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Lake Habitat and Fish Surveys on Interior Alaska National Wildlife Refuges, 1984–1986

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Alaska Fisheries Data Series Number 2011-12, December 2011
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Abstract

A large-scale lake study on Interior Alaska National Wildlife Refuges (NWR) was undertaken from 1984–1986. Six NWRs were surveyed (Innoko, Kanuti, Koyukuk, Nowitna, Tetlin, and Yukon Flats) and lake-specific habitat and fish data were collected from 135 lakes, though a comprehensive report of the findings was never published. This Alaska Fisheries Data Series Report presents these data, allowing public access to this important information. Lake locations, reference and bathymetric maps, lake habitat descriptions, and fisheries data are organized and presented. Lowland lakes were most commonly sampled (74), followed by foothill (31) and oxbow (30) lakes. The highest elevation and deepest sampled lakes were in Tetlin NWR. The highest water quality measurements (conductivity, total alkalinity, total hardness, and pH) came from Yukon Flats NWR lakes. Of the 135 lakes sampled, 102 lakes contained fish. A total of 15 fish species were collected throughout the study, with Tetlin NWR lakes having the highest species diversity (9 species) and Nowitna and Yukon Flats NWRs having the lowest (6 species). Humpback whitefish *Coregonus clupeaformis*, least cisco *C. sardinella*, and northern pike *Esox lucius* had the widest distribution, being present in all six refuges. The highest frequencies of fish occurrence were in oxbow and lowland lakes, lakes with river connections, and lakes with high flood potential. Foothill lakes and lakes without river connections had the lowest probability of fish capture. Koyukuk NWR had the most sampled lakes containing fish (96%) and Yukon Flats NWR had the fewest sampled lakes with fish present (49%). Northern pike was the most ubiquitous species, occurring in 90% of all lakes containing fish. Fish species diversity was highest in lakes with river connections (14 species).

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Introduction

From 1984 through 1986, a large-scale lake study on Interior Alaska National Wildlife Refuges (NWR) was undertaken by the U.S. Fish and Wildlife Service, Fairbanks Fishery Resources Office. The original project not only surveyed 135 lakes, but attempted to develop a habitat classification system that would enable resource managers, using existing topographic maps, to estimate fish habitat quality for the thousands of unsurveyed lakes present on Interior Alaska NWRs. The project was never completed, but survey data were collected on both the physical characteristic of each lake and the fish species present. This Alaska Fisheries Data Series Report presents these data, allowing public access to this important information. Lake locations, reference and bathymetric maps, habitat descriptions, and fisheries data are compiled and presented.

Study Area

The study area includes 135 lakes on six Interior Alaska NWRs (Innoko, Kanuti, Koyukuk, Nowitna, Tetlin, and Yukon Flats; Figure 1). The Northern Unit of Innoko NWR was not sampled. The general area is bounded on the south by the Alaska Range, north by the Brooks Range, east by the U.S.-Canada border, and west by the Nulato and Zane hills. All six Interior Alaska NWRs and their associated lakes are located entirely within the Yukon River Basin. The region has a continental subarctic climate characterized by extreme temperatures: –62ºC to 38ºC (Shulski and Wendler 2007). Precipitation ranges from 20 to 40 cm per year, with about half falling as rain in summer months (Brabets et al. 2000). The region is dominated by shallow, flatland lakes that may be closed or open to nearby river systems (Arp and Jones 2009).

Methods

Lake Classification and Habitat Sampling

Interior Alaska NWR lakes selected for this study included lowland, oxbow, and foothill lake types; river connected and land-locked systems, and low and high flood potential classifications. Lake types were determined using USGS 1:63,360 scale maps. Lakes were first categorized into lowland and foothill groups according to the surrounding contours on the topographic maps. Foothill lakes had surrounding 30.5-m contours exhibiting gradients greater than 30.5 m/1.6 km, whereas lowland lakes had surrounding 30.5-m contours less than 30.5 m/1.6 km. Oxbow lakes, those closely associated with larger river channels and formed from cutoff meanders of those channels, were separated from the lowland lake group to form a separate category. The presence or absence of river connections (land-locked) was determined initially from topographic maps and later verified in the field. Lakes less than 1.6 km from a major river channel (4th order or larger; Strahler 1957) and where surrounding terrain would not inhibit interchange of water from river to lake during flood periods were given a high flood potential rating. Lakes located farther than 1.6 km from a major river channel were given a low flood potential rating.

Physical lake characteristics were described for elevation, surface area, depth profile, maximum and mean depth, and water transparency. Lake elevation and surface area (by planimeter) were initially estimated from USGS 1:63,360 scale maps. If the lake perimeter varied between USGS maps and field observation, the perimeter was redrawn before measurement. A Lowrance Model X15 recording fathometer, mounted on a motorized inflatable raft, was used to obtain depth information for construction of bathymetric maps (depth profile) and to determine maximum depth. Transects were evenly space across the lake's width and distances were measured with a range finder. Mean depth was calculated from depth contour maps using methods outlined in

Welch (1948). Water transparency was measured using a Secchi disc. Total alkalinity, total hardness, and pH were measured using a Hach Model FF-1 water chemistry kit. Conductivity was measured using a Hach Model 17250 Mini Conductivity Meter. Recent drying of some Interior Alaska NWR lakes has been reported by Riordan et al. (2006) and Roach et al. (2011). Map-based data from this Data Series Report, specifically, lake surface area and river connectivity, should not be used for time-series comparative purposes unless corroborated by remote sensed data.

Fish Sampling

All captured fish were identified to species. Length was measured to the nearest mm. Fish species with forked caudal fins were measured to fork in tail (fork length), while species without forked tails were measured to tip of caudal fin (total length). Relative abundance of fish was determined by catch-per-unit effort (CPUE) data from experimental gill nets. Experimental gill nets consisted of five 7.6-m panels of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh sizes. Nets were fished in both littoral and off-shore habitats when available. Commonly, two to four gillnets were used at each lake. Additional effort was generally used for larger lakes. Fish species and lengths (mm) were recorded for each captured fish. Fyke netting, seining, angling, and observation were used opportunistically to document additional fish species present, along with stomach content examinations of captured northern pike *Esox lucius*.

Results

Lake Classification and Habitat Sampling

A total of 135 lakes in six Interior Alaska NWRs were sampled between 1984 and 1986. Since most lakes were accessed by Cessna 185 and 206 floatplanes, small lakes were generally not sampled due to landing limitations. Lakes were sampled once; most between late June and early August (see Table 1 for individual lake sampling dates). Lakes were not re-sampled during subsequent years. Most lake sampling (habitat and fish) was accomplished within approximately a 24-h period. Lake locations are presented in Table 1 and Figures 2–19. More lowland lakes were sampled (74) than either foothill (31) or oxbow (30) lakes (Table 2). Yukon Flats NWR had the most lakes sampled (37) and Kanuti NWR had the least sampled (11).

Physical and chemical data for each of the 135 lakes sampled are presented in Tables 3–8. Tetlin NWR had the highest elevation lakes sampled and Innoko NWR had the lowest elevations. The largest (1,070 ha) and smallest (6 ha) lakes sampled were both in Tetlin NWR. The deepest lakes were in Tetlin NWR (35.1 m deep) and Yukon Flats NWR (29.6 m deep). The highest measurements of conductivity, total alkalinity, total hardness and pH were from Yukon Flats lakes. Bathymetric maps for all sampled lakes are presented in Appendix Figures 1-135.

Fish Sampling

A total of 15 fish species were collected in Interior Alaska NWRs between 1984 and 1986 (Table 9). Tetlin NWR had the most fish species captured (9 species). Humpback whitefish *Coregonus clupeaformis*, least cisco *C. sardinella*, and northern pike were found in all six refuges. The list of fish species represents a record of what was captured or observed during this study and is not meant to provide a comprehensive species list for Interior NWR lakes. Species geographic distribution, specific habitat requirements, gear selectivity, and sampling date all influence a fish's probability of capture. Fish were captured in 102 (76%) of the 135 lakes sampled (Table 10). Oxbow lake type had the highest percentage of lakes containing fish (93%, 28 out of 30

lakes sampled). Lakes with river connections had 91% with fish present (69 out of 76 lakes) and lakes with no river connection only had 56% containing fish (33 of 59 lakes). Fish were also found more frequently in lakes with high flood potential (88%, 45 of 51 lakes) than in low flood potential lakes (68%, 57 of 84 lakes). Koyukuk NWR had the highest frequency of sampled lakes containing fish (96%, 23 of 24 lakes) and Yukon Flats NWR had the lowest frequency of lakes containing fish (49%, 18 of 37 lakes). Most of the Yukon Flats NWR lakes that were not river connected did not contain fish (93%, 14 of 15 lakes).

Northern pike was the most ubiquitous species, occurring in 90% of all lakes that had fish present (Table 11). They were collected in all habitat types and more frequently from oxbow (100%) and lowland (92%) lakes than from foothill lakes (73%). Least cisco, broad whitefish *Coregonus nasus*, humpback whitefish, and longnose sucker *Catostomus catostomus* were also collected in all lake habitat types. Alaska blackfish *Dallia pectoralis* were collected in all lake types except foothill lakes. Inconnu *Stenodus leucichthys*, ninespine stickleback *Pungitius pungitius*, and chum salmon *Oncorhynchus keta* were only captured in oxbow lakes while Arctic grayling *Thymallus arcticus*, slimy sculpin *Cottus cognatus*, burbot *Lota lota*, lake trout *Salvelinus namaycush*, round whitefish *Prosopium cylindraceum* and lake chub *Couesius plumbeus* were only captured in foothill lakes. Fish species diversity was highest in lakes with river connections (14 species). Species composition, length statistics, and gill-net CPUE data for each sampled Interior Alaska NWR lake are presented in Tables 12–17.

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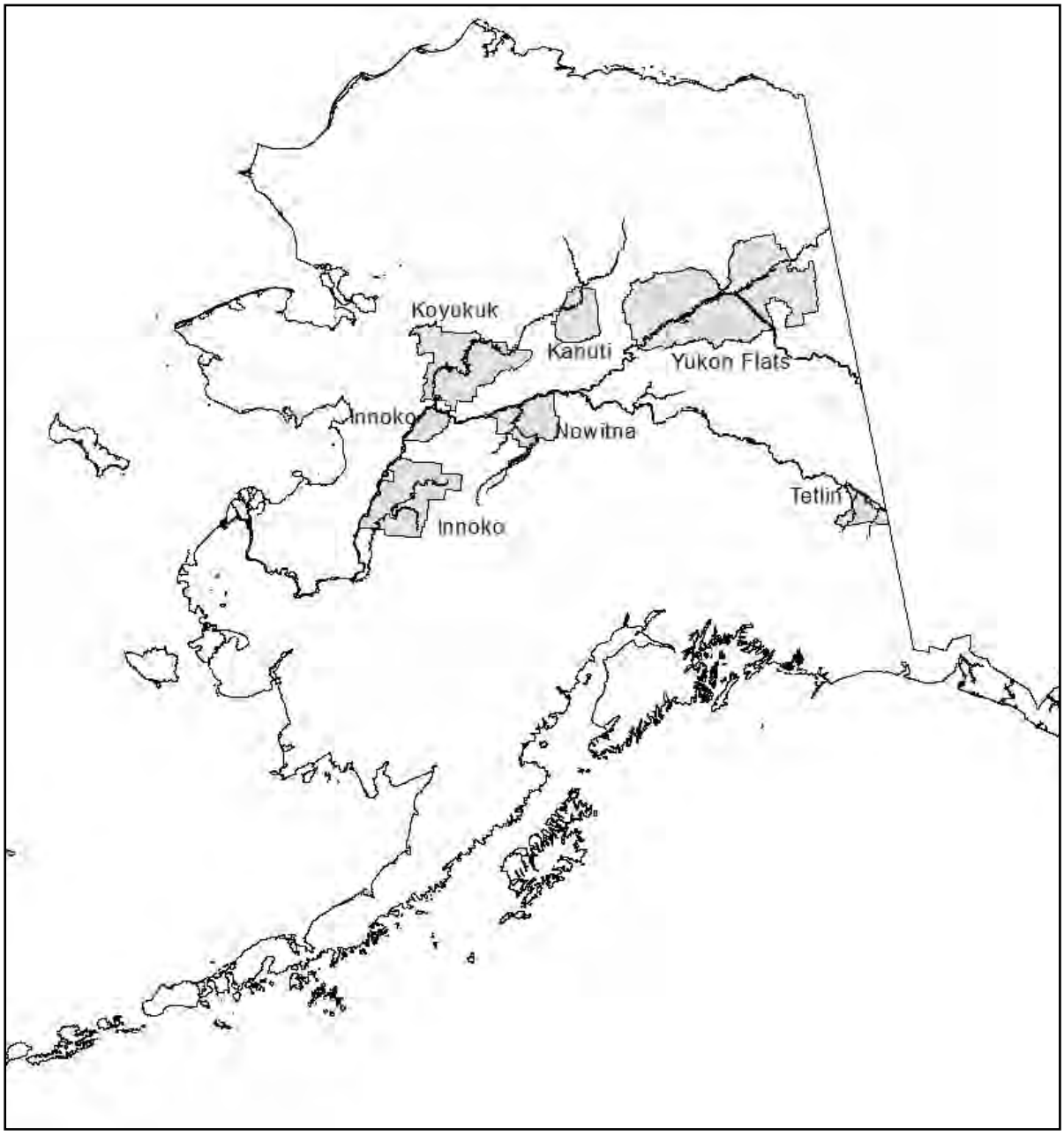


Figure 1. General locations of Interior Alaska NWRs. Note: Innoko NWR consists of the Northern and Southern units.

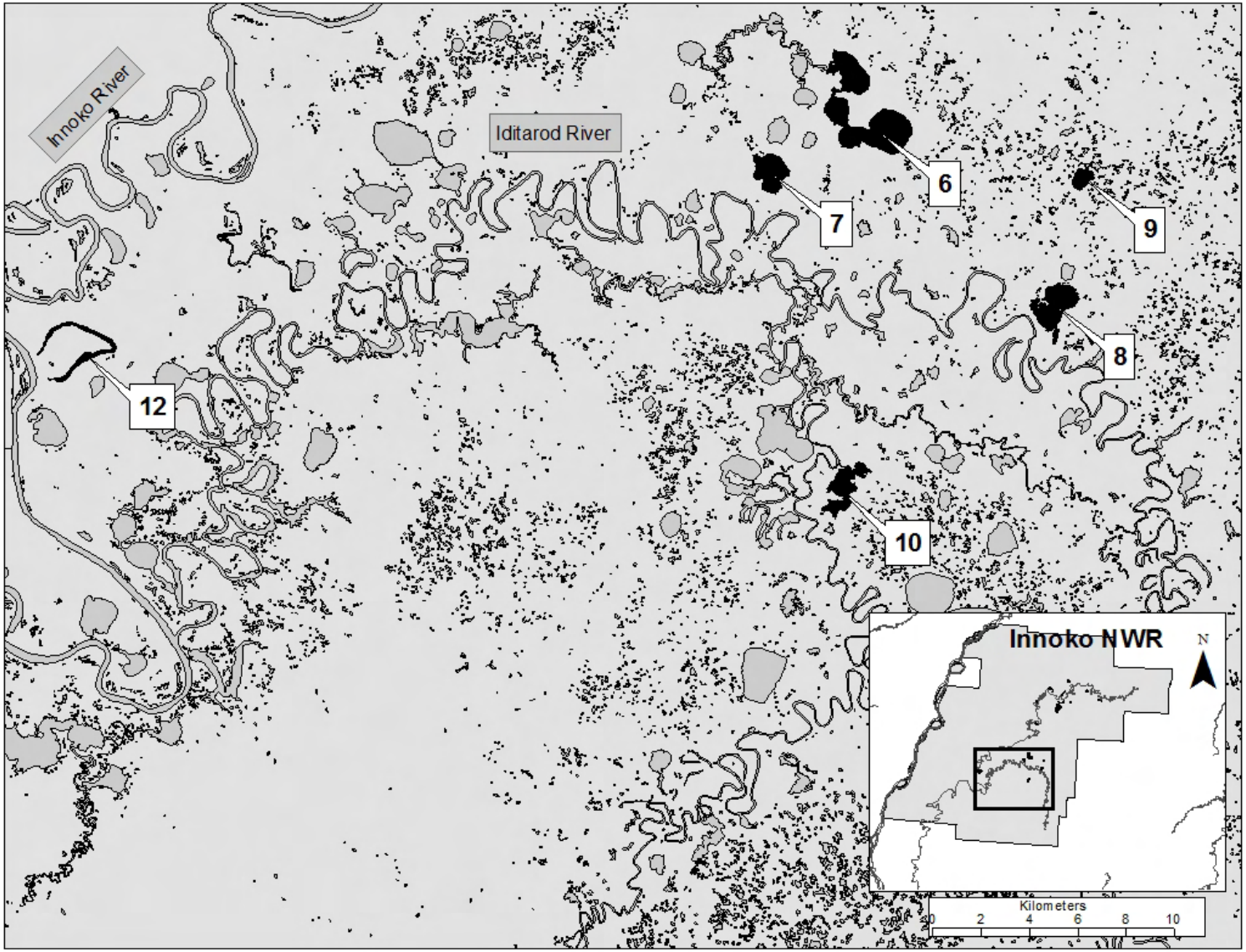


Figure 2. Locations of sampled lakes in Southern Unit of Innoko NWR (south). Table 1 cross-references lake sample number and name with map reference number.

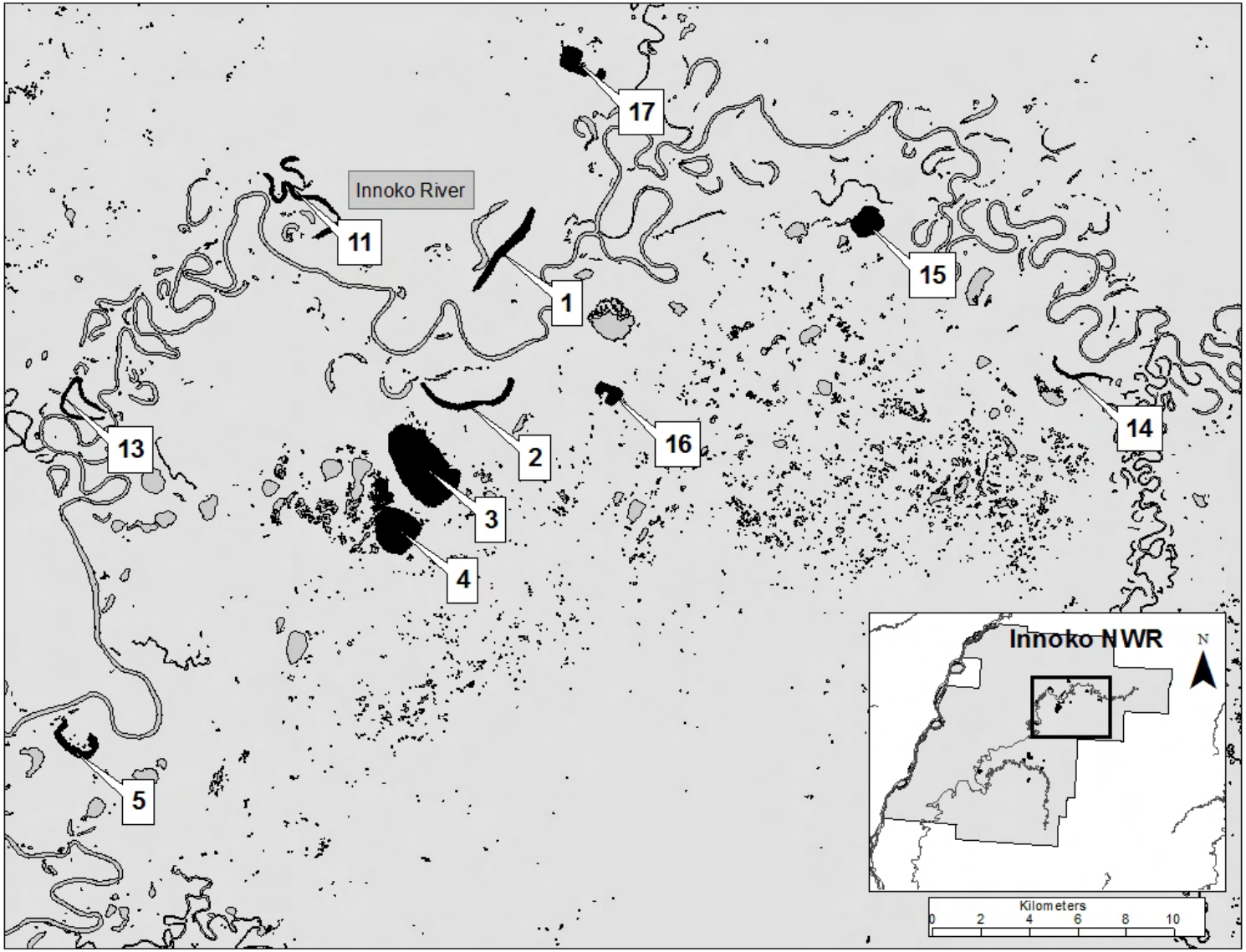


Figure 3. Locations of sampled lakes in Southern Unit of Innoko NWR (east). Table 1 cross-references lake sample number and name with map reference number.

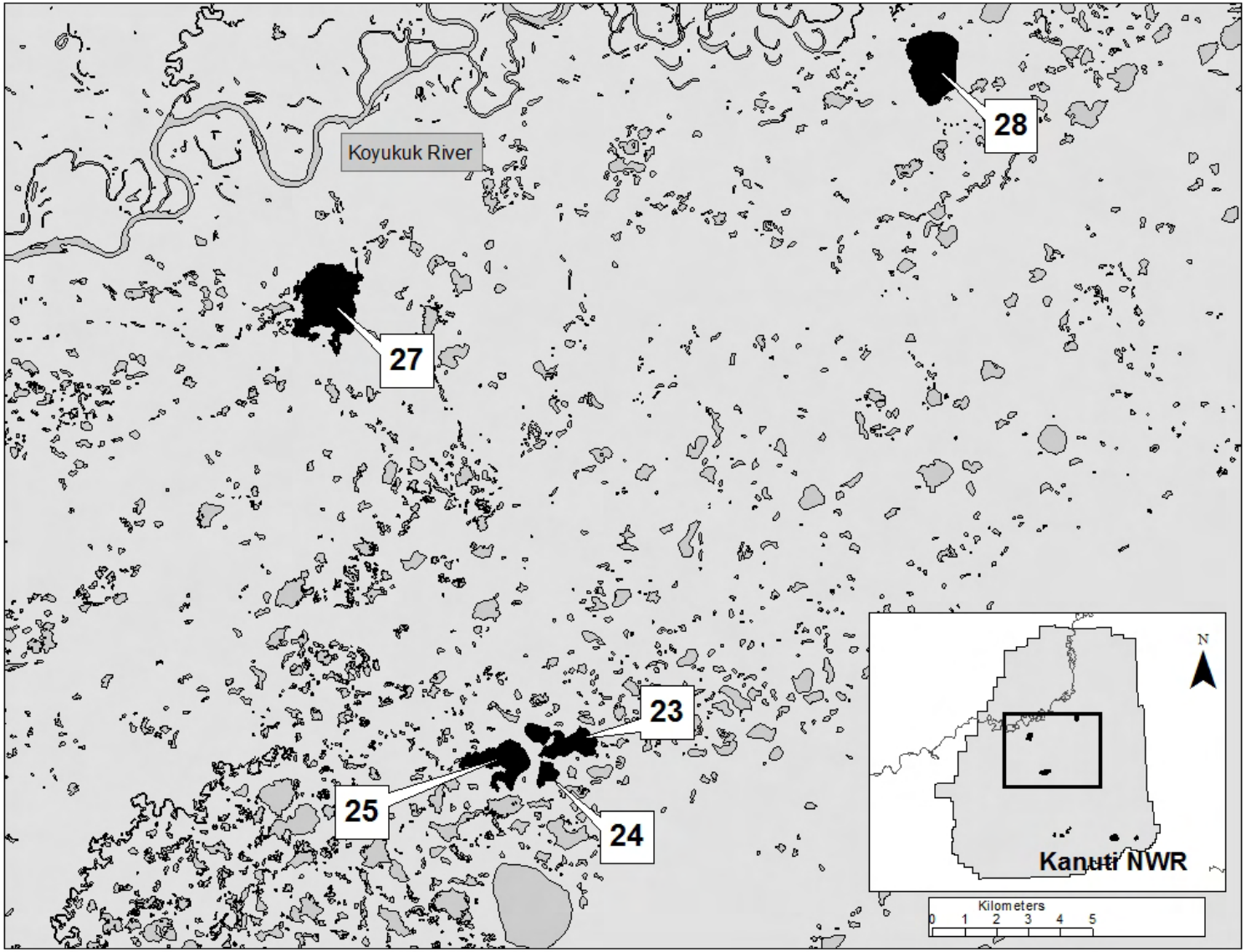


Figure 4. Locations of sampled lakes in Kanuti NWR (north). Table 1 cross-references lake sample number and name with map reference number.

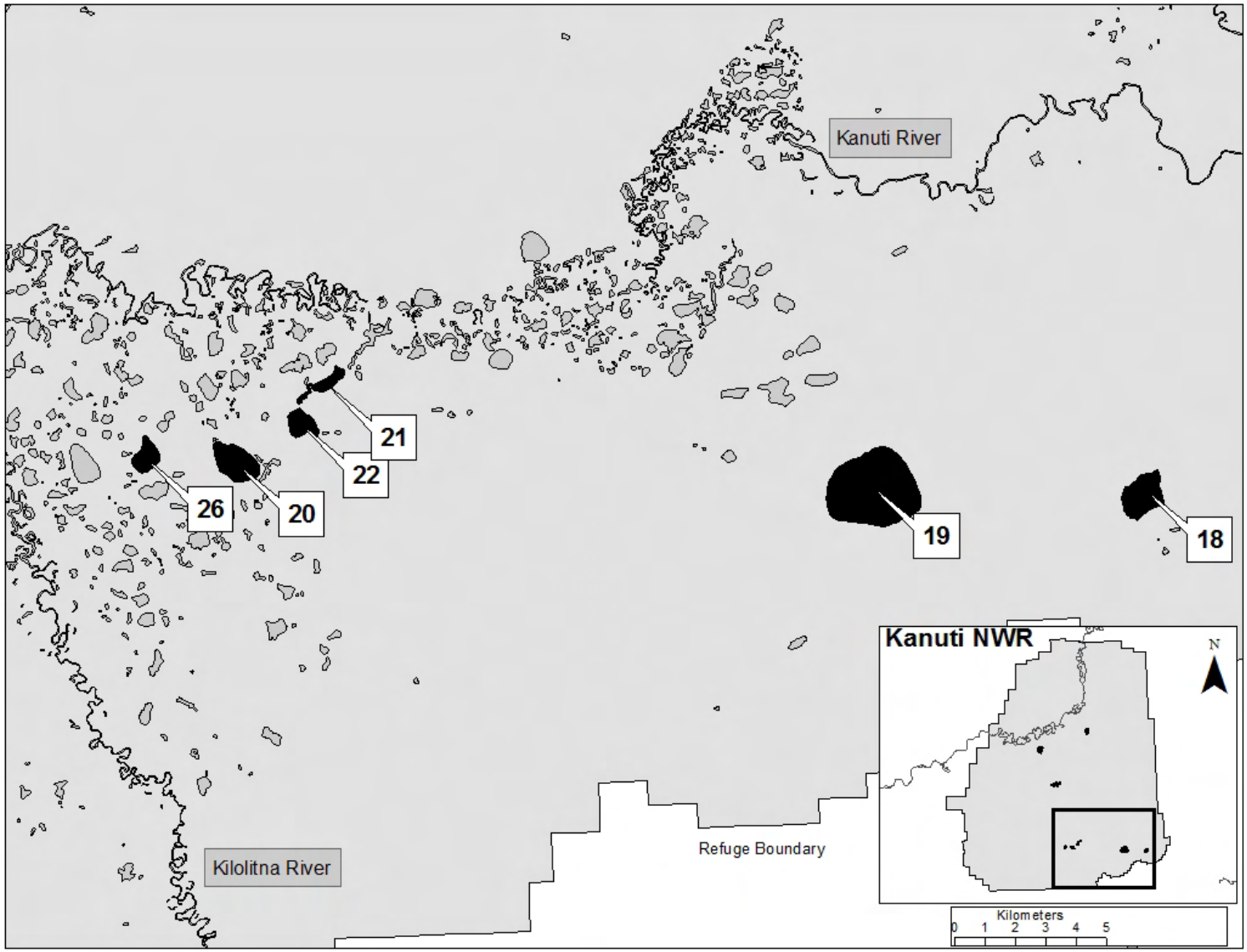


Figure 5. Locations of sampled lakes in Kanuti NWR (south). Table 1 cross-references lake sample number and name with map reference number.

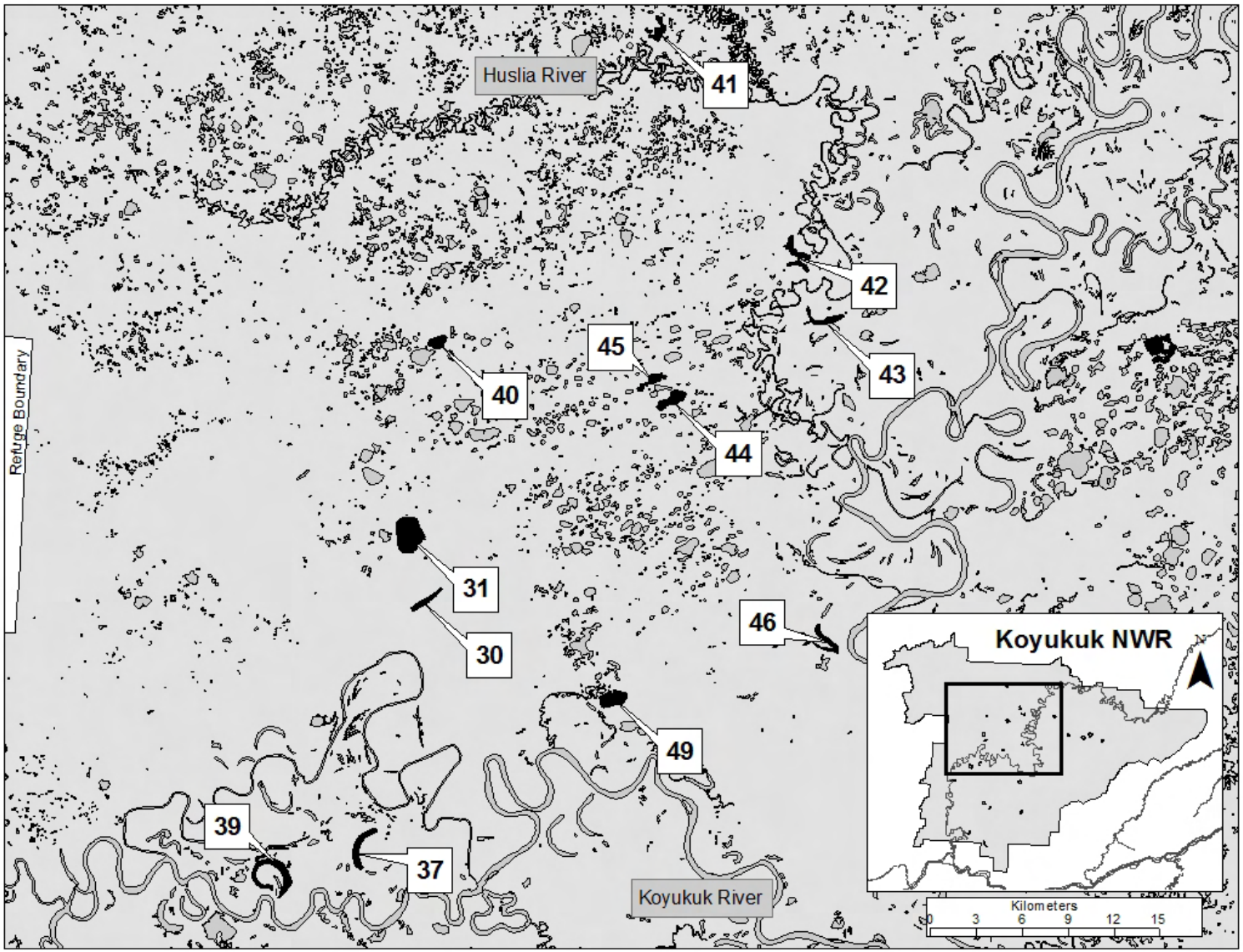


Figure 6. Locations of sampled lakes in Koyukuk NWR (north). Table 1 cross-references lake sample number and name with map reference number.

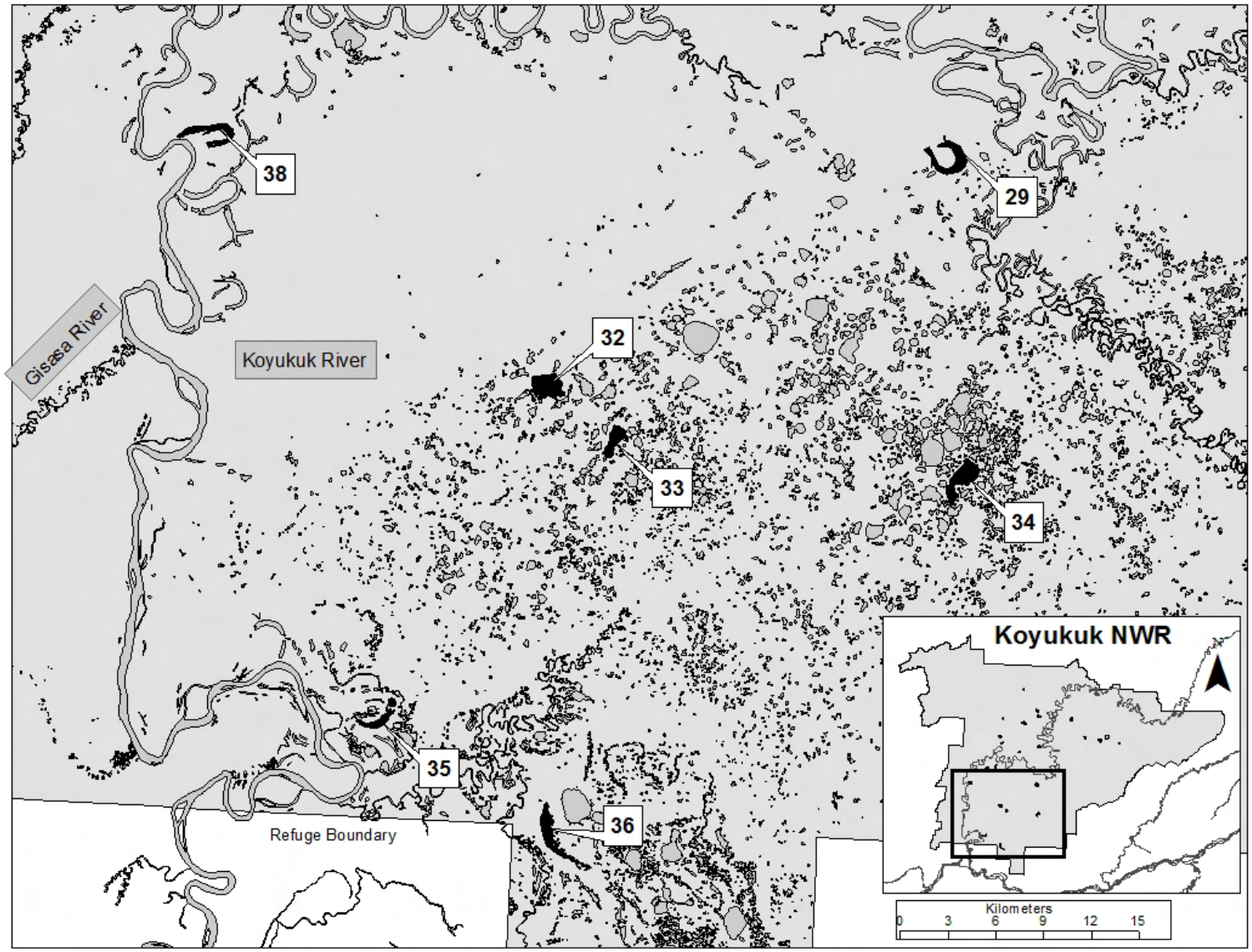


Figure 7. Locations of sampled lakes in Koyukuk NWR (south). Table 1 cross-references lake sample number and name with map reference number.

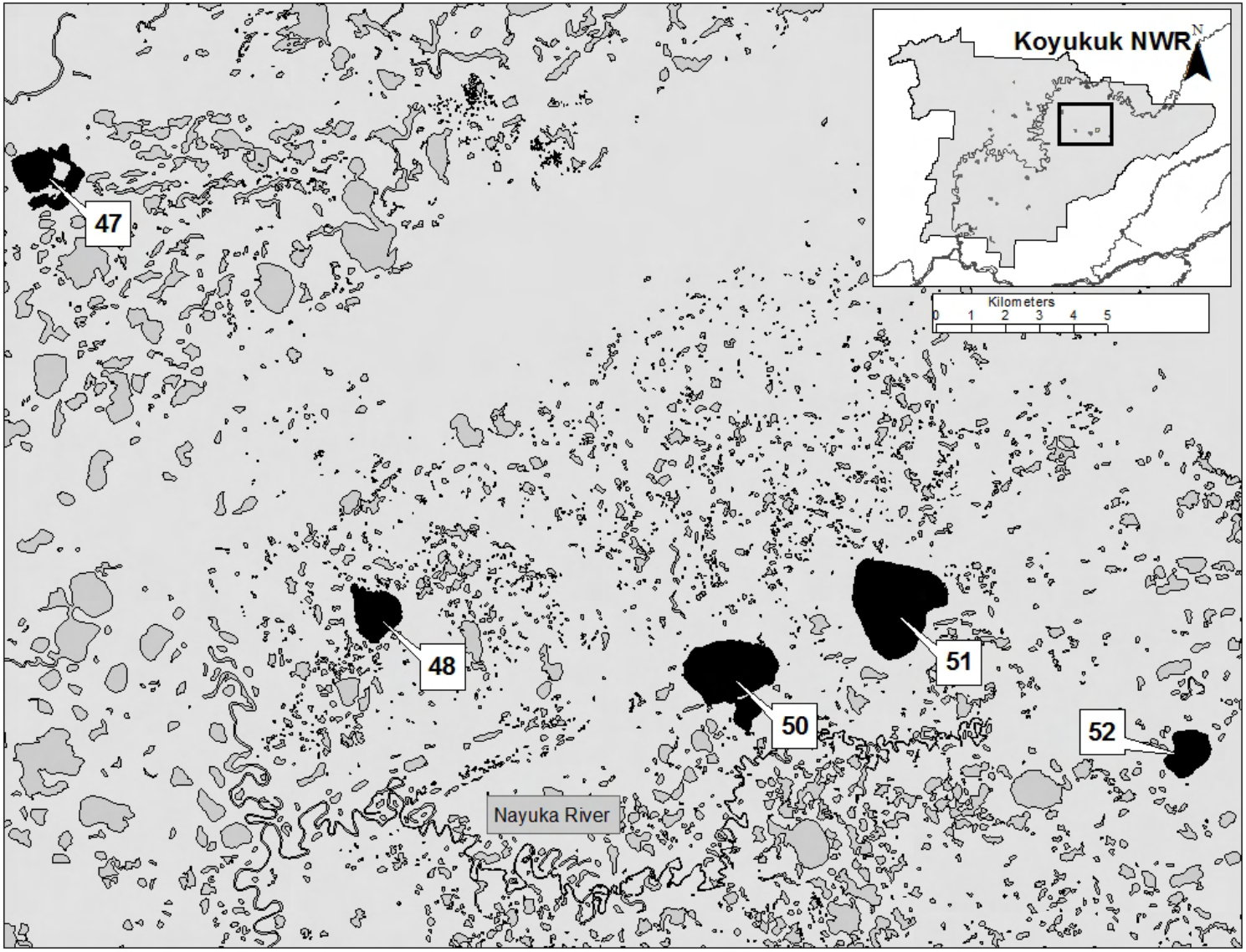


Figure 8. Locations of sampled lakes in Koyukuk NWR (east). Table 1 cross-references lake sample number and name with map reference number.

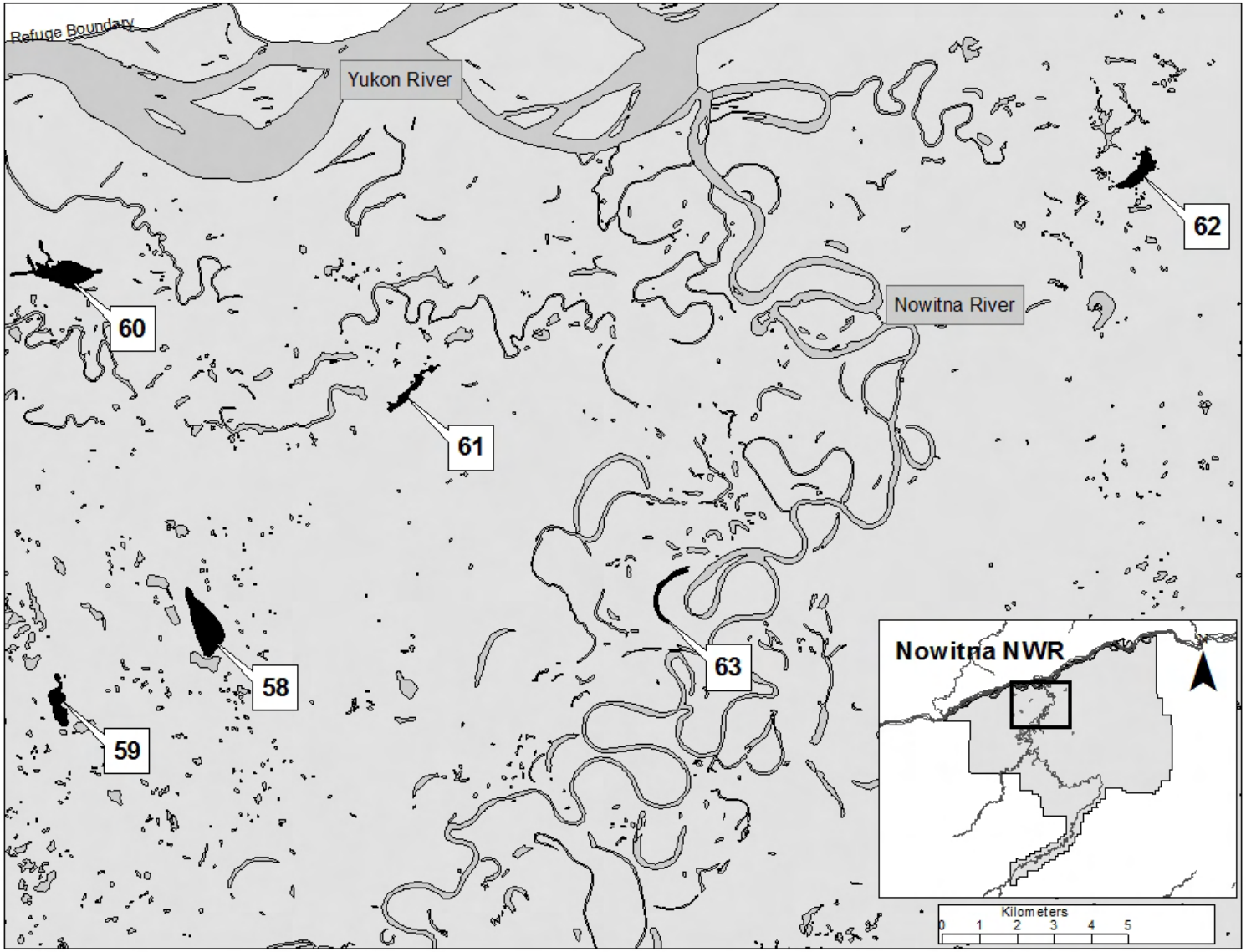


Figure 9. Locations of sampled lakes in Nowitna NWR (north). Table 1 cross-references lake sample number and name with map reference number.

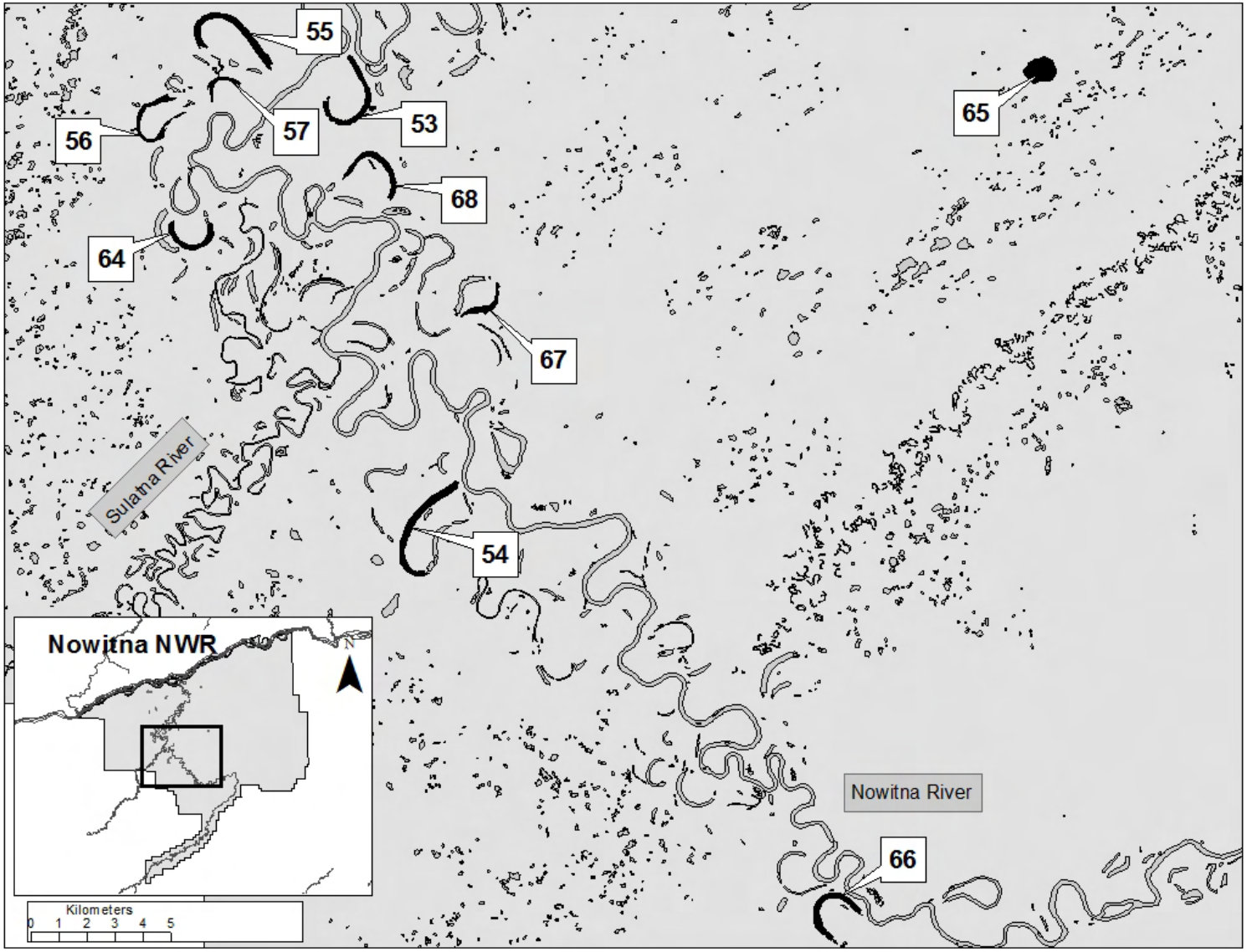


Figure 10. Locations of sampled lakes in Nowitna NWR (south). Table 1 cross-references lake sample number and name with map reference number.

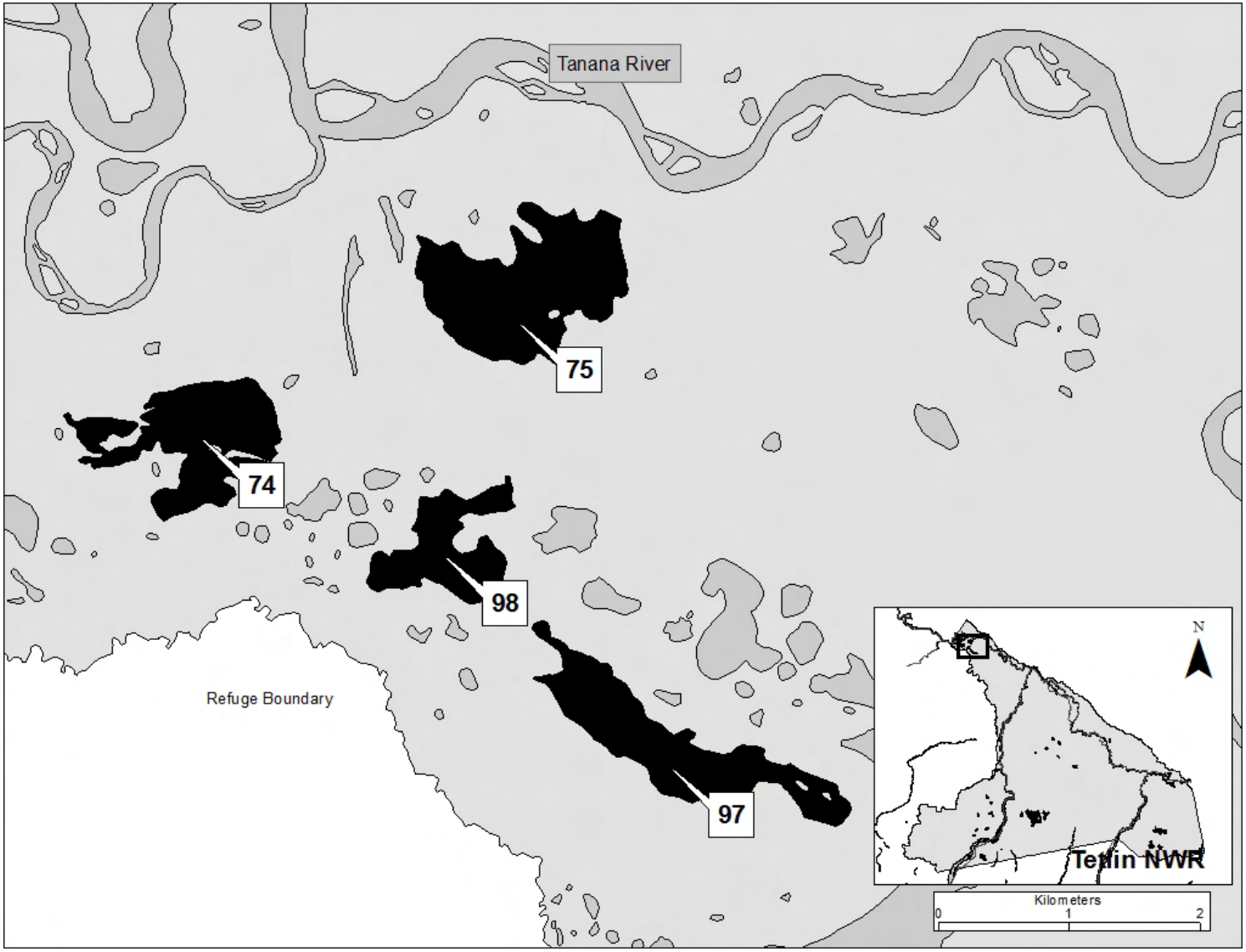


Figure 11. Locations of sampled lakes in Tetlin NWR (north). Table 1 cross-references lake sample number and name with map reference number.

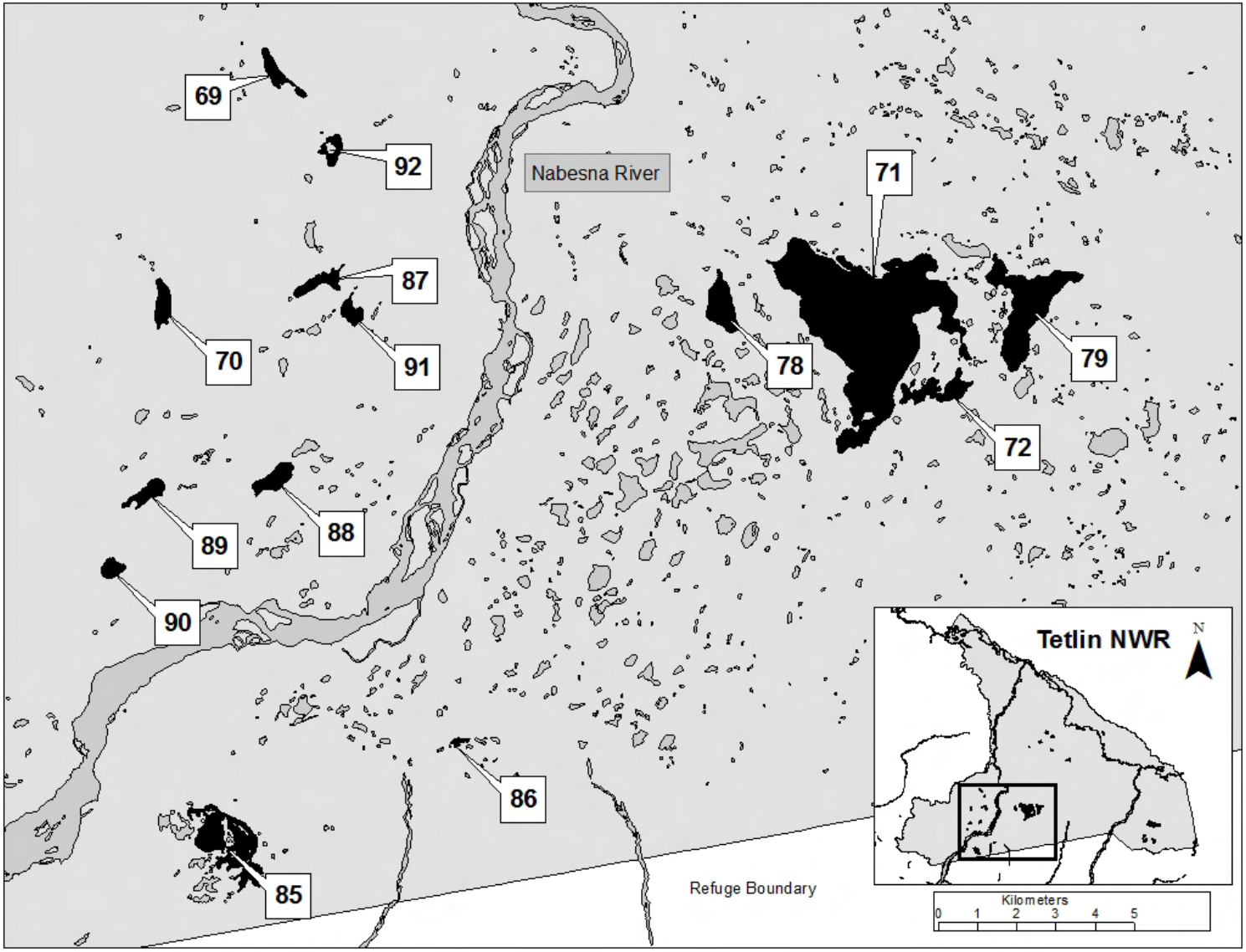


Figure 12. Locations of sampled lakes in Tetlin NWR (south). Table 1 cross-references lake sample number and name with map reference number.

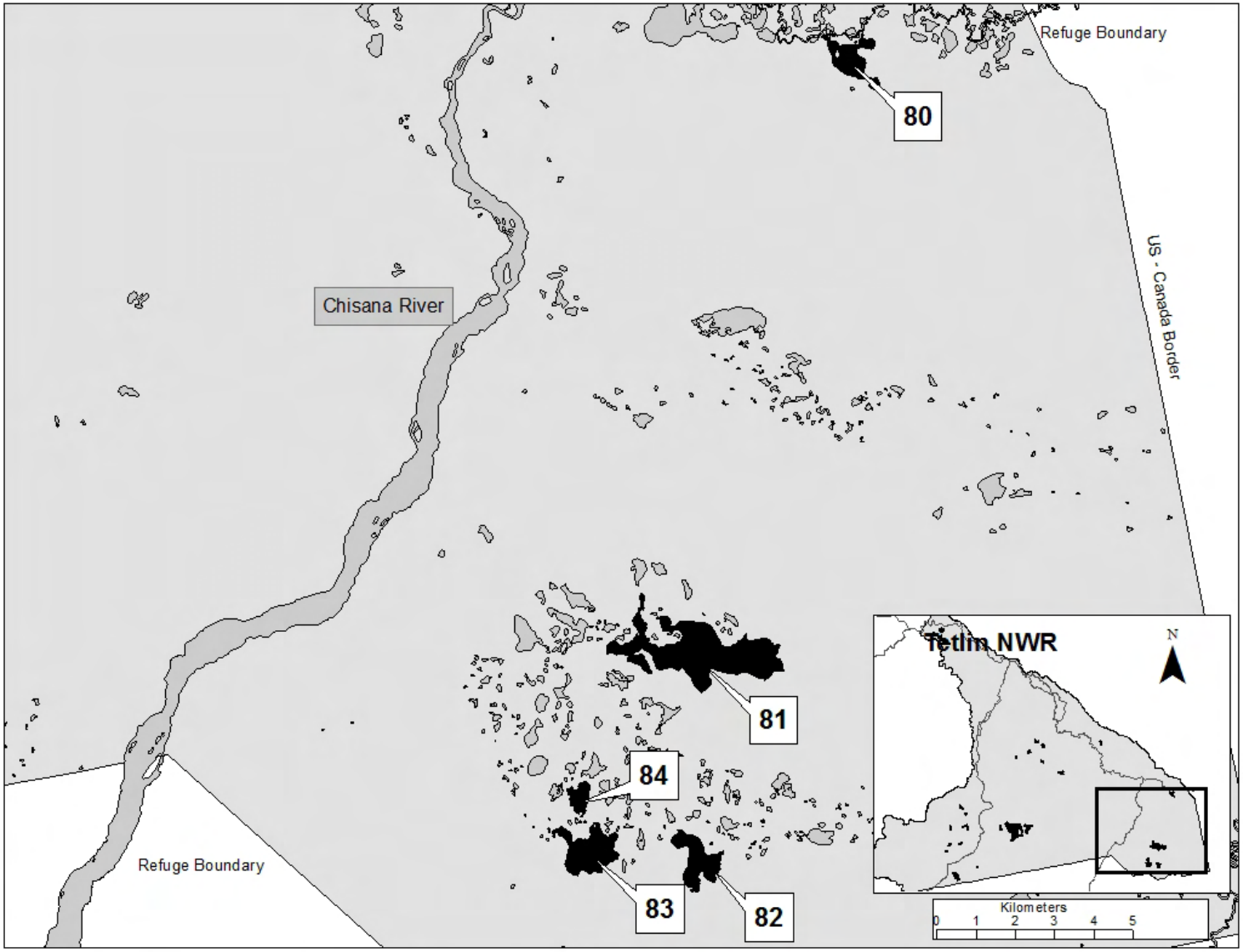


Figure 13. Locations of sampled lakes in Tetlin NWR (east). Table 1 cross-references lake sample number and name with map reference number.

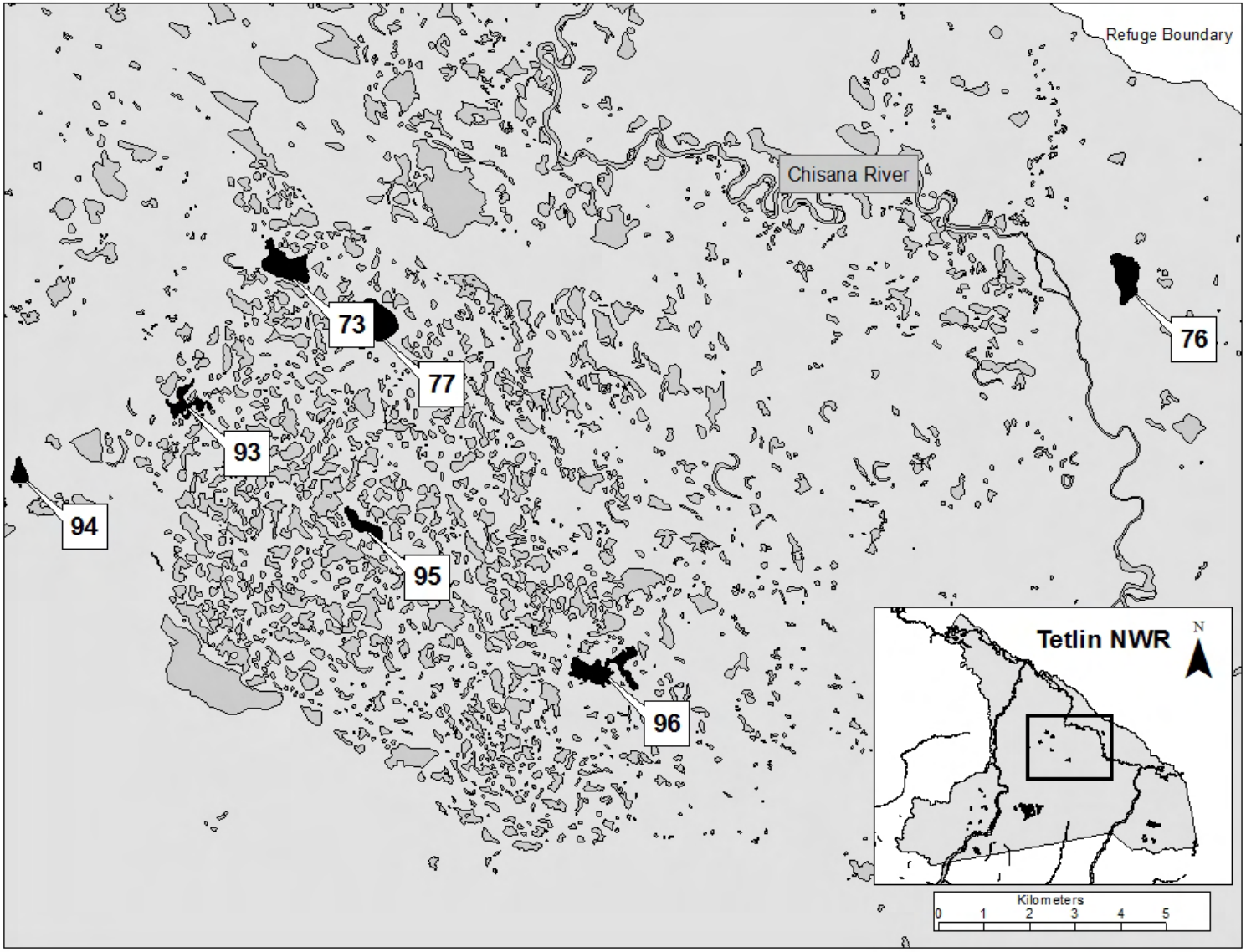


Figure 14. Locations of sampled lakes in Tetlin NWR (middle). Table 1 cross-references lake sample number and name with map reference number.

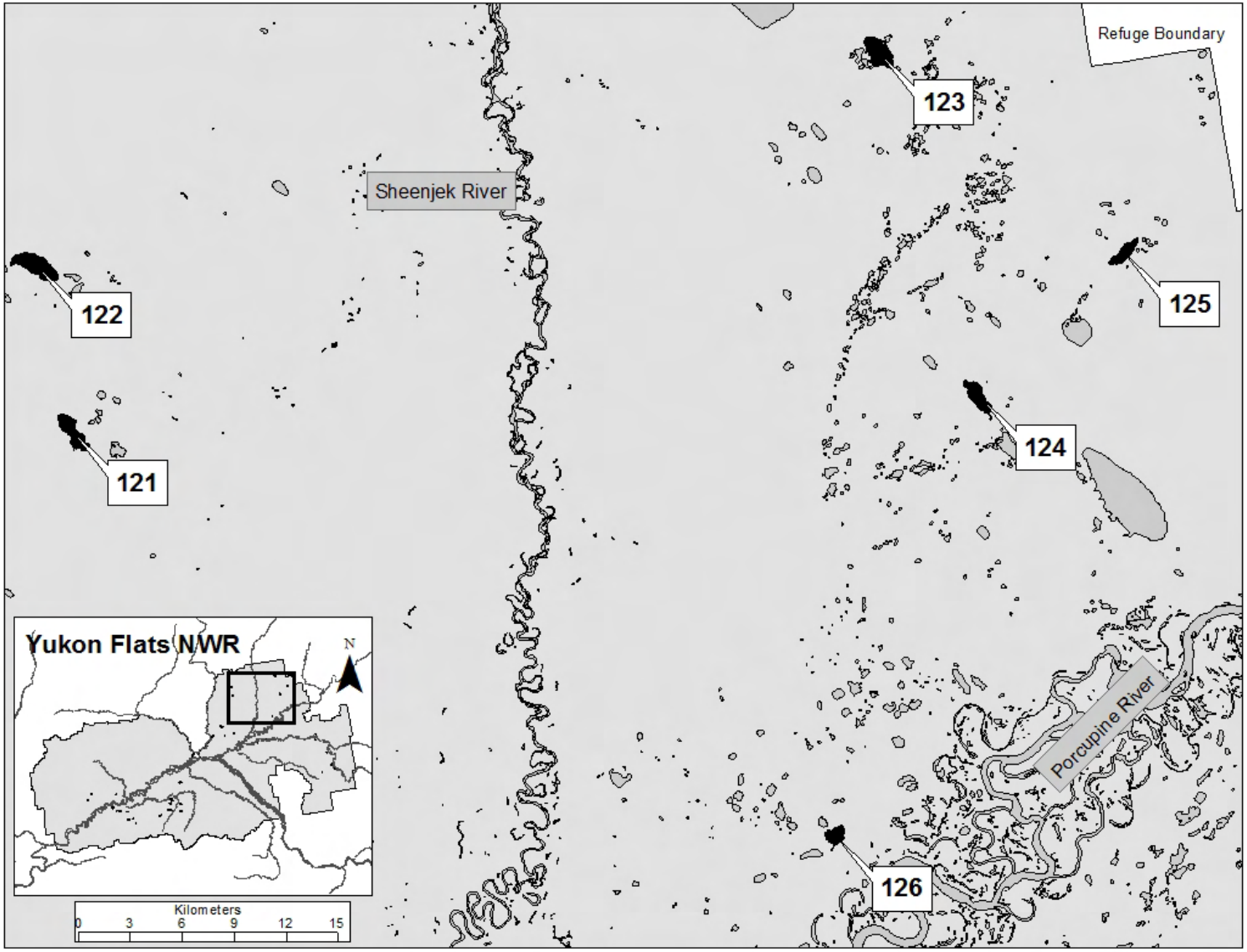


Figure 15. Locations of sampled lakes in Yukon Flats NWR (north). Table 1 cross-references lake sample number and name with map reference number.

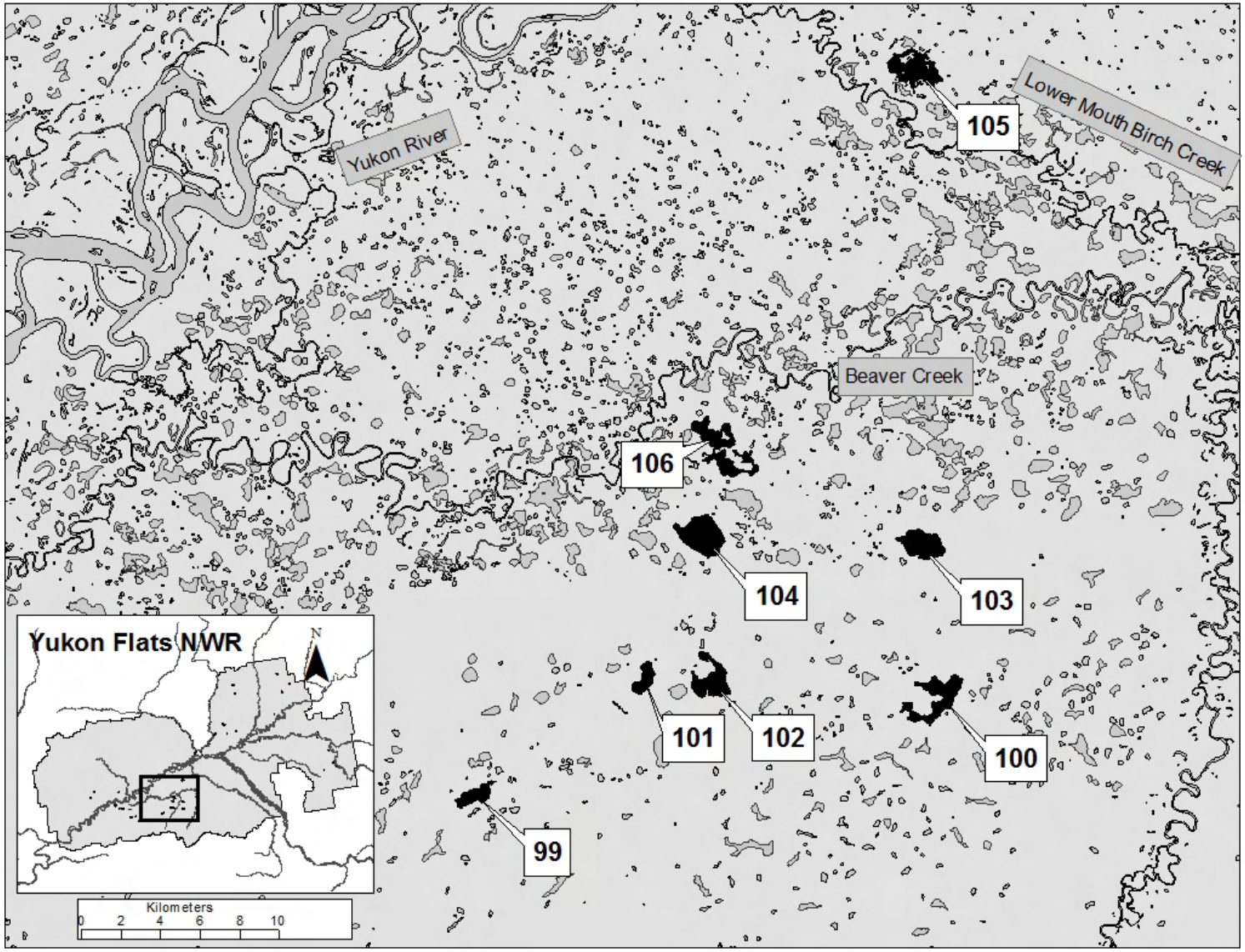


Figure 16. Locations of sampled lakes in Yukon Flats NWR (south). Table 1 cross-references lake sample number and name with map reference number.

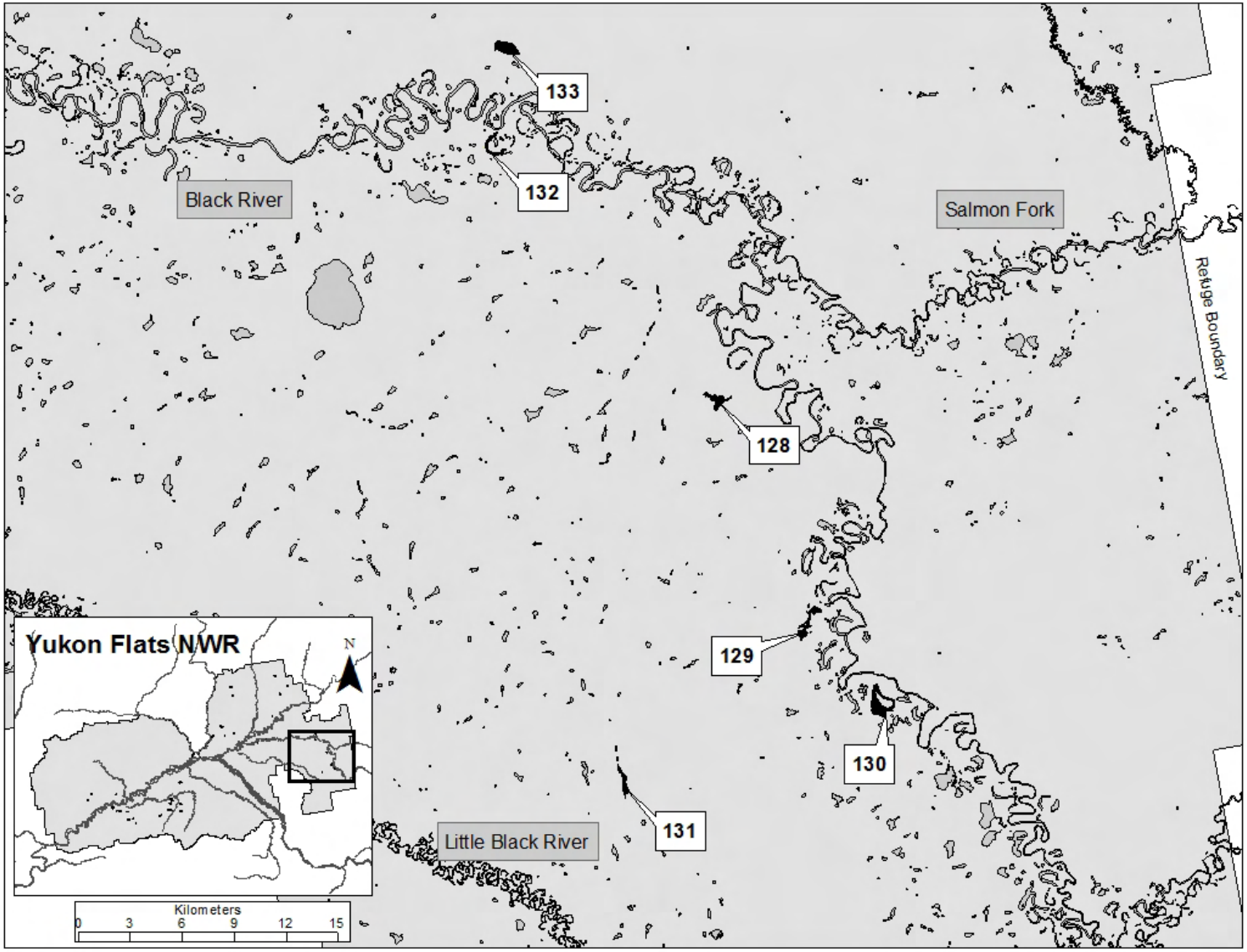


Figure 17. Locations of sampled lakes in Yukon Flats NWR (east). Table 1 cross-references lake sample number and name with map reference number.

