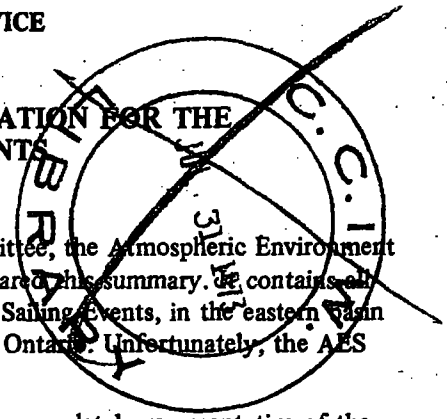
Environment Canada Imaging Cover Page

Report N.: 

SKP Box Number: 672572447

CDS #2-73

ATMOSPHERIC ENVIRONMENT SERVICE



BACKGROUND CLIMATOLOGICAL INFORMATION FOR THE 1976 OLYMPICS SAILING EVENTS

With the concurrence of the Kingston Organizing Committee, the Atmospheric Environment Service (AES) of the Canada Department of the Environment has prepared this summary. It contains all available climatological data relevant to the site of the 1976 Olympics Sailing Events, in the eastern basin of Lake Ontario a few miles to the southwest of the city of Kingston, Ontario. Unfortunately, the AES has no information on currents or waves in this area.

None of the stations whose data are presented below are completely representative of the precise site of the sailing courses. There is a pronounced lake breeze in the area which is modified to some extent by the surrounding topography. To help fill this obvious gap, the AES plans to operate a meteorological tower in the course area during the summers 1973, 1974 and 1975, as well as during the events themselves. At the end of each summer, the collected data will be summarized and mailed to those who have already requested and received this report. It is anticipated that the Kingston Organizing Committee will collect wave data from the same tower while the meteorological data are being gathered. Furthermore, because the weather data are telemetered from the tower to a shore location, they will be available during the events to the Organizing Committee, and through them to the competitors and their support staff.

The stations used in this summary are listed in table 1.

Trenton is the closest first-order station with a good length of record, and is located some 85 km west of Kingston, near the western end of the Bay of Quinte. In the tables which follow, only Trenton provides data on humidity, cloud amount and thunderstorm and fog occurrence. Where relevant, only data for 1000 hours to 1500 hours Eastern Standard Time (GMT-5) are presented. Climatological data are archived by local standard time, even though the time in use during the summer is "daylight saving." Thus, these data correspond to the 1100 to 1600 (local time) period during which the events will be held.

Main Duck Island is a lighthouse station about 20 km SSW of the site of the sailing events. In addition to being exposed to a long water fetch from most directions, the anemometer there is quite high. This means that the wind speeds shown in table 9(a) are higher than one would find in the course area at a standard 10m height. The wind record at Main Duck was not continuous through the 1944-1972 period, but this should not bias the summary.

Wind data in table 9(b) from Kingston Marine cover the interval 1963 through 1967 only. Thereafter, this station was replaced by Kingston Airport, shown in table 9(c). Data from these stations have not been combined because they show quite vividly the extent of the lake breeze and local topography effects. Apparently, on most summer days, the lake breeze dominates the circulation of the area during the period through which the events would take place. At Kingston A, local topography is such that the lake breeze is predominantly from the south, whereas at Kingston Marine, it is southwesterly. Because of a difference in wind equipment, the data at Main Duck and Kingston Marine are from eight points of the compass whereas at Kingston A they are to sixteen points.

The specific climatological information that is available is contained in the eight tables that follow. General information about the Great Lakes area is contained in "The Climate of the Great Lakes Basin." A complimentary copy of that publication will be made available to the official Olympic Committee of each country upon request, and additional copies may be purchased at $1.50 (Can.) each.

Surface water temperatures in the area in summer are determined largely by the major weather systems. The seasonal trend is quite variable, and on warm clear days, there is a considerable diurnal variation. Locally, rapid changes can be caused by the action of the wind. Temporarily, large horizontal gradients of temperature can be created by the downward transport of the warm surface water and resultant exposure of the cooler sub-surface water along lee shores. Scattered airborne infrared thermometer surveys undertaken by the AES since 1966 have included this area. All such data available are presented in the 18 maps of fig. 1. The equipment is such that information is gathered only along the aircraft tracks which are indicated. The indicated temperature values are such that one may interpolate linearly between plotted values.

For obvious reasons, no attempt has been made to summarize these water temperature data. It may be noted, however, that during July, temperatures as low as 13°C and as high as 22°C have been observed. The spread in August is much less – 19°C to 24°C.

It is hoped that the information presented here will satisfy initial needs for meteorological data for advance planning, and that information to be collected from the tower over the next three summers will permit suitable refinement of these plans.

May 16, 1973

Meteorological Application Branch
Atmospheric Environment Service
4905 Dufferin Street
Downsview, Ontario
M3H 5T4

Table 1. Stations quoted in this summary.

Name	North Lat.	West Long.	Height of anemometer
Trenton A	44°07′N	77°32′W	10 M
Main Duck Island	43°56′N	76°38′W	28 M
Kingston Marine	44°14′N	76°27′W	14 M
Kingston A	44°13′N	76°36′W	9 M
Kingston Ontario Hydro	44°16′N	76°30′W	–

Table 2.

Temperature – Normals of temperature and precipitation based on the period 1941–1970 for the months of July and August.

	Station					
	Kingston Ont Hydro		Main Duck Island		Trenton A	
	Jul	Aug	Jul	Aug	Jul	Aug
Mean Daily Temperature (Deg. F)	70.0	68.5	67.9	68.6	69.4	68.1
Mean Daily Maximum Temperature	79.8	78.5	73.8	74.2	79.0	77.8
Mean Daily Minimum Temperature	60.1	58.5	61.9	63.0	59.9	58.2
Extreme Maximum Temperature	95	97	84	87	102	97
No. of Years of Record	25	25	12	12	32	30
Extreme Minimum Temperature	43	39	49	48	42	38
No. of Years of Record	25	25	12	12	32	31
No. of Days with Frost	0	0	0	0	0	0
Mean Rainfall (Inches)	2.78	3.16	1.98	2.93	2.69	2.69
Mean Snowfall	0.0	0.0	0.0	0.0	0.0	0.0
Mean Total Precipitation	2.78	3.16	1.98	2.93	2.69	2.69
Greatest Rainfall in 24 hrs	4.67	2.32	2.79	2.10	2.78	2.81
No. of Years of Record	25	25	12	12	33	33
Greatest Snowfall in 24 hrs	0.0	0.0	0.0	0.0	0.0	0.0
No. of Years of Record	25	25	12	12	33	33
Greatest Precipitation in 24 hrs	4.67	2.32	2.79	2.10	2.78	2.81
No. of Years or Record	25	25	12	12	33	33
No. of Days with Measurable Rain	9	9	6	8	8	9
No. of Days with Measurable Snow	0	0	0	0	0	0
No. of Days with M. Precipitation	9	9	6	8	8	9

Table 3.

Humidity – Normals of Relative Humidity four times daily based on the period 1957–1966 for the months of July and August.

TRENTON (A), ONT.		Jul	Aug
01 EST			
Dry Bulb Temperature	(°F)	64	62
Dew Point Temperature	(°F)	57	57
Relative Humidity	(%)	79	83
07 EST			
Dry Bulb Temperature	(°F)	65	63
Dew Point Temperature	(°F)	58	58
Relative Humidity	(%)	79	85
13 EST			
Dry Bulb Temperature	(°F)	75	74
Dew Point Temperature	(°F)	59	58
Relative Humidity	(%)	57	58
19 EST			
Dry Bulb Temperature	(°F)	73	70
Dew Point Temperature	(°F)	59	58
Relative Humidity	(%)	62	65

Table 4.

Annual Maximim Wind Speeds – Annual maximum wind speeds that may be expected to occur once in 2, 5, 10, 25 and 50 years respectively. The values in this table do not necessarily pertain to the months of July and August, but take all months into consideration and are based on the full period of record of observations.

Station	No. of Years of Record	Return Period 2	5	10	25	50
Trenton (A)	22	43	49	53	58	62

Table 5.

