Prepared by the North American Ice Service

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

04 June 2008

Seasonal Outlook

For North American Arctic Waters

Summer 2008

Table of contents

Appendix

List of Tables

List of Figures

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. Thorough analyses have been done of extensive Radarsat/Envisat imagery collected during the past winter and spring. NOAA and MODIS satellite imageries were also used for the evaluation of the ice cover. 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 year’s 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 twice monthly 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 A provides a link to the key to ice symbols showing the principle features of the International Ice symbols used on the ice charts. Appendix B contains links to these broadcast schedules as well as Aerial Reconnaissance Radio Facsimile Broadcast and NOAA Alaskan Marine Radio frequencies.

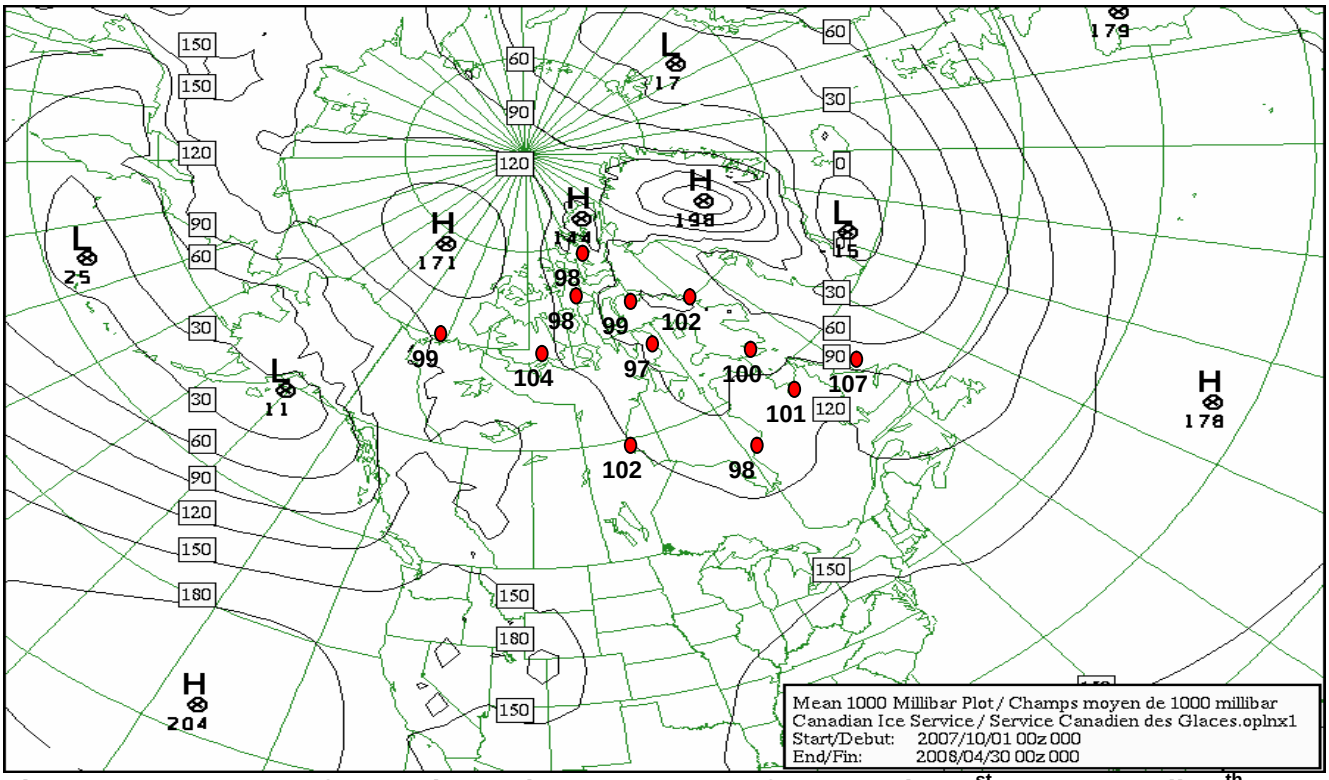

Figure 1: Percentage of Normal Freezing Degree Days from October 1st, 2007 to April 30th, 2008

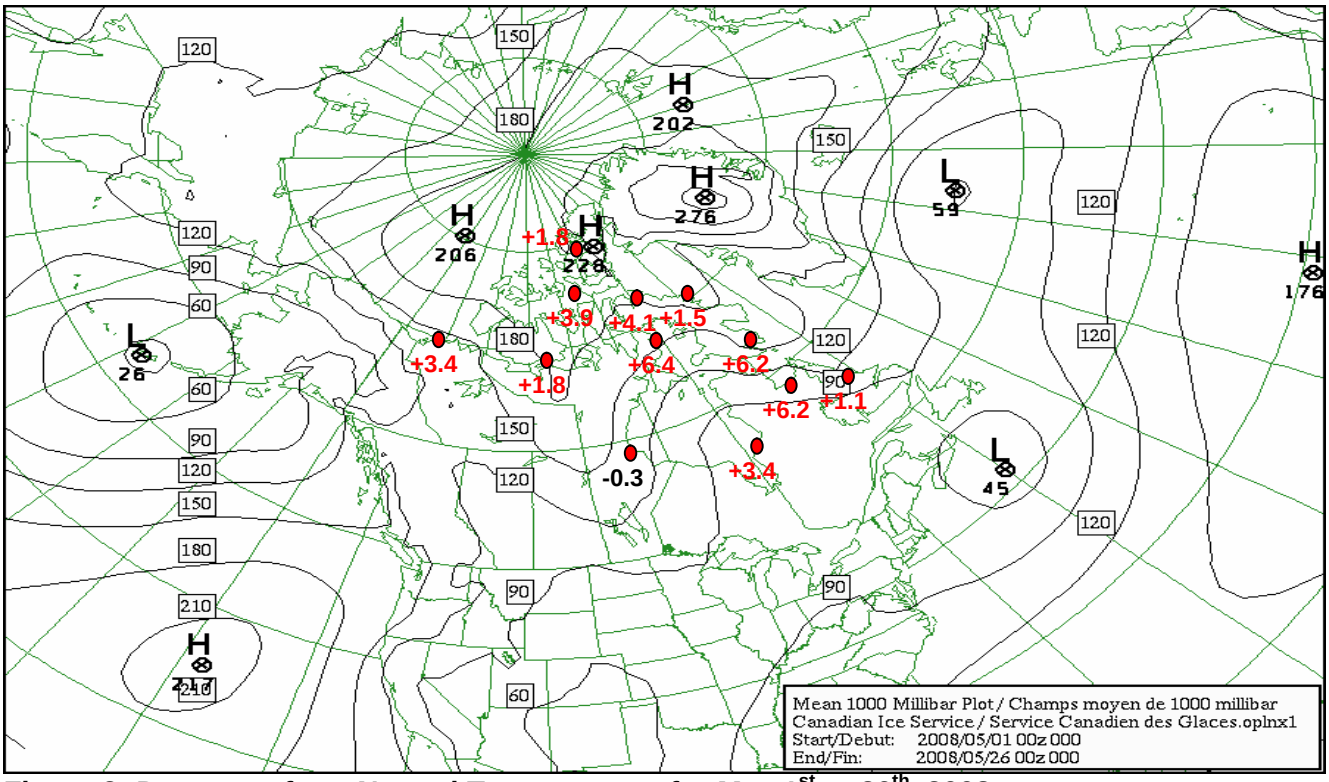

Figure 2: Departure from Normal Temperatures for May 1st to 26th, 2008

General Winter Conditions and Brief Outlook

The mean 1000 mb pressure pattern from October 01st, 2007 to April 30th, 2008 is represented in Figure 1. A low pressure system persisted east of southern Greenland with a trough lying along the western shore of Greenland. A weaker trough was also present over the eastern portion of Hudson Bay. A strong high pressure area prevailed over the Beaufort Sea. As a result, a light to moderate north to northwesterly flow prevailed along the Labrador Coast, in Davis Strait, over Hudson Bay and in Foxe Basin while a more westerly flow prevailed over the Hudson Strait area. Meanwhile, moderate northerly winds prevailed over the Canadian Arctic Archipelago while a moderate to strong easterly flow dominated the western Arctic regions west of Banks Island and along the Alaskan Coast.

