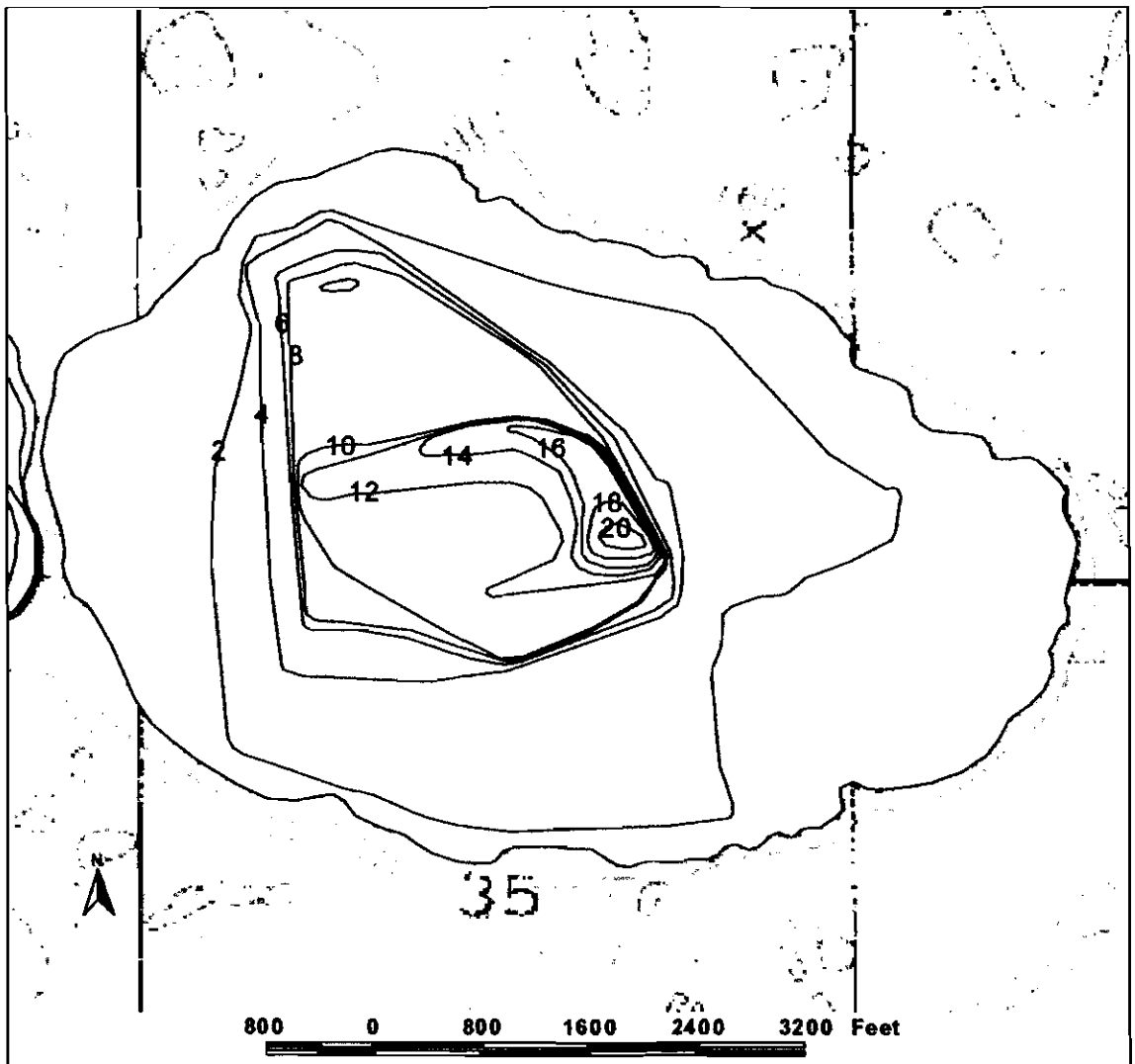




Regions of lake M0231 less than 4 ft deep (shaded), and likely to be available for ice chips, based on transects surveyed on July 26, 2002.



Depth transects surveyed on M0231 on July 26, 2002.



Depth contours of M0232, based on transects surveyed on July 26, 2002 (depth intervals in 2 foot increments).

Lake M0232

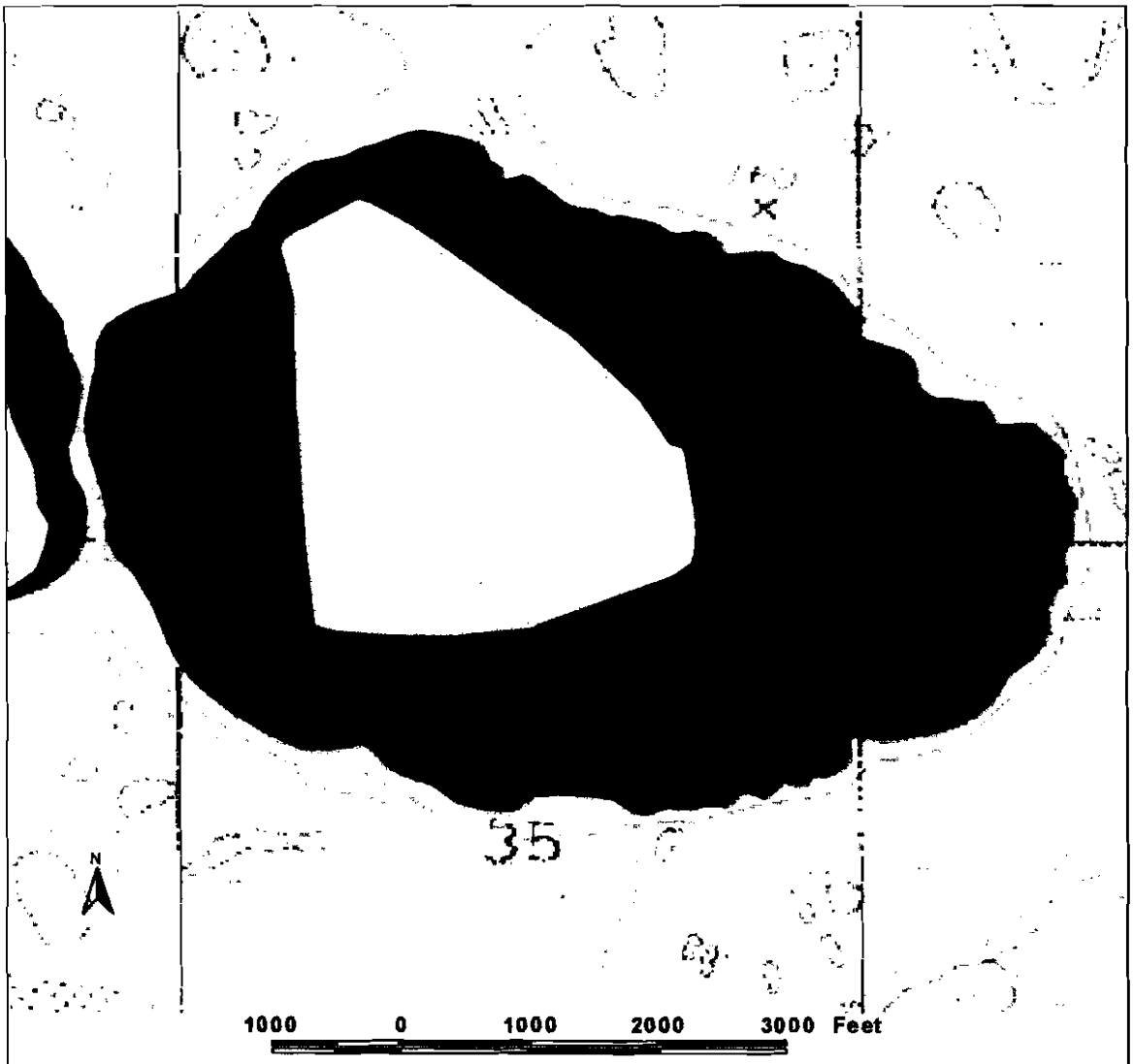
Other Names:
Location: 70.27204°N 153.07891°W
USGS Quad Sheet: Teshekpuk B-1: T11N R5W Sec. 25/26/27/34/35/36
Habitat: Drainage Lake
Area: 740.8 acres
Maximum Depth: 22.1 feet
Active Outlet: Yes
Calculated Volume: 943.69 million gallons
Permittable Volume: 24.43 million gallons
Potential Aggregate: 540.3 acres (water depth 4 ft or less)

Water Chemistry:

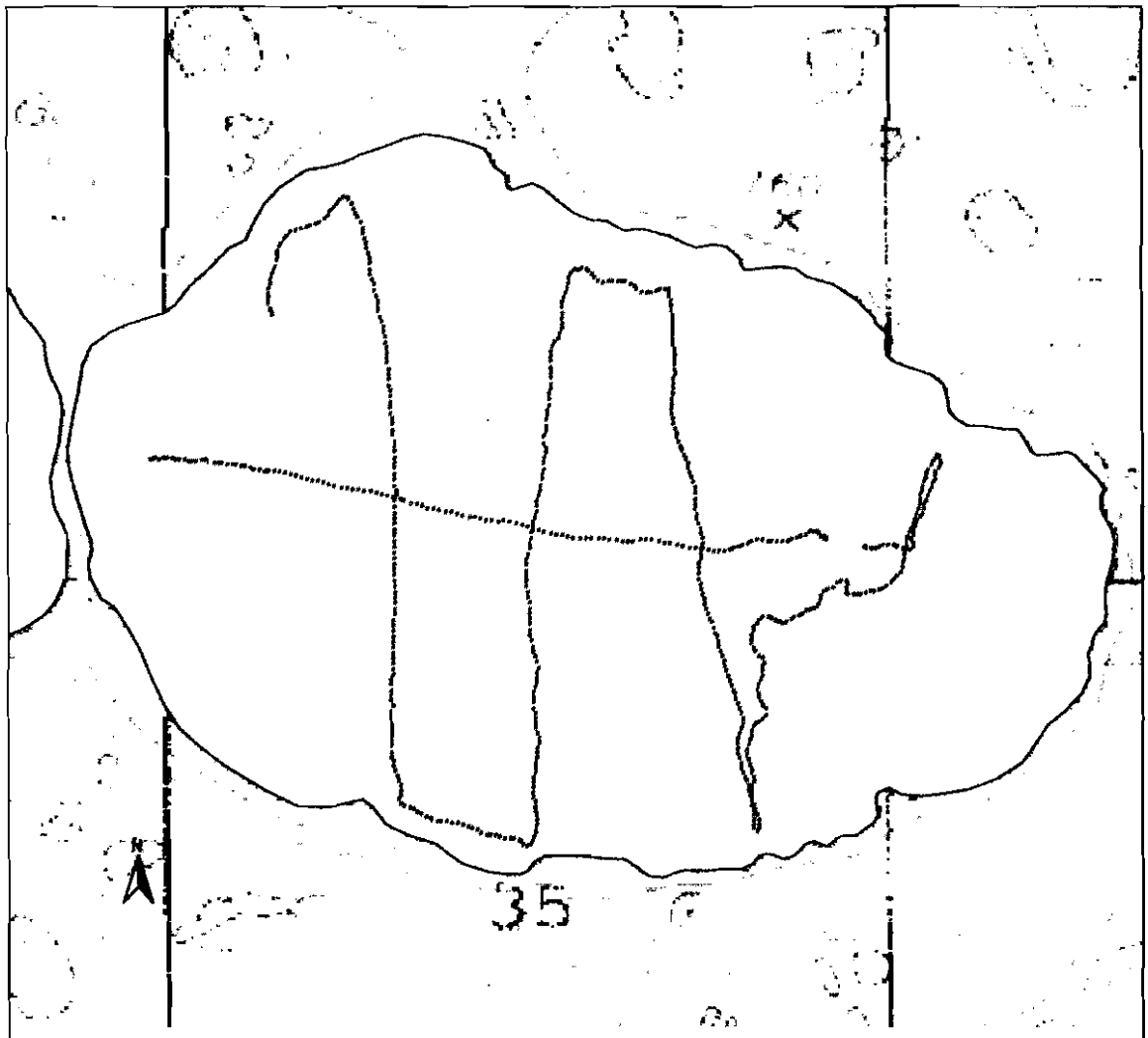
Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2002	19.0	2.1	4.4	9.6	56	196	1.3	7.54	This Study

Catch Record:

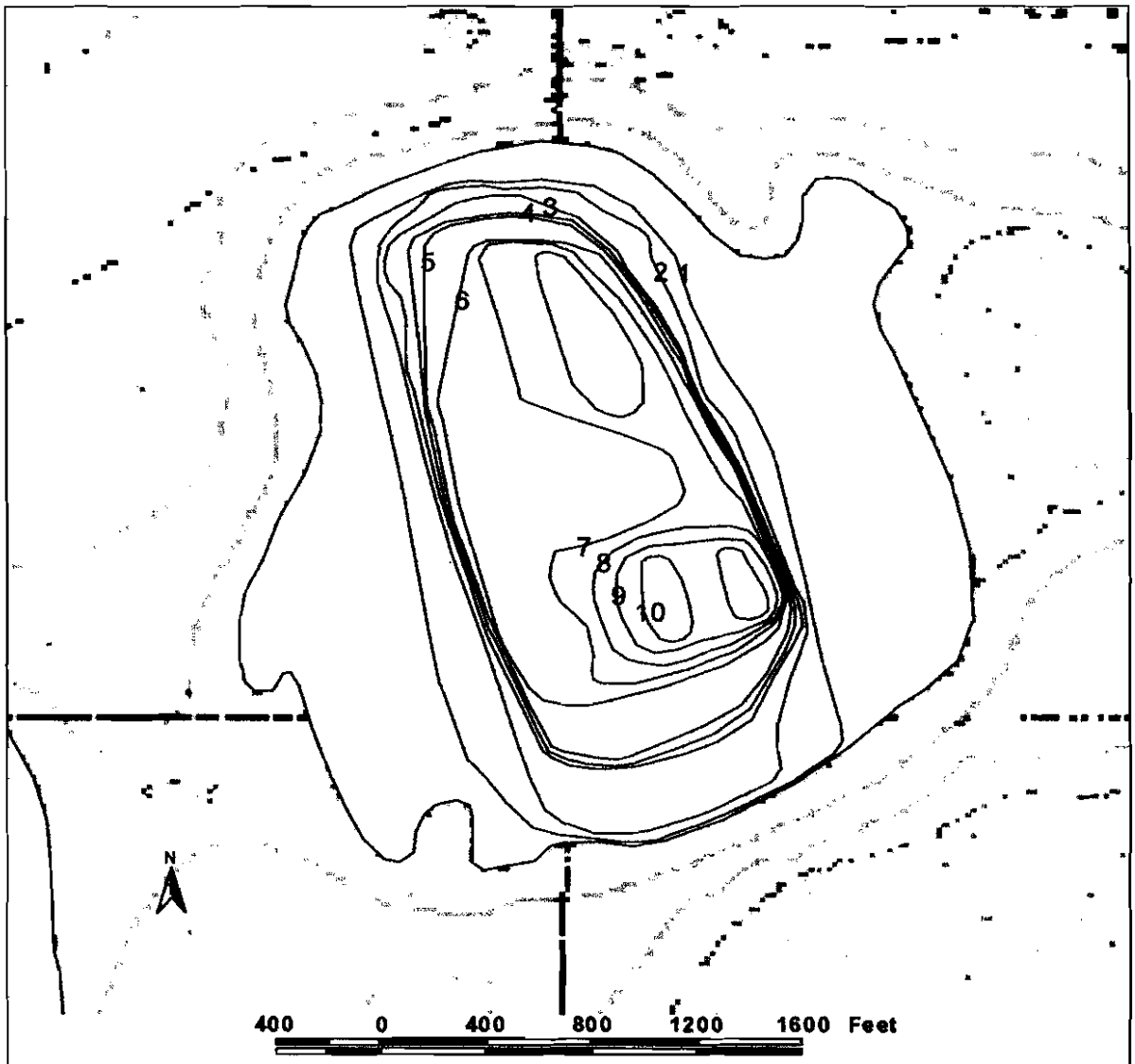
Gear	Date	Effort (hours)	Species	Number Caught
not sampled, connected to M0231				



Regions of lake M0232 less than 4 ft deep (shaded), and likely to be available for ice chips, based on transects surveyed on July 26, 2002.



Depth transects surveyed on M0232 on July 26, 2002.



Depth contours of M0233, based on transects surveyed on July 24, 2002 (depth intervals in 1 foot increments).

Lake M0233

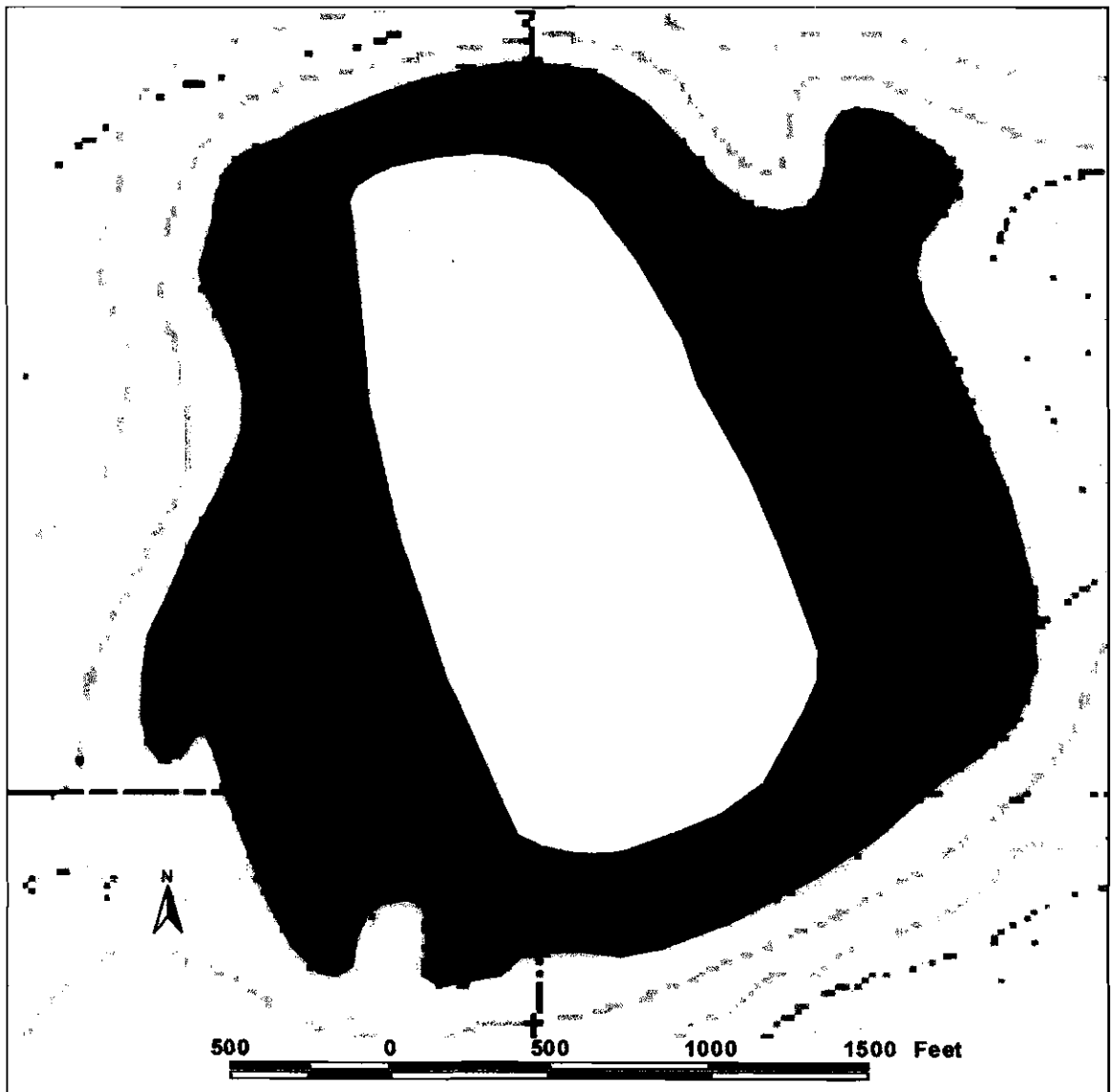
Other Names:
Location: 70.31650°N 153.10141°W
USGS Quad Sheet: Teshekpuk B-1: T11N R5W Sec. 10/11
Habitat: Tundra Lake
Area: 149.2 acres
Maximum Depth: 10.6 feet
Active Outlet: No
Calculated Volume: 151.88 million gallons
Permittable Volume: 10.28 million gallons
Potential Aggregate: 96.1 acres (water depth 4 ft or less)

Water Chemistry:

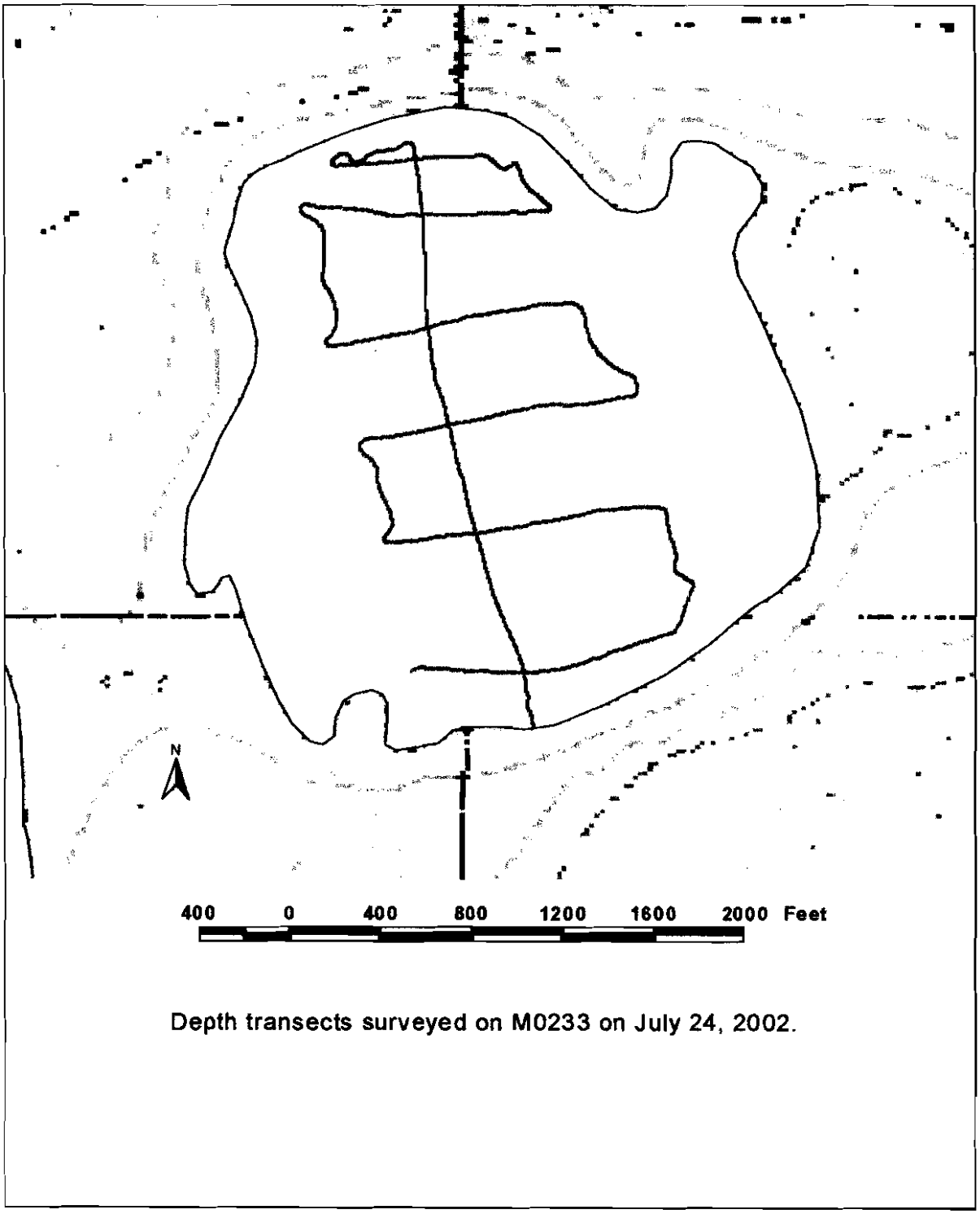
Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2002	21.1	2.2	3.8	7.7	62	144	0.6	7.40	This Study

Catch Record:

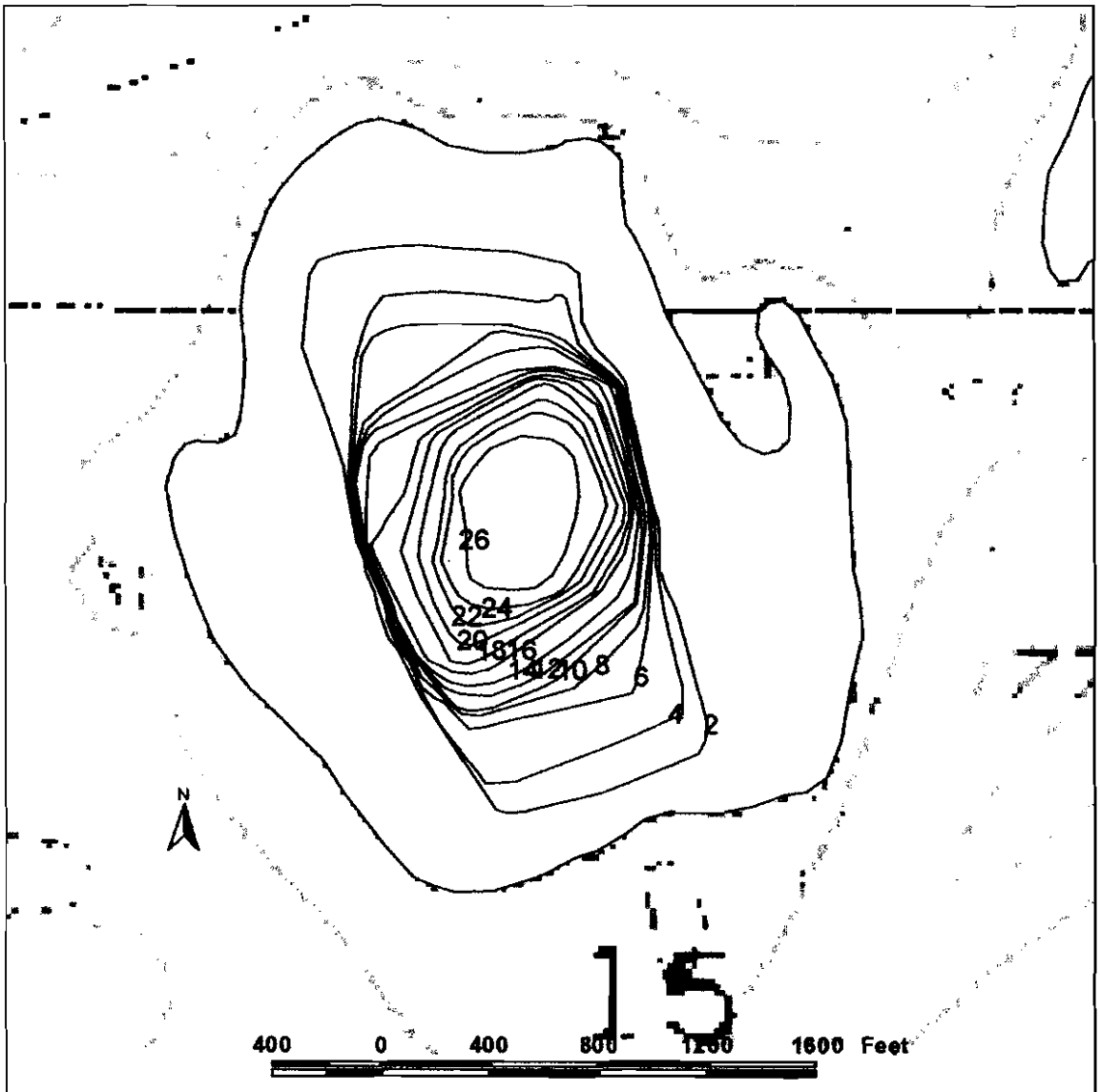
Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 24 02	8.1	None	0



Regions of lake M0233 less than 4 ft deep (shaded), and likely to be available for ice chips, based on transects surveyed on July 24, 2002.



Depth transects surveyed on M0233 on July 24, 2002.



Depth contours of M0234, based on transects surveyed on July 25, 2002 (depth intervals in 2 foot increments).

Lake M0234

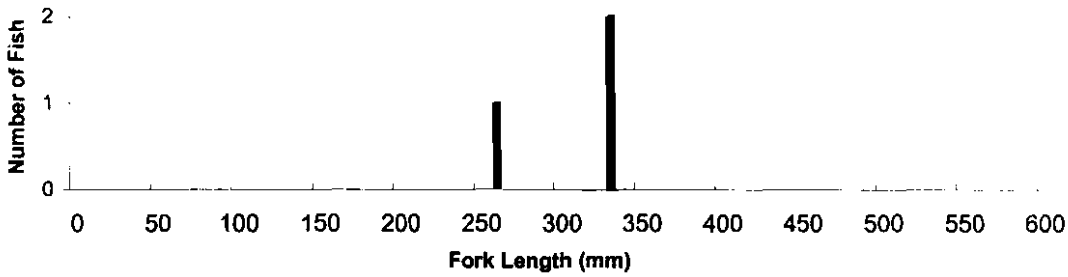
Other Names:
Location: 70.31238°N 153.12843°W
USGS Quad Sheet: Teshekpuk B-1: T11N R5W Sec. 10/15
Habitat: Tundra Lake
Area: 122.2 acres
Maximum Depth: 27.8 feet
Active Outlet: No
Calculated Volume: 225.94 million gallons
Permittable Volume: 14.88 million gallons
Potential Aggregate: 82.0 acres (water depth 4 ft or less)

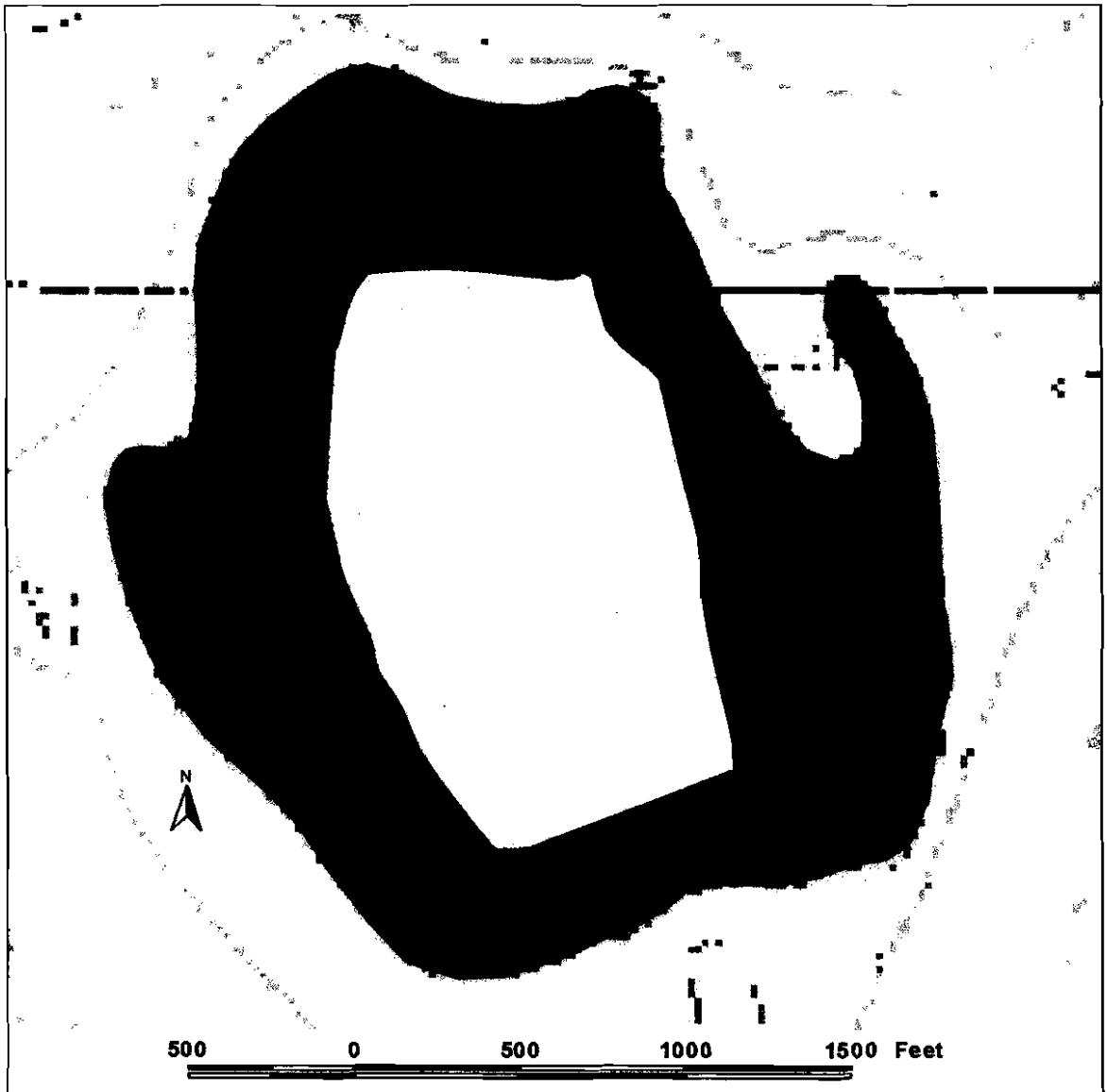
Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2002	24.2	2.4	4.2	8.6	70	165	0.9	7.69	This Study

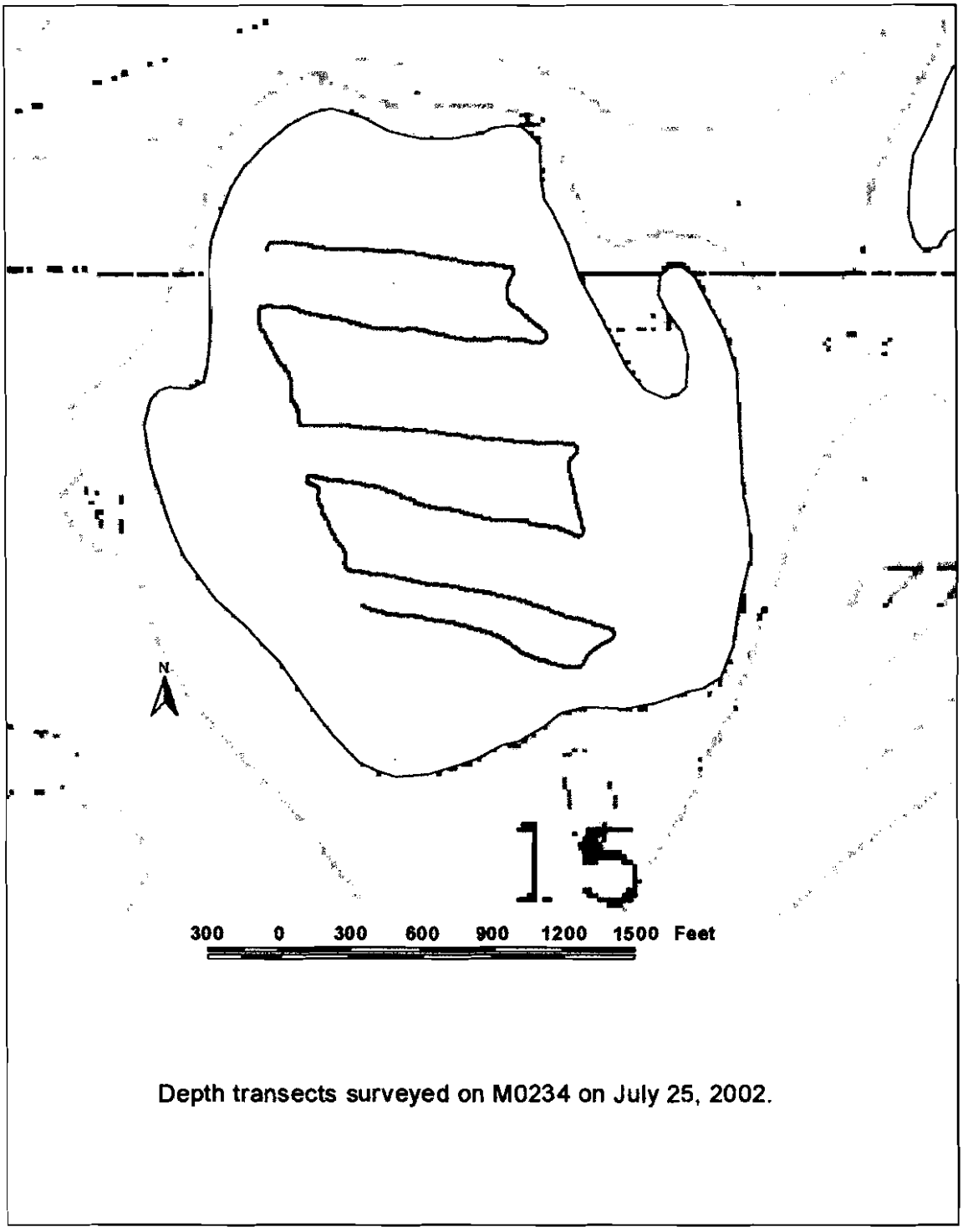
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Jul 25 02	2.4	Least cisco	3	260-337

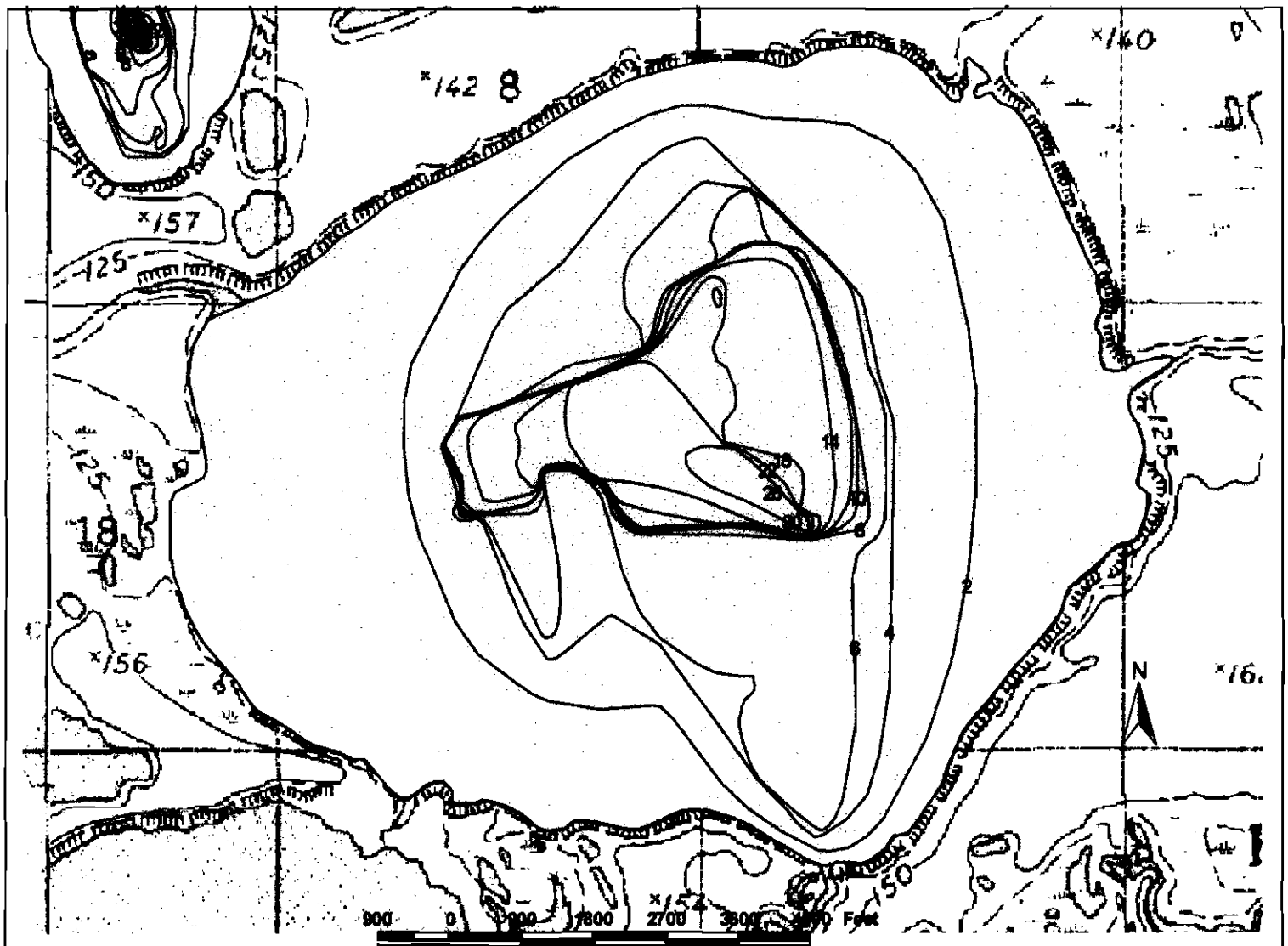




Regions of lake M0234 less than 4 ft deep (shaded), and likely to be available for ice chips, based on transects surveyed on July 25, 2002.



Depth transects surveyed on M0234 on July 25, 2002.



Depth contours of lake B84058, based on transects surveyed on July 20, 2003
(depth intervals in 2 foot increments to 10 ft, then 4 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake B84058

Other Names:
Location: 70.31001°N 152.93503°W
USGS Quad Sheet: Harrison Bay B-5: T11N R4W Sec. 8/9/16/17/18/20/21
Habitat: Drainage Lake
Area: 2,987.0 acres
Maximum Depth: 32.8 feet
Active Outlet: Yes
Calculated Volume: 3,320.8 million gallons
Permittable Volume: 180.53 million gallons
Potential Aggregate: 1,296.6 acres (water depth 4 ft or less)

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	19.0	2.2	4.2	8.1	57	138	1.3	7.99	This Study

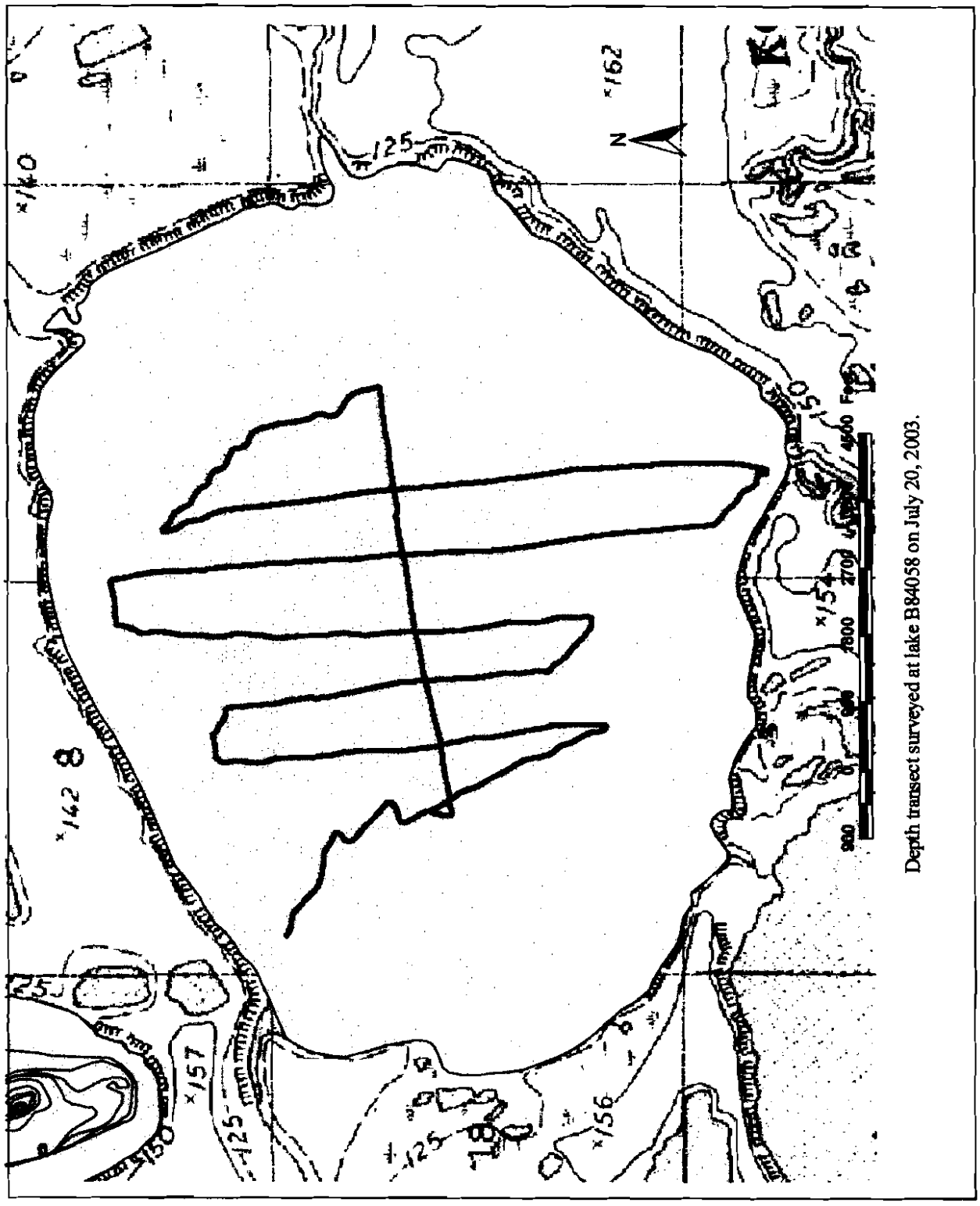
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net +observation	Jul 21 81	?	Lake trout	
			Broad whitefish	
			Least cisco	
			Round whitefish	
			9spine stickleback	

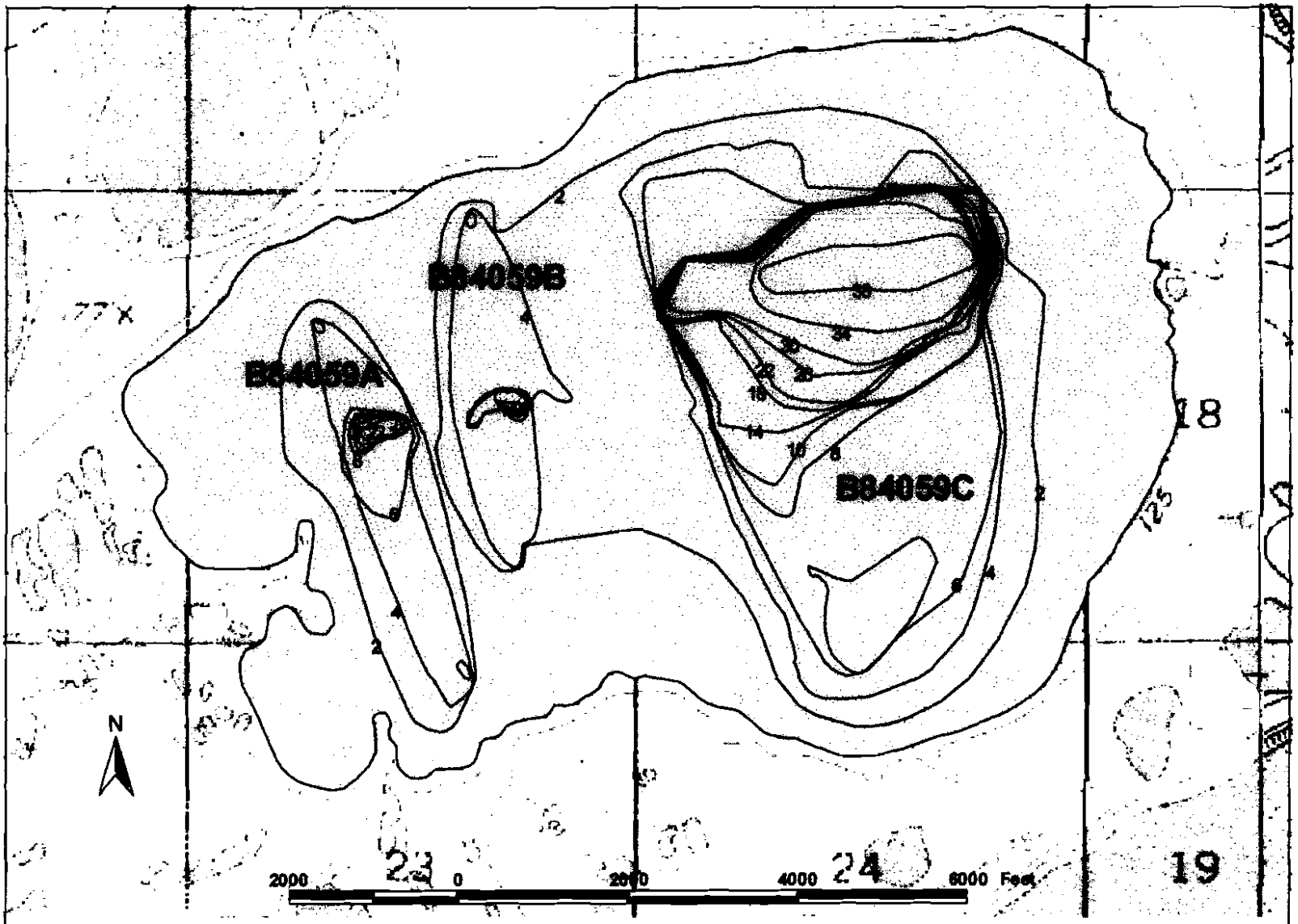
(catches reported by Bendock and Burr 1984)

Regions of lake B84058 less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 20, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transect surveyed at lake B84058 on July 20, 2003.