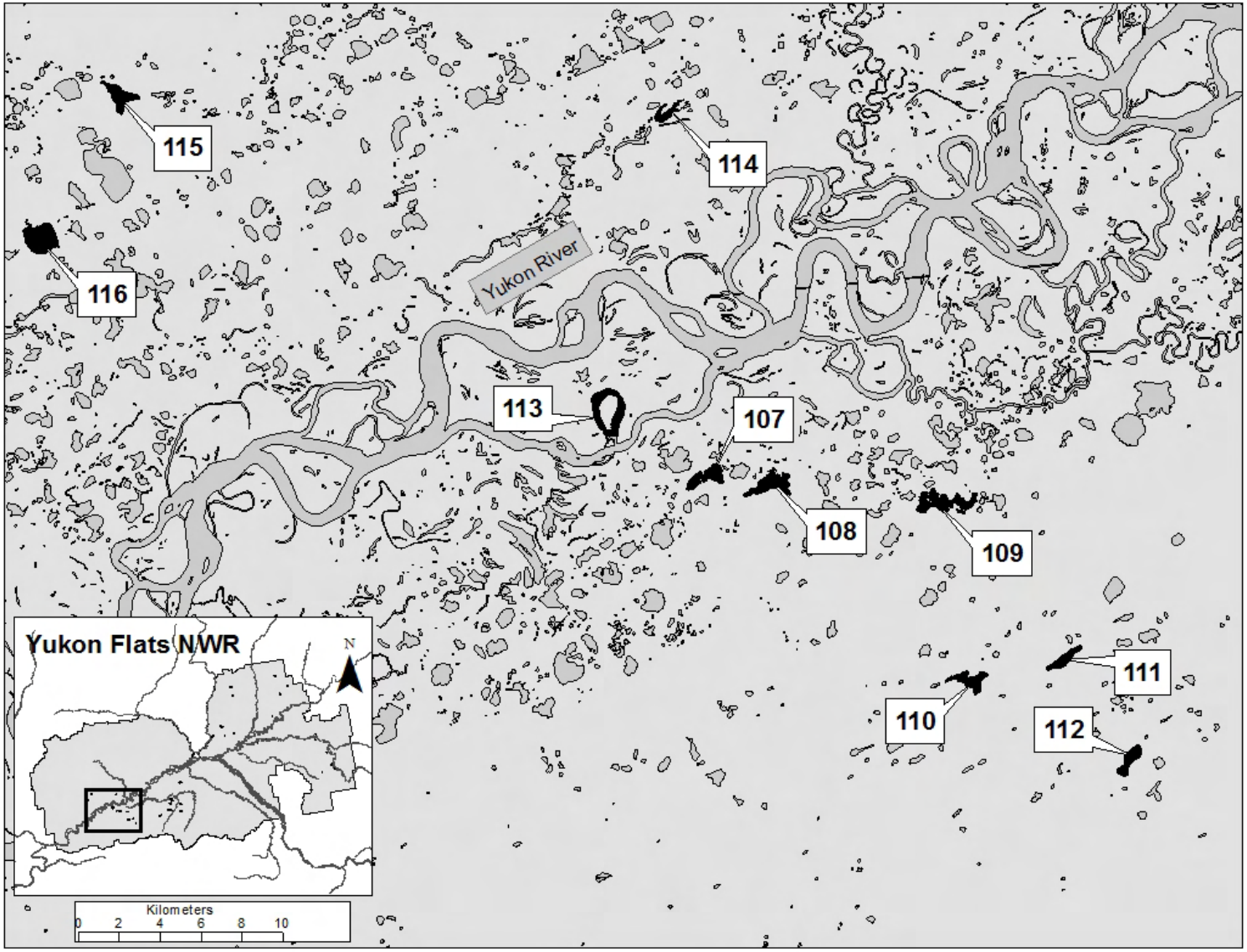


Figure 18. Locations of sampled lakes in Yukon Flats NWR (west). Table 1 cross-references lake sample number and name with map reference number.

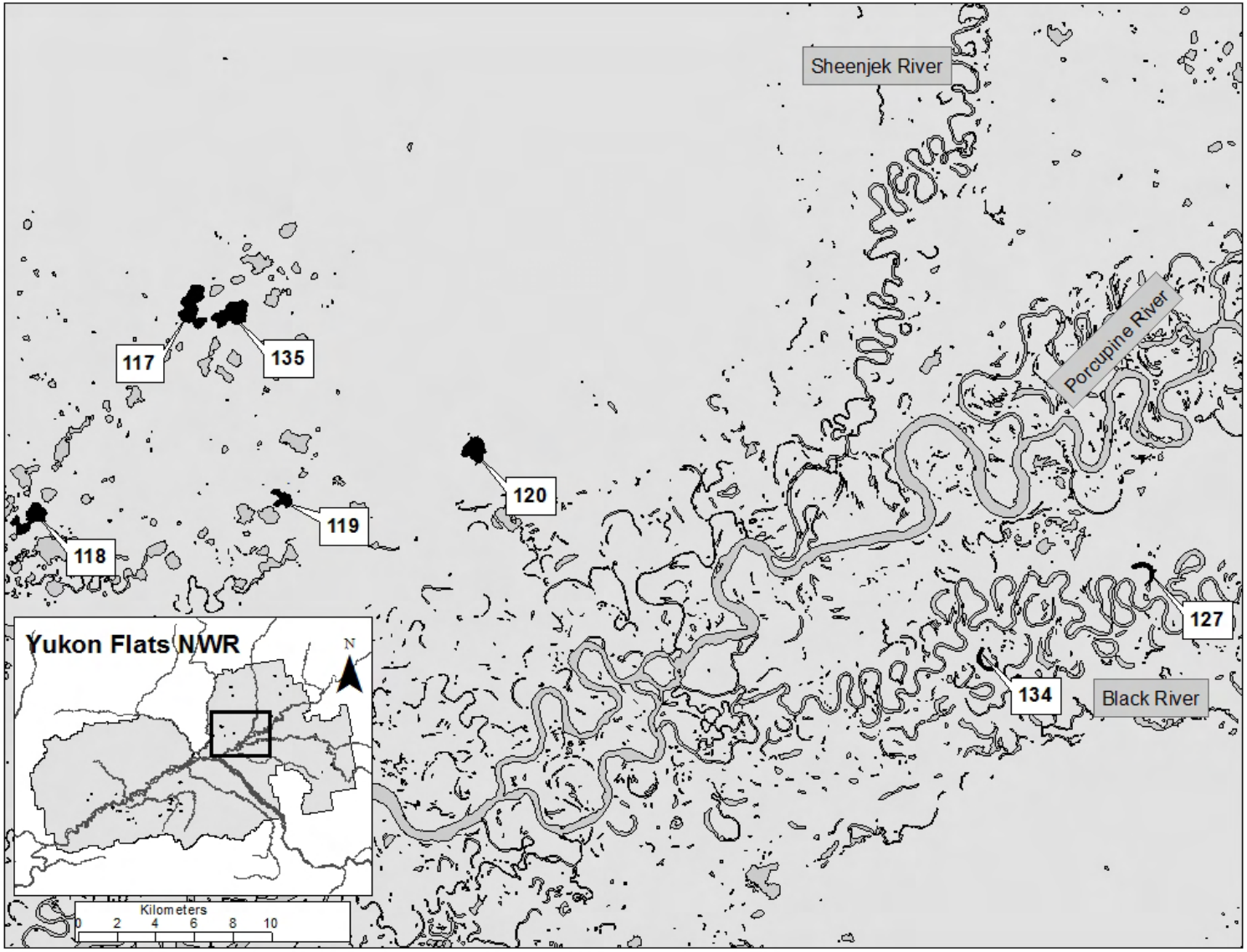


Figure 19. Locations of sampled lakes in Yukon Flats NWR (middle). Table 1 cross-references lake sample number and name with map reference number.

Table 1. Lake locations (WGS84 datum) and sampling date by Interior Alaska NWR, 1984–1986. Map reference refers to numbering of lake locations on Figures 2–19. Asterisk signifies no sampling date recorded, so listed by year only.

Lake number	Lake name	Map reference	Coordinates Lat (N)	Coordinates Long (W)	Sampling date
		Innoko NWR			
285-01	Unnamed	1	63.6234	157.8405	7/20/1985
285-02	Unnamed	2	63.5656	157.8595	7/20/1985
285-03	Unnamed	3	63.5418	157.8934	7/21/1985
285-04	Unnamed	4	63.5188	157.9140	7/22/1985
285-05	Unnamed	5	63.4296	158.1720	7/22/1985
285-06	Unnamed	6	63.2340	158.2202	7/23/1985
285-07	Unnamed	7	63.2164	158.3073	7/23/1985
285-08	Unnamed	8	63.1741	158.0675	7/25/1985
285-09	Unnamed	9	63.2217	158.0492	7/25/1985
285-10	Unnamed	10	63.1005	158.2316	7/25/1985
285-11	Unnamed	11	63.6415	158.0161	7/28/1985
285-12	Unnamed	12	63.1316	158.8588	8/01/1985
285-13	Unnamed	13	63.5595	158.1967	8/01/1985
285-14	Unnamed	14	63.5885	157.3565	8/01/1985
285-15	Unnamed	15	63.6414	157.5361	8/02/1985
285-16	Unnamed	16	63.5735	157.7406	8/02/1985
285-17	Unnamed	17	63.6958	157.7875	8/03/1985
		Kanuti NWR			
384-01	Tokusatatquaten	18	66.1208	151.1950	7/02/1984
384-02	Sithylemenkat	19	66.1252	151.3933	7/10/1984
384-03	Old Dummy	20	66.1384	151.8539	7/01/1984
384-04	Unnamed	21	66.1602	151.7852	6/30/1984
384-05	Unnamed	22	66.1493	151.8063	6/28/1984
385-01	Konedsin	23	66.3736	151.9525	1985*
385-02	Unnamed	24	66.3640	151.9731	1985*
385-03	Kodosin	25	66.3699	152.0000	1985*
385-04	Unnamed	26	66.1408	151.9202	1985*
385-05	Mingkoket	27	66.4998	152.1174	1985*
385-06	Minnkokut	28	66.5604	151.6885	1985*
		Koyukuk NWR			
484-01	Unnamed	29	65.3947	156.5800	1984*
484-02	Unnamed	30	65.6404	157.1457	1984*
485-01	Unnamed	31	65.6790	157.1699	6/16/1985
485-02	Unnamed	32	65.2521	157.1198	6/18/1985
485-03	Louis	33	65.2226	157.0278	6/19/1985
485-04	Unnamed	34	65.2116	156.5546	6/20/1985
485-05	Unnamed	35	65.0584	157.3211	6/20/1985
485-06	Unnamed	36	65.0025	157.0936	6/21/1985
485-07	Tachanlowa	37	65.4915	157.2236	6/23/1985
485-08	Unnamed	38	65.3883	157.5816	6/26/1985
485-09	Unnamed	39	65.4826	157.3345	6/26/1985
485-10	Upper Birch	40	65.7931	157.1414	6/27/1985

Table 1. Continued.

Lake number	Lake name	Map reference	Coordinates Lat (N)	Coordinates Long (W)	Sampling date
		Koyukuk NWR (cont.)			
485-11	Unnamed	41	65.9814	156.8462	6/28/1985
485-12	Evan	42	65.8521	156.6327	6/29/1985
485-13	Clay	43	65.8150	156.5900	6/30/1985
485-14	Crow	44	65.7655	156.8049	6/30/1985
485-15	Unnamed	45	65.7775	156.8352	7/02/1985
485-16	Tsedolalindin	46	65.6277	156.5666	7/03/1985
485-17	Unnamed	47	65.8081	156.1155	7/03/1985
485-18	Unnamed	48	65.6946	155.8945	7/05/1985
485-19	Unnamed	49	65.5895	156.8699	7/06/1985
485-20	Hadokhten	50	65.6816	155.6699	7/07/1985
485-21	Hahanudan	51	65.6993	155.5666	7/08/1985
485-22	Klymunget	52	65.6626	155.3791	7/09/1985
		Nowitna NWR			
584-01	Unnamed	53	64.6732	154.4504	1984*
584-02	Unnamed	54	64.5424	154.4067	1984*
586-01	Unnamed	55	64.7004	154.5298	6/22/1986
586-02	Unnamed	56	64.6671	154.6095	6/22/1986
586-03	Unnamed	57	64.6857	154.5434	6/24/1986
586-04	Unnamed	58	64.7956	154.5508	6/24/1986
586-05	Unnamed	59	64.7801	154.6347	6/25/1986
586-06	Unnamed	60	64.8819	154.6338	6/26/1986
586-07	Unnamed	61	64.8539	154.4413	6/26/1986
586-08	Unnamed	62	64.9077	154.0242	6/26/1986
586-09	Unnamed	63	64.8012	154.2949	6/27/1986
586-10	Unnamed	64	64.6367	154.5837	6/28/1986
586-11	Unnamed	65	64.6889	153.9349	6/30/1986
586-12	Unnamed	66	64.4241	154.0853	6/30/1986
586-13	Unnamed	67	64.6128	154.3494	6/30/1986
586-14	Unnamed	68	64.6520	154.4208	7/01/1986
		Tetlin NWR			
784-01	Fern	69	62.7016	142.2960	7/01/1984
784-02	Unnamed	70	62.6533	142.3714	7/04/1984
784-03	Jatahmund	71	62.6193	142.0277	7/20/1984
784-04	Unnamed	72	62.6022	141.9922	7/11/1984
784-05	Unnamed	73	62.8310	141.8118	7/24/1984
784-06	Fish Camp	74	63.1503	142.2788	7/26/1984
784-07	T1ocogn	75	63.1542	142.2282	7/29/1984
785-01	Unnamed	76	62.7975	141.4563	6/13/1985
785-02	Deep	77	62.8163	141.7786	6/10/1985
785-03	Unnamed	78	62.6298	142.0967	6/16/1985
785-04	Takomahto	79	62.6190	141.9468	7/09/1985
785-05	Unnamed	80	62.6365	141.1226	6/27/1985

Table 1. Continued.

Lake number	Lake name	Map reference	Coordinates Lat (N)	Coordinates Long (W)	Sampling date
		Tetlin NWR (cont.)			
785-06	American Wellesly	81	62.5079	141.2506	6/17/1985
786-01	East Wellesly	82	62.4640	141.2713	8/28/1986
786-02	West Wellesly	83	62.4706	141.3237	8/05/1986
786-03	Unnamed	84	62.4822	141.3239	8/07/1986
786-04	Pickerel	85	62.5309	142.3887	9/04/1986
786-05	Unnamed	86	62.5432	142.2654	9/03/1986
786-06	Unnamed	87	62.6533	142.2907	8/21/1986
786-07	Unnamed	88	62.6103	142.3312	8/19/1986
786-08	Unnamed	89	62.6124	142.3945	7/29/1986
786-09	Pie	90	62.5966	142.4194	7/29/1986
786-10	Unnamed	91	62.6445	142.2796	7/25/1986
786-11	Unnamed	92	62.6824	142.2747	7/23/1986
786-12	Fish	93	62.8099	141.8665	7/22/1986
786-13	Unnamed	94	62.8015	141.9409	7/17/1986
786-14	Unnamed	95	62.7796	141.7999	7/16/1986
786-15	Unnamed	96	62.7428	141.7099	7/15/1986
786-16	Tsilchin	97	63.1224	142.2174	7/10/1986
786-17	Tlechegn	98	63.1394	142.2456	6/30/1986
		Yukon Flats NWR			
884-01	Lower Halfway	99	66.0817	146.9404	1984*
884-02	Unnamed	100	66.1005	146.4113	1984*
884-03	Unnamed	101	66.1256	146.7412	1984*
884-04	Unnamed	102	66.1216	146.6663	7/24/1984
884-05	Unnamed	103	66.1722	146.4185	1984*
884-06	Ninemile	104	66.1857	146.6560	1984*
884-07	Canvasback	105	66.3859	146.3609	1984*
884-08	Unnamed	106	66.2314	146.6373	1984*
886-01	Sundown	107	66.1726	147.9707	7/08/1986
886-02	Tincan	108	66.1679	147.9107	7/09/1986
886-03	Sweeney	109	66.1512	147.7341	7/10/1986
886-04	Unnamed	110	66.0696	147.7151	7/10/1986
886-05	Unnamed	111	66.0764	147.6132	7/11/1986
886-06	Unnamed	112	66.0314	147.5508	7/11/1986
886-07	Indian Portage	113	66.2013	148.0899	7/12/1986
886-08	Mallard	114	66.3324	147.9803	7/16/1986
886-09	Unnamed	115	66.3604	148.5799	7/16/1986
886-10	Flat	116	66.2989	148.6746	7/17/1986
886-11	Unnamed	117	66.8888	145.2048	7/27/1986
886-12	Unnamed	118	66.8047	145.4153	7/23/1986
886-13	Unnamed	119	66.8034	145.1168	7/23/1986
886-14	Unnamed	120	66.8058	144.8954	7/23/1986
886-15	Unnamed	121	67.1799	144.8003	7/24/1986
886-16	Kwittevunkud	122	67.2688	144.8165	7/24/1986

Table 1. Continued.

Lake number	Lake name	Map reference	Coordinates Lat (N)	Coordinates Long (W)	Sampling date
		Yukon Flats NWR (cont.)			
886-17	Big	123	67.3144	143.6653	7/25/1986
886-18	Big Rat	124	67.1283	143.6029	7/25/1986
886-19	Unnamed	125	67.1905	143.3837	7/26/1986
886-20	Sams Big	126	66.9131	143.8796	7/26/1986
886-21	Unnamed	127	66.7040	144.1337	7/29/1986
886-22	Unnamed	128	66.4728	142.6834	7/28/1986
886-23	Birch	129	66.3468	142.6272	7/30/1986
886-24	Tommy	130	66.2985	142.5390	7/30/1986
886-25	Unnamed	131	66.2831	142.8858	7/31/1986
886-26	Rotten Fish Slough	132	66.6226	142.9241	7/31/1986
886-27	Unnamed	133	66.6723	142.8766	7/31/1986
886-28	Unnamed	134	66.6805	144.3445	8/01/1986
886-29	Unnamed	135	66.8844	145.1551	8/02/1986

Table 2. Total number of lakes sampled by lake type and grouped by Interior Alaska NWR, 1984–1986.

National Wildlife Refuge	Lake type			Total
	Lowland	Oxbow	Foothill	
Innoko NWR	10	7	0	17
Kanuti NWR	9	0	2	11
Koyukuk NWR	15	9	0	24
Nowitna NWR	6	10	0	16
Tetlin NWR	14	0	16	30
Yukon Flats NWR	20	4	13	37
Total	74	30	31	135

Table 3. Physio-chemical data for all lakes sampled in Innoko NWR, 1985.

Lake number	Lake type[1]	System type[2]	Flood potential[3]	Elevation (m)	Surface area (ha)	Max. depth (m)	Mean depth (m)	Secchi (m)	Conductivity (µS/cm)	Total alkalinity (mg/l)	Total hardness (mg/l)	pH
285-01	O	RC	H	34	225	2.7	1.6	0.8	22	17	17	6.5
285-02	O	RC	H	32	104	4.0	2.0	0.5	34	34	34	6.5
285-03	L	RC	L	33	624	1.5	0.8	1.1	8	17	17	6.0
285-04	L	NC	L	35	343	1.5	0.8	1.1	4	17	17	6.0
285-05	O	RC	H	29	115	7.6	3.6	1.5	23	17	17	6.5
285-06	L	RC	H	20	646	2.7	1.9	0.5	34	34	34	6.0
285-07	L	RC	H	18	189	1.8	1.5	0.7	30	34	34	6.5
285-08	L	RC	H	18	327	1.8	1.5	0.6	50	34	34	6.5
285-09	L	NC	L	44	55	1.5	0.8	>1.5	7	17	17	6.0
285-10	L	RC	H	24	159	2.7	1.6	0.8	28	34	34	6.0
285-11	O	NC	H	21	195	6.1	2.2	0.5	34	34	34	6.5
285-12	O	RC	H	21	98	7.0	1.5	0.5	58	51	51	6.5
285-13	O	RC	H	22	75	8.2	2.3	0.6	50	34	34	6.5
285-14	O	NC	H	37	61	3.4	1.9	1.5	43	34	34	6.5
285-15	L	NC	L	29	135	0.9	0.5	>0.9	6	17	17	6.0
285-16	L	NC	L	37	63	0.9	0.5	>0.9	7	17	17	5.8
285-17	L	RC	H	34	128	1.8	1.1	0.6	46	34	34	7.3

[1]Lake type: L = lowland, O = oxbow, F = foothill.

[2] System type: RC = river connected, NC = not connected to a river.

[3] Flood potential: H = high, L = low.

Table 4. Physio-chemical data for all lakes sampled in Kanuti NWR, 1984 and 1985.

Lake number	Lake type[1]	System type[2]	Flood potential[3]	Elevation (m)	Surface area (ha)	Max. depth (m)	Mean depth (m)	Secchi (m)	Conductivity (µS/cm)	Total alkalinity (mg/l)	Total hardness (mg/l)	pH
384-01	F	RC	L	363	140	0.9	0.9	>0.9	16	17	34	7.3
384-02	F	RC	L	119	630	12.2	5.1	3.7	50	34	34	7.3
384-03	L	NC	H	163	202	3.4	2.1	1.2	166	51	51	7.0
384-04	L	NC	H	162	47	1.2	0.6	0.3	52	68	34	9.5
384-05	L	NC	H	162	62	1.2	1.2	0.6	53	34	51	7.0
385-01	L	RC	L	158	139	3.7	1.9	1.7	72	51	68	9.0
385-02	L	RC	L	157	37	5.8	2.5	1.9	92	68	68	7.5
385-03	L	RC	L	156	157	5.5	2.0	2.1	62	51	34	7.5
385-04	L	NC	L	171	68	1.5	0.8	1.0	34	34	34	7.0
385-05	L	RC	L	169	364	12.8	1.8	1.2	23	34	34	6.5
385-06	L	RC	L	155	275	1.2	0.6	0.5	34	34	34	6.0

[1] Lake type: L = lowland, O = oxbow, F = foothill.

[2] System type: RC = river connected, NC = not connected to a river.

[3] Flood potential: H = high, L = low.

Table 5. Physio-chemical data for all lakes sampled in Koyukuk NWR, 1984 and 1985.

Lake number	Lake type[1]	System type[2]	Flood potential[3]	Elevation (m)	Surface area (ha)	Max. depth (m)	Mean depth (m)	Secchi (m)	Conductivity (µS/cm)	Total alkalinity (mg/l)	Total hardness (mg/l)	pH
484-01	O	NC	H	59	220	9.8	3.5	4.0	77	51	34	7.5
484-02	L	NC	L	59	77	4.9	2.2	1.5	130	68	68	8.0
485-01	L	RC	L	86	314	1.5	0.8	>1.5	100	86	86	7.5
485-02	L	NC	L	67	221	3.7	1.4	0.9	16	17	34	6.5
485-03	L	NC	L	67	169	1.5	1.2	0.7	9	34	34	6.0
485-04	L	NC	L	66	229	1.5	0.8	1.2	80	51	51	7.7
485-05	O	RC	H	37	145	5.5	3.3	1.2	67	51	51	6.5
485-06	O	RC	H	40	180	4.3	3.2	0.8	54	34	34	6.5
485-07	O	NC	H	43	388	7.9	2.0	1.8	64	51	34	7.0
485-08	O	NC	H	41	237	14.6	4.0	0.9	94	68	68	7.0
485-09	O	RC	H	41	222	11.0	4.8	0.8	110	68	86	6.8
485-10	L	RC	L	73	74	1.5	0.8	>1.5	95	68	86	7.8
485-11	L	RC	L	59	123	1.8	0.8	0.7	18	17	17	6.0
485-12	O	RC	H	48	115	5.5	1.7	0.7	37	34	68	6.5
485-13	O	RC	H	46	70	6.4	2.6	0.6	33	34	34	6.5
485-14	L	RC	L	62	115	1.2	0.6	>1.2	55	51	68	7.5
485-15	L	RC	L	61	72	2.4	1.4	1.8	48	34	68	7.0
485-16	O	RC	H	50	78	4.3	1.6	0.9	140	86	86	7.5
485-17	L	NC	L	51	212	1.5	0.8	>1.5	94	51	51	7.8
485-18	L	NC	L	54	166	1.8	1.6	0.6	21	34	34	7.0
485-19	L	NC	H	43	110	3.4	1.9	0.8	98	51	51	7.5
485-20	L	NC	L	57	438	7.3	2.1	6.1	220	137	154	8.0
485-21	L	NC	L	63	536	5.5	3.1	3.0	220	154	171	8.5
485-22	L	RC	H	66	197	1.5	0.8	0.6	47	34	34	6.8

[1] Lake type: L = lowland, O=oxbow, F = foothill.

[2] System type: RC = river connected, NC = not connected to a river.

[3] Flood potential: H = high, L = low.

Table 6. Physio-chemical data for all lakes sampled in Nowitna NWR, 1984 and 1986.

Lake number	Lake type[1]	System type[2]	Flood potential[3]	Elevation (m)	Surface area	Maximum depth (m)	Mean depth (m)	Secchi (m)	Conductivity (µS/cm)	Total alkalinity (mg/l)	Total hardness (mg/l)	pH
584-01	O	NC	H	64	68	6.7	2.9	0.9	69	34	34	6.5
584-02	O	RC	H	69	90	5.5	3.8	0.9	68	34	34	6.5
586-01	O	RC	H	62	78	4.3	1.5	0.9	150	103	103	7.0
586-02	O	NC	H	61	51	5.2	2.3	1.0	58	51	51	6.8
586-03	O	RC	H	61	33	3.1	4.4	0.9	150	103	103	7.0
586-04	L	NC	L	74	93	1.5	0.9	>1.5	6	17	17	6.3
586-05	L	NC	L	76	36	4.3	1.9	2.3	14	17	17	6.2
586-06	L	NC	H	50	112	2.5	0.9	2.1	16	17	17	6.5
586-07	L	NC	H	48	24	2.8	1.6	1.5	23	17	17	6.4
586-08	L	NC	H	51	40	1.8	1.2	>1.8	15	17	17	6.1
586-09	O	NC	H	61	25	5.2	2.6	1.5	150	103	103	7.4
586-10	O	RC	H	62	34	5.8	2.1	0.8	180	103	121	8.0
586-11	L	NC	L	146	88	1.2	0.6	>1.2	110	68	68	8.6
586-12	O	RC	H	76	70	3.7	1.7	1.1	44	34	34	7.2
586-13	O	NC	H	62	30	4.3	2.2	1.7	78	51	51	7.7
586-14	O	RC	H	76	39	4.6	2.1	1.5	90	68	68	6.9

[1] Lake type: L = lowland, O = oxbow, F = foothill.

[2] System type: RC = river connected, NC = not connected to a river.

[3] Flood potential: H = high, L = low.

Table 7. Physio-chemical data for all lakes sampled in Tetlin NWR, 1984–1986. NR denotes data not recorded.

Lake number	Lake type[1]	System type[2]	Flood potential[3]	Elevation (m)	Surface area (ha)	Max. depth (m)	Mean depth (m)	Secchi (m)	Conductivity (µS/cm)	Total alkalinity (mg/l)	Total hardness (mg/l)	pH
784-01	F	RC	L	723	39	27.4	10.8	1.2	64	51	51	7.5
784-02	F	RC	L	808	35	15.2	6.9	2.1	54	68	68	7.0
784-03	F	NC	L	662	1070	27.4	6.7	6.4	35	34	51	7.5
784-04	F	NC	L	662	60	9.8	3.9	3.4	32	34	51	7.0
784-05	L	NC	L	526	52	3.1	1.2	>3.1	32	34	51	7.0
784-06	L	NC	H	503	88	3.1	2.1	0.6	250	51	137	10.0
784-07	L	NC	H	504	112	2.4	0.8	1.5	140	34	68	10.0
785-01	L	RC	L	546	41	7.7	3.8	1.6	195	154	154	8.0
785-02	L	RC	L	526	66	1.5	1.2	1.2	190	154	154	8.5
785-03	F	RC	L	635	77	11.1	5.2	2.9	70	68	51	7.5
785-04	F	RC	L	661	265	35.1	10.9	2.1	30	51	NR	7.0
785-05	L	RC	H	555	57	8.0	3.5	0.8	50	51	51	6.5
785-06	F	RC	L	619	365	24.3	4.4	1.5	55	51	51	7.5
786-01	F	RC	L	625	91	29.2	4.4	1.7	150	103	120	8.0
786-02	F	RC	L	628	116	24.6	4.3	1.5	30	34	17	7.0
786-03	L	NC	L	625	31	4.0	1.5	2.1	40	34	17	7.5
786-04	L	RC	L	625	177	11.7	2.5	2.4	200	120	137	8.0
786-05	F	RC	L	625	6	3.4	1.4	1.8	120	103	86	8.0
786-06	F	RC	L	686	35	6.2	2.2	3.0	150	137	120	8.5
786-07	F	RC	L	661	45	5.5	1.9	1.8	100	51	86	8.0
786-08	F	RC	L	690	34	4.3	1.6	1.8	100	51	68	7.5
786-09	F	NC	L	650	22	4.9	2.7	1.8	60	51	51	7.5
786-10	F	RC	L	686	26	2.5	1.6	1.8	100	86	68	8.0
786-11	F	NC	L	727	24	24.6	4.3	2.1	50	68	34	7.5
786-12	L	RC	H	527	42	1.2	1.1	>1.2	190	137	137	8.0
786-13	L	RC	L	533	13	5.8	2.6	1.8	70	51	51	7.5
786-14	L	NC	L	533	32	2.2	1.3	1.8	250	188	188	8.5
786-15	L	NC	L	533	68	4.3	1.8	2.4	200	171	154	8.0
786-16	L	NC	H	503	71	1.2	0.8	>1.2	290	188	171	8.0
786-17	L	NC	H	503	58	1.2	0.6	>1.2	300	223	205	8.0

[1] Lake type: L = lowland, O = oxbow, F = foothill.

[2] System type: RC = river connected, NC = not connected to a river.

[3] Flood potential: H = high, L = low.

Table 8. Physio-chemical data for all lakes sampled in Yukon Flats NWR, 1984 and 1986.

Lake number	Lake type[1]	System type[2]	Flood potential[3]	Elevation (m)	Surface area (ha)	Max. depth (m)	Mean depth (m)	Secchi (m)	Conductivity (µS/cm)	Total alkalinity (mg/l)	Total hardness (mg/l)	pH
884-01	F	RC	L	205	132	22.0	9.5	2.4	200	137	137	8.7
884-02	F	RC	L	212	307	29.6	11.6	4.0	330	221	221	8.4
884-03	F	NC	L	195	97	12.8	5.5	2.4	890	514	428	9.3
884-04	F	NC	L	195	250	17.9	1.6	3.2	210	128	138	8.3
884-05	L	RC	L	129	244	3.4	1.9	1.8	215	128	120	9.0
884-06	L	NC	L	119	340	2.7	2.4	2.1	360	222	222	9.0
884-07	L	NC	L	117	340	3.1	1.1	2.4	640	462	256	9.5
884-08	L	RC	L	117	331	4.9	2.0	0.9	120	86	86	7.5
886-01	L	NC	L	104	145	3.7	1.3	1.2	225	103	103	9.5
886-02	L	NC	L	105	178	2.8	1.9	>1.5	185	86	103	9.5
886-03	L	RC	L	104	186	4.0	1.7	1.7	165	86	103	9.2
886-04	F	RC	L	177	95	10.2	3.4	1.1	75	17	68	7.4
886-05	F	RC	L	168	67	9.5	3.8	0.8	105	51	68	7.2
886-06	F	RC	L	229	74	10.8	5.0	2.4	125	68	68	7.7
886-07	O	RC	H	99	221	8.6	2.4	0.6	179	68	103	8.0
886-08	L	NC	L	105	56	0.9	0.8	>0.6	1250	684	171	9.2
886-09	L	RC	L	103	108	2.2	1.3	2.1	170	68	120	10.0
886-10	L	RC	L	99	203	1.8	0.9	>1.4	165	86	103	10.2
886-11	L	RC	L	132	214	9.5	3.4	2.9	304	154	154	8.0
886-12	L	RC	H	127	170	4.0	1.2	4.0	235	103	154	9.3
886-13	L	RC	L	128	71	9.8	5.0	3.2	410	274	222	9.0
886-14	L	NC	L	145	117	2.2	0.9	0.9	510	325	308	9.0
886-15	L	NC	L	217	284	5.8	2.6	1.5	495	205	239	9.0
886-16	F	NC	L	294	286	2.5	1.8	2.3	370	171	188	8.3
886-17	F	NC	L	254	193	2.2	1.4	1.7	275	137	103	9.6
886-18	F	RC	L	203	166	1.5	0.8	1.2	210	68	120	10.0
886-19	F	RC	L	244	115	3.7	1.1	0.8	85	34	51	7.5
886-20	L	RC	L	174	101	2.5	0.9	1.5	175	103	86	10.0
886-21	O	NC	H	155	56	4.0	1.9	2.3	218	103	103	8.0
886-22	F	RC	L	262	51	18.5	8.0	4.9	120	86	68	7.9
886-23	L	RC	L	211	62	3.7	1.2	1.2	65	51	51	6.9
886-24	L	RC	H	207	162	6.8	2.8	1.8	62	51	51	7.0
886-25	F	RC	L	229	41	7.1	4.2	1.5	110	68	68	7.1
886-26	O	NC	H	175	32	2.5	0.9	2.3	220	103	103	8.0
886-27	L	NC	L	196	81	2.5	1.8	1.8	62	52	34	7.5
886-28	O	NC	H	144	55	1.8	0.9	0.8	160	103	86	9.7
886-29	L	RC	L	132	162	10.2	3.6	2.4	350	221	205	8.0

[1] Lake type: L = lowland, O = oxbow, F = foothill.

[2] System type: RC = river connected, NC = not connected to a river.

[3] Flood potential: H = high, L = low.

Table 9. List of common and scientific names of fish collected from Interior Alaska NWR lakes during 1984–1986. The list of fish species is not a comprehensive species list for Interior Alaska NWR lakes, but only represents what was captured or observed during this study.

Common name	Species name	Innoko NWR	Kanuti NWR	Koyukuk NWR	Nowitna NWR	Tetlin NWR	Yukon Flats NWR
Alaska blackfish	*Dallia pectoralis*	X	X	X	X		
Arctic grayling	*Thymallus arcticus*		X			X	
Broad whitefish	*Coregonus nasus*	X	X	X	X		X
Burbot	*Lota lota*					X	
Chum salmon	*Oncorhynchus keta*						X
Humpback whitefish	*Coregonus clupeaformis*	X	X	X	X	X	X
Inconnu	*Stenodus leucichthys*			X	X		X
Lake chub	*Couesius plumbeus*					X	
Lake trout	*Salvelinus namaycush*					X	
Least cisco	*Coregonus sardinella*	X	X	X	X	X	X
Longnose sucker	*Catostomus catostomus*	X	X	X		X	
Ninespine stickleback	*Pungitius pungitius*	X		X			
Northern pike	*Esox lucius*	X	X	X	X	X	X
Round whitefish	*Prosopium cylindraceum*		X				
Slimy sculpin	*Cottus cognatus*					X	

Table 10. Number of sampled Interior Alaska NWR lakes containing fish; classified by lake type, river connectivity, and flood potential, 1984–1986. Total lakes sampled in parentheses.

	Lake type			River connectivity		Flood potential		
NWR	Lowland	Oxbow	Foothill	Connected	Not connected	High	Low	All lakes
Innoko	8 (10)	7 (7)	—	11 (11)	4 (6)	12 (12)	3 (5)	15 (17)
Kanuti	7 (9)	—	2 (2)	7 (7)	2 (4)	2 (3)	7 (8)	9 (11)
Koyukuk	14 (15)	9 (9)	—	12 (12)	11 (12)	11 (11)	12 (13)	23 (24)
Nowitna	3 (6)	10 (10)	—	6 (6)	7 (10)	12 (13)	1 (3)	13 (16)
Tetlin	10 (14)	—	14 (16)	16 (18)	8 (12)	4 (6)	20 (24)	24 (30)
Yukon Flats	10 (20)	2 (4)	6 (13)	17 (22)	1 (15)	4 (6)	14 (31)	18 (37)
Total	52 (74)	28 (30)	22 (31)	69 (76)	33 (59)	45 (51)	57 (84)	102 (135)

Table 11. Frequency of occurrence (%) for individual species and total species present by lake type, river connectivity, and flood potential for Interior Alaska NWR lakes containing fish during 1984–1986.

		Lake type			River connectivity		Flood potential	
Species	All lakes	Lowland lakes	Oxbow lakes	Foothill lakes	River connection	No river connection	High flood potential	Low flood potential
Northern pike	90	92	100	73	90	91	93	88
Least cisco	43	31	64	45	49	30	64	26
Broad whitefish	38	31	71	14	45	24	67	16
Humpback whitefish	30	29	54	5	36	18	62	5
Alaska blackfish	20	27	21	0	13	33	22	18
Longnose sucker	6	6	4	9	7	3	9	4
Arctic grayling	6	0	0	27	7	3	0	11
Inconnu	6	0	21	0	6	6	13	0
Ninespine stickleback	3	0	11	0	1	6	7	0
Slimy sculpin	3	0	0	14	3	3	0	5
Burbot	2	0	0	9	3	0	2	0
Lake trout	1	0	0	5	0	3	0	2
Round whitefish	1	0	0	5	1	0	0	2
Lake chub	1	0	0	5	1	0	0	2
Chum salmon	1	0	4	0	1	0	2	0
Total fish species present	15	6	9	11	14	11	10	11
Total lakes containing fish	102	52	28	22	69	33	45	57

Table 12. Fish species collected for each sampled lake and catch statistics for all experimental gill net captures, Innoko NWR, 1985. NR denotes data not recorded.

	Experimental gill net (38-m length)				
Fish species	Sample size	Percent composition	Mean length (mm)	Length range (mm)	CPUE (fish/h)
		Lake 285-01, unnamed			
Northern pike	39	84.8	442	236 – 759	0.57
Broad whitefish	7	15.2	486	453 – 530	0.10
Alaska blackfish		Northern pike stomach contents			
Ninespine stickleback		Northern pike stomach contents			
		Lake 285-02, unnamed			
Northern pike	61	78.2	553	80 – 735	0.88
Broad whitefish	14	17.9	487	380 – 560	0.20
Humpback whitefish	1	1.3	—	440	0.01
Least cisco	2	2.6	352	339 – 364	0.03
		Lake 285-03, unnamed			
Northern pike	56	100.0	521	277 – 765	0.97
Alaska blackfish		Northern pike stomach contents			
		Lake 285-04, unnamed			
Northern pike	16	100.0	410	302 – 604	0.27
		Lake 285-05, unnamed			
Northern pike	18	100.0	430	210 – 600	0.49
		Lake 285-06, unnamed			
Northern pike	6	2.7	487	145 – 747	0.09
Broad whitefish	61	27.9	430	372 – 528	0.88
Humpback whitefish	33	15.1	418	359 – 452	0.48
Least cisco	119	54.3	316	190 – 363	1.73
		Lake 285-07, unnamed			
Northern pike	18	52.9	567	152 – 965	0.43
Broad whitefish	11	32.4	471	427 – 510	0.26
Humpback whitefish	2	5.9	447	415 – 478	0.05
Least cisco	3	8.8	295	262 – 322	0.07
		Lake 285-08, unnamed			
Northern pike	22	33.8	624	188 – 910	0.39
Broad whitefish	14	21.5	486	443 – 536	0.25
Humpback whitefish	25	38.5	456	408 – 514	0.44
Least cisco	4	6.2	343	306 – 374	0.07

Table 12. Continued.

Fish species	Experimental gill net (38-m length)				
	Sample size	Percent composition	Mean length (mm)	Length range (mm)	CPUE (fish/h)
		Lake 285-09, unnamed			
		No fish collected			
		Lake 285-10, unnamed			
Northern pike	96	68.1	218	122 – 960	1.81
Broad whitefish	18	12.8	470	408 – 524	0.34
Humpback whitefish	9	6.4	437	379 – 484	0.17
Least cisco	17	12.0	303	207 – 384	0.32
Longnose sucker	1	0.7	—	521	0.02
		Lake 285-11, unnamed			
Northern pike	12	54.5	490	288 – 820	0.26
Broad whitefish	10	45.5	516	457 – 588	0.22
		Lake 285-12, unnamed			
Northern pike	51	100.0	186	133 – 751	2.83
		Lake 285-13, unnamed			
Northern pike	19	52.8	423	234 – 642	0.49
Broad whitefish	4	11.1	502	457 – 558	0.10
Humpback whitefish	1	2.8	—	NR	0.03
Least cisco	12	33.3	322	206 – 375	0.31
		Lake 285-14, unnamed			
Northern pike	14	100.0	387	257 – 900	0.38
Alaska blackfish		Northern pike stomach contents			
		Lake 285-15, unnamed			
Northern pike	8	100.0	425	235 – 646	0.18
		Lake 285-16, unnamed			
		No fish collected			
		Lake 285-17, unnamed			
Northern pike	23	65.7	547	272 – 661	0.60
Broad whitefish	8	22.9	492	240 – 558	0.21
Humpback whitefish	1	2.9	—	443	0.03
Least cisco	3	8.5	376	356 – 389	0.08

Table 13. Fish species collected for each sampled lake and catch statistics for all experimental gill net captures, Kanuti NWR, 1984 and 1985.

	Experimental gill net (38-m length)				
Fish species	Sample size	Percent composition	Mean length (mm)	Length range (mm)	CPUE (fish/h)
Lake 384-01, Tokusatatquaten Lake					
Arctic grayling	27	90.0	220	155 – 337	3.86
Round whitefish	3	10.0	369	324 – 400	0.43
Lake 384-02, Sithylemenkat Lake					
Northern pike	12	92.3	556	431 – 790	0.92
Humpback whitefish	1	7.7	—	402	0.08
Lake 384-03, Old Dummy Lake					
No fish collected					
Lake 384-04, unnamed					
Broad whitefish	2	5.6	529	518 – 540	0.25
Humpback whitefish	4	11.1	416	364 – 490	0.50
Least cisco	30	83.3	311	280 – 362	3.38
Lake 384-05, unnamed					
Northern pike	36	37.9	392	45 – 568	0.50
Humpback whitefish	37	38.9	454	361 – 519	0.58
Longnose sucker	1	1.1	—	474	0.01
Least cisco	21	22.1	332	291 – 408	0.33
Alaska blackfish	Northern pike stomach contents				
Lake 385-01, Konedsin Lake					
Northern pike	17	100.0	405	246 – 860	0.33
Lake 385-02, unnamed					
Northern pike	12	100.0	563	329 – 890	0.31
Lake 385-03, Kodosin Lake					
Northern pike	19	100.0	395	153 – 600	0.44
Alaska blackfish	Northern pike stomach contents				
Lake 385-04, unnamed					
No fish collected					
Lake 385-05, Mingkoket Lake					
Northern pike	12	100.0	356	208 – 531	0.27
Lake 385-06, Minnkokut Lake					
Northern pike	1	100.0	—	196	0.02

Table 14. Fish species collected for each sampled lake and catch statistics for all experimental gill net captures, Koyukuk NWR, 1984 and 1985.

	Experimental gill net (38-m length)				
Fish species	Sample size	Percent composition	Mean length (mm)	Length range (mm)	CPUE (fish/h)
		Lake 484-01, unnamed			
Northern pike	58	100.0	413	109 – 1010	0.86
Least cisco		Northern pike stomach contents			
Ninespine stickleback		Northern pike stomach contents			
		Lake 484-02, unnamed			
		No fish collected			
		Lake 485-01, unnamed			
Northern pike	20	80.0	434	301 – 695	0.29
Broad whitefish	2	8.0	529	498 – 559	0.03
Alaska blackfish	3	12.0	142	132 – 150	0.04
		Lake 485-02, unnamed			
Northern pike	23	100.0	360	286 – 492	0.17
Alaska blackfish		Northern pike stomach contents			
		Lake 485-03, Louis Lake			
Northern pike	19	100.0	368	210 – 725	0.23
		Lake 485-04, unnamed			
Northern pike	8	44.4	436	380 – 542	0.09
Alaska blackfish	10	55.6	155	127 – 187	0.11
		Lake 485-05, unnamed			
Northern pike	3	14.3	727	675 – 780	0.06
Broad whitefish	5	23.7	507	470 – 533	0.10
Humpback whitefish	6	28.6	453	406 – 489	0.13
Least cisco	6	28.6	295	250 – 405	0.13
Longnose sucker	1	4.8	—	460	0.02
		Lake 485-06, unnamed			
Northern pike	13	19.7	671	590 – 850	0.21
Broad whitefish	7	10.6	515	483 – 545	0.12
Humpback whitefish	14	21.2	441	338 – 490	0.23
Least cisco	32	48.5	272	190 – 393	0.53
		Lake 485-07, Tachanlowa Lake			
Northern pike	1	33.3	—	413	0.05
Alaska blackfish	1	33.3	—	261	0.05
Least cisco	1	33.3	—	201	0.05

Table 14. Continued.

Fish species	Experimental gill net (38-m length)				
	Sample size	Percent composition	Mean length (mm)	Length range (mm)	CPUE (fish/h)
Lake 485-08, unnamed					
Northern pike	39	86.7	407	198 – 625	0.85
Broad whitefish	6	13.3	477	458 – 515	0.13
Ninespine stickleback	Northern pike stomach contents				
Inconnu	Northern pike stomach contents				
Lake 485-09, unnamed					
Northern pike	6	9.2	427	326 – 720	0.13
Broad whitefish	4	6.2	509	472 – 535	0.08
Humpback whitefish	17	26.2	412	317 – 497	0.35
Least cisco	38	58.4	290	161 – 400	0.79
Lake 485-10, Upper Birch Lake					
Northern pike	3	100.0	336	234 – 500	0.07
Lake 485-11, unnamed					
Northern pike	13	44.8	391	230 – 600	0.26
Broad whitefish	13	44.8	499	473 – 525	0.26
Humpback whitefish	2	6.9	474	447 – 500	0.04
Least cisco	1	3.5	—	282	0.02
Lake 485-12, Evan Lake					
Northern pike	13	61.9	490	315 – 755	0.33
Broad whitefish	6	28.5	520	496 – 560	0.15
Humpback whitefish	2	9.6	440	395 – 484	0.05
Lake 485-13, Clay Lake					
Northern pike	15	60.0	491	322 – 890	0.43
Broad whitefish	8	32.0	499	470 – 572	0.23
Humpback whitefish	1	4.0	—	358	0.03
Least cisco	1	4.0	—	191	0.03
Lake 485-14, Crow Lake					
Northern pike	5	100.0	315	293 – 342	0.13
Alaska blackfish	Northern pike stomach contents				
Lake 485-15, unnamed					
Northern pike	6	100.0	539	330 – 658	0.17
Least cisco	Northern pike stomach contents				
Lake 485-16, Tsedolalindin Lake					
Northern pike	39	62.9	446	318 – 654	0.92
Broad whitefish	7	11.3	551	513 – 577	0.16
Least cisco	16	25.8	278	198 – 343	0.38
Alaska blackfish	Northern pike stomach contents				

Table 14. Continued.

Fish species	Experimental gill net (38-m length)				
	Sample size	Percent composition	Mean length (mm)	Length range (mm)	CPUE (fish/h)
Lake 485-17, unnamed					
Northern pike	1	100.0	—	560	0.04
Alaska blackfish	Northern pike stomach contents				
Lake 485-18, unnamed					
Northern pike	10	100.0	413	268 – 883	0.16
Alaska blackfish	Northern pike stomach contents				
Lake 485-19, unnamed					
Northern pike	23	39.7	432	258 – 618	0.38
Broad whitefish	23	39.7	493	165 – 577	0.38
Humpback whitefish	3	5.2	467	442 – 482	0.05
Least cisco	9	15.4	298	289 – 355	0.15
Alaska blackfish	Northern pike stomach contents				
Lake 485-20, Hadokhten Lake					
Northern pike	157	99.4	465	250 – 765	1.73
Broad whitefish	1	0.6	—	617	0.01
Alaska blackfish	Northern pike stomach contents				
Lake 485-21, Hahanudan Lake					
Northern pike	18	100.0	348	216 – 550	0.35
Lake 485-22, Klymunget Lake					
Broad whitefish	1	4.3	—	499	0.02
Humpback whitefish	1	4.3	—	420	0.02
Least cisco	16	69.6	322	194 – 385	0.28
Alaska blackfish	5	21.8	155	151 – 163	0.09

Table 15. Fish species collected for each sampled lake and catch statistics for all experimental gill net captures, Nowitna NWR, 1984 and 1986.

	Experimental gill net (38-m length)				
Fish species	Sample size	Percent composition	Mean length (mm)	Length range (mm)	CPUE (fish/h)
		Lake 584-01, unnamed			
Northern pike	27	65.9	397	252 – 870	0.36
Humpback whitefish	3	7.3	406	343 – 444	0.05
Broad whitefish	2	4.8	523	502 – 543	0.03
Least cisco	9	22.0	302	180 – 367	0.14
		Lake 584-02, unnamed			
Northern pike	31	31.6	453	162 – 824	0.40
Humpback whitefish	10	10.2	383	258 – 441	0.14
Broad whitefish	9	9.2	487	352 – 593	0.12
Least cisco	47	48.0	316	209 – 406	0.64
Inconnu	1	1.0	—	280	0.01
		Lake 586-01, unnamed			
Northern pike	37	46.8	491	371 – 735	0.77
Broad whitefish	5	6.3	536	442 – 579	0.10
Humpback whitefish	1	1.3	—	476	0.02
Least cisco	36	45.6	279	190 – 368	0.75
Alaska blackfish		Northern pike stomach contents			
		Lake 586-02, unnamed			
Northern pike	21	100.0	376	270 – 517	0.44
		Lake 586-03, unnamed			
Northern pike	25	41.0	489	352 – 865	0.64
Broad whitefish	7	11.5	464	216 – 530	0.18
Humpback whitefish	11	18.0	421	386 – 470	0.28
Least cisco	18	29.5	268	152 – 341	0.46
Alaska blackfish		Northern pike stomach contents			
		Lake 586-04, unnamed			
		No fish collected			
		Lake 586-05, unnamed			
Northern pike	9	100.0	469	264 – 615	0.19
Alaska blackfish		Northern pike stomach contents			
		Lake 586-06, unnamed			
Alaska blackfish	1	100.0	—	—	0.02
		Lake 586-07, unnamed			
Northern pike	5	100.0	372	340 – 422	0.10

Table 15. Continued.

Fish species	Experimental gill net (38-m length)				
	Sample size	Percent composition	Mean length (mm)	Length range (mm)	CPUE (fish/h)
		Lake 586-08, unnamed			
		No fish collected			
		Lake 586-09, unnamed			
Northern pike	11	16.4	596	481 – 744	0.31
Broad whitefish	10	14.9	496	477 – 524	0.28
Humpback whitefish	9	13.4	411	378 – 429	0.25
Least cisco	37	55.2	234	144 – 346	1.03
		Lake 586-10, unnamed			
Northern pike	24	42.1	572	229 – 825	0.63
Broad whitefish	15	26.3	501	289 – 549	0.40
Humpback whitefish	14	24.6	430	350 – 503	0.37
Least cisco	1	1.8	—	282	0.03
Inconnu	3	5.3	692	659 – 713	0.08
		Lake 586-11, unnamed			
		No fish collected			
		Lake 586-12, unnamed			
Northern pike	17	40.5	579	252 – 910	0.33
Humpback whitefish	12	28.6	461	426 – 492	0.23
Least cisco	11	26.2	345	280 – 419	0.21
Inconnu	2	4.8	572	554 – 589	0.04
		Lake 586-13, unnamed			
Northern pike	18	90.0	390	282 – 739	0.35
Inconnu	2	10.0	503	472 – 534	0.04
		Lake 586-14, unnamed			
Northern pike	17	94.4	491	322 – 743	0.45
Broad whitefish	1	5.6	—	504	0.03

Table 16. Fish species collected for each sampled lake and catch statistics for all experimental gill net captures, Tetlin NWR, 1984–1986.

	Experimental gill net (38-m length)				
Fish species	Sample size	Percent composition	Mean length (mm)	Length range (mm)	CPUE (fish/h)
Lake 784-01, Fern Lake					
Arctic grayling	32	7.9	231	130 – 328	0.33
Longnose sucker	146	92.1	120	51 – 228	1.52
Lake 784-02, unnamed					
Arctic grayling	16	100.0	140	84 – 228	0.80
Lake 784-03, Jatahmund Lake					
Northern pike	73	93.6	398	140 – 668	3.65
Least cisco	2	2.6	394	378 – 410	0.10
Lake trout	3	3.8	540	529 – 552	0.15
Slimy sculpin	Northern pike stomach contents				
Lake 784-04, unnamed					
Northern pike	32	100.0	391	69 – 638	1.52
Least cisco	Northern pike stomach contents				
Lake 784-05, unnamed					
No fish collected					
Lake 784-06, Fish Camp Lake					
No fish collected					
Lake 784-07, Tlocogn Lake					
No fish collected					
Lake 785-01, unnamed					
Northern pike	9	100.0	572	270 – 760	0.23
Lake 785-02, Deep Lake					
Northern pike	29	100.0	541	330 – 720	0.48
Lake 785-03, unnamed					
Northern pike	7	38.9	476	180 – 720	0.25
Least cisco	11	61.1	215	150 – 290	0.39
Slimy sculpin	Collected with seine				
Lake 785-04, Takomahto Lake					
Northern pike	14	82.4	446	160 – 670	0.26
Least cisco	3	17.6	133	110 – 170	0.06
Lake 785-05, unnamed					
Northern pike	1	4.8	—	830	0.08
Humpback whitefish	11	52.4	395	370 – 410	0.92
Longnose sucker	9	42.9	421	390 – 450	0.75

Table 16. Continued.

Fish species	Experimental gill net (38-m length)				
	Sample size	Percent composition	Mean length (mm)	Length range (mm)	CPUE (fish/h)
Lake 785-06, American Wellesly Lake					
Northern pike	18	90.0	597	330 – 770	0.75
Burbot	2	10.0	700	680 – 720	0.08
Lake 786-01, East Wellesly Lake					
Northern pike	2	16.7	560	400 – 720	0.06
Least cisco	10	83.3	258	90 – 320	0.28
Lake 786-02, West Wellesly Lake					
Northern pike	4	17.4	439	240 – 570	0.33
Least cisco	19	82.6	295	230 – 340	1.58
Burbot	Collected with seine				
Lake 786-03, unnamed					
Northern pike	3	100.0	307	280 – 330	0.08
Lake 786-04, Pickerel Lake					
Northern pike	6	100.0	573	510 – 620	0.75
Lake 786-05, unnamed					
Arctic grayling	3	60.0	203	140 – 240	0.09
Longnose sucker	1	20.0	—	120	0.03
Lake chub	1	20.0	—	110	0.03
Slimy sculpin	Collected with dip net				
Lake 786-06, unnamed					
Northern pike	6	100.0	395	295 – 485	0.17
Lake 786-07, unnamed					
Arctic grayling	22	100.0	280	225 – 340	2.75
Lake 786-08, unnamed					
No fish collected					
Lake 786-09, Pie Lake					
Arctic grayling	16	100.0	276	230 – 370	1.60
Lake 786-10, unnamed					
No fish collected					
Lake 786-11, unnamed					
Northern pike	8	100.0	331	280 – 350	0.33
Lake 786-12, Fish Lake					
Northern pike	6	31.6	422	130 – 610	0.43
Humpback whitefish	13	68.4	417	310 – 450	0.93

Table 16. Continued.

Fish species	Experimental gill net (38-m length)				
	Sample size	Percent composition	Mean length (mm)	Length range (mm)	CPUE (fish/h)
		Lake 786-13, unnamed			
Northern pike	6	100.0	413	290 – 460	0.25
		Lake 786-14, unnamed			
		No fish collected			
		Lake 786-15, unnamed			
Northern pike	11	100.0	560	460 – 660	0.79
		Lake 786-16, Tsilchin Lake			
Northern pike		Observation			
		Lake 786-17, Tlechegn Lake			
Northern pike	3	14.3	360	260 – 420	0.38
Humpback whitefish	18	85.7	404	380 – 430	2.25

Table 17. Fish species collected for each sampled lake and catch statistics for all experimental gill net captures, Yukon Flats NWR, 1984 and 1986. NR denotes data not recorded.

	Experimental gill net (38-m length)				
Fish species	Sample size	Percent composition	Mean length (mm)	Length range (mm)	CPUE (fish/h)
Lake 884-01, Lower Halfway Lake					
Northern pike	14	73.6	517	176 – 725	0.31
Broad whitefish	4	21.0	NR	90 – 724	0.02
Least cisco	1	5.4	—	225	0.02
Lake 884-02, unnamed					
Northern pike	40	100.0	343	84 – 655	0.44
Least cisco	Northern pike stomach contents				
Lake 884-03, unnamed					
No fish collected					
Lake 884-04, unnamed					
No fish collected					
Lake 884-05, unnamed					
Northern pike	32	100.0	172	136 – 201	0.17
Lake 884-06, Ninemile Lake					
No fish collected					
Lake 884-07, Canvasback Lake					
No fish collected					
Lake 884-08, unnamed					
Northern pike	26	52.0	512	94 – 790	1.91
Humpback whitefish	1	2.0	—	493	0.08
Broad whitefish	23	46.0	519	376 – 582	1.77
Least cisco	Northern pike stomach contents				
Lake 886-01, Sundown Lake					
No fish collected					
Lake 886-02, Tincan Lake					
No fish collected					
Lake 886-03, Sweeney Lake					
Northern pike	121	100.0	294	229 – 522	2.75
Lake 886-04, unnamed					
Northern pike	8	47.1	562	318 – 870	0.18
Broad whitefish	5	29.4	521	492 – 569	0.11
Least cisco	4	23.5	197	147 – 238	0.09

Table 17. Continued.

Fish species	Experimental gill net (38-m length)				
	Sample size	Percent composition	Mean length (mm)	Length range (mm)	CPUE (fish/h)
Lake 886-05, unnamed					
Northern pike	21	87.5	448	270 – 731	0.44
Broad whitefish	2	8.3	449	448 – 450	0.04
Least cisco	1	4.5	—	198	0.02
Lake 886-06, unnamed					
Northern pike	35	100.0	431	318 – 534	0.71
Lake 886-07, Indian Portage Lake					
Northern pike	48	45.7	553	325 – 843	0.34
Humpback whitefish	13	12.4	357	203 – 496	0.09
Broad whitefish	10	9.5	498	384 – 550	0.07
Least cisco	18	17.1	271	154 – 338	0.13
Inconnu	15	14.3	534	394 – 615	0.10
Chum salmon	1	1.0	—	652	
Lake 886-08, Mallard Lake					
No fish collected					
Lake 886-09, unnamed					
No fish collected					
Lake 886-10, Flat Lake					
Broad whitefish	26	28.3	500	399 – 540	0.68
Least cisco	66	71.7	228	159 – 337	1.74
Lake 886-11, unnamed					
Northern pike	108	95.6	413	206 – 985	0.95
Broad whitefish	5	4.4	424	414 – 446	0.04
Lake 886-12, unnamed					
Northern pike	78	86.7	484	276 – 607	1.66
Humpback whitefish	1	1.1	—	456	0.02
Broad whitefish	11	12.2	488	438 – 550	0.23
Least cisco	Northern pike stomach contents				
Lake 886-13, unnamed					
Northern pike	1	100.0	—	524	0.01
Lake 886-14, unnamed					
No fish collected					
Lake 886-15, unnamed					
No fish collected					
Lake 886-16, Kwittevunkud Lake					
No fish collected					

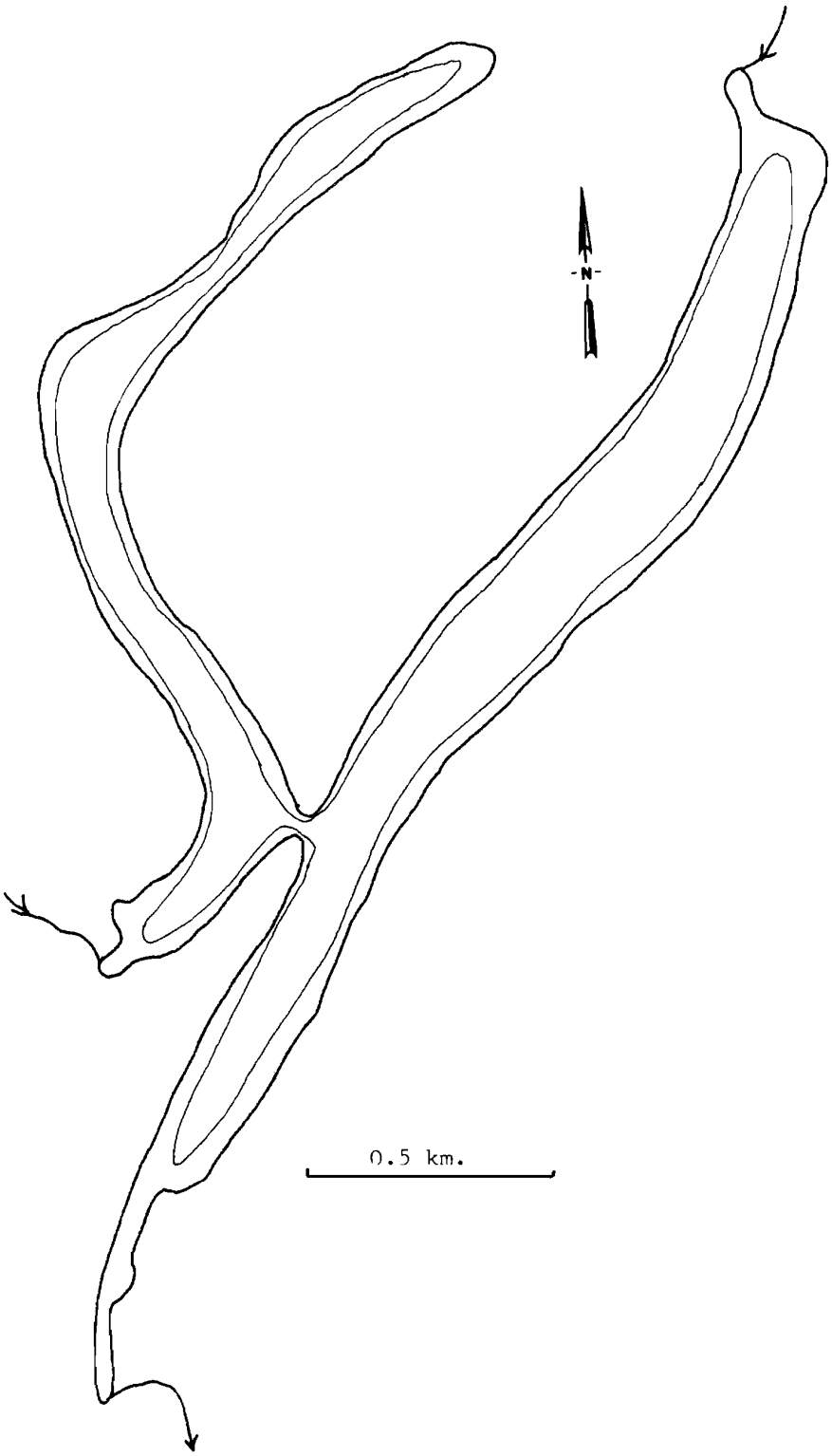
Table 17. Continued.

Fish species	Experimental gill net (38-m length)				
	Sample size	Percent composition	Mean length (mm)	Length range (mm)	CPUE (fish/h)
Lake 886-17, Big Lake					
No fish collected					
Lake 886-18, Big Rat Lake					
No fish collected					
Lake 886-19, unnamed					
No fish collected					
Lake 886-20, Sams Big Lake					
No fish collected					
Lake 886-21, unnamed					
No fish collected					
Lake 886-22, unnamed					
No fish collected					
Lake 886-23, Birch Lake					
Northern pike	6	85.7	435	315 – 557	0.15
Least cisco	1	14.3	—	403	0.03
Lake 886-24, Tommy Lake					
Northern pike	9	47.4	422	236 – 554	0.23
Broad whitefish	9	47.4	604	564 – 643	0.23
Least cisco	1	5.3	—	466	0.03
Lake 886-25, unnamed					
Northern pike	19	100.0	473	289 – 870	0.43
Lake 886-26, Rotten Fish Slough					
Northern pike	16	100.0	377	210 – 536	0.36
Broad whitefish	Northern pike stomach contents				
Least cisco	Northern pike stomach contents				
Lake 886-27, unnamed					
No fish collected					
Lake 886-28, unnamed					
No fish collected					
Lake 886-29, unnamed					
Northern pike	26	100.0	435	228 – 618	0.59

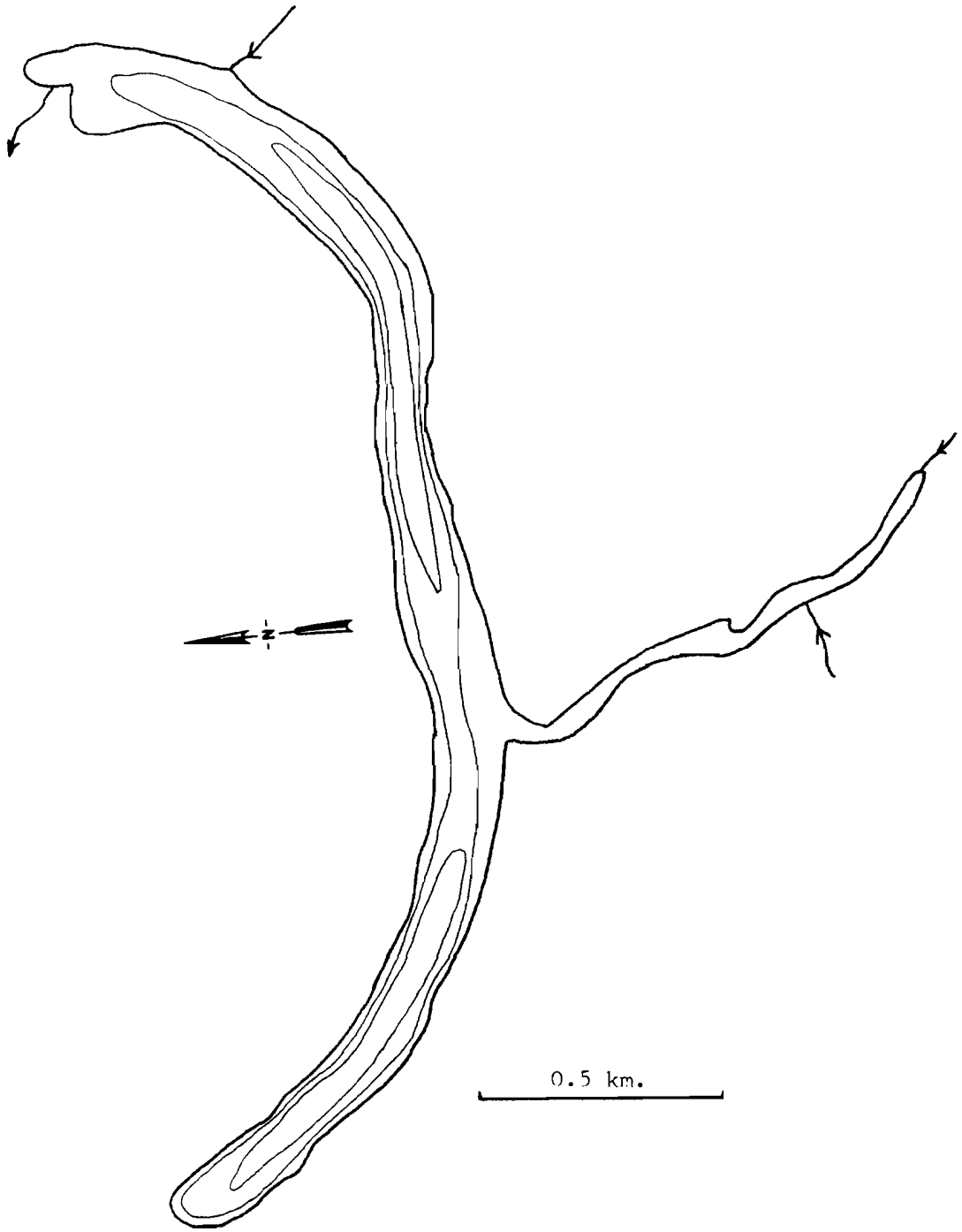
Appendix Figures 1–135

Bathymetric maps of all sampled lakes
Interior Alaska NWR lakes
1984–1986

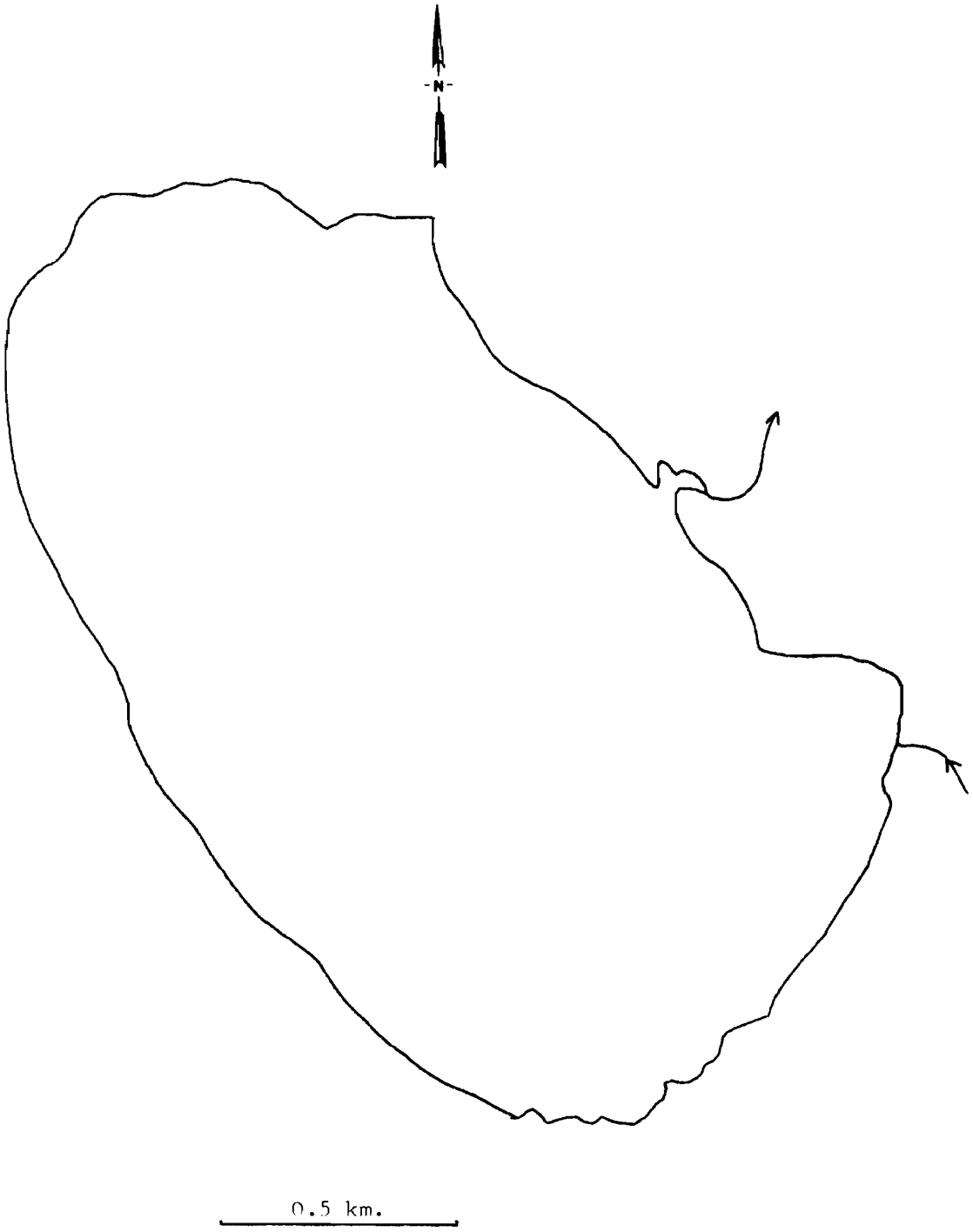
(all images scanned from originals)



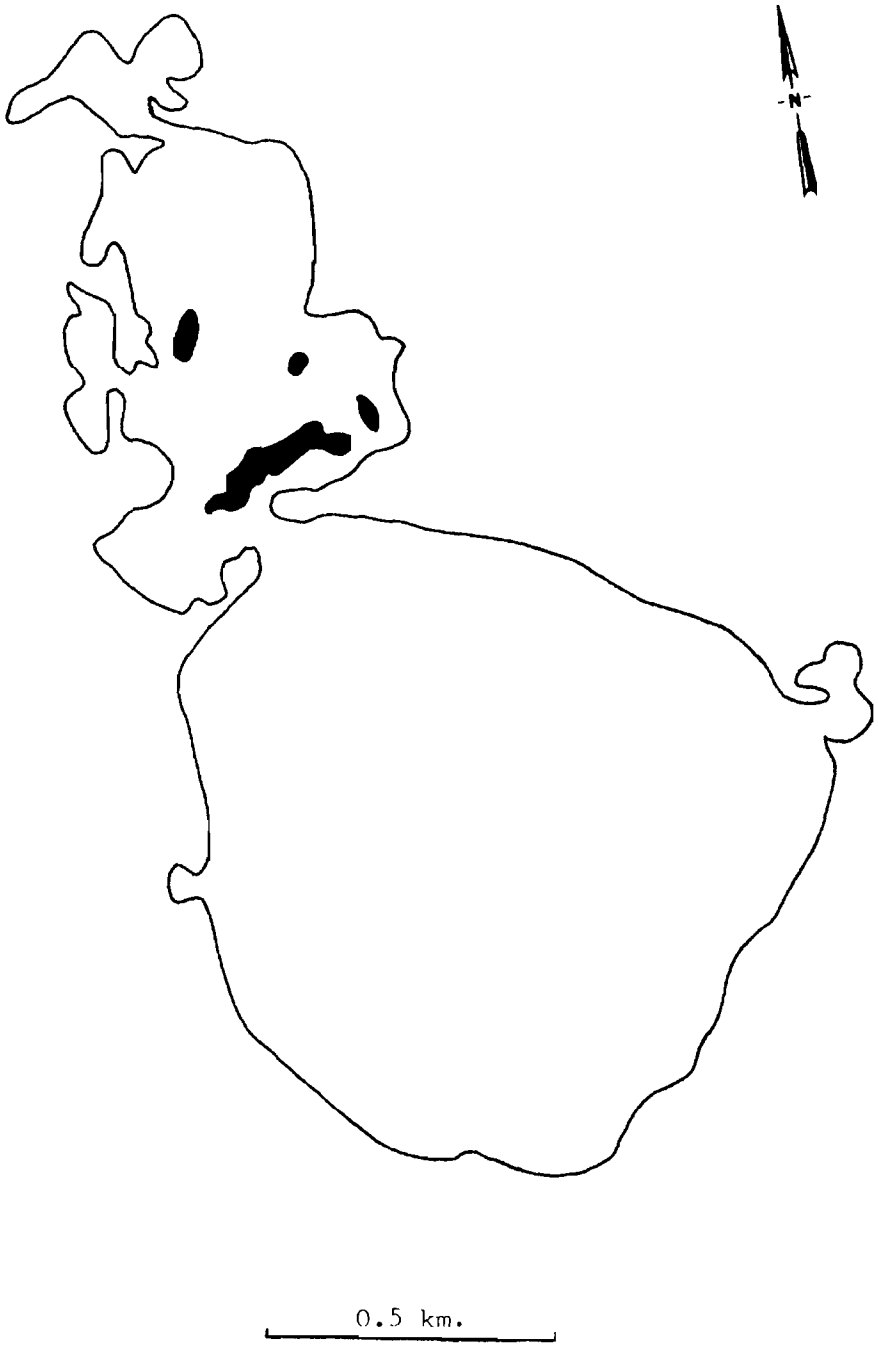
Appendix Figure 1. Bathymetric map of Lake 285-01, unnamed, Innoko NWR, with 5-ft contour interval (63.6234°N, 157.8405°W).