Cloud – Mean cloud amount and the percentage frequency of occurrence of amounts of 8 to 10 tenths, 3 to 7 tenths and 0 to 2 tenths for the months of July and August based on observations at the four synoptic hours which are 00, 06, 12 and 18 Greenwich Mean Time over the period 1941–1960.

		Jul	Aug
Trenton A	Mean Cloud (tenths)	5.2	5.2
	Frequency of 8-10/10 (%)	38	39
	3- 7/10 (%)	29	29
	0- 2/10 (%)	33	32

Table 6.

Thunderstorms (a) – The average number of days with thunderstorms for the months of July and August based on the period 1941–1960.

	Jul	Aug
Trenton A	4.6	3.9

Thunderstorms (b) – The total number of observations of thunderstorms for hours 1000 to 1500 Local Standard Time for the months of July and August during the period 1957–1966.

	Hour	Jul	Aug
Trenton A	10	1	
	11		4
	12	2	2
	13	6	
	14	4	5
	15	3	6

Table 7.

Fog (a) – Mean monthly days with fog for the months of July and August based on the period 1941–1970. In this table, a day with fog is one on which the fog reduced the visibility to less than 5/8 of a mile at any time during the 24 hour period.

	Jul	Aug
Trenton A	1.6	1.8

Fog (b) – The total number of observations of fog for hours 1000 to 1500 Local Standard Time for the months of July and August during the period 1957–1966. In this table, the values refer to all those cases in which the visibility was recorded as 6 miles or less and fog was reported.

	Hour	Jul	Aug
Trenton A	10	16	23
	11	13	12
	12	7	10
	13	8	9
	14	7	5
	15	5	9

Table 8.

Sunshine – Normal values of daily bright sunshine for the months of July and August based on the period 1941–1970.

	Jul	Aug
Kingston	289	262

Table 9.

The number of occurence by wind direction and speed (MPH) classes for the months of July and August, for the hours 1000 through 1500 EST, for the period of record shown.

Table 9(a) – Main Duck Island – 1944-1972

	Total	SPD	1-3	4-7	8-12	13-18	19-24	25-31	32+	Percent	Mean
July											
Calm	13									.3	
NE	333		27	81	89	74	42	17	3	8.3	11.9
E	24		11	8	5					.6	5.2
SE	216		21	66	77	43	8	1		5.4	9.3
S	913		41	196	308	222	114	31	1	22.8	12.0
SW	1,599		47	169	422	587	289	76	9	40.0	14.3
W	563		28	88	93	141	139	72	2	14.1	15.4
NW	132		22	39	29	28	9	5		3.3	9.6
N	209		31	72	51	39	11	5		5.2	9.1
Total	4,002*		228	719	1,074	1,134	612	207	15	100.0	12.9
August											
Calm	8									.2	
NE	421		20	88	87	115	76	34	1	9.6	13.6
E	34		6	10	14	4				.8	7.9
SE	203		10	46	59	44	27	12	5	4.6	13.0
S	1,071		62	240	347	253	125	40	4	24.4	11.7
SW	1,492		31	152	336	618	285	64	6	34.0	14.6
W	589		38	98	94	121	142	80	16	13.4	15.5
NW	223		29	33	47	63	32	11	8	5.1	13.1
N	342		45	108	76	66	38	8	1	7.8	10.2
Total	4,383*		241	775	1,060	1,284	725	249	41	100.0	13.4

* Percentages computed using this total

Table 9(b) – Kingston Marine – 1963-1967

	Total	SPD	1-3	4-7	8-12	13-18	19-24	25-31	32+	Percent	Mean
July											
Calm	2									.2	
NE	65		4	22	27	11	1			7.0	8.8
E	13		4	7	2					1.4	4.8
SE	45		5	22	6	12				4.9	8.1
S	24		1	16	7					2.6	6.7
SW	658		5	86	310	192	55	10		71.3	12.0
W	14		1	1	4	8				1.5	12.5
NW	74		1	13	55	3	2			8.0	9.7
N	28			7	19	1	1			3.0	9.4
Total	923*		21	174	430	227	59	10		100.0	11.1
August											
Calm	5									.5	
NE	66		1	22	32	11				7.2	9.3
E	26		4	16	6					2.8	5.4
SE	73		8	37	9	19				8.0	7.9
S	61		5	18	19	17	2			6.7	9.7
SW	510		6	75	197	161	61	10		55.9	12.7
W	28		1	3	7	11	6			3.1	13.1
NW	111		2	22	61	23	3			12.2	10.2
N	33		3	13	13	4				3.6	8.1
Total	913*		30	206	344	246	72	10		100.0	11.1

*Percentages computed using this total

Table 9(c) – Kingston Airport – 1967-1972

	Total	SPD	1-3	4-7	8-12	13-18	19-24	25-31	32	Percent	Mean
July											
Calm	22									2.0	
NNE	18			7	7	4				1.6	9.3
NE	24		1	2	15	6				2.2	10.4
ENE	8			2	5	1				.7	9.6
E	8		1	5	2					.7	6.3
ESE	4			2	2					.4	7.0
SE	20			7	12	1				1.8	8.5
SSE	68		1	27	32	8				6.1	8.1
S	466		6	85	237	131	5	2		41.8	10.7
SSW	183		1	32	73	71	6			16.4	11.5
SW	112		1	6	43	51	9	2		10.0	13.6
WSW	61		2	2	26	28	2	1		5.5	12.9
W	44		1	8	8	22	5			3.9	12.9
WNW	15			1	5	9				1.3	12.6
NW	29		1	13	11	4				2.6	8.4
NNW	16			2	12	2				1.4	9.4
N	18		1	3	12	2				1.6	9.7
Total	1,116*		16	204	502	340	27	5		100.0	10.7
August											
Calm	15									1.3	
NNE	25			4	9	8	4			2.2	12.4
NE	30		1	4	14	10	1			2.7	11.6
ENE	17			4	8	5				1.5	10.5
E	20			11	8	1				1.8	8.0
ESE	8		1	5	1	1				.7	6.3
SE	27		1	14	9	3				2.4	7.6
SSE	64			30	26	8				5.7	8.6
S	355		5	46	134	164	6			31.8	11.8
SSW	123		3	8	39	66	7			11.0	13.1
SW	153			15	46	70	19	3		13.7	13.8
WSW	70			6	12	36	14	2		6.3	14.5
W	40			10	14	15	1			3.6	11.2
WNW	29		1	3	8	13	3	1		2.6	13.3
NW	61		1	9	25	23	3			5.5	11.6
NNW	36			8	15	12	1			3.2	11.4
N	43		1	12	15	13	2			3.9	10.5
Total	1,116*		14	189	383	448	61	6		100.0	11.8

*Percentages computed using this total

LAKE ONTARIO

SURFACE WATER TEMPERATURE (°C)

