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Report of the International Ice Patrol Service in the North Atlantic Ocean

SEASON OF 1972

CG-188-27

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

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FOREWORD

Forwarded herewith is Bulletin No. 58 of the International Ice Patrol describing the Patrol's services, and ice observations and conditions during the 1972 season.

W. A. JENKINS
Chief, Office of Operations

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TABLE OF CONTENTS

Preface v
International Ice Patrol 1972 1
Aerial Ice Reconnaissance 3
Communications 5
Ice Conditions, 1972 Season:
    September through December 1971 8
    January 1972 8
    February 1972 9
    March 1972 9
    April 1972 10
    May 1972 11
    June 1972 11
    July 1972 12
    August 1972 13
    September 1972 13
Oceanographic Conditions, 1972 14
Discussion of Iceberg and Environmental Conditions
    During 1972 Season 16
List of Participating Nations' Ships reporting
    Ice and Sea Temperatures 19

PREFACE

This report is 58th in a series of annual reports on the International Ice Patrol Service in the North Atlantic Ocean. It contains information on Ice Patrol organization, communications and operations, on ice and environmental conditions and their relationship in 1972, and on the dynamic topography surveys conducted during April, May and June 1972.

The author of this report, LT Douglas W. CROWELL, USCG acknowledges ice and weather data supplied by the Canadian Department of Transport, weather data supplied by the U.S. National Weather Service, weather and oceanographic data supplied by the U.S. Coast Guard Oceanographic Unit. Acknowledgement is also made to Yeoman First Class Bruce S. COLLINS, USCG, Senior Chief Marine Science Technician Paul R. FLOWERS, USCG, Marine Science Technician First Class James A. SHAFER, USCG, Marine Science Technician Second Class Joseph C. DELWICHE, USCG, Marine Science Technician Third Class Larry D. STARK, USCG, and Marine Science Technician Third Class James M. GAYNOR, USCG for assistance in the preparation of the manuscript and illustrations for this report.

In January 1972, FINLAND became the eighteenth nation to sponsor the International Ice Patrol joining Belgium, Canada, Denmark, France, Germany, Great Britain, Greece, Israel, Italy, Japan, Liberia, Netherlands, Norway, Panama, Spain, Sweden, United States of America, and Yugoslavia.

The generosity and cooperation given by the Canadian Forces in permitting the International Ice Patrol to operate from their base at Summerside is gratefully acknowledged.

INTERNATIONAL ICE PATROL 1972

The 1972 International Ice Patrol Service in the North Atlantic Ocean was conducted by the U.S. Coast Guard under the provisions of Title 46, United States Code, Sections 738, 738a through 738d, and the International Convention for the Safety of Life at Sea, 1960, Regulations 5 through 8. The International Ice Patrol is a service for observing and disseminating information on ice conditions in the North Atlantic. During the ice season, the southeastern, southern and southwestern limits of the regions of icebergs in the vicinity of the Grand Banks of Newfoundland are guarded for the purpose of informing passing ships of the extent of this dangerous region. The International Ice Patrol also studies ice conditions in general, and affords assistance to ships and crews requiring aid within the limits of operation of Ice Patrol forces.

The International Ice Patrol was directed from the Ice Patrol Office located on U.S. Coast Guard Base, Governors Island, New York. The Ice Patrol Office gathers ice and other environmental reports from various sources, maintains an ice plot, forecasts ice conditions, prepares the Ice Bulletin, and maintains operational control of the Ice Reconnaissance Detachment, the Ice Patrol oceanographic cutter and the Surface Patrol cutter when assigned.

Vice Admiral Benjamin F. ENGEL, USCG, was Commander, International Ice Patrol. Captain Eugene A. DELANEY, USCG, was directly responsible for the management of the Patrol.

Preseason Ice Patrol flights were made in January and February, 1972. The Ice Reconnaissance Detachment deployed to Canadian Forces Base Summerside, Prince Edward Island, on 28 February and returned to the United States on 2 September.

The 1972 ice season officially commenced at 0000 GMT 29 February when the first Ice Bulletin was issued, and continued until 4 September. The twice daily Ice Bulletin was broadcast by International Ice Patrol Radio Station Boston/NIK, U.S. Naval Radio Station Washington/NSS, Canadian Maritime Command Radio Station Mill Cove/CFH, and Canadian Coastal Radio Station St. John's/VON. Radio Station Boston included the Ice Bulletin on the Western North Atlantic High Seas Broadcast eight times daily and broadcast an ice radiofacsimile chart once a day throughout the ice season.

The USCGC EVERGREEN, commanded by Lieutenant Commander William MONSON, USCG, conducted oceanographic cruises for the Ice Patrol during the periods 3 - 23 April, 5 - 21 May and 3 - 22 June. The EVERGREEN also served as Surface Patrol Cutter during the June oceanographic cruise.

For the first time since 1959 a surface patrol was initiated. On 25 April USCGC DUANE commanded by Commander Robert B. BACON, USCG, left Ocean Station DELTA and assumed duties as Surface Patrol cutter on 26 April. The following 210-class medium endurance cutters and the oceanographic cutter conducted the surface patrol during the periods indicated:

USCGC VIGOROUS	commanded by Commander James J. ROONEY III	2 - 14 MAY
USCGC DECISIVE	commanded by Commander Robert J. DESCOTEAUX	14 - 25 MAY
USCGC VALIANT	commanded by Commander Billy C. READ	25 MAY - 7 JUN; 15 - 24 JUN
USCGC EVERGREEN	commanded by Lieutenant Commander William A. MONSON	7 - 15 JUN
USCGC VIGOROUS	commanded by Commander Richard W. MICHAELS	24 JUN - 2 JUL
USCGC VIGILANT	commanded by Commander Edward R. BAUMGARTNER	2 - 17 JUL
USCGC ALERT	commanded by Commander Robert C. NICHOLS	17 - 25 JUL

On 25 July, with icebergs no longer a threat below 43°N, the surface patrol was terminated.

During the 1972 season an estimated 1587 icebergs drifted south of 48°N, the heaviest and longest season in the Ice Patrol 60-year history.

AERIAL ICE RECONNAISSANCE

During the period 1 September 1971 to 4 September 1972, a total of 82 ice observation flights were made. Preseason flights made in January and February accounted for 7 flights, and 75 flights made during the season accounted for the remainder. The purpose of the preseason flights was to study iceberg distribution patterns in the Labrador Sea and to evaluate the iceberg potential of the developing ice season. The purpose of the flights during the season was to guard the southeastern, southern, and southwestern limits of icebergs, to evaluate the short term iceberg potential of the waters immediately north of the Grand Banks, and occasionally to study the iceberg distribution along the Labrador coast. Flight statistics are shown in Table 1, and are exclusive of time required to deploy from U.S. Coast Guard Air Station, Elizabeth City, North Carolina, to the operating base.

Table 1. AERIAL ICE RECONNAISSANCE STATISTICS
SEPTEMBER 1971 TO AUGUST 1972

Month	Number of Flights	Flight Hours
PRESEASON		
Sep-Dec	0	0
January	3	26.6
February	4	39.1
Preseason total	7	65.7
SEASON		
March	9	68.0
April	15	120.3
May	19	132.4
June	8	45.9
July	14	92.4
August	9	58.6
September	1	8.0
Season total	75	525.6
Annual total	82	591.3

Aerial ice reconnaissance was accomplished by U.S. Coast Guard Lockheed HC130B aircraft from the U.S. Coast Guard Air Station at Elizabeth City, North Carolina. During the preseason flights the aircraft operated from U.S. Air Force Base Goose Bay, Labrador; U.S. Air Force Base Sondrestrom, Greenland; Canadian Forces Base Summerside, Prince Edward Island; and Torbay Airport St. John's, Newfoundland. During the iceberg season the aircraft operated out of Canadian Forces Base Summerside, Prince Edward Island; Torbay Airport St. John's, Newfoundland; and Gander Airport, Newfoundland.

On 28 February the Ice Reconnaissance Detachment deployed to Summerside from Elizabeth City. Occasionally, during periods of good visibility, the aircraft operated from St. John's due to its close proximity to the Grand Banks. The main base remained at Summerside until 2 September when the Detachment returned to the United States. Twice during the season, during 21-25 May and 16-19 June, it was necessary to deploy two C-130 aircraft to take advantage of forecast improvement in on scene weather conditions. A C-130 was not deployed 4-7 August, 20-23 August and 25-30 August due to poor weather present over the area and no forecast for improvement for at least several days.

COMMUNICATIONS

Ice Patrol communications included receiving reports of ice and environmental conditions, and transmitting ice bulletins, voice broadcasts, facsimile charts, and administrative traffic necessary to operate the patrol. The Ice Bulletins were disseminated by teletype from the Ice Patrol office in New York to over 30 addresses.

International Ice Patrol Ice Bulletins were broadcast twice daily by Coast Guard Radio Station Boston/NMF/NIK at 0018 GMT on 5320 and 8502 KHz, and at 1218 GMT on 8502 and 12750 KHz. After a 2-minute series of test signals the transmissions were made at 25 words per minute and then repeated at 15 words per minute. An abbreviated version of the Ice Bulletin was included in the Western North Atlantic High Seas Broadcast from Radio Boston/NMF on 8765.4 (8764.0) KHz upper side band mode at 0130, 0730, 1330 and 1930 GMT and on 8764.0 KHz double side band mode at 0200, 0800, 1400 and 2000 GMT. Coast Guard Radio Station Boston/NIK also transmitted a daily radiofacsimile broadcast on 8502 and 12750 KHz (drum speed 120) at 1600 GMT.

Ice Bulletins were also broadcast twice daily by U.S. Naval Radio Station Washington/NSS at 0430 and 1700 GMT on 88.0 (0430 only), 185.0, 5870, 8090, 12135 and 16180 KHz; Canadian Maritime Command Radio Station Mill Cove/CFH at 0130 and 1330 GMT on 4356.5, 6449.5, 12984, 7218.4 and 22587 KHz; and Canadian Coastal Radio Station St. John's/VON at 0000 and 1330 GMT on 478 KHz.

Special broadcasts were made by Canadian Coastal Radio Station St. John's/VON as required when icebergs were sighted outside the limits of ice between regularly scheduled broadcasts. These transmissions were preceded by the International Safety Signal (TTT) on 500 KHz.

Merchant ships calling to transmit ice sightings, weather and sea surface temperatures were requested to use the regularly assigned international call signs of the Coast Guard Ocean Stations, East Coast AMVER Radio Stations, or Canadian Coastal Radio Station, St. John's. Coast Guard Stations were alert to answer NIK/NIDK calls, if used.

Ice information services for the Gulf of St. Lawrence, as well as the approaches and coastal waters of Newfoundland and Labrador, were provided by the Canadian Department of the Environment from December until June. Ships obtained ice information by contacting the Ice Operations Officer, Sydney, Nova Scotia via Sydney Marine Radio/VCO or Halifax Marine Radio/VCS.

Communications statistics for the period 1 September 1971 through 4 September 1972 are shown in TABLE 2.

TABLE 2.- COMMUNICATIONS STATISTICS

Number of ice reports received from ships	1151
Number of ships furnishing ice reports	402
Number of ice reports received from aircraft	30
Number of sea surface temperature reports	432
Number of ships furnishing sea surface temperature reports	99
Number of ships requesting special information	16
Number of NIK Ice Bulletins issued	378
Number of NIK FAX Broadcasts	188

Of all the ships furnishing Ice Patrol with special sea surface temperature observations there were ten outstanding contributers:

M/V Atlantic Span/SLPN
M/V Ampere/FNVL
USCGC Spencer/NRDS
M/V Banija/YTEK
M/V Francois/FNLH
R/V Chain
M/V Baltic Wasa/SMHR
M/V Commandant Bourdais/FBTF
M/V Atlanta/DIMR
M/V Michelangelo/ICVI

TABLE 3. - Estimated Number of Icebergs South of Latitude 48°N, Season of 1972

Season	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	(SEP*)	TOTAL
1972	0	0	0	0	0	40	185	501	559	225	48	26	(3)	1584 (1587)
Total 1946-1972	5	2	4	5	10	127	761	2351	2098	1293	294	38		6988
Average 1946-1972	0	0	0	0	0	5	28	87	78	48	11	1		259
Total 1900-1972	251	109	110	85	130	578	2863	7196	9181	4811	1490	427		27231
Average 1900-1972	3	1	2	1	2	8	39	99	126	66	20	6		373

* Season ended 04 September. These 3 bergs actually drifted south of 48°N during the 1972 Ice Season; however, to provide statistical continuity they are not included in either the 1946-1972 or 1900-1972 tabulations. They will be included in the September monthly tabulation for the 1973 Ice Season.

ICE CONDITIONS, 1972 SEASON

September - December

After the close of the 1971 Ice Patrol season, occasional icebergs continued to drift south along the Labrador coast. During September there was a report of an iceberg and growler in the eastern portion of the Strait of Belle Isle and another report of an iceberg and several growlers in its eastern approaches. On 2 October a large iceberg was reported in the middle of the Strait of Belle Isle. A total of seven iceberg reports plus several reports of growlers were received for the remainder of October, November and December, all north of the Strait of Belle Isle. In addition, one bergy bit was reported 160 miles east of Cape Bauld, Newfoundland on 3 November. By the end of December open pack ice extended down into the Strait of Belle, closing it to navigation.

January

There were no icebergs reported to the Ice Patrol office in January. During the period 10-14 January preseason flights were made along the Labrador and Baffin Island coasts as far north as Cape Dyer. The results of this flight are shown in figure 1. Iceberg counts in the area between Hudson Strait and Cumberland Sound were one-half the 1963-71 average of 293 icebergs. The counts south of Hudson Strait were two-thirds the 1963-71 average of 76. The latitudinal distribution is illustrated graphically in figure 2. The ice east of Newfoundland had undergone considerable disintegration as storms crossed the area in early January. By 20 January the southern ice edge was near 50-15N but the eastern edge was near 52W from 50-30N to 53N. The ice south of latitude 52-30N was mostly in the grey-white and grey stages and close pack except along the southern and eastern pack edges where new and grey ice predominated.

February

During the first half of February a group of twenty icebergs was reported by the USCGC DUANE enroute Ocean Station BRAVO. The southernmost of these was at 49-12N 48-34W on 8 February. Due to the presence of icebergs this far south, preseason iceberg reconnaissance flights were conducted 15-25 February, a week earlier than usual. Only four of the five scheduled tracks were flown due to mechanical difficulties on the aircraft. The results of this survey are shown in figure 3. Iceberg counts in the area between Hamilton Inlet and Hudson Strait were slightly more than half the 1963-71 average of 320 icebergs. The counts south of Hamilton Inlet were more than twice the 1963-71 average of 79. The latitudinal iceberg distribution is illustrated graphically in figure 4. The southernmost iceberg during the preseason flight was sighted on 17 February at 47-58N 47-17W. On the basis of the above, the Ice Reconnaissance Detachment was deployed to CFB Summerside, Prince Edward Island on 28 February and the 1972 Ice Season began officially on 29 February. It was estimated that a total of 40 icebergs drifted south of 48N during February as compared to 4 in a normal year. The southernmost berg in February reached a position of 44-52N 48-33W while the easternmost was at 46-43N 42-11W. Almost constant northwesterly winds and below normal temperatures combined with the Labrador current to cause a rapid southeastern spreading of the pack ice. The southernmost extension of sea ice varied between the latitude of Cape Race (46-40N) and 46N; the easternmost extension reached 46-20W. The outer 50 miles of pack ice and the area 20 to 50 miles off the coast of Newfoundland, south of Cape Freels consisted largely of close to open pack grey-white and grey ice with a few first year floes. North of 50-30N the pack consisted of mostly first year ice.

