Homeland Security

United States Coast Guard

# Report of the International Ice Patrol in the North Atlantic

2007 Season
Bulletin No. 93
CG-188-62

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**Season of 2007**

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Forwarded herewith is Bulletin No. 93 of the International Ice Patrol (IIP), describing the Patrol's services and ice conditions during the 2007 season, which marked the 95th anniversary of the tragic sinking of RMS Titanic. Despite significant technological advances since 1912, icebergs remain a threat to mariners near the Grand Banks of Newfoundland. Following very light iceberg conditions in 2005 and 2006, during which a total of just 11 icebergs drifted south of 48°N, the icebergs returned in 2007, and IIP diligently monitored the drift and ultimate deterioration of some 324 icebergs south of 48°N, many of them carried by the in-shore branch of the cold Labrador Current.

It is important to remember that IIP relies on many critical partnerships in the conduct of our important mission. The 2007 season allowed for more thorough operational testing and successful use of our synchronized iceberg database with the Canadian Ice Service (CIS), which was described in detail in last year's report. IIP and CIS were honored to receive an Innovation Award from the state of Connecticut in 2007 for this advance in our collective operations. I am proud to report that the North American Ice Service (NAIS), an alliance between IIP, CIS and the U.S. National Ice Center (NIC), which was also described in our last annual report, continues to strengthen. In 2007 USCG Air Station Elizabeth City, NC and our NAIS partners helped IIP monitor the iceberg danger near the Grand Banks of Newfoundland and provide the limit of all known ice to the maritime community. Likewise, our partnership with C-CORE, first described in our 2004 annual report, remains strong. In 2007, we made notable progress to move towards space-borne iceberg reconnaissance. Finally, Appendices B and C summarize the critical role that mariners play in the successful execution of the International Ice Patrol mission, and how they are invaluable partners.

On behalf of all of the dedicated women and men of the International Ice Patrol, I hope that you enjoy reading this report on the 2007 season.

S. D. Rogerson
Commander, U. S. Coast Guard
Commander, International Ice Patrol

# International Ice Patrol
# 2007 Annual Report

## Contents



Cover photograph: Large wedge-shaped iceberg viewed from the ramp of the HC-130H aircraft over the Grand Banks of Newfoundland. This iceberg was successfully marked by a compact air launched ice beacon (CALIB), a satellite-tracked device that is air dropped from the back of the plane.

# Abbreviations and Acronyms

| | |
|---|---|
| AOR | Area of Responsibility |
| AXBT | Air-deployable eXpendable BathyThermograph |
| BAPS | iceBerg Analysis and Prediction System |
| CALIB | Compact Air Launched Ice Beacon |
| CAMSLANT | Communications Area Master Station atLANTic |
| CCG | Canadian Coast Guard |
| CIS | Canadian Ice Service |
| DDH | callsign for Hamburg Germany |
| DDK | callsign for Pinneberg Germany |
| FLAR | Forward-Looking Airborne Radar |
| GMES | Global Monitoring for Environment and Security |
| HF | High Frequency |
| HMCS | Her Majesty's Canadian Ship |
| IIP | International Ice Patrol |
| INMARSAT | INternational MARitime SATellite (also Inmarsat) |
| IRD | Ice Reconnaissance Detachment |
| KT | Knot |
| LAKI | Limit of All Known Ice |
| M | Meter |
| MB | Millibar |
| MCTS | Marine Communications and Traffic Service |
| M/V | Motor Vessel |
| NAIS | North American Ice Service |
| NAO | North Atlantic Oscillation |
| NIC | National Ice Center |
| NIK | callsign for CAMSLANT |
| NM | Nautical Mile |
| NMF | callsign for USCG Communications Station Boston |
| NTIS | National Technical Information Service |
| NWS | National Weather Service |
| PAL | Provincial Aerospace Limited |
| RADAR | RAdio Detection And Ranging (also radar) |
| RMS | Royal Mail Steamer |
| SOLAS | Safety Of Life At Sea |
| SLAR | Side-Looking Airborne Radar |
| VON | callsign for MCTS St. John's |
| WOCE | World Ocean Circulation Experiment |

# Introduction

This is the 93rd annual report of the International Ice Patrol, which is under the operational control of Commander, U.S. Coast Guard Atlantic Area. The report contains information on IIP operations, environmental conditions, and iceberg conditions in the North Atlantic during 2007. Funded by 17 member nations and conducted by the U.S. Coast Guard, Ice Patrol was formed soon after RMS *Titanic* sank on 15 April 1912. Since 1913, except for periods of World War, Ice Patrol has monitored the iceberg danger on and near the Grand Banks of Newfoundland and has broadcasted the Limit of All Known Ice (LAKI) to mariners. The activities and responsibilities of IIP are delineated in U.S. Code, Title 46, Section 738, and the International Convention for the Safety of Life at Sea, 1974.

The International Ice Patrol conducted aerial reconnaissance from St. John's, Newfoundland to search for icebergs in the southeastern, southern, and southwestern regions of the Grand Banks. In addition to IIP reconnaissance data, Ice Patrol received iceberg reports from other aircraft and mariners in the North Atlantic. At the Operations Center in Groton, Connecticut, personnel analyzed iceberg and environmental data and used the BAPS computer model to predict iceberg drift and deterioration. Based on the model's prediction, IIP produced the weekly/daily ice warnings, including the chart and text bulletin. In addition to these routine broadcasts, IIP responded to individual requests for iceberg information.

VADM D. Brian Peterman was Commander, U. S. Coast Guard Atlantic Area. CDR Michael R. Hicks was Commander, International Ice Patrol until 04 May 2007, when he was relieved by CDR Scott D. Rogerson.

For more information about the International Ice Patrol, including iceberg bulletins and charts, visit our website at http://www.uscg-iip.org.

# Summary of Operations

As mandated by the International Convention for the Safety of Life at Sea (SOLAS) and U.S. Code, International Ice Patrol (IIP) monitors iceberg danger near the Grand Banks of Newfoundland from 15 February to 01 July. This time period is regarded as the Ice Season because the Grand Banks are normally iceberg-free from August through January. In practice, however, IIP services will commence whenever iceberg populations pose a significant threat to the primary shipping routes between Europe and North America and continue for the duration of that threat. Weekly products commence the first Friday following 15 February and continue until season end or until ice conditions are severe enough to necessitate transmission of daily products.

In 2007, IIP actively monitored the iceberg danger to transatlantic shipping in the region bounded by 40°N, 50°N, 39°W, and 57°W (**Figure 1**). IIP opened the season on Friday, February 16th with the commencement of weekly products. Ice conditions were light throughout February and March, but by early April, a significant iceberg population was tracked south of 50°N prompting the transition to daily products on 09 April. IIP's ice products were then distributed daily until 03 August, the final day of the 2007 Ice Season. *Note: Unless otherwise stated all statistics reported in this summary are taken from data gathered during the 16 February through 03 August 2007 timeframe.*

During the 2007 Ice Season, IIP's Operations Center in Groton, Connecticut received and analyzed 926 information reports concerning oceanographic, atmospheric, and/or ice conditions throughout IIP's AOR. These reports were generated by various land, sea, air, and space platforms including: lighthouses along the Newfoundland coast, merchant and Canadian Coast Guard vessels operating within or near the Grand Banks of Newfoundland, IIP and CIS aerial reconnaissance flights, and satellite data processed by C-CORE (a commercial satellite reconnaissance provider located in St. John's, NL) and the National Ice Center.

From the 926 information reports received by IIP, 219 relayed ice information identifying 5,055 icebergs and/or stationary radar targets. Although 5,055 individual objects were reported to IIP, only 1,574 icebergs and radar targets were merged by IIP to the iceberg drift and deterioration model known as BAPS. It is important to understand that the disparity between the number of reported and merged objects does not reflect overwhelming inaccuracies with ice data or dereliction of duty by IIP personnel. Rather, it illustrates IIP's strong partnership with CIS, who merged the remaining 3,481 icebergs and radar targets. This was possible because CIS uses the same iceberg modeling software as IIP. Throughout the 2007 ice season, the BAPS databases at the CIS and IIP Operation Centers were synchronized, allowing both parties to quickly input and exchange environmental and ice information. By sharing the responsibility of updating the model, both IIP and CIS were able to provide the mariner with accurate and timely ice products while providing a measure of redundancy should either database be lost or corrupted. CIS merged icebergs and radar targets detected north of 50°N and/or west of 55°W. Consequently, their efforts accounted for the nearly 3,500 objects mentioned in the previous paragraph, as well as 4,880 additions to, or resights within, the iceberg drift and deterioration model during the entire 2007 Ice Season.

Overall, there were 6,454 objects merged to BAPS throughout the 2007 Ice Season, including 1,396 icebergs and radar targets within IIP's AOR.

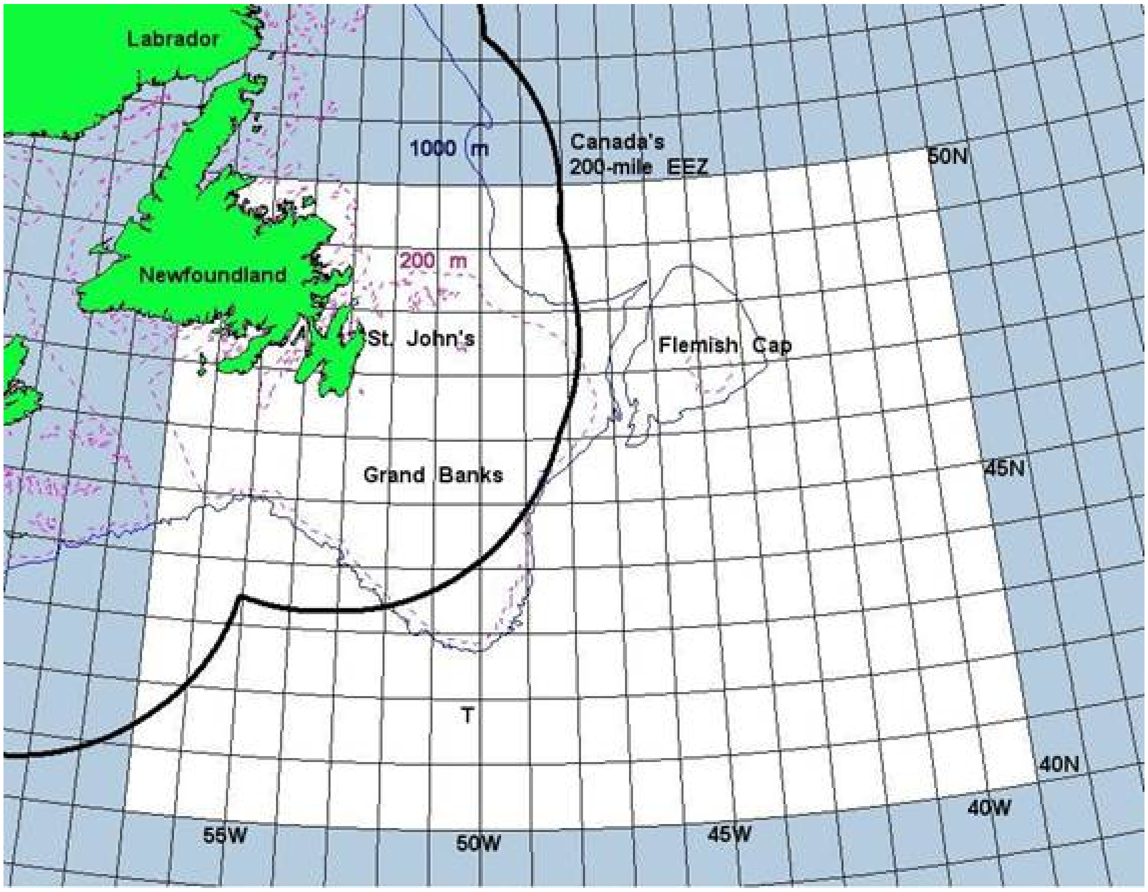


**Figure 1.** IIP's operating area. T indicates the location of *Titanic*'s sinking.

## Information Reports

An important factor contributing to IIP's successful history has been the support it receives from the maritime community. This influence is most easily, and perhaps best, measured by the sheer volume of voluntary information reports IIP receives from merchant vessels each year. These reports are sent in response to a long-standing IIP request for weather conditions, sea surface temperatures, and ice sightings from any vessel transiting within or near the Grand Banks of Newfoundland. Receiving on scene and up-to-date information helps ensure the accuracy of IIP's ice warnings. All ships that provided reports including weather, sea surface temperature, ice, and stationary radar target reports during the 2007 ice season are listed in **Appendix B**. IIP's customer outreach program is outlined in great detail in **Appendix C**.

Although the vast majority of reports were received from merchant vessels, IIP received valuable information from other sources as well. For example, the Canadian Government provided 91 reports, 10% of the total reports received. These reports originated from several different sources, including CIS privately contracted reconnaissance flights by Provincial Aerospace Limited, HMCS vessels at sea, and even coastal lighthouses. **Figure 2** provides the breakdown of the sources for all information reports received during the 2007 ice season.

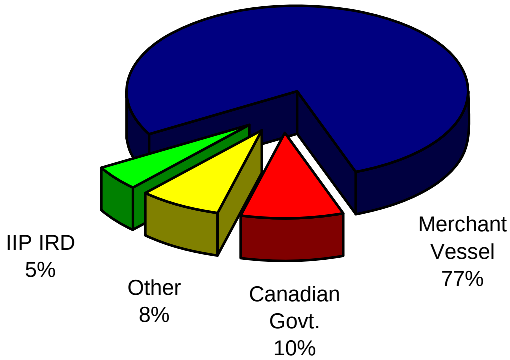


**Figure 2**. Reporting sources of the 926 information reports received at Ice Patrol during 2007. Information reports include ice, sea surface temperature, and weather reports.

## Ice Reports

In 2007, 219 of the 926 information reports contained data on icebergs or stationary radar targets. Straying slightly from the overall information reporting numbers described above, merchant vessels still accounted for the largest percentage of ice reports with 42%. However, the Canadian Government was not far behind reporting 37%. IIP aerial reconnaissance provided 20% of all iceberg reports. Various other sources, including NIC and C-CORE, combined to relay the remaining 1% of iceberg reports (**Figure 3**).

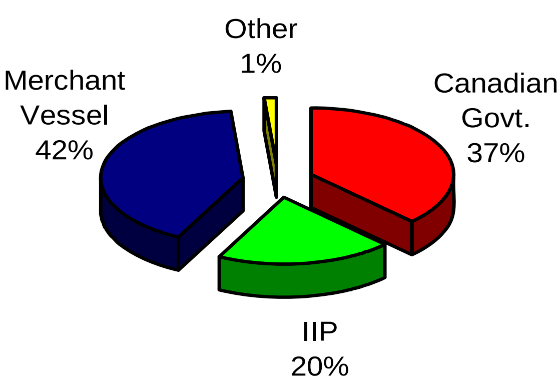


**Figure 3.** Reporting sources for the 219 ice reports received during the 2007 Ice Season. Ice reports include individual iceberg sightings and stationary radar target information.

## Merged Targets

The 219 ice reports received by IIP contained 5,055 objects (icebergs and stationary radar targets) that were added as new targets or resighted to existing targets. These resighted targets are considered to be "merged" into the BAPS database. The many platforms of the Canadian Government reported 3,207 (over 63%) of the objects. IIP accounted for 1,502 (nearly 30%) objects and merchant vessels reported 334 objects (almost 7%). The remaining sources provided information for only 12 objects merged to the BAPS model which accounted for less than 1% of all merged targets(**Figure4**).

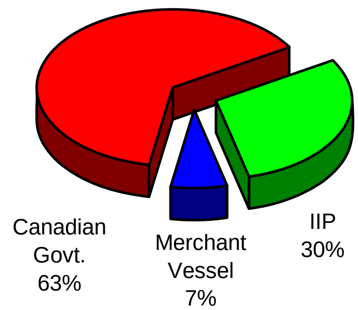


**Figure 4.** Reporting sources of the 5,055 individual targets merged into BAPS in 2007.

## LAKI Iceberg Sightings

SOLAS mandates that IIP guard the southeastern, southern, and southwestern regions of the Grand Banks. IIP incorporates all of the iceberg reports to develop a Limit of All Known Ice (LAKI) designating the southernmost limit of the iceberg population. A LAKI is not created when weekly products are issued. It is only developed when IIP issues daily products. During the 2007 ice season, IIP began creating and distributing the LAKI to the mariner with the commencement of daily products on 09 April. On this date, IIP tracked 22 bergs south of 48°N, with many more drifting towards this latitude that marks the nominal northern extent of the trans-Atlantic shipping lanes. The icebergs used to set the LAKI are of critical importance to IIP operations as they define the boundary for ice-free navigation. Because many of IIP's reconnaissance missions focus on this demarcation, IIP accounted for more than half of all LAKI iceberg sightings.

In a continued effort towards the development of the North American Ice Service (NAIS), IIP set the LAKI to 57°N during the 2007 Ice Season to relieve some of the responsibility from CIS. In the past, IIP only set the limit to 50°N, the northern limit of IIP's AOR. Because of the extension of the limit to 57°N, many limit-setting icebergs were sighted north of IIP's AOR. In fact, one third of LAKI iceberg sightings originated from the Canadian Government. Merchant vessels and satellite resources used by CIS generated the remaining LAKI iceberg detections (**Figure 5).**

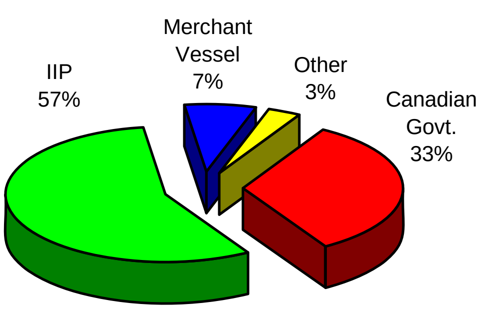


**Figure 5.** Initial reporting source of limit-setting icebergs during 2007 Ice Season.

## Products and Broadcasts

IIP issued a weekly ice chart and text bulletin each Friday from 16 February to 06 April stating that IIP was monitoring iceberg conditions, but was not yet issuing daily products. The weekly ice chart also illustrated the existing iceberg population. The transition to daily products occurred on 09 April when the iceberg population threatened the trans-Atlantic shipping lanes. Daily products containing LAKI data valid for 1200Z, as well as sea ice, iceberg distribution, and radar target information continued until the season was closed on 03 August.

During daily products, the IIP bulletin was transmitted several times daily via text and voice from locations in the United States and Canada. It was delivered in text over the Inmarsat-C SafetyNET via the Atlantic East and West satellites and by U.S. Coast Guard CAMSLANT/NMF and Canadian Coast Guard Marine Communications and Traffic Service St. Anthony/VCM using voice radio.

U.S. Coast Guard CAMSLANT/NMF was the primary HF transmission station that transmitted the ice chart. The German Federal Maritime and Hydrographic Agency stations Hamburg/DDH and Pinneberg/DDK were the secondary stations for the ice chart transmission. The IIP ice chart was broadcast via HF Fax three times per day from locations in the United States and twice a day from locations in Germany. It was also made available on the World Wide Web and by request using email or fax on demand.

IIP, NWS, and JAAWIN web sites were used as hosts for the IIP products throughout the season. The weekly ice chart and bulletins were broadcasted and made available by the same means as the daily products.

In 2007, IIP transmitted 117 scheduled ice bulletins via SafetyNET. All of these bulletins reached SafetyNET on time. The on-time delivery percentage for ice charts, although impressive, was not perfect, falling to 99.15% as three ice charts, including two consecutive transmissions, were not broadcast by CAMSLANT.

## Safety Broadcasts

Any iceberg or stationary radar target observed near or outside of the published LAKI challenges the accuracy of IIP products and is a potential threat to safe navigation. When IIP receives a report of one of these targets, IIP transmits an unscheduled safety broadcast to mariners to report the location and type of threat. During the 2007 Ice Season, IIP sent five unscheduled safety broadcasts for one iceberg and six stationary radar targets detected outside of the LAKI.

The information published in IIP's ice chart and bulletin is intended to be valid for 24 hours, stretching from 1200Z of the current day until 1200Z the following day. Iceberg reports requiring a safety broadcast also have the potential to impact IIP's published products. Depending on when the report is received, it may either require a revision of current IIP products or simply an inclusion in the next day's products. If the report comes in two hours or more from the release of the next day's products, IIP's current products will be revised and retransmitted.

Of the five ice reports requiring a safety broadcast during the 2007 Ice Season, three required a revision of the ice chart and bulletin. Only one of those revisions incorporated a change to the LAKI. In the other two situations, the report involved stationary radar targets which are not used by IIP to set the LAKI. In light of these revisions, the overall accuracy of IIP's products was 97.5% while LAKI accuracy was over 99% (**Figure 6**).

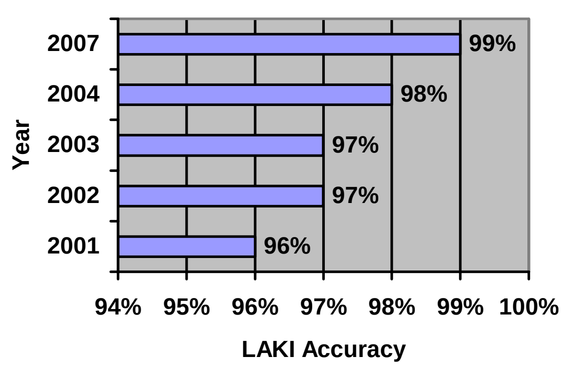


**Figure 6.** LAKI Accuracy. Note: No LAKI was established during the 2005 or 2006 ice seasons due to light ice conditions.

## Historical Perspective

To compare the severity of ice seasons, IIP uses two different measurements. The first is season length, measured in the number of days when daily products were issued (**Figure 7)**. The second measurement is the number of icebergs crossing south of 48°N (**Figure 8**). This number includes icebergs that were initially detected south of 48°N and those which were originally sighted further north and drifted south of that latitude by BAPS.

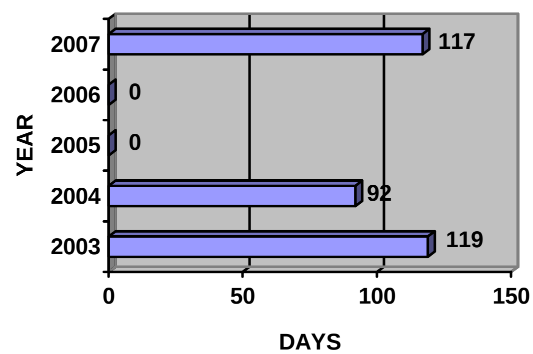


**Figure 7.** Length of ice season in days since 2003. The climatological mean (2003-2007) is 66 days.

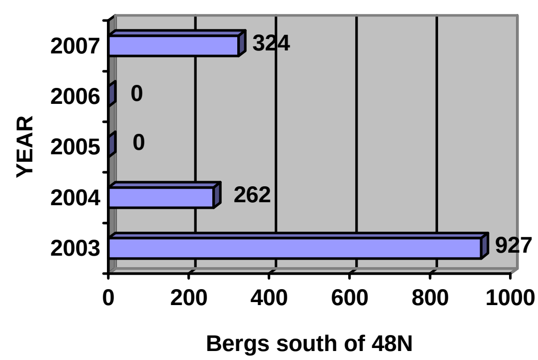


**Figure 8.** Count of individual icebergs (sighted and drifted) south of 48ºN since 2003. The climatological mean (2003-2007) is 303 icebergs.

The 2007 Ice Season lasted 117 days with 324 icebergs south of 48°N. Compared to the previous two years, the 2007 Ice Season marked a dramatic increase in both season length and iceberg population. However, when compared to the top ten most severe ice seasons from 1983-2007 (**Table 1**), this season was relatively mild.

| Rank | Year | Bergs South of 48°N |
|---|---|---|
| 1 | 1984 | 2022 |
| 2 | 1991 | 1976 |
| 3 | 1994 | 1765 |
| 4 | 1993 | 1753 |
| 5 | 1995 | 1432 |
| 6 | 1998 | 1380 |
| 7 | 1983 | 1352 |
| 8 | 1985 | 1063 |
| 9 | 1997 | 1011 |
| 10 | 2003 | 927 |

**Table 1.** Ranking of most severe ice seasons for the past 25 years (1983-2007) based on cumulative number of icebergs south of 48°N.