BY A.R.T. SURVEY

DATE: JULY 13, 1966 **MEAN TEMP:**

ATMOSPHERIC ENVIRONMENT SERVICE
ENVIRONMENT CANADA

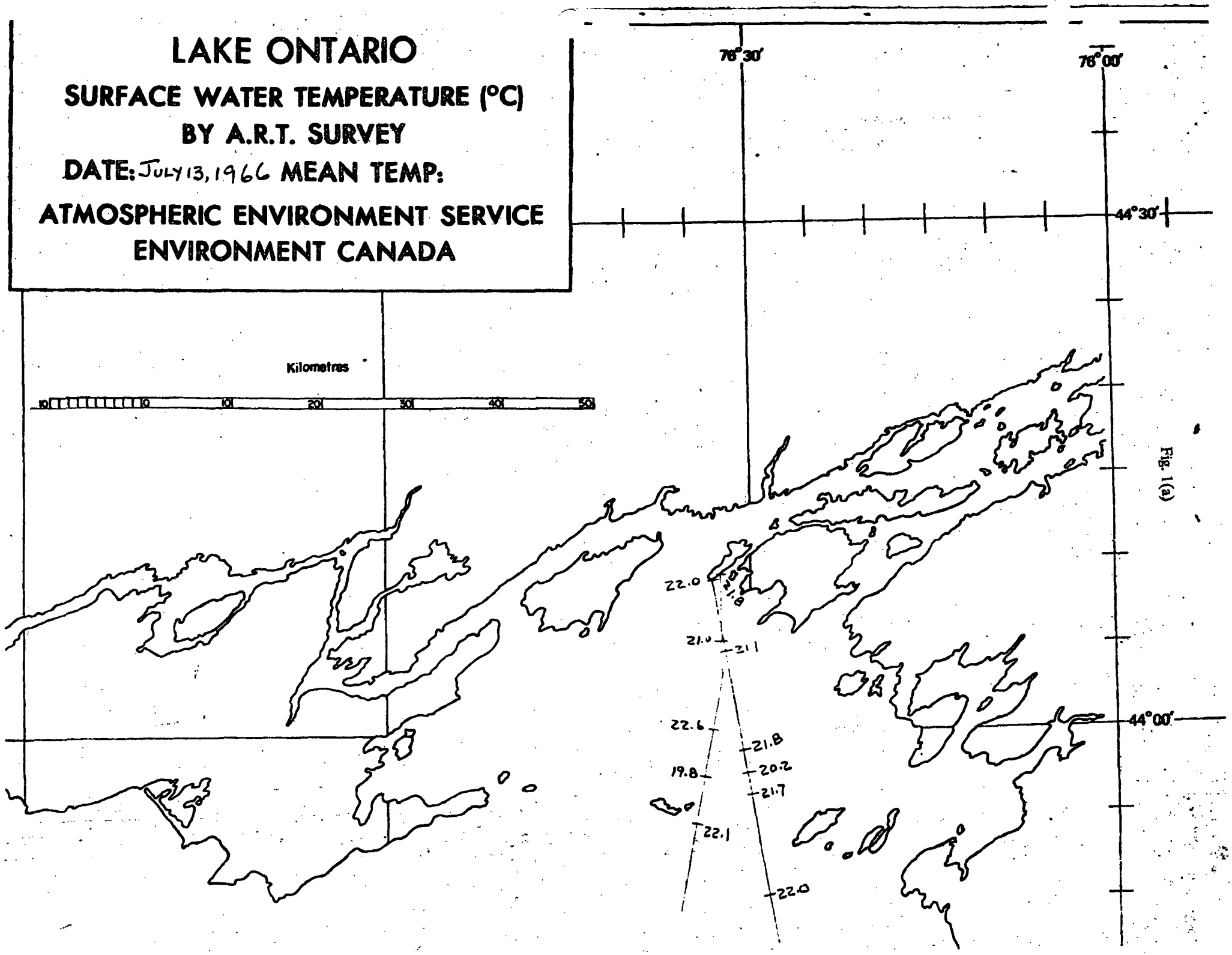


Fig. 1(a)

LAKE ONTARIO

SURFACE WATER TEMPERATURE (°C)

BY A.R.T. SURVEY

DATE: AUG. 17, 1966 **MEAN TEMP:**

ATMOSPHERIC ENVIRONMENT SERVICE
ENVIRONMENT CANADA

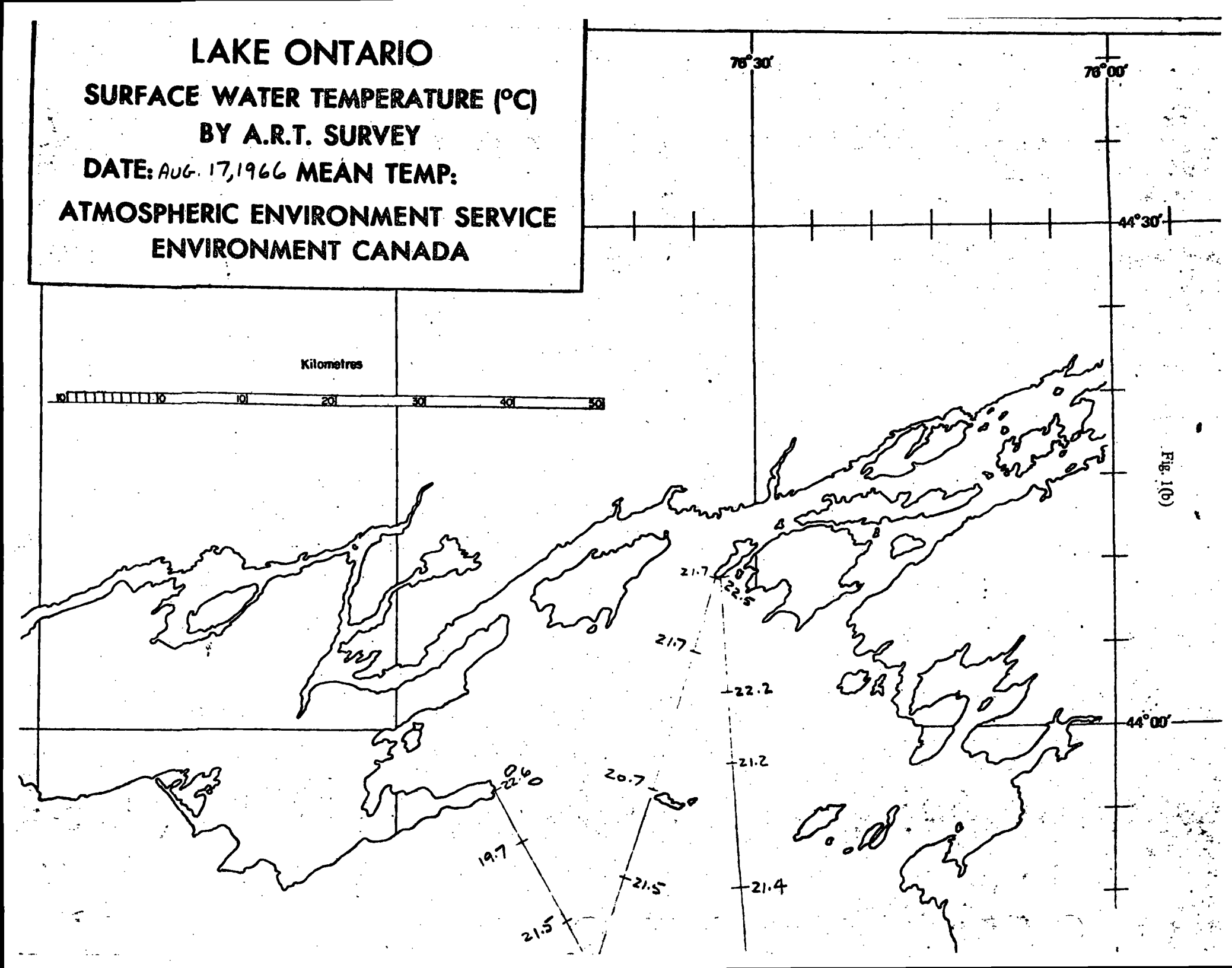


Fig. 1(b)

LAKE ONTARIO

SURFACE WATER TEMPERATURE (°C)

