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U. S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Ocean Survey

Great Lakes Ice Cover

Winter 1971-72

Lake Survey
Center

DETROIT, MICH.

October 1972

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GREAT LAKES ICE COVER

WINTER 1971-72

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Detroit, Michigan

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Great Lakes Ice Cover Winter 1971-72

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ABSTRACT. Thirty-five ice charts were produced from data collected on 23 Lake Survey Center ice reconnaissance flights made in the winter of 1971-72. In addition, five summary ice charts, illustrating ice distribution patterns for short intervals during the winter over the entire Great Lakes, were produced from Lake Survey Center, United States Coast Guard, and Canadian ice reports.

Freezing degree-day accumulations indicate that the 1971-72 winter was severe on western Lake Superior and near normal throughout the remainder of the Great Lakes.

Ice formation was reported November 10 in western Lake Superior at Duluth Harbor and along the perimeter of all the Great Lakes by the end of January. The period of maximum ice cover varied from the second week of February to the last week of March for individual lakes. During this time maximum ice cover was estimated to be as follows: Lakes Superior and Erie, 95 percent; Lake Michigan, 40 percent; Lake Huron, 70 percent; and Lake Ontario, 20 percent. Ice covers begin to decrease during March. Last reported ice ranged from May 5 for the lower lakes in the Niagara River to June 8 for the upper lakes in western Lake Superior.

INTRODUCTION

The Lake Survey Center began visual aerial ice reconnaissance flights over the Great Lakes in the winter of 1962-63 to gather information on the areal extent and structure of the Great Lakes ice cover. Reports describing those activities are available from the Lake Survey Center, Scientific Services Group. This report describes the 1971-72 visual aerial ice reconnaissance program and includes a brief discussion of ice and weather conditions. Canadian Department of the Environment and United States Coast Guard ice data supplement and add continuity to the Lake Survey Center data.

DATA COLLECTION

Aerial Observations

Approximately 64 hours and 5,183 miles (8,292 km) were logged during 23 flights (Table 1) made in the winter of 1971-72. The majority of flights were made in chartered aircraft flying at altitudes up to 6,000 feet (1,800 m). Flights on March 14, April 18, and May 3 were made in U.S. Coast Guard aircraft.

Visual observations of ice conditions were recorded on worksheets and ice charts were prepared immediately after each flight. Ice chart data was transmitted to the U.S. Coast Guard Ice Navigation Center in Cleveland, Ohio, on a real-time basis as part of the Lake Survey Center participation in the Navigation Season Extension Program on the Great Lakes and St. Lawrence Seaway. Ice charts prepared by Coast Guard Ice Navigation Center were transmitted to the Lake Survey Center throughout the winter.

Surface Observations

U.S. Coast Guard ice messages and Lake Survey Center ice observer reports were used to monitor nearshore ice conditions throughout the winter and to plan winter field activities. This data was used in identifying areas of first ice formation and areas where ice remained longest.

DATA PRESENTATION

Freezing Degree-Days

Freezing degree-day values were calculated for Duluth, Minn.; Sault Ste. Marie, Mich.; Green Bay, Wis.; Alpena, Mich.; Detroit, Mich.; Cleveland, Ohio; and Rochester, N.Y., (figs. 1-6) for the period November 1971 through April 1972. A freezing degree-day is defined as a day with the average air temperature one degree below 32°F (0°C). A cumulative sum of the daily values serves as an aid in scheduling reconnaissance flights, estimating time of maximum ice cover, and for winter classification. Average temperatures for the freezing degree-day calculations were taken from the Weekly Weather and Crop Bulletin of the Department of Commerce.

Summary Ice Charts

Summary ice charts were compiled to illustrate ice conditions for the entire Great Lakes during three periods of the ice season; (1) ice formation (figs. 7 and 8), (2) maximum ice cover (fig. 9), and (3) ice decay (figs. 10 and 11). They present a general view of ice concentrations and distributions on each lake for the time period shown and represent a composite of data and not synoptic conditions.

Area Ice Charts

Thirty-five ice charts (figs. 12-46) show ice conditions at specific areas in the Great Lakes system between January 15 and May 4, 1972. They cover Lake Superior, Whitefish Bay, the St. Marys River, the Straits of Mackinac, southern Lake Huron, Lake St. Clair, western Lake Erie, and eastern Lake Ontario. Data on ice charts include ice concentrations, ice boundaries, openings in the ice, age and size of ice floes, ice topography, snow cover, and stage of melting. Abbreviations and symbols used on ice charts are given in Table 2.

WINTER CHARACTERISTICS

Winter Classification

Based on maximum freezing degree-day accumulations at representative National Weather Service stations for each of the Great Lakes, winters are classified as mild, normal, or severe. A comparison of 1971-72 freezing degree-day accumulations with the 1961-70 means shows that western Lake Superior experienced a severe winter (fig. 1) while the remainder of the Great Lakes Basin experienced a near-normal winter, slightly above normal in the upper lakes and slightly below normal on the lower lakes (figs. 1-6).

Winter Weather

November was a month of rapid change as atmospheric pressure troughs and ridges moved in quick succession across the continent producing periods of above and below-normal air temperatures. The average monthly air temperature over the Great Lakes was near normal. November snowfalls of 16.7 inches (42 cm) and 12.6 inches (32 cm) occurred at Houghton Lake, Mich., and Green Bay, Wis., respectively. The Green Bay snowfall was the greatest in 72 years while the Houghton Lake snowfall was over twice the normal for November.

Air temperatures were above normal in December. The average at Cleveland was 39.7°F (4.3°C), the highest December temperature in 40 years. Precipitation was above normal and new monthly records were set at Houghton Lake, Mich., (4.48 inches (11 cm) - greatest in 53 years), Green Bay, Wis., (3.15 inches (8 cm) - greatest in 50 years) and Milwaukee, Wis., (4.34 inches (11 cm) - most December precipitation in 84 years).

Temperatures were generally below normal in early January. The third week of the month provided some relief from the cold as circulation off a high pressure center southeast of the Great Lakes brought warm air and above-normal temperatures to the region. Cold weather returned as artic air moved south the last week of January. A small cyclonic disturbance developed over the Rockies and intensified as it moved toward the Great Lakes and brought blizzard conditions to the region on January 24 and 25. Sault Ste. Marie, Mich., received 53.2 inches (135 cm) of snow in January, the greatest single monthly snowfall ever recorded for the Soo.

Winter storms during the first and third weeks of February brought high winds and heavy snowfall. Sault Ste. Marie set a new February snowfall record with 41.3 inches (105 cm) of snow. Erie, Pa., also set a new February record with 32.1 inches (82 cm), the greatest in 25 years. With the exception of the third week, February temperatures were below normal in the Great Lakes as arctic air dominated the region.

Air temperatures in March were also below normal. Snow depth at Sault Ste. Marie was 50 inches (127 cm), the greatest March snow accumulation in 84 years.

In April precipitation was generally above normal, while monthly temperatures were below normal for the fourth consecutive month. Average air temperatures rose above freezing by the second week in April. However, a new low temperature record of 12°F (-11° C) was set at Duluth, Minn., on April 25th. Milwaukee, Wis., experienced a temperature of 39.4°F (4.1°C), the lowest April temperature in 22 years.

DISCUSSION

Lake Superior

An ice reconnaissance flight was made over Lake Superior on March 14. Flights were made over the St. Marys River and Whitefish Bay on January 21, March 14, 23, April 5, 11, 20, 26, 27, and May 4. One ice chart was compiled for Lake Superior (fig. 12), six ice charts were compiled for Whitefish Bay (figs. 13-18), and seven ice charts were compiled for the St. Marys River (figs. 19-25).

Bays and harbors began to freeze over in late December and early January although temporary ice skims were reported at Duluth Harbor on November 10, in the shallows of Whitefish Bay on November 27, and in the lower portion of the St. Marys River on November 30. The southern half of the river was ice covered by the end of December. The northern half of the river and Whitefish Bay accumulated extensive ice cover by mid-January. By the end of January both the St. Marys River and Whitefish Bay were completely covered. As shown in figure 8 ice lined the shore and extended well into portions of the lake at that time. The last ship passed through the Soo Locks on February 1 ending a 307 day season, the longest on record. Ice-formation potential on western Lake Superior was above normal in February as indicated by the greater than normal freezing degree-day accumulations (fig. 1). By the end of February accumulations were approaching maximum. On February 27, the lake was estimated to be 95 percent ice-covered. Ice conditions observed on a reconnaissance flight over the lake on March 14, timed to coincide with the period of maximum ice cover, are as follows. Winter ice containing cracks and pools and having a light snow cover was observed in the west end of the lake. An area of young ice that extended to the north shore and eastward past Silver Bay was observed to originate about midway between Duluth and Bayfield. The lake between Bayfield and Houghton was covered primarily with lightly ridged winter and young ice. In the Houghton area ice rind lined the west shore of the peninsula while young ice was observed to the east of the peninsula. The open lake between Houghton and Whitefish Bay had winter ice with many cracks while along the south shore east of Munising ice of various ages lined the shore. Maximum freezing degree-day accumulations for the lake occurred during the first week of April, ending the period of ice formation. The St. Marys River ice cover began showing signs of decay in late March as evidenced by areas of open water north of Sugar Island on March 23. Open-water areas increased in number and size throughout April. On May 4 most of the ice in the river was located near Detour with only small amounts in the northern portion of the river.

During April the solid ice edge in Whitefish Bay gradually moved south from the mouth of the bay. Open-water areas developed at the mouth of the bay, along shore, and in ship tracks. By May 4, the bay was well into the ice-decay period.

In Lake Superior an unusually extensive ice cover gave shippers problems in the spring. The first commercial ship passed through the Soo Locks on April 10, nine days after the locks had officially opened. Ice was present in western Superior well into May and the last report of ice from that area of the lake came on June 8th.

Lake Michigan

Lake Survey personnel did not make any flights over Lake Michigan; however, one flight was made over the Straits of Mackinac on March 14, resulting in the production of one ice chart (fig. 26). The following discussion is based primarily on United States Coast Guard and Canadian Department of Environment ice data and Lake Survey Center ice reports.

Ice formation was reported along the north shore on December 14. Areas of Green Bay and the Straits of Mackinac were covered by mid-January and ice had formed along the perimeter of the lake by the end of January. The last commercial ship passed through the Straits on February 2, escorted by the U.S. Coast Guard Cutter Edisto. Ice forming conditions on the northern part of the lake were favorable in February, as indicated by greater than normal freezing degree-day accumulations at Green Bay, Wis., (fig. 2). By the end of February freezing degree-day accumulations were near their seasonal maximum. In early March, the lake was estimated to be 45 percent ice-covered with seven-to ten-tenths concentration over much of the northern portion and seven-to nine-tenths concentration along shore in the southern portion. In March the freezing degree-day accumulation rate was considerably lower than in February, indicating a reduced potential for ice formation. Maximum freezing degree-day accumulations at Green Bay occurred in early April, ending the period of ice formation in that area. Ice cover began to decrease in March, and by early April the only extensive areas remaining were located in Green Bay, the Straits of Mackinac, Little Traverse Bay, and Grand Traverse Bay. Last ice was reported along the north shore on April 26, in Green Bay on April 28, and in Little Traverse Bay on April 29.

Lake Huron

Ice conditions were observed on southern Lake Huron during flights made on January 27 (fig. 27), February 7 (fig. 28), March 10 (fig. 29) and April 17 (fig. 30).

Ice was reported forming in the shallows of Thunder and Saginaw Bays on December 12 and by mid-January both bays were completely covered. Ice was forming along the lake's shoreline by the end of January. Freezing degree-day accumulations were below normal through the beginning of March, and above normal thereafter. Ice cover was estimated to be at its maximum extent in March.

During March ice distribution changed, but the total concentration remained relatively unchanged. The lake was estimated to be 65 percent ice-covered in early March and 70 percent ice covered in late March. Freezing degree-day accumulation reached a maximum in early April, ending the period of ice formation (fig. 3). By late April, ice was still extensive in the Straits of Mackinac, the North Channel, Georgian Bay, and lower Lake Huron south of Saginaw Bay. In addition, Thunder and Saginaw Bays had four-to six-tenths concentrations while concentrations of seven-to nine-tenths were reported along shore between Thunder Bay and the Straits. Ice was last observed in the southern end of the lake on May 3 but was reported in the North Channel and Georgian Bay as late as May 9.

Lake St. Clair

Flights were made over Lake St. Clair and the St. Clair River on January 15, 27, February 7, 8,14, 22, March 3, 10, 24, and April 17. Ten ice charts (figs. 31-40) were produced as a result of these flights.

Skim ice began forming in Anchor Bay on December 3 although mild air temperatures, delayed extensive formation in December (fig. 4). The first flight over the lake (January 15) provided the following information. The lake was covered with young ice and drifted snow. A lead was observed along the central portion of the west shore and a pool was located lakeward from the Clinton River mouth. Large open water areas were observed at the mouths of the St. Clair River delta channels. They and the St. Clair River were ice-free except for small quantities of shore ice. Young ice of seven-to nine-tenths concentration occupied a small area immediately lakeward from the head of the Detroit River. On January 27 the lake was observed to be completely ice covered and along the western shore contained numerous cracks and pools. A mixture of winter and young ice made up mostly of brash, cake, and small-and medium-floes was observed in the central portion of the lake. The St. Clair River contained brash and ice rind. Concentrations in the river varied from six-tenths below Stag Island to nine-tenths above the island. The ice began to show signs of decay in late February, but remained intact through early March. By March 24, the west shore and the delta area were ice-free. Ice rind and brash of one-to five-tenths concentration filled the central portion of the lake and winter ice and brash of eight-to ten-tenths lined the Canadian shore. On April 17 the lake was ice-free except for some brash which extended from the delta channels. They contained brash of nine-tenths concentration and the St. Clair River contained seven-to nine-tenths brash. Drifting ice was reported from the St. Clair River delta area as late as May 1.

Lake Erie

Ice charts (figs. 41-44) were produced from data collected on flights over western Lake Erie on January 27, February 22, March 3, and March 10.

Ice skims were reported in the shallows of bays and harbors as early as November 24; however, above-normal temperatures in November and December did not favor extensive early season formation. Bays and harbors began to freeze over in late December and early January. The Welland Canal closed on January 8 setting a record late closing date. By January 17 the western end of the lake from Point Pelee to the south shore was partially covered with young ice. On January 27, the western end of the lake was observed to be completely ice covered. Winter and young ice composed of small floes, brash, and cake was observed in the island area of western Lake Erie. West of the islands there was a mixture of ice rind and young ice consisting of almost equal parts of brash and cake and floes of various sizes. Low air temperatures in early February improved ice-forming conditions and the lake was estimated to be 95 percent ice-covered on February 10. A combination of above-freezing air temperatures, high winds, and rain in late February reduced the ice cover. Maximum freezing degree-day accumulation at Cleveland occurred during the last week of February (fig. 5) at which time Lake Erie was estimated to be 85 percent ice-covered. Freezing-air temperatures in the first part of March was responsible for late season ice formation. On March 10 a shore lead was observed along the east shore of Point Pelee extending south to Pelee Island. West of the island area the ice was observed to contain many cracks and rafted areas and ice rind lined the west shore of the lake from Toledo to the Detroit River. Warmer air temperatures the last two weeks in March brought an end to ice formation and by March 27 the lake was well into the ice-decay period. The Welland Canal opened on March 29 terminating its shortest down period in its history 80 days. Last ice was reported at Buffalo, N. Y., on April 17, and in the Niagara River on May 5.

Lake Ontario

Two ice reconnaissance flights were made over eastern Lake Ontario, on February 23 and March 28. These flights resulted in two ice charts (figs. 45-46).

Ice was first reported at the North Pond embayment northeast of Oswego on November 11 and at Henderson Harbor, southeast of Cape Vincent on December 2. By the end of January bays and harbors in the eastern part of the lake were frozen over. On February 23 brash ice of various concentrations was observed along the south shore from Rochester to Oswego, N. Y. An area of nine-tenths brash extended from just east of Oswego northwesterly to the north shore. Young ice was present in the area north of a line from Prince Edward Point to Stoney Point and winter ice with a heavy snow cover was observed in the area north of a line from Stoney Point to Amherst Island. Freezing degree-day accumulation was near its maximum the last week in February. On February 27, Lake Ontario was estimated to be 20 percent ice-covered. Maximum freezing degree-day accumulation occurred the week ending March 12. By the end of March the only extensive ice in the lake was located in the bay area at the extreme northeast end. On March 28 the ice edge extended from Prince Edward Point in a semi-circle through Amherst, Wolf and Galloo Islands across the lake to Stoney Point.

Winter ice with a heavy snow cover was observed landward of this line. An area of seven-tenths brash extended from Wolf to Galloo Island. A narrow zone of brash ice lined the shore from Stoney Point southward to Mexico Bay. The St. Lawrence Seaway opened April 12, twelve days later than scheduled as heavy ice gave shippers problems. Last report of ice came from Cape Vincent, N. Y. on April 22.

ACKNOWLEDGEMENTS

Lake Survey Center visual aerial ice reconnaissance activities were carried out under the general guidance of L. Bajorunas, Chief of the Limnology Division, and Donald R. Rondy of the Lake Hydrology Branch. Lake Survey ice observers included D. R. Rondy, R. N. Kelley, L. B. Smith, J. Weiser, and R. R. Bagalay.

U.S. Coast Guard flight support was provided by the U.S. Coast Guard, Ninth District (U.S.C.G. Air Stations, Detroit, Mich., and Traverse City, Mich.).

Climatological data used in this report was taken from the U.S. Department of Commerce publications, Weekly Weather and Crop Bulletin, Daily Weather Maps Weekly Series, Monthly Weather Review, and Local Climatological Data.

Table 1. Ice reconnaissance flights - winter 1971-72

Flight no.	Date (1972)	Area
1	January 15	Lake St. Clair
2	January 21	St. Marys River
3	January 27	Southern Lake Huron, Lake St. Clair, western Lake Erie
4	February 7	Southern Lake Huron, Lake St. Clair
5	February 8	Lake St. Clair
6	February 14	Lake St. Clair, western Lake Erie
7	February 22	Lake St. Clair, western Lake Erie
8	February 23	Eastern Lake Ontario
9	March 3	Lake St. Clair, western Lake Erie
10	March 10	Lake St. Clair, western Lake Erie, southern Lake Huron
11	March 14	Lake Superior, Straits of Mackinac, St. Marys River
12	March 23	Whitefish Bay, St. Marys River
13	March 24	Lake St. Clair
14	March 28	Eastern Lake Ontario
15	April 5	Whitefish Bay, St. Marys River
16	April 11	Whitefish Bay, St. Marys River
17	April 17	Southern Lake Huron, Lake St. Clair
18	April 18	Southern Lake Huron
19	April 20	Whitefish Bay, St. Marys River
20	April 26	Whitefish Bay, St. Marys River
21	April 27	St. Marys River
22	May 3	Southern Lake Huron
23	May 4	Whitefish Bay, St. Marys River

Table 2. Key to ice chart symbols

Age and size of floes

Station model

$$\frac{A}{DOM,\ SEC}\ \frac{C_n}{n_1 n_2 n_3}\ +\ \frac{C}{NEW}$$

A - IND for C_n AGE

DOM - 10ths DOM AGE

SEC - 10th SEC AGE

AGE - Y (Yng) - Young ice
W - Winter ice
MW - Medium winter
TW - Thick winter

C_n - Total CONC of $n_1 n_2$ and n_3 in 10ths

n_1 - CONC of brash and cakes in 10ths

n_2 - CONC of small and medium floes in 10ths

n_3 - CONC of big bloes and ice field in 10ths

C - CONC of NEW ice in 10ths

NEW - SLH - Slush
IR - Ice rind
SLG - Sludge
PCK - Pancake

Notes are used with just one CONC or when reporting unusual observation

All times refer to eastern standard time.

Total concentration

Open water

1 - 3 Tenths Coverage (very open pack)

4 - 6 Tenths Coverage (open pack)

7 - 9 Tenths Coverage (close pack)

10 Tenths Coverage (consol pack)

Boundaries

Observed visually

Assumed

Undercast (limits)

Limit of observed data

Snow cover

Station model

S_n

AMT, COND

S_n - IND for snow

AMT - O - No Snow
L - Light
H - Heavy

NOTE: No AMT mean MOD

COND - D - Drifted
CR - Crusted
Pd - Puddled

Topography

T

COND

T - Type of pressure ice

 - Rafted

 - Ridged

 - Hummocked

COND - L - Light
H - Heavy

NOTE: No COND means MOD.

