

Fishery Data Series No. 94-2

**An Examination of Twelve Lakes in Northern
Southeast Alaska for Stocking With Juvenile
Coho Salmon**

by

Randolph P. Ericksen

May 1994

Alaska Department of Fish and Game

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ABSTRACT

Physical, biological, and water chemistry data were collected during 1980 on twelve lakes in northern Southeast Alaska that were believed to be blocked to migrations of anadromous salmonids. The potential of each lake to support introduced juvenile coho salmon *Oncorhynchus kisutch* was evaluated and rated. Islet and the unnamed Kanalku Bay lakes were rejected because they already contained anadromous salmonids and Glory Lake was rejected because the outlet falls would kill most emigrants. Adale, Taylor, Shelter, and Slide lakes received scores high enough to be considered for stocking with the caveat that Adale Lake had low zooplankton abundance.

KEY WORDS: Coho salmon, *Oncorhynchus kisutch*, lake stocking, Southeast Alaska, fish culture, enhancement, bathymetry.

INTRODUCTION

Early experiments to produce coho salmon *Oncorhynchus kisutch* by stocking juveniles in landlocked lakes of southeast Alaska were conducted by the National Marine Fisheries Service (NMFS 1976). After stocking, the lakes produced coho salmon smolt more efficiently than the stream from which the brood stock had been taken (NMFS 1976). Though fishless lakes produced the most smolt/ha, Osprey Lake which contained indigenous Dolly Varden *Salvelinus malma*, unexpectedly produced significant numbers of coho salmon smolt. Schmidt and Robards (1976) determined that after Osprey Lake was stocked, Dolly Varden and coho salmon used different areas of the lake and ate different types of food, behavior which is thought to reduce interspecific competition and result in optimum production. Examination of stomach contents also showed that Dolly Varden did not prey on the stocked fish.

Proceeding on the success of these programs, the Alaska Department of Fish and Game, Fisheries Rehabilitation, Enhancement, and Development Division (FRED) listed all lakes in northern southeast Alaska below 230 m elevation, greater than 12 ha surface area and thought to be inaccessible to anadromous salmonids, and rated the fisheries management and enhancement potential of each (Smith and Kron 1980). During 1980, the USDA Forest Service in cooperation with the Alaska Department of Fish and Game, surveyed twelve of these lakes to further explore their potential for producing coho salmon smolt. Investigations were limited to lakes on the mainland between Hobart Bay and Berners Bay, and on Shelter and Admiralty islands (Figure 1) some of which had been surveyed by past projects (Table 1).

This paper presents data on the biological, physical, and chemical properties of the twelve lakes and rates each for coho salmon stocking, based on criteria in "Lake Stocking for Marine Production Specifically Those Systems With Natural or Manmade Barriers to Upstream Migration Guidelines" (ADF&G 1980).

METHODS

Survey procedures used in this study were developed from Crone (1980). Water temperature, water chemistry and zooplankton samples were collected at the deepest point in the major basin of each lake.

Physical

An outline map of each lake was drawn from aerial photographs. The outline map and a sounding line were used to develop a bathymetric map of each lake. A Kemmerer bottle was used to measure water temperature for each meter of depth to 25 m, and then at 10 m increments to 100 m or the bottom. Secchi-disc measurements were taken between the hours 1100 and 1400. The outlet stream of each lake was surveyed by foot or air, from the lake downstream to tidal water. This survey was accomplished to determine if plunge pools at the base of a falls were absent, and if rocks and other objects projecting into the main water flow. These conditions may cause high rates of mortality to emigrant coho salmon smolt (R.A. Crone, Northern Southeast Regional Aquaculture Association (NSRAA), Sitka, personal communication, 1980).

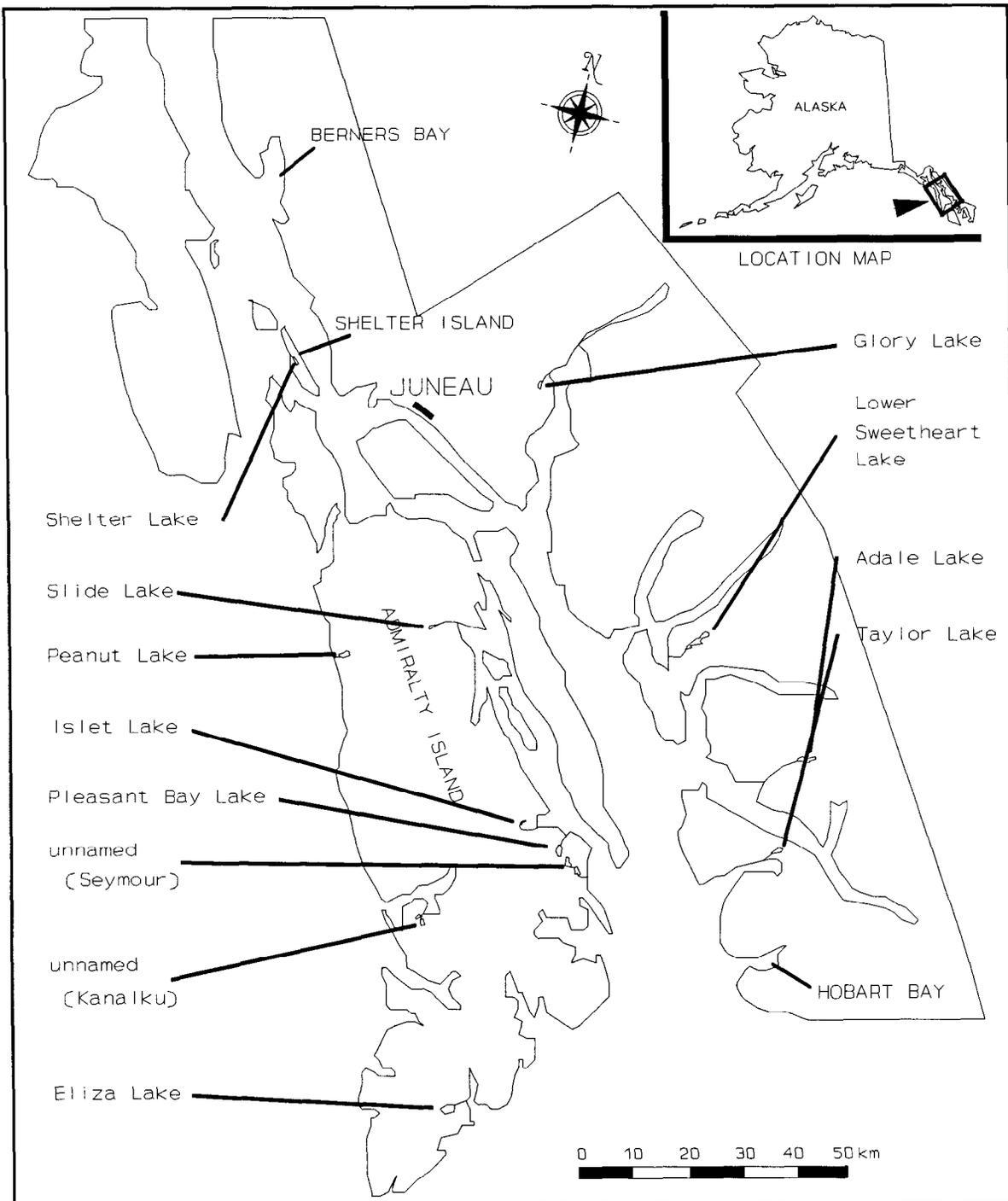


Figure 1. Lakes and lake chains surveyed in northern southeast Alaska during 1980.

Table 1. Southeast Alaska lakes for which there are historical data located in ADF&G, Division of Sport Fish stream and lake files.

LAKE	YEAR	TYPE OF WORK
Adale	1972	Sport Fish Division survey ^a
Eliza	unknown	Sport Fish Division survey
Glory	1956	Stocked with rainbow trout
	1962	Treated with rotenone
	1963	Stocked with grayling
	1970	Sport Fish Division survey
Shelter	unknown	Sport Fish Division survey
Slide	1951	Stocked with grayling
Lower Sweetheart	1954	Stocked with rainbow trout
	1955	Stocked with rainbow trout
	1972	Sport Fish Division survey

^a An exploratory survey conducted by ADF&G Sport Fish Division usually to assess the fish population in the lake.

Biological

Fish were collected with one or more of the following: small minnow traps, gill nets, seine nets, and sport fishing gear. Soak times, gear locations, numbers and species of fish captured, and length (snout to fork of tail to the nearest millimeter) of fish were recorded. Two zooplankton samples were collected using a 153-mg mesh conical net hauled vertically. The samples were preserved in a 10 percent formalin solution, and were later analyzed at the ADF&G limnology lab in Soldotna, to determine the organisms present and their relative densities.

Chemical

A Kemmerer bottle was used to collect water samples 1.0 m below the surface, just below the hypolimnion, and near the bottom. Alkalinity, Ph, hardness, and dissolved oxygen of the samples were analyzed using a HACH kit and conductivity was determined using a YSI model-33 salinity meter.

Evaluation of Smolt Mortality at Lower Sweetheart Lake

Attempts to estimate mortality rates of live coho salmon smolt emigrating from Lower Sweetheart Lake were abandoned because of difficulty recapturing fish in the turbulent water below the falls. Instead, liquid-filled floats were used as surrogates for live fish based on methods in ADF&G (1980). A series of balloons, Ziplock bags, and baggies were filled with fluorescein dye and water such that they floated just below the surface, and were released above the falls. The floats that burst or leaked or remained intact were counted. The method assumed that the floats have the same probability of surviving the trip down the falls as a smolt.

RESULTS AND DISCUSSION

Twelve lakes, totaling 1,156 ha, were surveyed between June 3 and September 24, 1980 (Table 2). Bathymetric maps were prepared (Appendix A1-A10) for all lakes, except Lower Sweetheart and Taylor Lakes which were omitted because of gear limitations and access problems. Outline maps showing the location of sampling sites on Lower Sweetheart Lake and Taylor lakes are included as appendices A11 and A12.