The 2007 Ice Season numbers were less than half the modern seasonal average (1983-2007) of 823 icebergs, when compared against data collected since the modern era of iceberg reconnaissance marked by the advent of radar detection techniques in 1983. The 324 icebergs detected or drifted south of 48°N in 2007 was also below the seasonal average of 471 icebergs measured against iceberg records dating back to 1900.

### Canadian Support

As they do every year, the Canadian Government generously supported IIP in 2007. CIS shared its valuable reconnaissance data and ice expertise with IIP. The synchronized iceberg modeling database, now in its second year of operation, ensured that all ice information received by IIP or CIS was quickly merged and accurately reflected on both agencies' ice products. IIP also appreciated the support from Provincial Aerospace Limited and C-CORE who supplied valuable ice data throughout the 2007 season. Although C-CORE data was only evaluated for accuracy and future use at IIP, CIS entered targets provided by C-CORE into BAPS operationally.

## References

Alfultis, M. (1987). Iceberg Populations South of 48°N since 1900. *Report of the International Ice Patrol in the North Atlantic*, Bulletin No. 73, 63-67.

Marko, S. R., Fissel, D. B., Wadhams, P., Kelly, P. M., & Brown, R. D. (1994). Iceberg Severity off Eastern North America: It's Relationship to Sea-ice Variability and Climate Change. *Journal of Climate*, 7(9), 1335-1351.

# Iceberg Reconnaissance and Oceanographic Operations

## Iceberg Reconnaissance

The Ice Reconnaissance Detachment (IRD) is a sub-unit under Commander, International Ice Patrol (IIP) partnered with Coast Guard Air Station Elizabeth City. Air Station Elizabeth City provided the aircraft platform for reconnaissance in 2007. IRDs deployed to observe and report sea-ice, icebergs, and oceanographic conditions on the Grand Banks of Newfoundland. Oceanographic observations were used for operational support and research.

Ice Patrol's pre-season IRD departed on 23 January to determine the early–season iceberg distribution. Because the pre-season IRD detected only a light iceberg distribution, IRD1 was cancelled. All remaining IRDs were executed as scheduled with the exception of IRD14 that was cancelled due to light ice conditions at the end of the season. The 2007 Ice Season opened on 09 April during IRD5 and closed on 03 August upon completion of IRD13. The post-season IRD was completed on 23 August concluding the 2007 IIP ice reconnaissance operations and deployments to St. John's, Newfoundland.

Throughout the 2007 ice season, IRDs were deployed to IIP's base of operations in St. John's for a total of 113 days. IIP flew a total of 42 sorties, including 5 research flights and 37 iceberg reconnaissance flights. The 2007 IRD operations are summarized in **Table 2.**

| IRD | Deployed Days | Iceberg Patrols | Flight Hours |
|---|---|---|---|
| PRE | 11 | 2 | 32.9 |
| 1 | Cancelled | | |
| 2 | 9 | 3 | 27.8 |
| 3 | 6 | 2 | 24.7 |
| 4 | 9 | 2 | 18.1 |
| 5 | 9 | 4 | 32.9 |
| 6 | 11 | 4 | 34.5 |
| 7 | 7 | 3 | 29.2 |
| 8 | 9 | 2 | 24.7 |
| 9 | 9 | 4 | 38.1 |
| 10 | 8 | 4 | 35.4 |
| 11 | 9 | 5 | 43.4 |
| 12 | 7 | 4 | 33 |
| 13 | 6 | 3 | 27.3 |
| 14 | Cancelled | | |
| POST | 3 | 0 | 12 |
| **TOTAL** | **113** | **42** | **414** |

**Table 2.** 2007 IRD summary (Flight hours include patrol, logistics, and transit hours).

In addition to the 42 sorties, 28 transit flights were conducted from Coast Guard Air Station Elizabeth City to St. John's. **Figure 9** shows IIP's flight hours for 2007. IIP used 414 flight hours in 2007, representing a significant increase from 2005 and 2006 (**Figure 10**). **Figure 11** compares flight hours with the number of icebergs south of 48°N since 1997.

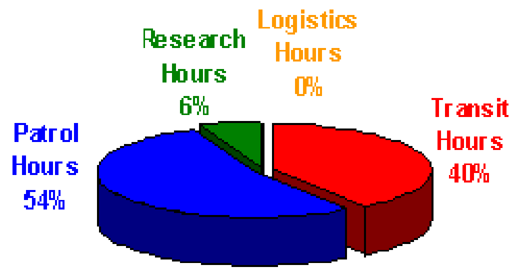


**Figure 9**. 2007 flight hours.

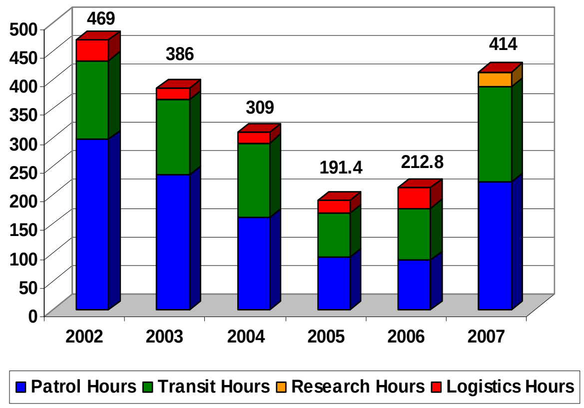


**Figure 10.** Summary of flight hours (2002-2007).

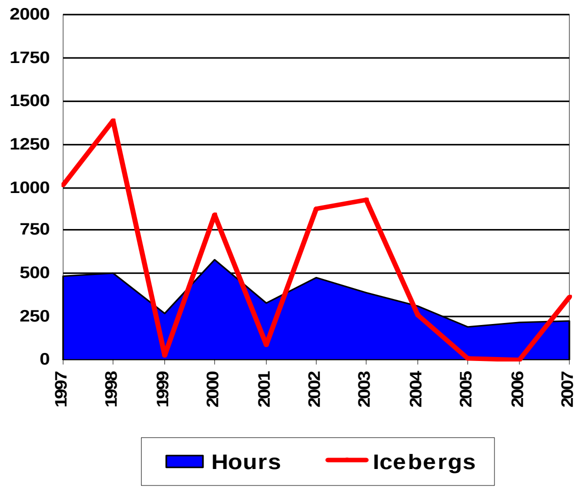


**Figure 11.** Flight hours versus icebergs south of 48°N (1997-2007).

The 2007 IRD oceanographic operations consisted of five WOCE buoy drops, two CALIB drops, two AXBT drops in conjunction with WOCE buoy drops, and two dedicated satellite underflights in support of C-CORE ENVISAT reconnaissance efforts. Four wreaths were also dropped from the aircraft: three to commemorate the 95th anniversary of the sinking of the RMS Titanic and one for the Greenland Patrol Memorial.

## Reconnaissance Techniques

### *Radar Types*

Coast Guard aircraft provided the primary means of detecting icebergs in the vicinity of the Grand Banks. To conduct iceberg reconnaissance, IIP used a Coast Guard HC-130H long-range aircraft equipped with the Motorola AN/APS-135 Side-Looking Airborne Radar (SLAR) and the Texas Instruments AN/APS-137 Forward-Looking Airborne Radar (FLAR). Ice Patrol began using SLAR in 1983, FLAR in 1993, and incorporated the Maritime Surveillance System 5000 with SLAR in 2000. In 2007, IIP established yet another technological milestone when the Automatic Identification System (AIS) was incorporated into the sensor package. This system is capable of tracking every AIS-equipped ship in VHF radio range and displaying data which includes ship name, call sign, course and speed, classification, cargo, last port, and destination. As a result of its ability to quickly identify ambiguous radar targets as ships, AIS has proven to be a valuable asset.

### *Track Spacing*

The SLAR-FLAR combination allowed IIP to use 30 nm track spacing and provide 200% radar coverage on each patrol despite poor visibility (**Figure 12**). A detailed description of IIP's reconnaissance strategy is provided at: http://www.uscg- iip.org/FAQ/FAQ_ReconnOp.shtml.

### *SLAR Detection and FLAR Identification*

Identifying the various types of targets on the Grand Banks is a perpetual challenge for IIP reconnaissance. Frequently, poor visibility forces the IRD to identify targets based solely on the nature of their radar image. Both SLAR and FLAR provide valuable clues to target identity, but in most cases, FLAR's superior imaging capability allows target identification.

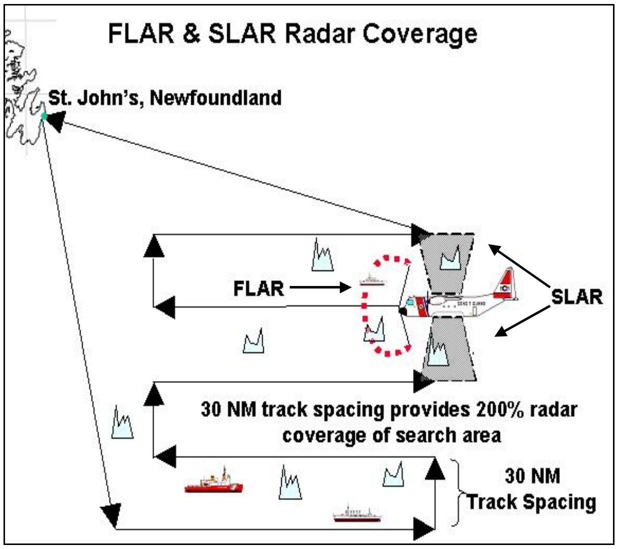


**Figure 12.** IIP Radar Reconnaissance Plan.

**Figure 13** displays the number and types of targets that reconnaissance patrols detected during 2007.

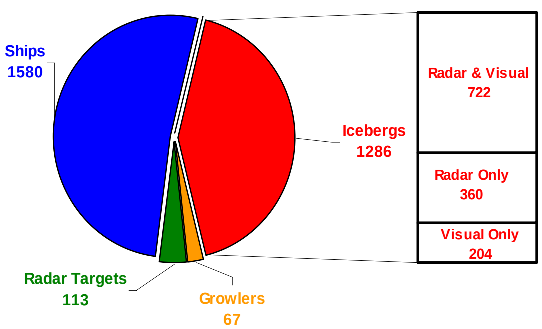


**Figure 13.** Breakdown of targets detected by IRDs in 2007.

2007 IIP IRDs detected a total of 1286 icebergs; 28% (360) were identified with radar alone (FLAR and/or SLAR; not seen visually), while the remaining 72% (926) were identified using a combination of visual and radar information or by visual means alone.

The Grand Banks are a productive fishing ground frequented by fishing vessels, ranging from 20 to over 70 meters in length. Determining whether an ambiguous radar contact is an iceberg or a vessel is particularly difficult with small targets. These contacts sometimes create similar radar returns and cannot easily be differentiated. Therefore, when a radar image does not present distinguishing features, Ice Patrol classifies the contact as a radar *target*.

The Grand Banks region has been rapidly developed for its oil reserves since 1997. In November 1997, Hibernia, a gravity-based oil-production platform, was set in position approximately 150 nm offshore on the northeastern portion of the Grand Banks. In addition to Hibernia, other drilling facilities—including Glomar Grand Banks, Terra Nova, and Henry Goodrich—are routinely on the Grand Banks. Consequently, this escalated drilling has increased air and surface traffic in IIP's area of responsibility, further complicating target identification. However, this difficulty is offset by the information reports this traffic provides. Reports from ships, aircraft, and drilling platforms greatly aid IIP in the creation of a LAKI that is as accurate and reliable as possible.

### *Environmental conditions*

Environmental conditions on the Grand Banks permitted adequate visibility (≥10 nm) only 28% of the time during iceberg reconnaissance. Consequently, Ice Patrol relied heavily on its two airborne radar systems to detect and identify icebergs in cloud cover and fog. The combination of SLAR and FLAR enabled detection and identification of icebergs in pervasive low-visibility conditions, minimizing the flight hours necessary to accurately monitor the iceberg population.

## Oceanographic Operations

IIP's oceanographic operations peaked in the 1960s, when the U.S. Coast Guard dedicated substantial ship resources to collect oceanographic data. Since that time, however, IIP's involvement in oceanographic surveys on the Grand Banks has declined. First, increased competition among various U.S. Coast Guard missions made it increasingly difficult for IIP to obtain the ship resources necessary to continue extensive oceanographic surveys. Second, because the capability and reliability of air-deployable oceanographic instruments has improved vastly, Ice Patrol can collect oceanographic data without the aid of ships. Finally, the wide availability of oceanographic information now on the internet enables IIP personnel to focus on iceberg reconnaissance.

In 2007, IIP collected oceanographic data from air- and ship-deployed satellite-tracked drifting buoys. Satellite-tracked drifting WOCE buoys, drogued at a depth of fifteen or fifty meters, provided near real-time ocean-current information. Ice Patrol deployed WOCE buoys on the Grand Banks and in the offshore and inshore branches of the Labrador Current and used data from these buoys to modify the historical-current database within IIP's computer model. IIP deployed eleven satellite-tracked drifter buoys – five from reconnaissance aircraft and six from Canadian Coast Guard vessels (**Figure 14**). Of the eleven WOCE buoys deployed, ten functioned properly and transmitted oceanographic data for sufficient durations, which ranged from two months to nine months and counting. The one WOCE buoy that did not function properly was successful deployed from a Canadian Coast Guard vessel but ceased transmitting three days after the deployment.

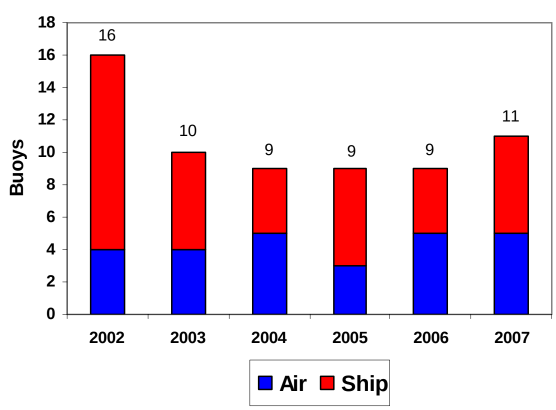


**Figure 14.** WOCE buoy deployments (2002-2007).

In addition to the WOCE buoys, all air deployed WOCE buoys functioned properly. Two Compact Air Launched Ice Beacons (CALIB's) were also deployed from reconnaissance aircraft. Each CALIB was successful deployed onto large tabular icebergs, however no transmissions from either CALIB were received.

All air deployed drifter buoys are prepared and deployed by Ice Patrol personnel in conjunction with crewmembers from Air Station Elizabeth City. The buoy deployments are conducted while flying reconnaissance patrols near the desired drop locations. The ship deployed drifter buoys are purchased and prepared by IIP and delivered to the Canadian Coast Guard (CCG) in St. John's. As part of a volunteer operation, the CCG deploys the drifter buoys at locations requested by IIP. Usually, the CCG is given 15 meter drifters to deploy in the shallow waters of the Grand Banks while the vessels are underway performing their normal operations. The ship deployments are done on a "not to interfere" basis. This partnership with the Canadian Coast Guard allows the Ice Patrol to save significant amounts of time and money while strengthening an existing and extremely valuable international relationship. **Figure 15** depicts composite drift tracks for the buoys deployed in 2007. Detailed drifter information is provided in IIP's *2007 WOCE Buoy Drift Track Atlas*, which is available upon request.

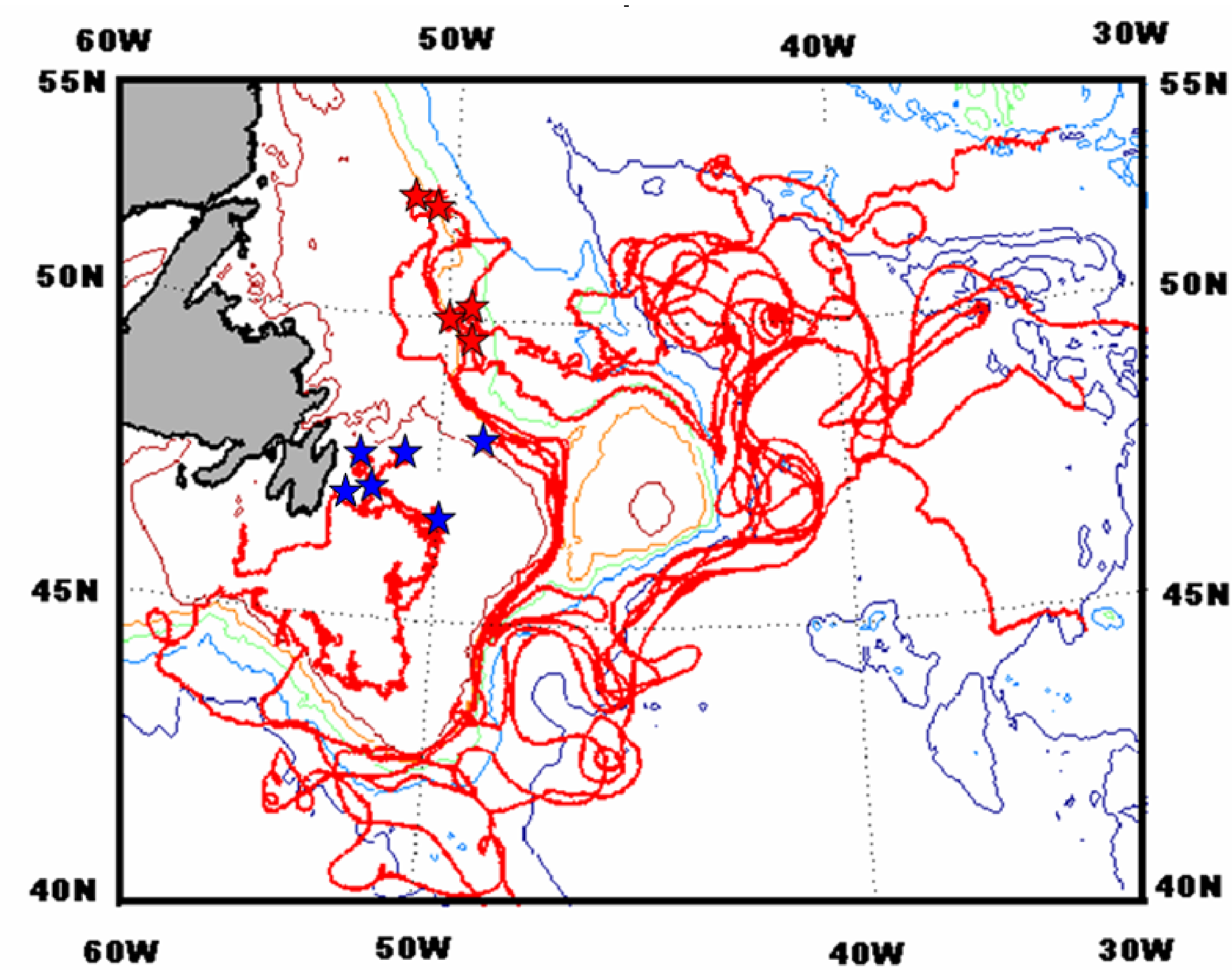


**Figure 15.** Composite buoy tracks. Red stars represent drop locations of air-deployed buoys. Blue stars represent ship-deployed buoys.

# Ice and Environmental Conditions

## Introduction

Although far from an extreme year, 2007 saw icebergs return to the Grand Banks of Newfoundland in substantial numbers. During the ice year, which extends from October through September, IIP estimated that 324 icebergs passed into the shipping lanes south of 48°N.

This section describes the progression of the ice year and the accompanying environmental conditions. The following month-by-month narrative begins as sea ice began forming along the Labrador coast in December 2006, and concludes on 3 August 2007 when Ice Patrol stopped sending daily ice chart and bulletin updates to mariners. The narrative draws from several sources, including the *Seasonal Summary for Eastern Canadian Waters, Winter 2006-2007* (Canadian Ice Service, 2007); sea-ice analyses provided by the Canadian Ice Service (CIS) and the U. S. National Ice Center (NIC); sea surface temperature anomaly plots provided by the U. S. National Weather Service's Climate Prediction Center (NOAA/NWS, 2007); and, finally, summaries of the iceberg data collected by Ice Patrol and CIS. The plots on pages 41 to 56 document the limit of all known ice (LAKI) twice a month (the 15th and last day of each month) for the period during which Ice Patrol provided daily warnings to mariners in 2007. The sea-ice historical data are derived from the *Sea-ice Climatic Atlas, East Coast of Canada, 1971-2000* (CIS, 2001), which provides a 30-year median of ice concentration at seven-day intervals for the period from 26 November to 16 July. Historical iceberg information is derived from Viekman and Baumer (1995), who present LAKI climatology from mid-March to 30 July based on 21 years of Ice Patrol observations from 1975 through 1995. They provide the extreme, 25$^{th}$ percentile, median, 75$^{th}$ percentile, and minimum LAKIs for the period. The 25$^{th}$ and 75$^{th}$ percentiles indicate that, respectively, 25% and 75% of the LAKI were more extensive than those climatological positions. Finally, the average number of icebergs estimated to have drifted south of 48°N for each month was calculated using 107 years (1900 through 2006) of Ice Patrol records (IIP, 2008).

The preseason sea-ice forecast (CIS, 2006), which was issued on 01 December, predicted:

- Movement of the southern ice edge to the area just south of the entrance to the Strait of Belle Isle **(Figure 16)** by the middle of January, which is about two weeks later than normal,
- During March the southern ice edge would reach Cape St. Francis, but most of the significant ice would remain north of Cape Bonavista, and
- Sea-ice retreat would begin during the last half of March.