Appendix Figure 2. Bathymetric map of Lake 285-02, unnamed, Innoko NWR, with 5-ft contour intervals (63.5656°N, 157.8595°W).

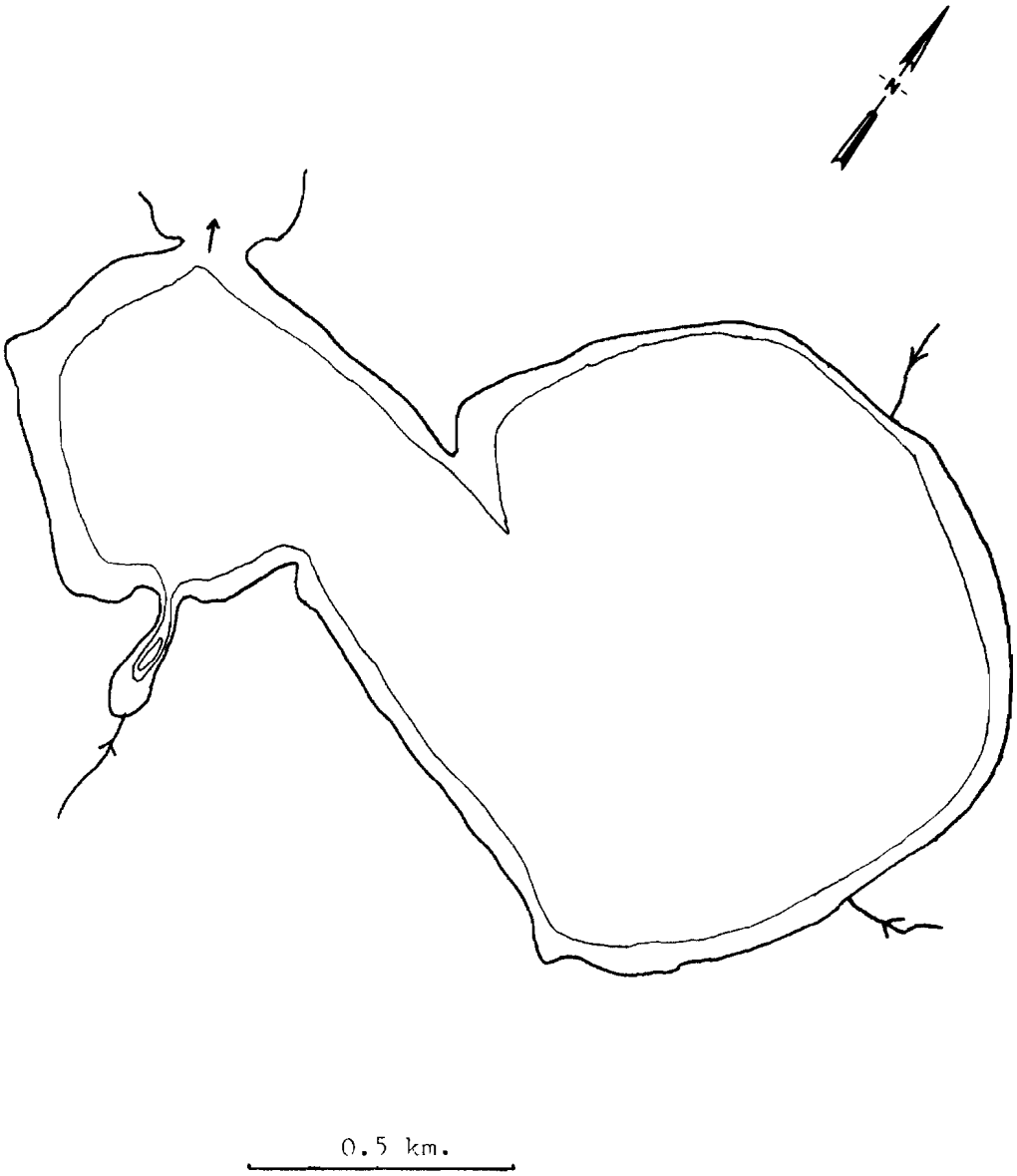


Appendix Figure 3. Bathymetric map of Lake 285-03, unnamed, Innoko NWR, maximum depth less than 5 ft (63.5418°N, 157.8934°W).

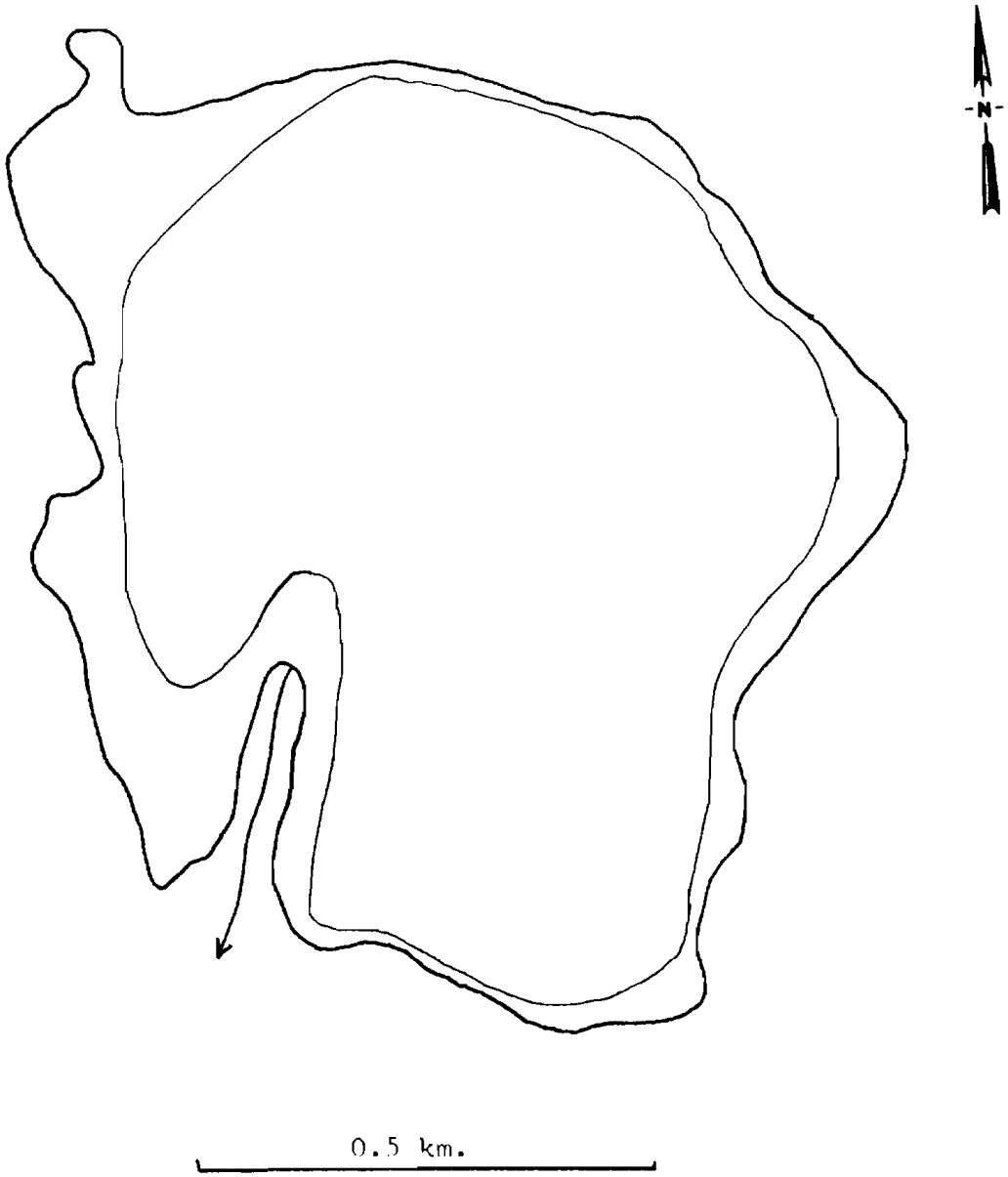


Appendix Figure 4. Bathymetric map of Lake 285-04, unnamed, Innoko NWR, maximum depth less than 5 ft (63.5188°N, 157.9140°W).

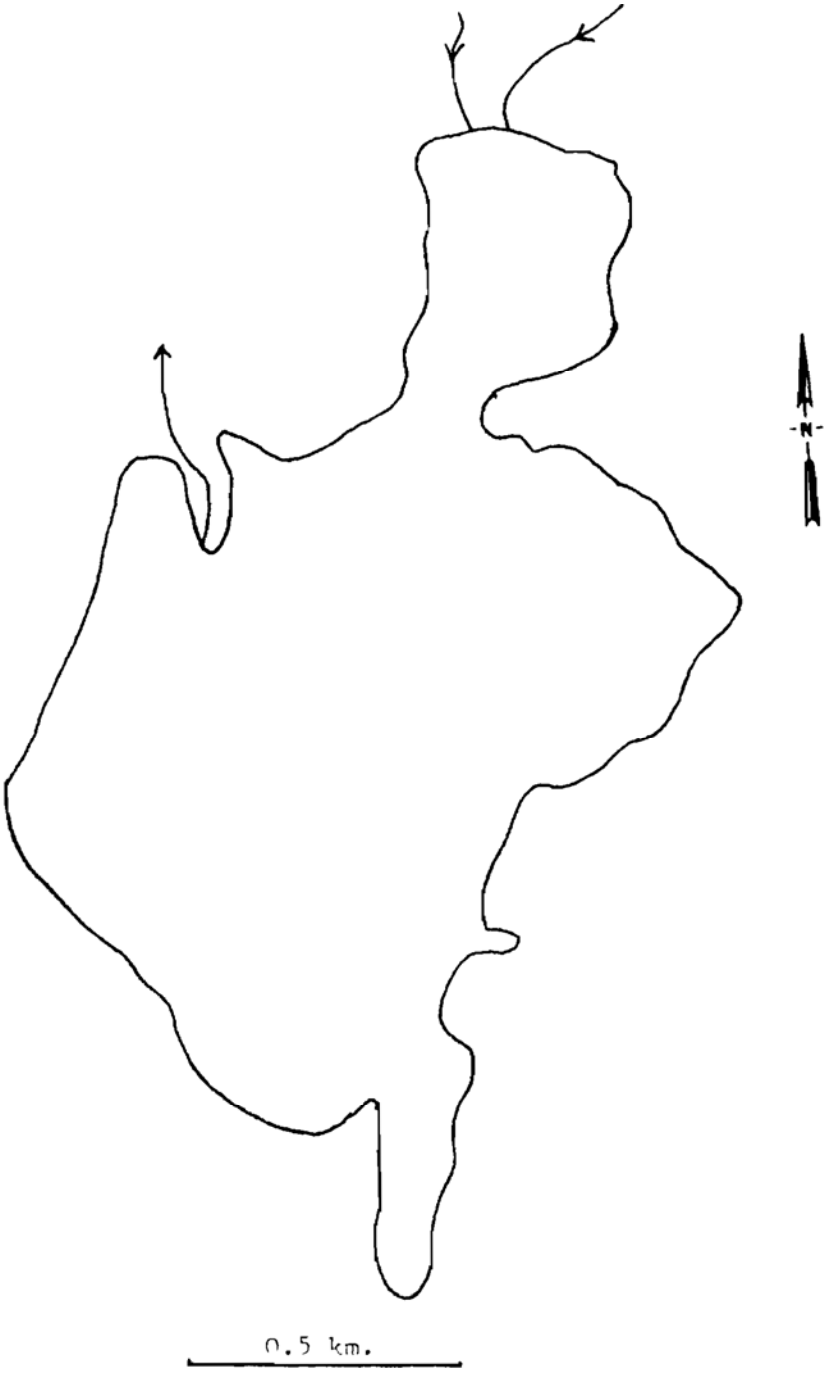
Appendix Figure 5. Bathymetric map of Lake 285-05, unnamed, Innoko NWR, with 5-ft contour intervals (63.4296°N, 158.1720°W).



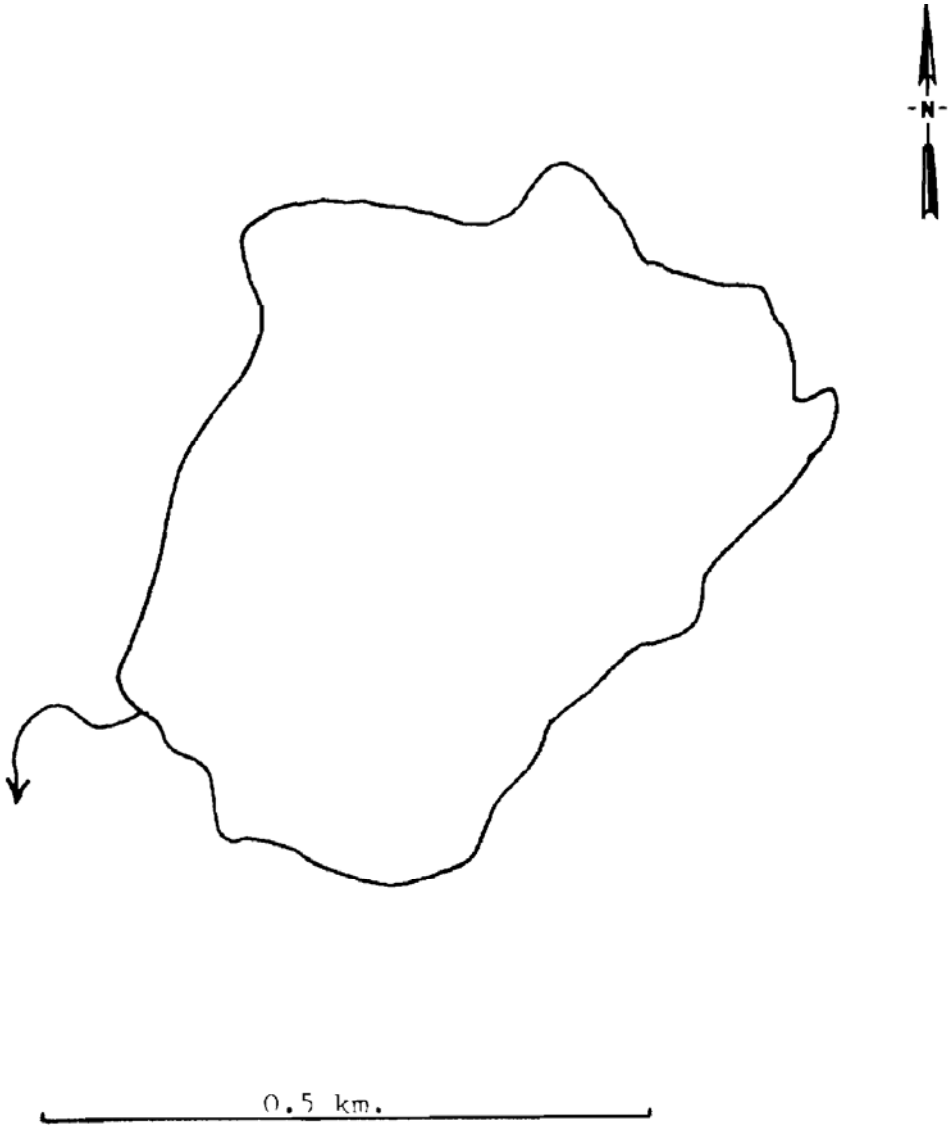
Appendix Figure 6. Bathymetric map of Lake 285-06, unnamed, Innoko NWR, with 5-ft contour intervals (63.2340°N, 158.2202°W).



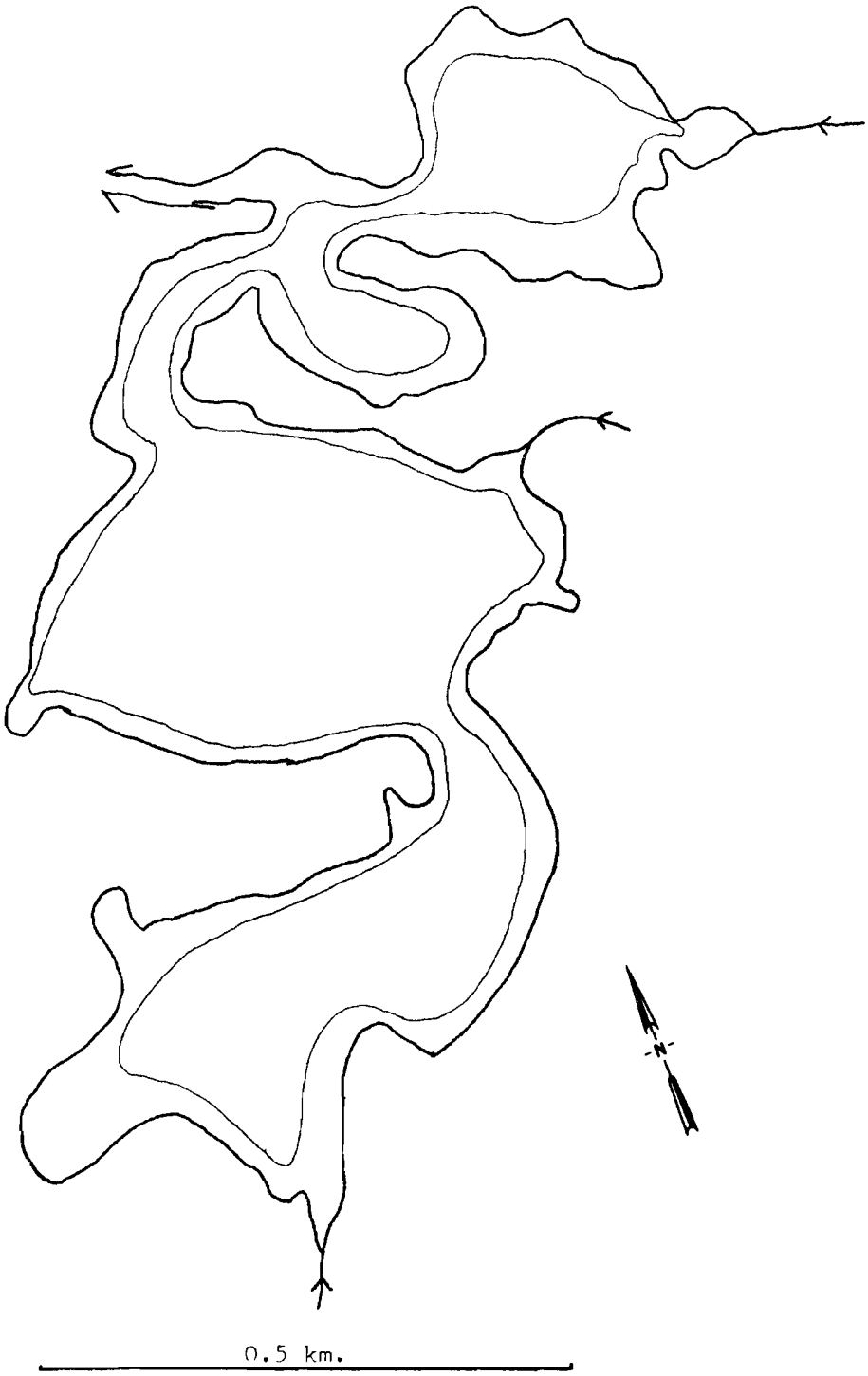
Appendix Figure 7. Bathymetric map of Lake 285-07, unnamed, Innoko NWR, with 5-ft contour interval (63.2164°N, 1583073°W).



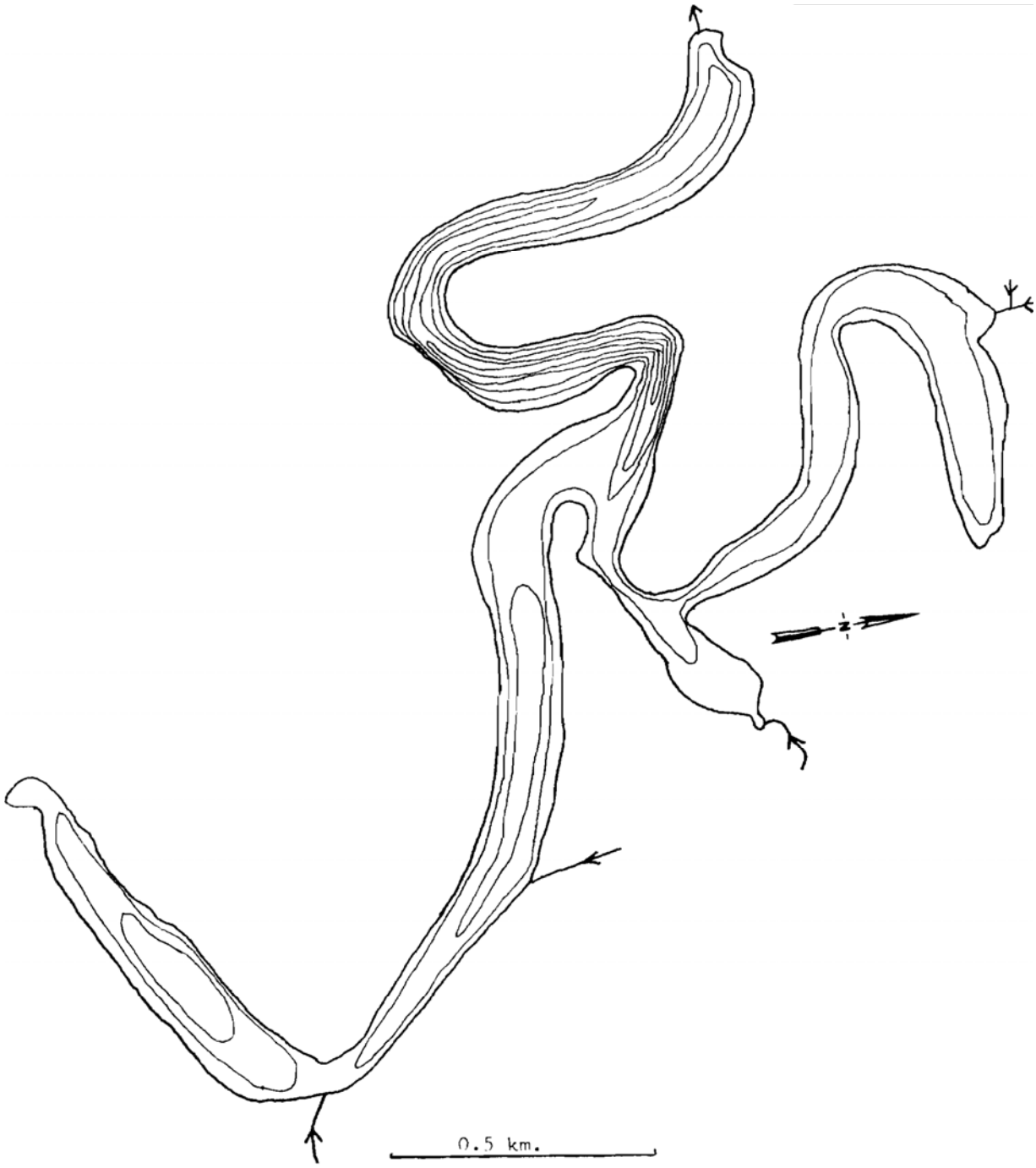
Appendix Figure 8. Bathymetric map of Lake 285-08, unnamed, Innoko NWR, maximum depth less than 5 ft (63.1741°N, 158.0675°W).



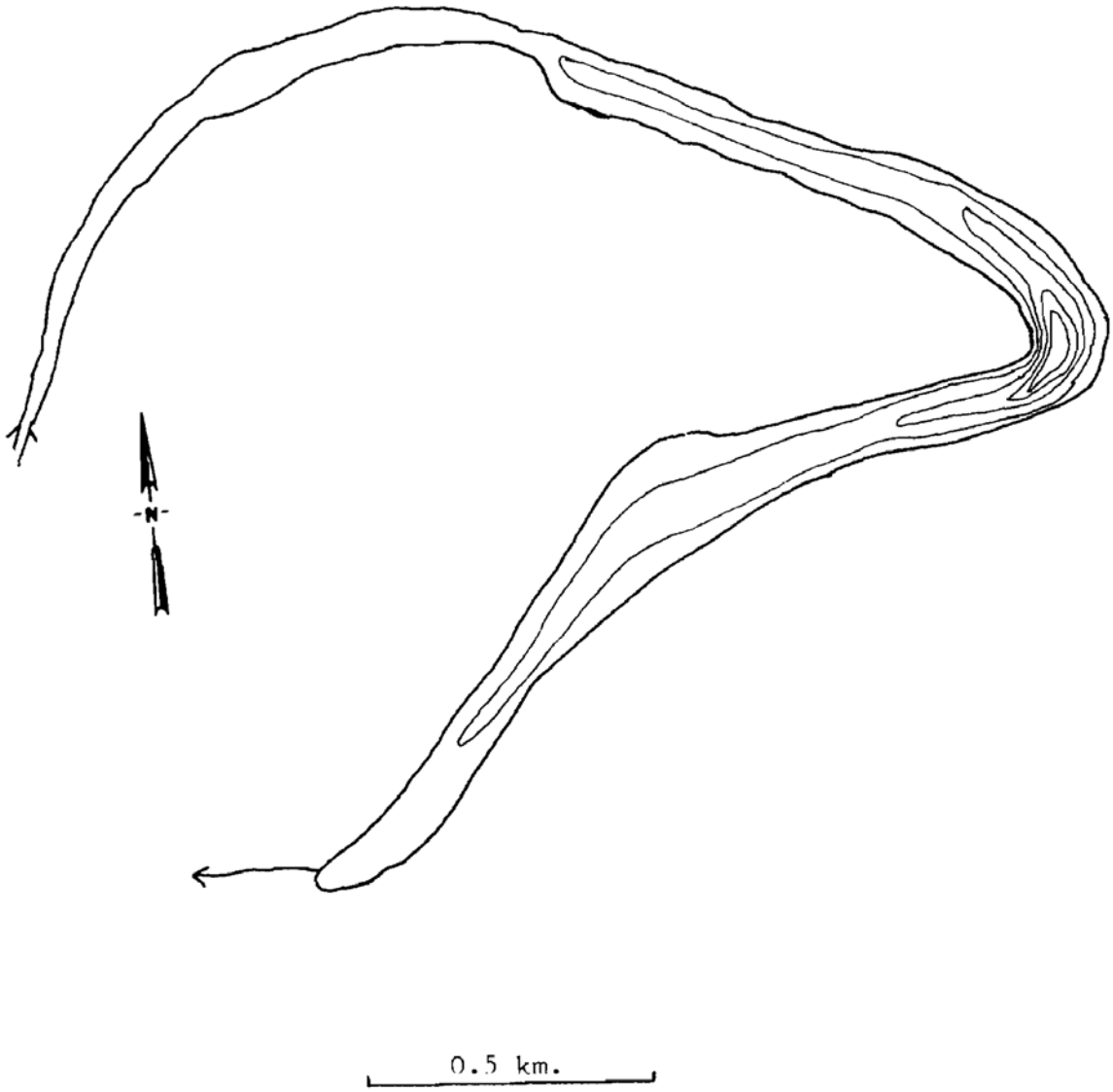
Appendix Figure 9. Bathymetric map of Lake 285-09, unnamed, Innoko NWR, maximum depth less than 5 ft (63.2217°N, 158.0492°W).



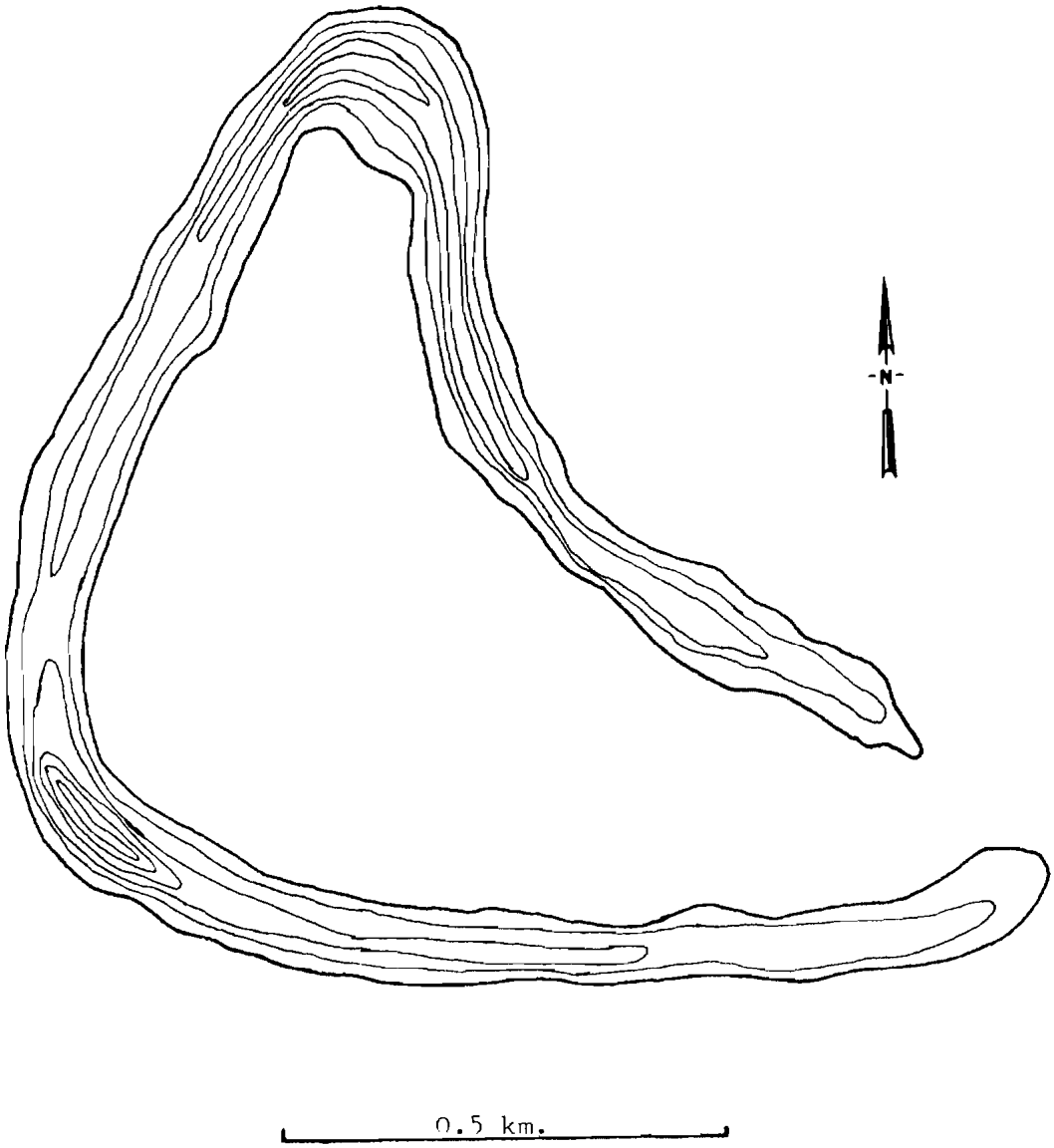
Appendix Figure 10. Bathymetric map of Lake 285-10, unnamed, Innoko NWR, with 5-ft contour interval (63.1005°N, 158.2316°W).



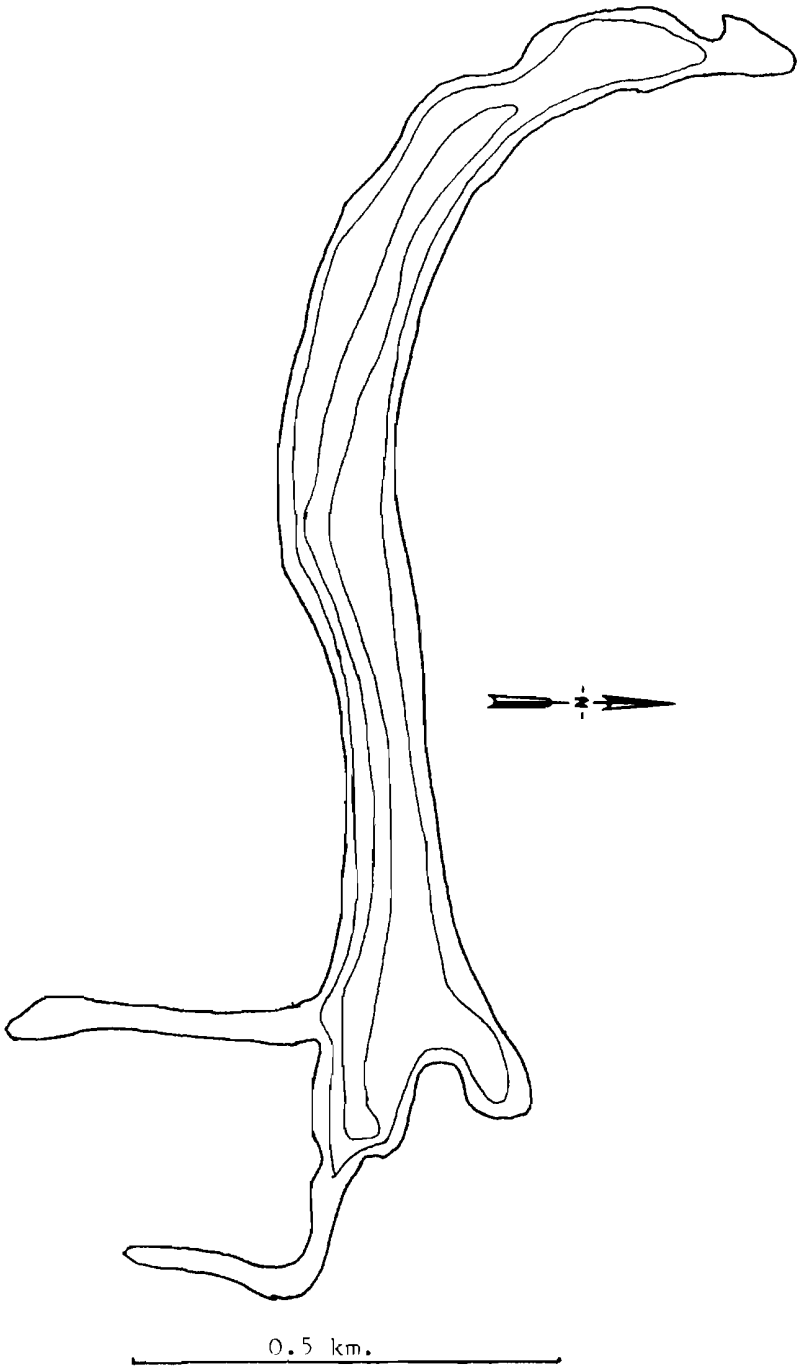
Appendix Figure 11. B Bathymetric map of Lake 285-11, unnamed, Innoko NWR, with 5-ft contour intervals (63.6415°N,158.0161°W).



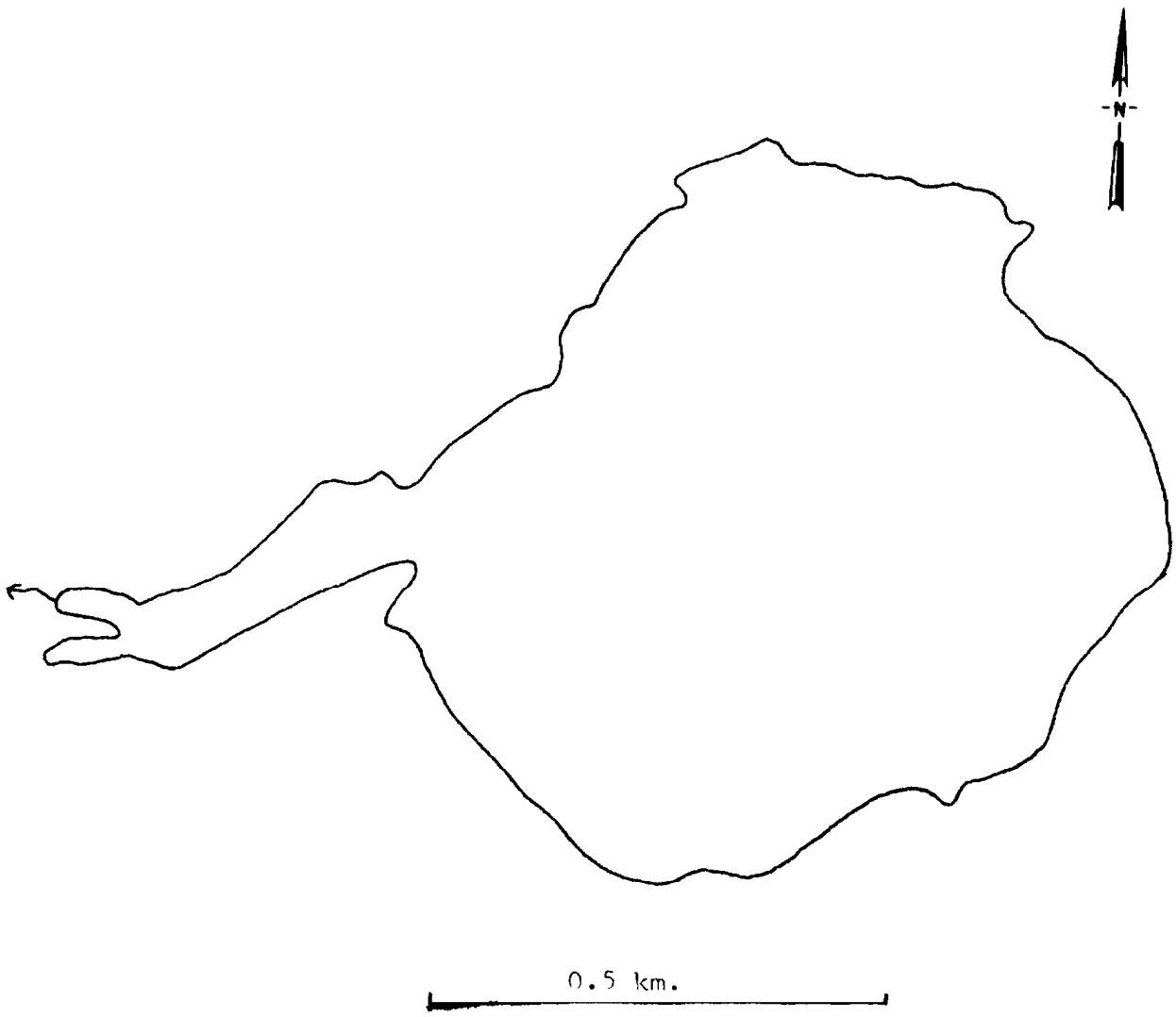
Appendix Figure 12. Bathymetric map of Lake 285-12, unnamed, Innoko NWR, with 5-ft contour intervals (63.1316°N, 158.8588°W).



Appendix Figure 13. Bathymetric map of Lake 285-13, unnamed, Innoko NWR, with 5-ft contour intervals (63.5595°N, 158.1967°W).

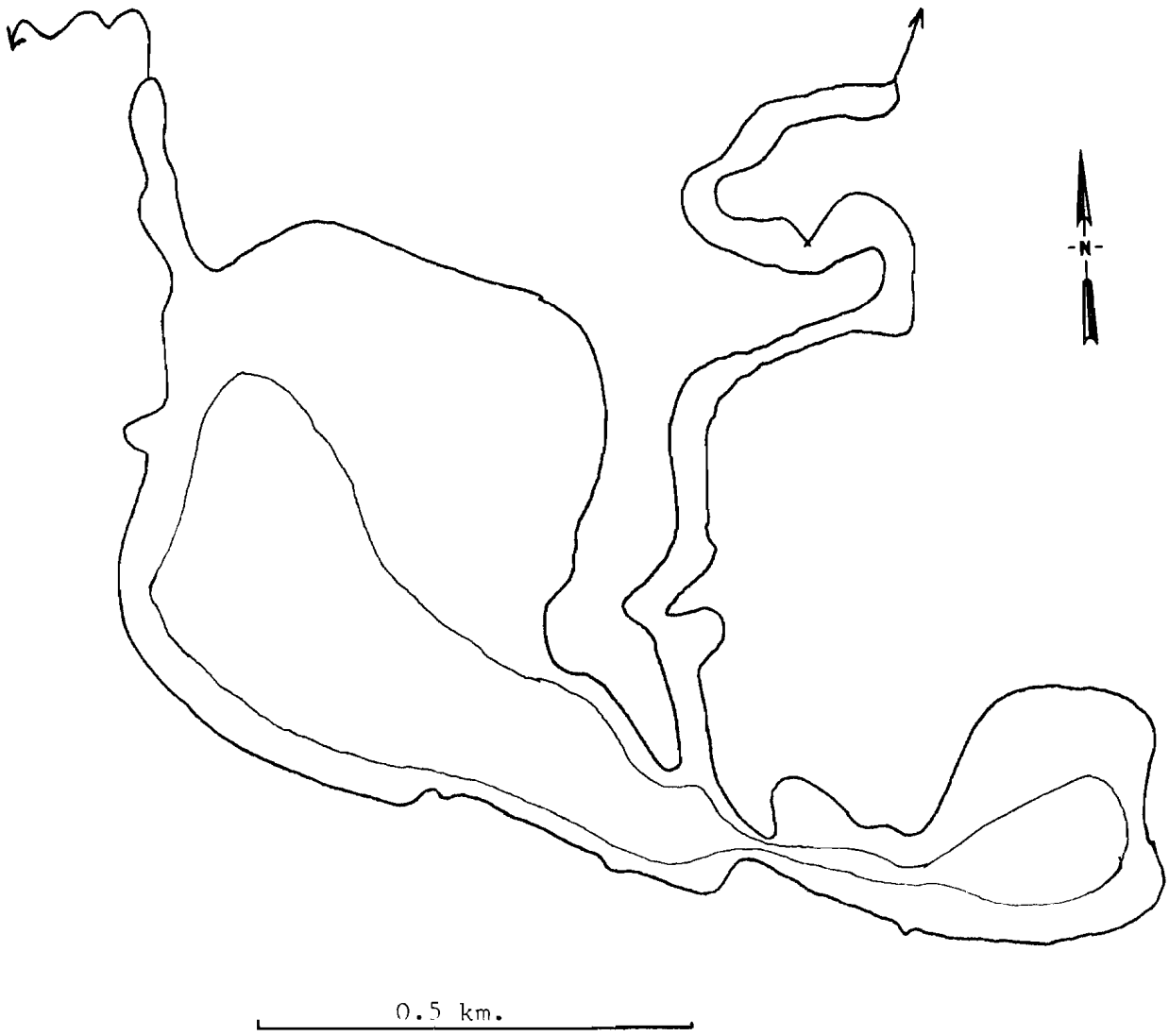


Appendix Figure 14. Bathymetric map of Lake 285-14, unnamed, Innoko NWR, with 5-ft contour intervals (63.5885°N, 157.3565°W).

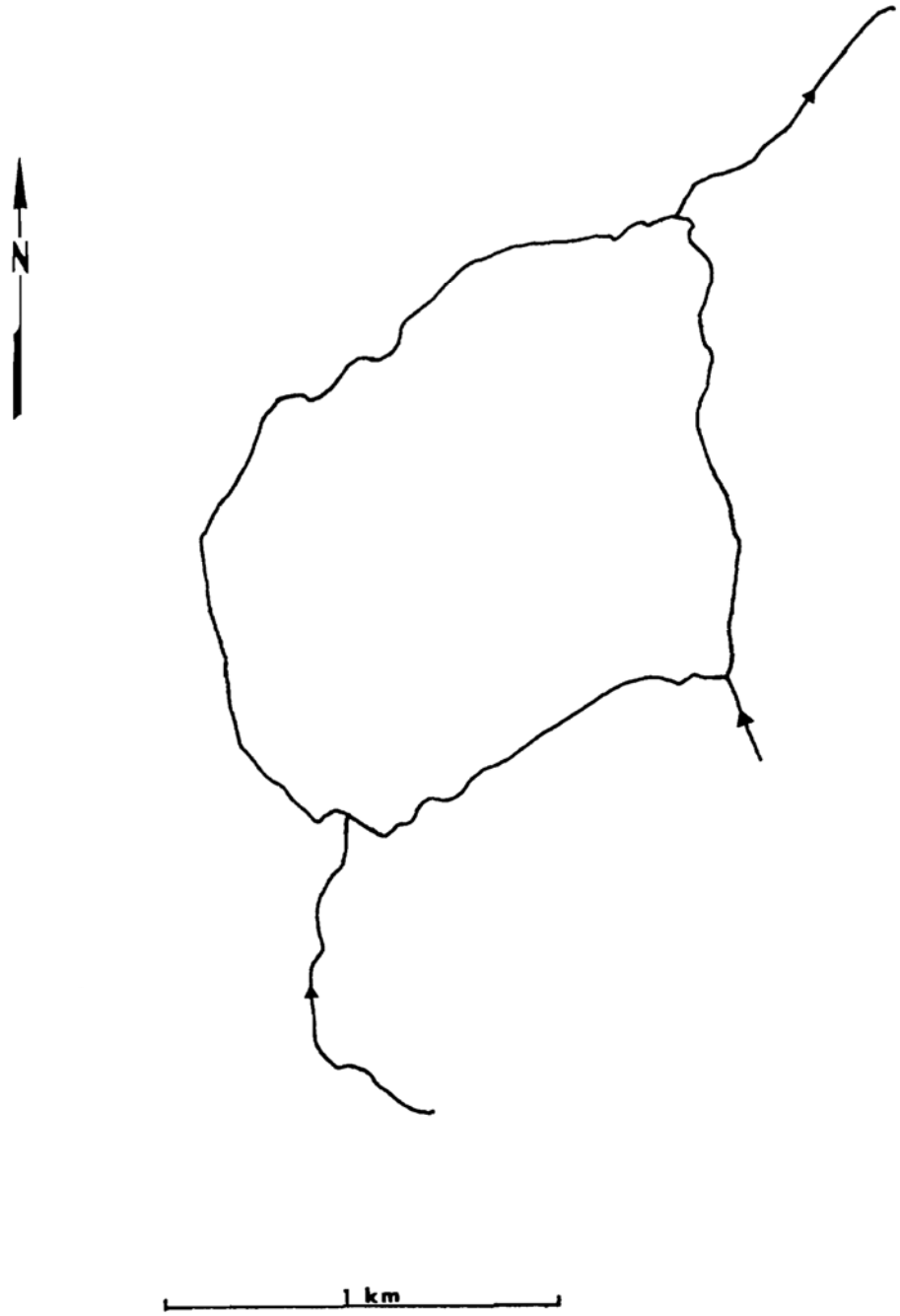


Appendix Figure 15. Bathymetric map of Lake 285-15, unnamed, Innoko NWR, maximum depth less than 5 ft (63.6414°N, 157.5361°W).

Appendix Figure 16. Bathymetric map of Lake 285-16, unnamed, Innoko NWR, maximum depth less than 5 ft (63.5735°N, 157.7406°W).

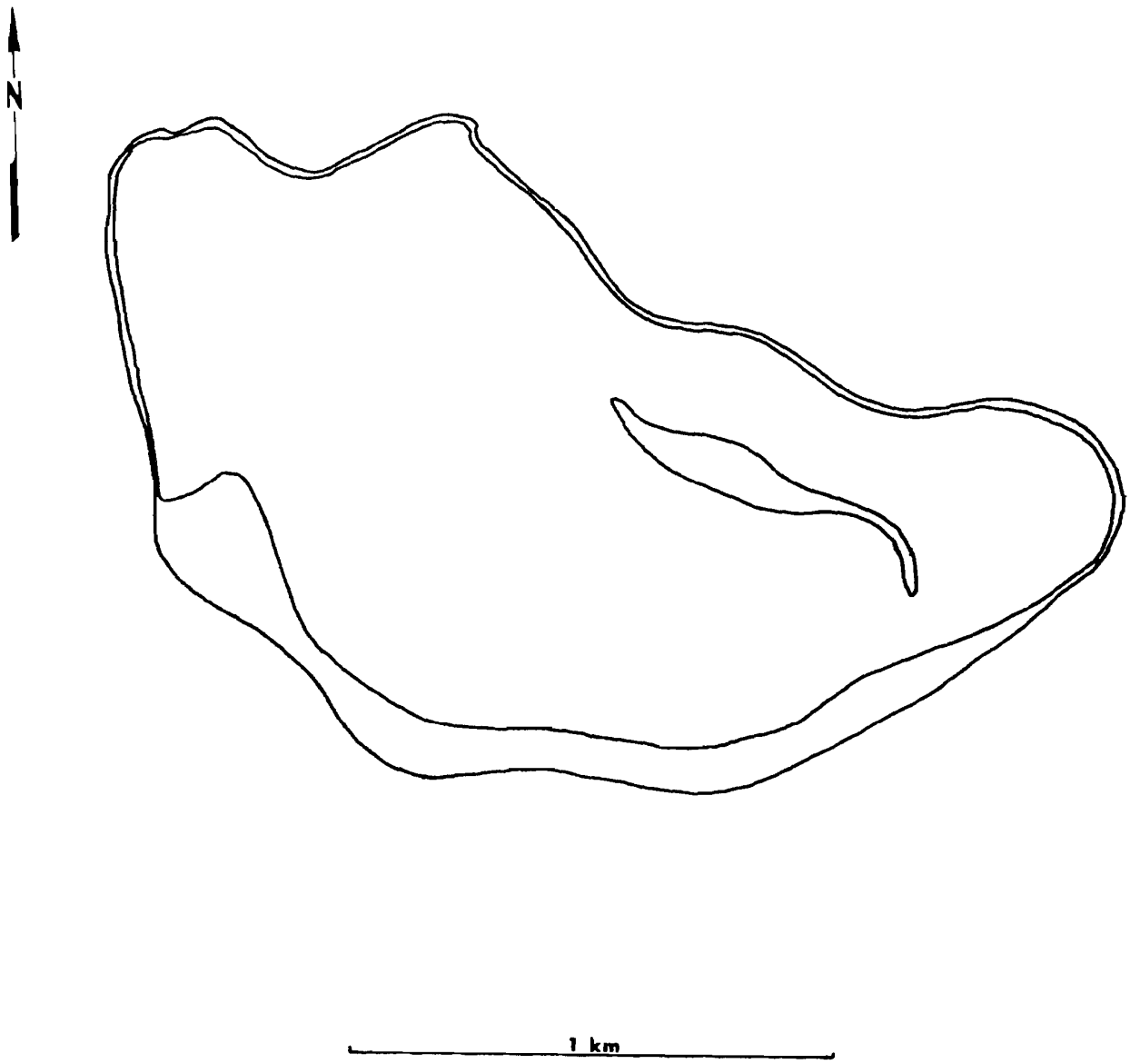


Appendix Figure 17. Bathymetric map of Lake 285-17, unnamed, Innoko NWR, with 5-ft contour interval (63.6958°N, 157.7875°W).

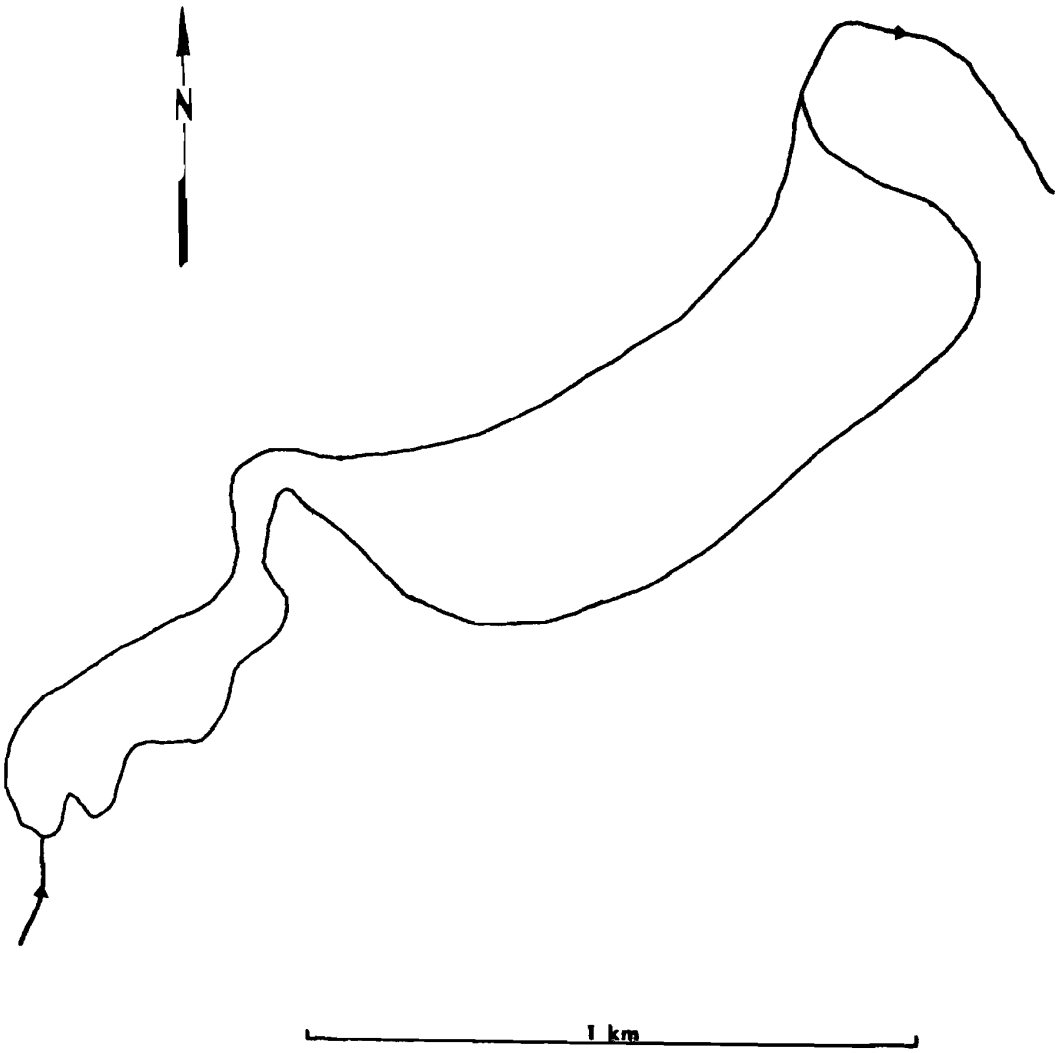


Appendix Figure 18. Bathymetric map of Lake 384-01, Tokusatatquaten Lake, Kanuti NWR, maximum depth less than 5 ft (66.1208°N 151.1950°W).

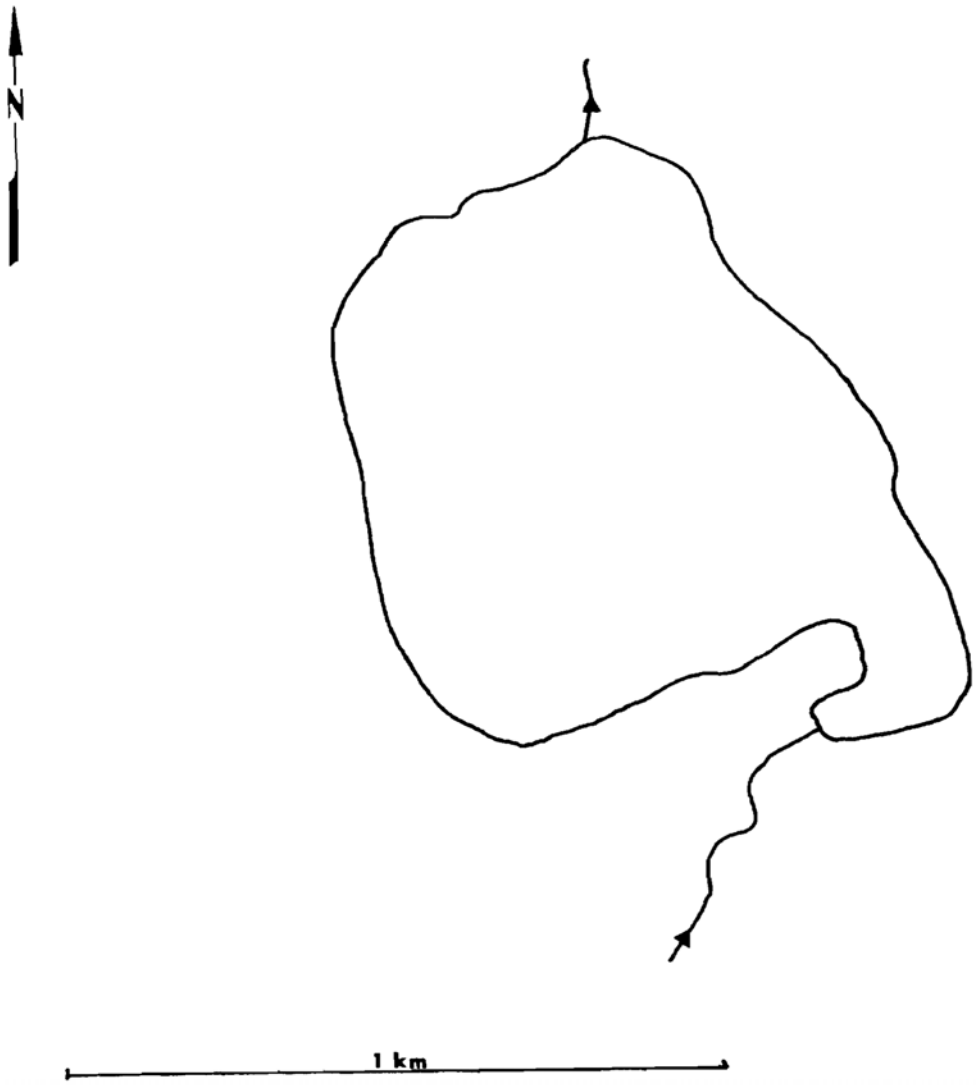
Appendix Figure 19. Bathymetric map of Lake 384-02, Sithylemenkat Lake, Kanuti NWR, with 5-ft contour intervals (66.1252°N, 151.3933°W).



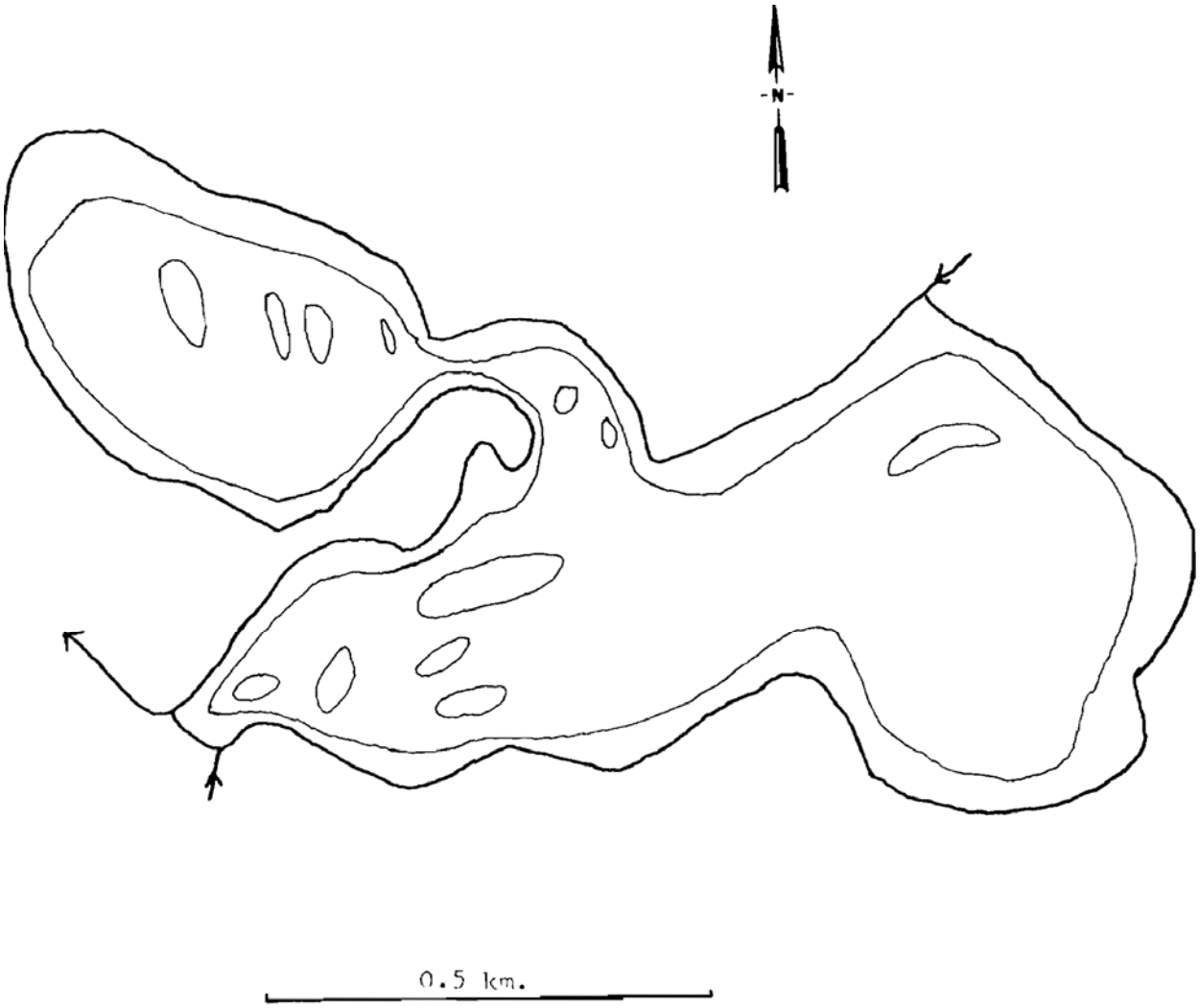
Appendix Figure 20. Bathymetric map of Lake 384-03, Old Dummy Lake, Kanuti NWR, with 5-ft contour intervals (66.1384°N, 151.8539°W).



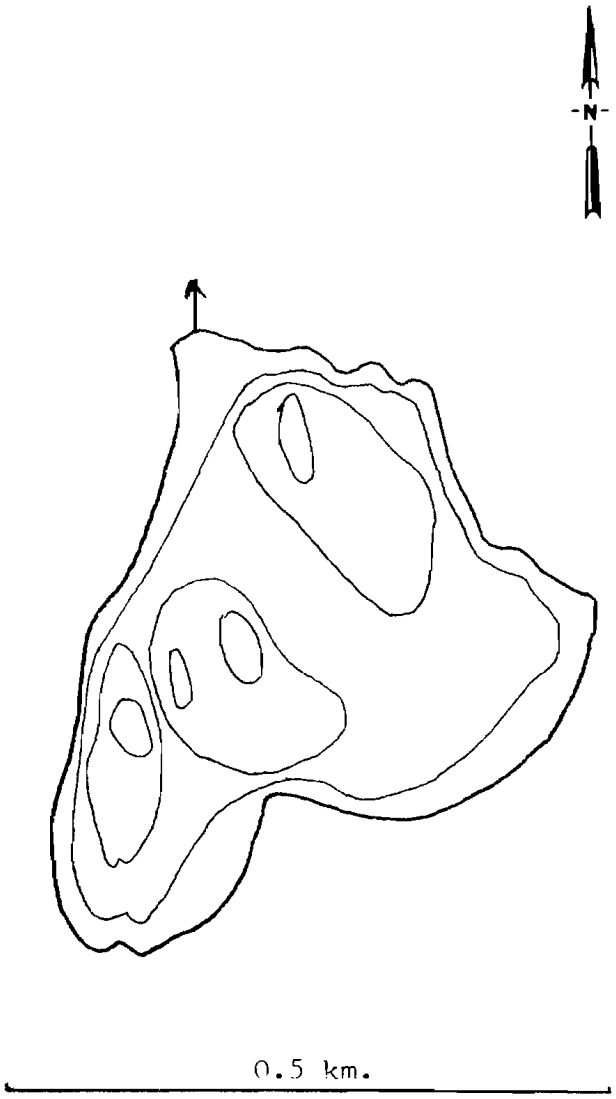
Appendix Figure 21. Bathymetric map of Lake 384-04, unnamed, Kanuti NWR, maximum depth less than 5 ft (66.1602°N, 151.7852°W).



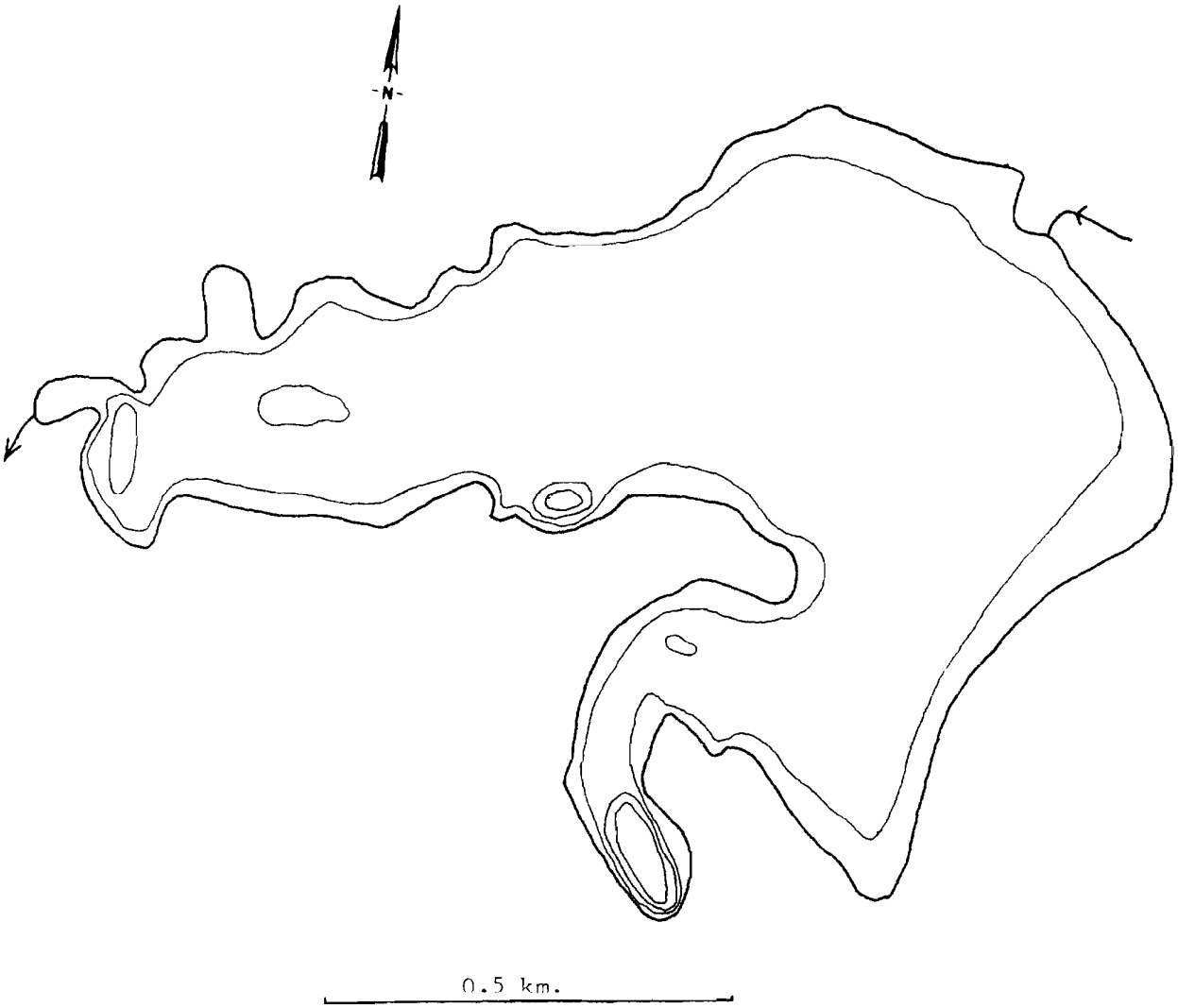
Appendix Figure 22. Bathymetric map of Lake 384-05, unnamed, Kanuti NWR, maximum depth less than 5 ft (66.1493°N, 151.8063°W).



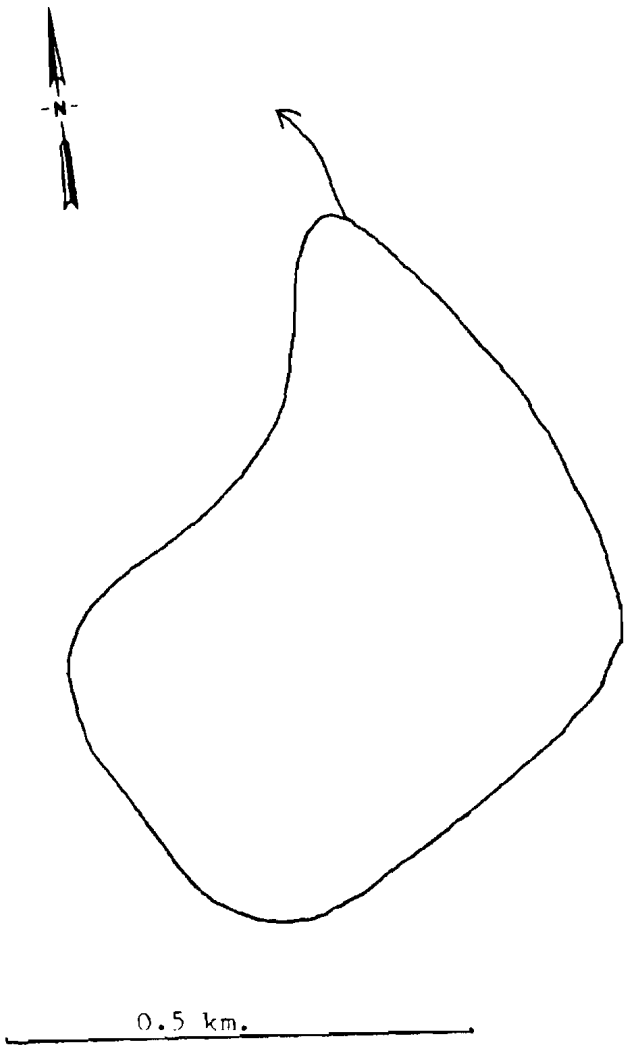
Appendix Figure 23. Bathymetric map of Lake 385-01, Konedsin Lake, Kanuti NWR, with 5-ft contour intervals (66.3736°N, 151.9525°W).



Appendix Figure 24. Bathymetric map of Lake 385-02, unnamed, Kanuti NWR, with 5-ft. contour intervals (66.3640°N, 151.9731°W).

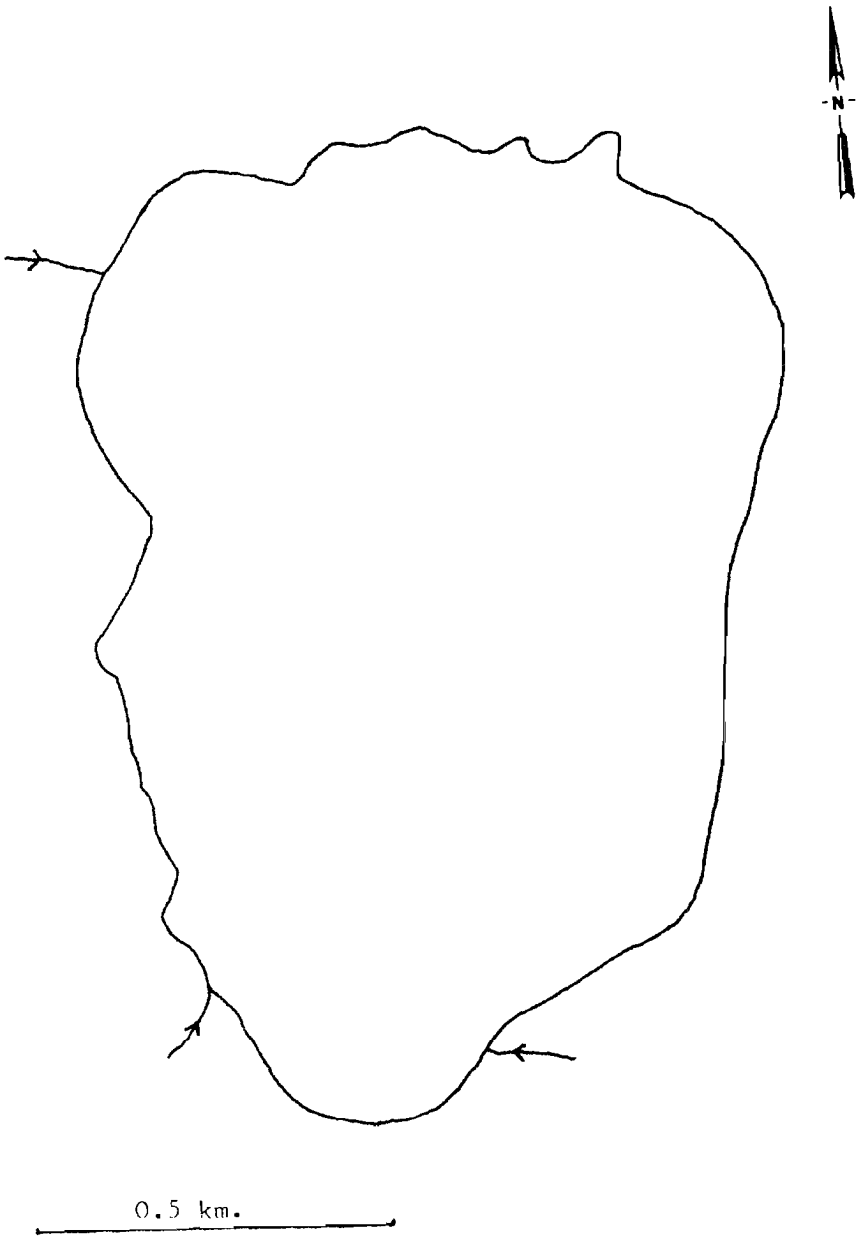


Appendix Figure 25. Bathymetric map of Lake 385-03, Kodosin Lake, Kanuti NWR, with 5-ft contour intervals (66.3699°N, 152.0000°W).