During the winter season from October 2007 to April 2008, mean air temperatures were normal over most of the Arctic. However, temperatures were above normal in the western Arctic region west of Banks Island. Temperatures were 1 to 2 °C above normal along the coastal regions of the Yukon and Northwest Territories west of the Amundsen Gulf area. The temperatures reached 1°C below normal values in the Cambridge Bay region. Freezing degree day accumulations for the winter period reached normal values everywhere except exceeded normal values by 4 to 7 percent in the Central Arctic region and along the Labrador Coast. These values are indicated in Figure 1.

The mean 1000 mb pressure pattern up to May 26th is shown in Figure 2. A broad high pressure area dominated the High Arctic with a primary ridge extending southward along the east coast of Baffin Island and a secondary ridge extending southward through Cambridge Bay. Low pressure systems remained well south of the Arctic regions (60°N) with a first system on the East Coast south of Sable Island and a second one near the Aleutian Islands. Trough lines extended along the west coast of Greenland and across central Hudson Bay. Light to moderate east to northeast winds prevailed in the Eastern Arctic and Hudson Bay regions while the High Arctic remained under a light easterly flow during the period. Moderate easterly winds persisted over the Western Arctic during much of May. Throughout this period, above normal temperatures ranging between +1 to +6 °C prevailed over all Arctic regions except for the western shore of Hudson Bay which remained near normal values.

For the first half of June, above normal temperatures are generally forecast for the whole Arctic area except for near normal temperatures over south-western Hudson Bay. From June to August the temperatures are forecast to remain above normal for much of the Arctic regions south of 75°N while the High Arctic regions temperatures are forecast to remain near normal. Consequently, the Western Arctic region will experience an earlier than normal break up pattern, while the Central and High Arctic should expect near normal break up events. The presence of old ice east of the Baffin Island coast coupled with above normal temperature will cause the break up events to occur near normal dates. The Hudson Bay region will see normal break up events while the Hudson Strait and the Labrador Coast will see earlier than normal break up events.

Hudson Bay and Approaches

Freeze-up and Winter Ice Regime

Air temperatures were near normal for most of Hudson Bay during freeze-up. Below normal air temperatures over west coast sections during the last week of October led to a 1-week earlier-than-normal freeze-up there. Elsewhere, freeze-up was delayed by 1 week over most of the bay and by 2 weeks to the east of the Belcher Islands. In Hudson Strait, freeze-up was 1 week early along the western shores of Ungava Bay, 1 week late over the extreme western part of Hudson Strait and southeast of Baffin Island, but near normal elsewhere. Measured ice thicknesses at Coral Harbour were normal at the beginning of December and slightly greater than normal at the end of January.

Ice growth began early along the west and south coasts of Hudson Bay, and then slowed significantly by mid-November. New ice started to form along the shores of Southampton Island, in Roes Welcome Sound and along the western shore of Hudson Bay during the last week in October. By mid-November, new ice also extended along the southern shore of Hudson Bay and had formed along the western shores of Ungava Bay. By the end of November, grey-white ice dominated Roes Welcome Sound and extended south of Southampton Island. Grey-white ice in western Davis Strait reached south of Cumberland Sound, which was filled with grey ice. New and grey ice lay along all the shores of Hudson Bay and James Bay except southeast of the Belcher Islands. New and grey ice filled the southern halves of Hudson Strait and Ungava Bay.

Ice growth was slightly slower-than-normal in December. By the end of the month, Hudson Bay, Hudson Strait, Davis Strait, and the Labrador Coast were completely ice covered, and concentrations were everywhere near-normal. However, ice thicknesses in southeastern Hudson Bay and in Hudson Strait were less-than-normal, with grey-white as opposed to first-year ice predominating in these areas.

By the end of January, Hudson Bay and Davis Strait were covered with thin to medium first-year ice. Hudson Strait and the Labrador Coast were covered with thin first-year ice. The ice extent was near normal over all areas except much greater than normal along the northern Labrador Coast and in Davis Strait. The trace of old ice lay just east of Cape Chidley at this time. Higher-than-normal concentrations of old ice were present in Davis Strait and extending south of Cape Dyer.

From early February until the end of March temperatures were below normal over all of Hudson Bay and its Approaches. This resulted in significant ice growth throughout the regions and the unusual development of young ice which extended much further east than normal along the northern portion of the Labrador Sea. By the end of March, the entire region had caught up to normal with respect to freezing degree days and ice thicknesses. Very close pack medium and thick first-year ice covered most of the area except for open drift to close pack grey-white and first-year ice along the ice edge. The ice edge extended about 100 to 200 miles off the Labrador Coast. By the end of March, the old ice had

continued its southward movement. A narrow band of 1 to 3 tenths multi-year ice lay roughly 40 to 60 miles off the Baffin Island Coast. The southern extent of this narrow band of old ice covered the entrance to Hudson Strait to just north of 60°N. A trace of multi-year ice was also present further offshore along the Baffin Coast and along the Labrador Coast.

During April and most of May, the temperature trend had reversed and above normal temperatures were reported over the entire area except for near normal temperature along the western shore of Hudson Bay. Some cracks and leads developed along portions of the coast in late April and some areas widened by late May to create larger areas of open water in the northwestern portion of Hudson Bay and bergy water regions at both ends of Hudson Strait. In Hudson Bay, coastal leads helped loosen the prevailing very close pack thick first-year ice condition. Small areas of open water seen along the eastern coast of Hudson Bay and in the vicinity of most islands in early May had widened by late May to a 30 to 60 mile open water corridor running along most of the entire eastern shore of Hudson and James Bays. Despite these large openings, many major ports are still affected by the coastal fast ice. During this two-month period, the eastern ice edge in southern Davis Strait retreated westward to a slightly less than normal extent. This westward ice drift forced some old ice which trickled along the east coast of Baffin Island to move into Hudson Strait north of Ungava Bay. However, by late May, much of the old ice had flushed out of the entrance to Hudson Strait leaving only a trace of old ice in that area. Further south along the Labrador Coast, the ice pack had loosened somewhat in April to create areas of close pack to open drift medium and thick first-year ice with a trace of old ice. By late May, the prevailing easterly winds had packed the ice closer to the coast into a lesser than normal extent. The Groswater Bay area was showing areas of bergy water near the shore in early April and the bergy water areas expanded during May as the first-year ice melted back. Lake Melville broke up during the third week of May and open water conditions were reported towards the end of May.

Over Newfoundland waters, despite near normal temperatures between April and late May, the retreat of the ice pack was, in general, delayed by nearly two weeks. By late May, much of Newfoundland and south Labrador Coast waters were bergy water with only an area of very close pack first-year ice remaining near the Baie Verte Peninsula. Isolated patches of open drift ice were also present along portions of the Northern Peninsula coast and off the south-Labrador coast regions.

Observed Ice Conditions

The regional ice chart in figure 3 was based on the analysis of Radarsat/Envisat and NOAA/MODIS imageries from around May 26th, 2008. This chart reveals some of the following features:

a) A 30 to 60 mile open water lead running along most of the eastern side of Hudson and James Bays.

b) The ice edge over Davis Strait and Labrador Waters is slightly further west than normal but the ice was more closely packed than normal.

c) Normal leads were present along the northwestern shore of Hudson Bay and west of Southampton Island.

d) The coastal fast ice grew thicker this winter than in past 3 to 5 years.