The lakes ranged from 12 - 509 ha, 10 - 167 m in elevation, and were 7 - 100+ m deep (Table 3). Only Adale Lake contained no resident fish populations. Water temperature (Appendix B1) and clarity (Appendix B2) were sampled in only one lake of each lake chain. Ten of the twelve lake systems had some form of barrier at the lake outlet (Appendix B3). The barriers consisted of cascades, falls, or velocity barriers and were deemed likely to prevent upstream passage of fish. Islet Lake and the unnamed lake in Kanalku Bay had no barriers and contained anadromous salmonids.

Only 44% of the floats released over the lowest falls on the outlet of Lower Sweetheart Lake remained intact (Appendix B4) indicating that substantial mortality could be expected in populations of emigrating smolt.

Dolly Varden were captured in all lakes that had resident fish populations

Table 2. Southeast Alaska lakes evaluated in 1980 for coho salmon stocking.

Lake	ADF&G Stream No.	Survey Dates
Adale	111-21-53	June 3 to 6
Eliza	109-30-06	August 15 to 17
Glory	111-32-30	July 21 to 24
Islet	111-13-10	September 13
Unnamed (Kanalku Bay)	112-18-75	September 23 to 24
Peanut	112-17-10	August 1 to 4
Pleasant Bay	111-12-05	August 18 to 20
Unnamed (Seymour Canal)	110-42-02	September 9 to 11
Shelter	111-50	July 11 to 15
Slide	111-16-40	August 4 to 6
Lower Sweetheart	111-35-20	June 6 to 10, June 24 to July 2
Taylor	110-32-05	August 13 to 15

Table 3. Physical properties and resident fish population of southeast Alaska lakes surveyed during 1980.

Lake	Latitude	Longitude	Elev. (m)	Surface Area (ha)	Maximum Depth (m)	Lake Source	Resident ^a Fish Species
Adale	57°45'N	133°17'W	197	93	10	glacial	none
Eliza	57°37'N	134°18'W	66	83	67	surface runoff	DV
Glory	58°23'N	134°08'W	30	90	100	surface runoff	DV
Islet	57°39'N	134°10'W	107	12	7	muskeg	CT, DV, SB, SS
Unnamed (Kanalku)	57°29'N	134°28'W	10	62	19	muskeg	CT, DV, SS, CO
Peanut	57°54'N	134°42'W	90	75	30	muskeg	DV, CO, SB, KO
Pleasant Bay	57°37'N	134°02'W	42	45	24	surface runoff	CT, DV, KO
Unnamed (Seymour) upper	57°34'N	134°57'W	115	26	15	muskeg	DV
lower			85	36	20	muskeg	DV, SB
Shelter	58°25'N	134°52'W	30	24	7	muskeg	CT, DV, SB
Slide	58°00'N	134°23'W	115	73	35	surface runoff	DV
Sweetheart	57°57'N	133°35'W	167	509	100+	glacial/surface runoff	DV, RB
Taylor	57°37'N	133°23'W	61	28	no data	surface runoff	DV, CT

^a DV = Dolly Varden, CT = cutthroat trout, RB = rainbow trout, KO = kokanee, CO = cottids, SB = stickleback, SS = coho salmon

(Appendix B5); cutthroat trout were found in five lakes. The density of zooplankters ranged from 7 - 52,000 and averaged 11,608 plankters/m³. (Table 4, Appendix B6).

Conductivity data (Appendix B7) was not collected for most lakes due to lack of equipment and a complete survey of Taylor Lake was not possible because log jams prevented aircraft from landing on the lake.

Rating and Evaluation

Islet and unnamed (Kanalku Bay) lake were rejected for stocking of coho salmon because both lakes already contained populations of anadromous salmonids. Glory and Lower Sweetheart lakes were rejected based on expected high rates of mortality of emigrating smolt. The remaining lakes (Table 5) were rated using criteria in ADF&G (1980) and Smith and Kron (1980) to determine their suitability for stocking. Adale, Taylor, Shelter, and Slide Lakes received total ratings \geq 40. Adale Lake was given the highest rating (52) though our sampling found zooplankton abundance was too low to support a salmonid population. Taylor Lake contained cutthroat trout that would prey on juvenile salmonids. Shelter Lake earned a high total rating of 45, despite a low competition rating of 0 (resident stickleback and cutthroat trout would be expected to compete with stocked coho salmon). Also low dissolved oxygen (DO) levels in Shelter lake may limit fish distribution (we experienced significant mortality of Dolly Varden in a trap set in the deepest portion of the lake where the DO was low) and zooplankton density was lower than the mean for the twelve lakes. Slide Lake received a total rating of 44. The resident population of Dolly Varden in this lake should not cause significant competition with, or predation upon, juvenile salmonids, and high zooplankton densities should provide an ample food supply for stocked coho salmon.

Eliza, Pleasant Bay, Peanut, and the unnamed lakes in Seymour Canal received ratings lower than 40. Eliza Lake was rated a 39 because fishery that develops from this enhancement could cause overharvest of wild stocks in nearby mixed stock fisheries. Pleasant Bay Lake received a rating of 37 because of potential competition between resident kokanee and stocked coho salmon. Also, cutthroat trout in this lake would prey on stocked coho salmon. Peanut Lake received a rating of 34 because of potential interspecific competition with stickleback and kokanee. The unnamed lake chain in Seymour Canal has two barrier falls that appear hazardous to emigrating smolt. The upper of these two lakes had the highest density of zooplankton of all lakes sampled.

My evaluation of smolt passage at the Sweetheart Lake outlet indicated prohibitive levels of mortality - an assessment that may have been incorrect. In 1988, Alaska Department of Fish and Game, FRED conducted further tests (Ron Josephson, personal communication, Alaska Department of Fish and Game, Douglas). Over 20,000 live coho salmon smolt were stocked in the lake and lake outlet and recovered just upstream of tidal influence. Of fish recovered, about 6% were dead. Also, coded wire tag returns from common property fisheries indicate smolt to adult survival rates were greater from this release, than control groups released at nearby Snettisham hatchery. Based on these experiments, emigrant mortality was deemed low and the lake was stocked with sockeye fry *Oncorhynchus nerka* in 1990.

Table 4. Zooplankton densities in twelve southeast Alaska lakes surveyed during 1980.^a

Lake	Date Sampled	Density (No./m ³)	Percent of Population		
			Cladocera	Copepoda	Rotifera
Adale	Jun 4 1980	7	36%	50%	14%
Eliza	Aug 17 1980	3,611	41%	4%	5%
Glory	Jul 23 1980	14,785	9%	81%	10%
Islet	Sep 13 1980	10,194	27%	38%	35%
Unnamed (Kanalku)					
Lower	Sep 24 1980	4,491	26%	57%	17%
Peanut	Aug 04 1980	8,284	18%	63%	19%
Pleasant Bay	Aug 20 1980	6,195	60%	27%	13%
Unnamed (Seymour)					
Upper	Sep 10 1980	51,499	36%	59%	5%
Lower	Sep 11 1980	51,796	13%	82%	5%
Shelter	Jul 14 1980	681	3%	70%	27%
Slide	Aug 05 1980	23,961	14%	72%	14%
Lower Sweetheart					
A	Jun 08 1980	7,380	1%	99%	0%
B	Jun 09 1980	4,021	1%	98%	1%

^a Taylor Lake was not sampled.

Table 5. Numerical rating of selected northern southeast Alaska lakes that are candidates for coho lake stocking^a.

Lake	Subjective Barrier Rating ^b	Competition Rating ^c	Management Rating ^d	Enhancement Rating ^e	Total Rating
Adale	10	15	15	12	52
Eliza	10	10	7	12	39
Peanut	10	0	11	13	34
Pleasant Bay	15	0	10	12	37
Unnamed (Seymour)	5	0	10	12	27
Shelter	15	0	15	15	45
Slide	10	10	11	13	44
Taylor	15	5	14	11	45

^a Islet and unnamed (Kanalku Bay) lake are excluded because they contain anadromous fish; Glory and Lower Sweetheart lakes are excluded because of high-mortality outlets.

^b 15 - no emigrant mortality concern.
10 - moderate emigrant mortality concern.
5 - high emigrant mortality concern.

^c 15 - fishless
10 - single species
5 - multi-species (non-planktivors)
0 - multi-species (including planktivors)

^d Taken directly from Smith and Kron (1980). This is a rating which is designed to give a numeric rating to the distance of the harvest area from existing commercial fisheries or wild stocks. A low rating indicates greater difficulties with management of commercial fisheries.

^e Taken directly from Smith and Kron (1980). This is a rating describing the accessibility of the system to brood stock sources, hatcheries, transportation, etc.

Finally, the outlet of Glory Lake was considered excessively hazardous for passage of emigrant smolt. Islet Lake and the unnamed lakes at Kanalku Bay contain anadromous fish. These three lakes should not stocked with coho salmon.

Need for Future Studies

Further studies should be done on those lakes with the greatest potential for stocking to estimate the mortality rates of emigrants using procedures described by Crone (1980). Further work is needed to confirm Adale Lake as a stocking candidate. Future studies could search for alternative sources of food for stocked coho salmon or whether lake fertilization could improve the lake's zooplankton abundance.