March

By early March, heavy sea ice extended well below Cape Race to near 46N and eastward in a east-northeast direction to about 200 to 250 miles offshore paralleling the Newfoundland coast northward, more than 100 miles beyond any known extreme. South of 48°N most of the ice was in the new and grey stages while farther north, grey-white and first year close to very close pack ice predominated. The sea ice was so heavy on the western coast of Newfoundland that 36 vessels were trapped in the vicinity of Cabot Strait during 3 to 6 March. There were no flights by the ice reconnaissance detachment during the first 9 days of March due to both poor weather and aircraft mechanical difficulties. During the next three days consecutive flights located a total of 72 icebergs, 13 growlers and 32 radar targets as shown in figure 5. The westerly winds during the previous two weeks and the heavy sea ice along the Newfoundland coast account for the grouping in the eastern portions of the search areas.

The ice edge remained below Cape Race at 46N and on 13 March reached its southernmost extension at 45-50N 53W. During the next week two more flights were attempted but very few icebergs were observed due to poor weather. On 20 March the pack ice east of Newfoundland lay several miles offshore from Notre Dame Bay eastward and southward to near 47-30N 52W then to 47N 48W, 51N 49W and northwestward. The central pack was very close first year ice as far south as 49N with lower concentrations of grey-white and grey ice along the edges. Then on 23 and 25 March 80 icebergs were located as shown in figure 6. Like earlier in the month, bergs were located in the eastern half of the search areas. Meanwhile the sea ice had extended itself to its easternmost limit at 45-50N 46W on 24 March. By the end of March the limits of all known ice had extended southward to 43-20N with 141 icebergs on plot as shown in figure 7. It is estimated that 185 bergs had drifted south of 48N in March 1972, the southernmost of which was at 43-21N and the easternmost at 45-49N 39-14W.

April

During the first week of April, 340 icebergs were located by the Ice Reconnaissance Detachment as shown in figure 8. It should be noted that an easterly wind component concentrated the distribution of bergs in the western half of the search areas. This tremendous gathering exceeded the normal for an entire season and was only an indication of things to come. The southernmost extension of sea ice was at 47N 48-50W at this time and consisted of open to close pack grey-white and white ice. The remainder was very close first year ice lying onshore from Cape Bonavista through Notre Dame Bay and northward along the coast. This began slowly receeding northward reaching 49-30N on 13 April. Then with a shift in wind the sea ice advanced southward again to 47-30N on 22 April. At the end of the month, the sea ice was concentrated just above 48N extending eastward 200 miles (to 49W). South of 49N and immediately inside the pack edge to 52N the ice concentration varied from open to very open pack. The remainder of the pack consisted of very close first year ice, much of it 2-4 feet thick. Another good series of flights was obtained by the Detachment during the week of 11 to 17 April locating 549 icebergs, 130 growlers and 37 radar targets as shown in figure 9. The bergs, as a result of being subjected to a norrthwesterly wind, were much more evenly distributed than as was previously shown. The icebergs continued their southeastward march reaching 40-40N 45-08W on 24 April. Then under the building influence of a southwesterly wind, the bergs drifted out of the Labrador Current and moved eastward and even east-northeastward for the remainder of the month. The easternmost berg was located on the last day of the month at 48-06N 41-27W. The iceberg limits at this time are shown in figure 10. It is estimated that 501 icebergs drifted across 48N as compared to 82 for the April normal.

May

The early May sea ice limits were stable with the eastern and southernmost limits at 48N 48W. A flight on 1 May over the western portion of the Grand Banks verified an earlier flight (over the middle and eastern parts) that all icebergs were indeed drifting eastward. Subsequent flights on 2 and 3 May located 550 icebergs poised as potential dangers to navigation for the remainder of the month as shown in figure 11. Some two weeks later, 267 of these bergs were relocated slightly south and east of the former locations. The sea ice, influenced by lower than normal temperatures and a southeastward wind induced drift, moved to an extreme of 46-40N 46-30W. The central pack moved northwestward starting at mid-month; however, a southeastward tongue was left behind extending to 46-10N 46-50W at the end of the month. At the latitude of Belle Isle the eastern edge was near 50W. This tongue consisted of open to very open pack ice. On 15 May, the easternmost iceberg of the 1972 Season was located at 47-02N 36-59W extending the limits of all known ice some 640 miles east of Newfoundland's Avalon Peninsula and encompassing some 175,825 square miles of area south of 48N as shown in figure 12. On 23 and 24 May two aircraft were assigned to the Ice Reconnaissance Detachment to take advantage of the short period of forecast good weather (the previous two weeks having been plagued with fog). They located a large concentration of bergs on the northeastern edge of the Grand Banks, scattered bergs on the eastern slope, and none at all on the Banks or south of it. The numbers and exact distribution are shown in figure 13. The southernmost icebergs of the season were computed to be in position 39-57N 45-06W on 23 May. The ice limits then encompassed 236,400 square miles, as shown in figure 14. On 27 May, 208 of the bergs sighted on 23 May were relocated and no further flights were made for the remainder of the month due to poor on scene weather. 559 icebergs drifted south of 48N as compared to a normal of 63.

June

On 3 June the main pack of sea ice was located above 50N with a narrow tongue extending almost 350 miles to the southeast as shown in figure 15. This tongue of very open pack ice receded until 10 June when its southernmost edge stabilized at 49N. With the Grand Banks completely fog-bound, the Ice Reconnaissance Detachment flew northward on 6 June to assess the iceberg potential for the remainder of the season. The flight located 1517 icebergs between 52N and 55N, from the coast to 49W. On 9 June the easternmost iceberg for the month had drifted to 47-07N 39-07W. On 13 June, with fog still persisting over the Grand Banks, a short flight between 49N and 50N from the coast to 49W located some 380 icebergs. A week later, on 20 June, a flight farther to the north between 50N and 52N from the coast to 47W revealed a record 3423 icebergs and growlers as a potential for the rest of the season.

The southernmost iceberg for the month drifted to 41-36N 48-46W on 22 June. By the end of the month the sea ice had gradually receded to 50N and consisted of open to close pack melting first year ice in the central pack and very open pack ice elsewhere. The limits of all known ice were then as shown in figure 16 with 133 icebergs on plot south of 48N. The southernmost 23 bergs had been located by a flight on 28 June. During June it is estimated that 225 icebergs drifted south of 48N as compared to 40 in a normal year.

July

In early July the sea ice consisted of rapidly disintegrating open to very open pack ice north of 50N. By 9 July the Strait of Belle Isle was open to maritime traffic and the ice pack had receded to 54N on 11 July. With a dominant wind from the southwest, the large concentration of icebergs located in June between 50N and 52N never drifted south of 49N. This wind also continued to generate a constant fog over the Grand Banks making reconnaissance flights next to impossible. Throughout the month, weekly flights were conducted south of the Tail of the Banks to update the southernmost iceberg positions. On 17 July another flight between 50N and 52N showed 1476 bergs distributed between the coast and 48W. Fog persisted for almost the entire month between 43N and 50N, but partially abated during the last week so that a series of flights could be flown in this area. The tracks covered on 26, 27 and 29 July are shown in figure 17. By the end of July, an estimated 48 icebergs had drifted south of 48N. The limits of all known ice are shown in figure 18.

August

Flight operations on 1, 2 and 4 August showed only two icebergs south of 45-30N as shown in figure 19. Two additional flights on 10 and 12 August located 73 bergs posing a significant threat to shipping. (See figure 20). The eastward wind-induced drift moved them into warmer waters and most melted within a few days. On 18 August a flight covering the eastern slope of the Grand Banks revealed only three surviving icebergs. No further flights were possible for the remainder of August due to the poor weather on scene. Many icebergs were continuously being reported in the Strait of Belle Isle and its eastern approaches by passing ships. The iceberg limits at the end of August are shown in figure 21. It is estimated that a total of 26 icebergs drifted south of 48N.

September

On 1 September the final flight of the season located 3 icebergs as shown in figure 22. Two bergs were also reported by ships on the same day. On 4 September, the 1972 Ice Season officially ended with three additional bergs drifting south of 48N during these four days. The final iceberg limits are shown in figure 23. Thus ended the longest and heaviest iceberg season on record.

OCEANOGRAPHIC CONDITIONS, 1972

A. D. ROSEBROOK

(U.S. Coast Guard Oceanographic Unit)

Three oceanographic cruises during the period 3-23 April, 5-22 May, and 3-22 June 1972 were conducted in support of the International Ice Patrol aboard USCGC EVERGREEN (WAGO-295). Salinity and temperature data were collected to a depth of at least 1000 meters using a Salinity-Temperature-Depth (STD) Sensor System. Data were recorded on magnetic tape using a digital data logger further processing upon return to the C.G. Oceanographic Unit. From these processed data, charts of dynamic topography of the sea surface relative to the 1000 decibar level of no assumed motion were constructed (figures 24-26). The dynamic topography charts show several prominent features of the general circulation pattern on the Grand Banks. The Labrador Current can be seen flowing southward along the eastern slope of the Grand Banks near the 1000 meter depth contour. Located to the east is a dynamic trough separating the colder Labrador Current waters from the northward flowing North Atlantic Current water. Water from the dynamic trough is characterized by its low specific volume resulting from mixing between the two currents

The dynamic topography charts of the Grand Banks region from the three surveys agreed well with the normal or average dynamic topography for the months of April, May, and June. There was evidence of an additional dynamic low in the vicinity of 44°N, 47°W during the April survey (figure 24). During the May survey, a poorly defined dynamic low was observed farther to the east near 44°N, 46°W (figure 25). The modified survey taken during June did not extend far enough to the east to determine if a dynamic low was still present during this period. During the period 7-15 June, EVERGREEN was assigned as Surface Patrol Vessel and stood by a large tabular iceberg (mass approximately 3 x 10^9 kgs.) located near 42.5°N, 49.5°W. While standing by the iceberg, EVERGREEN occupied a series of 12 oceanographic stations around the berg. As a result, a total of 28 stations was taken in a rather small area during the survey. The resulting dynamic topography of this region is much more complex than that found in the remainder of the survey area (figure 26).

Preliminary analysis of the data collected during the surveys indicated that the water temperatures of the Labrador Current and on the Grand Banks were generally colder than normally encountered. Except for an unusually strong geostrophic current of 2.3 knots observed near 44°37'N, 49°02'W on 14 May, the maximum value of the Labrador Current seldom exceeded 1 knot. The colder water temperatures and almost constant current velocities were two of the factors contributing to the record number of icebergs (1587) encountered south of 48°N during the 1972 season.

A more detailed analysis of the oceanographic of the Grand Banks in 1972 will be published in the U.S. Coast Guard Oceanographic Report Series (CG-373).

DISCUSSION OF ICEBERG AND ENVIRONMENTAL CONDITIONS

1972 ICE SEASON

In attempting to explain the environmental factors producing a record season, both in longevity and number of icebergs, four major conditions must be considered. First is the number of icebergs available to drift south of 48°N latitude, second is the strength and duration of the northwesterly wind component producing a drift which transports the icebergs south, thirdly, the development of the features of the Labrador Current, and finally, the reduced rate of deterioration of the icebergs due to colder air and sea temperatures and wave action inhibited by sea ice.

The total number of icebergs counted during the pre-season flights (194 in January, 360 in February) makes up but a small part of those icebergs which drifted south of 48°N latitude. The January survey went only as far north as Cape Dyer and the February flight extended to Cape Chidley. Normally this is all that is necessary as the icebergs north of Davis Strait rarely survive the 1000-mile drift without melting. This ice season, as will next be discussed, was by no means normal.

Figures 27a through 27e show the normal and the 1971/1972 surface pressure patterns for November through August. During December a strong low pressure system centered near the southeastern tip of Greenland became clearly defined. Then for the next six consecutive months a strong northwesterly wind anomaly persisted. These extreme, excessive conditions caused thousands of icebergs to drift out of Baffin Bay, through Davis Strait and into the Labrador Current. This same intensification created a mean southwesterly wind over the Grand Banks by late February which remained until early July. Thus the majority of icebergs were forced out of the influence of the Labrador Current and drifted eastward into the somewhat warmer waters of the North Atlantic Current.

Examining each of figures 27a through 27e more closely, the November Greenland High and a 4-mb positive anomaly lay over the northern half of Greenland with the mean pressures from Labrador westward as much as 5 mb above normal. The Icelandic low was way out of position over the Barents Sea (normally south of Denmark Strait) and 8 mb below normal. A trough of low pressure extended southward from Baffin Bay through the Labrador Sea into the waters well south of Newfoundland. Pressures inside the trough ranged from 4 mb below normal near 40°N 55°W to 7 mb above normal near the low pressure system west of Kap Farvel.

During December the Icelandic Low near 61°N, 34°W was 4 mb below normal and about 125 miles offits mean monthly location. The 1014-mb Greenland High was 2 mb weaker than normal. A negative 5-mb anomaly was located about 500 miles east of Cape Race near 48°N, 40°W. A positive 6-mb anomaly over eastern Quebec brought pressure departures of more than 4 mb to the western Labrador Sea.

January found the Icelandic Low near 61°N, 40°W and 16 mb below normal. It was only about 100 miles west of its average monthly location. In February the 994-mb Icelandic Low near 59°N, 30°W was 8 mb below normal and 300 miles east of its mean position. This large negative anomaly was the only significant low over the North Atlantic. A slightly stronger than normal Greenland High resulted in positive 5-mb anomalies south of 75°N, 33°W.

During March the 998-mb Icelandic Low near 63°N, 35°W was 6 mb below normal and about 350 miles northeast of its mean location. A weak 1014-mb low was near Cape Sable, Nova Scotia. Two 8-mb positive anomalies lay east of Newfoundland centered near 49°N, 44°W and 46°N, 30°W. The 1016-mb Greenland High was 4 mb below normal.

April shows the Icelandic Low (1005 mb) as a trough extending from the Labrador to the Norwegian Seas. The Greenland High (1026 mb) near 76°N, 38°W was 4 mb above normal. In May the Icelandic Low near 60°N, 26°W further intensified to 5 mb below normal and was located about 300 miles northeast of its average position. West of the Icelandic Low, pressures near Kap Farvel were 7 mb below normal.

During June a positive 8-mb anomaly lay over the central North Atlantic near 45°N, 37°W and a negative 10-mb anomaly was south of Iceland near 62°N, 18°W. The Icelandic Low itself (1002 mb) was more than 8 mb below normal. The 1015 mb Greenland High near 76°N, 38°W was close to normal. July found the Greenland High (1014 mb) near normal in central pressure but 400 miles northwest of its average position for the month at 77°N, 44°W. The Icelandic Low split into two parts, the stronger (1008 mb) off the west coast of Iceland, the weaker (1010 mb) near Cape Smith (Hudson Bay). During August, average pressures were from 1 to 3 mb above normal over almost the entire North Atlantic.

To determine and assign numerical values to the existing wind conditions, surface pressure gradients (differences in atmospheric pressure along a geographically orientated line) may be used. Four such gradients are labeled in figure 28. Gradients 1 and 2 measure the winds which are important in setting up the drift for transporting icebergs to the general area of the waters off northeast Newfoundland. Gradient 3 measures the component which assists or impedes icebergs as they drift along the eastern slope of the Grand Banks. Gradient 4 is a measure of the influence of the generally westerly winds along the northern slopes of the Grand Banks. This is important in drifting the icebergs away from the northeast Newfoundland coast and into the Labrador Current. If, however, they are too strong (or persistent) when the icebergs reach the northeast corner of the Grand Banks they may be carried eastward out of the Labrador Current and into warmer waters which drift generally northeastward (as happened this year).