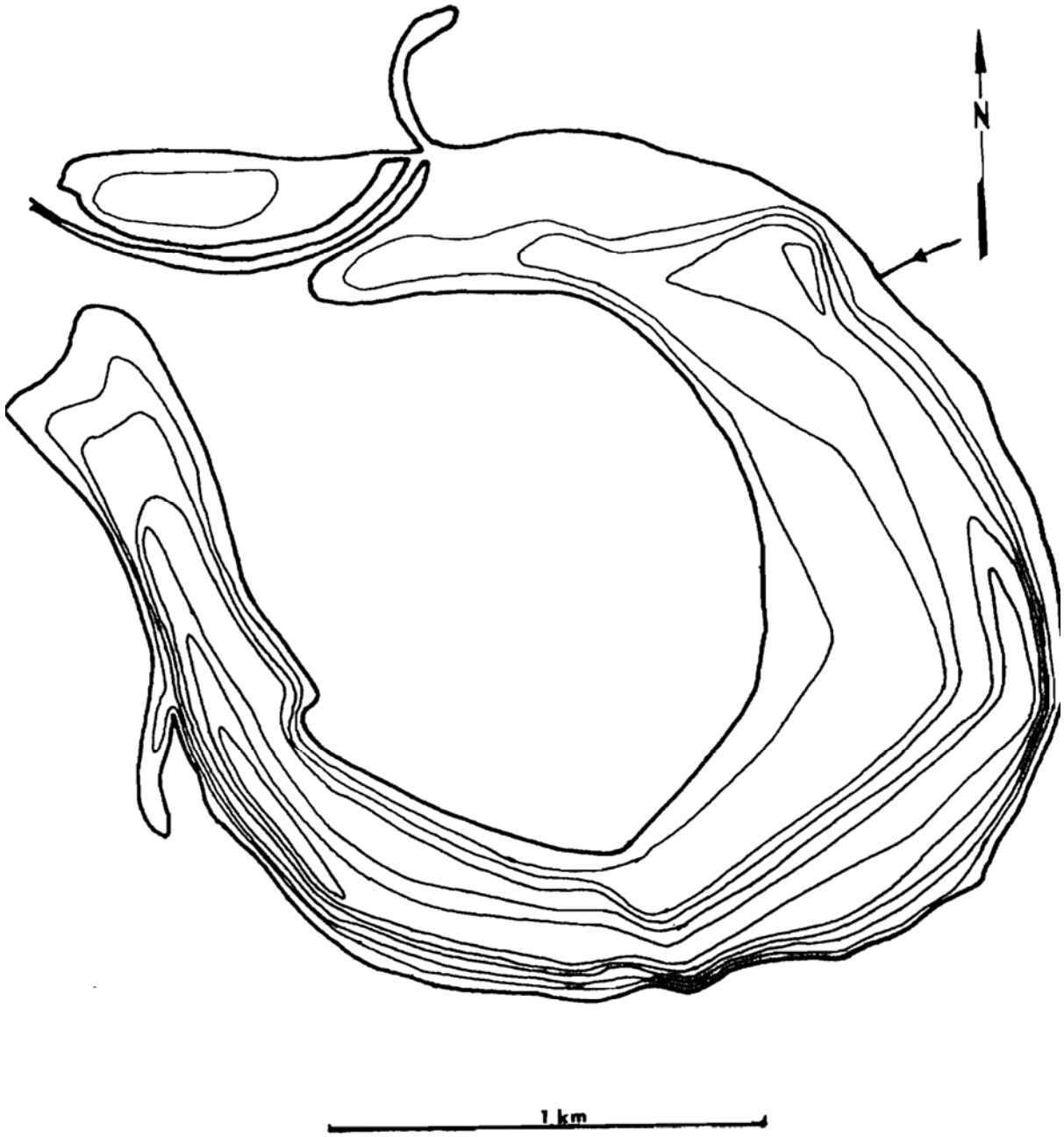


Appendix Figure 26. Bathymetric map of Lake 385-04, unnamed, Kanuti NWR, maximum depth less than 5 ft (66.1408°N, 151.9202°W).

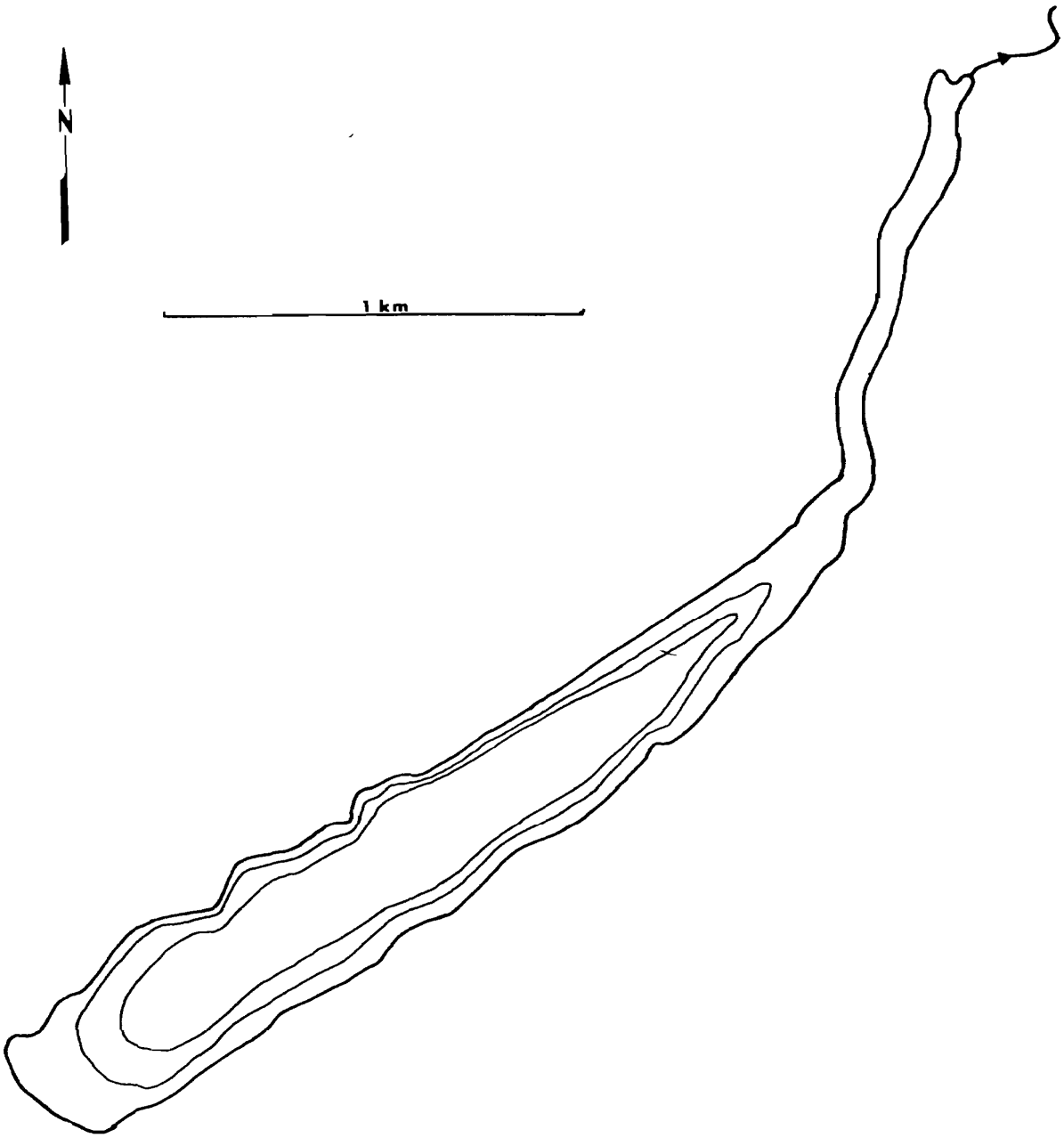
Appendix Figure 27. Bathymetric map of Lake 385-05, Mingkoket Lake, Kanuti NWR, with 5-ft contour intervals (66.4998°N, 152.1174°W).



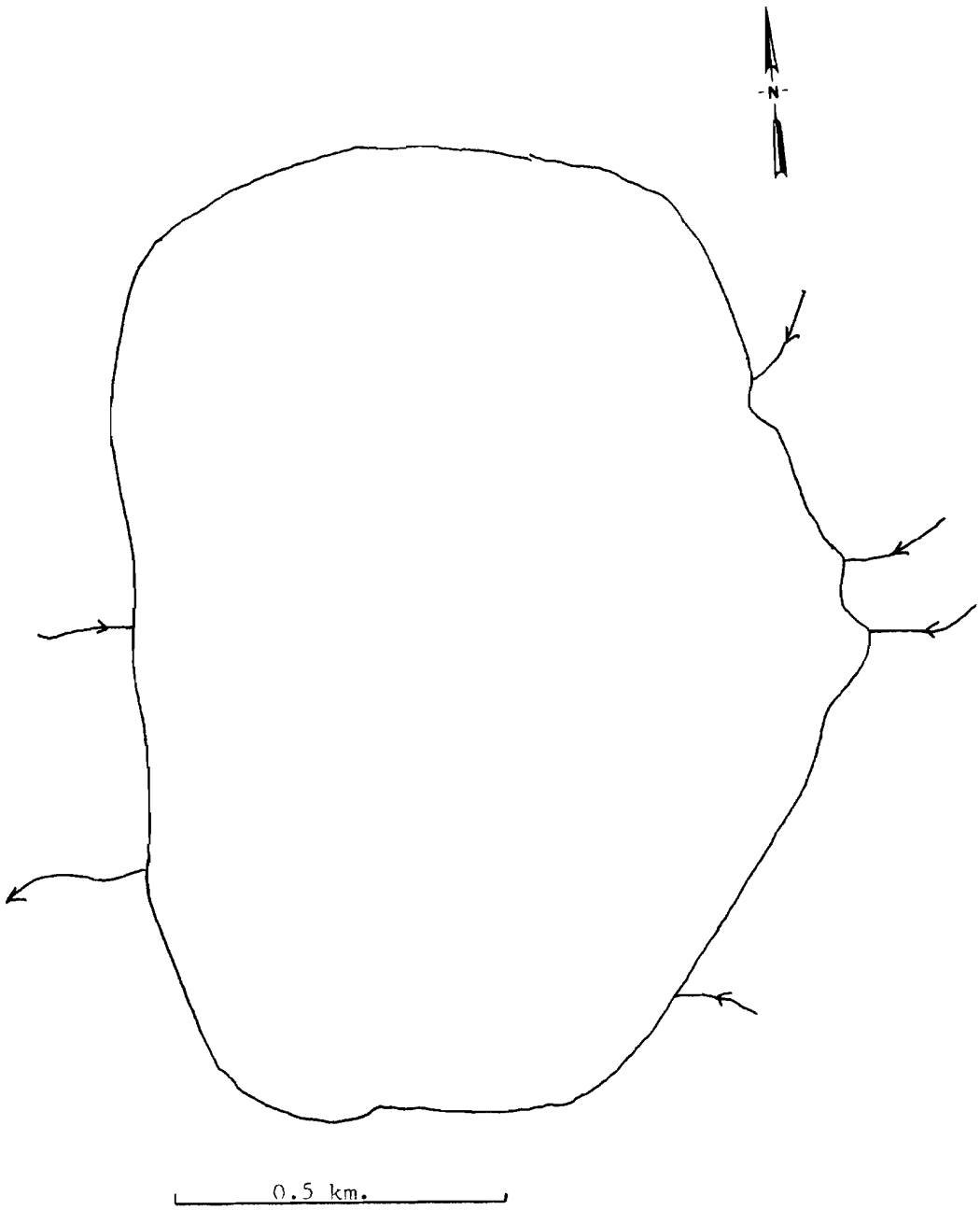
Appendix Figure 28. Bathymetric map of Lake 385-06, Minnkokut Lake, Kanuti NWR, maximum depth less than 5 ft (66.5604°N, 151.6885°W).



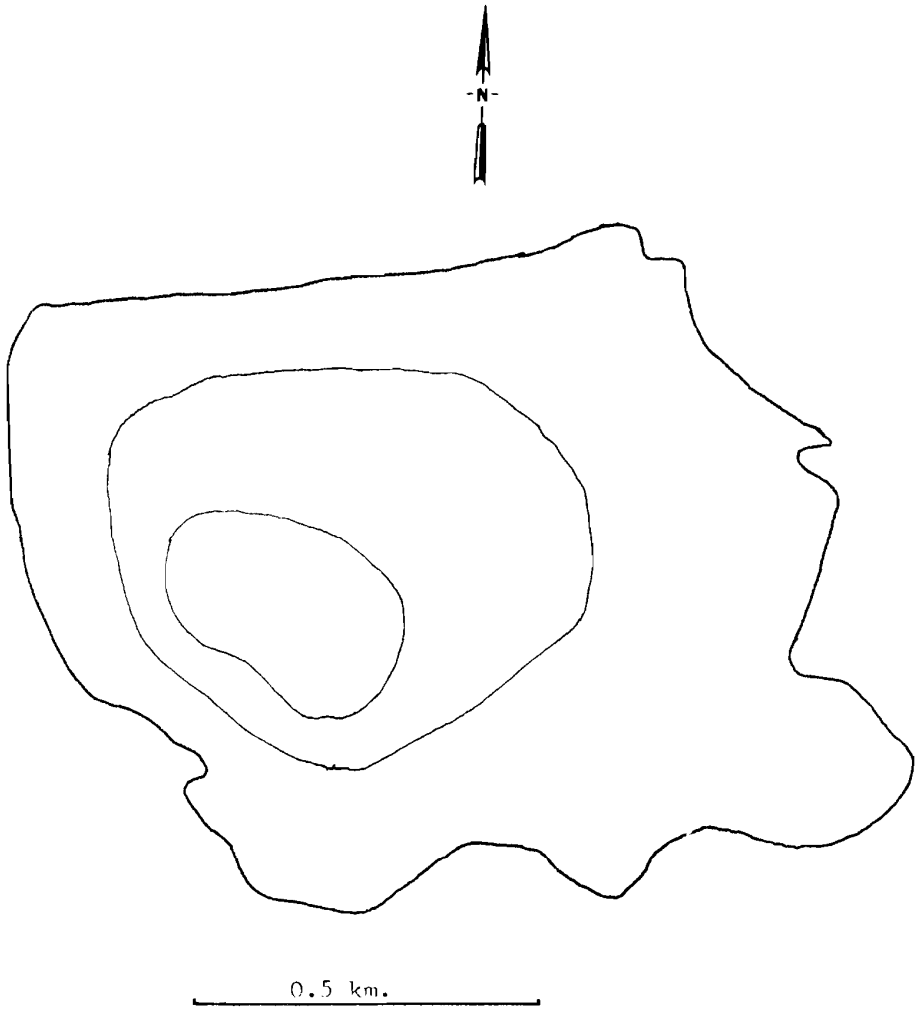
Appendix Figure 29. Bathymetric map of Lake 484-01, unnamed, Koyukuk NWR, with 5-ft contour intervals (65.3947°N, 156.5800°W).



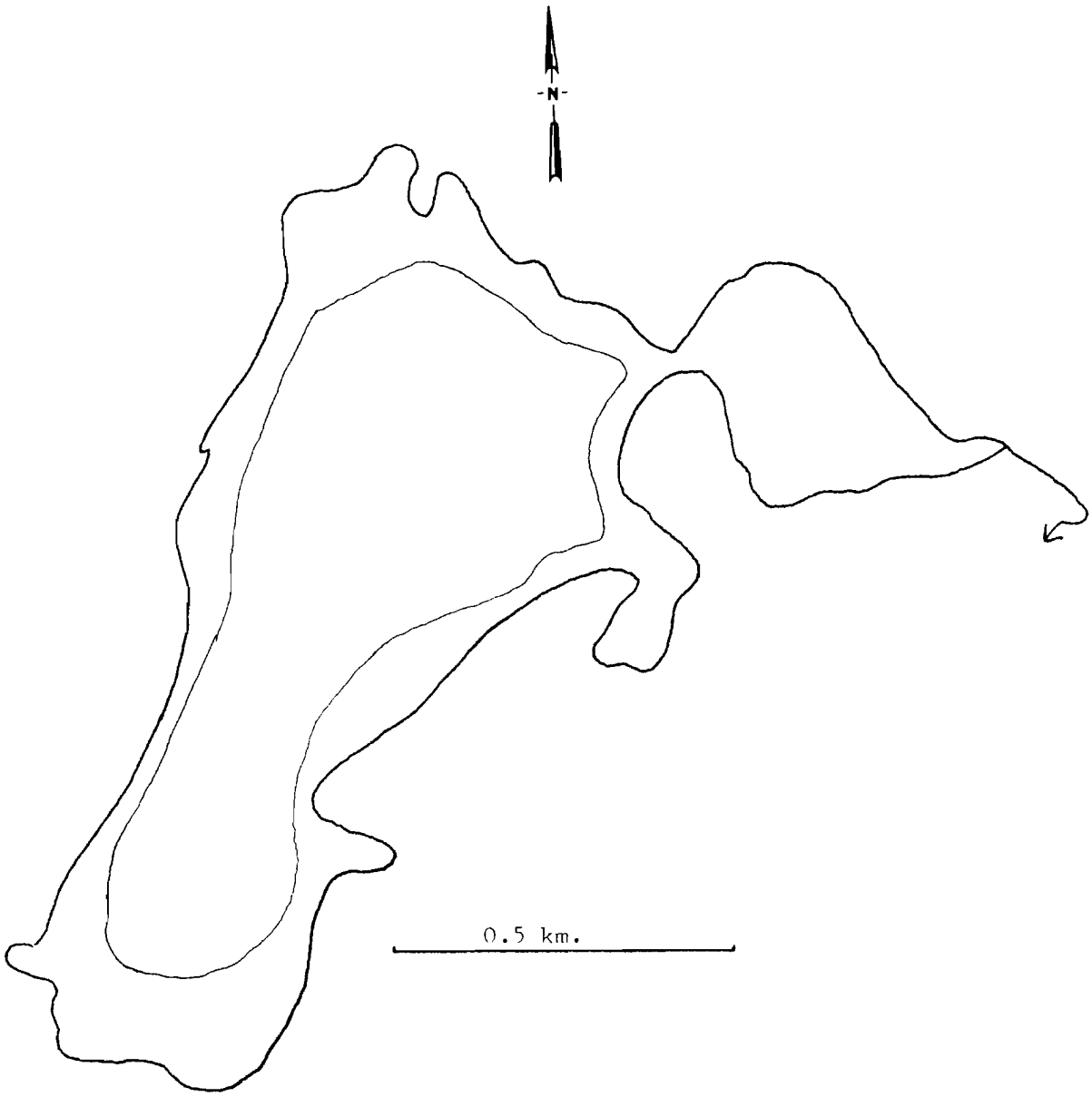
Appendix Figure 30. Bathymetric map of Lake 484-02, unnamed, Koyukuk NWR, with 5-ft contour intervals (65.6404°N, 157.1457°W).



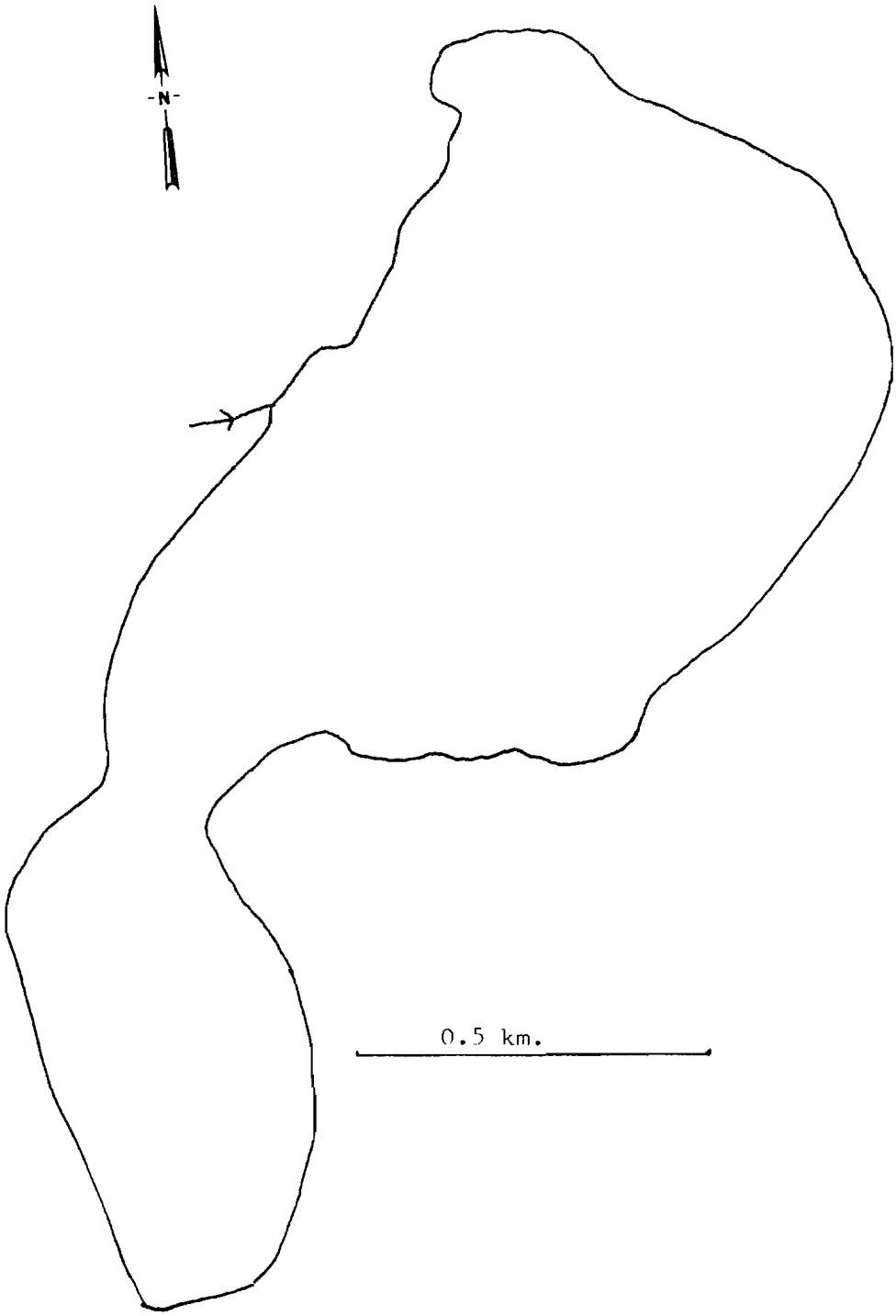
Appendix Figure 31. Bathymetric map of Lake 485-01, unnamed, Koyukuk NWR, maximum depth is less than 5 ft (65.6790°N, 157.1699°W).



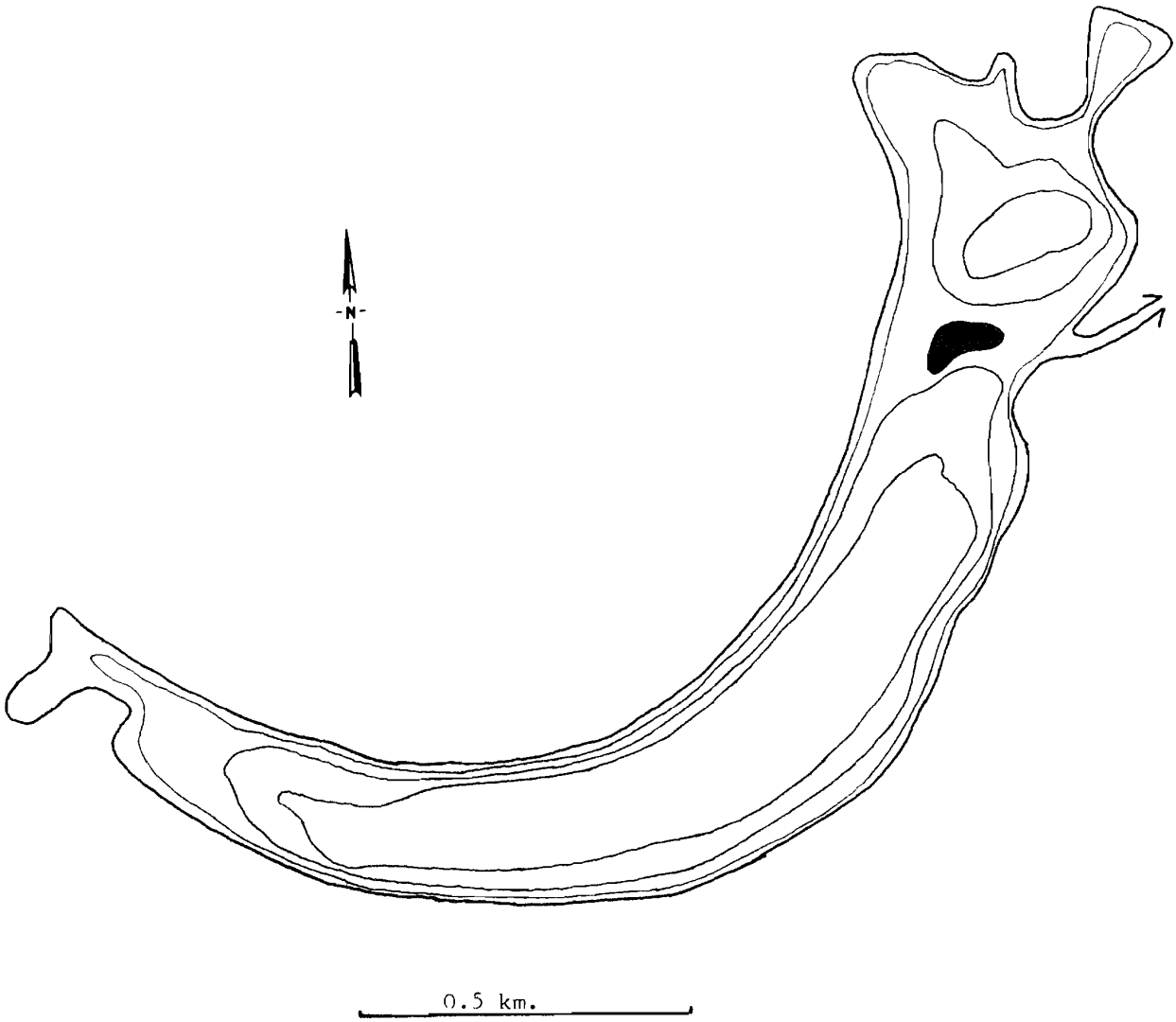
Appendix Figure 32. Bathymetric map of Lake 485-02, unnamed, Koyukuk NWR, with 5-ft contour interva1s (65.2521°N, 157.1198°W).



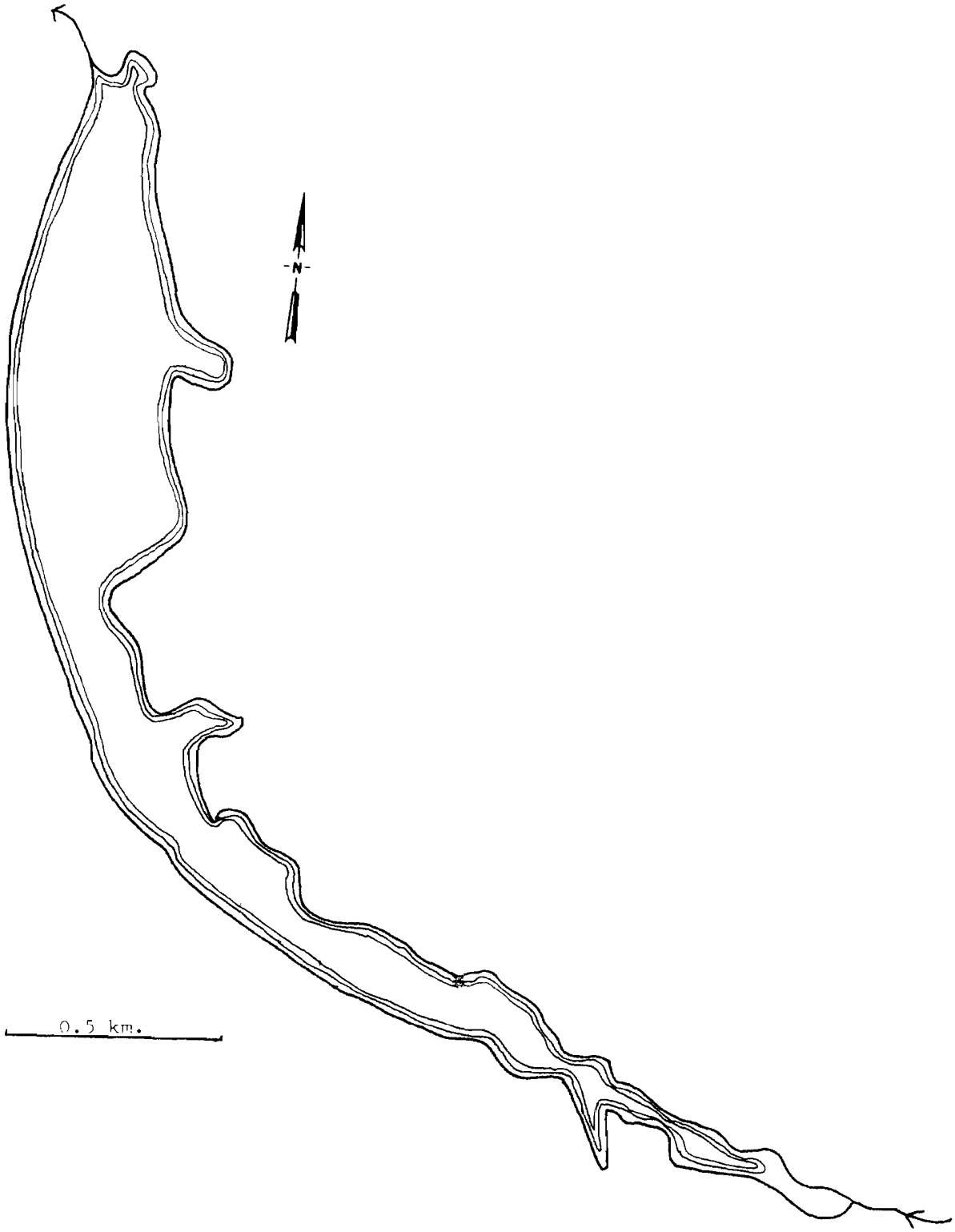
Appendix Figure 33. Bathymetric map of Lake 485-03, Louis Lake, Koyukuk NWR, with 5-ft contour intervals (65.2226°N, 157.0278°W).



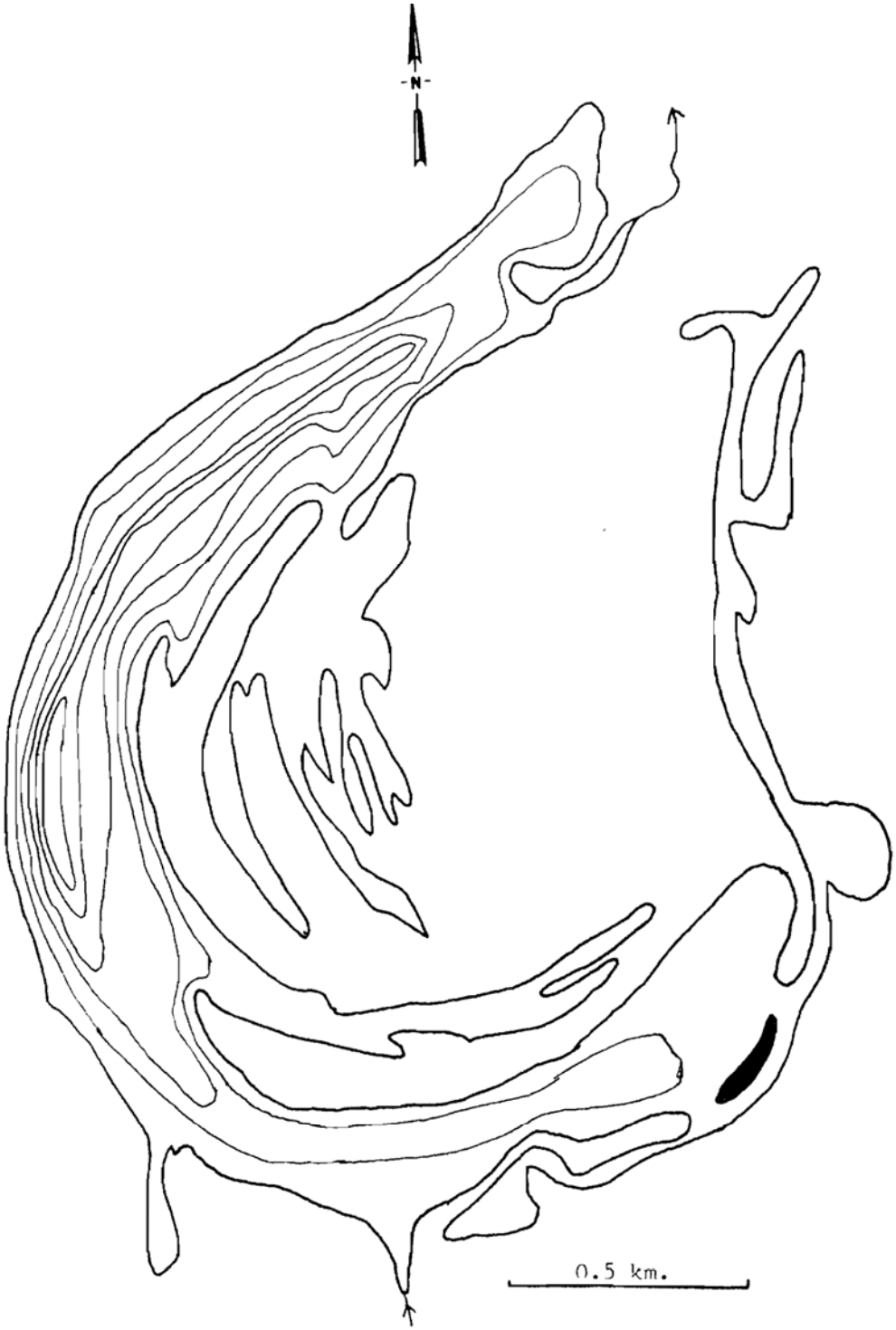
Appendix Figure 34. Bathymetric map of Lake 485-04 unnamed, Koyukuk NWR, maximum depth is less than 5 ft (65.2116°N, 156.5546°W).



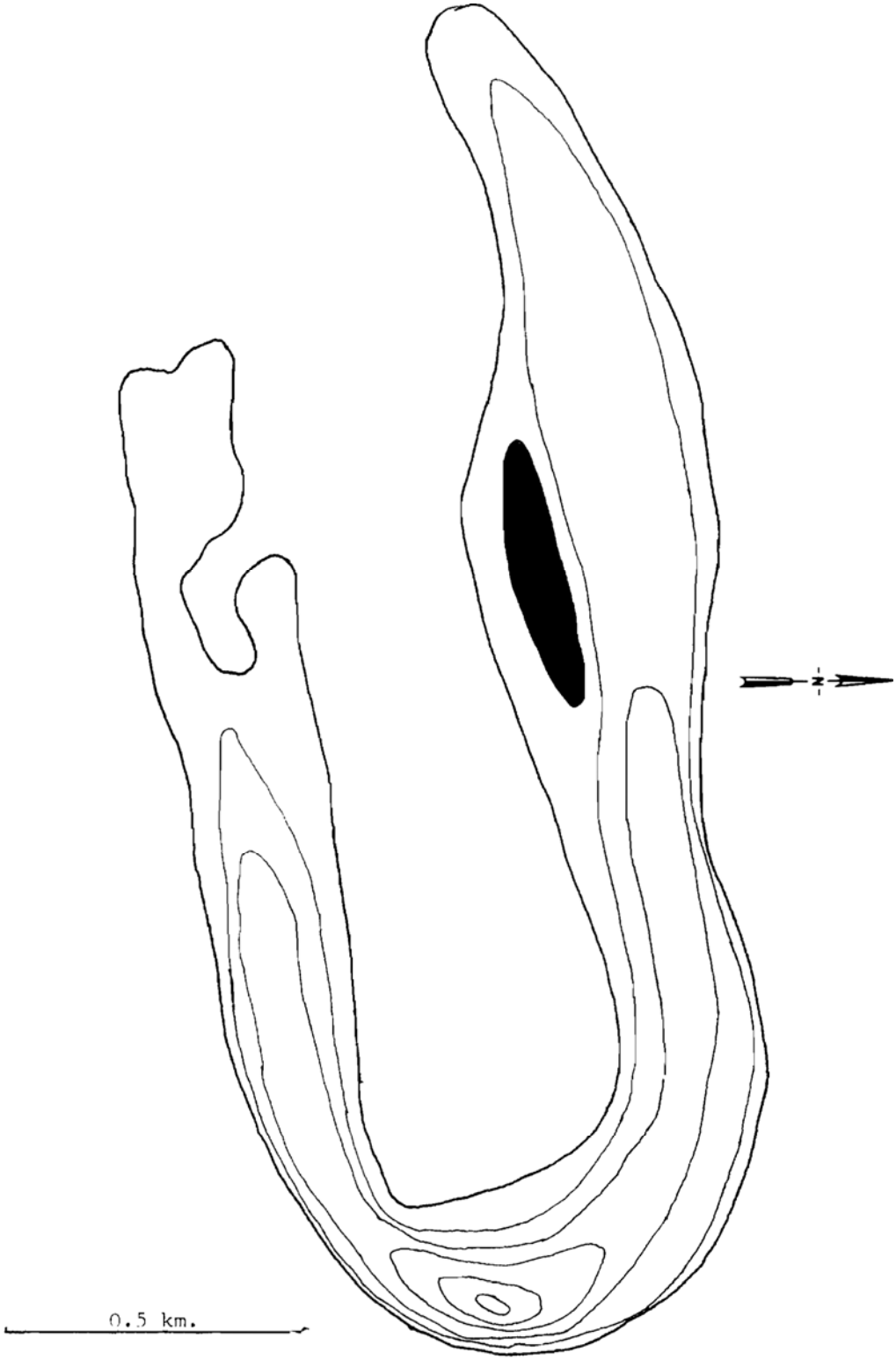
Appendix Figure 35. Bathymetric map of Lake 485-05, unnamed, Koyukuk NWR, with 5-ft contour intervals (65.0584°N, 157.3211°W).



Appendix Figure 36. Bathymetric map of Lake 485-06, unnamed, Koyukuk NWR, with 5-ft contour intervals (65.0025°N, 157.0936°W).

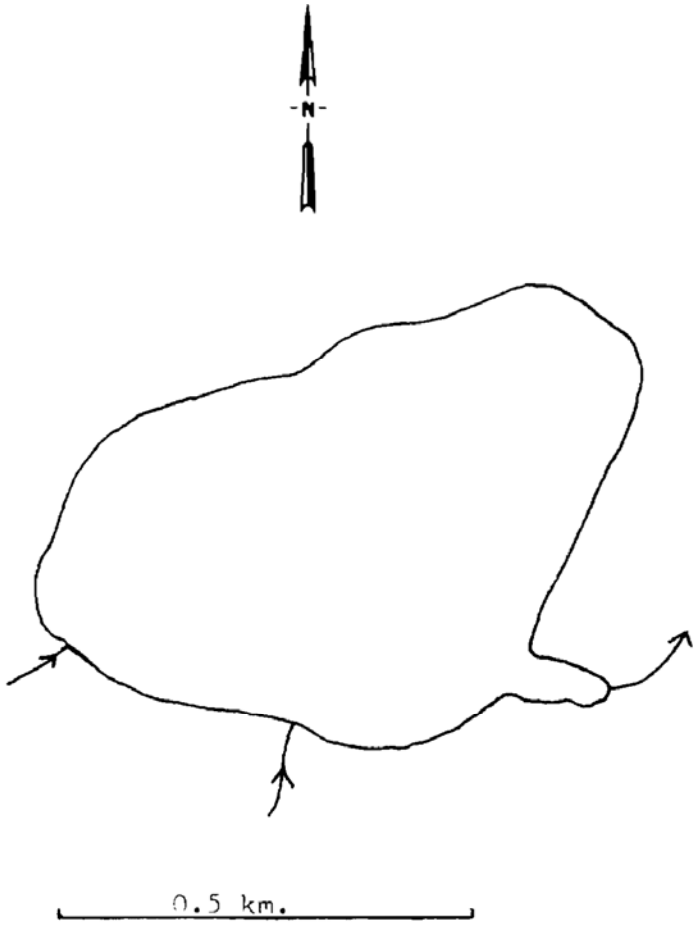


Appendix Figure 37. Bathymetric map of Lake 485-07, Tachanlowa Lake, Koyukuk NWR, with 5-ft contour intervals (65.4915°N, 157.2236°W).

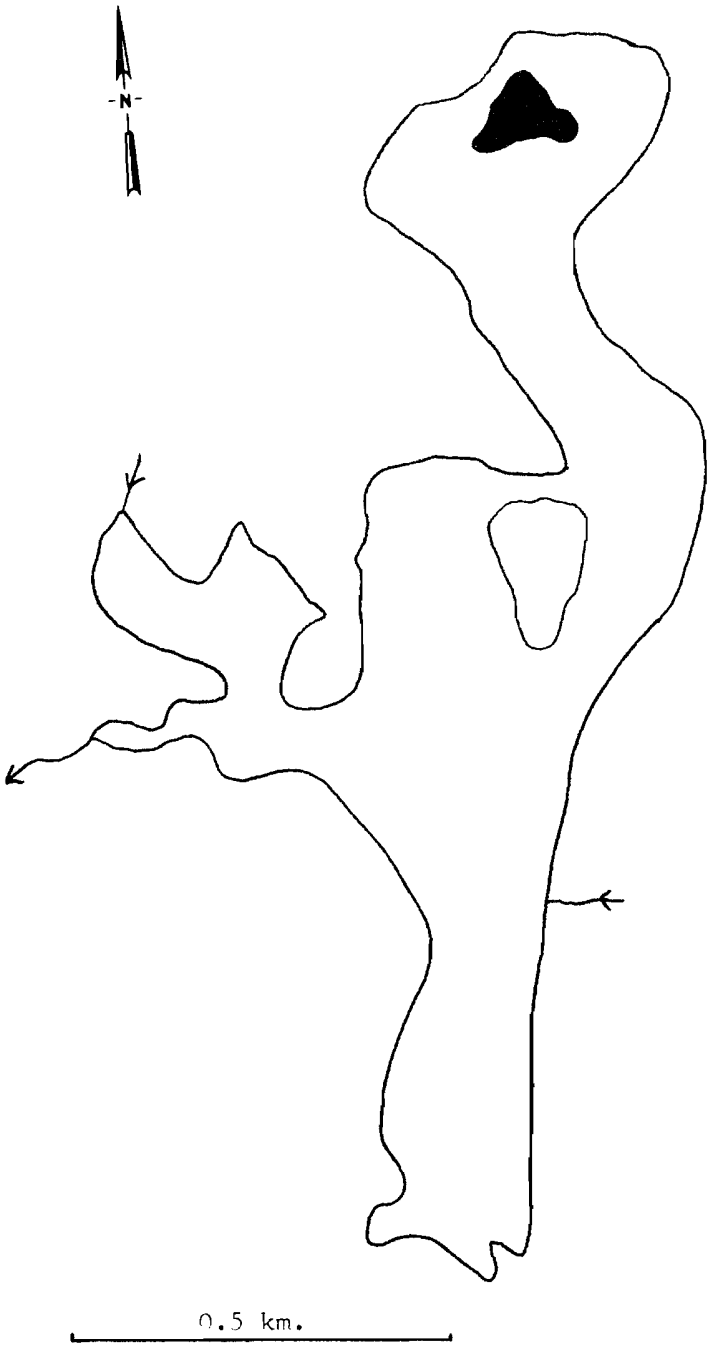


Appendix Figure 38. Bathymetric map of Lake 485-08, unnamed, Koyukuk NWR, with 10-ft contour intervals (65.3883°N, 157.5816°W).

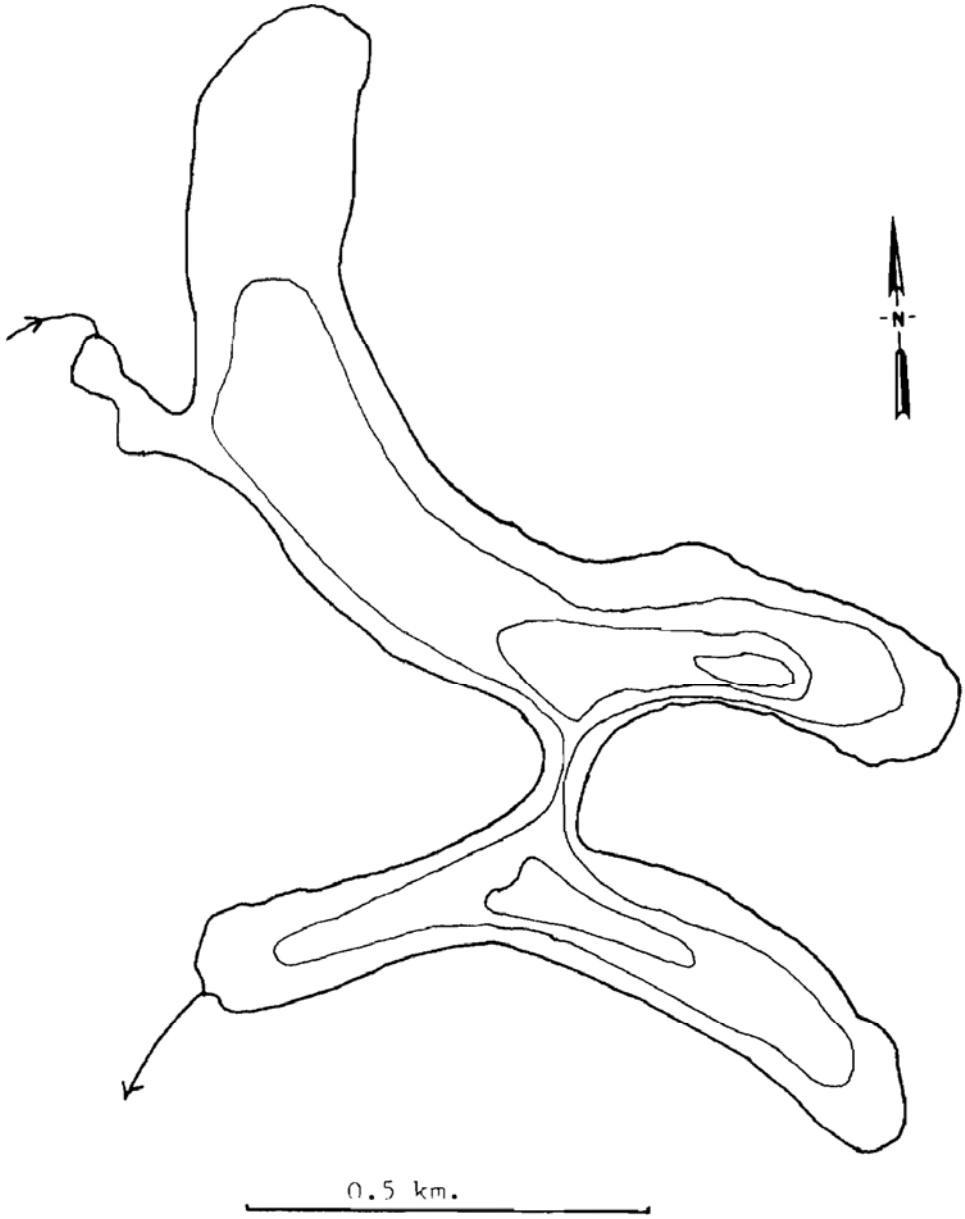
Appendix Figure 39. Bathymetric map of Lake 485-09, unnamed, Koyukuk NWR, with 10-ft contour intervals (65.4826°N, 1573345°W).



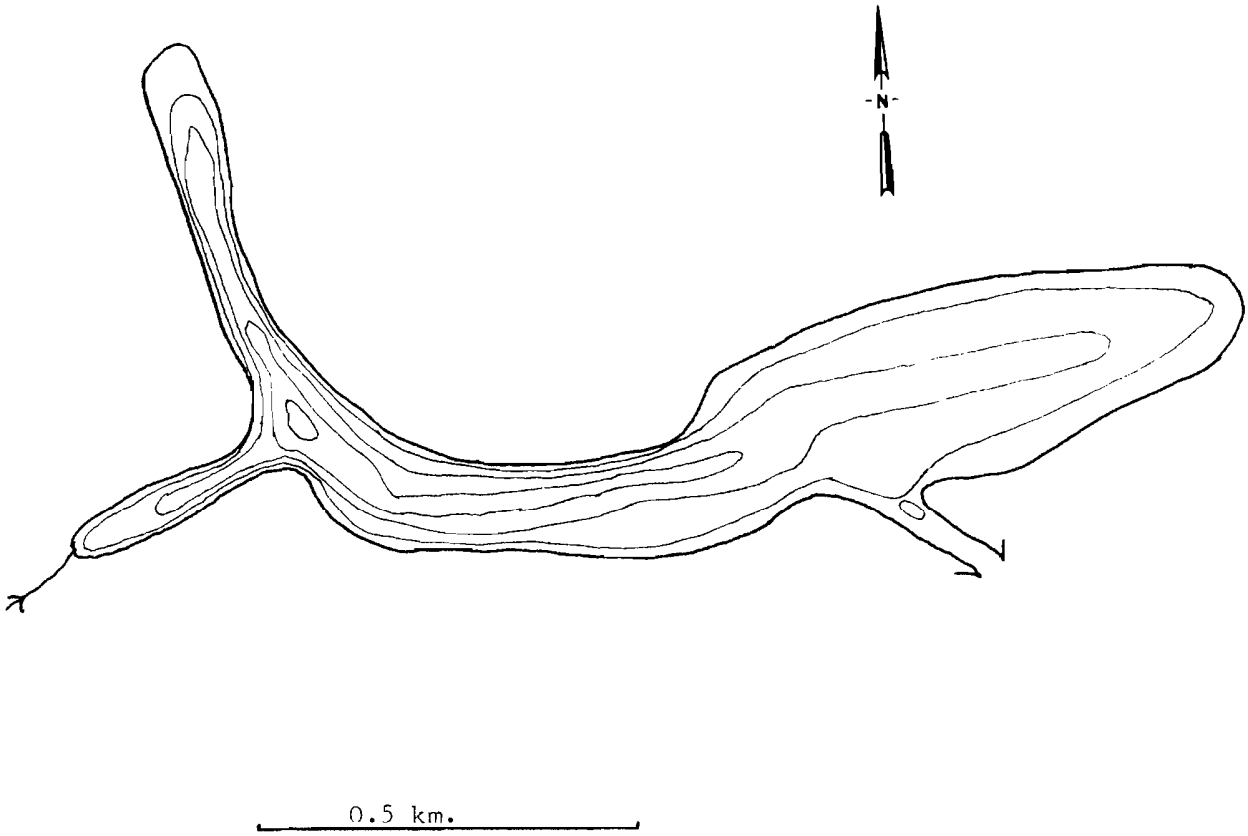
Appendix Figure 40. Bathymetric map of Lake 485-10, Upper Birch Lake, Koyukuk NWR, maximum depth less than 5 ft (65.7931°N, 157.1414°W).



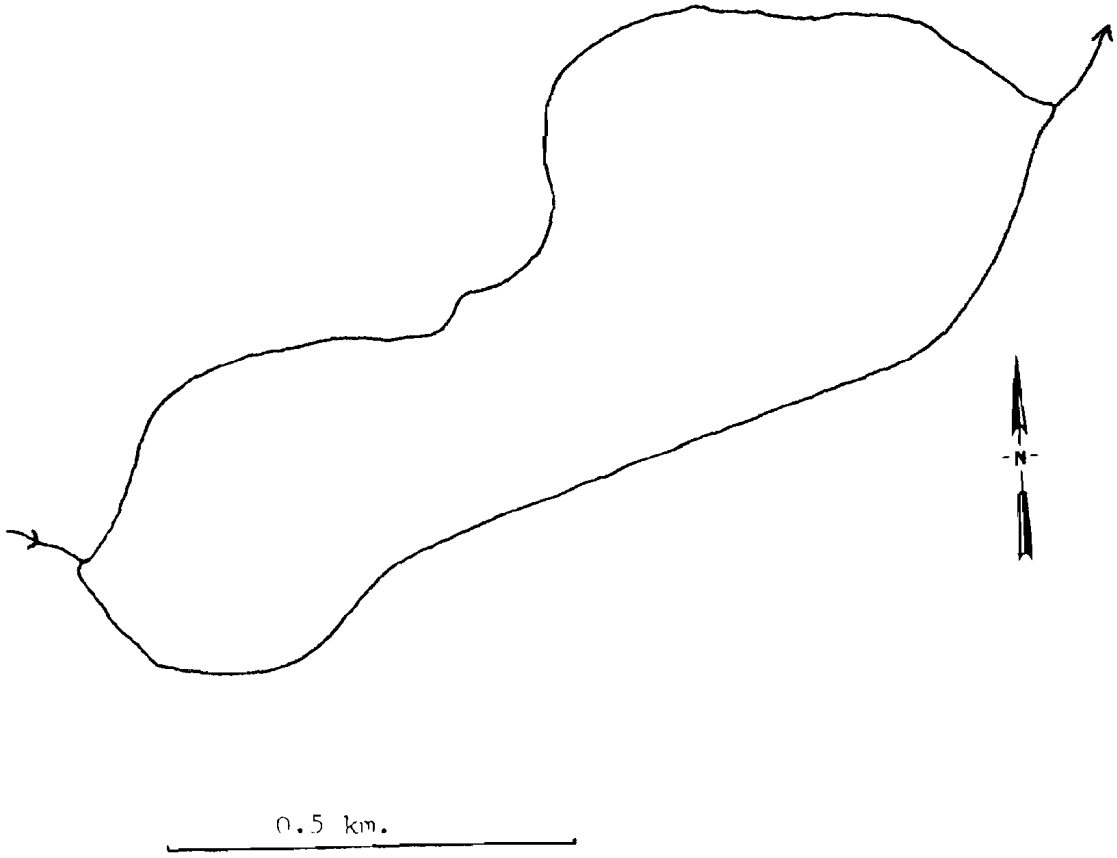
Appendix Figure 41. Bathymetric map of Lake 485-11, unnamed, Koyukuk NWR, with 5-ft contour interval (65.9814°N, 156.8462°W).



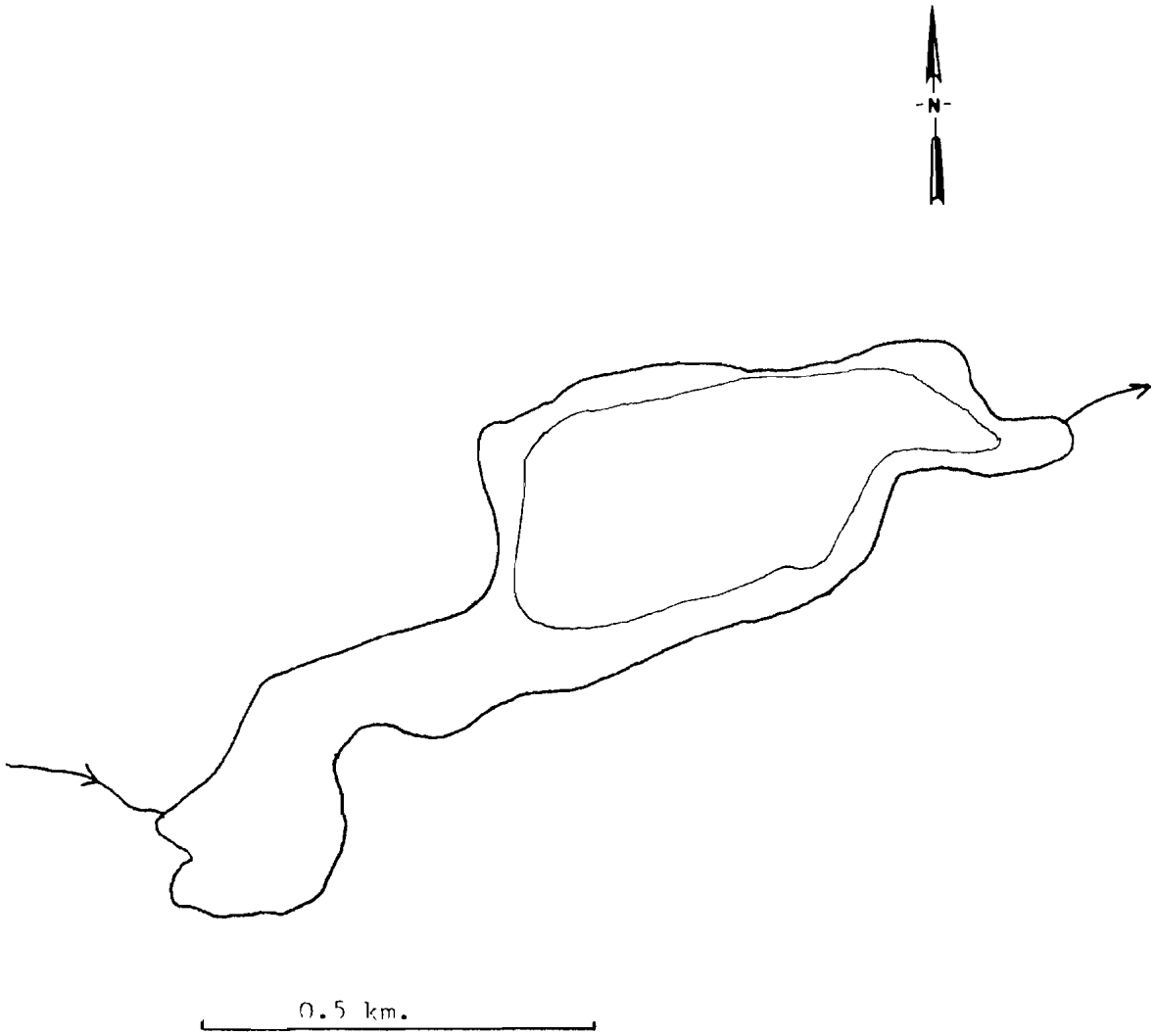
Appendix Figure 42. Bathymetric map of Lake 485-12, Evan Lake, Koyukuk NWR, with 5-ft contour intervals (65.8521°N, 156.6327°W).



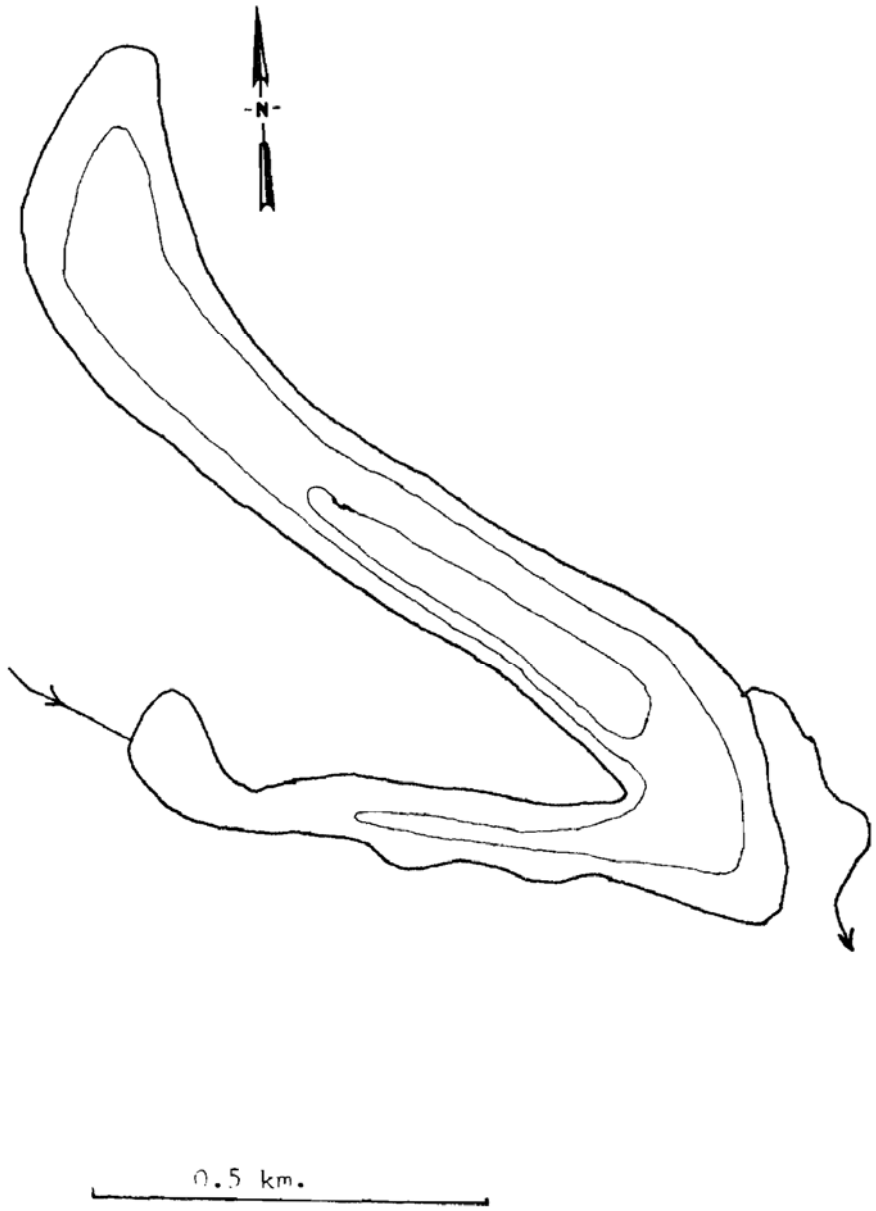
Appendix Figure 43. Bathymetric map of Lake 485-13, Clay Lake, Koyukuk NWR, with 5-ft contour intervals (65.8150°N, 156.5900°W).



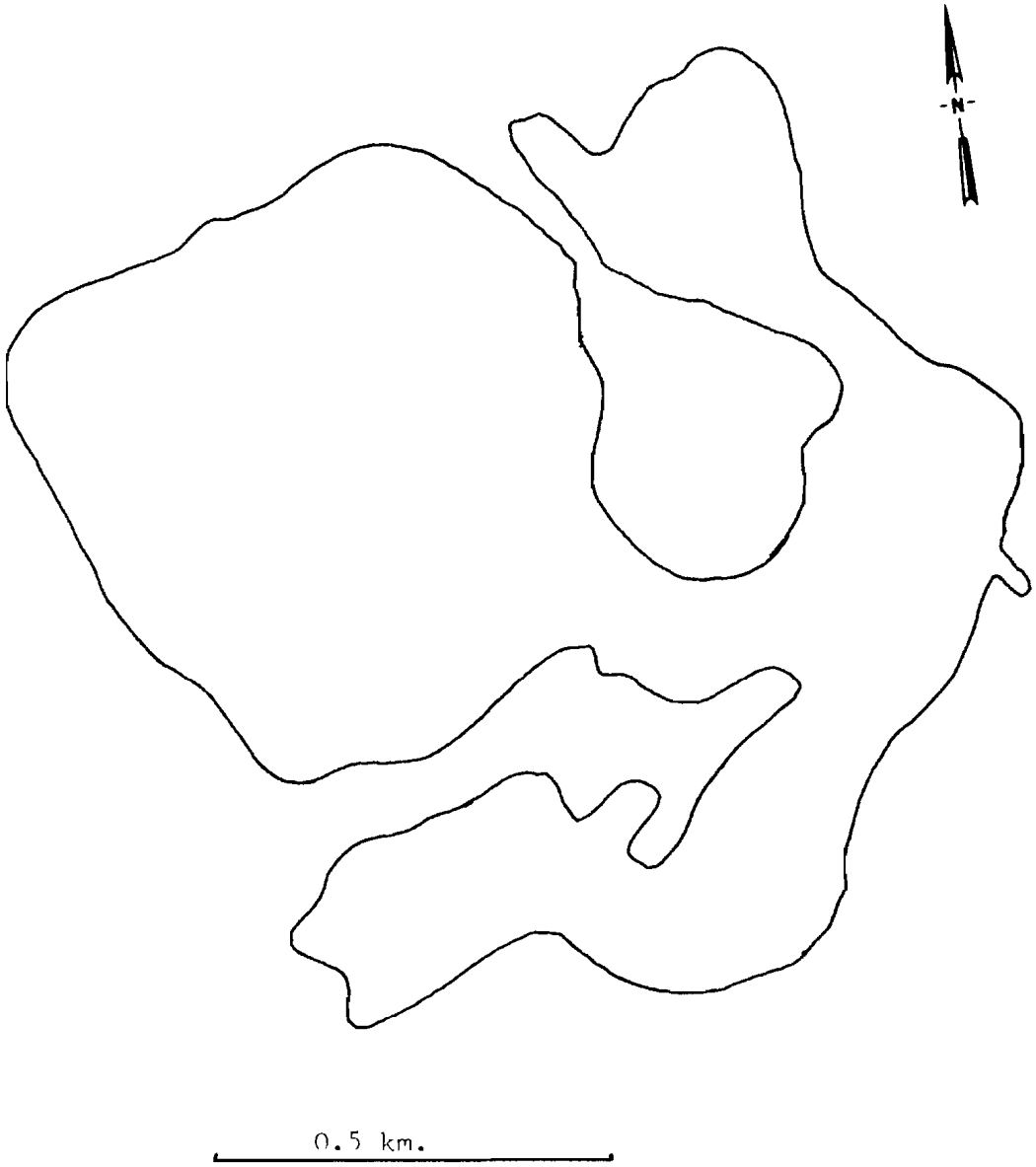
Appendix Figure 44. Bathymetric map of Lake 485-14, Crow Lake, Koyukuk NWR, maximum depth less than 5 ft (65.7655°N, 156.8049°W).



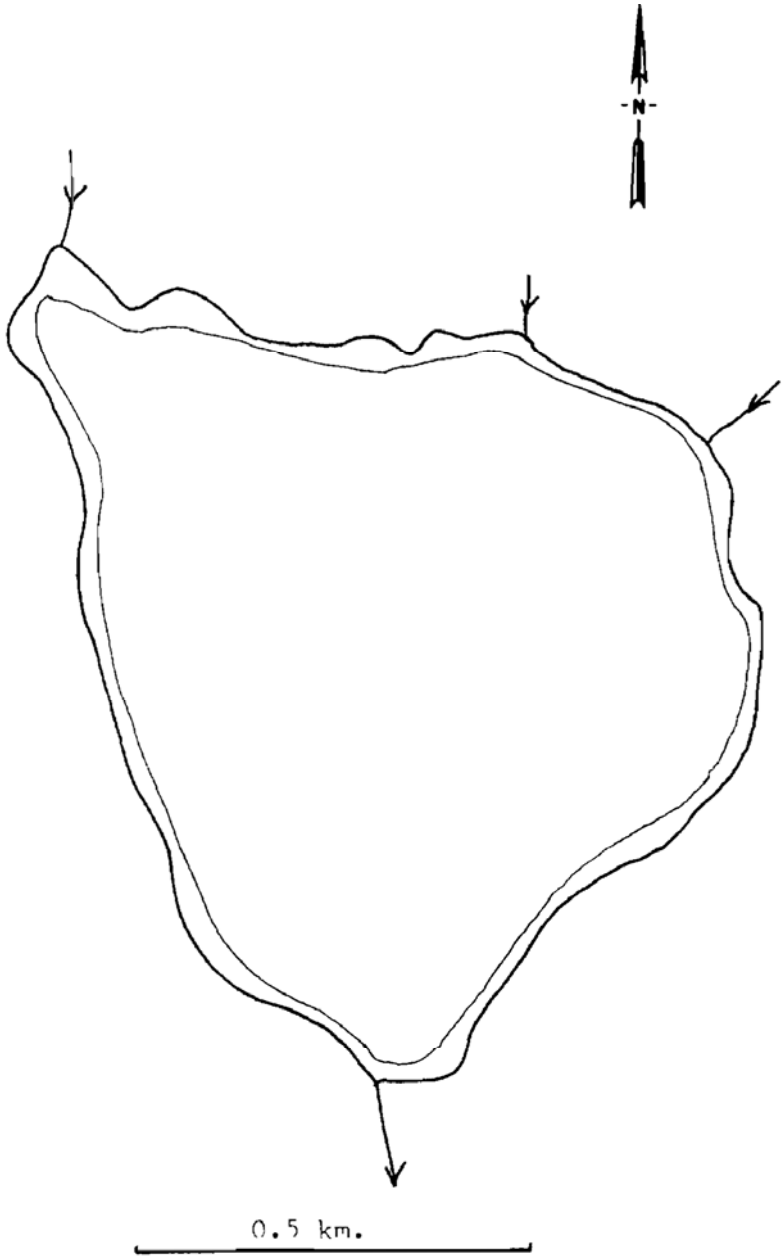
Appendix Figure 45. Bathymetric map of Lake 485-15, unnamed, Koyukuk NWR, with 5-ft contour interval (65.7775°N, 156.8352°W).



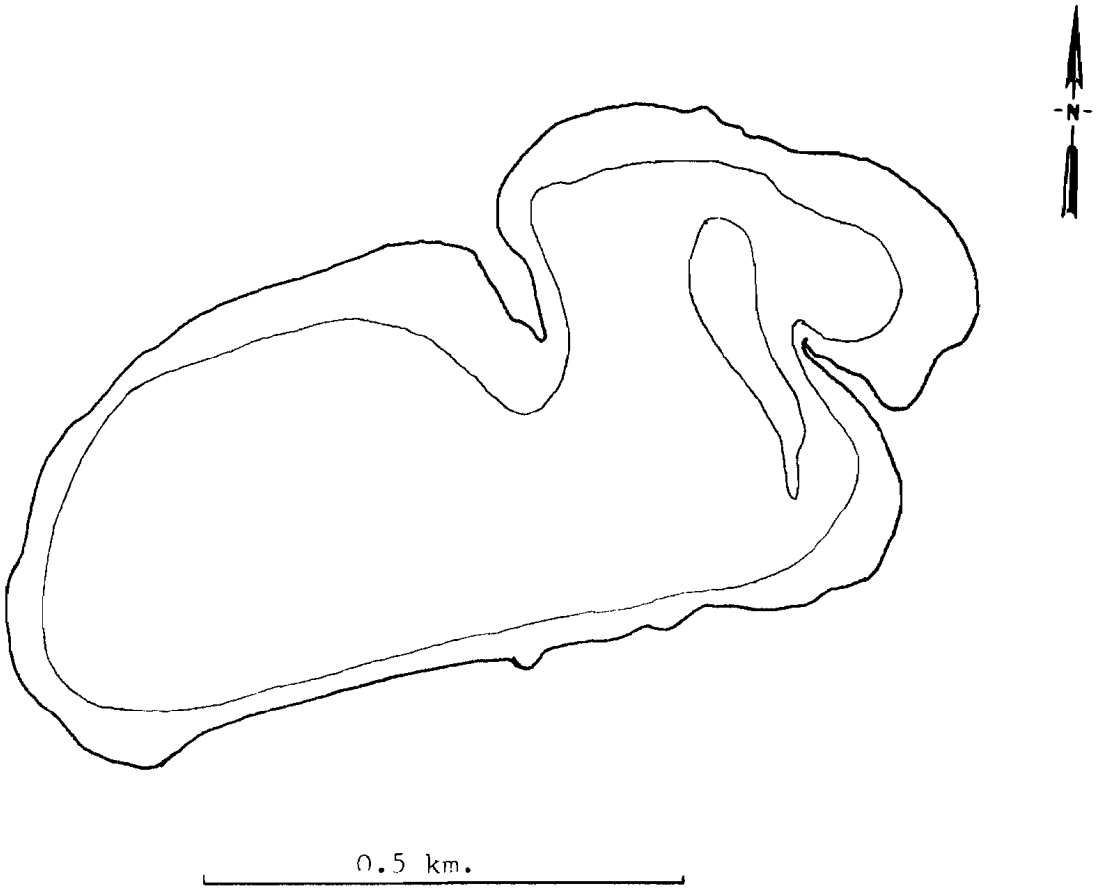
Appendix Figure 46. Bathymetric map of Lake 485-16, Tsedolalindin Lake, Koyukuk NWR, with 5-ft contour intervals (65.6277°N, 156.5666°W).



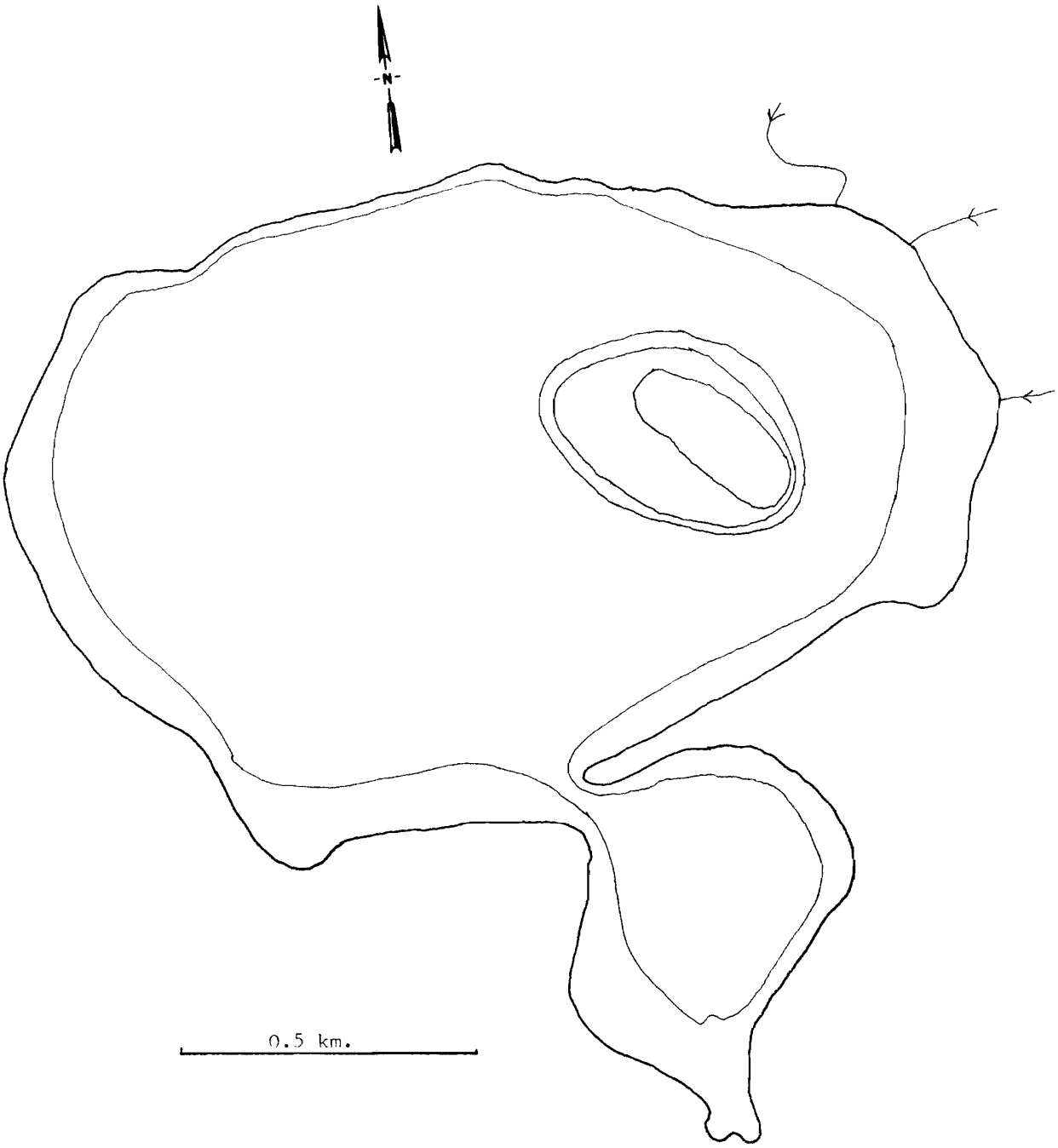
Appendix Figure 47. Bathymetric map of Lake 485-17, unnamed, Koyukuk NWR, maximum depth less than 5 ft (65.8081°N, 156.1155°W).