Stage of melting

Station model

Pd

n, COND

Pd - IND for melting
n - 10ths of area
COND - TH - Thaw hole
R - Rotten ice
RFZN - Refrozen puddles

Openings in ice

 Crack (Crk)

 Lead

 Pool or Polynya (Plya)

Abbreviations

BSH - Brash

CK - Cake

CONC - Concentration

COND - Condition

NT OBS - Not Observed

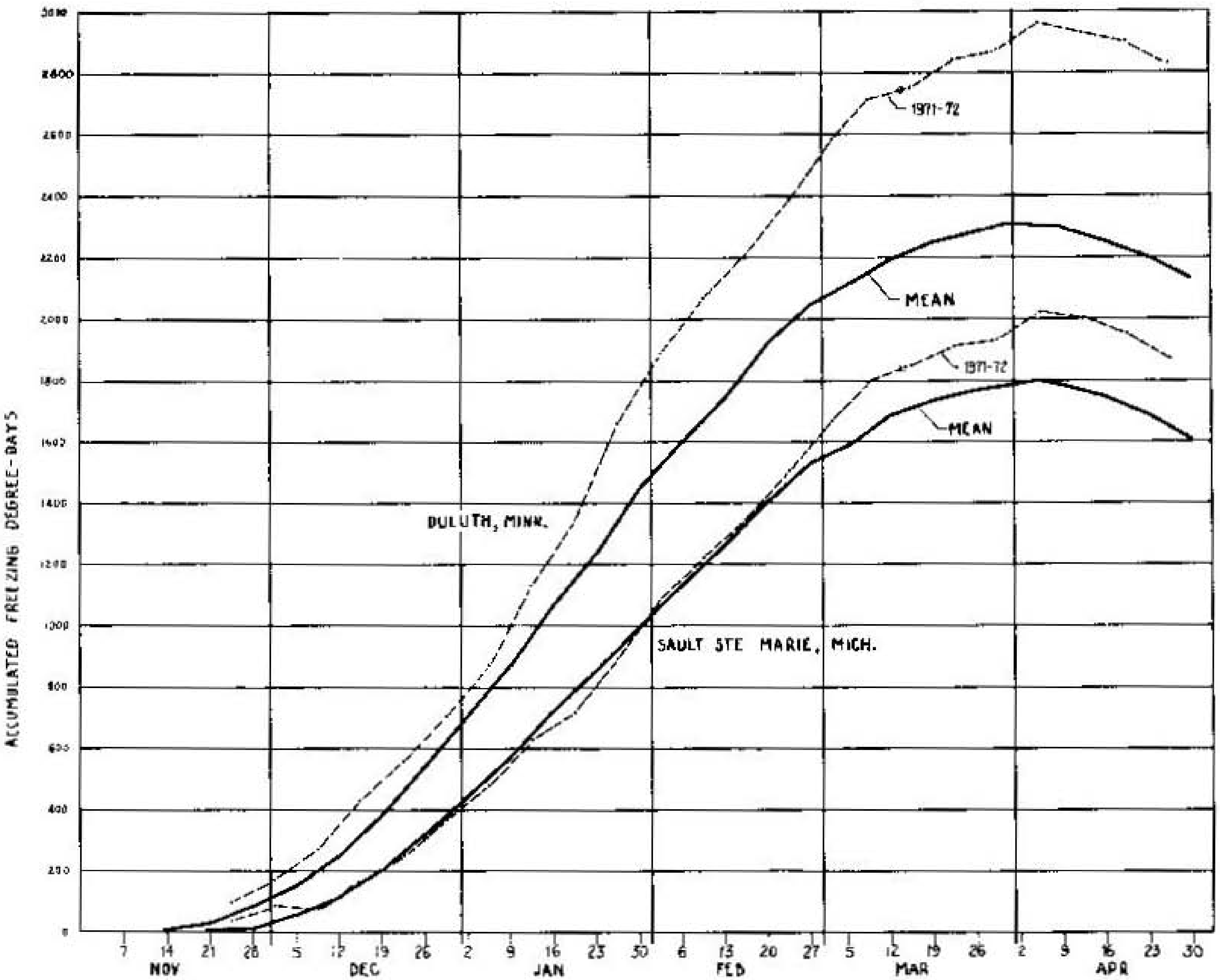

Figure 1.--Lake Superior. O indicates ice observation flights.

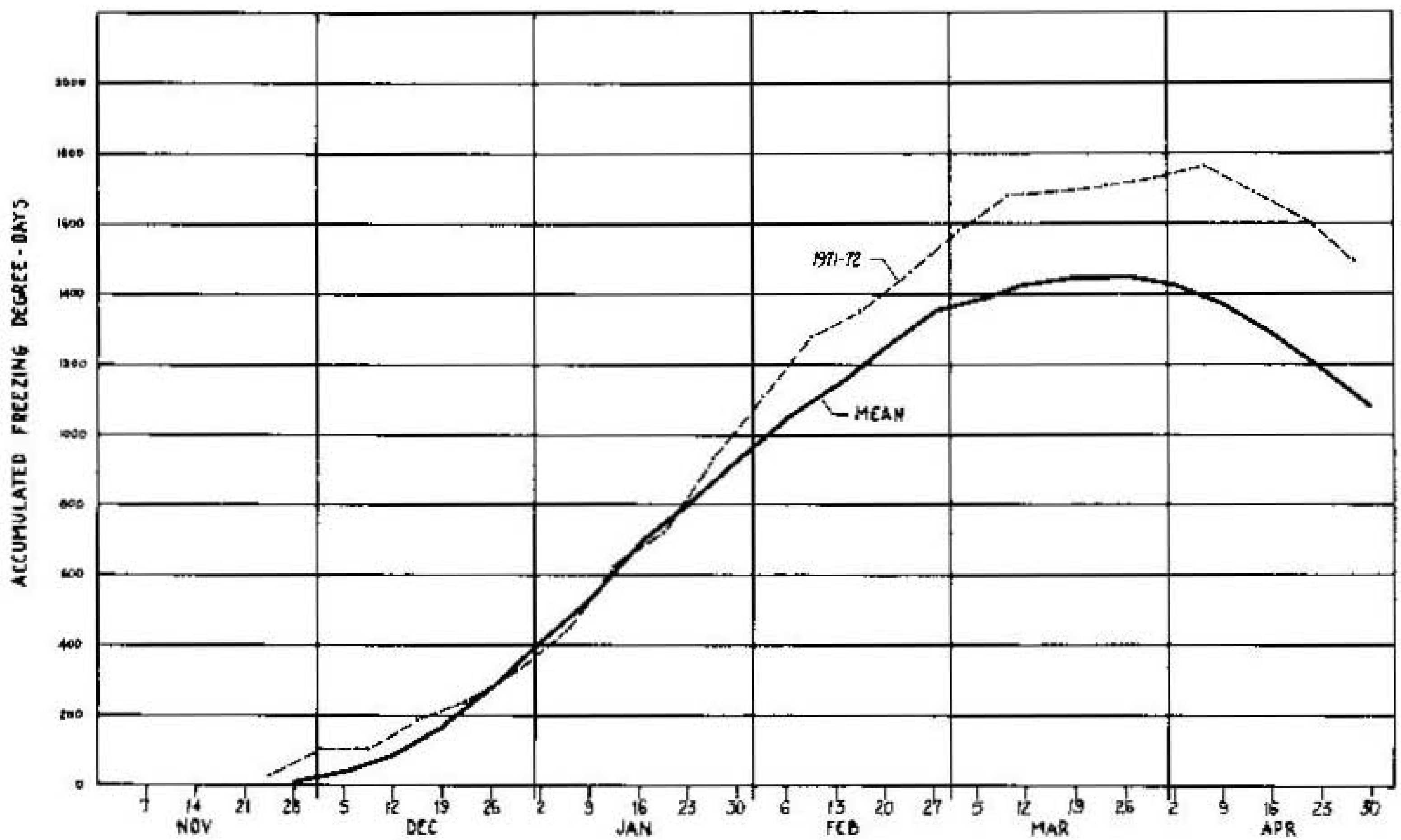

Figure 2.--Lake Michigan at Green Bay, Wisc.

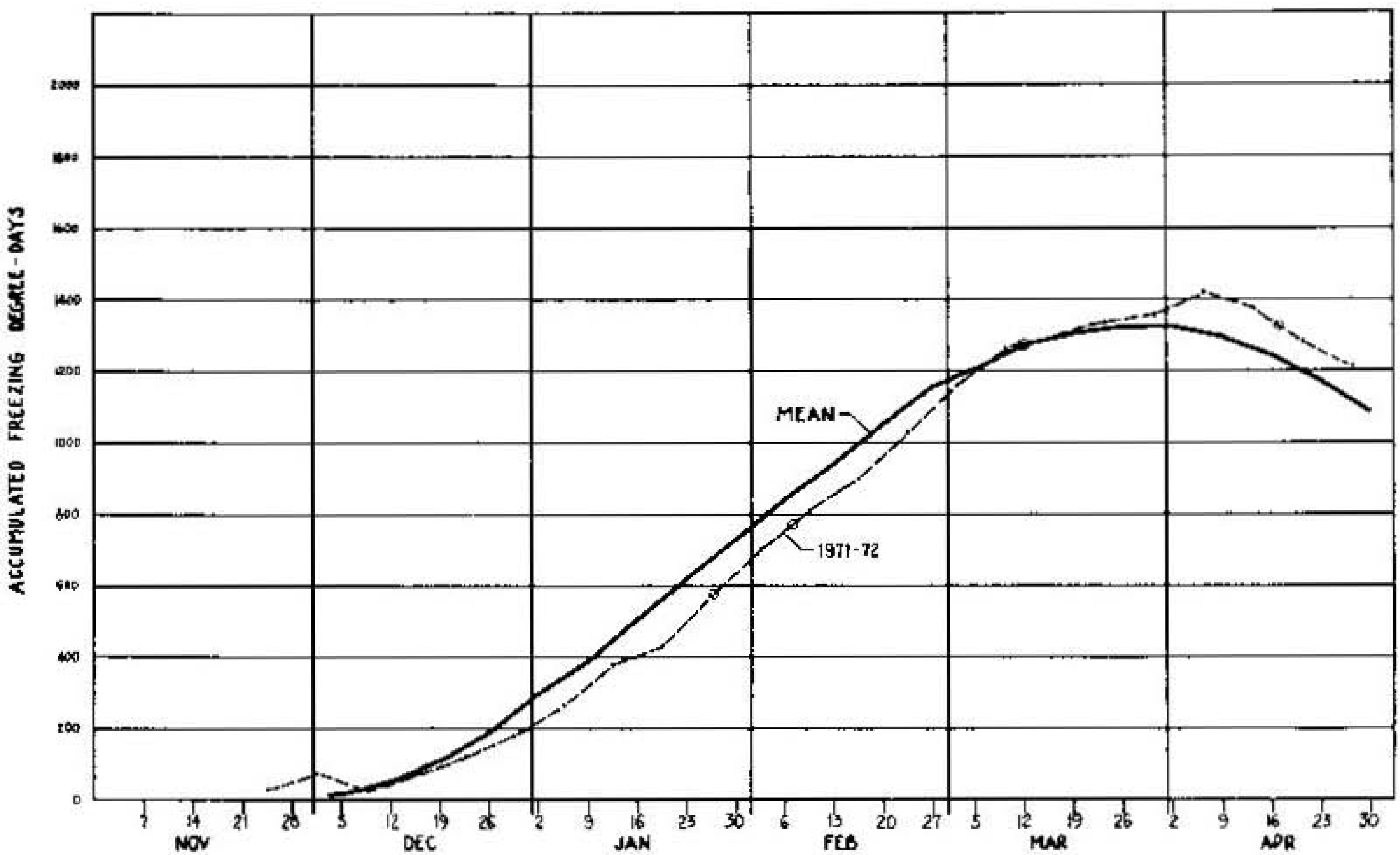

Figure 3.--Lake Huron at Alpena, Mich. O indicates ice observation flights.

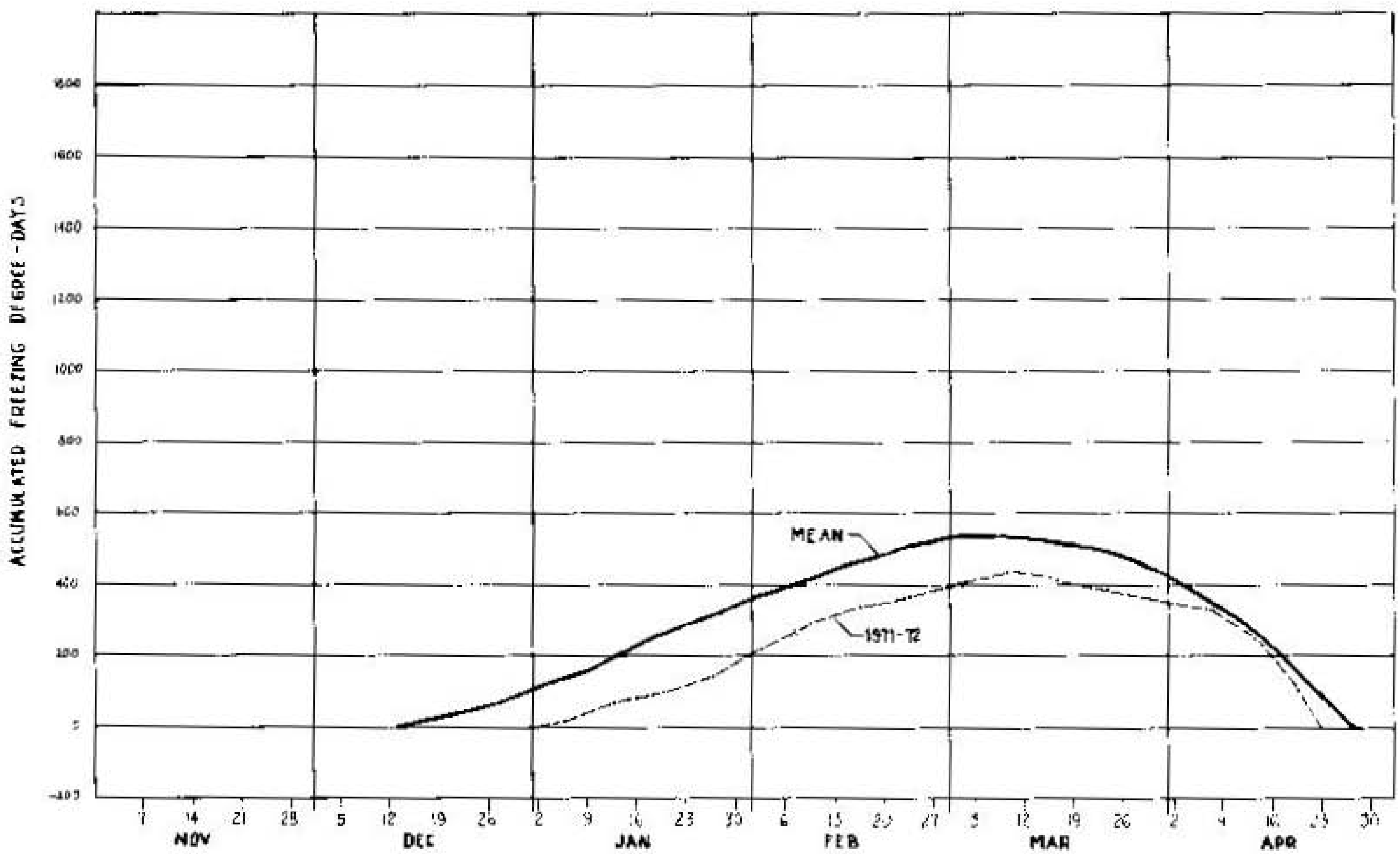

Figure 4.--Lake St. Clair at Detroit, Mich. O indicates ice observation flights.

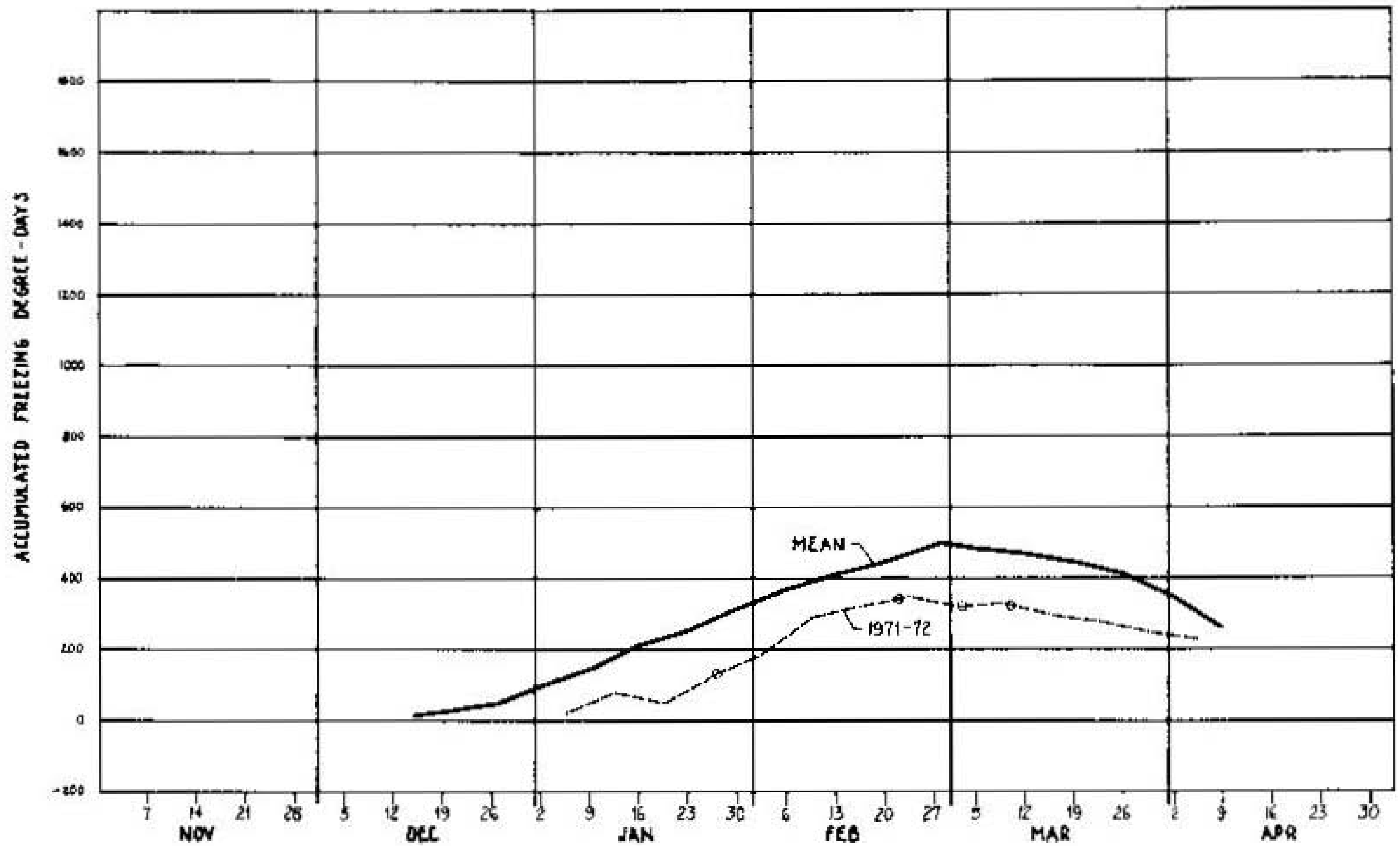

Figure 5.--Lake Erie at Cleveland, Ohio. O indicates ice observation flights.