Referring now to the graphical representations of figure 29, Gradient 2 is significantly above normal while gradient 1 averaged more than twice the normal magnitude of favorable southward-induced iceberg drift. These persistent winds provided a constant iceberg supply to the waters off northeast Newfoundland. Gradient 3 shows an unfavorable drift along the eastern slopes of the Grand Banks while Gradient 4 shows a tendency for iceberg drift eastward out of the Labrador Current, especially during the months of April, May and June. Had either or both pressure Gradients 3 and 4 been closer to normal, hundreds (perhaps even thousands) more icebergs could have drifted south of 48°N.

December air temperatures along the Baffin Island, Labrador and Newfoundland coasts set a record low. Temperatures continued much colder than normal during the remaining winter and all the spring months as shown in figure 30. Temperatures averaged in excess of 7°F below normal. The locations of the stations are shown in figure 28. A frost degree day, as used in figure 30, is defined as one day at a temperature of one Fahrenheit degree below 32° (e.g., one day at 20°F would be 12 frost degree days). Similarly a melting degree day is one day at a temperature of one Fahrenheit degree above 32°. All the stations had a much greater than normal frost degree day accumulation and all but St. John's, Newfoundland had a smaller than normal melting degree day accumulation. Adding these influences together, iceberg deteioration due to both wave action (inhibited due to the large extent of sea ice already discussed in a prior section) and melting was greatly retarded thus extending the Ice Season approximately two months longer than normal.

ICE AND SEA SURFACE TEMPERATURE REPORTS
RECEIVED FROM SHIPS OF PARTICIPATING NATIONS
DURING 1972

	ICE	SST
BELGIUM		
BELVAL	1	
DART EUROPE	2	
FEDERAL SCHELDE	1	
MINERAL SERAING	2	
CANADA		
ALERT	3	3
AMOCO CANADA SUPPLY VESSELS	2	
HMCS ANNAPOLIS	3	
CCGS BAFFIN	6	
CAPE FREELS	1	
CCGS HUDSON	1	
J.E. JONSSON	4	
LOUIS ST. LAURENT	2	
MARY B VI	1	
NARWHAL	7	
CS NORTHERN	1	
PROTECTEUR	36	1
QUEBEC	1	
QUEST	1	
SACKVILLE	1	
HMCS SKEENA	7	
DENMARK		
BYMOS	1	
ESKIMO	1	
FREEZER SCAN	1	
GRETE SKOU	2	
HEERING ELSIE	3	
HELGA DAN	3	5
LEISE MAERSK	2	
RITVA DAN	2	
SLESVIG	3	2
FINLAND		
ATLAS	1	
FINN AMERICAN	1	
GERMUNDO	4	7
HANSA	3	
SOLANO	1	1
UNARI	3	
FRANCE		
ALEX PLEVEN	1	
AMPERE	30	25
ANDROMEDE	19	2
ATLANTIC CHAMPAGNE	2	

	ICE	SST
CATHERINE	1	
CHRISTINE	5	7
COMMANDANT BOURDAIS	7	13
FRANCE	5	
FRANCOIS L.D.	6	19
JEAN SCHNEIDER		4
PENGALL	2	
PENRUZ	2	
MICHIGAN	1	
MONT LAURIER	2	1
ONDINE	1	
PENERF	2	
VILLE DE MEXICO	1	
ROBERT L.D.	1	
FEDERAL REPUBLIC OF GERMANY		
ALSTER EXPRESS	2	
ANNA KATRIN FRITZEN	1	
ANNA REHDER	3	3
ANNA WESCH	3	
AROSIA	2	
ATHENE	2	
ATLANTA		11
ATLANTIC CINDERELLA	3	1
ATLANTICA LIVORNO	2	2
ATLANTICA NEW YORK	1	
AUGUSTE SCHULTE	1	
BARI	5	
BOCKENHEIM	7	
BORNHEIM	1	
BOSTON SAND	1	
BRAGE		3
BUCHENSTEIN	1	
CARSTEN RUSS	3	
DORTHEA BOLTEN	1	
ECKERT OLDENDORF	1	
ELBE EXPRESS	4	
ELIZABETH OLDENDORF	1	1
ELSFLETH	3	
EUROPA	1	
HAMBURG	1	
HANS BORNHOFEN	1	
HARTFORD EXPRESS	1	
HAVELLAND	1	1
HERMANN SCHULTE	4	
IDA BLUMENTHAL	1	

	ICE	SST
ISABELLA	1	
JENNES	1	
JOHANNES RUSS	1	
JORG KRUGER		8
JOSEF STEWING	1	
JOULLA	2	
JUDITH SCHULTE	2	
LUISE BORNHOFEN	1	
MAIN EXPRESS	3	
MARITA LEONHARDT	1	
MAX BORNHOFEN	1	
MAYSTIGHOLD	1	
MONIQUE SCHROEDER	5	
MOSEL EXPRESS	2	
PASSAT	2	
PAUL LORENZ RUSS	1	
PETER WESCH	1	
POLAR PARAGUAY		3
RANDO	1	
RENDSBURG	1	
SAARLAND	1	
SLOMAN SENIOR	2	
SUSANNE FRITZEN	3	2
TAEPING	2	1
TRANSAMERICA	3	
TRANSATLANTIC	3	
TRANSCANADA	2	
TRANSONTARIO	2	
WESER	2	3
WIEN		1
GREAT BRITAIN		
AFGHANISTAN	11	6
ALBRIGHT EXPLORER	2	
ALBRIGHT PIONEER	5	
ARCTIC SHORE	1	
ARCTIC TROLL	5	3
ASIA LINER	1	
ATLANTIC CAUSEWAY	2	1
ATLANTIC CONVEYOR	3	1
AVONFIELD	3	3
BEAVER PINE	1	
BELLNES	1	
BRIMMES	1	
BRITISH HERO		
BRITISH OFFICER	1	
BRITISH SWIFT	1	
BRITISH VISION	1	

	ICE	SST
C.P. AMBASSADOR	26	
C.P. DISCOVERER	6	1
CP EXPLORER	6	1
C.P. TRADER	8	
CP VOYAGEUR	9	2
CAPE HOWE	3	
CITY OF CANBERRA		6
CHERRYWOOD	1	
CHEVOIT	1	
DART AMERICA	3	
DART ATLANTIC	2	
DUKESGARTH	1	
DUNGRAIG	8	2
DUNKYLE	1	
EDENMORE	1	
FARSISTAN	1	
GLOXINIA	1	
GOTHLAND	2	
INISHOWEN HEAD	8	2
INVERALMOND	1	
KING ALFRED	2	2
KING JAMES		4
KNIGHTSGARTH		1
LA SIERRA	2	
LECTWORTH	1	
LONGSTONE	3	
LOTTINGE	2	
LYMINGE	1	
MANCHESTER CHALLENGE	1	
MANCHESTER CONCEPT	11	
MANCHESTER CONCORDE	10	
MANCHESTER COURAGE	6	
MANCHESTER CRUSADE	3	
MANCHESTER QUEST	6	
MATINA	1	
MONKSGARTH	3	1
NEWFOUNDLAND	3	1
NICOLAS BOWATER	3	
NIGARISTAN	2	
NOVA SCOTIA	1	1
ORESSA	2	
OTHELLO	3	
OVERSEAS ADVENTURE	1	
OXFORDSHIRE	1	
PHOTINIA	1	
QUEEN ELIZABETH II	7	
QUEENSGARTH	2	
RATTREY HEAD	1	

	ICE	SST
ROSEWOOD	2	
SILVER SHORE	1	
SCOTTISH WASA	2	
TEKOA	1	
TORONTO CITY	2	3
TORR HEAD	3	
VANCOUVER ISLAND	1	
WELSH HERALD	4	
WILKAWA	1	
ZINNIA	3	
GREECE		
ARIEL	1	
ARIES		1
ATHLON	2	
CALLIROY	2	
CALYPSO	1	
COSTAS FRANGOS	1	
FEDERAL SEAWAY	8	8
GRECIAN VALOUR	1	
KHIAN WAVE	1	
KING LEONIDAS	1	
KING NESTOR	2	
LILYM	1	
PROSO	1	1
QUEEN ANNA MARIA	4	5
RUDOLF LEONHARD	1	
SCAPLAKE	1	
SOPHIA COLOCOTRON	1	1
STEELY CARRIER	1	
TARPON SANDS	1	
TITIKA HALCOUSSI	1	
CALL SIGN - SYHF	1	
ISRAEL		
ARAD	1	
MEZADA	7	
TIMNA	1	
ITALY		
CRISTOFORO COLOMBO		1
GIOVANNI AGNELLI	2	
INTEGRITAS	1	
LEONARDO DA VINCI		3
MICHELANGELO	2	10

	ICE	SST
JAPAN		
ASAMA MARU		1
KANAGAWA MARU	3	
MIKUNISAN MARU	2	
TSURUGA MARU	4	
LIBERIA		
AEGEAN SKY	1	
ALKOR	1	4
ASTERI	2	
BELLE MICHAELS		2
CAPE PALMAS	1	
CORONADO	2	
CORTEREAL	1	
CYNTHIA		3
DORADO	3	
GRECIAN ISLES	1	
HEGOLAND	2	
HELENE	1	
ILKON NIKI	1	
KONKAR PIONEER	1	
LAMDA	1	
LIBERTY BELL		1
MAIN ORE	1	2
MELTEMI	1	
MOZART	1	
NAESS SPIRIT	1	
NEW HAVEN	9	
NEW HORIZON	2	
OLYMPIC PALM	1	
ORIENTAL CLIPPER	2	1
OSWEGO VENTURE	2	
PATIGNIES	1	
PHOSPHOROUS CONVEYOR	1	
RIO MACAREO	1	
STOLT ATLANTIC	1	
VOLTA VIGILANCE	2	
WHITE RIVER	1	
NETHERLANDS		
ABIDA	2	
ACILA		1
ASMIDISK		2
ATLANTIC CROWN	1	
ATLANTIC STAR	3	
CLYDE	1	

	ICE	SST
GREBBEDYK	1	
LEO POLARIS	1	
RIJN	1	
STELLA NOVA	2	
STOLT MUNTTOREN	2	
NORWAY		
ANETTE	3	2
ANGELITA	1	
ANITA	1	2
ARAPRIDE	1	
BANAK	1	
BARDU	1	
BELBLUE	2	1
BELCARGO		3
BETH	2	
BOW CEDAR	1	
BRUNITA	1	
CONDO	1	
EVITA	1	
FERNLEAF	3	1
FERNSIDE	2	
FINSHIP	1	
FOSSUM	1	
GRONG	1	1
HARDANGER	1	
HAVIS	1	
HAVMANN		2
HELENE PRESTHUS	3	
HERULV	1	
HOEGH MERCHANT	3	
HOEGH MERIT	3	
IDEFJORD	3	
JANOVA	2	
JAROSA		2
LIANA	2	
LIVANITA	5	
MARDINA COOLER	3	
MARGARITA	1	
MUNDOGAS BERMUDA	1	
NAESSCOMET	1	
NANFRI	1	1
NOPAL REX	1	
NORSE CARRIER	1	6
NORSE RIVER	4	
NORSE TRANSPORTER	1	7
NORSE VARIANT	1	
ROBERT STOVE	1	
ROSS SEA	1	

	ICE	SST
SAGAFJORD	5	
SANDVIKEN	1	
SKIENSFJORD	3	
SNELAND	2	
STOVE SCOTIA	1	
TOPDALSFJORD	3	
TRESFONN	1	
VIGAN	1	
VIKFROST	1	
WILFRED	2	2
PANAMA		
ASIA FIDELITY		2
ESSO SANTOS	1	
FEDERAL SALSO	1	
HAMBURGER MICHEL	1	
LOCARNO	1	
SPAIN		
AIBOA	2	
LLARANES	5	
MANCHESTER RAPIDO	1	
MARECOSA	2	
PLAYA DE LAS NIEVES	1	
SIERRA JARA	1	
TRASONA	2	
CALL SIGN - EGAQ	1	
SWEDEN		
ADAK	2	
ATLANTIC SPAN	2	58
AVAFORS	5	
AVENIR	2	
BALTIC WASA	3	13
EXPECTATION	1	
FALSTER	1	
FINLAND	1	
GRIPSHOLM	1	
LAPONIA	4	
OKANAGAN VALLEY		1
SEGERO	2	4
TAVASTLAND	1	1
UNITED STATES OF AMERICA		
AMERICAN ARGOSY	2	2
AMERICAN DELTA II	1	
BOSTON	1	
CV LIGHTNING	3	
C.V. SEA WITCH	1	

	ICE	SST
CHAIN	6	18
COMMANDER	1	
GENTOL		1
KNORR		7
LASH TURKIYE	1	
NIOBE	6	
STAGHOUND	4	
TRIDENT	1	7
YOUNG AMERICA	1	
U.S. COAST GUARD CUTTERS	253	52
U.S. NAVY SHIPS	5	0
<u>YUGOSLAVIA</u>		
BANIJA	6	16
BIOKOVO	1	
BOSANKA		2
LJUBIJA	1	

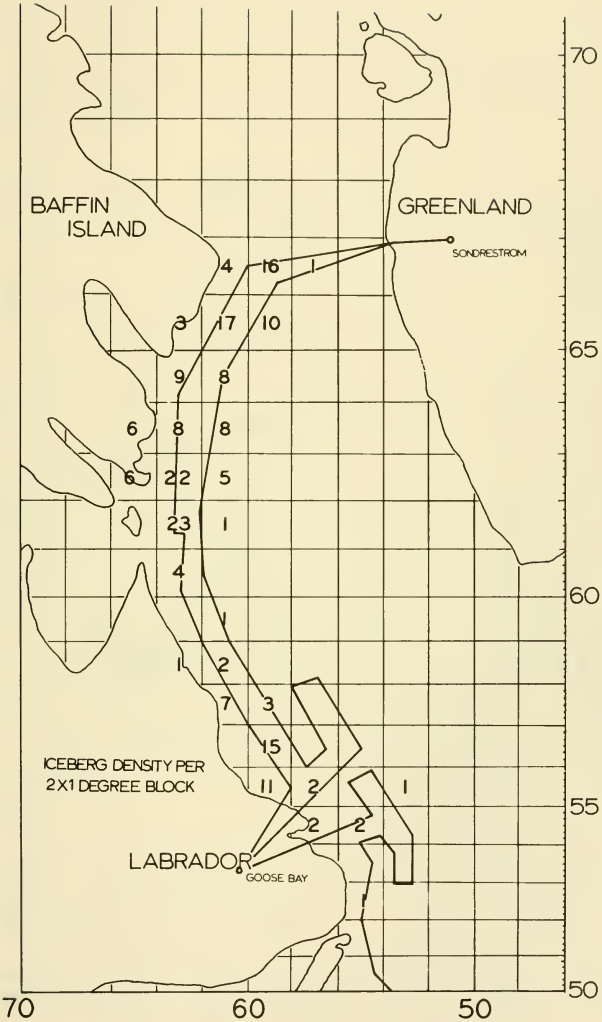

FIGURE 1.—Pre-season Iceberg Survey, 10–14 January 1972.