Depth contours of lake B84059, based on transects surveyed on July 20, 2003
(depth intervals in 2 foot increments to 10 feet, then 4 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake B84059

Location:	70.30828°N 153.07017°W
USGS Quad Sheet:	Teshekpuk B-1: T11N R5W Sec. 11/12/13/14/23/24
Habitat:	Drainage Lake

	Basin A	Basin B	Basin C	
Area:	514.4	455.0	1,791.6	acres
Maximum Depth:	22.2	16.1	40.3	feet
Active Outlet:	Yes	Yes	Yes	
Calculated Volume:	280.4	252.0	2,390.1	million gallons
Permittable Volume:	2.00	0.54	196.33	million gallons
Potential Aggregate:	328.2	221.1	640.1	acres (water 4 ft or less)

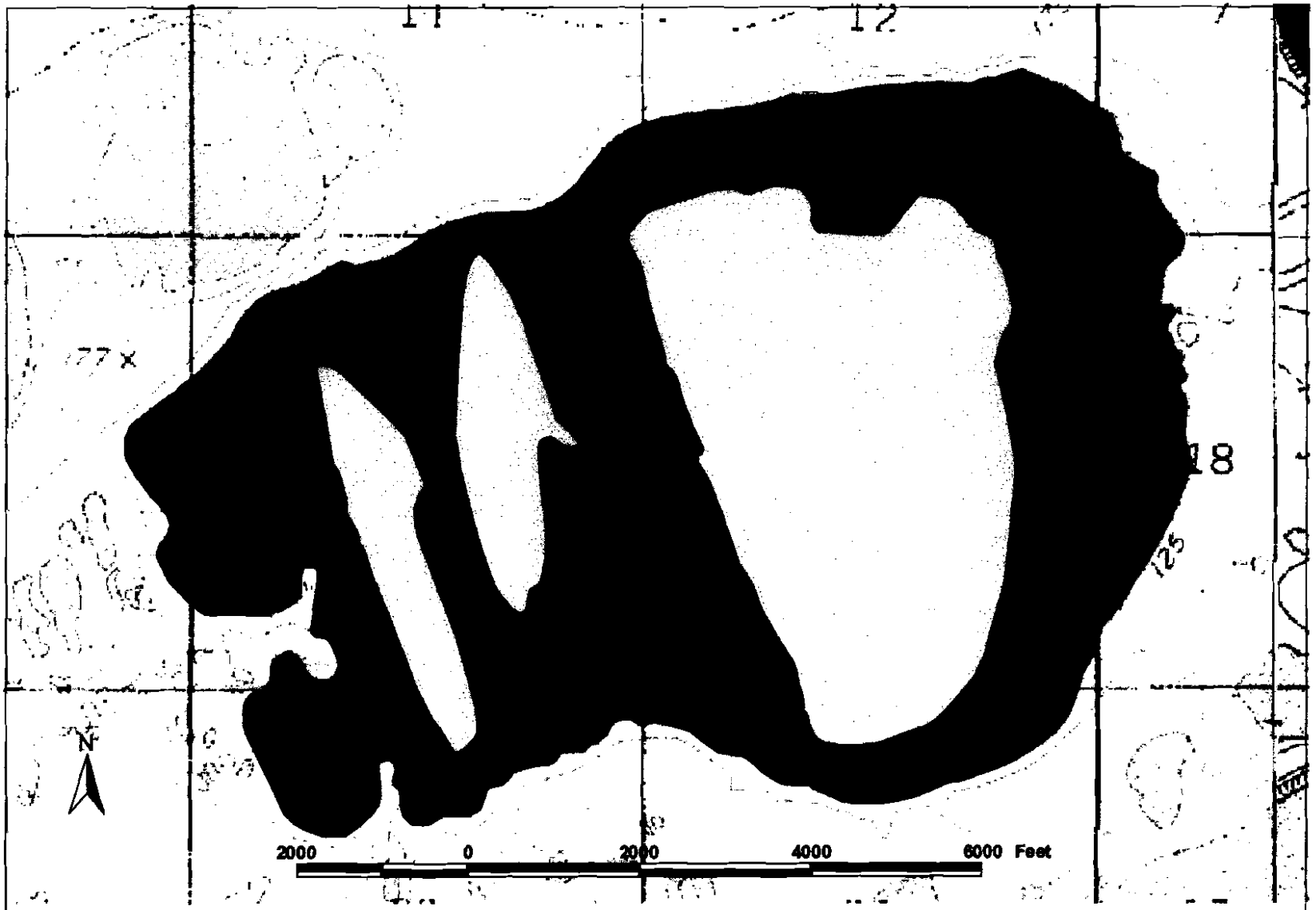
Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	19.0	2.2	4.1	8.1	56	135	1.5	7.99	This Study

Catch Record:

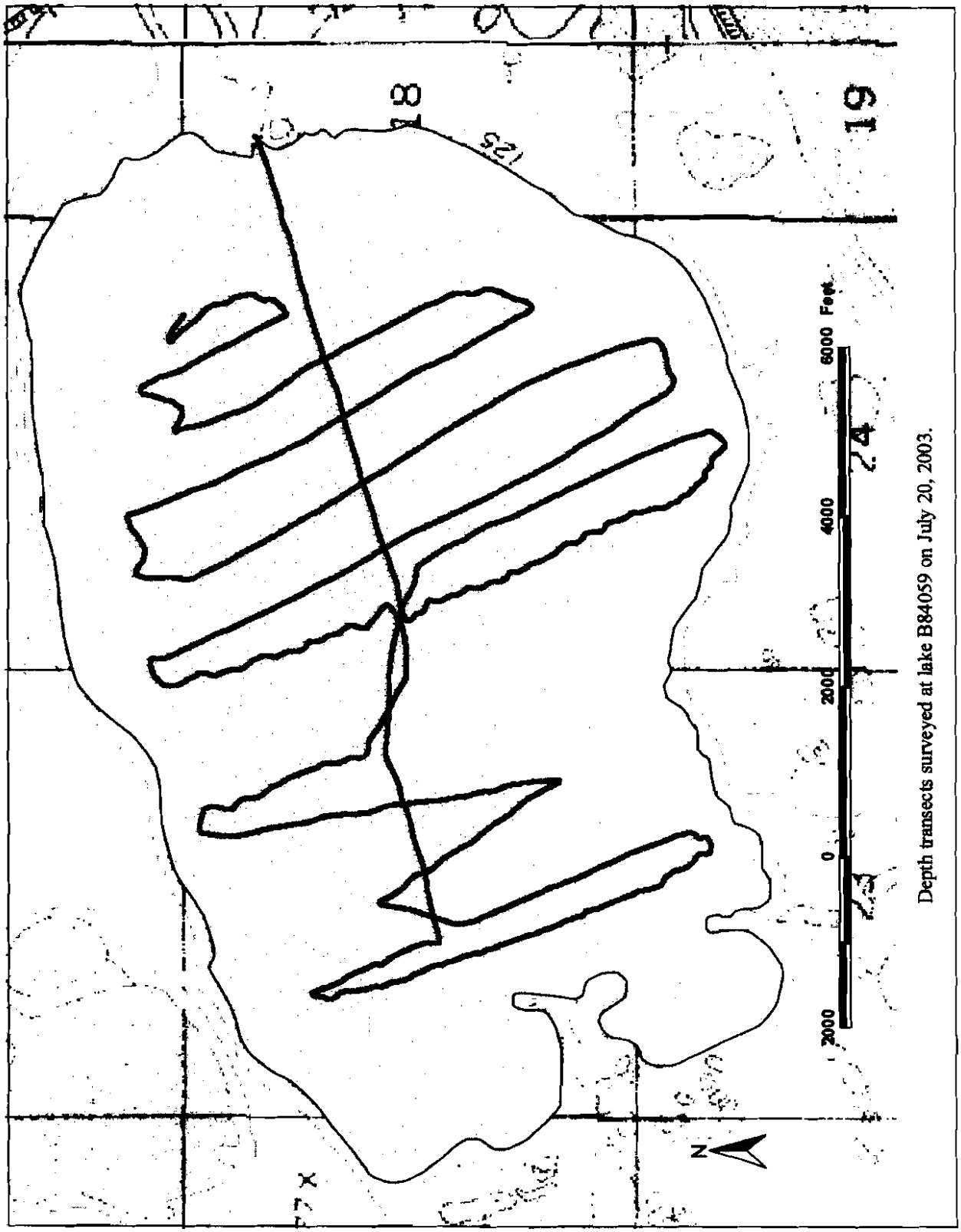
Gear	Date	Effort (hours)	Species	Number Caught
Gill Net +observation	Jul 21 81	?	Lake trout	
			Broad whitefish	
			Least cisco	
			Round whitefish	
			9spine stickleback	

(catches reported by Bendock and Burr 1984)

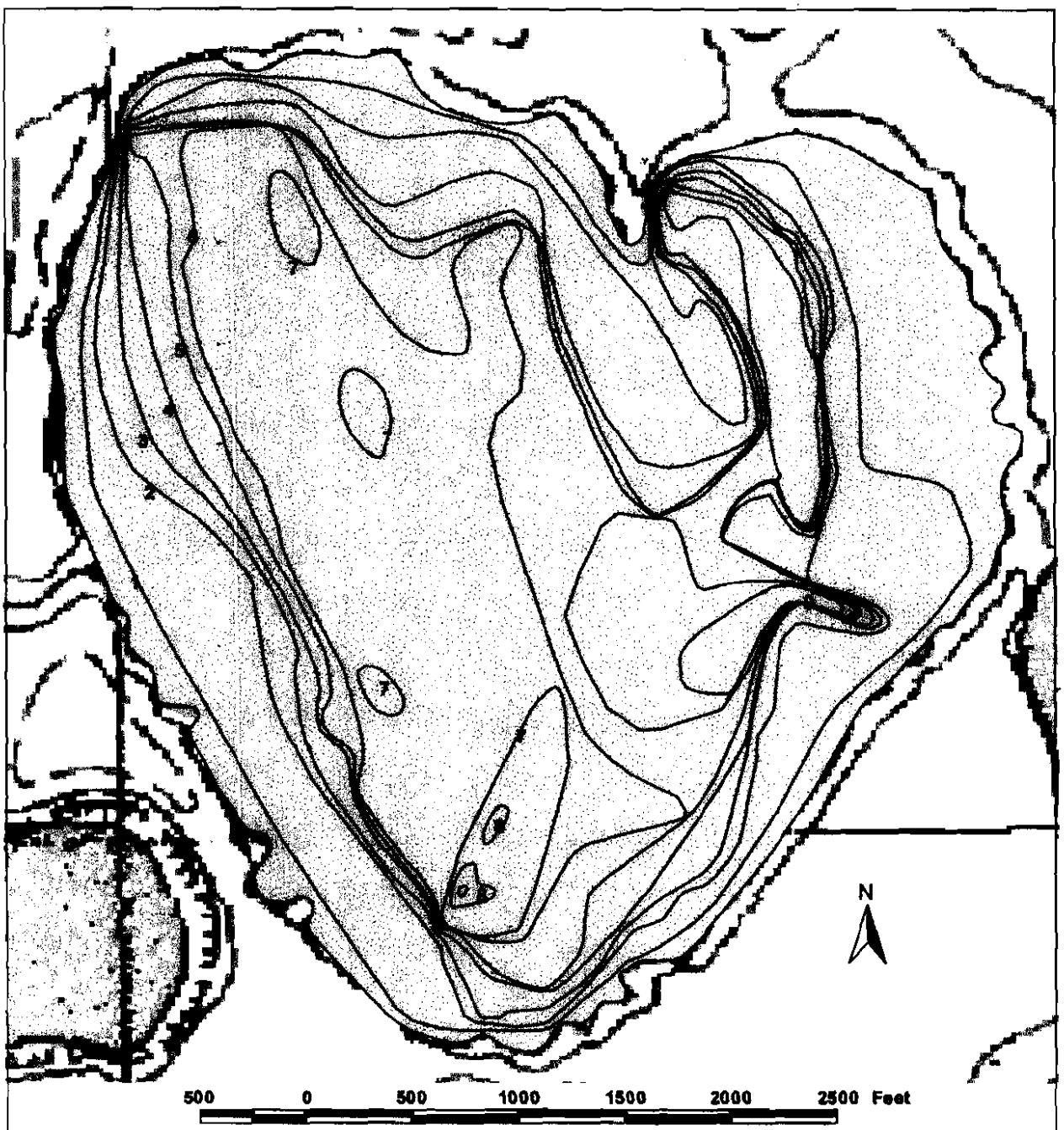


Regions of lake B84059 less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 20, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyed at lake B84059 on July 20, 2003.



Depth contours of lake M0301, based on transects surveyed on July 12, 2003
(depth intervals in 1 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0301

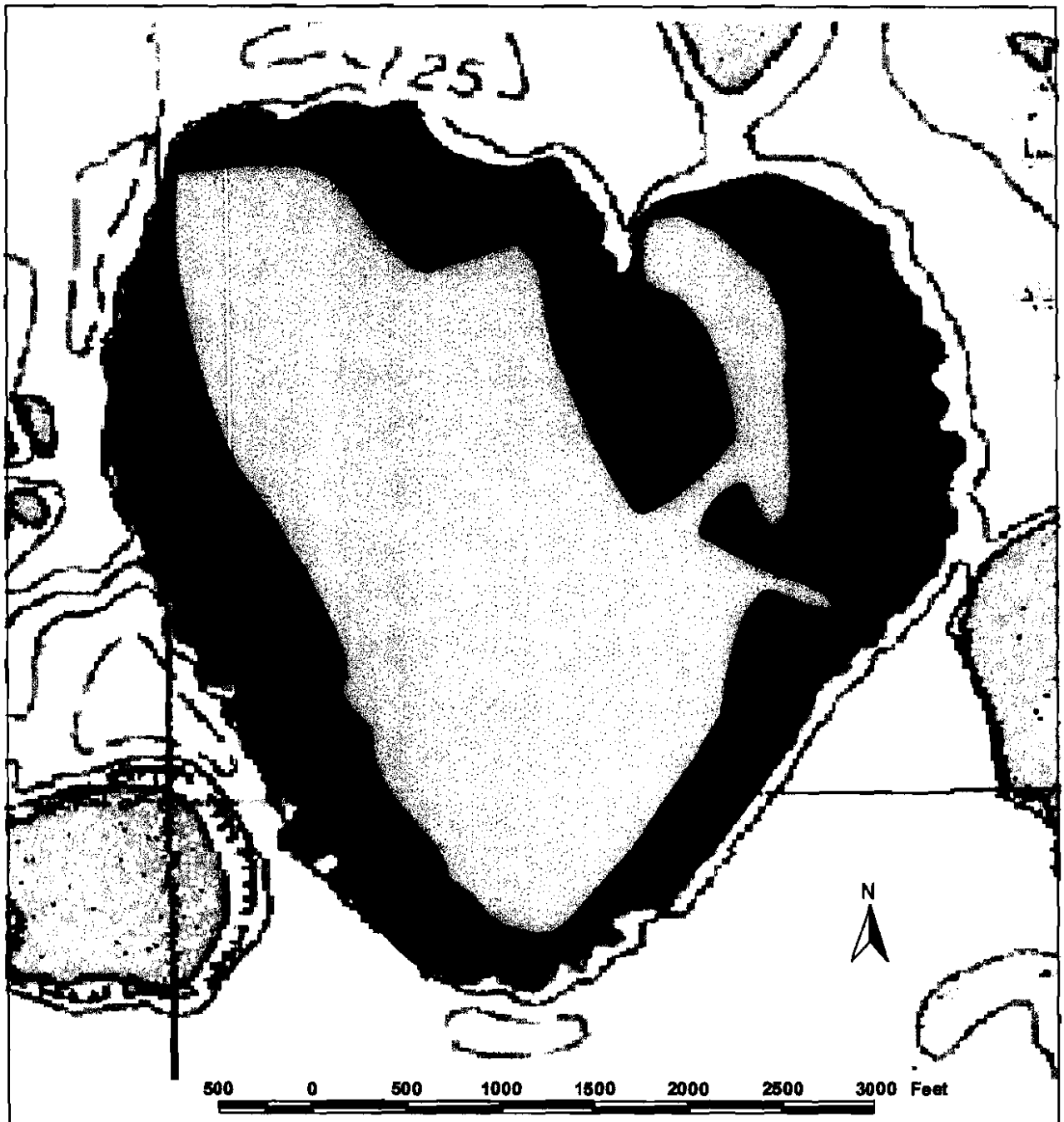
Other Names:
Location: 70.27545°N 152.07134°W
USGS Quad Sheet: Harrison Bay B-4: T11N R1W Sec. 26
Habitat: Tundra Lake
Area: 362.6 acres
Maximum Depth: 9.9 feet
Active Outlet: No
Calculated Volume: 466.61 million gallons
Permittable Volume: 20.69 million gallons
Potential Aggregate: 176.4 acres (water depth 4 ft or less)

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	30.0	5.4	9.0	24.0	97	246	1.3	8.27	This Study

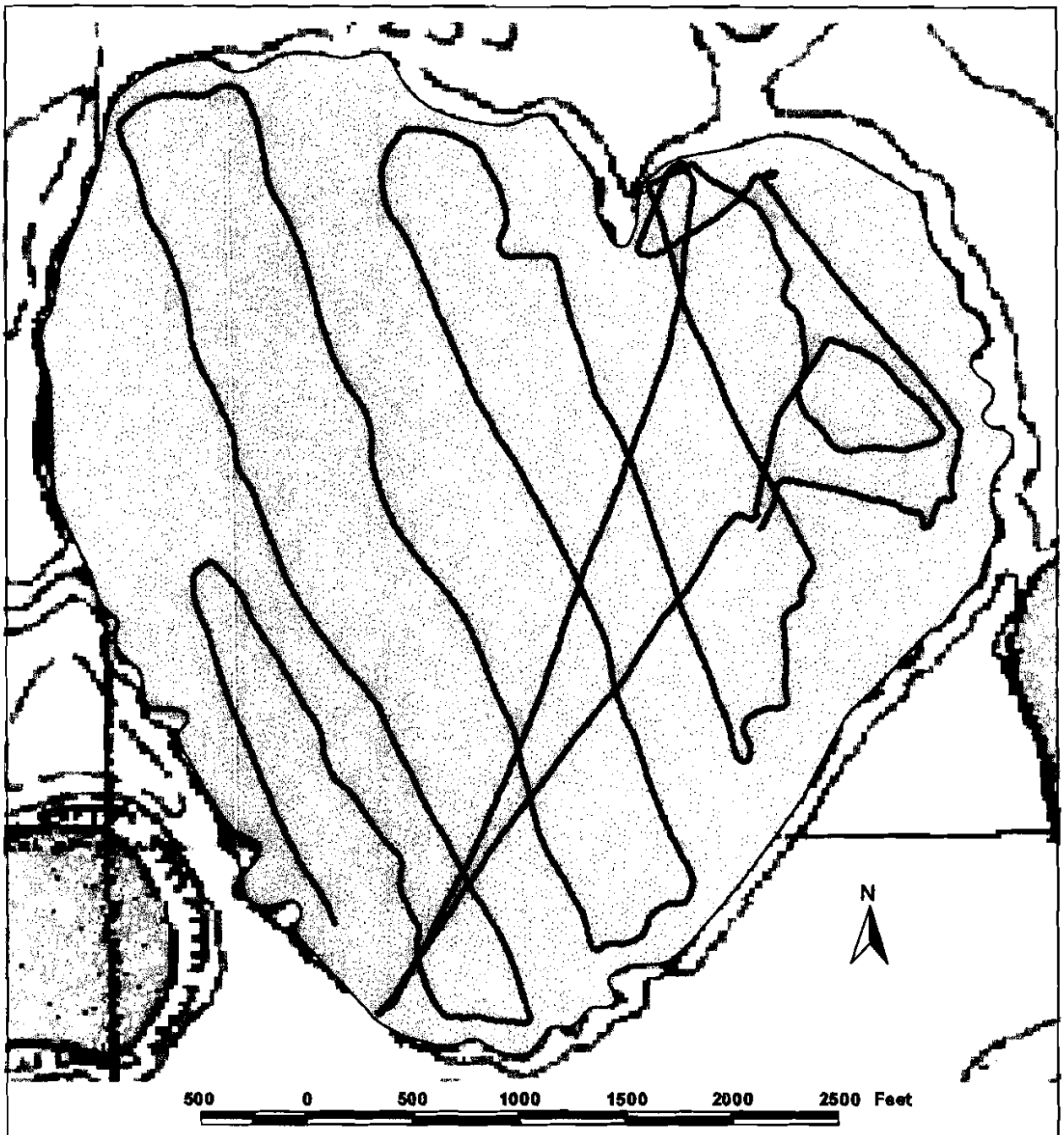
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 12 03	10.4	None	0
Minnow Trap	Jul 12 03	7.3	9spine stickleback	1
Seine		0 hauls		

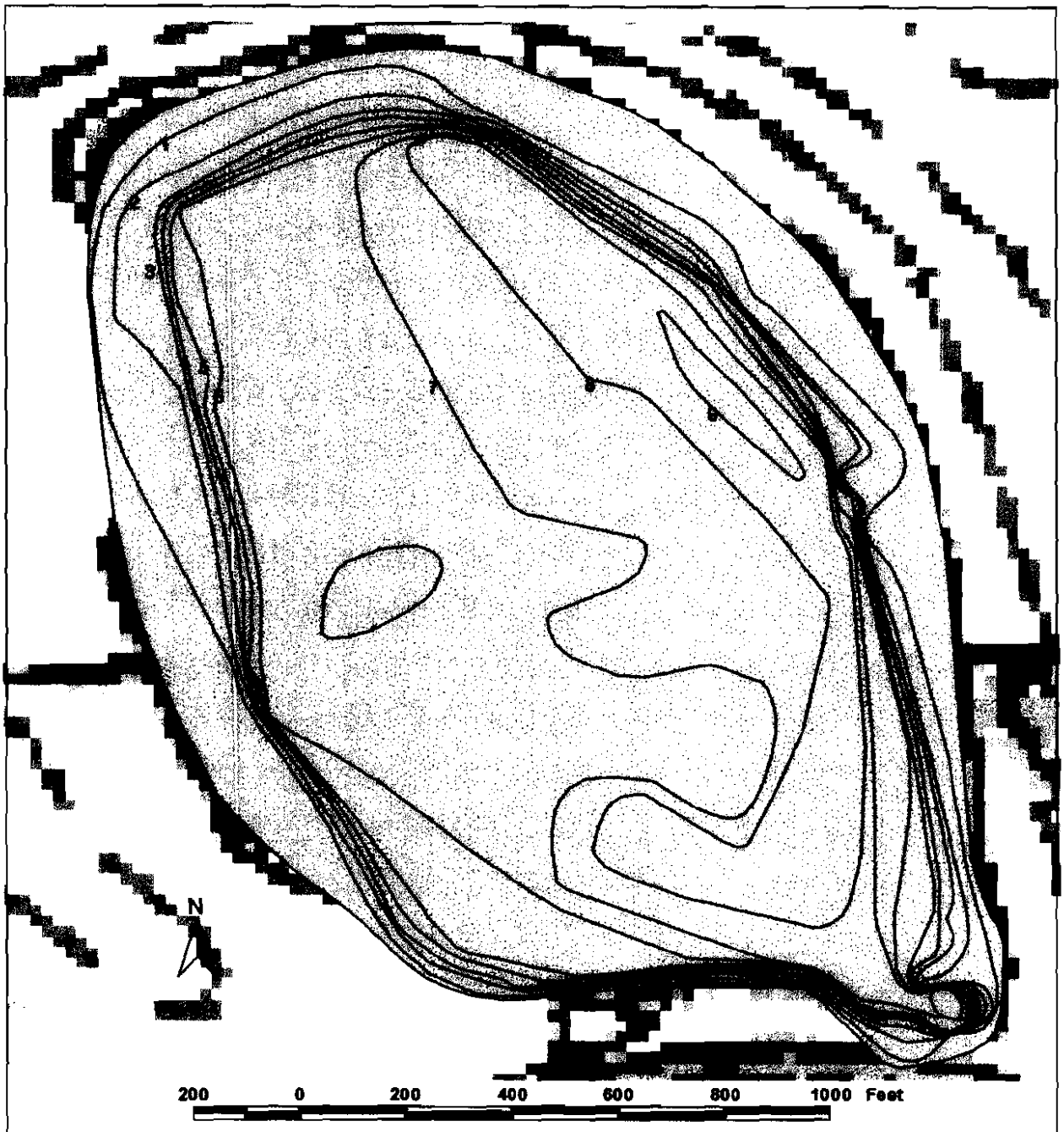


Regions of lake M0301 less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 12, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyed at lake M0301 on July 12, 2003.



Depth contours of lake M0302, based on transects surveyed on July 12, 2003
(depth intervals in 1 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0302

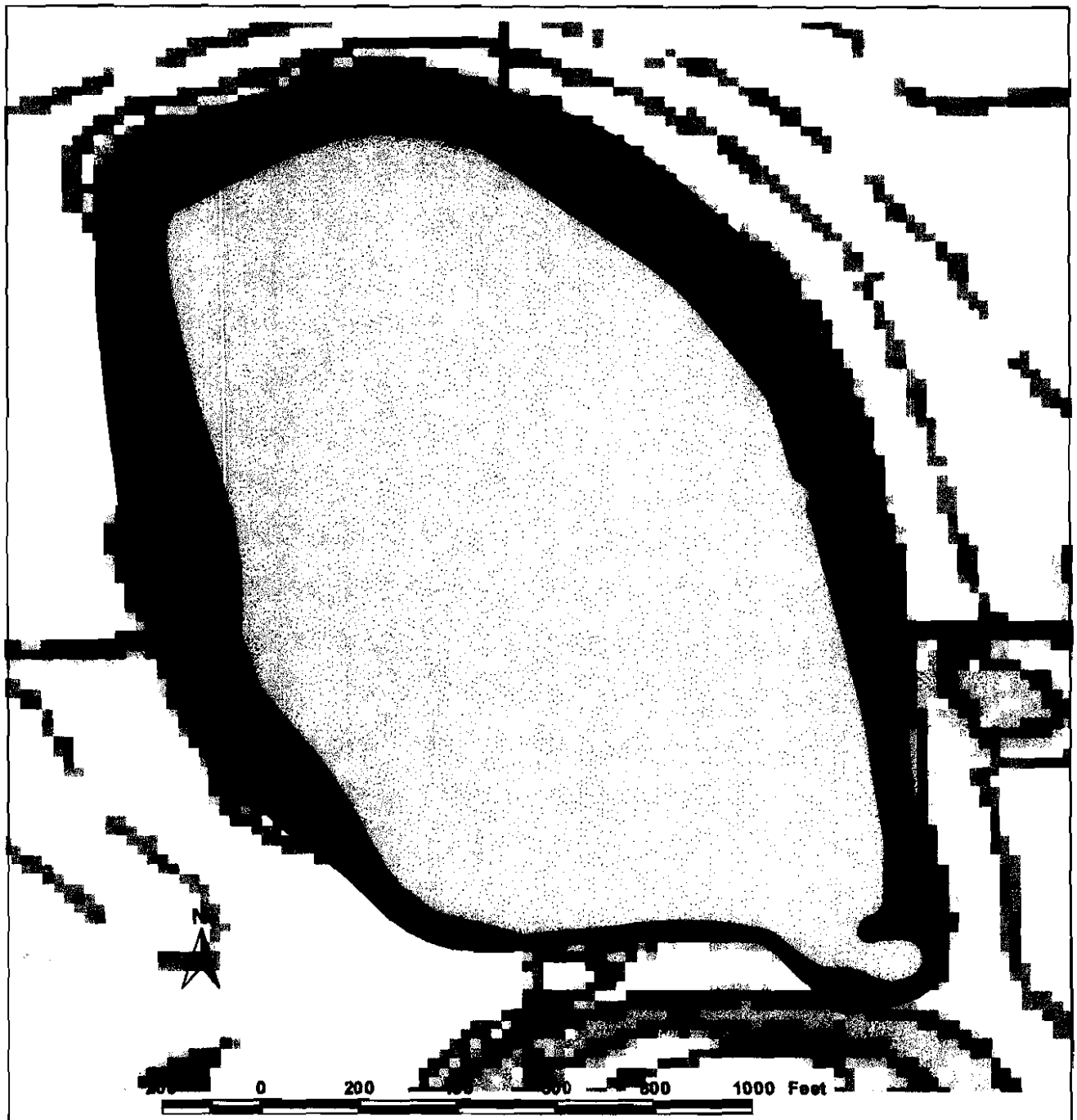
Other Names:
Location: 70.25754°N 152.17293°W
USGS Quad Sheet: Harrison Bay B-4: T11N R1W Sec. 4/5/32/33
Habitat: Tundra Lake
Area: 58.8 acres
Maximum Depth: 9.4 feet
Active Outlet: No
Calculated Volume: 93.93 million gallons
Permittable Volume: 3.27 million gallons
Potential Aggregate: 16.9 acres (water depth 4 ft or less)

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	22.0	5.5	22.0	39.0	77	276	1.0	8.22	This Study

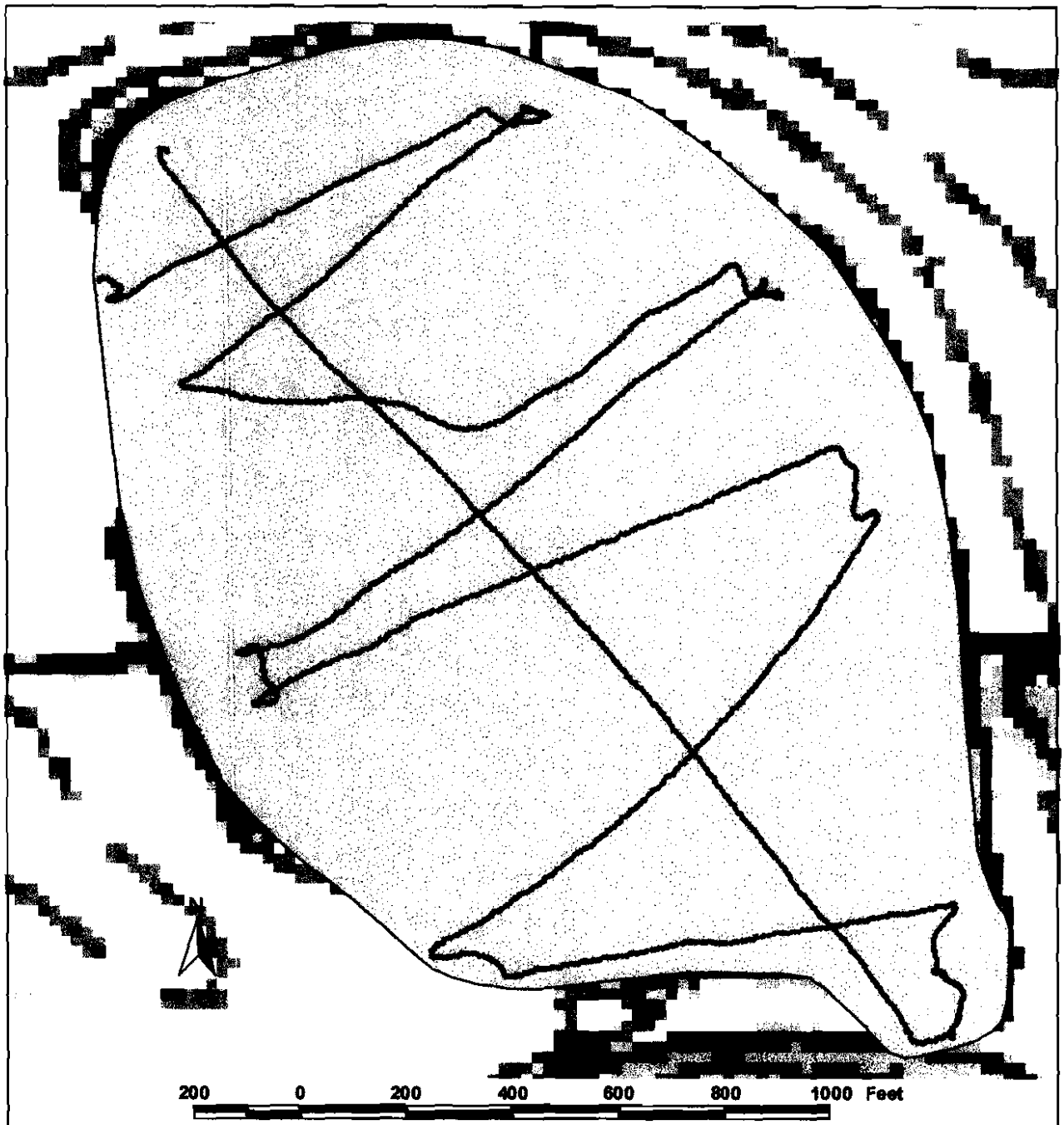
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Jul 12 03	3.0	Least cisco	1	150
Minnow Trap	Jul 12 03	7.5	None	0	
Seine		0 hauls			

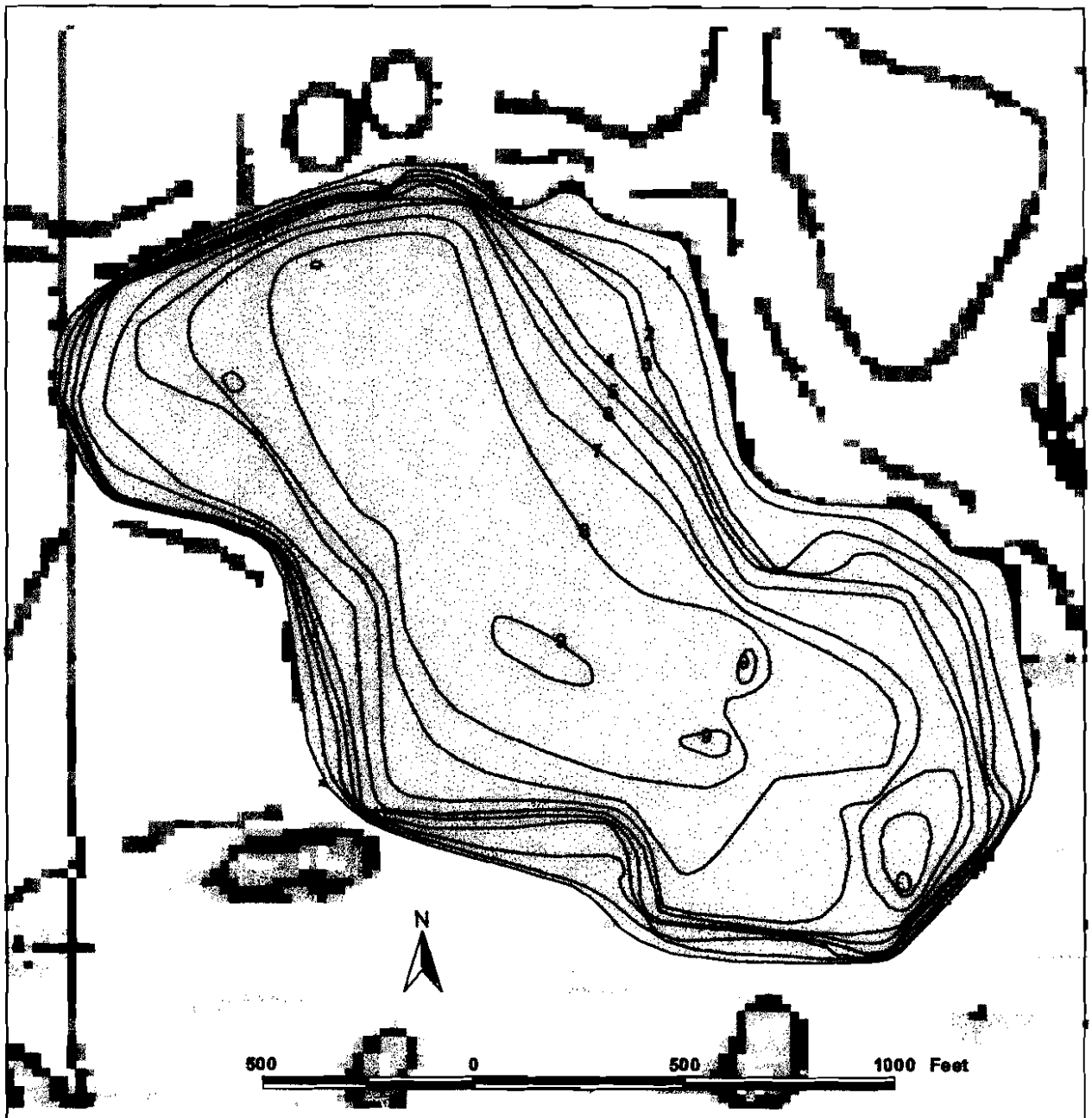


Regions of lake M0302 less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 12, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyed at lake M0302 on July 12, 2003.



Depth contours of lake M0303, based on transects surveyed on July 13, 2003
(depth intervals in 1 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0303

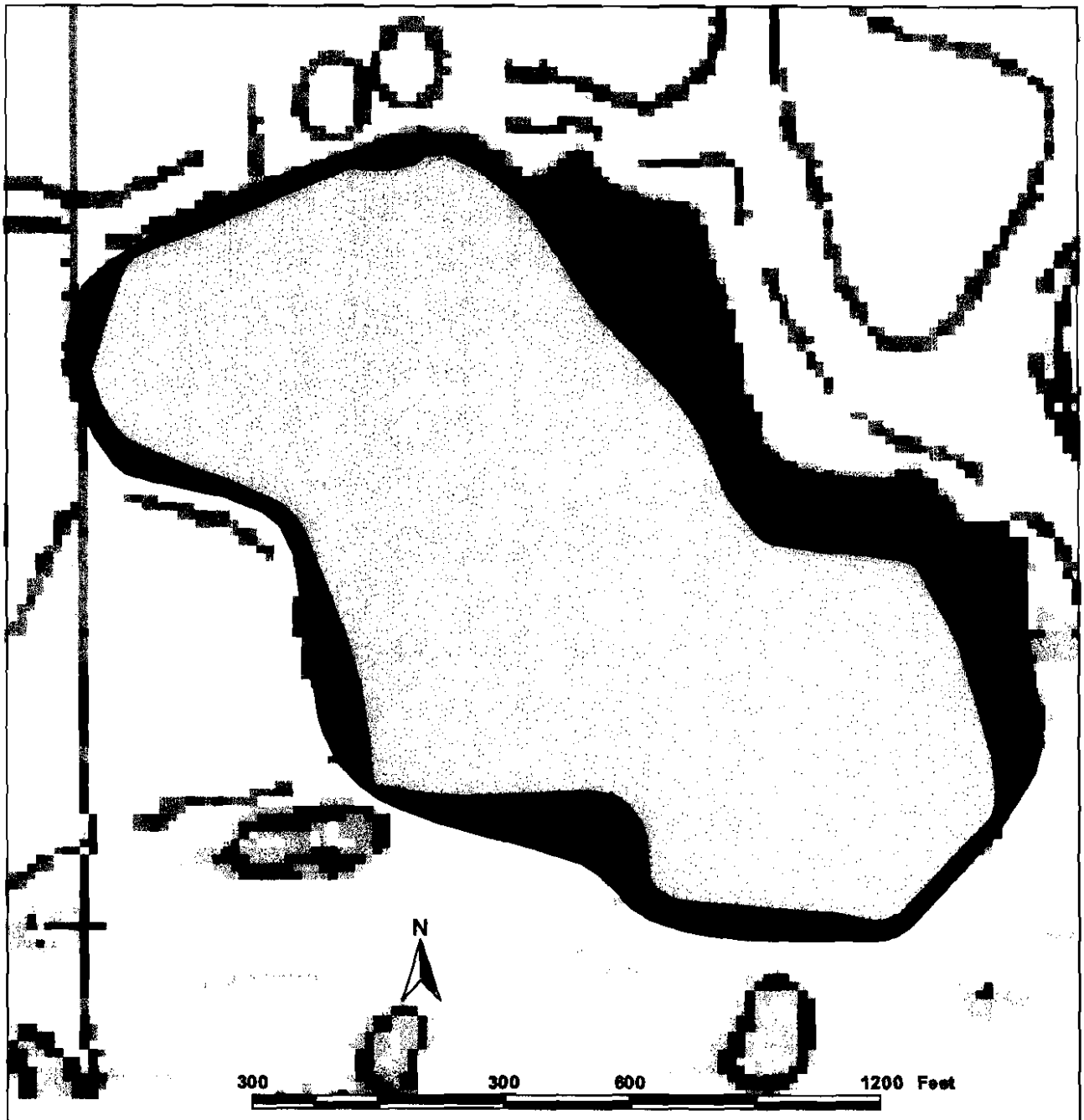
Other Names:
Location: 70.26740°N 152.20501°W
USGS Quad Sheet: Harrison Bay B-4: T11N R1W Sec. 32
Habitat: Drainage Lake
Area: 65.5 acres
Maximum Depth: 9.8 feet
Active Outlet: No
Calculated Volume: 123.89 million gallons
Permittable Volume: 10.17 million gallons
Potential Aggregate: 16.0 acres (water depth 4 ft or less)

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	11.0	1.9	4.8	11.0	36	104	1.9	7.92	This Study

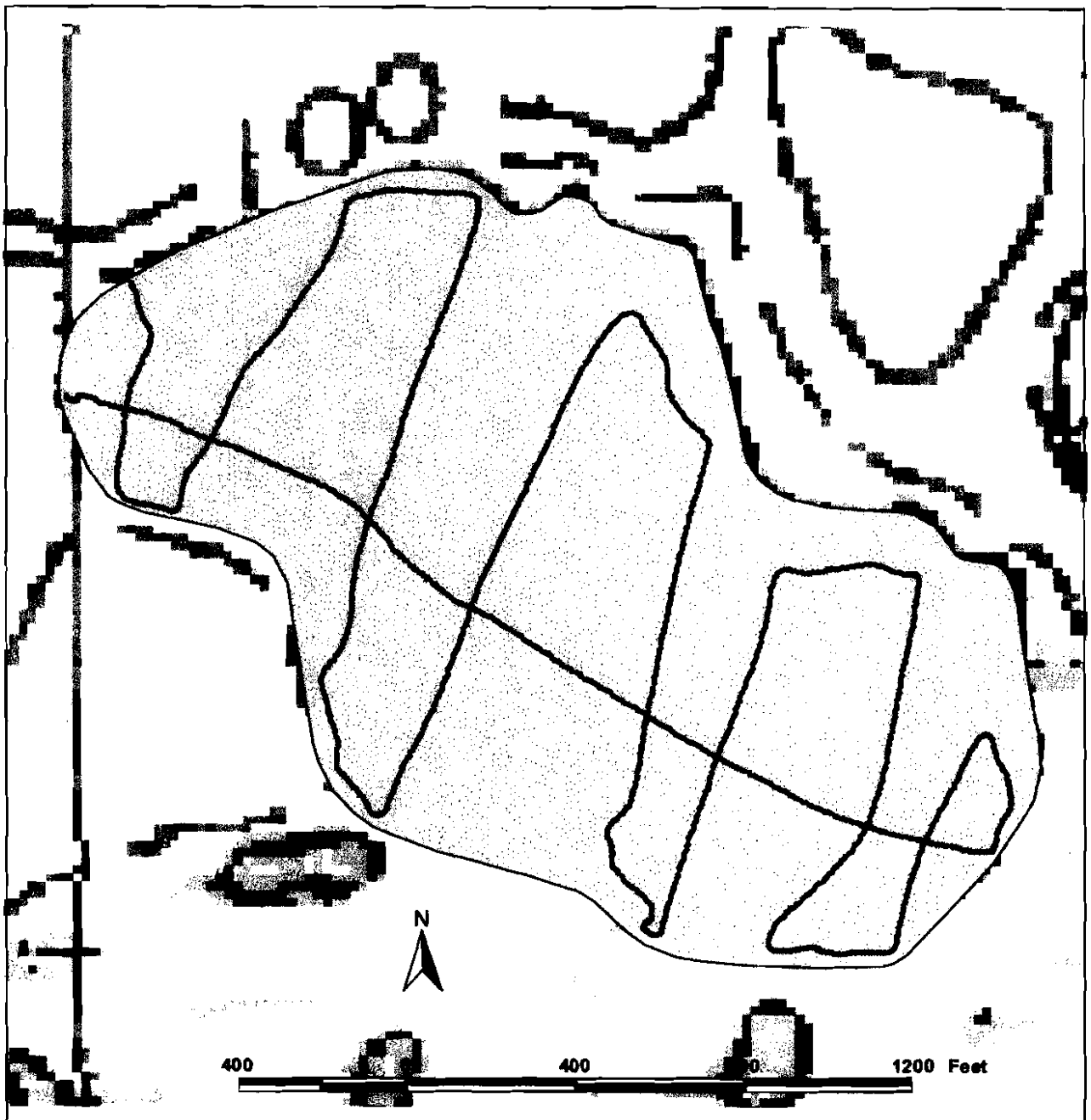
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 13 03	4.8	None	0
Minnow Trap	Jul 13 03		None	0
Seine	Jul 13 03	2 hauls	9spine stickleback	2

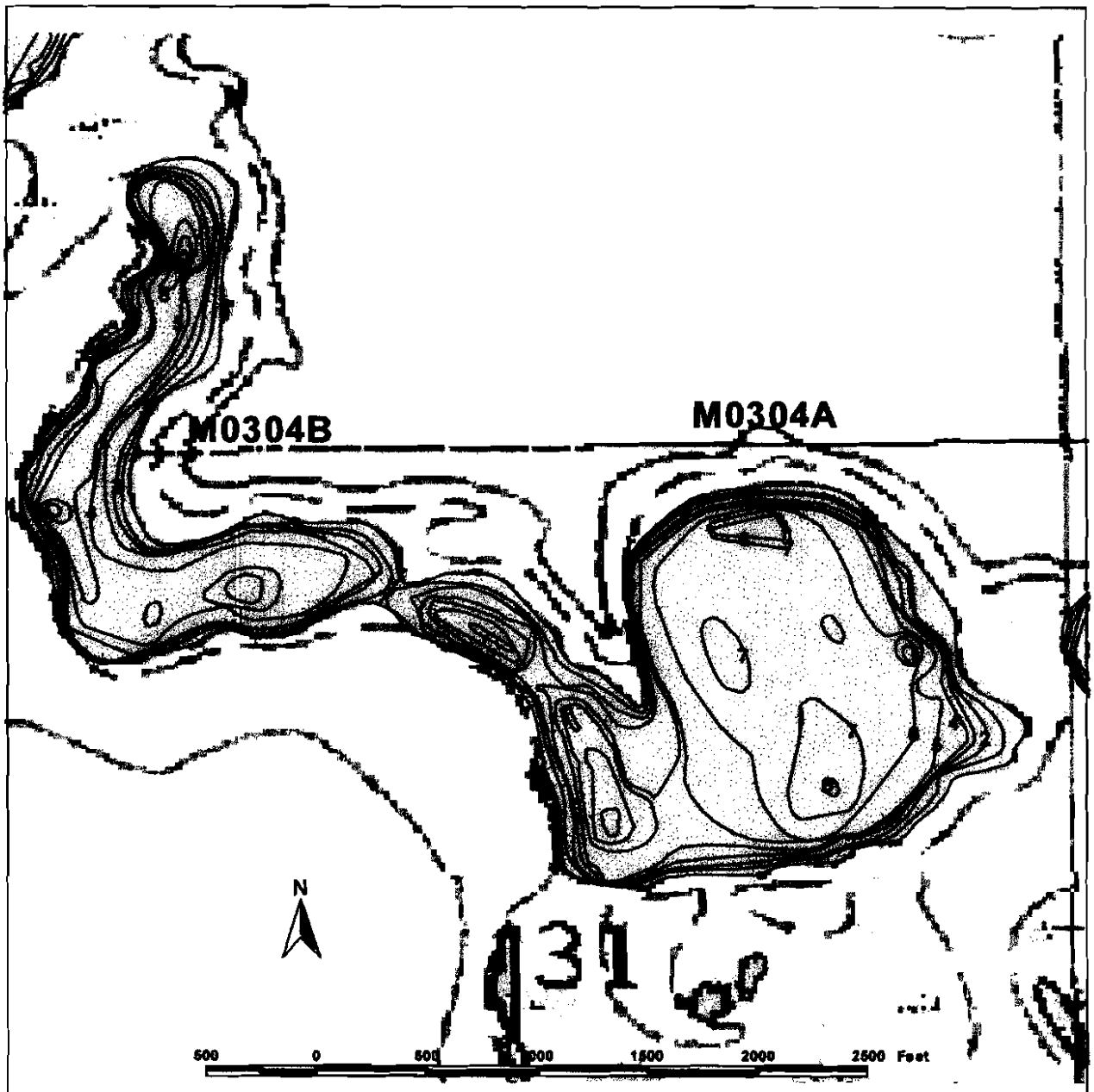


Regions of lake M0303 less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 13, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyed at lake M0303 on July 13, 2003.