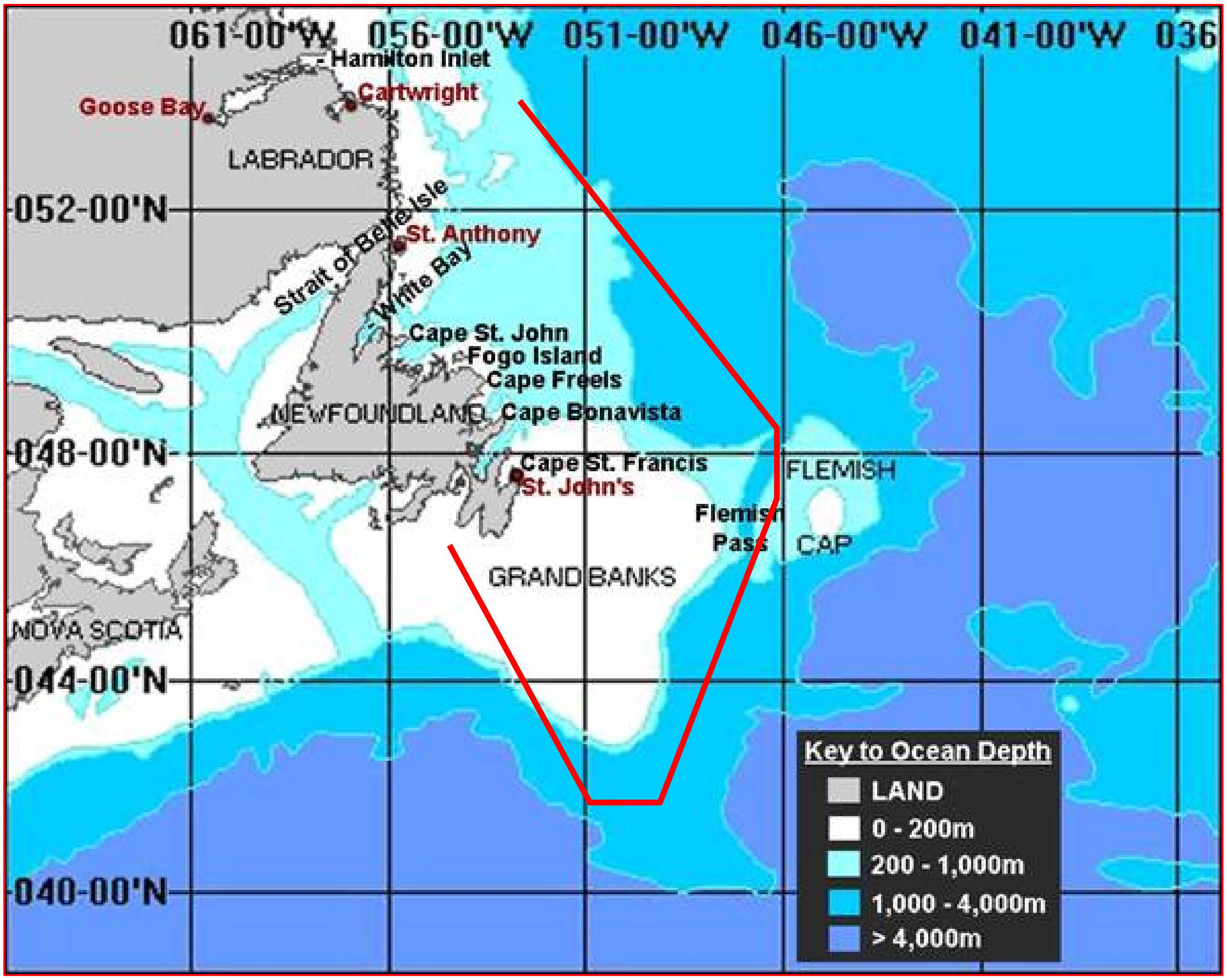


**Figure 16.** Grand Banks of Newfoundland with 11 July 2007 LAKI.

### December 2006

Warmer-than-normal air temperatures in Labrador throughout December slowed sea-ice development along the Labrador coast. The mean monthly air temperatures at Cartwright, Goose Bay and Nain, Labrador were 1.9° to 3.3°C above normal (Environment Canada, 2008). Although near normal sea surface temperature conditions persisted near the Labrador coast in December, farther off shore, the surface waters of the central Labrador Sea were approximately 1.0°C warmer than normal (NOAA/NWS, 2008). The southern edge of the main ice pack reached Cape Chidley, the northernmost point in Labrador, during the last week of December, about three weeks later than normal. These weather and sea-ice conditions were very similar to those experienced in December 2005.

### January 2007

Labrador was extraordinarily warm in January. Early in the month, Goose Bay experienced temperatures that were 20°C above normal, bringing the temperature above freezing **(Figure 17)** for several days. The monthly averaged temperatures in Cartwright, Goose Bay and Nain were, respectively, 3.7°, 3.7° and 4.5°C warmer than normal (Environment Canada, 2008). Newfoundland also experienced warmer-than-normal conditions, with St. Anthony registering 2.5°C above normal for the month. Consequently, sea-ice development was well behind normal for most of the month.

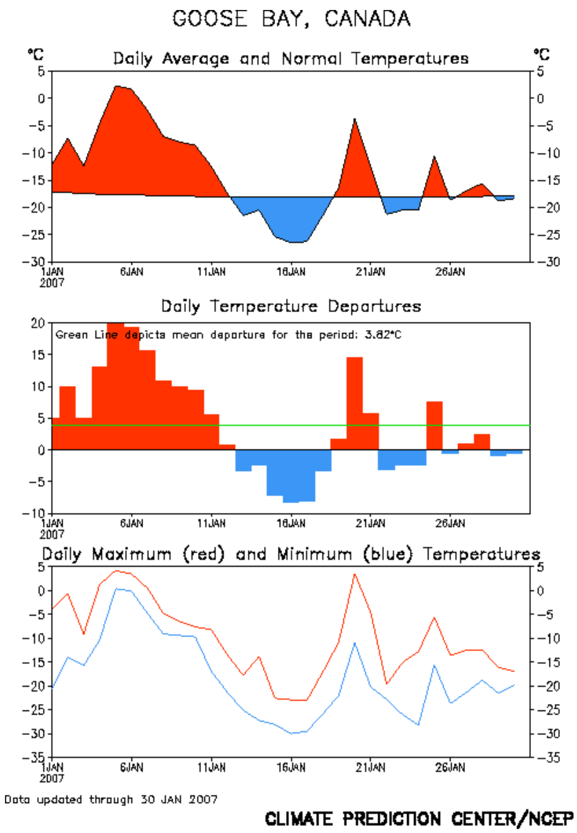


**Figure 17.** January 2007 air temperature in Goose Bay, Labrador.

In the beginning of January, the southern sea-ice edge reached the northern entrance to the Strait of Belle Isle about a week later than normal. By mid-month, it moved southward across the strait to the northern tip of Newfoundland as forecast by CIS (2006). The mean position for this date is approximately 90 nm farther south.

By 20 January, a high-pressure system moved into place in the central North Atlantic forcing a series of low-pressure systems to move from Newfoundland northward along the Labrador coast. This caused ice destruction and compressed the sea ice along the southern and central coast.

The combination of the warmer-than-normal air temperatures and the gale-force winds of the late-January storms resulted in a month's end sea-ice distribution in east Newfoundland waters that was less extensive than normal. The mean position of the southern ice edge is near Cape Freels, while in 2007 it was 80 nm to the north. At the end of January, the eastward extent of the ice edge was also well below normal along the southern Labrador coast. At 52°N, the latitude of Belle Isle, the eastern ice edge was approximately 60 nm offshore while its mean position is 160 nm offshore.

By 31 January 2007, three to four weeks later than normal, the sea-ice concentration in the Strait of Belle Isle and its approaches prompted the Canadian Coast Guard to recommend that the strait not be used by transatlantic shipping.

During the last half of January, four iceberg reconnaissance patrols documented a small iceberg population off Labrador. Two of the flights, conducted by Provincial Aerospace Limited (PAL) under CIS sponsorship, focused on the area near and within the sea-ice edge north of Goose Bay. PAL found 24 icebergs, all north of 56°N.

IIP's preseason reconnaissance detachment conducted the remaining two January flights on 28 and 31 January. They searched the northern Grand Banks and open water east of the ice edge along the Labrador coast to 58°N. They found a small population of icebergs, all in the sea ice north of 54°N. Thus, the early iceberg-reconnaissance results pointed to a light iceberg season.

In January 2007, no icebergs passed south of 48°N. The 1900-2006 mean for January is three.

## February

Warmer-than-normal conditions continued in northern Newfoundland and Labrador during February. The average temperature for the month was 1.7°C and 3.3°C above normal at St. Anthony and Cartwright, respectively. On the other hand, St. John's monthly mean air temperature was 0.7°C below normal.

The southward movement of the ice edge was slow during the first half of February. By mid-month, the southern ice edge was 20 nm north of Fogo Island, which is about 120 nm north of its mean position for the date. The eastern extent of the ice grew faster during the period but at mid-month was still short of the mean for the date. The eastern ice edge was 150 nm east of St. Anthony at mid-month, while its mean position is about 50 nm farther to the east.

The southern and eastern ice edge continued to expand during the second half of February, albeit slowly. Ice movement during the period was dominated by two intense low-pressure systems that passed through the region.

The first storm (20–21 February), the stronger of the two, generated hurricane force winds offshore and caused much ice destruction. The second storm **(Figures 18 and 19)**, nearly as strong, had a much greater impact on the sea ice because it lingered in the region for three days (25–27 February). The storm-driven, onshore winds compressed the sea ice along the southern Labrador coast **(Figure 20)**. At month's end, the eastern and southern sea-ice extents were much less than mean conditions.

Several reconnaissance flights by IIP and PAL found a very small population of icebergs in February. Most were far inside the sea-ice edge along the Labrador coast. During the month, no icebergs passed south of 48°N. The 1900-2006 mean for February is 15.

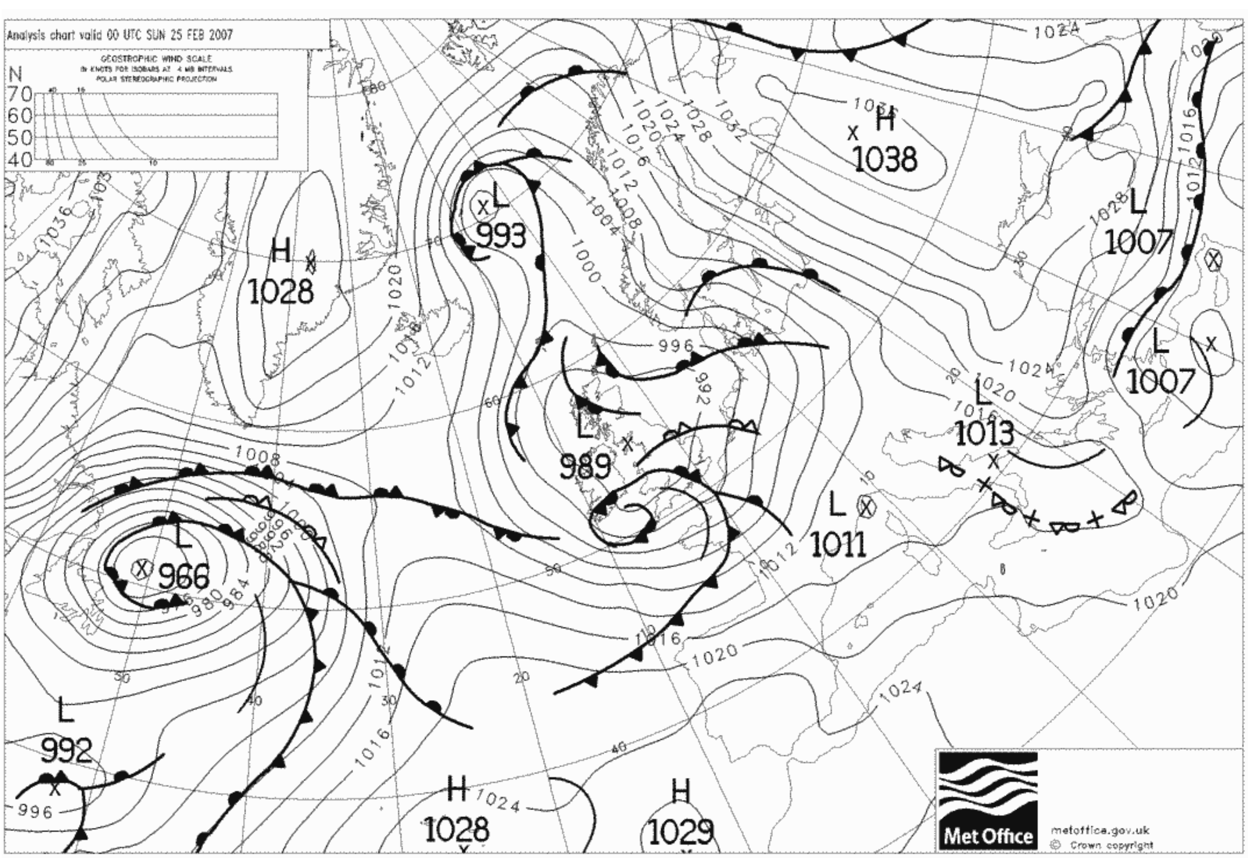


**Figure 18.** Sea-level pressure for 00Z 25 February 2007. Plot courtesy of Met Office, Bracknell, UK.

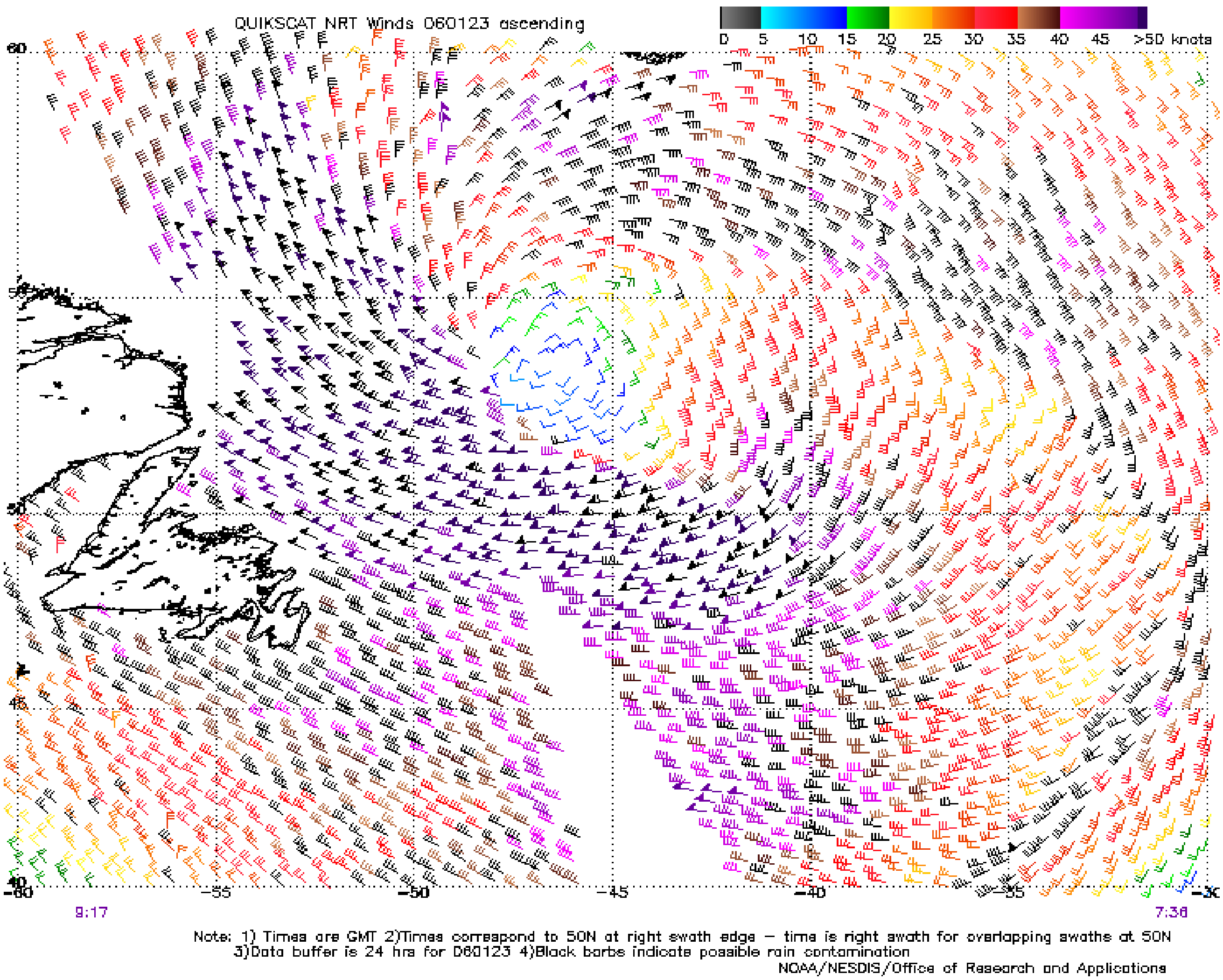


**Figure 19.** Surface winds for 0717Z 25 February 2007. Image courtesy the National Oceanic and Atmospheric Administration / National Environmental Satellite, Data, & Information Service / Center for Satellite Applications and Research.

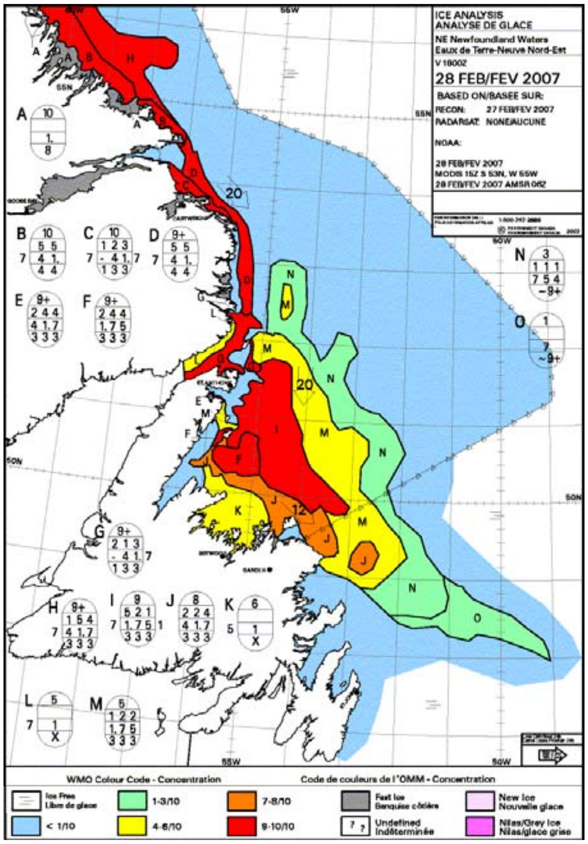

**Figure 20.** Sea-ice concentrations for 28 February 2007. Map Courtesy of the Canadian Ice Service.

## March

During March, mean air temperatures returned to near-normal conditions in Newfoundland and southern Labrador. Following the relaxation of the late February storm-driven winds, the sea ice resumed its southward and eastward expansion during the first two weeks of March. By 12 March, the southern ice edge was approximately at the latitude of Cape St. Francis. In a normal year, the southern ice edge is about 40 nm farther south. The eastern extent of the ice edge was also less than the mean. On this date, the eastern ice edge was approximately 60 nm inshore of its mean position.

During the third week of March, the southern sea-ice edge began what appeared to be its seasonal retreat, only to push farther south during the final week of the month. On 22 March, the southern ice edge had retreated to 50°N, but by month's end, it advanced 120 nm southward to the vicinity of Cape Bonavista. **Figure 21** shows the sea ice during its southward movement. On 31 March, the southern sea-ice edge was about 30 nm north of its mean position for the date, while the eastern edge of the ice was nearly 40 nm inshore of its mean position.

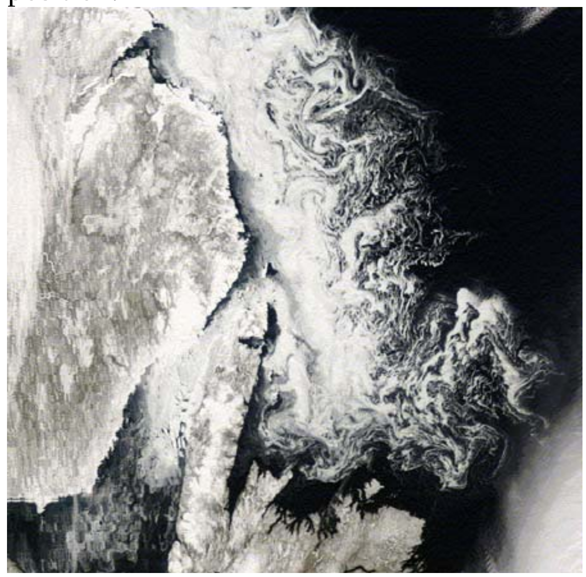
**Figure 21.** MODIS image (1435Z 26 March 2007) showing the sea-ice distribution in northeast Newfoundland waters and along the southern Labrador coast. Image courtesy of MODIS Rapid Response Project at the National Aeronautics and Space Administration/ Goddard Space Flight Center.

Throughout March, IIP reconnaissance detachments monitored a small population of icebergs on the northeast Newfoundland shelf, most of which were inshore of the sea-ice edge. Farther to the north, a 10 March PAL reconnaissance flight found well over 100 icebergs in the sea ice along the mid-Labrador coast. Later in the month, two additional PAL flights (27-28 March) spotted over 350 icebergs within or near the sea ice along the central Labrador coast. While it was clear that there was no imminent danger to transatlantic shipping in March, there was a substantial iceberg population poised to move into the shipping lanes in the coming months.

In March, four icebergs passed south of 48°N, much less than the mean of 60.

## April

Near-normal to slightly cooler-than-normal conditions prevailed in Newfoundland and Labrador in April. St. John's and Goose Bay were, respectively, 1.1° and 1.2°C cooler than normal for the month, while Cartwright and Nain were within one degree of normal.

The southern sea-ice edge continued a slow but persistent southward growth in early April. It reached Cape St. Francis on the 8th, which is about 60 nm south of its normal position for the date.

For a five-day period from 15 through 19 April, persistent and strong northeast winds caused significant shoreward sea-ice movement in east Newfoundland waters. The wind compressed the sea ice along Newfoundland's northeast shore from the Strait of Belle Isle to Cape Freels, resulting in a dramatic increase in ice pressure. In addition to the immense ice pressure, the pack ice in the region contained a greater-than-normal concentration of old ice, which is stronger than first-year ice. The resulting extreme ice conditions trapped more than 100 fishing vessels in the ice, triggering a massive and extended rescue effort by the Canadian Coast Guard.

Westerly winds during April's last week relaxed the pack ice along the northeast Newfoundland shore. The ice distribution at the end of the month was much more extensive than normal. On 30 April, the southern ice edge was located south of Cape Bonavista, nearly 100 nm south of its mean position. The eastern ice edge was over 60 nm east of Cape Freels.

In early April, icebergs on the Grand Banks began to move away from the sea ice toward the shipping lanes, particularly close to Newfoundland. In addition, there were numerous reports of icebergs within the sea ice north of Cape Freels and the Strait of Belle Isle. These icebergs were monitored by Ice Patrol and PAL aerial reconnaissance, as well as many Canadian Coast Guard vessels responding to the beset fishing vessels.

On 09 April, IIP began providing daily iceberg warnings to transatlantic mariners. At mid-month, the icebergs were confined to the northern Grand Banks. The southern LAKI was between the median and 75th percentile, while the eastern LAKI was at the 75th percentile. The southern LAKI changed little during the second half of April, while the eastern LAKI retreated somewhat, ending the month between the 75th percentile and the median.

In April, 40 icebergs passed south of 48°N. The 1900-2006 mean is 119.

## May

Slightly colder-than-normal conditions occupied Newfoundland and southern Labrador in May, with St John's reporting a monthly mean air temperature 0.9°C below normal and Cartwright recording 1.4°C below normal.

Sea ice lingered in northeast Newfoundland waters much longer than usual. At mid-month, the southern ice edge was south of Cape Bonavista, while the eastern ice edge was more than 60 nm offshore of Cape Freels. In normal years, significant sea-ice concentrations are restricted to the vicinity of Newfoundland's northern peninsula. By the end of May, the southern ice edge typically moves to the north of Belle Isle. In 2007, there was sea ice at Cape Freels and along the entire length of the northern arm offshore to 40-50 nm. This places the sea-ice retreat about three weeks behind the normal pace.

During May there was a small iceberg population on the Grand Banks, mostly confined to the northern part. Not far to the north, however, reconnaissance flights by Ice Patrol and PAL were monitoring a large iceberg population, mostly in the receding sea ice **(Figure 22).**

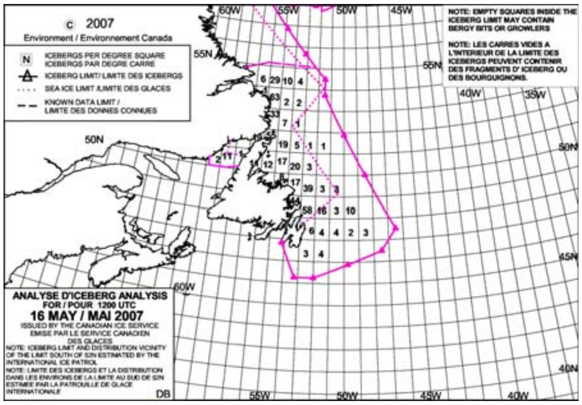


**Figure 22.** Iceberg distribution on 16 May 2007. The numbers indicate the number of icebergs and radar targets within a 1° by 1° of latitude and longitude bin. Map Courtesy of the Canadian Ice Service.

The southern iceberg limit remained in the vicinity of 45°N throughout the month, which places it near the 75th percentile. The eastern iceberg limit was also near the 75th percentile the entire month.

In May, 71 icebergs passed south of 48°N, much fewer than the 1900-2006 mean of 148.

