

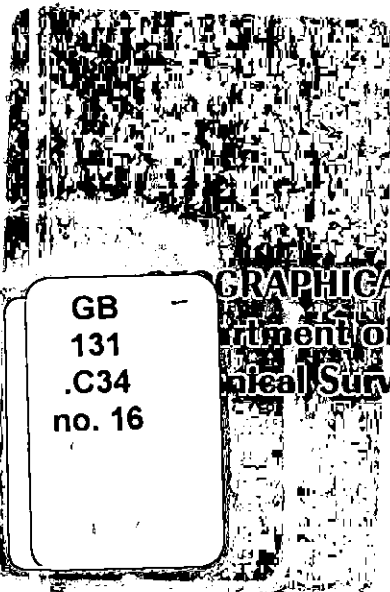


Canada

**GEOGRAPHICAL PAPER No. 16**

# **Ice Conditions in the Gulf of St. Lawrence during the Spring Seasons 1953 - 1957**

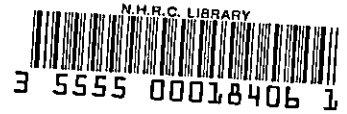
*C. N. Forward*



**GRAPHICAL BRANCH**  
**Department of Mines and**  
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## P R E F A C E

In 1954, the Geographical Branch published a report on ice distribution in the Gulf of St. Lawrence which was based on observational data collected from 1940 to 1952 inclusive. This report has been of great use to the many agencies concerned with the problem of extending the navigation season through the Gulf, many of whom have requested that it be brought up to date using the results of surveys conducted since 1952. This then is the purpose of the present study.

N. L. Nicholson,  
Director,  
Geographical Branch.

## ICE CONDITIONS IN THE GULF OF ST. LAWRENCE

### DURING THE SPRING SEASONS 1953-1957

The possibility of extending the navigation season on the St. Lawrence Seaway is being explored by several government and private organizations. One of the requirements of these investigations is an extensive and accurate knowledge of ice conditions. The results of aerial ice surveys carried out in the Gulf of St. Lawrence during thirteen break-up seasons (1940 to 1952) were available in 1952 and formed the basis for a detailed analysis of the ice distribution and patterns of break-up.<sup>1</sup> These spring ice surveys operated by the Department of Transport have continued to date and provide additional information. A winter aerial ice survey began in 1956 to obtain information covering the period from the end of January until early March, prior to the commencement of the spring survey.<sup>2</sup> In addition to these surveys, investigations of ice behaviour in the St. Lawrence River and estuary are now in progress and are based on shore and aerial observations.

The purpose of this study is to analyse and interpret the spring ice survey reports issued by the Department of Transport since 1952, in order to supplement the previous study.<sup>1</sup> The accompanying maps (Figures 1 to 5) show the limits of the main ice areas at specified dates in March and April of each year. The survey area shown on the maps is restricted by the ice information available. The main ice areas do not include regions of widely scattered strings and patches of ice that would not impede navigation.

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<sup>1</sup>Forward, C.N. "Ice Distribution in the Gulf of St. Lawrence during the Break-up Season", Geographical Bulletin No. 6, 1954. pp. 45-84.

<sup>2</sup>Black, W.A. and Forward, C.N., "Gulf of St. Lawrence Ice Survey, Winter 1956", Geographical Paper No. 12, Ottawa, 1956.

Black, W.A. "Gulf of St. Lawrence Ice Survey, Winter 1957", Geographical Paper No. 14, Ottawa, 1957.

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The method of delimitation by main ice areas has been used because the ice reports do not provide sufficient information for the detailed plotting of ice concentrations. A standardized and specific ice reporting technique has recently been adopted by the Department of Transport and other Canadian government agencies and will provide detailed information in future ice surveys.

The graph that appears on each map shows the departure from normal of mean monthly temperatures in the Gulf of St. Lawrence area, based on data presented in the monthly weather map published by the Meteorological Division, Department of Transport.

In four of the five years under consideration the gulf was clear of ice during April, but in 1957 the final clearing was delayed until mid-May. Relatively low temperatures throughout the winter promoted rapid ice formation, leading to the presence of abundant ice in the spring of 1957. In contrast, ice was much less abundant during the warmer winters of 1953 to 1956 inclusive, although the season of 1956 had a greater abundance of ice than the three preceding years. The rate of break-up was fairly rapid in each year, except in 1953 and 1957 when the break-up proceeded slowly during April. Easterly winds in March and April 1953 caused the ice to accumulate in the western part of the gulf, thereby delaying the break-up. In 1957 the extensive coverage of ice was a major factor in retarding break-up. Except for 1953, when the ice accumulated along the western shore of the gulf, the pattern of break-up was similar in each year; the ice shifted from west to east through Cabot Strait.