BY A.R.T. SURVEY

DATE: JULY 18, 1967 **MEAN TEMP:**

ATMOSPHERIC ENVIRONMENT SERVICE
ENVIRONMENT CANADA

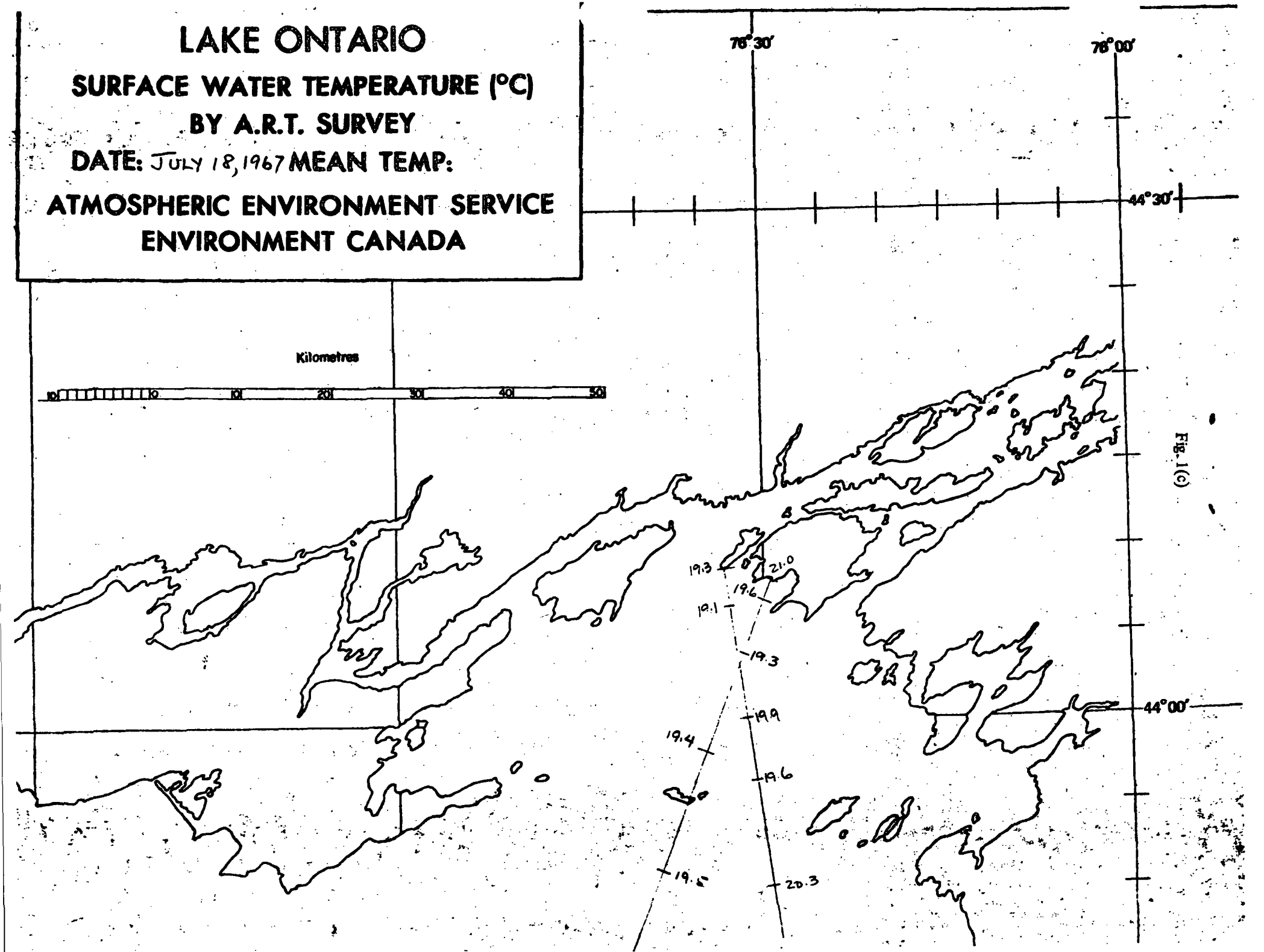


Fig. 1(c)

LAKE ONTARIO

SURFACE WATER TEMPERATURE (°C)

BY A.R.T. SURVEY

DATE: AUG. 14, 1967 **MEAN TEMP:**

ATMOSPHERIC ENVIRONMENT SERVICE
ENVIRONMENT CANADA

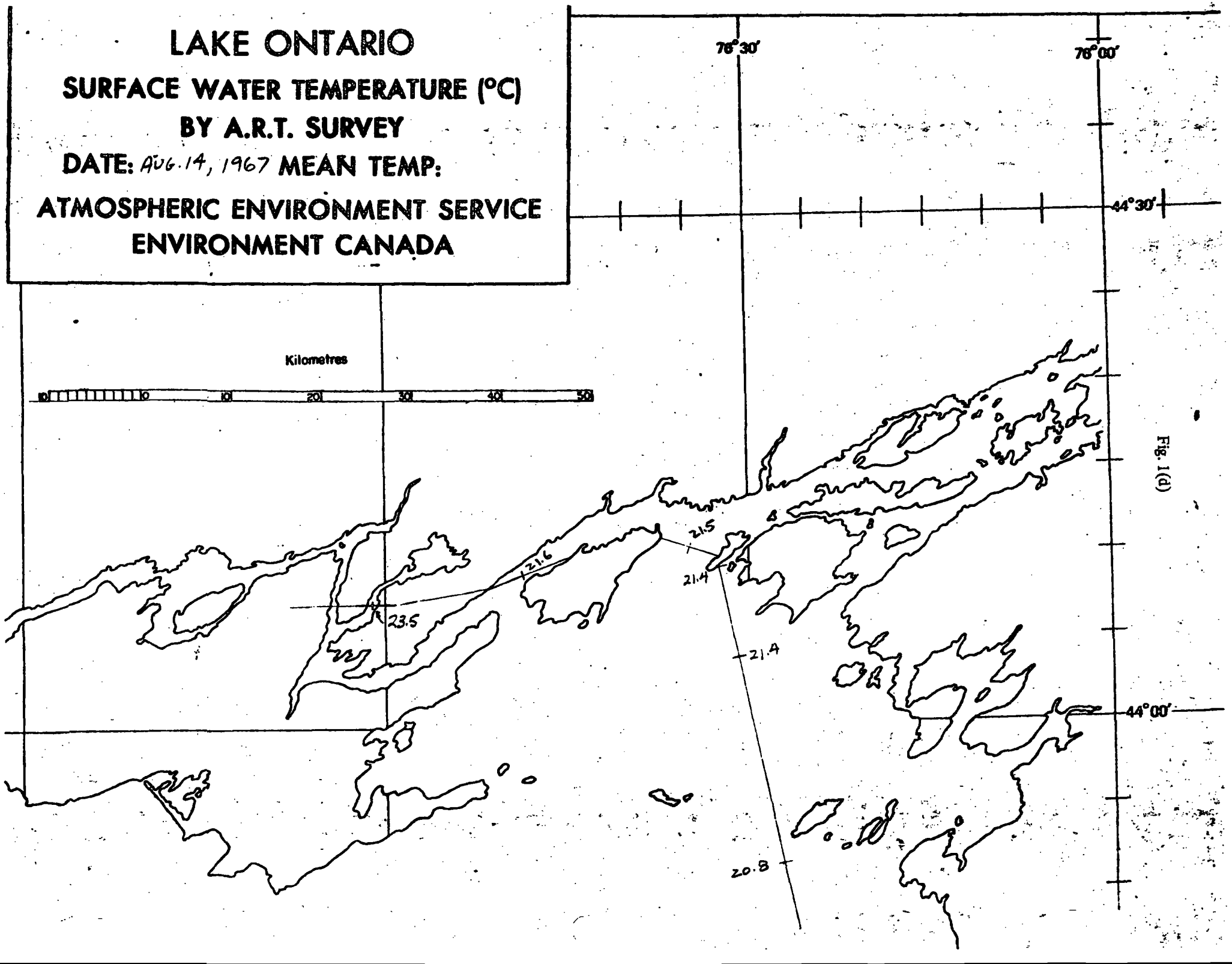


Fig. 1(d)