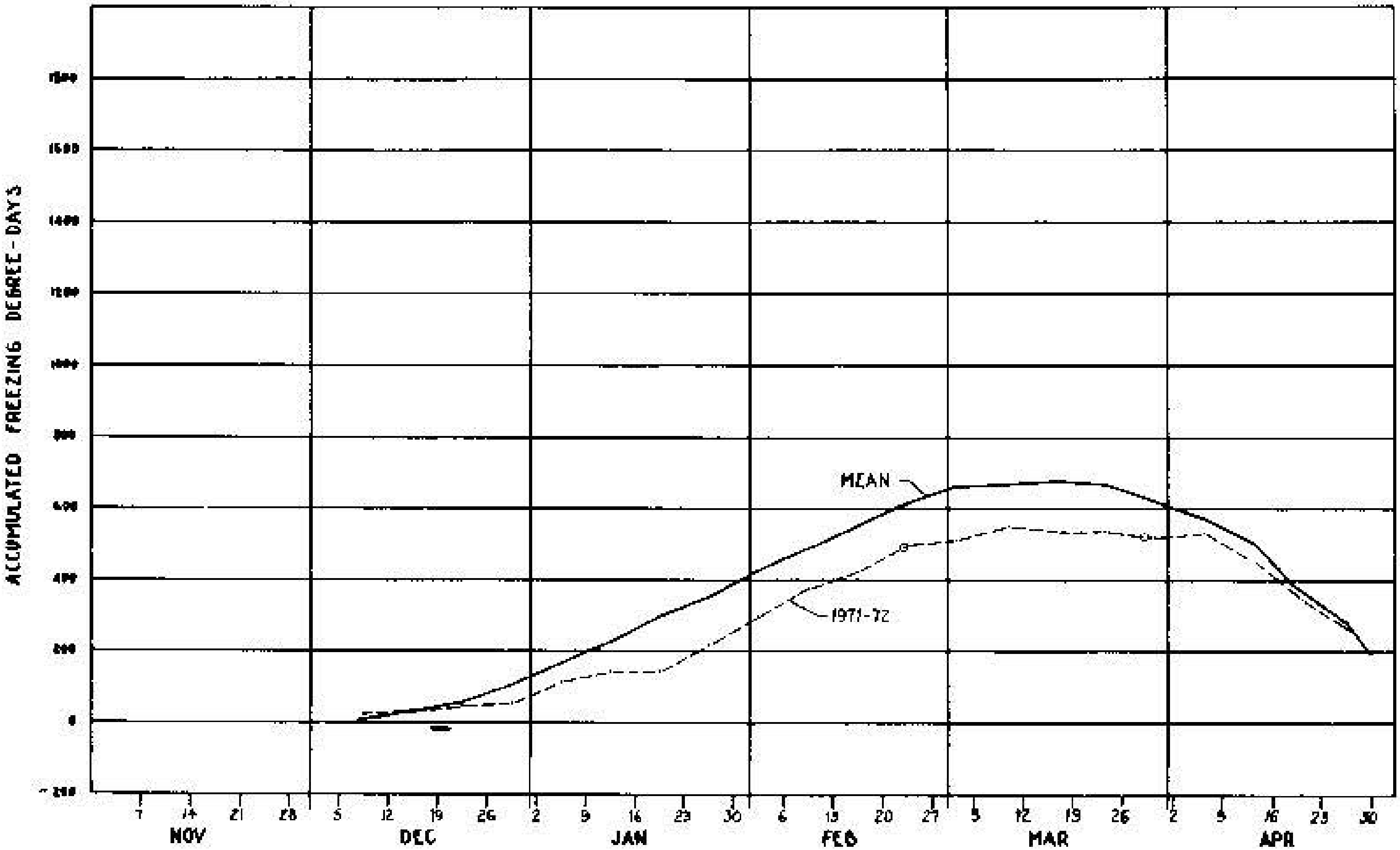

Figure 6.--Lake Ontario at Rochester, N. Y. O indicates ice observation flights.

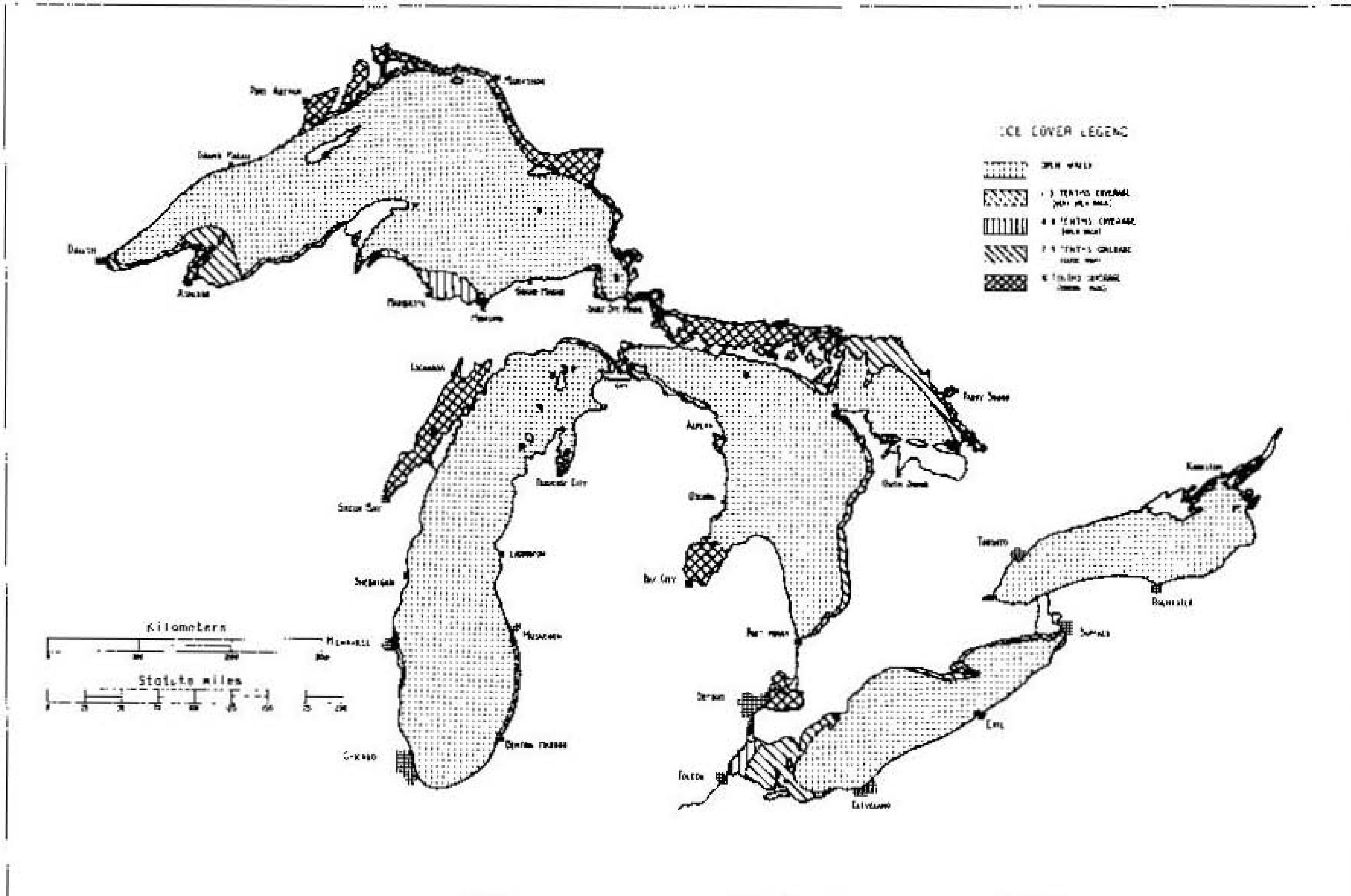

Figure 7.--Lake Survey Center ice summary chart, Jan. 16 to 21, 1972. The information was obtained from Lake Survey Center, United States Coast Guard and Canadian ice reports.

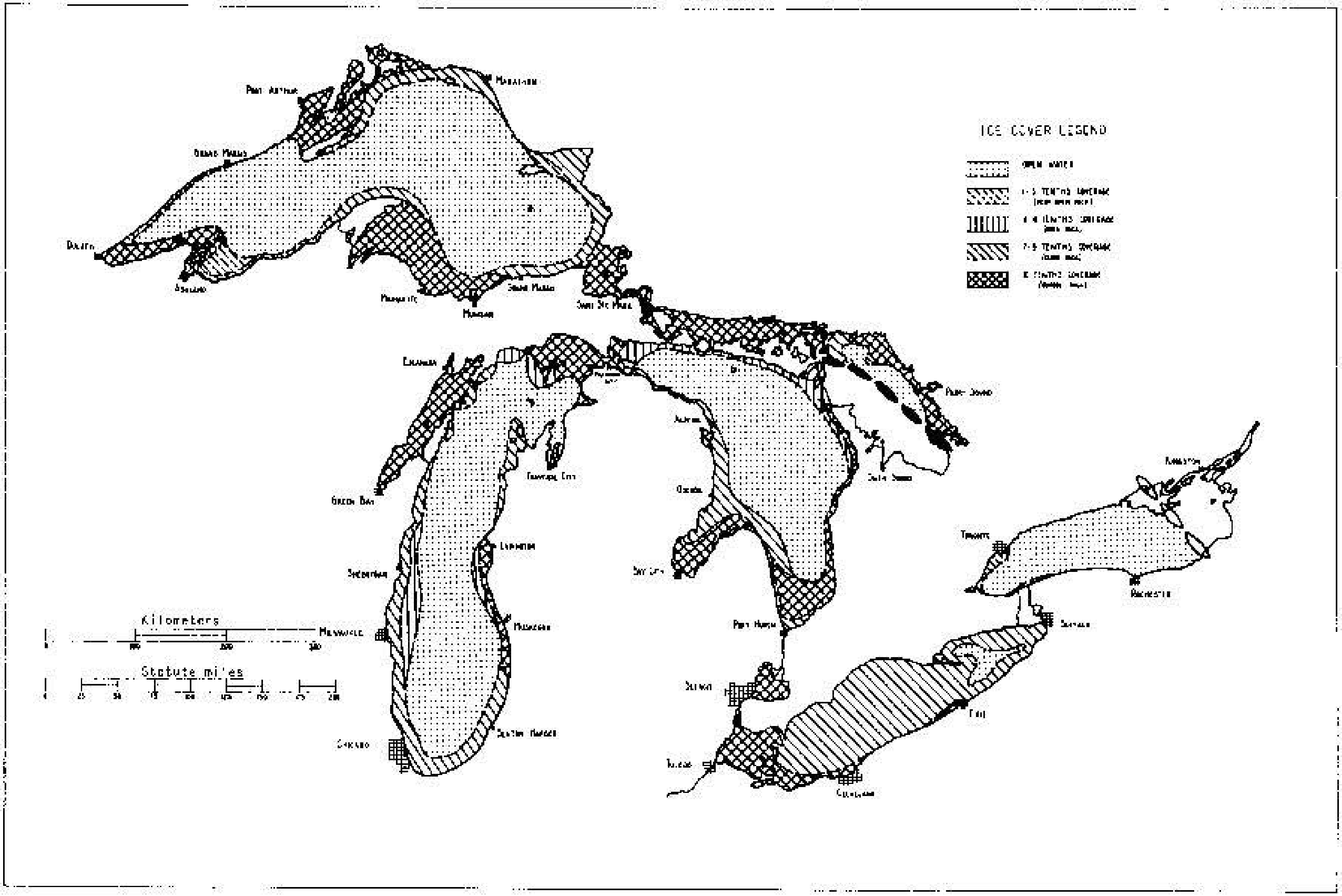

Figure 8.--Lake Survey Center ice summary chart, Jan. 28 to Feb. 2, 1972. The information was obtained from Lake Survey Center, United States Coast Guard and Canadian ice reports.

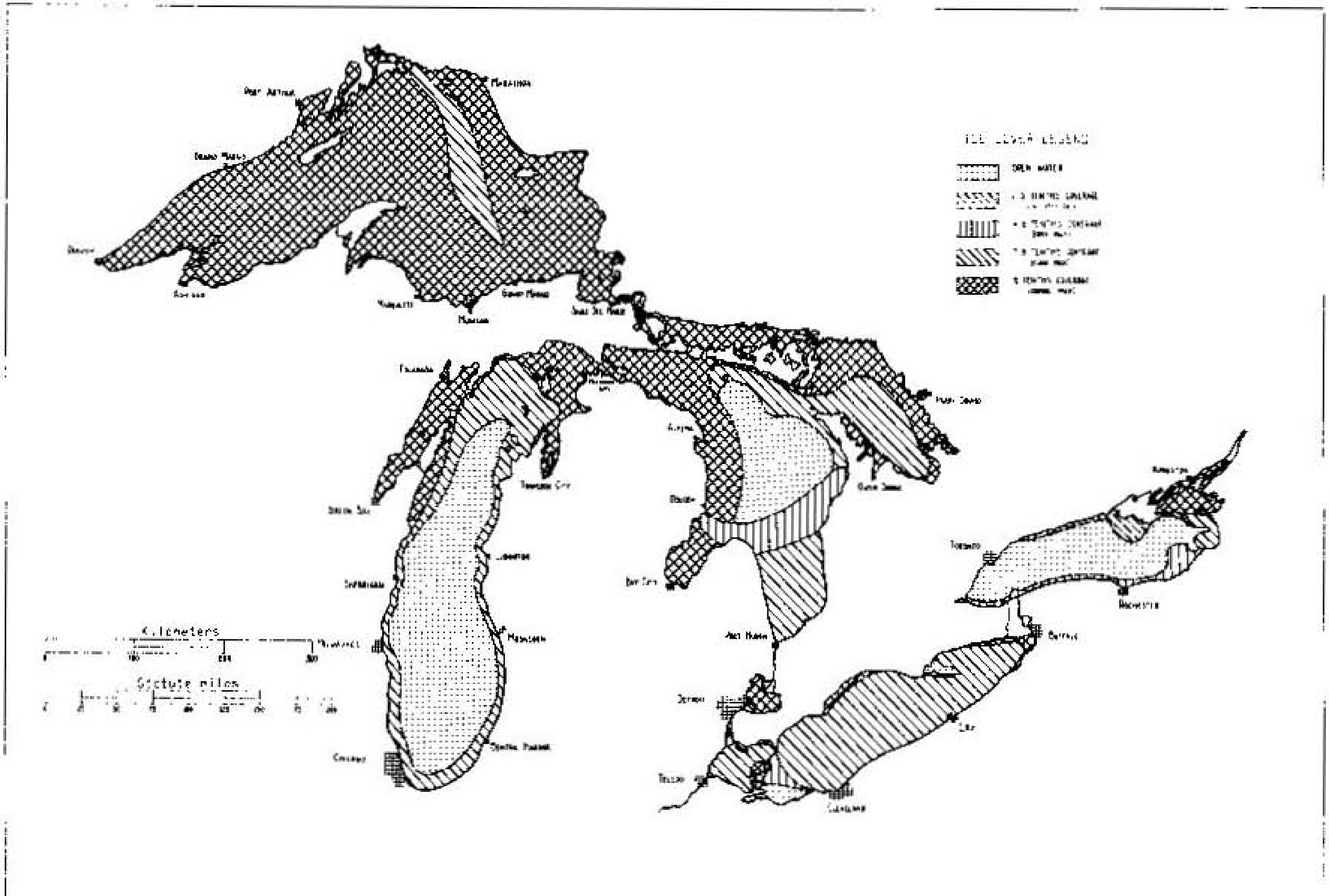

Figure 9.--Lake Survey Center ice summary chart, Feb. 27 to Mar. 6, 1972. The information was obtained from Lake Survey Center, United States Coast Guard and Canadian ice reports.

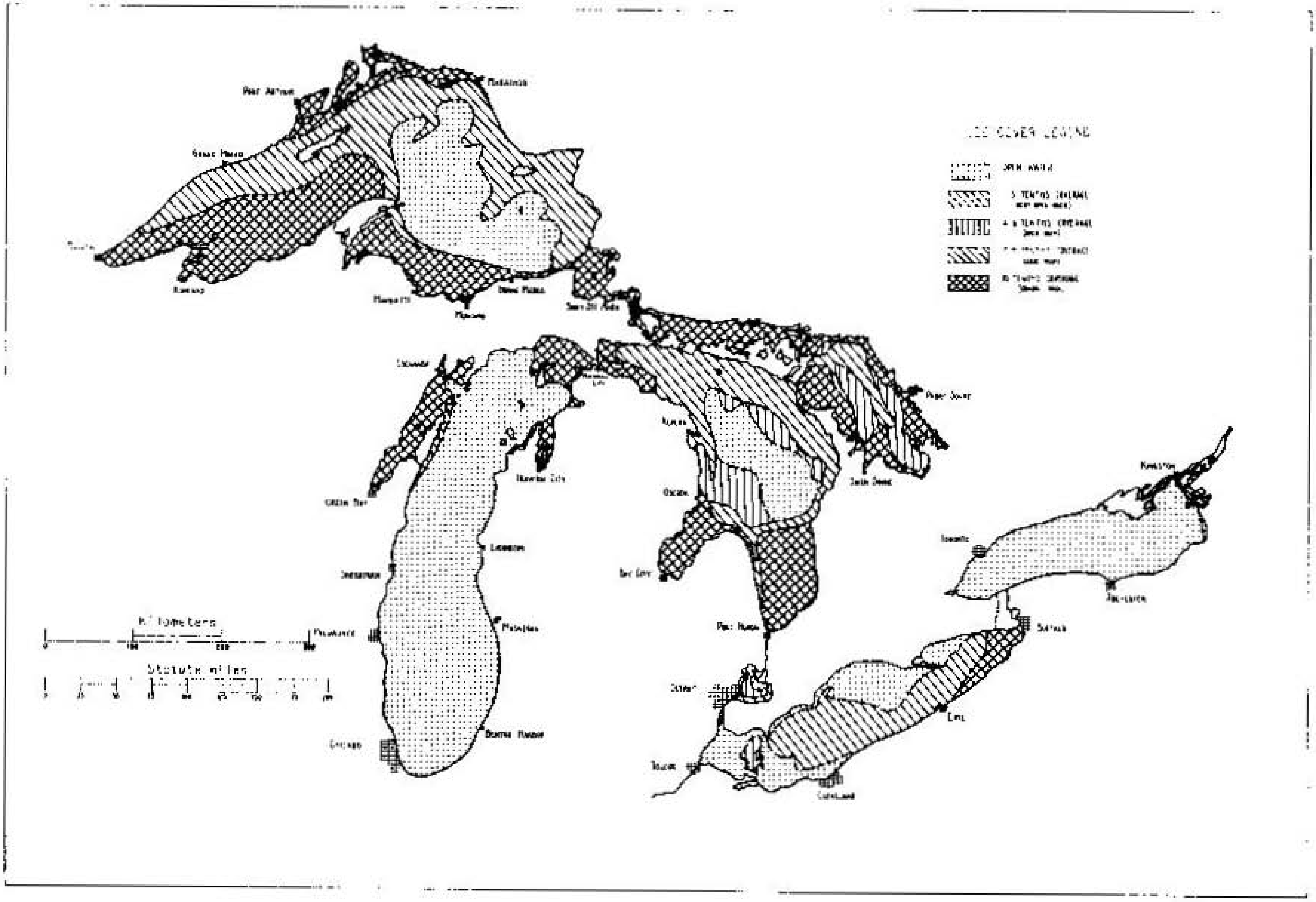

Figure 10.--Lake Survey Center ice summary chart, Mar. 24 to 27, 1972. The information was obtained from Lake Survey Center, United States Coast Guard and Canadian ice reports.

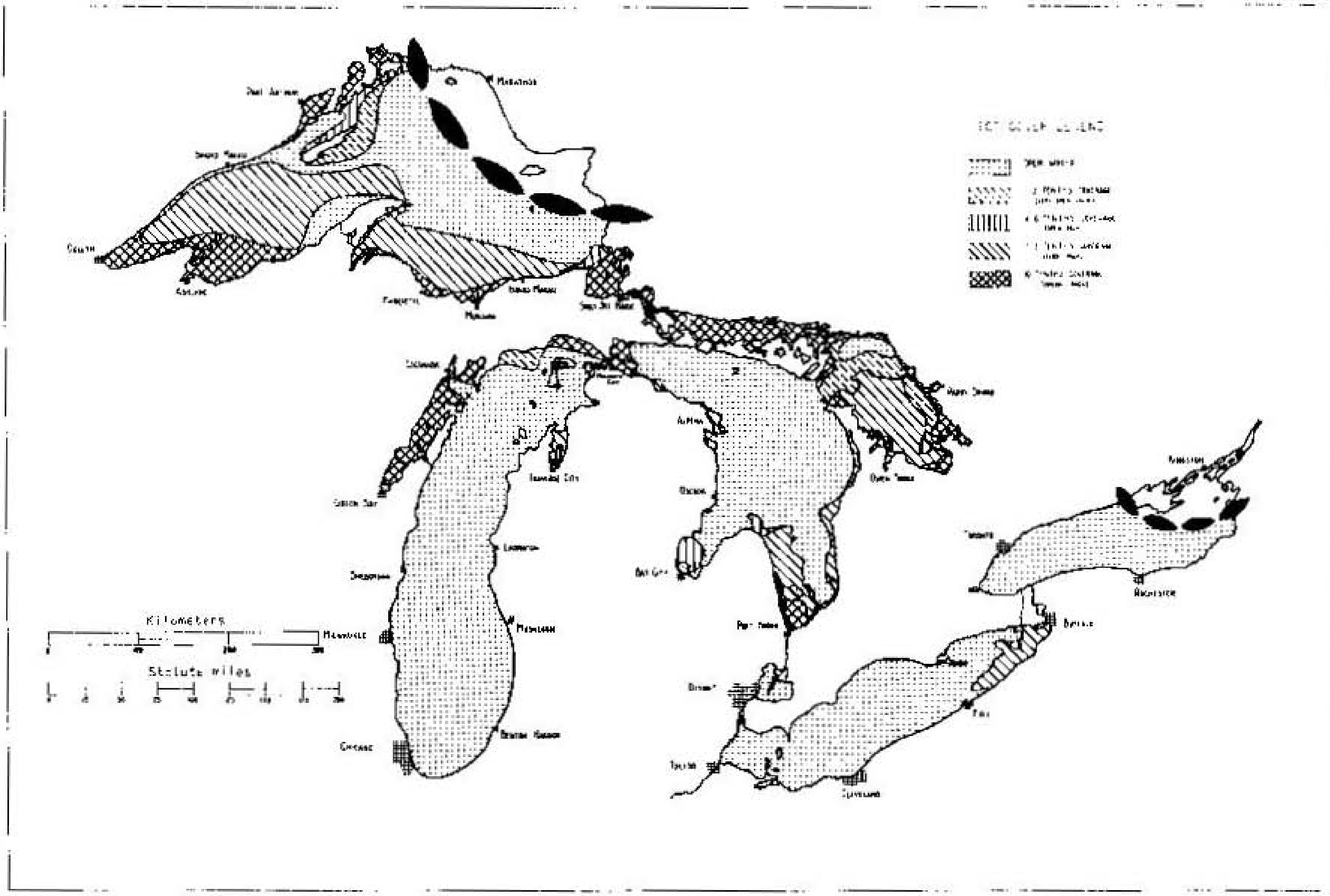

Figure 11.--Lake Survey Center ice summary chart, Apr. 14 to 20, 1972. The information was obtained from Lake Survey Center, United States Coast Guard and Canadian ice reports.