In the previous study the characteristics of the ice seasons from 1940 to 1952 were summarized in tabular form. For the purpose of continuity this table is reproduced in the present study with the addition of the seasons 1953 to 1957 (Table 2). It is organized basically on air temperature characteristics and shows the relationship of temperature and wind to ice break-up in the area.

ICE CONDITIONS IN THE GULF OF ST. LAWRENCE 1953-1957

A comparison of the mean monthly temperatures in the Gulf of St. Lawrence area during the ice season (November to May) from 1940 to 1957 indicates that temperatures were above normal during the nine of the eighteen seasons, and below normal during four only (Table 1). The remaining seasons had approximately normal temperatures.

TABLE 1  
TEMPERATURE CHARACTERISTICS OF THE ICE  
SEASONS IN THE GULF OF ST. LAWRENCE AREA  
1940 TO 1957

	Years with below-normal temperatures	Years with approx. normal temperatures	Years with above-normal temperatures
Ice seasons (November to May)	1943 1944 1948 1957	1941 1946 1947 1950 1956	1940 1942 1945 1949 1951 1952 1953 1954 1955
Total	4	5	9

Consequently, a moderating influence on ice conditions has occurred during the past two decades. On the basis of the air temperature factor only, normal ice conditions would be expected in five of the eighteen years. On the other hand, less abundant ice would be expected in nine years of the total, and more abundant ice in the remaining four years. Essentially this was the case, although factors such as winds and water movements were responsible for variations. This analysis suggests that, in general, ice conditions have been favourable to navigation during the last eighteen

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TABLE 2 RELATIONSHIPS BETWEEN TEMPERATURE, WIND

Group		Temperatures	Year	Winds
(1)  above average temperatures	A	every month well above average	1945	strong westerly
			1951	strong easterly and northerly
			1953	easterly in late March and in April
	B	Most months well above average	1949	northerly and westerly
			1952	strong northerly and light variable
			1954	strong westerly in March and April
			1955	strong easterly followed by strong westerly
	C	most months above average or near average	1940	(insufficient data)
			1956	strong westerly in March and April with easterly in mid- April
(2)  first 3 months colder than last 3	A	first 3 months near average, last 3 months higher than average	1942	strong northerly
			1946	strong westerly followed by northerly and easterly
	B	first 3 months lower than average, last 3 months higher than average	1941	(insufficient data)
			1947	westerly and southerly
	C	2 of first 3 months well below average, last 3 near average	1957	strong northerly followed by westerly
	(3)  first 3 months warmer than last 3	A	first 3 months above average, last 3 below average	1948
1950				strong northerly
B		2 of first 3 months above average, last 3 below average	1944	strong westerly and northerly
(4) below average temperatures		A	4 months well below average	1943



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 ICE CONDITIONS IN THE GULF OF ST. LAWRENCE 1953-1957
 

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 AND ICE CONDITIONS IN THE GULF OF ST. LAWRENCE
 

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Pattern of Break-up	Rate of Break-up	Time of Final Clearing
west to east direct withdrawal	rapid in March and April	early April
west side accumulation	slow in March and April	late April
west side accumulation	rapid in March, slow in April	late April
west to east, direct withdrawal	rapid in March and April	late April
stagnation in south	slow in March and April	early May
west to east, direct withdrawal	rapid in March and April	early April
west to east, direct withdrawal	rapid in March and April	early April
west to east, direct withdrawal	moderate in March, rapid in April	early May
west to east, direct withdrawal	rapid in March and April	late April
stagnation in south	moderate in March, slow in April	early May
stagnation in south	rapid in March, slow in April	early May
west to east, direct withdrawal	rapid in March and April	late April
west to east, direct withdrawal	rapid in March and April	early May
west to east, direct withdrawal	moderate in March, slow in April	middle of May
west to east, direct withdrawal	rapid in March and April	middle of May
stagnation in south	moderate in March, slow in April	middle of May
stagnation in south	rapid in March, slow in April	late April
south to north, direct withdrawal	rapid in March and April	early April

years. In planning extension of the navigation season, however, it should be observed that a series of winters with below-normal temperatures may lead to ice conditions that are unfavourable to navigation.