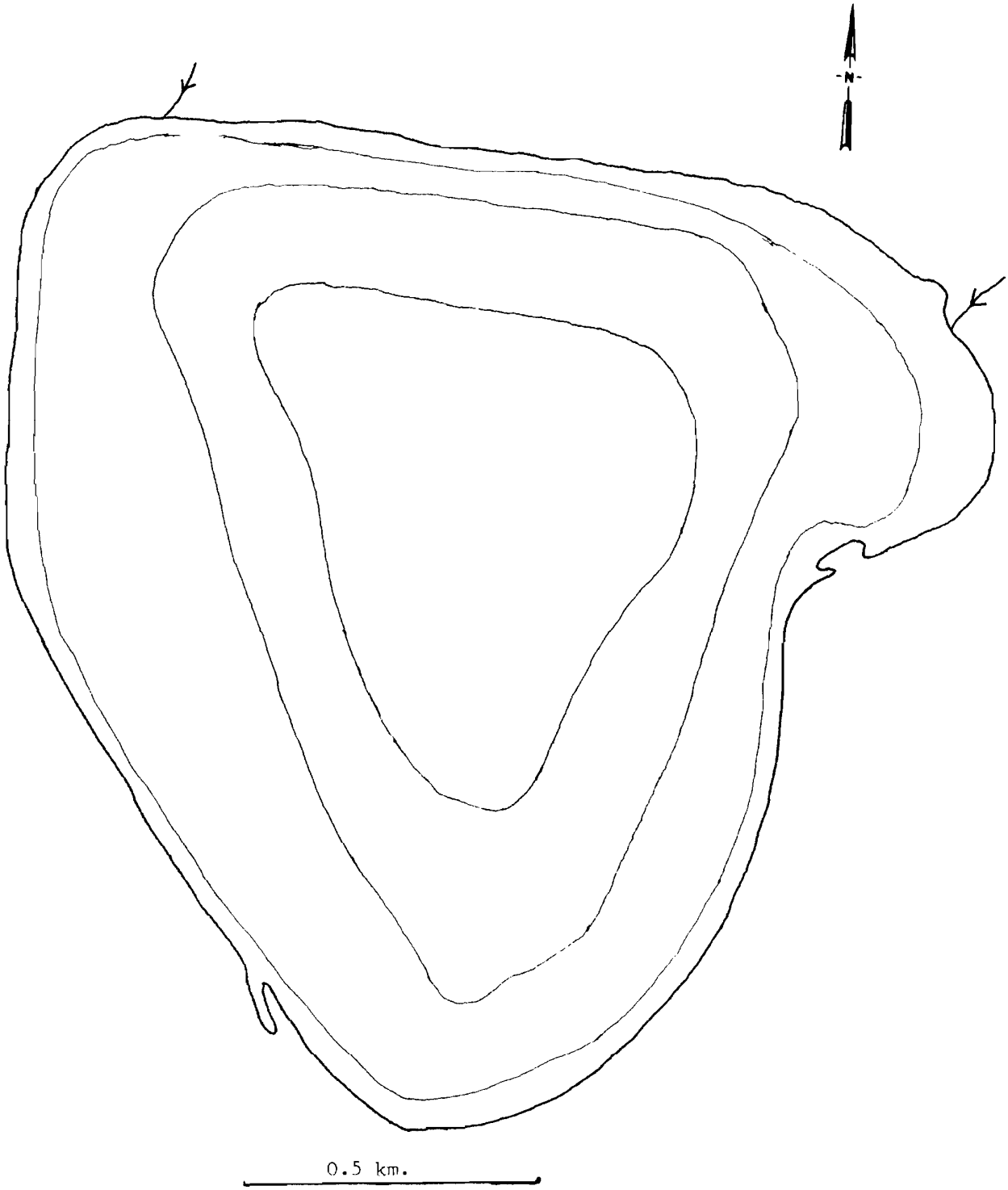
Appendix Figure 48. Bathymetric map of Lake 485-18, unnamed, Koyukuk NWR, with 5-ft contour interval (65.6946°N, 155.8945°W).



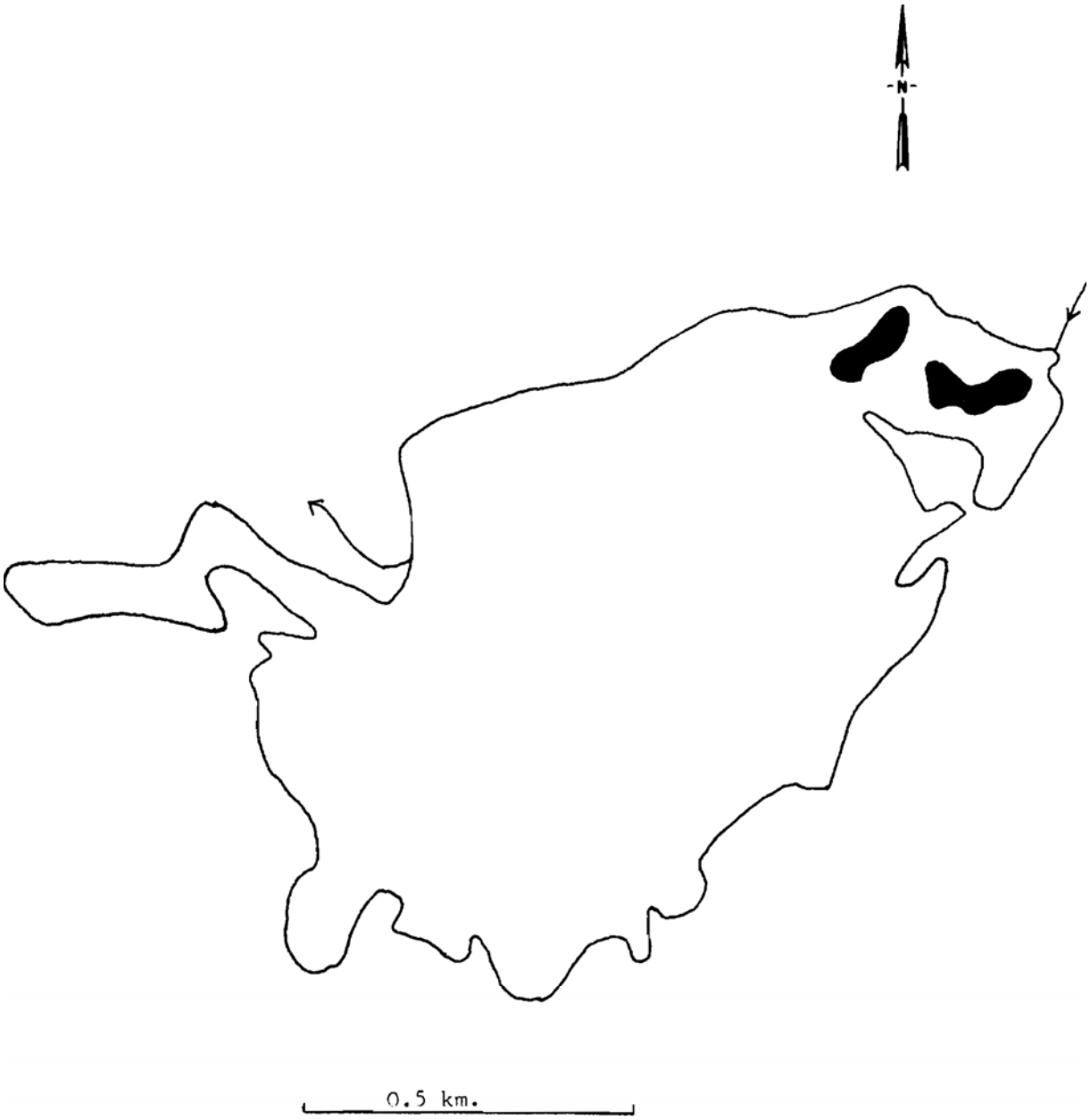
Appendix Figure 49. Bathymetric map of Lake 485-19, unnamed, Koyukuk NWR, with 5-ft contour intervals (65.5895°N, 156.8699°W).



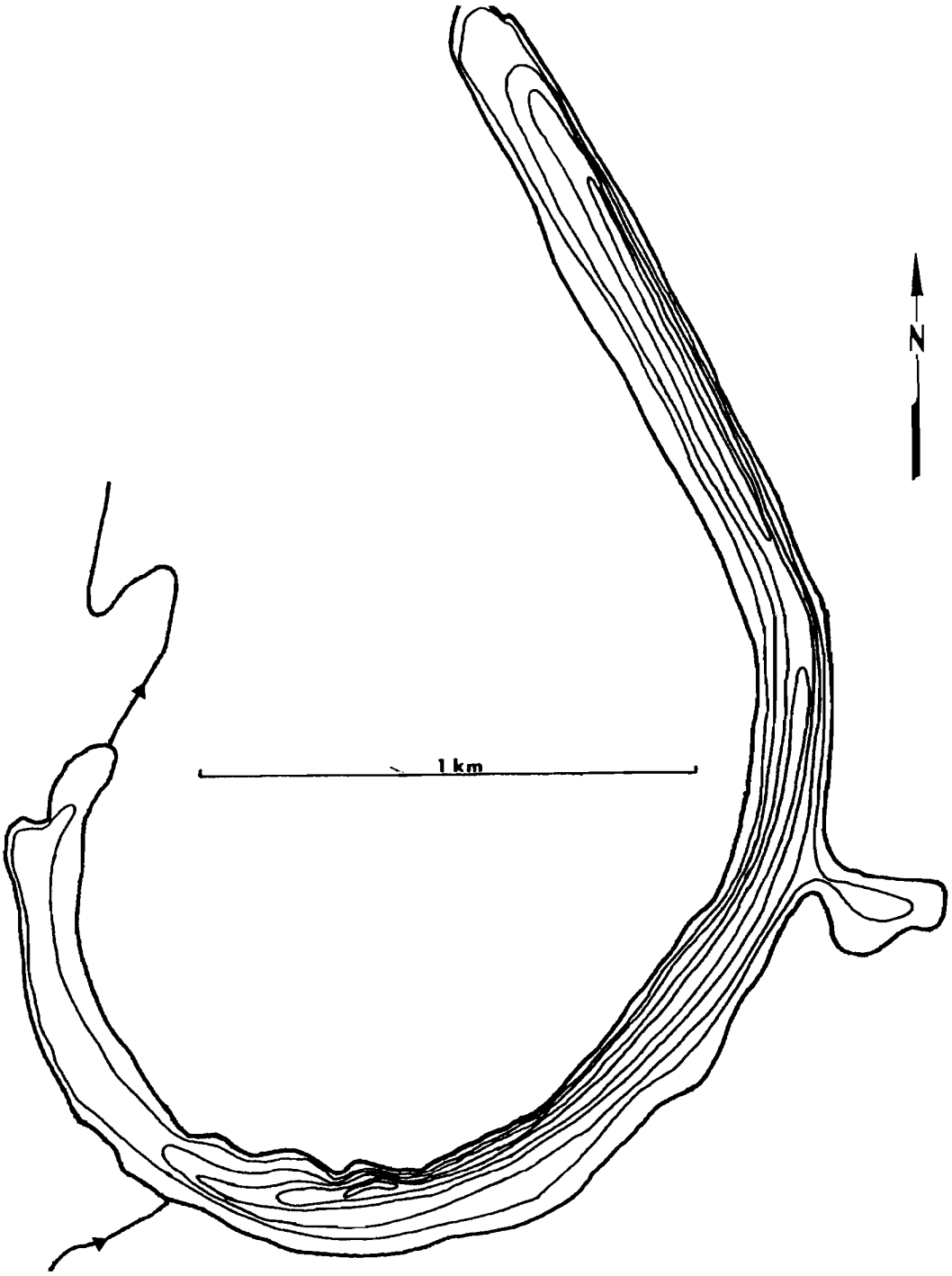
Appendix Figure 50. Bathymetric map of Lake 485-20, Hadokhten Lake, Koyukuk NWR, with 5-ft contour intervals (65.6816°N, 155.6699°W).



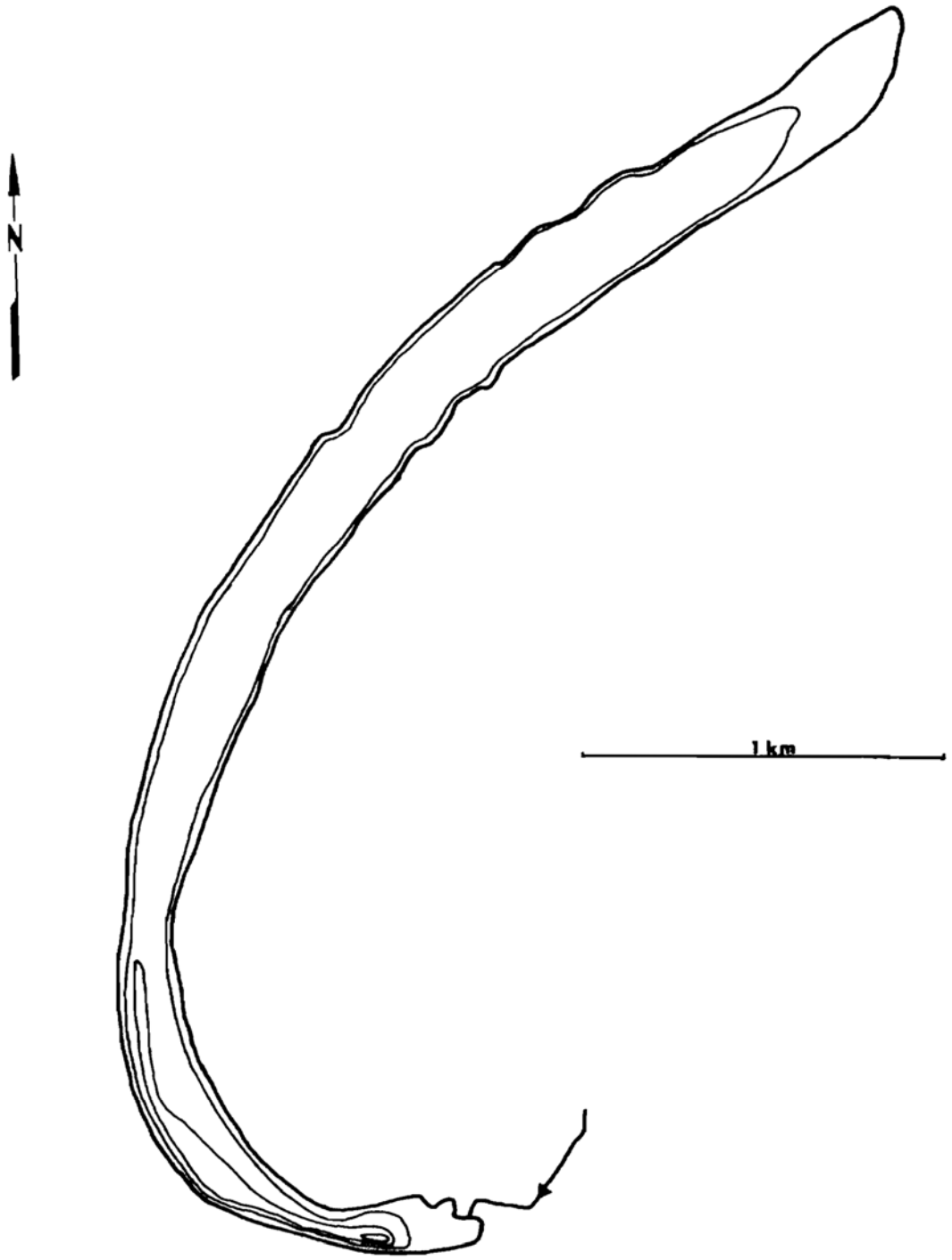
Appendix Figure 51. Bathymetric map of Lake 485-21, Hahanudan Lake, Koyukuk NWR, with 5-ft contour intervals (65.6993°N, 155.5666°W).



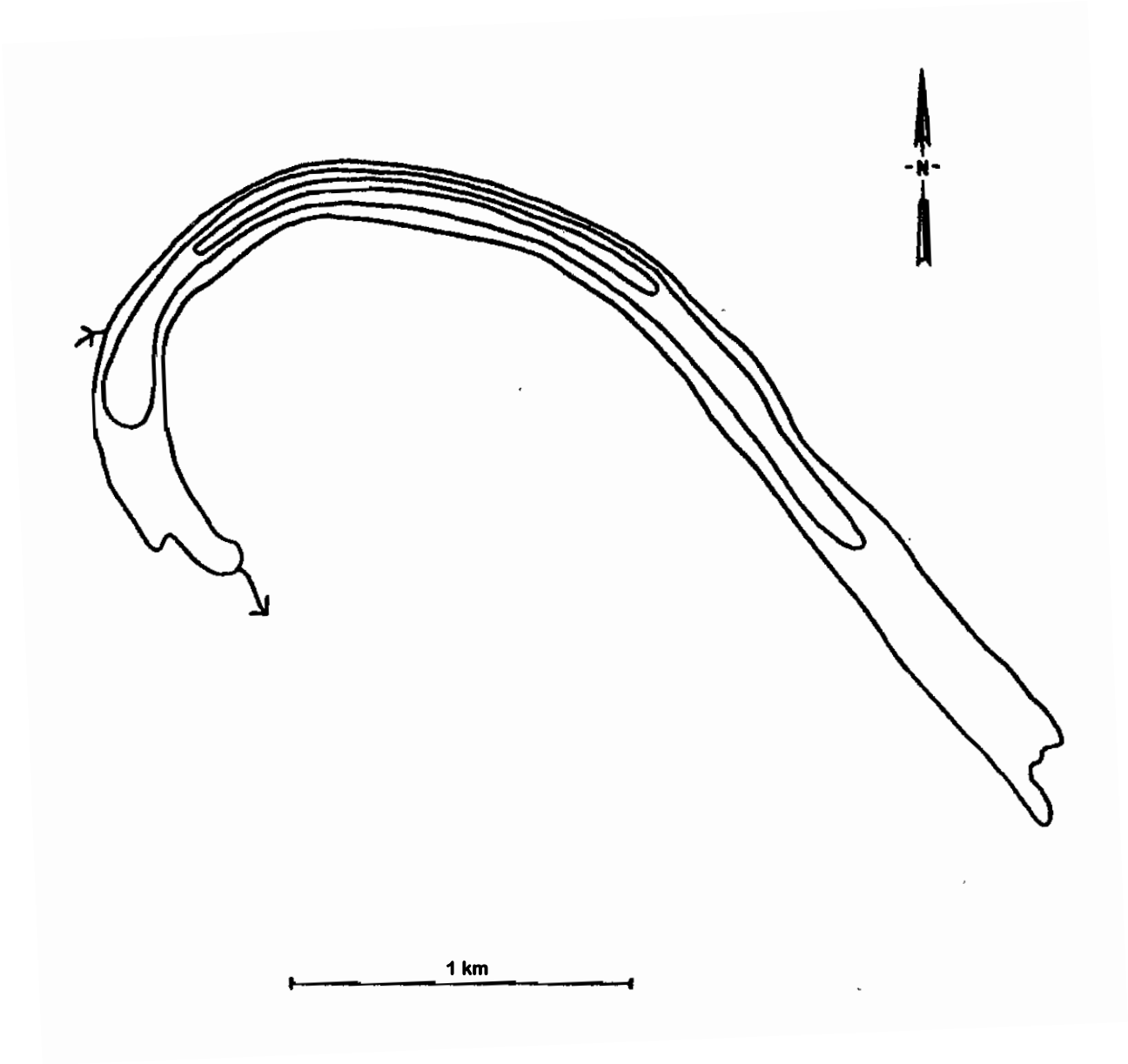
Appendix Figure 52. Bathymetric map of Lake485-22, Klymunget Lake, Koyukuk NWR, maximum depth less than 5 ft (65.6626°N, 155.3791°W).



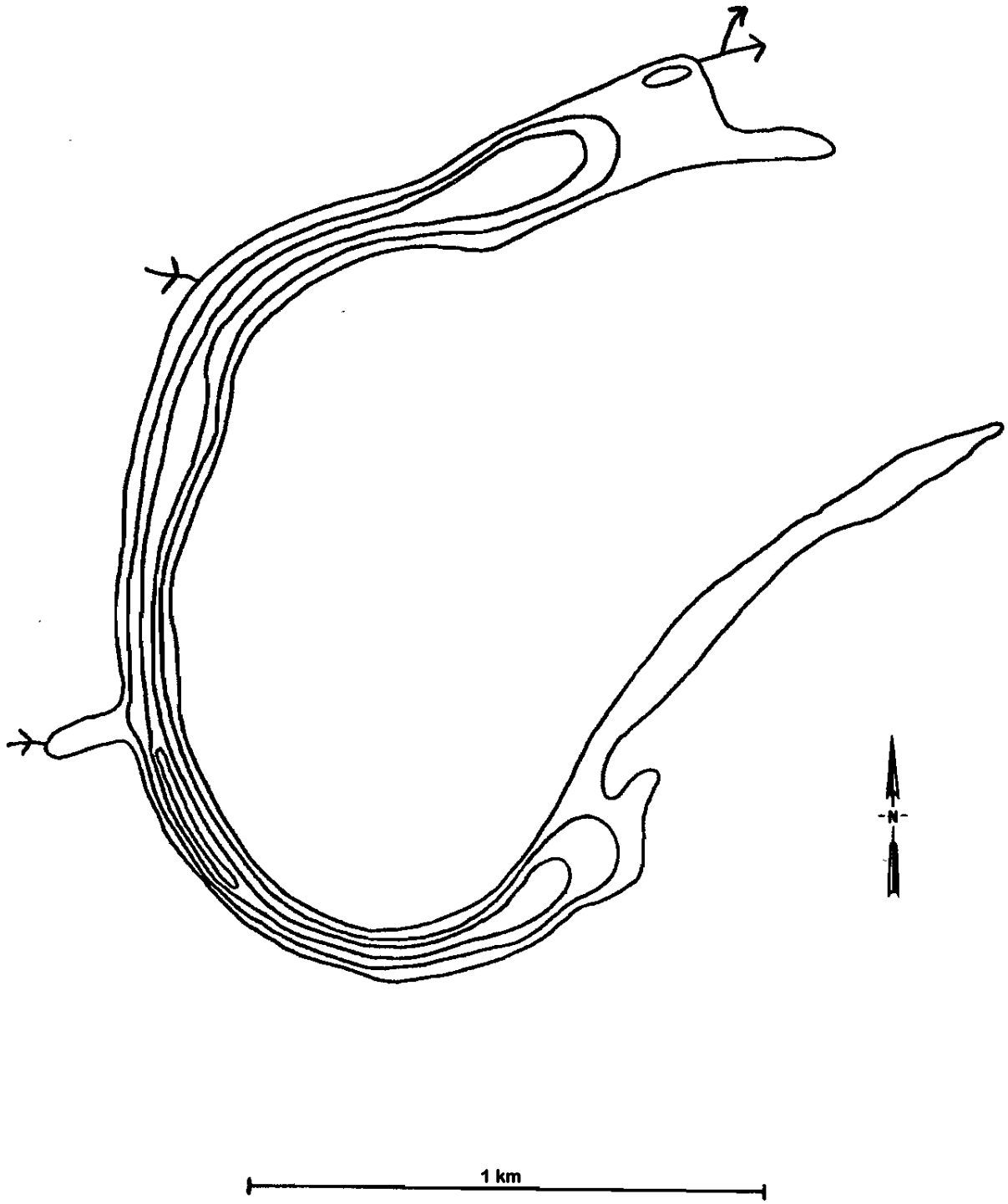
Appendix Figure 53. Bathymetric map of Lake 584-01, unnamed, Nowitna NWR, with 5-ft contour intervals (64.6732°N, 154.4504°W).



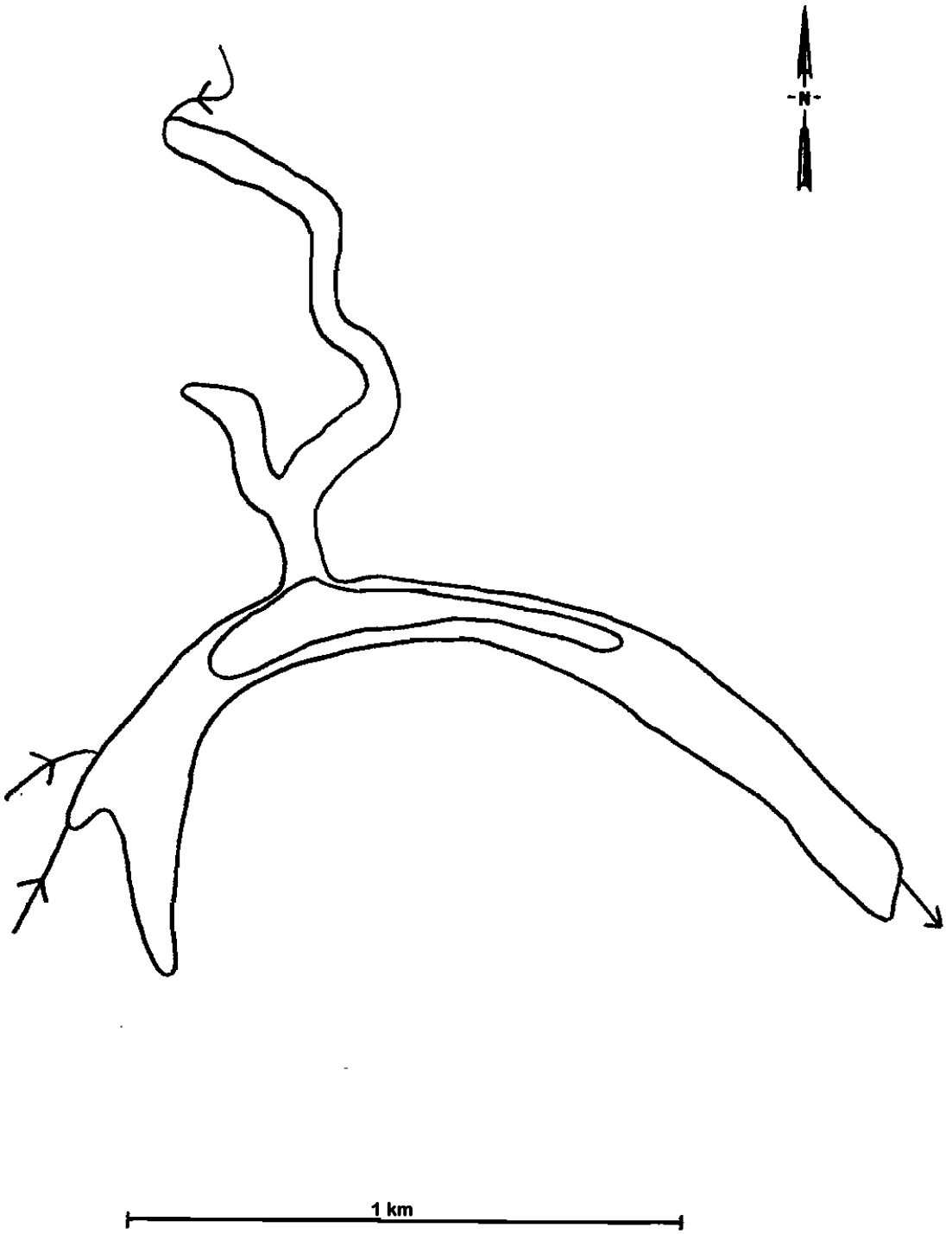
Appendix Figure 54. Bathymetric map of Lake 584-02, unnamed, Nowitna NWR, with 5-ft contour intervals (64.5424°N, 154.4067°W).



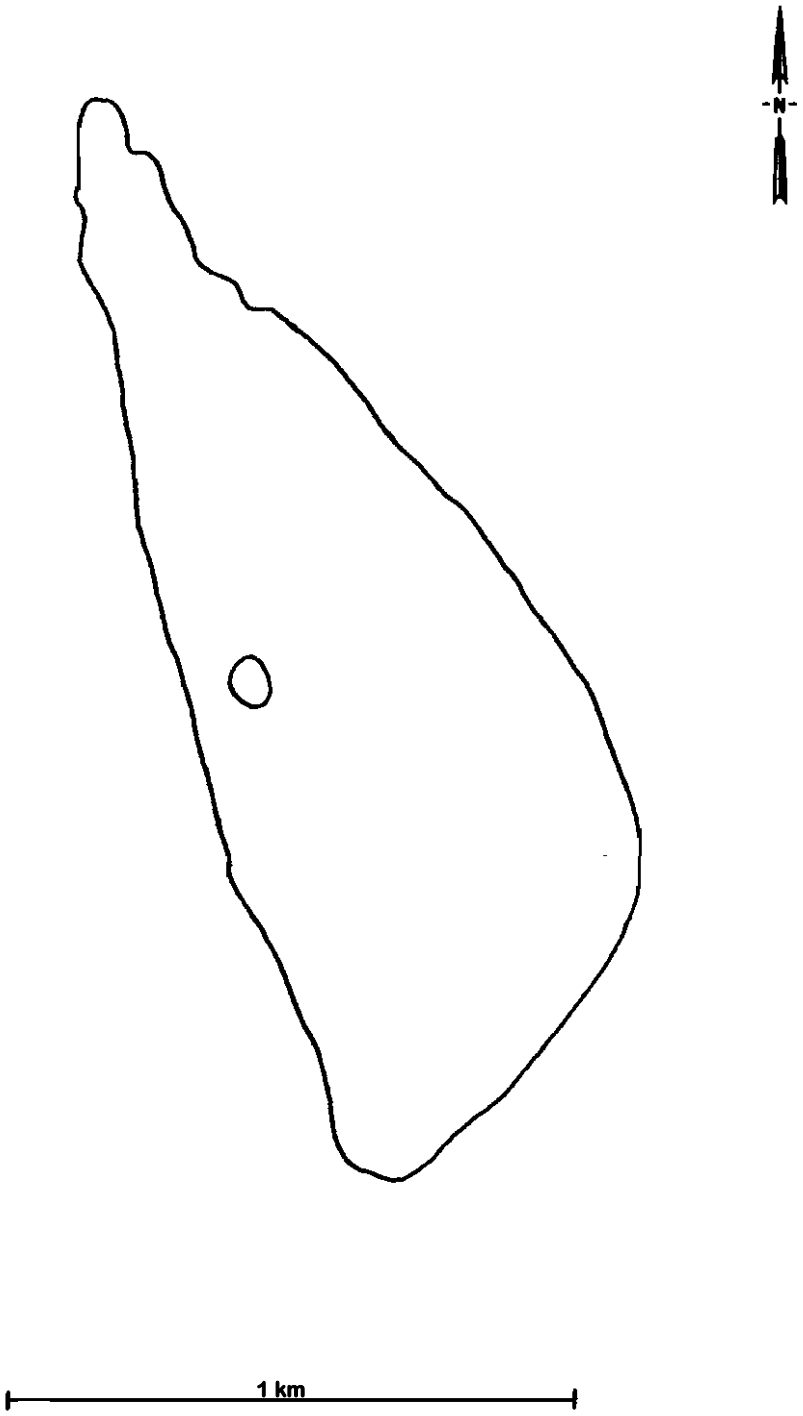
Appendix Figure 55. Bathymetric map of Lake 586-01, unnamed, Nowitna NWR, with 5-ft contour intervals (64.7004°N, 154.5298°W).



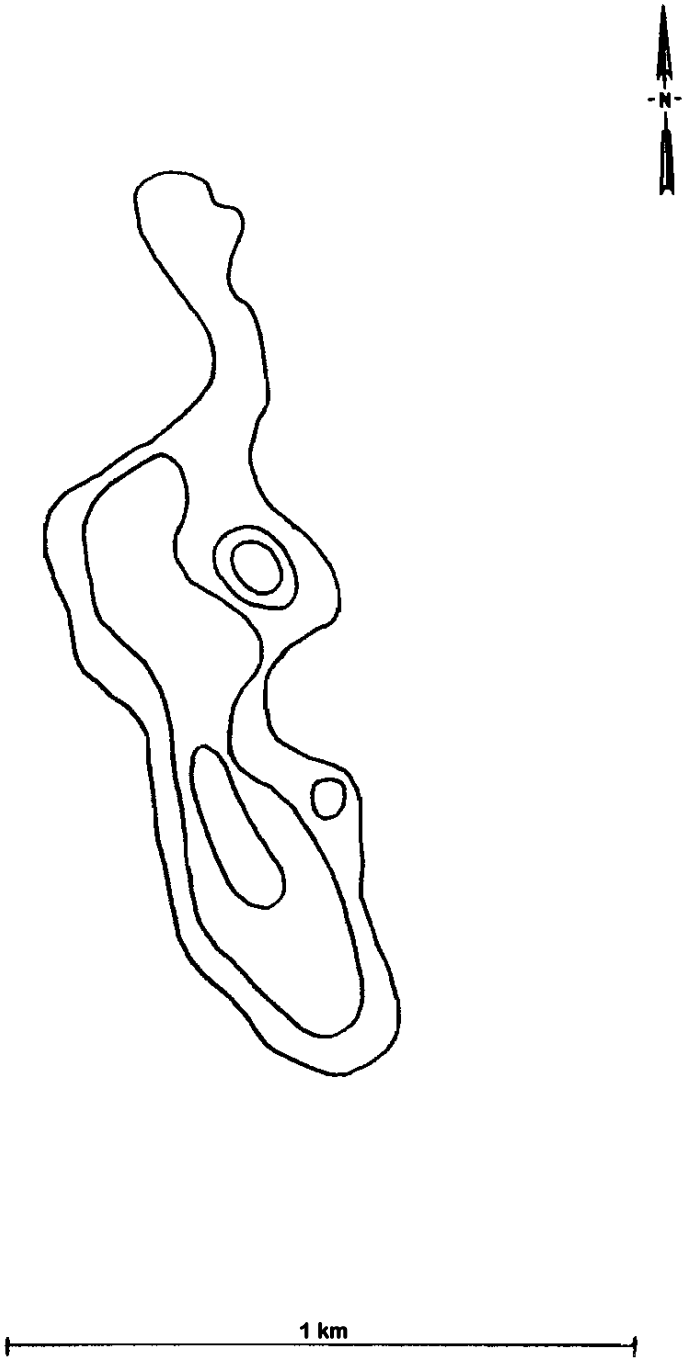
Appendix Figure 56. Bathymetric map of Lake 586-02, unnamed, Nowitna NWR, with 5-ft contour intervals (64.6671°N, 154.6095°W).



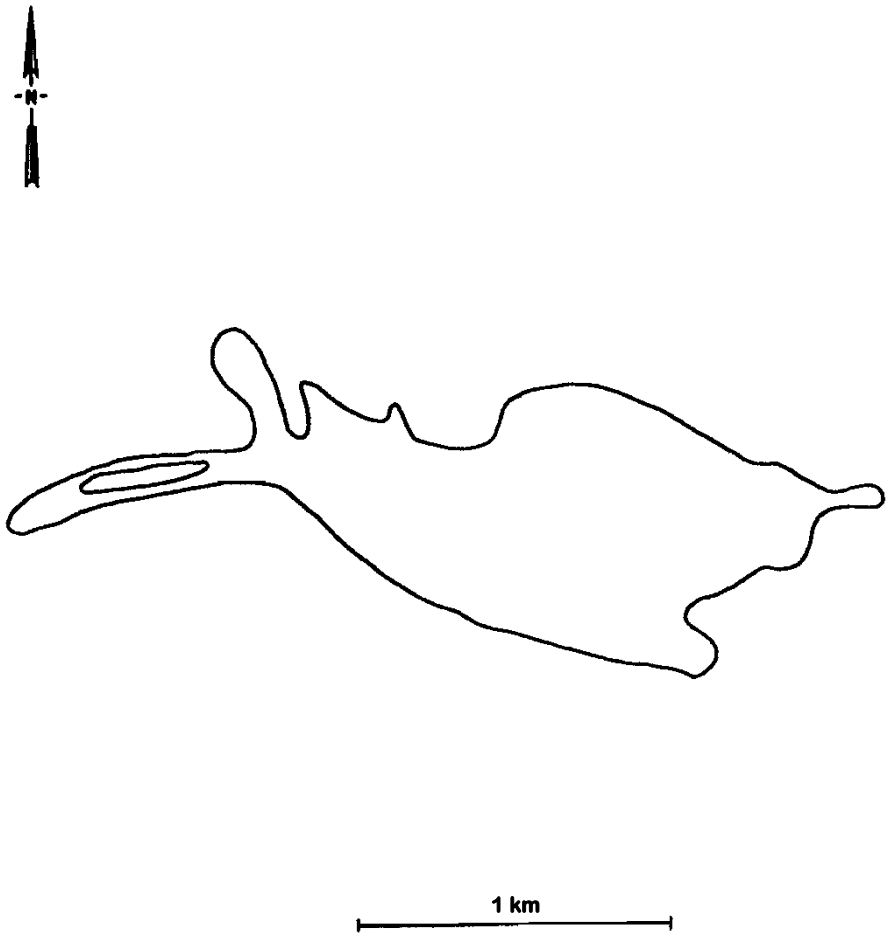
Appendix Figure 57. Bathymetric map of Lake 586-03, unnamed, Nowitna NWR, with 5-ft contour intervals (64.6857°N, 154.5434°W).



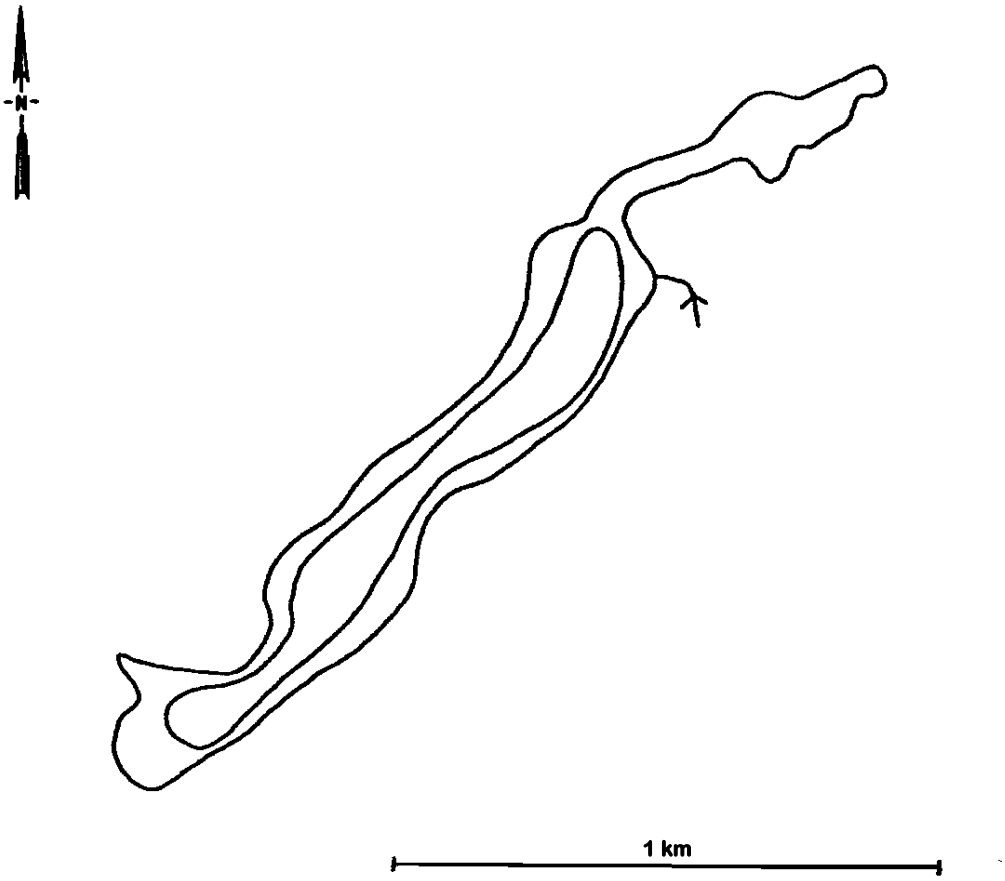
Appendix Figure 58. Bathymetric map of Lake 586-04, unnamed, Nowitna NWR, with 5-ft contour interval (64.7956°N, 154.5508°W).



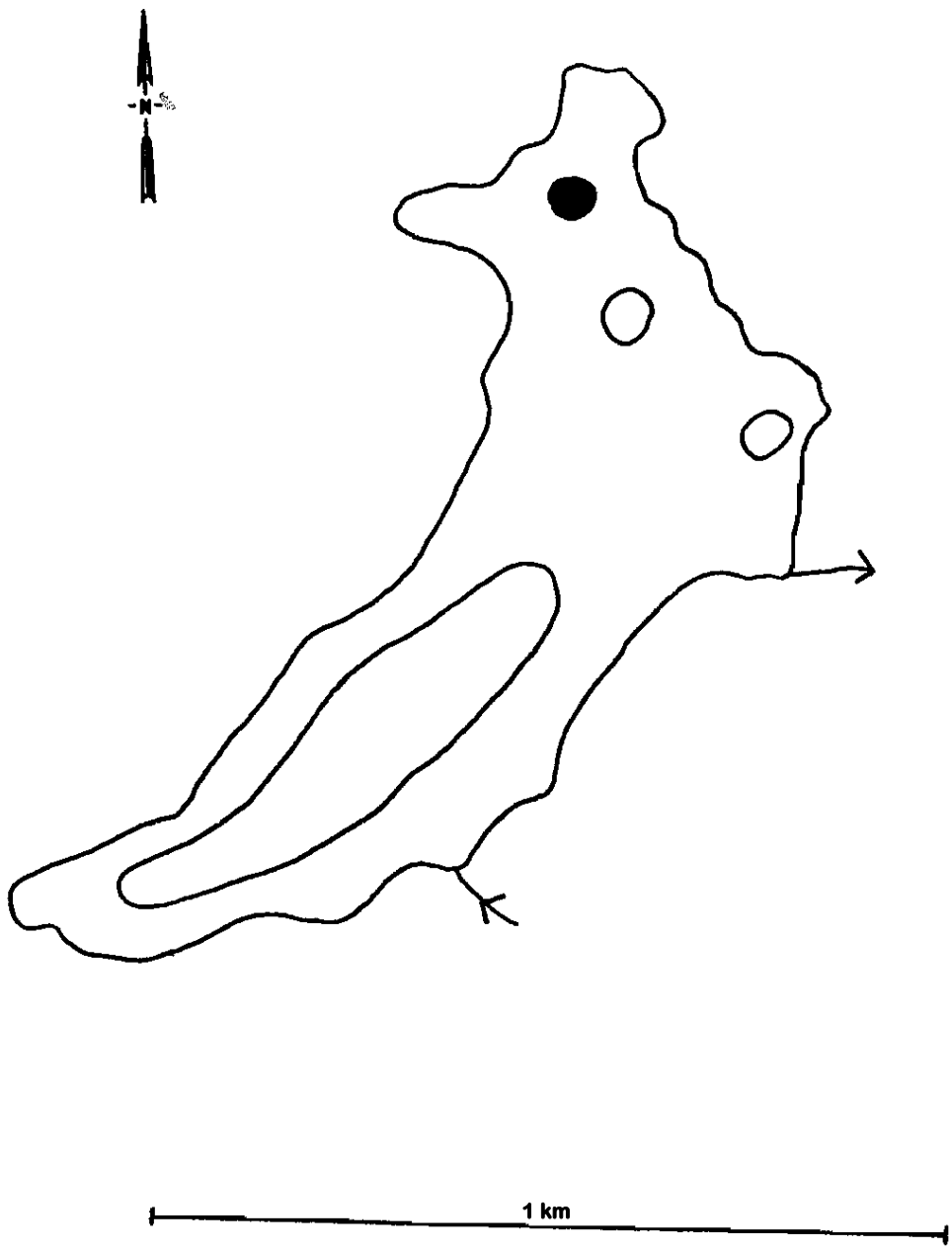
Appendix Figure 59. Bathymetric map of Lake 586-05, unnamed, Nowitna NWR, with 5-ft contour intervals (64.7801°N, 154.6347°W).



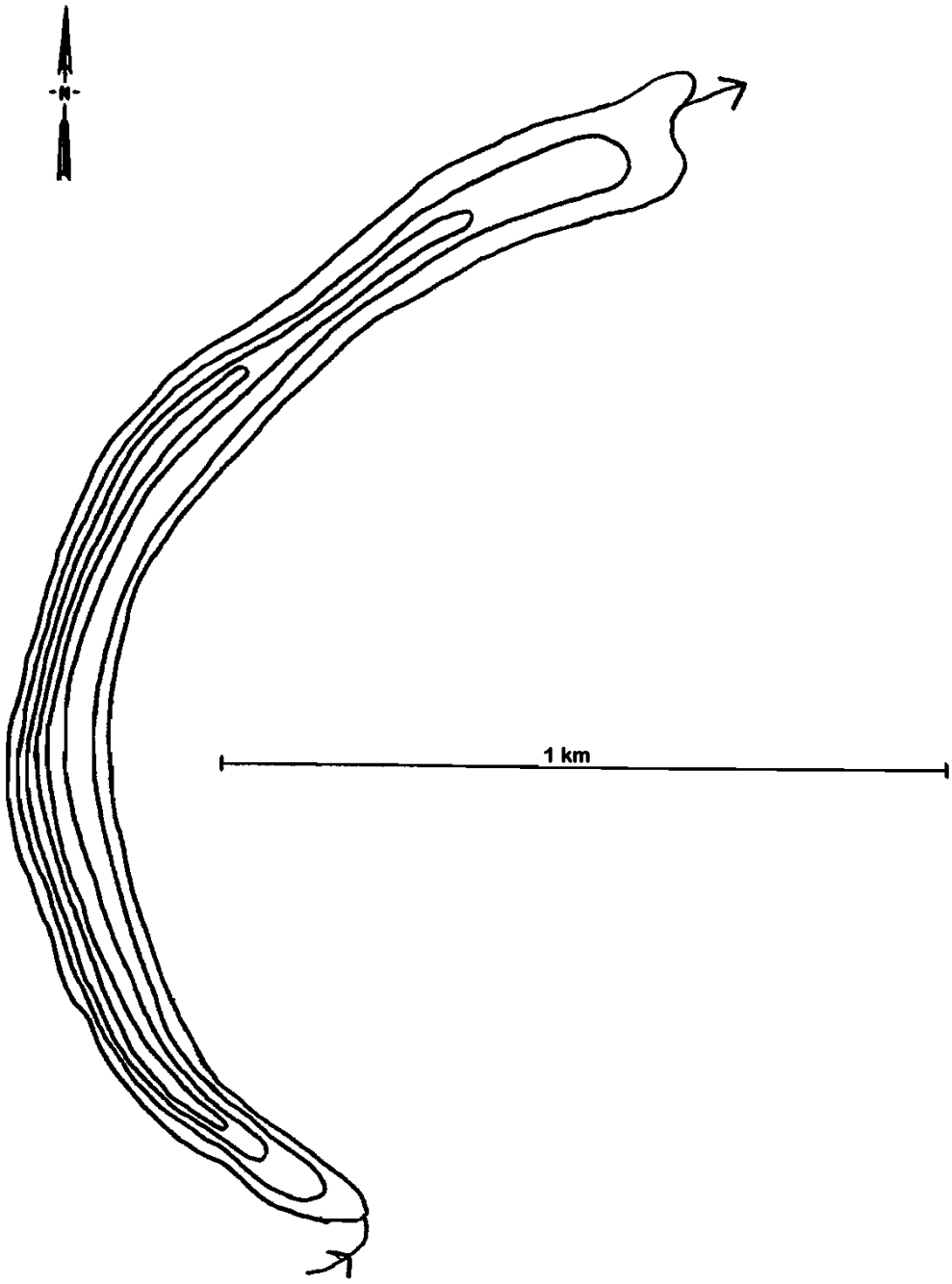
Appendix Figure 60. Bathymetric map of Lake 586-06, unnamed, Nowitna NWR, with 5-ft contour interval (64.8819°N, 154.6338°W).



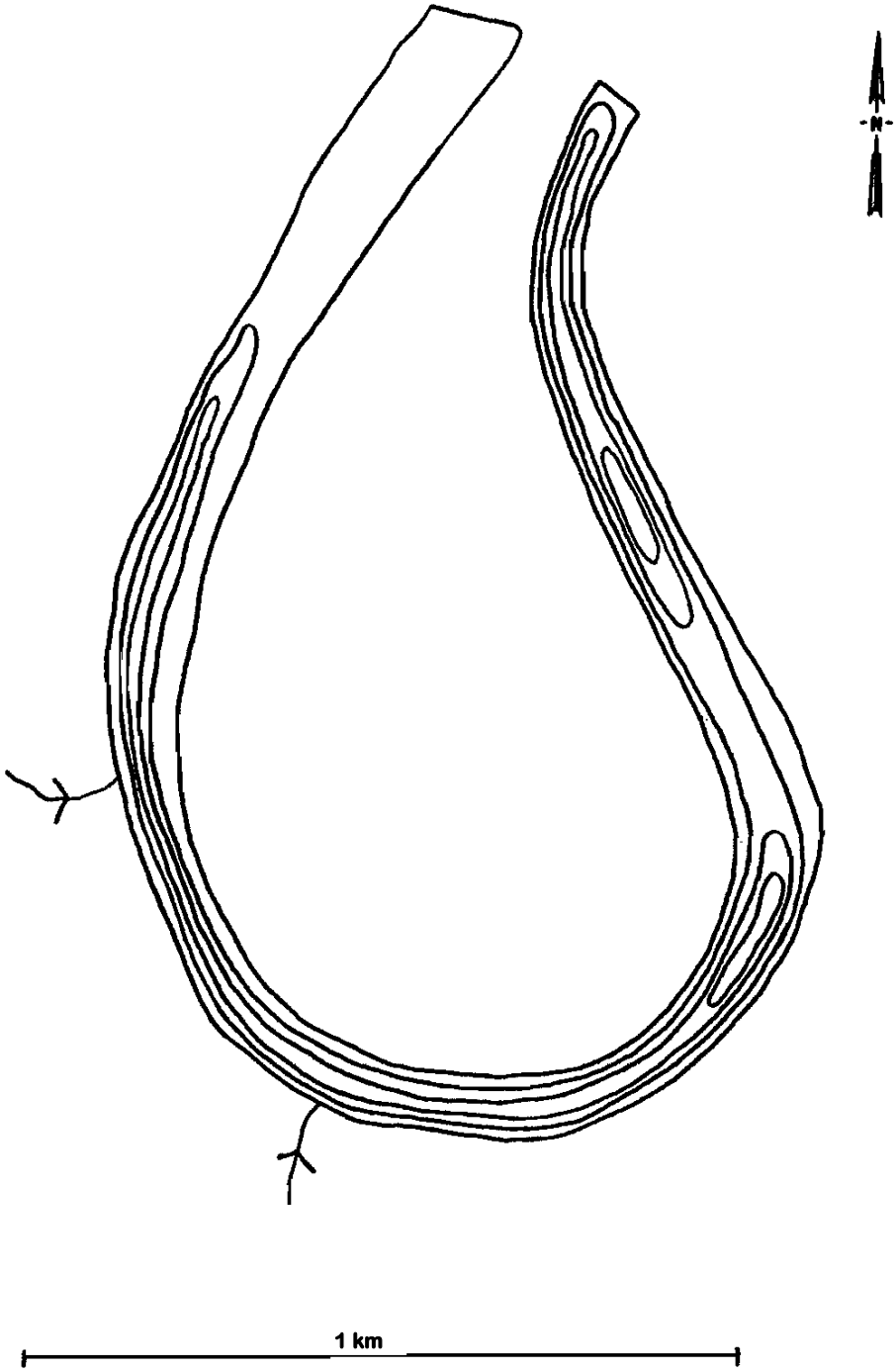
Appendix Figure 61. Bathymetric map of Lake 586-07, unnamed, Nowitna NWR, with 5-ft contour interval (64.8539°N, 154.4413°W).



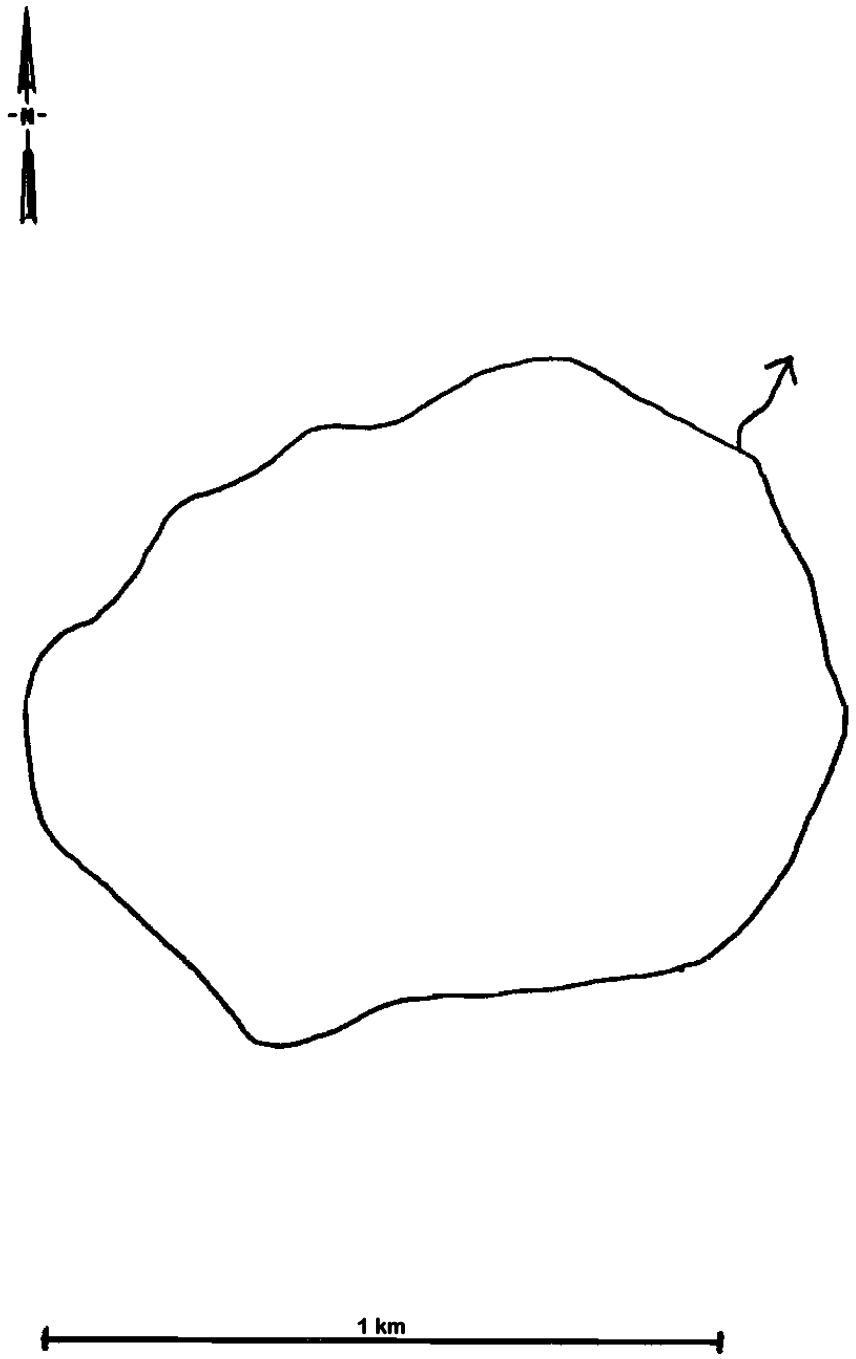
Appendix Figure 62. Bathymetric map of Lake 586-08, unnamed, Nowitna NWR, with 5-ft contour interval (64.9077°N, 154.0242°W).



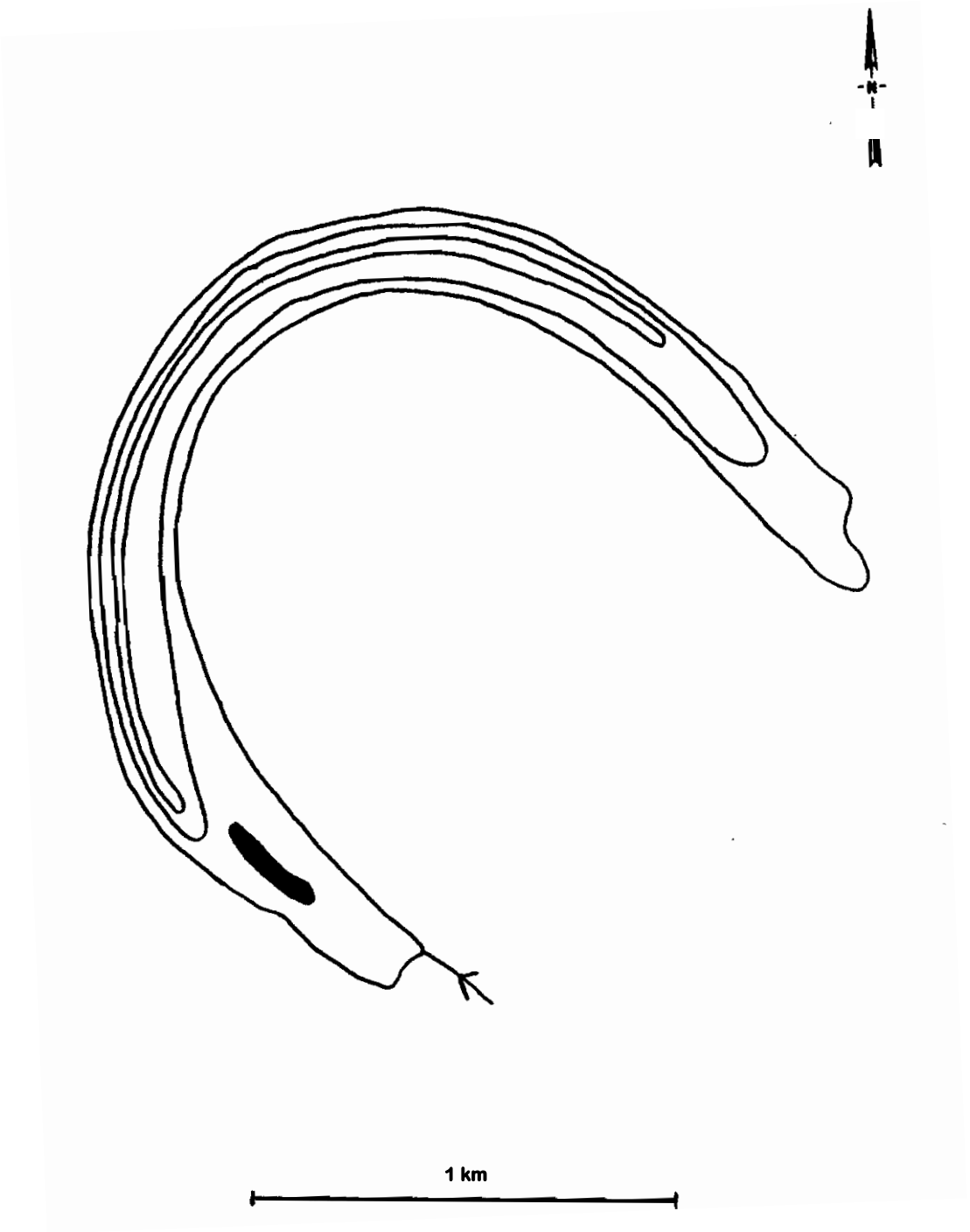
Appendix Figure 63. Bathymetric map of Lake 586-09, unnamed, Nowitna NWR, with 5-ft contour intervals (64.8012°N, 154.2949°W).



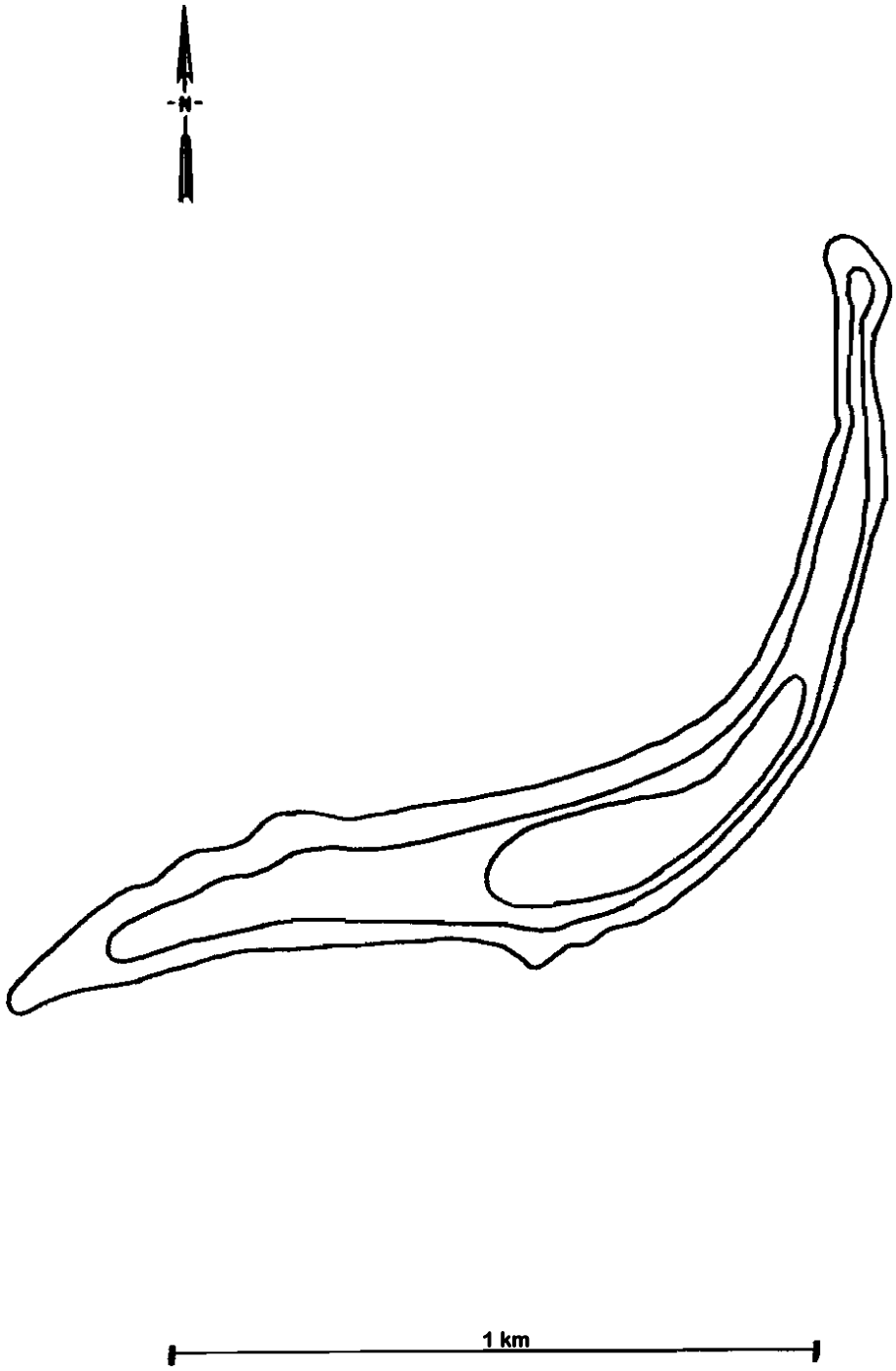
Appendix Figure 64. Bathymetric map of Lake 586-10, unnamed, Nowitna NWR, with 5-ft contour intervals (64.6367°N, 154.5837°W).



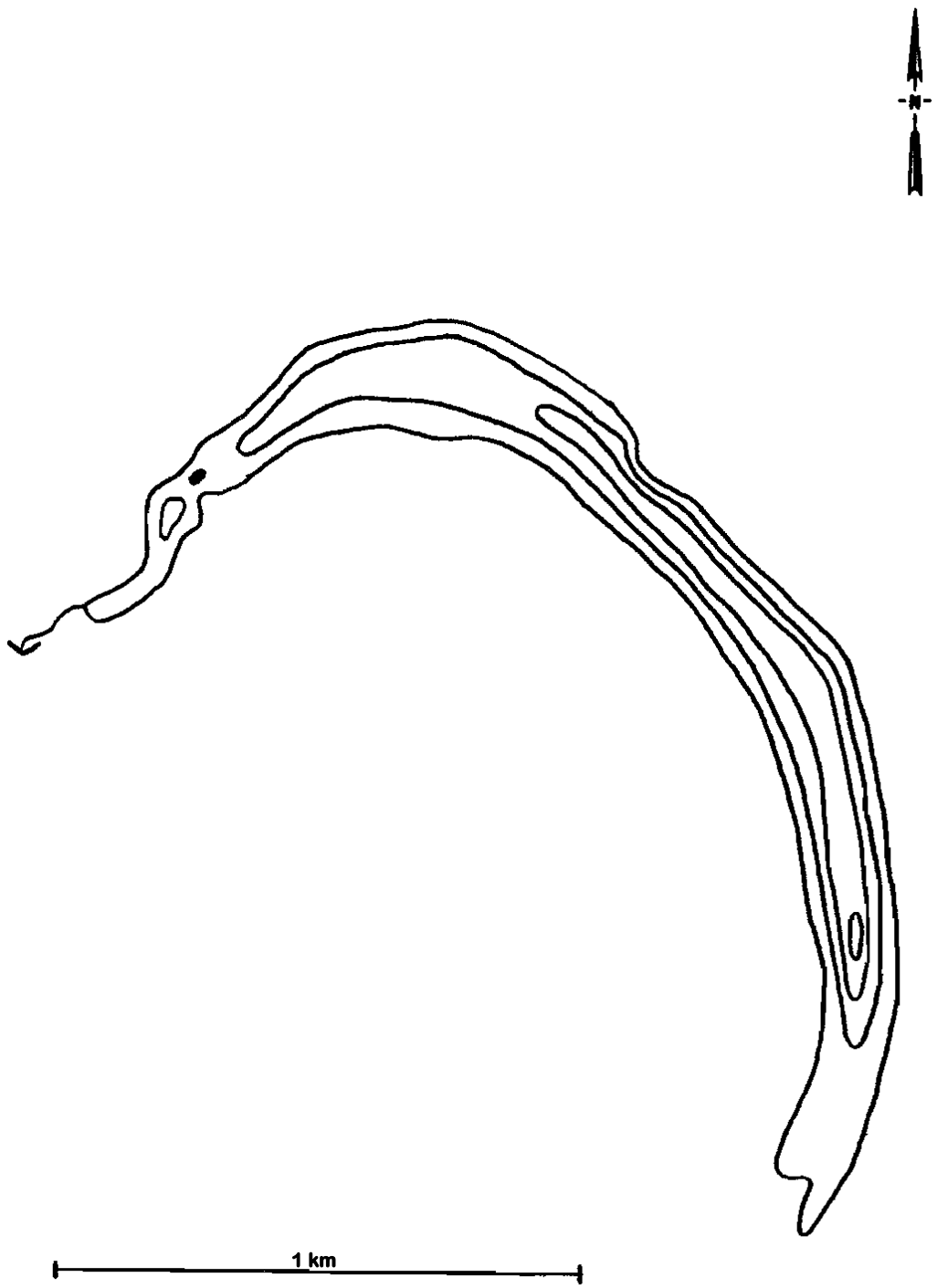
Appendix Figure 65. Bathymetric map of Lake 586-11, unnamed, Nowitna NWR, maximum depth less than 5 ft (64.6889°N, 153.9349°W).



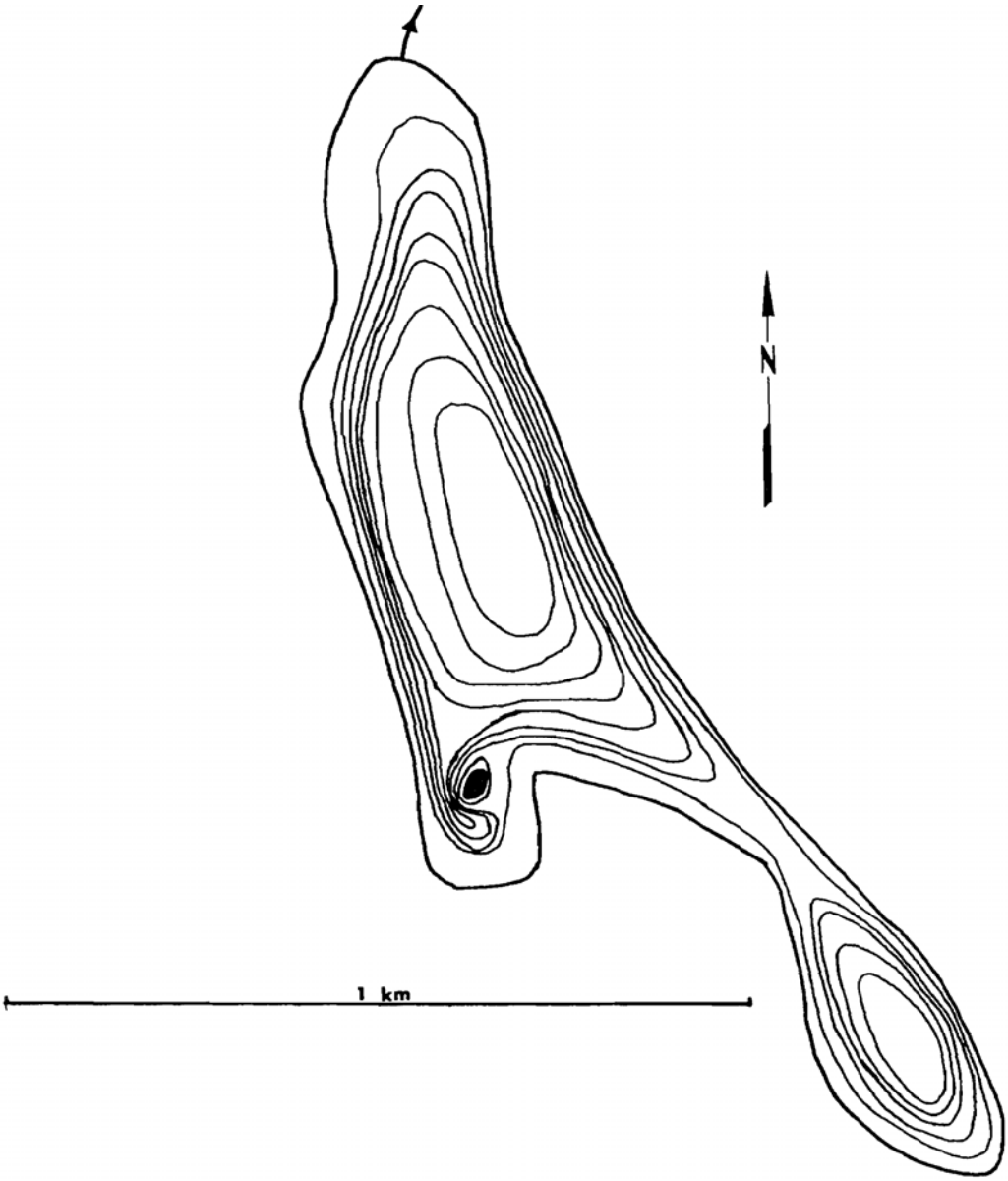
Appendix Figure 66. Bathymetric map of Lake 586-12, unnamed, Nowitna NWR, with 5-ft contour intervals (64.4241°N, 154.0853°W).



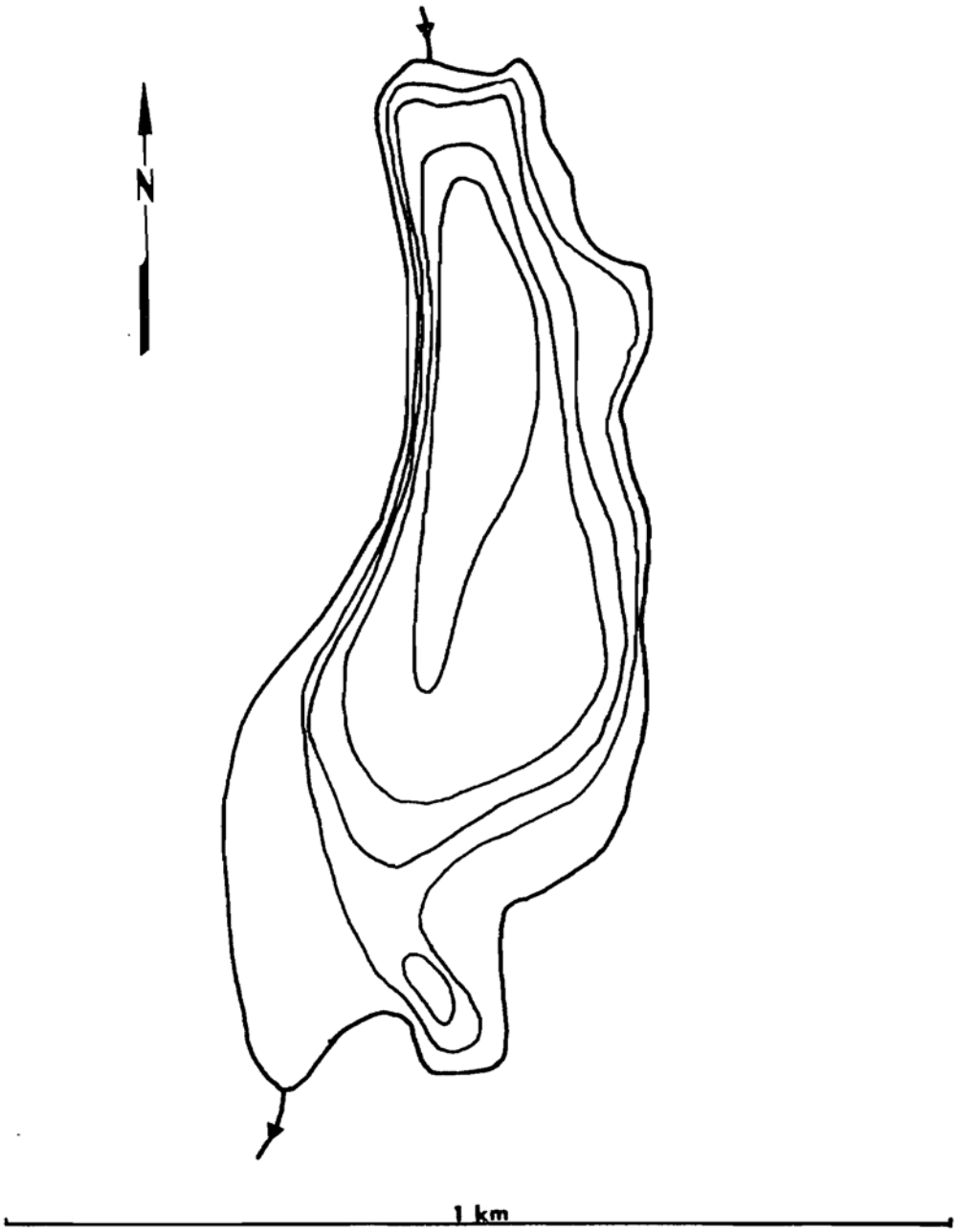
Appendix Figure 67. Bathymetric map of Lake 586-13, unnamed, Nowitna NWR, with 5-ft contour intervals (64.6128°N, 154.3494°W).