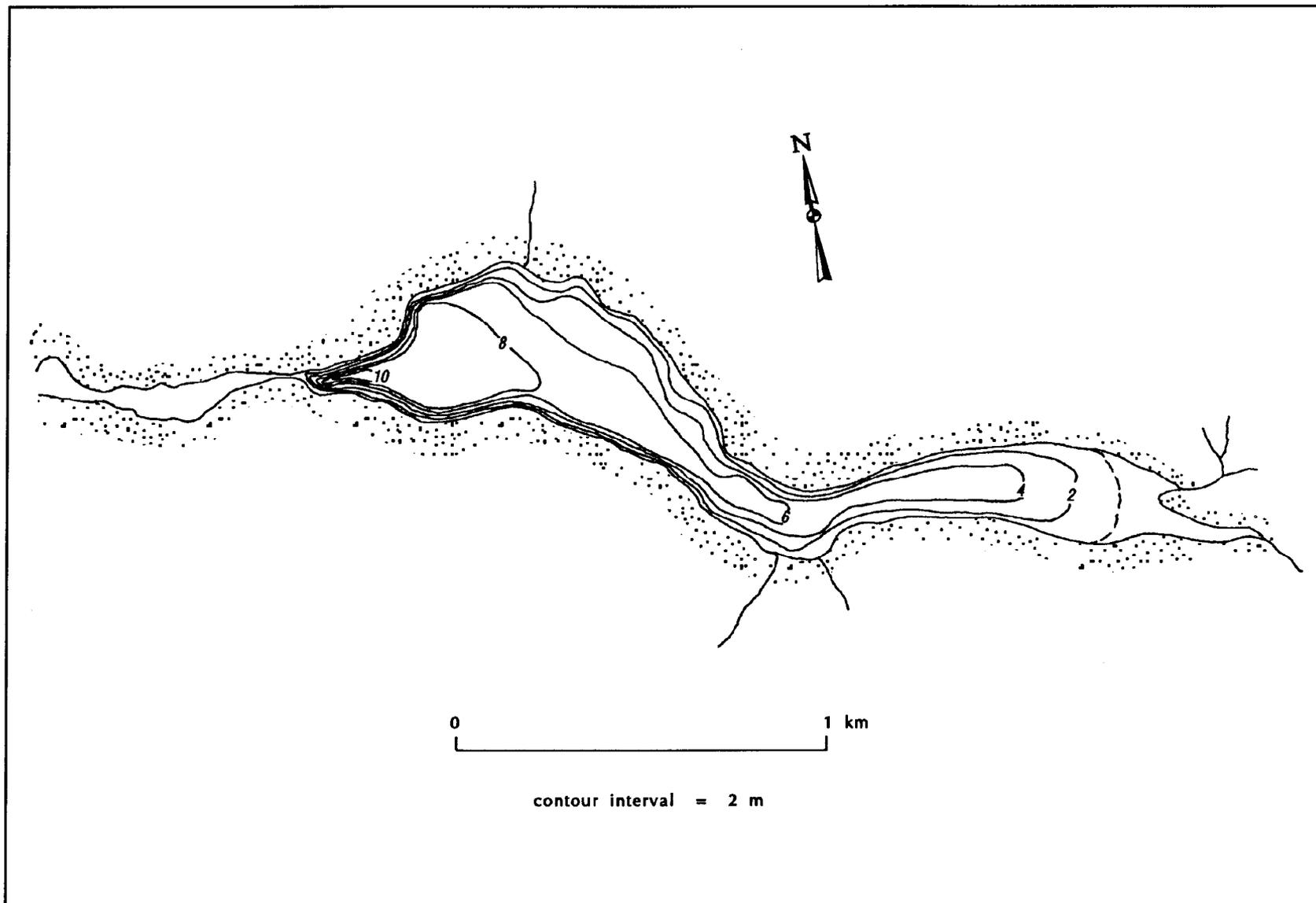
ACKNOWLEDGEMENTS

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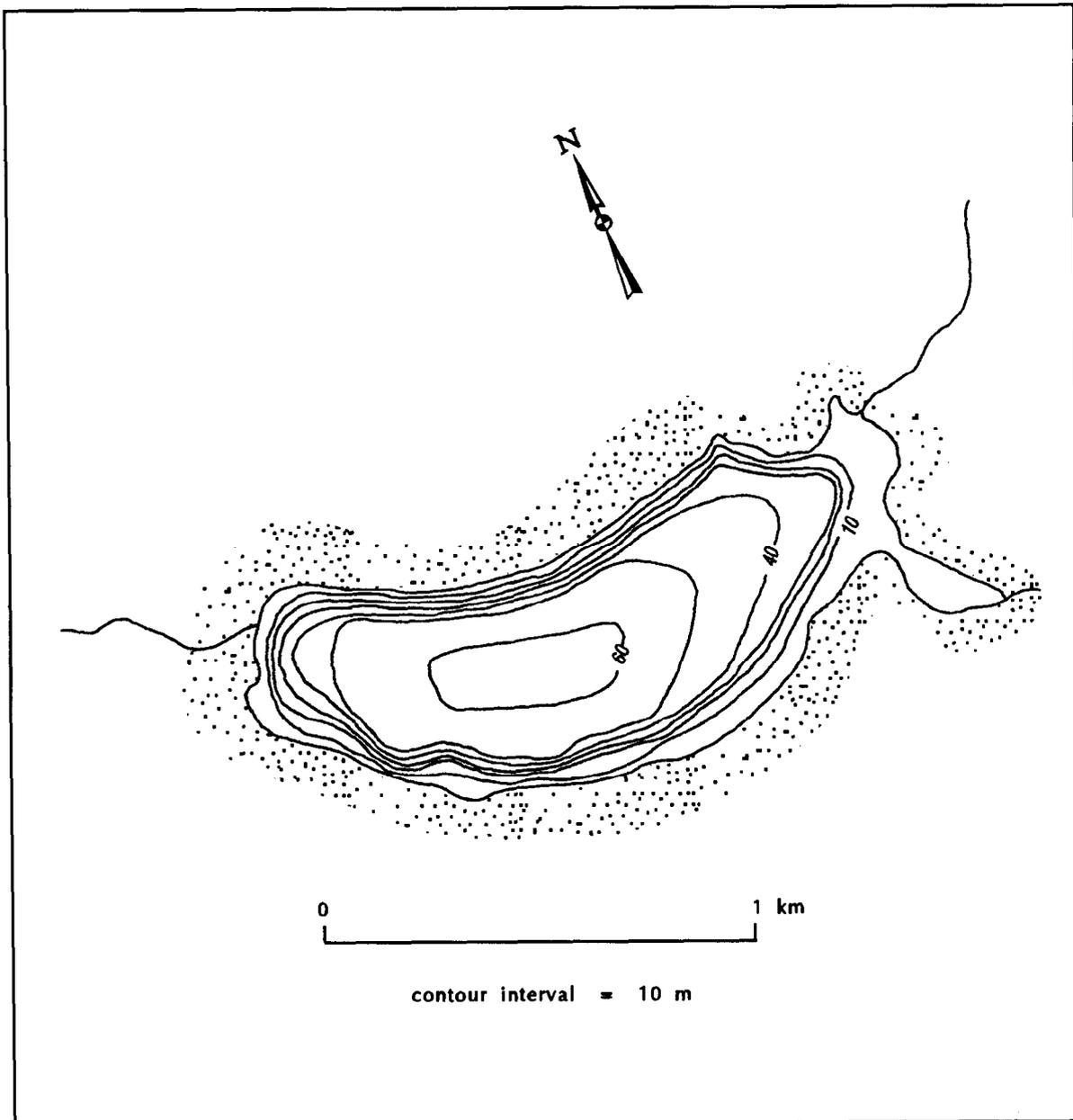
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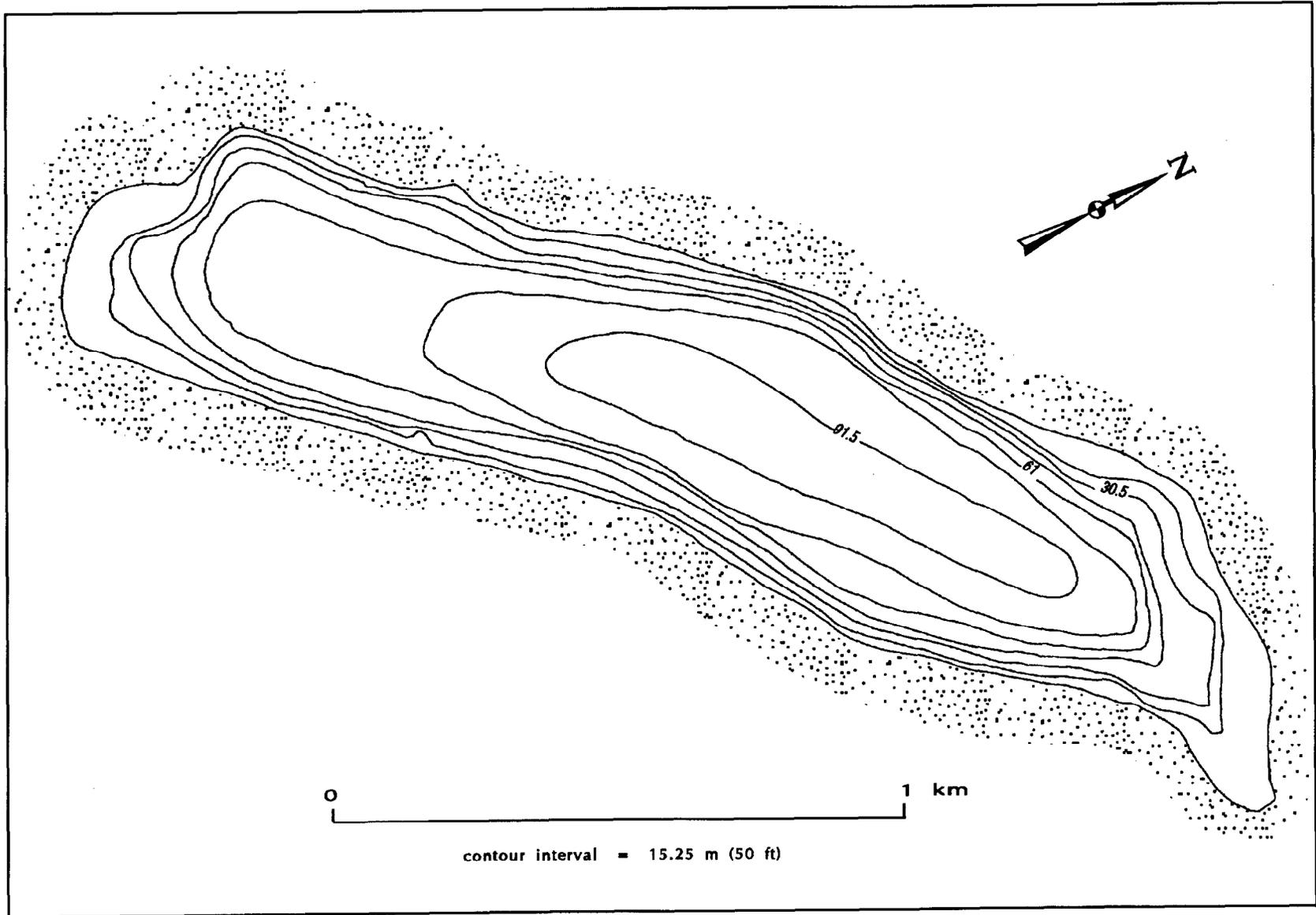
APPENDIX A