### June

Warmer-than-normal conditions returned to northern Newfoundland and southern Labrador in June. St. Anthony, Cartwright and Goose Bay reported monthly average air temperatures more than 2°C above normal. Early in the month, the temperature of the sea surface along the southern Labrador coast also warmed rapidly **(Figure23).**

By mid-June, sea ice departed northeast Newfoundland waters. While this is over two weeks later than normal, it was clear that the retreat was accelerating because of the warmer-than-normal air and sea temperatures. By the end of June, the southern sea-ice edge moved north of Cartwright, which is approximately its normal position for the date.

The disappearance of sea ice from the Strait of Belle Isle led the Canadian Coast Guard to recommend its use for transatlantic voyages on 13 June 2007, which is nearly 7 weeks later than in 2006.

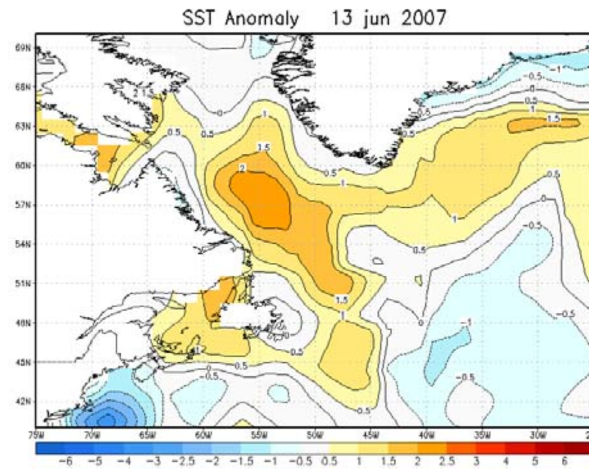


**Figure 23.** Sea surface temperature anomaly for 13 June 2007 in degrees C. Plot courtesy of National Oceanic and Atmospheric Administration / National Weather Survey.

The departing sea ice left many hundreds of icebergs drifting in open water in northeast Newfoundland waters, in the Strait of Belle Isle, and along the southern Labrador coast. While these icebergs were a danger to the vessels using the Strait of Belle Isle or navigating near Newfoundland, very few were in a position to move toward Flemish Pass and into the major transatlantic shipping lanes south of Newfoundland. As a result, the southern and eastern iceberg limits remained near the 75th percentile for the month, never reaching south of 44°N and reaching east of 45°W only once.

In June, Ice Patrol estimated that 183 icebergs passed south of 48°N, about one hundred more than the 1900-2006 mean of 84.

## July and August

Above-normal air and sea temperatures persisted into July. By mid-month, about a week ahead of normal, sea ice departed the Labrador coast.

In early July, several icebergs that advanced into Flemish Pass moved quickly southward, expanding the iceberg limit to the vicinity of the Tail of the Bank (see Figure 16) on 11 July before melting completely. At mid-month, both the southern and eastern iceberg limits were at the median. By the end of July, the iceberg population had declined dramatically, resulting in southern and eastern iceberg limits that were at the minimum.

In July, 26 icebergs passed south of 48°N, slightly fewer than the 1900-2006 mean of 30.

Throughout July, seasonal warming of the atmosphere and ocean took its toll on the numerous icebergs left behind by the sea ice. During the second half of the month, the sea surface temperature along most of Labrador's coast was more than 2°C above normal.

The southern and easternmost icebergs found during the 2007 ice year were detected in July by Ice Patrol reconnaissance aircraft. The southernmost was detected on 03 July at 44°40.2'N, 49°06.0'W and the easternmost on 15 July at 47°25.8'N, 45°15.0'W. These two icebergs also achieved the southernmost (43°01.8'N, 49°24.6'W on 11 July) and easternmost (47°22.2'N, 44°58.2'W on 17 July) positions estimated by the iceberg drift model for the year, respectively.

On 01 August, after verifying that there were no icebergs threatening the transatlantic shipping lanes, Ice Patrol's last 2007 ice reconnaissance detachment returned from Newfoundland. On 03 August, Ice Patrol broadcast its last daily iceberg warning to mariners.

## Discussion

While the number of icebergs that reached the Grand Banks in 2007 greatly exceeded the total of the previous two years, it was well less than the 1900-2006 average of 473. Ice Patrol estimated that 324 icebergs passed south of 48°N, placing the year in the low end of the moderate range (300-600 icebergs) as defined by Trivers (1994). The 116-day season length (defined as the number of days IIP provided daily iceberg warnings to mariners) placed 2007 in the average season-length category (105-180 days).

Both sea ice **(Figure 24)** and icebergs **(Figure 25)** exhibited similar patterns during the 2006-2007 season. They arrived later than normal on the Grand Banks and for most of the year were less extensive than normal. Their patterns were also similar in that, late in the season, both populations exceeded their mean. In the case of the sea ice, the coverage on the Grand Banks slightly exceeded the norm in late May. In the case of the iceberg population, the number of icebergs that passed south of 48°N in June was more than twice the monthly average.

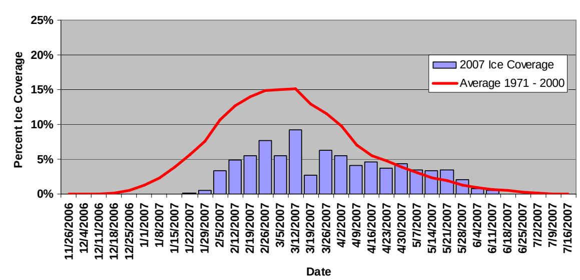


**Figure 24.** Weekly sea ice coverage for the 2006-2007 season on the Grand Banks. Ice data courtesy of the Canadian Ice Service's Ice Graph web page (CIS, 2008).

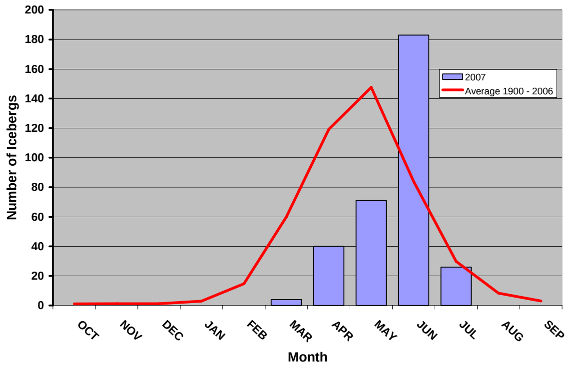


**Figure 25.** Estimated number of icebergs that passed south of 48° N each month during 2007.

The large-scale weather patterns in Labrador and Newfoundland were consistent with the observed ice conditions. In December 2006 and January 2007, much warmer-than-normal air temperatures in Labrador coincided with the slow development of sea ice and late arrival of icebergs on the Grand Banks. After March and April's near-normal conditions, May was colder than normal, which was consistent with the slow northward retreat of the ice edge. Finally, the warmer-than-normal conditions in June and July fueled the rapid withdrawal of sea ice from Newfoundland waters.

The winter 2007 (December 2006 through March 2007) North Atlantic Oscillation (NAO) Index was 2.80 (Hurrell, 2008). This value is calculated using the difference of normalized sea-level atmospheric pressure between Lisbon, Portugal and Stykkisholmur/Reykjavik, Iceland.

The NAO, the dominant pattern of winter atmospheric variability in the North Atlantic, fluctuates between positive and negative phases. The positive phase is associated with meteorological conditions that favor the movement of icebergs into the shipping lanes. These include strong and persistent northwest winds along the Labrador coast, which bring colder-than-normal air temperatures and greater-than-normal sea-ice extent off Labrador and Newfoundland. In addition, the persistent northwest winds promote southward iceberg movement. Warmer-than-normal conditions and less extensive sea ice off the Labrador coast are associated with the negative NAO phase. The 2.80 NAOI value in 2007 was strongly positive, which is inconsistent with the warmer-than-normal air temperatures in Labrador in December 2006 and January 2007 and the moderate sea-ice extent and iceberg year that followed.

Predicting the timing and the severity of an iceberg season has long been recognized as a difficult undertaking. Desjardins' forecast (Desjardins, 2006) that the iceberg season would begin in mid- to late-March was not far off. Ice Patrol started providing daily warnings to mariners on 09 April. In addition, based on the October 2006 pre-season survey of the iceberg population in Davis Strait, he predicted that a light iceberg season was impending. The final iceberg count, 324, was barely into the moderate range. The remarkably close agreement between his Davis Strait iceberg count (304) and the number of icebergs that passed south of 48°N is simply fortuitous. It is unlikely that those same 304 icebergs made up the bulk of the icebergs that arrived on the Grand Banks from March through July.

Peterson (2004) developed an iceberg-population forecast system based on the positive correlation between the number of icebergs reaching the Grand Banks and the antecedent sea-ice extent from CIS. From February though July each year, she calculates two monthly forecasts (Peterson, personal communication), one based on the sea-ice extent one to two months prior to the forecast month (1-2 month prediction), and the other using the sea-ice extent of the previous month (0-1 month prediction). While this is still a research product, the results from 2007 were promising. For most months, the 0-1 month prediction forecast iceberg populations were on the low end of the normal range or slightly below normal. The exception was June, which was forecast to be at the upper end of the normal range. These short-term forecasts were largely correct. This is not surprising given the close similarities between the progression of the sea-ice and iceberg population during the year **(Figures 24 and 25)**. These figures show a late arriving and below-average sea-ice and iceberg population early in the year and greater-than-normal conditions toward the end of the season. The 0-2 month predictions were not as accurate, but still captured the general character of the 2007 iceberg season as one being on the low end of the moderate range.

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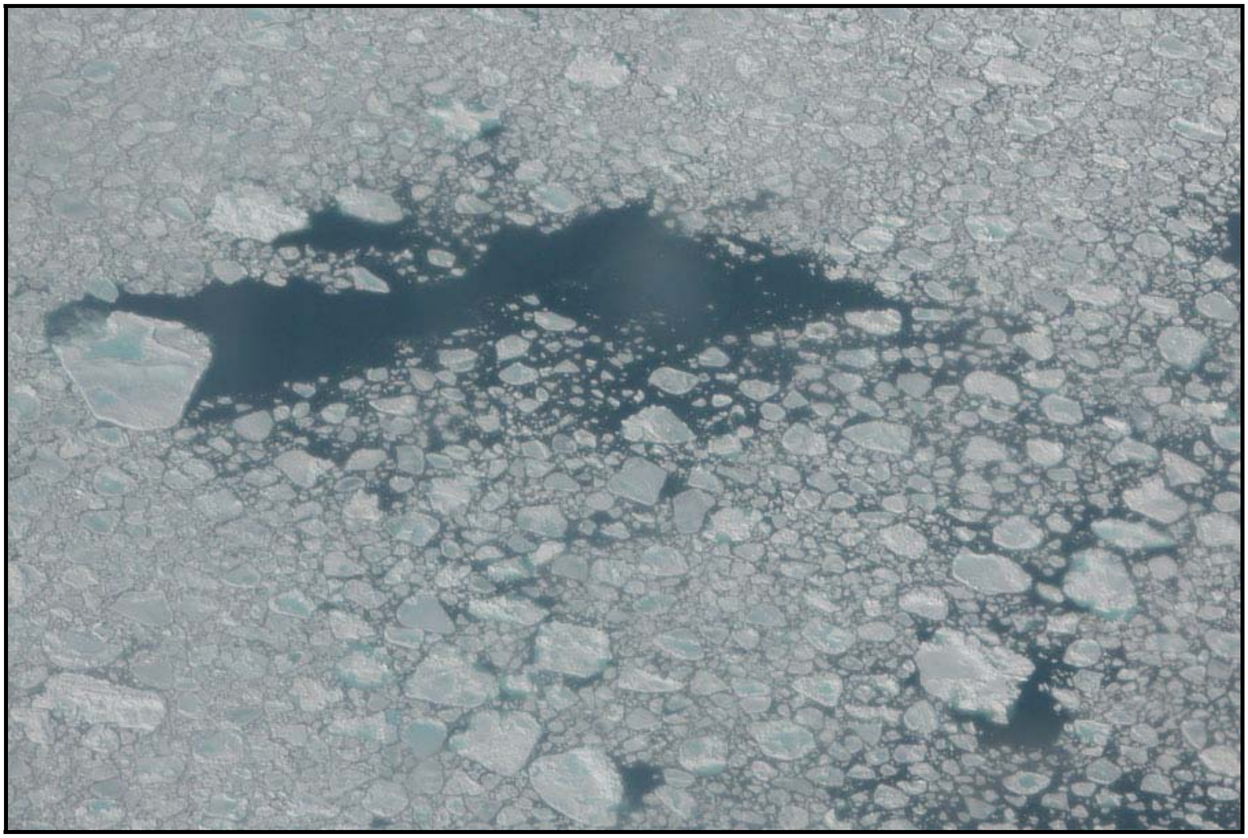
# Monthly Sea-Ice Charts



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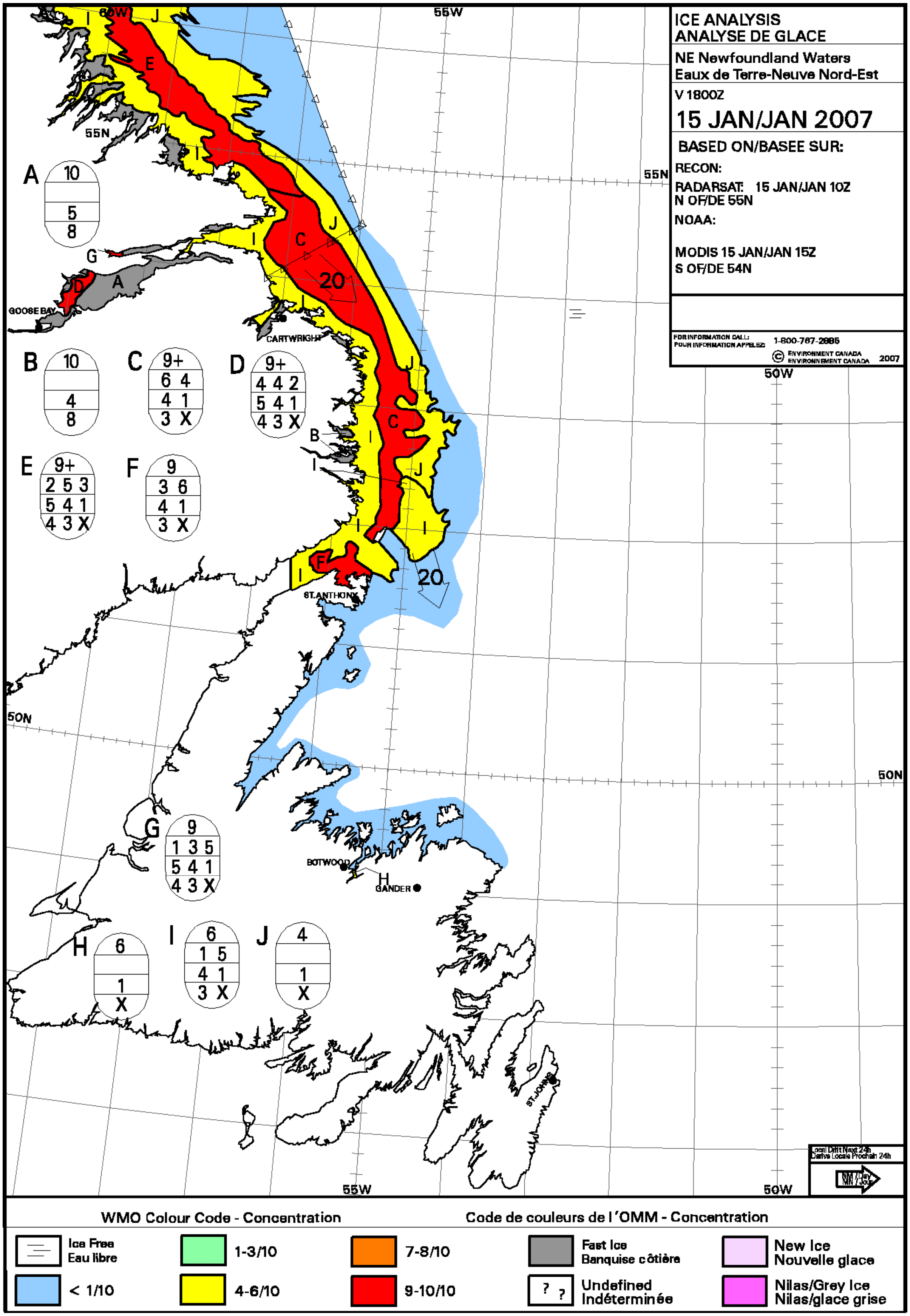
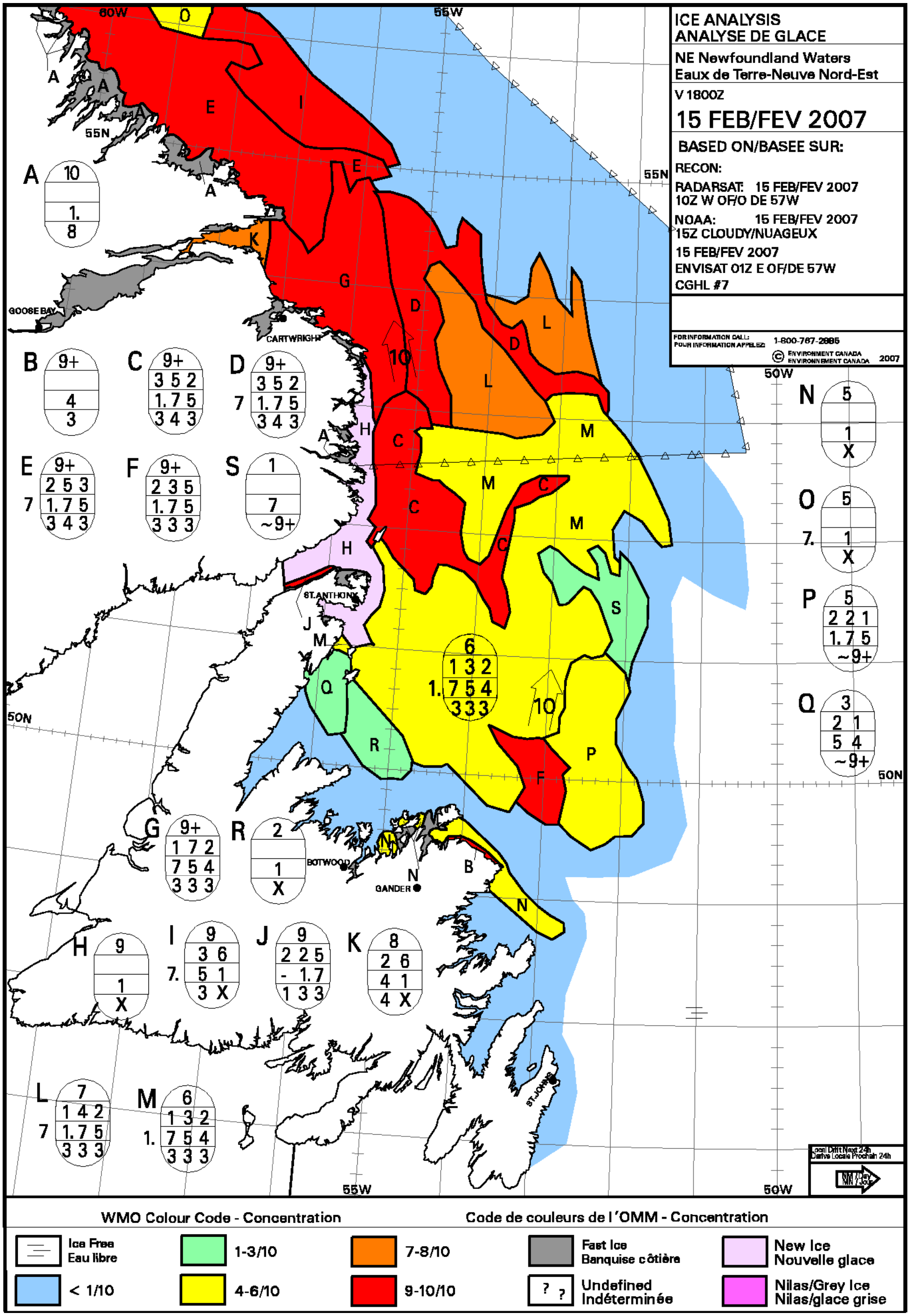
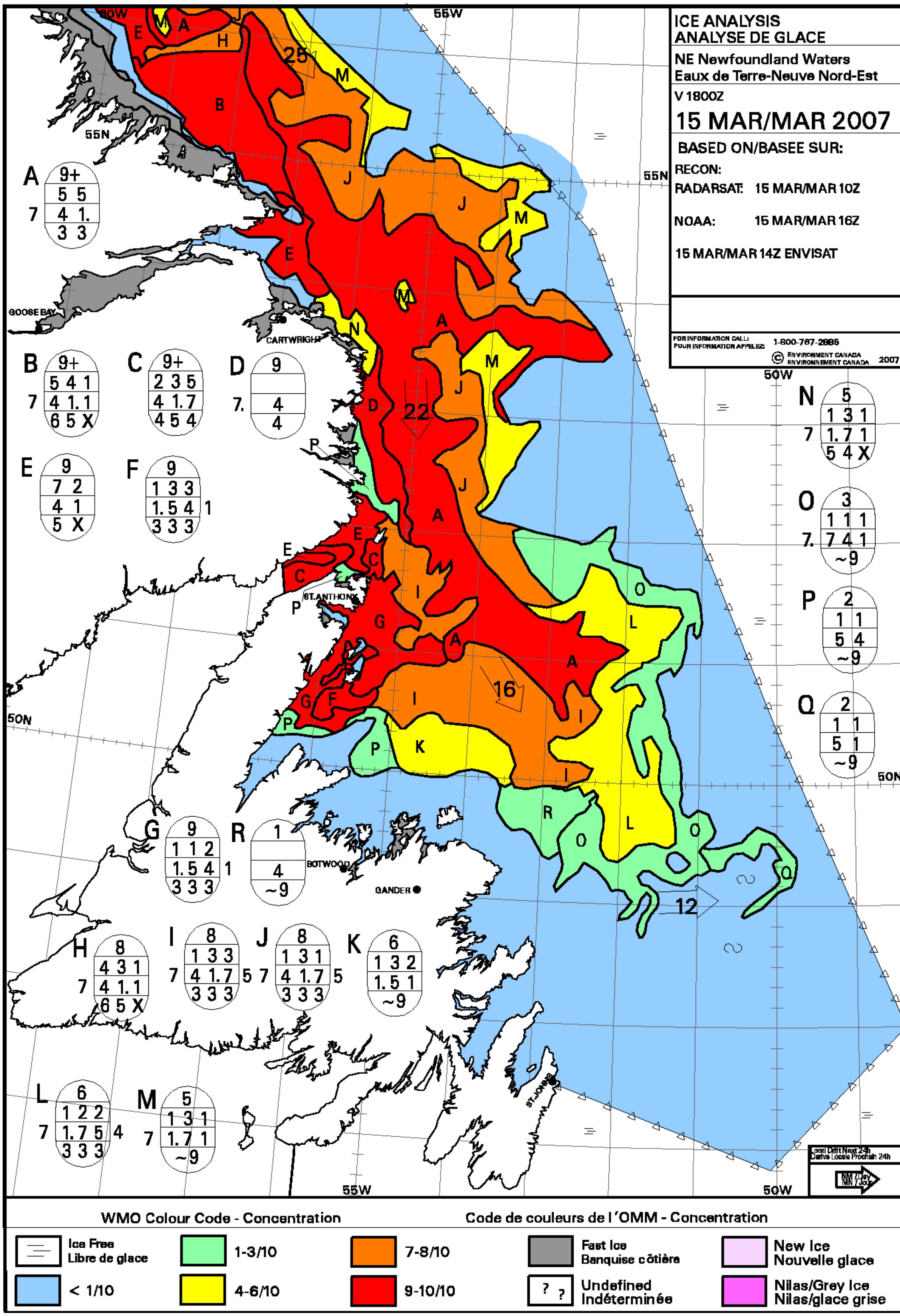
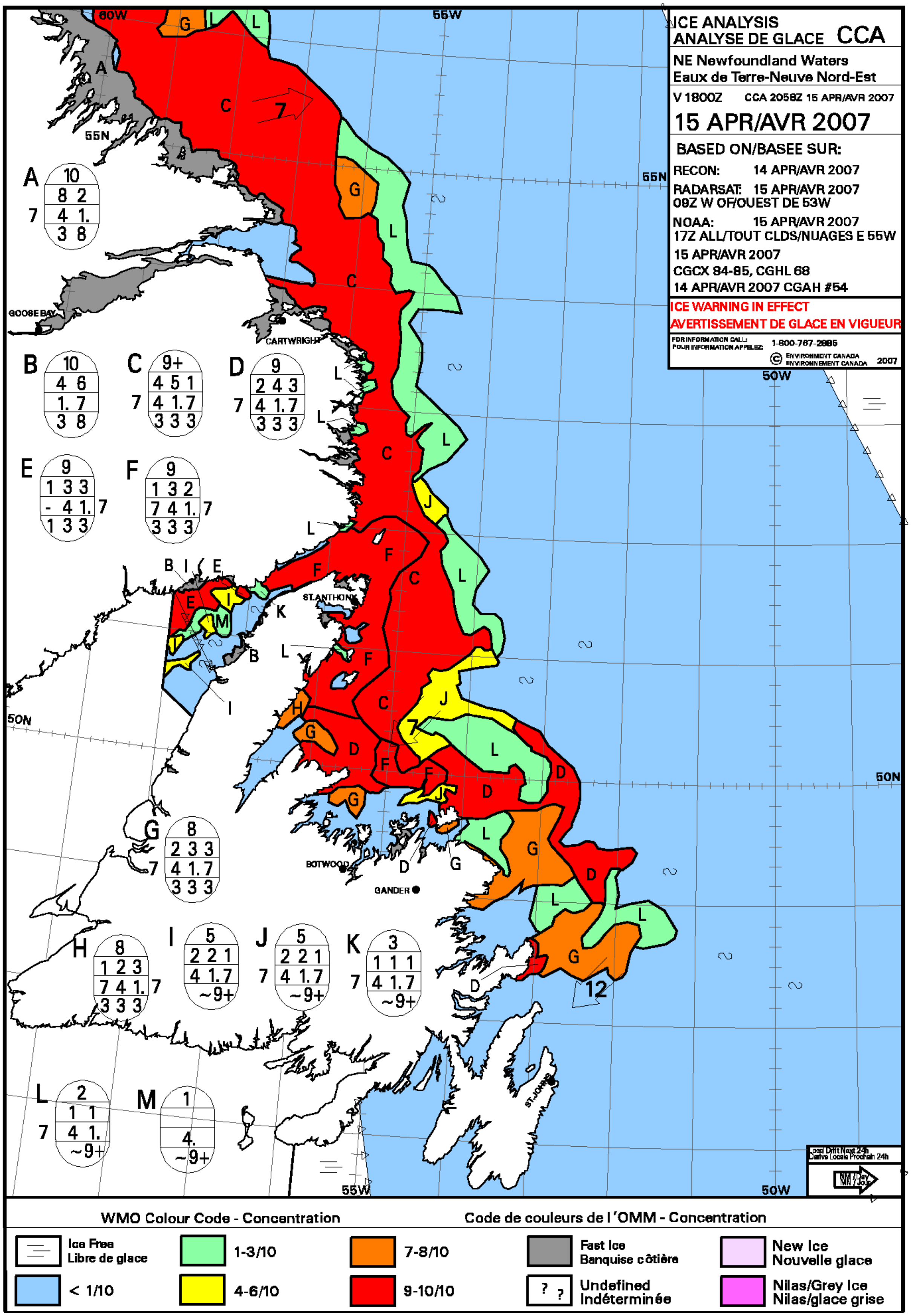
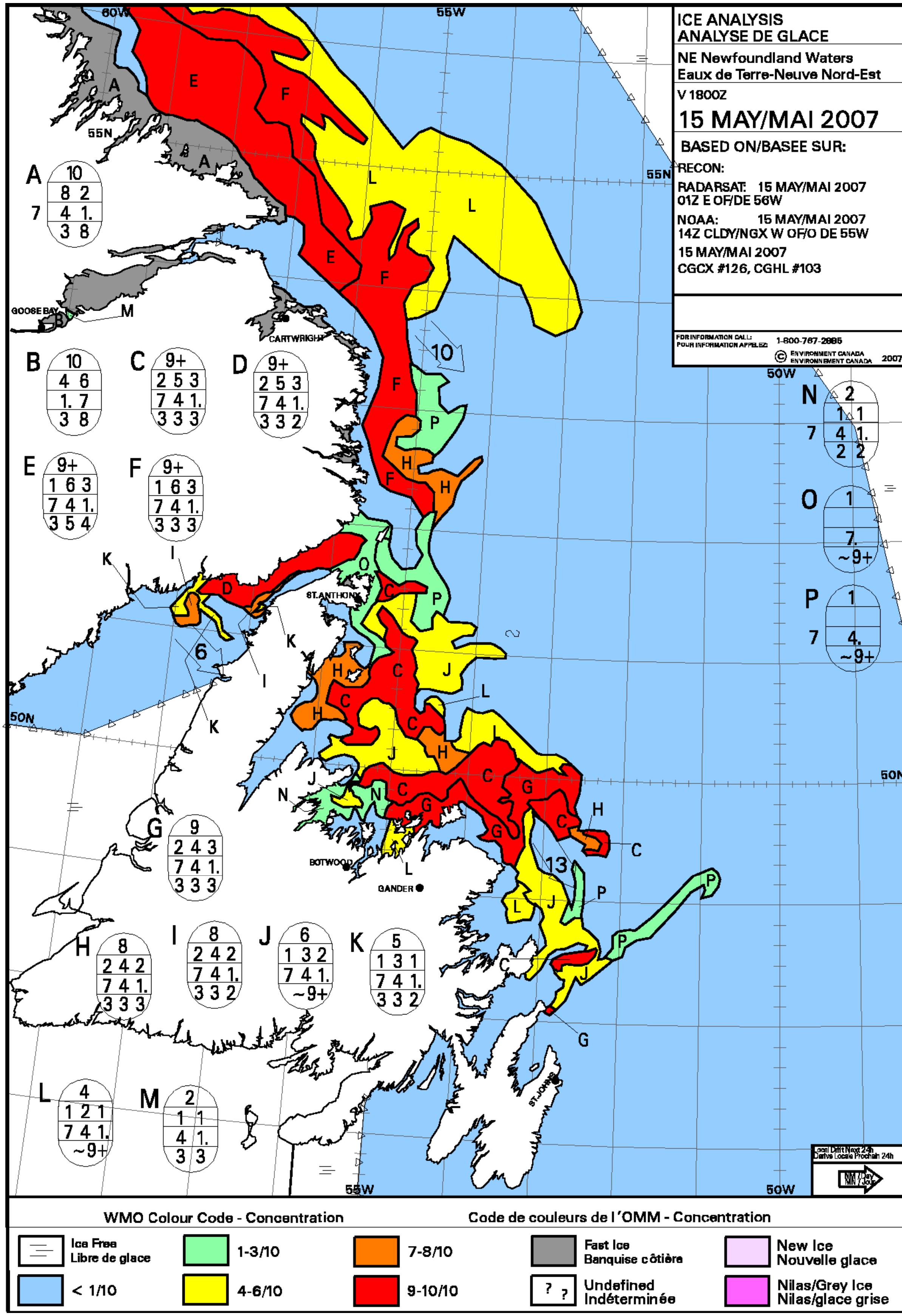