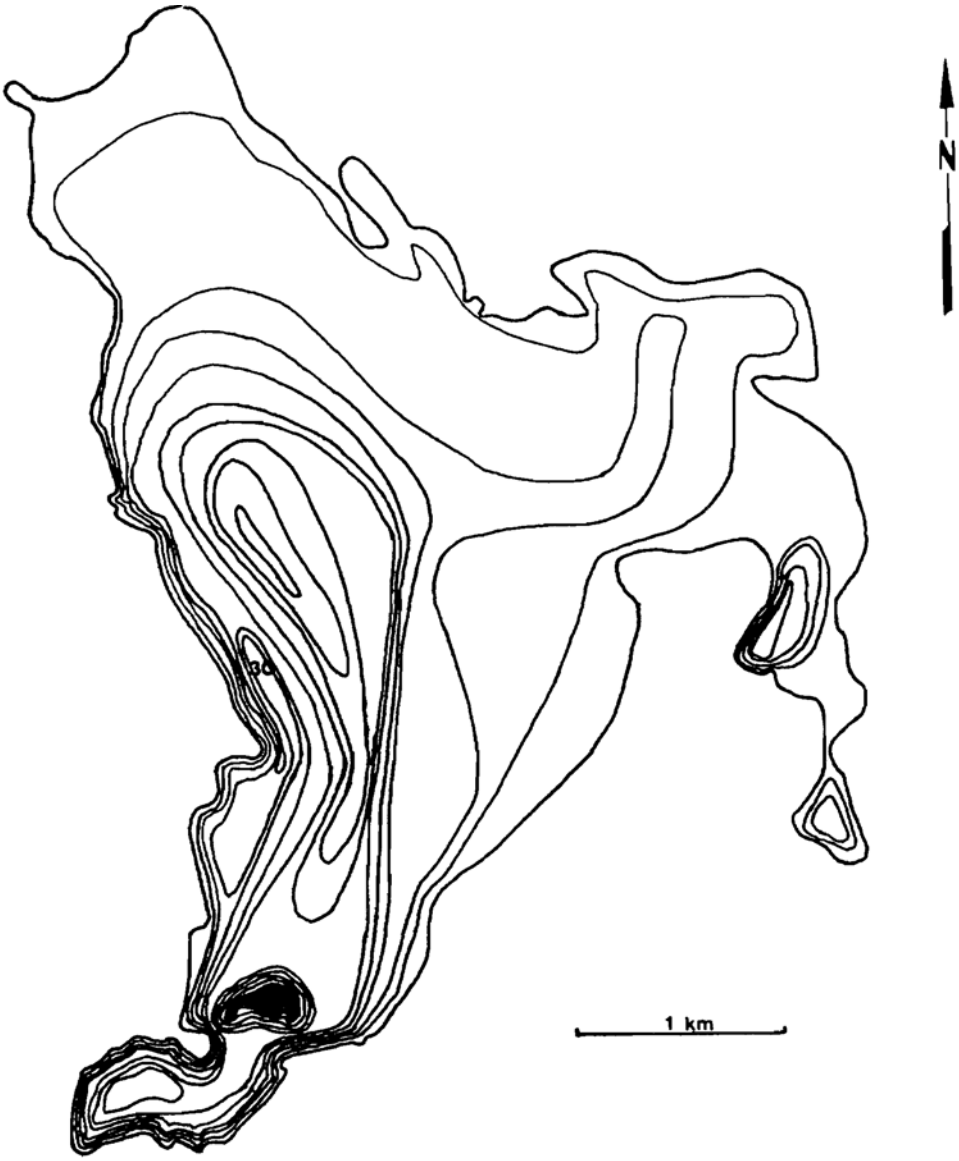
Appendix Figure 68. Bathymetric map of Lake 586-14, unnamed, Nowitna NWR, with 5-ft contour intervals (64.6520°N, 154.4208°W).



Appendix Figure 69. Bathometric map of Lake 784-01, Fern Lake, Tetlin NWR, with 10-ft contour intervals (62.7016°N, 142.2960°W).

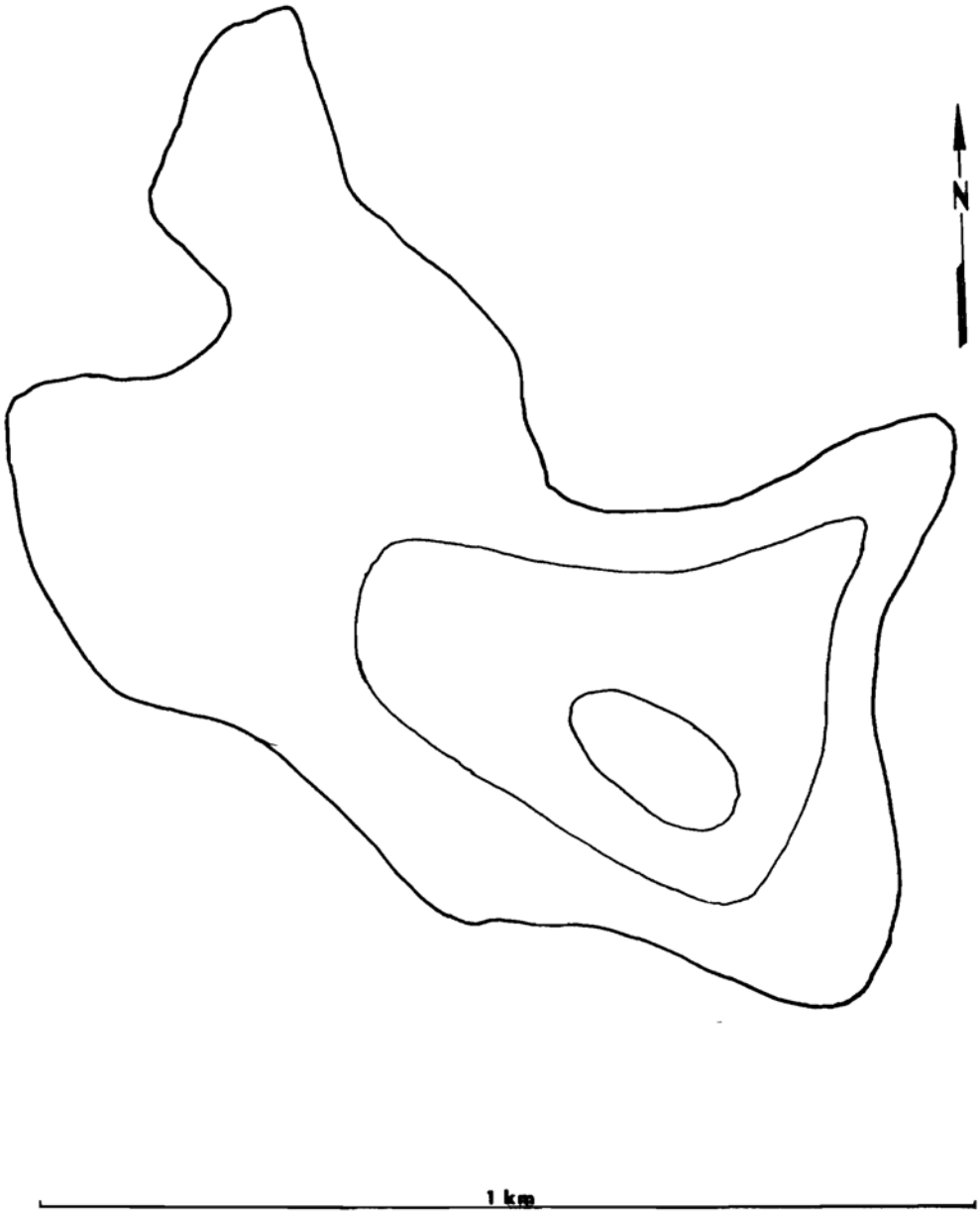


Appendix Figure 70. Bathometric map of Lake 784-02, unnamed, Tetlin NWR, with 5-ft contour intervals (62.6533°N, 142.3714°W).

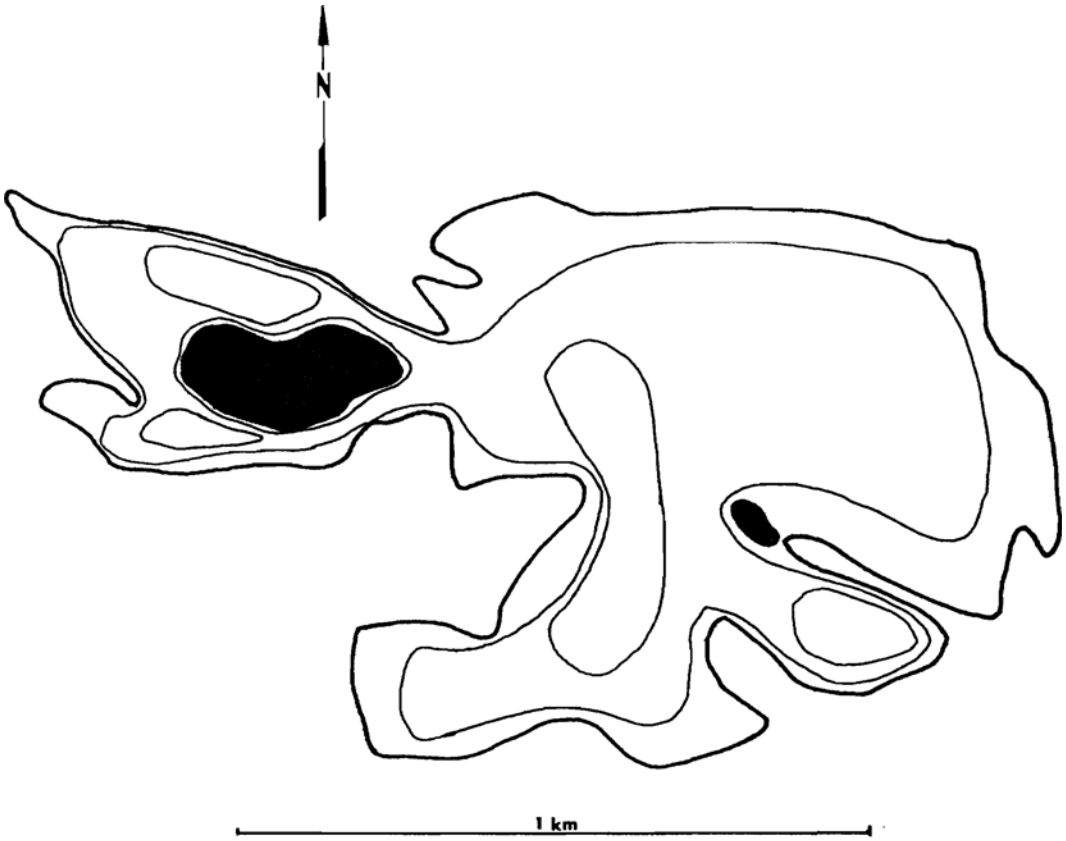


Appendix Figure 71. Bathometric map of Lake 784-03, Jatahmund Lake, Tetlin NWR, with 10-ft contour intervals (62.6193°N, 142.0277°W).

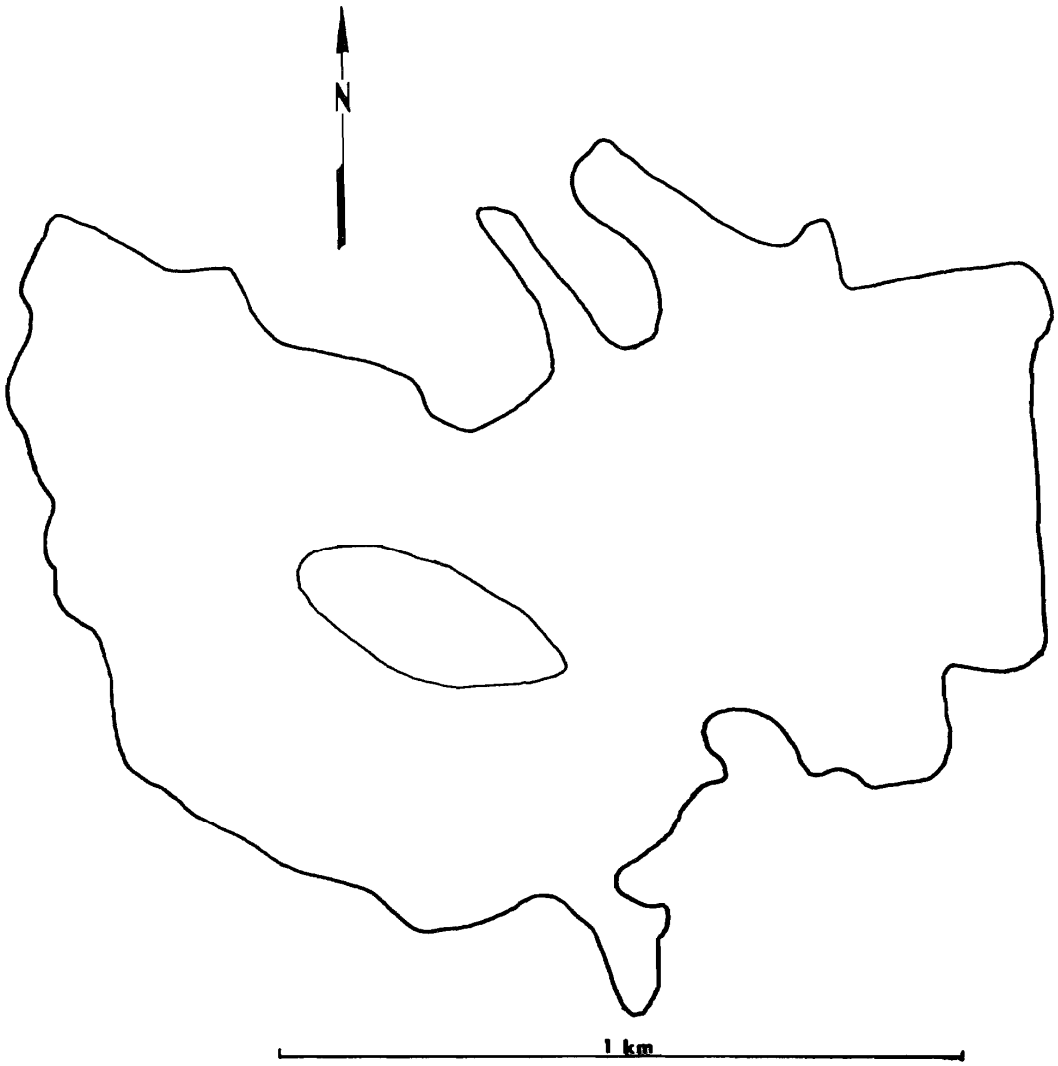
Appendix Figure 72. Bathometric map of Lake 784-04, unnamed, Tetlin NWR, with 5-ft contour intervals (62.6022°N, 141.9922°W).



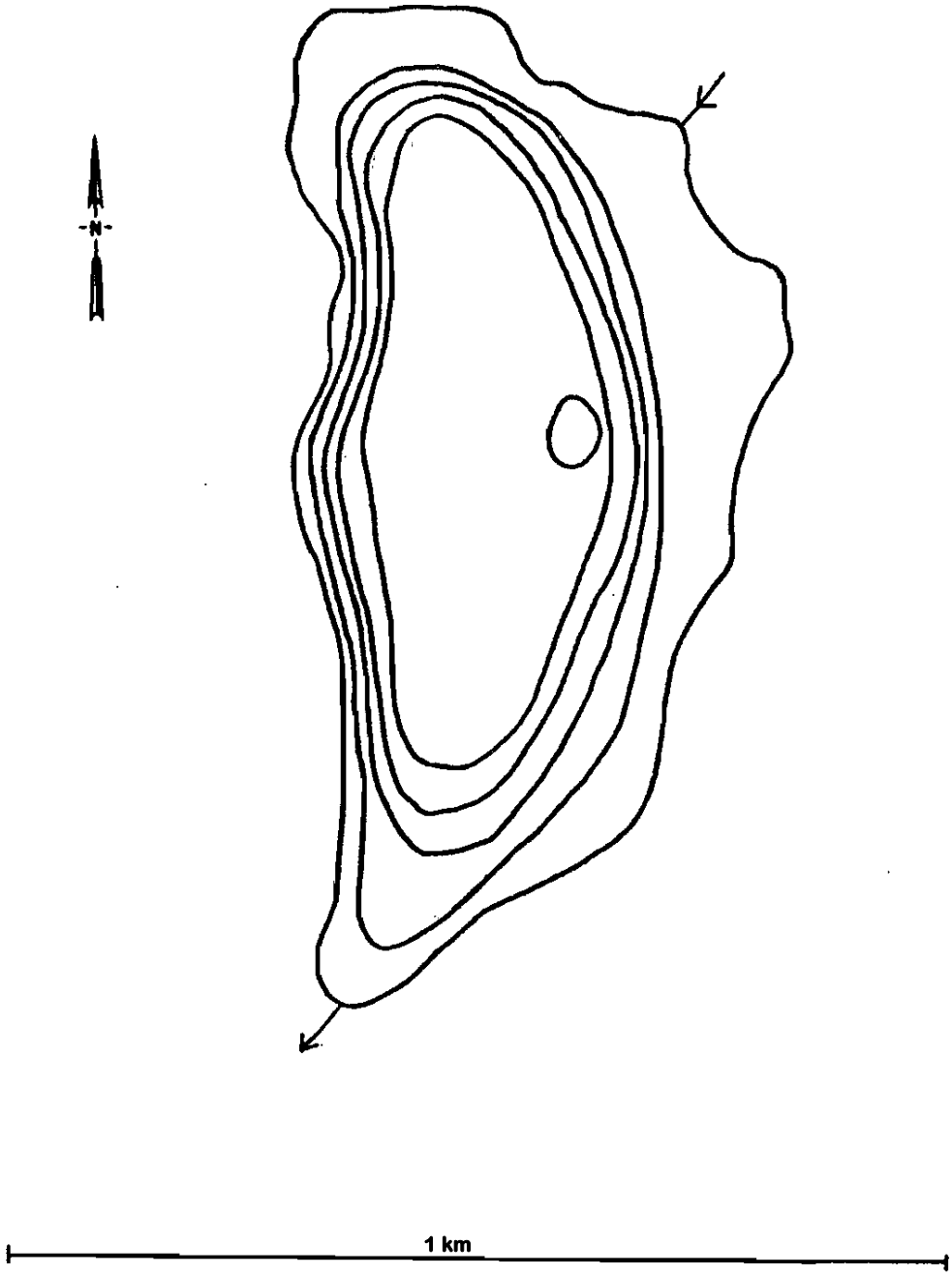
Appendix Figure 73. Bathometric map of Lake 784-05, unnamed, Tetlin NWR, with 5-ft contour intervals (62.8310°N, 141.8118°W).



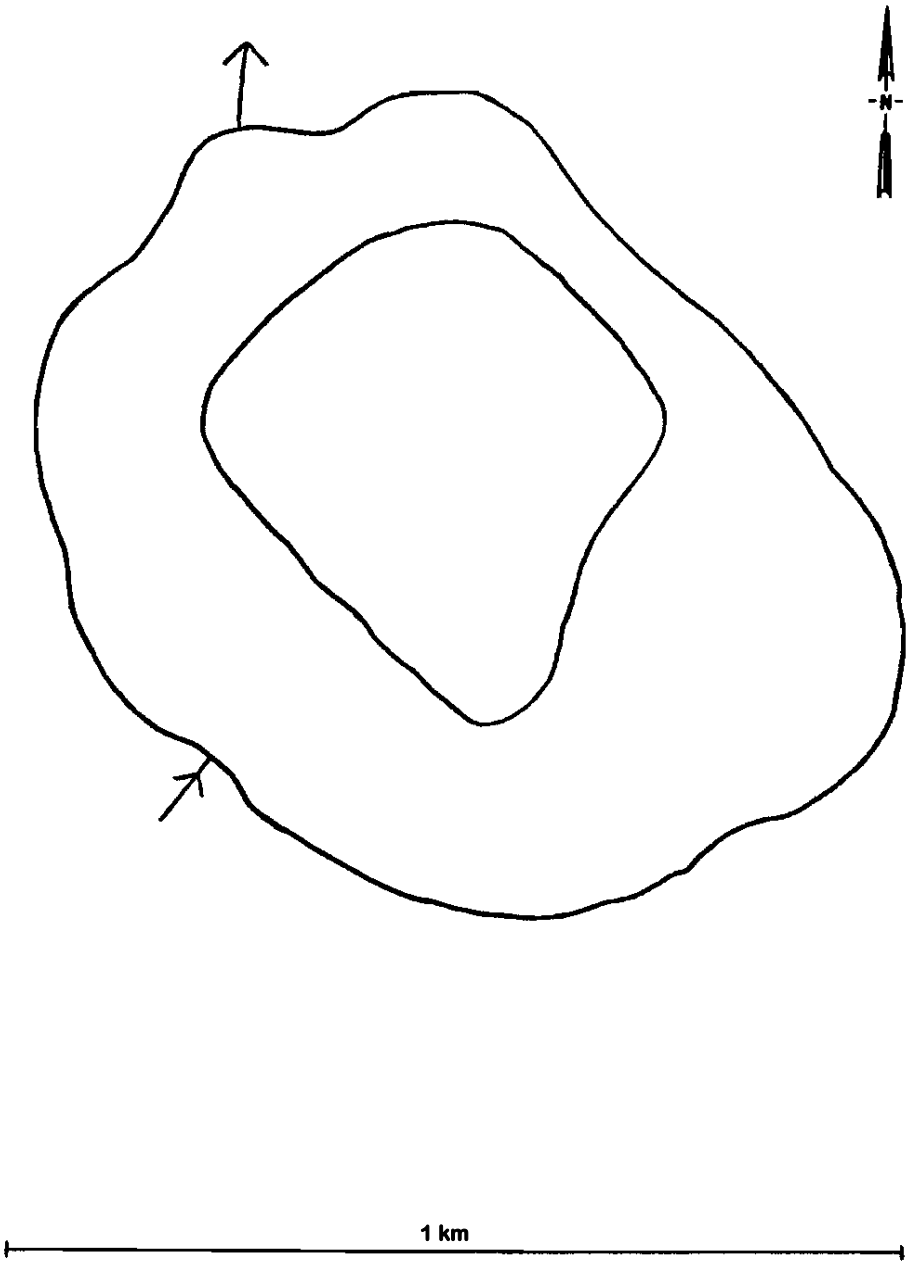
Appendix Figure 74. Bathometric map of Lake 784-06, Fish Camp Lake, Tetlin NWR, with 5-ft contour intervals (63.1503°N, 142.2788°W).



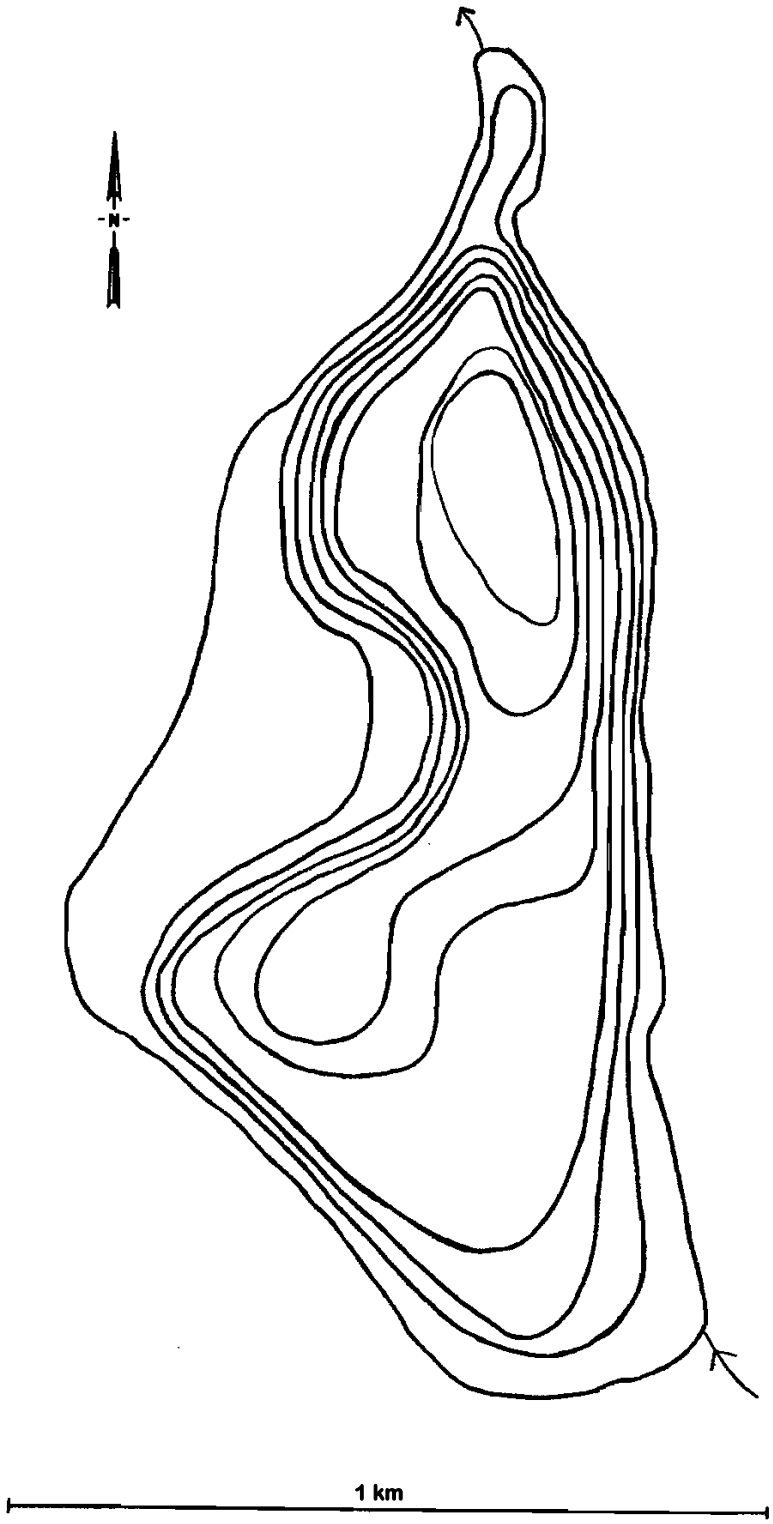
Appendix Figure 75. Bathometric map of Lake 784-07, Tlocogn Lake, Tetlin NWR, with 5-ft contour interval (63.1542°N, 142.2282°W).



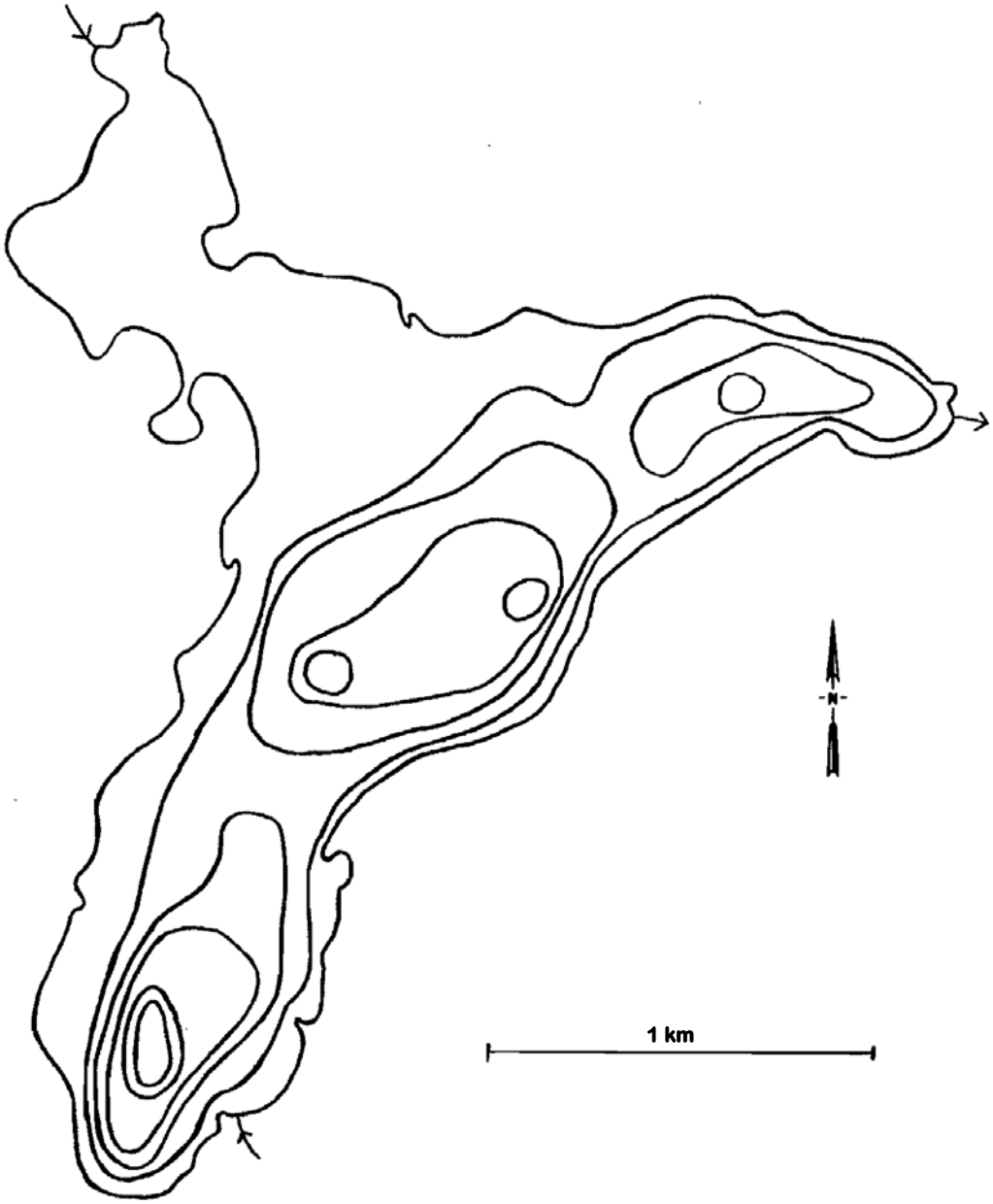
Appendix Figure 76. Bathometric map of Lake 785-01, unnamed, Tetlin NWR, with 5-ft contour intervals (62.7975°N, 141.4563°W).



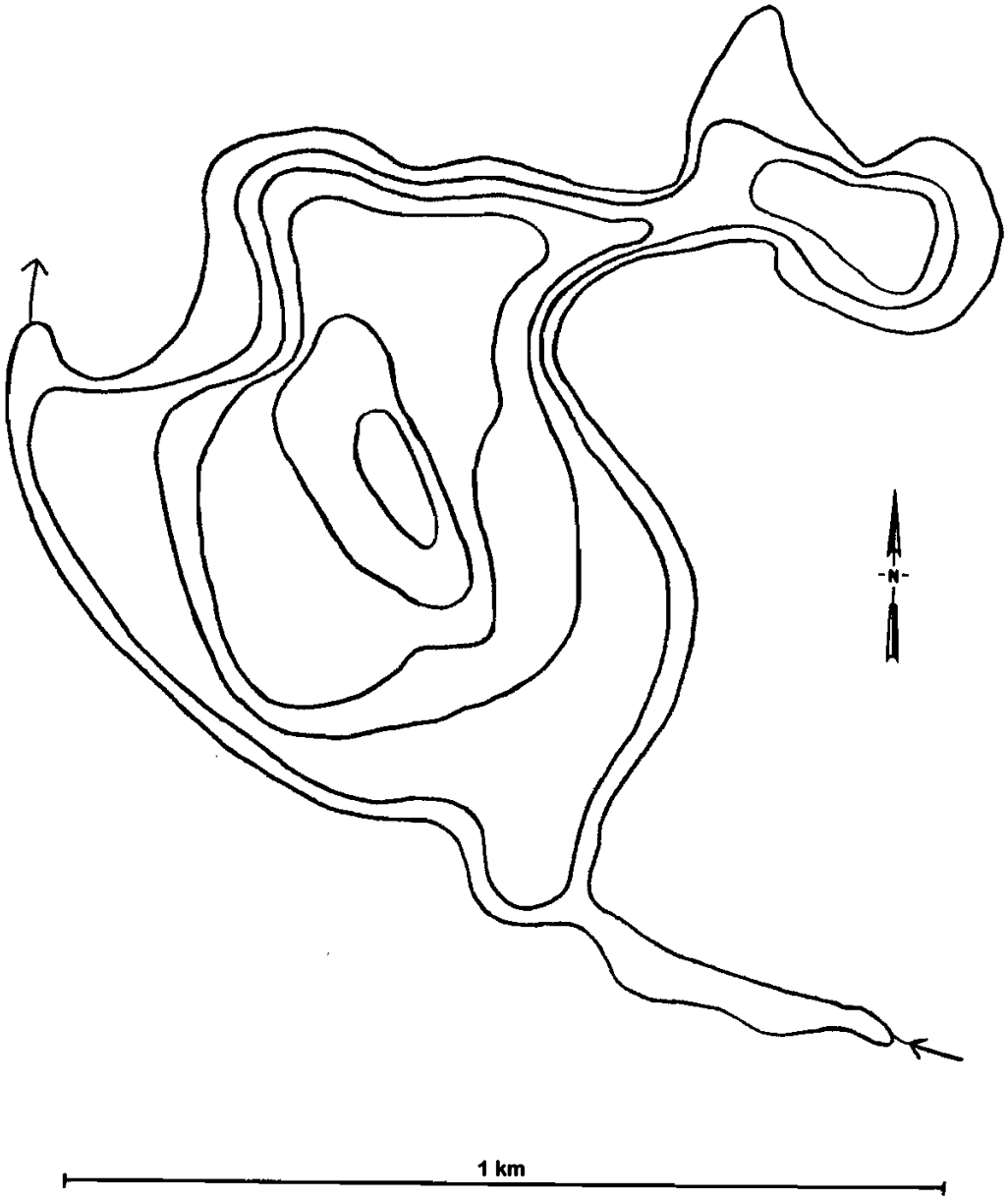
Appendix Figure 77. Bathometric map of Lake 785-02, Deep Lake, Tetlin NWR, with 5-ft contour interval (62.8163°N, 141.7786°W).



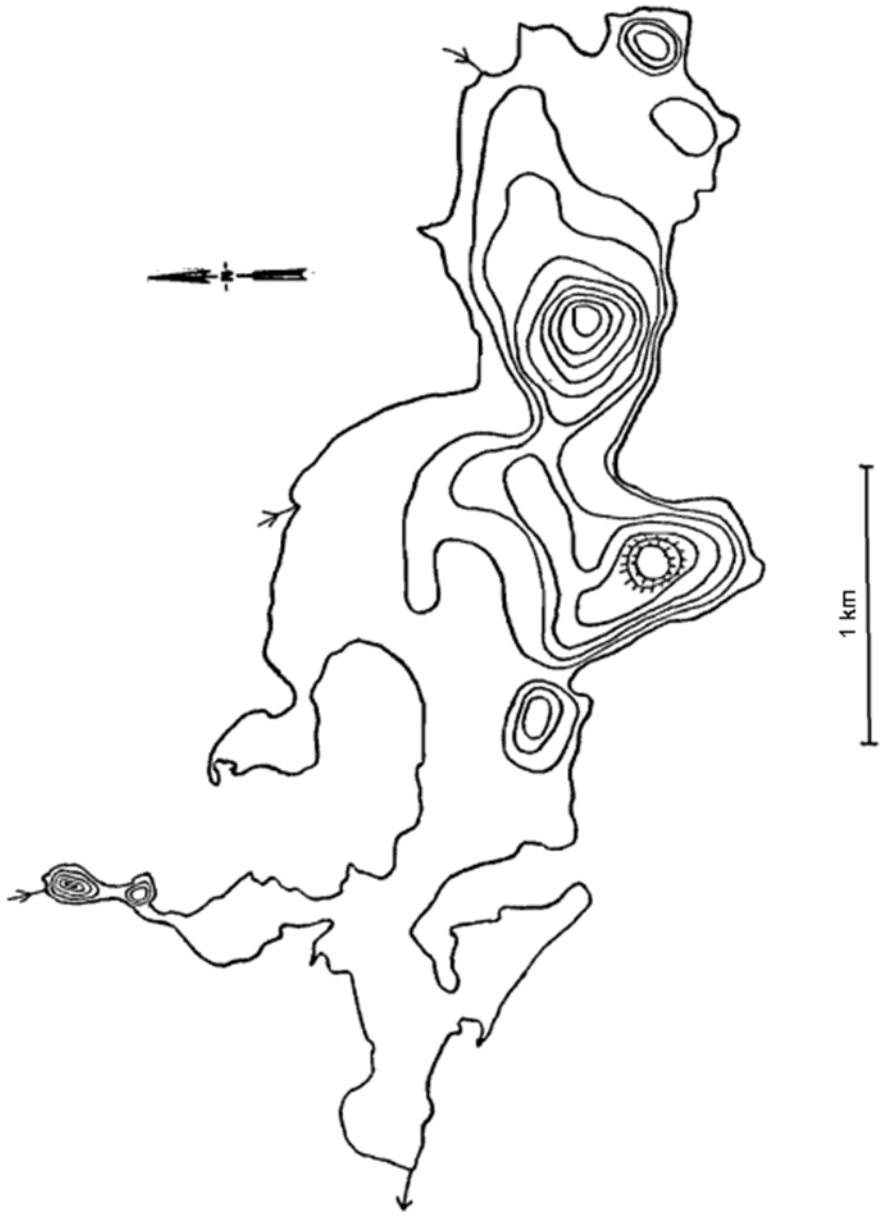
Appendix Figure 78. Bathometric map of Lake 785-03, unnamed, Tetlin NWR, with 5-ft contour intervals (62.6298°N, 142.0967°W).



Appendix Figure 79. Bathometric map of Lake 785-04, Takomahto Lake, Tetlin NWR, with 20-ft contour intervals (62.6190°N, 141.9468°W).

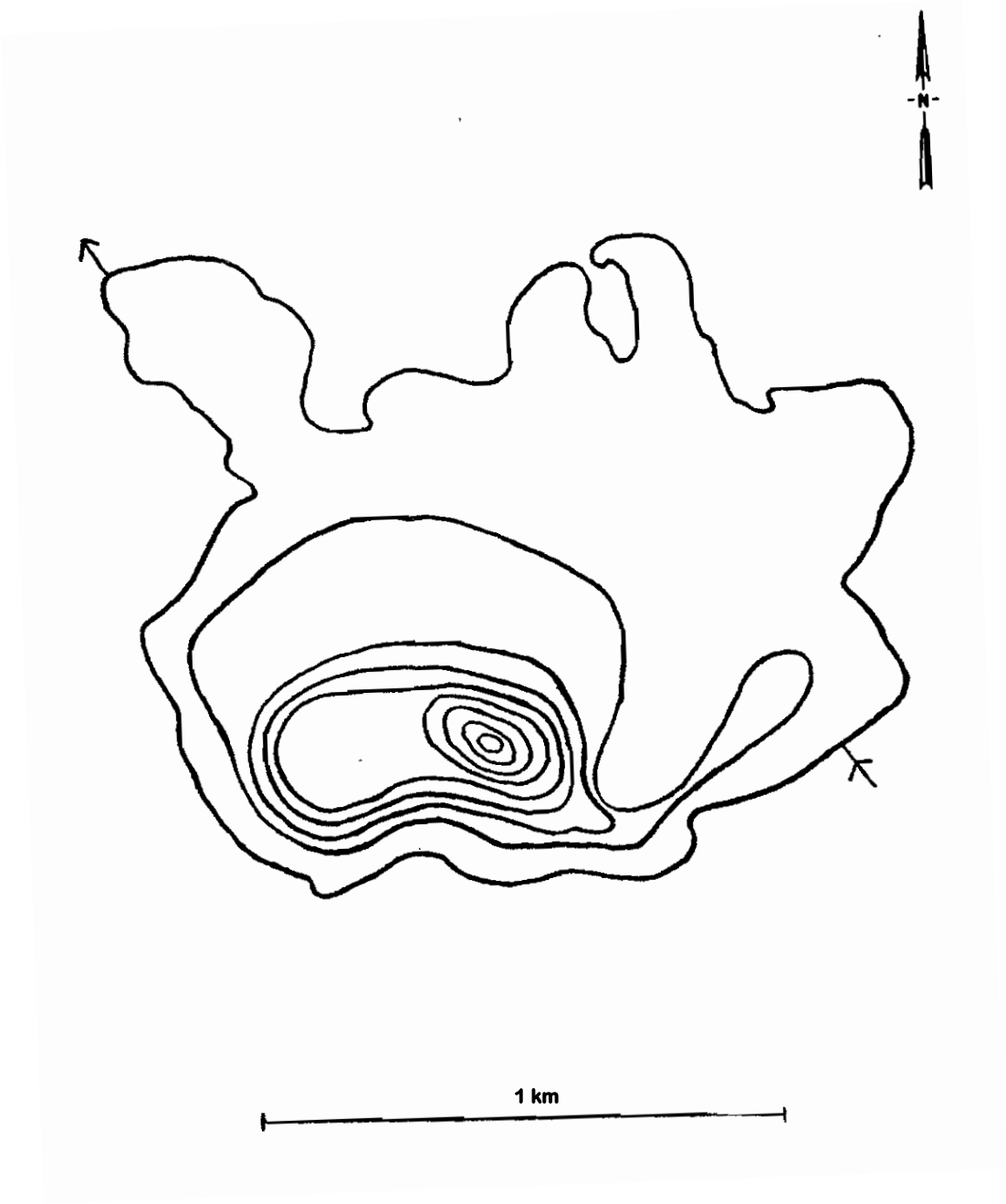


Appendix Figure 80. Bathometric map of Lake 785-05, unnamed, Tetlin NWR, with 5-ft contour intervals (62.6365°N, 141.1226°W).

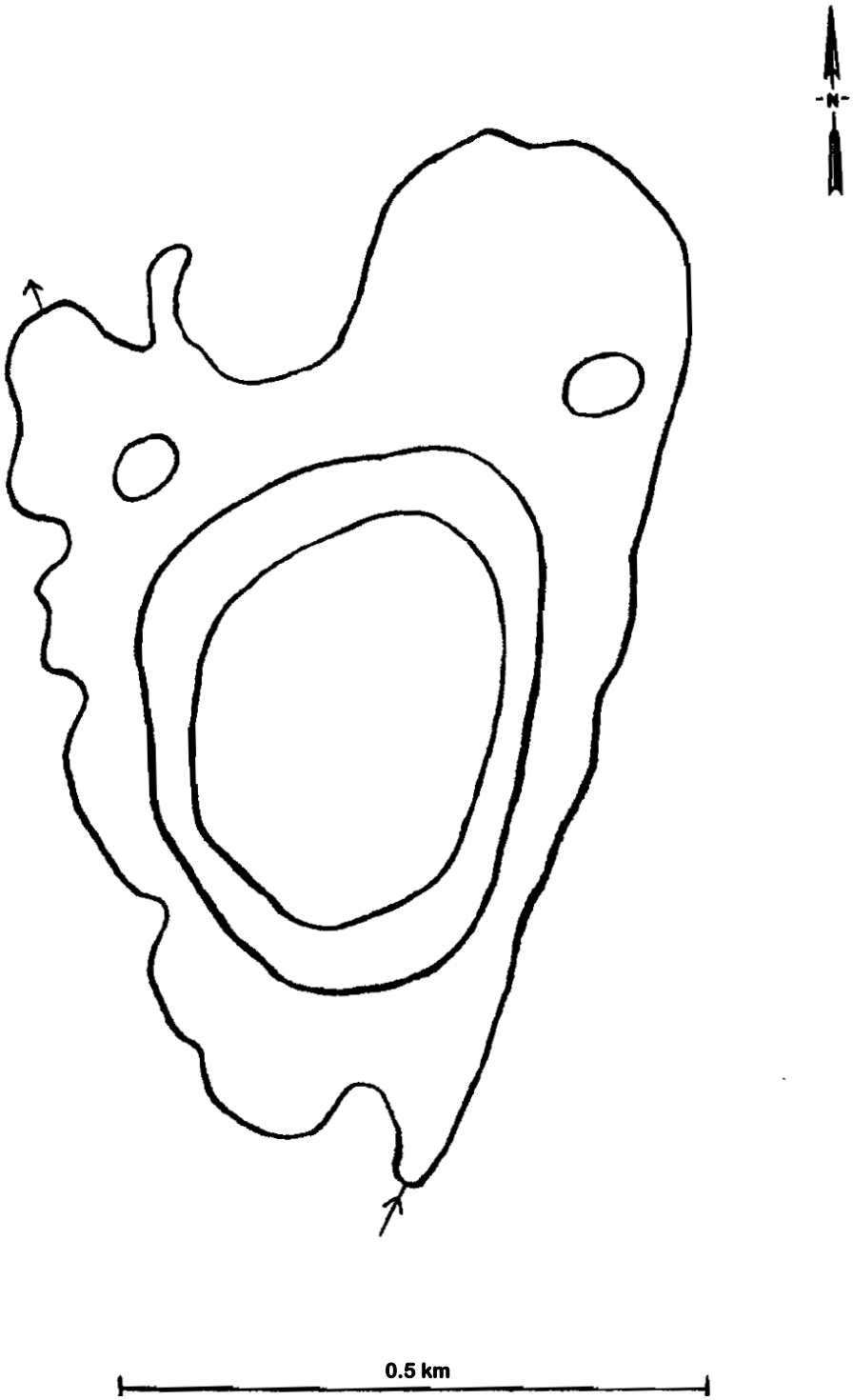


Appendix Figure 81. Bathometric map of Lake 785-06, American Wellesly Lake, Tetlin NWR, with 10-ft contour intervals (62.5079°N, 141.2506°W).

Appendix Figure 82. Bathometric map of Lake 786-01, East Wellesly Lake, Tetlin NWR, with 10-ft contour intervals (62.4640°N, 141.2713°W).

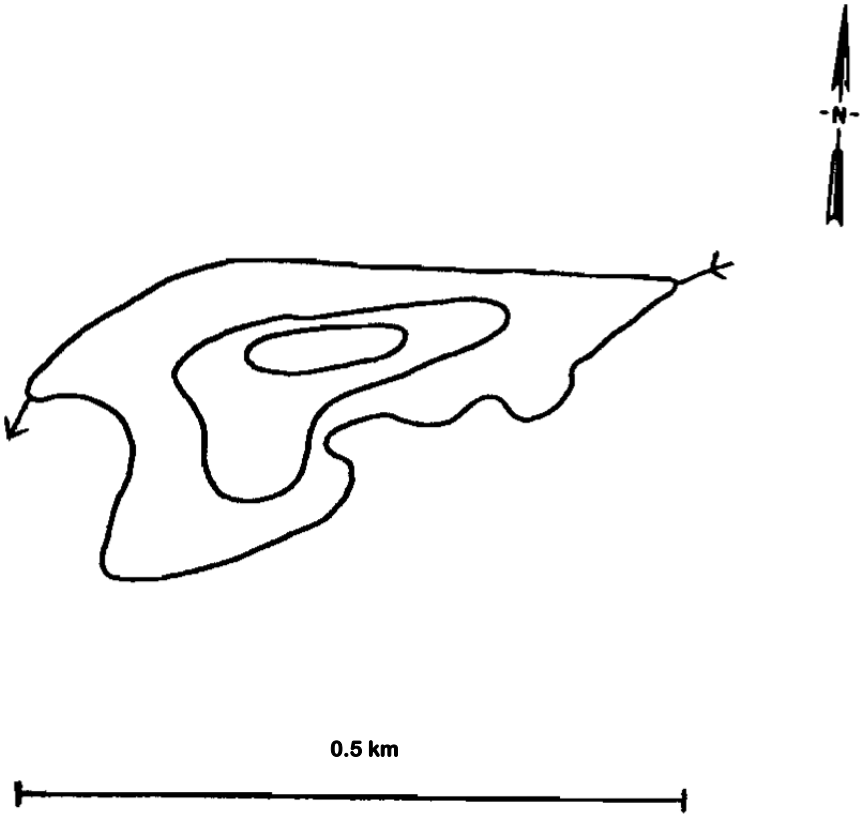


Appendix Figure 83. Bathometric map of Lake 786-02, West Wellesly Lake, Tetlin NWR, with 10-ft contour intervals (62.4706°N, 141.3237°W).

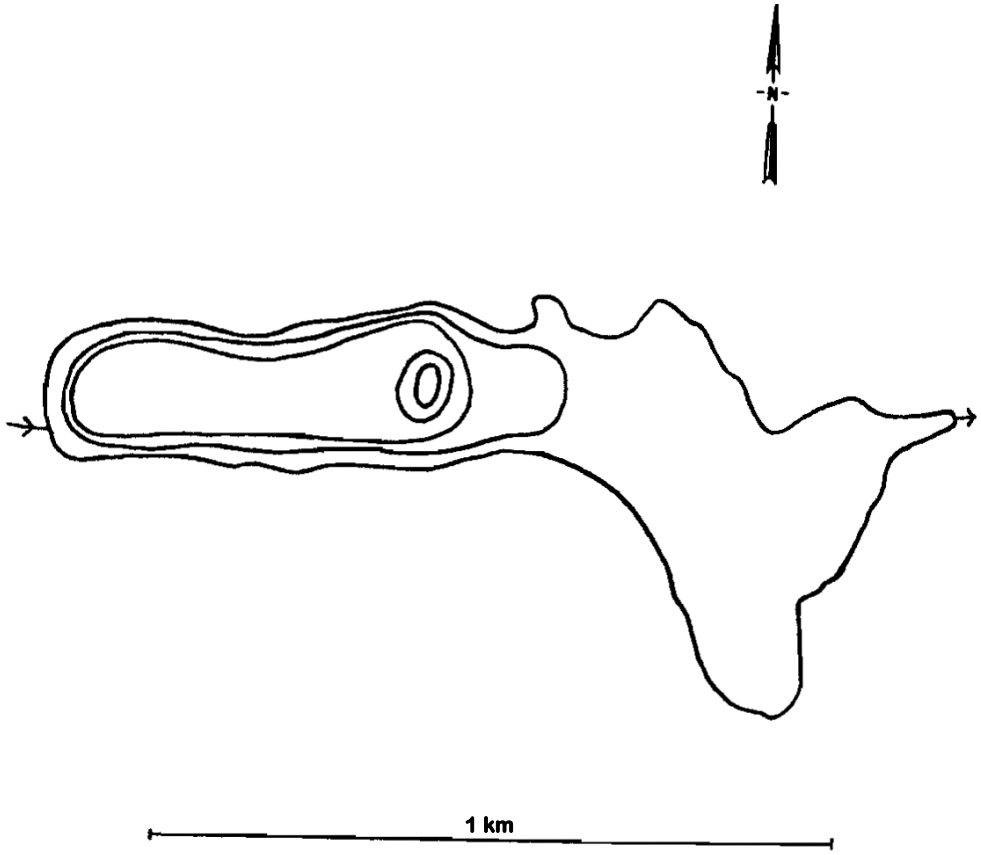


Appendix Figure 84. Bathometric map of Lake 786-03, unnamed, Tetlin NWR, with 5-ft contour intervals (62.4822°N, 141.3239°W).

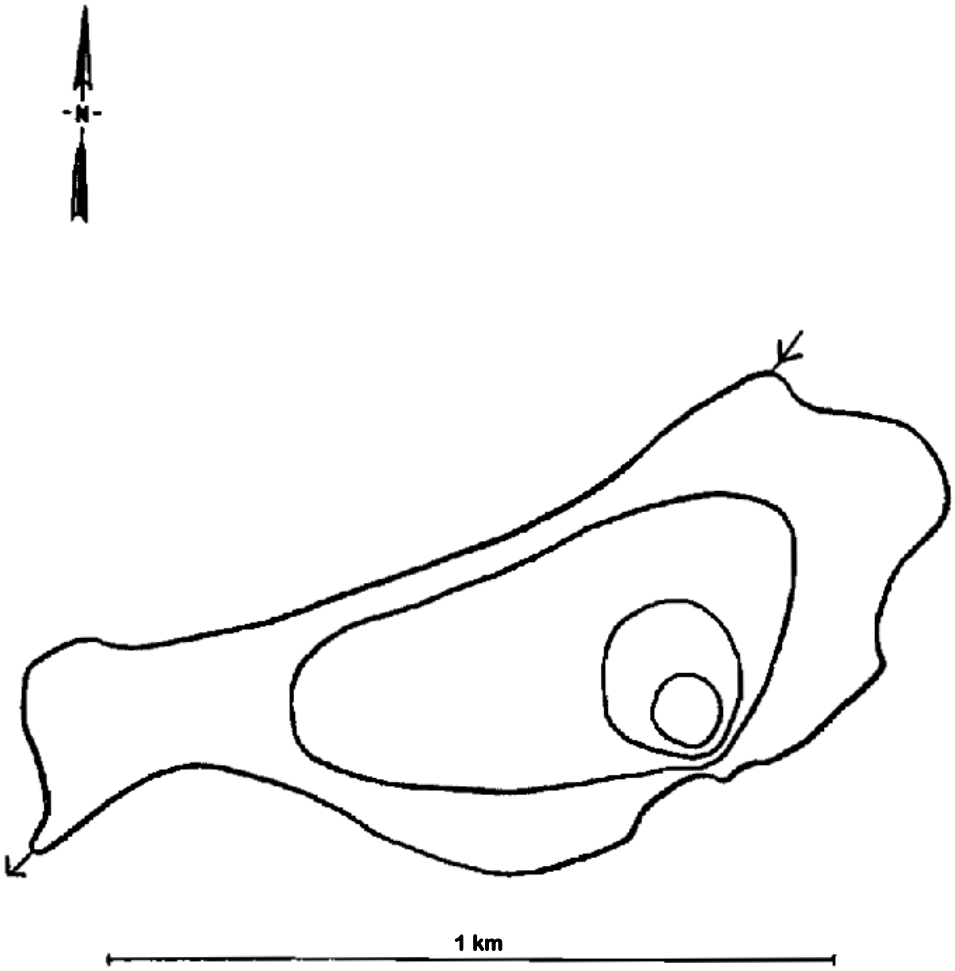
Appendix Figure 85. Bathometric map of Lake 786-04, Pickerel Lake, Tetlin NWR, with 5-ft contour intervals (62.5309°N, 142.3887°W).



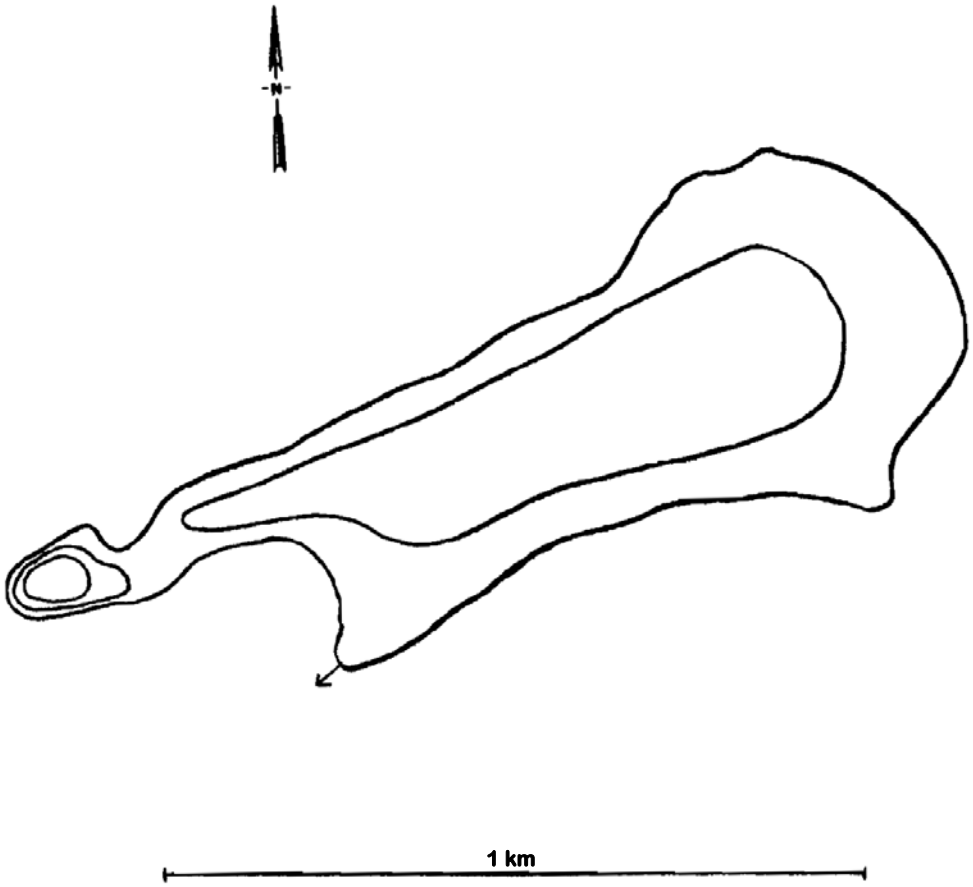
Appendix Figure 86. Bathometric map of Lake 786-05, unnamed, Tetlin NWR, with 5-ft contour intervals (62.5432°N, 142.2654°W).



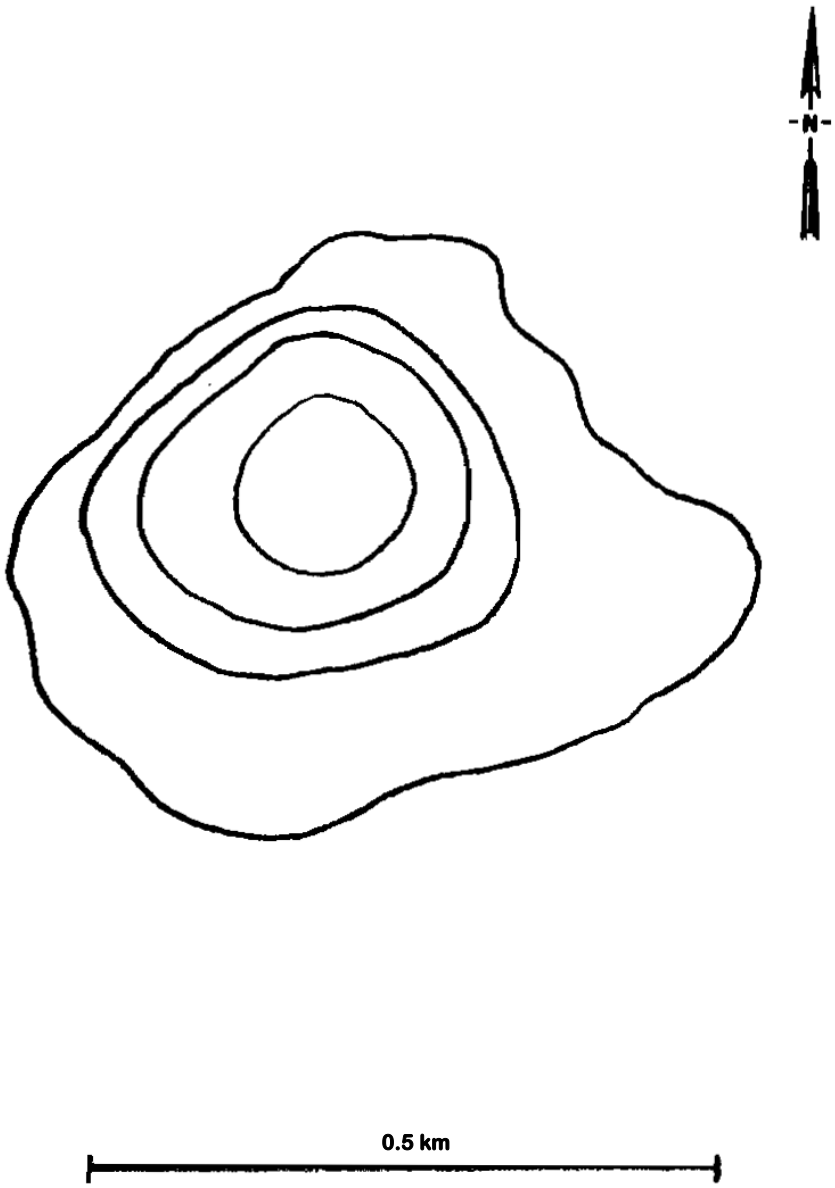
Appendix Figure 87. Bathometric map of Lake 786-06, unnamed, Tetlin NWR, with 5-ft contour intervals (62.6533°N, 142.2907°W).



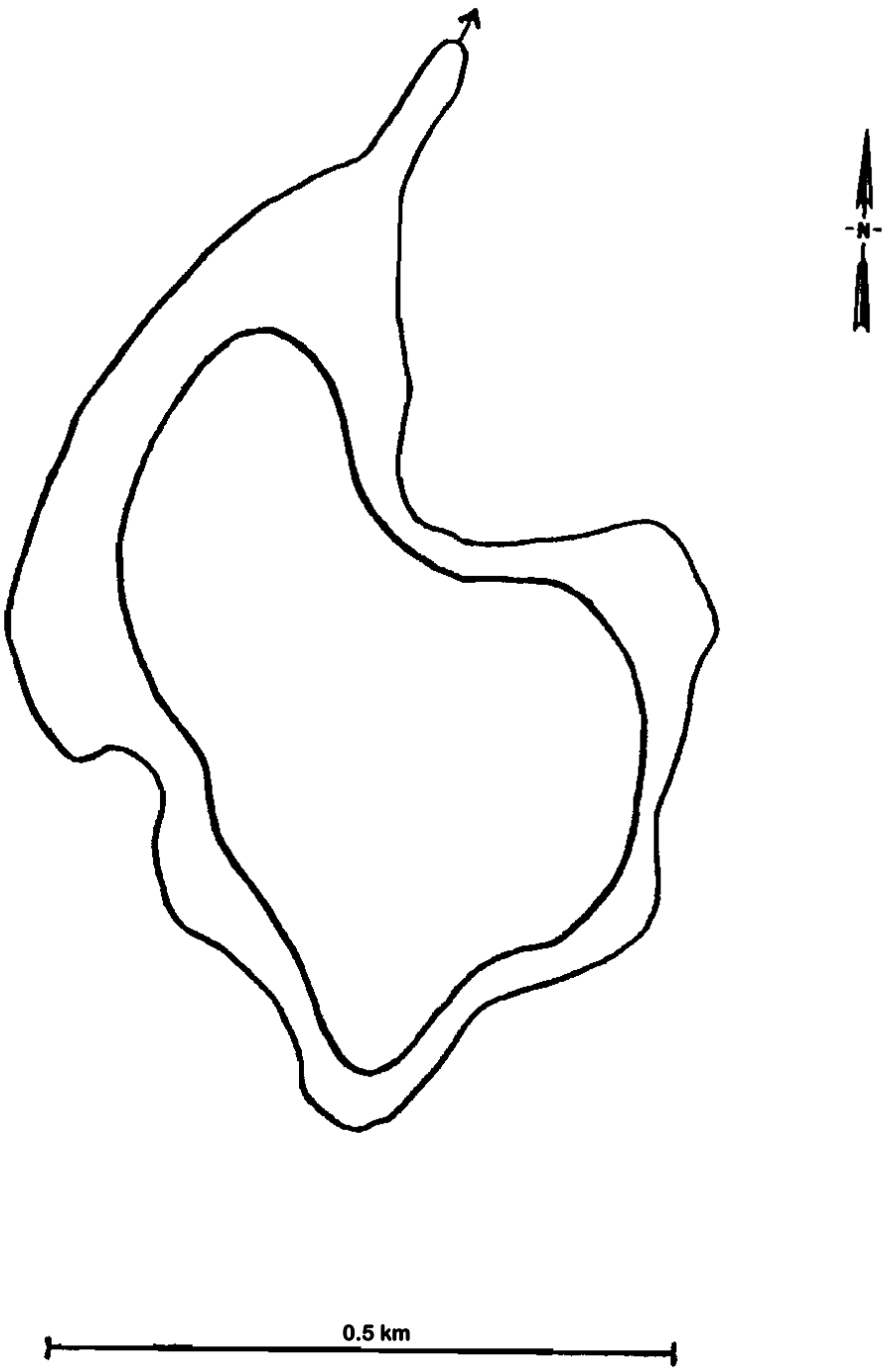
Appendix Figure 88. Bathometric map of Lake 786-07, unnamed, Tetlin NWR, with 5-ft contour intervals (62.6103°N, 142.3312°W).



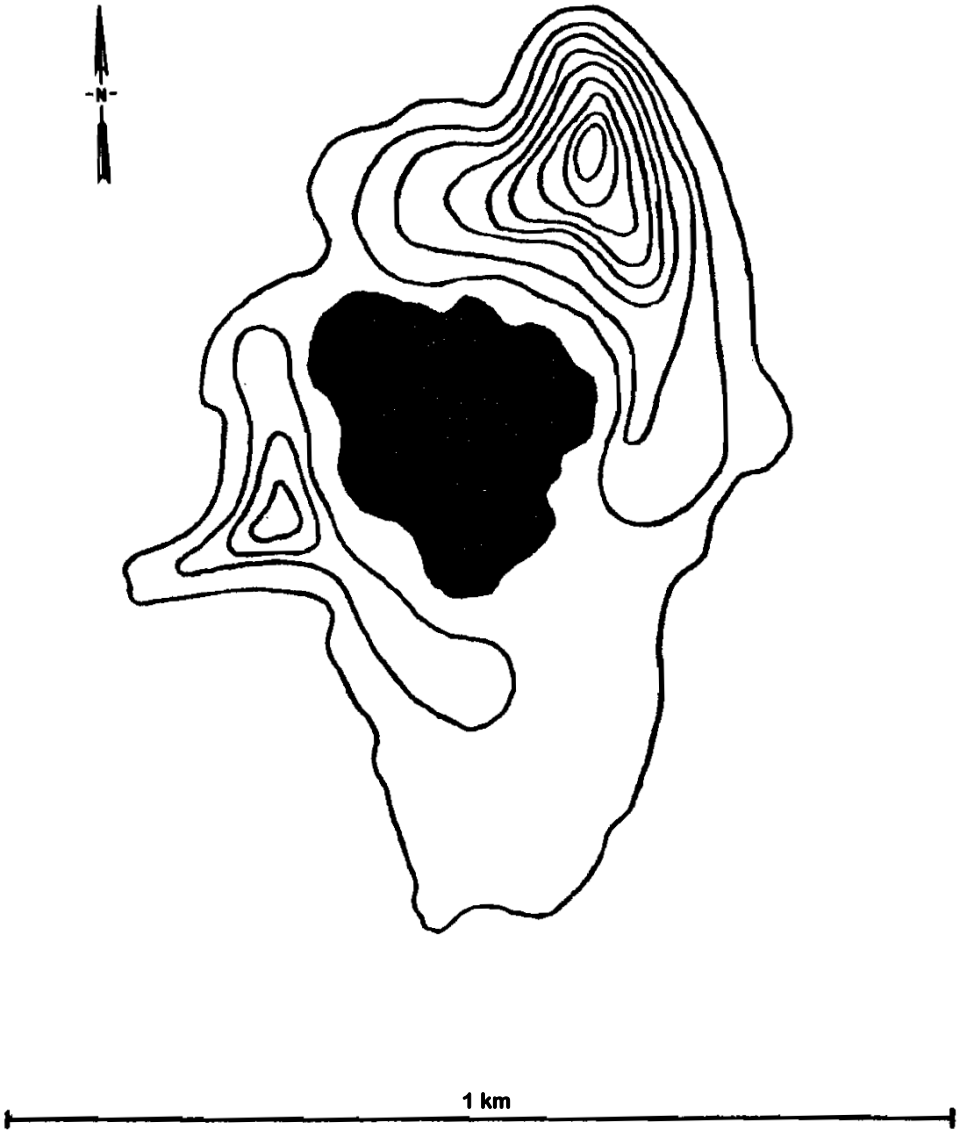
Appendix Figure 89. Bathometric map of Lake 786-08, unnamed, Tetlin NWR, with 5-ft contour intervals (62.6124°N, 142.3945°W).



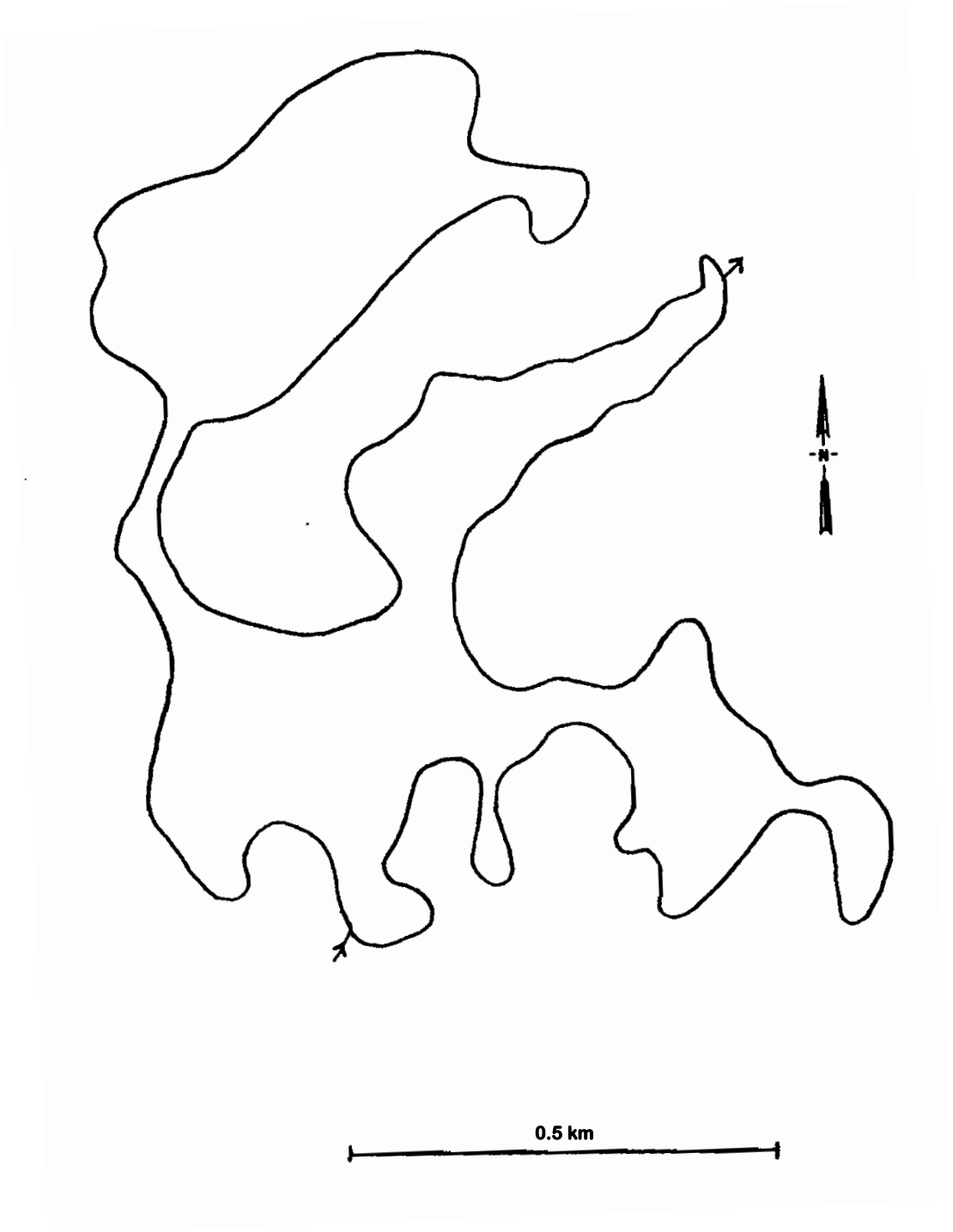
Appendix Figure 90. Bathometric map of Lake 786-09, Pie Lake, Tetlin NWR, with 5-ft contour intervals (62.5966°N, 142.4194°W).



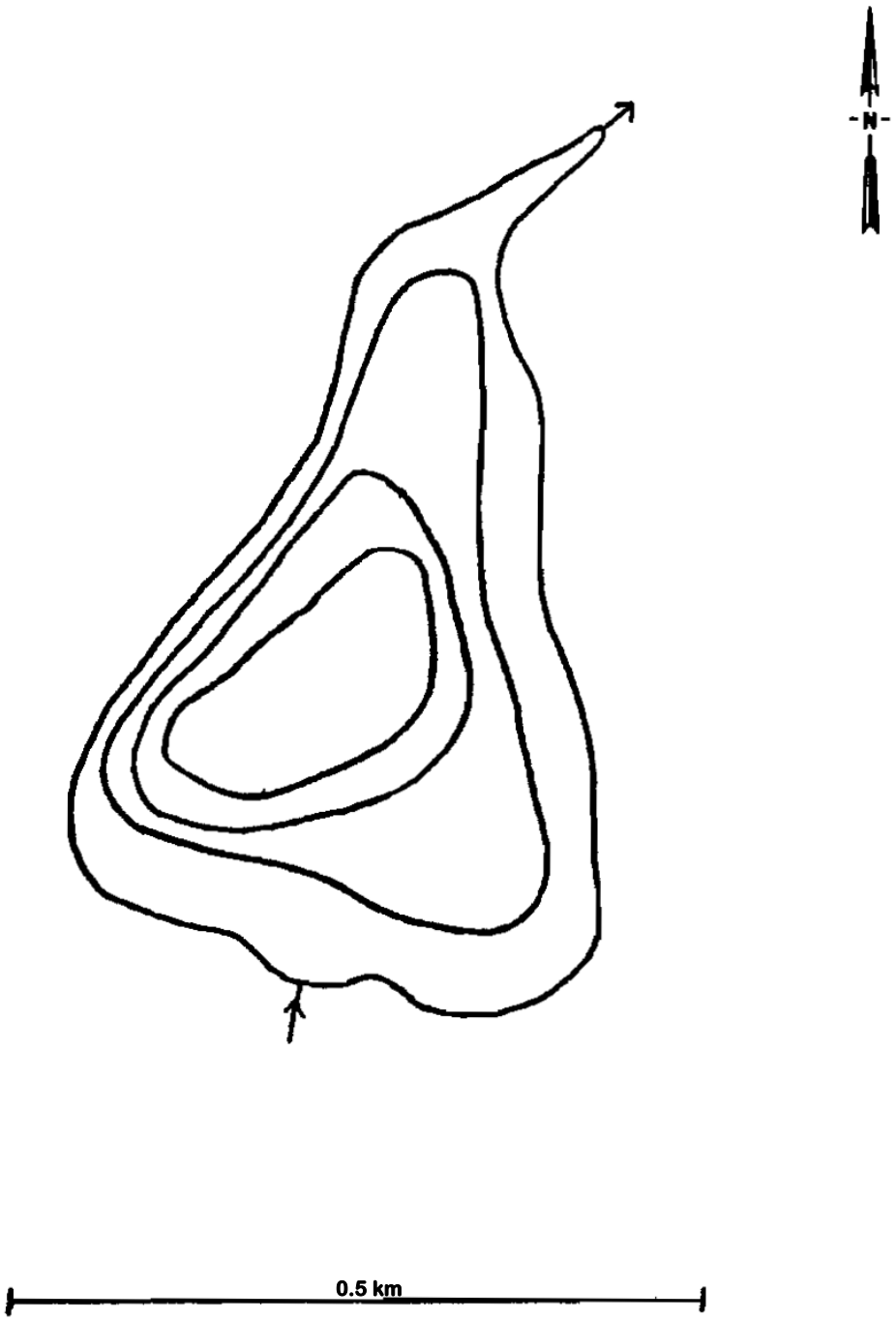
Appendix Figure 91. Bathometric map of Lake 786-10, unnamed, Tetlin NWR, with 5-ft contour interval (62.6445°N, 142.2796°W).