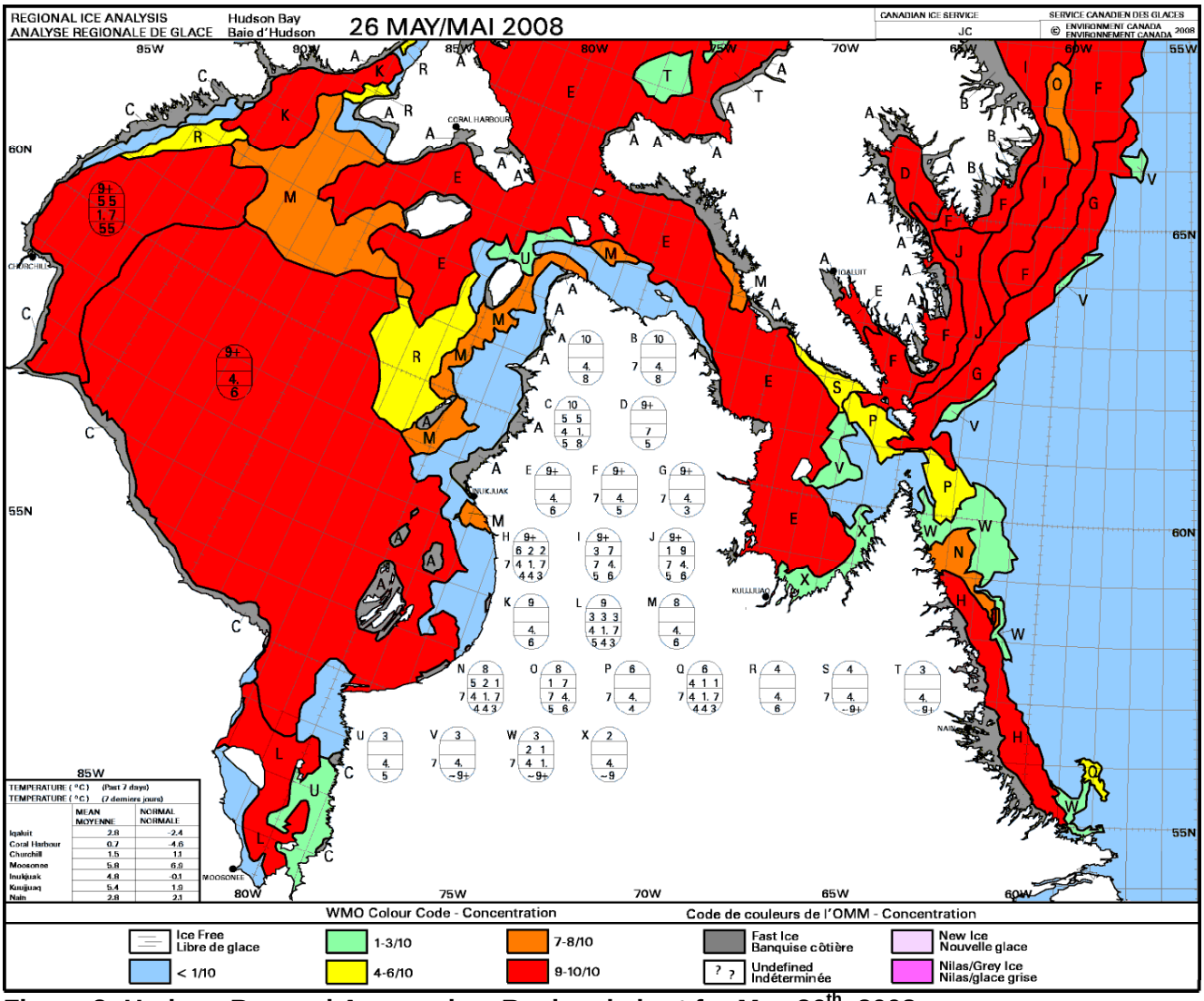

Figure 3: Hudson Bay and Approaches Regional chart for May 26th, 2008

Outlook for Hudson Bay and Approaches

For the end of May through mid-June, temperatures are forecast to be above normal values everywhere except for near normal values along the western shore of Hudson Bay. Summer temperatures from June to August are forecast to be above normal over all areas of Hudson Bay and the East Coast. These above normal temperatures are expected to counteract the additional freezing degree days accumulated during the second half of the winter. The significant melt of the ice along the southern region of the Labrador Coast will favour an early clearing of the ice along the Labrador Coast up to Cape Chidley; this is

expected to occur near mid-July. The Hudson Strait region, which is already showing regions of bergy water at both ends, is expected to develop a bergy water route near mid-July while the complete clearing of the ice in the strait and Ungava Bay will not occur until the end of July. The ice in Hudson Bay will continue to loosen along the eastern shore while maintaining higher ice concentrations along the western shore. At the end of July, much of the ice along the shores will have melted allowing for an open water route into Churchill. The last ice will clear from the south central region of the bay by mid-August. For James Bay, even though the break up had already started in the southern region by mid-May, the overall melt pattern in the southern part of Hudson Bay will affect the clearing of the northern half of James Bay. As a result, the total clearing will only occur in early August. For the Frobisher Bay area, the temperature forecast points toward a rapid clearing of the bay, however, the presence of old ice flowing southward along the Baffin Island coast and near the entrance of the bay will result in a normal break up pattern. Consequently, the open drift or less route will develop near mid-July while the bergy water route to Frobisher Bay will only develop in the first week of August.

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

	2007	Median	Outlook for 2008
Labrador Coast to Cape Chidley **- Clearing**	15 Jul	29 Jul	12-14 Jul
Frobisher Bay **- Open drift or less** **- Clearing**	15 Jul 03 Aug	19 Jul 07 Aug	17-19 Jul 05-07 Aug
Ungava Bay **- Clearing**	17 Jul	03 Aug	27-29 Jul
Bergy water route through Hudson Strait (eastern entrance to south of Nottingham Island)	10 Jul	27 Jul	14-16 Jul
Hudson Strait **- Clearing**	22 Jul	08 Aug	28-30 Jul
Bergy/open water route to Churchill (eastern entrance of Hudson Strait to Churchill)	10 Jul	30 Jul	26-28 Jul
Open water route through northern Hudson Bay (south of Nottingham Island to Churchill)	08 Jul	20 Jul	26-28 Jul
Hudson Bay **- Clearing**	03 Aug	16 Aug	16-18 Aug
James Bay **- Clearing**	30 Jul	30 Jul	04-06 Aug

Eastern Arctic

Freeze-up and Winter Ice Regime

Temperatures were above normal over most of the area until the end of October. They were below normal over sections south and west of Jones Sound during the first 3 weeks of November, and below normal in southern Baffin Bay and Davis Strait in the last week of November. Temperatures were again above normal everywhere through most of December. Freeze-up was 1-2 weeks early in the very extreme northwest of Baffin Bay, but delayed by a week over Jones Sound and Baffin Bay / Davis Strait and delayed by 3-4 weeks in Lancaster Sound, Prince Regent Inlet, and the Gulf of Boothia. By the end of January, measured ice thicknesses in Resolute Bay and Eureka were greater than normal due to patchy colder-than-normal January temperatures, although calculated ice thicknesses predicted normal conditions in these areas. End-of-January measured ice thicknesses in Hall Beach were normal.

By the end of the summer of 2007, the old ice distribution was greater than normal along the east coasts of Ellesmere and Devon Islands, in Nansen and Eureka Sounds, and in Norwegian Bay. At the same time, old ice amounts in the Gulf of Boothia and Committee Bay were drastically reduced.

By mid-September, new ice started forming in Nansen and Eureka Sounds and in northwestern Norwegian Bay. By the end of September it was forming in Jones Sound and northwestern Baffin Bay.

By mid-October, ice had not yet formed in Lancaster Sound, Prince Regent Inlet or the Gulf of Boothia. Ice in these areas did finally form by the end of October, later than normal. By the end of October, ice in the Gulf of Boothia, Lancaster and Jones Sounds, and Northern Baffin Bay had thickened to grey and grey-white ice, while ice in Norwegian Bay and northwards had thickened to thin first-year ice. Nansen and Eureka Sounds consolidated near mid-October, both areas 1 week later than normal.