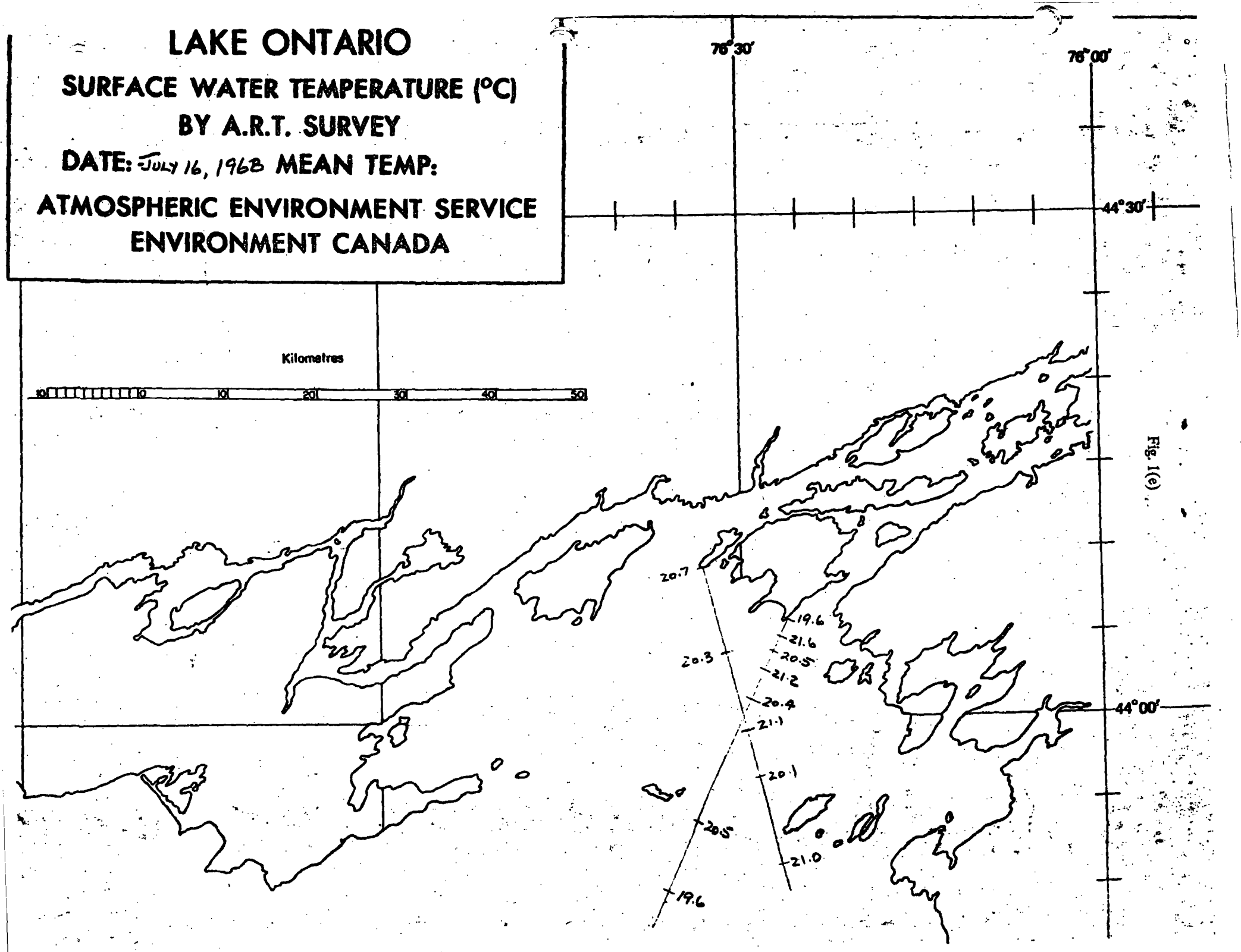

LAKE ONTARIO
SURFACE WATER TEMPERATURE (°C)
BY A.R.T. SURVEY
DATE: JULY 16, 1968 MEAN TEMP:
ATMOSPHERIC ENVIRONMENT SERVICE
ENVIRONMENT CANADA
Kilometres
0 10 20 30 40 50
76°30'
76°00'
44°30'
44°00'
20.7
19.6
21.6
20.3
20.5
21.2
20.4
21.1
20.1
20.5
21.0
19.6

Fig. 1(e)

LAKE ONTARIO

SURFACE WATER TEMPERATURE (°C)

BY A.R.T. SURVEY

DATE: Aug. 18, 1971 **MEAN TEMP:**

ATMOSPHERIC ENVIRONMENT SERVICE
ENVIRONMENT CANADA

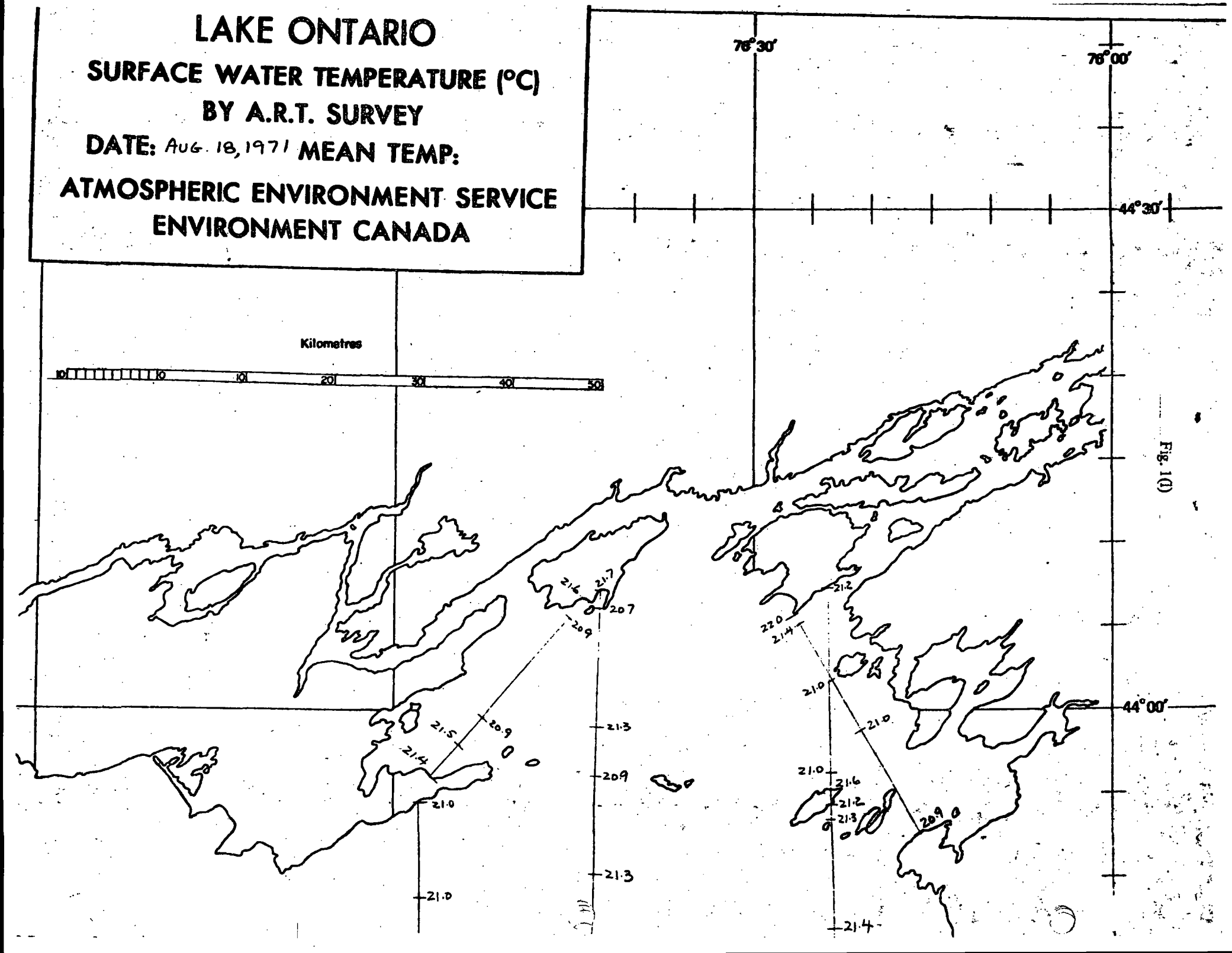


Fig. 1(i)

LAKE ONTARIO

SURFACE WATER TEMPERATURE (°C)