Depth contours of lake M0304A and M0304B, based on transects surveyed on July 15, 2003
(depth intervals in 1 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0304

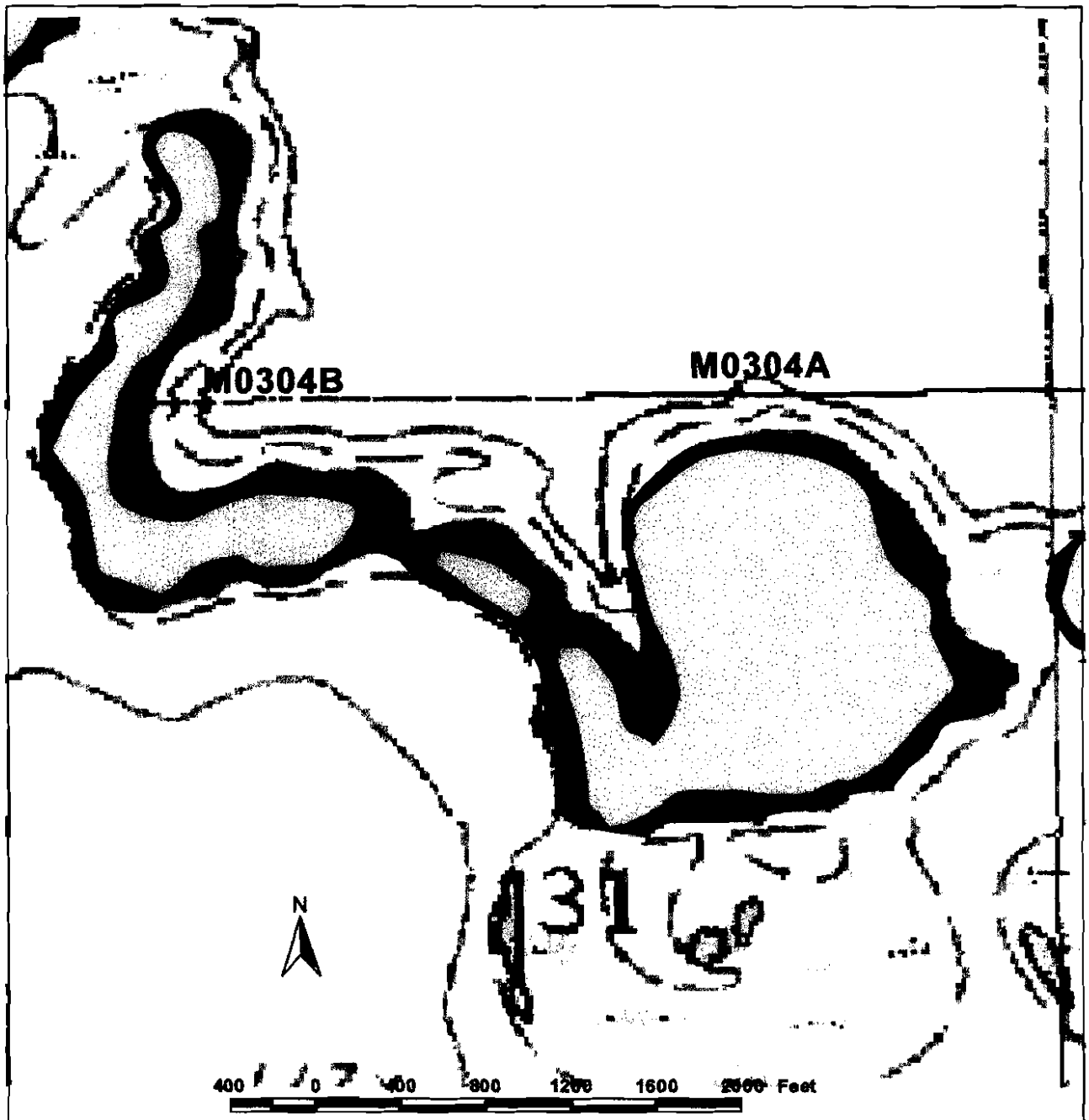
	Basin A	Basin B
Other Names:		
Location:	70.26801°N 152.22509°W	70.26993°N 152.24909°W
USGS Quad Sheet:	Harrison Bay B-4: T11N R1W Sec. 30/31	
Habitat:	Tundra Lake	Tundra Lake
Area:	77.8 acres	36.0 acres
Maximum Depth:	9.2 feet	8.2 feet
Active Outlet:	No	No
Calculated Volume:	119.27 million gallons	43.34 million gallons
Permittable Volume:	34.86 million gallons	5.92 million gallons
Potential Aggregate:	23.0 acres (water 4 ft or less)	19.7 acres (water 4 ft or less)

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	10.0	1.8	3.7	10.0	32	96	1.2	7.69	This Study

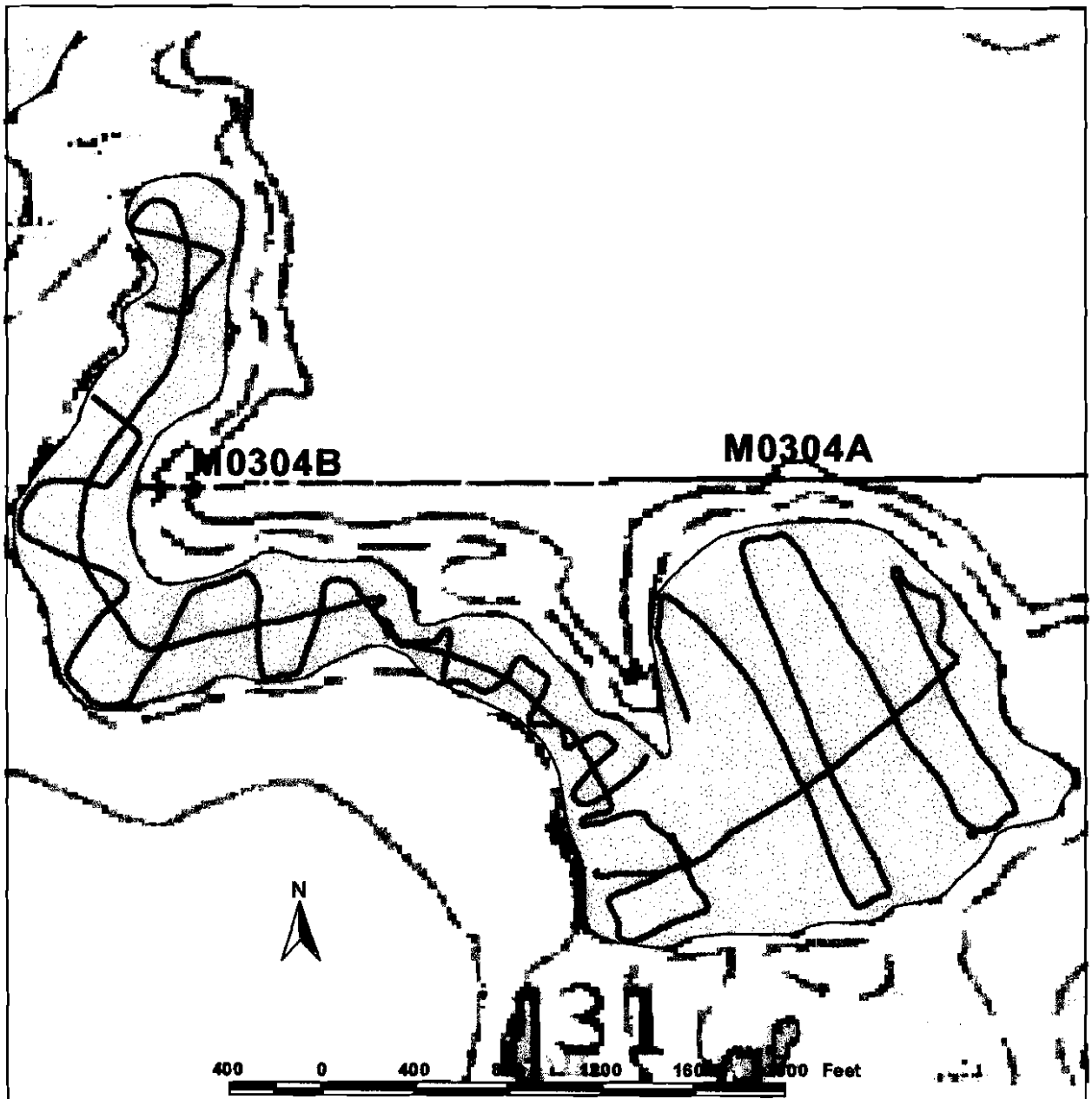
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 15 03	5.4	None	0
Minnow Trap	Jul 15 03	6.0	None	0
Seine	Jul 15 03	3 hauls	None	0

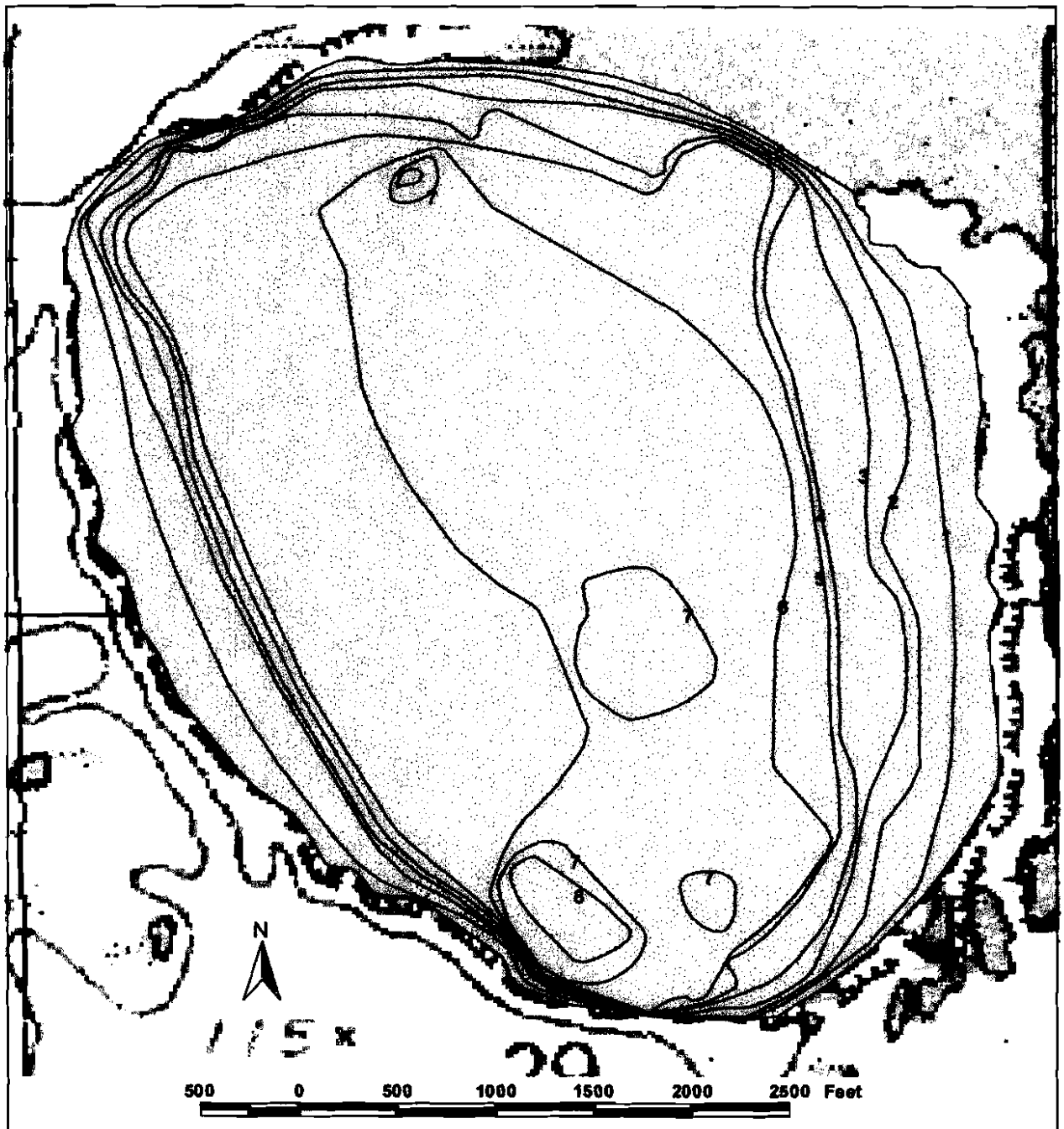


Regions of lakes M0304A and M0304B less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 15, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyed at lake M0304A and M0304B on July 15, 2003.



Depth contours of lake M0305, based on transects surveyed on July 24, 2003
(depth intervals in 1 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0305

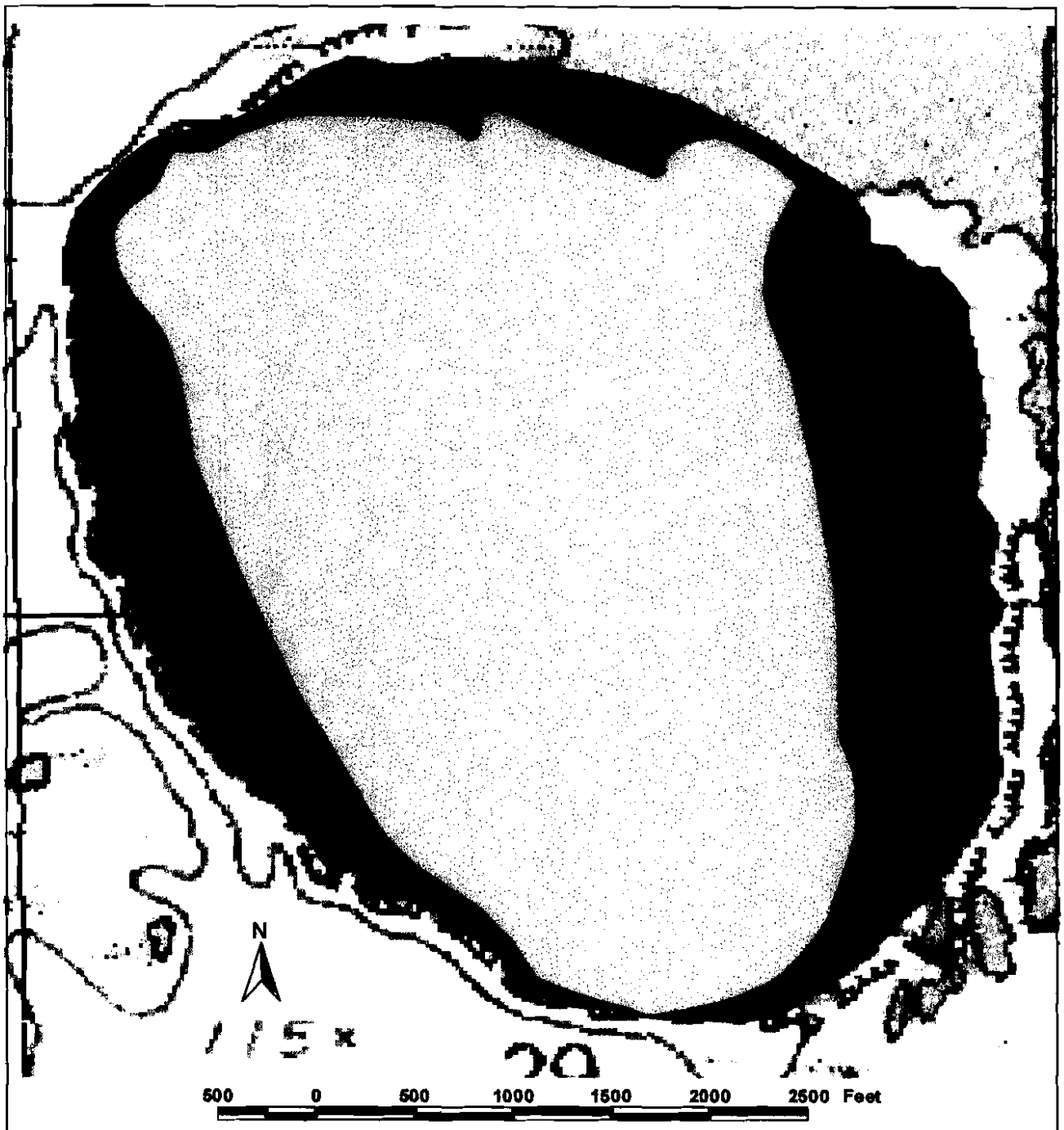
Other Names:
Location: 70.28729°N 152.19363°W
USGS Quad Sheet: Harrison Bay B-4: T11N R1W Sec. 16/17/20/21/29
Habitat: Tundra Lake
Area: 440.1 acres
Maximum Depth: 8.7 feet
Active Outlet: No
Calculated Volume: 665.85 million gallons
Permittable Volume: 28.88 million gallons
Potential Aggregate: 142.0 acres (water depth 4 ft or less)

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	18.0	2.8	6.4	15.0	56	141	3.4	7.95	This Study

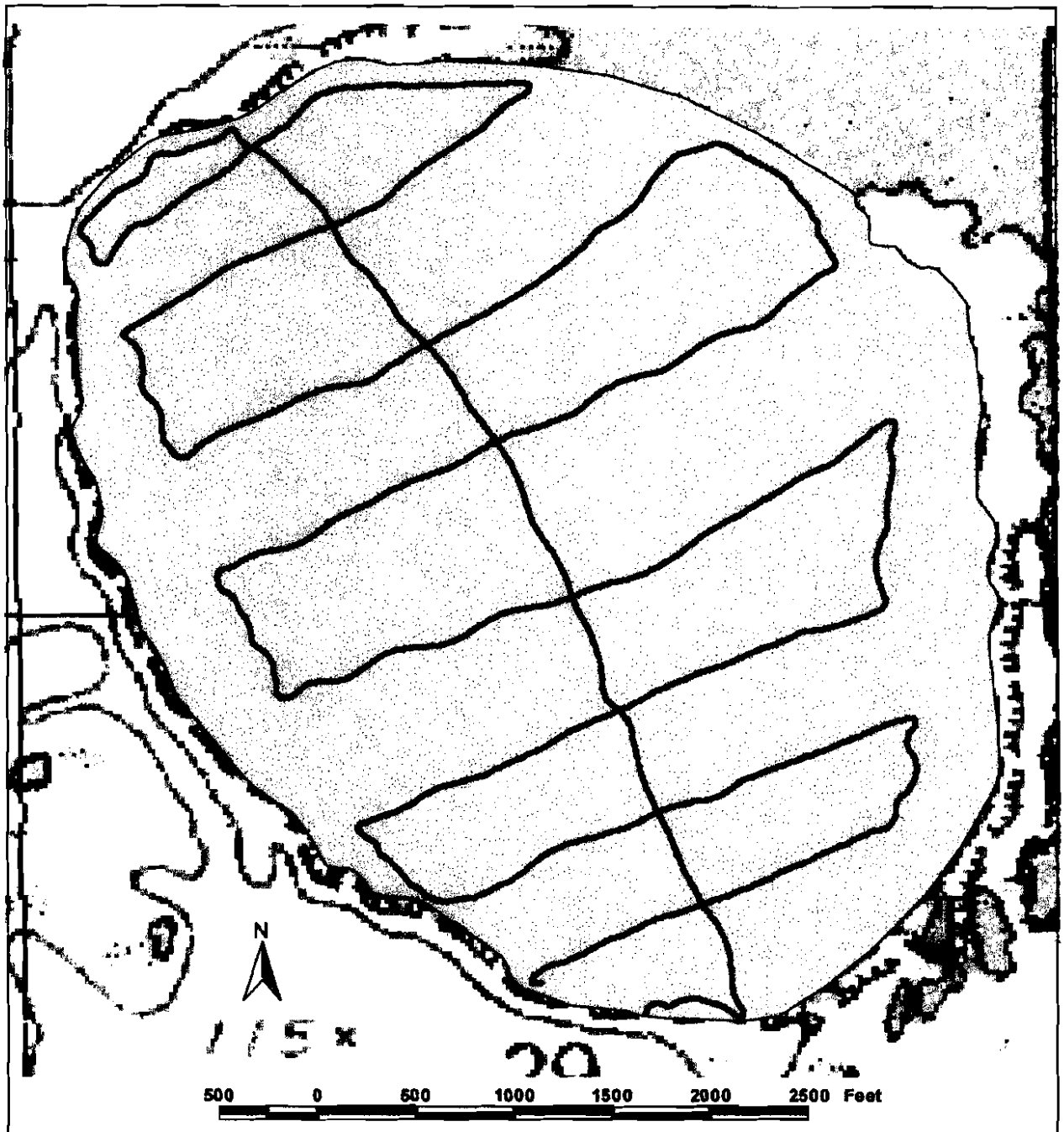
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 24 03	6.0	None	0
Minnow Trap	Jul 24 03	6.0	9spine stickleback	3
Seine		0 hauls		

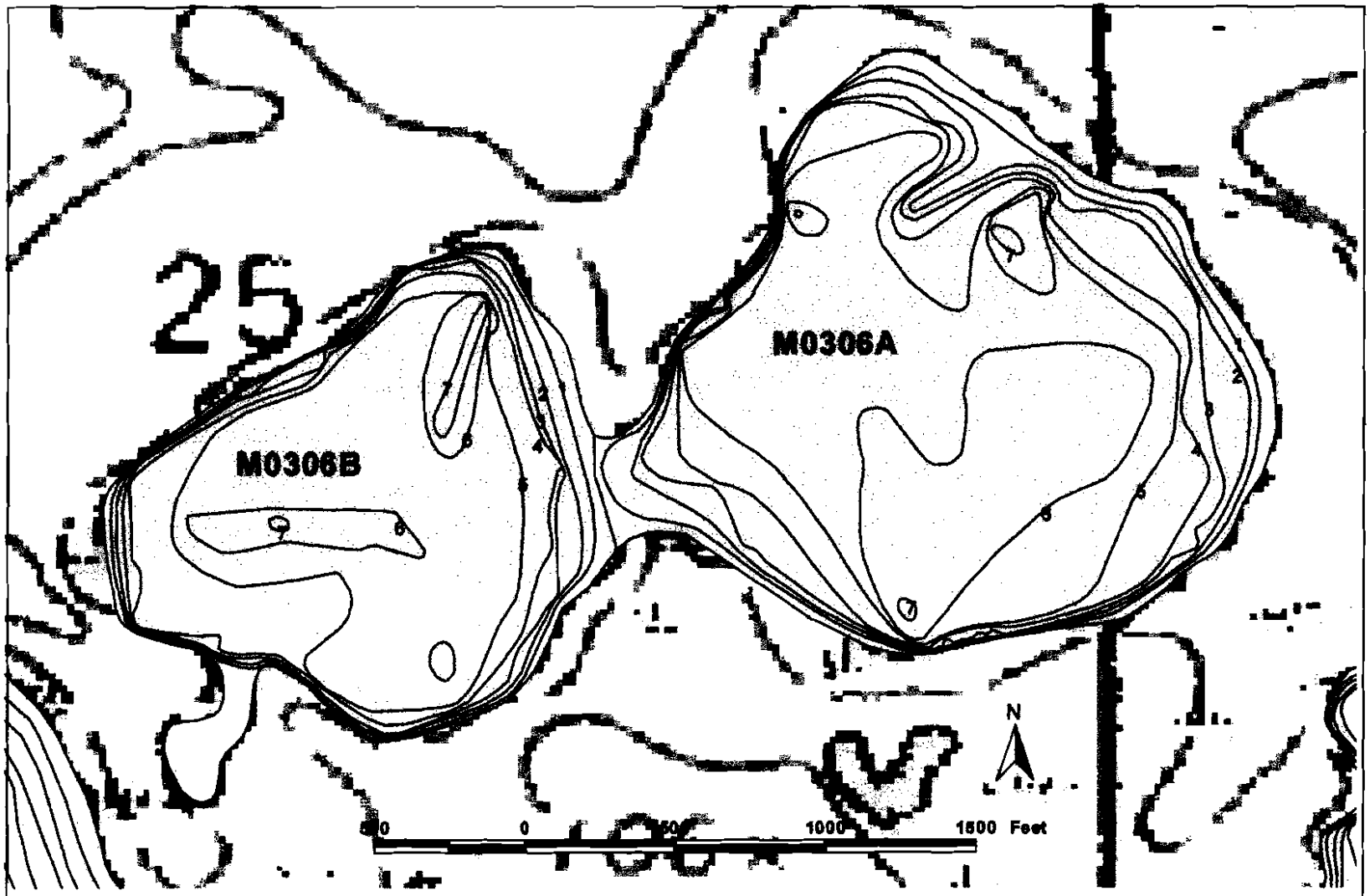


Regions of lake M0305 less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 24, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects aurveyd at lake M0305 on July 24, 2003.



Depth contours of lake M0306A and M0306B, based on transects surveyed on July 15, 2003 (depth intervals in 1 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0306

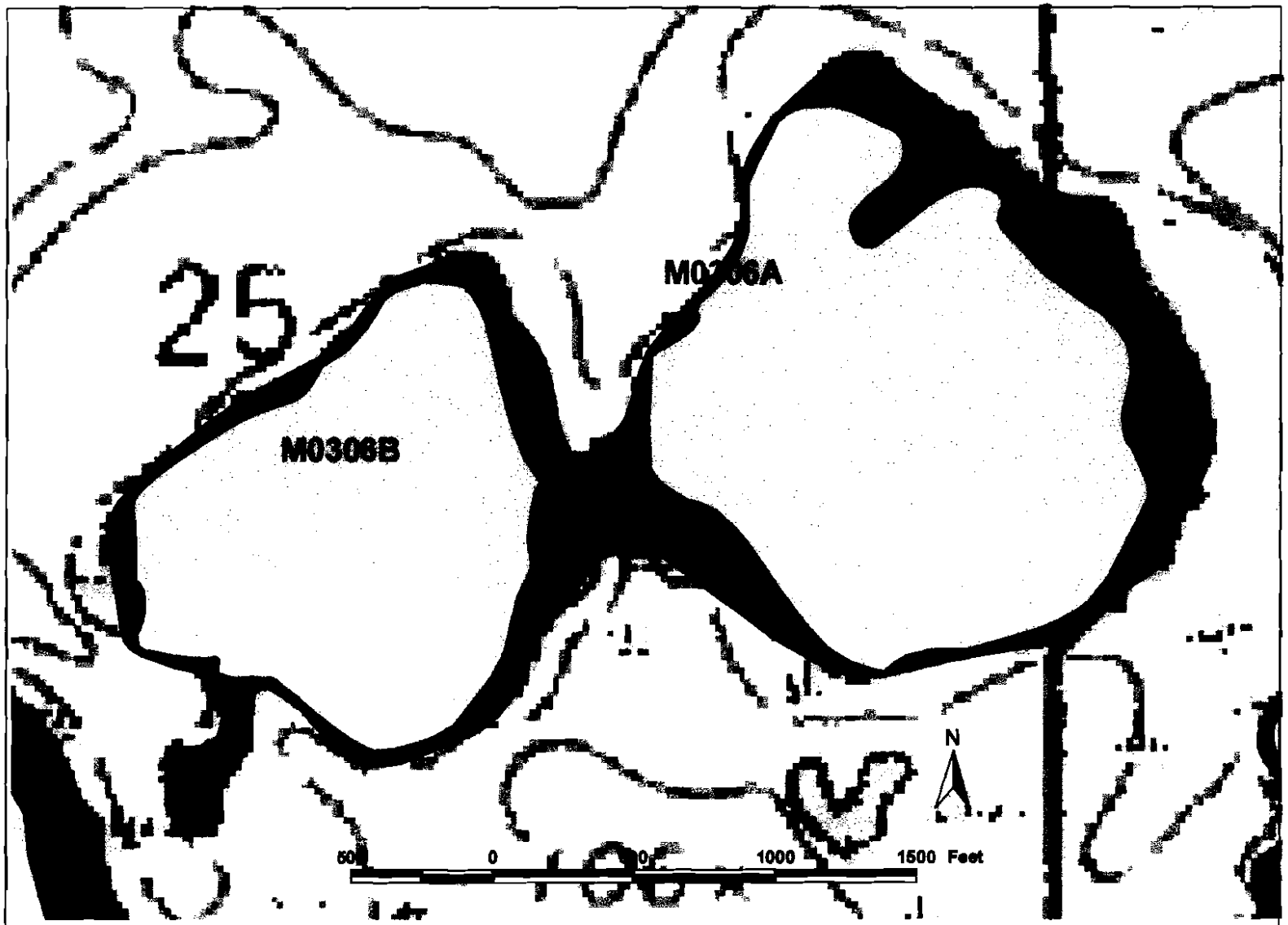
	Basin A	Basin B
Other Names:		
Location:	70.27827°N 152.25843°W	70.27712°N 152.27401°W
USGS Quad Sheet:	Harrison Bay B-4: T11N R2W Sec. 25/30	
Habitat:	Tundra Lake	Tundra Lake
Area:	73.9 acres	46.1 acres
Maximum Depth:	7.5 feet	7.5 feet
Active Outlet:	No	No
Calculated Volume:	107.99 million gallons	67.84 million gallons
Permittable Volume:	25.50 million gallons	15.13 million gallons
Potential Aggregate:	4.5 acres (water 4 ft or less)	37.8 acres (water 4 ft or less)

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	11.0	1.8	5.8	11.0	36	107	0.5	7.69	This Study

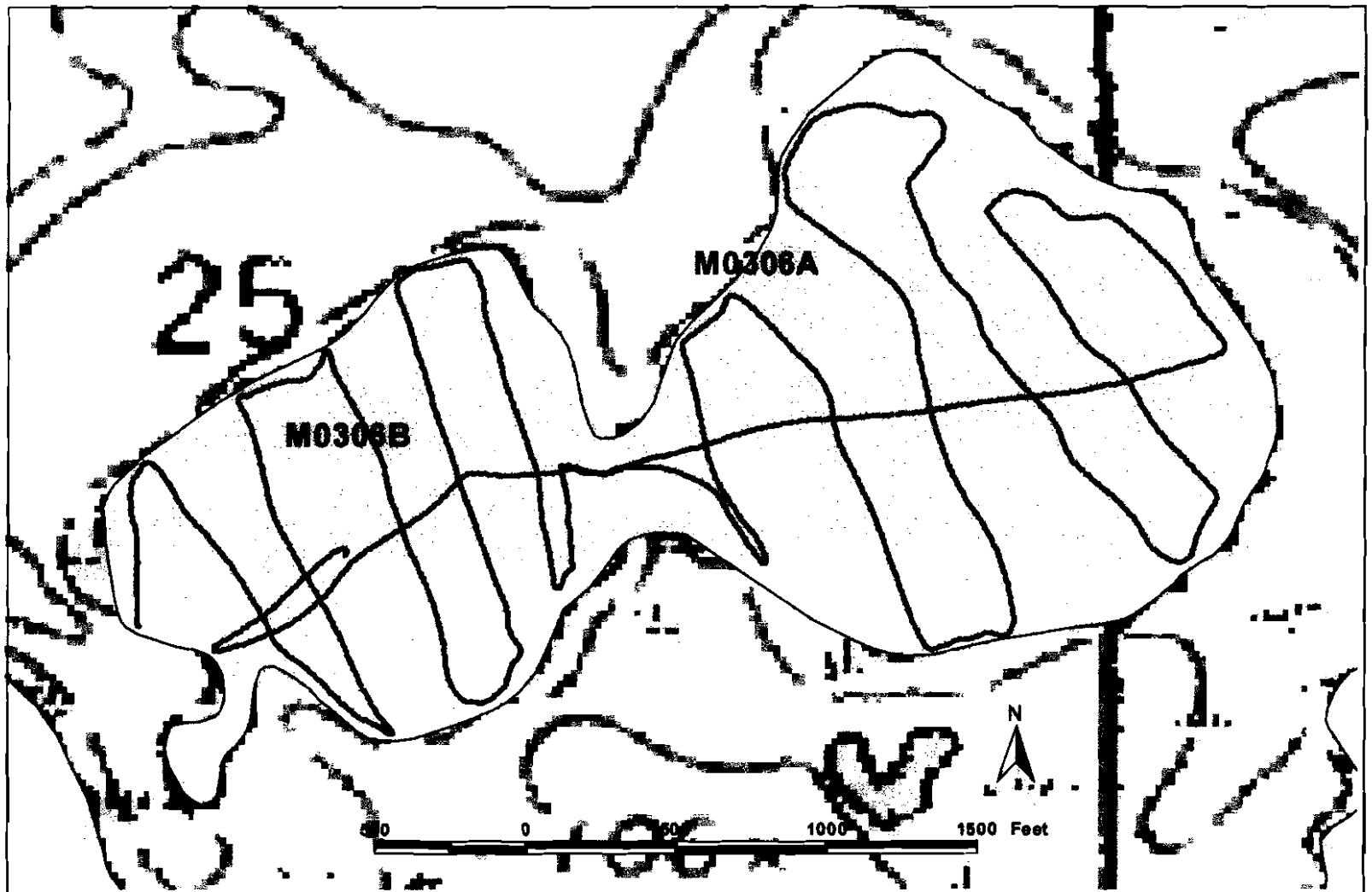
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 15 03	6.0	None	0
Minnow Trap	Jul 15 03	9.0	None	0
Seine	Jul 15 03	3 hauls	None	0

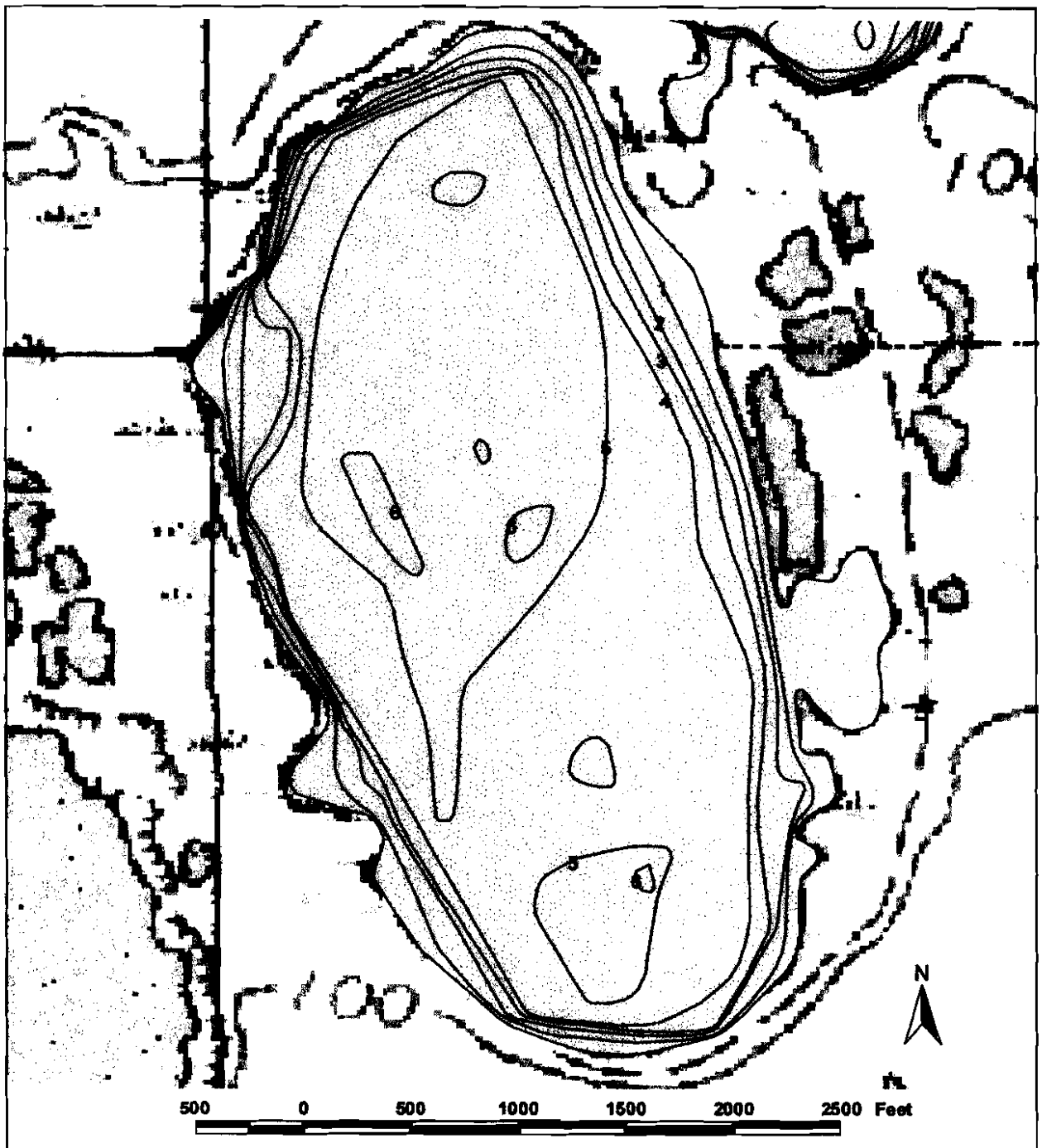


Regions of lake M0306A and lake M0306B less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 15, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyed at lake M0306A and M0306B on July 15, 2003.



Depth contours of lake M0307, based on transects surveyed on July 14, 2003
(depth intervals in 1 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0307

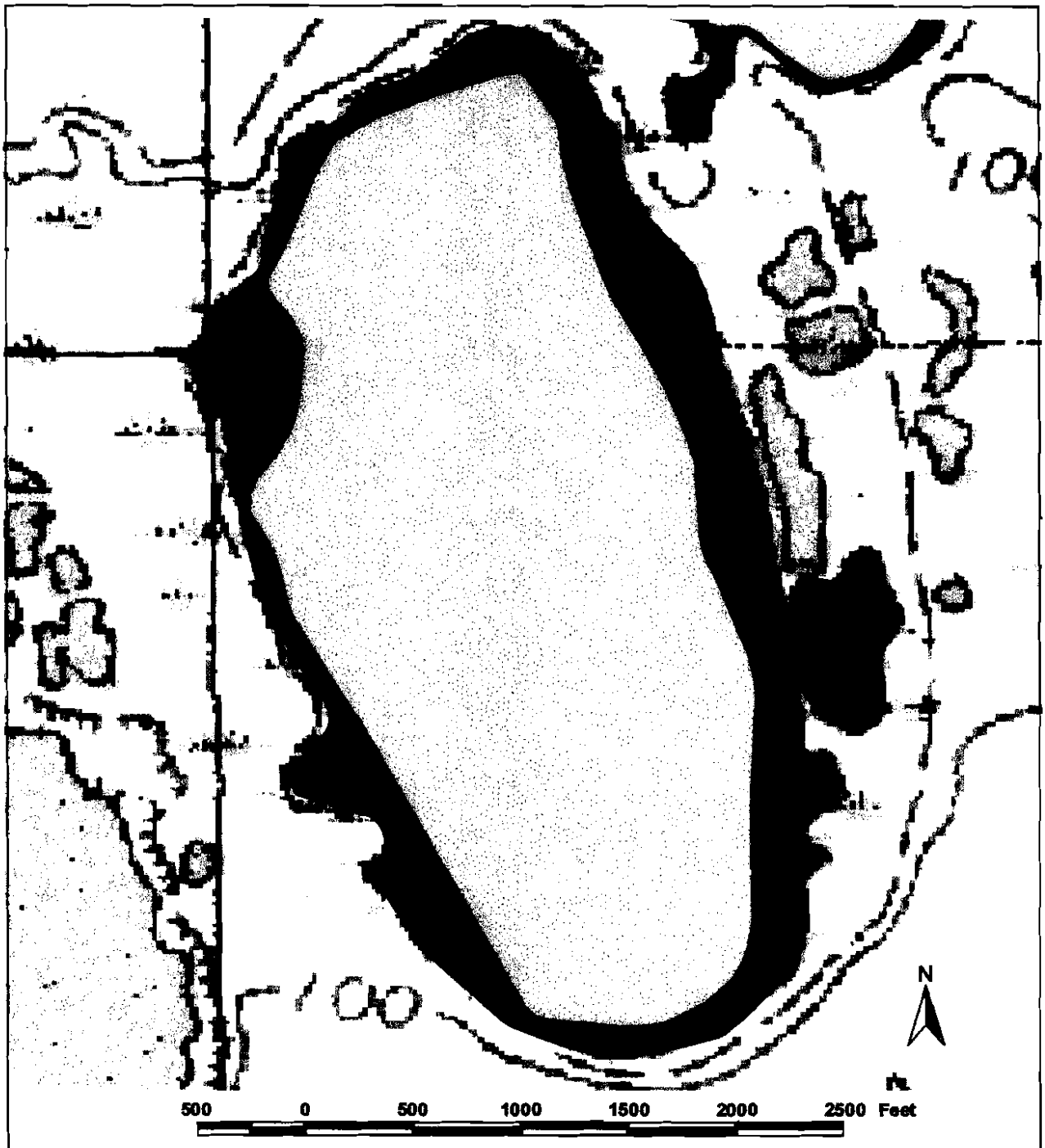
Other Names:
Location: 70.26872°N 152.28570°W
USGS Quad Sheet: Harrison Bay B-4: T11N R2W Sec. 25/36
Habitat: Tundra Lake
Area: 227.3 acres
Maximum Depth: 7.0 feet
Active Outlet: No
Calculated Volume: 48.97 million gallons
Permittable Volume: 3.31 million gallons
Potential Aggregate: 65.9 acres (water depth 4 ft or less)

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	14.0	2.2	5.9	13.0	43	120	0.7	7.91	This Study

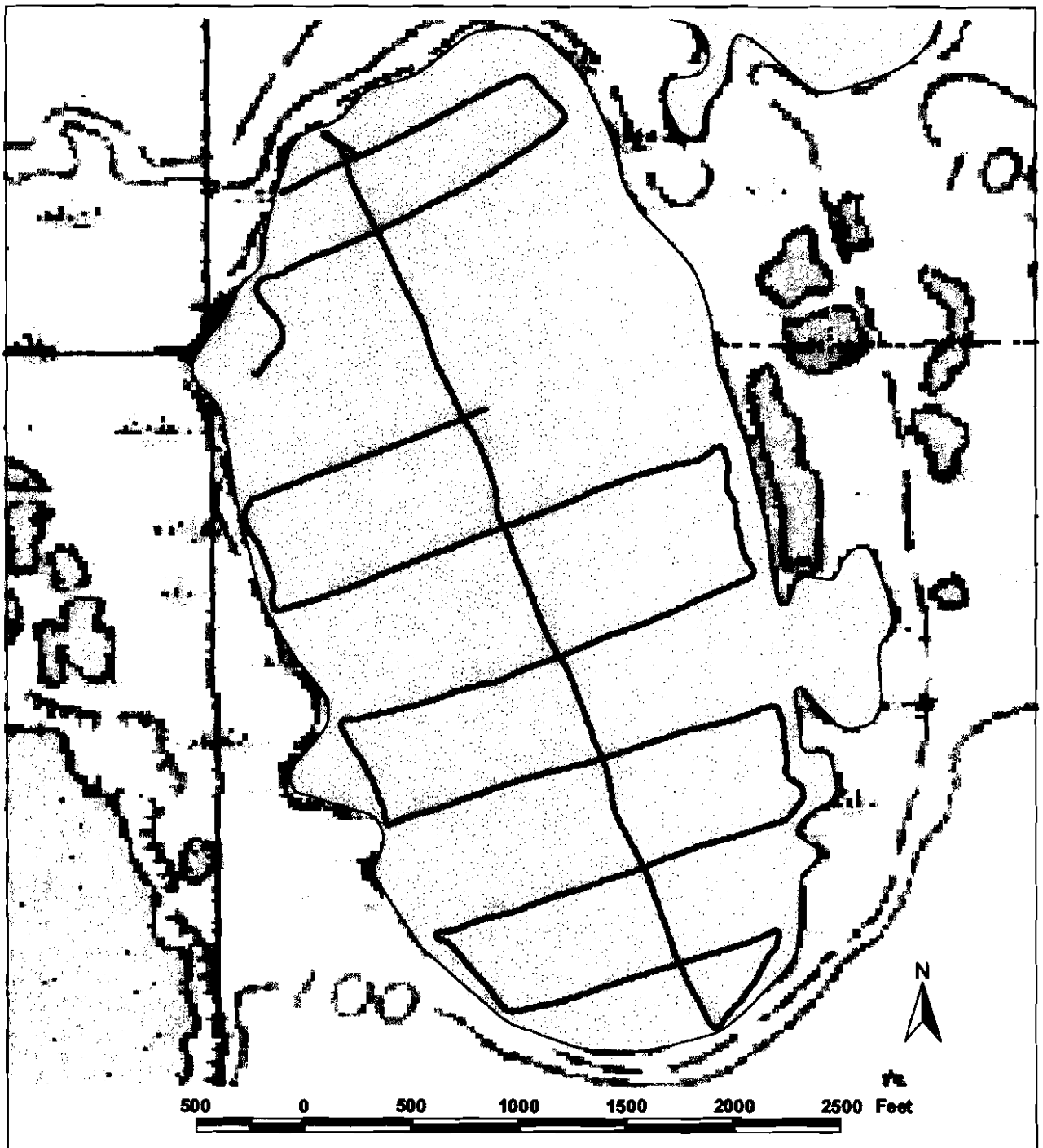
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 13 03	5.5	None	0
Minnow Trap	Jul 13 03	6.2	None	0
Seine	Jul 13 03	3 hauls	9spine stickleback	1

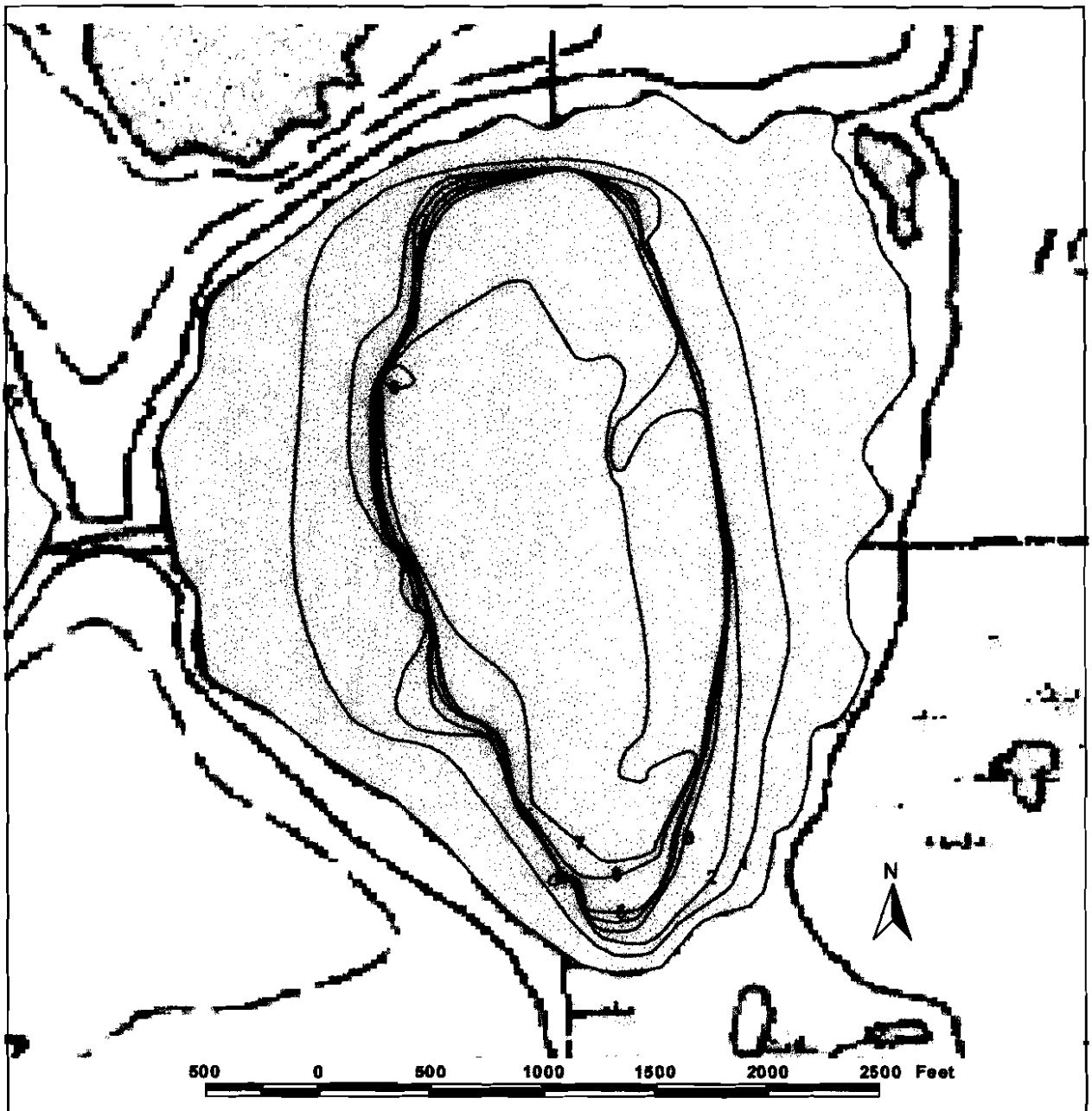


Regions of lake M0307 less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 14, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyd at lake M0307 on July 14, 2003.