This five-year record of spring ice conditions provides a valuable addition to the 1940-1952 record, and shows the recurrence of typical patterns of break-up. With improved and more frequent observation it is expected that a broader understanding of ice behaviour may be obtained in the future.

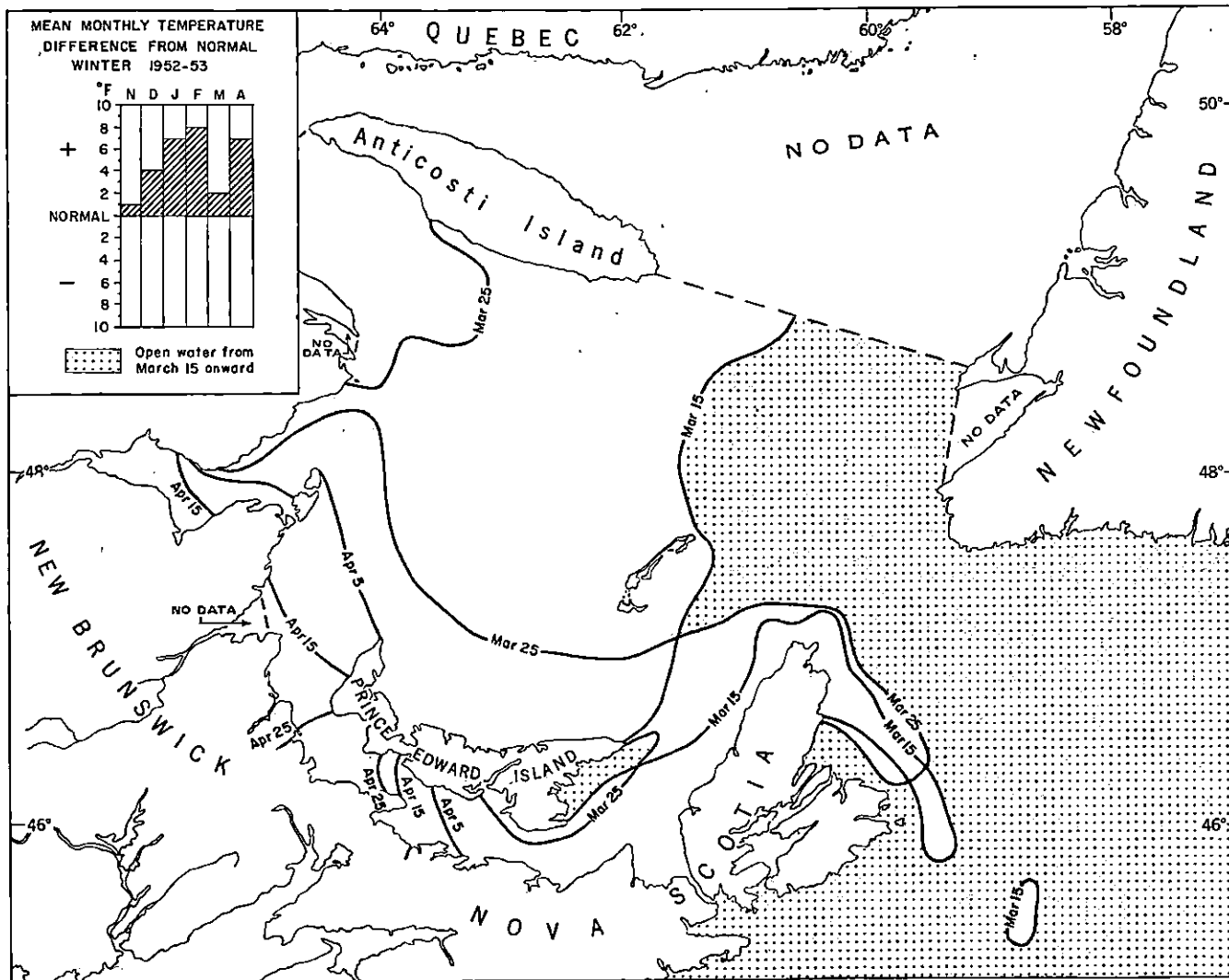


Figure 1. Ice season, 1953.

