Prepared by the North American Ice Service

A collaboration of the Canadian Ice Service and the National/Naval Ice Center

4 June 2004

Seasonal Outlook

For North American Arctic Waters

Summer 2004

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Ice Conditions in Northern American Arctic Waters

Introduction

This outlook is produced by the North American Ice Service, which is a joint co-operation of the Canadian Ice Service and the U.S. National Ice Center.

It will give an indication of the expected pattern of breakup and clearing of ice in the North American Arctic waters. It will identify areas and timings when breakup and clearing will likely occur with emphasis on those areas where there is ship navigation and other marine activities.

The outlook has been developed through the analysis of the meteorological and ice growth regimes. A thorough analysis has been done of extensive Radarsat imagery collected in February. NOAA, MODIS and ERS-1 satellite imagery were also used for the evaluation of the ice cover. These analyses were updated at the beginning of each month for the remainder of the winter and during the spring. All of this ice information was used in the preparation of regional ice analyses for the Arctic and Hudson Bay.

The results of the meteorological and ice analyses are then compared with previous years ice conditions and, in conjunction with the forecast for wind and temperatures for June, are applied to evaluate the breakup and the clearing of ice in the areas of interest. The Canadian Meteorological Centre provides the temperature regime for the period from the end of June to the end of August. Any variations from these forecast parameters have an impact on the forecast breakup pattern and timing.

Tables are included showing the forecast breakup or clearing dates along with median dates and last year's dates for each region. During the summer these events will be updated by a bimonthly issue of a 30-day forecast to enable planning of shipping or other activities according to changing trends. These forecasts will also include a prediction of the beginning of the freeze-up process throughout the regions.

Daily radio broadcasts of ice charts and forecasts will be made to support ongoing operations in the various areas where ice affects marine activities. Appendix C contains links to these broadcast schedules as well as Aerial Reconnaissance Radio Facsimile Broadcast and NOAA Alaskan Marine Radio frequencies. Appendix A provides a link to the key to ice symbols showing the principle features of the International Ice symbols used on the ice charts, while Appendix B defines the ice terminology which is most frequently used.

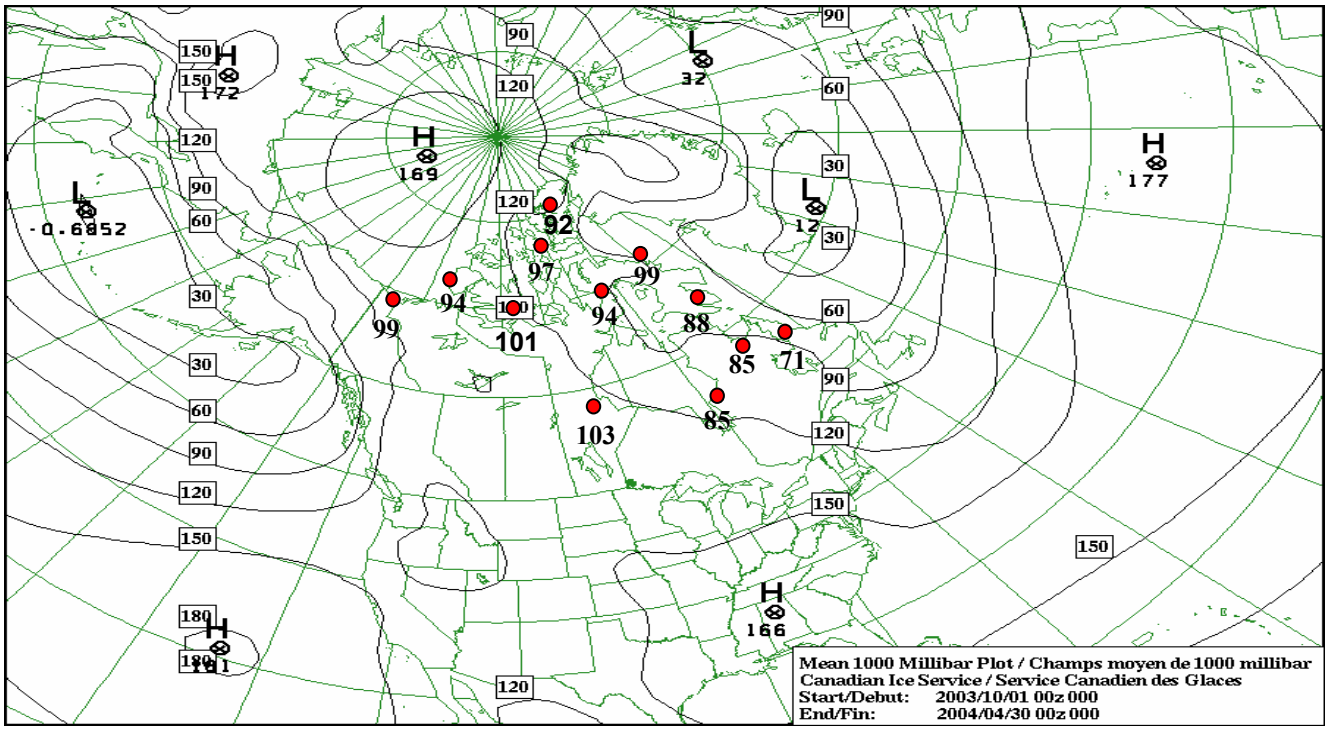

Figure 1: 100mb mean pressure pattern from October 1st, 2003 to April 30th, 2004 with percentage of normal freezing degree-days over the winter season.