By mid-November, Pelly Bay, McDougall Sound, Admiralty Inlet (up to Nanisivik), Eclipse Sound and Navy Board Inlet had consolidated. Ice extents were near normal everywhere except along the leading edge of the ice in mid-Baffin Bay, in Cumberland Sound and along the west Greenland Coast. At this time the ice growth in Davis Strait / Baffin Bay extended eastward to 60°W and southward from 75°N along the western Greenland Coast to 65°N near the entrance to Cumberland Sound. Freeze-up in most of Baffin Bay was about 1 week later than normal. There was patchy two-tenths of old ice in western Baffin Bay. Most of Foxe Basin was covered with grey-white to thin first-year ice.

By the end of December, Barrow Strait west of Resolute Bay had become consolidated. Baffin Bay was covered with medium first-year ice with areas of 3-tenths of old ice in western sections. The bergy water lead along the west Greenland Coast had closed down to near 67°N.

By the end of January, the ice extent was normal everywhere except greater than normal along the Greenland Coast. Barrow Strait had entirely consolidated with Lancaster Sound and Prince Regent Inlet remaining mobile. Ice in Nares Strait remained mobile, allowing old ice to continue flowing from the Lincoln Sea into Baffin Bay. As a result, there was a long line of three to five tenths of old ice in the main ice pack in Baffin Bay. The bergy water along the west Greenland Coast was restricted to a much narrower-than-normal strip, barely reaching north of 67°N.

Between early February and the end of March temperatures were below normal inside the archipelago while temperatures along the east coast of Baffin Island remained near normal, with warmer periods interspersed with colder ones. The ice thickened up to mostly thick first-year ice inside the archipelago while medium first-year ice was the predominant ice type in Baffin Bay, Davis Strait and Foxe Basin. The ice continued to be mobile in Lancaster Sound and Prince Regent Inlet. The old ice continued to pour into the western portion of Baffin Bay because the bridge in Nares Strait only briefly formed in Smith Sound at the end of March. This initial bridge formation collapsed a few days later and a new bridge reformed by mid-April, roughly 60 miles further north in Kane Basin. A 120-mile wide corridor of old ice, with pockets reaching concentrations of 3 to 5 tenths, continued to move southward along the east coast of Baffin Island. This corridor narrowed significantly south of 68°N. The overall ice extent along the Greenland coast was still greater than normal with a brief period of no bergy water at all appearing on the regional charts near mid-March. The ice thickness near the Greenland Coast, however, was only a mix of grey-white and thin first-year ice.

From early April to late May, with the advent of the spring sunrise, temperatures were predominantly above normal over all regions, although the mean air temperature remained below zero. By late May, predominantly thick first-year ice existed throughout the region except for a large region of bergy water south of the Nares Strait ice bridge. The ice bridge re-consolidated in its usual location across Smith Sound near the end of April and has been holding ever since. From April through mid-May small areas of coastal fast ice containing old ice broke off south of the bridge. As a result, small pieces of old ice drifted into northwestern Baffin Bay and across the entrance to Lancaster Sound. During the latter part of May, ice concentrations decreased significantly along the west Greenland Coast, allowing for an open drift navigable route to develop there. The ice edge in Davis Strait was slightly further west than normal; however the ice was more closely packed than usual. Small openings in the ice in Cumberland Sound near mid-May gradually filled back up by the end of May. The ice in Lancaster Sound briefly consolidated north of the Brodeur Peninsula and in the northern portion of Prince Regent Inlet during the third week of April but managed to become mobile again as far west as Prince Leopold Island near mid-May. At that time, several small areas of lower ice concentrations were appearing in the Foxe Basin region. By late May, these small regions grew slightly bigger to form several pockets of open water.

Observed Ice Conditions

The regional ice chart in figure 4 was based on the analysis of Radarsat/Envisat and NOAA/MODIS imageries from around May 26th, 2008. This chart reveals some of the following features:

a) The bergy water lead along the west Greenland Coast extended northward to 73°N which is further north than normal; an open drift route was already present north of this point.

b) The fast ice edge in eastern Barrow Strait was located near Prince Leopold Island which is normal.

c) No old ice was present in Admiralty Inlet, the Gulf of Boothia and Committee Bay.

d) The eastern extent of the sea ice was slightly further west than normal in Davis Strait and southern Baffin Bay.

e) More old ice than normal was present in western Baffin Bay, in northern Davis Strait and in Eureka Sound.

f) The North Open Water polynia had extended into a large area of bergy water.

g) More openings than normal were present in the Foxe Basin region.

h) A tightly packed multi-year ice region prevailed beyond the northwestern coast of the Canadian Arctic Archipelago.