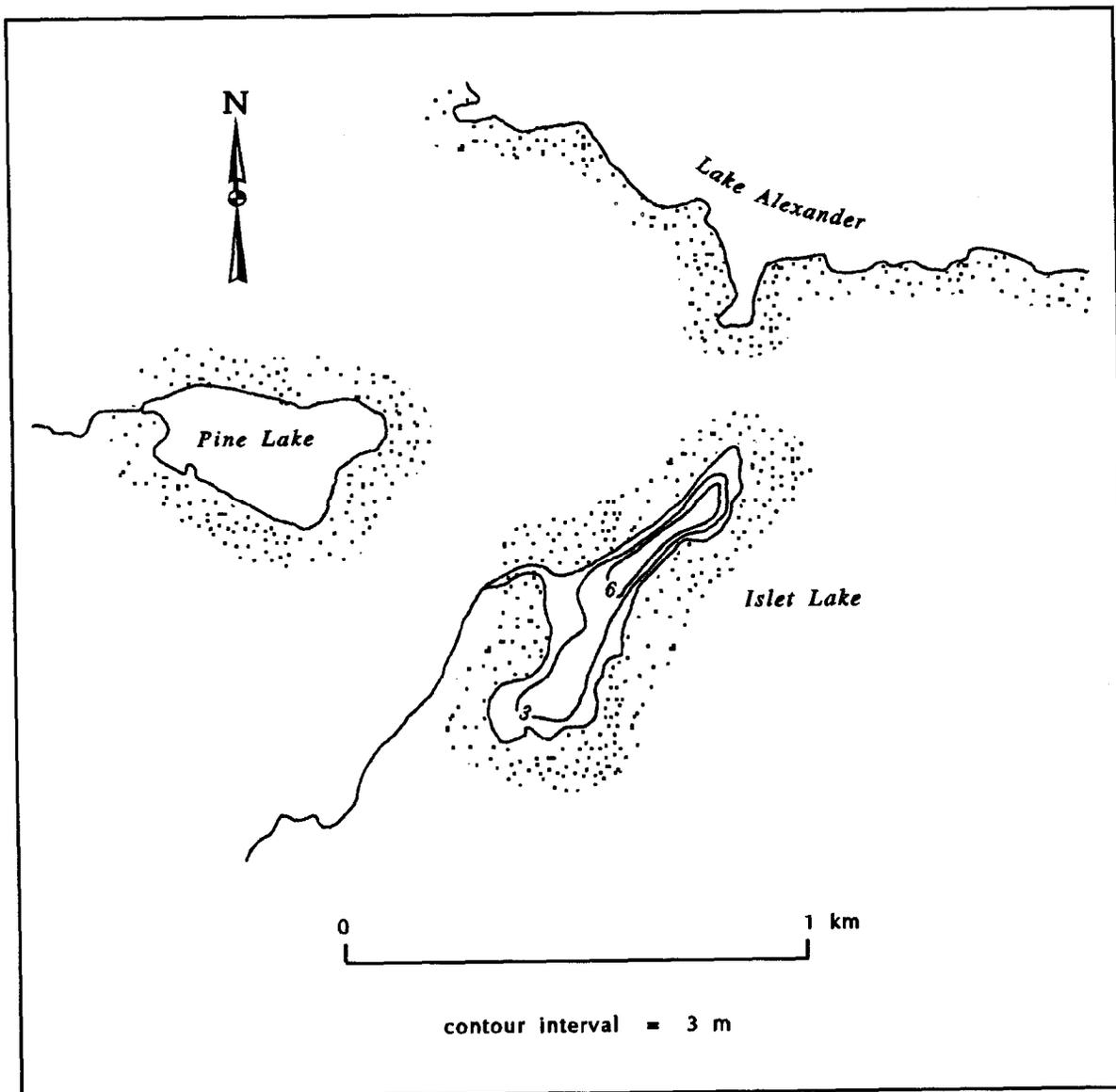
Appendix A1. Bathymetric map of Adale Lake.



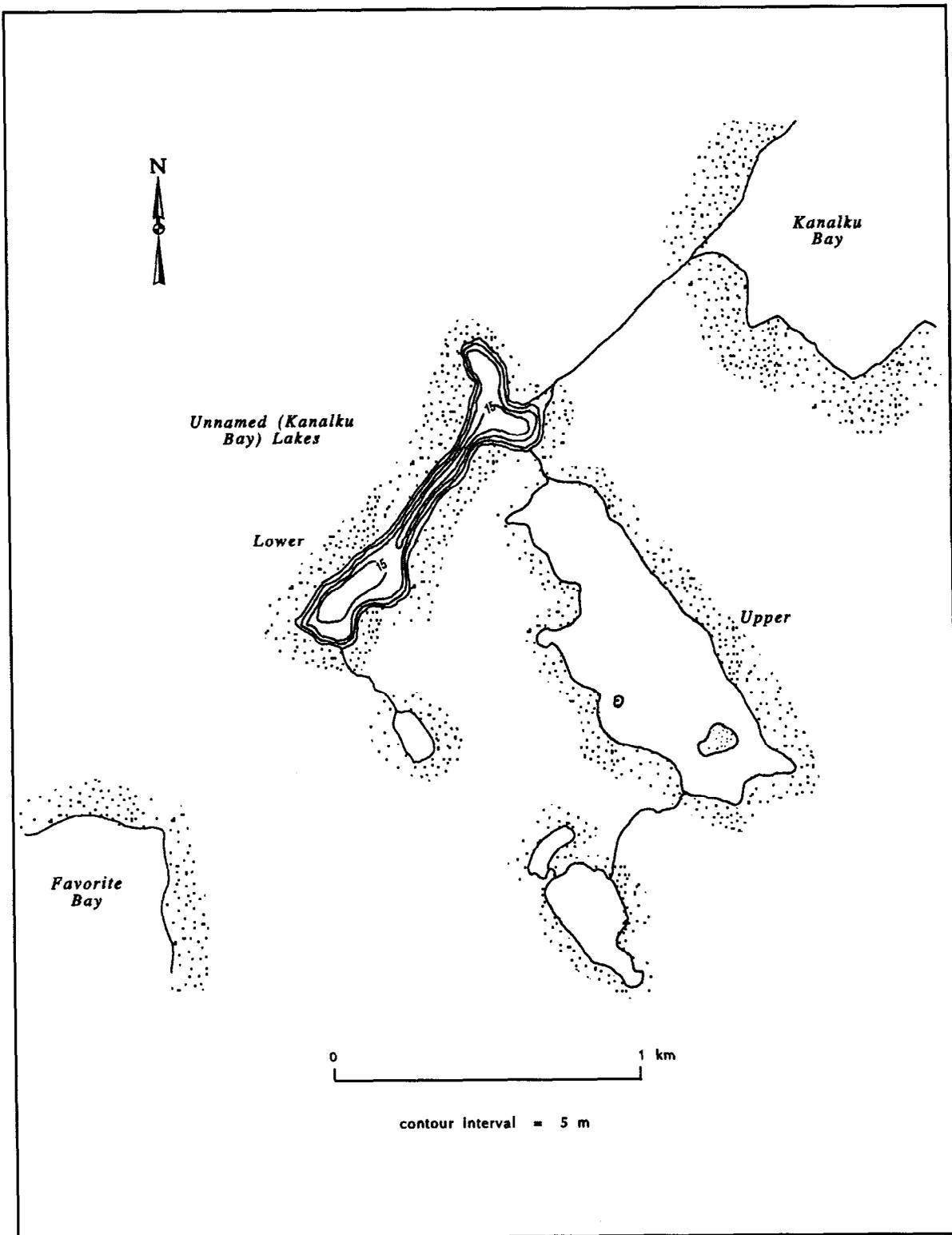
Appendix A2. Bathymetric map of Eliza Lake.



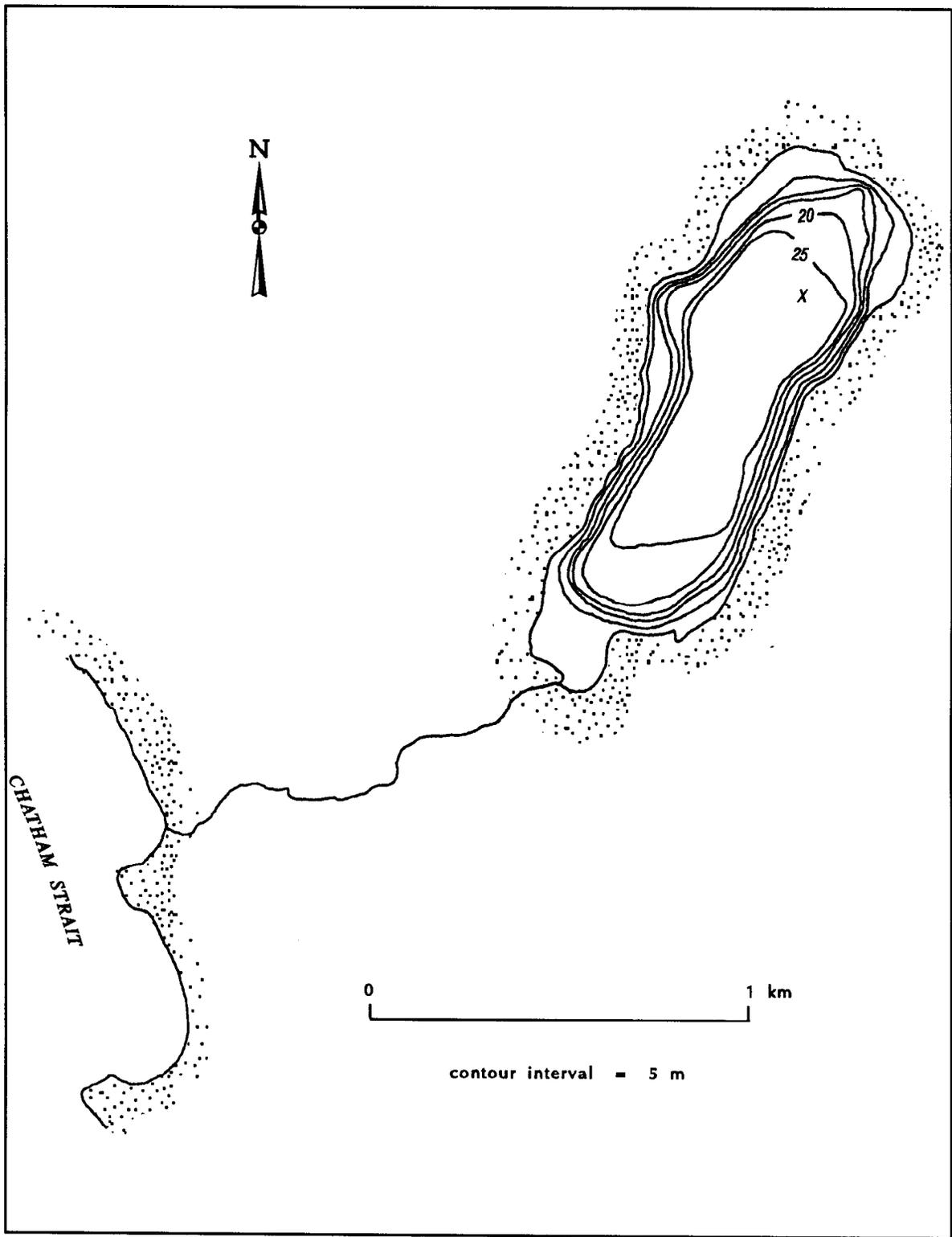
Appendix A3. Bathymetric map of Glory Lake.