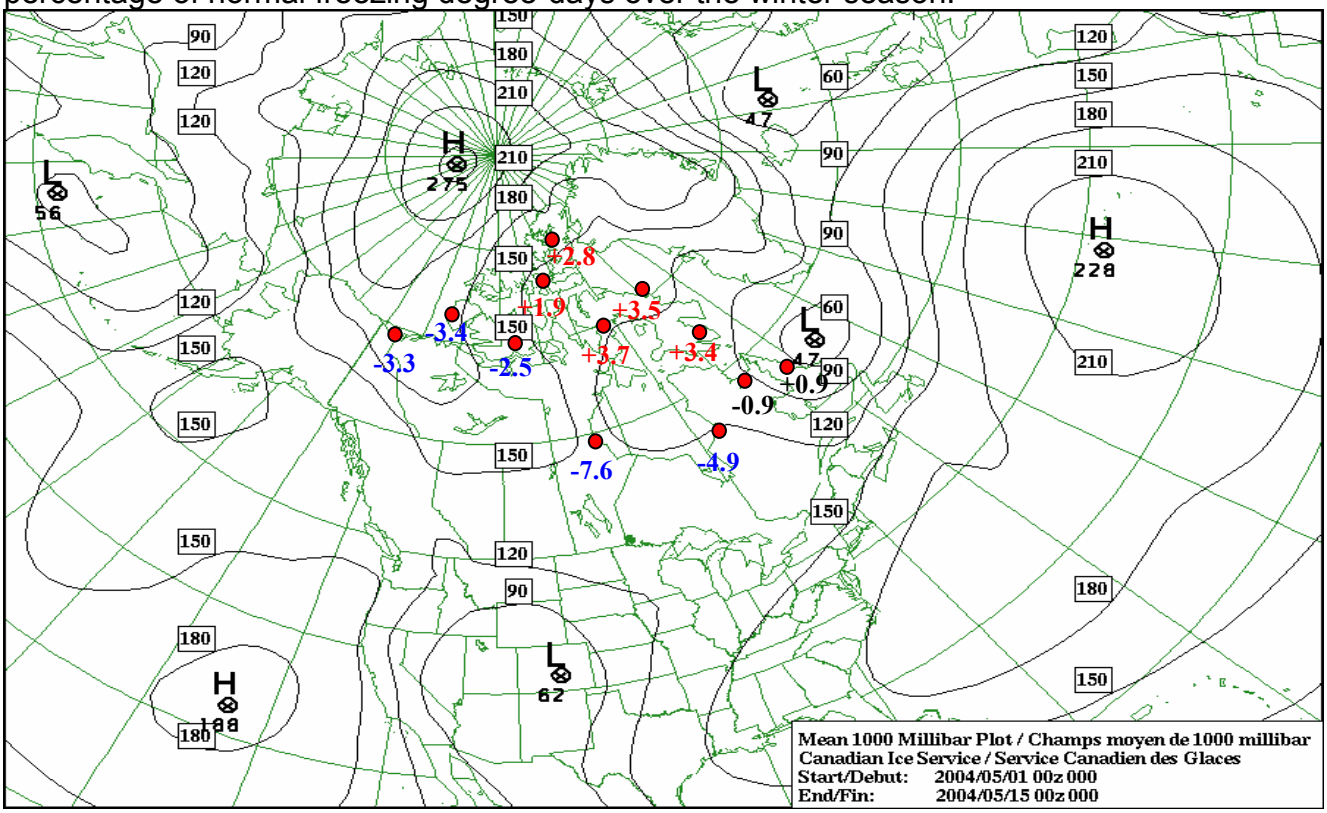

Figure 2: 1000 mb mean pressure pattern from May 1st to May 15th 2004 with departure from normal temperatures.

General Winter Conditions and Brief Outlook

The mean 1000 mb pressure pattern from October 01st, 2003 to April 30th, 2004 is represented in Figure 1. It indicates a low system located near the southern tip of Greenland with a trough extending northwestward into northern Baffin Bay. A light to moderate north to northwesterly flow resulted over the central and eastern arctic as well as over Hudson Bay and Hudson Strait. North to northeasterly winds were predominated over most of the Labrador Coast. A high pressure system with a trough stretching southeastward dominated the pressure pattern over the western Arctic. As a result eastern Beaufort Sea was generally under the influence of a light northeasterly flow while a light to moderate southeasterly flow dominated along the Alaskan coast. The western central Beaufort Sea saw a light and variable flow. A low pressure system over the Aleutians generated a moderate northeasterly flow over the Bering Strait.

During the last three month of 2003 temperatures were generally above to much above normal over the entire forecast area. The high Arctic as well as Foxe Basin and the north coast of Labrador experienced temperatures close to 4C above normal over that period. December was notably warmer than normal over most of the High and eastern Arctic and Hudson Bay where reported temperatures were in some locations 6C above normal. A reverse trend was noted during the first four months of 2004 when temperatures turned colder and were generally below normal. The exceptions were the High Arctic where temperatures were near normal and the northern Labrador and eastern Hudson Bay areas which continued to experienced above normal temperatures. February was the coldest month in Western Hudson Bay with average temperatures ranging between 5C and 6C below normal. March was the coldest month in the central and western Arctic with temperatures ranging from 4.5C to 6.0C below normal at Inuvik and Taloyoak respectively. Overall, over the entire winter, temperatures were close to normal except above normal over the eastern Hudson Bay eastward to the northern Labrador coast. Freezing degree-day accumulation were generally within 5 percent of the normal but within 10 to 15 percent in the High Arctic, along the southeastern coast of Baffin Bay and in eastern Hudson Bay eastward to the northern Labrador coast. These values are indicated in Figure 1.

The mean 1000 mb pressure pattern for the first half of May is shown in Figure 2. It indicates a low pressure system just off the mid-Labrador coast with a trough extending north northwestward. In the Western Arctic the pressure pattern was dominated by a broad area of high pressure north of the Beaufort Sea with a ridge extending southeastward. Temperatures were above normal over the High and eastern Arctic and southward into northern Hudson Bay and Hudson Strait ranging from 1.9C above normal in Resolute to 3.7C above normal in Hall Beach. Below normal temperatures were reported over the western Arctic as well as into southwestward Hudson Bay. Temperatures at Churchill were 7.7C below normal over the first half of May while they were 3.3C below in Inuvik.

Hudson Strait, the Labrador coast and the Eastern Arctic will experience slightly above normal temperatures in June. Temperatures in Hudson Bay will be near or slightly above normal except for the northwestern section of the bay where temperatures will be slightly below. As for the Western Arctic, temperatures will be near to above normal. As for the rest of the summer, temperatures will generally be above normal over the entire arctic region

except near or slightly below normal in northwestern Hudson Bay and in the Amundsen Gulf area eastward to Queen Maud Gulf. Break-up events will generally be earlier than normal due to thinner than normal ice thicknesses in most regions. The exception will be Eureka Sound and western Barrow Strait where break-ups will be slightly delayed due to higher than normal old ice concentration.

Hudson Bay and Approaches

Freeze-up and Winter Ice Regime

Above to much above normal temperatures prevailed over the entire area from October to December except near normal over James Bay area. Over the first three months of 2004 temperatures averaged below normal over western Hudson Bay and James Bay, near to above normal over the rest of Hudson Bay and Hudson Strait and above to much above normal over the Labrador coast. Freeze-up was delayed by 10 days to two weeks in northern Hudson Bay but was a few days early along the coast in the southwestern portion of the bay. A delay of nearly three weeks was noted in the ice formation in Hudson Strait as well as along the Labrador coast. At the end of the year the calculated ice thicknesses were less than normal in Hudson Bay, Hudson Strait and along the Labrador coast. At that time the amount of ice along the Labrador coast was near its minimum record. A month later the ice extent along the Labrador coast was still much less than normal and was again approaching its record minimum extent. Calculated ice thicknesses were less than normal over the entire region at the end of January, except slightly above normal over western Hudson Bay.

Ice started to form around the coast of Southampton Island during the last week of October and along the central and northern shores of western Hudson Bay a week later. Ice spread along the southwestern shore of Hudson Bay during the second week of November. Ice expended over the northern half of Hudson Bay and in Foxe Channel during the last week in November. At that time new ice started to form over western Hudson Strait. At mid-December most of Hudson Bay was covered by greywhite and grey ice except for open water along most of the eastern shore. Open water or very open drift conditions prevailed in Ungava Bay and Hudson Strait except very close pack grey ice along the southern shores.

Ice continued to form and spread so that by the end of the December, eastern Hudson Bay, Hudson Strait as well as Ungava Bay were entirely ice covered. However the ice was thinner than normal. At the end of December thin first year ice was covering the northern two thirds of Hudson Bay and Foxe Channel while greywhite ice was predominant in the southern third of the bay as well as in Hudson Strait and Ungava Bay. At the time a narrow band of new and grey ice had formed along the Labrador coast however conditions there continued to be much less severe than normal. New and grey ice developed in Frobisher Bay near mid-December and the bay became entirely ice covered with grey and greywhite ice by the end of the year.