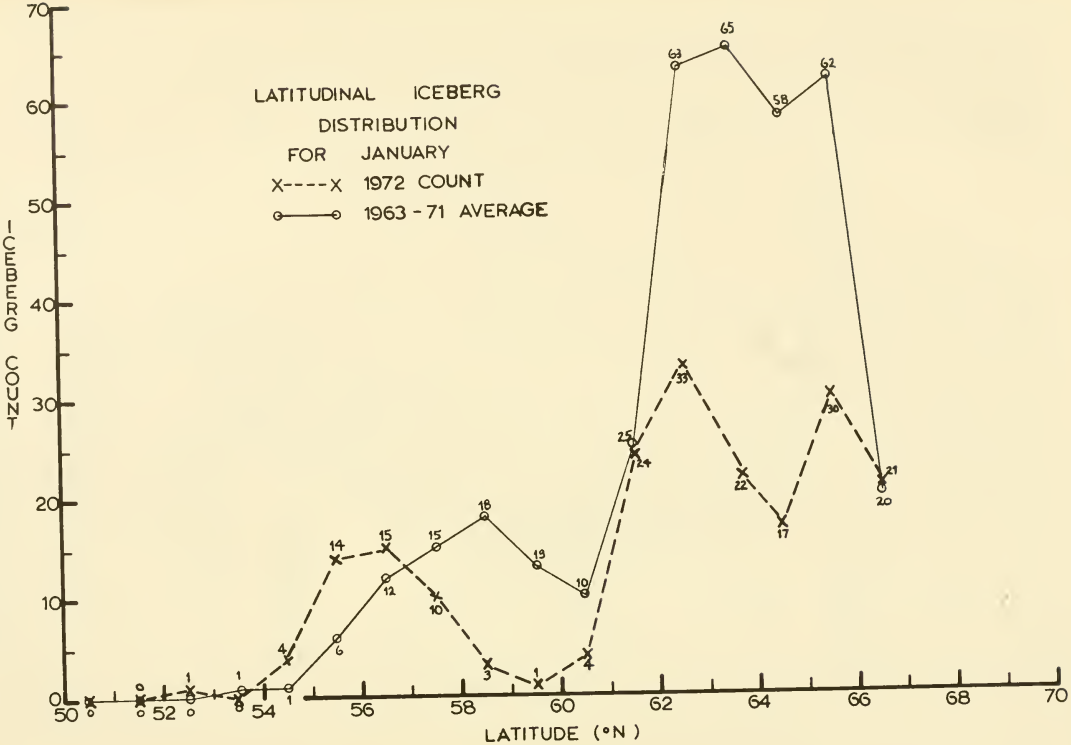

FIGURE 2.—Latitudinal Iceberg Distribution, January Pre-Season Flight.

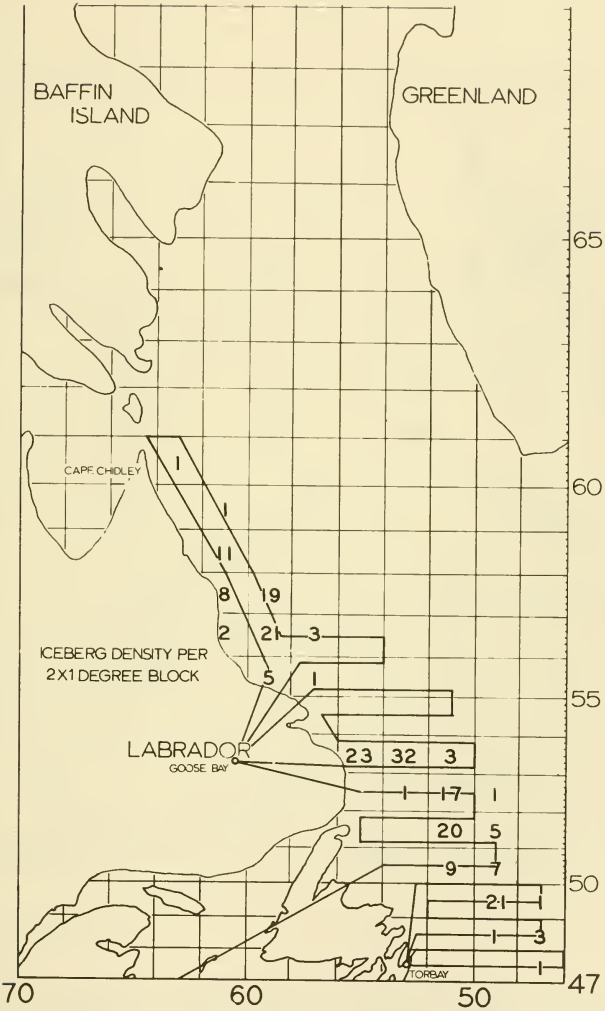

FIGURE 3.—Pre-Season Iceberg Survey, 16–26 February 1972.

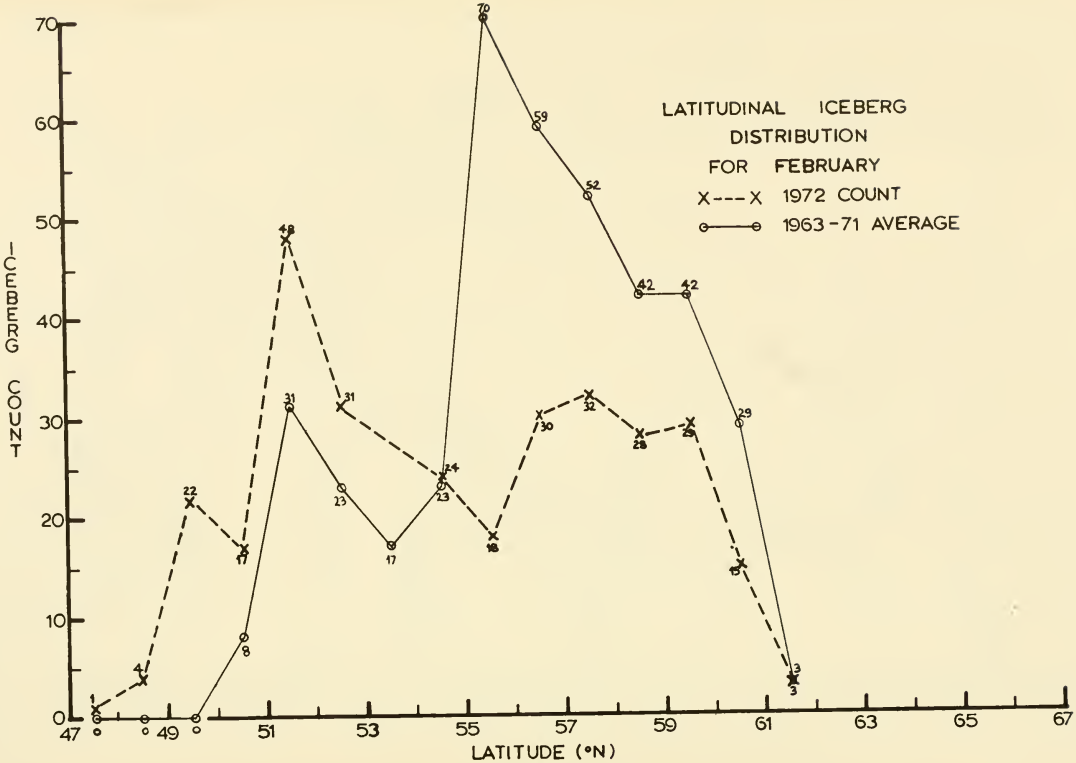

FIGURE 4.—Latitudinal Iceberg Distribution, February Pre-Season Flight.

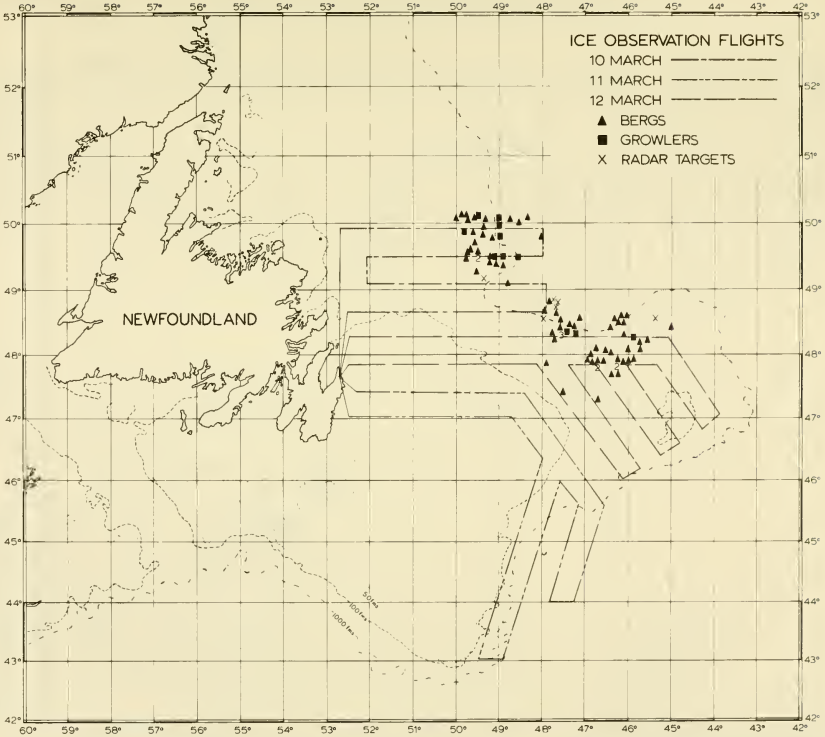

FIGURE 5.—Ice Observation Flights 10–12 March 1972.

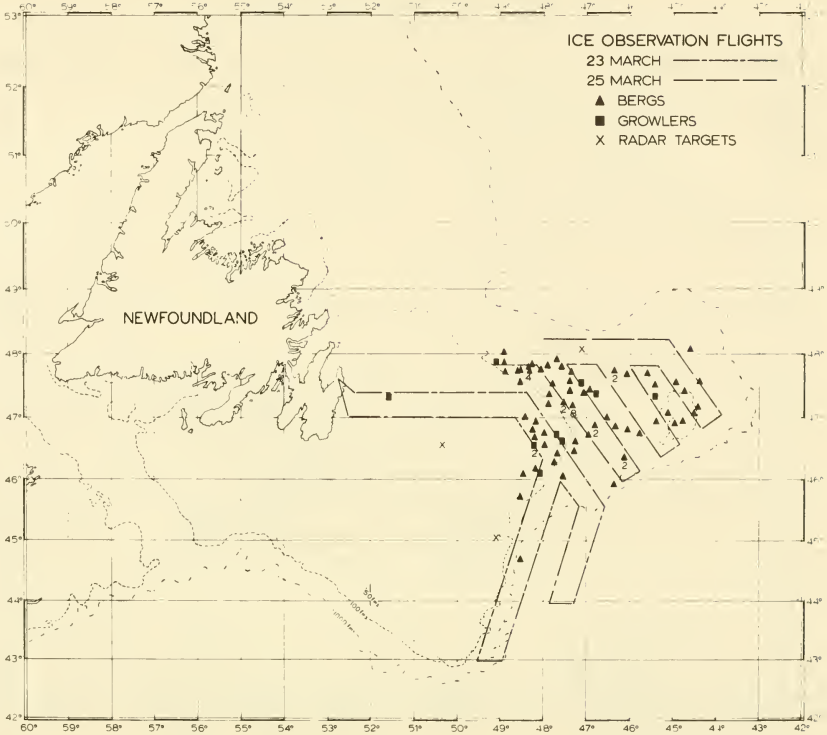

FIGURE 6.—Ice Observation Flights 23 and 25 March 1972.

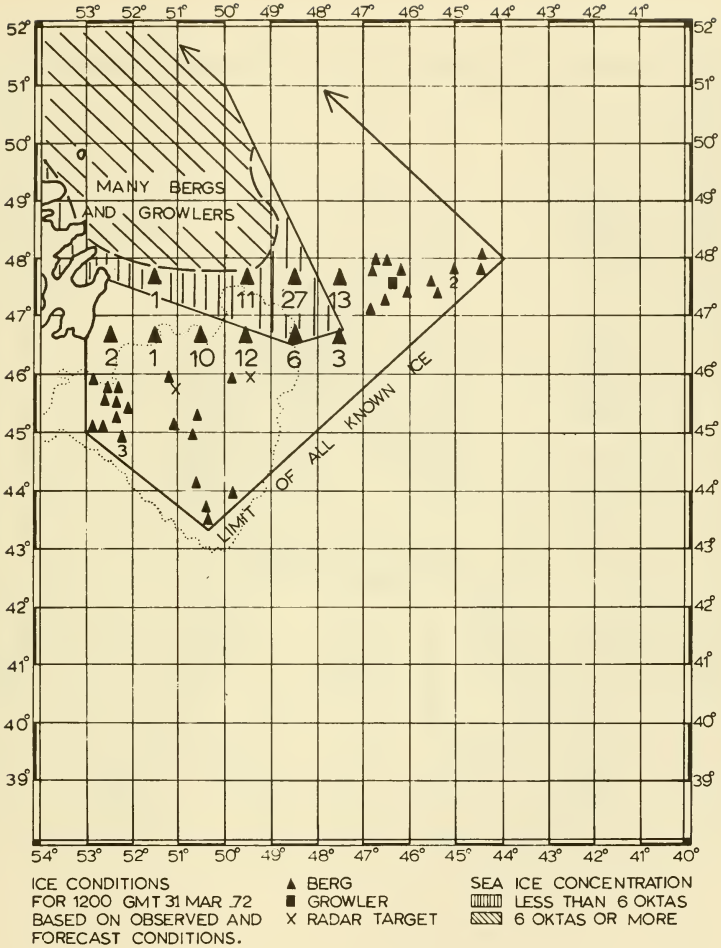

Figure 7.—Ice Conditions, 1200 GMT 31 March 1972.

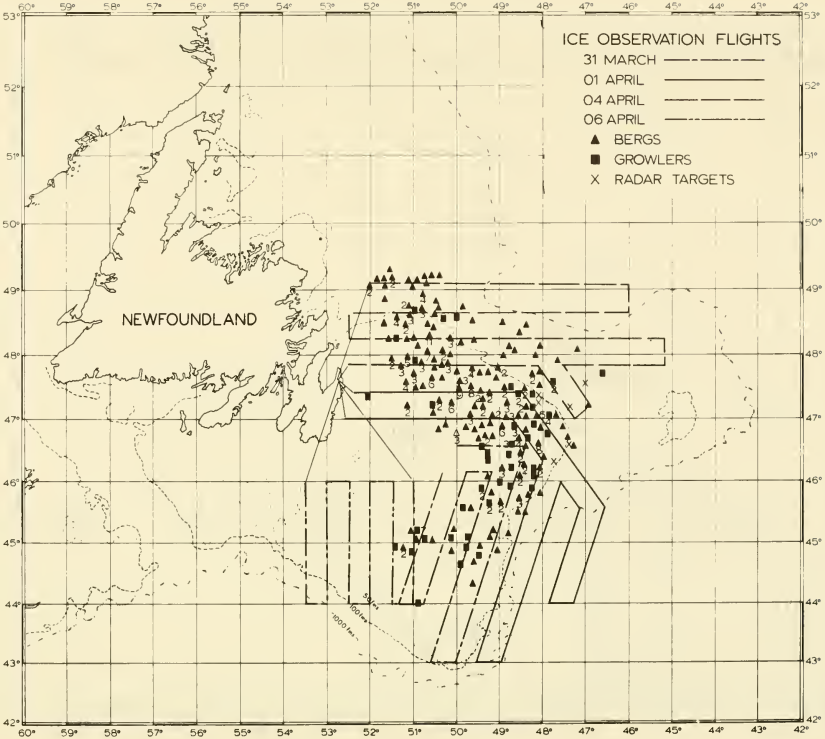

FIGURE 8.—Ice Observation Flights 31 March–6 April 1972.