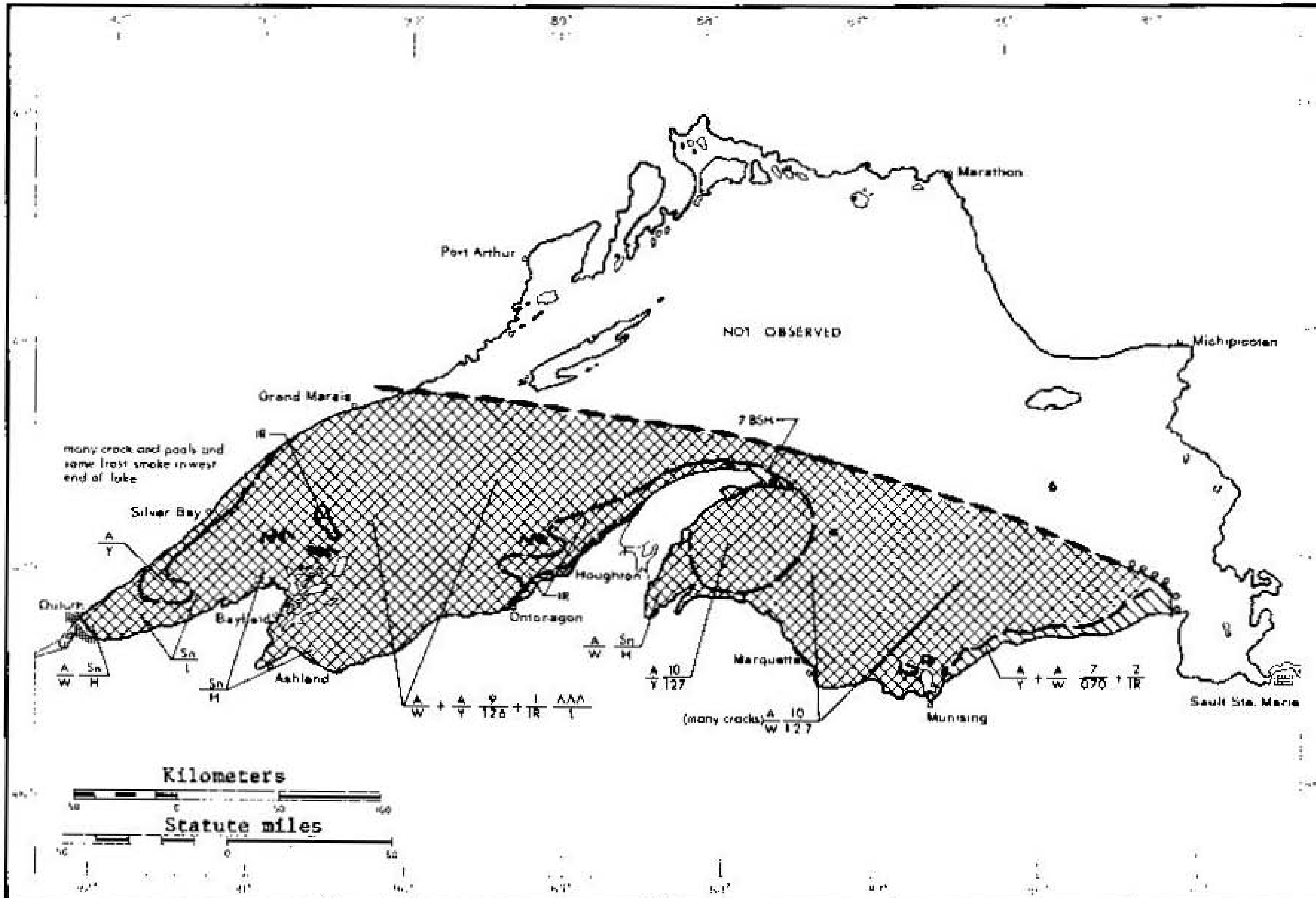

Figure 12.--Lake Superior ice chart, reconnaissance no. S-1-72, Mar. 14, 1972, 1012 to 1244.

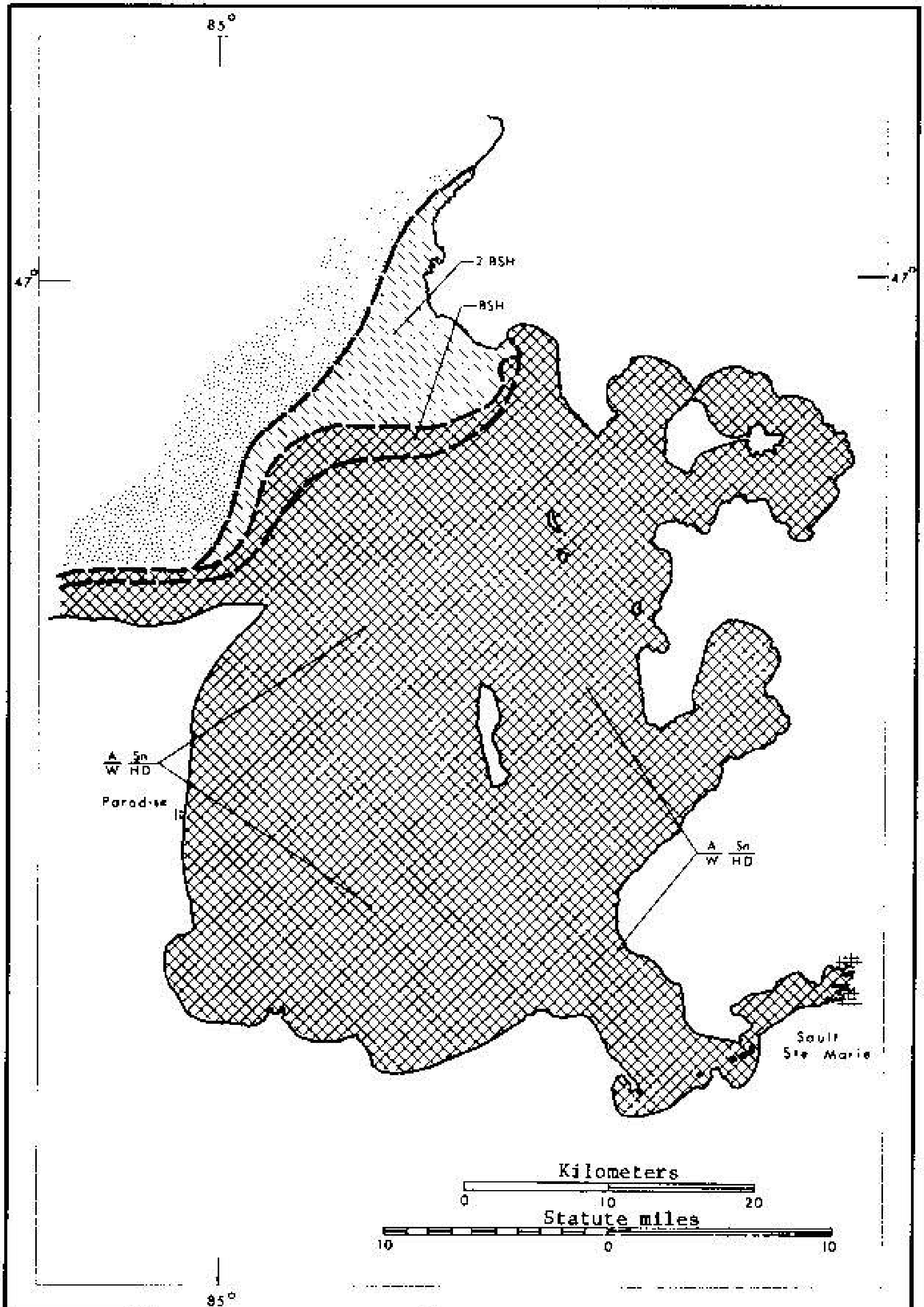

Figure 13.--Whitefish Bay ice chart, reconnaissance no. WB-1-72, Mar. 23, 1972, 1530 to 1600.

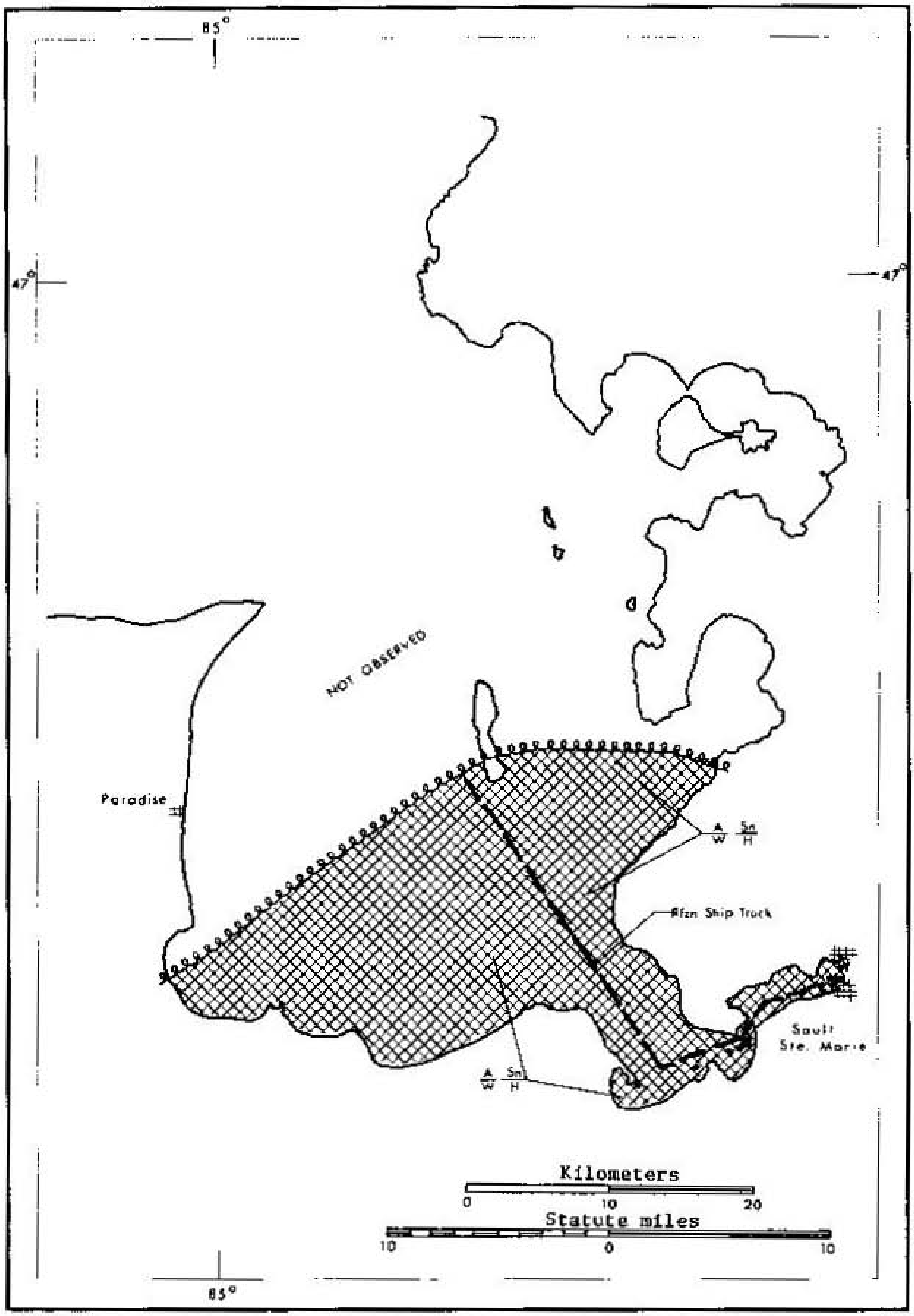

Figure 14.--Whitefish Bay ice chart, reconnaissance no. WB-2-72, Apr. 5, 1972, 0920 to 0937.

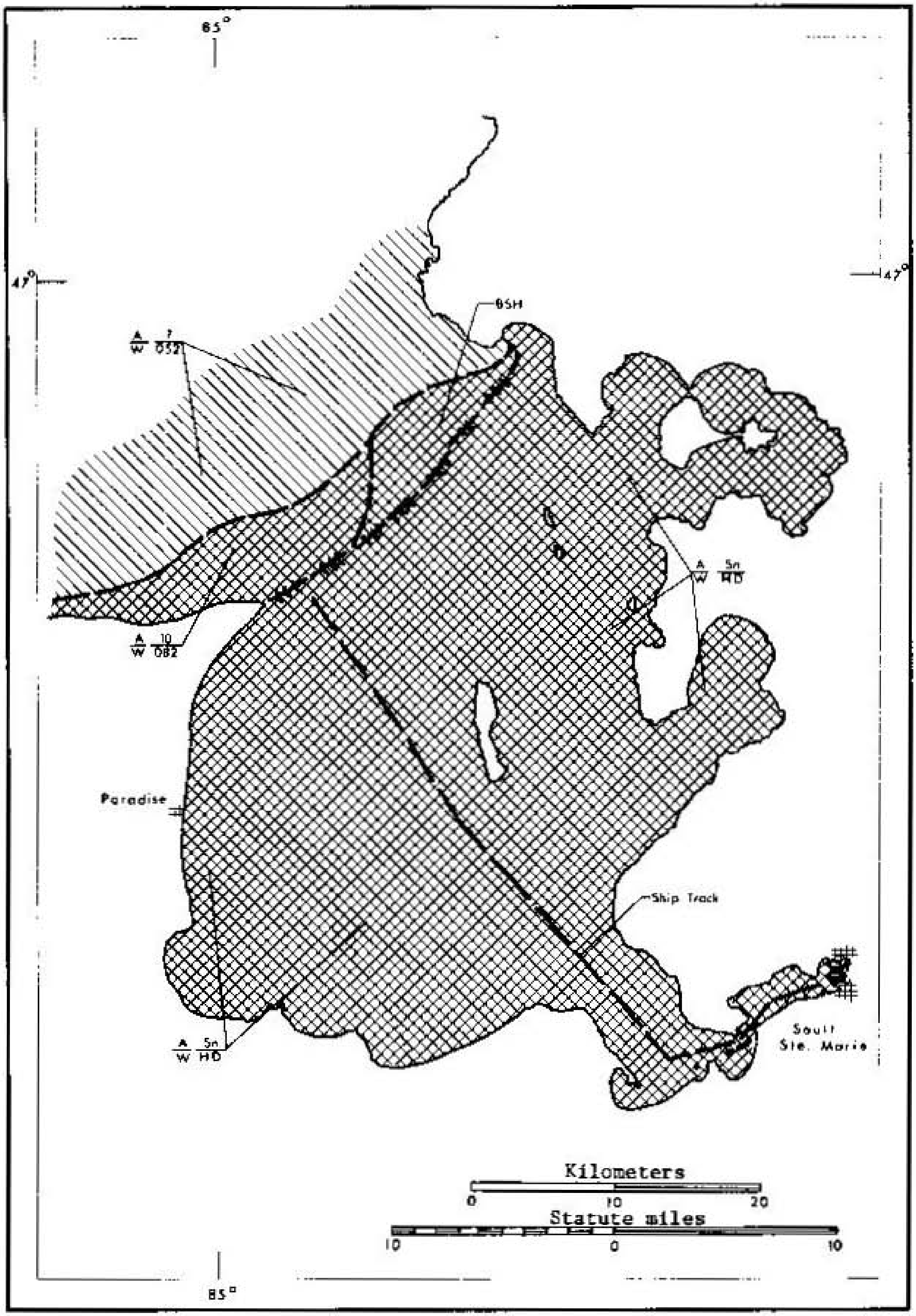

Figure 15.--Whitefish Bay ice chart, reconnaissance no. WB-3-72, Apr. 11, 1972, 1340 to 1410.

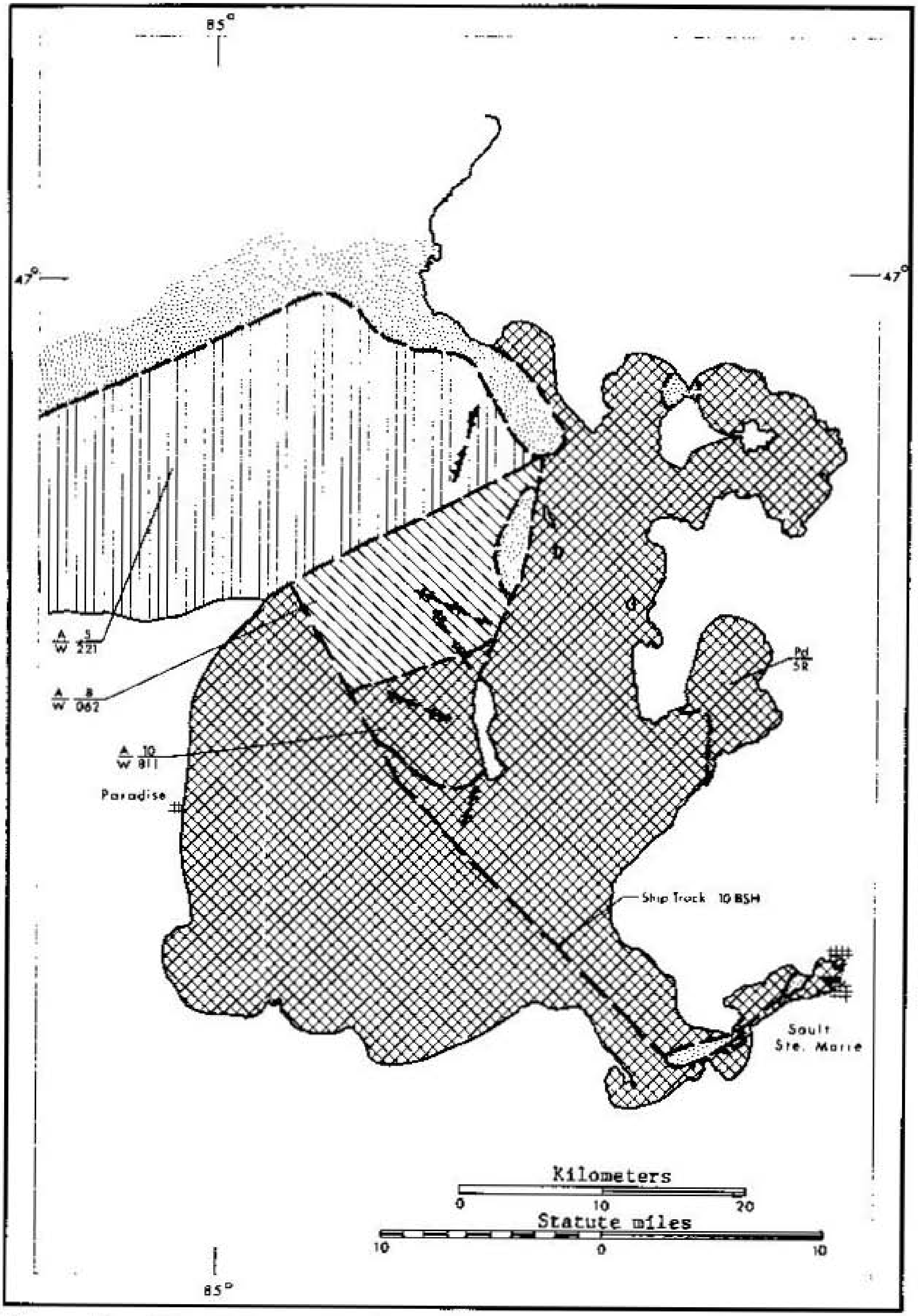

Figure 16.--Whitefish Bay ice chart, reconnaissance no. WB-4-72, Apr. 20, 1972, 1600 to 1630.