Ice continued to develop and grow and at the end of January thin and medium first year ice was predominant in Hudson Bay, Foxe Channel, in Hudson Strait as well as in Frobisher Bay. The exception was the thinner ice along the northwestern shore of Hudson Bay and the northern shore of Hudson Strait. Ice consolidated along much of the shores of Hudson Bay and Hudson Strait, around the Belcher Islands as well as in northwestern Frobisher Bay. First year and greywhite ice were predominant along the Labrador coast

however the eastern ice edge was much closer to the shore than normal due mainly to predominant onshore winds, during January and February. These winds prevented any significant seaward expansion of the ice pack. The ice in Hudson Bay, Hudson strait and Ungava Bay thickened to medium and thick first year ice at the end of February. A trace of old ice reached the entrance to Frobisher Bay in late January and gradually spread into eastern Hudson Strait, Ungava Bay and along the Labrador coast during the following month. The leading edge of one tenth old ice embedded in the ice pack was located about 100 miles southeast of Cape Dyer at the end of February.

Temperatures in March and April were generally below normal except near normal along the Labrador coast and in James Bay. Ice continued to thicken and thick first year ice was prevalent in Hudson Bay, Hudson Strait and along the southeastern Baffin Island coast at the end of March. Elsewhere medium first year predominated. The fast ice in northern Frobisher Bay was much less extensive than normal. Persistent northwesterly winds, in March, push the thick ice out of Frobisher Bay and at the end of the month much of the bay was covered with new ice. Persistent west southwesterly winds during April resulted in looser ice conditions developing along the southern shore of Hudson Strait and in western Ungava Bay. At the end of April areas of looser ice had developed in Roes Welcome Sound as well as along the northwest coast of Hudson Bay and in James Bay. The seaward ice extent in southern Davis Strait and along the Labrador coast continued to be significantly less than normal. As well the ice concentration along the Labrador coast was a lot less than normal due to continued above normal temperatures. At the end of March the leading edge of one tenth old ice embedded in the pack was located about 80 miles southeast of Cumberland Sound. A month later this old ice edge was located just east of Resolution Island.

During the first half of May much colder than normal temperatures prevailed over northwestern Hudson Bay but persistent northwesterly winds developed open water or loose ice areas along the northwestern shore of the bay. Northwesterly winds in Hudson Strait closed the bergy water lead along the southern shore of the Strait but developed another lead along the northern shore. At mid-May much less ice than normal was found in Ungava Bay as bergy water was predominant in much of the southwestern section of the bay. The ice along the northern Labrador coast continued to melt during the first two weeks in May and ice extent there was much less than normal. The seaward extent of the ice in the approaches to Frobisher Bay continued to be a lot less than normal and some bergy water areas has already developed in the bay itself which is earlier than normal. The calculated ice thicknesses were thinner than normal in most locations at mid-May.

Observed Ice Conditions

The regional chart in figure 3 was based on the analysis of Radarsat and NOAA imageries around May 15th, 2004. This chart reveals some of the following features:

a) Much looser than normal ice conditions along the northwestern shore of Hudson northward into Roes Welcome Sound.

b) Ice edge in Southern Davis and along the Labrador coast much closer to the shore than normal. As well ice there generally much looser than normal.

c) Bergy water areas in Frobisher Bay, Ungava bay and northern Hudson Strait.

d) Near normal ice thickness in western Hudson Bay. Thinner ice than normal in eastern Hudson Bay, James Bay and in Hudson Strait.

e) Smaller fast ice areas east of the Belcher Islands than normal.