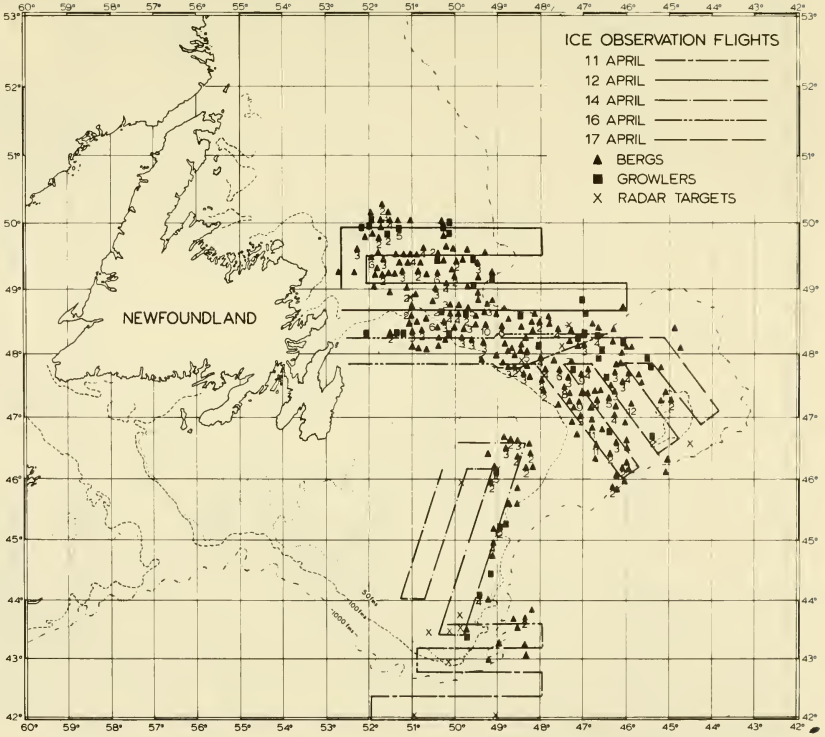

FIGURE 9.—Ice Observation Flights 11–17 April 1972.

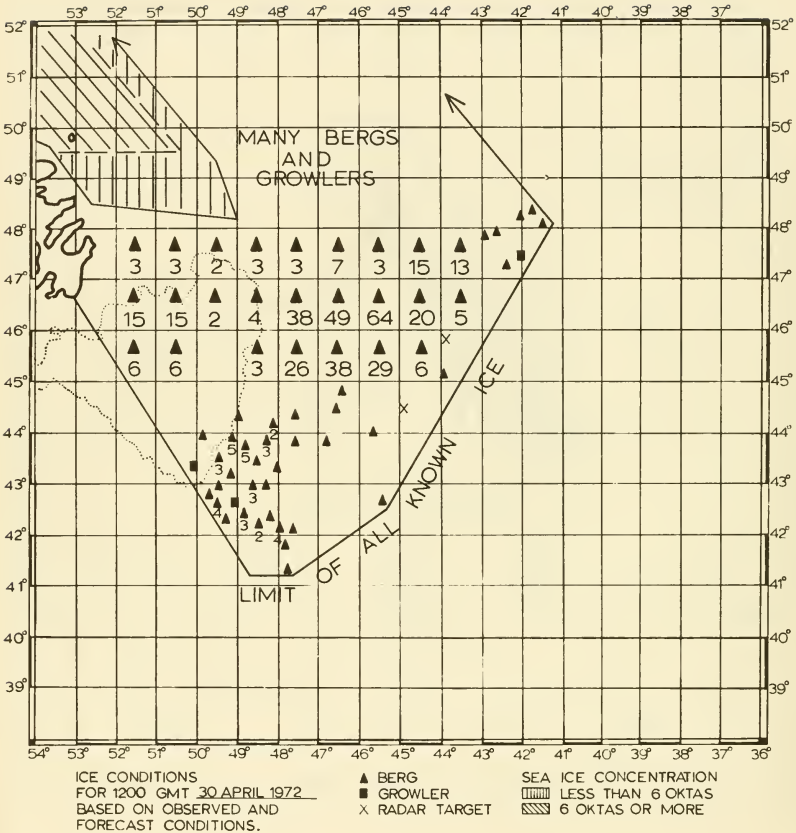

FIGURE 10.—Ice Conditions, 1200 GMT 30 April 1972.

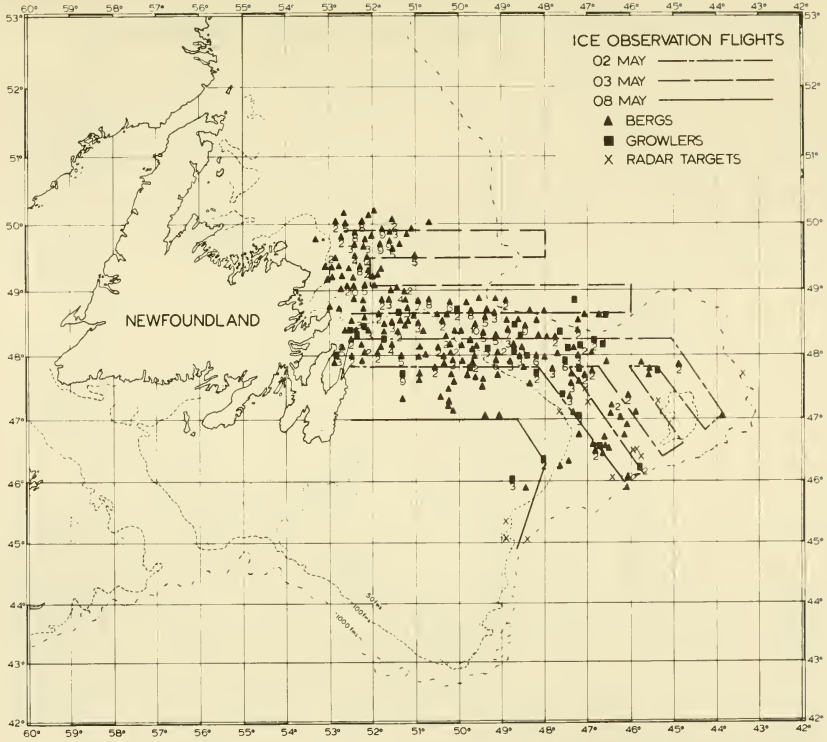

FIGURE 11.—Ice Observation Flights 2–8 May 1972.

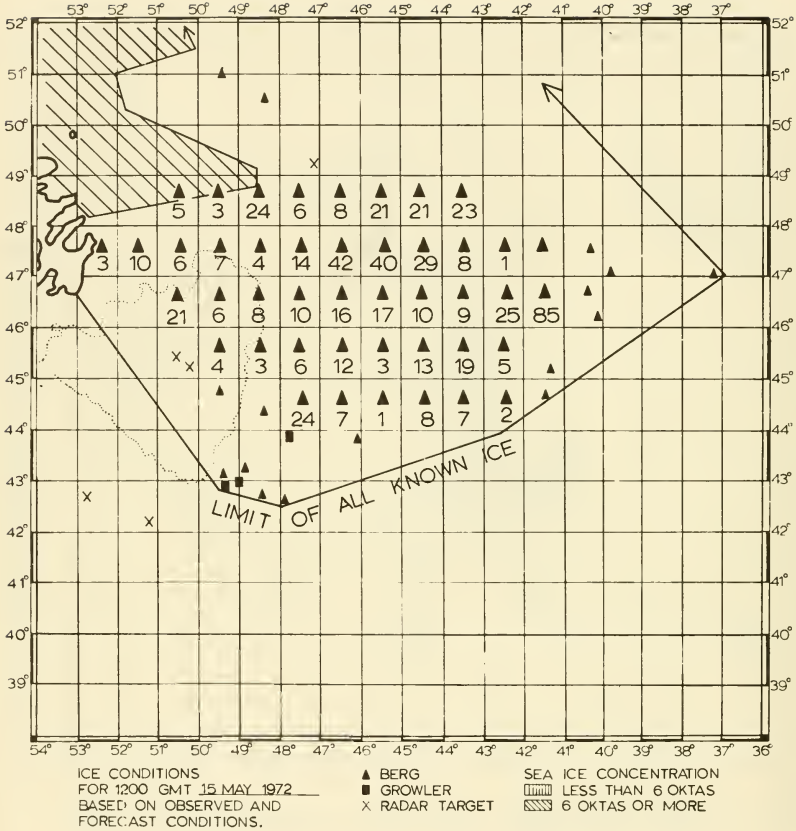

FIGURE 12.—Ice Conditions, 1200 GMT 15 May 1972.

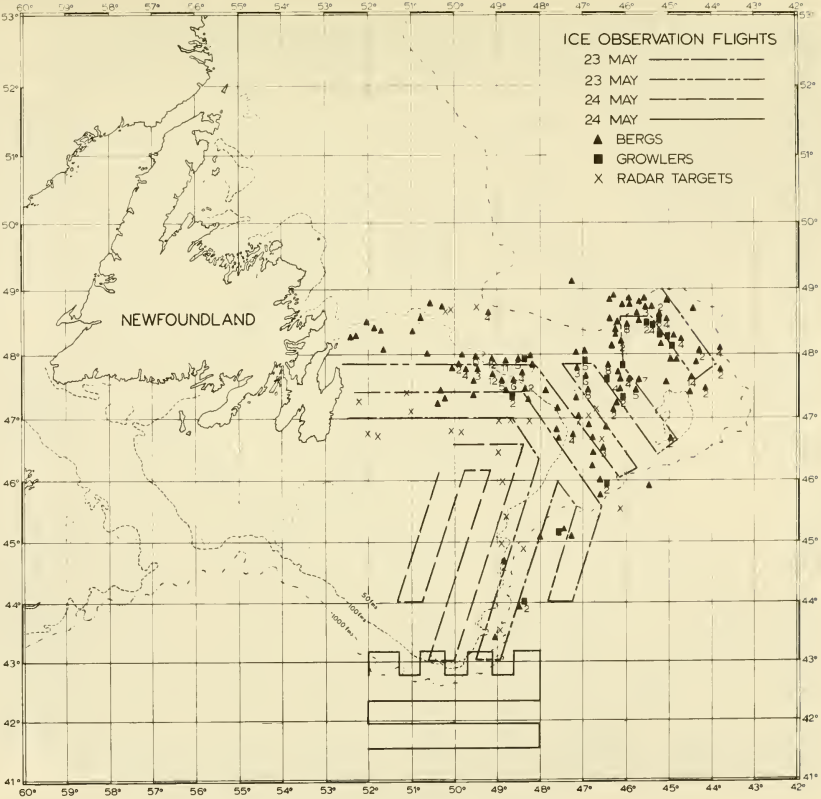

FIGURE 13.—Ice Observation Flights 23 and 24 May 1972.

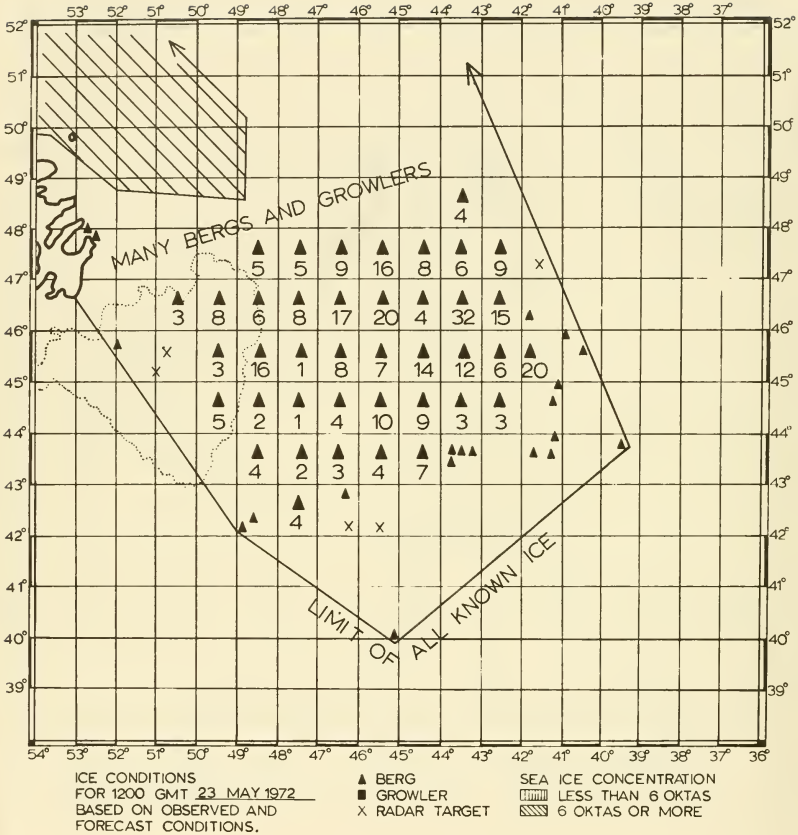

FIGURE 14.—Ice Conditions, 1200 GMT 23 May 1972.

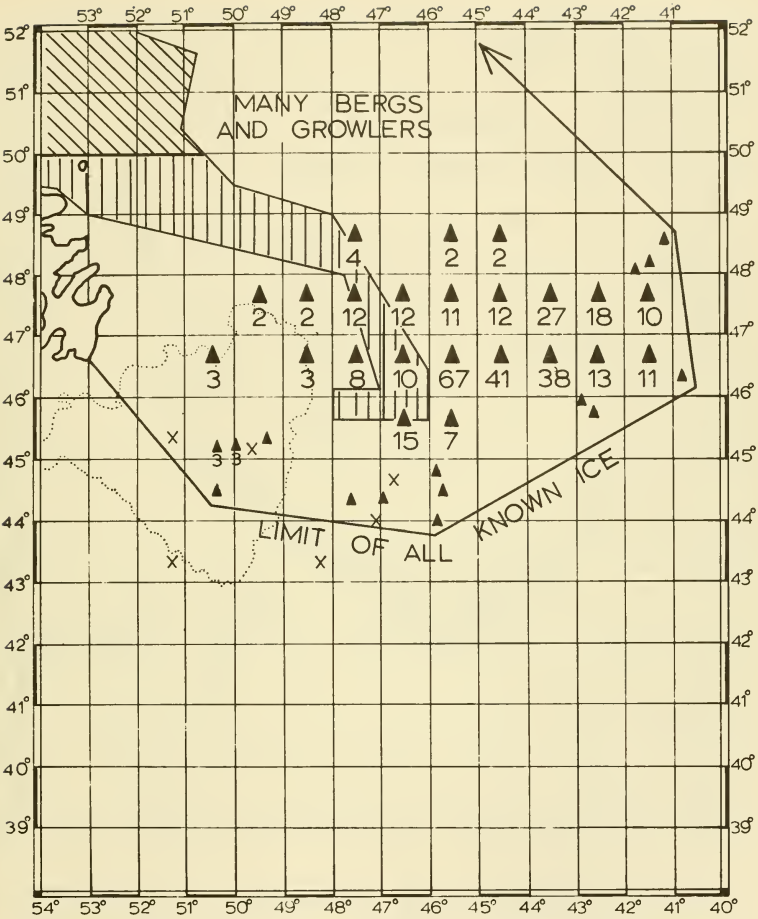

FIGURE 15.—Ice Conditions, 1200 GMT 3 June 1972.