Depth contours of lake M0308, based on transects surveyed on July 17, 2003
(depth intervals in 1 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0308

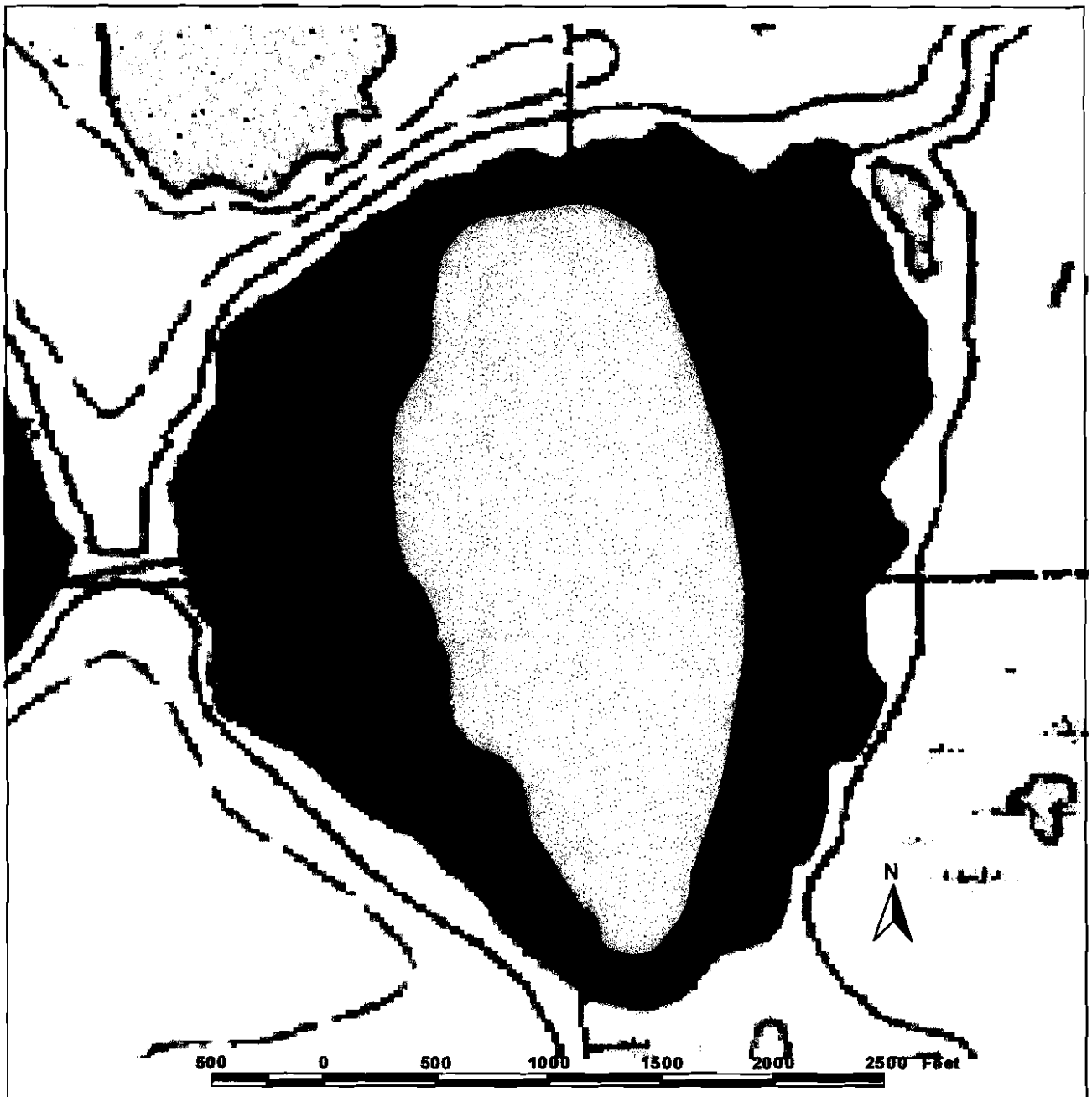
Other Names:
Location: 70.31527°N 152.42589°W
USGS Quad Sheet: Harrison Bay B-5: T11N R2W Sec. 8/9/16/17
Habitat: Tundra Lake
Area: 237.6 acres
Maximum Depth: 10.2 feet
Active Outlet: No
Calculated Volume: 257.56 million gallons
Permittable Volume: 87.69 million gallons
Potential Aggregate: 142.8 acres (water depth 4 ft or less)

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	27.0	2.8	5.6	11.0	79	188	0.6	8.23	This Study

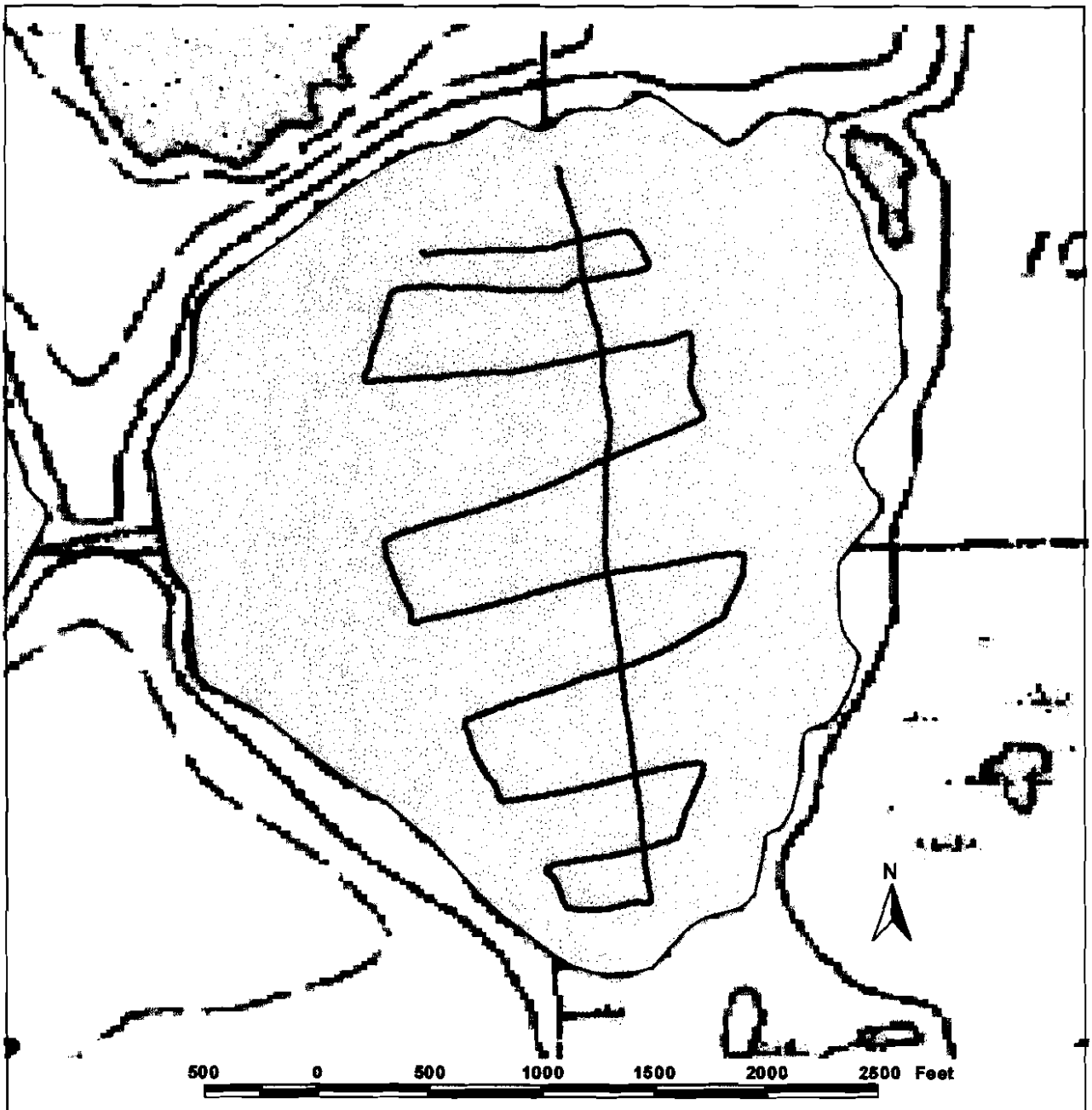
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 17 03	6.7	None	0
Minnow Trap	Jul 17 03	9.2	None	0
Seine		0 hauls		

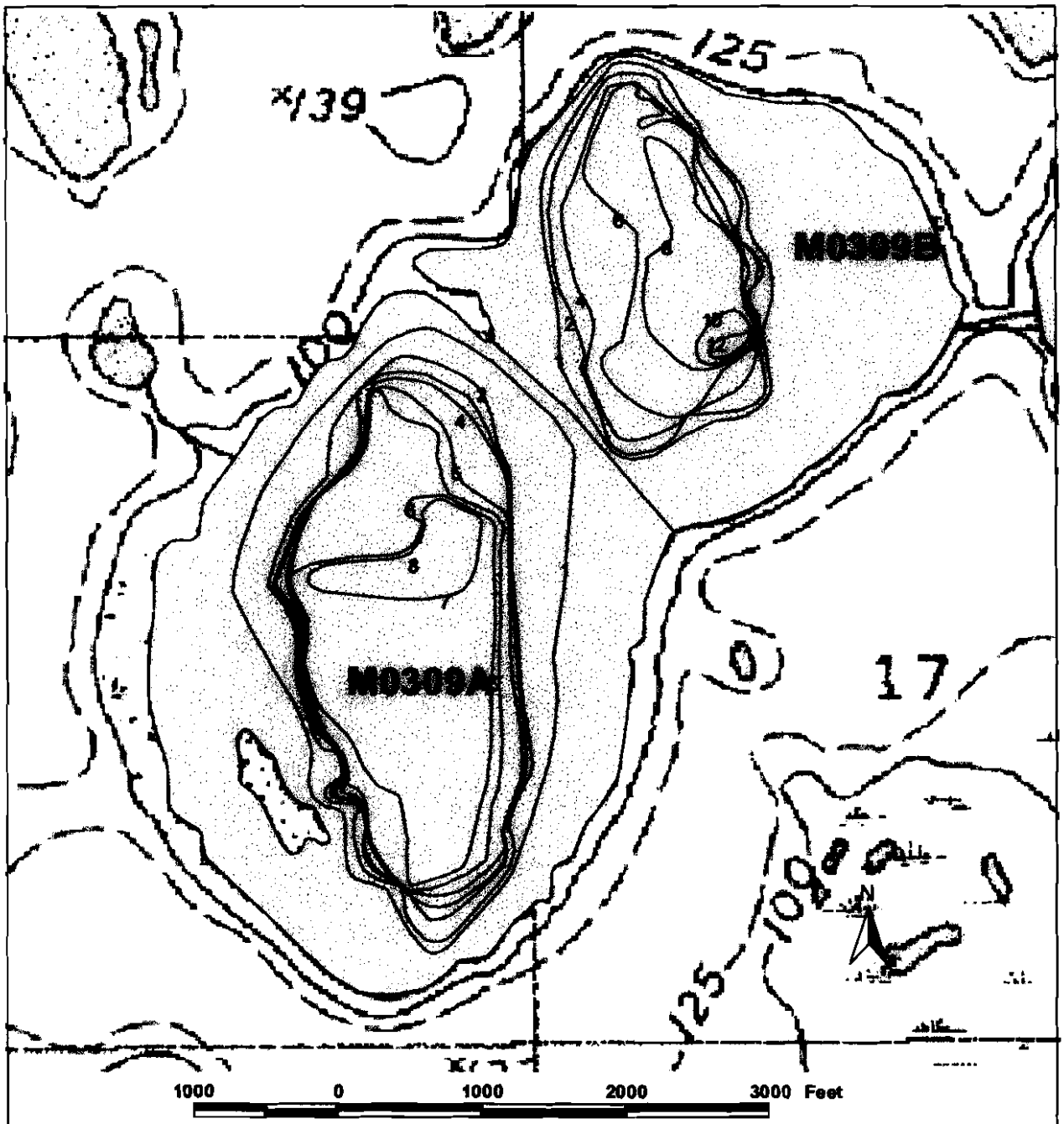


Regions of lake M0308 less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 17, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyed at lake M0308 on July 17, 2003.



Depth contours of lake M0309A and M0309B, based on transects surveyed on July 17, 2003
(depth intervals in 1 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0309

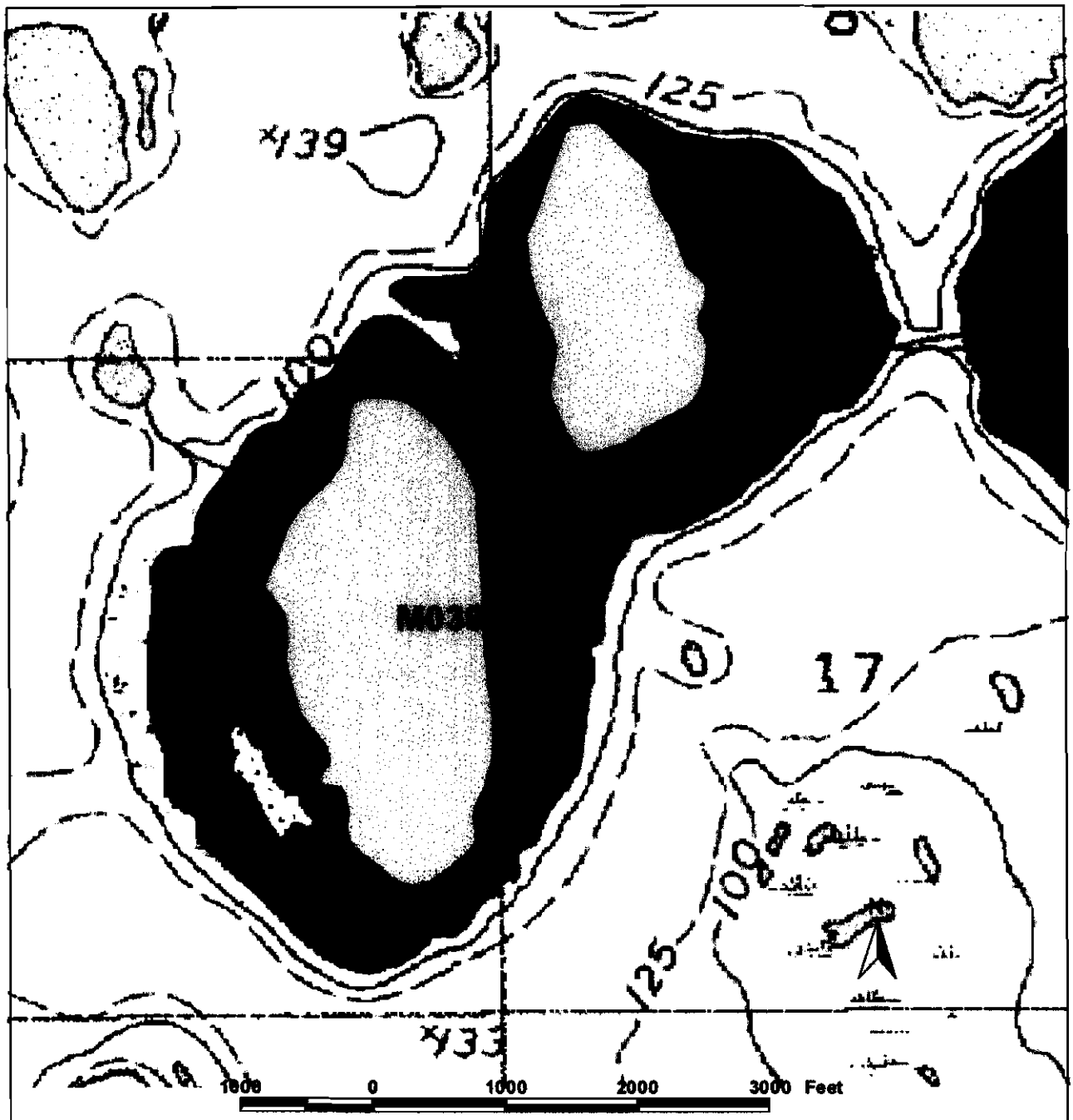
	Basin A	Basin B
Other Names:		
Location:	70.30868°N 152.47590°W	70.31584°N 152.45795°W
USGS Quad Sheet:	Harrison Bay B-5: T11N R2W Sec. 8/17/18	
Habitat:	Tundra Lake	Tundra Lake
Area:	301.0 acres	168.8 acres
Maximum Depth:	8.6 feet	12.3 feet
Active Outlet:	No	No
Calculated Volume:	293.51 million gallons	171.89 million gallons
Permittable Volume:	97.59 million gallons	7.06 million gallons
Potential Aggregate:	182.0 acres (water 4 ft or less)	124.3 acres (water 4 ft or less)

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	28.0	2.8	5.2	11.0	82	194	0.6	8.24	This Study

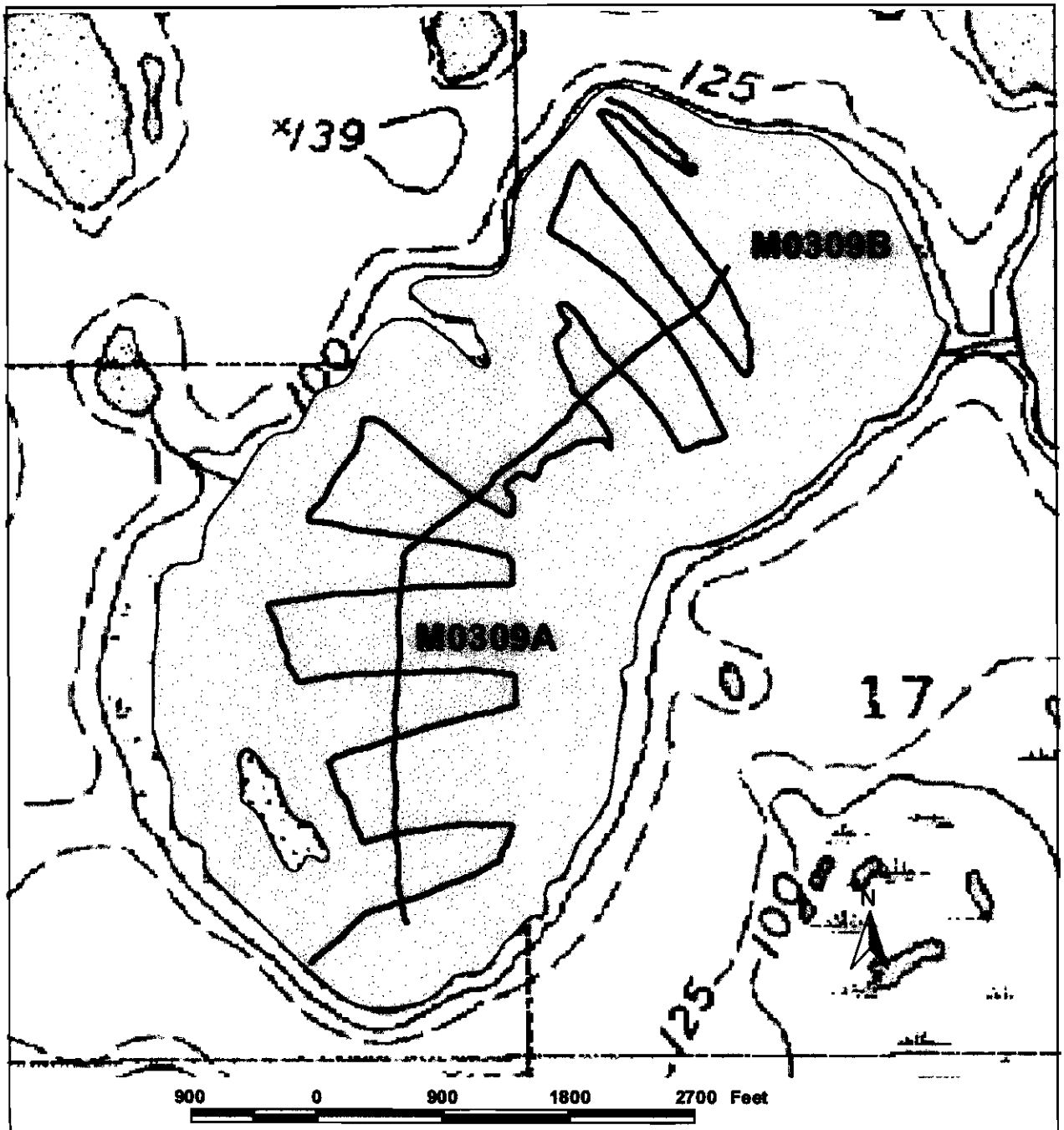
Catch Record:

Gear	Date	Effort (hours),	Species	Number Caught
Gill Net	Jul 17 03	6.3	None	0
Minnow Trap	Jul 17 03	9.7	None	0
Seine	Jul 17 03	2 hauls	None	0

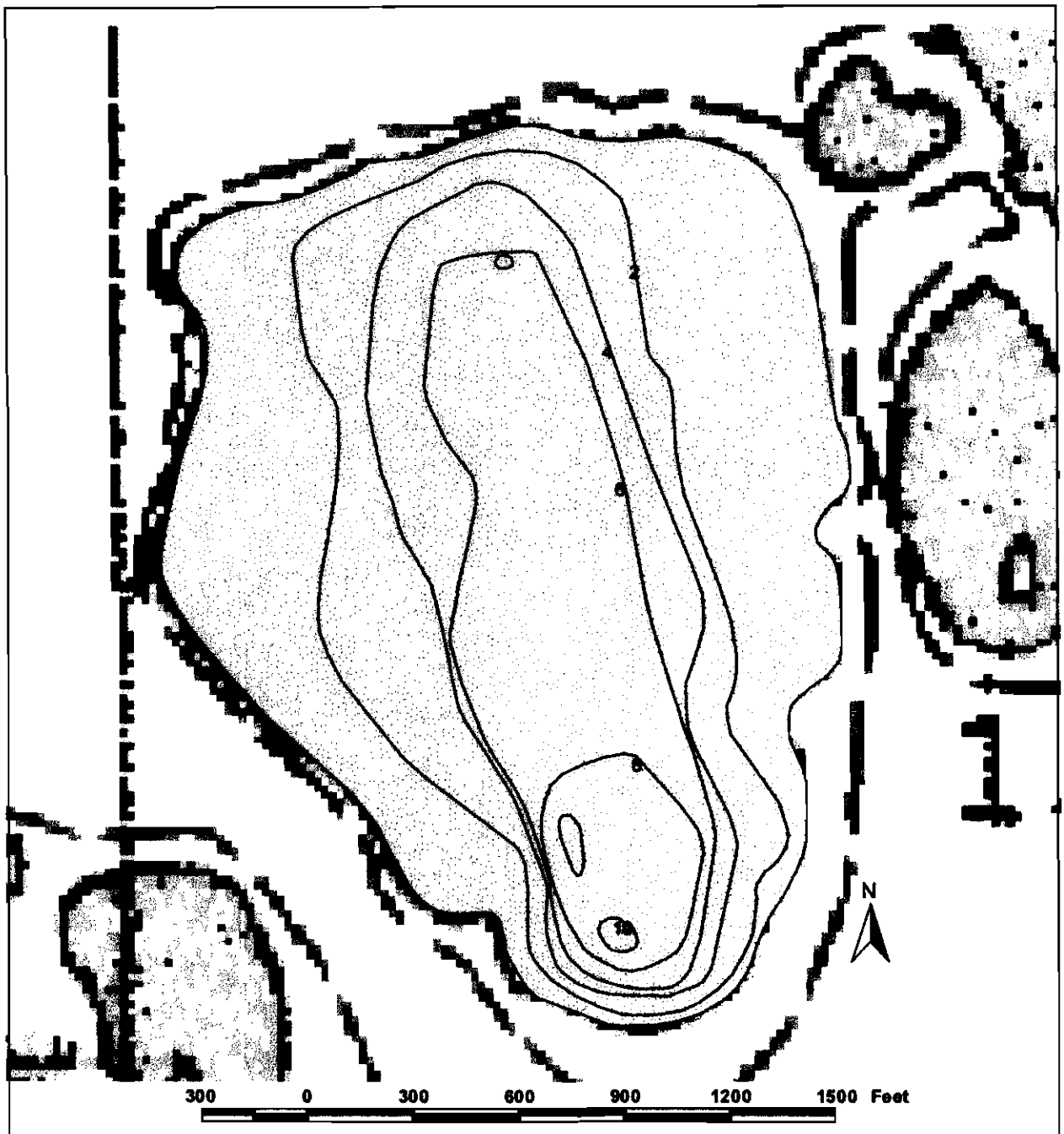


Regions of lake M0309A and lake M0309B less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 17, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyed at lake M0309A and M0309B on July 17, 2003.



Depth contours of lake M0310, based on transects surveyed on July 15, 2003
(depth intervals in 2 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0310

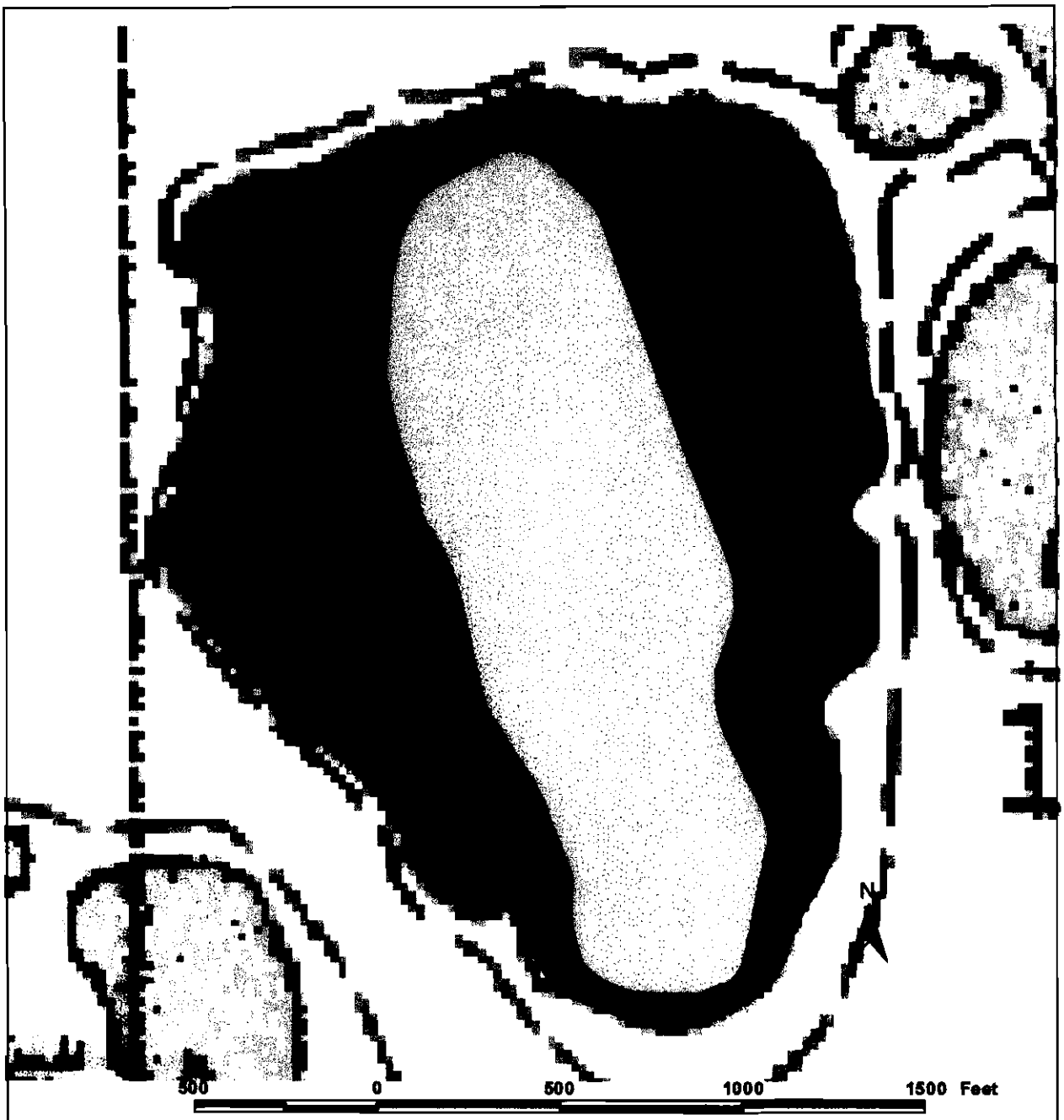
Other Names:
Location: 70.30956°N 152.54279°W
USGS Quad Sheet: Harrison Bay B-5: T11N R3W Sec. 13
Habitat: Tundra Lake
Area: 90.9 acres
Maximum Depth: 11.8 feet
Active Outlet: No
Calculated Volume: 104.47 million gallons
Permittable Volume: 4.67 million gallons
Potential Aggregate: 55.9 acres (water depth 4 ft or less)

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	31.0	3.5	6.8	14.0	92	219	0.4	8.27	This Study

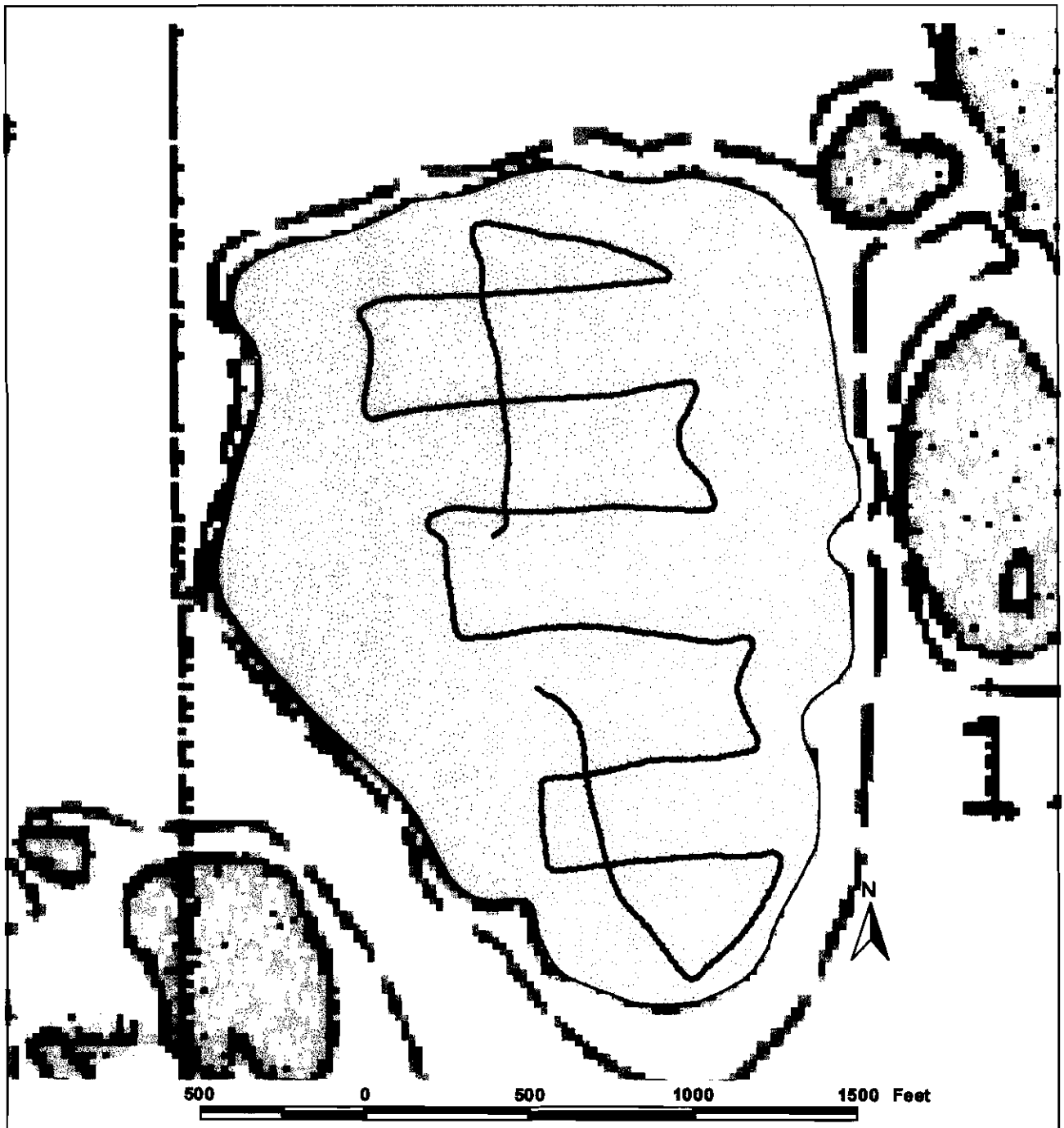
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 15 03	5.4	None	0
Minnow Trap	Jul 15 03	7.3	None	0
Seine	Jul 15 03	2 hauls	9spine stickleback	2

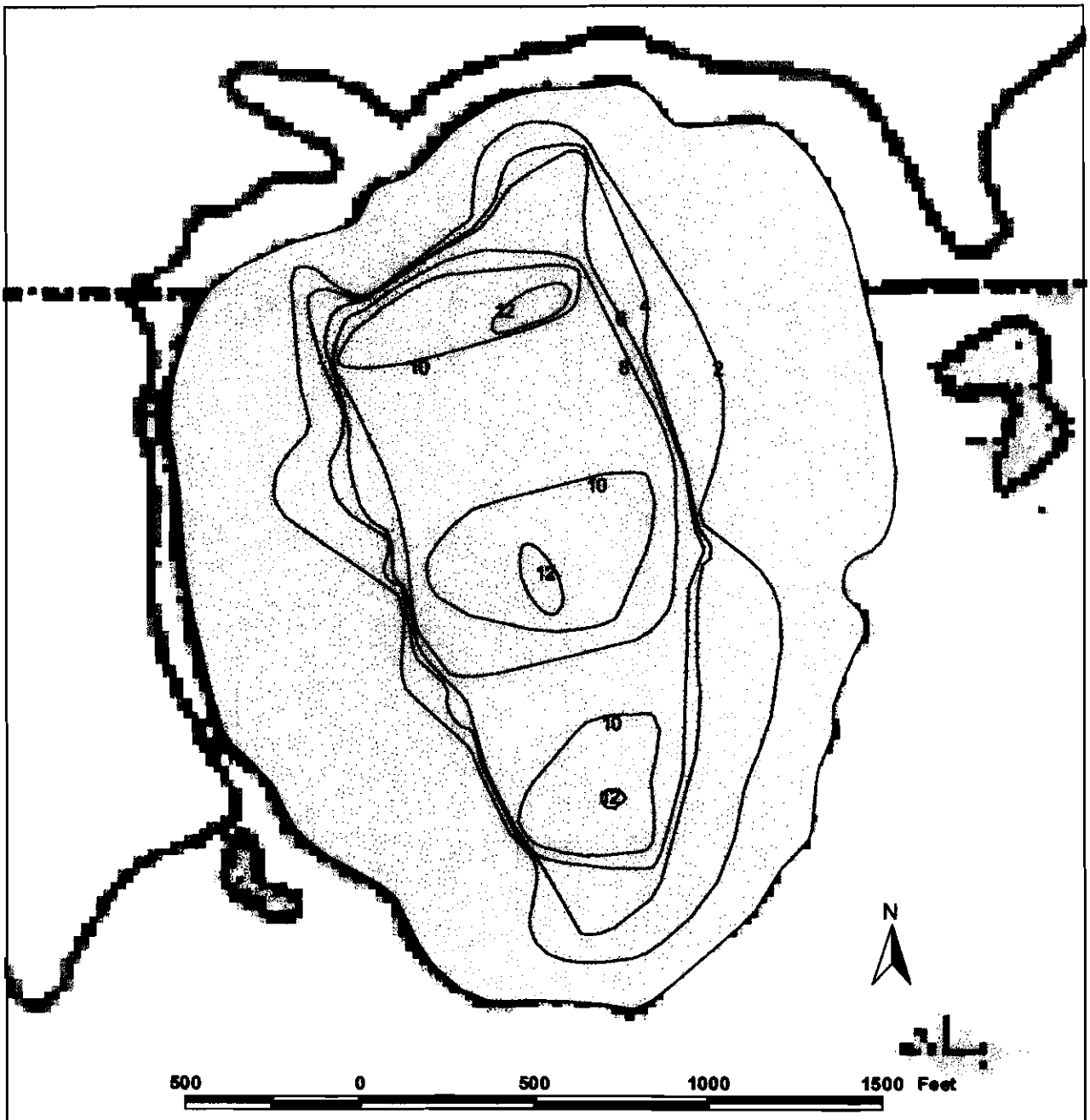


Regions of lake M0310 less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 15, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyed at lake M0310 on July 15, 2003.



Depth contours of lake M0311, based on transects surveyed on July 16, 2003
(depth intervals in 2 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0311

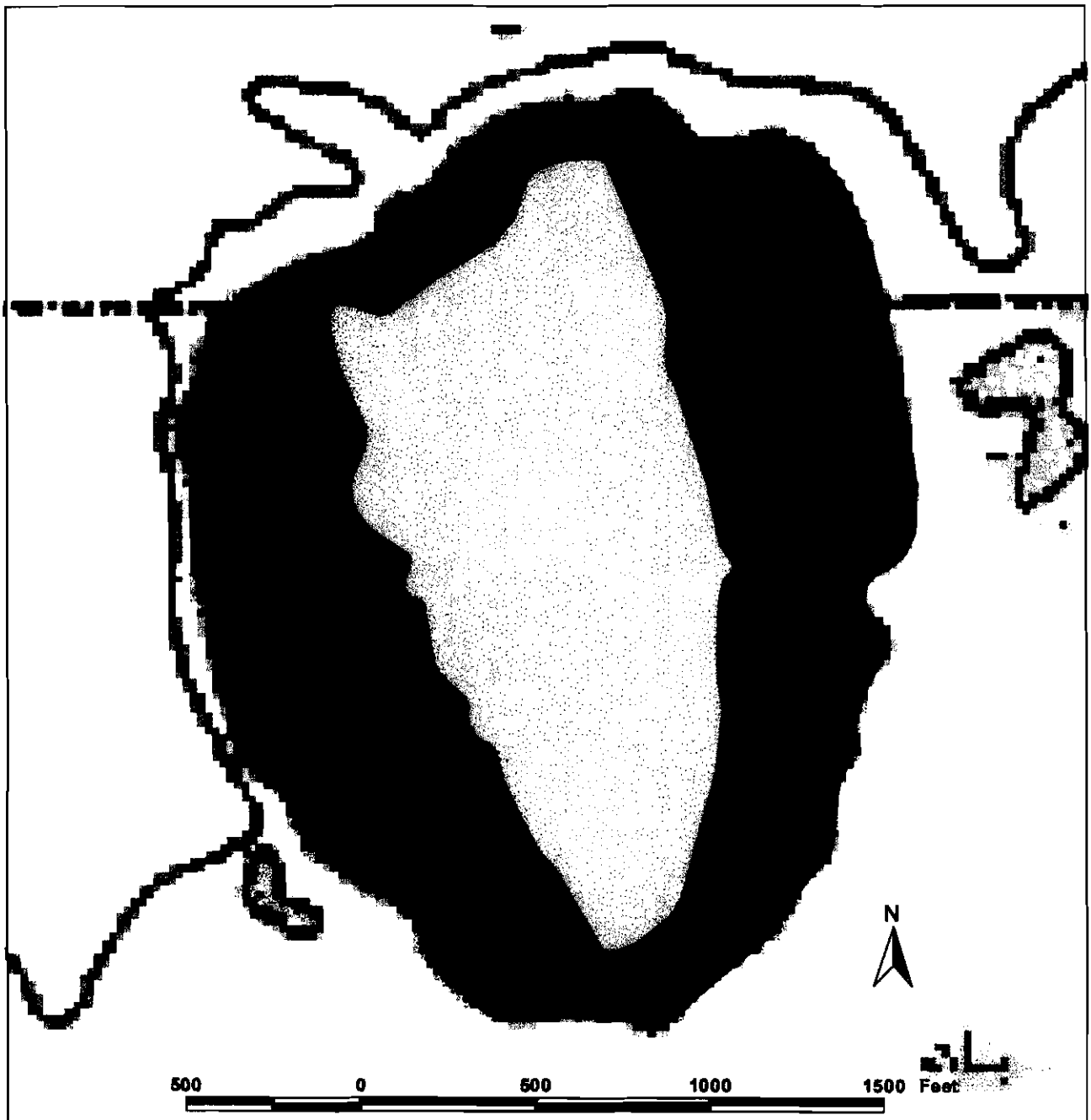
Other Names:
Location: 70.31259°N 152.56773°W
USGS Quad Sheet: Harrison Bay B-5: T11N R3W Sec. 11/14
Habitat: Tundra Lake
Area: 101.8 acres
Maximum Depth: 13.7 feet
Active Outlet: No
Calculated Volume: 133.88 million gallons
Permittable Volume: 10.33 million gallons
Potential Aggregate: 63.4 acres (water depth 4 ft or less)

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	19.0	2.1	3.9	8.1	56	137	0.5	7.96	This Study

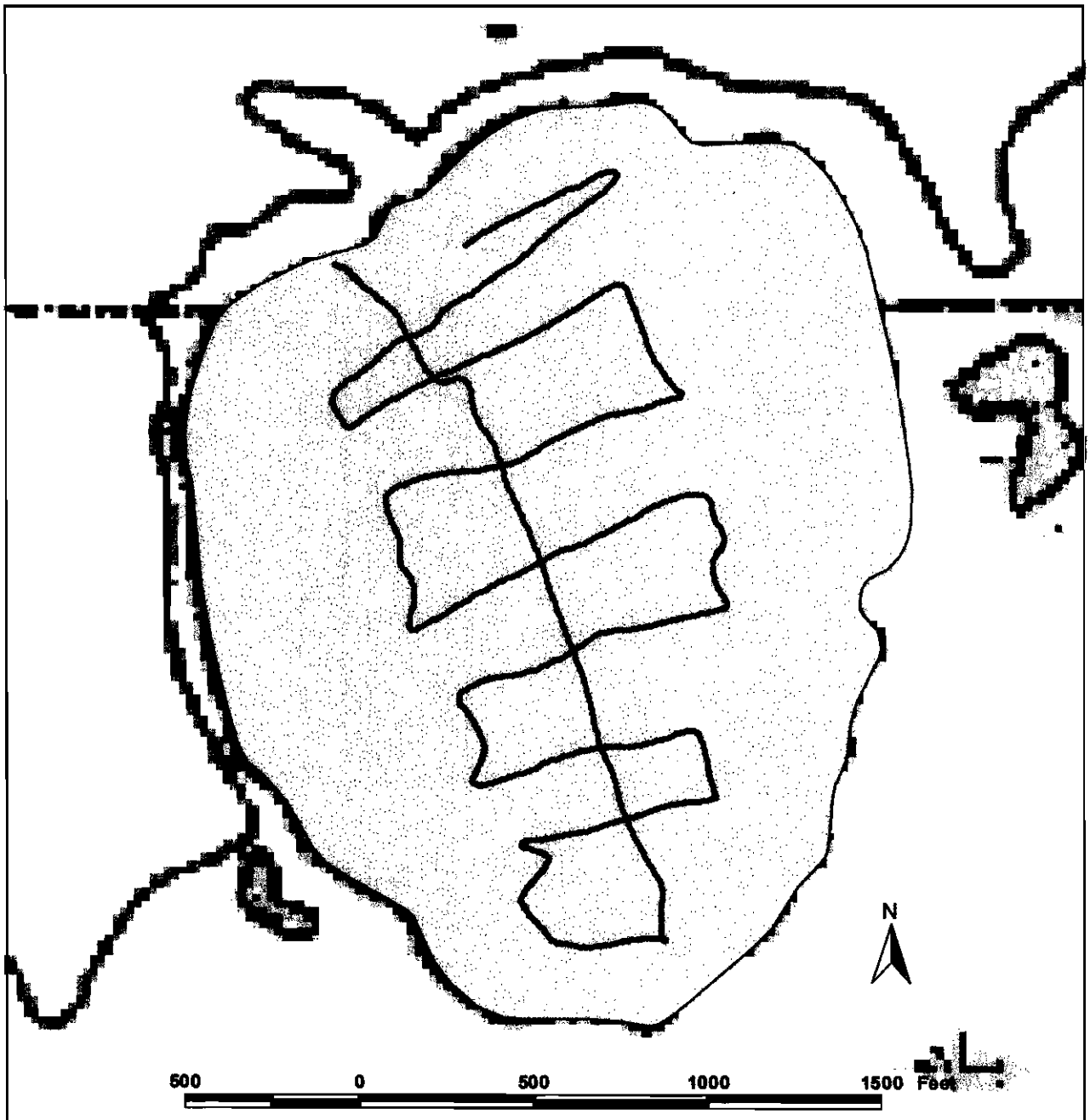
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 16 03	6.1	None	0
Minnow Trap	Jul 16 03	5.0	9spine stickleback	2
Seine		0 hauls		

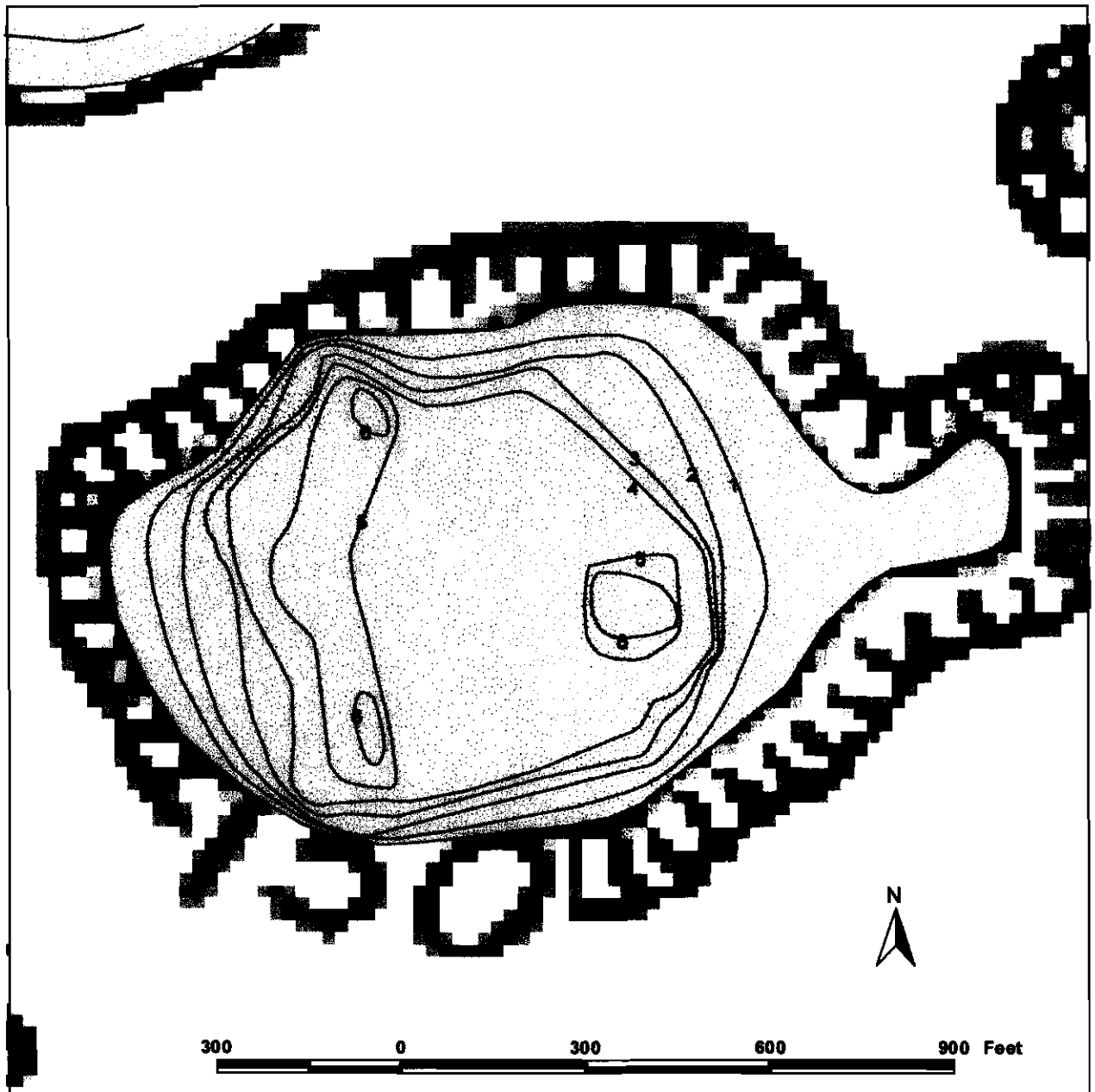


Regions of lake M0311 less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 16, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyed at lake M0311 on July 16, 2003.