BY A.R.T. SURVEY

DATE: JULY 04, 1972 **MEAN TEMP:**

ATMOSPHERIC ENVIRONMENT SERVICE
ENVIRONMENT CANADA

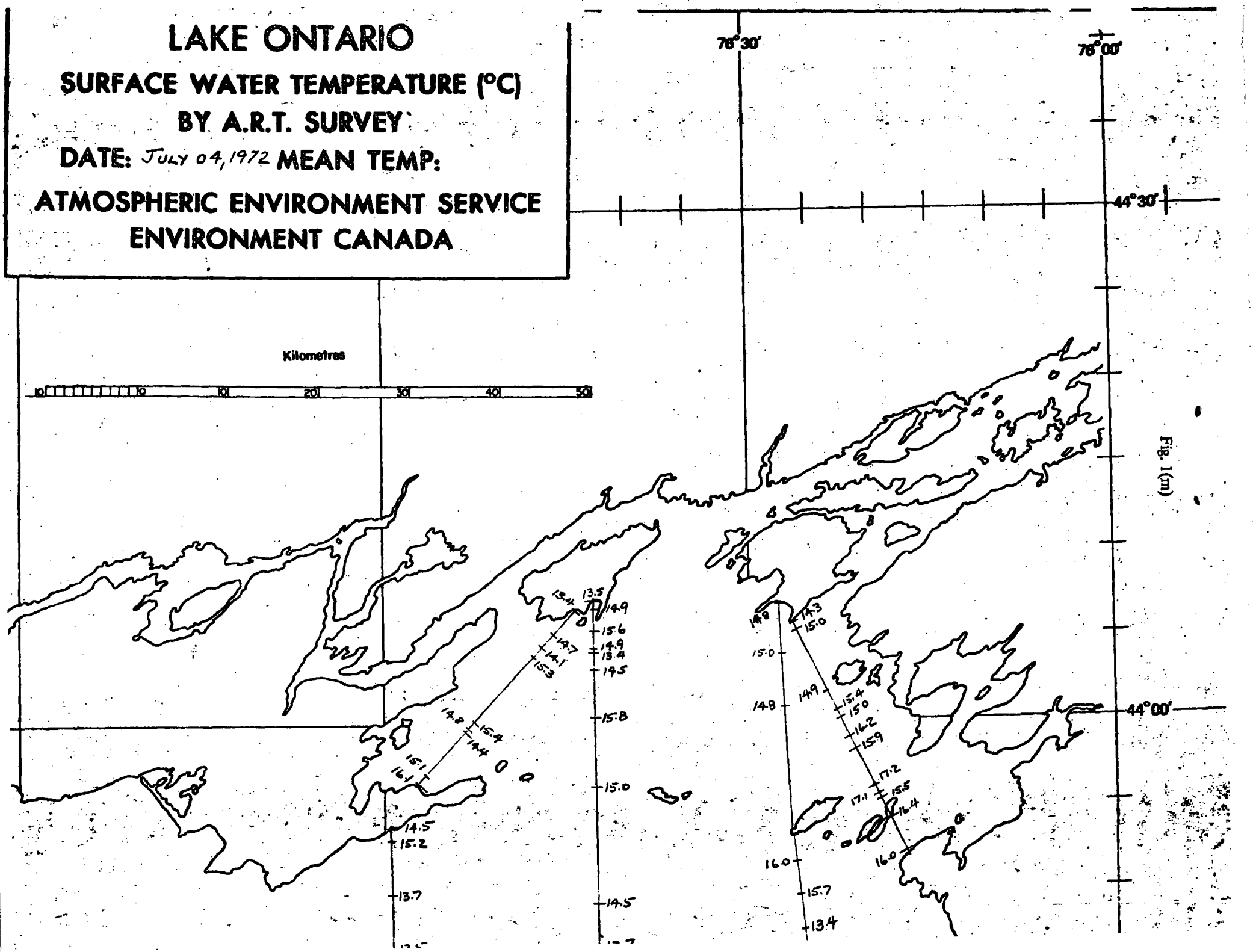


Fig. 1(m)

LAKE ONTARIO

SURFACE WATER TEMPERATURE (°C)

BY A.R.T. SURVEY

DATE: JULY 24, 1972 **MEAN TEMP:**

ATMOSPHERIC ENVIRONMENT SERVICE
ENVIRONMENT CANADA

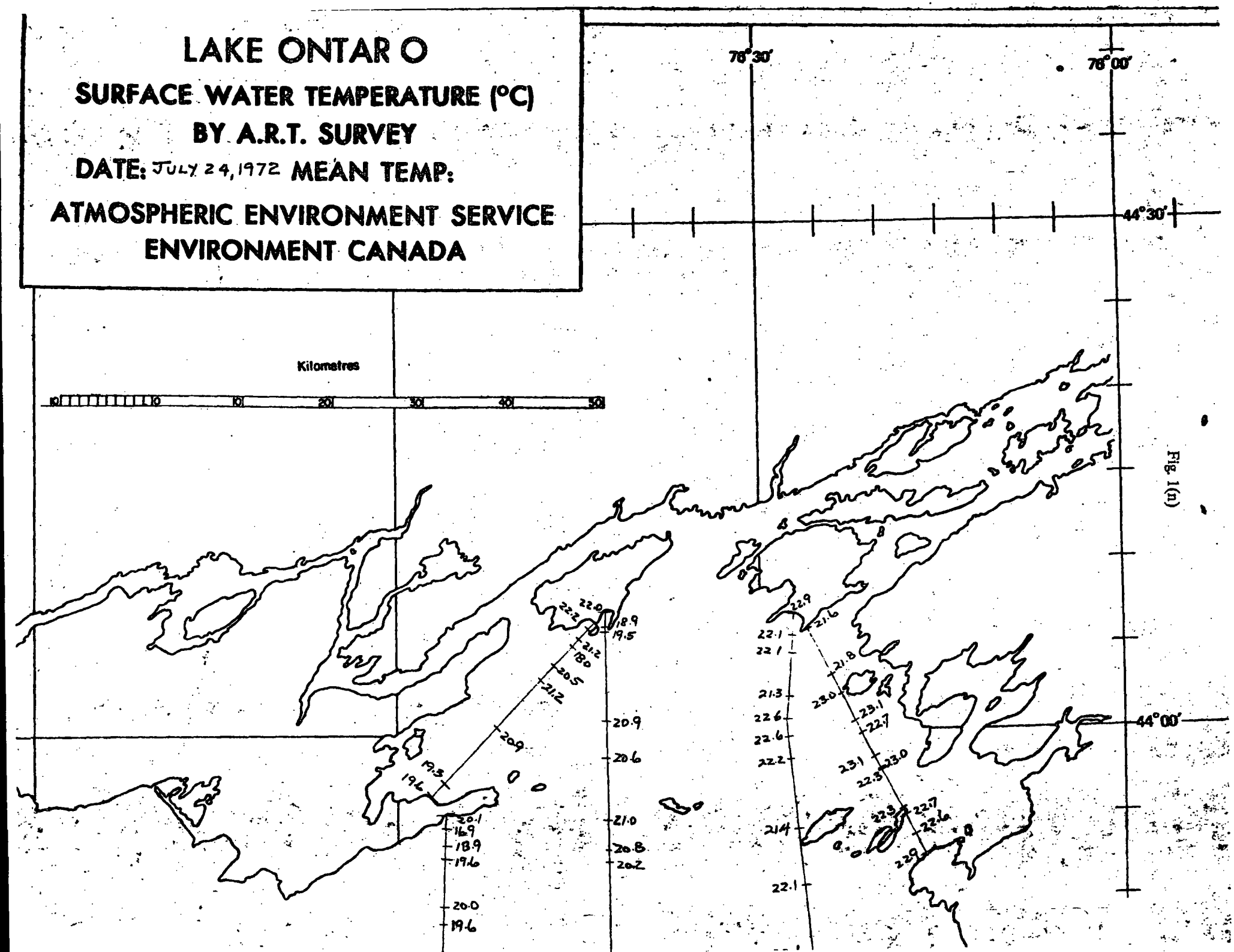


Fig. 1(n)

LAKE ONTARIO

SURFACE WATER TEMPERATURE (°C)