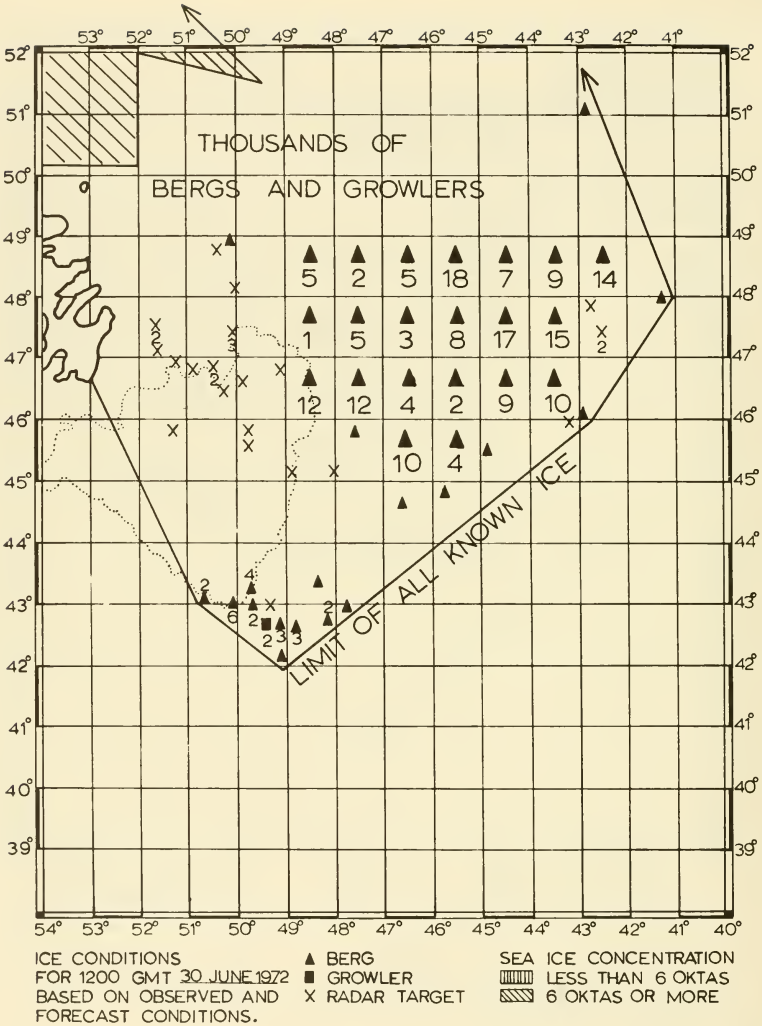

FIGURE 16.—Ice Conditions, 1200 GMT 30 June 1972.

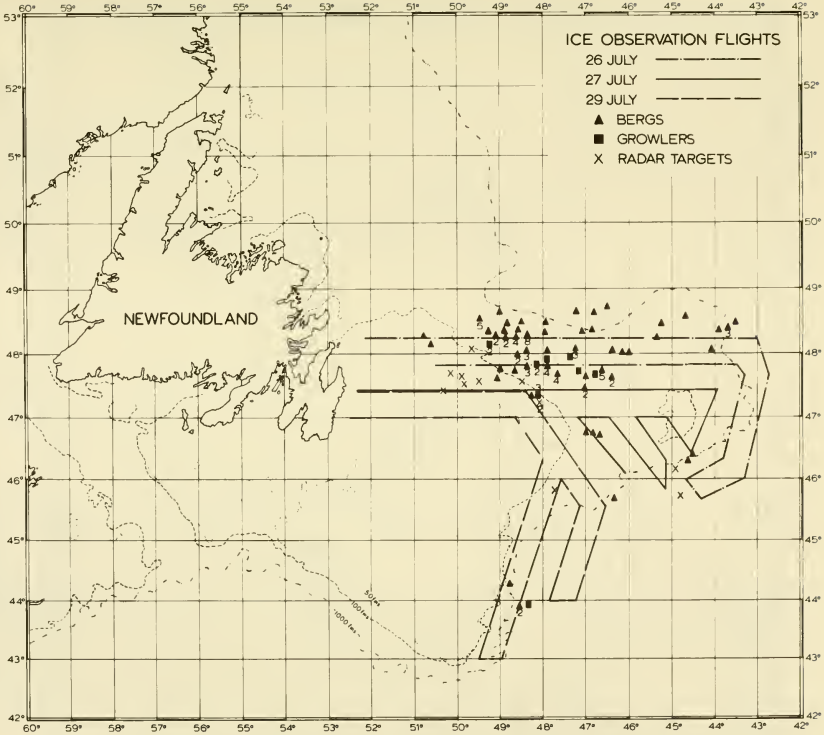

FIGURE 17.—Ice Observation Flights 26–29 July 1972.

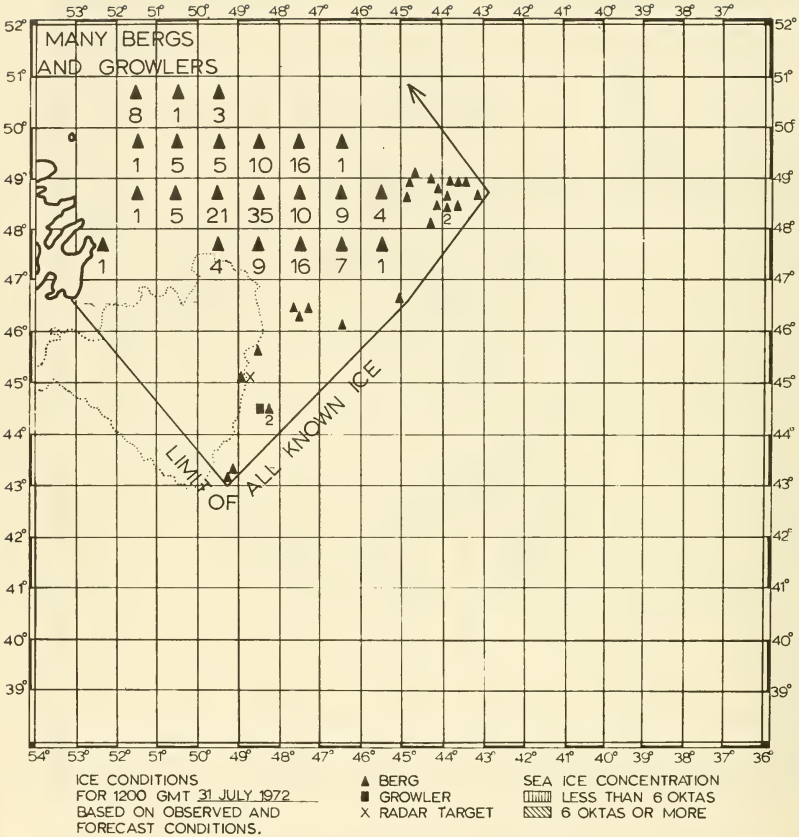

Figure 18.—Ice Conditions, 1200 GMT 31 July 1972.

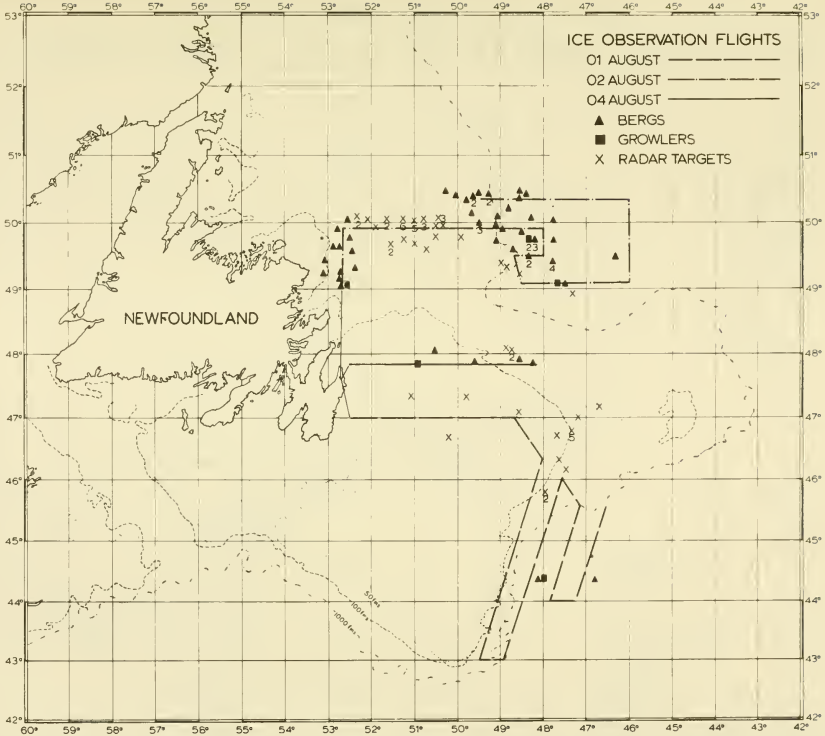

FIGURE 19.—Ice Observation Flights 1–4 August 1972.

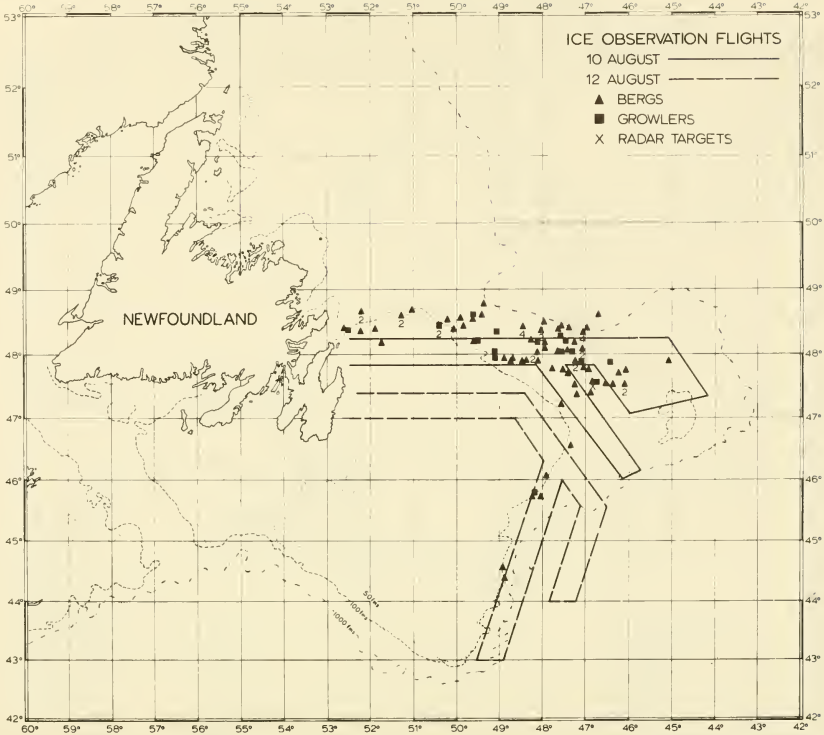

FIGURE 20.—Ice Observation Flights 10 and 12 August 1972.

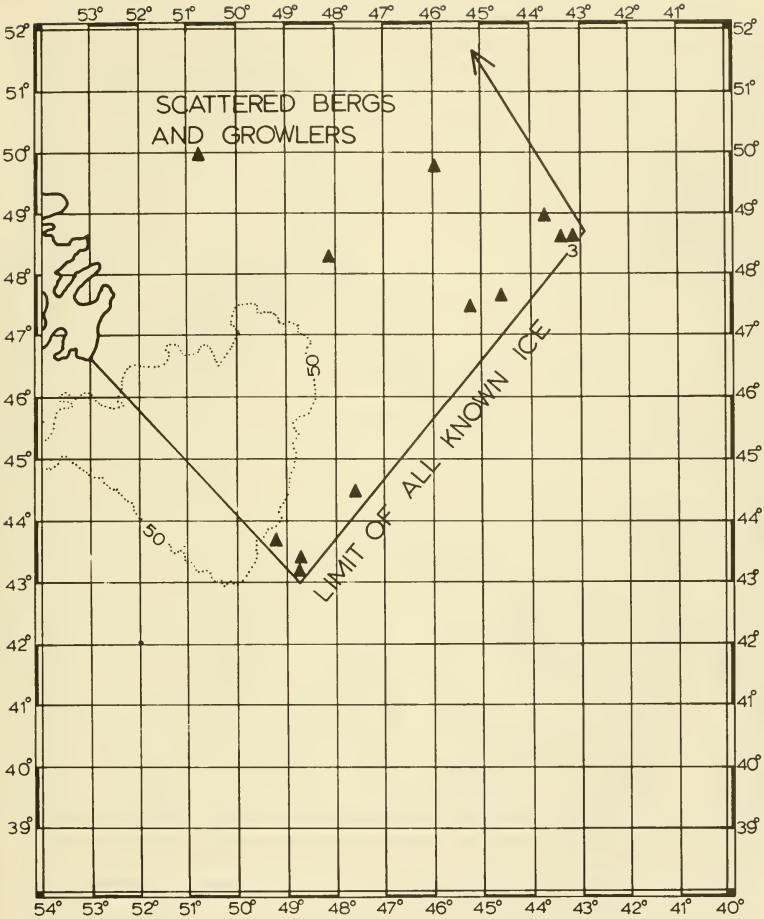

FIGURE 21.—Ice Conditions, 1200 GMT 31 August 1972.

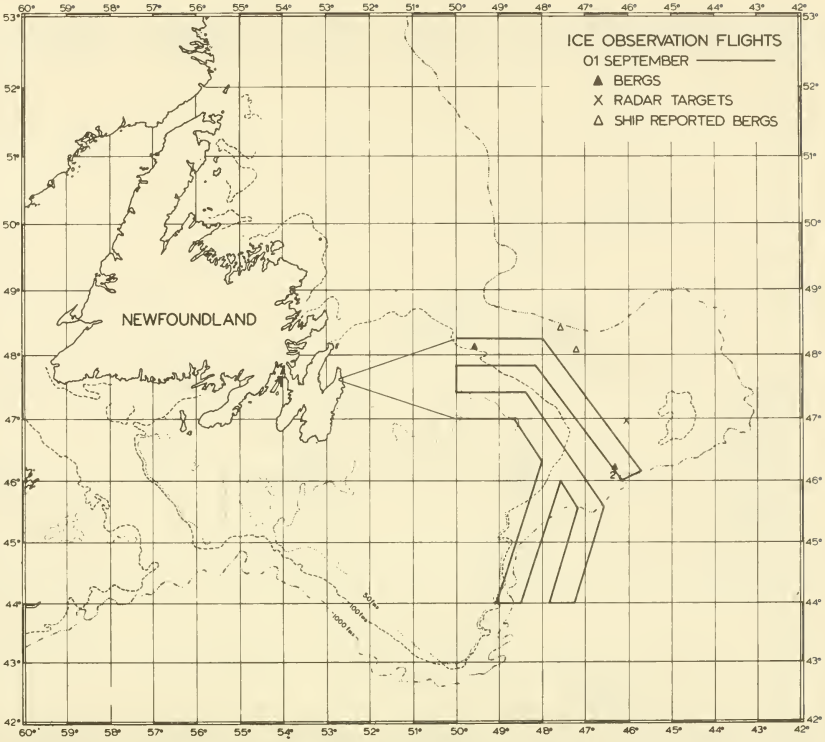

FIGURE 22.—Ice Observation Flight 1 September 1972.