The small quantity of ice present in the gulf in mid-March cleared rapidly during the last half of the month. The central and eastern part of the gulf was ice-free in early April while the ice remained in the southwestern section owing to moderate but sustained easterly winds throughout the month. Consequently, Northumberland Strait and Baie de Chaleur were the last areas to become ice-free. The pattern of break-up is similar to that of 1951. Temperatures were above average in each month from November to April and correspond to 1951 temperatures.

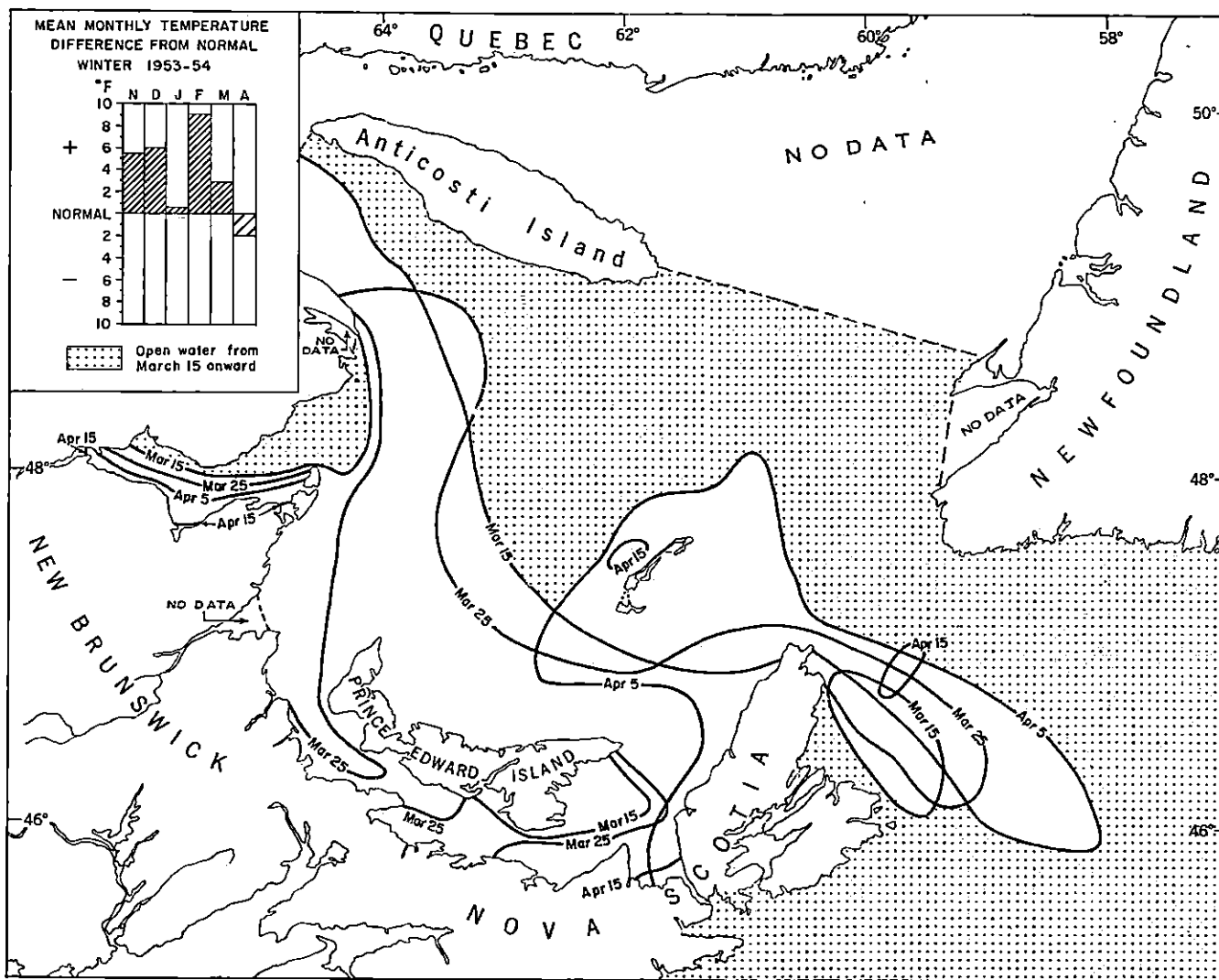


Figure 2. Ice season, 1954.