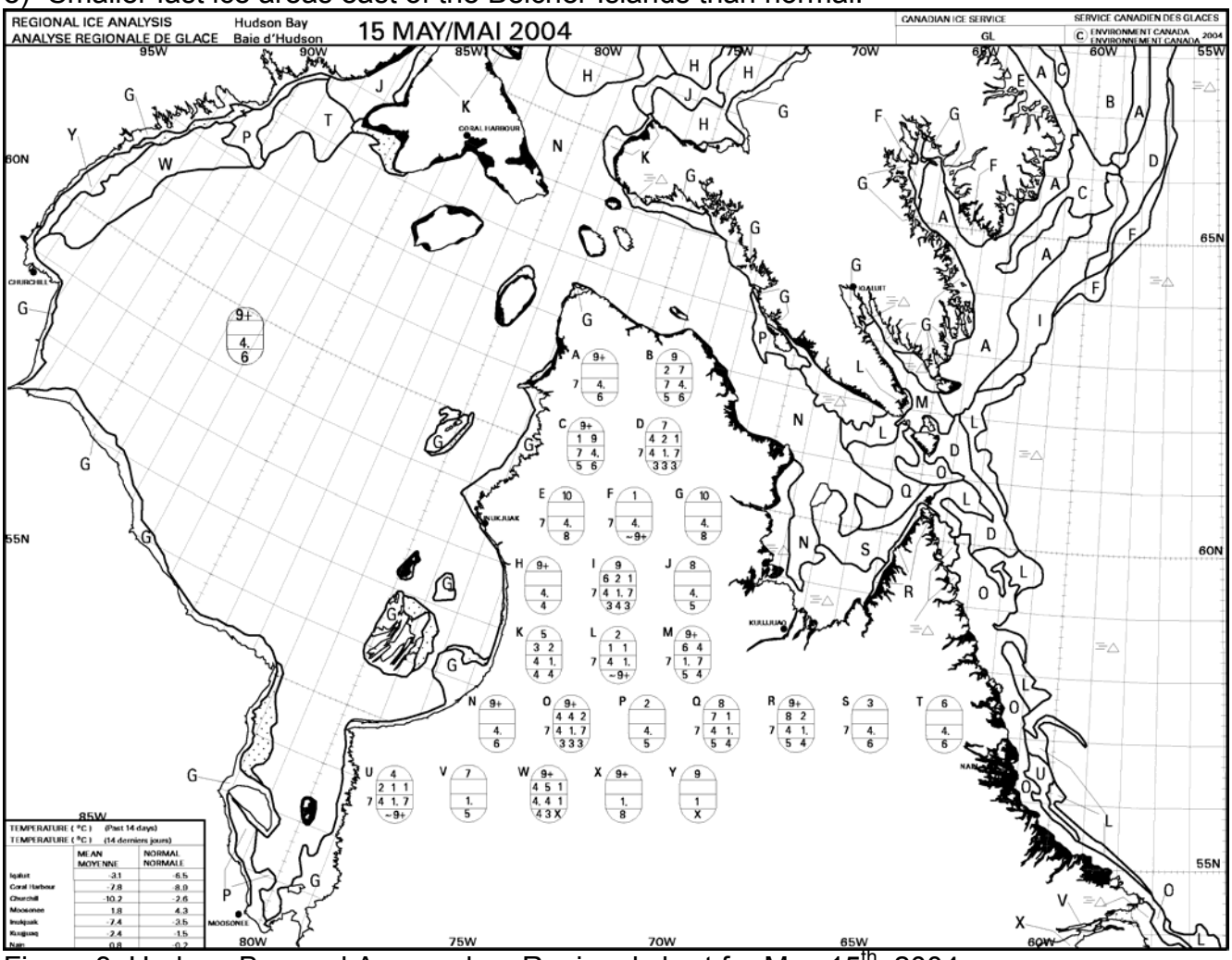

Figure 3: Hudson Bay and Approaches Regional chart for May 15th, 2004

Outlook for Hudson Bay and Approaches

A moderate, occasionally strong, northwesterly flow dominated the weather pattern over Hudson Bay area during the last half of May. A light to moderate west northwesterly flow was prevalent over Hudson Strait area as well as along the northern Labrador coast. During that period above normal temperatures were reported along the northern Labrador coast and over southeastern Baffin Island. Below normal temperatures prevailed over Hudson Bay and Hudson Strait except much below over northwestern Hudson Bay where average temperatures were 6.9C below normal. Even though temperatures were much below normal over northwestern Hudson Bay the prevailing northwesterly winds developed a wide open water, or loose ice area, along the northwest coast of the bay. At the end of May ice conditions were near normal over the rest of Hudson Bay. At that time, less than normal ice concentration were reported in Ungava Bay as prevailing winds pushed the ice towards the eastern section and developed much looser than normal ice conditions over the western section. The looser ice area in northern Hudson Strait continued to expand during the last half of May. Offshore winds as well as above normal temperatures helped to keep looser than normal ice conditions along the northern Labrador coast. The fast ice in western Lake Melville broke up during the third week of May and the eastern section late during the last week of the month.

During the first half of June, a series of low pressure centres will cross the southern part of Labrador. As a result near to slightly below normal temperatures will prevail over the first week in June followed by above normal temperatures over the second week. For the rest of the summer near to above normal temperatures are generally forecast except for slightly below normal temperatures over western Hudson Bay. The fact that break-up is already in advance compared to normal and that looser than normal ice conditions are encountered in many areas we expect the ice to clear at a significantly faster pace than normal. The exception is southwestern Hudson Bay which should clear near its normal date or slightly earlier. The open water route to Churchill will develop and James Bay will clear near mid-July which is a week to 10 days earlier than normal for the route to Churchill but two weeks earlier for James Bay. Ungava Bay will clear during the second of July which is two to three weeks earlier than normal. Labrador coast up to Chidley will clear during the first week of July which is close to a month before its normal date. The last of the ice in Hudson Strait will melt early in the last week of July which is close to a week early. An open drift or less route to Frobisher Bay will develop during the first of July and the bay will become bergy water a month later. Both events are 10 days to two weeks earlier than normal. Hudson Bay will clear entirely during the second week of July which is a few days earlier than normal.

Table 1: Hudson Bay and Approaches Break-up Pattern and Outlook

	2003	Median	Outlook for 2004
Labrador Coast to Cape Chidley **- Clearing**	1 July	1 August	1-4 July
Frobisher Bay **- Open drift or less** **- Clearing**	15 July 01 August	21 July 12 August	4-7 July 1-4 August
Ungava Bay **- Clearing**	12 July	5 August	10-13 July
Hudson Strait **- Clearing**	30July	10 August	26-29 July
Open water route to Churchill	17 July	23 July	14-17 July
Hudson Bay **- Clearing**	11 August	19 August	8-11 Aug
James Bay **- Clearing**	24 July	30 July	14-17 July

Eastern Arctic

Freeze-up and Winter Ice Regime

During the period from September to the end of December, temperatures were above to well above normal over the entire area. As a result, at the end of 2003, the ice extent was less than normal over southeastern Baffin Bay and northeastern Davis Strait. Colder to much colder than normal temperatures prevailed over the first three months of 2004 and as a result calculated ice thicknesses were generally close to normal at the end of March.

At the end of the summer of 2003, the distribution of the old ice was generally near normal in Norwegian Bay, Eureka Sound, Jones Sound and Kane Basin. At that time significantly more old ice than normal was found in Penny Strait, Wellington Channel, McDougall Sound, Prince Regent Inlet, eastern Lancaster Sound as well as in Pelly Bay.
Because of warmer than normal temperatures in late summer, the formation of the new ice was delayed. New ice started to form in the High Arctic around mid-September and a week later in the central Arctic. Near normal temperatures during the last part of September thickened the ice to the grey ice stage.

By mid-October, Gulf of Boothia, and Prince Regent Inlet had mostly grey ice with some old ice. Most of the thick first year ice in Pelly Bay and Committee Bay did not melt last summer and as a result old ice was predominant in these areas at the beginning of October. Barrow Strait was covered by mostly old ice and Lancaster Sound by grey and old ice. Much of the old ice in central and eastern Lancaster Sound drifted out of the sound during the second half of October and dispersed itself into Baffin Bay. At that time, thin first year ice had developed in western Wellington Channel and in southern McDougall Sound. Grey ice had formed along the northwestern shore of Baffin Island and northern Eureka Sound became consolidated. The southward progression of the old in Kane Basin was later than normal as its southern ice edge was near Smith Bay at mid-October.

By the end of October new and grey ice had developed along most of the shores as well as into the northern third of Foxe Basin. Greywhite and old ice prevailed in Prince Regent Inlet and in the Gulf of Boothia. Old was predominant in Barrow Strait and in Western Lancaster Sound and mostly grey ice with up to one tenth of old ice was found over the rest of the Sound. The ice in eastern Wellington Channel has thickened to thin first year. New and grey ice had formed in Admiralty Inlet as well as into Navy Board Inlet and Eclipse Sound. At that time the ice became consolidated in southern Eureka Sound and in Norwegian Bay. Ice growth in Foxe Basin and in Baffin Bay was two weeks later than normal. Higher than normal old ice concentration was found in Barrow Strait, western Lancaster Sound, northern Prince Regent Inlet as well as in Pelly Bay. The ice in Pelly Bay consolidated late in October.

By the middle of November, thin first year and greywhite ice was covering the northern and western sections of Baffin Bay while mainly grey ice was reported over the eastern section. Thin first year ice was predominant in most of Lancaster Sound, in Prince Regent Inlet, and in the Gulf of Boothia except for mainly old ice in northern Prince Regent Inlet and in the western end of Lancaster Sound. Old and thin first year ice was found in Barrow Strait and in Wellington

channel. Greywhite ice was predominant in northern Foxe Basin while grey ice predominated in the eastern section. Open water still prevailed over the southwestern section of the Basin.

At the end of November greywhite and thin first year ice was covering Foxe Basin which was two weeks behind normal in terms of thicknesses. Ice continued to thicken and expand in Baffin Bay but bergy water was still prevalent along the west coast of Greenland as far north as 74N. The main ice edge at that time was located just south of Cape Dyer which was three weeks behind normal. Old ice drifting southward from Nares Strait reached the entrance to Lancaster Sound in late November. The ice in Baffin Bay continued to progress southward along the Baffin Island coast and reached Cape Dyer late in November and the entrance to Frobisher Bay a month later. At that time the amount of old ice in Baffin Bay was higher than normal due to the delay in the formation of the ice bridge in Kane Basin. This delay permitted more old ice to drift into Baffin Bay. The southward extent of the old ice was near the entrance to Cumberland Sound which was near normal.