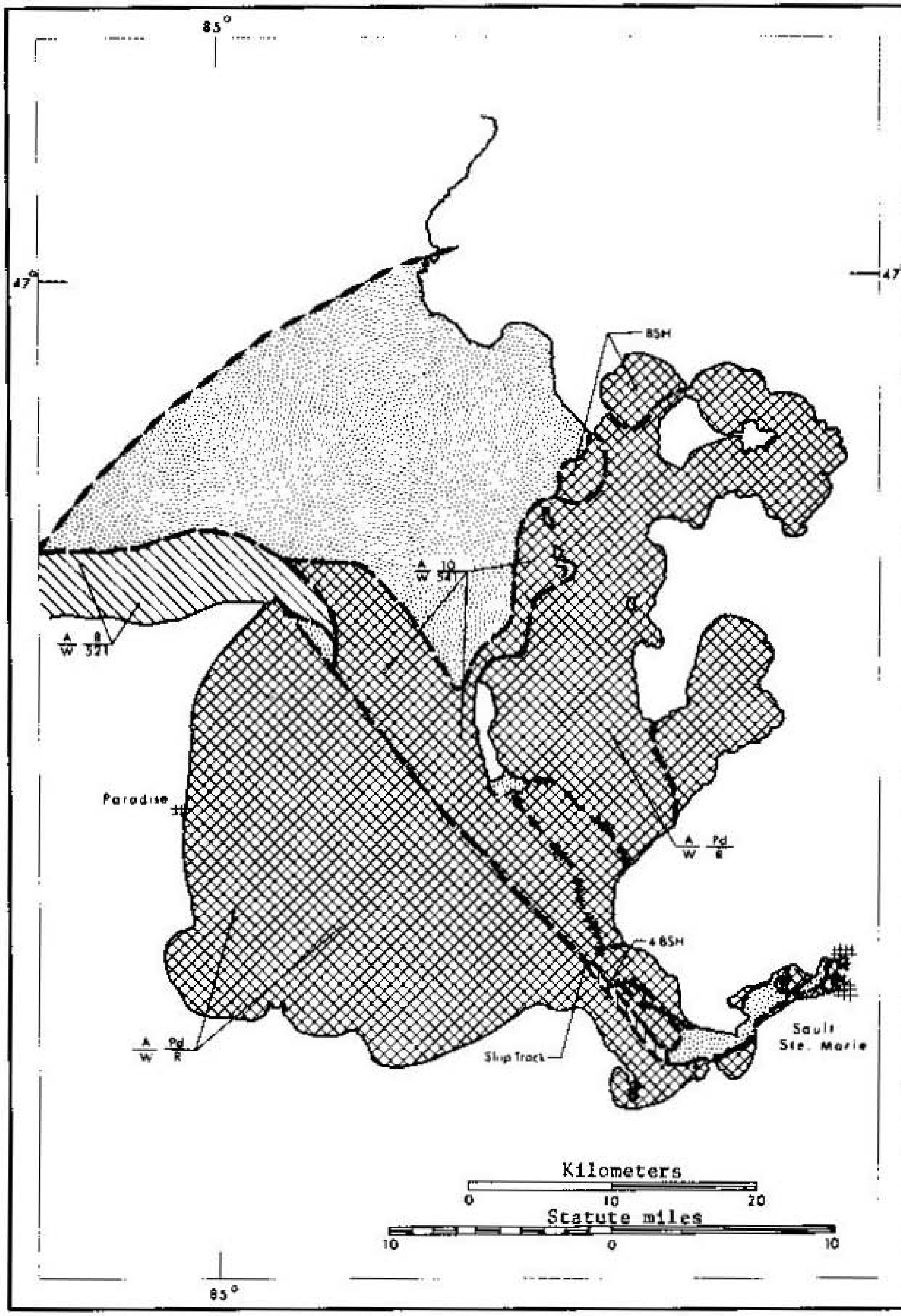

Figure 17.--Whitefish Bay ice chart, reconnaissance no. WB-5-72, Apr. 26, 1972, 1615 to 1700.

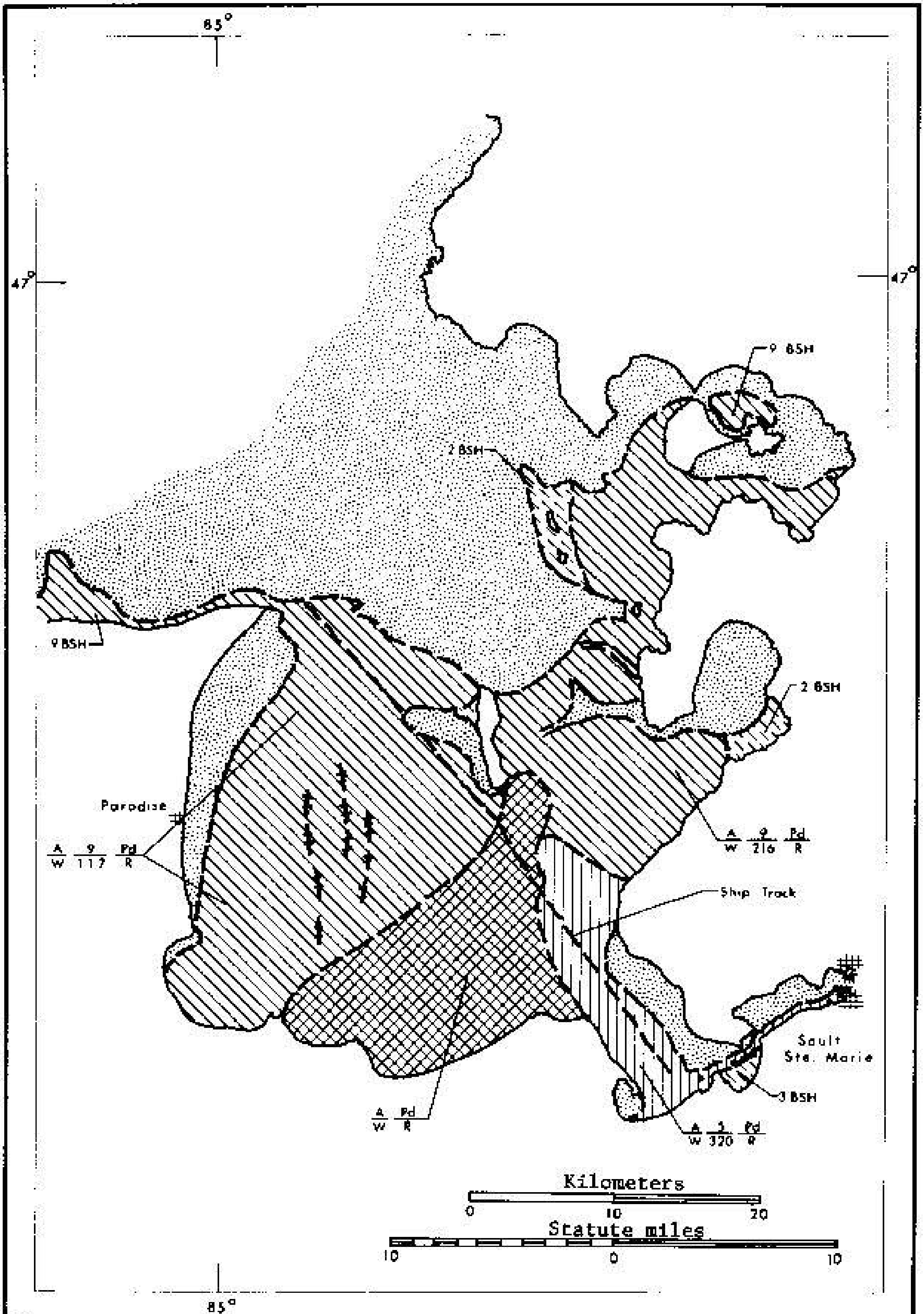

Figure 18.--Whitefish Bay ice chart, reconnaissance no. WB-6-72, May 4, 1972, 1255 to 1340.

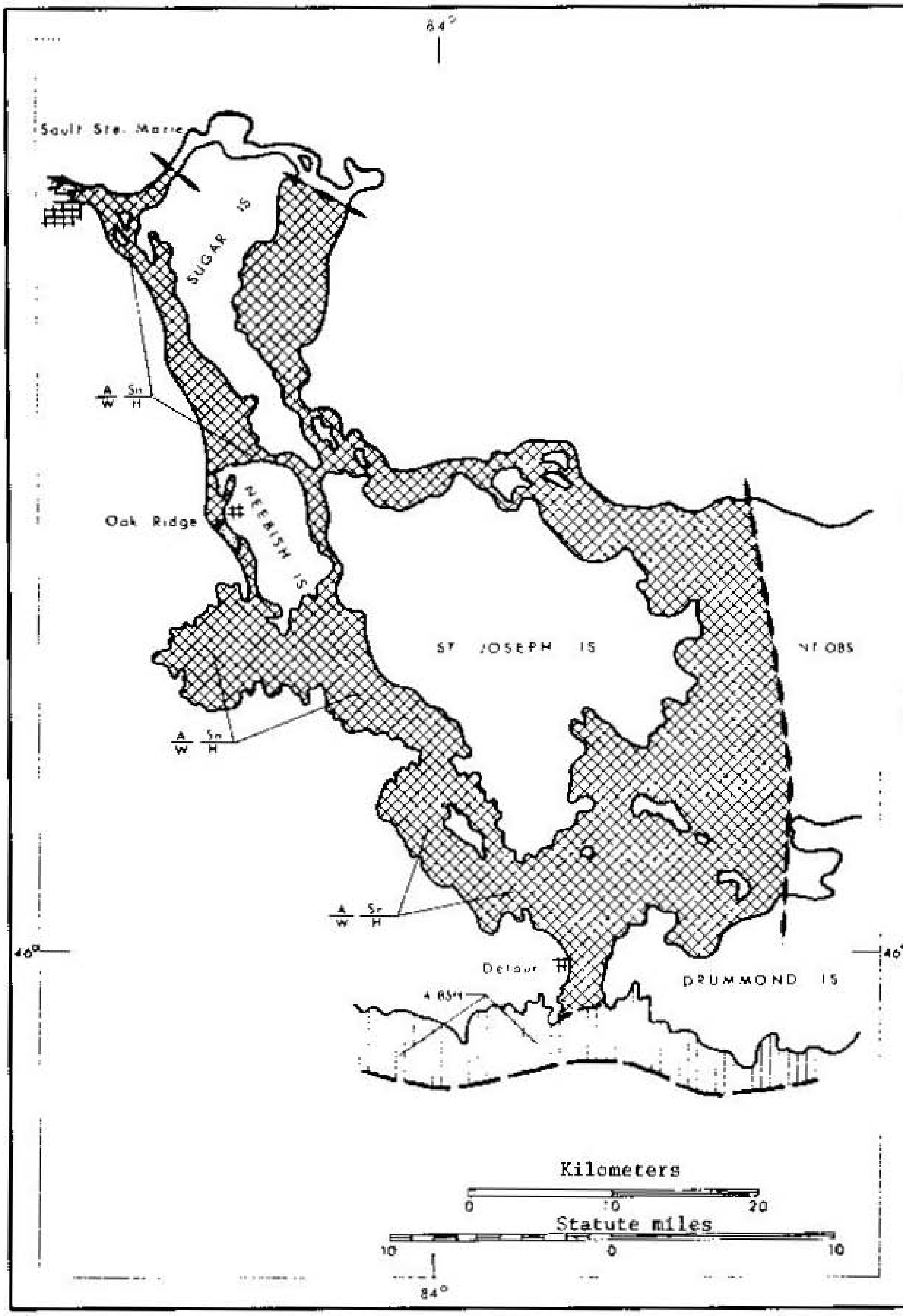

Figure 19.--St. Marys River ice chart, reconnaissance no. SMR-1-72, Mar. 14, 1972, 1315 to 1325.

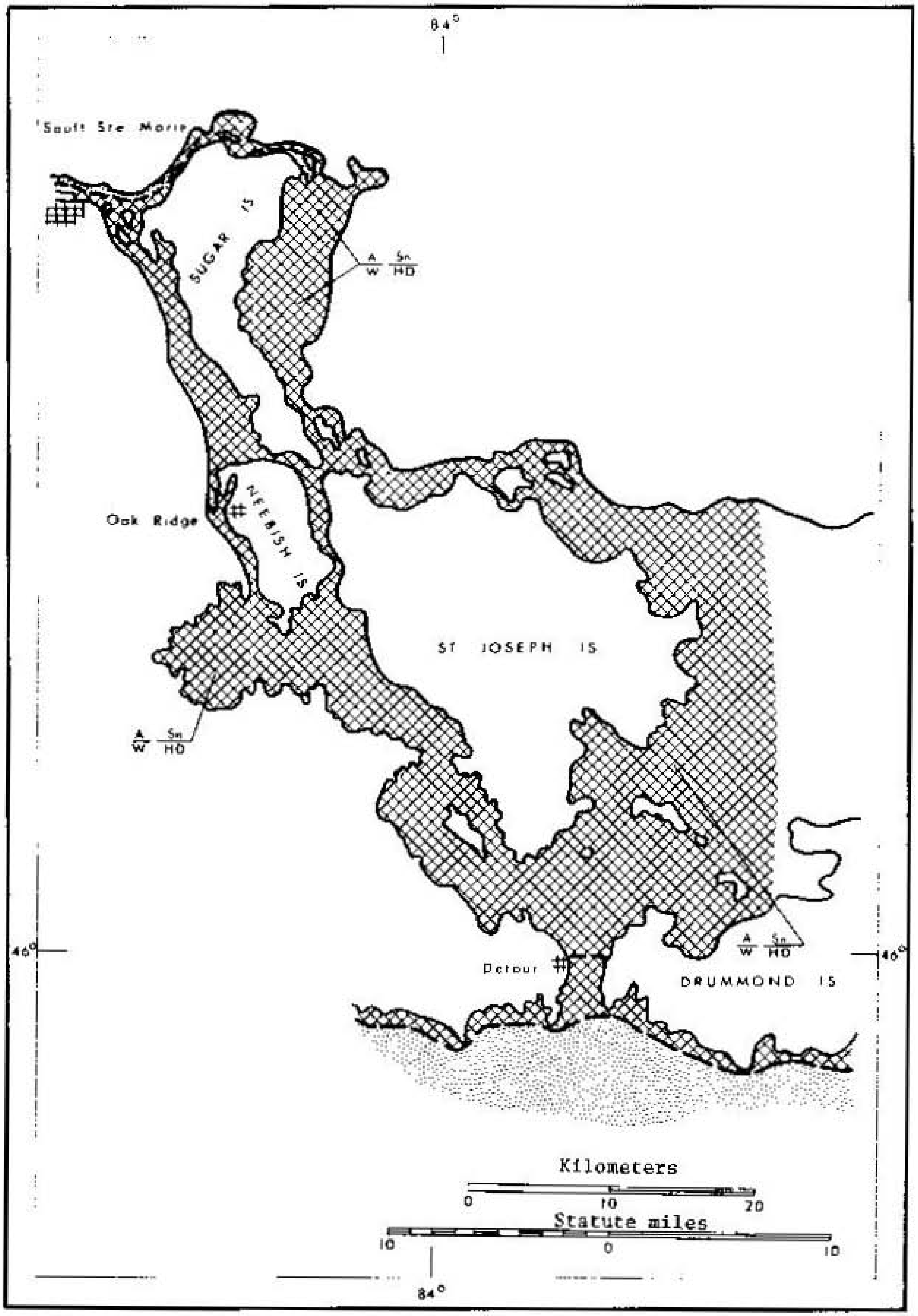

Figure 20.--St. Marys River ice chart, reconnaissance no. SMR-2-72, Mar. 23, 1972, 1415 to 1530.

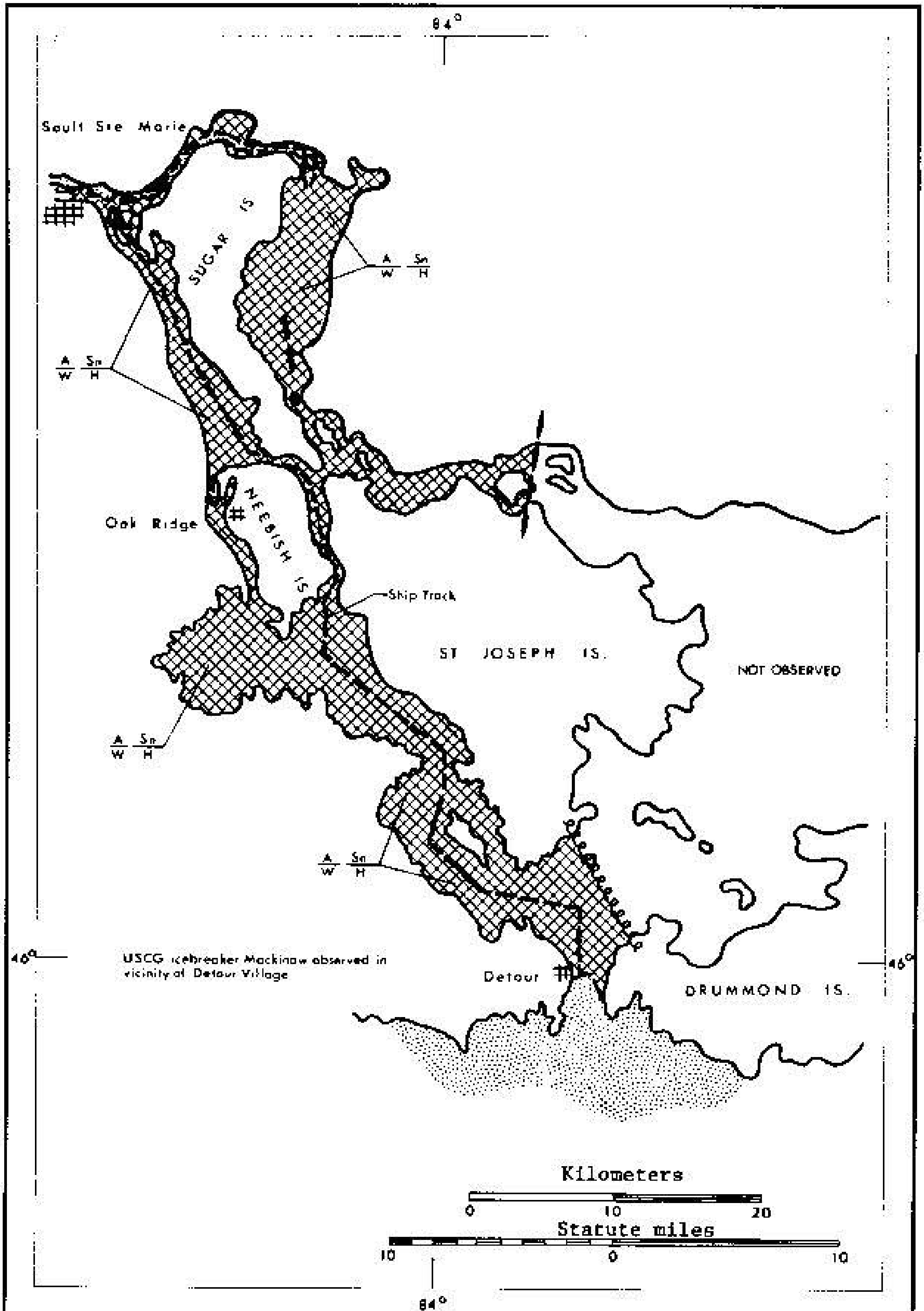

Figure 21.--St. Marys River ice chart, reconnaissance no. SMR-3-72, Apr. 5, 1972, 0937 to 1120.