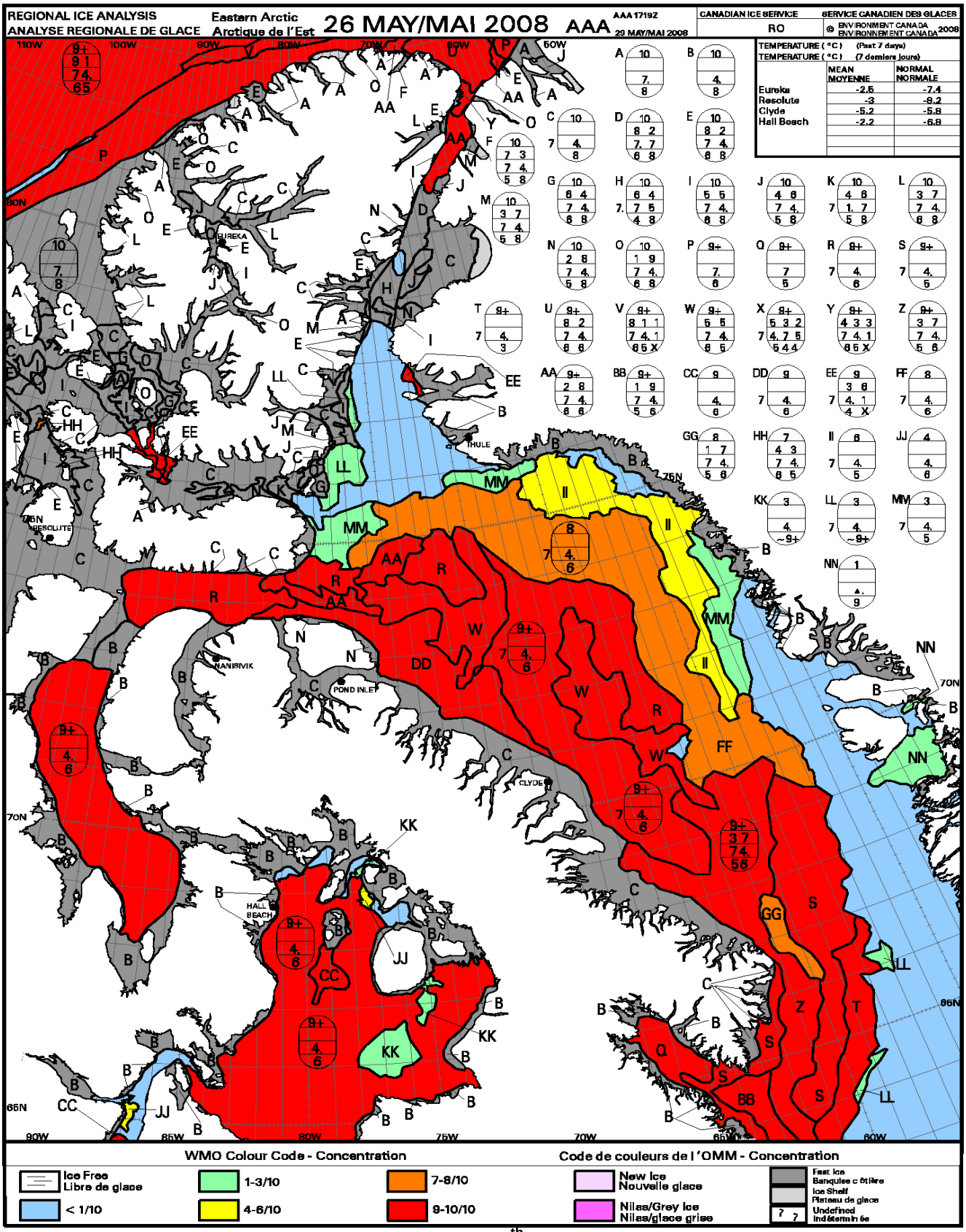

Figure 4: Eastern Arctic Regional chart for May 26th, 2008

Outlook for the Eastern Arctic

The temperature from mid-May through mid-June and throughout the months of July and August is forecast to be above normal for most of the Arctic regions. Normal temperatures are expected for only a few areas north of 75°N. This will help the open drift or less route in northern Baffin Bay to develop after mid-July. The ice bridge in Nares Strait is also expected to collapse during this time, allowing for more old ice to penetrate the entrance of Lancaster Sound and invade that area during the summer months. Because of the significant concentration of old ice, the complete clearing of Baffin Bay is not expected until the second week of September while the Davis Strait region is expected to clear in early September. The open drift or less routes into Home Bay and Cape Dyer will occur normally towards the end of July or the first week of August.

A warmer than normal temperature forecast coupled with a trace of old ice in the eastern half of the Northwest Passage will promote a navigable passage again this summer; this could represent the first time in history that the Northwest Passage will be predominantly open water two years in a row. Unfortunately, because the Archipelago region was subjected to below normal temperatures during the winter months, this event is only expected to occur in early August. Consequently, the usual fracturing events over the various regions will take place on normal dates (e.g. early July for the eastern portion of Barrow Strait and the third week of July for the western section). The fracturing of Jones, McDougall and Eureka Sounds including Norwegian Bay is expected to occur in the first week of August at the latest.

The Foxe Basin region will continue to develop more extensive areas of open water around the many islands throughout June and July, but the open water route into Hall Beach is only expected to develop at the end of August.

For Pelly Bay, no old ice was observed southeast of Somerset Island during the winter and only a small area containing trace amounts of old ice was noted east of the island. This situation will help in the melting of the first-year ice this summer. The clearing of the southern part of Prince Regent Inlet, however, will only occur at the end of August or in early September.

Although the open drift or less route to Thule is almost navigable now, the coastal fast ice in the vicinity of Thule will not break until the third week of June. The annual Pacer Goose mission will not be threatened by ice conditions this summer.

Table 2: Eastern Arctic - Break-up Outlook Dates

	2007	Median	Outlook for 2008
Route across Northern Baffin Bay			
- Open drift or less	21 Jun	18 Jul	19-21 Jul
- Bergy water route	27 Jul	28 Jul	29-31 Jul
Baffin Bay			
- Clearing	06 Sep	10 Sep	09-11 Sep
Davis Strait			
- Clearing	04 Sep	02 Sep	02-04 Sep
Home Bay			
- Open drift or less	06 Aug	08 Aug	05-07 Aug
Cape Dyer			
- Open drift or less	28 Jul	27 Jul	28-30 Jul
Open water route			
to Hall Beach	29 Aug	03 Sep	29-31 Aug
Foxe Basin			
- Clearing	03 Oct	21 Sep	20-22 Sep
Pond Inlet			
- Fracture[1]	22 Jul	24 Jul	19-21 Jul
- Clearing	07 Aug	12 Aug	06-08 Aug
Admiralty Inlet northern half			
- Fracture[1]	19 Jul	21 Jul	20-22 Jul
- Bergy water	11 Aug	10 Aug	10-12 Aug
Lancaster Sound			
- Fracture[1]	Not consolidated	08 Jul	Not consolidated
Barrow Strait to Resolute			
- Fracture/eastern[1]	23 Jun	09 Jul	04-06 Jul
- Fracture/western[1]	15 Jul	25 Jul	19-21 Jul
Wellington Channel			
- Fracture[1]	16 Jul	28 Jul	26-28 Jul
McDougall Sound			
- Fracture[1]	21 Jul	03 Aug	02-04 Aug
Kane Basin			
- Fracture[1]	Not consolidated	23 Jul	18-20 Jul
Jones Sound			
- Fracture[1]	28 Jul	31 Jul	01-03 Aug
Norwegian Bay			
- Fracture/southern[1]	21 Jul	01 Aug	02-04 Aug
- Fracture/northern[1]	26 Jul	08 Aug	09-11 Aug
Eureka Sound			
- Fracture[1]	26 Jul	02 Aug	01-03 Aug
- Bergy water	Never cleared	18 Aug	Never clear
Pacer Goose route to Thule			
-Open drift or less	25 Jun	19 Jul	19-21 Jun
-Bergy water route	09 Jul	29 Jul	28-30 Jun

[1] Fracture indicates complete breakage of consolidated ice.

Western Arctic

Freeze-up and Winter Ice Regime

Temperatures were above normal everywhere until the end of October. As a result, freeze-up was delayed by one to two weeks over all areas. Two periods of below-normal temperatures occurred: 1) in early November, east of Amundsen Gulf and M'Clure Strait; and 2) beginning in late December along the Alaskan coast, then spreading across the entire Beaufort Sea in early January. As a result, by the end of January, measured ice thicknesses were close to normal at Cambridge Bay, although calculated ice thicknesses were less than normal. Measured and calculated ice thicknesses were less than normal at Inuvik and Tuktoyaktuk as a result of persistent warmer than normal sea surface temperatures in the southern Beaufort Sea.

At the end of summer 2007 (at the beginning of freeze-up), the old ice extent was considerably less than normal in the Beaufort Sea, M'Clure Strait, Viscount Melville Sound and M'Clintock Channel. Although pockets of greater than normal concentrations of old ice could be found in narrow straits and bays, the Northwest Passage was open from end to end. The Ayles Ice Island had entered Sverdrup Channel, where it had fractured into two pieces. There was open water from Larsen Sound through Dease Strait into the Amundsen Gulf and over the southern Beaufort Sea up to 75°N, except for a section of the pack between 130-150°W which reached down to 72°N. The main pack of old ice had disappeared north of the Alaskan Coast.

New ice growth started in mid-September in M'Clure Strait and Viscount Melville Sound, thickening to grey ice by the end of September in these areas. Elsewhere, new ice formation did not occur until the second and third weeks of October, 1-2 weeks later than normal.

By the end of October, new and grey ice covered most of the southern Beaufort Sea and the southern route of the Northwest Passage. The old ice pack remained well north, concentrated in the central Beaufort Sea, and grey-white ice surrounded the edges of the pack. Areas of open water still existed in Coronation Gulf, between the shore and pack ice north of the Alaskan coast, and west of Point Barrow. Thin first-year ice filled M'Clure Strait, M'Clintock Channel and Peel Sound, and Larsen Sound was covered with predominantly grey-white ice. Portions of the Tuktoyaktuk Peninsula and Mackenzie Bay had become consolidated. By the end of October, ice had consolidated in Prince Gustaf Adolf Sea and in Sverdrup and Peary Channels. The two fragments of the Ayles Ice Island had become trapped in the fast ice, one on either side of Amund Ringnes Island.

By mid-November, Larsen Sound was covered in thin first-year ice and the southern route of the Northwest Passage, from Rae Strait to Amundsen Gulf was covered in grey-white ice. By the end of November, Rae Strait to Amundsen Gulf was also covered in thin first-year ice, and thin first-year ice also surrounded the old ice pack in the central Beaufort Sea, which remained north of 73°N. Ice had consolidated in M'Clure Strait and Viscount

Melville Sound as well as from Peel Sound to Coronation Gulf, although not in M'Clintock Channel. Ice had also consolidated around Cape Parry and along the Alaskan coast east of Point Barrow. West of Amundsen Gulf, between the mainland coast and 71.5°N, ice continued to be composed mainly of new and grey ice, and significant areas of open water persisted. Normally, by the end of November, this area would be entirely covered with thin first-year ice and the old ice edge would extend southwards to 71.5°N.