Temperatures were generally colder than normal over the area in January, except above normal over the high Arctic, and close to normal in February. The ice in Barrow Strait and in western Lancaster Sound, west of the Brodeur Peninsula, was still mobile at the end of March which is not normally the case. Usually this area consolidates near mid-February. Northern Prince Regent Inlet became consolidated in late January which was about a month earlier than normal. The eastward extent of the ice pack in northern Davis Strait was less than normal at the end of February. Temperatures in March were much below normal over the area. At the end of March thick first year ice was predominant in Baffin Bay and in Foxe Basin and the ice was still mobile in Barrow Strait and Lancaster Sound. At that time the amount of old ice in northern Baffin Bay and in the approaches to Lancaster Sound was higher than normal.
At the end of April a bergy water area had already developed in Nares Strait south of the ice bridge and extended southward to near the entrance to Jones Sound. The extent of this bergy water area was greater than normal. As well a bergy water area had developed in the southeast entrance to Jones Sound which was an earlier event than normal. At that time a bergy route along the Greenland coast up to Disko Island existed and ice was still mobile in Barrow Strait and Lancaster Sound.

During the first half of May, a low pressure system with a trough extending towards Baffin Bay generated a light north northeasterly flow over the Eastern Arctic. Above normal temperatures were widespread over the entire Eastern Arctic during the period. Temperatures ranged from 1.9C above normal at Resolute to 6.7C above in Pond Inlet. The bergy water areas in southern Nares Strait and along the western coast of Greenland, north of Disko Island, continued to expand over that two week period. Eastern Barrow Strait was still mobile at mid-May and covered mainly by young ice while thick first year ice was predominant in Lancaster Sound. Small areas of open water started to develop in northern Foxe Basin during the second week of May which is normal for the time of the year. As well ice started to loosen up inside the pack over the eastern section of the Basin. Loose ice areas developed in Cumberland.

Observed Ice Conditions

The regional chart in figure 4 was based on the analysis of Radarsat and NOAA imageries around May 15th, 2004. This chart reveals the following features:

a) The bergy water lead along the west Greenland Coast was further north than normal.

b) The fast ice edge in Parry Channel was located in Barrow Strait south of Cornwallis Island. Thinner than normal ice conditions were reported in eastern Barrow Strait.

c) Bergy water or thinner ice areas south of Kane Basin was larger than normal.

d) More old ice than normal was present in Prince Regent Inlet, Pelly Bay and in central Baffin Bay.

e) Areas of open water are developing in northern Foxe Basin.

f) Seaward extent of the ice pack in northern Davis Strait less than normal.

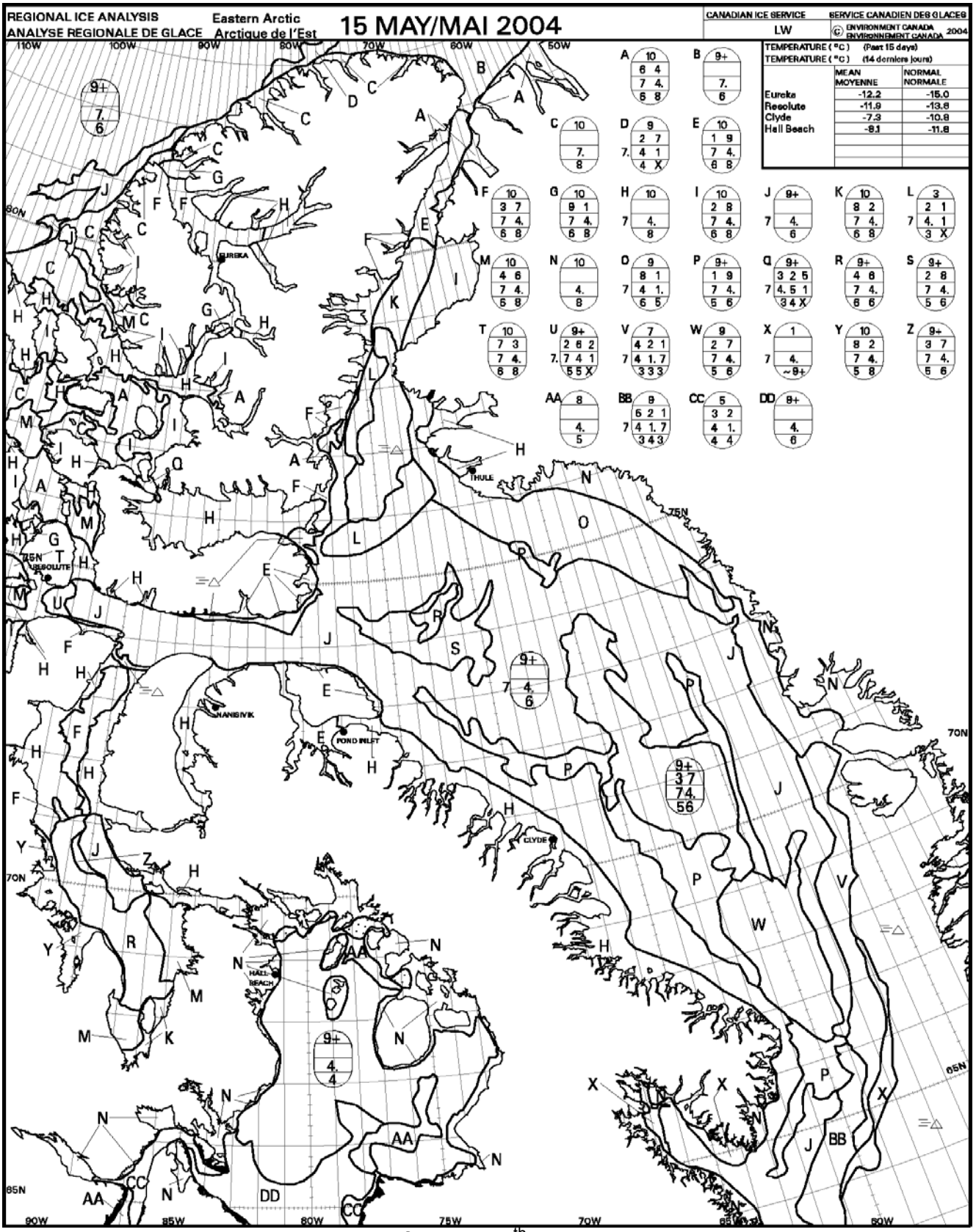

Figure 4: Eastern Arctic regional chart for May 15th, 2004

Outlook for the Eastern Arctic

Baffin/Davis Area and Foxe Basin

A low pressure area just southwest of Greenland generated a light to moderate northeasterly flow over Baffin Bay and Davis Strait and a light to moderate northwesterly flow over Foxe Basin for the last two weeks of May. Temperatures were above normal over the entire area. The bergy water or loose ice area in Smith Sound expanded and was covering much of northwestern Baffin Bay down to the entrance to Lancaster Sound at the end of May. The bergy water area along the east coast of Baffin Bay expanded northward and the ice along the fast ice edge in Melville Bay loosened up. The open water areas in northern Foxe Basin grew larger due to prevailing northwesterly winds. As well ice continued to loosen up in the southeastern section of the basin. At the end of May most of the fast ice in northwestern Cumberland Sound had fractured.