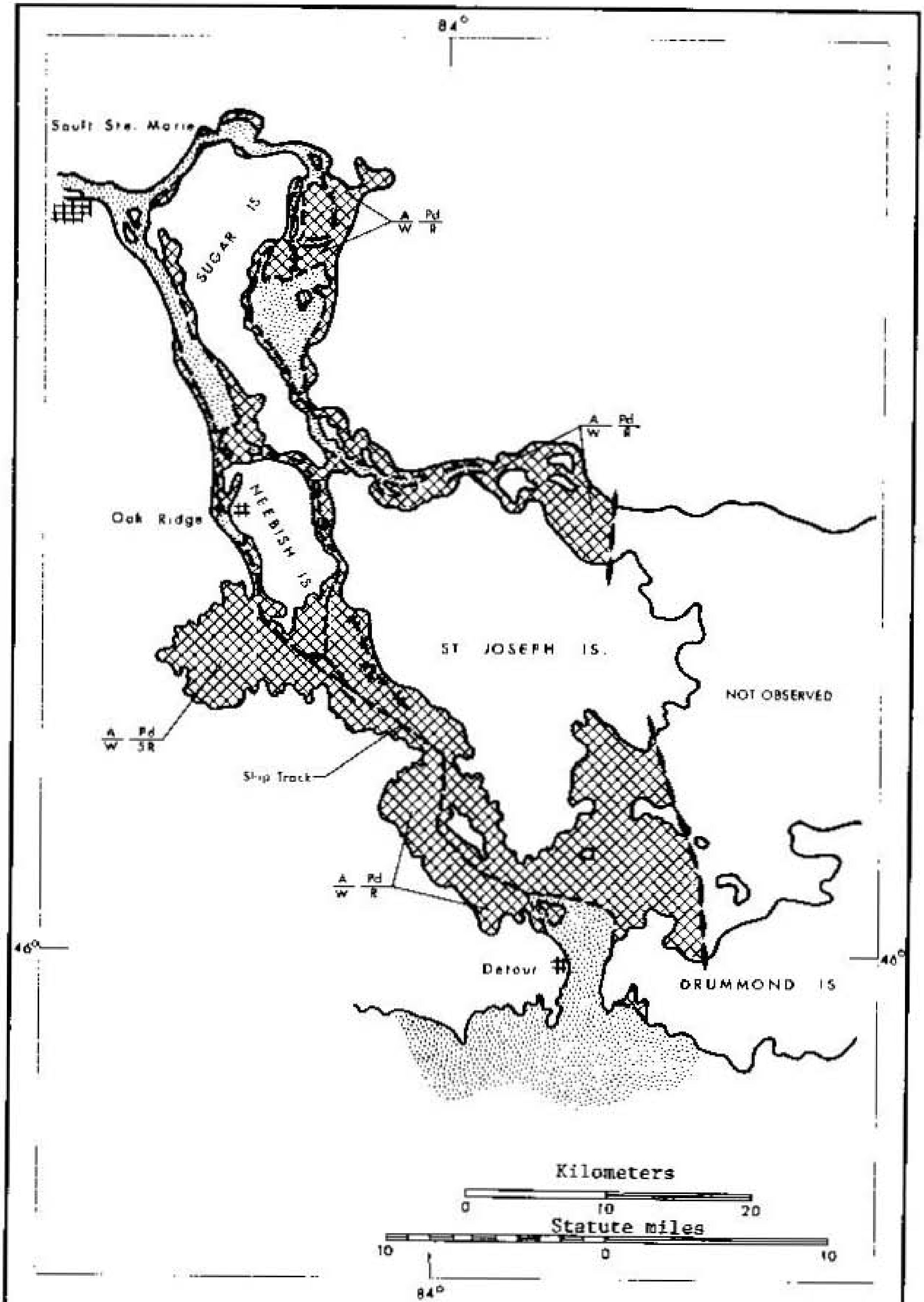

Figure 24.--St. Marys River ice chart, reconnaissance no. SMR-6-72, Apr. 26, 1972, 1355 to 1615.

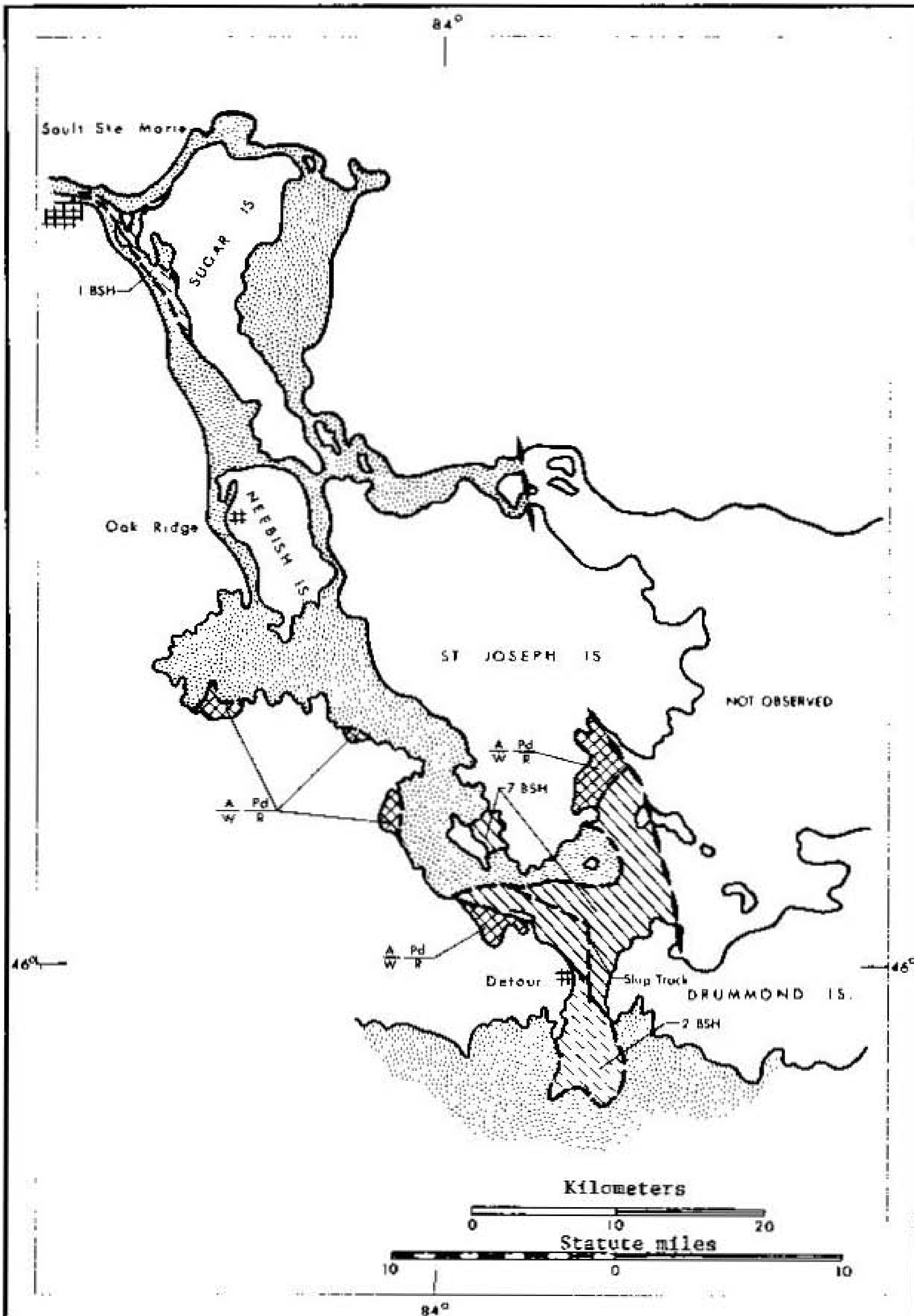

Figure 25.--St. Marys River ice chart, reconnaissance no. SMR-7-72, May 4, 1972, 1250 to 1430.

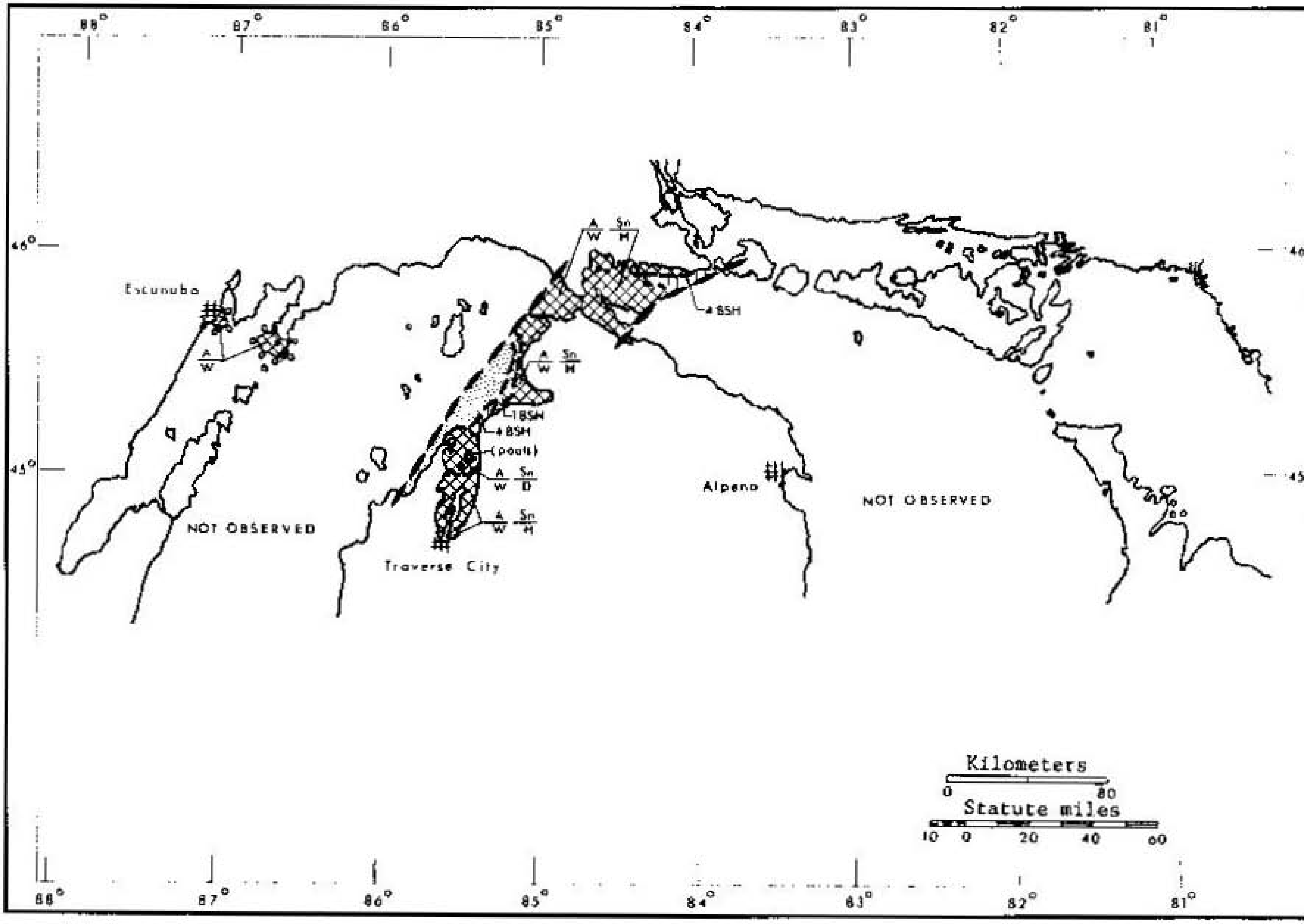

Figure 26.--Straits of Mackinac ice chart reconnaissance no. SM-1-72, Mar. 14, 1972, 1325 to 1417.

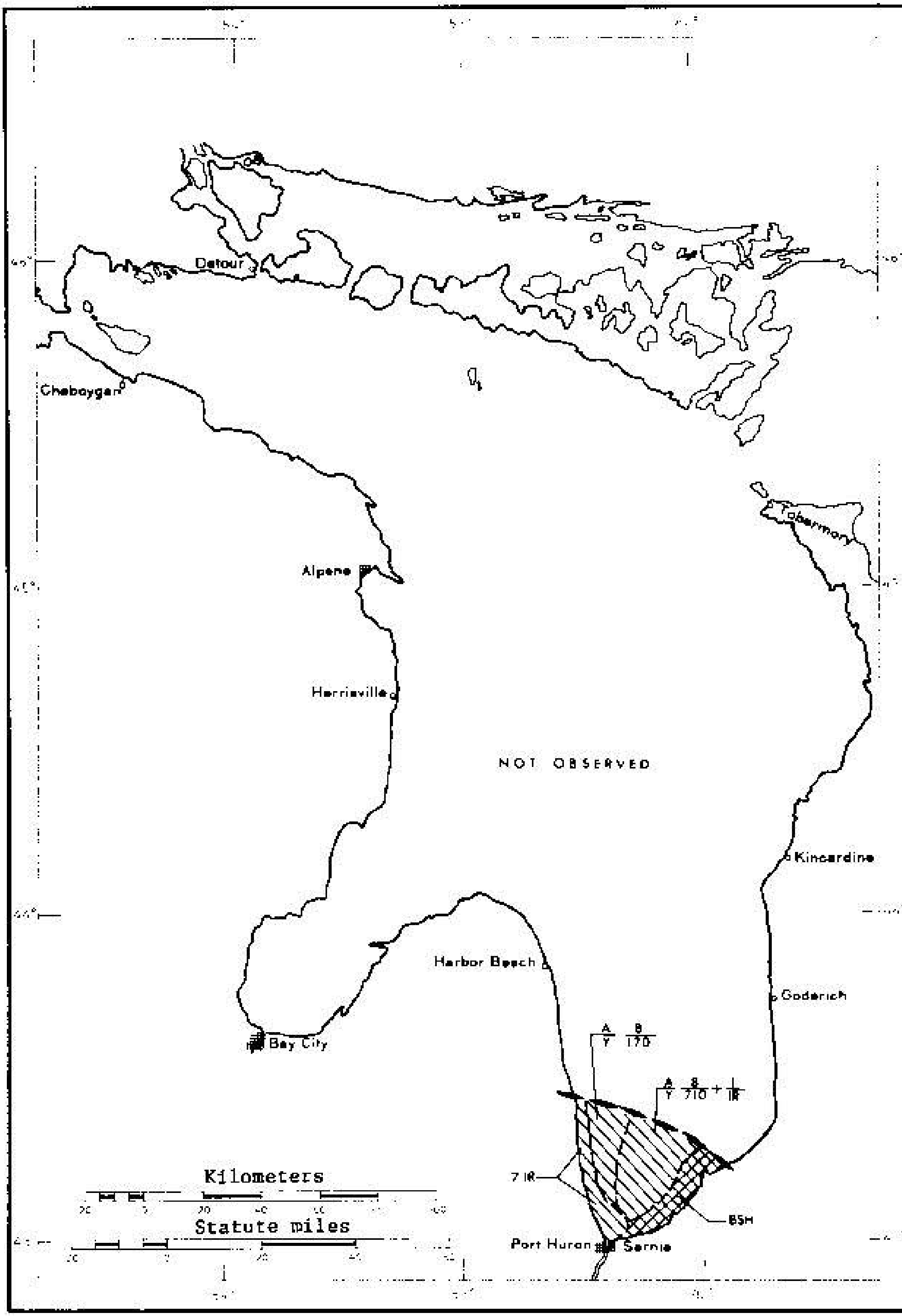

Figure 27.--Lake Huron ice chart, reconnaissance no. H-1-72, Jan. 27, 1972, 1212 to 1218.

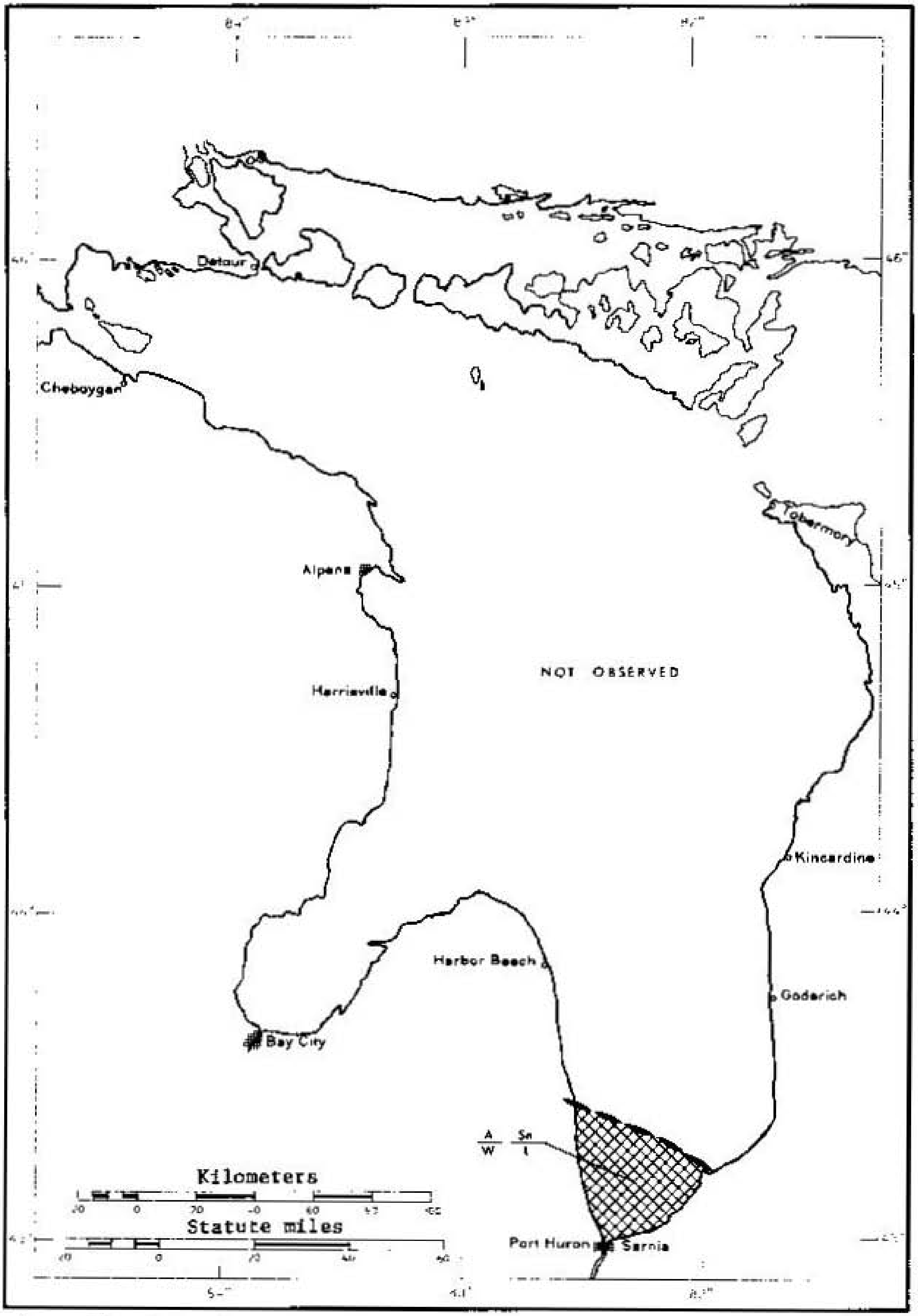

Figure 28.--Lake Huron ice chart, reconnaissance no. H-2-72, Feb. 7, 1972, 1350 to 1400.

Figure 29.--Lake Huron ice chart, reconnaissance no. H-3-72, Mar. 10, 1972, 1100 to 1110.