BY A.R.T. SURVEY

DATE: JULY 31, 1972 **MEAN TEMP:**

ATMOSPHERIC ENVIRONMENT SERVICE
ENVIRONMENT CANADA

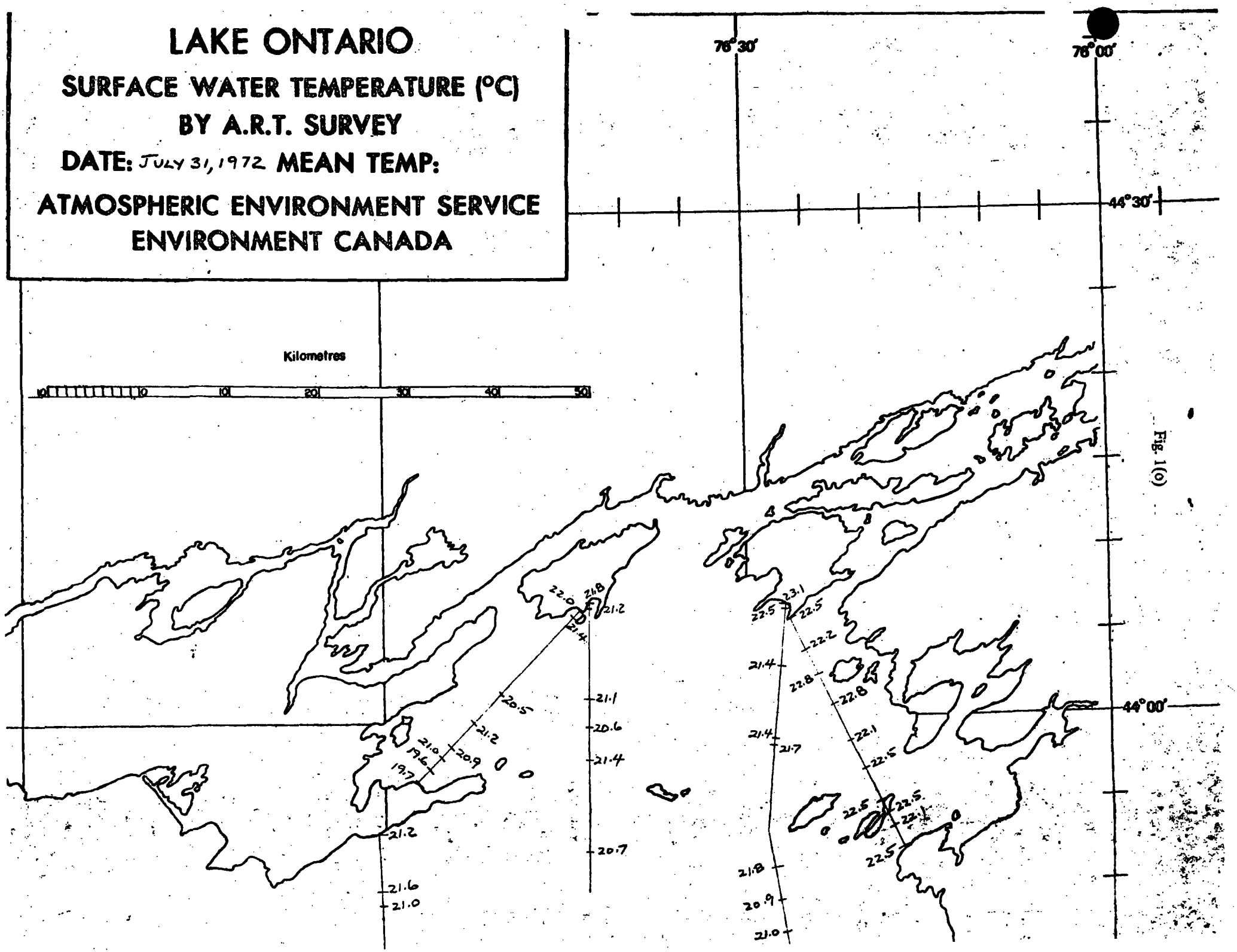


Fig. 1(o)

LAKE ONTARIO

SURFACE WATER TEMPERATURE (°C)

BY A.R.T. SURVEY

DATE: Aug. 08, 1972 **MEAN TEMP:**

ATMOSPHERIC ENVIRONMENT SERVICE
ENVIRONMENT CANADA

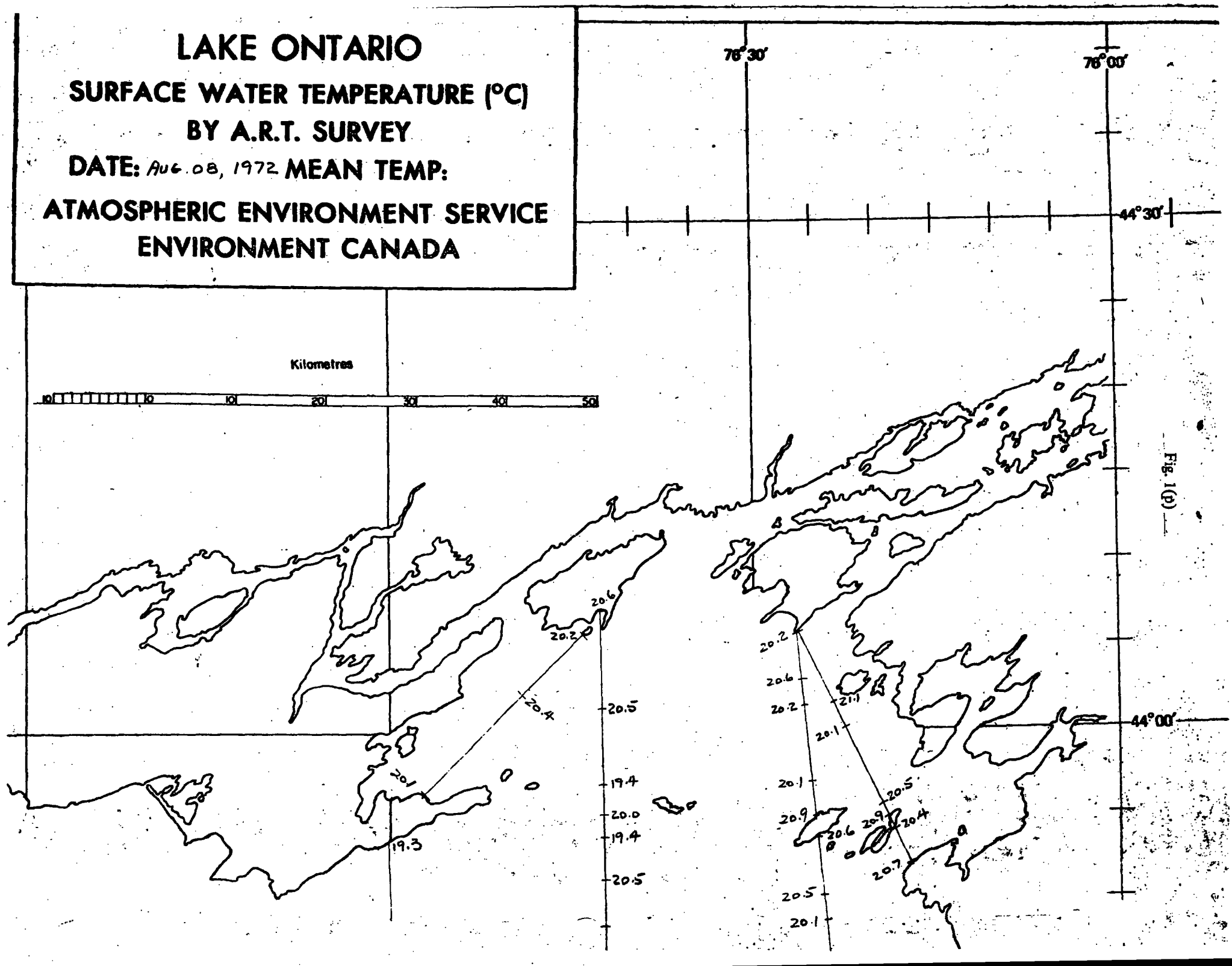


Fig. 1(p)

LAKE ONTARIO

SURFACE WATER TEMPERATURE (°C)