Depth contours of lake M0312, based on transects surveyed on July 19, 2003
(depth intervals in 1 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0312

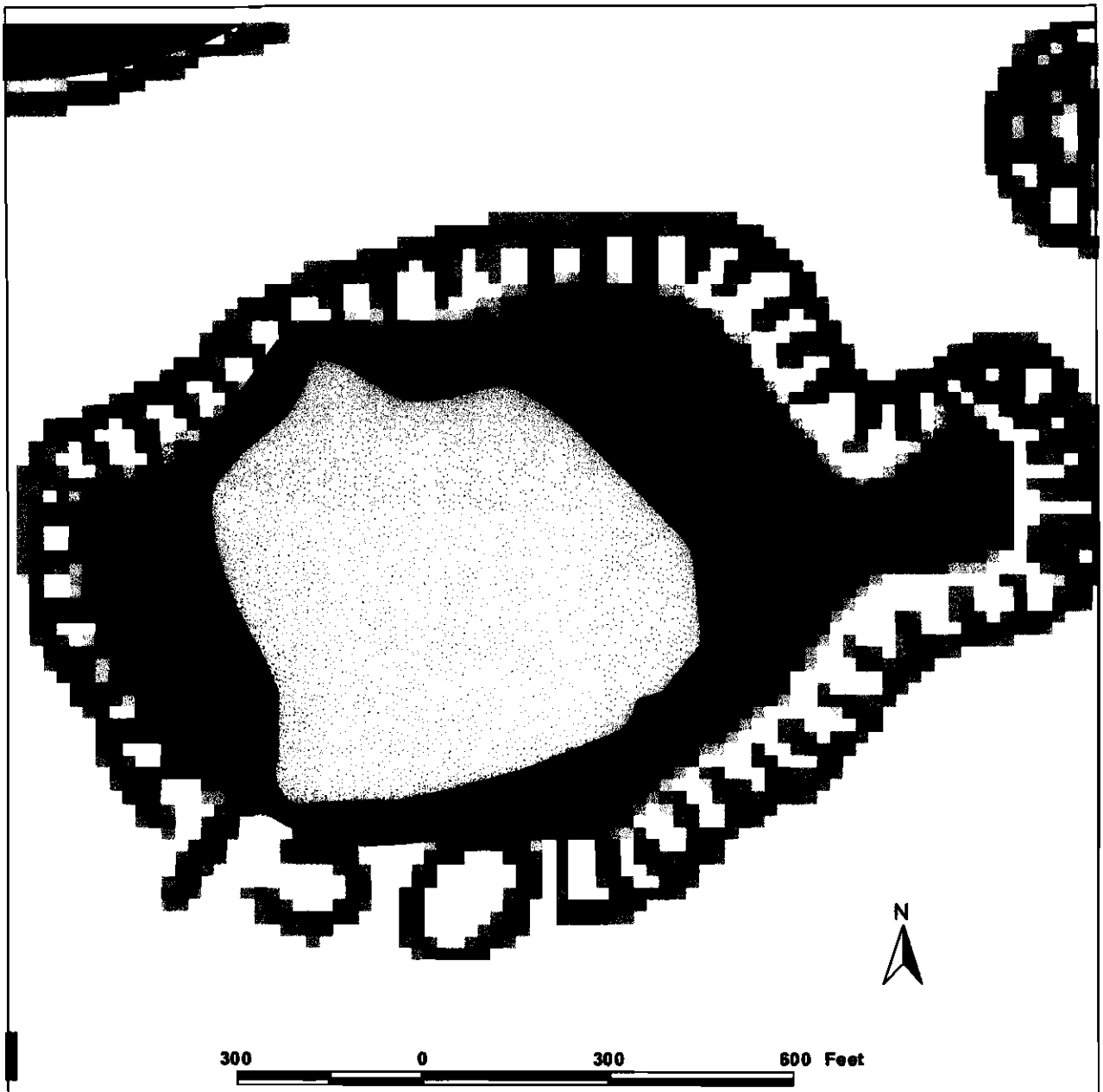
Other Names:
Location: 70.30996°N 152.60741°W
USGS Quad Sheet: Harrison Bay B-5: T11N R3W Sec. 15
Habitat: Tundra Lake
Area: 21.0 acres
Maximum Depth: 6.7 feet
Active Outlet: No
Calculated Volume: 20.99 million gallons
Permittable Volume: 2.39 million gallons
Potential Aggregate: 10.9 acres (water depth 4 ft or less)

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	18.0	2.2	3.3	5.8	55	128	0.4	8.14	This Study

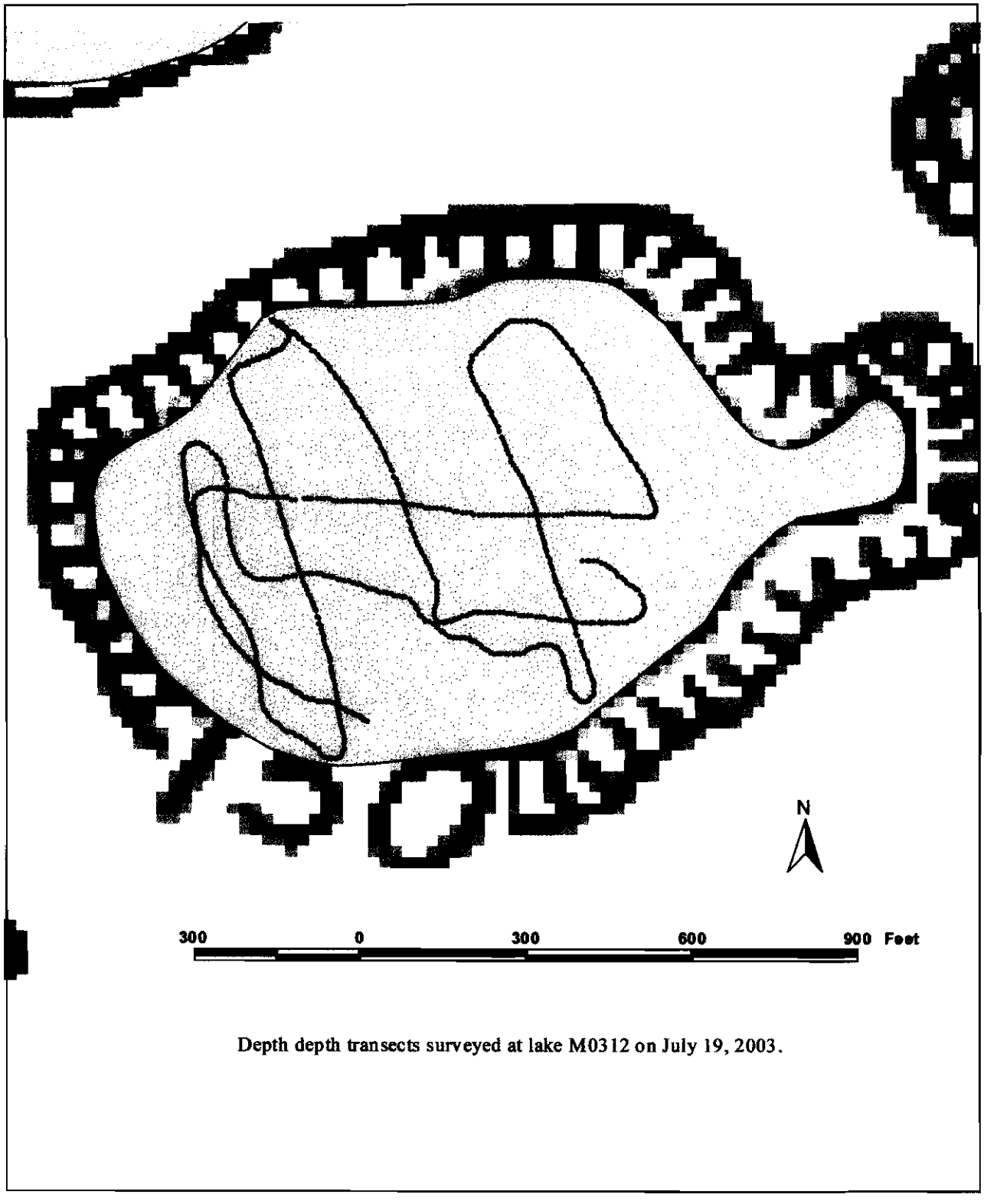
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 19 03	6.4	None	0
Minnow Trap	Jul 19 03	6.7	None	0
Seine	Jul 19 03	3 hauls	None	0

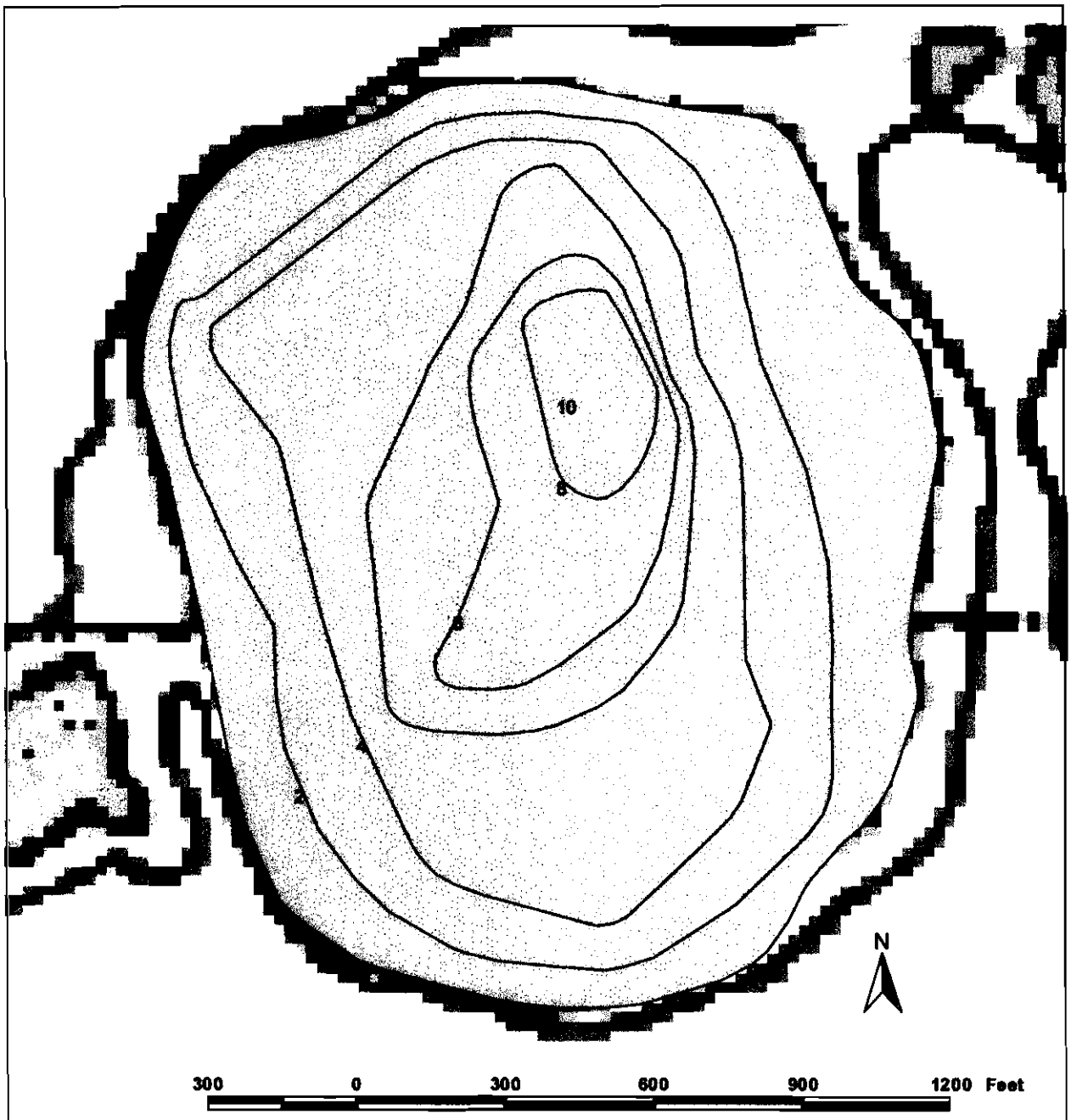


Regions of lake M0312 less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 19 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth depth transects surveyed at lake M0312 on July 19, 2003.



Depth contours of lake M0313, based on transects surveyed on July 19, 2003
(depth intervals in 2 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0313

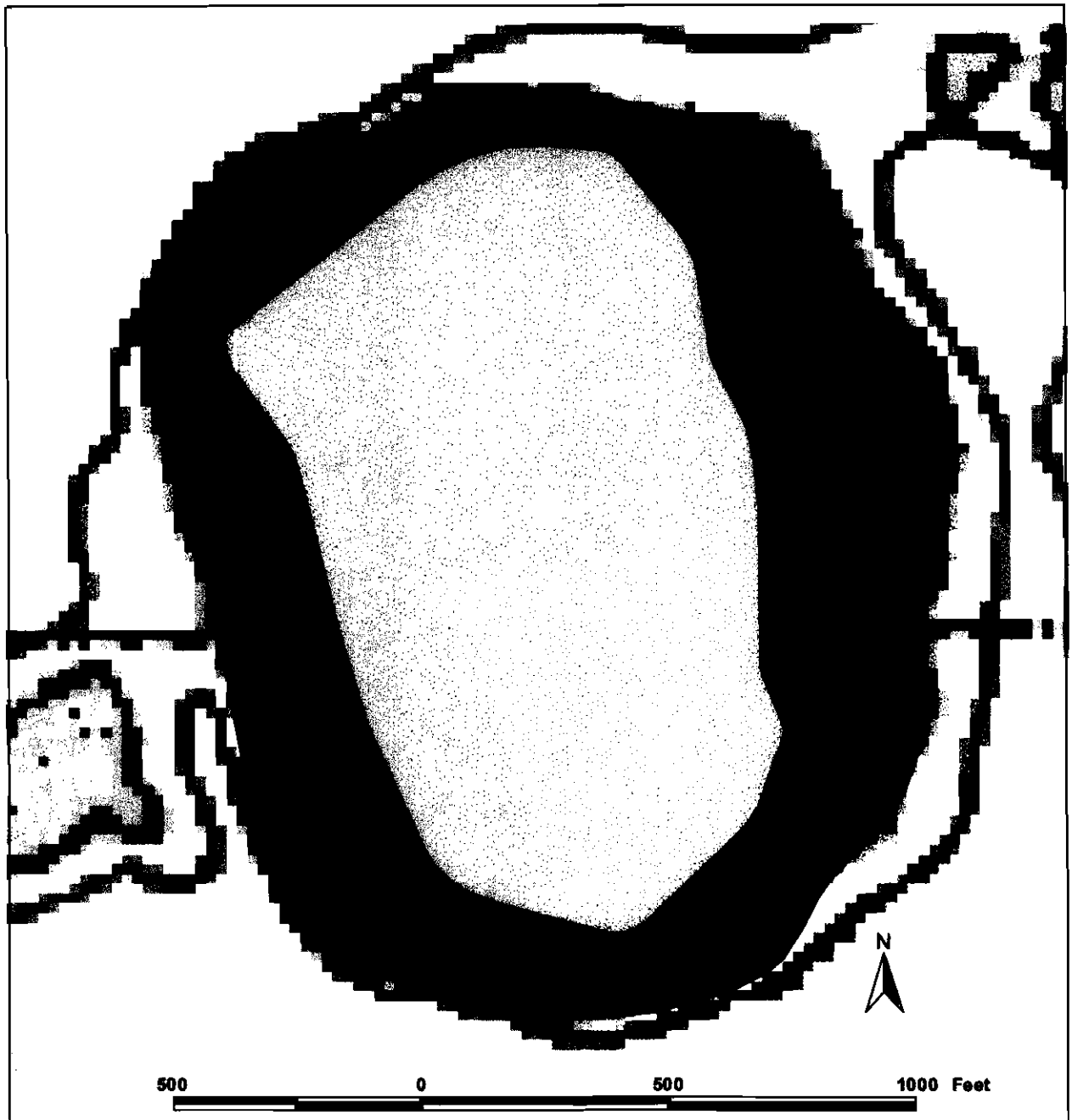
Other Names:
Location: 70.31522°N 152.61432°W
USGS Quad Sheet: Harrison Bay B-5: T11N R3W Sec. 10/15
Habitat: Tundra Lake
Area: 58.5 acres
Maximum Depth: 11.9 feet
Active Outlet: No
Calculated Volume: 79.52 million gallons
Permittable Volume: 3.19 million gallons
Potential Aggregate: 28.8 acres (water depth 4 ft or less)

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	21.0	2.6	5.2	10.0	62	155	0.5	8.09	This Study

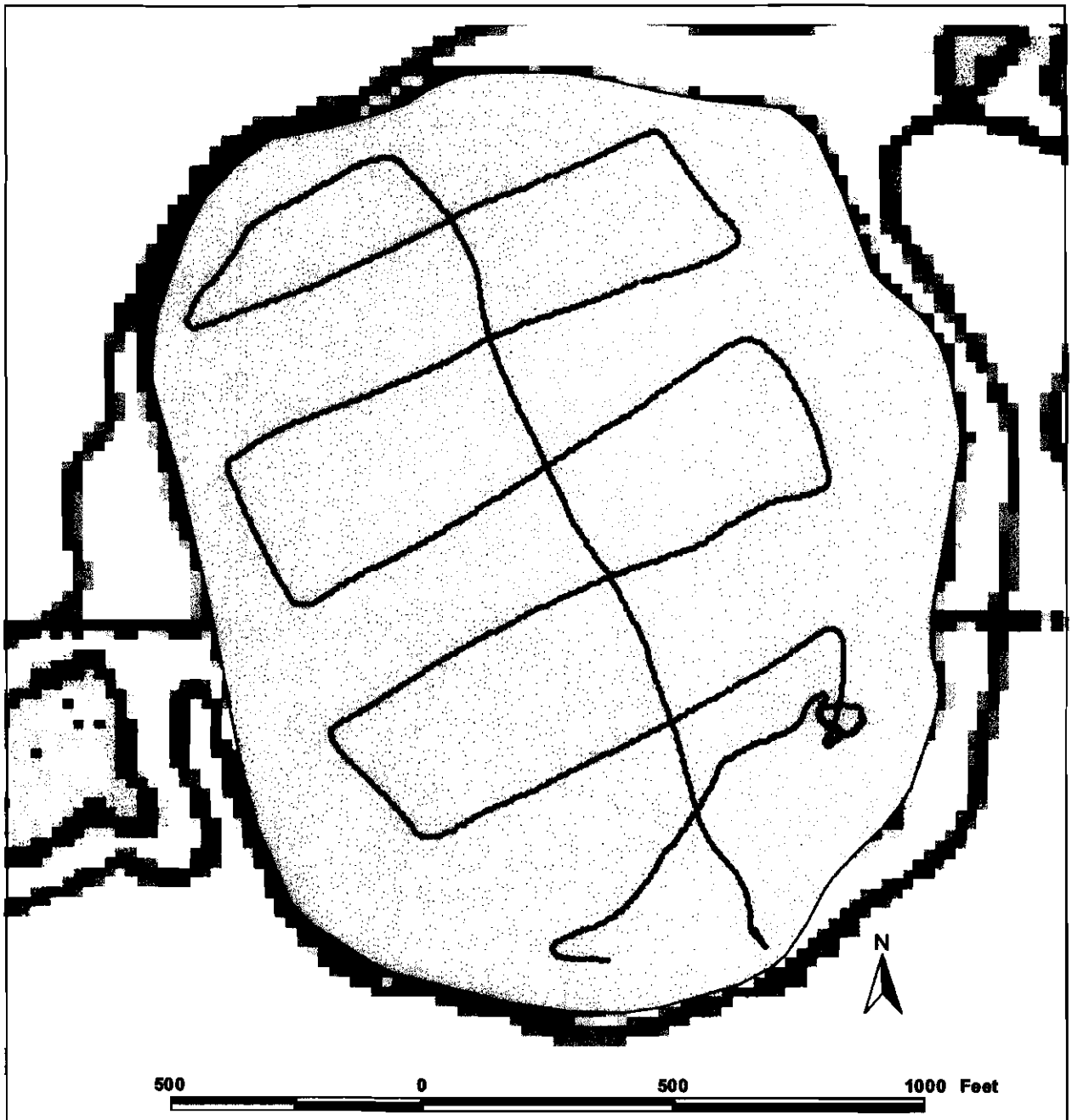
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 19 03	6.3	None	0
Minnow Trap	Jul 19 03	8.0	9spine stickleback	1
Seine	Jul 19 03	3 hauls	None	

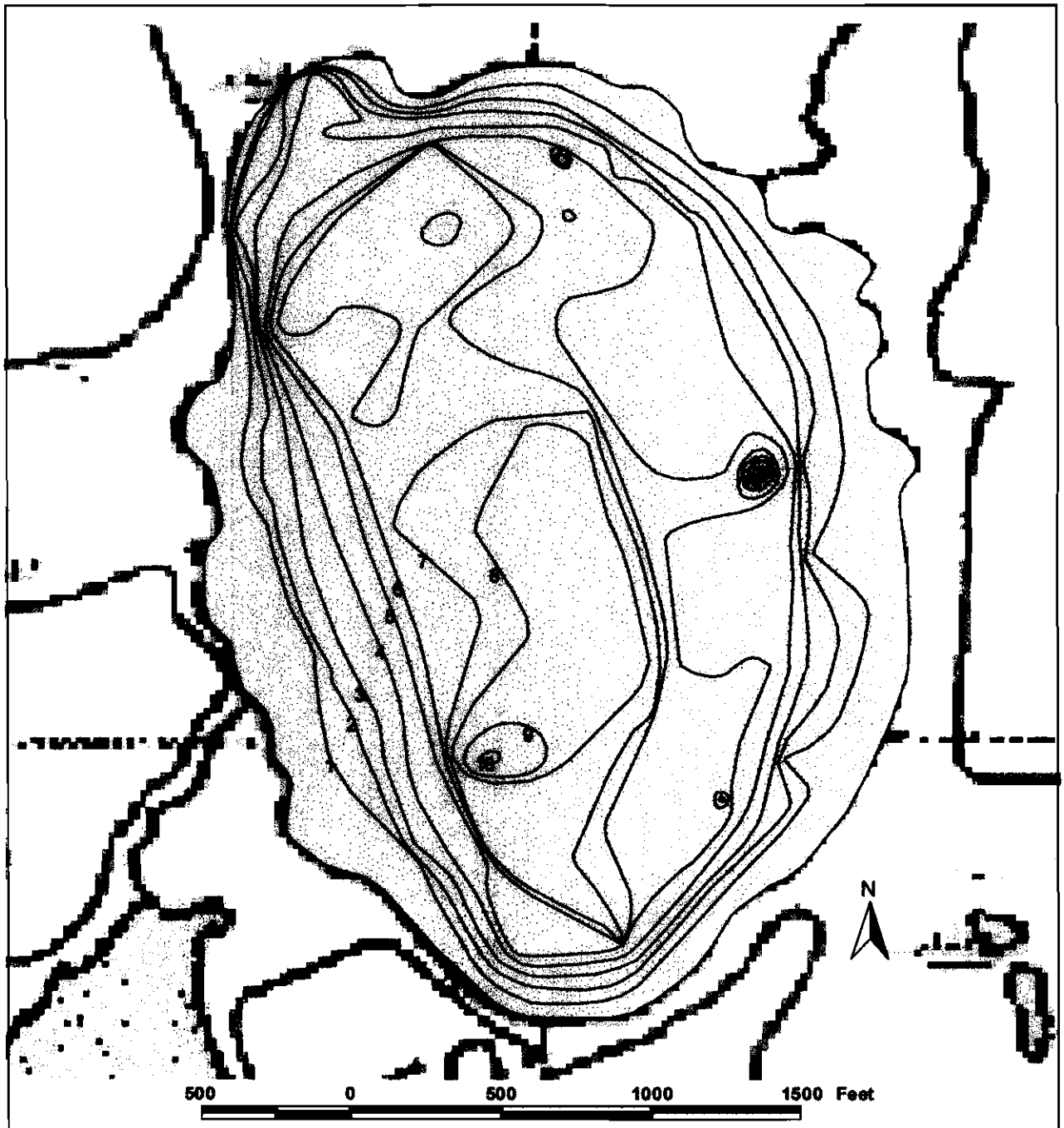


Regions of lake M0313 less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 19 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyed at lake M0313 on July 19, 2003.



Depth contours of lake M0314, based on transects surveyed on July 16, 2003
(depth intervals in 1 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0314

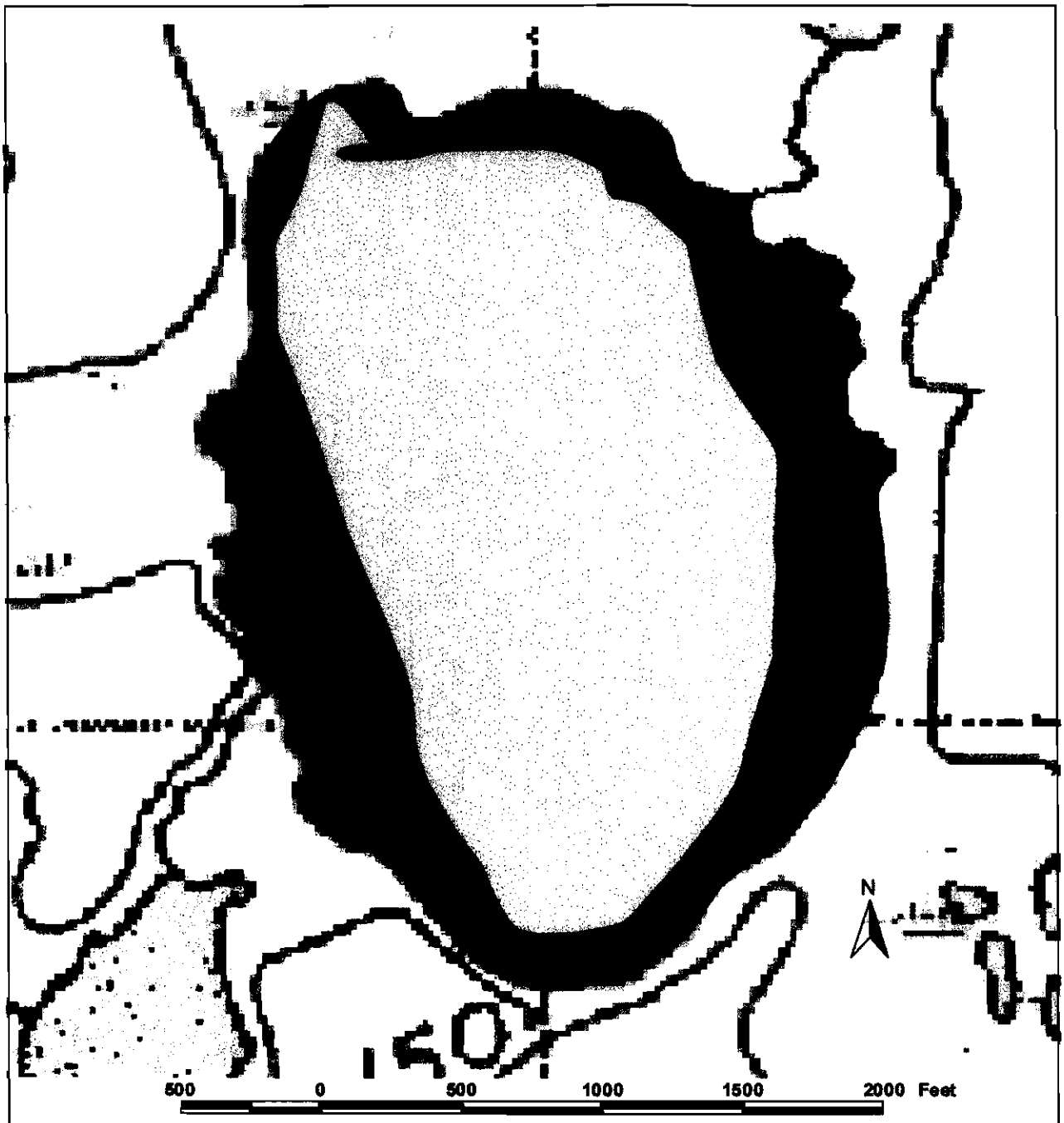
Other Names:
Location: 70.33101°N 152.59358°W
USGS Quad Sheet: Harrison Bay B-5: T11N R3W Sec. 2/3/10/11
Habitat: Tundra Lake
Area: 143.3 acres
Maximum Depth: 10.5 feet
Active Outlet: No
Calculated Volume: 205.22 million gallons
Permittable Volume: 62.41 million gallons
Potential Aggregate: 55.6 acres (water depth 4 ft or less)

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	21.0	2.1	3.5	6.6	61	140	0.7	8.10	This Study

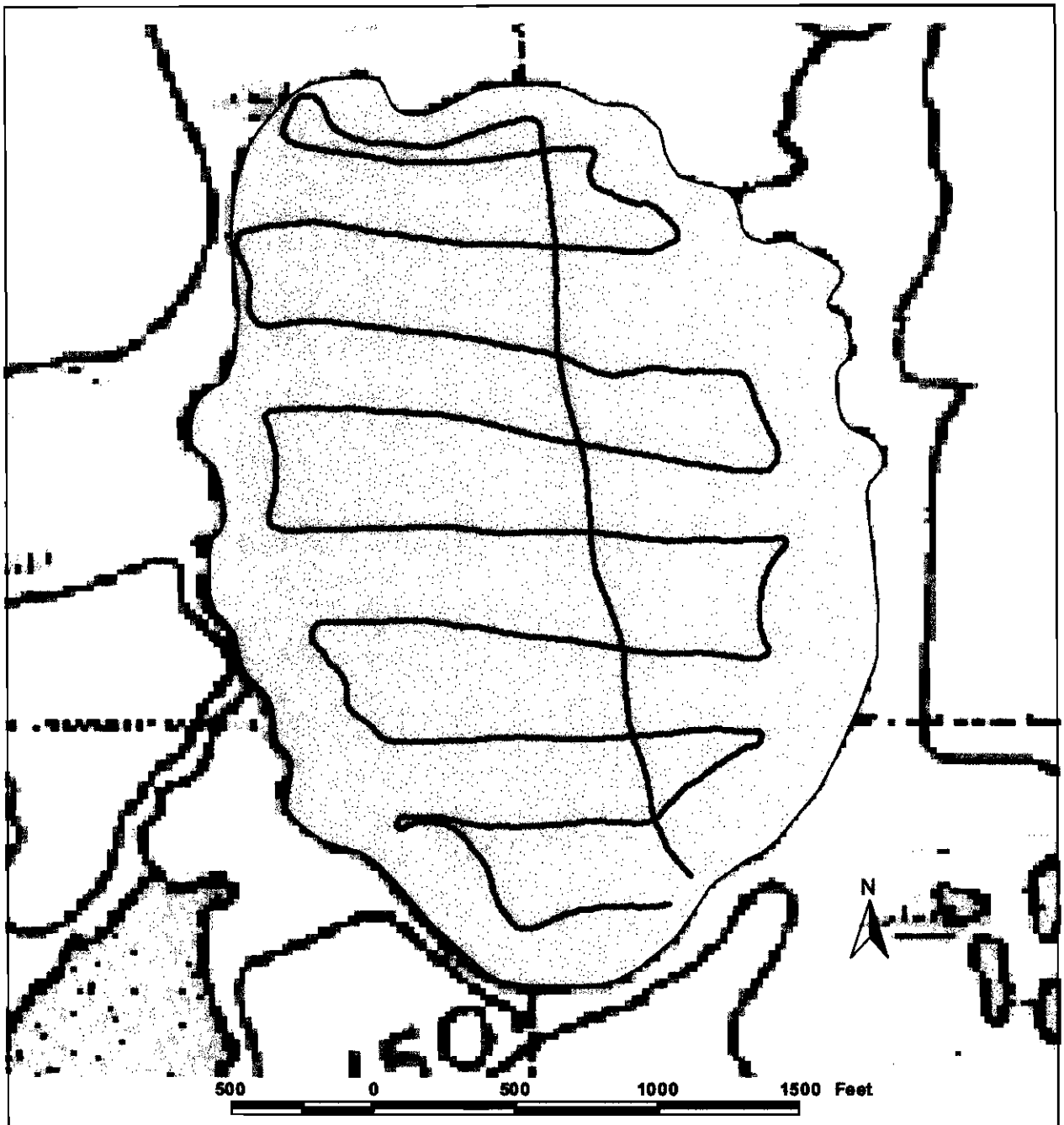
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 16 03	6.1	None	0
Minnow Trap	Jul 16 03	8.2	None	0
Seine	Jul 16 03	4 hauls	None	0

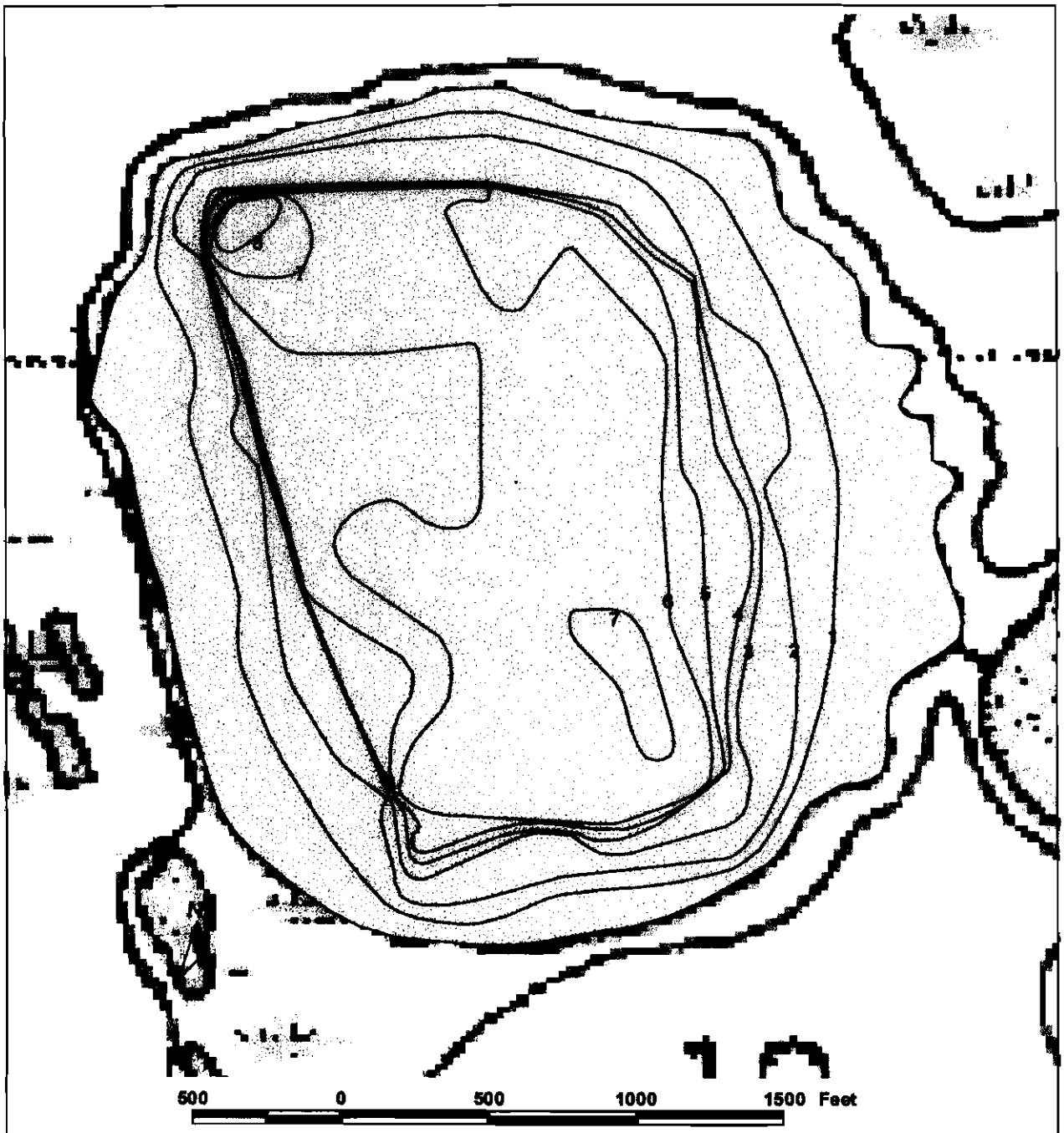


Regions of lake M0314 less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 16, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyed at lake M0314 on July 16, 2003.



Depth contours of lake M0315, based on transects surveyed on July 19, 2003
(depth intervals in 1 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0315

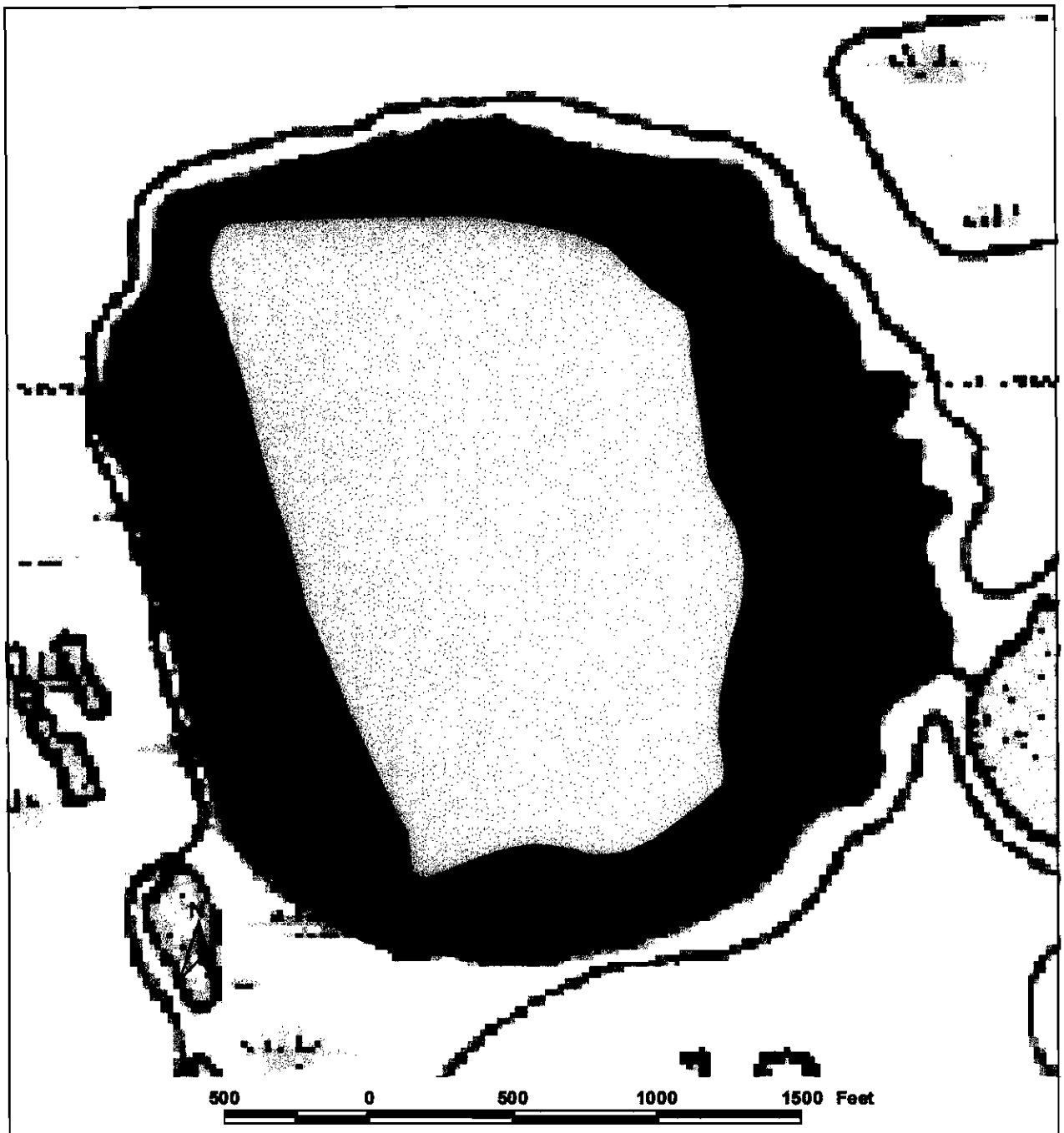
Other Names:
Location: 70.32727°N 152.62213°W
USGS Quad Sheet: Harrison Bay B-5: T11N R3W Sec. 3/10
Habitat: Tundra Lake
Area: 157.7 acres
Maximum Depth: 8.7 feet
Active Outlet: No
Calculated Volume: 185.75 million gallons
Permittable Volume: 7.86 million gallons
Potential Aggregate: 81.4 acres (water depth 4 ft or less)

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	31.0	3.5	5.9	11.0	93	209	0.6	8.29	This Study

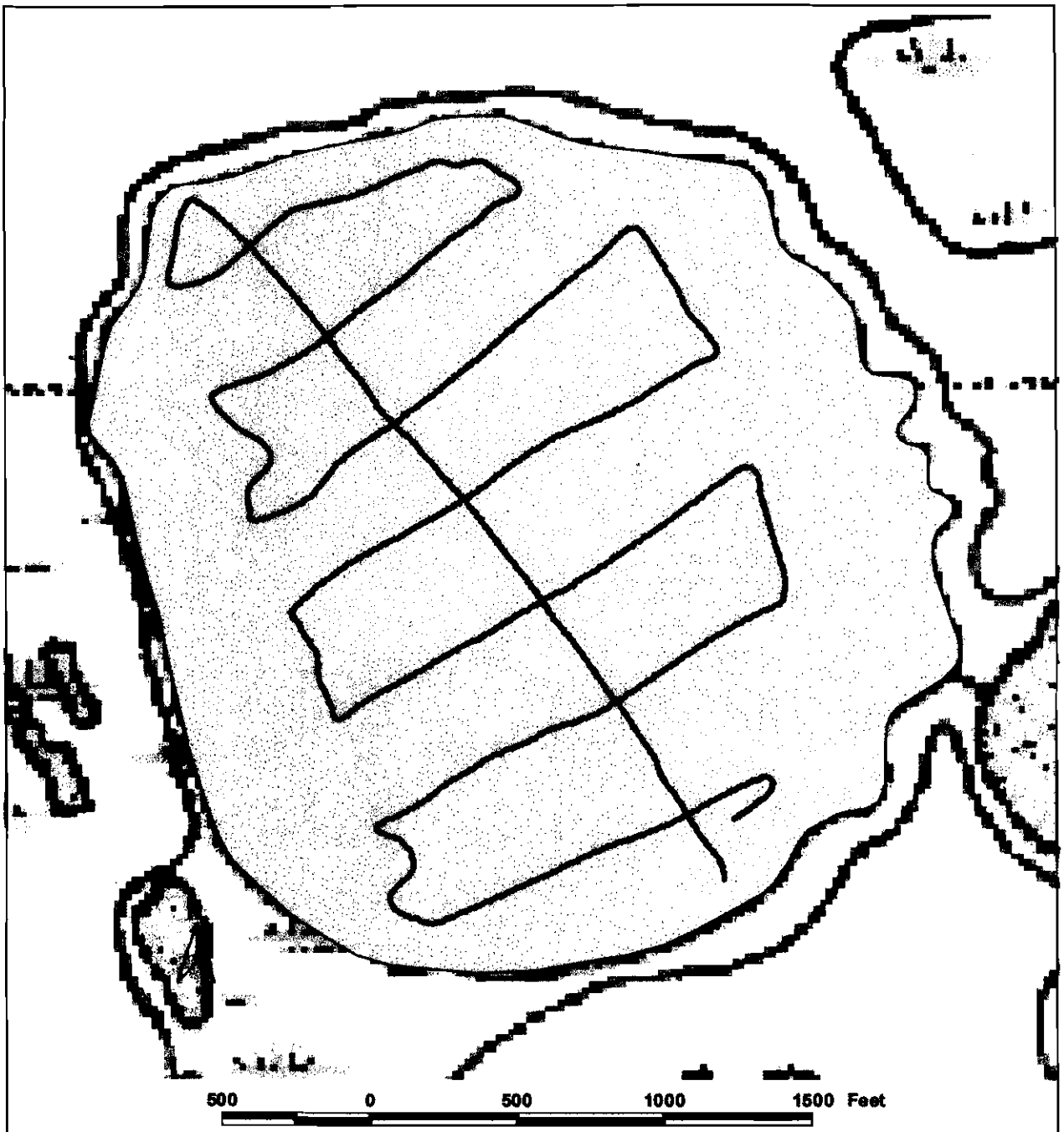
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 19 03	6.6	None	0
Minnow Trap	Jul 19 03	6.2	None	0
Seine	Jul 19 03	2 hauls	9spine stickleback	2

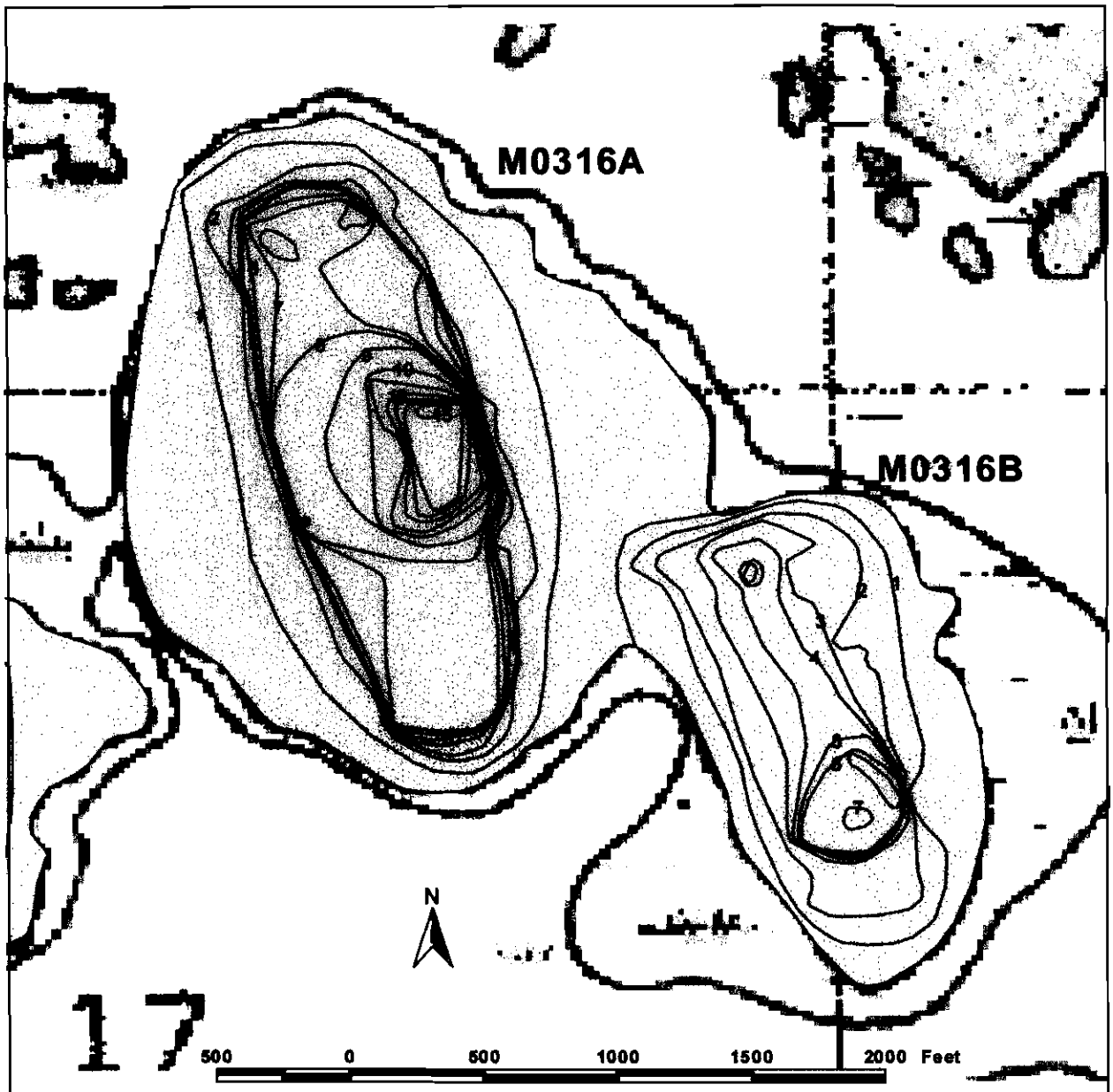


Regions of lake M0315 less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 19, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyed at lake M0315 on July 19, 2003.