During the first half of June, a light, occasionally moderate, northerly flow will prevail over Baffin Bay and Foxe Basin. Davis Strait will experience a light to moderate southerly during the first week in June followed by a moderate northeasterly flow during the second week. Temperatures will be near to slightly above normal over Baffin Bay, Davis Strait and Foxe Basin. Assuming slightly above normal temperatures for the remainder of the summer, earlier than normal breakup events are forecast for most regions. The open drift or less route for the Pacer Goose route to Thule, including the route across northern Baffin Bay, will develop during the second week of June which is more than a month earlier than normal. A bergy water route for the above areas will develop a week or so later. The open drift or less route to Cape Dyer and Home Bay will be established during the third week of July and the first week in August respectively which is about a week to 10 days early for both events. Clearing of Davis Strait will occur during the second week in August, two to three weeks early, while bergy water will prevail in Baffin Bay during the first week of September, a week to 10 days earlier than normal. The open water route to Hall Beach will develop during the third week in August, which is 2 weeks earlier than normal and the entire Foxe Basin will be open water about 10 days earlier than normal, that is to say during the second week of September.

Parry Channel

During the last two weeks of May, a light to moderate east to northeasterly flow prevailed over the Parry Channel. Temperatures were generally below normal over the area. The western half of Barrow Strait was still consolidated at the end of May while bergy water or loose ice was reported over the Eastern section of the Strait. Very close pack ice conditions were generally reported in Lancaster Sound except for looser ice in the western end of the Sound as well as in the northeast entrance. Elsewhere, all the bays and inlets were still consolidated at the end of May.

A generally light northerly circulation will prevail over the area during the first half of June. Temperatures will be slightly above normal for June. Assuming slightly above normal

temperatures for the rest of the summer, earlier than normal break-up events are forecast. The fast ice in Pond inlet, northern Admiralty Inlets and Wellington Channel will fracture during the third week of July, which is a few days earlier than normal. Because of higher old ice concentration than usual, western Barrow Strait will fracture a few days late that is to say during the last week in July. McDougall Sound will fracture during the first week of August which is near its normal date. Pond Inlet will clear during the second week in August. There will be a continuous flow of old ice from McClure Strait into southern Lancaster Sound and into Northern Admiralty inlet and as a result Northern Admiralty Inlet is not expected to completely clear this summer.

High Arctic

During the last two weeks of May, a light west southwesterly flow prevailed over the High Arctic. Temperatures were above normal over the area. At the end of May, conditions in the High Arctic were near normal.

Light and variable winds will predominate over the High Arctic during the first half of June. Mean air temperatures will be near to slightly above normal for June. Assuming slightly above normal temperatures for the rest of the summer, breakup events will be generally earlier than normal. Kane Basin will fracture near mid-July, which is a week to 10 days earlier than normal. Jones Sound will fracture during the second week of July, about two weeks earlier than normal. Southern Norwegian Bay is forecast to fracture during the third week of July while northern Norwegian Bay will fracture a week later. Both events are about 10 days earlier than normal. The fracture and clearing in Eureka Sound will be delayed by a few days due to a higher than normal amount of old ice in the sound. The fracture in Eureka Sound will occur during the first week in August while the clearing is not expected before the third week of the month.

Table 2: Eastern Arctic - Break-up Pattern and Outlook

	2003	Median	Outlook for 2004
Route across Northern Baffin Bay			
- Open drift or less	16 June	21 July	13-16 June
- Bergy water route	20 June	29 July	18-21 June
Baffin Bay			
- Clearing	10 September	11 September	5-8 September
Davis Strait			
- Clearing	11 August	03 September	8-11 August
Home Bay			
- Open drift or less	04 August	09 August	2-5 August
Cape Dyer			
- Open drift or less	19 July	29 July	19-22 July
Open water route			
to Hall Beach	21 August	06 September	20-23 August
Foxe Basin			
- Clearing	12 September	21 September	8-11 September
Pond Inlet			
- Fracture[1]	18 July	26 July	18-21 July
- Clearing	05 August	13 August	8-11 August
Admiralty Inlet northern half			
- Fracture[1]	19 July	22 July	21-24 July
- Mostly open water	Never	12 August	Never
Lancaster Sound			
- Fracture[1]	Not consolidated	08 July	Broken
Barrow Strait to Resolute			
- Fracture/eastern[1]	Not consolidated	11 July	Broken
- Fracture/western[1]	15 July	25 July	24-27 July
Wellington Channel			
- Fracture[1]	21 July	29 July	20-23 July
McDougall Sound			
- Fracture[1]	02 August	06 August	05-08 August
Kane Basin			
- Fracture[1]	14 July	24 July	12-15 July
Jones Sound			
- Fracture[1]	18 July	02 August	10-13 July
Norwegian Bay			
- Fracture/southern[1]	21 July	02 August	20-23 July
- Fracture/northern[1]	27 July	10 August	26-29 July
Eureka Sound			
- Fracture[1]	27 July	03 August	01-04 Aug
- Mostly bergy water	Never	18 August	20-23 Aug
Pacer Goose route to Thule			
-Open drift or less	16 June	21 July	13-16 June
-Bergy water route	20 June	29 July	18-21 June

[1] Fracture indicates complete breakage of consolidated ice.

Western Arctic

Freeze-up and Winter Ice Regime

Mean air temperatures during October through December were above normal over all areas. Colder to much colder than normal temperatures prevailed over the first three months of 2004. As a result the calculated ice thicknesses were in general close to normal.

At the end of the summer the old ice extent was near normal over the eastern section of the Beaufort Sea. However the old ice extent was significantly less than normal over western Beaufort Sea with the southern old ice edge lying about 220 miles north of Point Barrow. At that time open water prevailed from Amundsen Gulf eastward to southern Larsen Sound. Normally 3 to 8 tenths thick first year with 1 to 3 tenths old ice persist in Victoria Strait and southern Larsen Strait in late September, but this year it had all melted. Open drift to very close pack thick first year with some old ice was predominant in northern Larsen Sound as well as in Peel Sound which is a little bit more ice than what is normally found at the onset of freezing. Freeze-up started in southwestern McClintock channel near mid-September and in Parry Channel, Peel Sound and along the ice edge in western Beaufort Sea during the last week of the month. New ice spread over Victoria Strait and Queen Maud Gulf during the first week of October. Ice continued to develop and grow and at the end of October greywhite and thin first year ice was predominant in Queen Maud as well as in Beaufort Sea south of the old ice edge. At that time new and grey ice was covering Queen Maud and Rasmussen Basin but open water was still reported over most of the Waterways. During the second half of October significant amount of old ice drifted from McClintock Channel into Victoria Strait.

Grey ice developed in the Waterways during the second week in November and grew to thin first year by the last week of the month. At that time thin first year ice was also reported in Queen Maud Gulf and in southern Beaufort Sea except for thinner ice right along the Alaskan coast. Fast ice developed along the Tuk peninsula and in Rasmussen Basin during the third week of November and in the Waterways east of Dolphin and Union Strait late in the month. At the beginning of December the old ice extent in eastern Beaufort Sea was close to normal. However in the western section of the Beaufort Sea the old ice extent was a lot less than normal as the old ice edge, north of Point Barrow, was lying about 300 miles north of its normal position. At that time thin first year and old ice covered Peel Sound while old ice was predominant in McClintock Channel and in Victoria Strait.