BY A.R.T. SURVEY

DATE: AUG. 18, 1972 **MEAN TEMP:**

ATMOSPHERIC ENVIRONMENT SERVICE
ENVIRONMENT CANADA

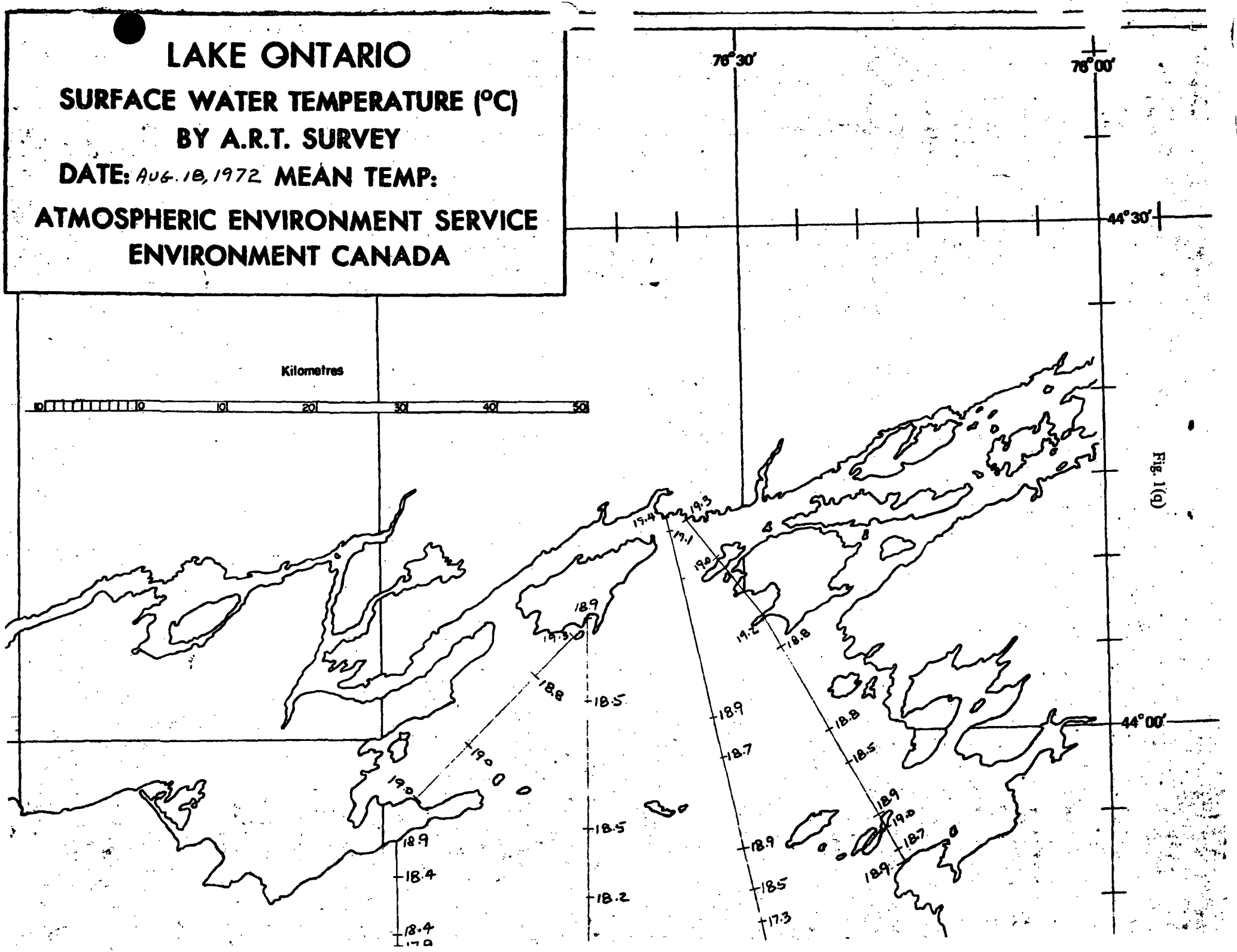


Fig. 1(a)

LAKE ONTARIO

SURFACE WATER TEMPERATURE (°C)

BY A.R.T. SURVEY

DATE: Aug. 30, 1972 **MEAN TEMP:**

ATMOSPHERIC ENVIRONMENT SERVICE
ENVIRONMENT CANADA

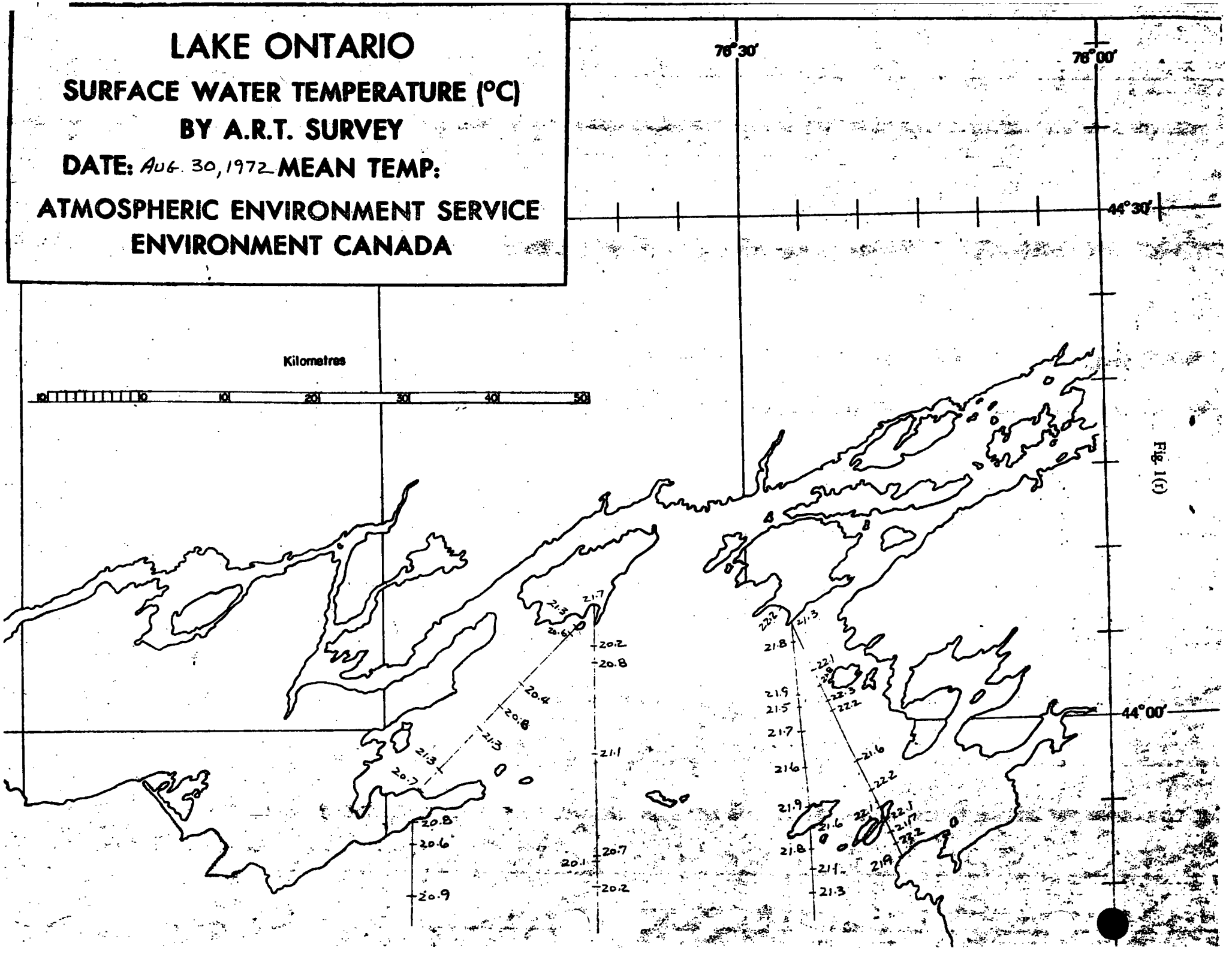


Fig. 1(c)