By mid-December, ice in and to the east of M'Clure Strait and Dolphin and Union Strait had thickened to medium first-year ice. Ice had consolidated in Dolphin and Union Strait. The old ice pack in the central Beaufort Sea had skewed eastward and lay close to the Banks Island coast. Thin first-year ice mostly covered the southern Beaufort Sea except in the vicinity of Point Barrow and westward, which was covered in grey-white ice. By the end of December, the old ice pack in the Beaufort Sea showed significant fragmentation and was interspersed with areas of grey, grey-white, and medium first-year ice. The ice in M'Clintock Channel had finally consolidated, one month later than normal.

During the first week of January, the consolidated ice in M'Clure Strait fractured in an unusual event. A large lead also opened between the consolidated ice in Dolphin and Union Strait and the mobile first-year ice in Amundsen Gulf. Large leads of grey and grey-white ice could be seen in the old ice pack in the Beaufort Sea. By mid-January, the ice in the leads in the old ice pack had thickened to predominantly thin first-year ice, while the lead or polynia in Amundsen Gulf remained predominantly covered in grey-white ice. By the end of January, all consolidated ice within the archipelago and along the mainland Canadian and Alaskan coasts had thickened to thick first-year ice. Elsewhere, except for the old ice pack, the ice cover was primarily composed of medium first-year ice. The old ice pack had pushed southwards to 70.5°N, but remained extremely fragmented and narrow, not reaching further west than 150°W.

From the beginning of February to the end of March, the temperature oscillated between cold outbreaks and warm spells for the area west of Amundsen Gulf but remained predominantly below normal within the central Canadian Arctic region. The week-long warm spells during the winter months were responsible for creating large leads in the eastern part of Amundsen Gulf, west of Banks Island and off the fast ice edge along the Yukon and Northwest Territories' coast. The leads quickly filled with young ice which thickened back up to thin and medium first-year ice by the end of March. Meanwhile, the old ice pack south of 75°N raced westward – traveling more than 120 miles – along the Alaskan coast but managed to stay beyond 60 miles north of the coast. Further north, prevailing northerly winds kept the old ice tightly packed along the west coasts of the northern islands of the archipelago. Although M'Clure Strait reconsolidated east of 120°W by mid-March, the Amundsen Gulf never consolidated during the period.

From April to mid-May, the sun had already started to warm the entire region. Near to above normal temperatures prevailed over all areas although the actual values remained below zero. For the last two weeks of May, temperature started to rise above zero at the coastal stations located on the mainland and at Sachs Harbour located on the southwestern tip of Banks Island.

By early April, M'Clure Strait had reconsolidated between Banks Island and Prince Patrick Island. Most of the winter seasonal ice had thickened to thick first-year ice throughout the Archipelago. By the end of April, the accumulated freezing degree days in the central Canadian Arctic had reached values not seen for the past four years, while Cambridge Bay had reached values unrivalled in the past 17 years. By late May, large openings existed in the pack ice east of a line between Herschel Island and the southwestern tip of Prince Patrick Island and in the Amundsen Gulf, although the thickening of the ice in the leads was by now considerably reduced due to the warmer air temperatures. Such openings in the pack ice are usually seen in late June. This suggests the current deterioration of the ice in that region is one full month ahead of normal. Medium and thick first-year ice still prevailed in these more loosely packed ice areas with the thinnest observed ice being grey-white ice; the grey and new ice have already melted. Meanwhile, the old ice has continued its westward movement along the Alaskan Coast and the heaviest concentration now lies northwest of Point Barrow. Only a trace to one tenth of old ice is found within 100 miles of the Alaskan Coast. Most of the Bering Strait is still covered with medium and thick first-year ice. A lead off the coastal fast ice has developed early along the western Alaskan coast between Point Barrow and Cape Lisburne. Only a narrow band of very close packed medium first-year ice near Point Hope prevents the open drift or less route to Wainwright from forming at this time.

Observed Ice Conditions

The regional ice charts in figures 5 and 6 were based on the analysis of Radarsat/Envisat and NOAA/MODIS imageries from around May 26th, 2008. These charts reveal some of the following features:

a) Only a trace of old ice can be found in the western portion of the Northwest Passage between Amundsen Gulf and Peel Sound.

b) The maximum southern extent of the old ice was normal in the Beaufort Sea; however, the main old ice pack was roughly 250 miles further north than normal with an abnormally broad region of 6 to 8 tenths old ice concentration found between 72 and 77°N.

c) The northern sections of M'Clure Strait and Viscount Melville Sound only contained a trace of old ice while the southern sections only showed 6 tenths of old ice; this represents significantly less old ice than normal for both regions.

d) A significant lead was present between Cape Lisburne and Point Barrow.