Ice consolidated in McClintock Channel, Peel Sound, Victoria Strait and in Queen Maud Gulf during the first week in December which is 10 days to two weeks later than normal. Ice thicknesses at the end of December were in general less than normal because of above normal temperatures that prevailed since the beginning of the fall. The fast ice edge in Viscount Melville Sound, at that time, was located near Stefansson Island which is about 150 miles further west than normal.

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During January and February the pack of old ice in Beaufort Sea drifted gradually southwestward along the Alaskan coast. However a light and variable flow prevented any significant amount of old ice to drift back into the western central section of the Beaufort Sea so only a small amount of old ice was reported there at the end of the winter. At the end of February the portion of the old ice pack that drifted along the Alaskan coast was at the coast at Point Barrow and 50 miles offshore at Barter Island. Below than normal temperatures were widespread over the entire area from January thought March allowing the ice thicknesses to catch up and eventually surpass the normal values. The eastern portion of Amundsen Gulf consolidated in January which is about 6 weeks earlier than normal. However the fast ice edge is in a more easterly position than normal. The eastern portion of Viscount Melville Sound consolidated in January.

Little change was noted over the Beaufort Sea and along the Alaskan coast in March except for the old ice pack moving southwestward, past point Barrow, along the Alaskan coast. The old ice area which was at the coast at Point Barrow at the beginning of April drifted gradually offshore and was lying about 25 miles offshore at the end of the month. At that time a predominant easterly flow had developed a band of thin ice along the fast ice edge in Amundsen Gulf which was located further east than normal.

Observed Ice Conditions

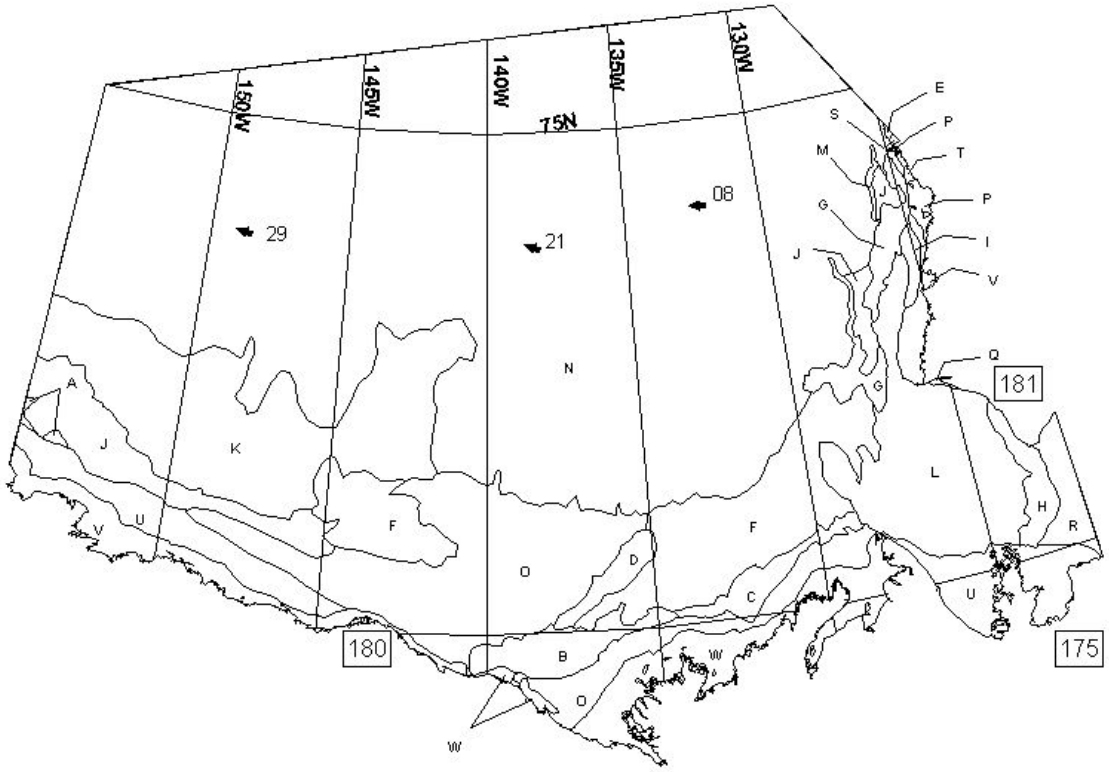
The regional ice charts in figure 5 and 6 were based on an analysis of Radarsat and NOAA imagery from around 24 May, 2004. These charts reveal some of the following features:

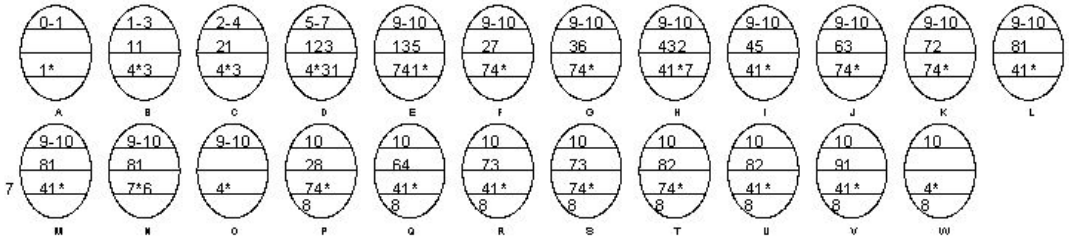
a) The main pack of old ice north of Point Barrow was closer.

b) Normal amount of old ice in Victoria Strait.

c) Near normal ice thickness in the western Beaufort Sea and slightly above normal in Amundsen Gulf and Coronation Gulf .

d) Smaller fast ice area in Amundsen Gulf.