ICE ANALYSIS
ANALYSE DE GLACE
NE Newfoundland Waters
Eaux de Terre-Neuve Nord-Est
V 1800Z
15 JAN/JAN 2007
BASED ON/BASEE SUR:
RECON:
RADARSAT: 15 JAN/JAN 10Z
N OF/DE 55N
NOAA:
MODIS 15 JAN/JAN 15Z
S OF/DE 54N
1-800-767-2885
2007
GOOSE BAY
CARTWRIGHT
ST. ANTHONY
BOTWOOD
GANDER
ST. JOHNS
55N
50N
55W
50W
WMO Colour Code - Concentration
Code de couleurs de l'OMM - Concentration
Ice Free
Eau libre
< 1/10
1-3/10
4-6/10
7-8/10
9-10/10
Fast Ice
Banquise côtière
Undefined
Indéterminée
New Ice
Nouvelle glace
Nilas/Grey Ice
Nilas/glace grise

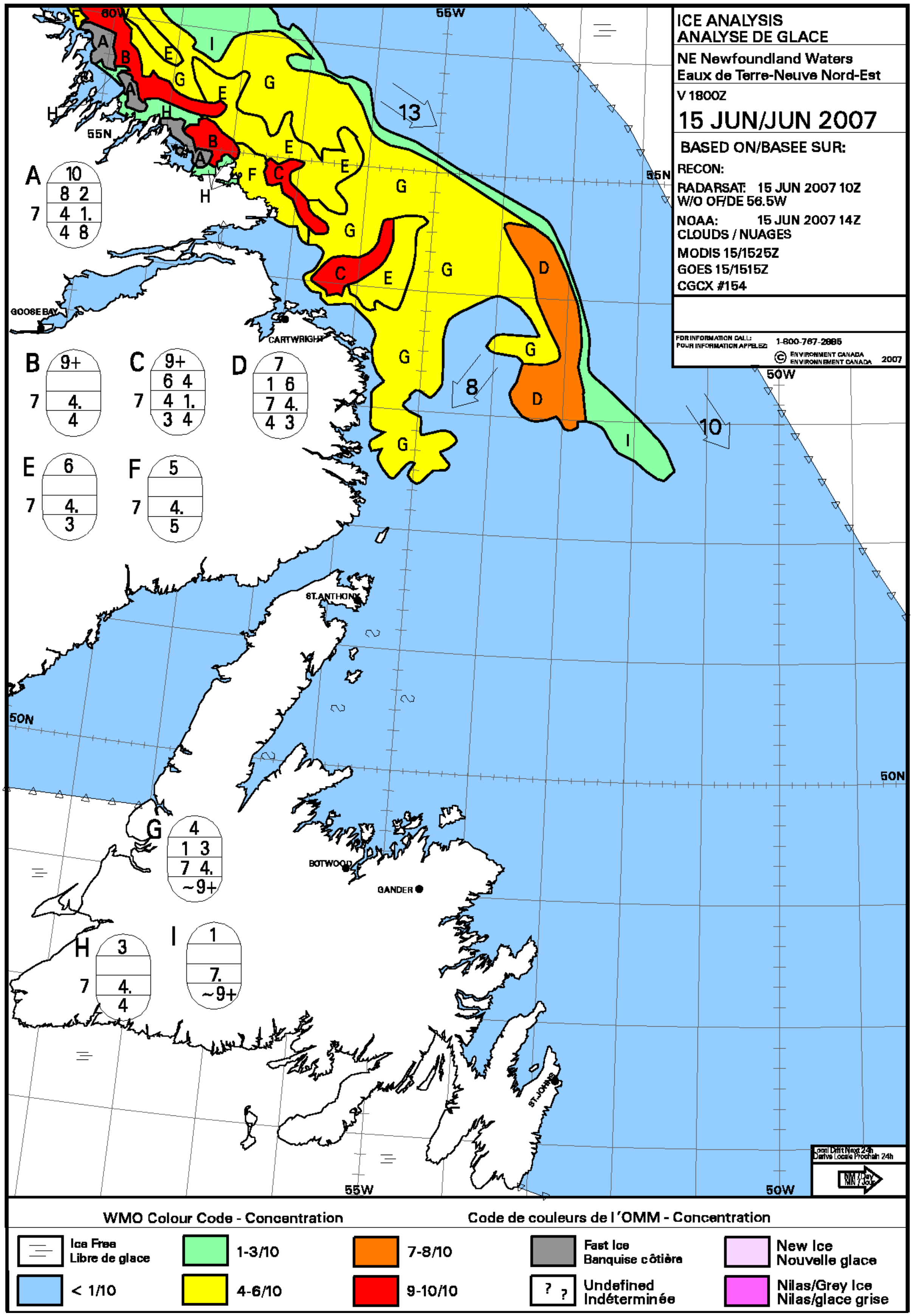

ICE ANALYSIS
ANALYSE DE GLACE
NE Newfoundland Waters
Eaux de Terre-Neuve Nord-Est
V 1800Z
15 FEB/FEV 2007
BASED ON/BASEE SUR:
RECON:
RADARSAT: 15 FEB/FEV 2007
10Z W OF/O DE 57W
NOAA: 15 FEB/FEV 2007
15Z CLOUDY/NUAGEUX
15 FEB/FEV 2007
ENVISAT 01Z E OF/DE 57W
CGHL #7
1-800-767-2885
ENVIRONMENT CANADA
ENVIRONNEMENT CANADA
2007
60W
55W
50W
55N
50N
GOOSE BAY
CARTWRIGHT
ST.ANTHONY
BOTWOOD
GANDER
ST.JOHN'S
WMO Colour Code - Concentration
Code de couleurs de l'OMM - Concentration
Ice Free
Eau libre
< 1/10
1-3/10
4-6/10
7-8/10
9-10/10
Fast Ice
Banquise côtière
Undefined
Indéterminée
New Ice
Nouvelle glace
Nilas/Grey Ice
Nilas/glace grise

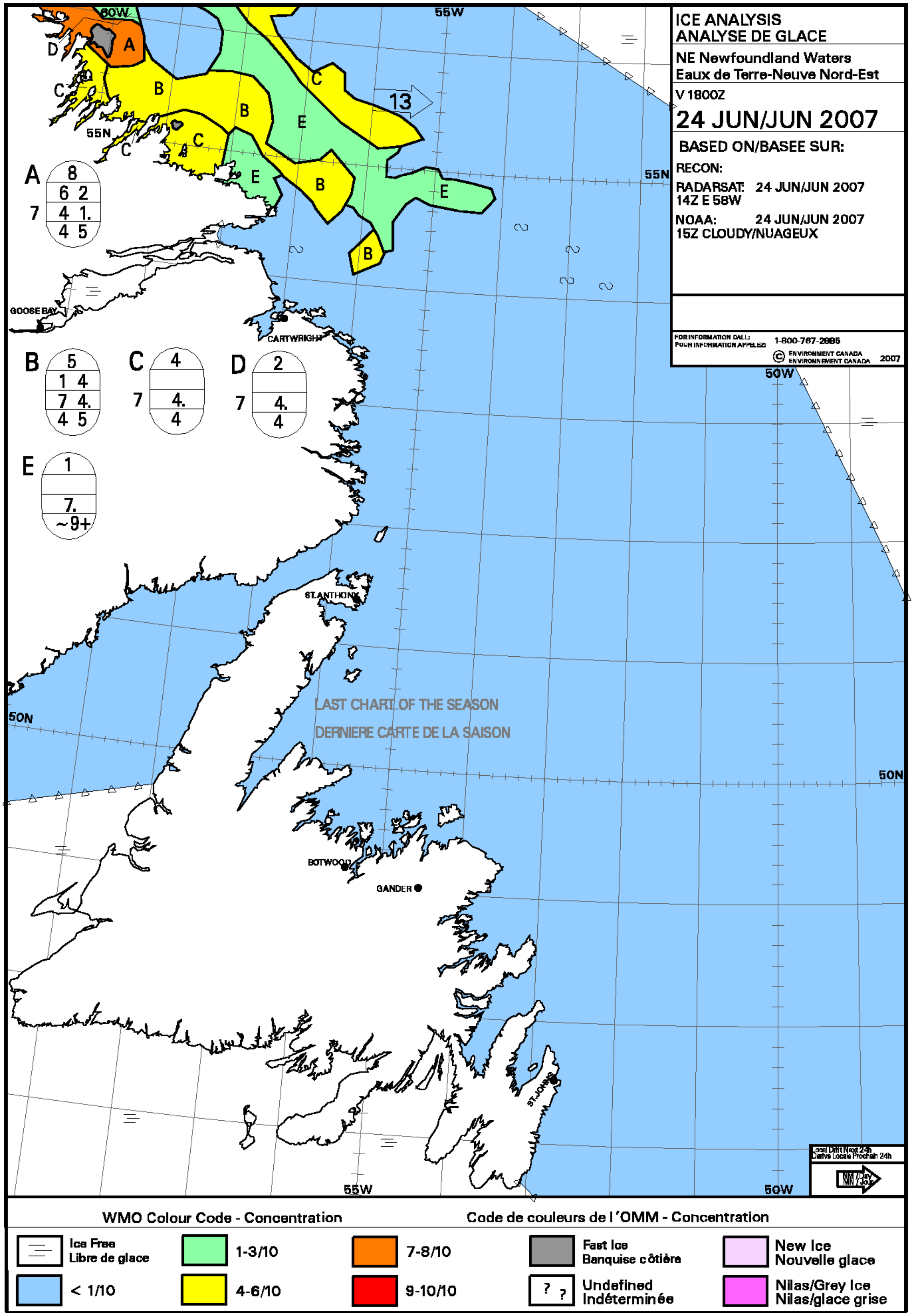


ICE ANALYSIS
ANALYSE DE GLACE
NE Newfoundland Waters
Eaux de Terre-Neuve Nord-Est
V 1800Z
15 MAR/MAR 2007
BASED ON/BASEE SUR:
RECON:
RADARSAT: 15 MAR/MAR 10Z
NOAA: 15 MAR/MAR 16Z
15 MAR/MAR 14Z ENVISAT
FOR INFORMATION CALL: POUR INFORMATION APPELEZ: 1-800-767-2885
© ENVIRONMENT CANADA ENVIRONNEMENT CANADA 2007
GOOSE BAY
CARTWRIGHT
ST. ANTHONY
BOTWOOD
GANDER
ST. JOHN'S
55N
50N
60W
55W
50W
WMO Colour Code - Concentration
Code de couleurs de l'OMM - Concentration
Ice Free
Libre de glace
< 1/10
1-3/10
4-6/10
7-8/10
9-10/10
Fast Ice
Banquise côtière
Undefined
Indéterminée
New Ice
Nouvelle glace
Nilas/Grey Ice
Nilas/glace grise


ICE ANALYSIS
ANALYSE DE GLACE CCA
NE Newfoundland Waters
Eaux de Terre-Neuve Nord-Est
V 1800Z CCA 2058Z 15 APR/AVR 2007
15 APR/AVR 2007
BASED ON/BASEE SUR:
RECON: 14 APR/AVR 2007
RADARSAT: 15 APR/AVR 2007
09Z W OF/OUEST DE 53W
NOAA: 15 APR/AVR 2007
17Z ALL/TOUT CLDS/NUAGES E 55W
15 APR/AVR 2007
CGCX 84-85, CGHL 68
14 APR/AVR 2007 CGAH #54
ICE WARNING IN EFFECT
AVERTISSEMENT DE GLACE EN VIGUEUR
1-800-767-2885
60W
55W
50W
55N
50N
GOOSE BAY
CARTWRIGHT
ST.ANTHONY
BOTWOOD
GANDER
ST.JOHNS
WMO Colour Code - Concentration
Code de couleurs de l'OMM - Concentration
Ice Free
Libre de glace
< 1/10
1-3/10
4-6/10
7-8/10
9-10/10
Fast Ice
Banquise côtière
Undefined
Indéterminée
New Ice
Nouvelle glace
Nilas/Grey Ice
Nilas/glace grise

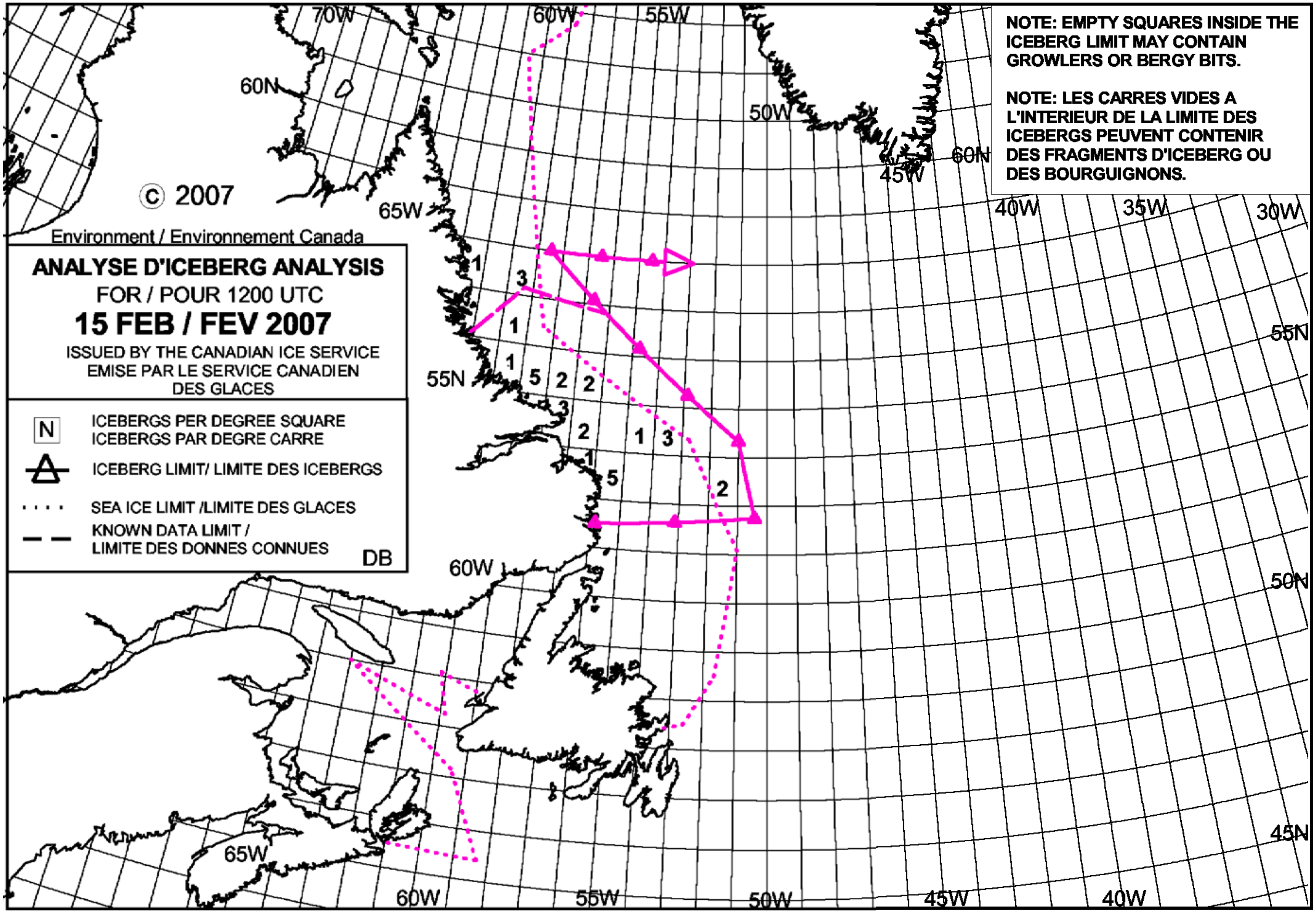

ICE ANALYSIS
ANALYSE DE GLACE
NE Newfoundland Waters
Eaux de Terre-Neuve Nord-Est
V 1800Z
15 MAY/MAI 2007
BASED ON/BASEE SUR:
RECON:
RADARSAT: 15 MAY/MAI 2007 01Z E OF/DE 56W
NOAA: 15 MAY/MAI 2007 14Z CLDY/NGX W OF/O DE 55W
15 MAY/MAI 2007 CGCX #126, CGHL #103
1-800-767-2885
ENVIRONMENT CANADA
ENVIRONNEMENT CANADA
2007
60W
55W
50W
55N
50N
GOOSE BAY
CARTWRIGHT
ST.ANTHONY
BOTWOOD
GANDER
ST.JOHNS
Local Drift Next 24h
Dérive Locale Prochain 24h
WMO Colour Code - Concentration
Code de couleurs de l'OMM - Concentration
Ice Free
Libre de glace
< 1/10
1-3/10
4-6/10
7-8/10
9-10/10
Fast Ice
Banquise côtière
Undefined
Indéterminée
New Ice
Nouvelle glace
Nilas/Grey Ice
Nilas/glace grise