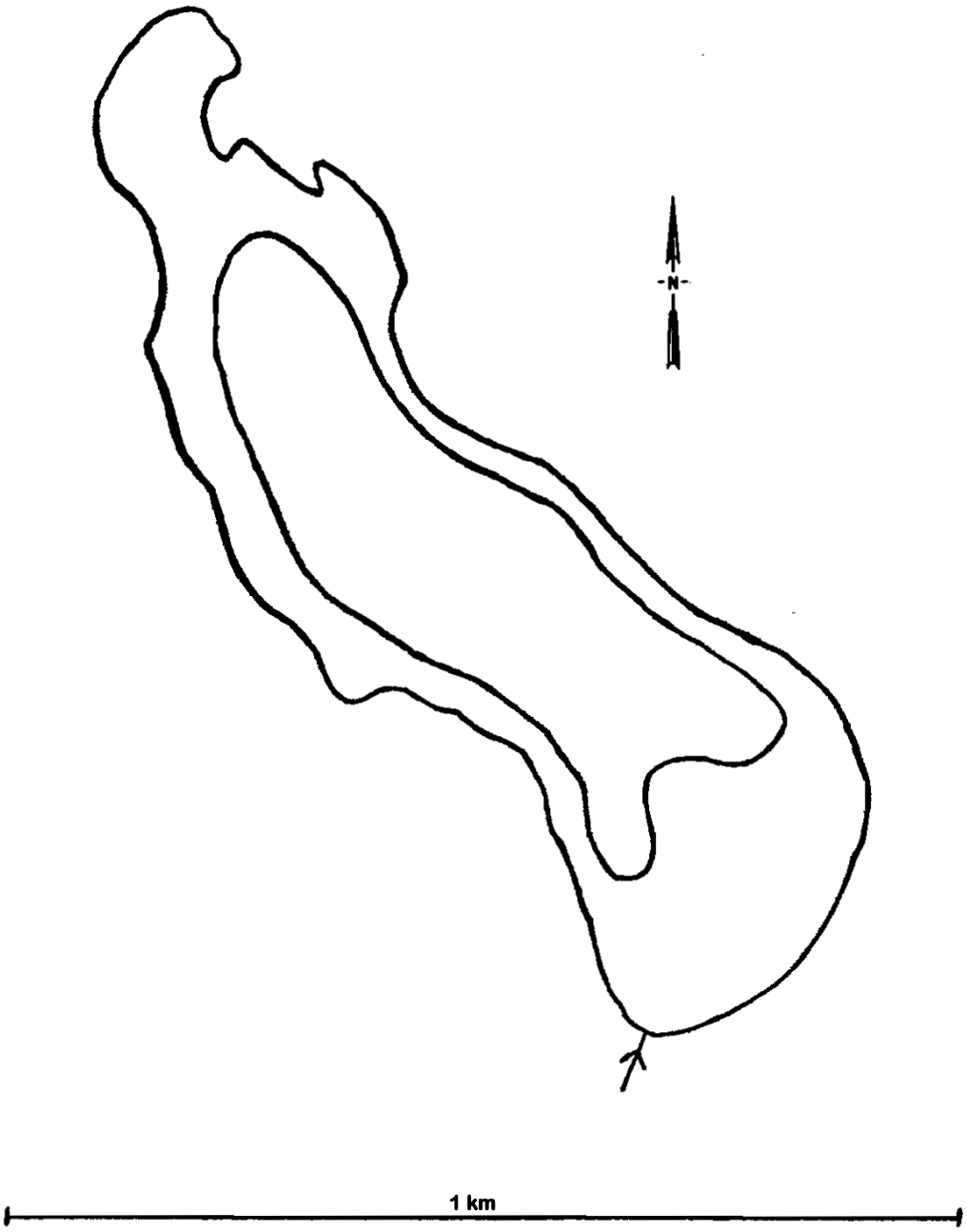
Appendix Figure 92. Bathometric map of Lake 786-11, unnamed, Tetlin NWR, with 10-ft contour intervals (62.6824°N, 142.2747°W).



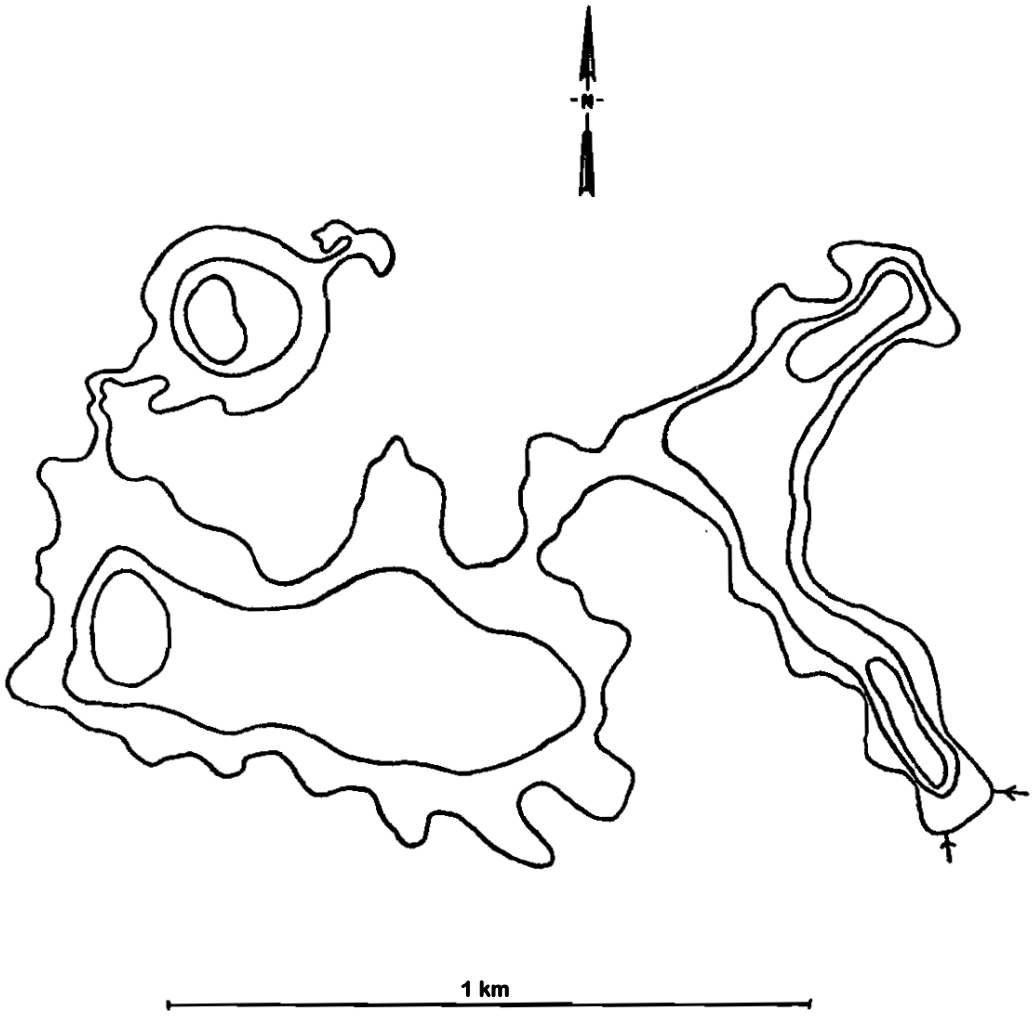
Appendix Figure 93. Bathometric map of Lake 786-12, Fish Lake, Tetlin NWR, maximum depth less than 5 ft (62.8099°N, 141.8665°W).



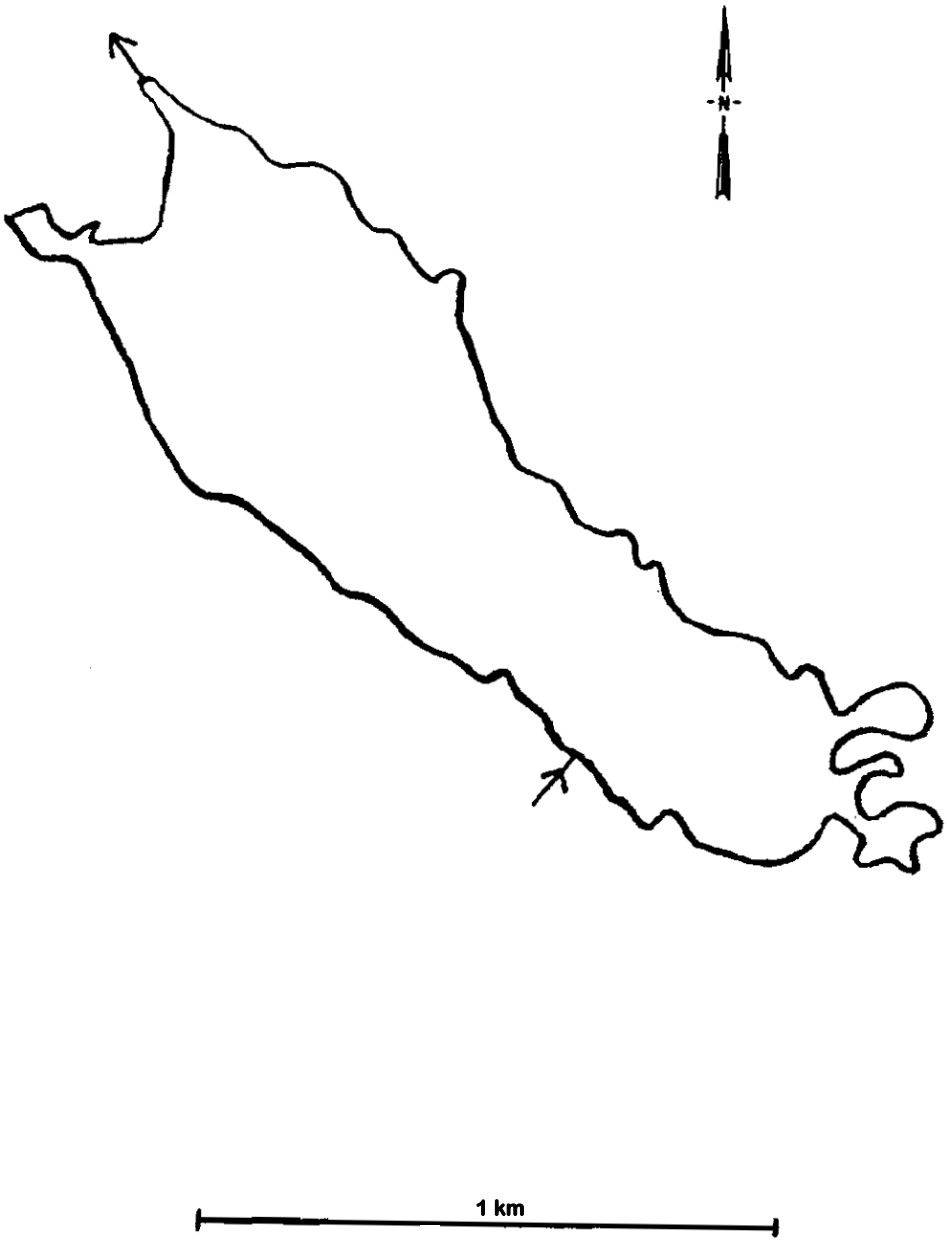
Appendix Figure 94. Bathometric map of Lake 786-13, unnamed, Tetlin NWR, with 5-ft contour intervals (62.8015°N, 141.9404°W).



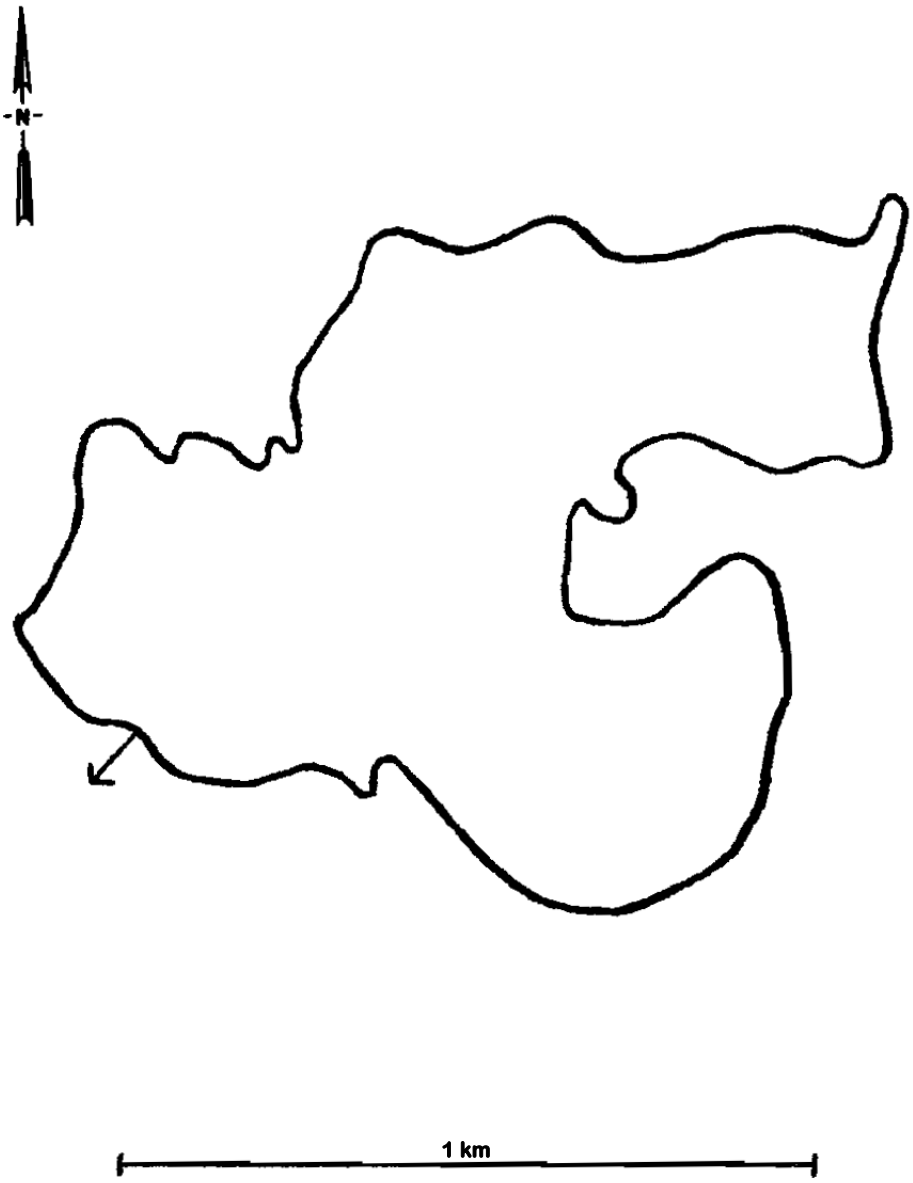
Appendix Figure 95. Bathometric map of Lake 786-14, unnamed, Tetlin NWR, with 5-ft contour interval (62.7796°N, 141.7999°W).



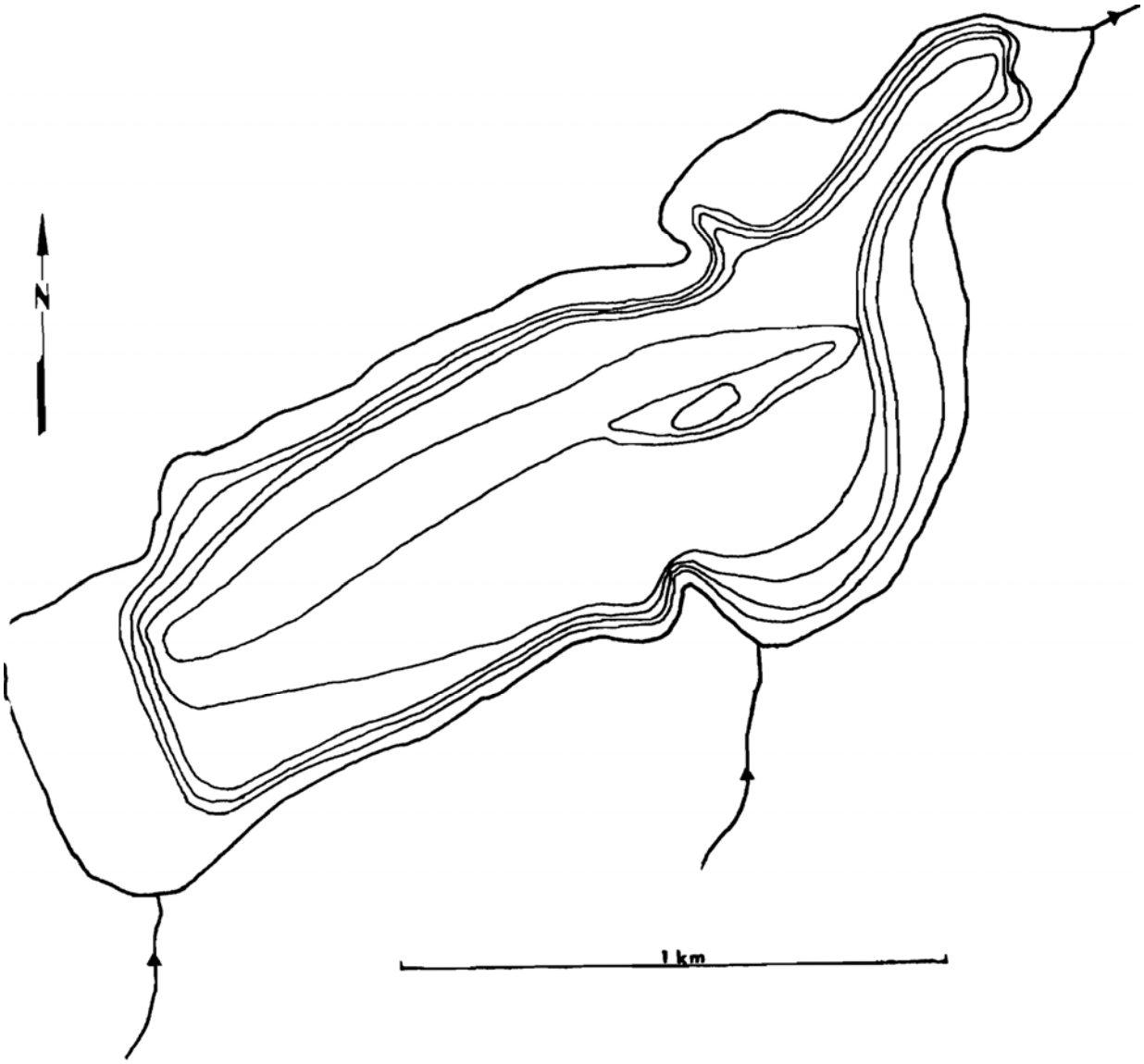
Appendix Figure 96. Bathometric map of Lake 786-15, unnamed, Tetlin NWR, with 5-ft contour intervals (62.7428°N, 141.7099°W).



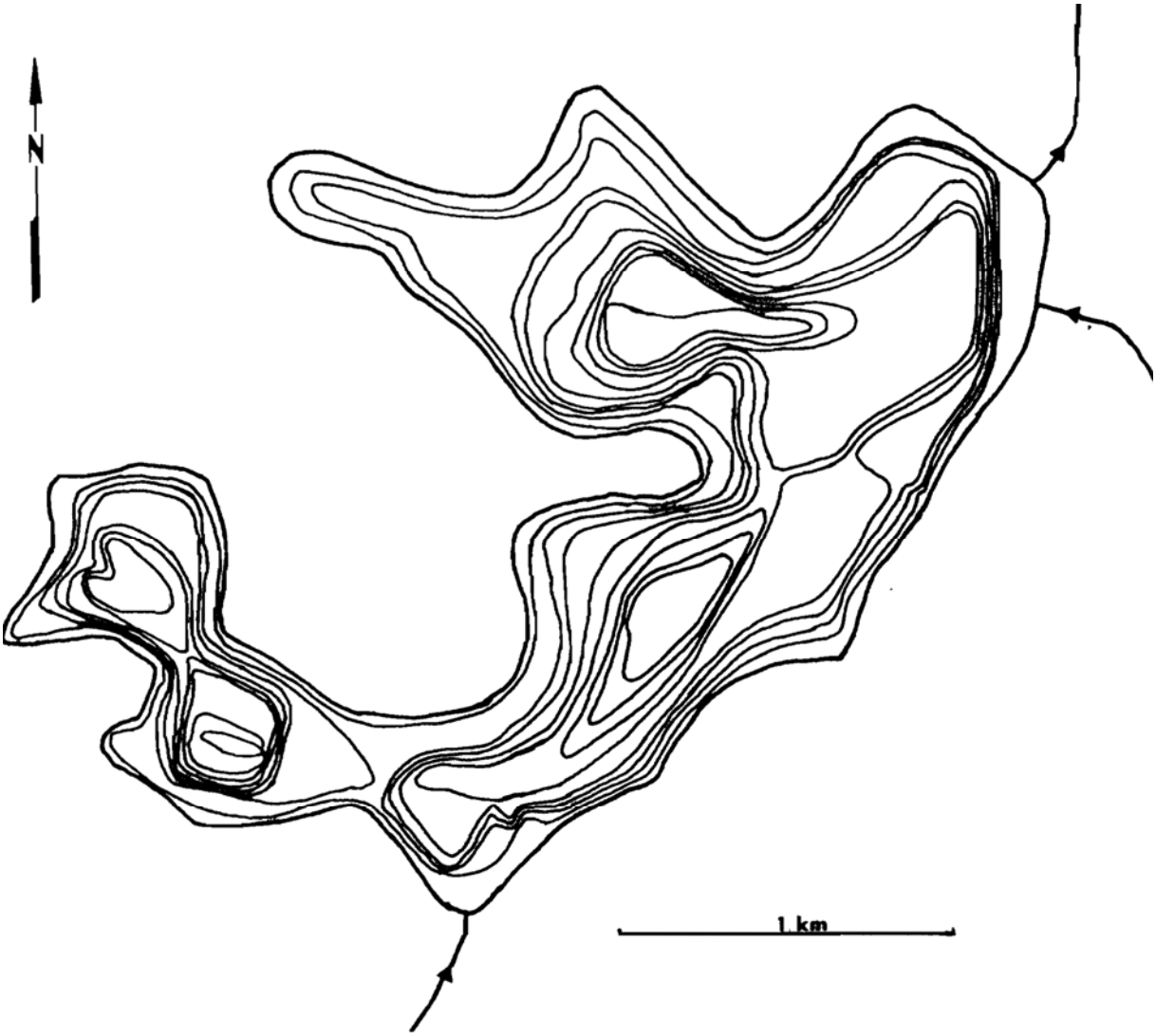
Appendix Figure 97. Bathometric map of Lake 786-16, Tsilchin Lake, Tetlin NWR, maximum depth less than 5 ft (63.1224°N, 142.2174°W).



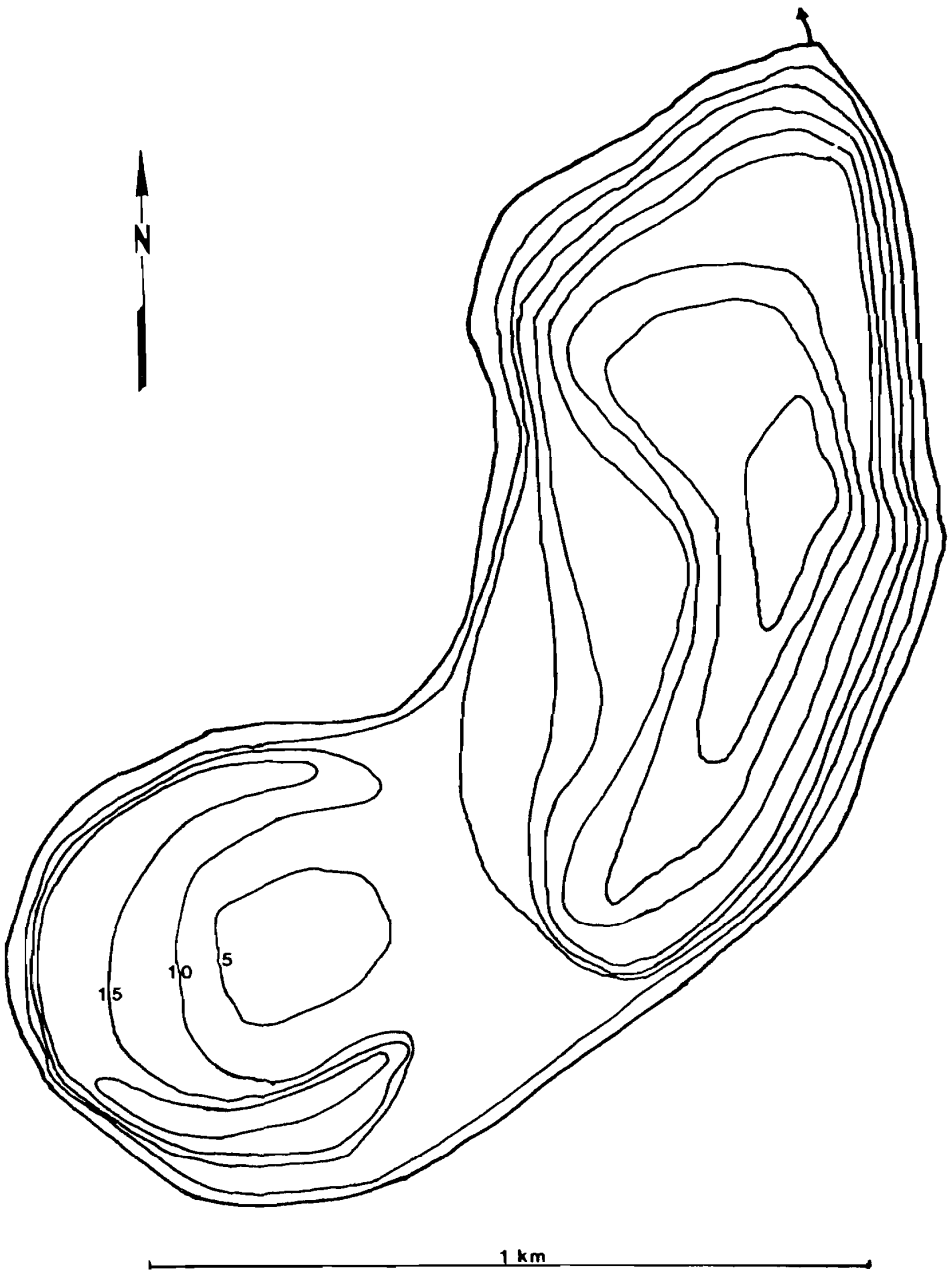
Appendix Figure 98. Bathometric map of Lake 786-17, Tlechegn Lake, Tetlin NWR, maximum depth less than 5 ft (63.1394°N, 142.2456°W).



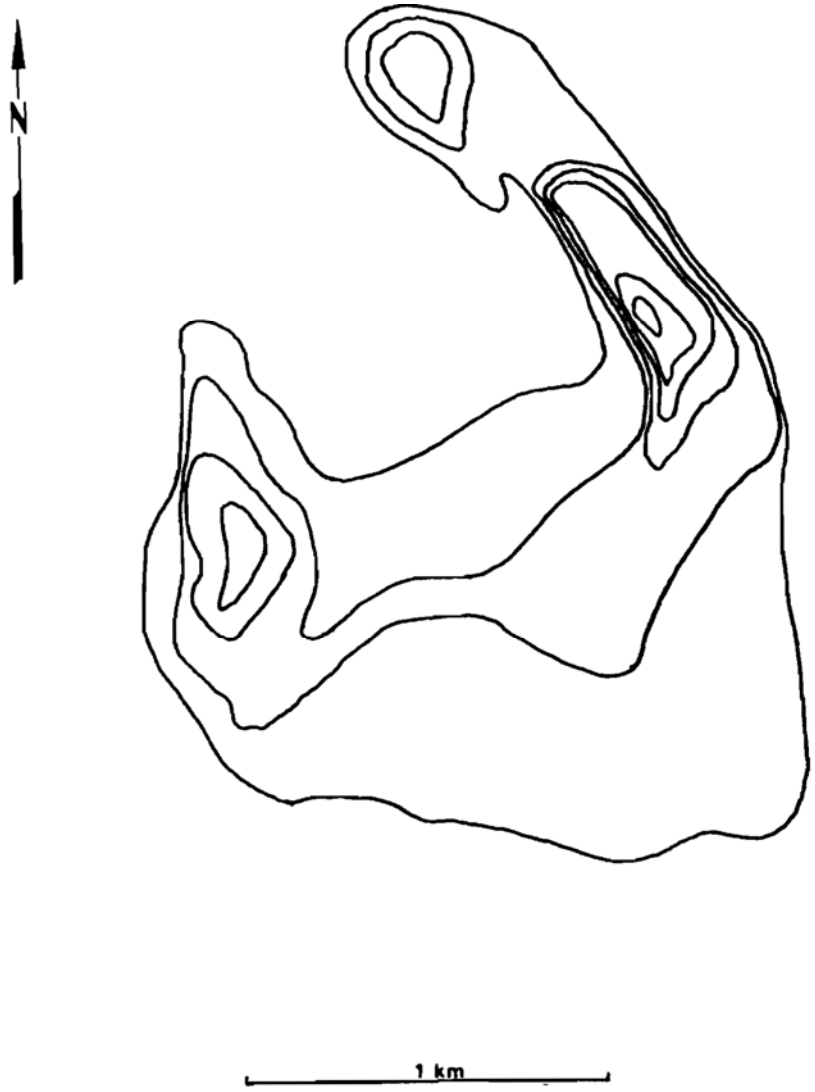
Appendix Figure 99. Bathymetric map of Lake 884-01, Lower Halfway Lake, Yukon Flats NWR, with 5-ft contour intervals (66.0817°N, 146.9404°W).



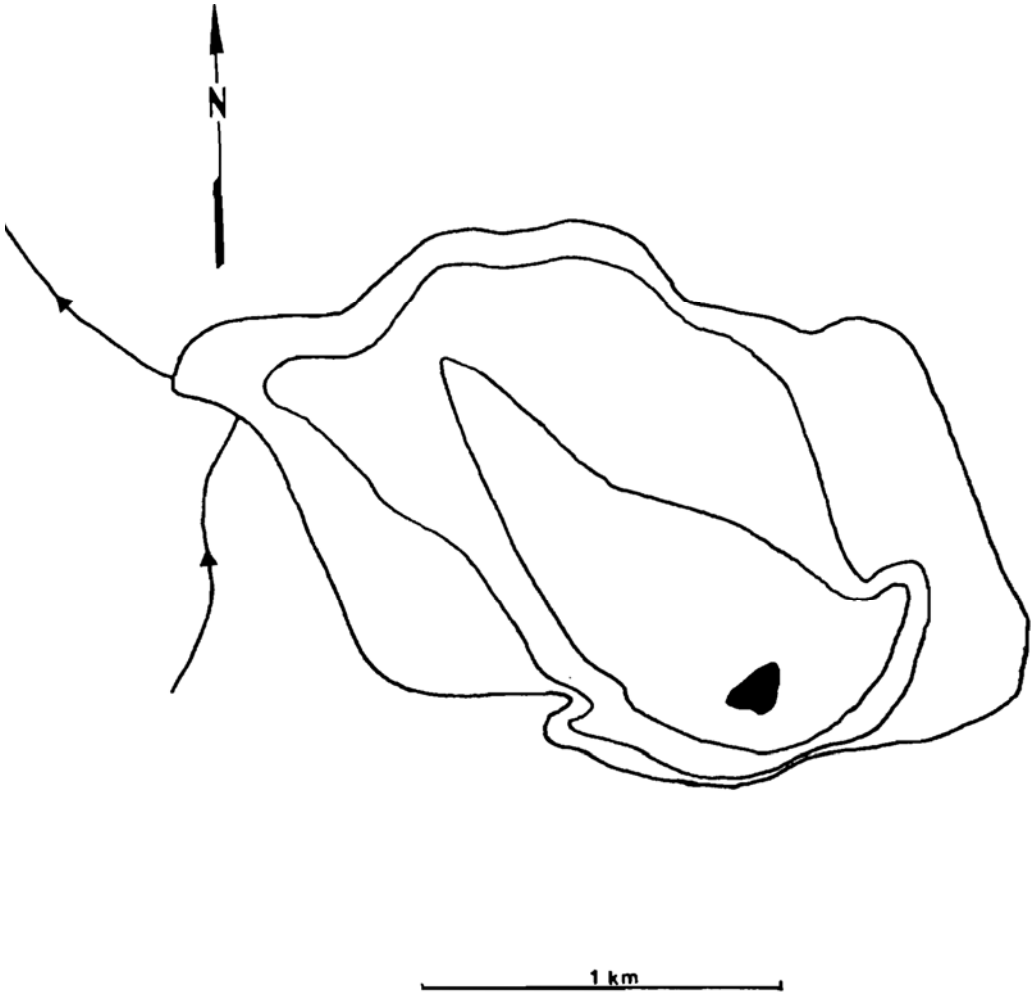
Appendix Figure 100. Bathymetric map of Lake 884-02, unnamed, Yukon Flats NWR, with 10-ft contour intervals (66.1005°N, 146.4113°W).



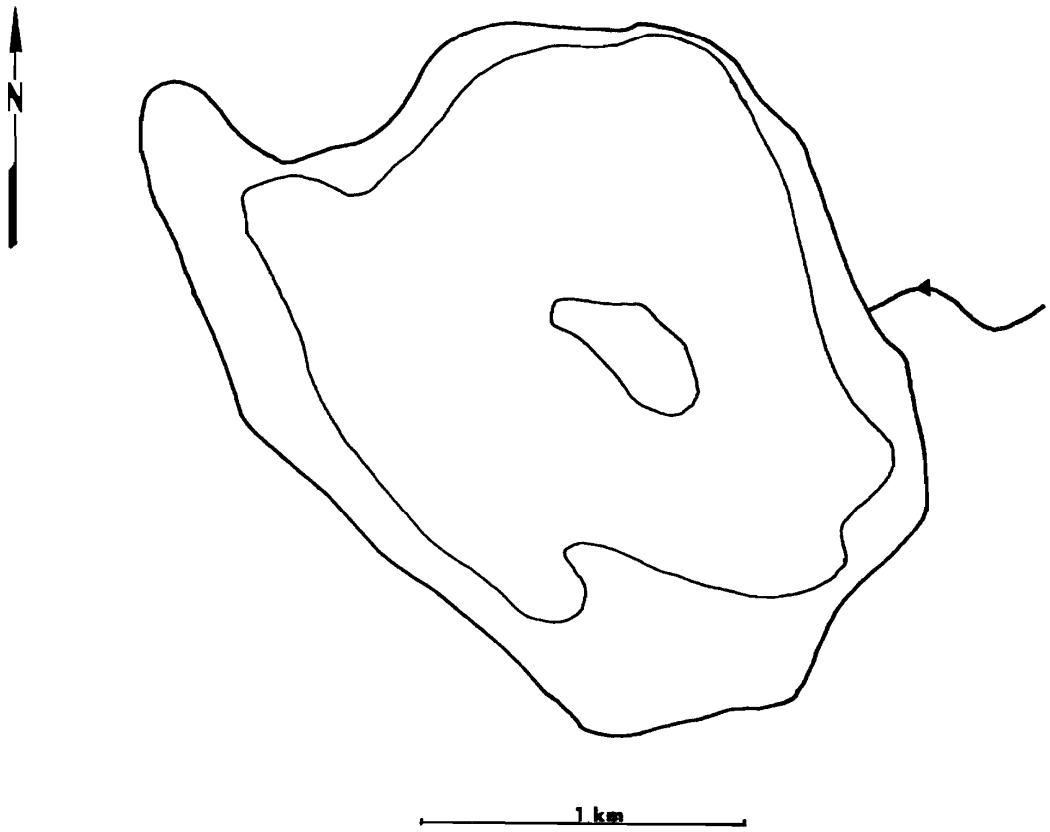
Appendix Figure 101. Bathymetric map of Lake 884-03, unnamed, Yukon Flats NWR, with 5-ft contour intervals (66.1256°N, 146.7412°W).



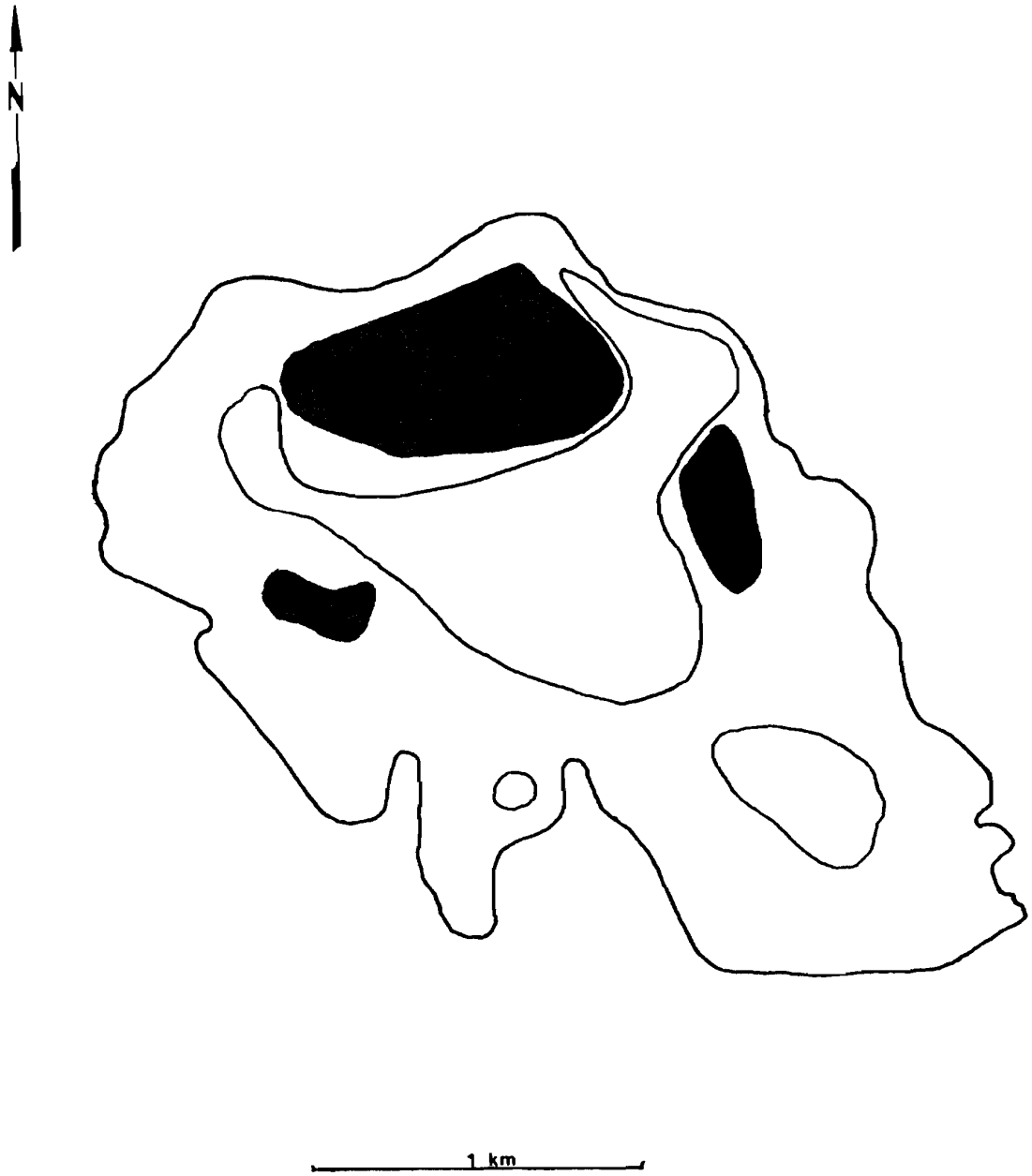
Appendix Figure 102. Bathymetric map of Lake 884-04, unnamed, Yukon Flats NWR, with 5-ft contour intervals (66.1216°N, 146.6663°W).



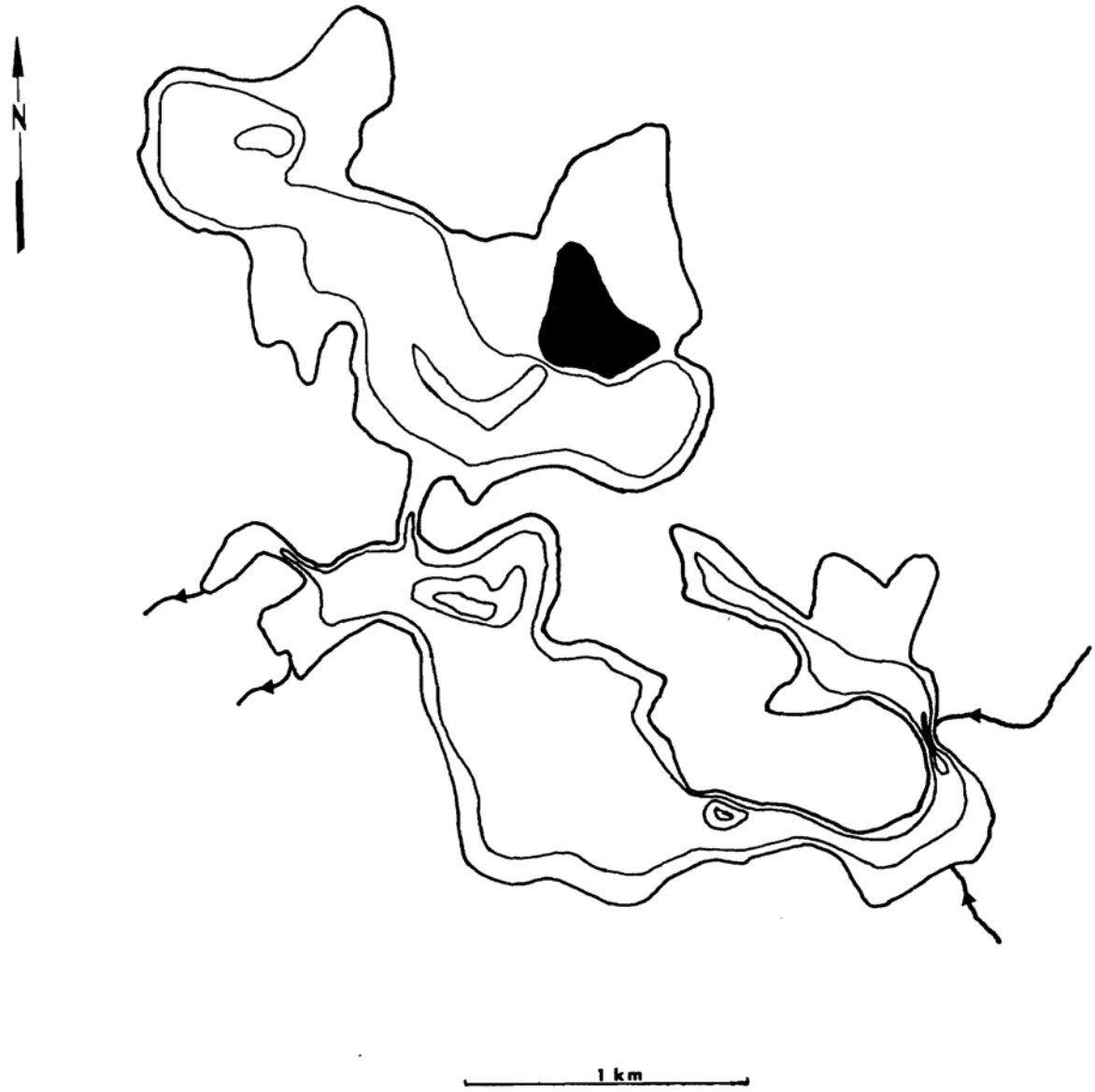
Appendix Figure 103. Bathymetric map of Lake 884-05, unnamed, Yukon Flats NWR, with 5-ft contour intervals (66.1722°N, 146.4185°W).



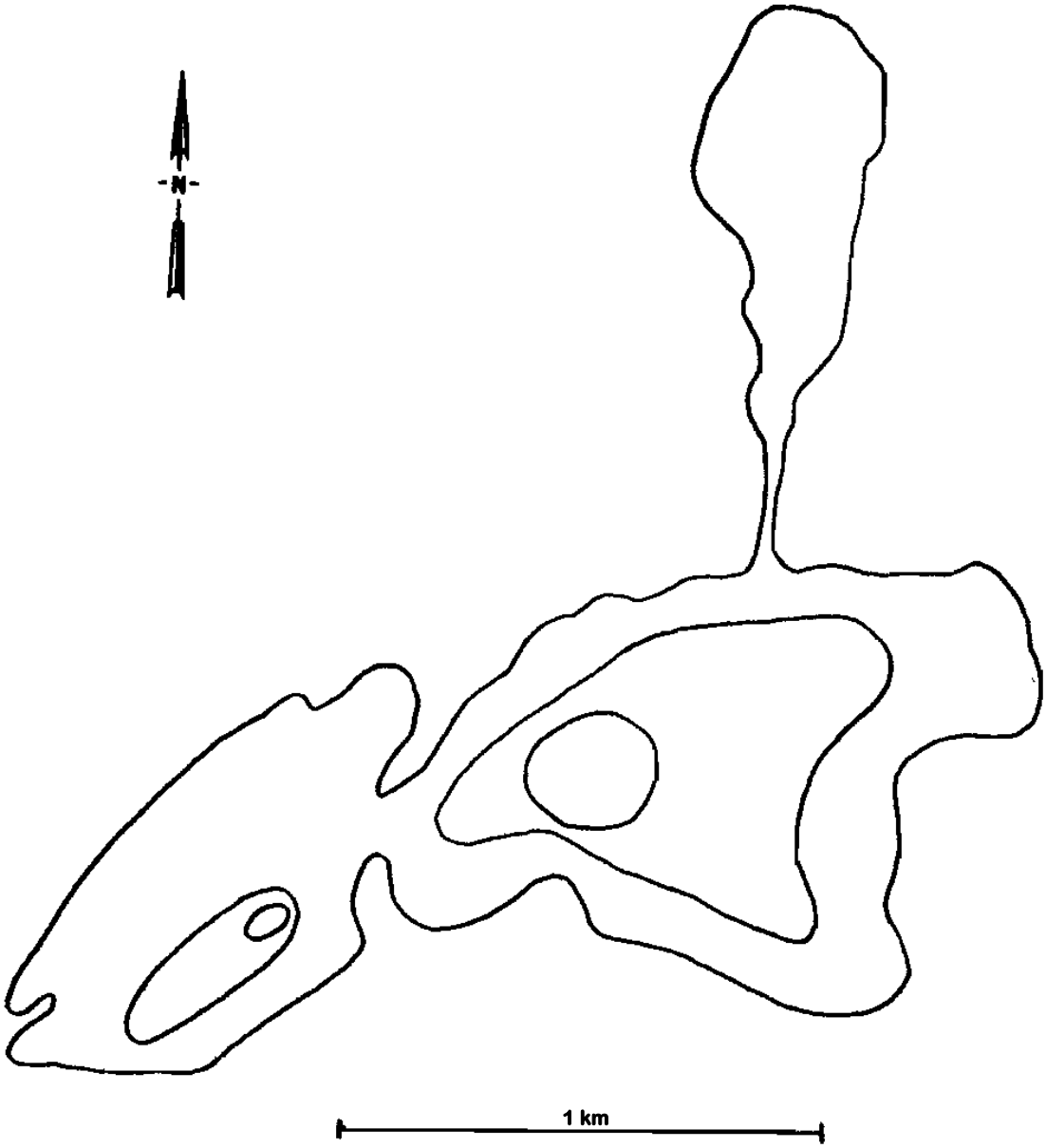
Appendix Figure 104. Bathymetric map of Lake 884-06, Ninemile Lake, Yukon Flats NWR, with 5-ft contour intervals (66.1857°N, 146.6560°W).



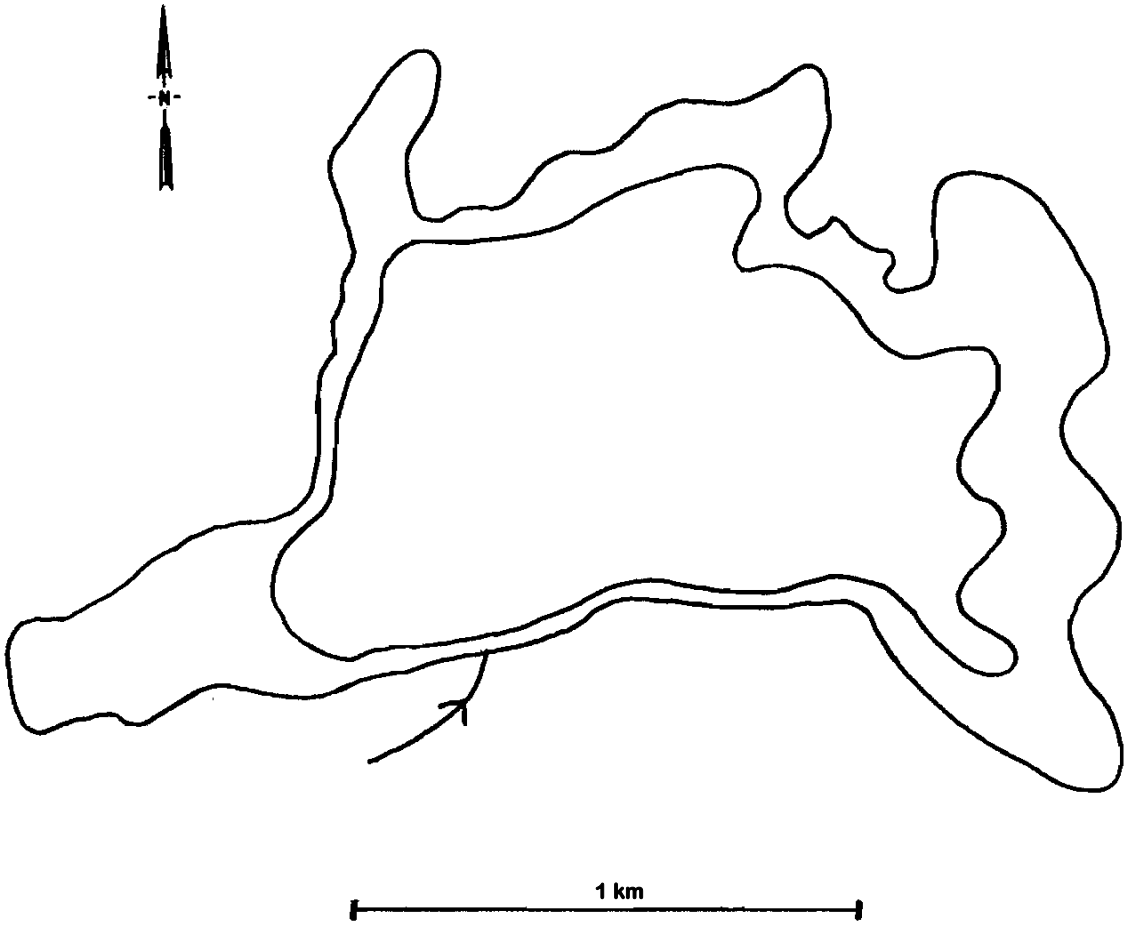
Appendix Figure 105. Bathymetric map of Lake 884-07, Canvasback Lake, Yukon Flats NWR, with 5-ft contour interval (66.3859°N, 146.3609°W).



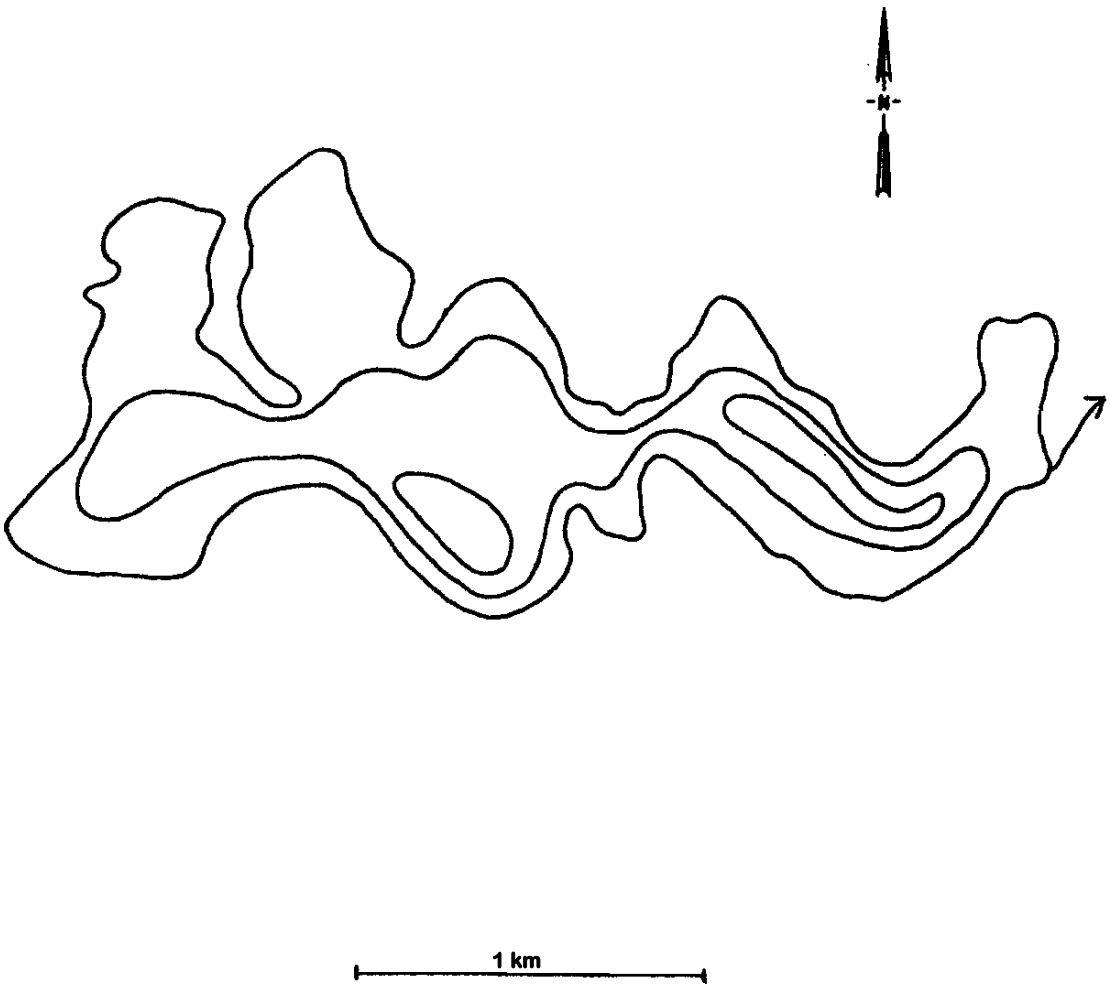
Appendix Figure 106. Bathymetric map of Lake 884-08, unnamed, Yukon Flats NWR, with 5-ft contour intervals (66.2314°N, 146.6373°W).



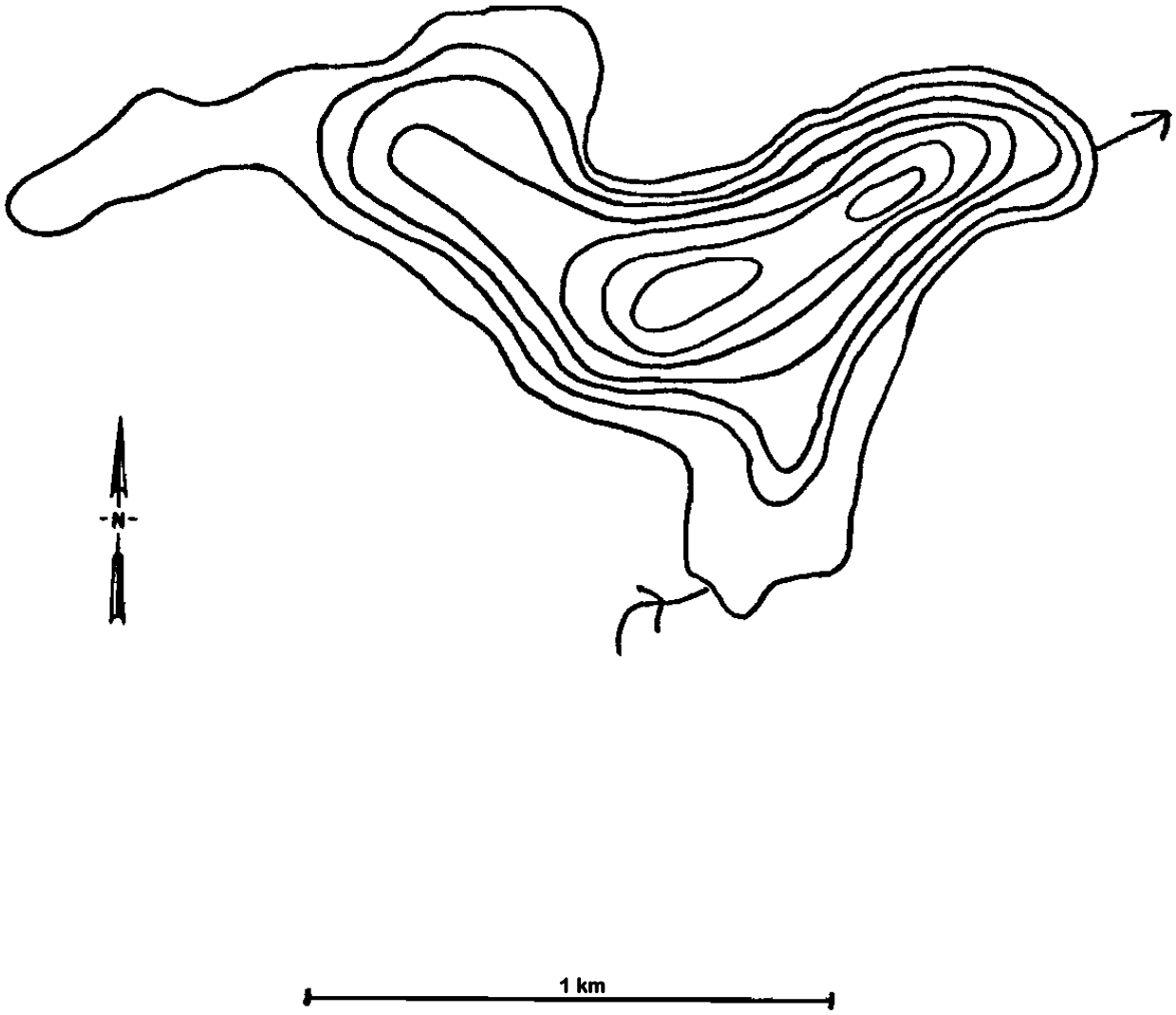
Appendix Figure 107. Bathymetric map of Lake 886-01, Sundown Lake, Yukon Flats NWR, with 5-ft contour intervals (66.1726°N, 147.9707°W).



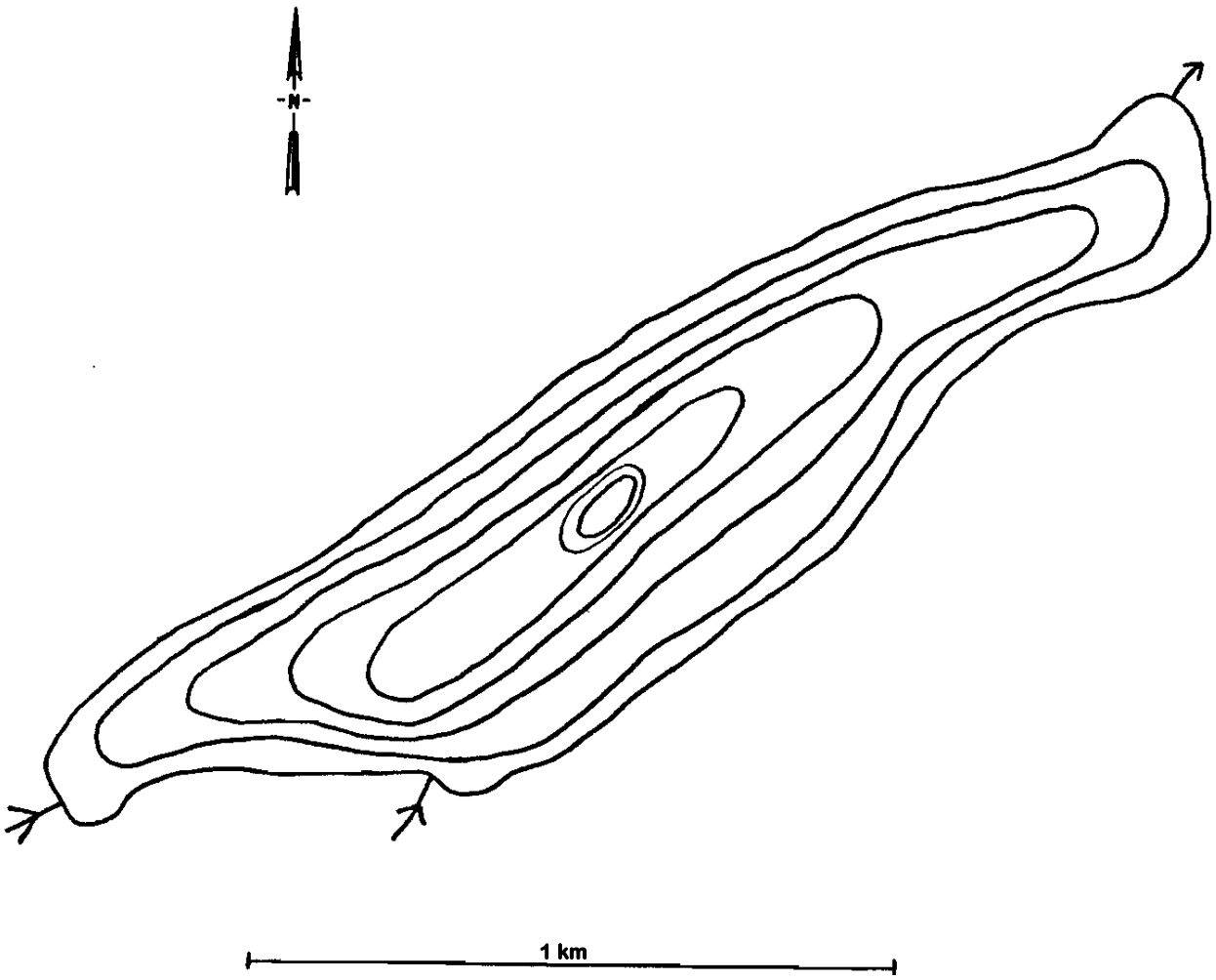
Appendix Figure 108. Bathymetric map of Lake 886-02, Tincan Lake, Yukon Flats NWR, with 5-ft contour interval (66.1679°N, 147.9107°W).



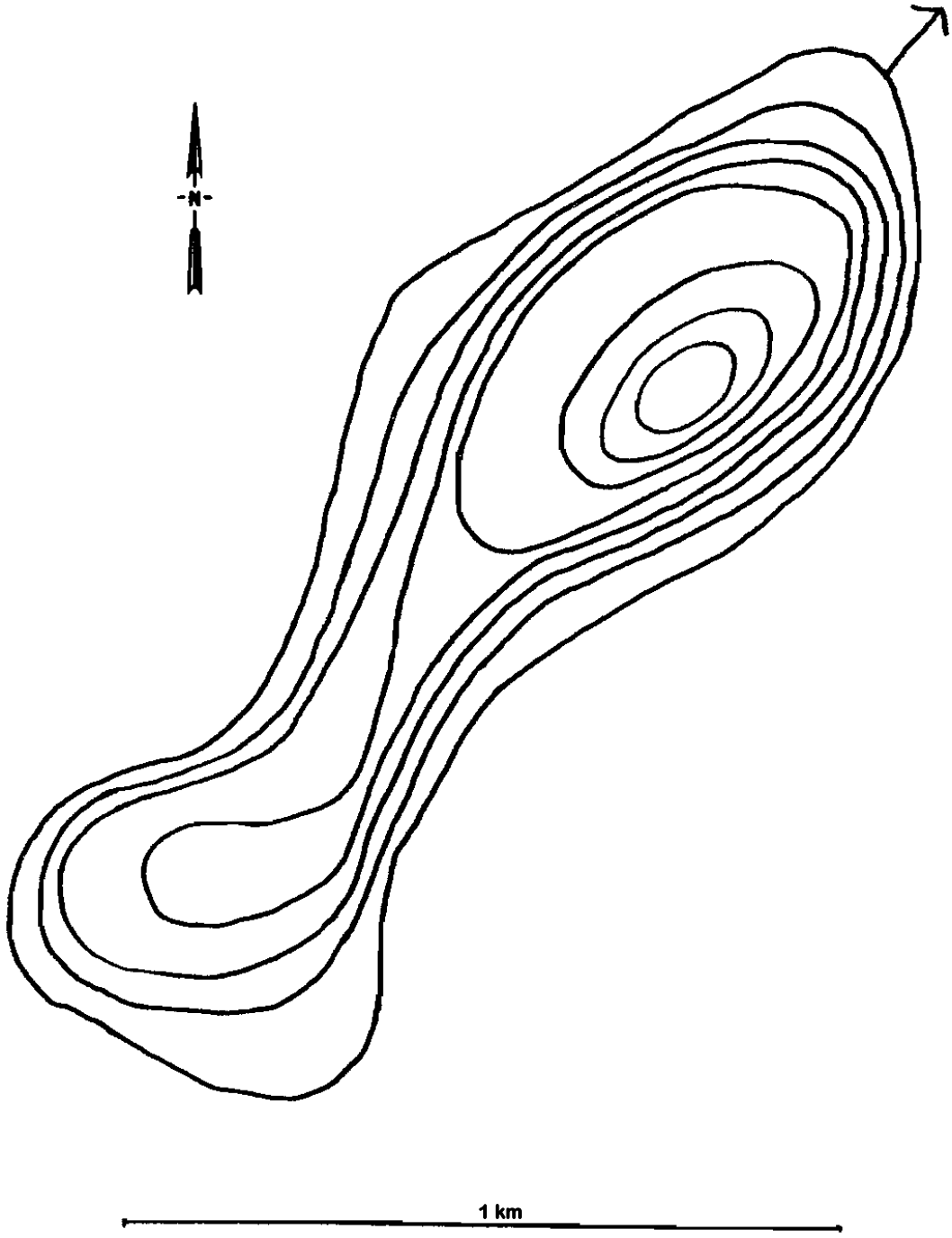
Appendix Figure 109. Bathymetric map of Lake 886-03, Sweeney Lake, Yukon Flats NWR, with 5-ft contour intervals (66.1512°N, 147.7341°W).



Appendix Figure 110. Bathymetric map of Lake 886-04, unnamed, Yukon Flats NWR, with 5-ft contour intervals (66.0696°N, 147.7151°W).

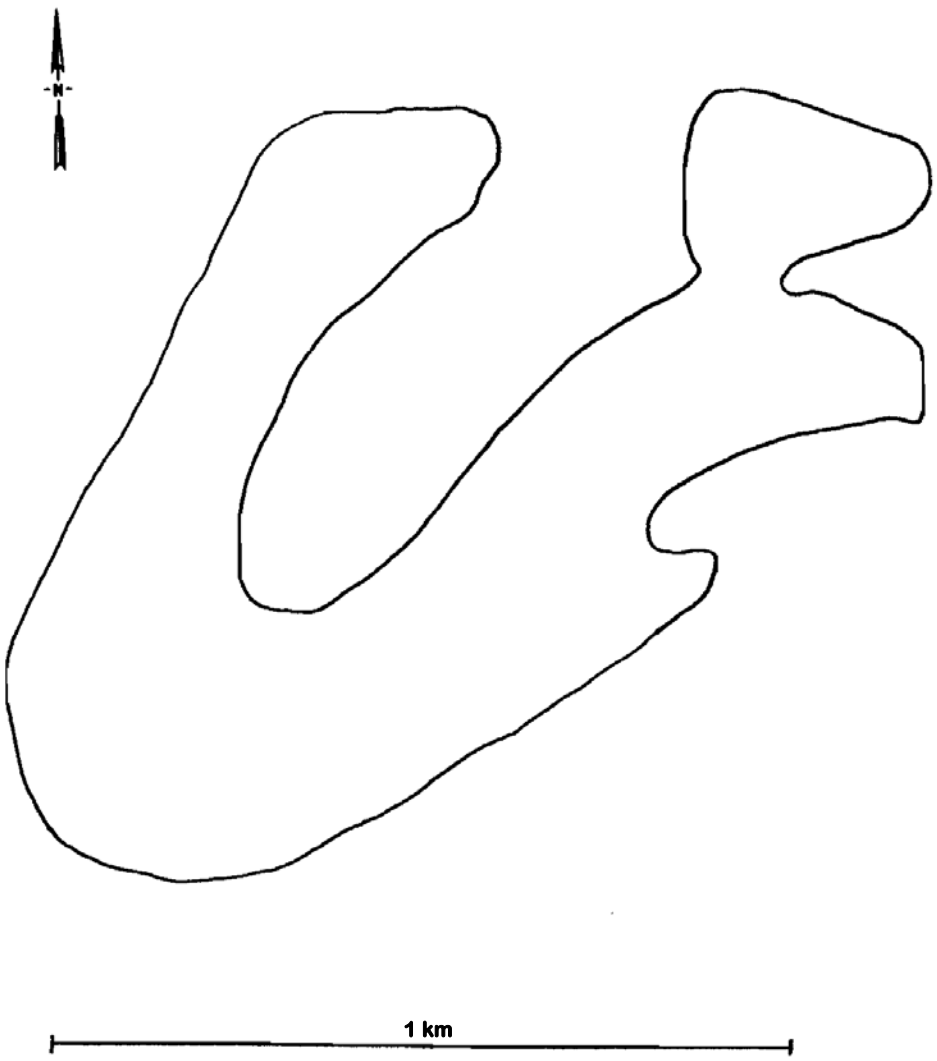


Appendix Figure 111. Bathymetric map of Lake 886-05, unnamed, Yukon Flats NWR, with 5-ft contour intervals (66.0764°N, 147.6132°W).

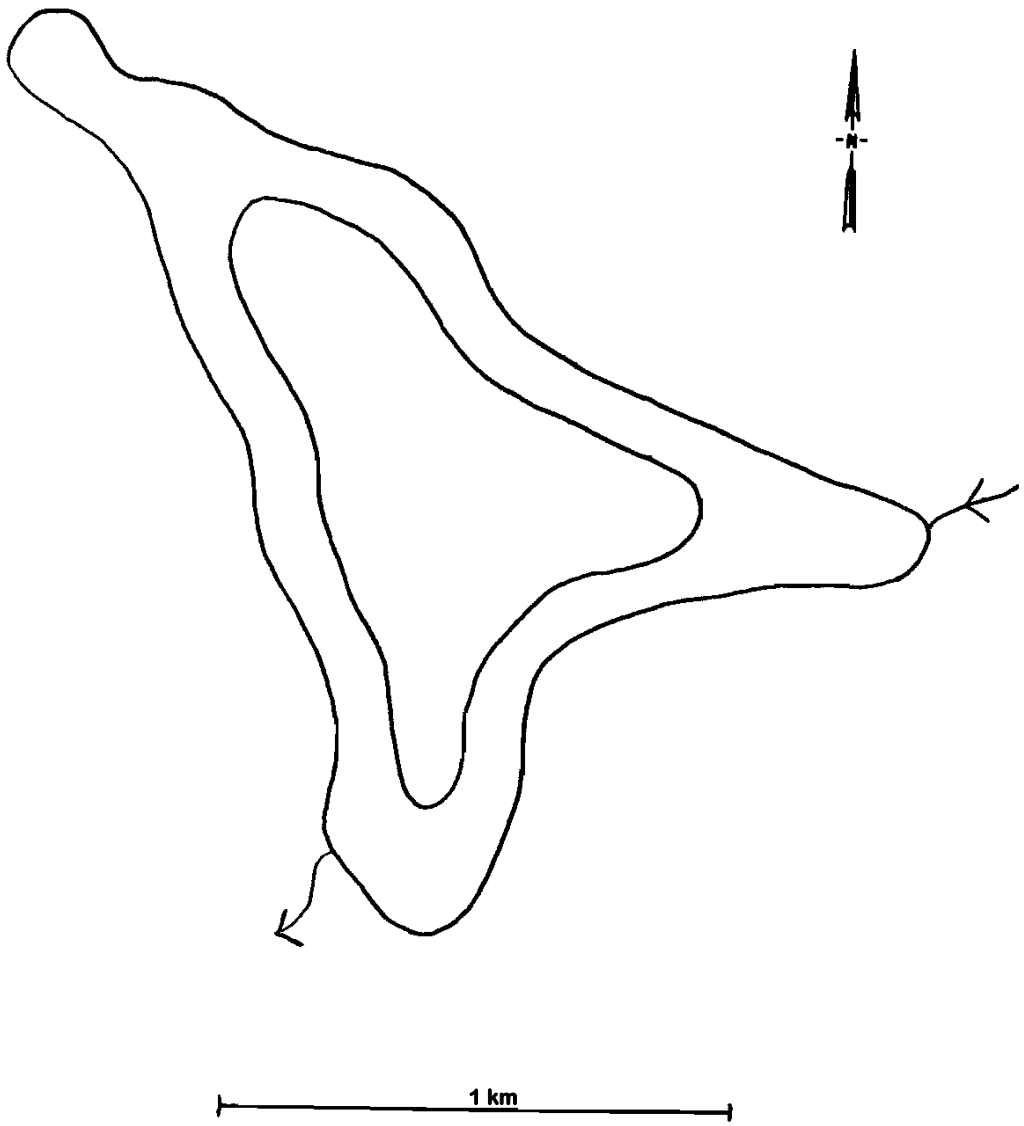


Appendix Figure 112. Bathymetric map of Lake 886-06, unnamed, Yukon Flats NWR, with 5-ft contour intervals (66.0314°N, 147.5508°W).