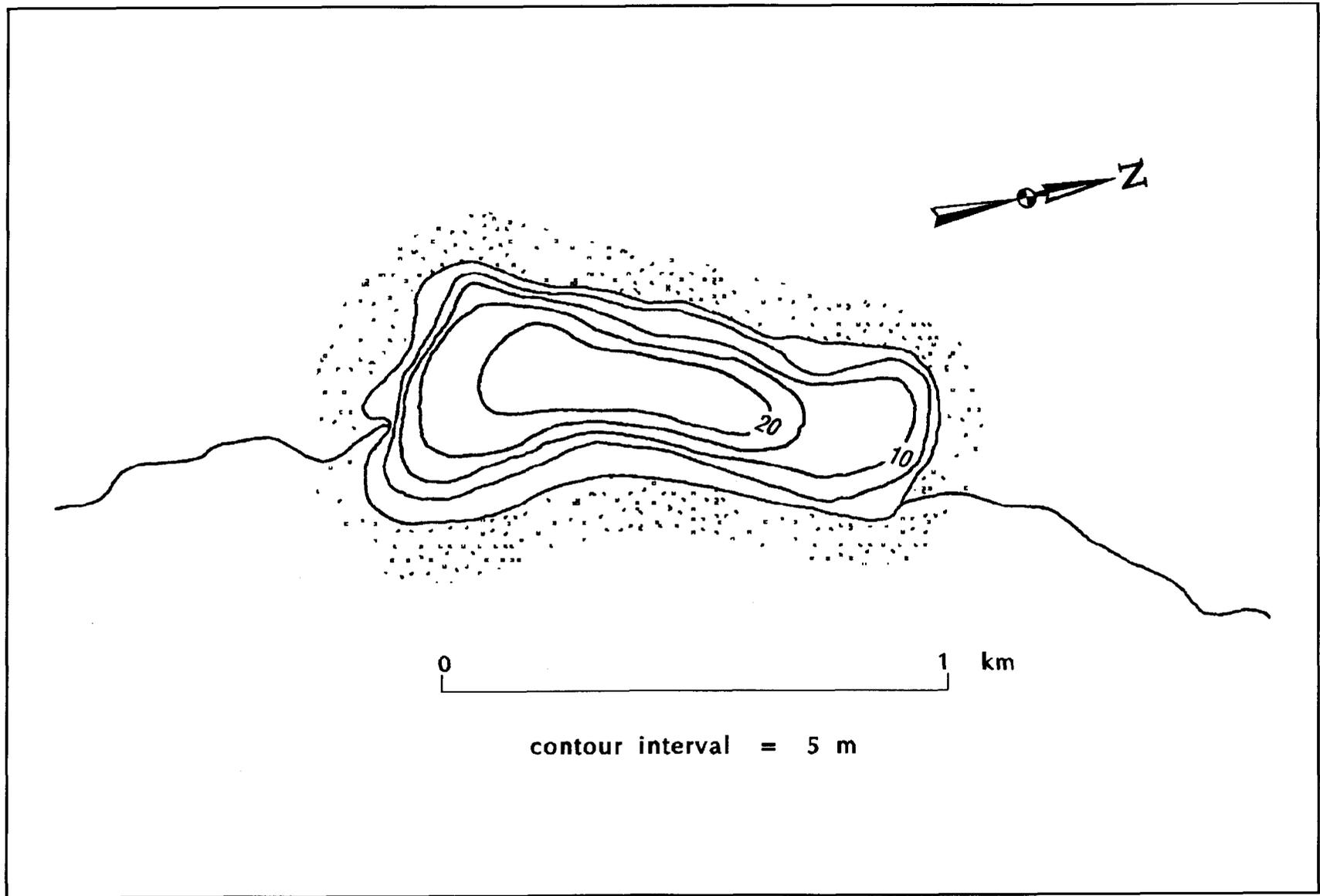
Appendix A4. Bathymetric map of Islet Lake.



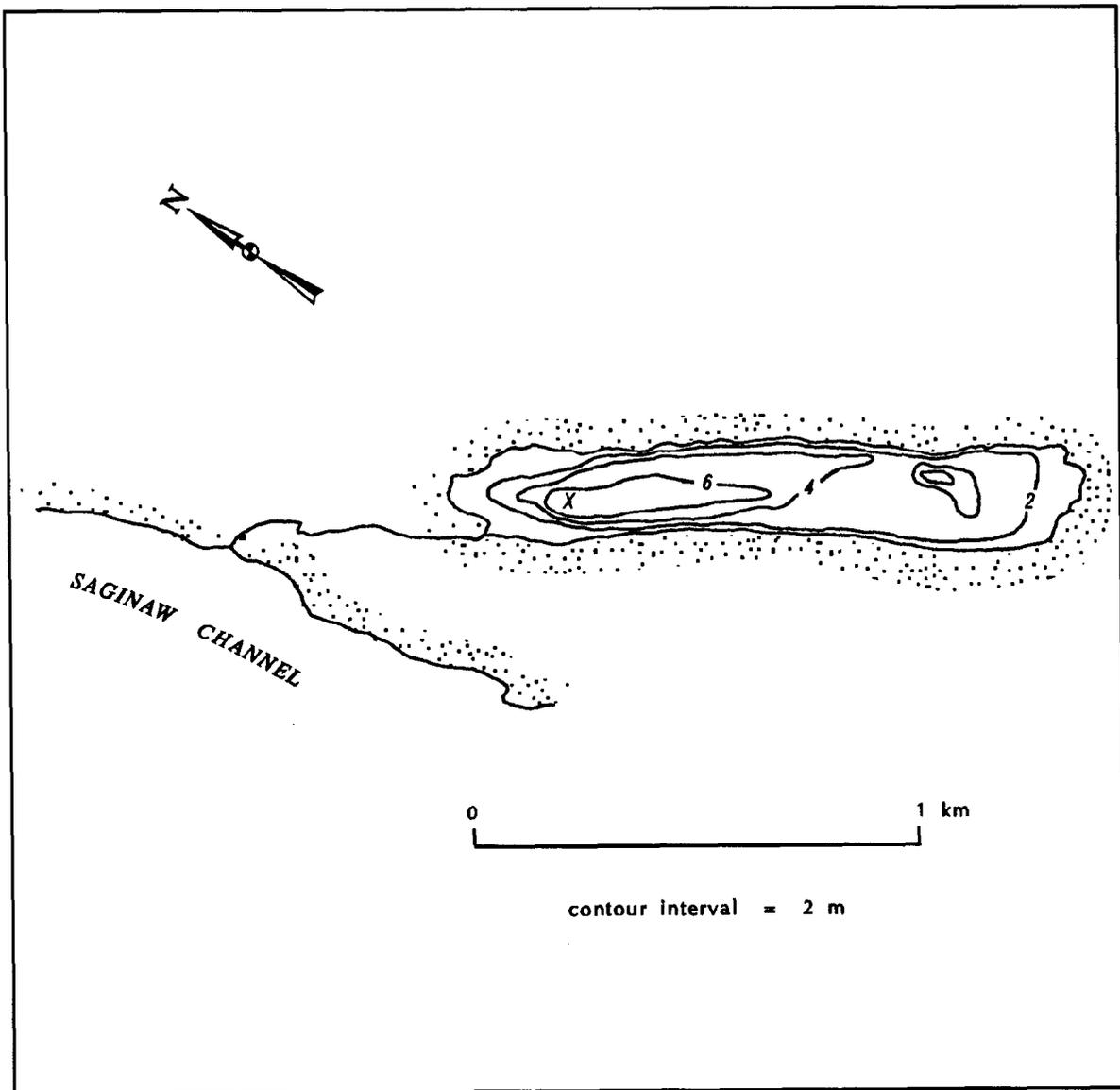
Appendix A5. Bathymetric map of unnamed lake (Kanalku Bay).