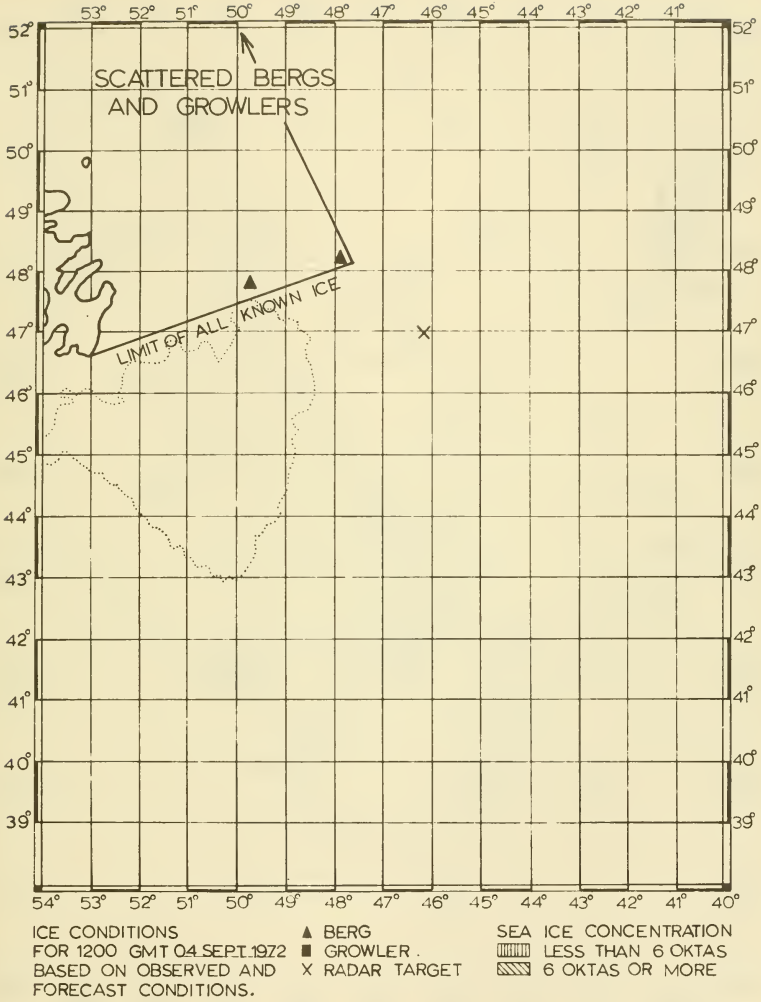

FIGURE 23.—Ice Conditions, 1200 GMT 4 September 1972.

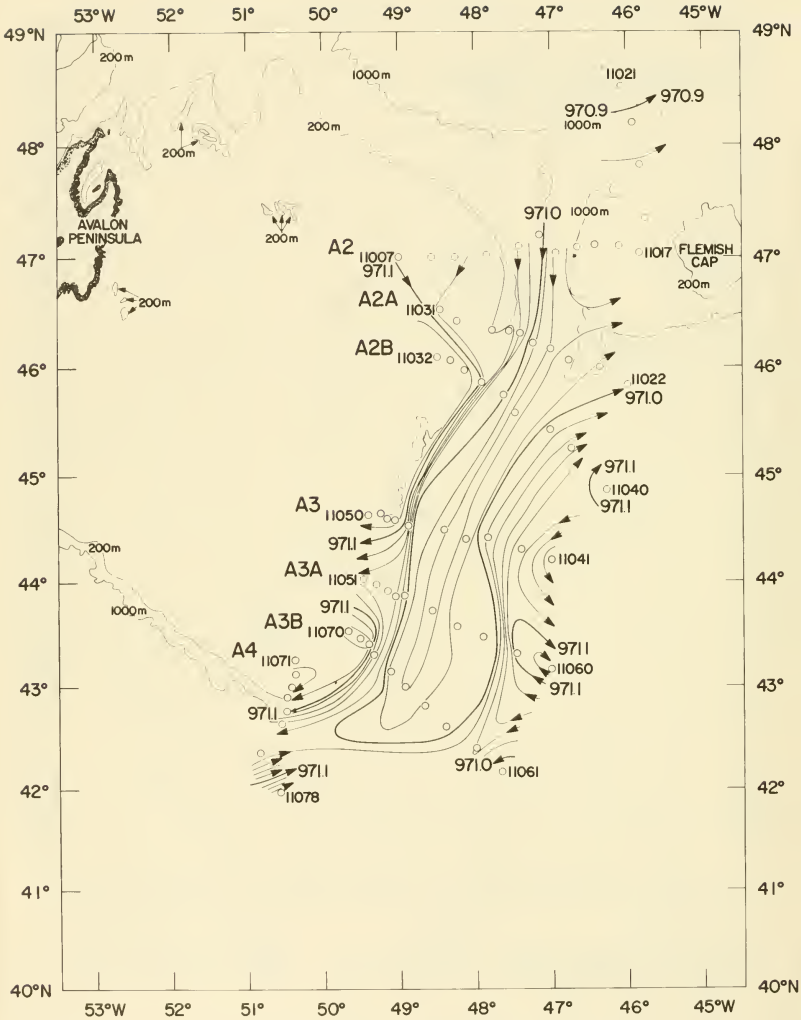

FIGURE 24.—Dynamic Topography of the Sea Surface with Reference to the 1000 Decibar Surface. First Cruise, April 1972.

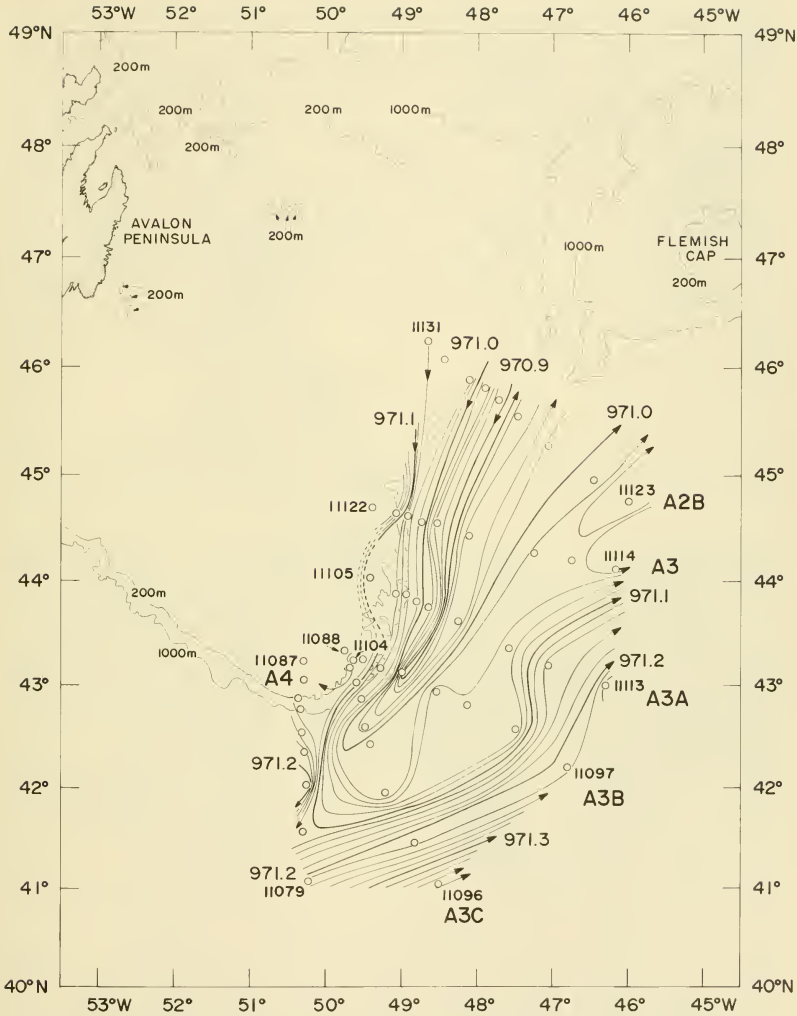

FIGURE 25.—Dynamic Topography of the Sea Surface with Reference to the 1000 Decibar Surface. Second Cruise, May 1972.

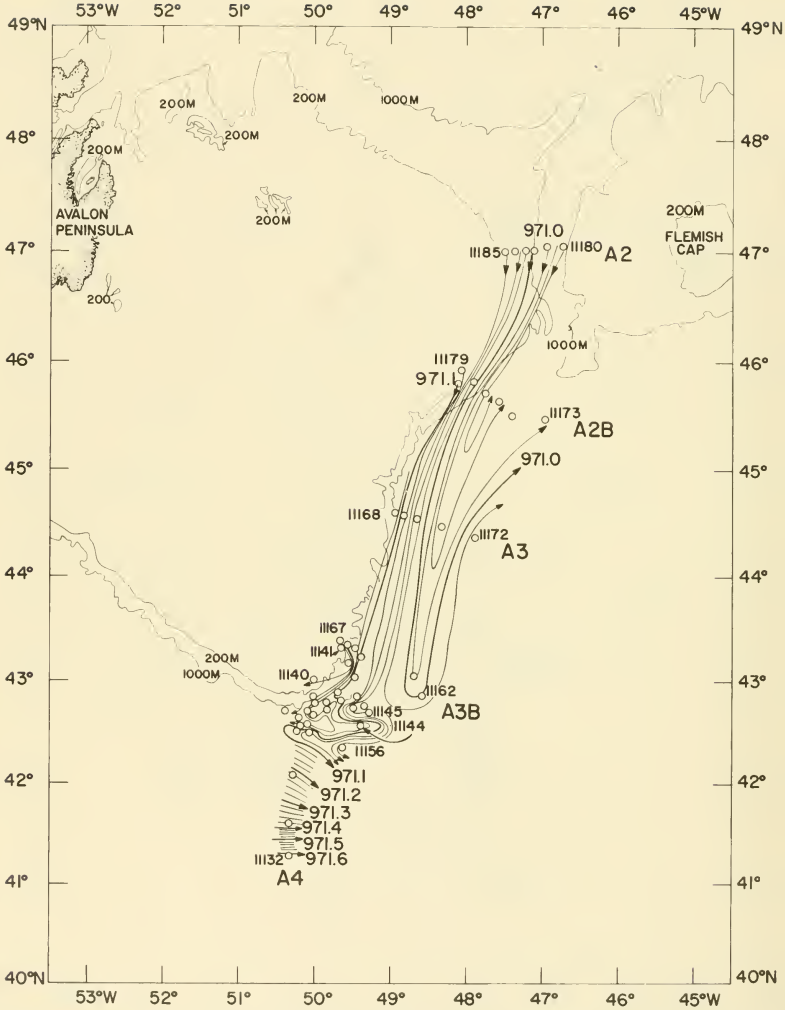

FIGURE 26.—Dynamic Topography of the Sea Surface with Reference to the 1000 Decibar Surface. Third Cruise, June 1972.

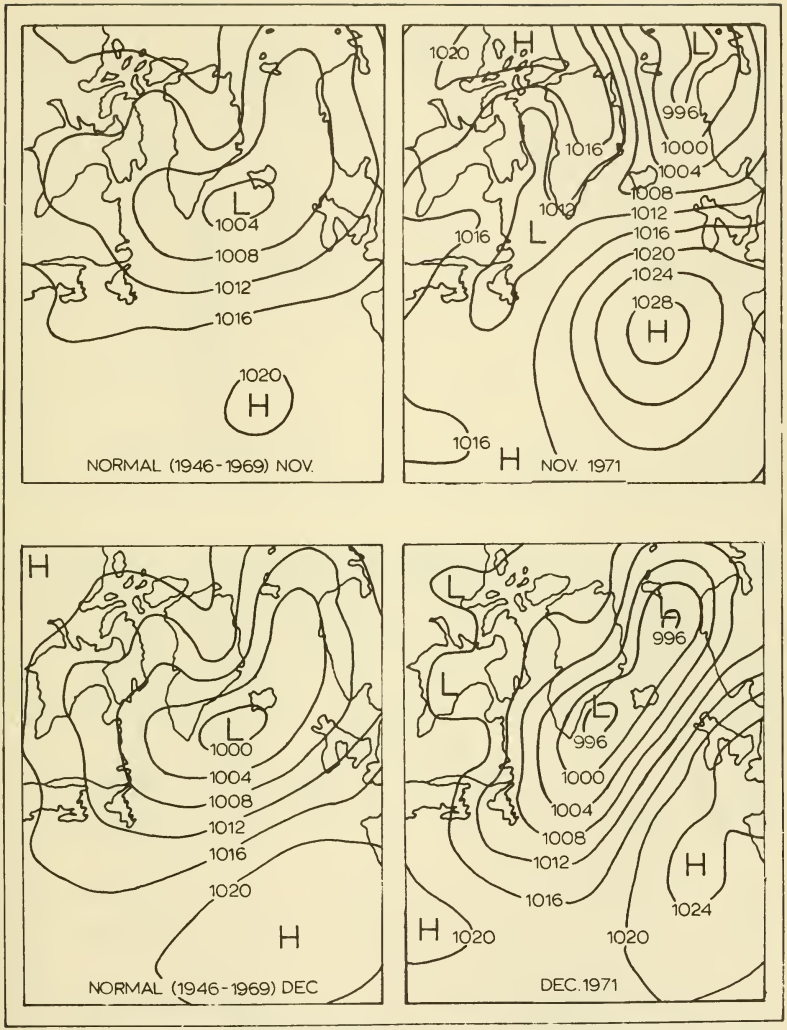

FIGURE 27a.—November and December Normal and 1971 Monthly Average Surface Pressure in mbs Relative to 1000 mbs.

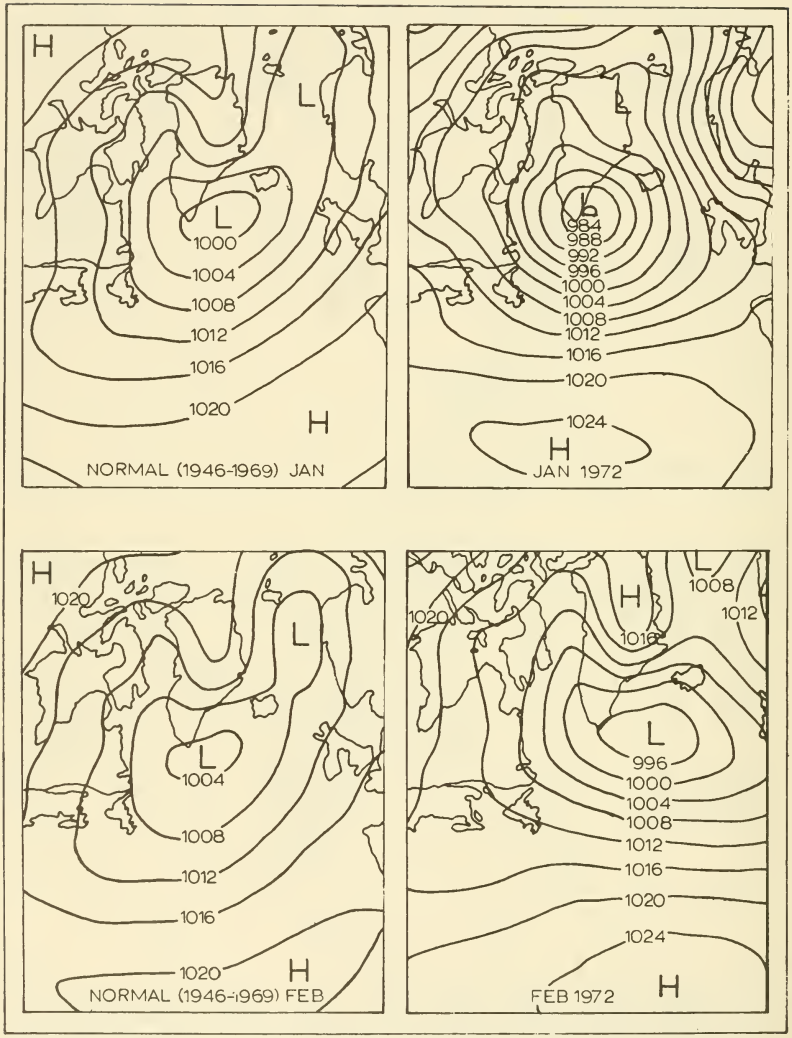

FIGURE 27b.—January and February Normal and 1972 Monthly Average Surface Pressure in mbs Relative to 1000 mbs.