By mid-March the northern part of the area was ice-free, and during the latter half of the month the western and southern areas became ice-free. The clearing of ice proceeded quickly during the first ten days of April and only small patches remained by April 15. Throughout most of March and April winds were westerly and moderately strong for several days at a time and assisted the movement of ice through Cabot Strait. The pattern of break-up resembled that of 1944, although the rate of clearing in 1954 was much more rapid. Above normal temperatures prevailed during the whole winter and spring period, except in April.

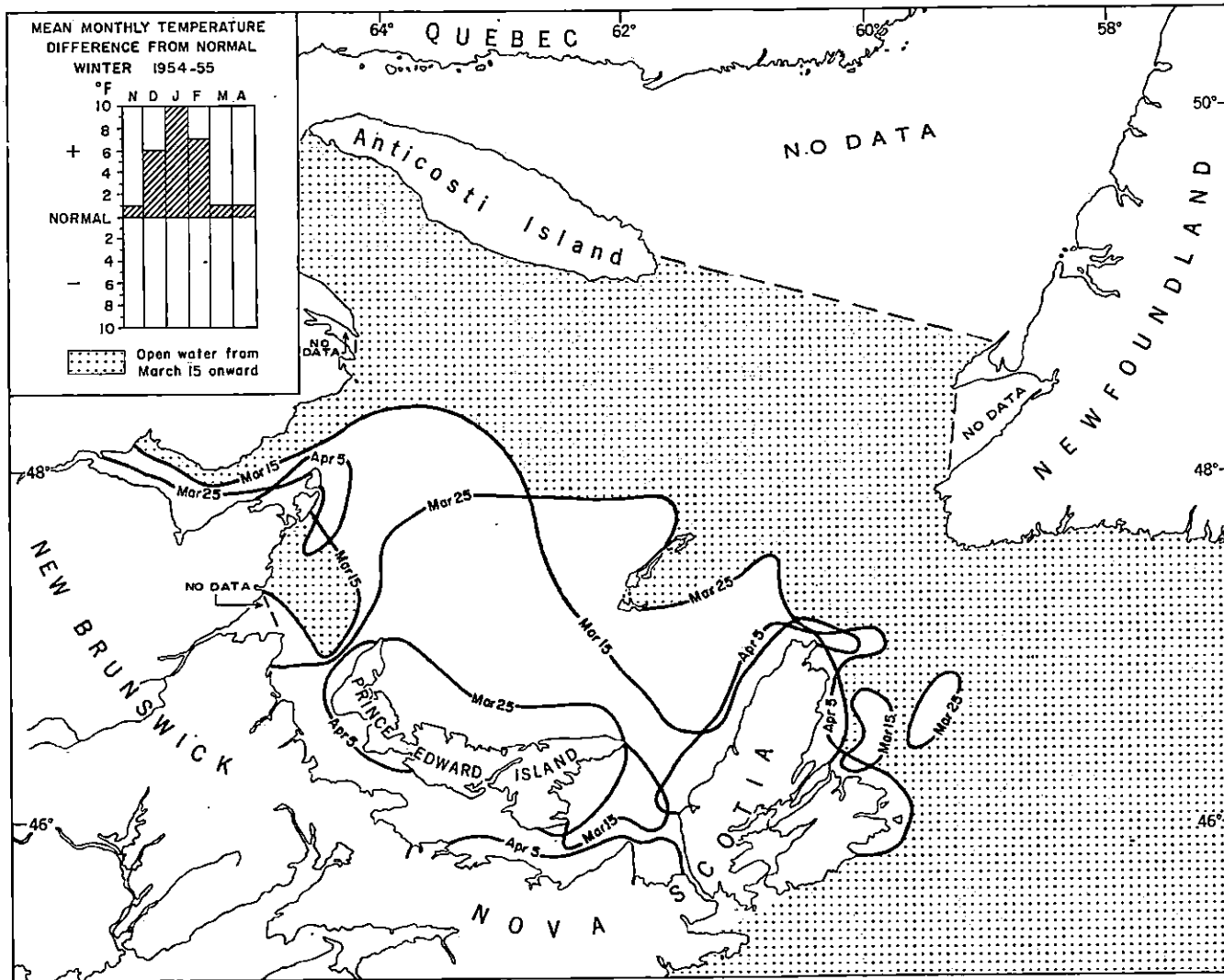


Figure 3. Ice season, 1955.

Ice was confined to the southern half of the gulf during the middle of March and cleared rapidly during the first week of April. Strong northerly and easterly winds in mid-March drove the ice southward. Near the end of March and in the beginning of April strong westerly winds tended to shift the ice eastward, piling it along the Nova Scotia coast. The ice conditions of 1955 and the pattern of break-up closely resembled conditions in 1945. In both these years temperatures were above normal from November to April.