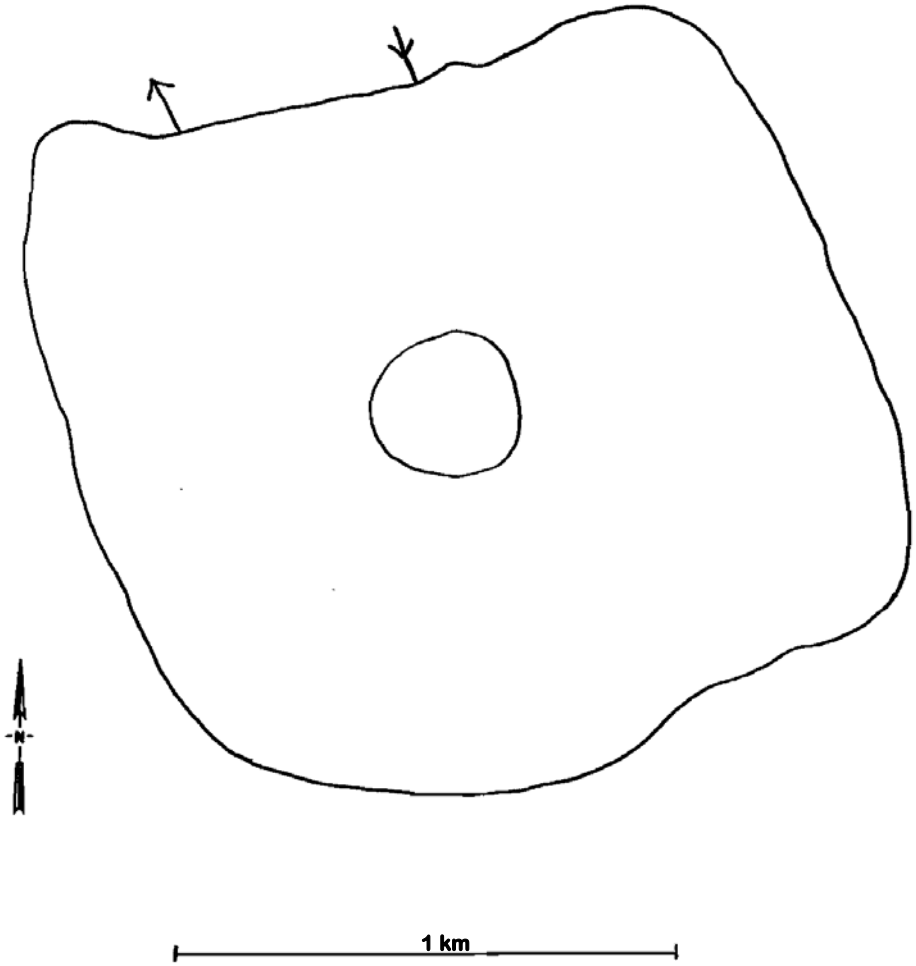
Appendix Figure 113. Bathymetric map of Lake 886-07, Indian Portage Lake, Yukon Flats NWR, with 5-ft contour intervals (66.2013°N, 148.0899°W).



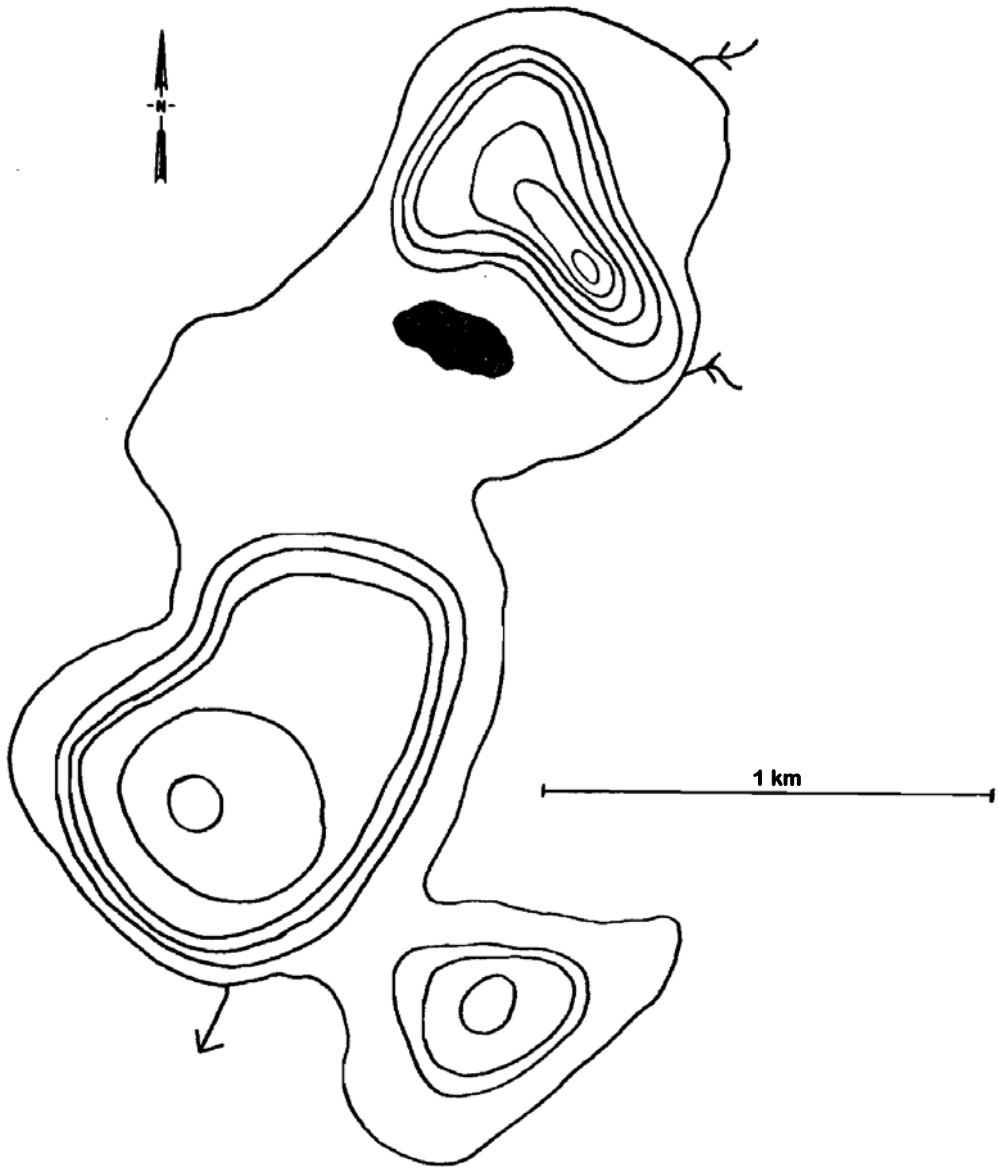
Appendix Figure 114. Bathymetric map of Lake 886-08, Mallard Lake, Yukon Flats NWR, maximum depth less than 5 ft (66.3324°N, 147.9803°W).



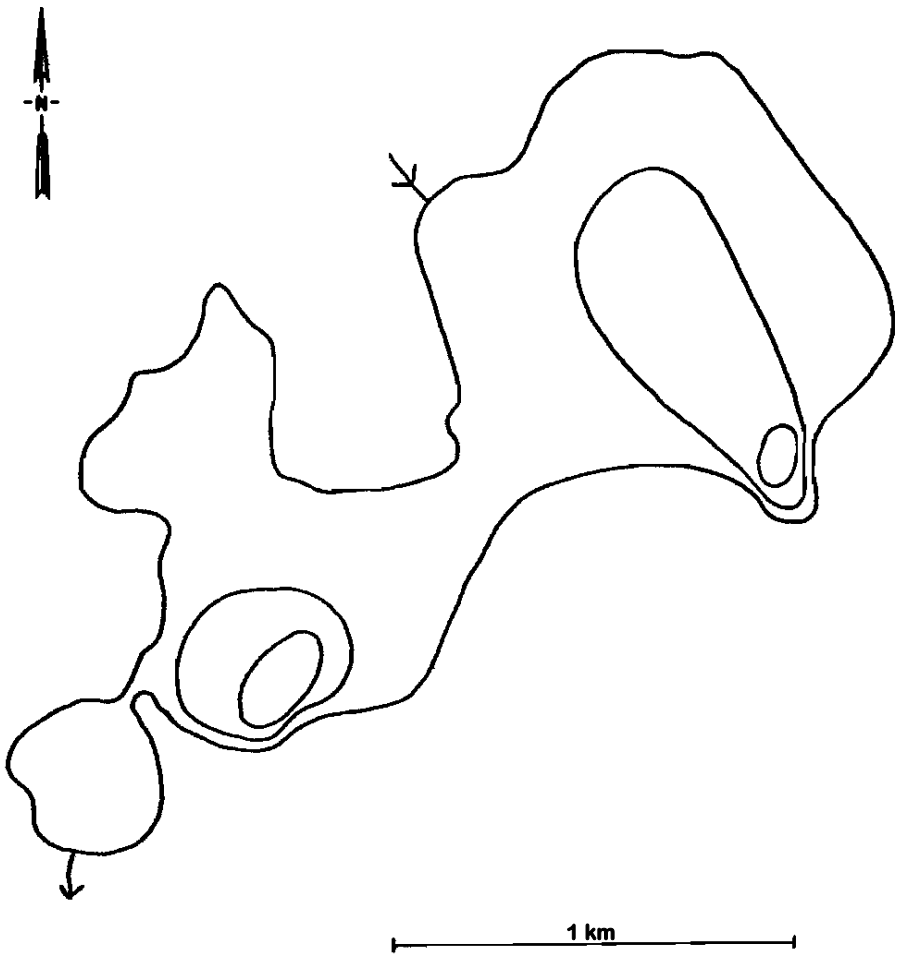
Appendix Figure 115. Bathymetric map of Lake 886-09, unnamed, Yukon Flats NWR, with 5-ft contour interval (66.3604°N, 148.5799°W).



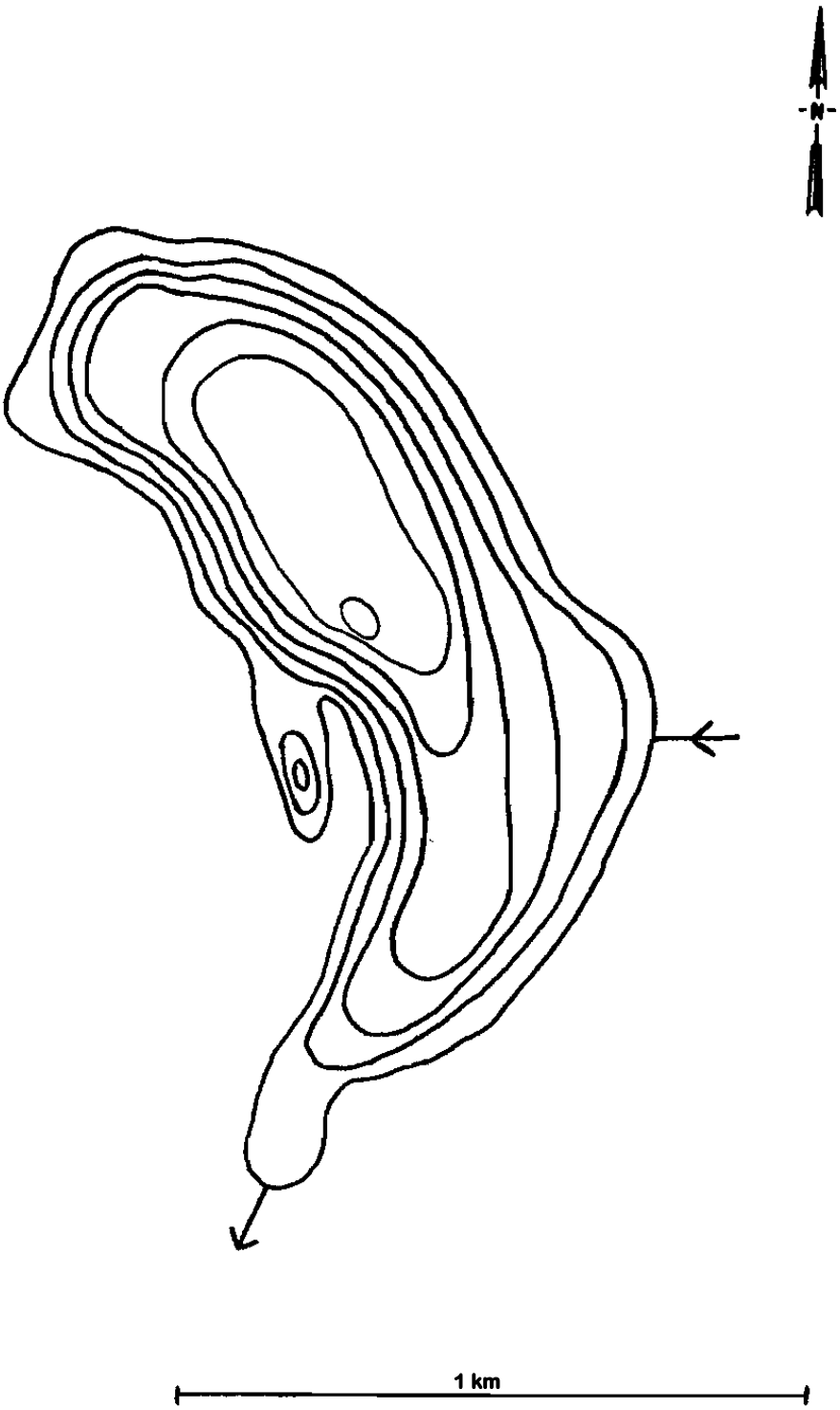
Appendix Figure 116. Bathymetric map of Lake 886-10, Flat Lake, Yukon Flats NWR, with 5-ft contour interval (66.2989°N, 148.6746°W).



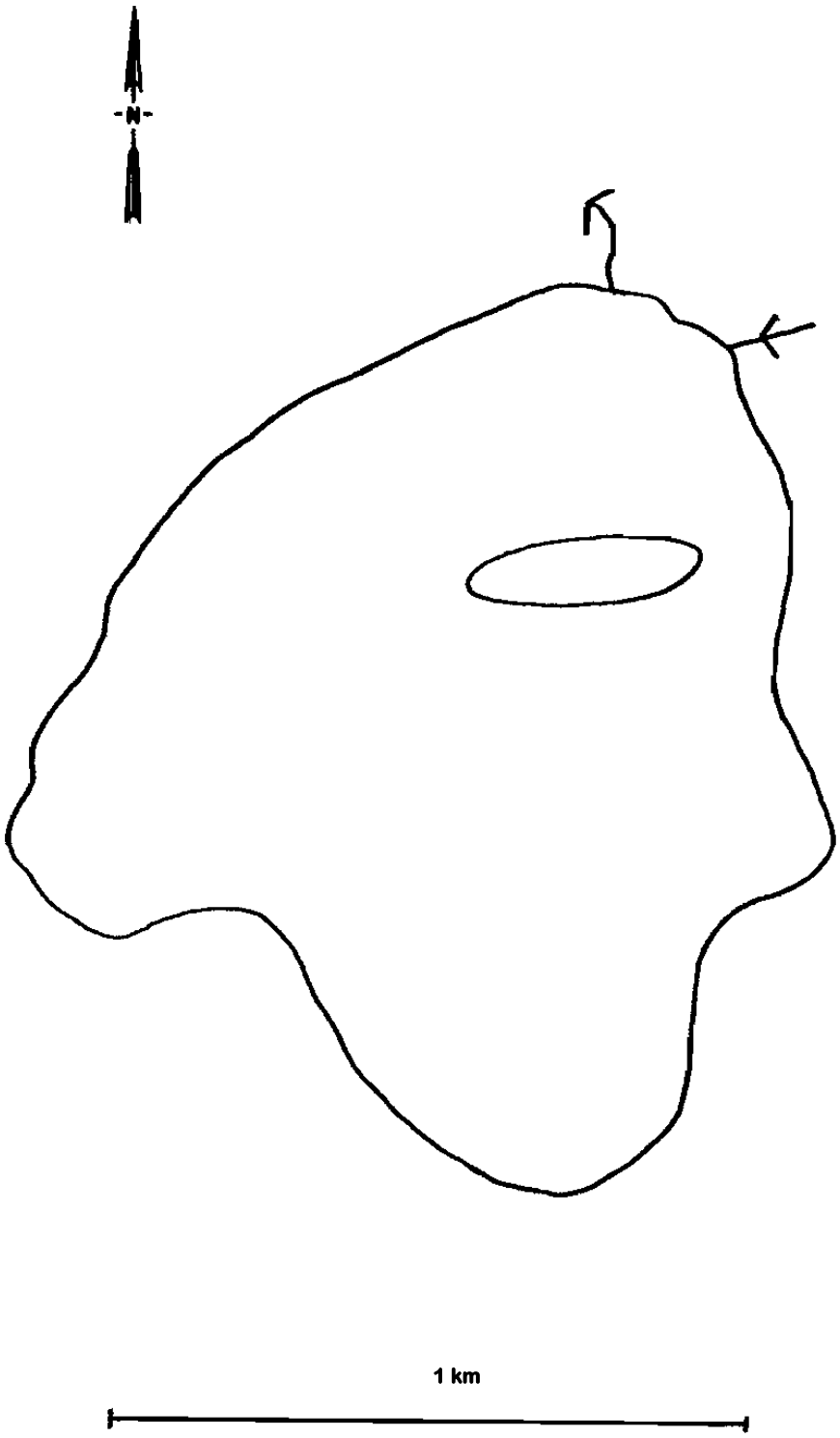
Appendix Figure 117. Bathymetric map of Lake 886-11, unnamed, Yukon Flats NWR, with 5-ft contour intervals (66.8888°N, 145.2048°W).



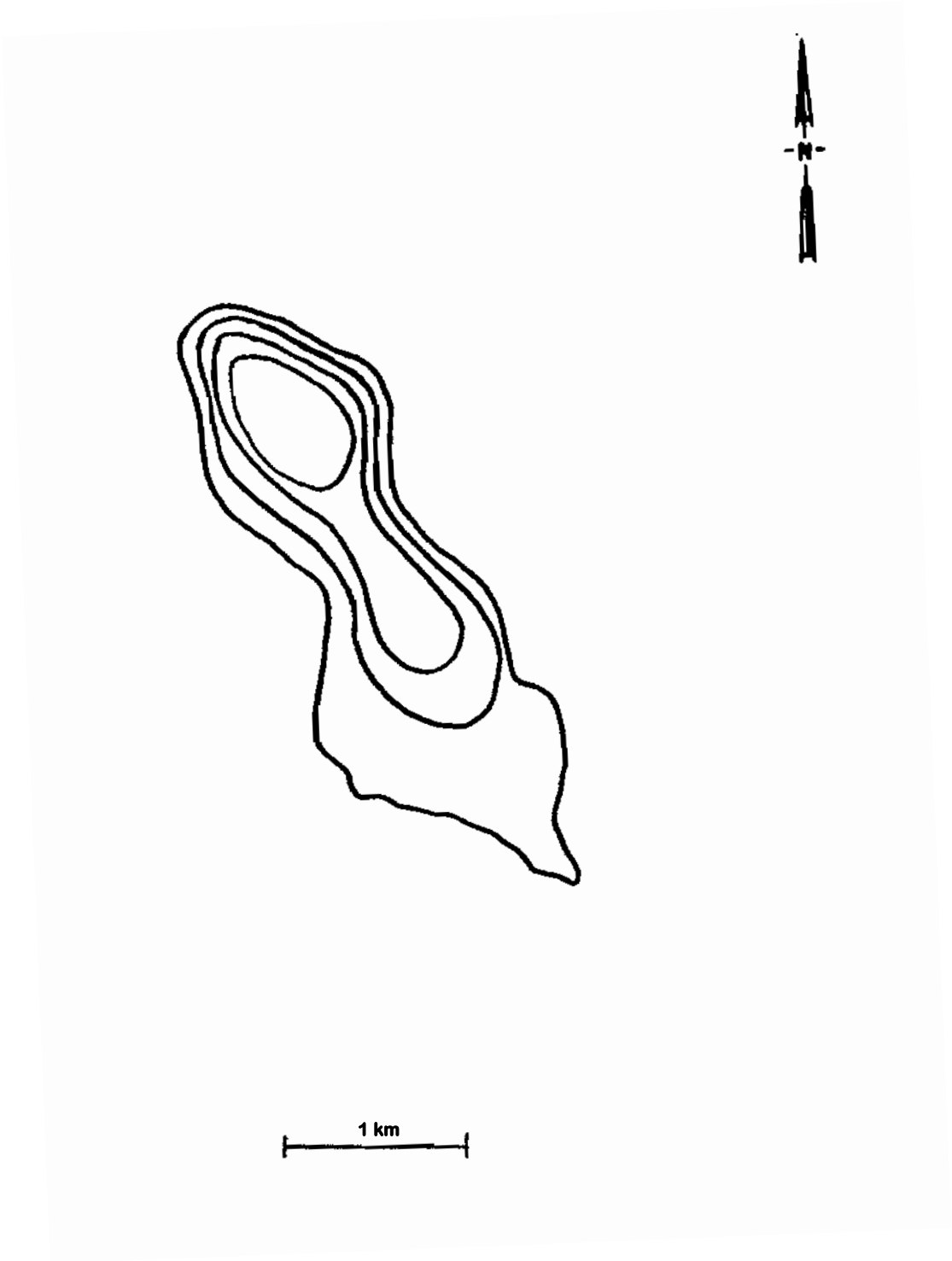
Appendix Figure 118. Bathymetric map of Lake 886-12, unnamed, Yukon Flats NWR, with 5-ft contour intervals (66.8047°N, 145.4153°W).



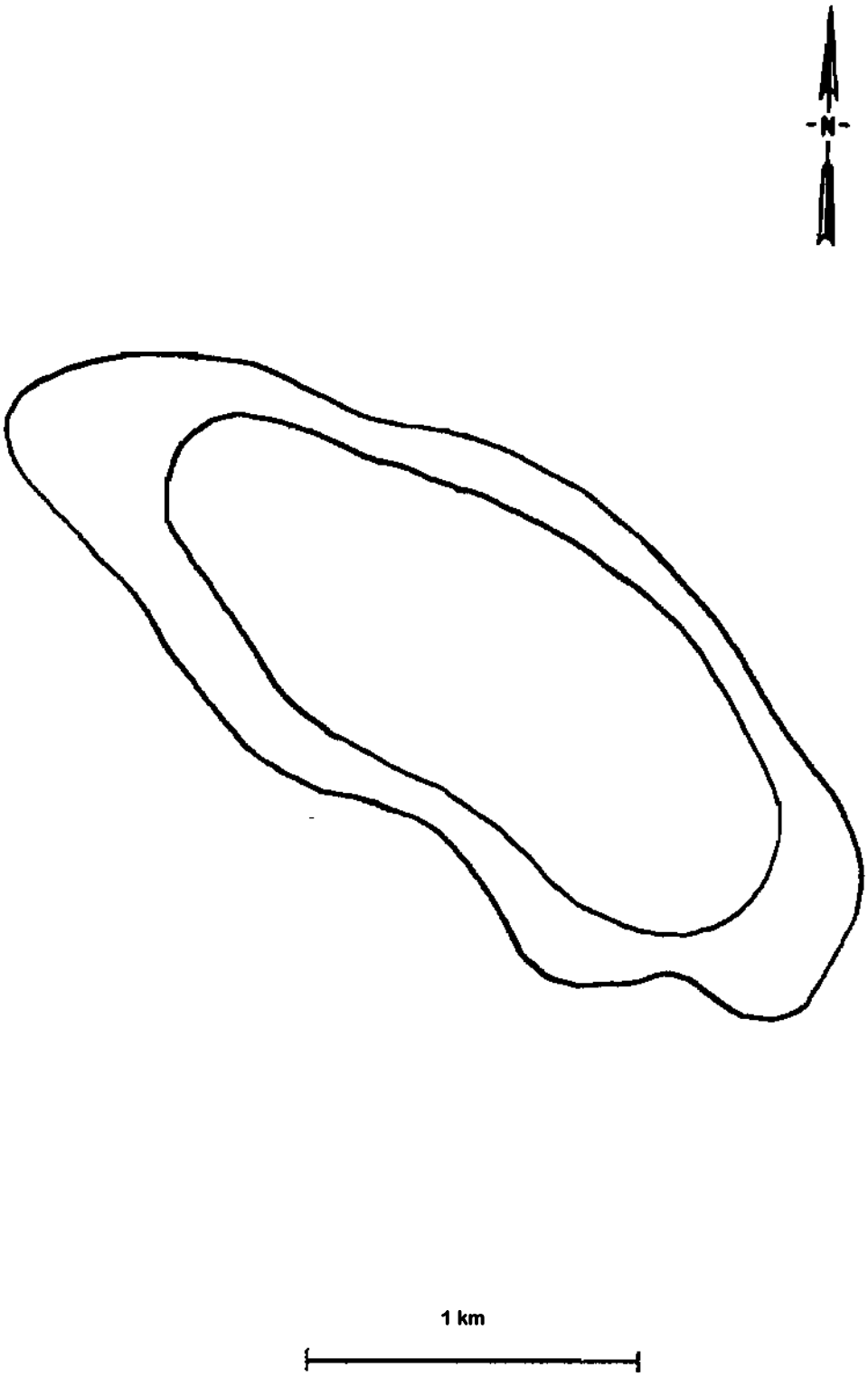
Appendix Figure 119. Bathymetric map of Lake 886-13, unnamed, Yukon Flats NWR, with 5-ft contour intervals (66.8034°N, 145.1168°W).



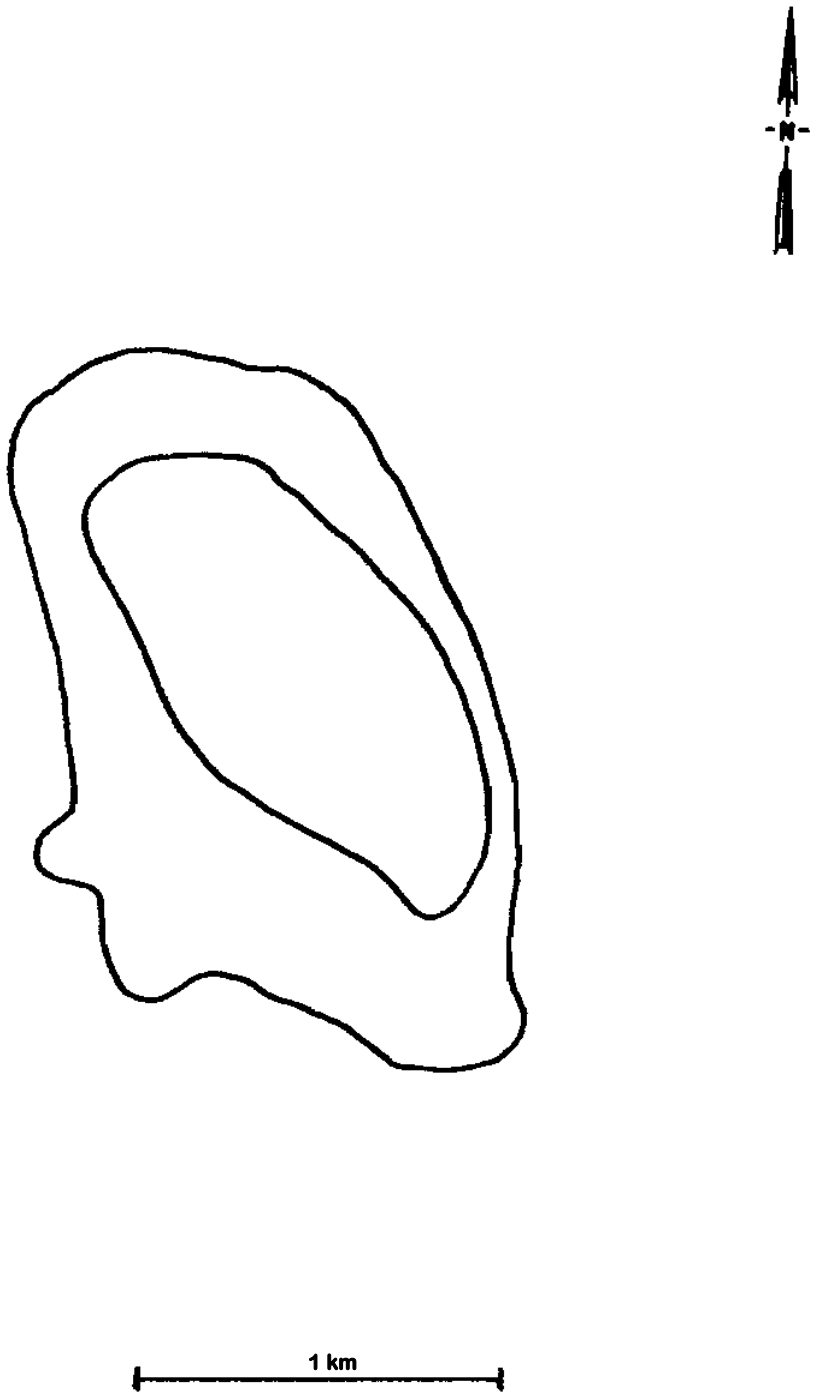
Appendix Figure 120. Bathymetric map of Lake 886-14, unnamed, Yukon Flats NWR, with 5-ft contour interval (66.8058°N, 144.8954°W).



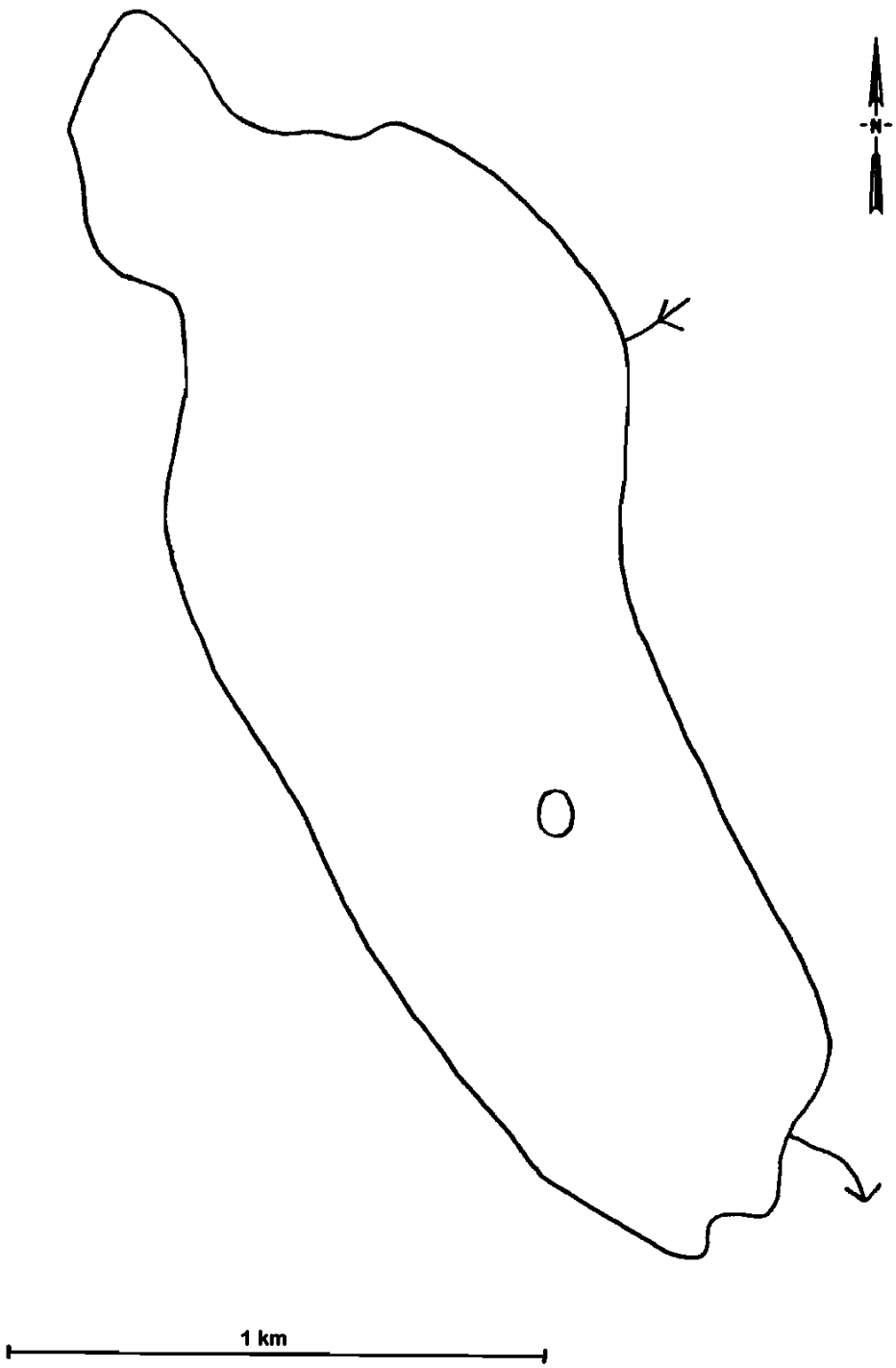
Appendix Figure 121. Bathymetric map of Lake 886-15, unnamed, Yukon Flats NWR, with 5-ft contour intervals (67.1799°N, 144.8003°W).



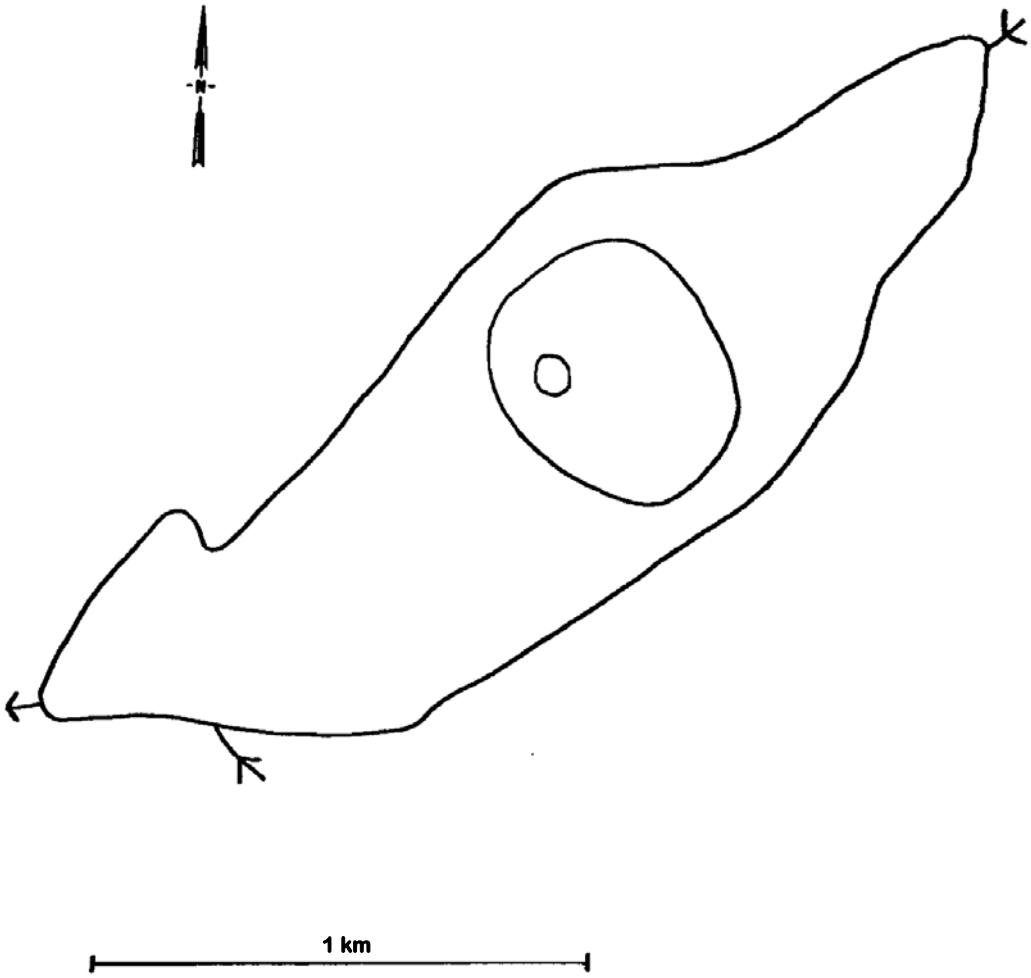
Appendix Figure 122. Bathymetric map of Lake 886-16, Kwittevunkud Lake, Yukon Flats NWR, with 5-ft contour interval (67.2688°N, 144.8165°W).



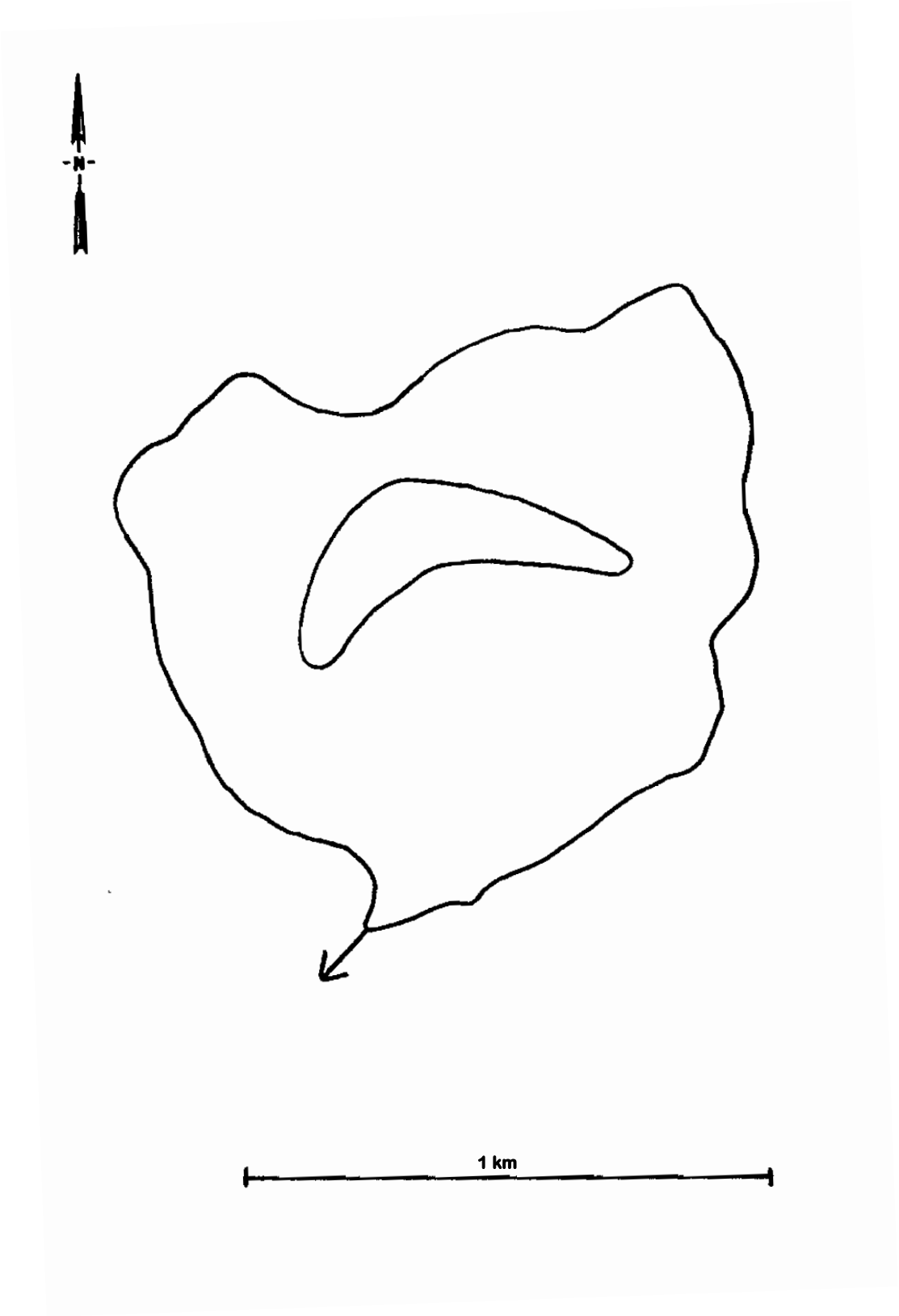
Appendix Figure 123. Bathymetric map of Lake 886-17, Big Lake, Yukon Flats NWR, with 5-ft contour interval (67.3144°N, 143.6653°W).



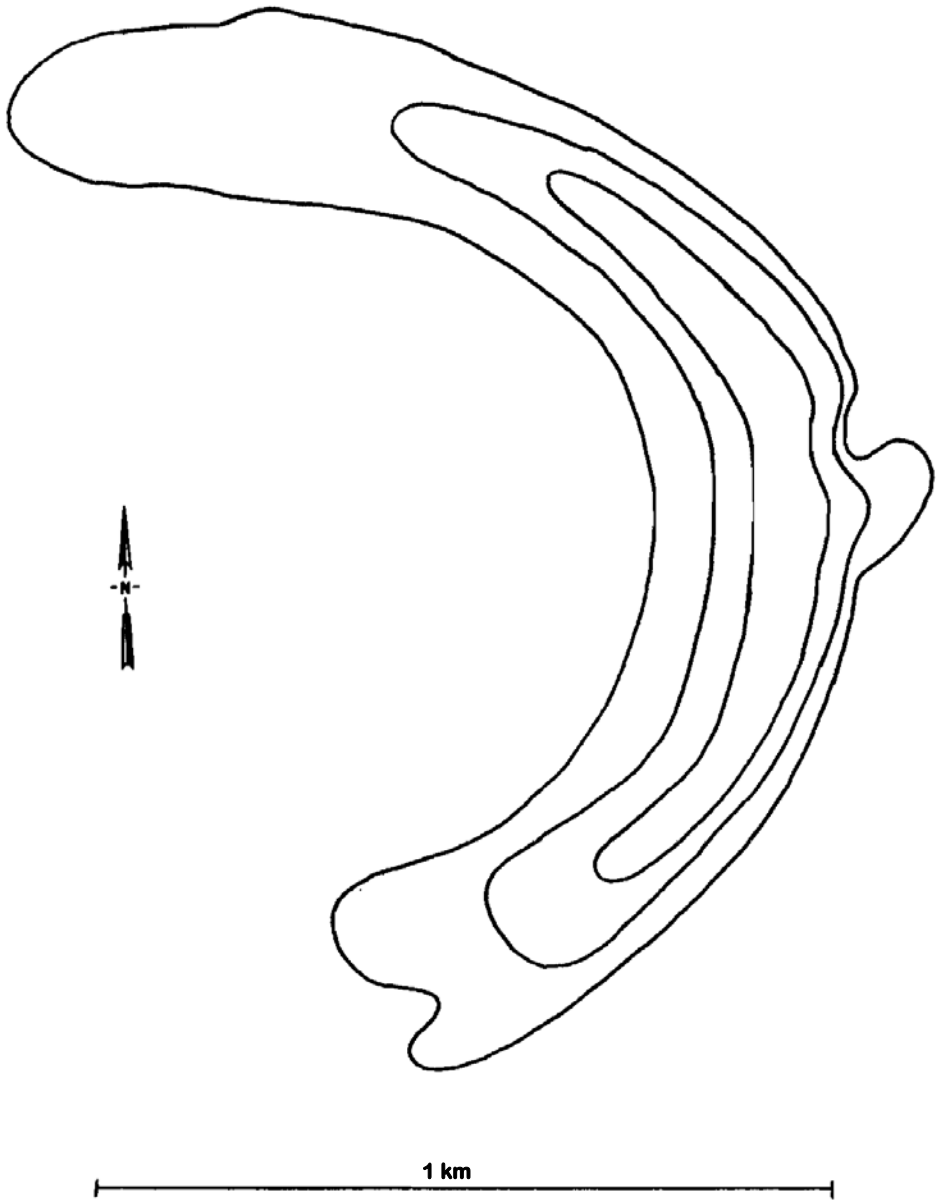
Appendix Figure 124. Bathymetric map of Lake 886-18, Big Rat Lake, Yukon Flats NWR, with 5-ft contour interval (67.1283°N, 143.6029°W).



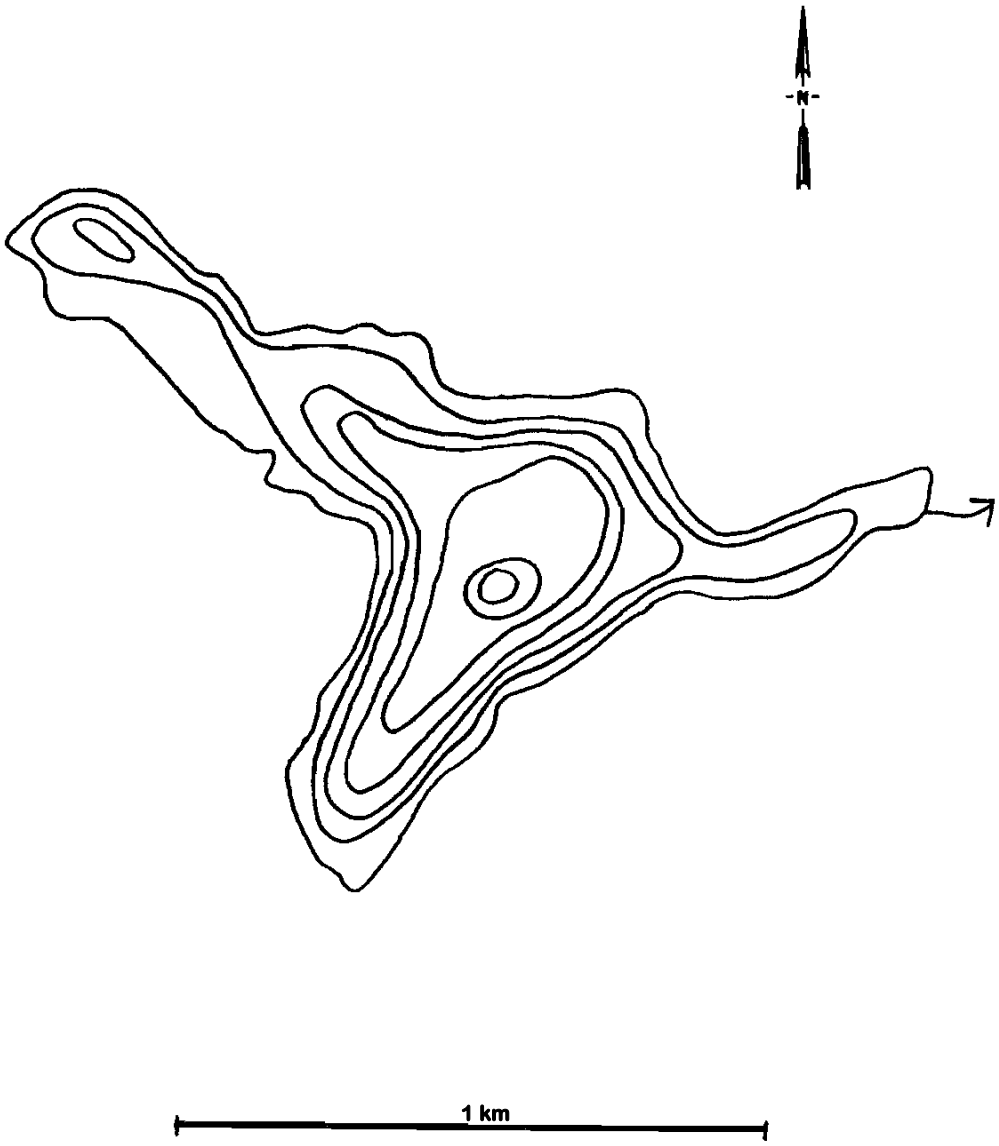
Appendix Figure 125. Bathymetric map of Lake 886-19, unnamed, Yukon Flats NWR, with 5-ft contour intervals (67.1905°N, 143.3837°W).



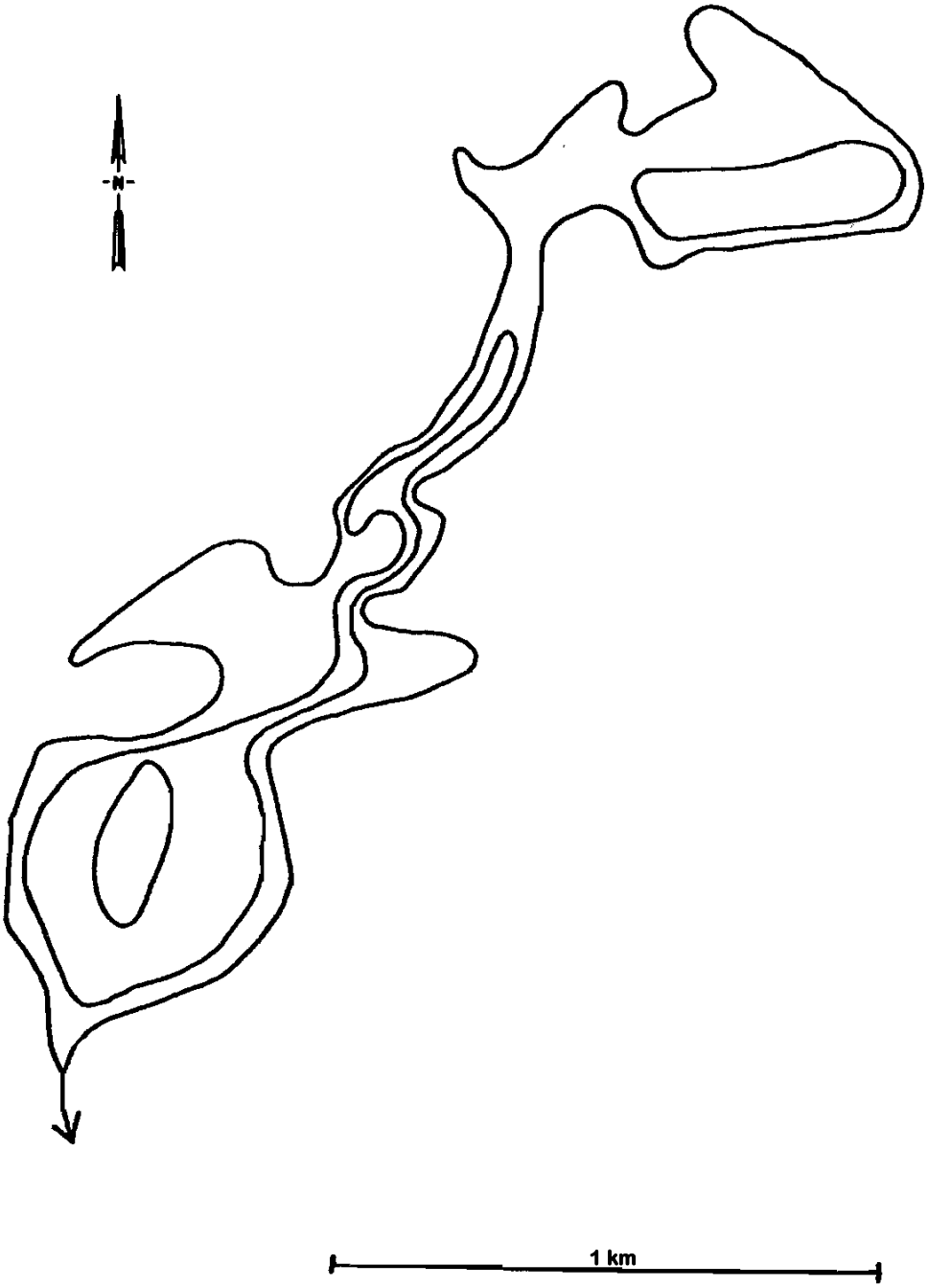
Appendix Figure 126. Bathymetric map of Lake 886-20, Sams Big Lake, Yukon Flats NWR, with 5-ft contour interval (66.9131°N, 143.8796°W).



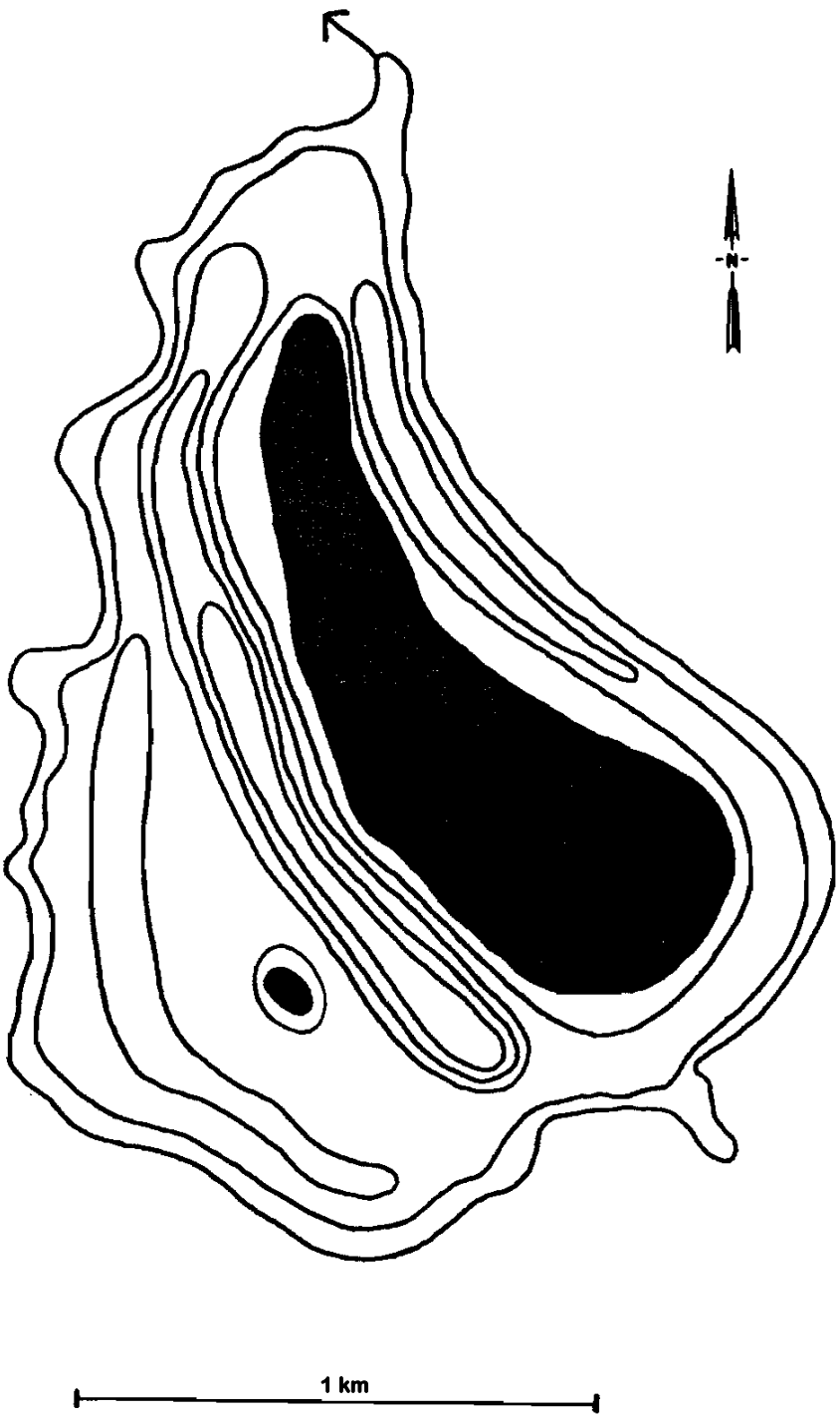
Appendix Figure 127. Bathymetric map of Lake 886-21, unnamed, Yukon Flats NWR, with 5-ft contour intervals (66.7040°N, 144.1337°W).



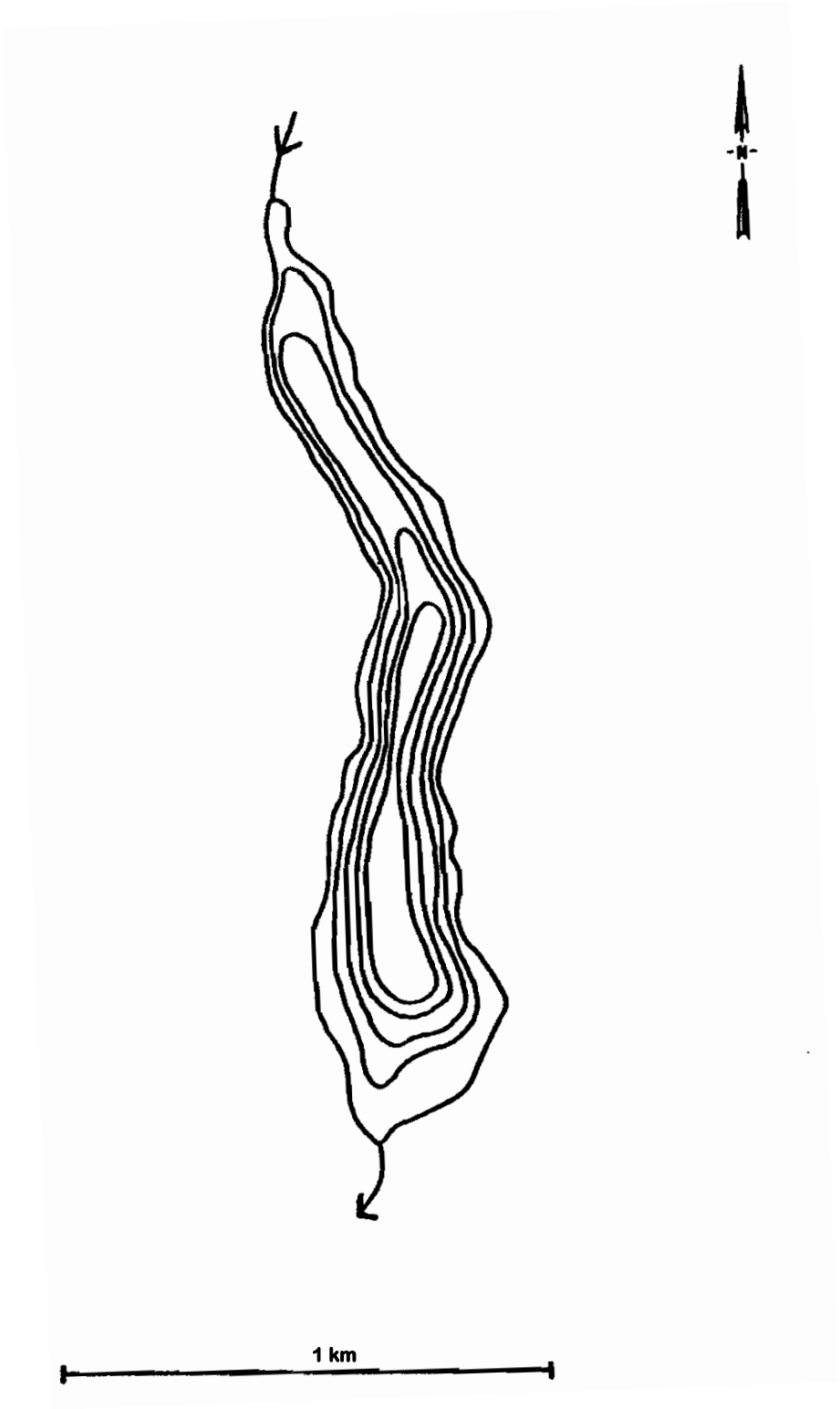
Appendix Figure 128. Bathymetric map of Lake 886-22, unnamed, Yukon Flats NWR, with 10-ft contour intervals (66.4728°N, 142.6834°W).



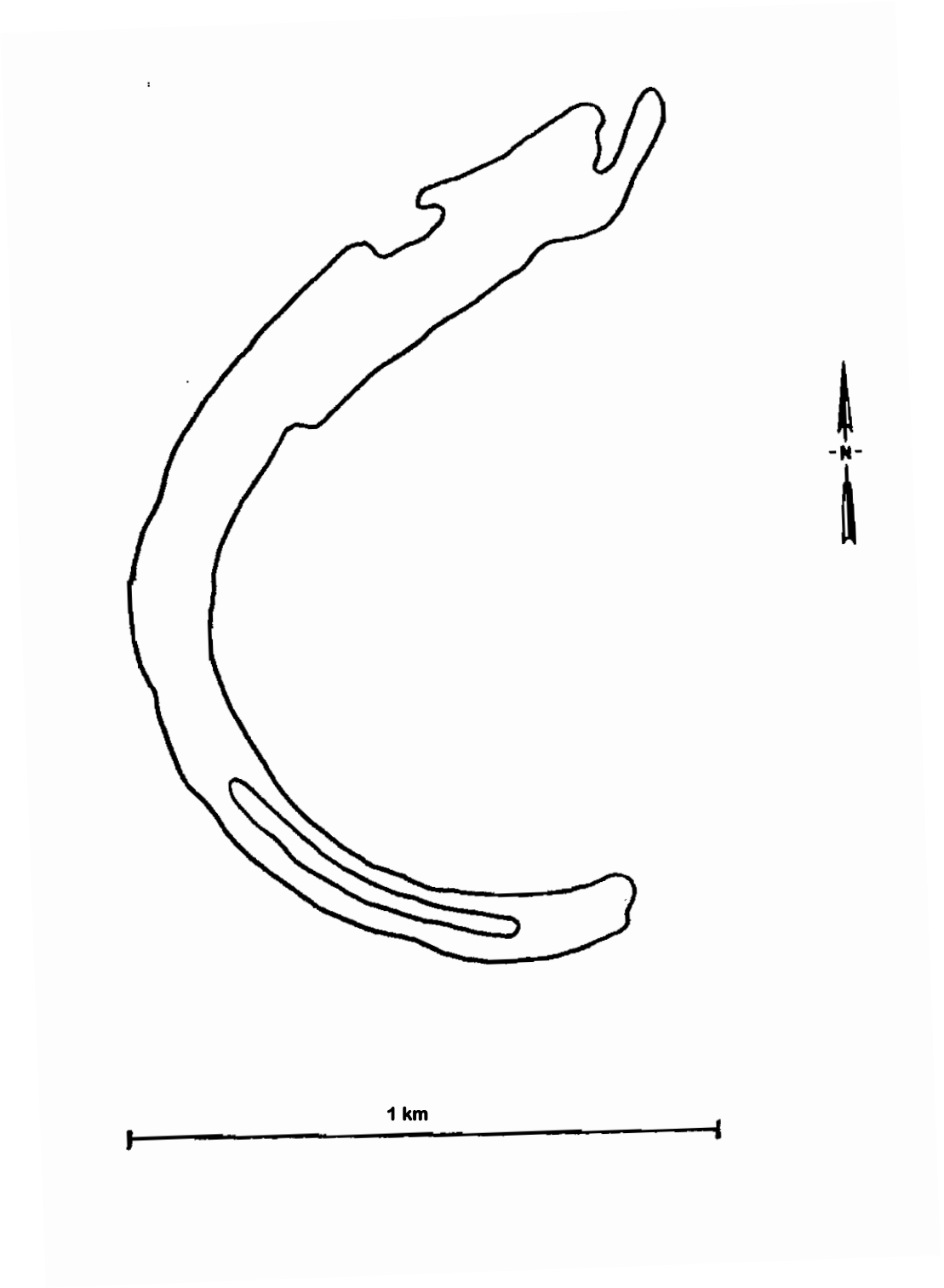
Appendix Figure 129. Bathymetric map of Lake 886-23, Birch Lake, Yukon Flats NWR, with 5-ft contour intervals (66.3468°N, 142.6272°W).



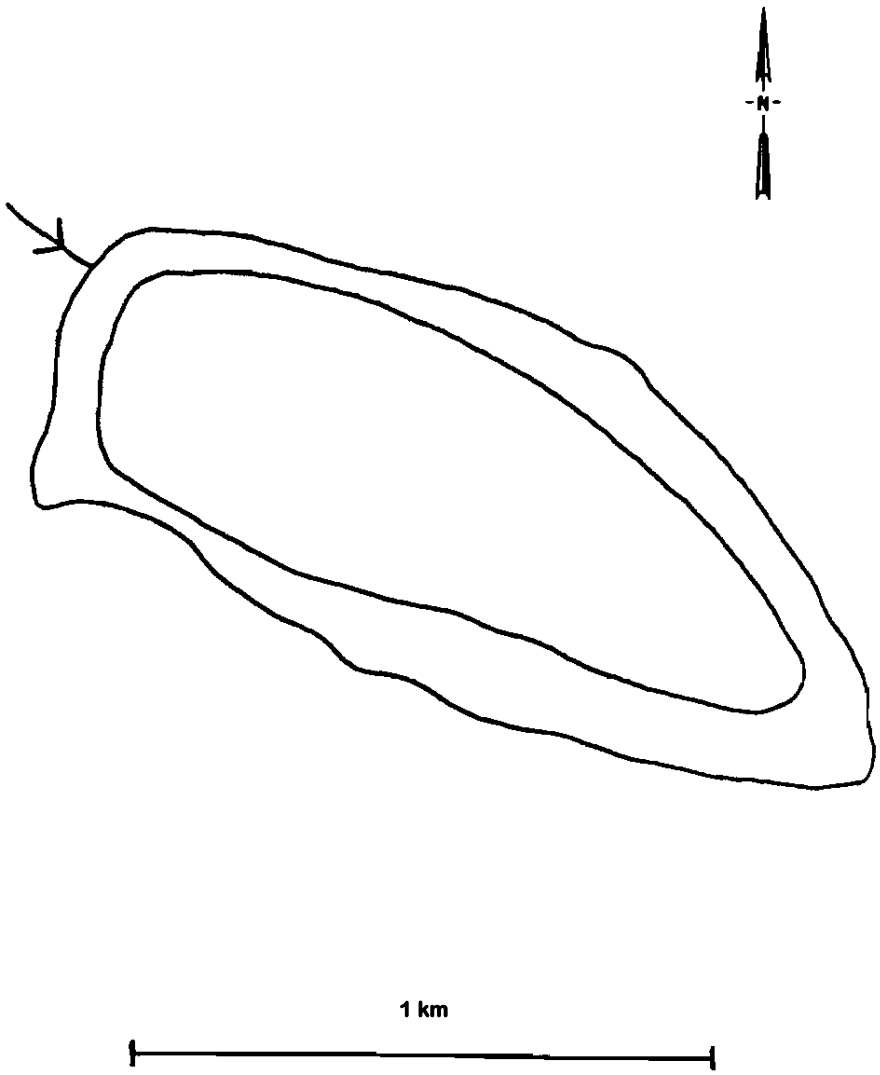
Appendix Figure 130. Bathymetric map of Lake 886-24, Tommy Lake, Yukon Flats NWR, with 5-ft contour intervals (66.2985°N, 142.5390°W).



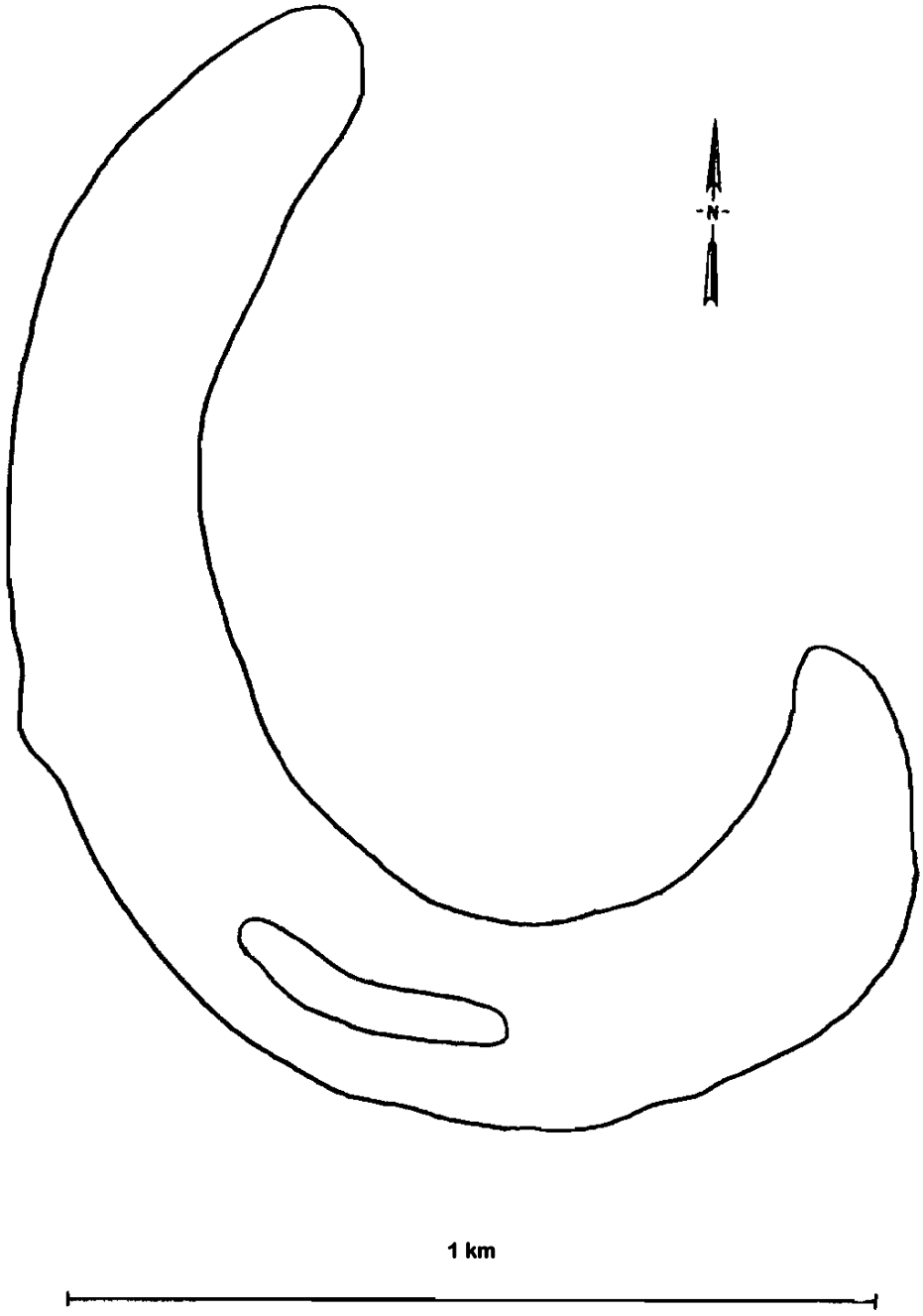
Appendix Figure 131. Bathymetric map of Lake 886-25, unnamed, Yukon Flats NWR, with 5-ft contour intervals (66.2831°N, 142.8858°W).



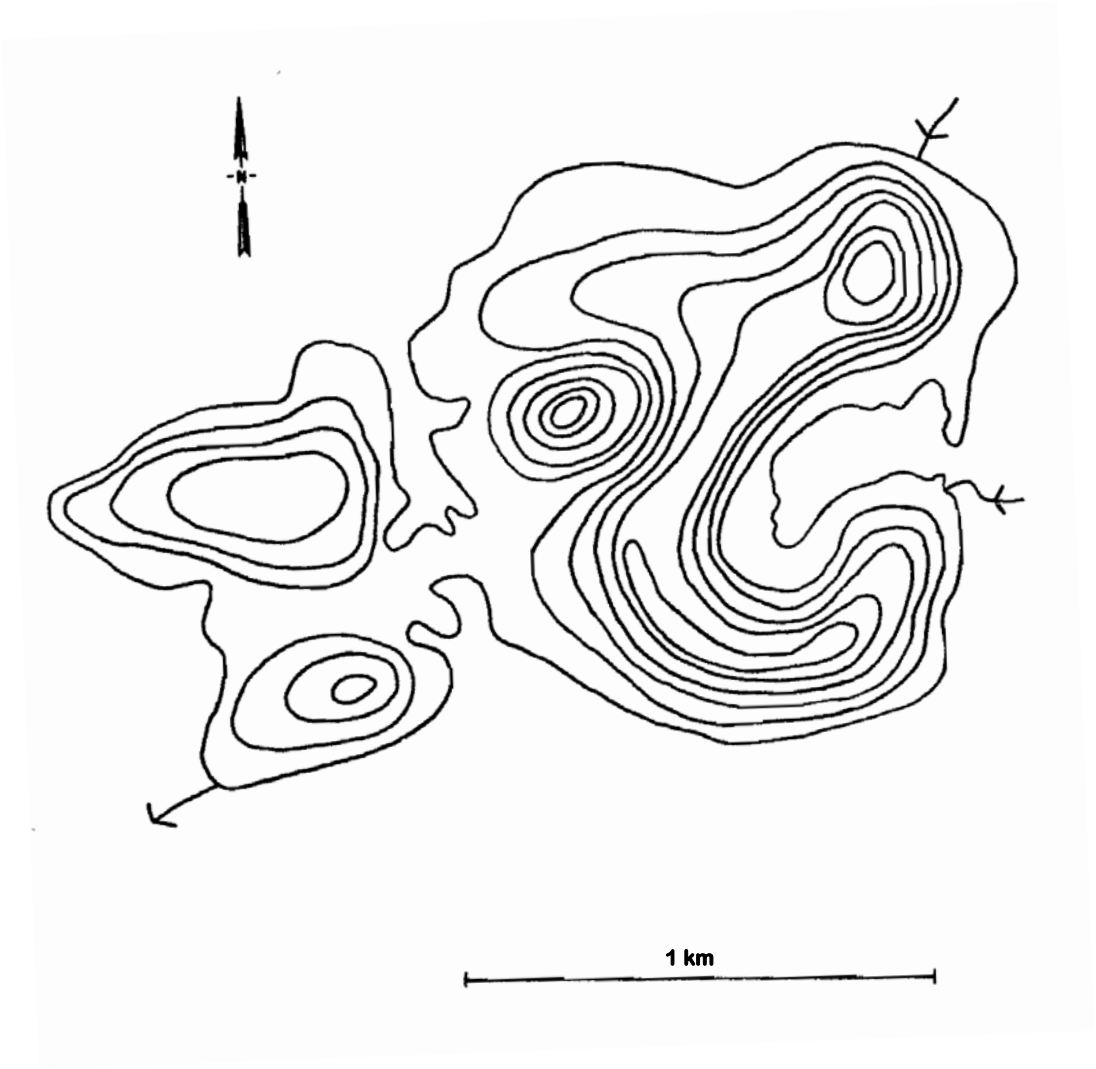
Appendix Figure 132. Bathymetric map of Lake 886-26, Rotten Fish Slough, Yukon Flats NWR, with 5-ft contour interval (66.6226°N, 142.9241°W).



Appendix Figure 133. Bathymetric map of Lake 886-27, unnamed, Yukon Flats NWR, with 5-ft contour interval (66.6723°N, 142.8766°W).



Appendix Figure 134. Bathymetric map of Lake 886-28, unnamed, Yukon Flats NWR, with 5-ft contour interval (66.6805°N, 144.3445°W).



Appendix Figure 135. Bathymetric map of Lake 886-29, unnamed, Yukon Flats NWR, with 5-ft contour intervals (66.8844°N, 145.1551°W).