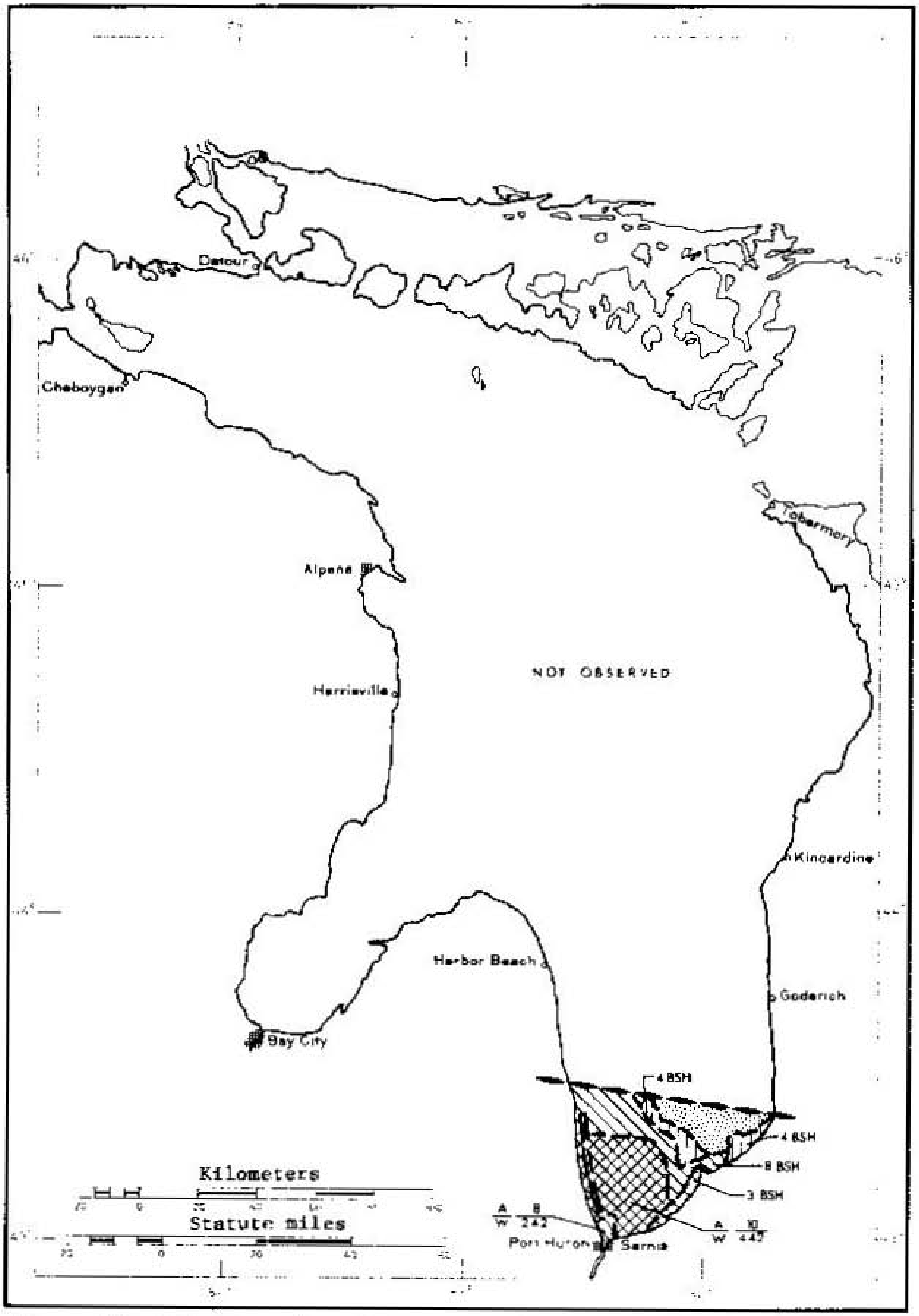

Figure 30.—Lake Huron ice chart, reconnaissance no. H-4-72, Apr. 17, 1972, 1200 to 1230.

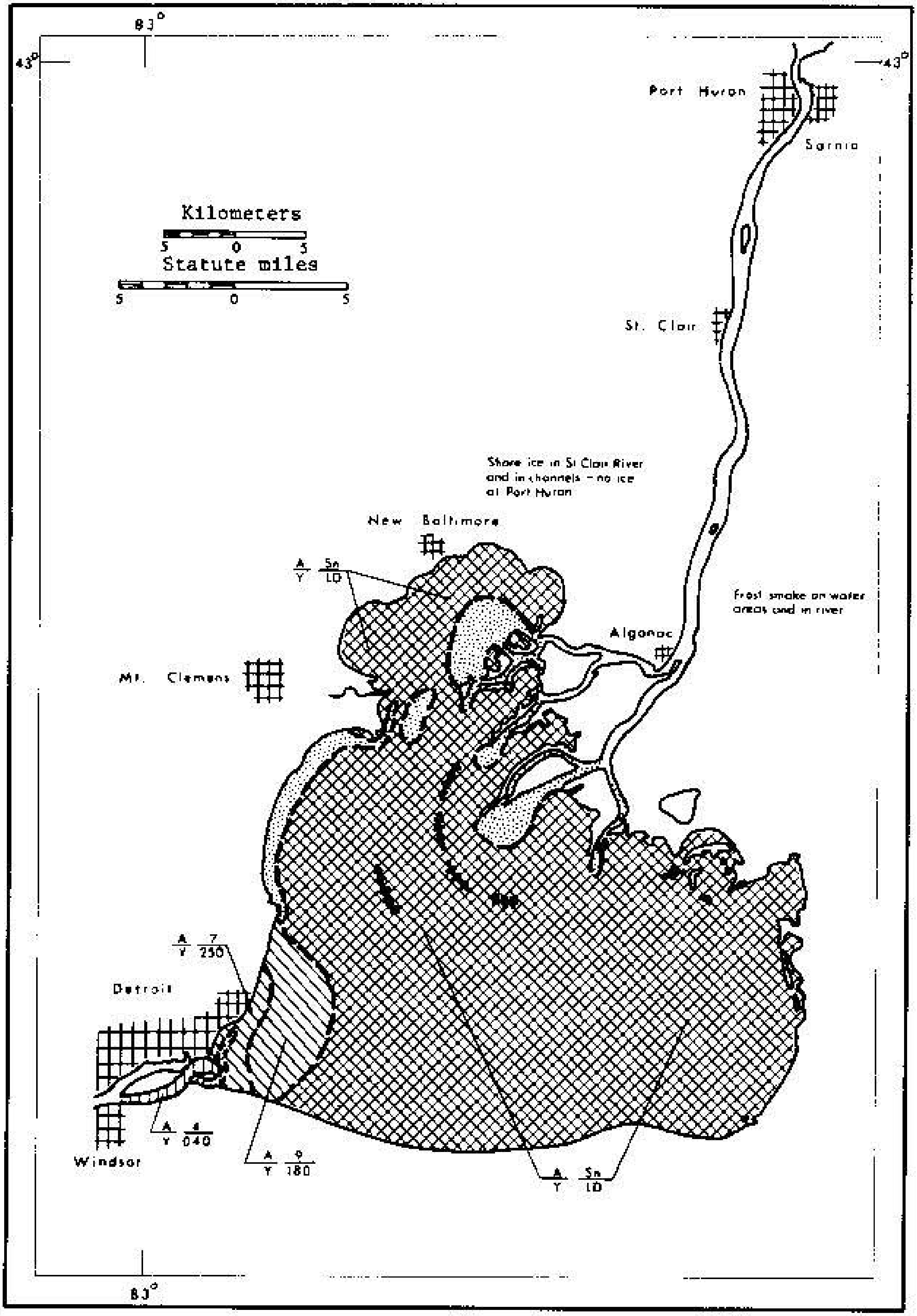

Figure 31.--Lake St. Clair ice chart, reconnaissance no. STC-I-72, Jan. 15, 1972, 1245 to 1425.

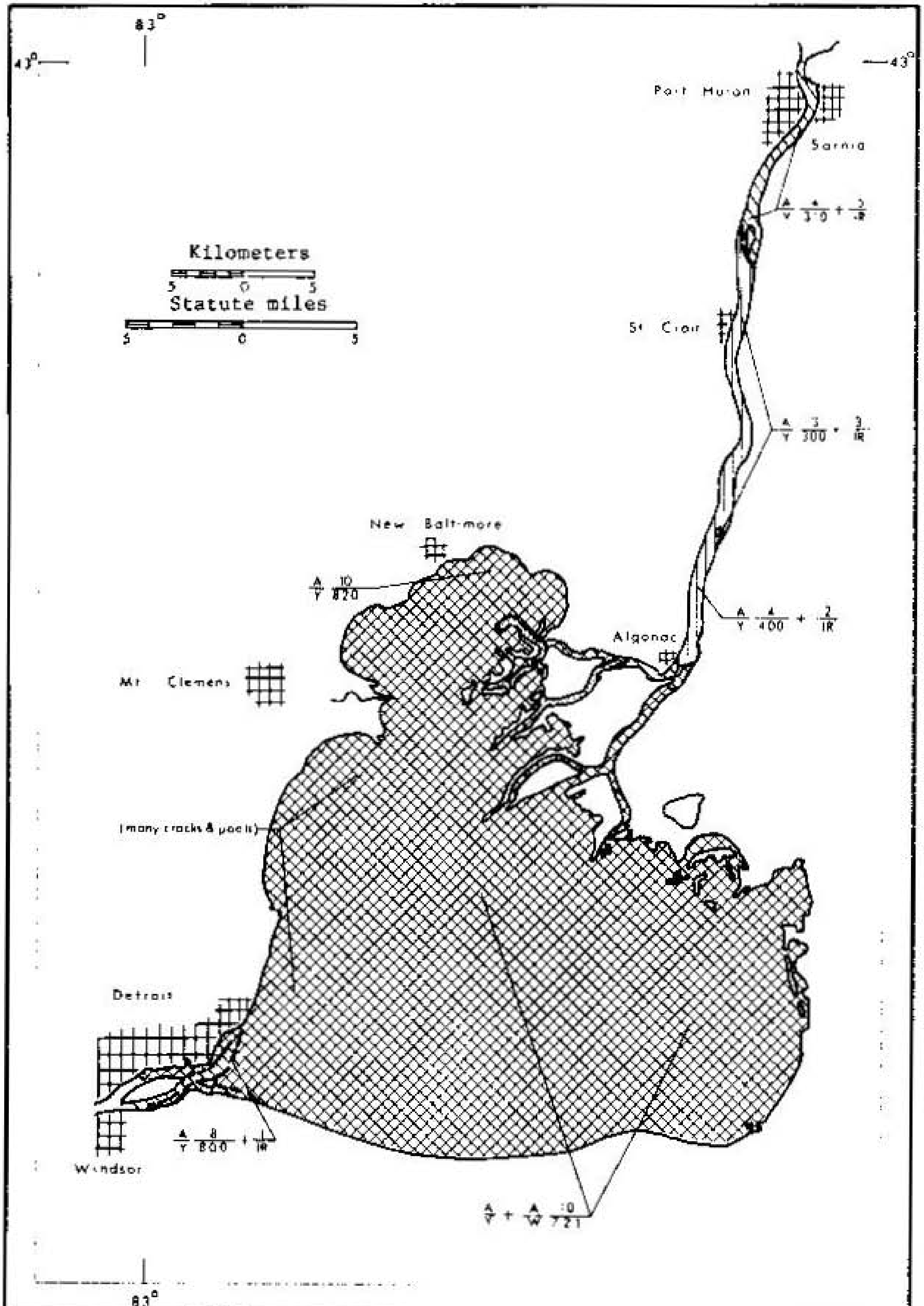

Figure 32.--Lake St. Clair ice chart, reconnaissance STC-2-72, Jan. 27, 1972, 1130 to 1300.

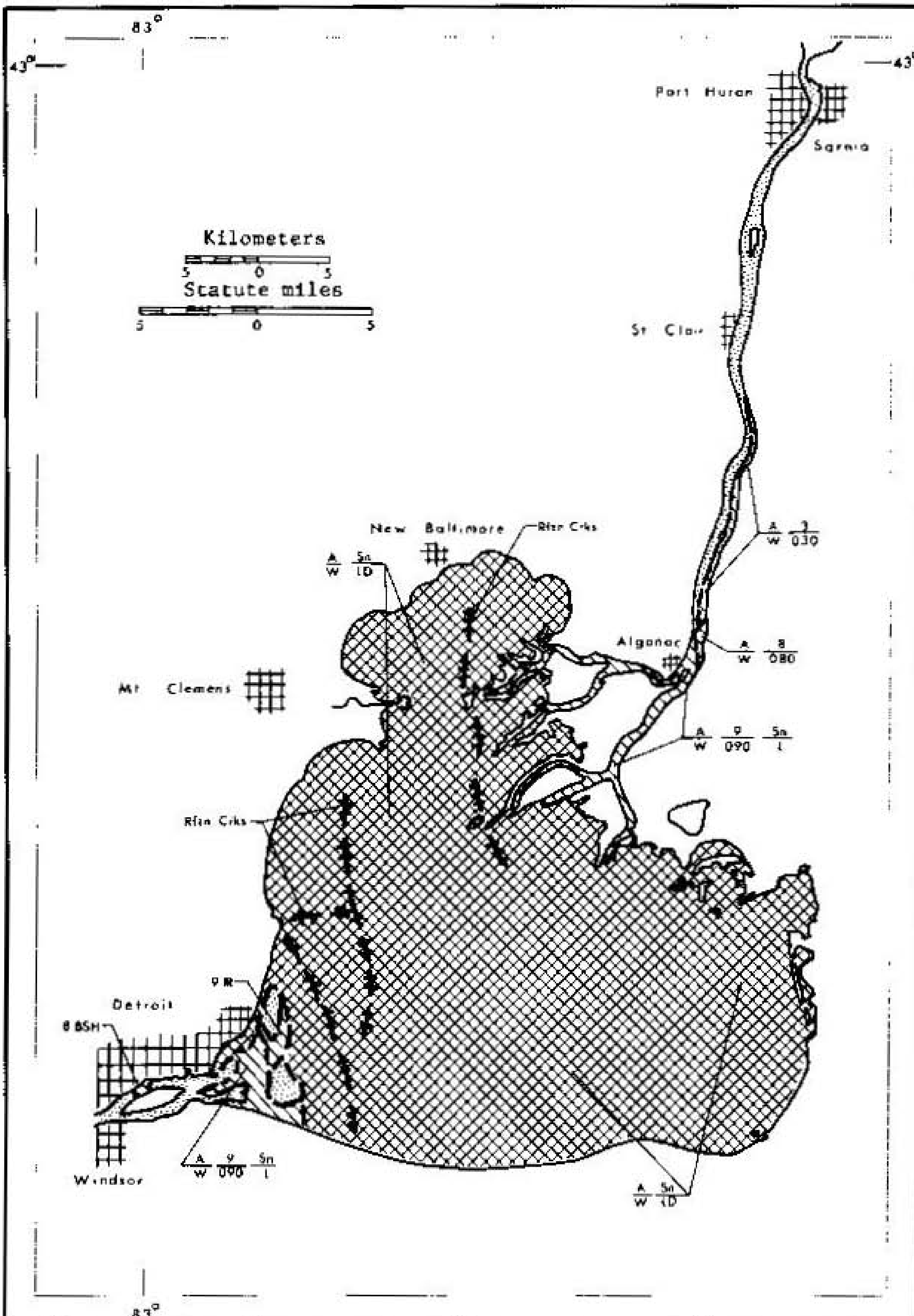

Figure 33.--Lake St. Clair ice chart, reconnaissance STC 3-72, Feb. 7, 1972, 1145 to 1345.

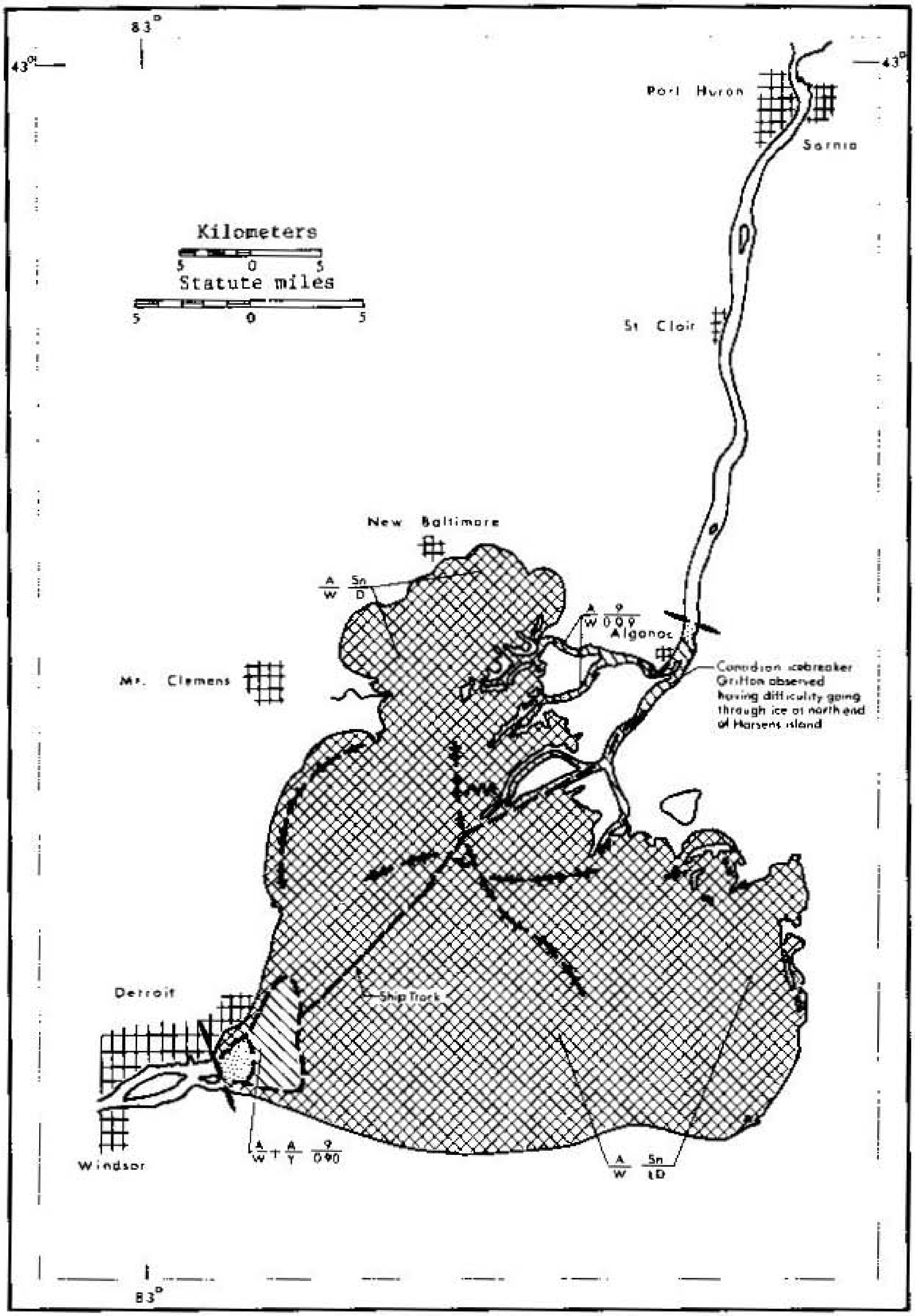

Figure 34.--Lake St. Clair ice chart, reconnaissance no. STC-4-72, Feb. 8, 1972, 1040 to 1300.

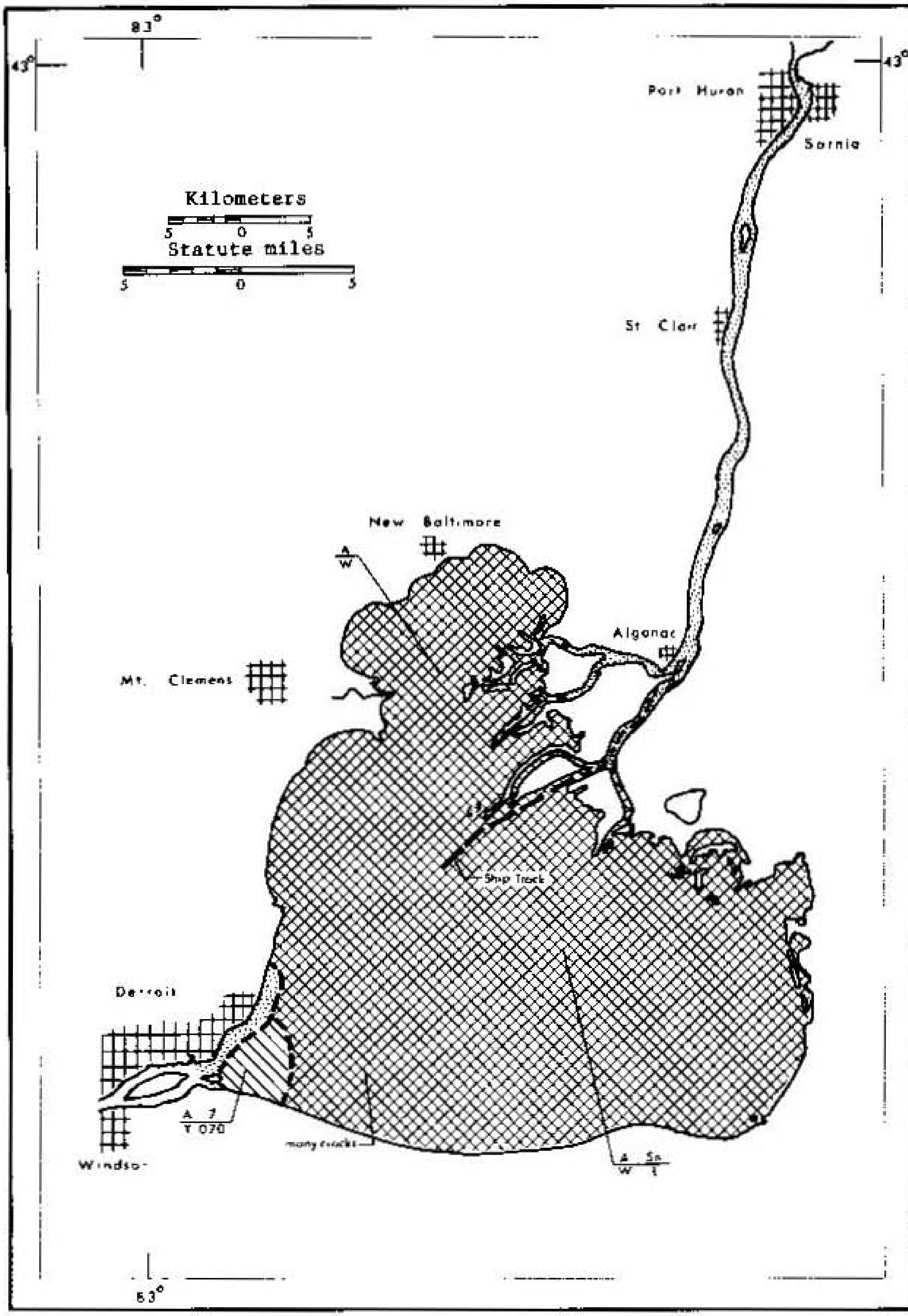

Figure 35.--Lake St. Clair ice chart reconnaissance no. STC-5-72, Feb. 14, 1972, 1105 to 1325.