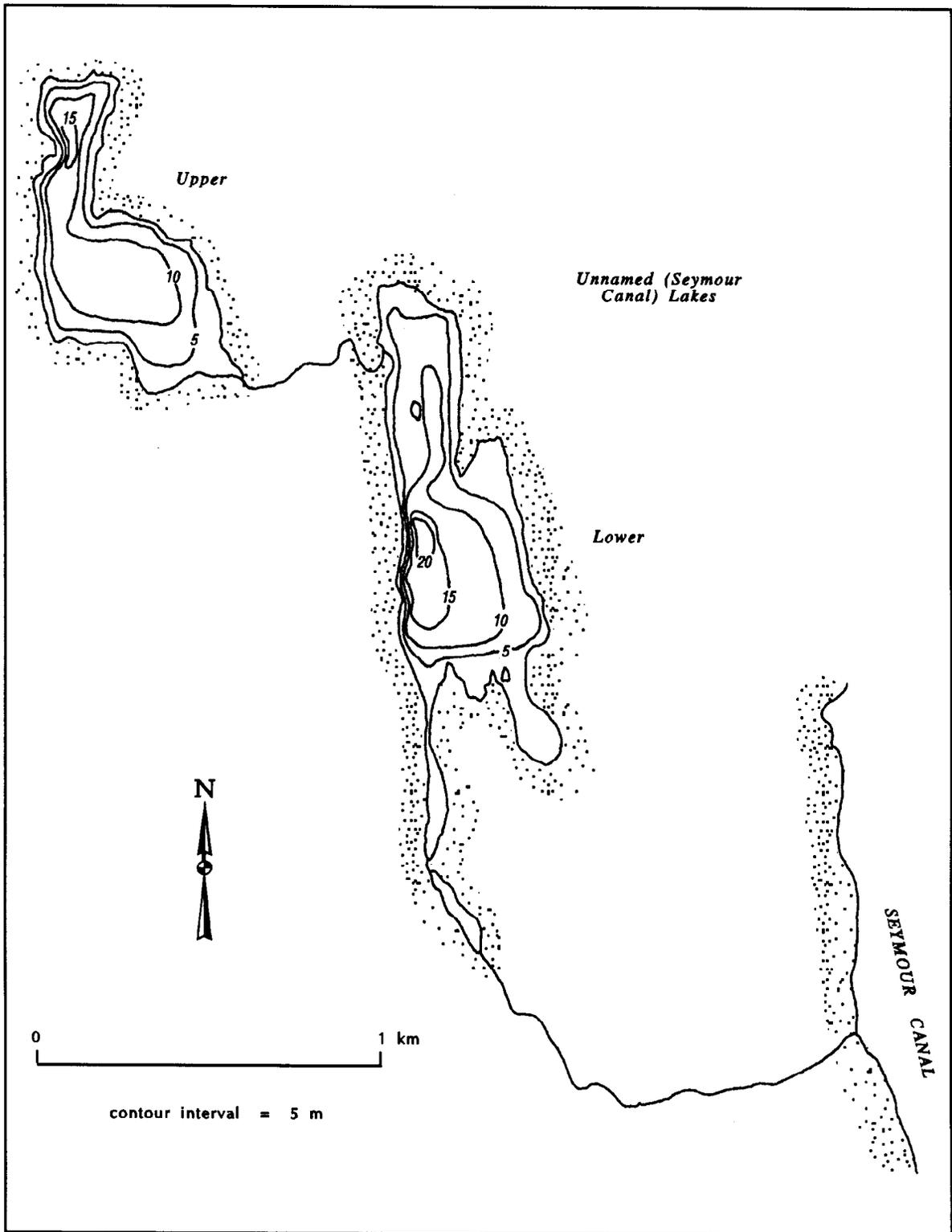
Appendix A6. Bathymetric map of Peanut Lake.



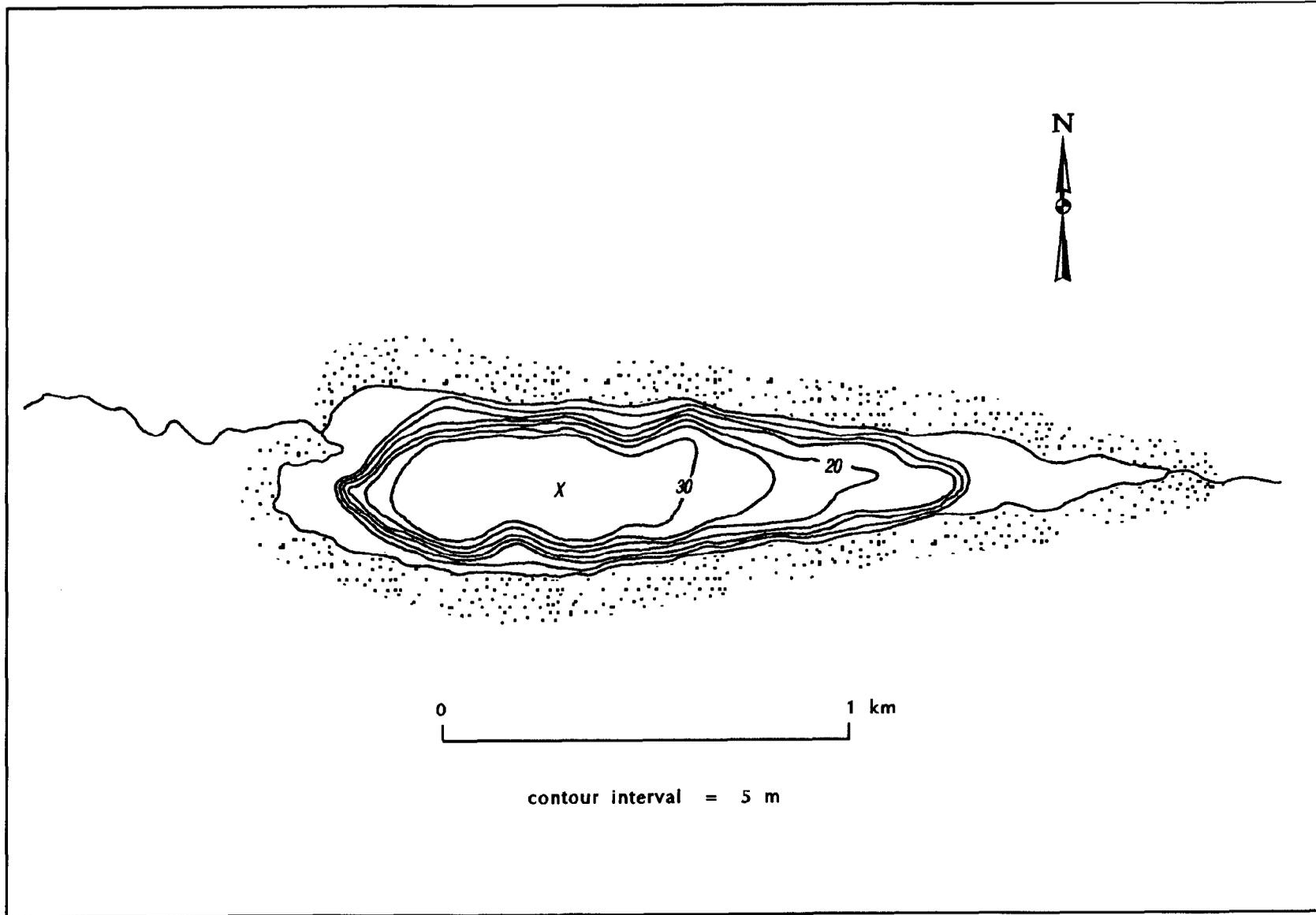
Appendix A7. Bathymetric map of Pleasant Bay Lake.



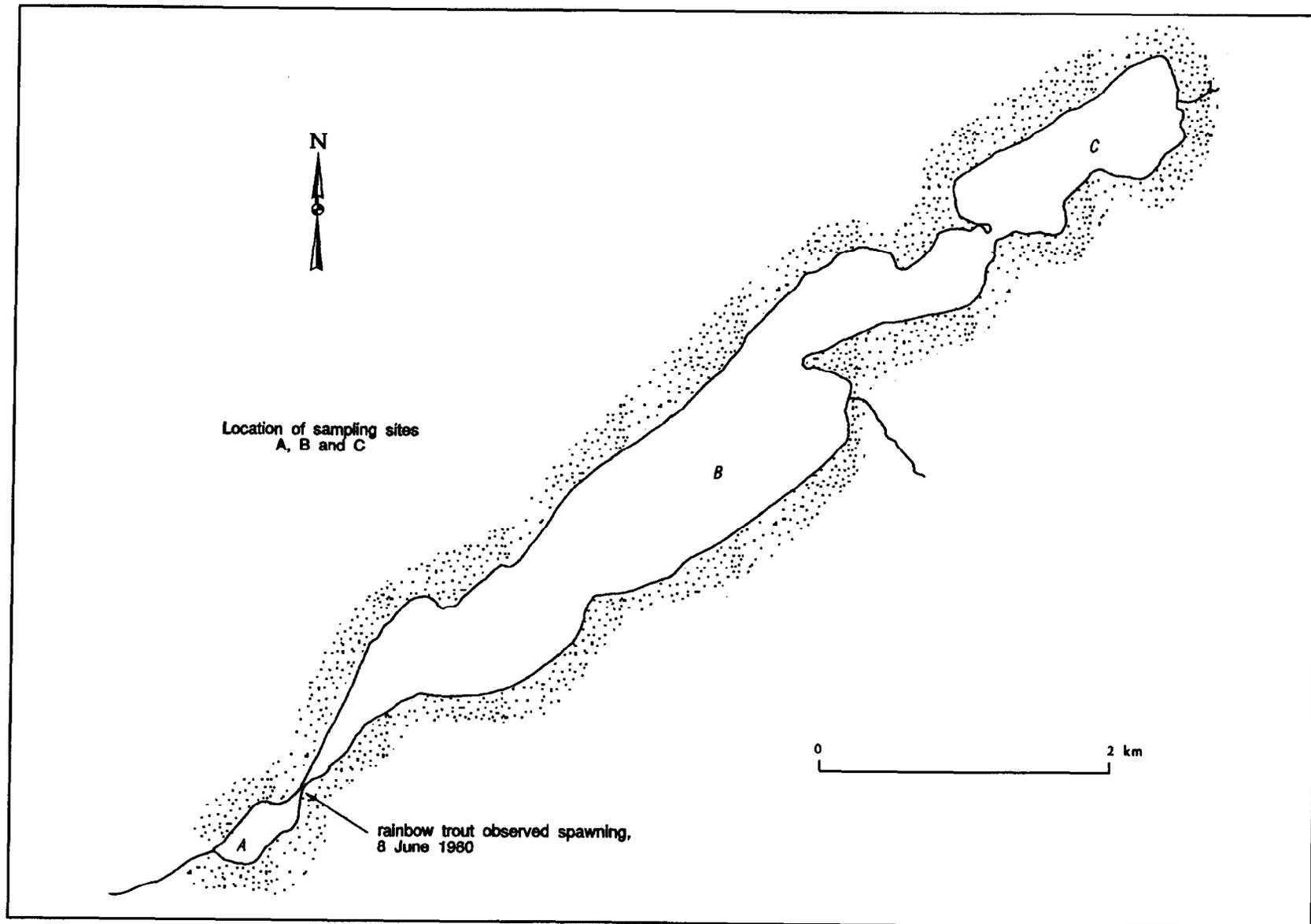
Appendix A8. Bathymetric map of Shelter Lake.