Depth contours of lake M0316A and M0316B, based on transects surveyed on July 25, 2003
(depth intervals in 1 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0316

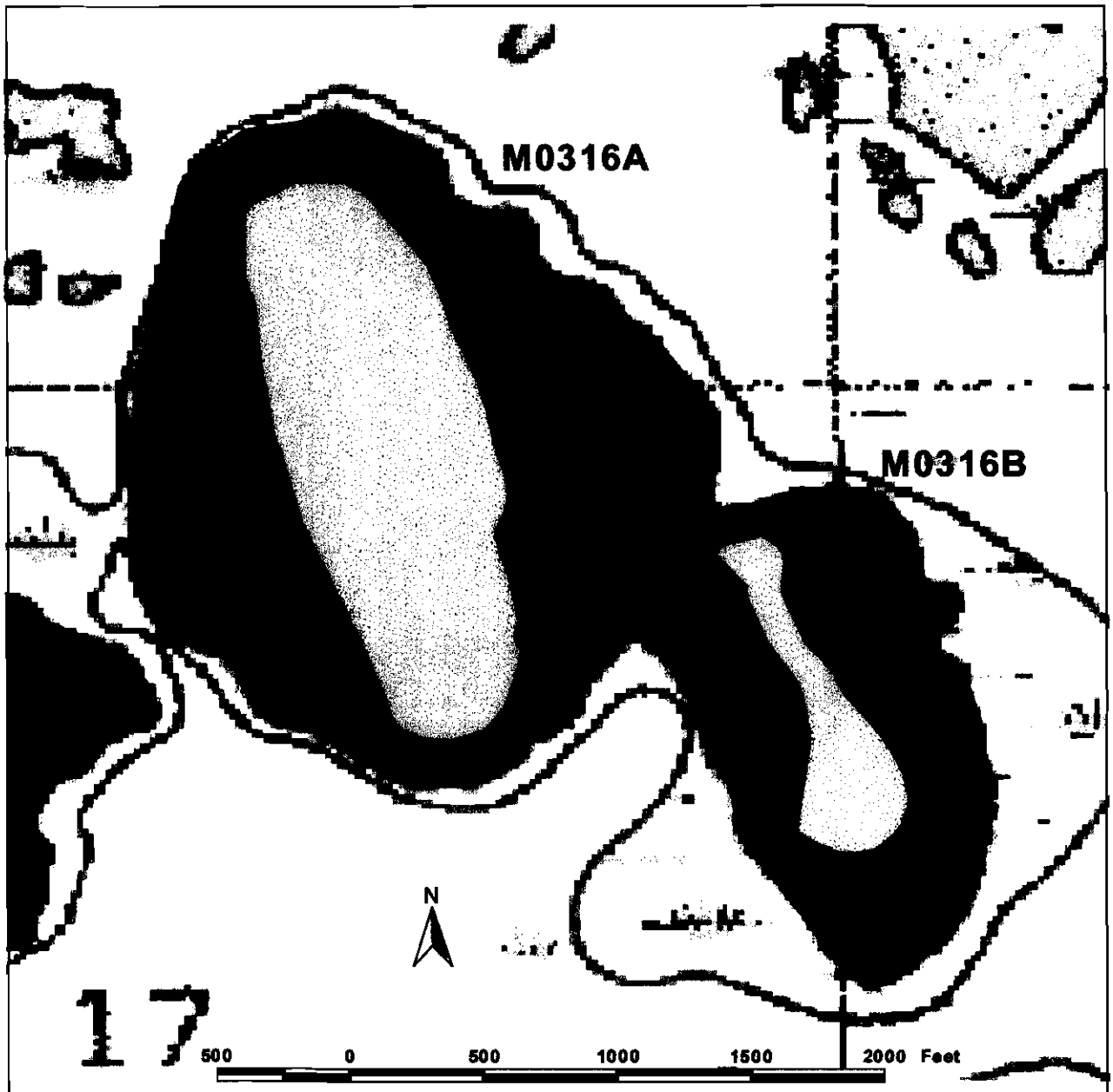
	Basin A	Basin B
Other Names:		
Location:	70.31356°N 152.69249°W	70.31082°N 152.68031°W
USGS Quad Sheet:	Harrison Bay B-5: T11N R3W Sec. 8/16/17	
Habitat:	Tundra Lake	Tundra Lake
Area:	94.7 acres	46.1 acres
Maximum Depth:	15.2 feet	7.6 feet
Active Outlet:	No	No
Calculated Volume:	114.75 million gallons	31.85 million gallons
Permittable Volume:	11.25 million gallons	0.16 million gallons
Potential Aggregate:	63.4 acres (water 4 ft or less)	35.0 acres (water 4 ft or less)

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	18.0	2.2	4.6	9.0	54	128	1.0	7.93	This Study

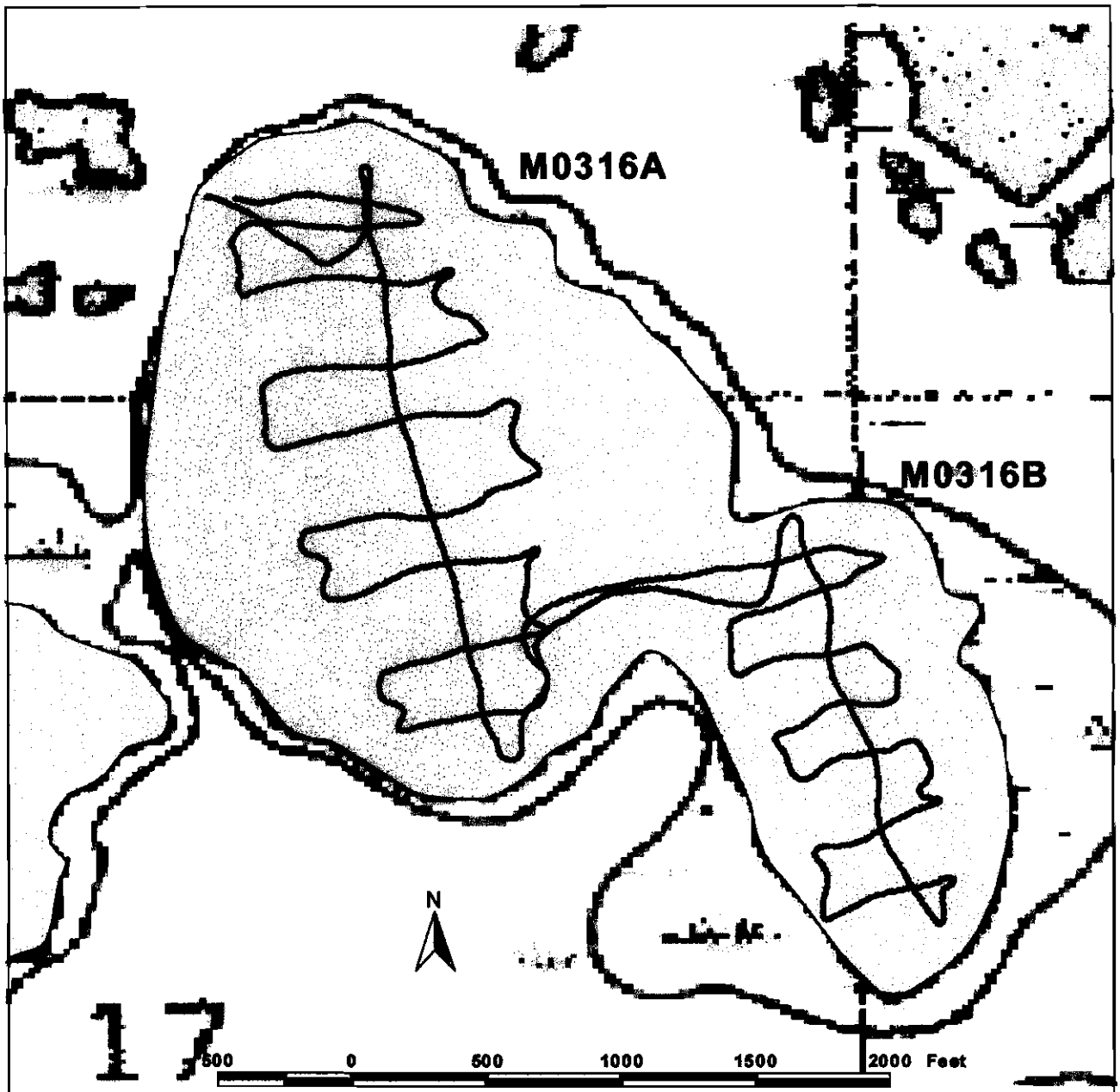
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 25 03	8.5	None	0
Minnow Trap	Jul 25 03	11.4	9spine stickleback	2
Seine		0 hauls		

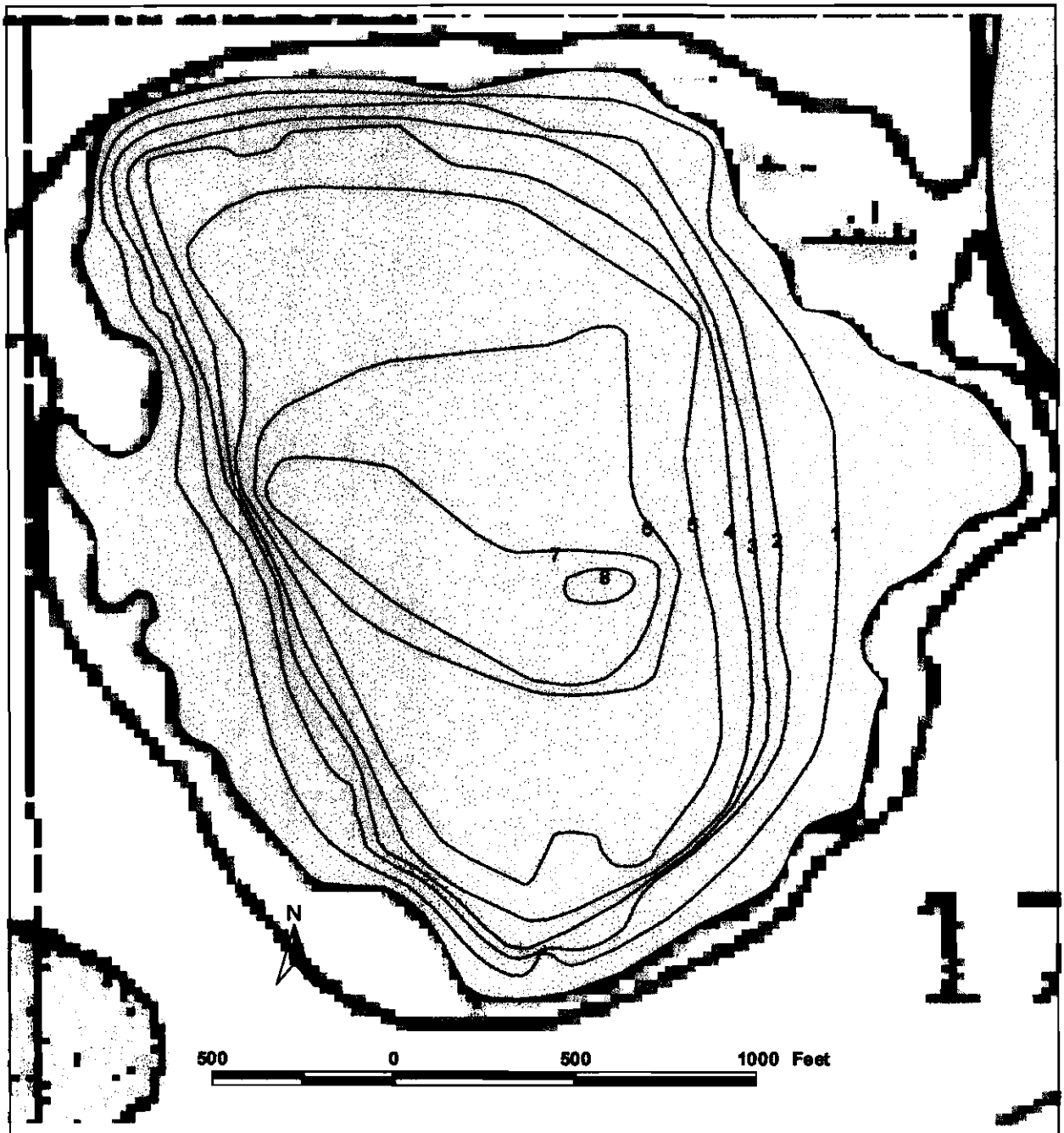


Regions of lake M0316A and M0316B less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 25, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyed at lake M0316A and M0316B on July 25, 2003.



Depth contours of lake M0317, based on transects surveyed on July 25, 2003
(depth intervals in 1 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0317

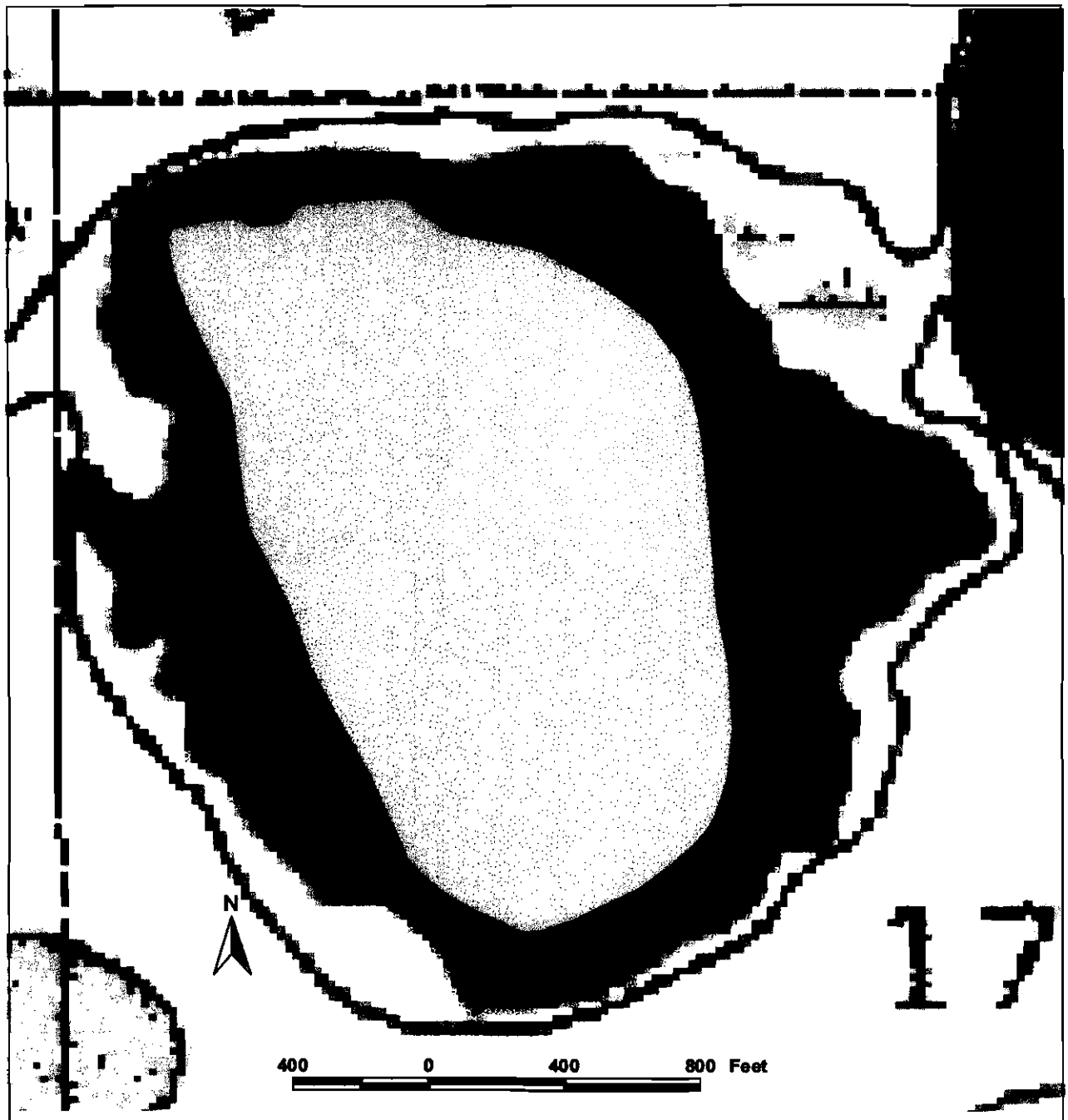
Other Names:
Location: 70.31092°N 152.71202°W
USGS Quad Sheet: Harrison Bay B-5: T11N R3W Sec. 17
Habitat: Tundra Lake
Area: 108.3 acres
Maximum Depth: 8.5 feet
Active Outlet: No
Calculated Volume: 133.41 million gallons
Permittable Volume: 4.82 million gallons
Potential Aggregate: 49.6 acres (water depth 4 ft or less)

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	26.0	2.6	4.7	9.4	75	169	1.1	8.00	This Study

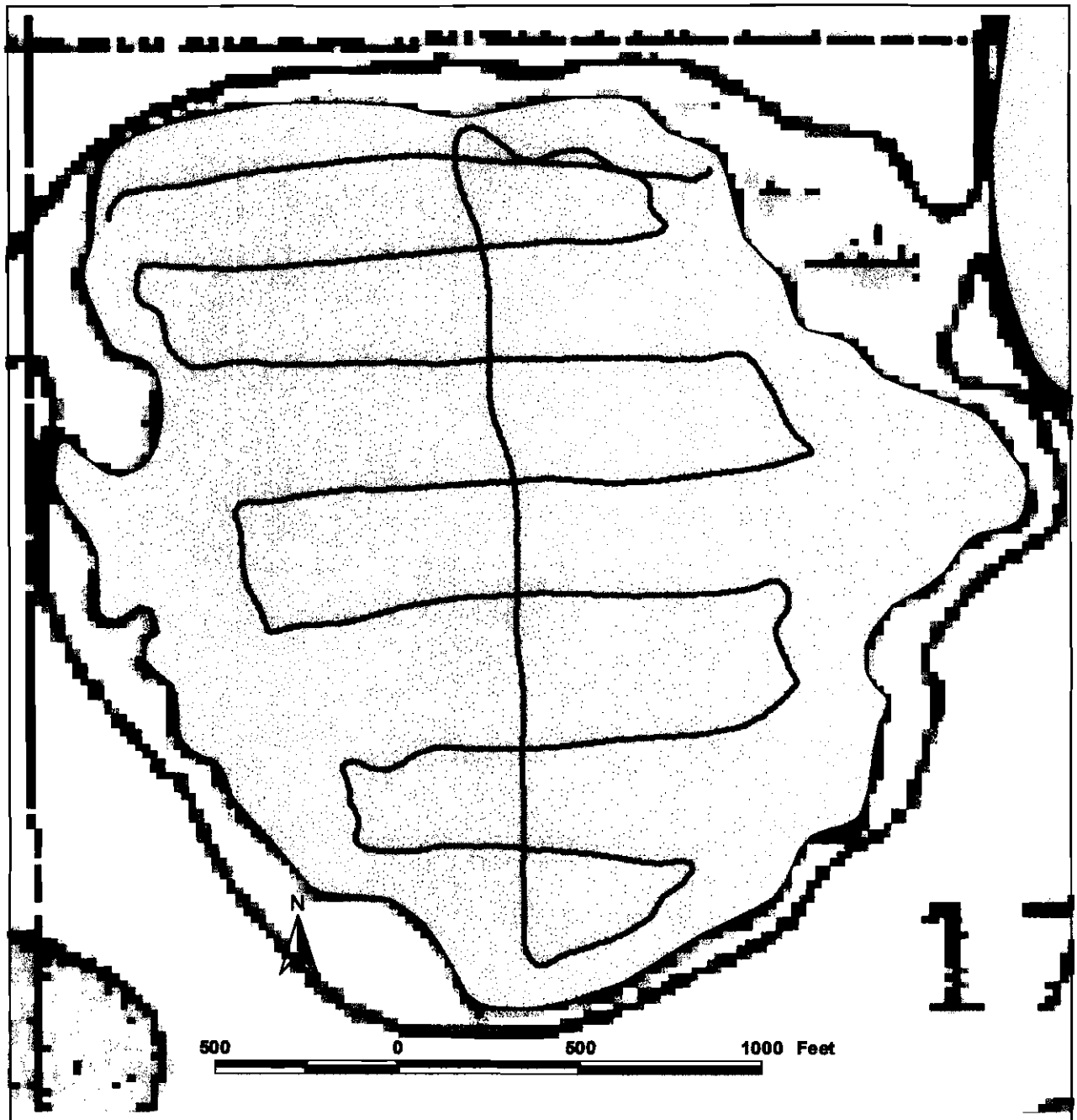
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 25 03	8.5	None	0
Minnow Trap	Jul 25 03	11.4	9spine stickleback	2
Seine		0 hauls		

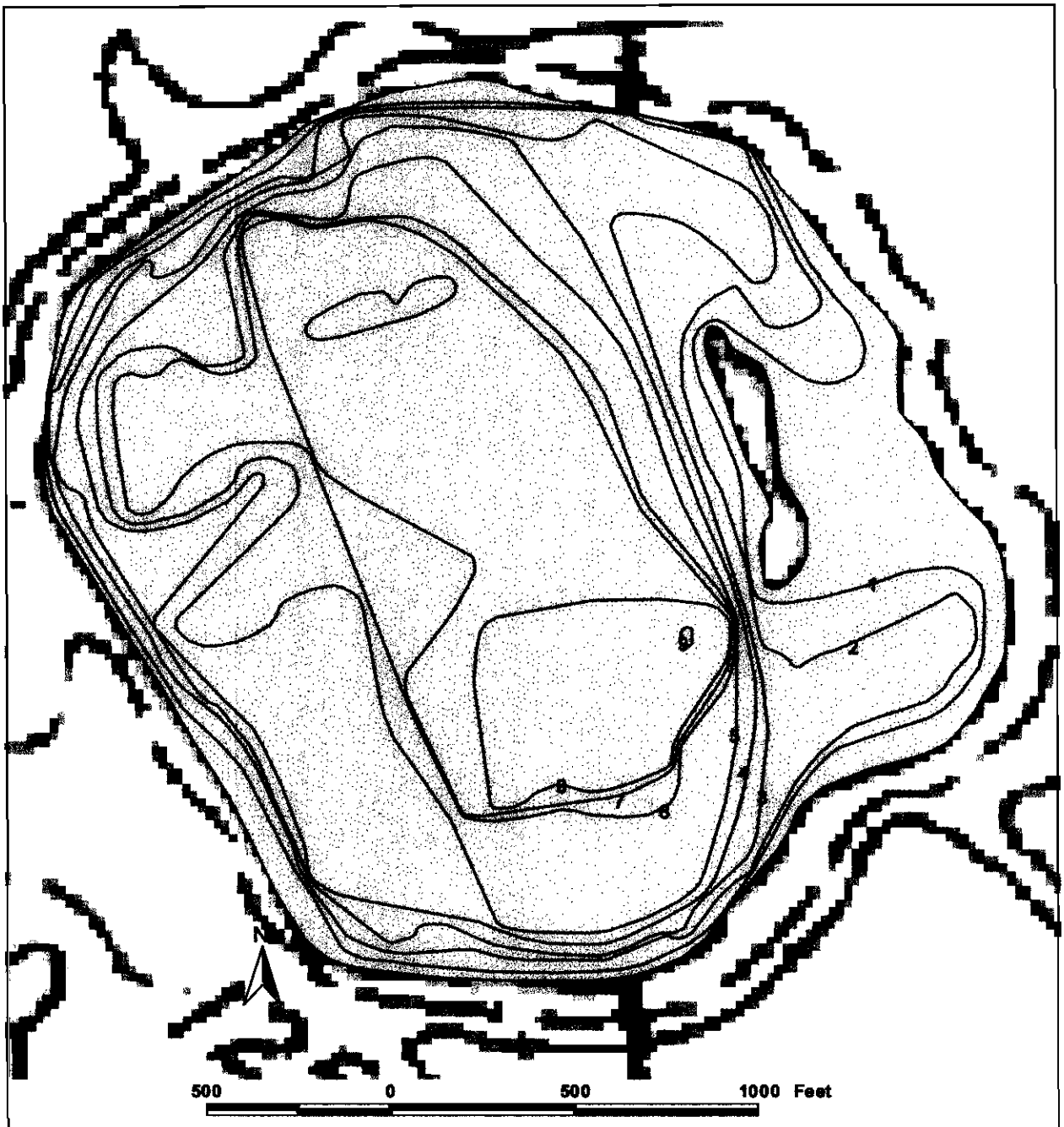


Regions of lake M0317 less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 25, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyed at lake M0317,on July 25, 2003.



Depth contours of lake M0318, based on transects surveyed on July 24, 2003
(depth intervals in 1 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0318

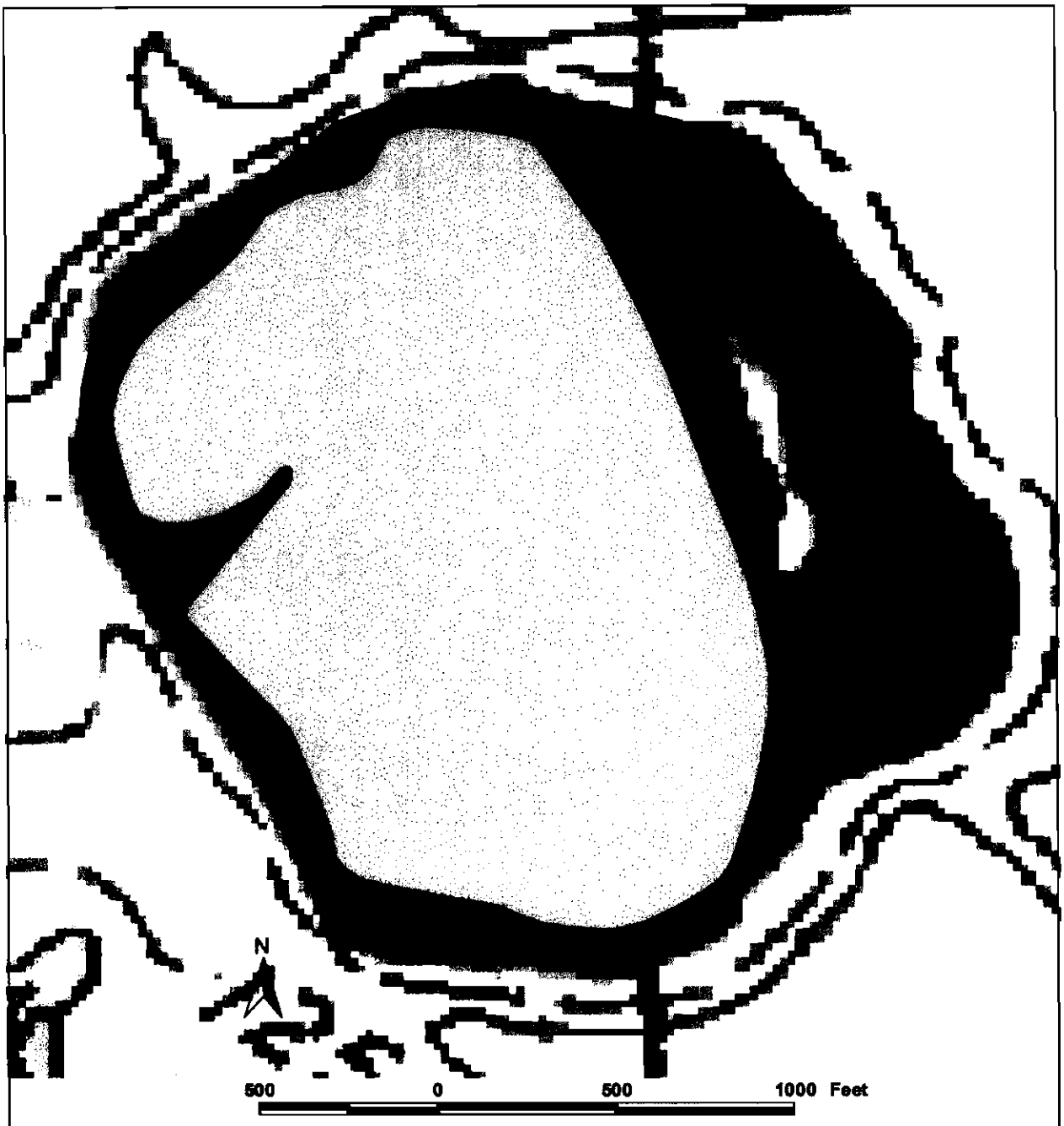
Other Names:
Location: 70.30617°N 152.76521°W
USGS Quad Sheet: Harrison Bay B-5: T11N R3W/4W Sec. 13/18
Habitat: Tundra Lake
Area: 110.7 acres
Maximum Depth: 9.6 feet
Active Outlet: No
Calculated Volume: 164.74 million gallons
Permittable Volume: 9.20 million gallons
Potential Aggregate: 43.4 acres (water depth 4 ft or less)

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	19.0	2.4	4.7	9.6	57	134	1.3	7.86	This Study

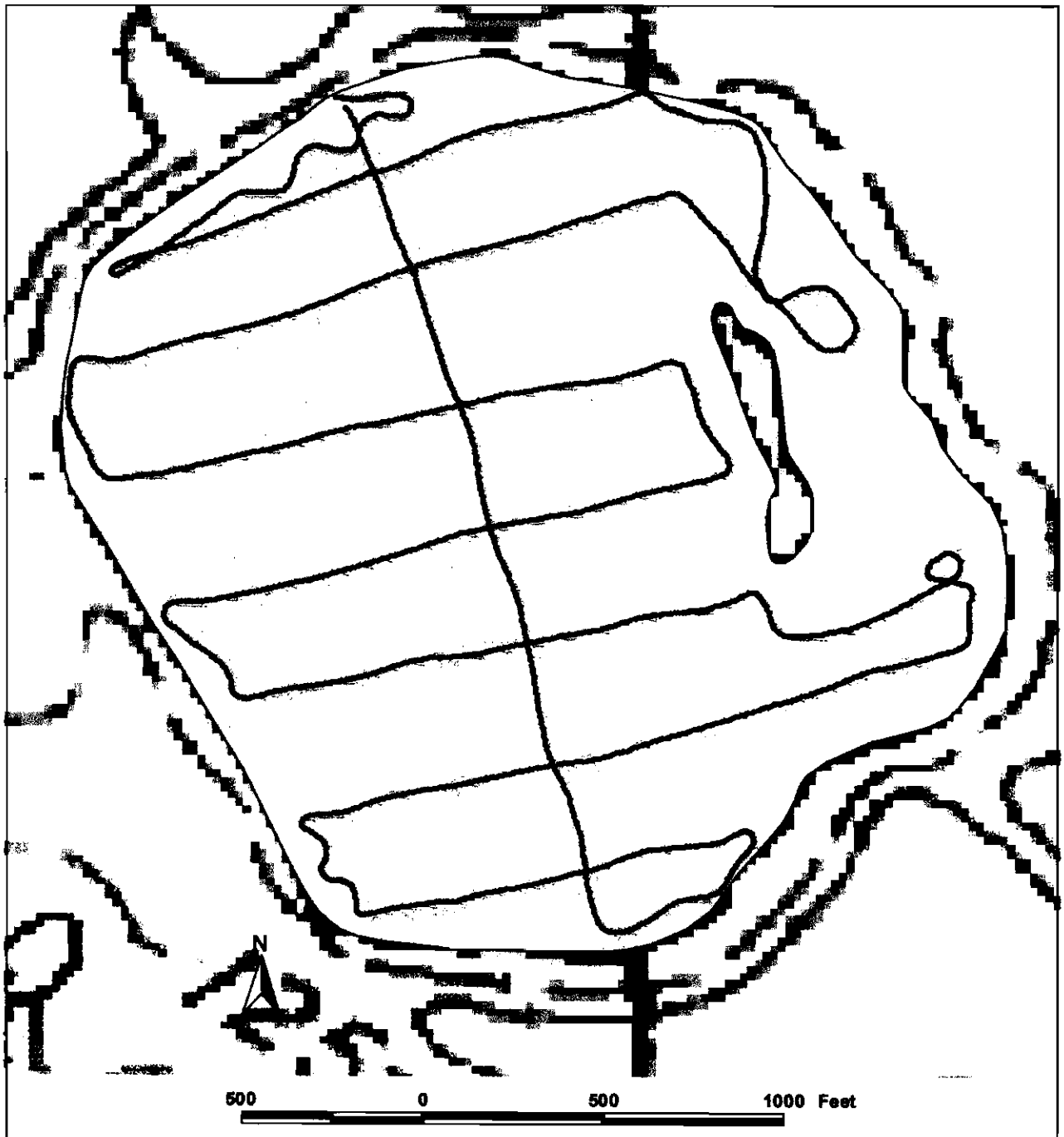
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 24 03	5.8	None	0
Minnow Trap	Jul 24 03	3.7	9spine stickleback	2
Seine		0 hauls		

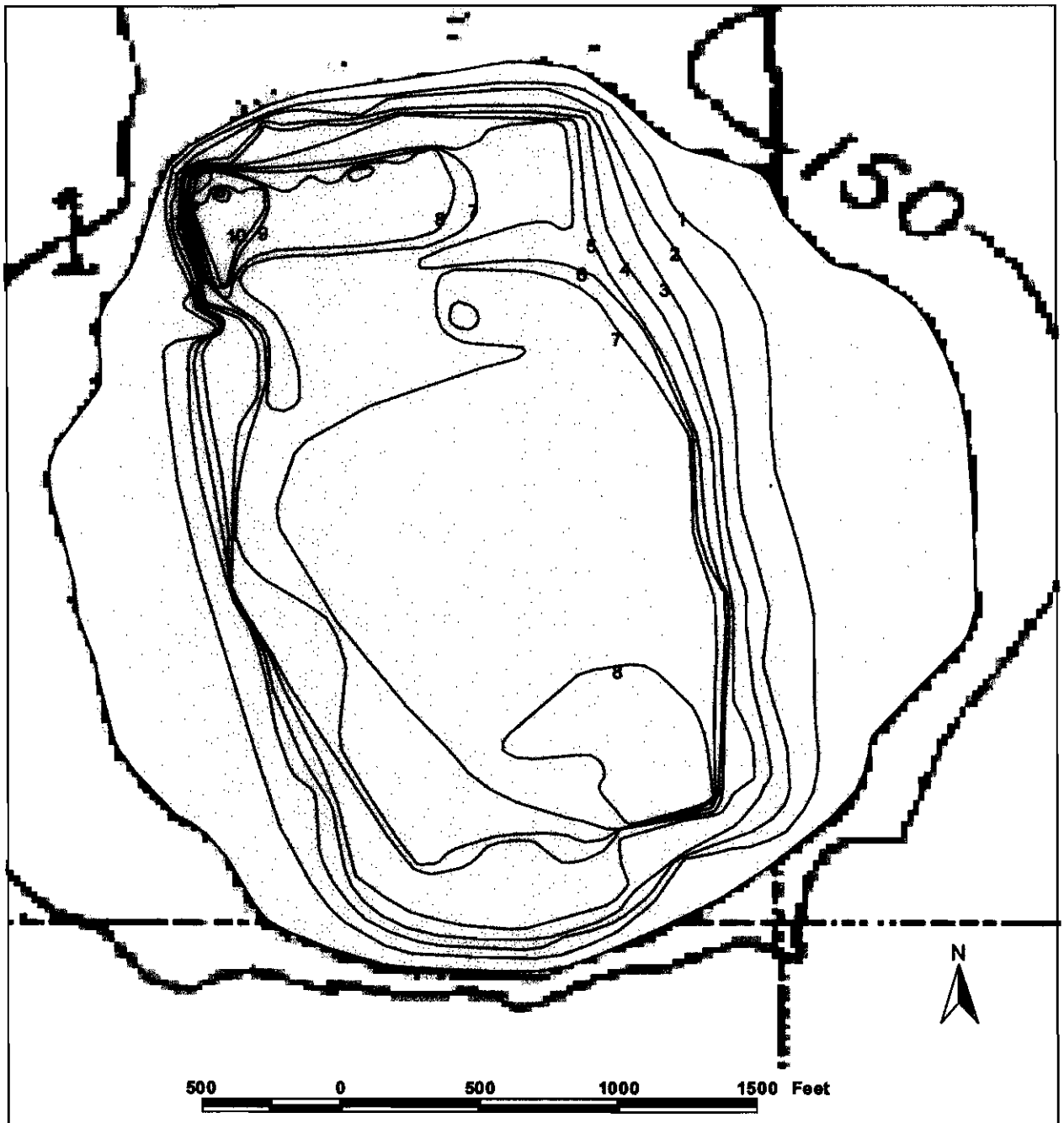


Regions of lake M0318 less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 24, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyed at lake M0318 on July 24, 2003.



Depth contours of lake M0319, based on transects surveyed on July 24, 2003
(depth intervals in 1 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0319

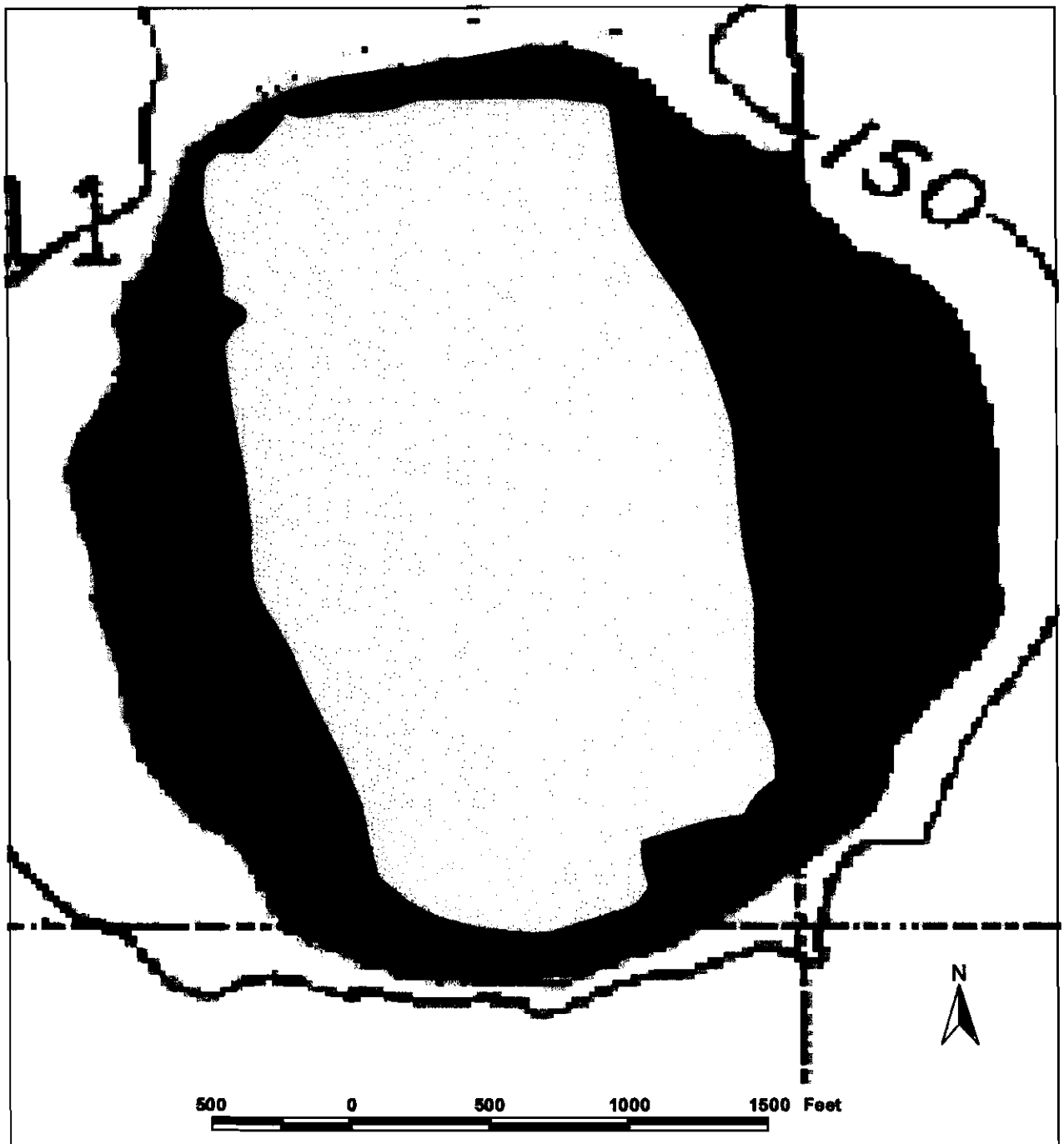
Other Names:
Location: 70.31872°N 152.81360°W
USGS Quad Sheet: Harrison Bay B-5: T11N R4W Sec. 11/12
Habitat: Tundra Lake
Area: 202.4 acres
Maximum Depth: 12.5 feet
Active Outlet: No
Calculated Volume: 278.72 million gallons
Permittable Volume: 20.32 million gallons
Potential Aggregate: 93.0 acres (water depth 4 ft or less)

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	25.0	2.3	3.8	7.3	72	157	0.7	8.15	This Study

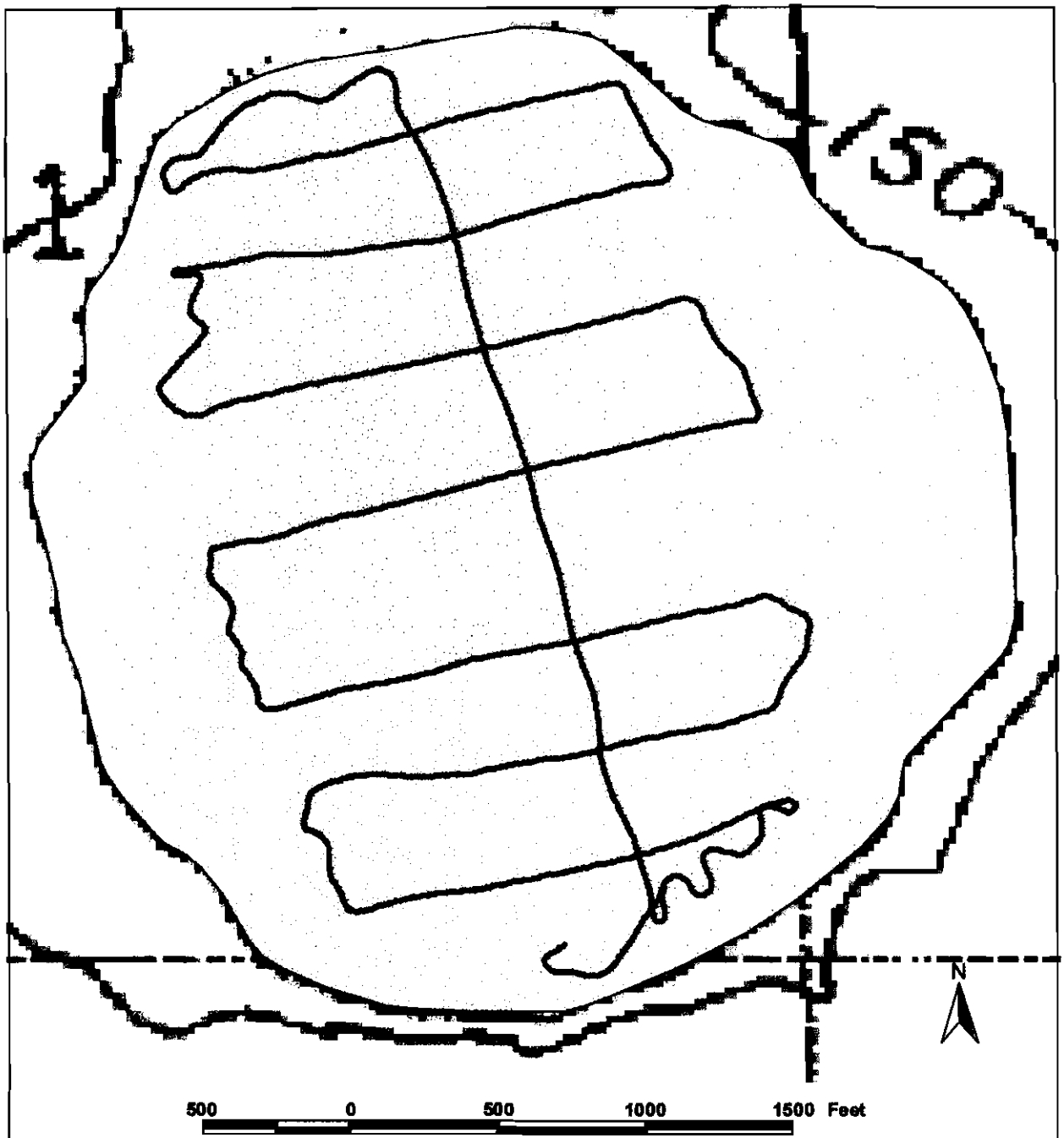
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 24 03	5.5	None	0
Minnow Trap	Jul 24 03	4.0	9spine stickleback	7
Seine		0 hauls		

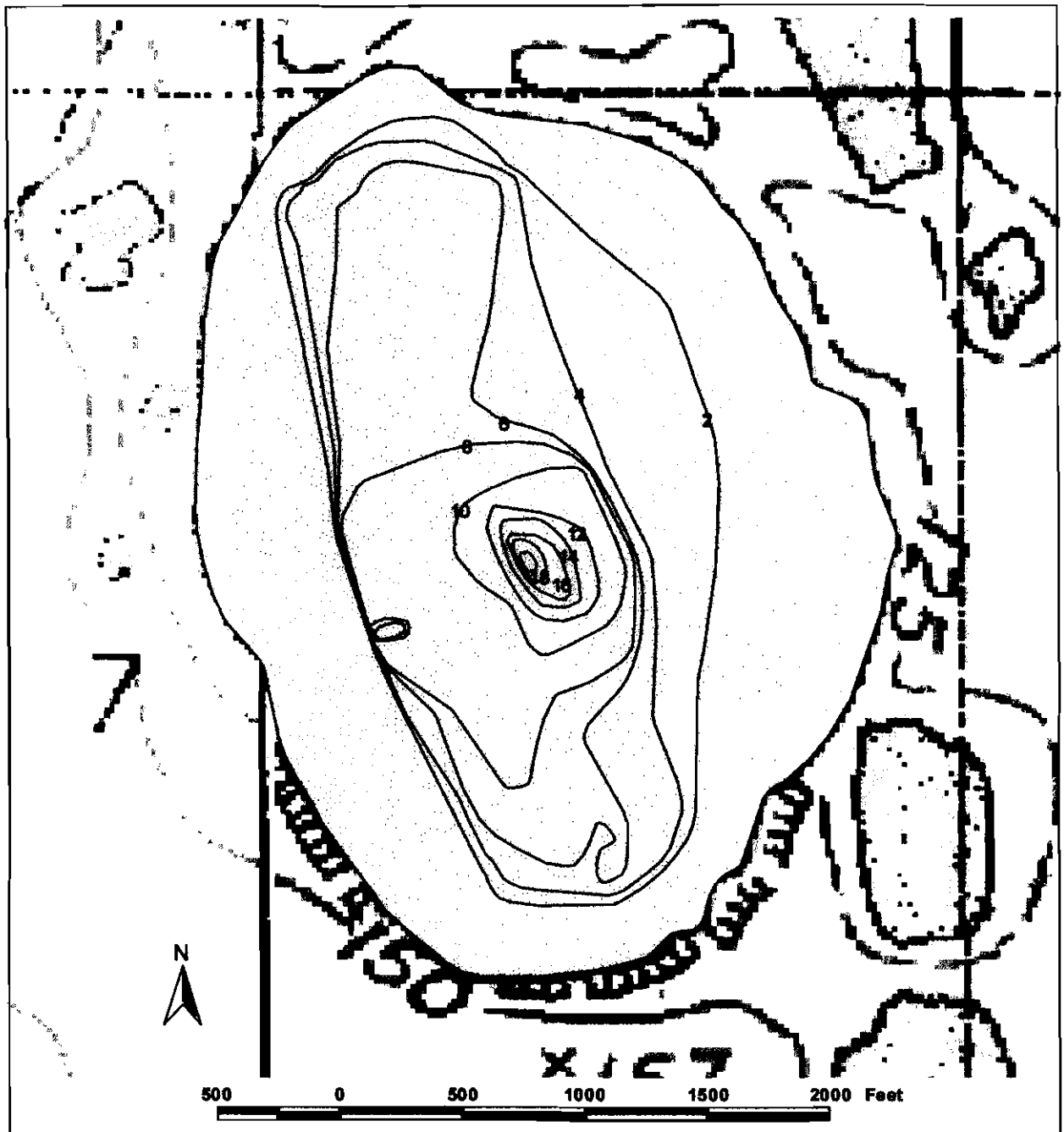


Regions of lake M0319 less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 24, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyed at lake M0319 on July 24, 2003.