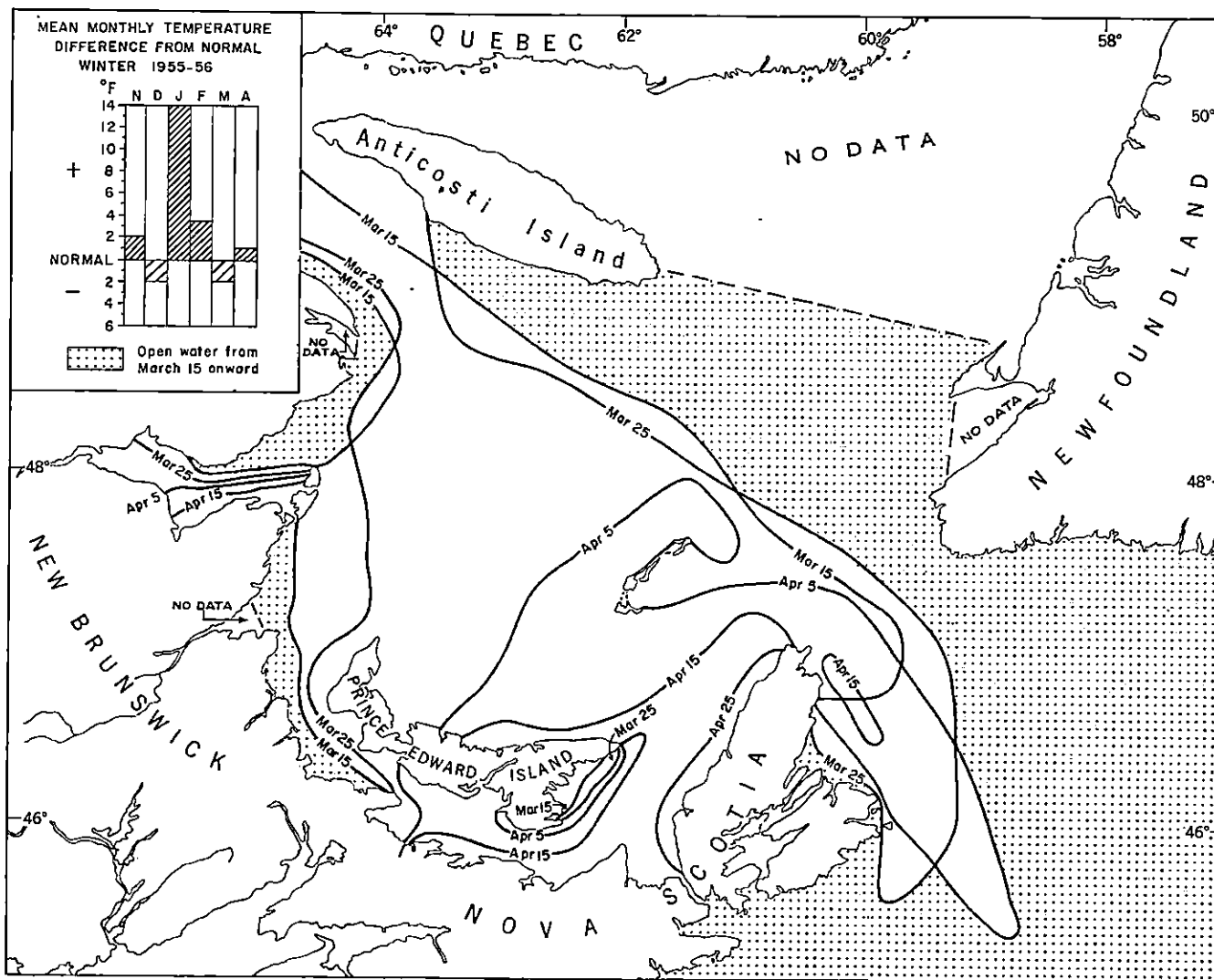


Figure 4. Ice season, 1956.

Ice was fairly extensive during the latter half of March but dispersed rapidly under the influence of westerly winds. A period of strong northeast winds in mid-April retarded the final clearing of the ice. The break-up followed a pattern similar to that of 1954, although the ice was of greater extent in 1956 and was later in clearing. Temperatures were above normal during all months except December and March.