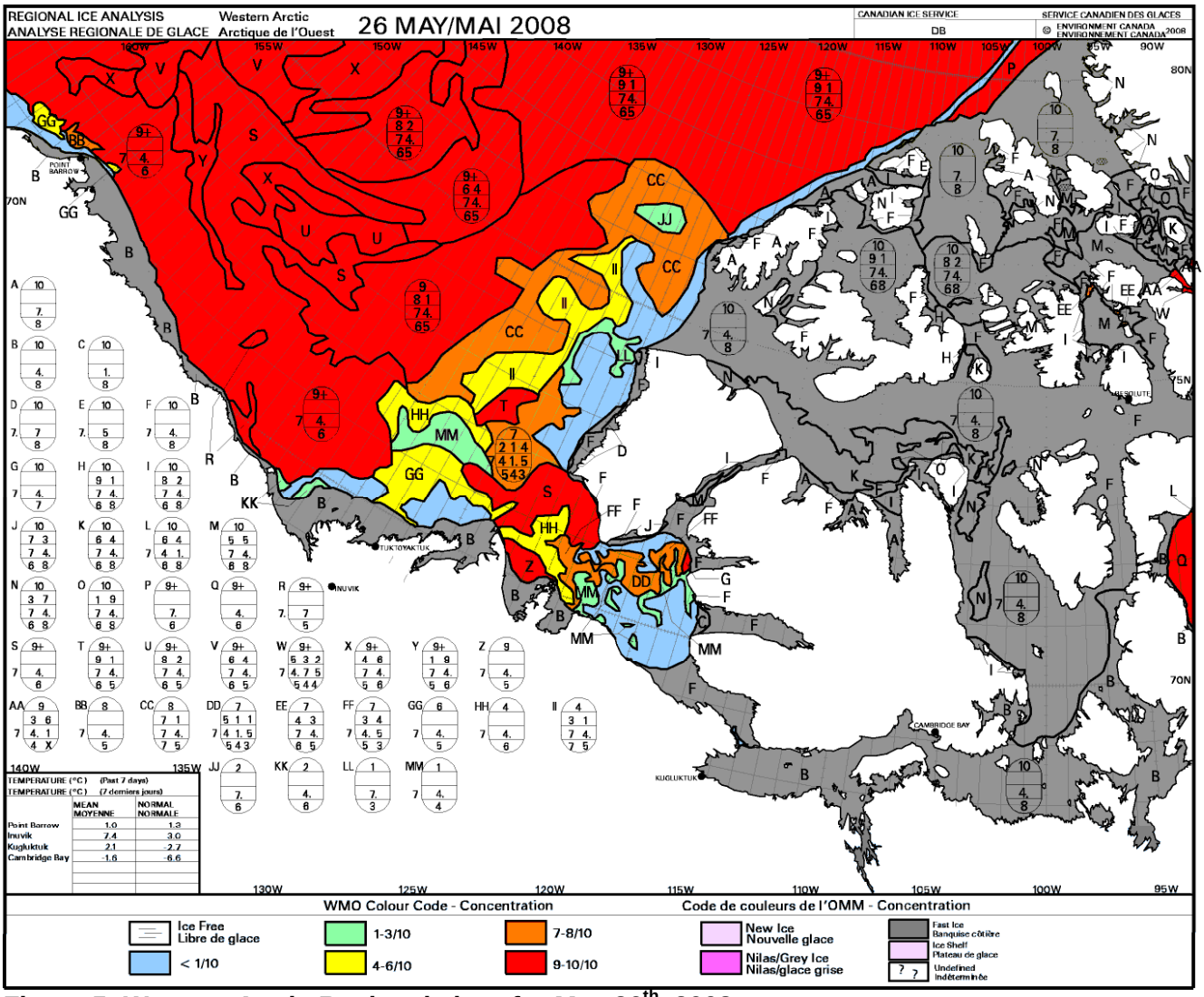

Figure 5: Western Arctic Regional chart for May 26th, 2008

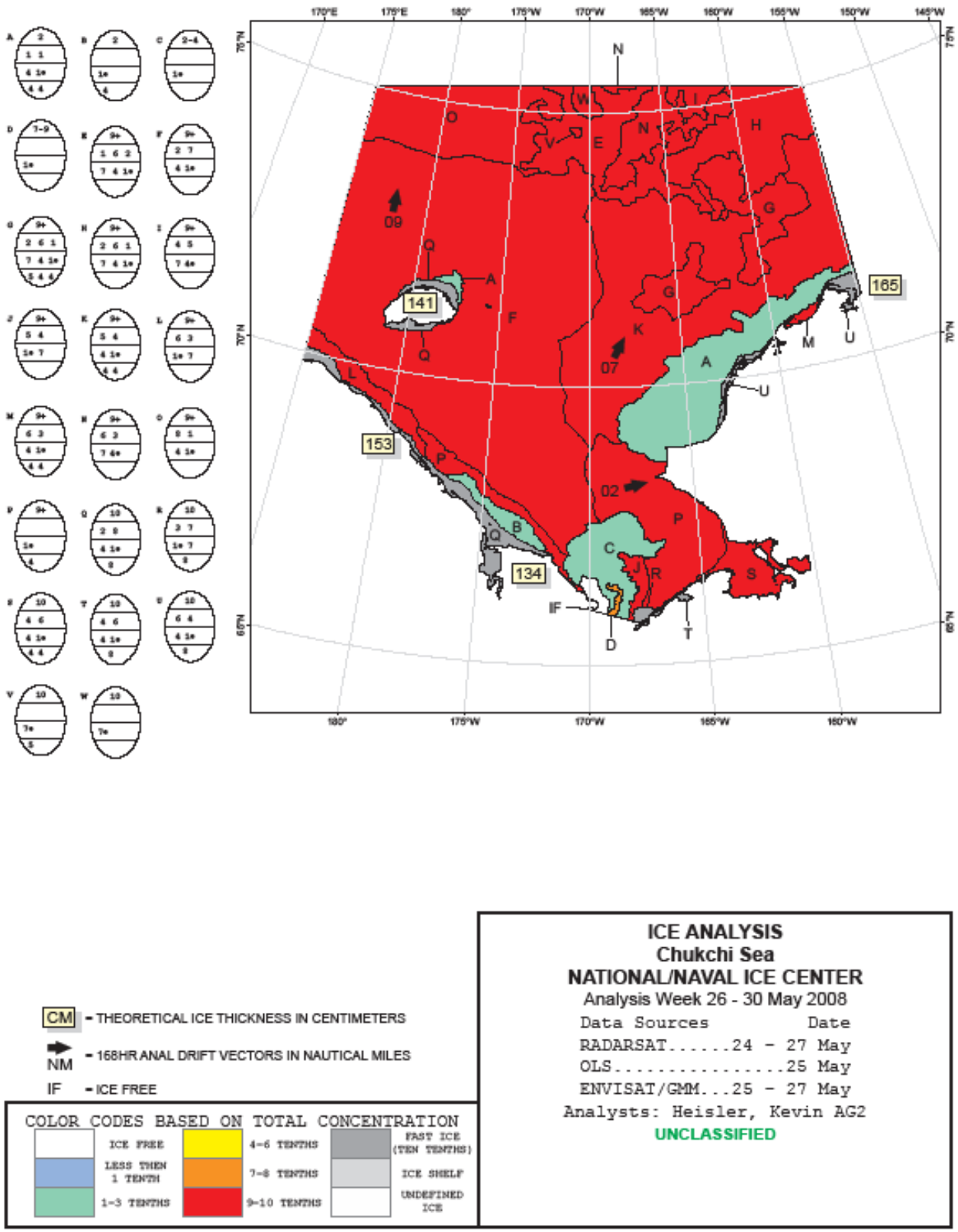

Figure 6: Chukchi Sea Regional chart for May 26th, 2008

Outlook for the Western Arctic

Temperatures for June are forecast to be above normal over all coastal regions of Alaska, Yukon and the Northwest Territories while the three-month period from June through August is forecast to be above normal. Only the northwestern portion of the Canadian Arctic Archipelago is forecast to experience normal temperatures throughout the entire summer. The June coastal temperatures support the early clearing of the Amundsen Gulf region. However, it should be remembered that once the first-year ice has melted, the multi-year ice in Prince of Wales Strait will be free to drift into the northern portion of the Amundsen Gulf region. This will prevent the region from clearing completely this summer. Although an open water route between Mackenzie Bay and Cape Bathurst is expected to develop roughly one full month earlier than normal, the coastal route will only be navigable near the mid-July period once the fast ice breaks free from the Tuktoyaktuk Peninsula. The old ice pack in the Beaufort Sea should remain 90 miles beyond the coast and should not pose a serious threat to offshore shipping or transit. The coastal fast ice along the Alaskan Coast will break and melt near normal dates. This will cause the open drift or less coastal route from Mackenzie Bay to Prudhoe Bay to be fully navigable by the tugs in the second week of August. The above normal temperature forecast for the central Arctic region will counteract the additional freezing degree day values accumulated during the winter months. Consequently, the fracturing of the ice in Coronation Gulf is expected to occur during mid-July while the Queen Maud Gulf, Larsen Sound and Peel Sound areas will only fracture in the last week of July or in early August. Once the ice starts fracturing, the melt of the ice will accelerate. This will promote a navigable corridor across the western portion of the Northwest Passage by mid-August. The open water route to Taloyoak is the only event which is forecast to occur later than normal; this should take place towards the end of August. At that time, the southern route of the Northwest Passage will also be open water.

This summer is the last field season of the International Polar Year. Science vessels are expected to venture far inside the Beaufort Sea region where the multi-year ice pack traditionally resides. Subsequent to the huge leads and cracks which opened in the multi-year ice pack throughout the winter south of 76.5°N, the overall concentration of old ice will range between 5 to 8 tenths in that region. The old ice concentration will increase rapidly as vessels travel north of 77°N.