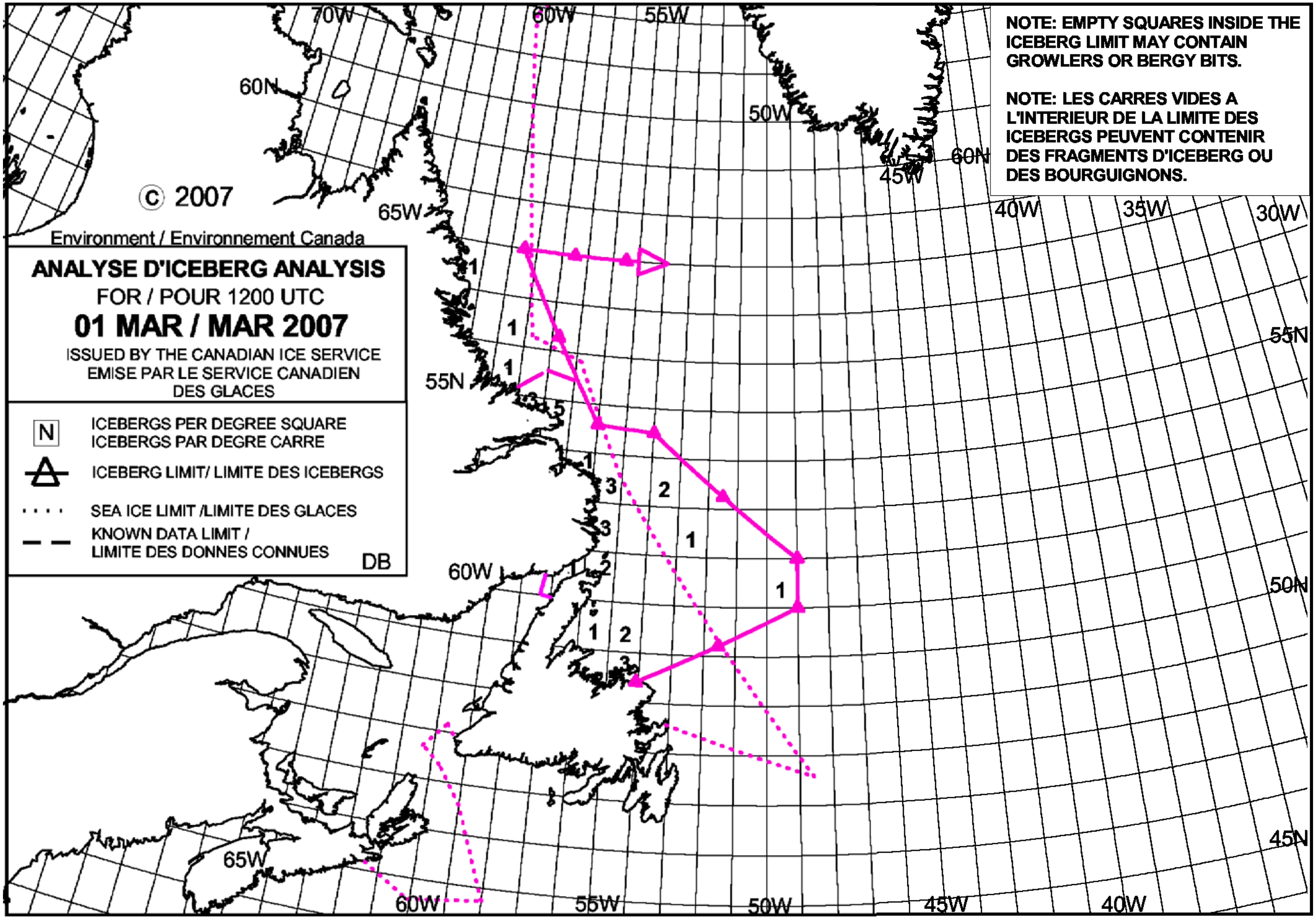

ICE ANALYSIS
ANALYSE DE GLACE
NE Newfoundland Waters
Eaux de Terre-Neuve Nord-Est
V 1800Z
15 JUN/JUN 2007
BASED ON/BASEE SUR:
RECON:
RADARSAT: 15 JUN 2007 10Z
W/O OF/DE 56.5W
NOAA: 15 JUN 2007 14Z
CLOUDS / NUAGES
MODIS 15/1525Z
GOES 15/1515Z
CGCX #154
FOR INFORMATION CALL:
POUR INFORMATION APPELEZ:
1-800-767-2885
© ENVIRONMENT CANADA
ENVIRONNEMENT CANADA
2007
60W
55W
50W
55N
50N
GOOSE BAY
CARTWRIGHT
ST.ANTHONY
BOTWOOD
GANDER
ST.JOHN'S
13
8
10
Local Drift Next 24h
Dérive Locale Prochain 24h
NM / Day
MN / Jour
WMO Colour Code - Concentration
Code de couleurs de l'OMM - Concentration
Ice Free
Libre de glace
< 1/10
1-3/10
4-6/10
7-8/10
9-10/10
Fast Ice
Banquise côtière
Undefined
Indéterminée
New Ice
Nouvelle glace
Nilas/Grey Ice
Nilas/glace grise

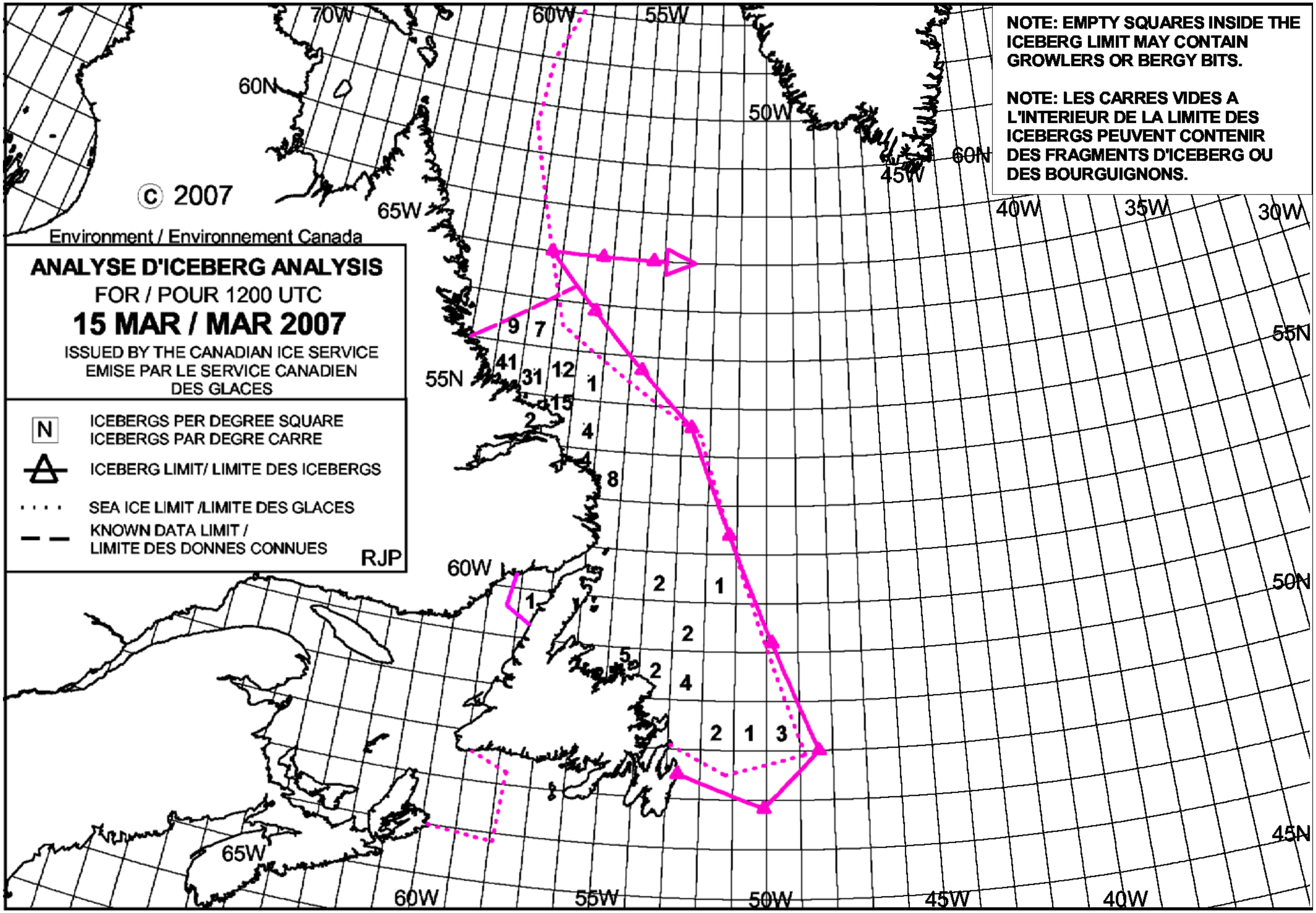

ICE ANALYSIS
ANALYSE DE GLACE
NE Newfoundland Waters
Eaux de Terre-Neuve Nord-Est
V 1800Z
24 JUN/JUN 2007
BASED ON/BASEE SUR:
RECON:
RADARSAT: 24 JUN/JUN 2007
14Z E 58W
NOAA: 24 JUN/JUN 2007
15Z CLOUDY/NUAGEUX
1-800-767-2885
ENVIRONMENT CANADA
ENVIRONNEMENT CANADA
2007
60W
55W
50W
55N
50N
GOOSE BAY
CARTWRIGHT
ST.ANTHONY
BOTWOOD
GANDER
ST.JOHN'S
LAST CHART OF THE SEASON
DERNIERE CARTE DE LA SAISON
WMO Colour Code - Concentration
Code de couleurs de l'OMM - Concentration
Ice Free
Libre de glace
< 1/10
1-3/10
4-6/10
7-8/10
9-10/10
Fast Ice
Banquise côtière
Undefined
Indéterminée
New Ice
Nouvelle glace
Nilas/Grey Ice
Nilas/glace grise

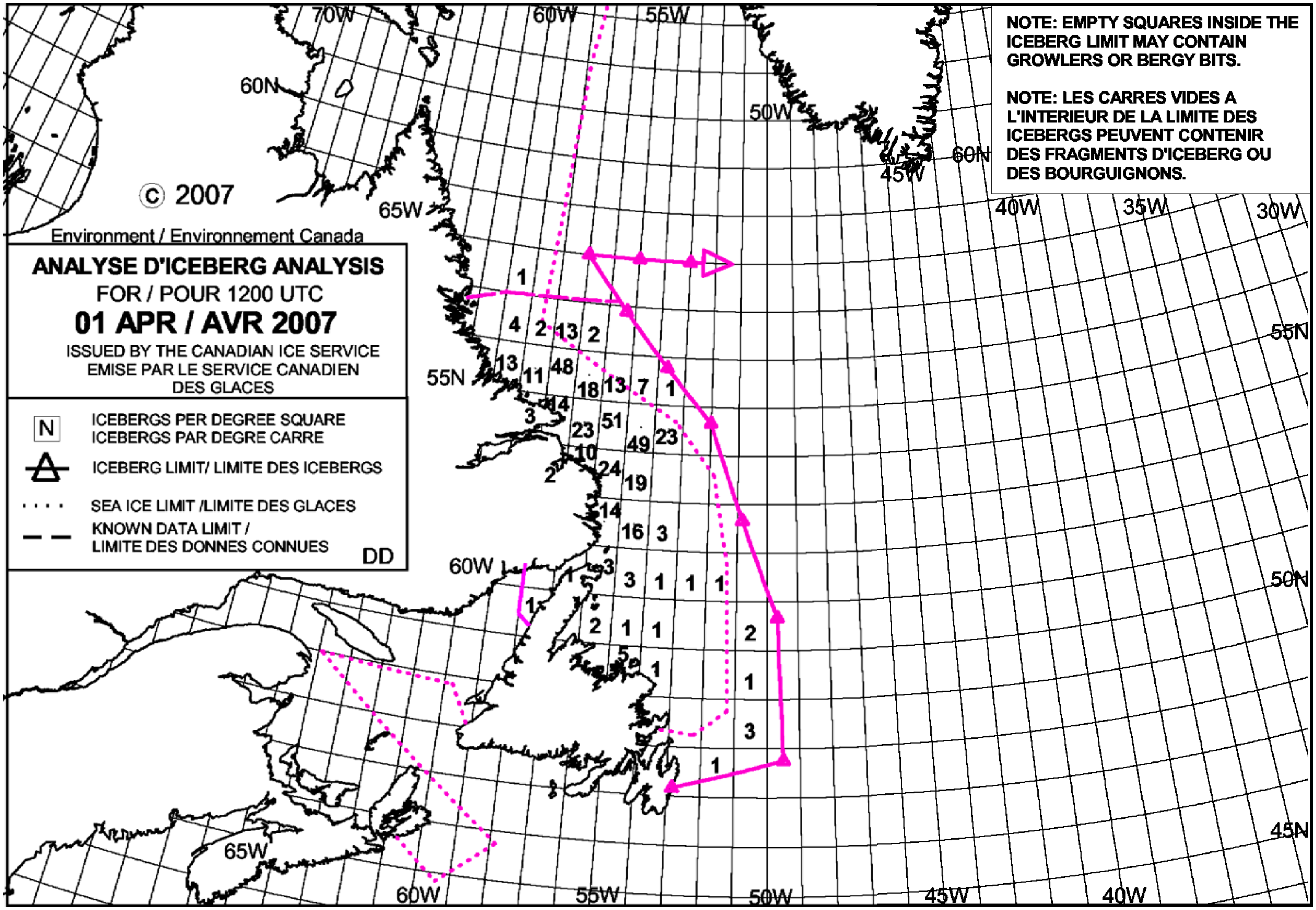
# Biweekly Iceberg Charts

Iceberg charts are reprinted with permission of the Canadian Ice Service.


NOTE: EMPTY SQUARES INSIDE THE ICEBERG LIMIT MAY CONTAIN GROWLERS OR BERGY BITS.
NOTE: LES CARRES VIDES A L'INTERIEUR DE LA LIMITE DES ICEBERGS PEUVENT CONTENIR DES FRAGMENTS D'ICEBERG OU DES BOURGUIGNONS.
© 2007
Environment / Environnement Canada
ANALYSE D'ICEBERG ANALYSIS
FOR / POUR 1200 UTC
15 FEB / FEV 2007
ISSUED BY THE CANADIAN ICE SERVICE
EMISE PAR LE SERVICE CANADIEN DES GLACES
ICEBERGS PER DEGREE SQUARE
ICEBERGS PAR DEGRE CARRE
ICEBERG LIMIT/ LIMITE DES ICEBERGS
SEA ICE LIMIT /LIMITE DES GLACES
KNOWN DATA LIMIT /
LIMITE DES DONNES CONNUES
DB


NOTE: EMPTY SQUARES INSIDE THE ICEBERG LIMIT MAY CONTAIN GROWLERS OR BERGY BITS.
NOTE: LES CARRES VIDES A L'INTERIEUR DE LA LIMITE DES ICEBERGS PEUVENT CONTENIR DES FRAGMENTS D'ICEBERG OU DES BOURGUIGNONS.
© 2007
Environment / Environnement Canada
ANALYSE D'ICEBERG ANALYSIS
FOR / POUR 1200 UTC
01 MAR / MAR 2007
ISSUED BY THE CANADIAN ICE SERVICE
EMISE PAR LE SERVICE CANADIEN DES GLACES
N ICEBERGS PER DEGREE SQUARE
ICEBERGS PAR DEGRE CARRE
ICEBERG LIMIT/ LIMITE DES ICEBERGS
SEA ICE LIMIT /LIMITE DES GLACES
KNOWN DATA LIMIT /
LIMITE DES DONNES CONNUES
DB
70W
60W
55W
50W
45W
40W
35W
30W
65W
60N
55N
50N
45N


NOTE: EMPTY SQUARES INSIDE THE ICEBERG LIMIT MAY CONTAIN GROWLERS OR BERGY BITS.
NOTE: LES CARRES VIDES A L'INTERIEUR DE LA LIMITE DES ICEBERGS PEUVENT CONTENIR DES FRAGMENTS D'ICEBERG OU DES BOURGUIGNONS.
© 2007
Environment / Environnement Canada
ANALYSE D'ICEBERG ANALYSIS
FOR / POUR 1200 UTC
15 MAR / MAR 2007
ISSUED BY THE CANADIAN ICE SERVICE
EMISE PAR LE SERVICE CANADIEN DES GLACES
ICEBERGS PER DEGREE SQUARE
ICEBERGS PAR DEGRE CARRE
ICEBERG LIMIT/ LIMITE DES ICEBERGS
SEA ICE LIMIT /LIMITE DES GLACES
KNOWN DATA LIMIT /
LIMITE DES DONNES CONNUES
RJP
70W
65W
60W
55W
50W
45W
40W
35W
30W
60N
55N
50N
45N