CM = THEORETICAL ICE THICKNESS IN CENTIMETERS

NM = 168HR ANAL DRIFT VECTORS IN NAUTICAL MILES

ICE ANALYSIS
BEAUFORT
NATIONAL/NAVAL ICE CENTER
ANALYSIS WEEK: 24-28 MAY 2004

DATA SOURCES	DATE
RADARSAT	23-26 MAY
DMSP/OLS	26 MAY

ANALYST: AG1(AW/SW) PREMO
AG1 SWOPE (U/I)
UNCLASSIFIED

Figure 5: Beaufort Sea Regional chart for May 24th, 2004

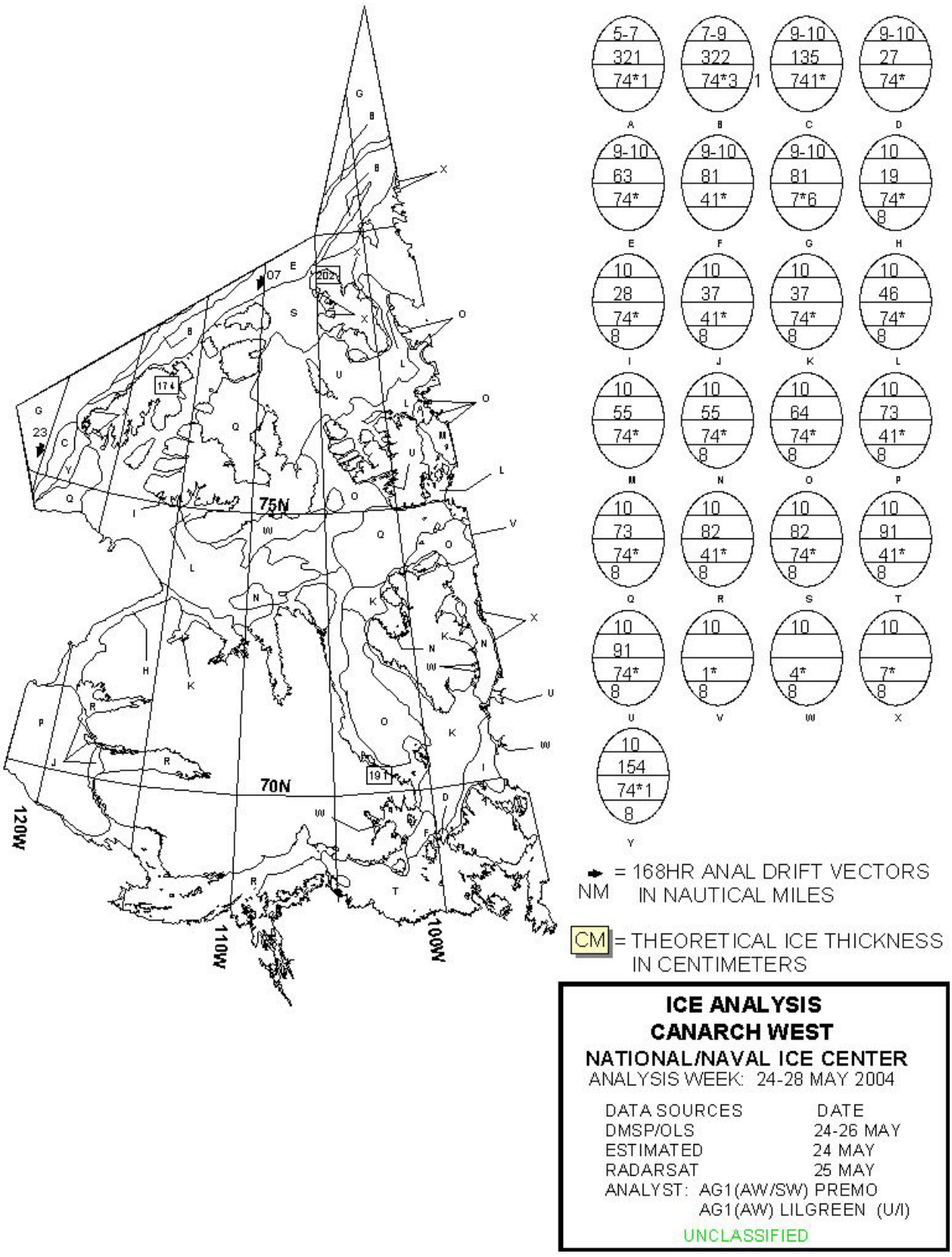


Figure 6: Canadian Archipelago Regional chart for May 24th, 2004

Outlook for the Western Arctic

With generally close to normal temperatures over the past winter the fracture and clearing events in the western Arctic area should occur near their normal dates. Mackenzie Bay will clear during the third week in June and Kugmallit bay a few days later. The fast ice along the Tuktoyaktuk peninsula and in Amundsen Gulf will fracture during the first week of July and an open water route from Mackenzie Bay to Cape Bathurst will become established during the third week. Amundsen Gulf will clear and an open water route to Taloyoak will develop during the third week of August. The Coastal waterway between Point Barrow and Prudhoe Bay is expected to open during the third week of July and forecasted to close the first week of October.

Coronation Gulf will fracture near mid-July and clear by the end of the month. Queen Maud Gulf will fracture during the last week in July. Larsen Sound and Peel Sound will both fracture during the first week in August which is a few days later than normal. Due to the unusual amount of old ice, McClure Strait and Viscount Melville Sound will fracture near mid-August which is about a week later than normal.

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Table 3: Western Arctic – Break-up Pattern and Outlook

	2003	Median	Outlook for 2004
Mackenzie Delta			
- Clearing	22 June	17 June	18-21 June
Kugmallit Bay			
- Clearing	24 June	27 June	26-29 June
Tuktoyaktuk Peninsula			
- Fracture[1]	1 July	2 July	30 June – 4 July
Mackenzie Bay to Cape Bathurst			
- Open water	Never	26 July	25-28 July
Coastal waterway Mackenzie Bay to Prudhoe Bay			
- Open drift or less	15 August	13 August	19-22 August
Coastal waterway Prudhoe Bay to Point Barrow			
- Open drift or less	21 July	1 August	19-22 July
- Close pack (refreeze)	20 October	6 October	3 October
Point Barrow to Cape Lisbourne			
- Open drift or less	26 June	3 July	2-5 July
- Open water	14 July	18 July	14-17 July
Open water route to Taloyoak	30 August	16 August	15-18 August
Amundsen Gulf			
- Fracture[1]	2 July	7 July	6-9 July
- Clearing	Never	15 August	13-16 August
Coronation Gulf			
- Fracture[1]	14 July	15 July	14-17 July
- Clearing	1 August	31 July	29 July – 1 August
Queen Maud Gulf			
- Fracture	23 July	23 July	21-24 July
Larsen Sound			
- Fracture[1]	31 July	31 July	1-4 August
Peel Sound			
- Fracture[1]	29 July	31 July	3-6 August

[1] Fracture indicates complete breakage of consolidated ice.

Appendix A - Key To Sea Ice Symbols

For more information on this section, please refer to the following web link on the Canadian Ice Service web site:

http://ice-glaces.ec.gc.ca/App/WsvPageDsp.cfm?ID=155&LnId=3&Lang=eng

or on the National Ice Center web site:

http://www.natice.noaa.gov/egg_code/index.html

Appendix B – Stages of Development of Sea Ice

For more information on this section, please refer to the following web link on the Canadian Ice Service web site:

http://ice-glaces.ec.gc.ca/App/WsvPageDsp.cfm?ID=11170&LnId=32&Lang=eng

Appendix C - Broadcast Schedules For Arctic Ice and Marine Conditions

For more information on this section, please refer to the following web links:

Canadian coast guard:

http://www.ccg-gcc.gc.ca/mcts-sctm/ramn_arnm/Atlantic/part_5_e.htm

Alaska Marine VHF Voice:

http://www.nws.noaa.gov/om/marine/akvhfv.htm

NOAA MF/HF Voice – 4125kHZ:

http://www.nws.noaa.gov/om/marine/noaahfv.htm

NOAA Weather Radio at U.S. Coast Guard Sites in Alaska:

http://www.nws.noaa.gov/om/marine/aknwr.htm

For further information concerning these services please contact Canadian Ice Service by phone (613) 996-1550 or email at cis-scg.client@ec.gc.ca or the National Ice Center by phone at (301) 394-3050 or email liaison@natice.noaa.gov.