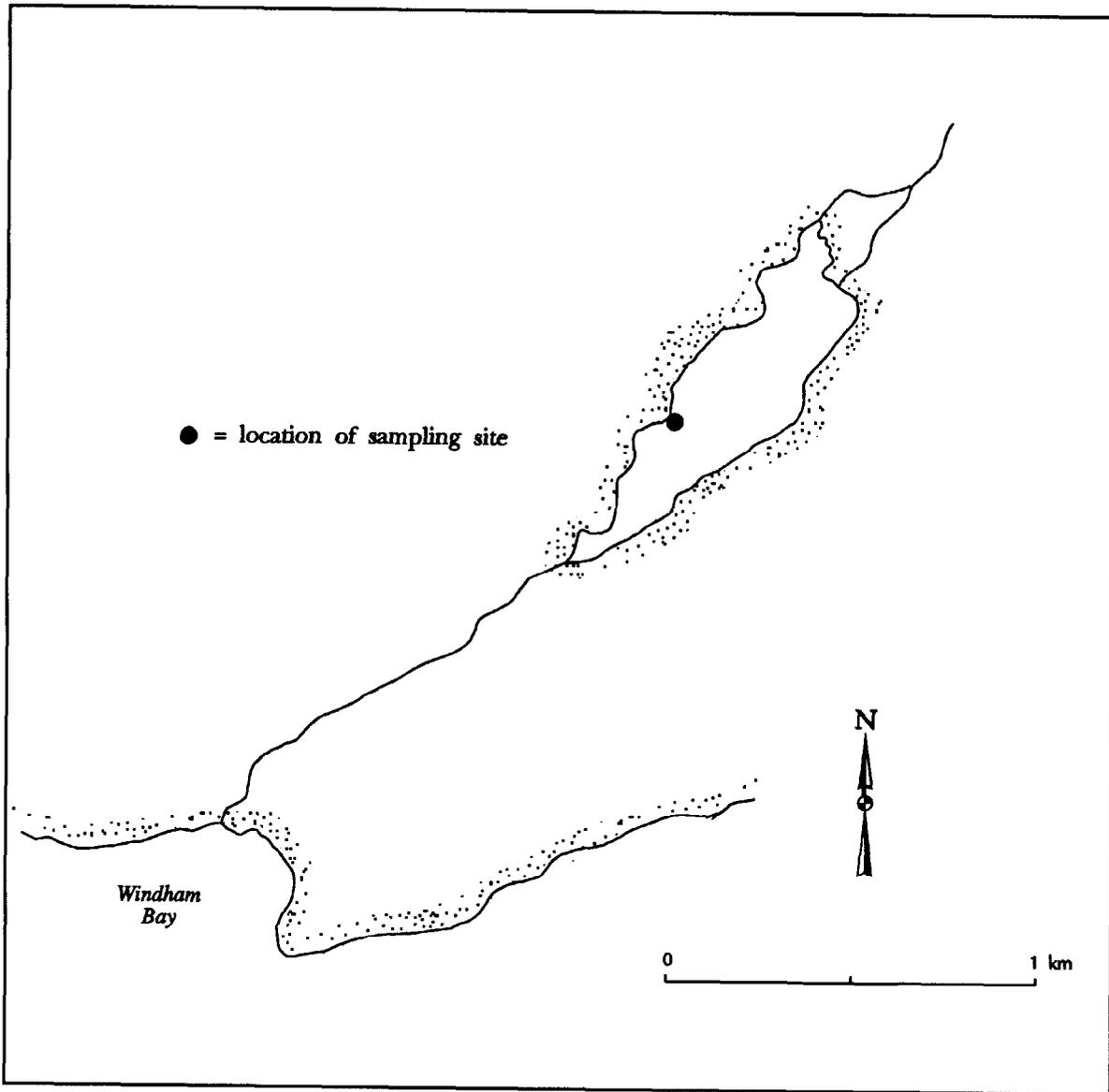
Appendix A9. Bathymetric map of unnamed lakes (Seymour Canal).



Appendix A10. Bathymetric map of Slide Lake.



Appendix All. Map of Lower Sweetheart Lake.



Appendix A12. Map of Taylor Lake.

APPENDIX B

Appendix B1. Temperature profiles (°C) of northern southeast Alaska lakes surveyed, 1980.^a

Depth (m)	Adale	Eliza	Glory	Islet	Lower (Kanalku)	Peanut	Pleasant Bay	Lower (Seymour)	Shelter	Slide	Lower Sweetheart		
											A	B	C
Air	26.1	15.5	12.0	11.5	10.0	12.0	15.5	10.0	18.5	19.0	23.0	13.0	14.5
0	9.4	14.8	11.4	12.7	12.6	15.8	13.3	12.0	18.8	11.8	11.2	11.6	9.5
1	9.0	14.6	11.0	12.7	12.5	15.8	12.4	12.0	18.8	11.8	11.5	10.5	9.5
2	8.6	14.6	11.0	12.6	12.5	15.8	12.2	11.8	18.8	11.5	11.5	10.5	9.4
3	8.4	14.3	10.6	12.5	12.5	12.5	15.4	11.2	11.2	17.5	11.4	10.5	9.0
4	8.0	13.4	10.4	12.5	12.5	15.4	10.9	11.0	17.2	11.0	10.5	11.0	8.8
5	8.6	12.5	9.8	12.1	11.8	15.4	10.6	11.0	15.5	10.9	10.2	11.0	7.8
6	7.4	12.2	9.8	10.1	9.6	15.4	10.5	11.0	11.2	10.6	10.2	10.5	7.7
7	7.0	11.7	9.4	7.8	8.2	14.8	10.3	10.9	9.9	10.3	10.0	9.0	7.5
8	6.8	11.6	9.0		6.6	10.2	10.2	10.8		10.3	10.0	8.0	7.5
9	6.4	10.8	9.0		6.0	8.0	10.1	10.8		10.3	10.0	7.2	7.0
10		10.2	8.6		5.8	7.8	9.7	10.6		10.2	10.0	7.2	7.0
11		9.8	8.0		5.5	6.3	9.5	9.2		10.1	10.0	7.0	6.9
12		9.1	7.1		5.3	5.8	9.1	7.6		10.0	9.8	7.0	6.5
13		8.1	6.8		5.2	5.6	8.6	6.8		10.0	9.6	6.5	6.2
14		7.0	6.3		5.2	5.2	8.2	6.2		9.8	9.5	6.5	6.1
15		6.5	6.0		5.2	5.2	7.9	5.8		9.6	9.5	6.2	6.1
16		6.0	5.7			5.0	7.0	5.6		9.2	9.4	5.8	6.0
17		5.3	5.5			5.0	6.9	5.2		8.8	9.4	5.5	6.0
18		5.0	5.2			5.0	6.8	5.2		7.2	9.4	5.2	5.9
19		5.0	5.0			5.0	6.6	5.0		6.2	9.3	5.2	5.9
20		5.0	5.0			4.9	6.5	5.0		6.2	9.2	5.2	5.6
21		4.9	5.0			4.8	6.4			5.8		5.0	5.6
22		4.8	4.8			4.8	6.4			5.8		4.9	5.6
23		4.8	4.8			4.8	6.2			5.6		4.9	5.6
24		4.6	4.6			4.8	6.1			5.6		4.4	5.6
25		4.6	4.4			4.8				5.6		4.4	5.5
30		4.6	4.2			4.4				5.2		4.2	4.9
40		4.6	4.0									4.0	
50		4.6	3.9									4.0	
60		4.5	3.8									4.0	
70			3.8									4.0	
80			3.8									4.0	
90			3.8									4.0	
100			3.8									4.0	

^a Taylor Lake was not sampled.

Appendix B2. Secchi disc readings of northern southeast Alaska lakes surveyed, 1980.^a

LAKE	DATE	TIME (h)	DEPTH (m)	
			Disappeared	Reappeared
Eliza	August 17	1130	13.2	12.0
Glory	July 23	1200	13.5	13.0
Islet	September 13	1330	3.3	3.1
Unnamed (Kanalku)				
Lower	September 24	1245	2.7	2.3
Peanut	August 4	1130	4.0	3.5
Pleasant Bay	August 20	1152	5.0	5.0
Unnamed (Seymour)				
Lower	September 11	1145	2.6	2.4
Shelter	July 14	1200	3.4	2.5
Slide	August 5	1135	8.0	7.5
Lower Sweetheart A	June 25	1200	9.5	9.0
Lower Sweetheart B	June 26	1100	8.5	8.0
Lower Sweetheart C	June 26	1200	7.0	7.0

^a Adale and Taylor Lakes were not sampled.

Appendix B3. Fish barriers on the outlet of northern southeast Alaska lake surveyed, 1980.^a

Lake	Location of Barrier	Type of Barrier	Height (m)	Comments
Adale	immediately below lake 4.0 km above MHW	underground	25	flows beneath a boulder field for approximately 200 m. no significant vertical drops
		velocity barrier	50	
Eliza	3.0 km above MHW	velocity barrier	20	one 2 m vertical drop the upper falls has an adequate plunge pool, the lower falls may not have an adequate plunge pool no significant drops
	1.0 km above MHW	two vertical falls	20	
	50 m above MHW	cascading falls	10	
Glory	400 m below lake	cascading falls	30	
Peanut	500 m above MHW	cascading falls	5	no significant drops
	75 m above MHW	vertical falls	4	has adequate plunge pool
Pleasant Bay	800 m downstream	cascading falls	6	no significant vertical falls from the lake
Unnamed (Seymour)	200 m below upper lake	vertical falls	4	no plunge pool
	400 m below upper lake	cascading falls	6	no significant vertical drops
	1.0 km below lower lake	vertical falls	10	no significant vertical drops
	1.2 km below lower lake	vertical falls	6	no adequate plunge pool
	50 m above MHW	vertical falls	5	deep plunge pool
Shelter	just below lake	beaver blockage	1	very low water flow over this blockage
	5 m above MHW	cascading falls	3	no significant vertical drops
Slide	50 m below lake	velocity barrier	50	one 3 m vertical drop
	1.0 km above MHW	vertical falls	10	minimal plunge pool
Lower Sweetheart	begin 300 m below lake to 50 m above MHW	series of approximately ten vertical falls (range 3-30)	160	2 falls in excess of 20 m, lowest falls has a bad rock outcrop
Taylor	30 m below lake	vertical falls	3	adequate plunge pool
	50 m above MHW	vertical falls	3	adequate plunge pool

^a Islet Lake and the unnamed lakes at Kanalku Bay had no barriers and contained anadromous fish.