NOTE: EMPTY SQUARES INSIDE THE ICEBERG LIMIT MAY CONTAIN GROWLERS OR BERGY BITS.
NOTE: LES CARRES VIDES A L'INTERIEUR DE LA LIMITE DES ICEBERGS PEUVENT CONTENIR DES FRAGMENTS D'ICEBERG OU DES BOURGUIGNONS.
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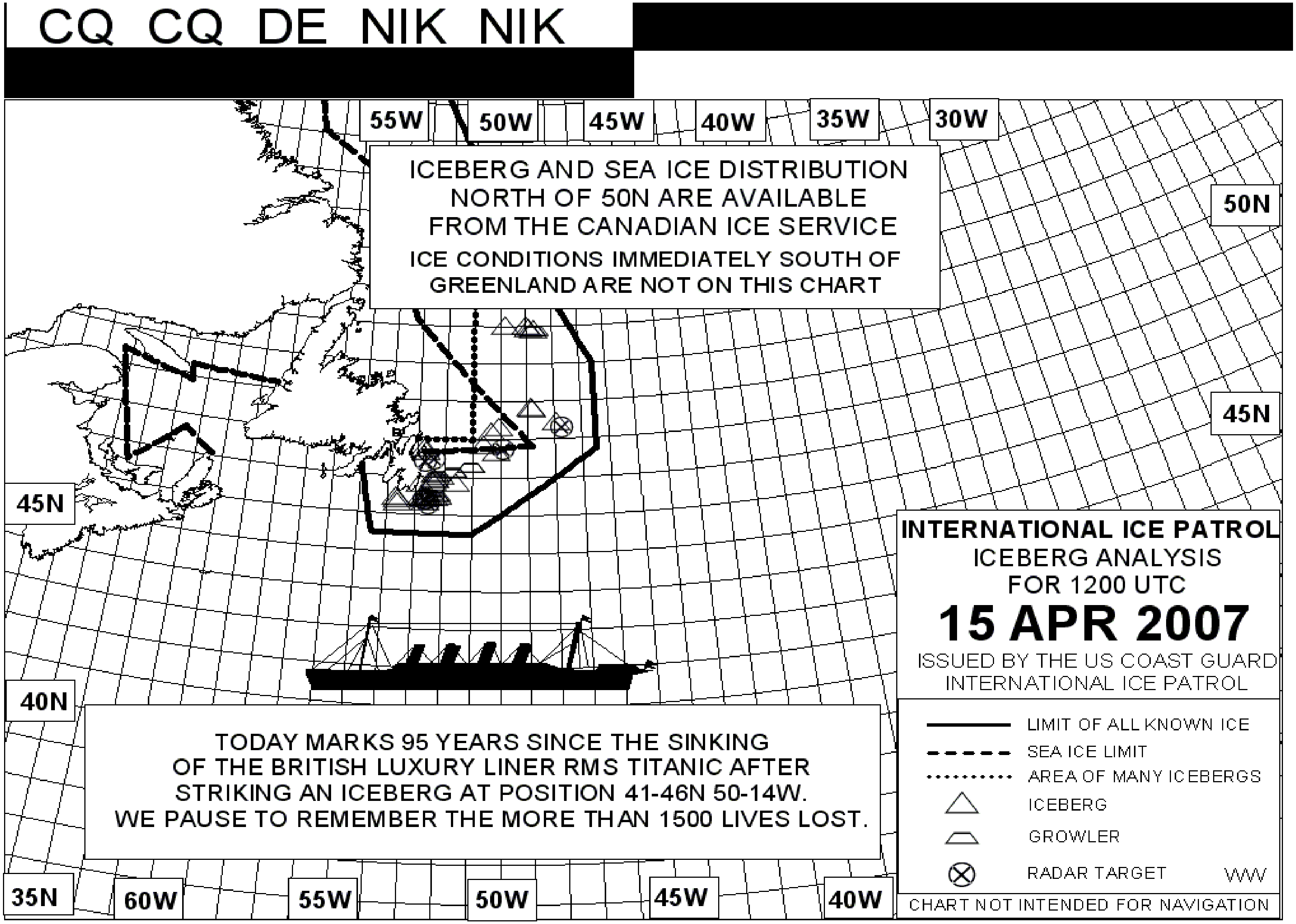
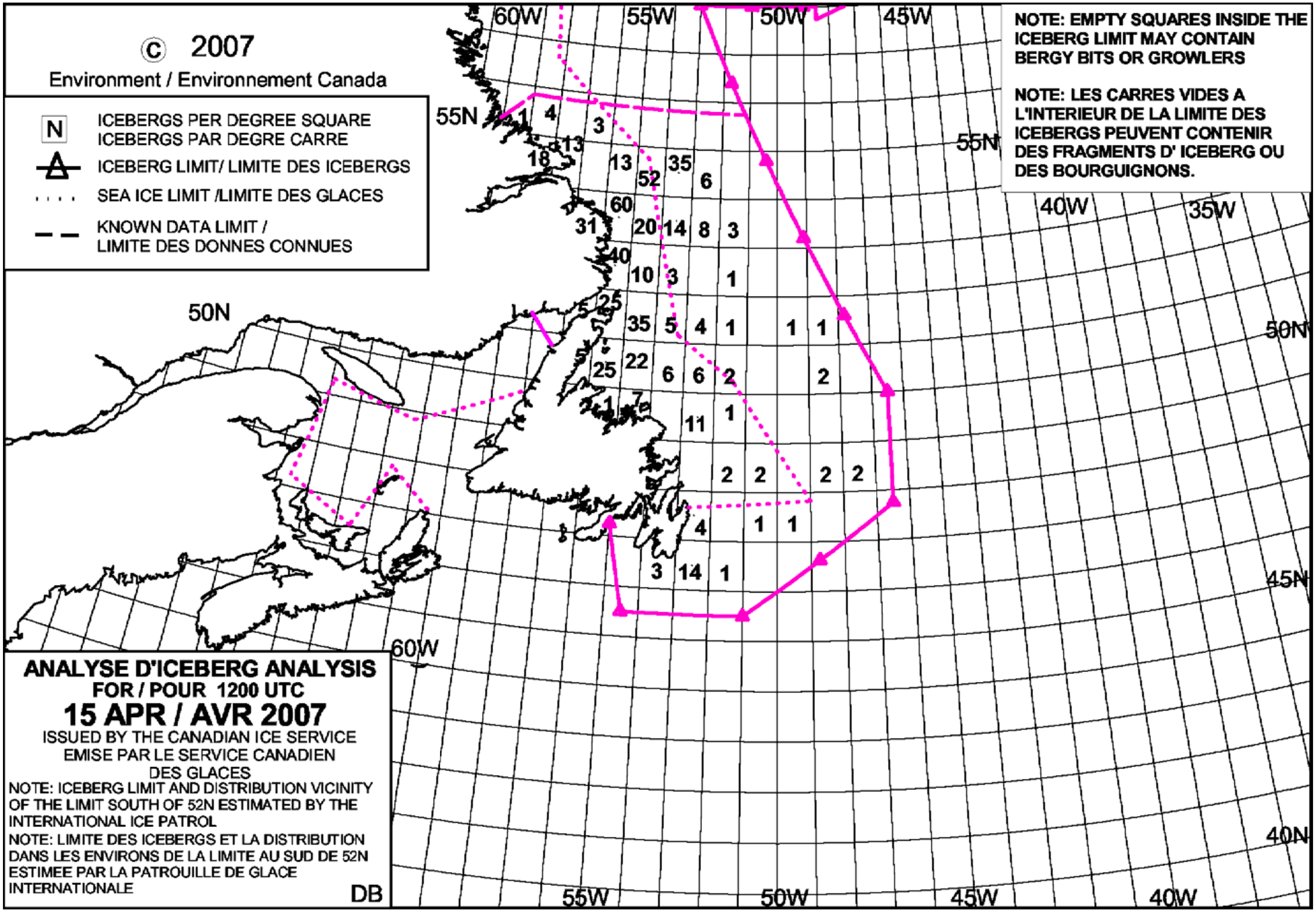
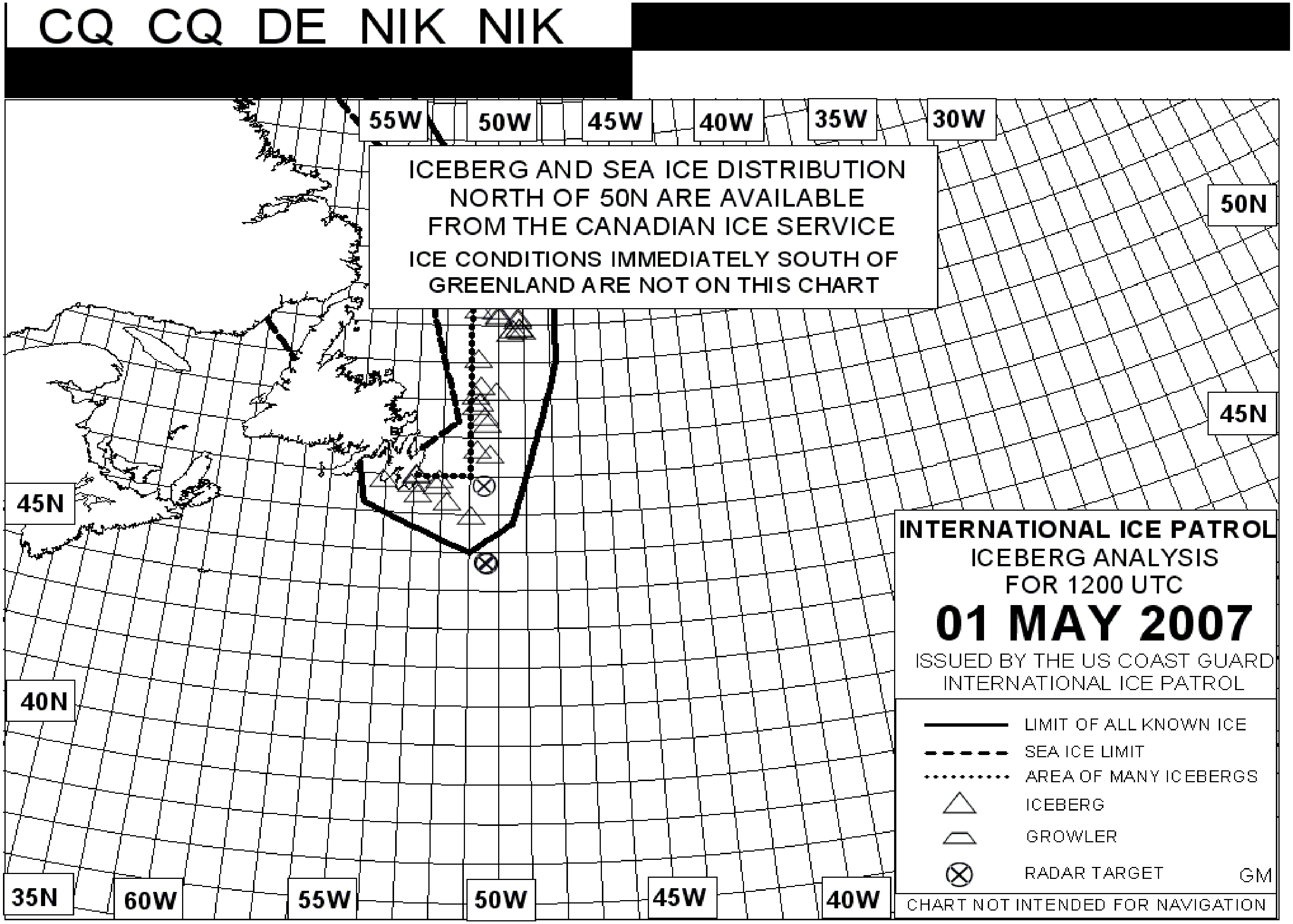
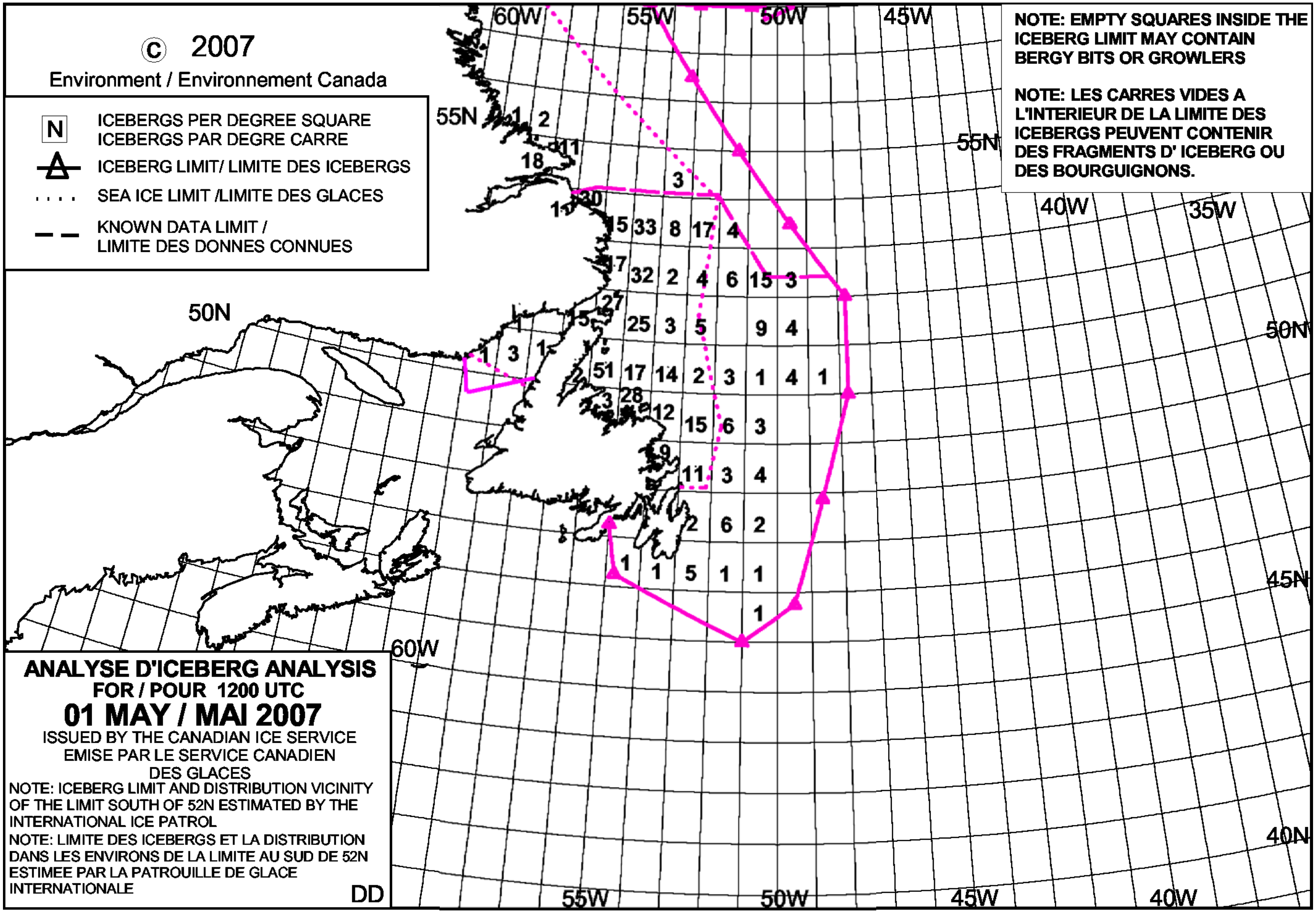
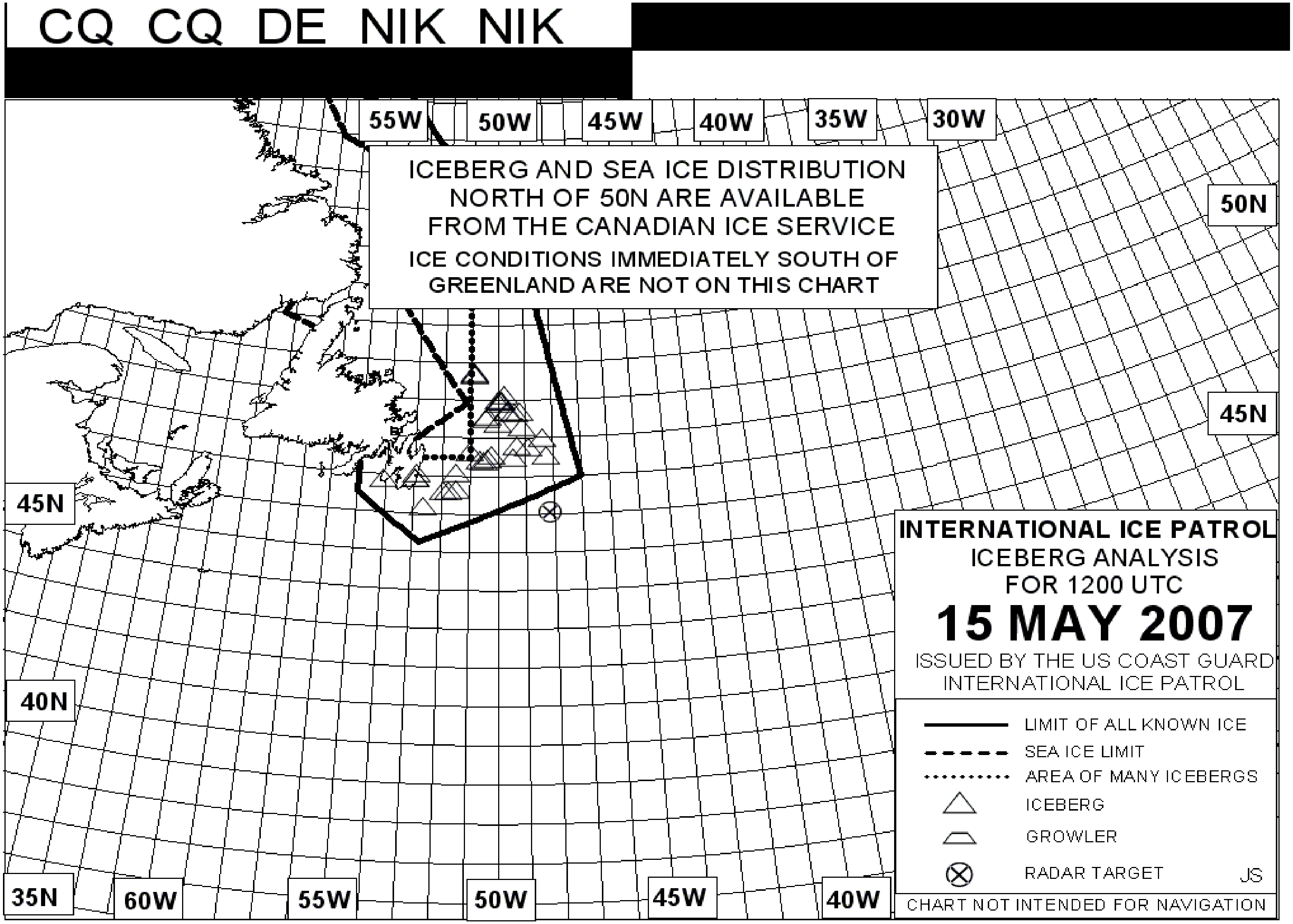
ANALYSE D'ICEBERG ANALYSIS
FOR / POUR 1200 UTC
01 APR / AVR 2007
ISSUED BY THE CANADIAN ICE SERVICE
EMISE PAR LE SERVICE CANADIEN DES GLACES
N ICEBERGS PER DEGREE SQUARE
ICEBERGS PAR DEGRE CARRE
ICEBERG LIMIT/ LIMITE DES ICEBERGS
SEA ICE LIMIT /LIMITE DES GLACES
KNOWN DATA LIMIT /
LIMITE DES DONNES CONNUES
DD
70W
65W
60W
55W
50W
45W
40W
35W
30W
60N
55N
50N
45N

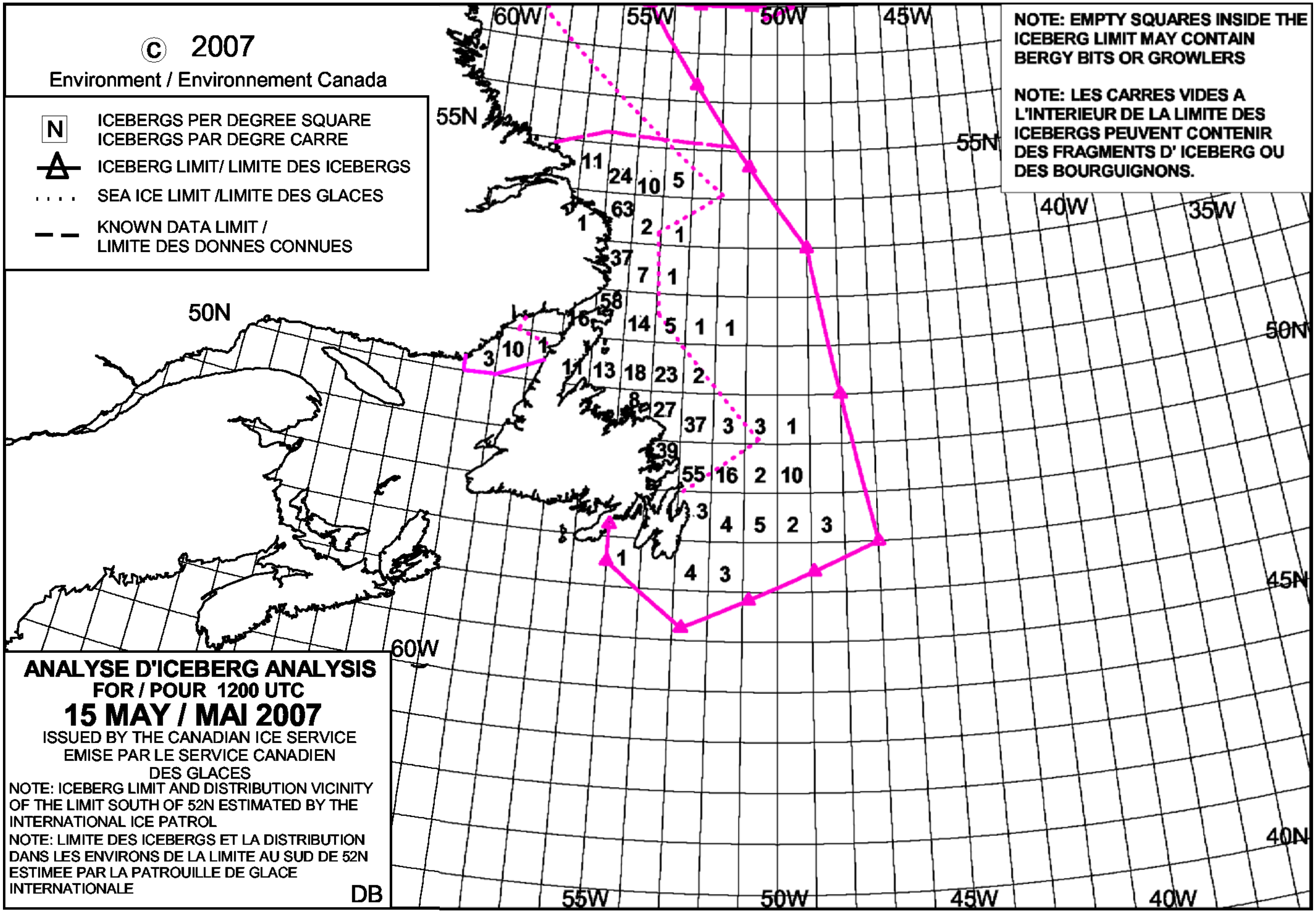

CQ CQ DE NIK NIK
ICEBERG AND SEA ICE DISTRIBUTION
NORTH OF 50N ARE AVAILABLE
FROM THE CANADIAN ICE SERVICE
ICE CONDITIONS IMMEDIATELY SOUTH OF
GREENLAND ARE NOT ON THIS CHART
55W
50W
45W
40W
35W
30W
50N
45N
40N
35N
60W
TODAY MARKS 95 YEARS SINCE THE SINKING
OF THE BRITISH LUXURY LINER RMS TITANIC AFTER
STRIKING AN ICEBERG AT POSITION 41-46N 50-14W.
WE PAUSE TO REMEMBER THE MORE THAN 1500 LIVES LOST.
INTERNATIONAL ICE PATROL
ICEBERG ANALYSIS
FOR 1200 UTC
15 APR 2007
ISSUED BY THE US COAST GUARD
INTERNATIONAL ICE PATROL
LIMIT OF ALL KNOWN ICE
SEA ICE LIMIT
AREA OF MANY ICEBERGS
ICEBERG
GROWLER
RADAR TARGET
WW
CHART NOT INTENDED FOR NAVIGATION


© 2007
Environment / Environnement Canada
N ICEBERGS PER DEGREE SQUARE
ICEBERGS PAR DEGRE CARRE
ICEBERG LIMIT/ LIMITE DES ICEBERGS
SEA ICE LIMIT /LIMITE DES GLACES
KNOWN DATA LIMIT /
LIMITE DES DONNES CONNUES
NOTE: EMPTY SQUARES INSIDE THE ICEBERG LIMIT MAY CONTAIN BERGY BITS OR GROWLERS
NOTE: LES CARRES VIDES A L'INTERIEUR DE LA LIMITE DES ICEBERGS PEUVENT CONTENIR DES FRAGMENTS D' ICEBERG OU DES BOURGUIGNONS.
ANALYSE D'ICEBERG ANALYSIS
FOR / POUR 1200 UTC
15 APR / AVR 2007
ISSUED BY THE CANADIAN ICE SERVICE
EMISE PAR LE SERVICE CANADIEN DES GLACES
NOTE: ICEBERG LIMIT AND DISTRIBUTION VICINITY OF THE LIMIT SOUTH OF 52N ESTIMATED BY THE INTERNATIONAL ICE PATROL
NOTE: LIMITE DES ICEBERGS ET LA DISTRIBUTION DANS LES ENVIRONS DE LA LIMITE AU SUD DE 52N ESTIMEE PAR LA PATROUILLE DE GLACE INTERNATIONALE
DB
60W
55W
50W
45W
40W
35W
55N
50N
45N
40N


CQ CQ DE NIK NIK
55W
50W
45W
40W
35W
30W
ICEBERG AND SEA ICE DISTRIBUTION
NORTH OF 50N ARE AVAILABLE
FROM THE CANADIAN ICE SERVICE
ICE CONDITIONS IMMEDIATELY SOUTH OF
GREENLAND ARE NOT ON THIS CHART
50N
45N
45N
40N
35N
60W
55W
50W
45W
40W
INTERNATIONAL ICE PATROL
ICEBERG ANALYSIS
FOR 1200 UTC
01 MAY 2007
ISSUED BY THE US COAST GUARD
INTERNATIONAL ICE PATROL
LIMIT OF ALL KNOWN ICE
SEA ICE LIMIT
AREA OF MANY ICEBERGS
ICEBERG
GROWLER
RADAR TARGET
GM
CHART NOT INTENDED FOR NAVIGATION


© 2007
Environment / Environnement Canada
N ICEBERGS PER DEGREE SQUARE
ICEBERGS PAR DEGRE CARRE
ICEBERG LIMIT/ LIMITE DES ICEBERGS
SEA ICE LIMIT /LIMITE DES GLACES
KNOWN DATA LIMIT /
LIMITE DES DONNES CONNUES
NOTE: EMPTY SQUARES INSIDE THE ICEBERG LIMIT MAY CONTAIN BERGY BITS OR GROWLERS
NOTE: LES CARRES VIDES A L'INTERIEUR DE LA LIMITE DES ICEBERGS PEUVENT CONTENIR DES FRAGMENTS D' ICEBERG OU DES BOURGUIGNONS.
ANALYSE D'ICEBERG ANALYSIS
FOR / POUR 1200 UTC
01 MAY / MAI 2007
ISSUED BY THE CANADIAN ICE SERVICE
EMISE PAR LE SERVICE CANADIEN DES GLACES
NOTE: ICEBERG LIMIT AND DISTRIBUTION VICINITY OF THE LIMIT SOUTH OF 52N ESTIMATED BY THE INTERNATIONAL ICE PATROL
NOTE: LIMITE DES ICEBERGS ET LA DISTRIBUTION DANS LES ENVIRONS DE LA LIMITE AU SUD DE 52N ESTIMEE PAR LA PATROUILLE DE GLACE INTERNATIONALE
DD