Depth contours of lake M0320, based on transects surveyed on July 20, 2003
(depth intervals in 2 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0320

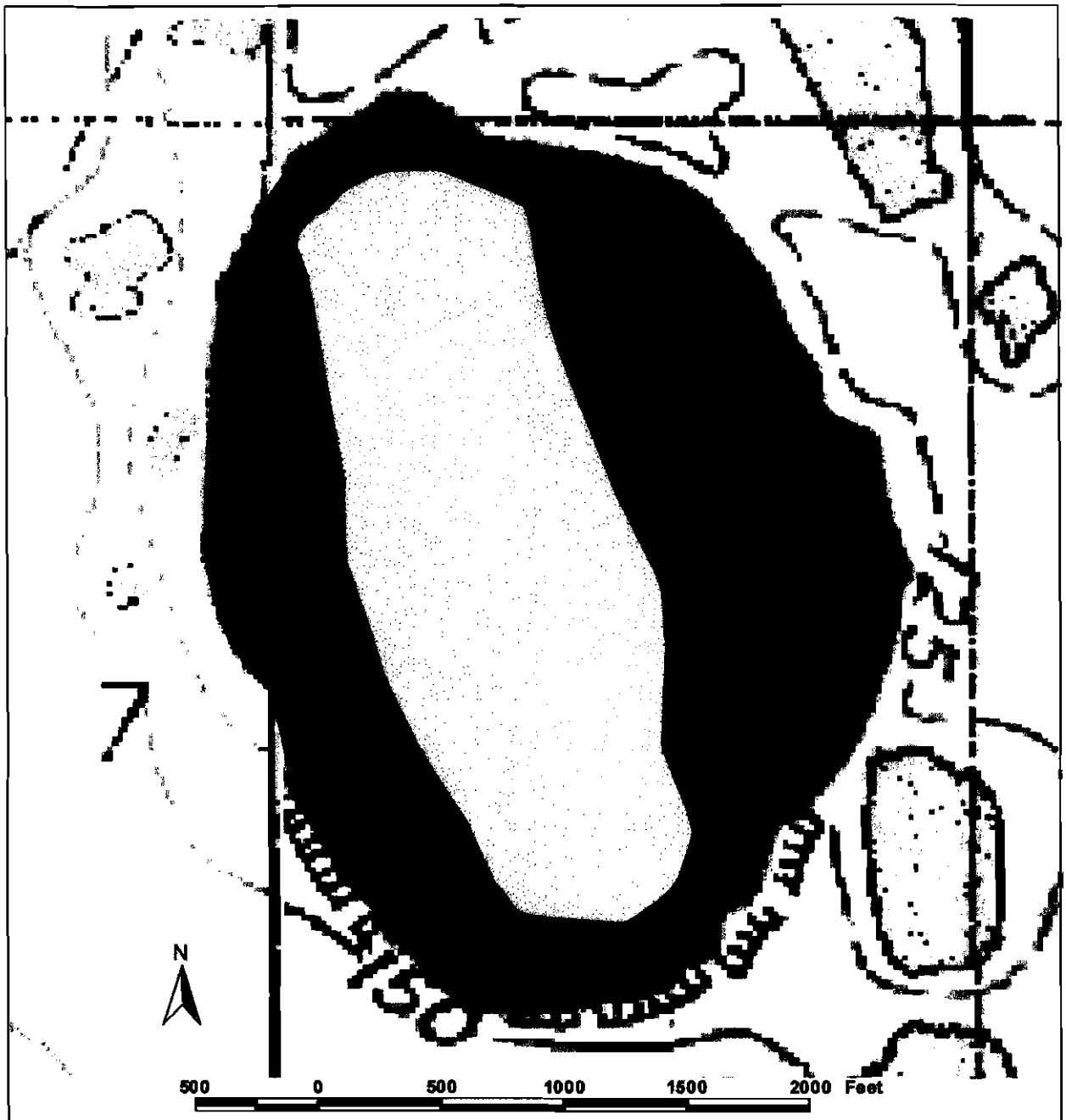
Other Names:
Location: 70.32398°N 152.99086°W
USGS Quad Sheet: Harrison Bay B-5: T11N R4W Sec. 7
Habitat: Tundra Lake
Area: 188.0 acres
Maximum Depth: 20.5 feet
Active Outlet: No
Calculated Volume: 235.11 million gallons
Permittable Volume: 15.45 million gallons
Potential Aggregate: 113.6 acres (water depth 4 ft or less)

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	30.0	2.7	4.2	7.2	87	193	2.1	8.32	This Study

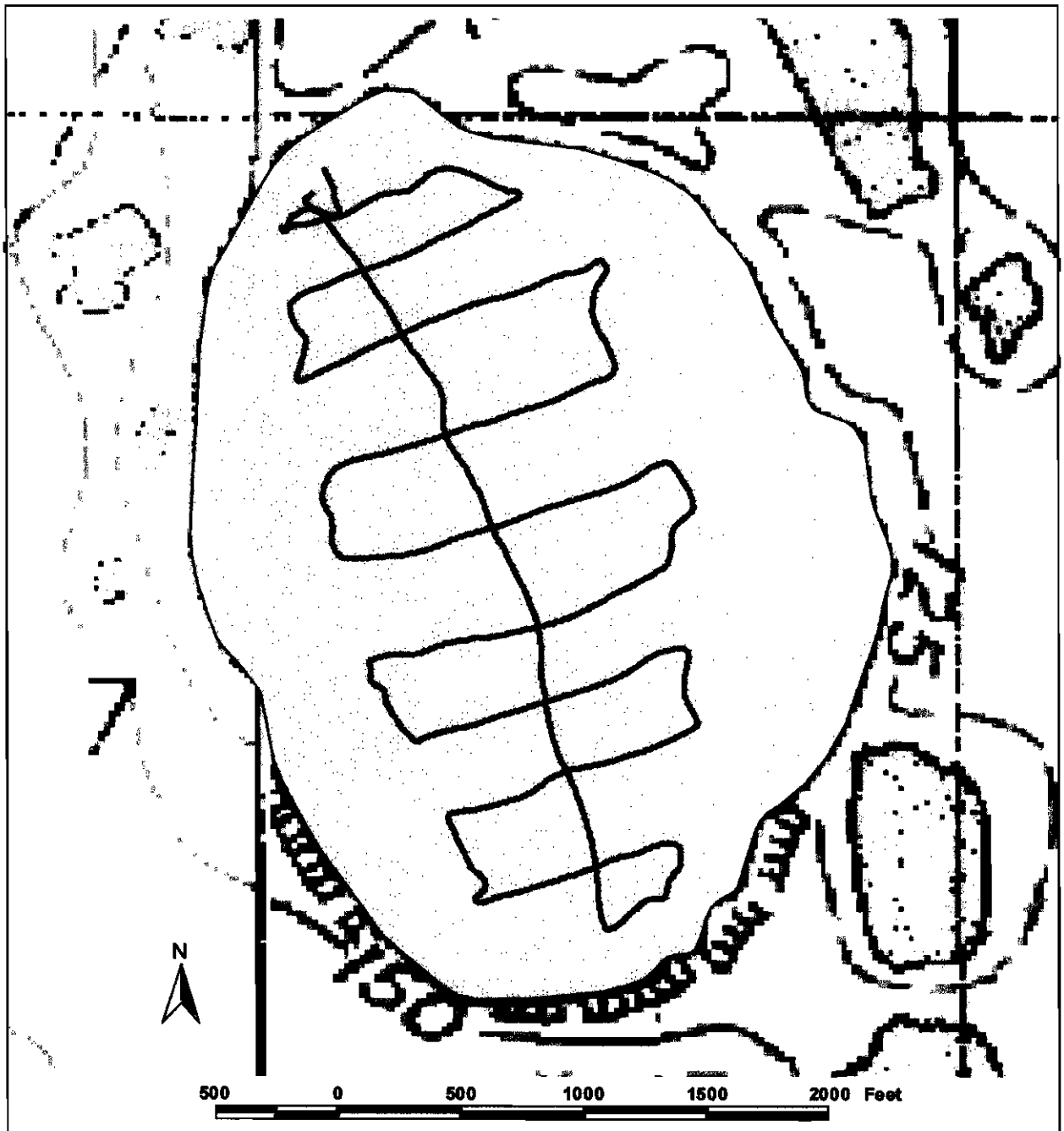
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 20 03	6.5	None	0
Minnow Trap	Jul 20 03	4.6	9spine stickleback	1
Seine	Jul 20 03	2 hauls	9spine stickleback	1

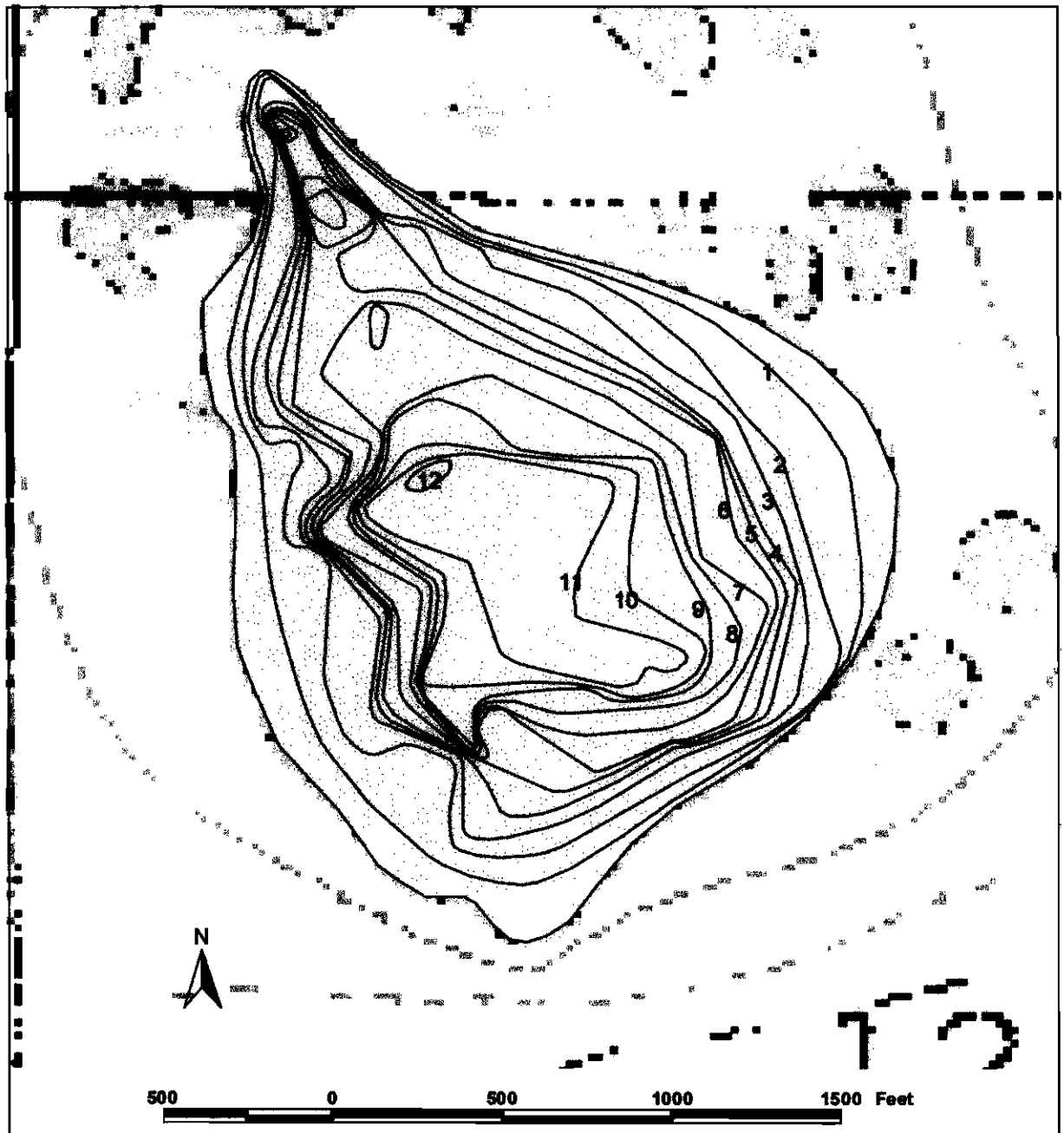


Regions of lake M0320 less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 20, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyed at lake M0320 on July 20, 2003.



Depth contours of lake M0321, based on transects surveyed on July 23, 2003
(depth intervals in 1 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0321

Other Names:
Location: 70.32621°N 153.04762°W
USGS Quad Sheet: Teshekpuk B-1: T11N R5W Sec. 12
Habitat: Tundra Lake
Area: 78.3 acres
Maximum Depth: 12.3 feet
Active Outlet: No
Calculated Volume: 131.87 million gallons
Permittable Volume: 12.91 million gallons
Potential Aggregate: 36.1 acres (water depth 4 ft or less)

Water Chemistry:

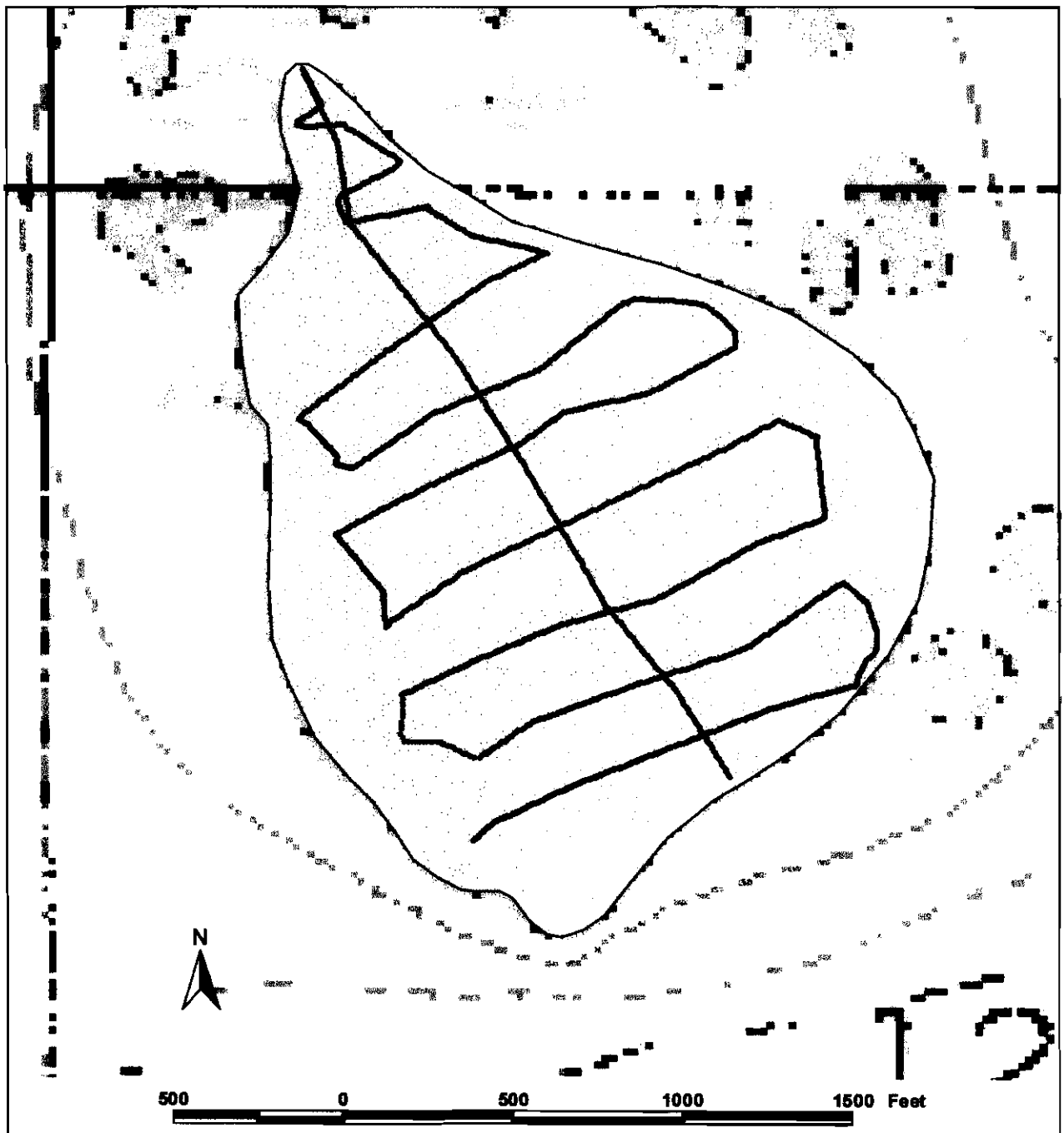
Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	9.0	1.0	1.9	3.3	27	63	0.6	7.78	This Study

Catch Record:

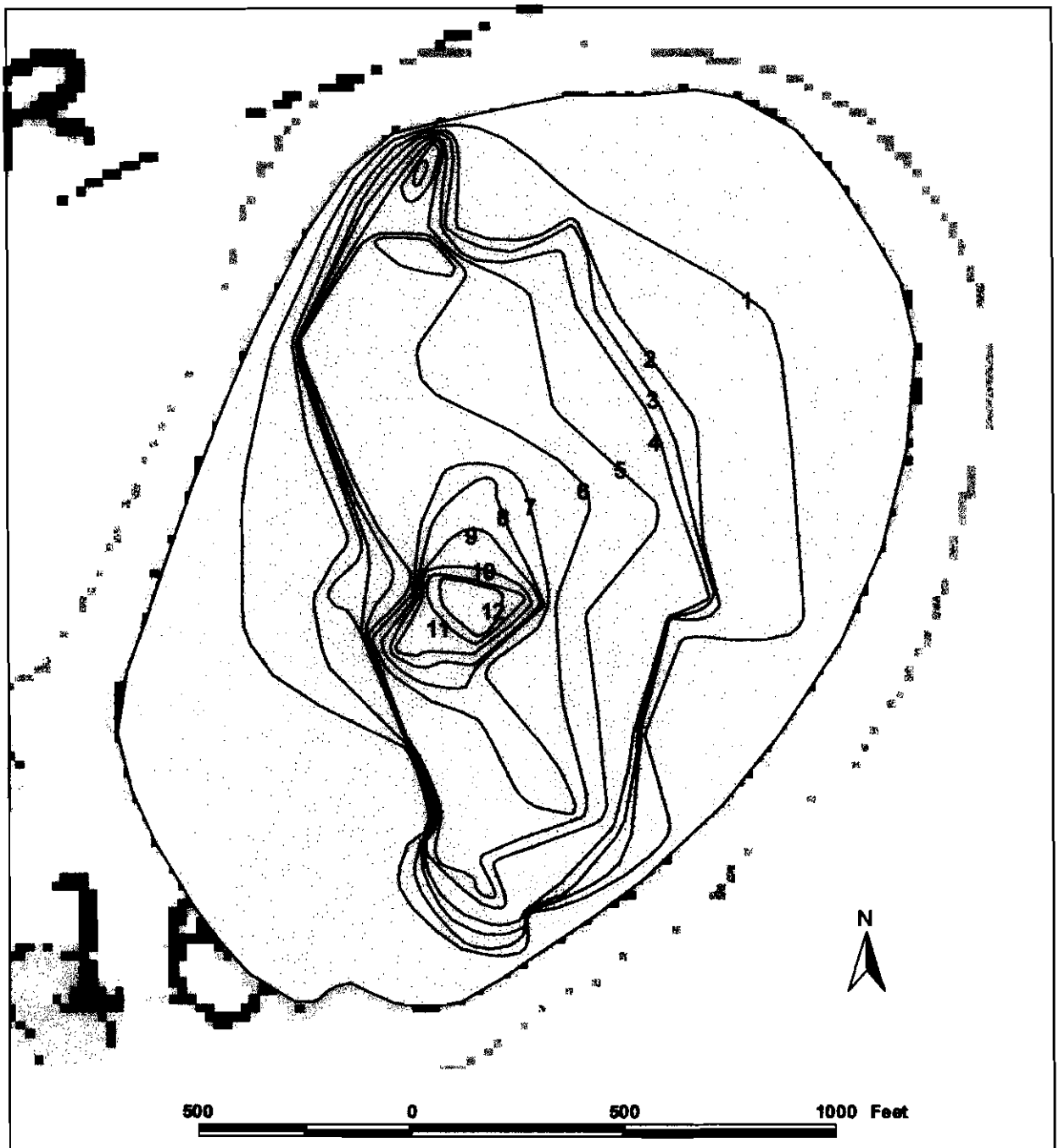
Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 23 03	6.9	None	0
Minnow Trap	Jul 23 03	0.0		
Seine	Jul 23 03	0 hauls	9spine stickleback	observed

Regions of lake M0321 less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 23, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyed at lake M0321 on July 23, 2003.



Depth contours of lake M0322, based on transects surveyed on July 22, 2003
(depth intervals in 1 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0322

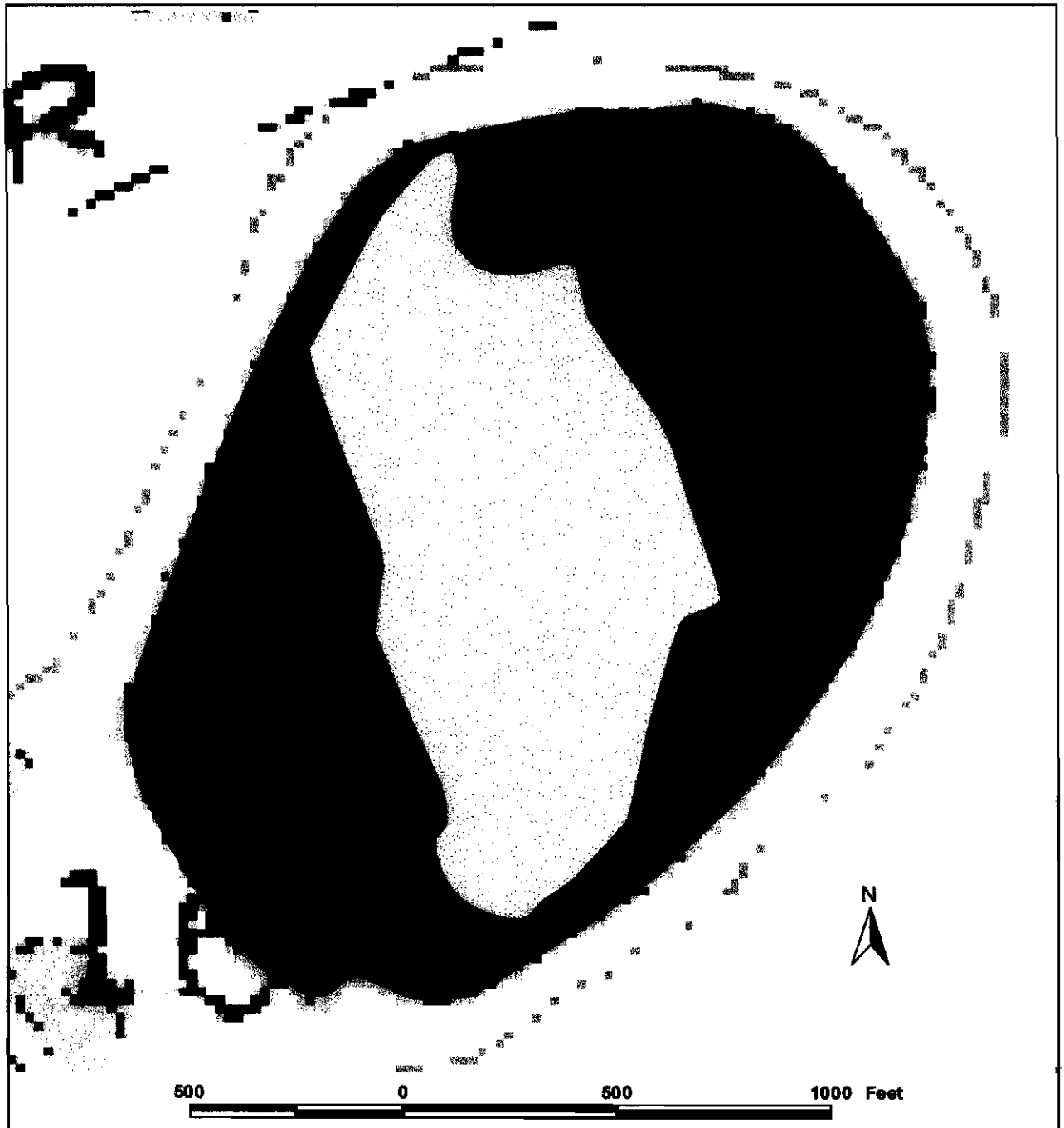
Other Names:
Location: 70.31017°N 153.15995°W
USGS Quad Sheet: Teshekpuk B-1: T11N R5W Sec. 16
Habitat: Tundra Lake
Area: 68.7 acres
Maximum Depth: 13.1 feet
Active Outlet: No
Calculated Volume: 63.00 million gallons
Permittable Volume: 3.14 million gallons
Potential Aggregate: 44.8 acres (water depth 4 ft or less)

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	19.0	2.1	2.7	4.7	57	124	0.8	8.13	This Study

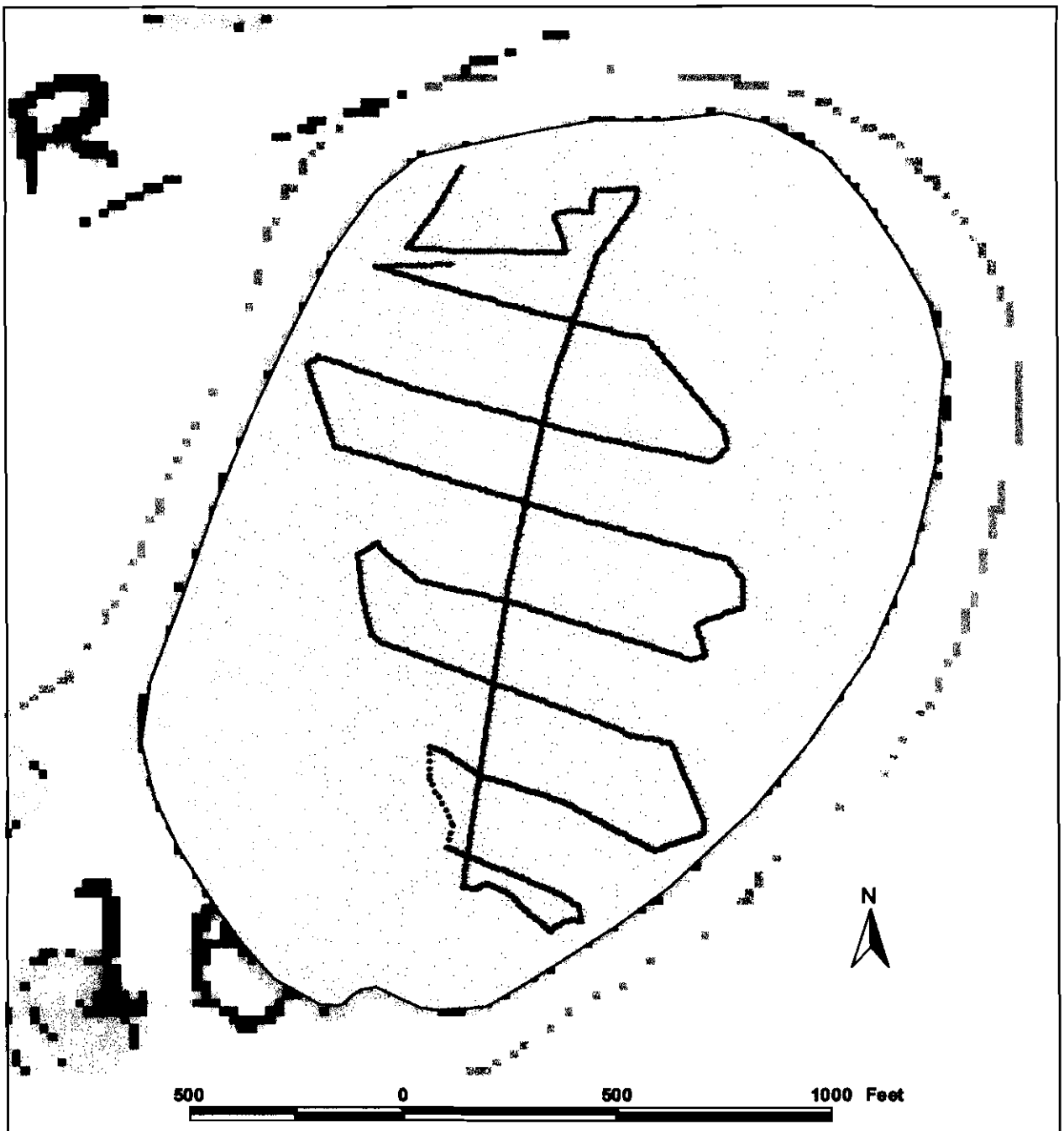
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 22 03	7.5	None	0
Minnow Trap	Jul 22 03	2.5	9spine stickleback	2
Seine		0 hauls		

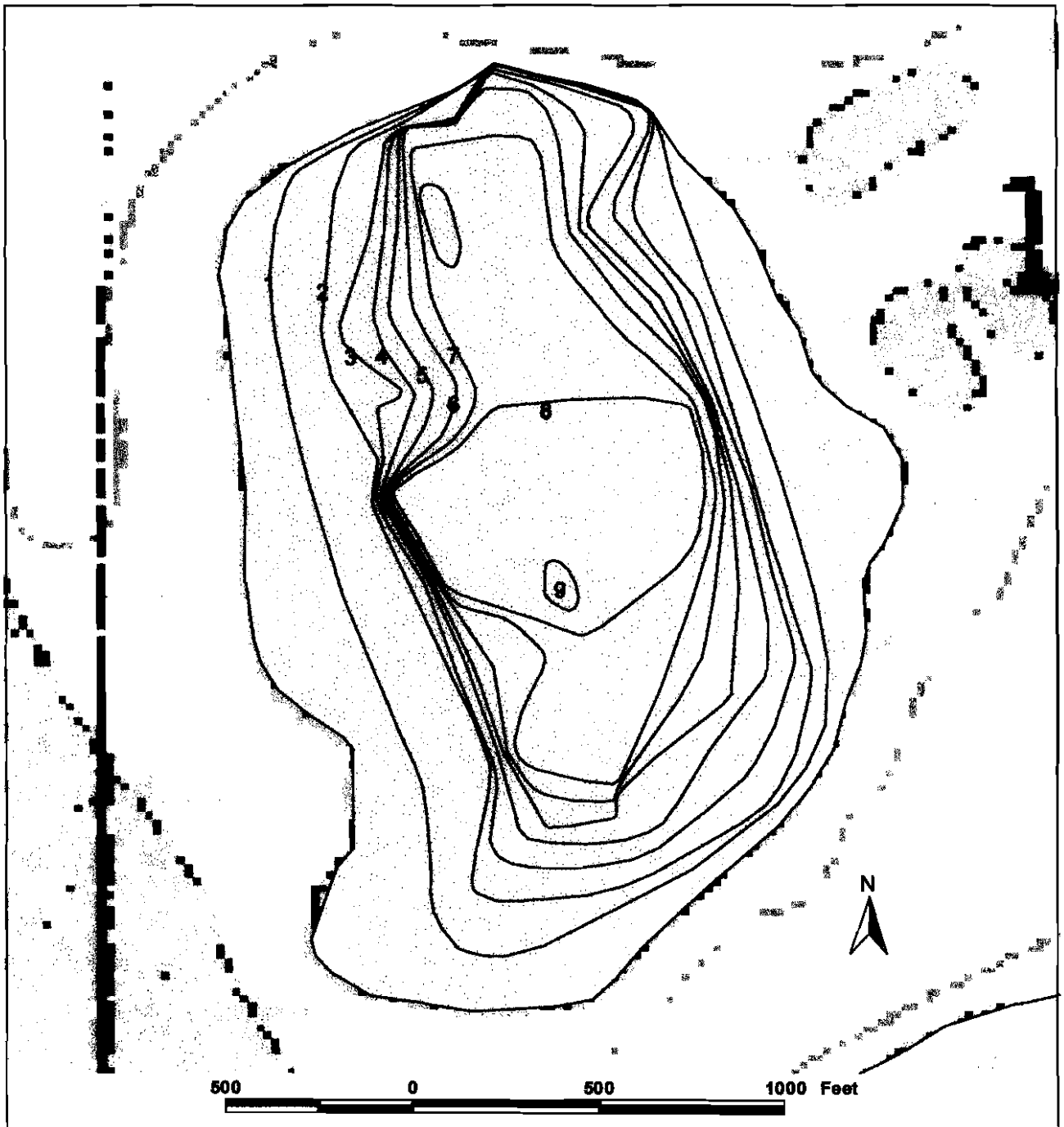


Regions of lake M0322 less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 22, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyed at lake M0322 on July 22, 2003.



Depth contours of lake M0323, based on transects surveyed on July 22, 2003
(depth intervals in 1 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0323

Other Names:
Location: 70.30532°N 153.17858°W
USGS Quad Sheet: Teshekpuk B-1: T11N R5W Sec. 16
Habitat: Tundra Lake
Area: 82.0 acres
Maximum Depth: 9.5 feet
Active Outlet: No
Calculated Volume: 102.13 million gallons
Permittable Volume: 7.04 million gallons
Potential Aggregate: 46.0 acres (water depth 4 ft or less)

Water Chemistry:

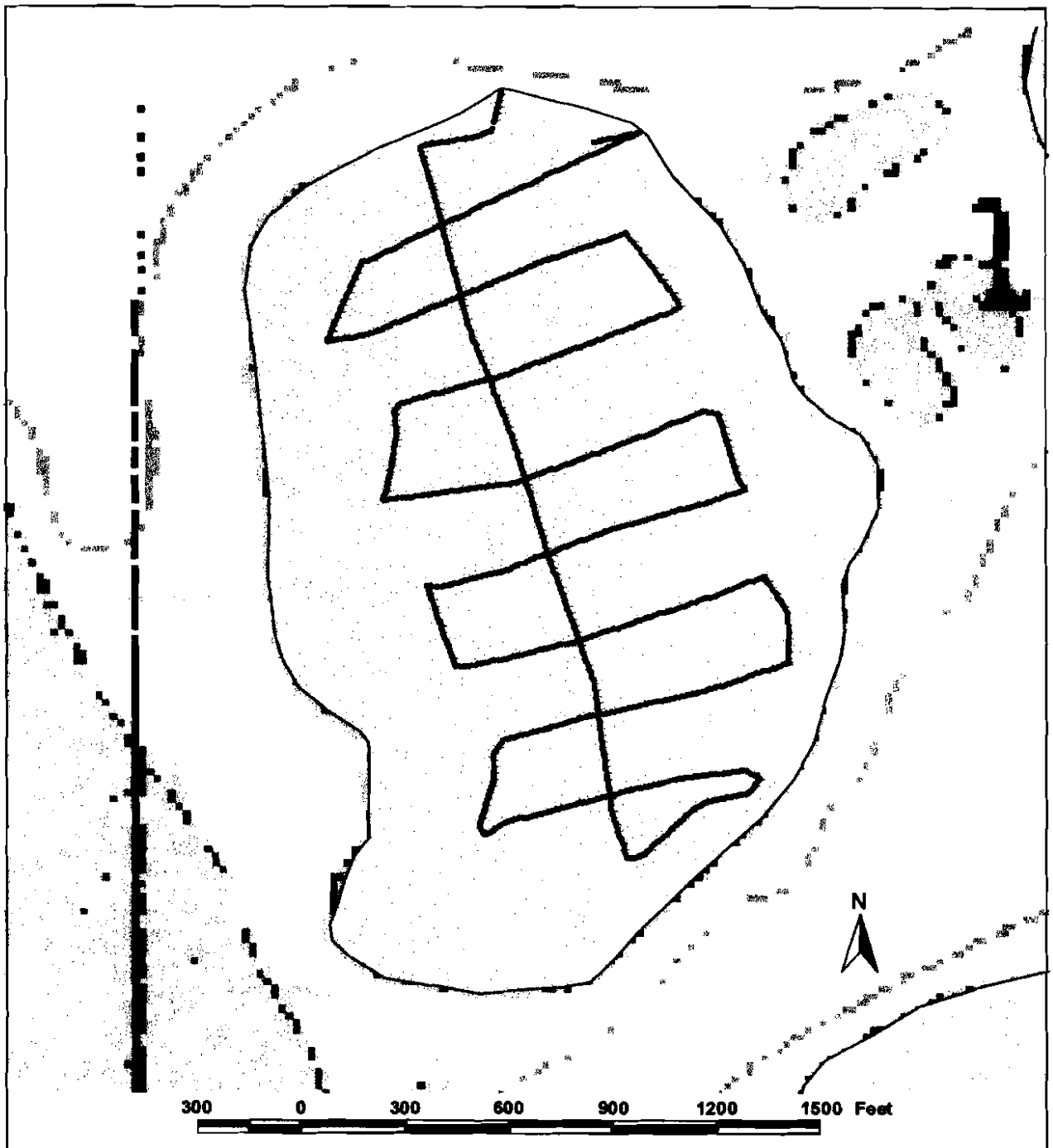
Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	15.0	1.9	3.2	6.1	46	112	0.7	8.03	This Study

Catch Record:

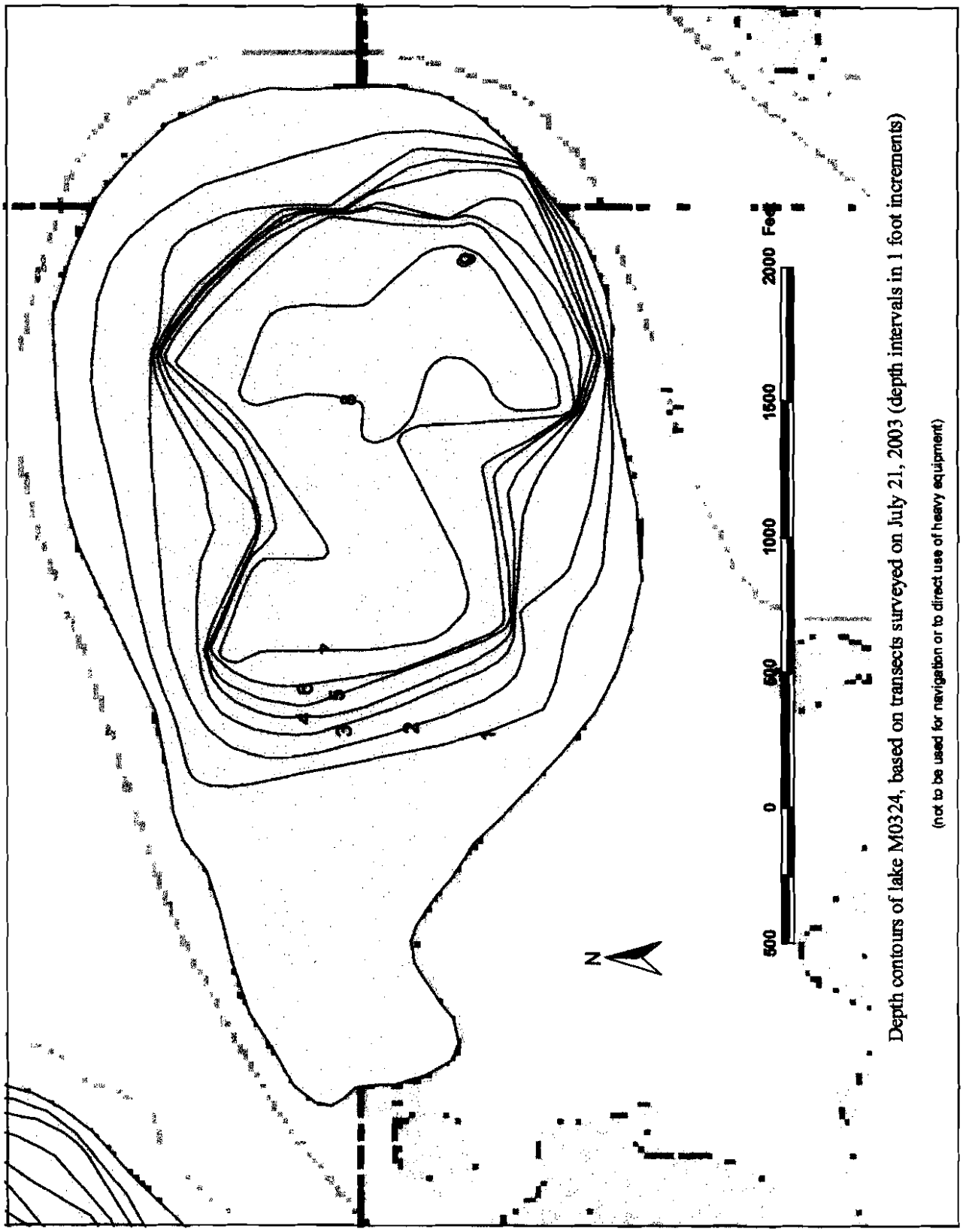
Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 22 03	6.0	None	0
Minnow Trap	Jul 22 03	7.8	9spine stickleback	1
Seine		0 hauls		

Regions of lake M0323 less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 22, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyed at lake M0323 on July 22, 2003.



Depth contours of lake M0324, based on transects surveyed on July 21, 2003 (depth intervals in 1 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0324

Other Names:
Location: 70.30036°N 153.15485°W
USGS Quad Sheet: Teshekpuk B-1: T11N R5W Sec. 16/21
Habitat: Tundra Lake
Area: 128.1 acres
Maximum Depth: 9.2 feet
Active Outlet: No
Calculated Volume: 147.26 million gallons
Permittable Volume: 10.14 million gallons
Potential Aggregate: 76.9 acres (water depth 4 ft or less)

Water Chemistry:

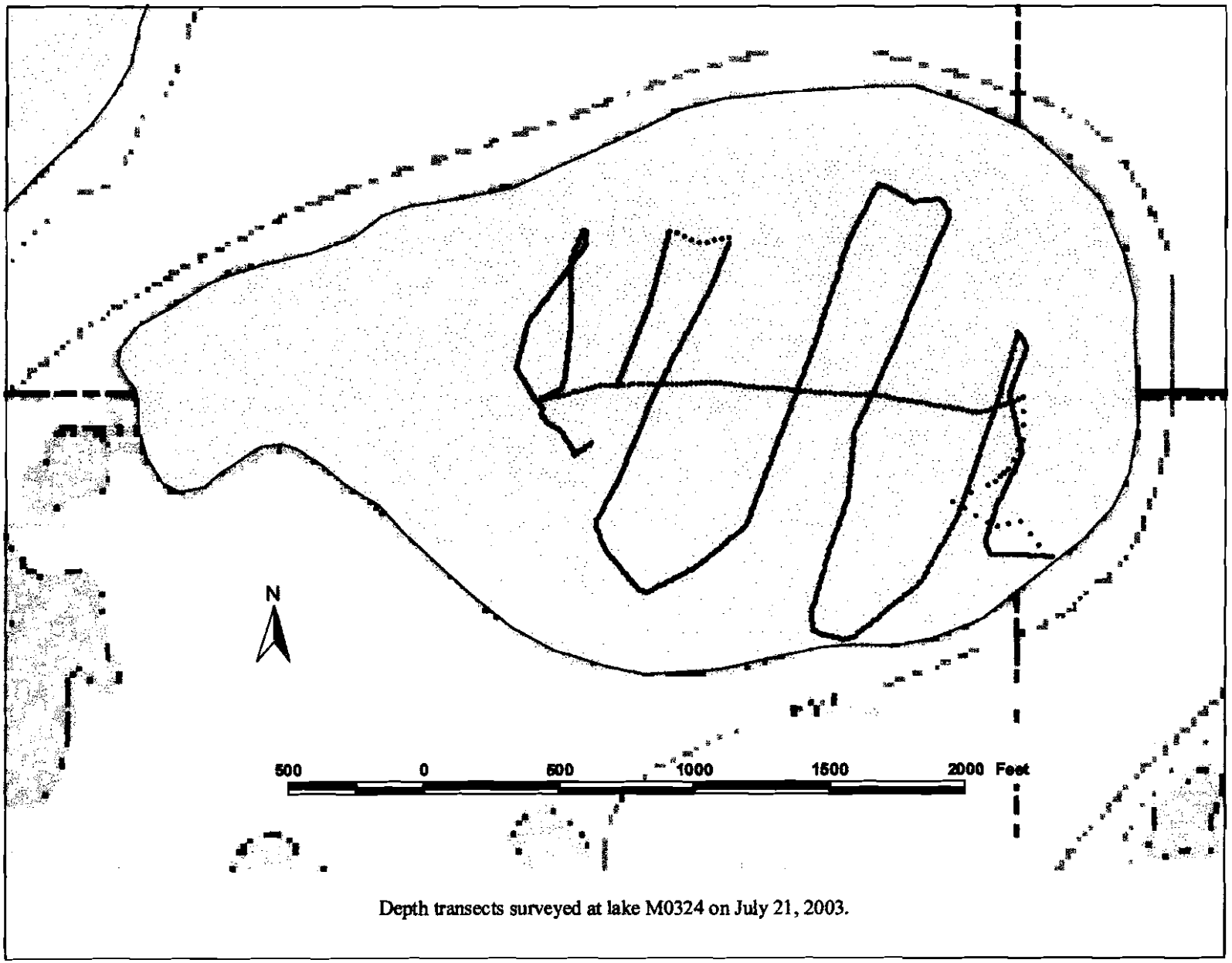
Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	32.0	3.1	4.6	8.1	91	199	0.9	8.34	This Study

Catch Record:

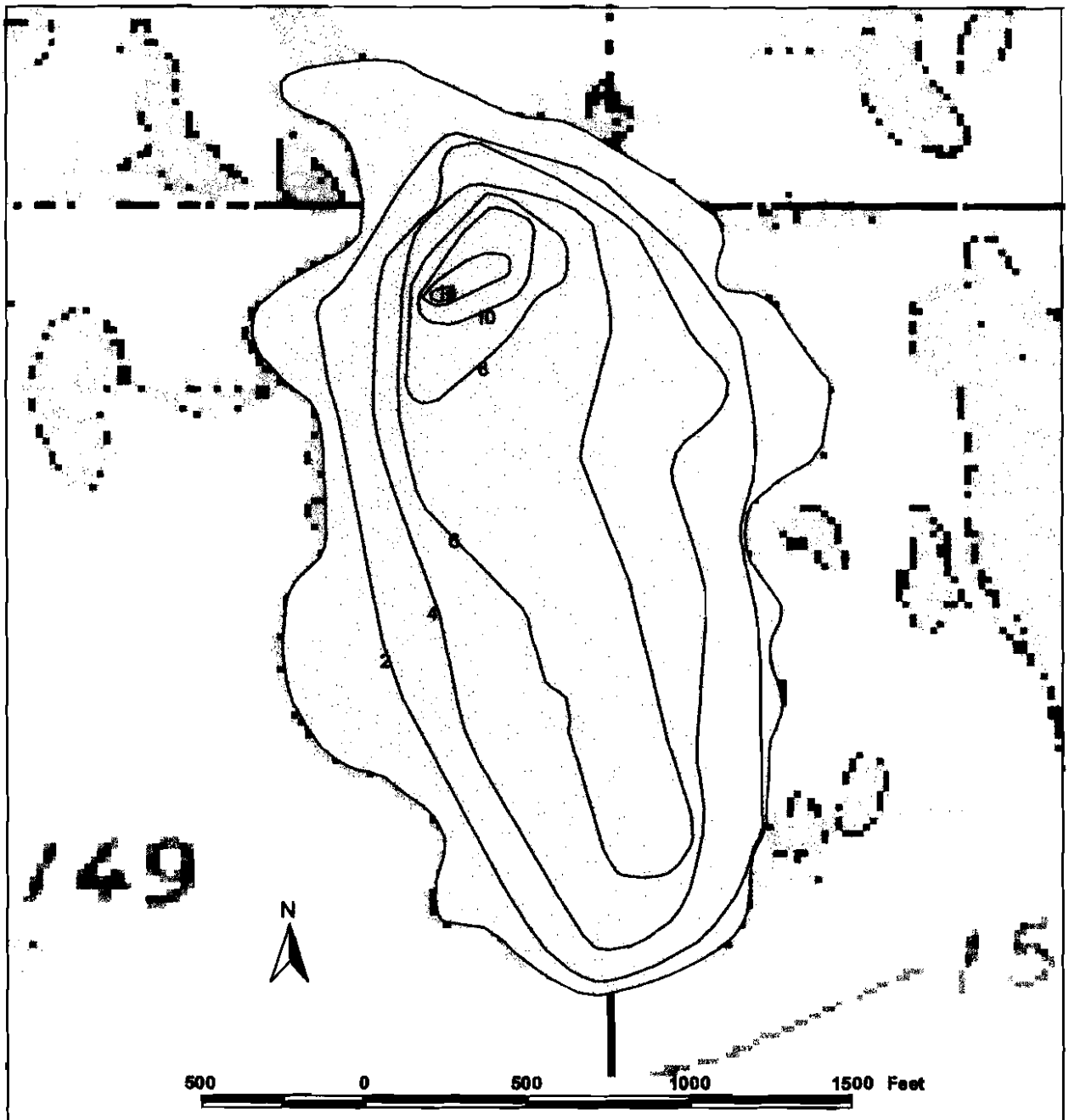
Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 21 03	6.2	None	0
Minnow Trap	Jul 21 03	6.7	9spine stickleback	1
Seine	Jul 21 03	0 hauls	9spine stickleback	observed

Regions of lake M0324 less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 21, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyed at lake M0324 on July 21, 2003.