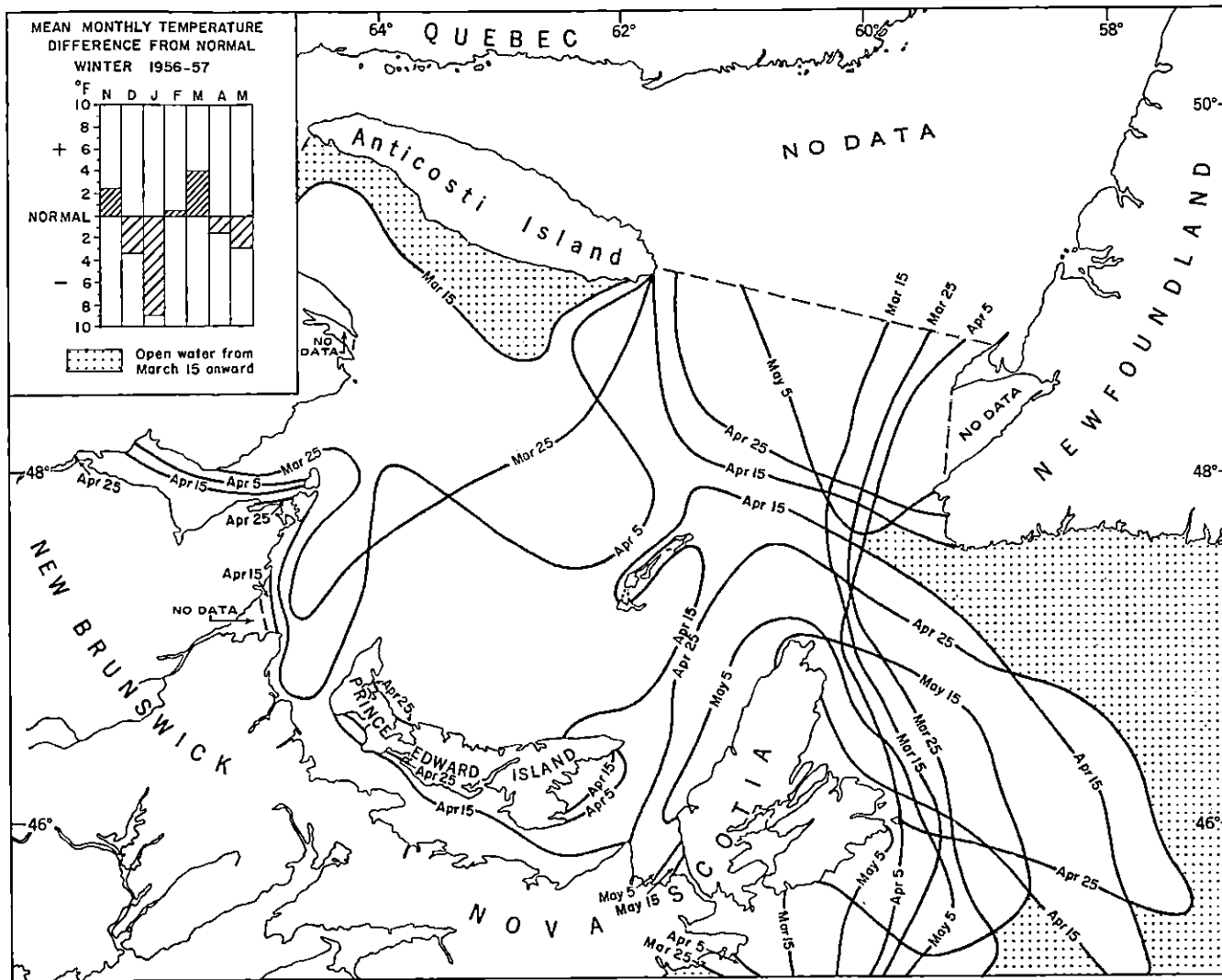


Figure 5. Ice season, 1957.

Ice coverage was more extensive than in recent years. The western part of the gulf was ice-free by mid-April, but ice remained along the Cape Breton and south Newfoundland coasts until May. The east coast of Cape Breton became ice-free after mid-May. In late March strong northerly winds assisted the freeing of the area south of Anticosti Island. Temperatures were below normal during four of the months from November to May. The pattern of break-up was similar to that of 1948; however, the ice was more extensive in 1957 and the final clearance of the gulf was longer delayed.