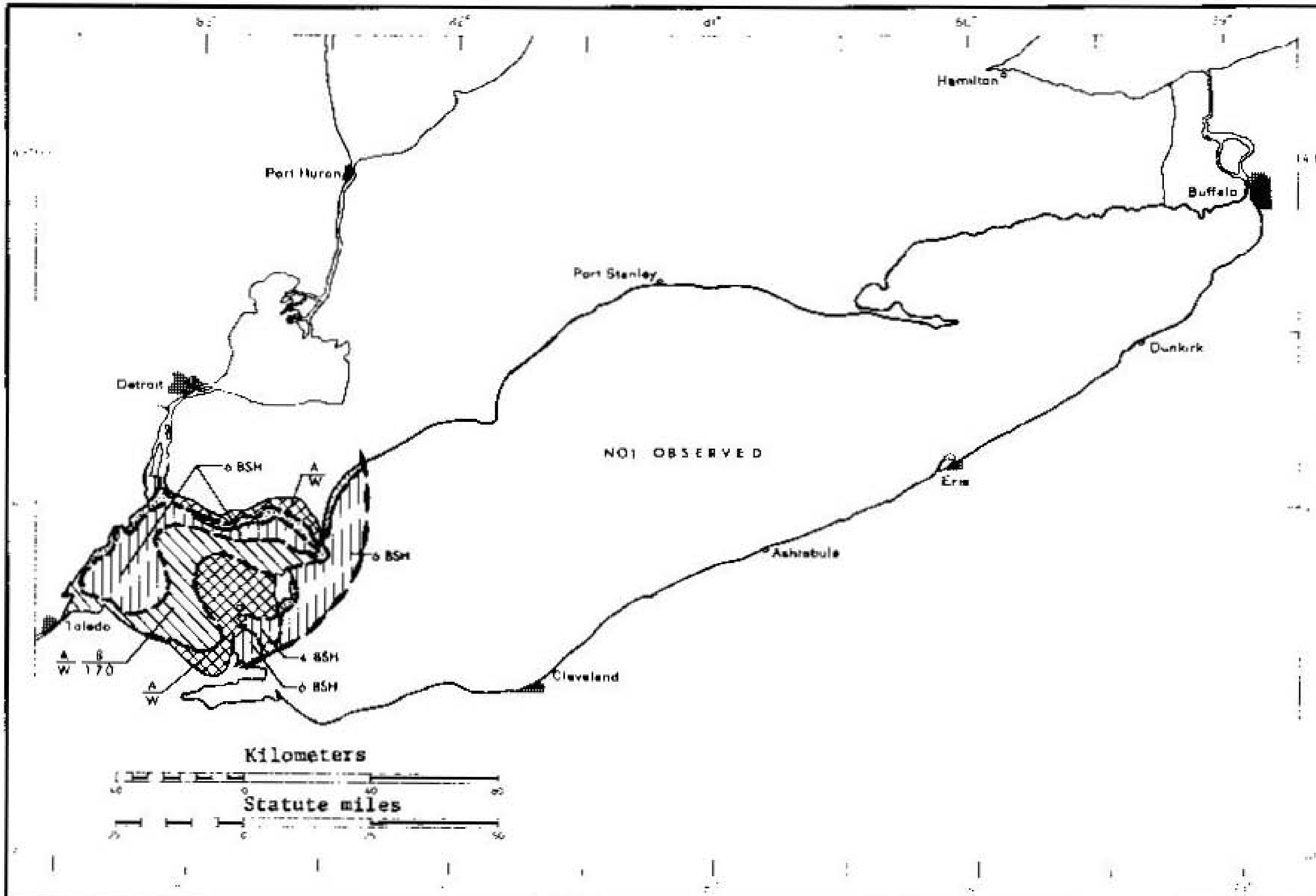

Figure 42.--Lake Erie ice chart, reconnaissance no. E-2-72, Feb. 22, 1972, 1248 to 1333.

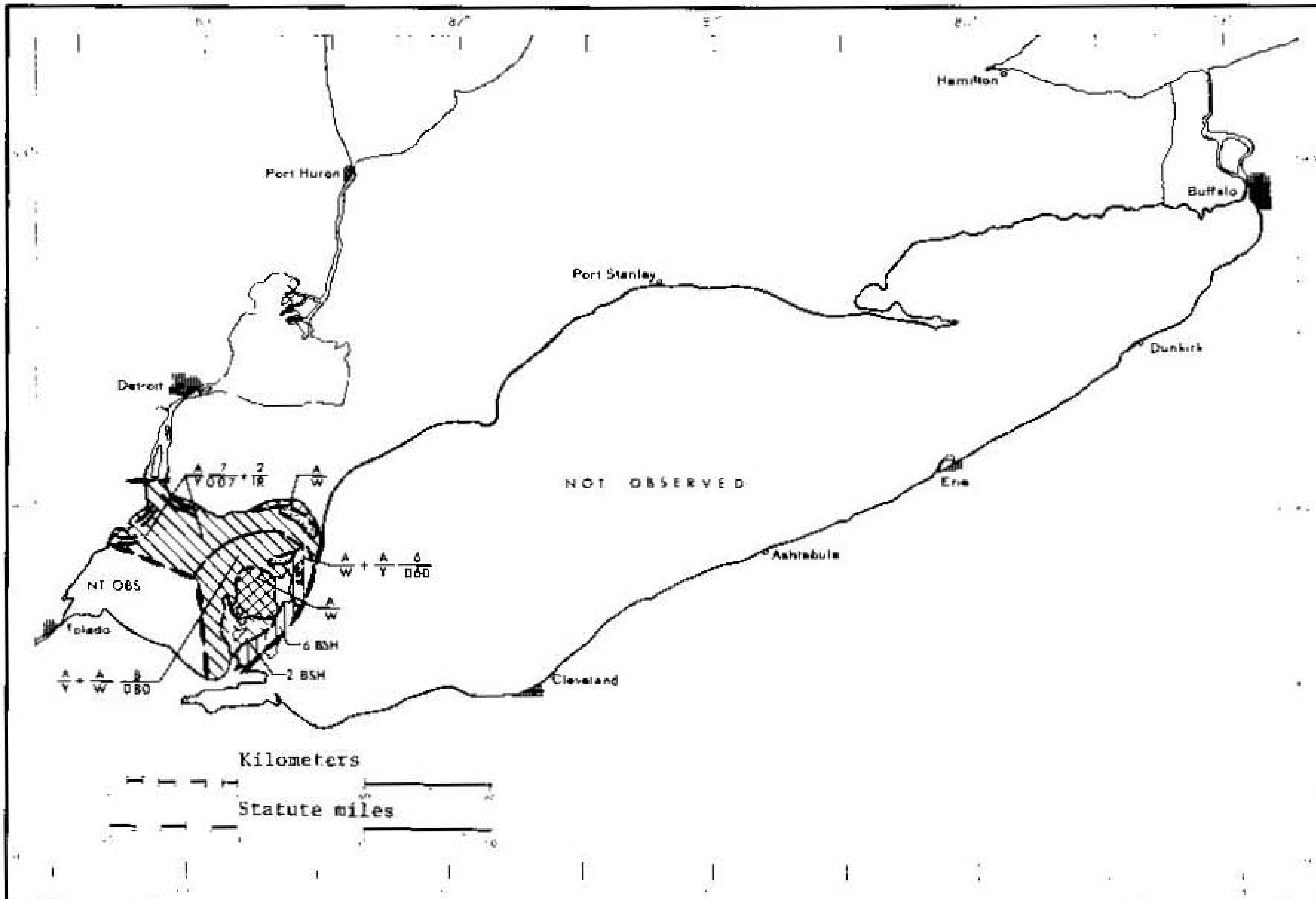

Figure 43.--Lake Erie ice chart, reconnaissance no. E-3-72, Mar. 3, 1972, 1200 to 1250.

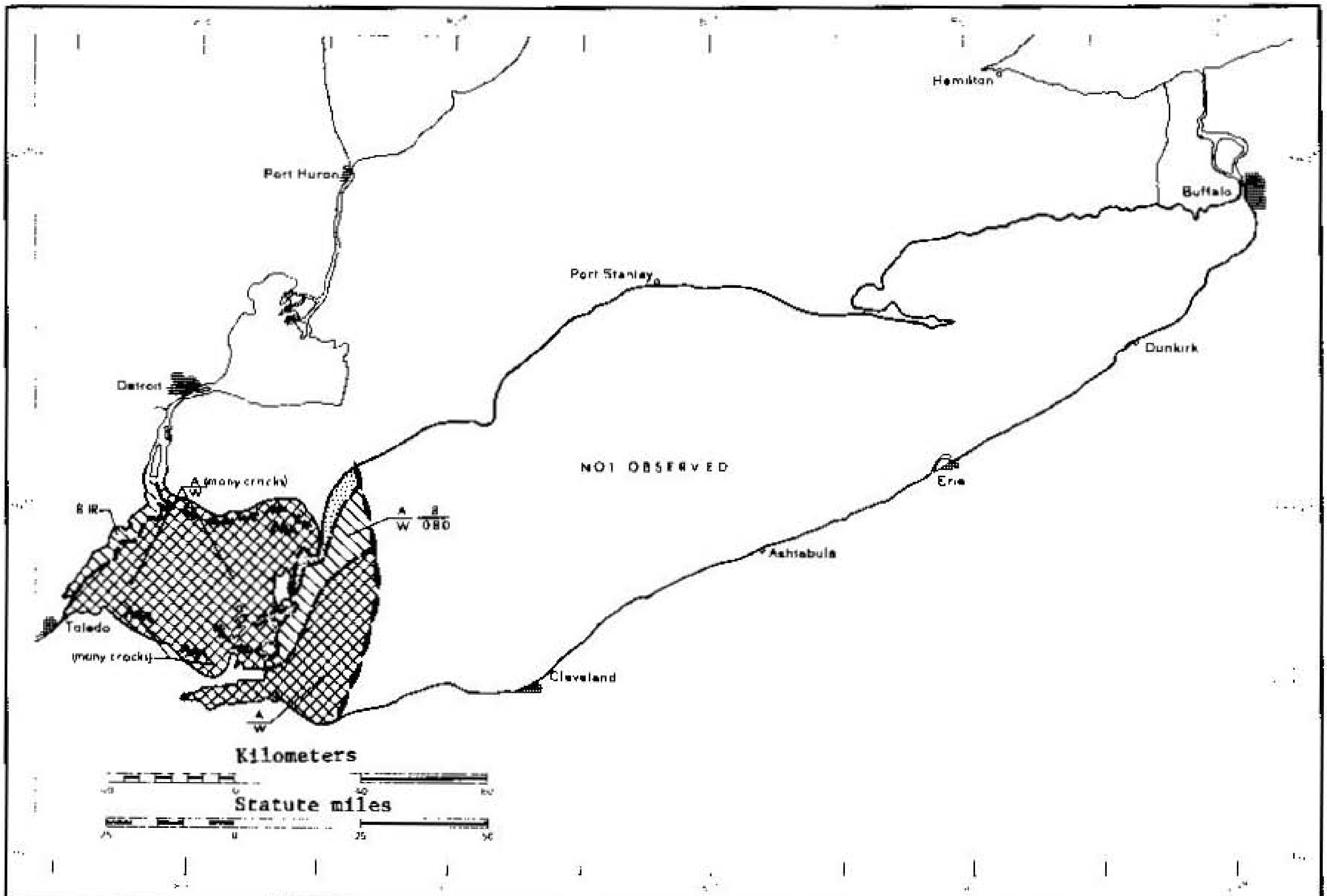

Figure 44.--Lake Erie ice chart, reconnaissance no. E-4-72, Mar. 10, 1972, 1147 to 1237.

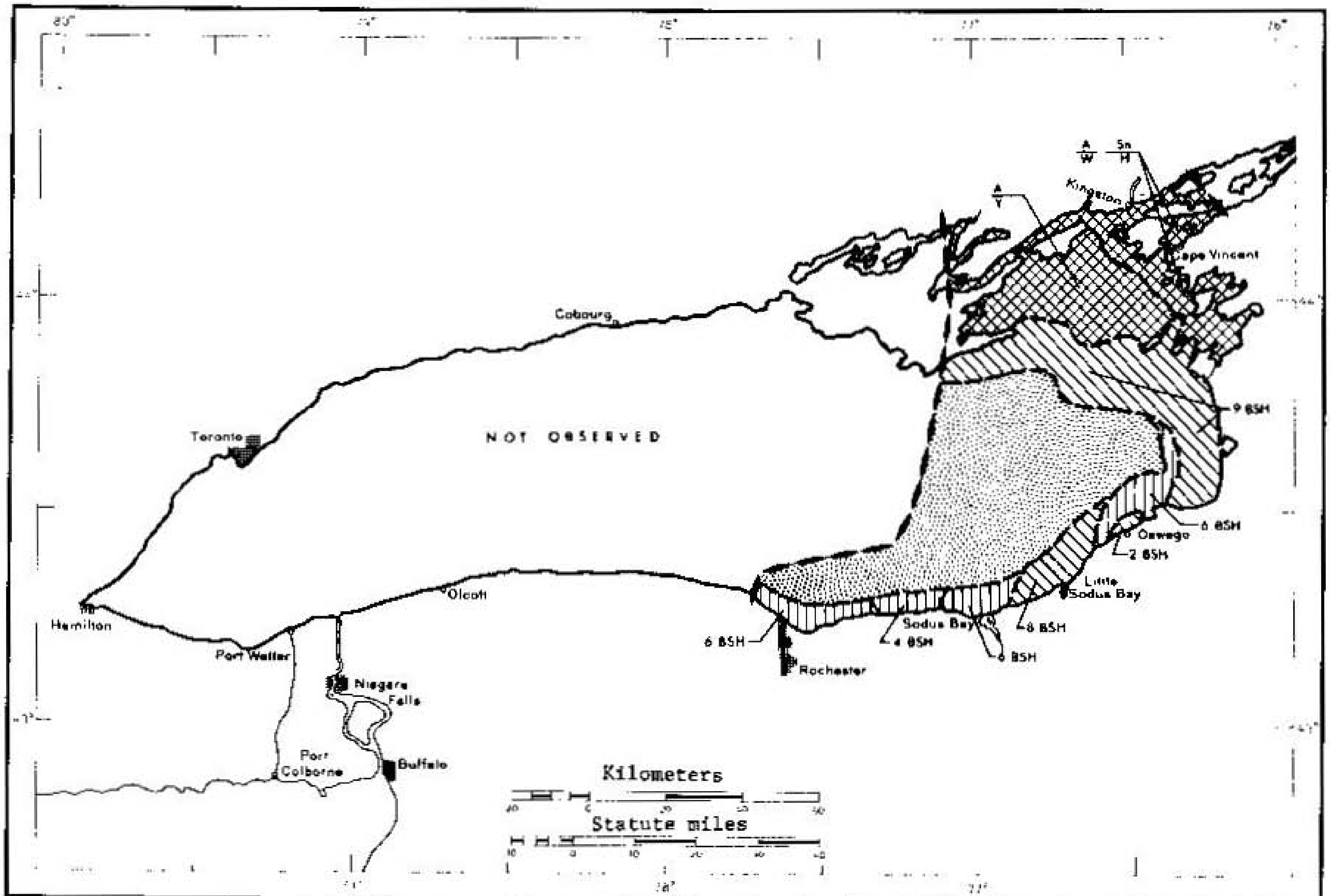

Figure 45.--Lake Ontario ice chart, reconnaissance no. O-1-72, Feb. 23, 1972, 0923 to 1155.

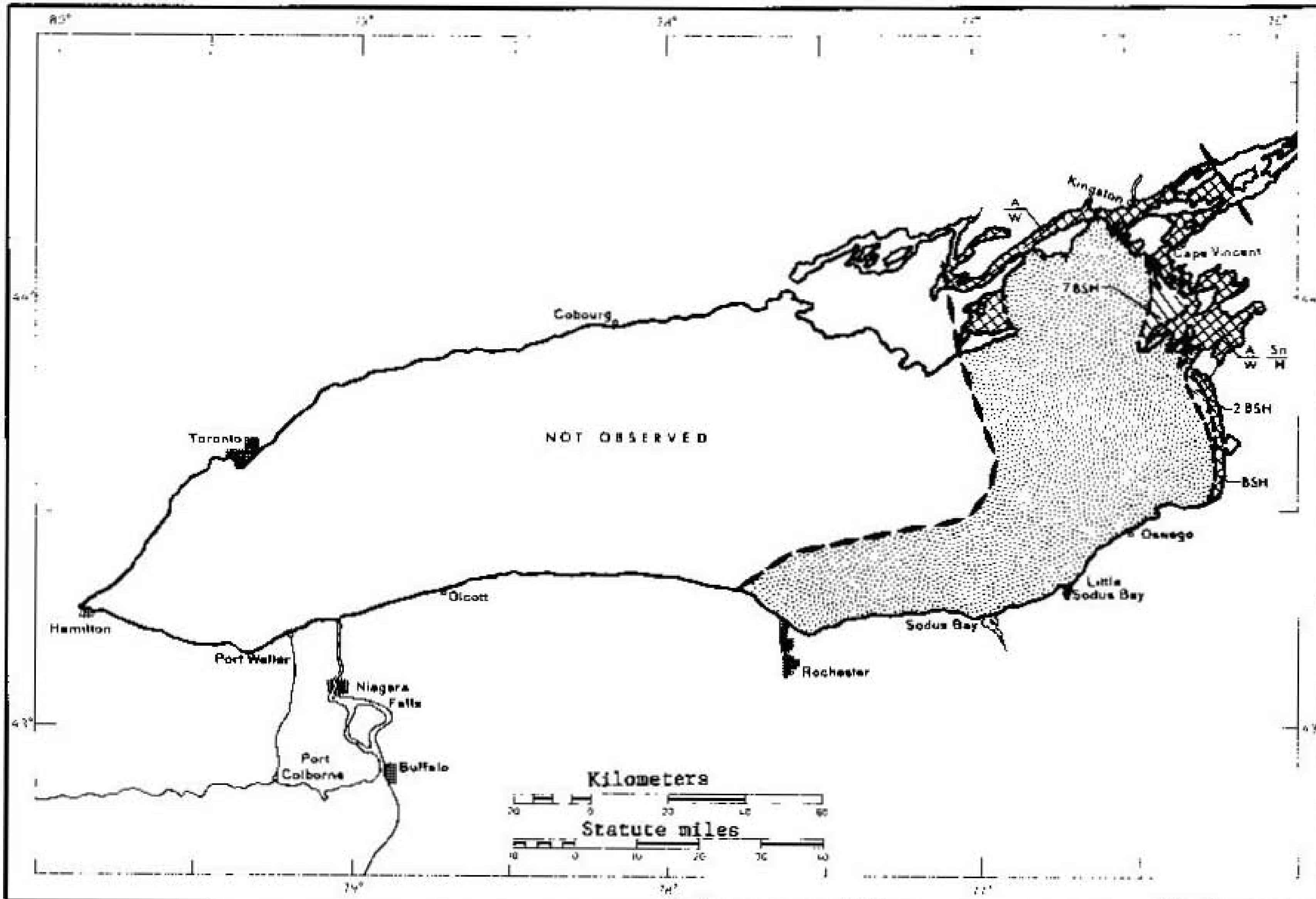

Figure 46.--Lake Ontario ice chart, reconnaissance no. O-2-72, Mar. 28, 1972, 0930 to 1210.