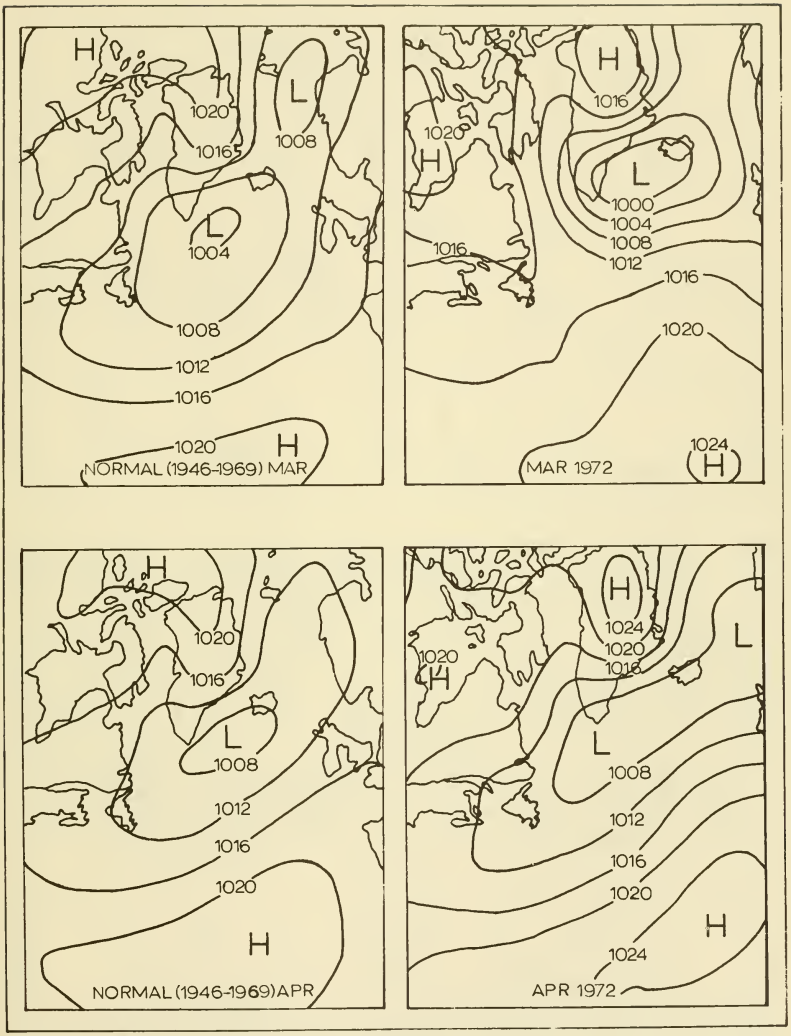

FIGURE 27c.—March and April Normal and 1972 Monthly Average Surface Pressure in mbs Relative to 1000 mbs.

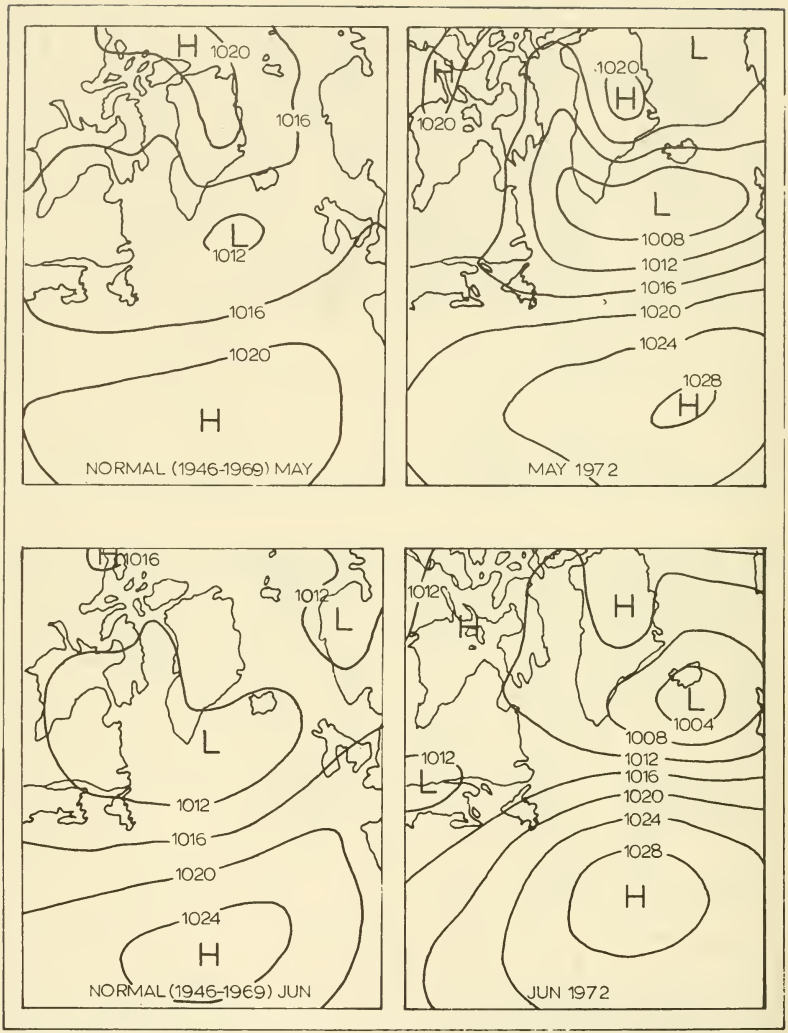

FIGURE 27d.—May and June Normal and 1972 Monthly Average Surface Pressure in mbs Relative to 1000 mbs.

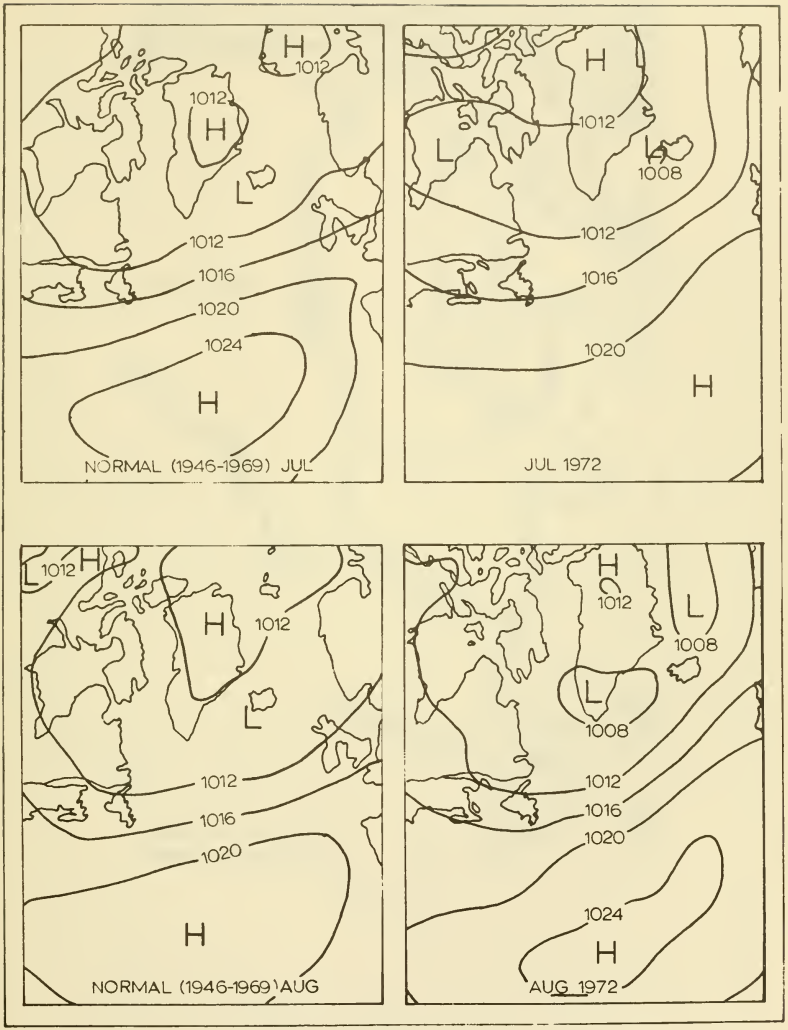

FIGURE 27e.—July and August Normal and 1972 Monthly Average Surface Pressure in mbs Relative to 1000 mbs.

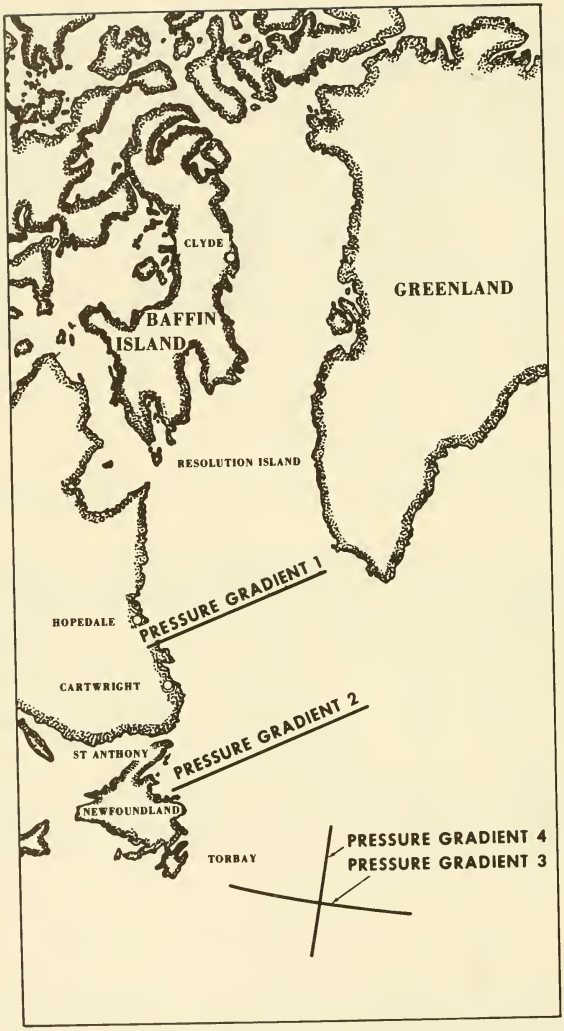

FIGURE 28.—Locater Chart.

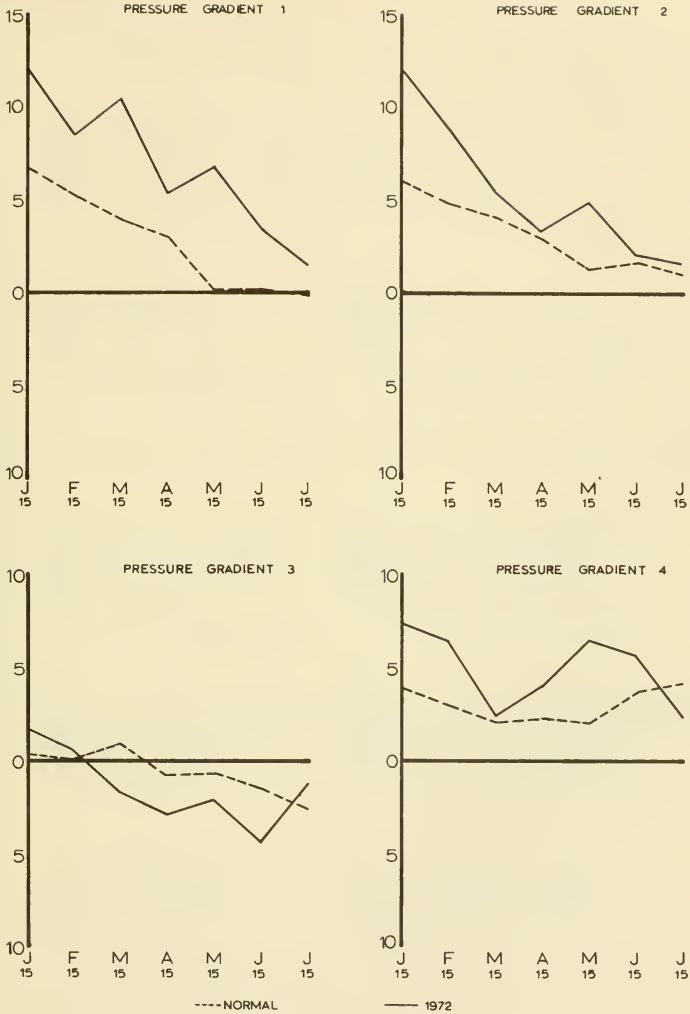

FIGURE 29.—Pressure Gradients 1–4.

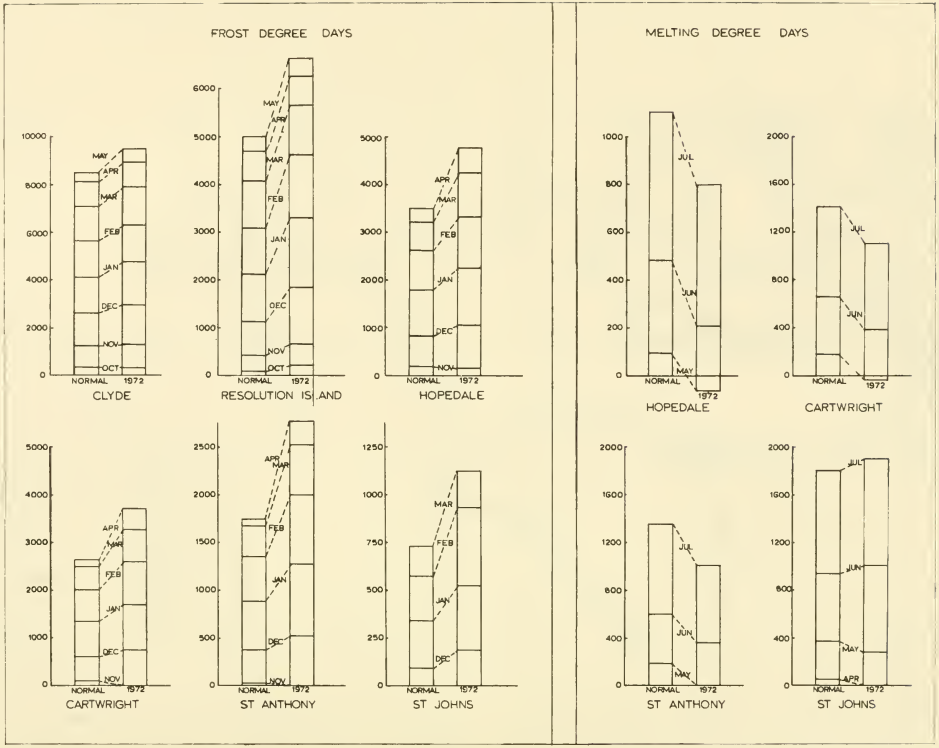

FIGURE 30—Frost Degree Day and Melting Degree Day Accumulations Calculated from Monthly Mean Fahrenheit Air Temperature.