Appendix B4. Results of the barrier falls evaluation of the lowermost falls on the outlet of Lower Sweetheart Lake, 1980.

	Ziplock Bag	Baggie	Balloon	Total
Number Broken	3	3	3	9
Number Unbroken	2	1	4	7
Total	5	4	7	16
Proportion Unbroken	0.40	0.25	0.57	0.44

Appendix B5. Fish collected at northern southeast Alaska lakes, by sampling method, 1980.

Lake	Number & Type of Gear ^a	Mean Soak Time (h)	Species ^b	Number	Fork Length (mm)	
					Range	Mean
Adale	12 MT	23	... ^c
	1 SG	1
Eliza	7 MT	23	DV	83	50-195	111
Glory	9 MT	23	DV	76	66-178	119
Islet	4 MT	4	CT	2	130-173	152
			DV	1	ND ^d	172
			SB	35	ND	ND
			SS	1	ND	50
	1 GN	4	DV	2	202-350	276
			CT	7	103-380	213
	SS	12	220-400	265		
Unnamed (Kanalku)	9 MT	20	DV	1	ND	79
			CT	1	ND	81
			CO	11	59-76	72
			SS	19	47-75	69
Peanut	7 MT	21	DV	37	78-158	126
			CO	25	53-106	76
			SB	3	41-50	46
			KO	1	ND	153
Pleasant Bay	12 M	18	DV	21	62-207	108
			DV	1	ND	410
			CT	7	140-300	224
			KO	3	160-175	168
	1 SG	1	CT	5	202-398	350
			DV	7	322-412	370
Upper Unnamed (Seymour)	4 MT	4	DV	4	110-162	138
	1 GN	3	DV	1	ND	123
Lower Unnamed (Seymour)	9 MT	15	DV	129	83-175	137
			SB	4	43-65	57
	1 GN	4	DV	33	120-460	233
Shelter	12 MT	20	CT	15	103-200	154
			DV	65	99-191	142
			SB	1	ND	48

-continued-

Lake	Number & Type of Gear ^a	Mean Soak Time (h)	Species ^b	Number	Fork Length (mm)	
					Range	Mean
Shelter						
-continued-	2 SN	ND	CT	1	ND	158
			SB	21	ND	50
	1 SG	1	CT	1	ND	196
Slide	7 MT	7	DV	60	55-196	121
Lower	21 MT	17	DV	424	50-165	96
Sweetheart			RB	1	ND	102
	1 SG	1	RB	1	ND	397
Taylor	5 MT	4	CT	6	117-170	142
			DV	32	85-150	119
	1 SG	1	CT	2	170-280	225
			DV	2	185-290	238

^a MT - small minnow trap
 SG - sport fishing gear
 GN - gillnet
 SN - seine net

^b DV - Dolly Varden
 CT - cutthroat
 SB - stickleback
 CO - cottid
 KO - kokanee
 RB - rainbow trout
 SS - coho salmon

^c No fish were caught.

^d ND - No data.

Appendix B6. Zooplankton composition in samples from twelve lakes in northern southeast Alaska, 1980.^a

LAKE	DATE	#	D	CLADOCERA				COPEPODA				ROTIFERA			TOTAL	TOTAL ^b
				Besminid	Daphnid	Holopod	Chydor	Cyclo- poid	Calanoid	Nauplii	Kelli- cot	Asplan- cha	Cono- chilus	Cono- chiloid	PER SAMPLE	USABLE PER SAMPLE
Adale	June 4	1	9	6	0	0	0	0	6	0	3	0	0	0	15	12
		2	7	2	0	0	0	0	5	0	0	0	0	0	7	7
Eliza	August 17	1	50	5,845	4,550	4,655	0	14,350	4,305	105	945	0	945	245	35,945	33,810
		2	50	3,955	5,005	4,655	0	16,800	2,905	0	305	0	1,155	105	34,930	33,320
Glory	July 23	1	50	10,220	420	0	0	103,180	420	16,800	16,380	0	0	980	148,400	131,040
		2	50	14,980	0	0	0	104,580	0	10,220	11,620	0	0	420	141,820	129,780
Islet	Sept. 13	1	5	130	370	2,670	0	530	2,700	600	570	0	1,170	2,900	11,640	7,000
		2	5	200	230	1,870	0	930	1,970	870	570	0	830	900	8,370	6,070
Unnamed (Kanalku)	Sept. 24	1	15	2,530	900	0	0	5,030	430	2,870	730	0	30	1,830	14,350	11,760
		2	15	2,330	1,170	0	0	5,630	400	670	470	0	30	1,400	12,100	10,200
Peanut	August 4	1	27	7,700	1,505	0	0	26,250	0	0	1,050	5,005	1,050	595	43,155	35,455
		2	27	5,705	245	105	0	29,400	0	0	105	3,745	255	2,800	44,660	35,455
Pleasant Bay	August 20	1	21	11,075	1,925	0	75	0	6,325	0	2,575	0	0	0	21,975	29,100
		2	21	16,500	1,075	0	0	0	7,425	175	3,925	0	0	0	29,100	25,175
Unnamed (Seymour) Upper	Sept. 10	1	12	35,980	6,020	0	0	58,800	4,200	420	1,820	0	0	980	108,220	106,400
		2	12	36,820	8,400	0	0	75,180	4,620		7,420	0	0	980	133,420	125,020
Lower	Sept. 11	1	20	8,610	700	0	0	42,000	490	5,110	3,290	0	0	210	60,410	56,910
		2	20	5,110	1,400	0	0	47,810	210	6,790	2,100	0	0	210	63,630	61,320
Shelter	July 14	1	5.5	0	0	26	0	131	41	86	50	0	51	35	419	284
		2	5.5	5	0	0	0	300	125	56	75	0	71	0	632	486
Slide	July 5	1	31	3,220	18,620	0	0	101,220	980	4,620	7,980	1,820	3,780	0	142,240	128,660
		2	31	2,880	16,380	0	0	95,620	980	5,600	6,580	1,400	3,220	16,800	149,380	121,380
Lower Sweetheart A	June 8	1	18	0	0	75	0	18,075	0	7,925	0	0	0	0	26,075	26,075
		2	50	0	0	675	0	26,675	0	675	425	0	0	0	43,600	43,175
B	June 9	1	50	0	0	425	0	26,325	0	8,575	0	0	0	0	35,325	35,325
		2	50	0	0	425	0	26,325	0	8,575	0	0	0	0	35,325	35,325

^a Taylor Lake was not sampled.

^b Does not include inedible fish food (Rotifers, Ostracods, etc.)

Appendix B7. Water chemistry of ten lakes in northern southeast Alaska surveyed in 1980.

Lake	Date	Time (h)	Sample Depth (m)	Sample Temp. (°C)	Total Hardness (mg/l)	Alkalinity (mg/l)	Ph	Conductivity (μmhos/cm)	Dissolved Oxygen (mg/l)
Adale	June 3	1000	1	9.0	3	2	7.2	...	13
		1200	4.5	8.5	2	4	7.2	...	13
		1300	9	6.4	2	4	7.3	...	12
Eliza	August 17	1440	1	14.6	1	1	6.9	...	10
		1540	17	5.3	3	2	6.8	...	12
		1630	65	4.5	1	1	6.6	...	10
Glory	July 23	1300	1	11.0	1	2	6.7	...	10
		1330	20	5.0	1	1	6.4	...	11
		1400	95	3.8	1	1	5.8	...	8
Islet	Sept. 13	1630	1	12.7	1	2	6.6	...	9
		1715	3	12.5	1	1	6.4	...	8
		1700	7	7.8	2	2	6.4	...	1
Unnamed (Kanalku) Lower	Sept. 24	1545	1	12.5	2	2	6.9	...	9
		1620	15	5.2	2	2	6.4	...	5
Peanut	August 4	1400	1	15.8	3	3	7.3	185	9
		1600	10	7.8	3	3	7.0	...	9
		1530	30	4.4	3	4	6.9	...	7
Pleasant Bay	August 20	1105	1	12.4	3	3	7.1	...	10
		1145	24	6.1	3	2	6.9	...	8
Unnamed (Seymour) Upper	Sept. 10	1830	1	8.5	2	3	7.1
Lower	Sept. 11	1705	1	12.0	2	2	7.0	...	10
		1800	13	6.8	2	2	6.7	...	9
		1745	20	6.0	2	2	6.5	...	8
Shelter	July 14	1300	1	18.8	2	2	7.1	900	10
		1320	6.5	9.5	2	2	6.4	990	5

-continued-

Appendix B7. (Page 2 of 2).

Lake	Date	Time (h)	Sample Depth (m)	Sample Temp. (°C)	Total Hardness (mg/l)	Alkalinity (mg/l)	Ph	Conductivity (µmhos/cm)	Dissolved Oxygen (mg/l)
Slide	August 5	1650	1	11.8	2	2	7.1	1,000	10
		1635	20	6.2	2	2	6.9	...	10
		1800	34	5.0	3	2	6.7	...	8
Lower Sweetheart A	June 25	1345	1	11.5	1	2	7.0	2	12
		1330	7	10.0	1	2	6.9	2.1	11
		1300	19	9.3	1	2	6.9	2.5	11
B	June 27	1430	1	10.5	1	1	7.0	390	10
		1630	20	5.2	1	2	...	290	10
		1600	100	4.0	3	3	7.4	...	11
C	June 26	1530	1	9.5	2	2	6.9	2.0	11
		1515	10	7.0	2	2	6.9	2.2	12
		1500	31	4.9	3	3	6.9	2.8	10
Taylor	August 14	1230	1	10.4	3	4	7.1	...	10

^a Data not collected.