Depth contours of lake M0325, based on transects surveyed on July 14, 2003
(depth intervals in 1 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0325

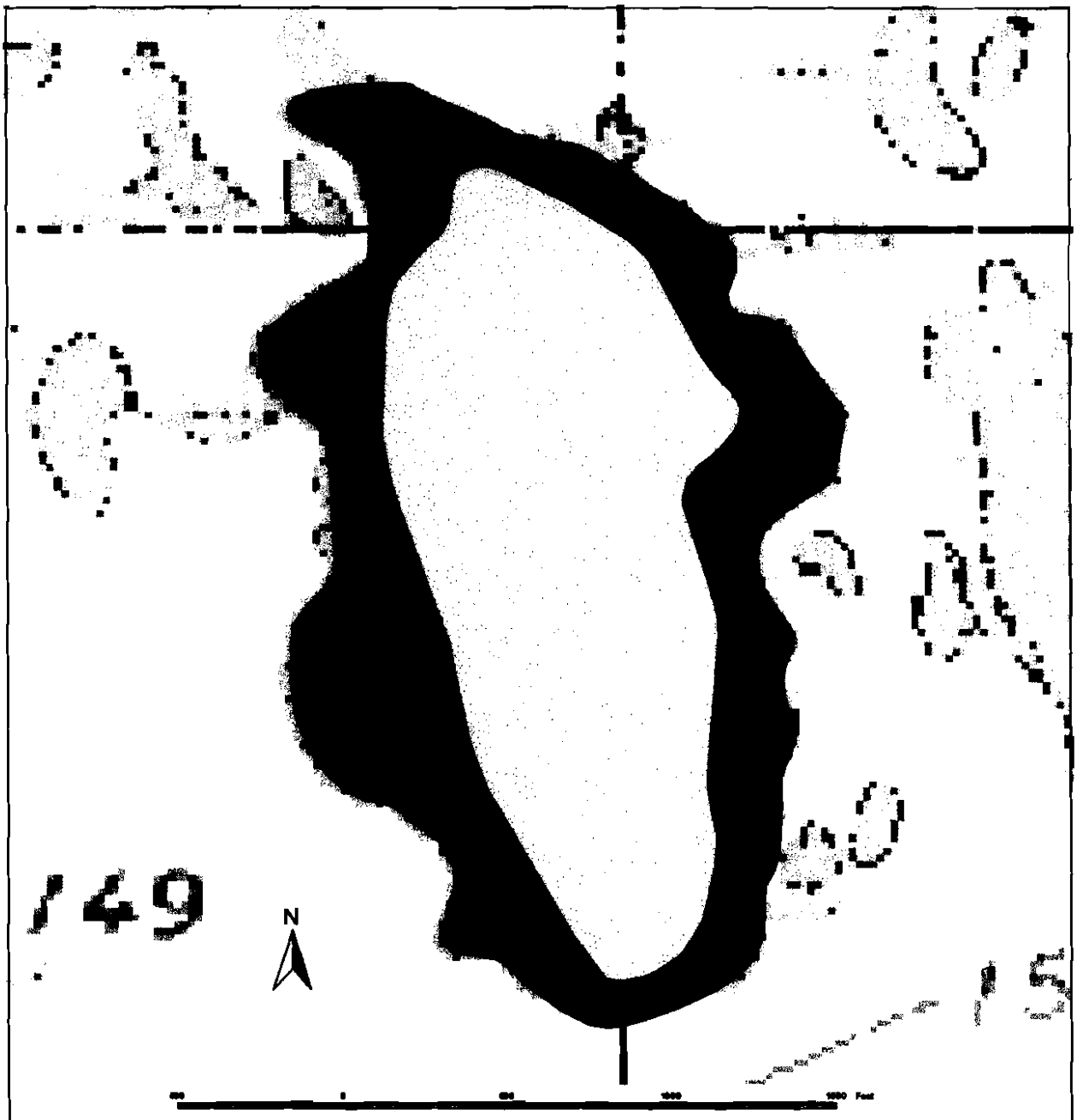
Other Names:
Location: 70.26848°N 153.18932°W
USGS Quad Sheet: Teshekpuk B-1: T11N R5W Sec. 32/33
Habitat: Tundra Lake
Area: 82.3 acres
Maximum Depth: 16.0 feet
Active Outlet: No
Calculated Volume: 113.01 million gallons
Permittable Volume: 5.29 million gallons
Potential Aggregate: 39.1 acres (water depth 4 ft or less)

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	19.0	2.0	3.0	5.6	57	132	1.3	8.04	This Study

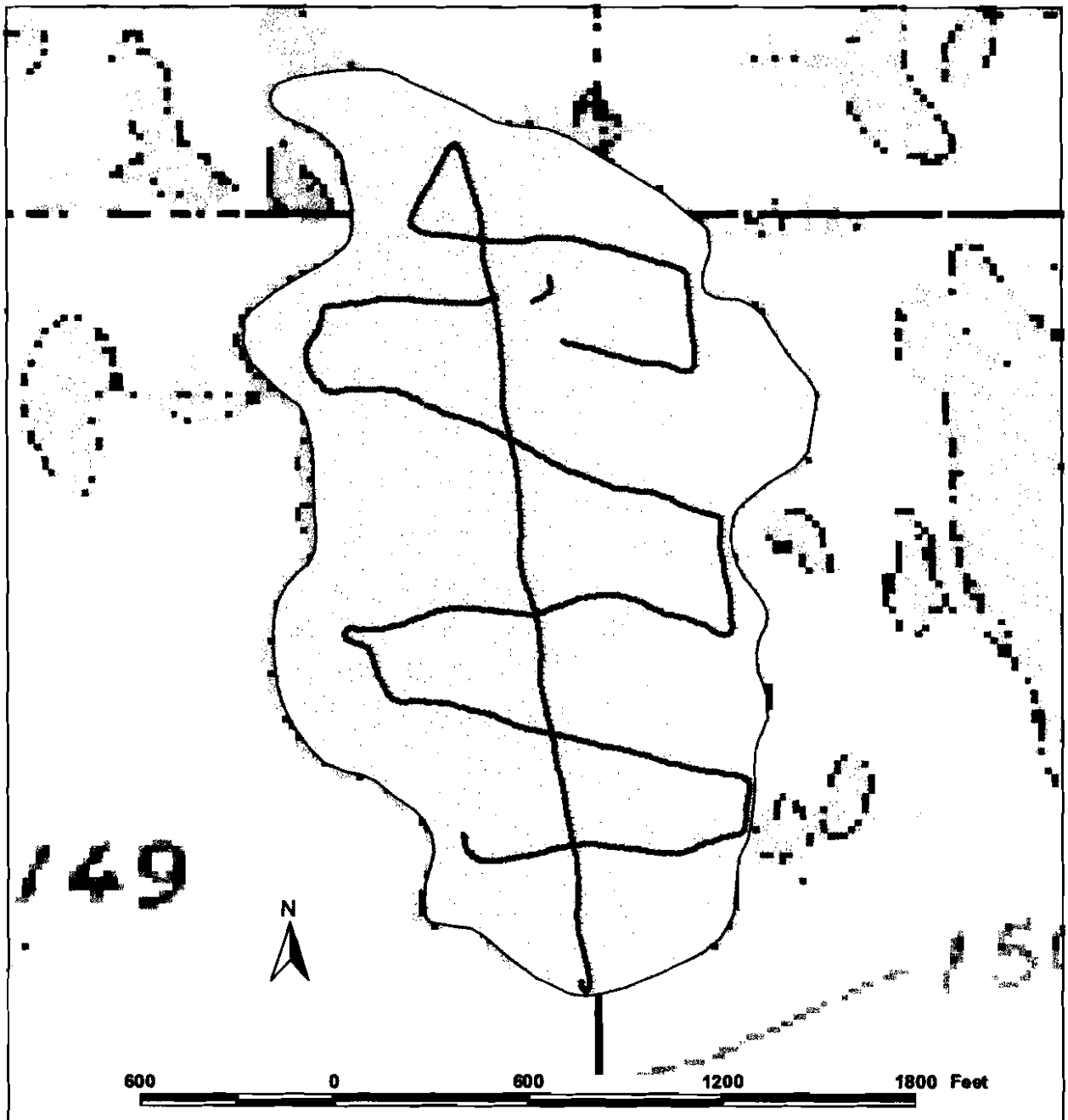
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 14 03	6.5	None	0
Minnow Trap	Jul 14 03	8.3	9spine stickleback	1
Seine		0 hauls		

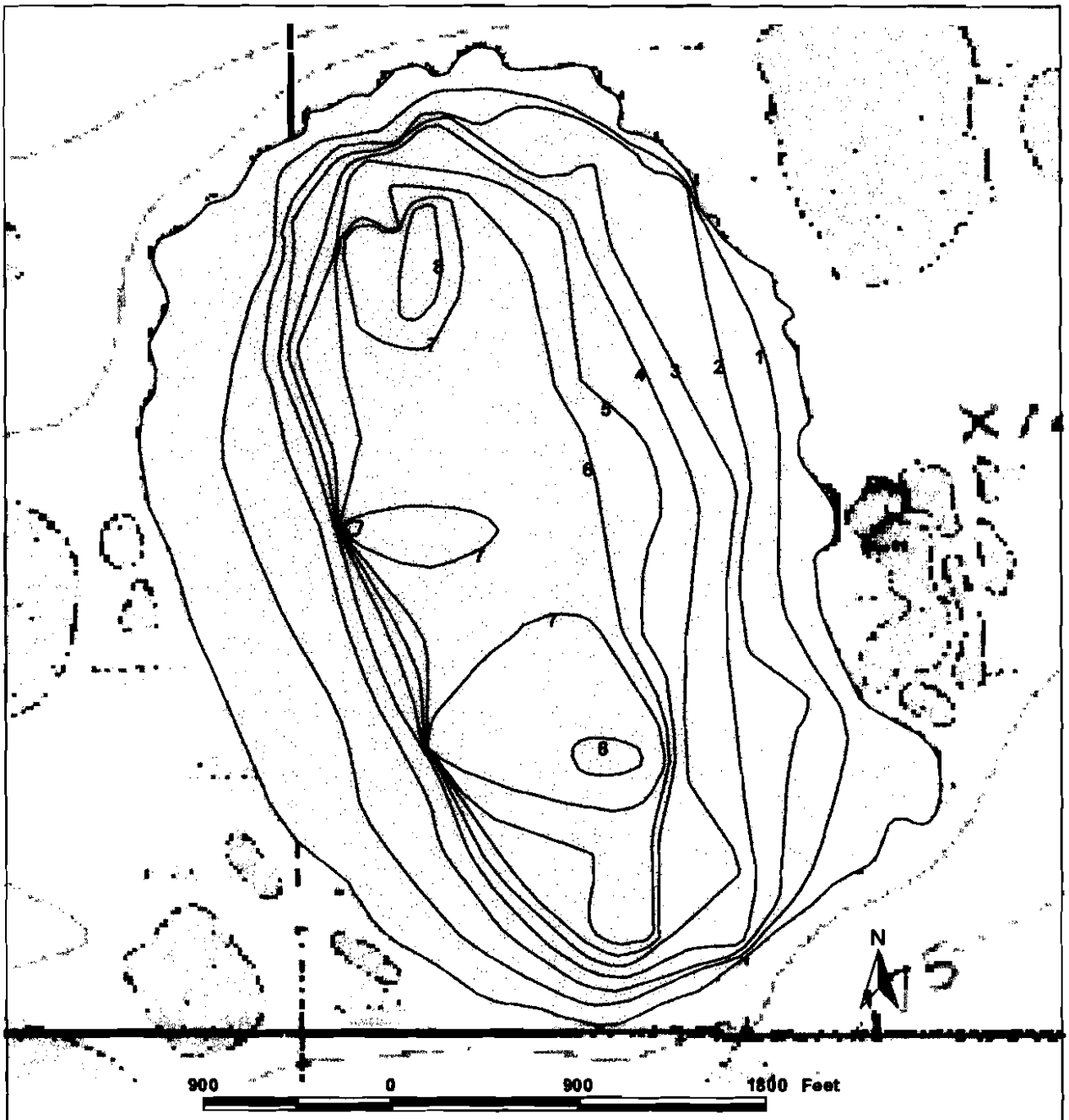


Regions of lake M0325 less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 14, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyed at lake M0325 on July 14, 2003.



Depth contours of lake M0326, based on transects surveyed on July 21, 2003
(depth intervals in 1 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0326

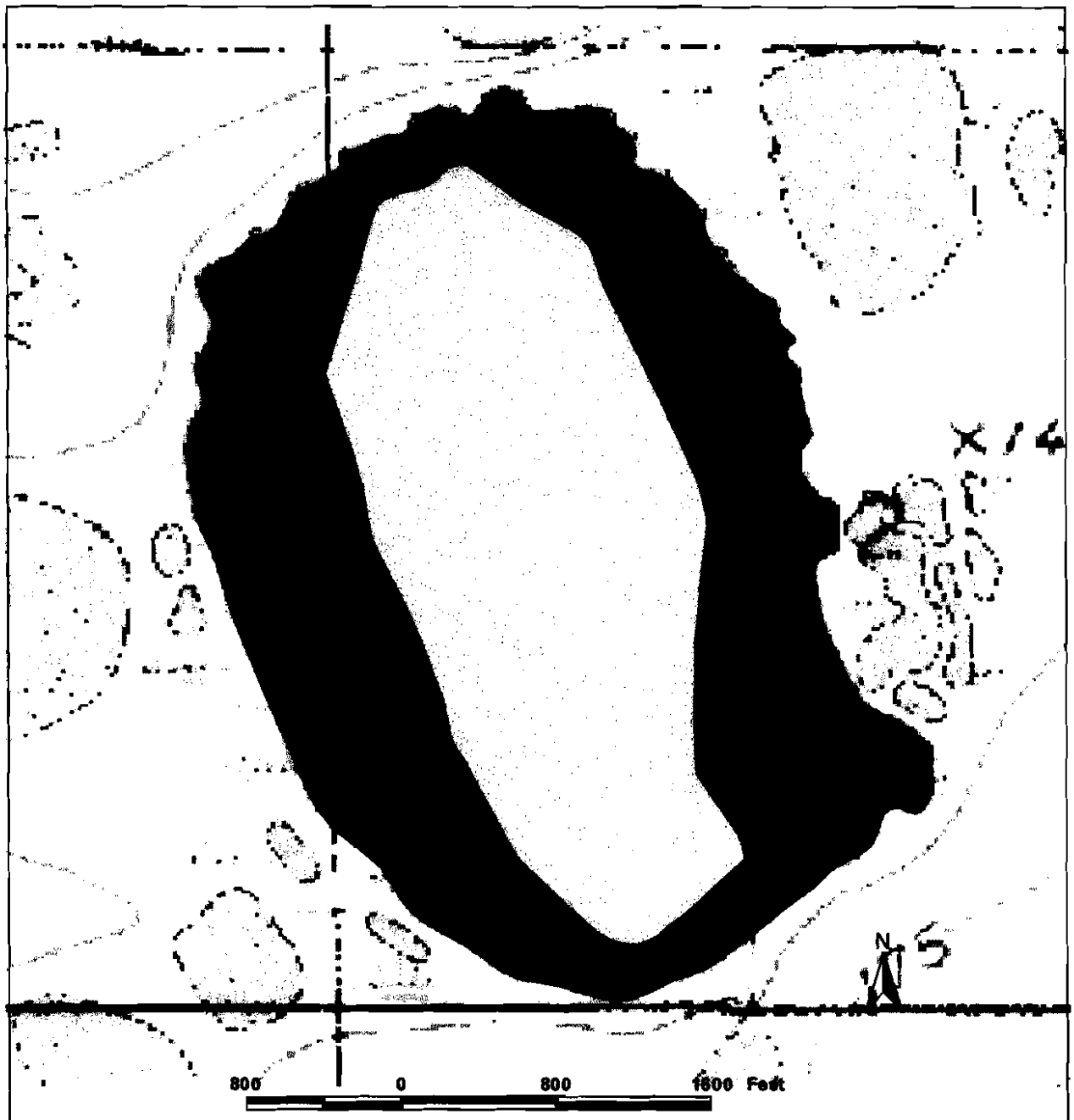
Other Names:
Location: 70.26342°N 153.22200°W
USGS Quad Sheet: Teshekpuk B-1: T11N R5W Sec. 31/32
Habitat: Tundra Lake
Area: 296.2 acres
Maximum Depth: 9.4 feet
Active Outlet: No
Calculated Volume: 345.04 million gallons
Permittable Volume: 15.69 million gallons
Potential Aggregate: 167.4 acres (water depth 4 ft or less)

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	27.0	2.5	2.7	6.7	77	176	3.8	8.22	This Study

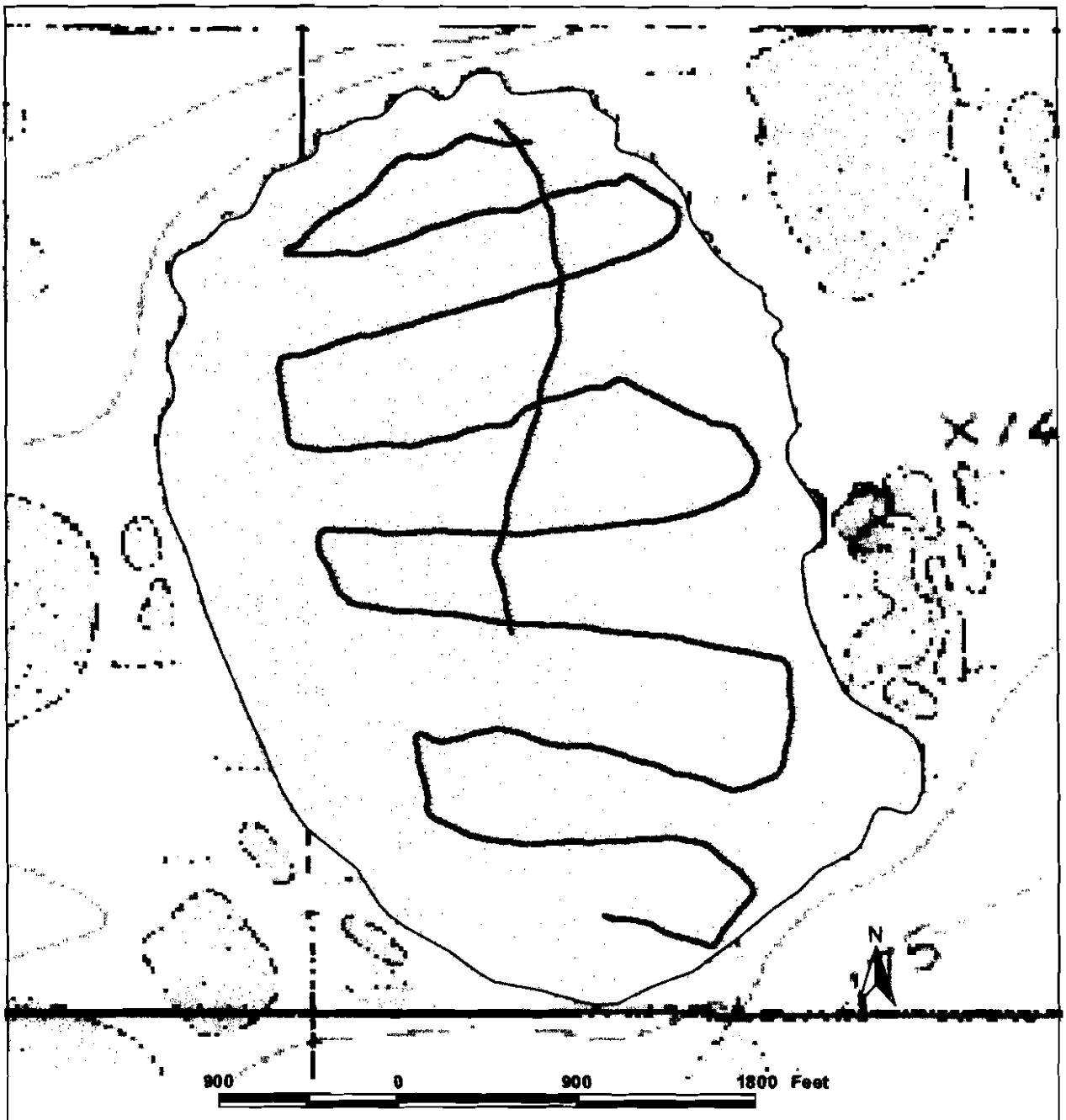
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 21 03	6.8	None	0
Minnow Trap	Jul 21 03	9.7	9spine stickleback	1
Seine		0 hauls		

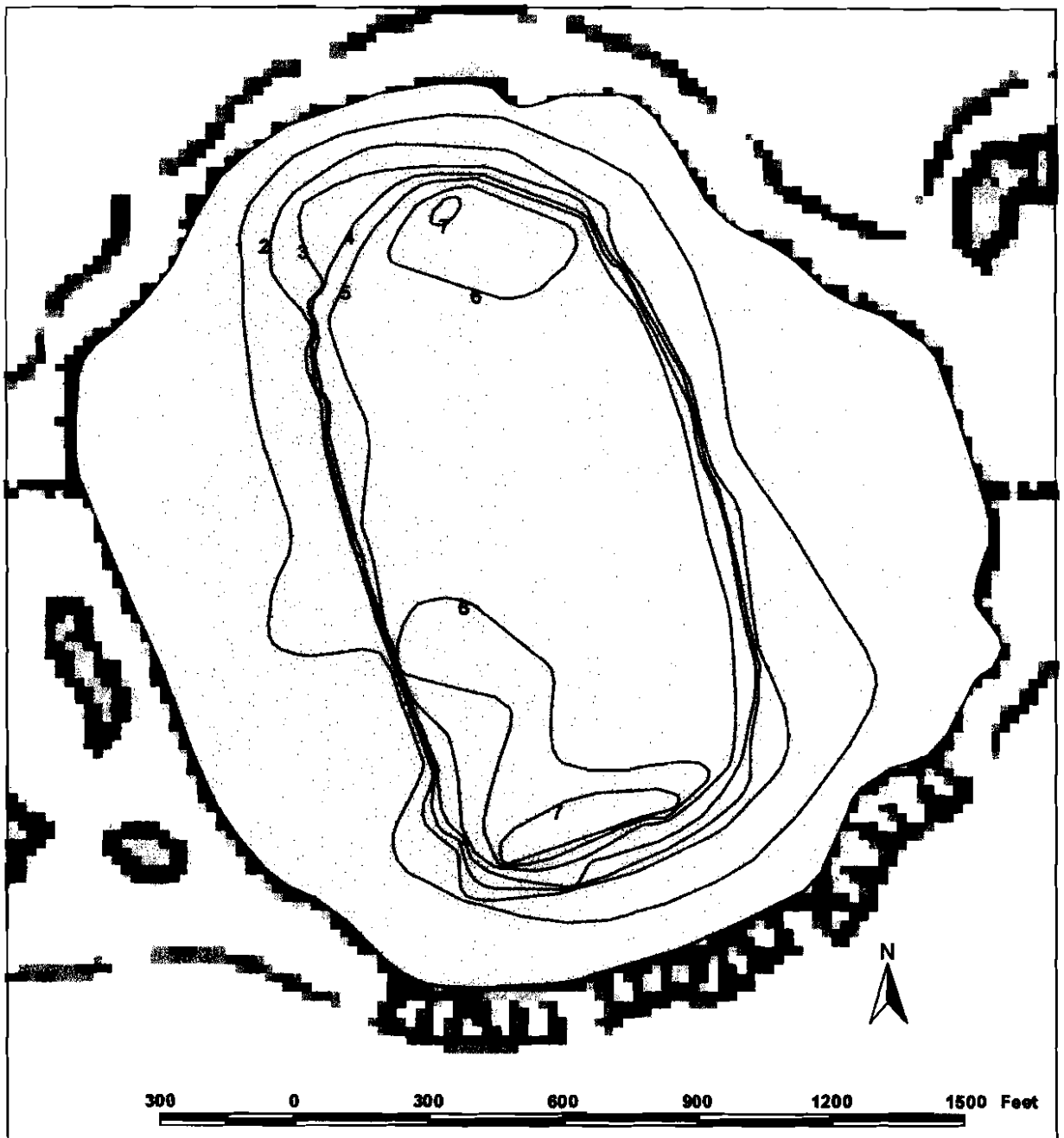


Regions of lake M0326 less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 21, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyed at lake M0326 on July 21, 2003.



Depth contours of lake M0327, based on transects surveyed on July 23, 2003
(depth intervals in 1 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0327

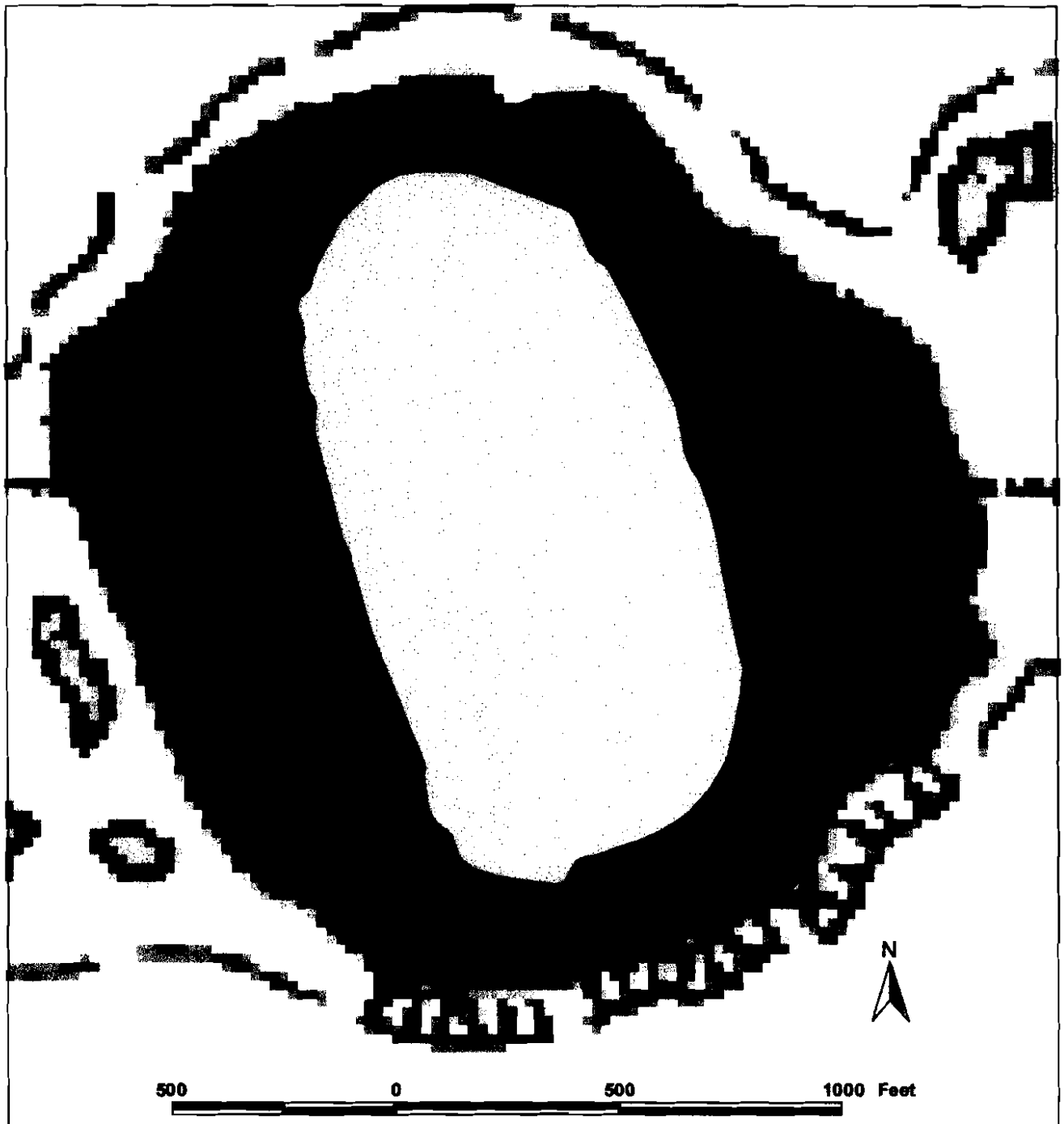
Other Names:
Location: 70.32888°N 152.92134°W
USGS Quad Sheet: Harrison Bay B-5: T11N R4W Sec. 4/9
Habitat: Tundra Lake
Area: 72.8 acres
Maximum Depth: 7.4 feet
Active Outlet: No
Calculated Volume: 62.47 million gallons
Permittable Volume: 1.60 million gallons
Potential Aggregate: 46.2 acres (water depth 4 ft or less)

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	22.0	2.2	3.4	5.8	64	139	0.5	8.23	This Study

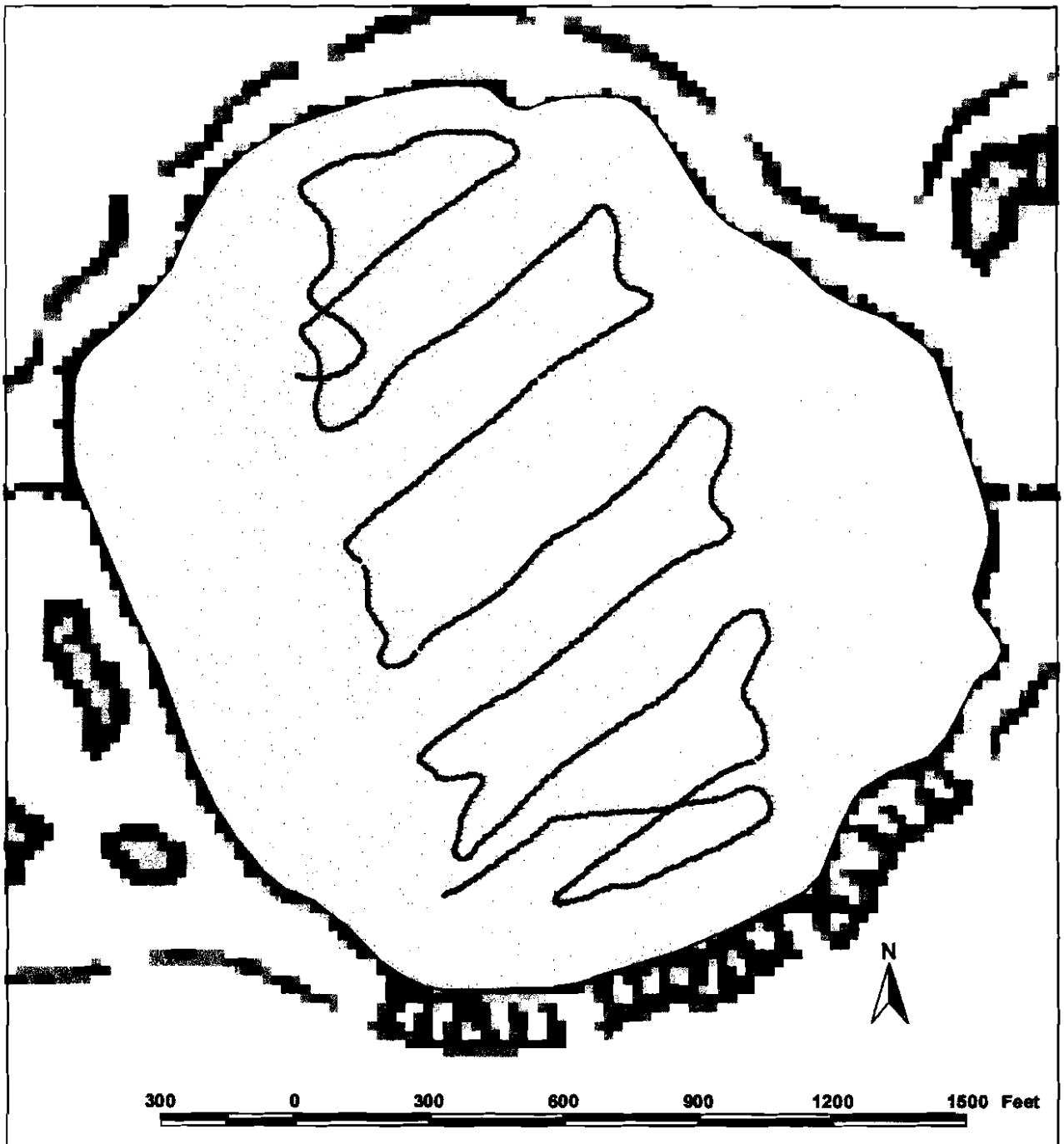
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 23 03	11.0	None	0
Minnow Trap	Jul 23 03	0.0		
Seine	*Jul 23 03*	*0 hauls*	*9spine stickleback*	*observed*

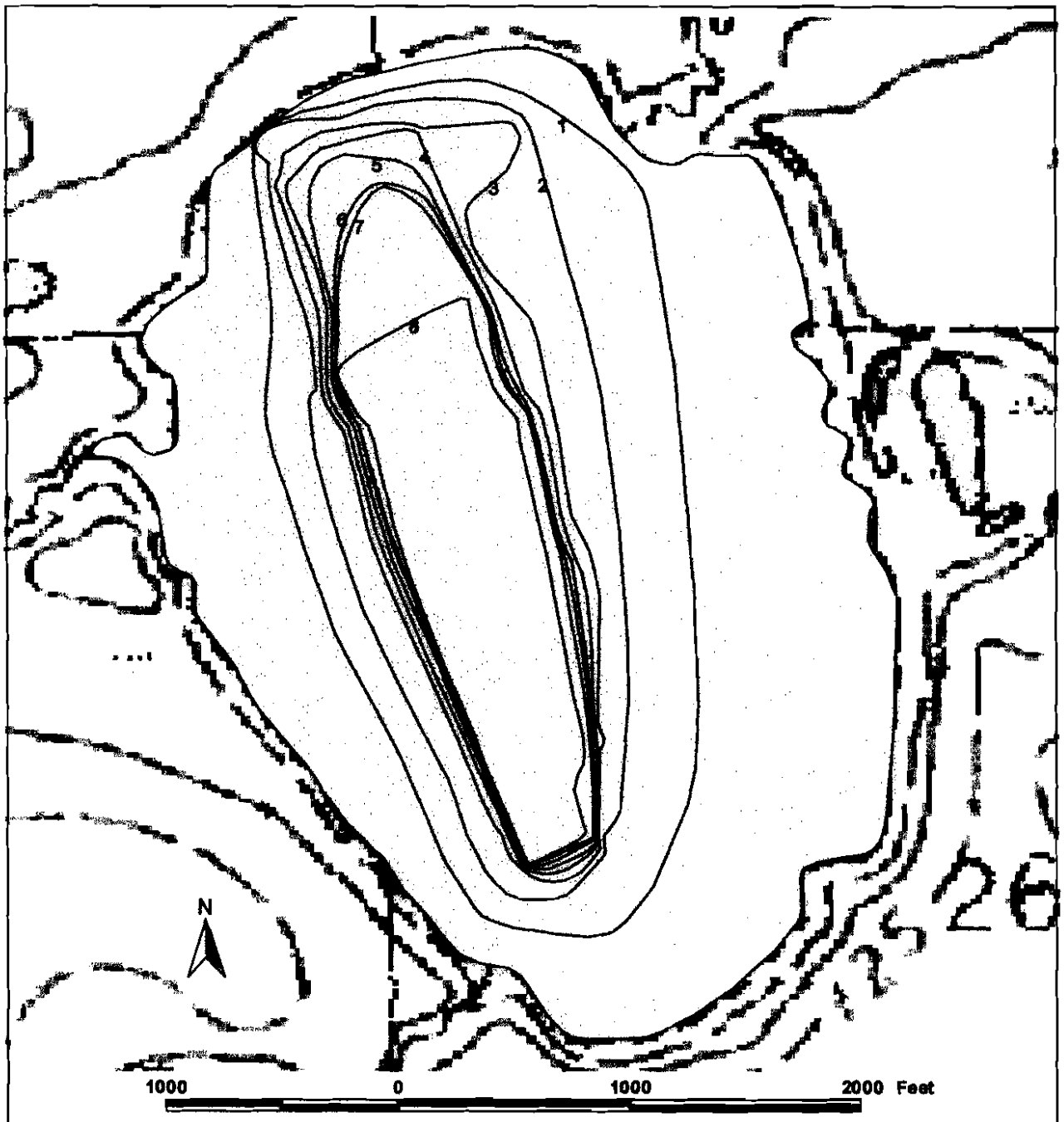


Regions of lake M0327 less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on July 23, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyed at lake M0327 on July 23, 2003.



Depth contours of lake M0328, based on transects surveyed on August 1, 2003
(depth intervals in 1 foot increments)

(not to be used for navigation or to direct use of heavy equipment)

Lake M0328

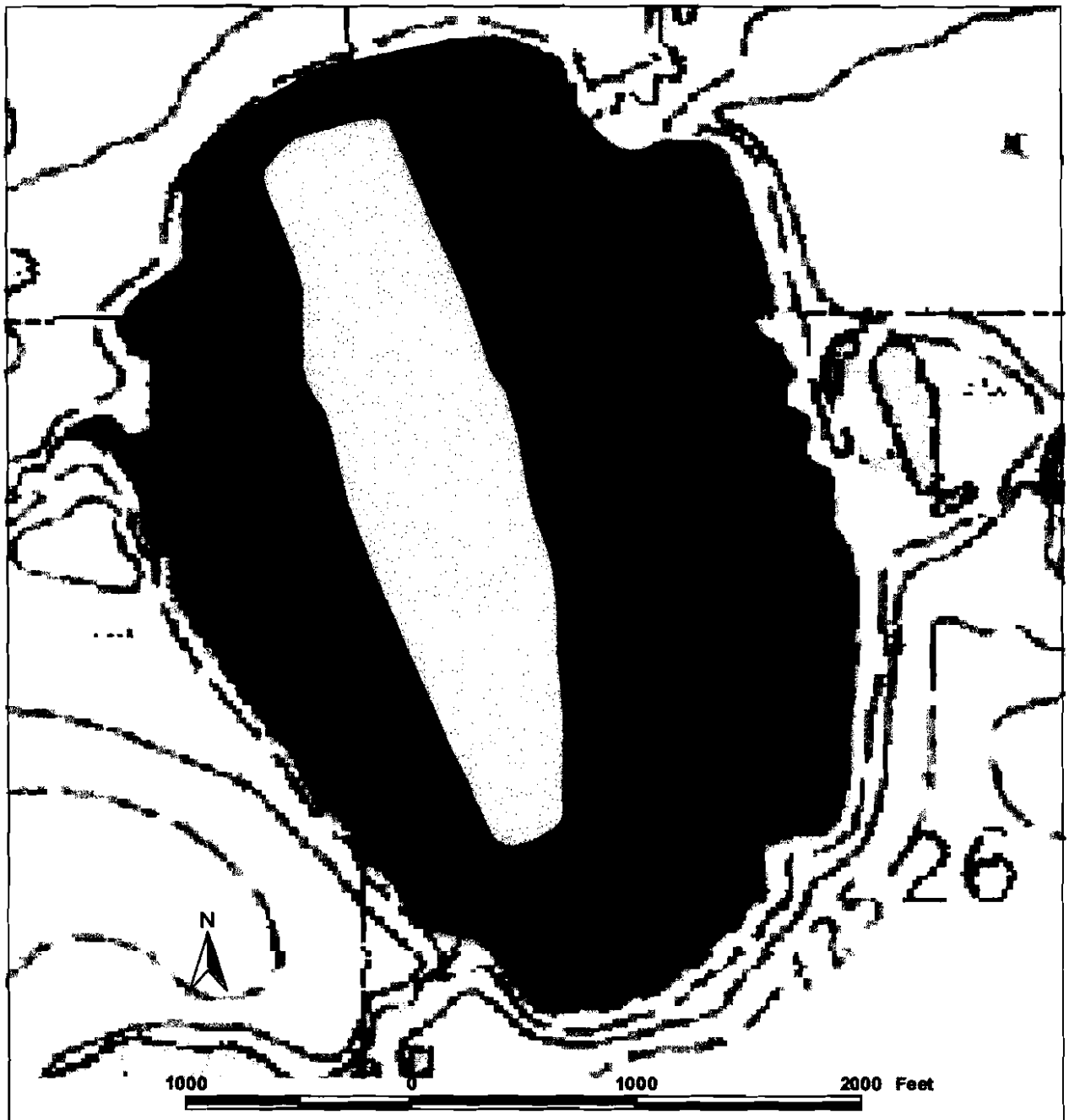
Other Names:
Location: 70.28334°N 152.33426°W
USGS Quad Sheet: Harrison Bay B-4: T11N R2W Sec. 22/23/26/27
Habitat: Drainage Lake
Area: 241.9 acres
Maximum Depth: 9.0 feet
Active Outlet: Yes
Calculated Volume: 198.56 million gallons
Permittable Volume: 2.22 million gallons
Potential Aggregate: 188.5 acres (water depth 4 ft or less)

Water Chemistry:

Year of Test	Calcium (mg/l	Magnesium (mg/l)	Chloride (mg/l)	Sodium (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2003	30.0	3.4	5.7	12.0	88				This Study

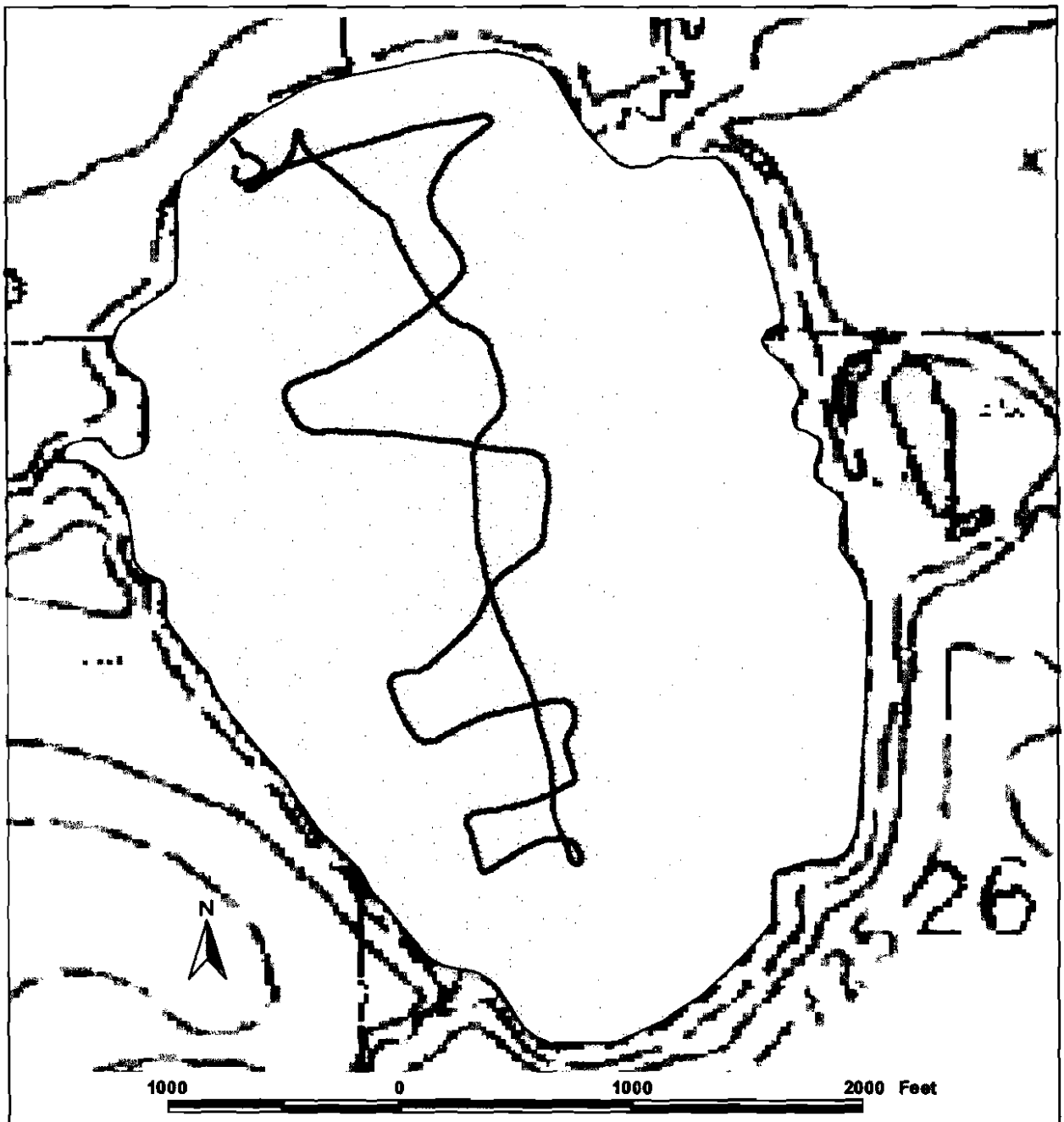
Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Aug 1 03	0.0		0
Minnow Trap	Aug 1 03	0.0		0
Seine	Aug 1 03	0 hauls	Arctic grayling	observed



Regions of lake M0328 less than 4 ft deep (dark shaded), and likely to be available for ice chips, based on transects surveyed on August 1, 2003.

(not to be used for navigation or to direct use of heavy equipment)



Depth transects surveyed atrlake M0328 on August 1, 2003.