Table 3: Western Arctic - Break-up Outlook Dates

	2007	Median	Outlook for 2008
Mackenzie Bay			
- Clearing	21 Jun	18 Jun	18-20 Jun
Kugmallit Bay			
- Clearing	21 Jun	26 Jun	22-24 Jun
Tuktoyaktuk Peninsula			
- Fracture[1]	01 Jul	02 Jul	03-05 Jul
Mackenzie Bay to Cape Bathurst			
- Open water route	12 Jul	27 Jul	18-20 Jul
Coastal waterway Mackenzie Bay to Prudhoe Bay			
- Open drift or less	22 Jul	14 Aug	08-10 Aug
Coastal waterway Prudhoe Bay to Point Barrow			
- Open drift or less	25 Jul	01 Aug	08-10 Aug
- Close pack (refreeze)	08 Oct	08 Oct	10-12 Oct
Cape Lisburne to Point Barrow			
- Open drift or less	10 Jun	03 Aug	18-20 Jun
- Open water route	02 Jul	17 Aug	06-08 Aug
Wainwright			
- Open drift or less	24 Jun	29 Jun	18-20 Jun
Coastal waterway Prudhoe Bay to Barter Island			
- Open drift or less	20 Jul	12 Aug	08-10 Aug
Open water route to Taloyoak	07 Aug	16 Aug	26-28 Aug
Amundsen Gulf			
- Fracture[1]	Not consolidated	07 Jul	Not consolidated
- Clearing	Never	15 Aug	Never clear
Coronation Gulf			
- Fracture[1]	15 Jul	15 Jul	17-19 Jul
- Clearing	26 Jul	31 Jul	04-06 Aug
Queen Maud Gulf			
- Fracture	21 Jul	22 Jul	26-28 Jul
Larsen Sound			
- Fracture[1]	23 Jul	31 Jul	01-03 Aug
Peel Sound			
- Fracture[1]	23 Jul	31 Jul	01-03 Aug

[1] Fracture indicates complete breakage of consolidated ice.

Table 4: Selected Sea Ice Data and Severity Index for the north coast of Alaska (1953-2007)

		1	2	3	4	5	6	7	8	9		
Rank	Year	10 Aug	15 Sep	10 Aug	15 Sep	date	date	# days	# days	# days	Obs Inx	Fcst Indx
1	2007	150	397	183	515	16-Jul	08-Oct	63	84	77	1136	221
2	2004	13	238	70	260	16-Jul	08-Oct	71	68	77	637	602
3	1958	50	150	50	210	19-Jul	25-Oct	92	99	74	624	446
4	1968	25	165	30	200	19-Jul	18-Oct	86	91	74	615	495
5	1998	15	105	20	240	15-Jul	21-Oct	72	100	78	584	486
6	2005	70	130	85	250	23-Jul	03-Oct	63	70	70	580	381
7	2003	18	167	27	185	21-Jul	20-Oct	52	92	72	568	481
8	1993	0	130	5	185	18-Jul	07-Nov	64	112	75	565	388
9	2002	0	135	18	225	13-Aug	14-Oct	32	64	49	504	293
10	1962	25	150	30	150	19-Jul	30-Sep	49	68	74	490	406
11	1973	5	80	5	190	31-Jul	20-Oct	73	82	62	486	344
12	1954	20	115	20	210	01-Aug	30-Sep	38	61	61	484	552
13	1997	28	150	40	150	08-Aug	10-Oct	47	63	54	463	297
14	1963	5	130	5	130	13-Aug	18-Oct	67	67	49	442	351
15	1990	0	90	40	90	23-Jul	12-Oct	75	105	70	429	173
16	1961	15	105	15	135	25-Jul	24-Sep	49	62	68	418	414
17	1996	10	65	70	155	16-Jul	25-Sep	37	71	77	405	446
18	1979	0	125	0	125	04-Aug	08-Oct	31	56	58	394	178
19	1989	10	70	55	110	19-Jul	22-Oct	34	95	74	383	284
20	1974	10	100	10	100	06-Aug	05-Oct	35	61	56	351	372
21	1978	5	70	30	95	25-Jul	09-Oct	35	76	68	343	492
22	1986	10	80	10	110	29-Jul	21-Oct	30	58	64	342	517
23	1999	15	45	45	105	30-Jul	08-Oct	56	70	63	338	98
24	1977	5	55	25	85	02-Aug	15-Oct	63	74	60	336	381
25	1959	20	65	20	65	19-Jul	06-Oct	42	86	74	331	271
26	1995	30	30	50	50	15-Jul	17-Oct	70	94	78	329	477
27	1972	0	60	30	90	31-Jul	01-Oct	45	63	62	320	251
28	1982	0	85	0	95	03-Aug	10-Oct	21	69	59	318	271
29	2006	17	18	17	69	04-Aug	13-Oct	60	70	58	275	-462
30	1994	10	35	10	60	05-Aug	24-Sep	44	55	57	251	334
31	1957	5	45	70	60	01-Aug	06-Oct	18	67	61	250	300
32	1987	0	10	0	85	05-Aug	30-Oct	35	59	57	250	299
33	1981	0	0	35	100	26-Jul	01-Oct	0	66	67	232	521
34	2000	10	70	10	75	31-Jul	02-Oct	19	33	62	228	274
35	1985	0	35	0	55	01-Aug	15-Oct	22	52	61	224	245
36	1967	15	0	30	50	25-Jul	12-Oct	25	68	68	213	212
37	1984	0	25	0	50	11-Aug	15-Oct	21	42	51	209	219
38	1966	5	0	5	45	01-Aug	22-Oct	24	65	61	194	296
39	1992	15	0	15	75	09-Aug	19-Sep	24	37	53	188	560
40	1965	0	10	0	70	25-Aug	25-Sep	25	32	37	173	182
41	2001	0	25	15	25	17-Aug	08-Oct	26	52	45	172	262
42	1980	15	25	15	25	05-Aug	30-Sep	11	42	57	159	426

		1	2	3	4	5	6	7	8	9		
Rank	Year	10 Aug	15 Sep	10 Aug	15 Sep	date	date	# days	# days	# days	Obs Inx	Fcst Indx
43	1953	0	0	5	35	27-Jul	16-Sep	5	52	66	157	213
44	1976	0	15	0	15	15-Aug	07-Oct	21	53	47	150	106
45	1971	0	0	0	30	23-Aug	01-Nov	8	71	39	147	166
46	1991	0	0	0	20	16-Aug	02-Oct	0	46	46	111	199
47	1960	0	0	20	20	05-Aug	07-Sep	0	34	57	110	231
48	1988	0	0	0	25	09-Aug	20-Sep	0	32	53	110	354
49	1964	0	0	0	5	13-Aug	20-Sep	0	39	49	95	536
50	1983	0	10	0	10	08-Aug	16-Sep	0	21	54	92	41
51	1970	0	0	5	0	06-Aug	14-Sep	0	32	56	87	251
52	1956	0	0	0	40	07-Sep	30-Sep	0	24	24	87	93
53	1969	0	0	0	30	07-Sep	18-Sep	5	12	24	70	157
54	1955	0	0	5	15	13-Sep	24-Sep	0	12	18	44	44
55	1975	5	0	5	0	NEVER	NEVER	0	0	0	0	8

1 - Distance from Point Barrow northward to ice edge (10 Aug)

2 - Distance from Point Barrow northward to ice edge (15 Sept)

3 - Distance from Point Barrow northward to boundary of five tenths ice concentration (10 Aug)

4 - Distance from Point Barrow northward to boundary of five tenths ice concentration (15 Sep)

5 - Initial date the entire sea route to Prudhoe Bay is less than or equal to five tenths ice concentration.

6 - Date that combined ice concentration and thickness dictate end of prudent navigation.

7 - Number of days the entire sea route to Prudhoe Bay is ice free.

8 - Number of days entire sea route to Prudhoe Bay less than/equal to five tenths ice concentration.

9 - Number of days between initial opening date and 01 Oct.

Appendix A : Key To Canadian Ice Service 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?Lang=eng&lnid=76&ScndLvl=no&ID=11030

or on the National Ice Center web site:

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

Appendix B : Broadcast Schedules For Arctic Ice and Marine Conditions

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

Canadian Coast Guard (Radio Aids to Marine Navigation):

http://www.ccg-gcc.gc.ca/eng/CCG/MCTS_Radio_Aids

Alaska Marine VHF Voice:

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

NOAA MF/HF Voice – 4125 kHz:

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, please contact Canadian Ice Service by:

Phone: 1-877-789-7733
Fax: 1-613-947-9160
E-Mail: ECWeather-Meteo@ec.gc.ca

Or National Ice Center by:

Phone: 1-301-394-3099
E-Mail: liaison@natice.noaa.gov