CQ CQ DE NIK NIK
ICEBERG AND SEA ICE DISTRIBUTION
NORTH OF 50N ARE AVAILABLE
FROM THE CANADIAN ICE SERVICE
ICE CONDITIONS IMMEDIATELY SOUTH OF
GREENLAND ARE NOT ON THIS CHART
55W
50W
45W
40W
35W
30W
50N
45N
40N
35N
60W
INTERNATIONAL ICE PATROL
ICEBERG ANALYSIS
FOR 1200 UTC
15 MAY 2007
ISSUED BY THE US COAST GUARD
INTERNATIONAL ICE PATROL
LIMIT OF ALL KNOWN ICE
SEA ICE LIMIT
AREA OF MANY ICEBERGS
ICEBERG
GROWLER
RADAR TARGET
JS
CHART NOT INTENDED FOR NAVIGATION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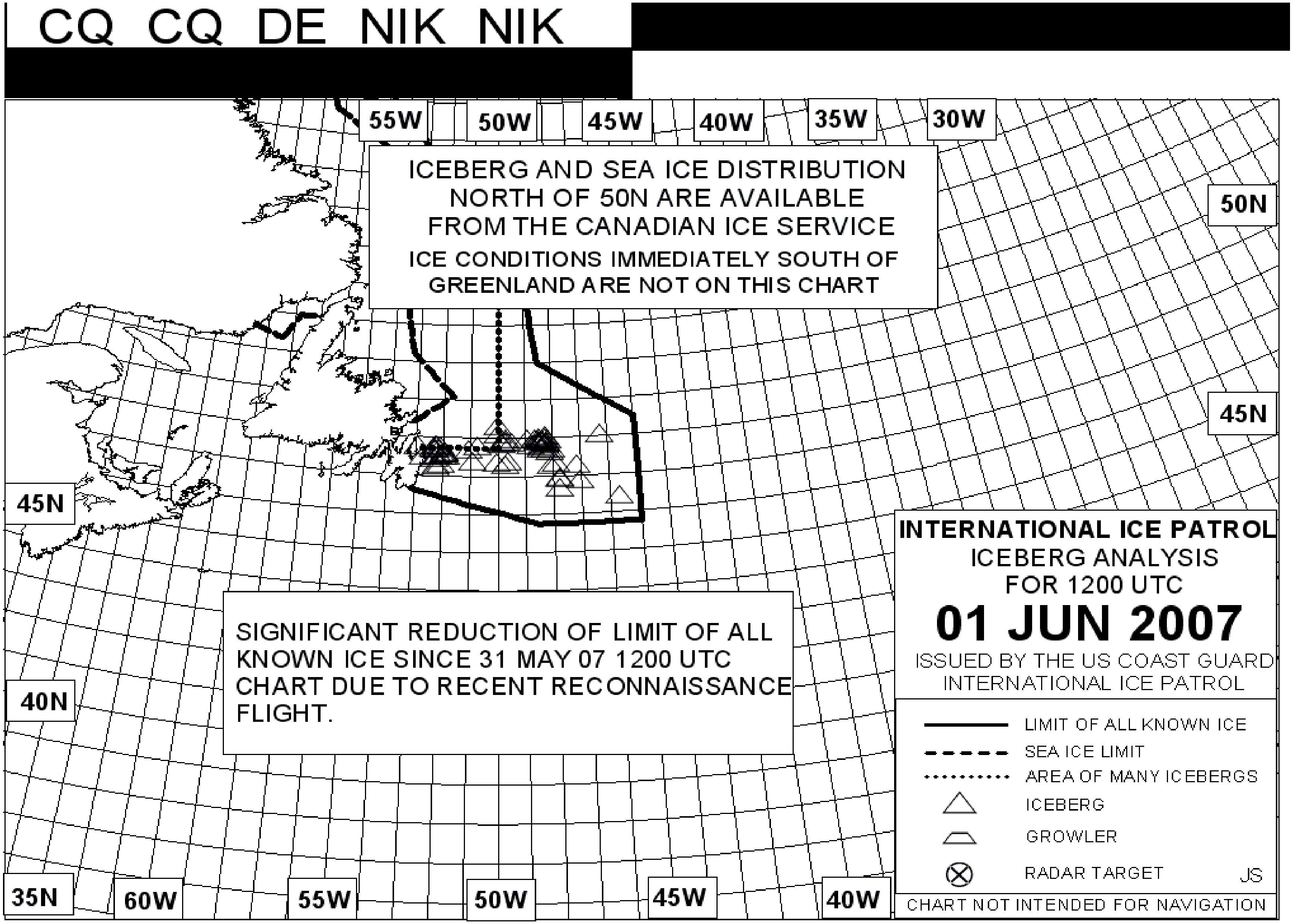
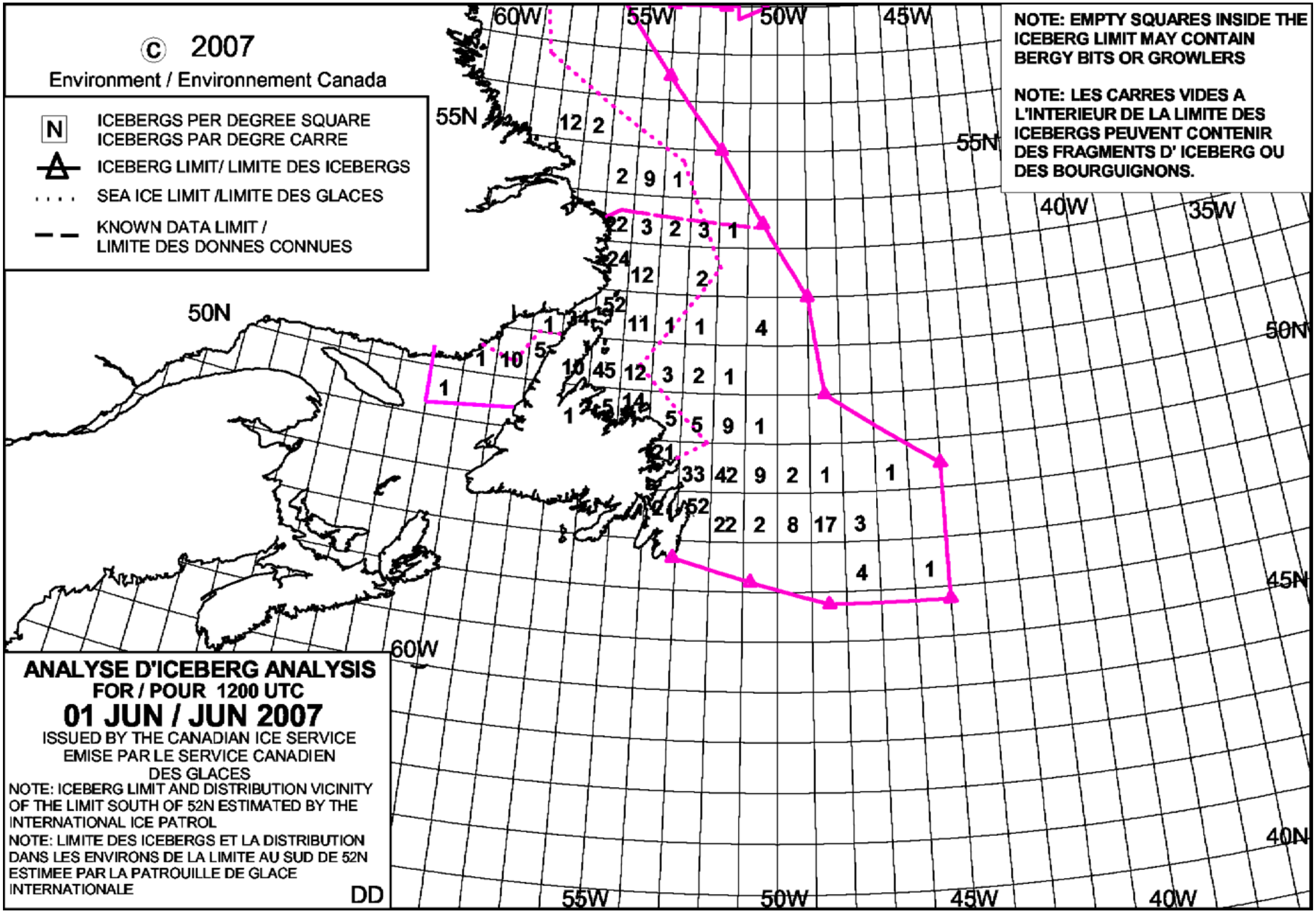
Environment / Environnement Canada
ICEBERGS PER DEGREE SQUARE
ICEBERGS PAR DEGRE CARRE
ICEBERG LIMIT/ LIMITE DES ICEBERGS
SEA ICE LIMIT /LIMITE DES GLACES
KNOWN DATA LIMIT /
LIMITE DES DONNES CONNUES
NOTE: EMPTY SQUARES INSIDE THE ICEBERG LIMIT MAY CONTAIN BERGY BITS OR GROWLERS
NOTE: LES CARRES VIDES A L'INTERIEUR DE LA LIMITE DES ICEBERGS PEUVENT CONTENIR DES FRAGMENTS D' ICEBERG OU DES BOURGUIGNONS.
ANALYSE D'ICEBERG ANALYSIS
FOR / POUR 1200 UTC
15 MAY / MAI 2007
ISSUED BY THE CANADIAN ICE SERVICE
EMISE PAR LE SERVICE CANADIEN DES GLACES
NOTE: ICEBERG LIMIT AND DISTRIBUTION VICINITY OF THE LIMIT SOUTH OF 52N ESTIMATED BY THE INTERNATIONAL ICE PATROL
NOTE: LIMITE DES ICEBERGS ET LA DISTRIBUTION DANS LES ENVIRONS DE LA LIMITE AU SUD DE 52N ESTIMEE PAR LA PATROUILLE DE GLACE INTERNATIONALE
DB
60W
55W
50W
45W
40W
35W
55N
50N
45N
40N


CQ CQ DE NIK NIK
55W
50W
45W
40W
35W
30W
ICEBERG AND SEA ICE DISTRIBUTION
NORTH OF 50N ARE AVAILABLE
FROM THE CANADIAN ICE SERVICE
ICE CONDITIONS IMMEDIATELY SOUTH OF
GREENLAND ARE NOT ON THIS CHART
50N
45N
45N
40N
35N
SIGNIFICANT REDUCTION OF LIMIT OF ALL
KNOWN ICE SINCE 31 MAY 07 1200 UTC
CHART DUE TO RECENT RECONNAISSANCE
FLIGHT.
INTERNATIONAL ICE PATROL
ICEBERG ANALYSIS
FOR 1200 UTC
01 JUN 2007
ISSUED BY THE US COAST GUARD
INTERNATIONAL ICE PATROL
LIMIT OF ALL KNOWN ICE
SEA ICE LIMIT
AREA OF MANY ICEBERGS
ICEBERG
GROWLER
RADAR TARGET
JS
CHART NOT INTENDED FOR NAVIGATION
60W
55W
50W
45W
40W



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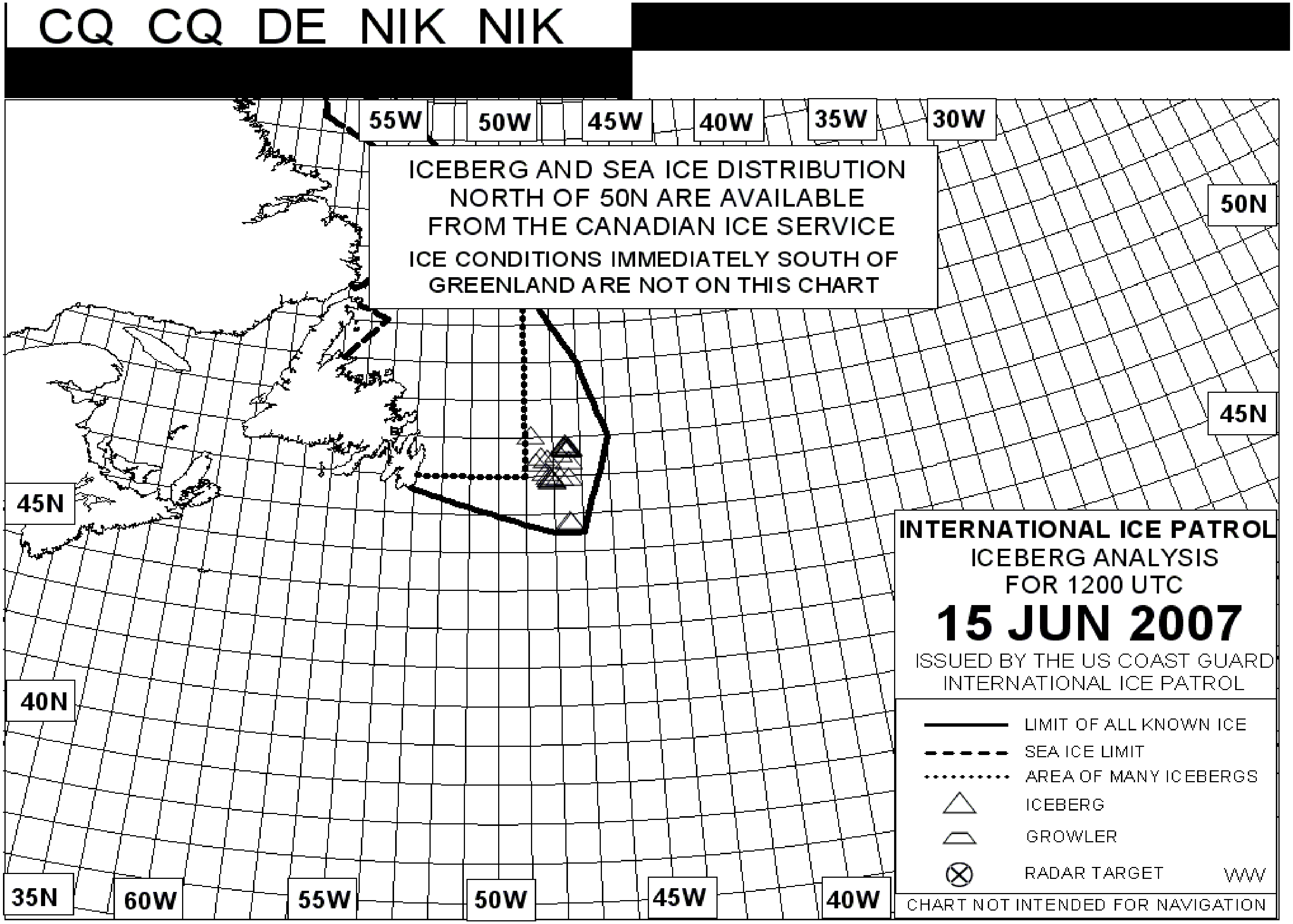
Environment / Environnement Canada
ICEBERGS PER DEGREE SQUARE
ICEBERGS PAR DEGRE CARRE
ICEBERG LIMIT/ LIMITE DES ICEBERGS
SEA ICE LIMIT /LIMITE DES GLACES
KNOWN DATA LIMIT /
LIMITE DES DONNES CONNUES
NOTE: EMPTY SQUARES INSIDE THE ICEBERG LIMIT MAY CONTAIN BERGY BITS OR GROWLERS
NOTE: LES CARRES VIDES A L'INTERIEUR DE LA LIMITE DES ICEBERGS PEUVENT CONTENIR DES FRAGMENTS D' ICEBERG OU DES BOURGUIGNONS.
ANALYSE D'ICEBERG ANALYSIS
FOR / POUR 1200 UTC
01 JUN / JUN 2007
ISSUED BY THE CANADIAN ICE SERVICE
EMISE PAR LE SERVICE CANADIEN DES GLACES
NOTE: ICEBERG LIMIT AND DISTRIBUTION VICINITY OF THE LIMIT SOUTH OF 52N ESTIMATED BY THE INTERNATIONAL ICE PATROL
NOTE: LIMITE DES ICEBERGS ET LA DISTRIBUTION DANS LES ENVIRONS DE LA LIMITE AU SUD DE 52N ESTIMEE PAR LA PATROUILLE DE GLACE INTERNATIONALE
DD
60W
55W
50W
45W
40W
35W
55N
50N
45N
40N


CQ CQ DE NIK NIK
55W
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ICEBERG AND SEA ICE DISTRIBUTION
NORTH OF 50N ARE AVAILABLE
FROM THE CANADIAN ICE SERVICE
ICE CONDITIONS IMMEDIATELY SOUTH OF
GREENLAND ARE NOT ON THIS CHART
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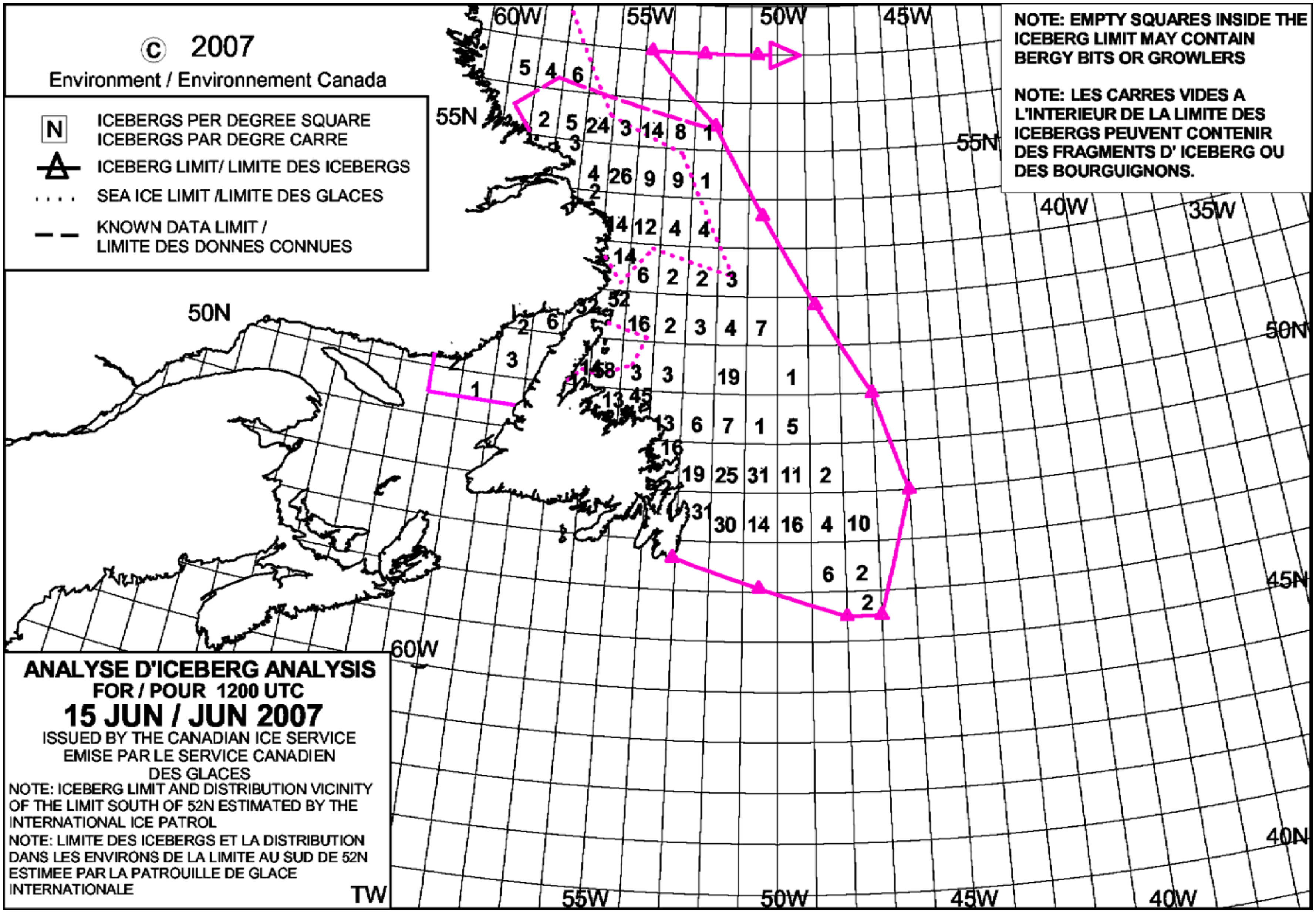
INTERNATIONAL ICE PATROL
ICEBERG ANALYSIS
FOR 1200 UTC
15 JUN 2007
ISSUED BY THE US COAST GUARD
INTERNATIONAL ICE PATROL
LIMIT OF ALL KNOWN ICE
SEA ICE LIMIT
AREA OF MANY ICEBERGS
ICEBERG
GROWLER
RADAR TARGET
WW
CHART NOT INTENDED FOR NAVIGATION


© 2007
Environment / Environnement Canada
ICEBERGS PER DEGREE SQUARE
ICEBERGS PAR DEGRE CARRE
ICEBERG LIMIT/ LIMITE DES ICEBERGS
SEA ICE LIMIT /LIMITE DES GLACES
KNOWN DATA LIMIT /
LIMITE DES DONNES CONNUES
NOTE: EMPTY SQUARES INSIDE THE ICEBERG LIMIT MAY CONTAIN BERGY BITS OR GROWLERS
NOTE: LES CARRES VIDES A L'INTERIEUR DE LA LIMITE DES ICEBERGS PEUVENT CONTENIR DES FRAGMENTS D' ICEBERG OU DES BOURGUIGNONS.
ANALYSE D'ICEBERG ANALYSIS
FOR / POUR 1200 UTC
15 JUN / JUN 2007
ISSUED BY THE CANADIAN ICE SERVICE
EMISE PAR LE SERVICE CANADIEN DES GLACES
NOTE: ICEBERG LIMIT AND DISTRIBUTION VICINITY OF THE LIMIT SOUTH OF 52N ESTIMATED BY THE INTERNATIONAL ICE PATROL
NOTE: LIMITE DES ICEBERGS ET LA DISTRIBUTION DANS LES ENVIRONS DE LA LIMITE AU SUD DE 52N ESTIMEE PAR LA PATROUILLE DE GLACE INTERNATIONALE
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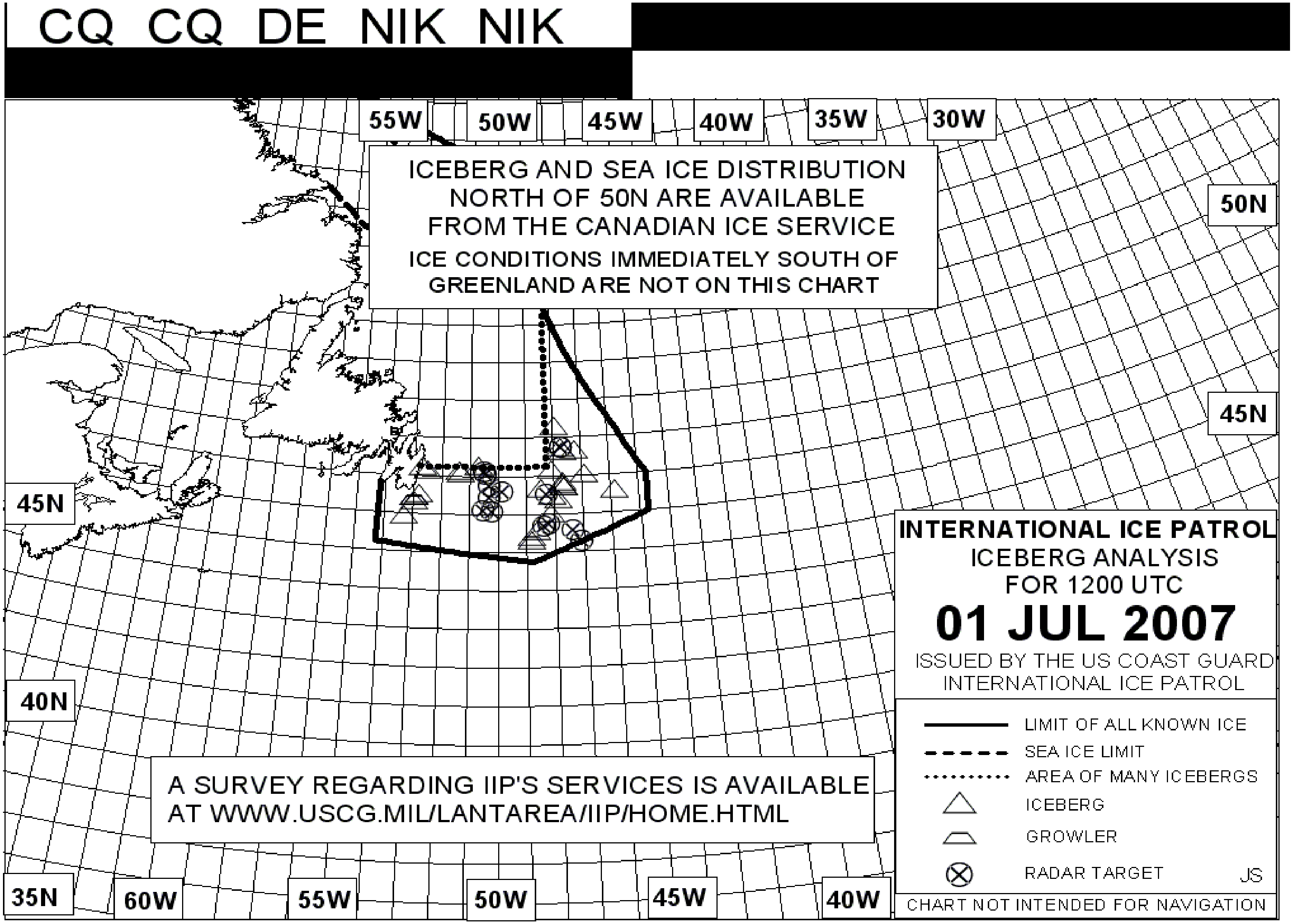
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ICEBERG AND SEA ICE DISTRIBUTION
NORTH OF 50N ARE AVAILABLE
FROM THE CANADIAN ICE SERVICE
ICE CONDITIONS IMMEDIATELY SOUTH OF
GREENLAND ARE NOT ON THIS CHART
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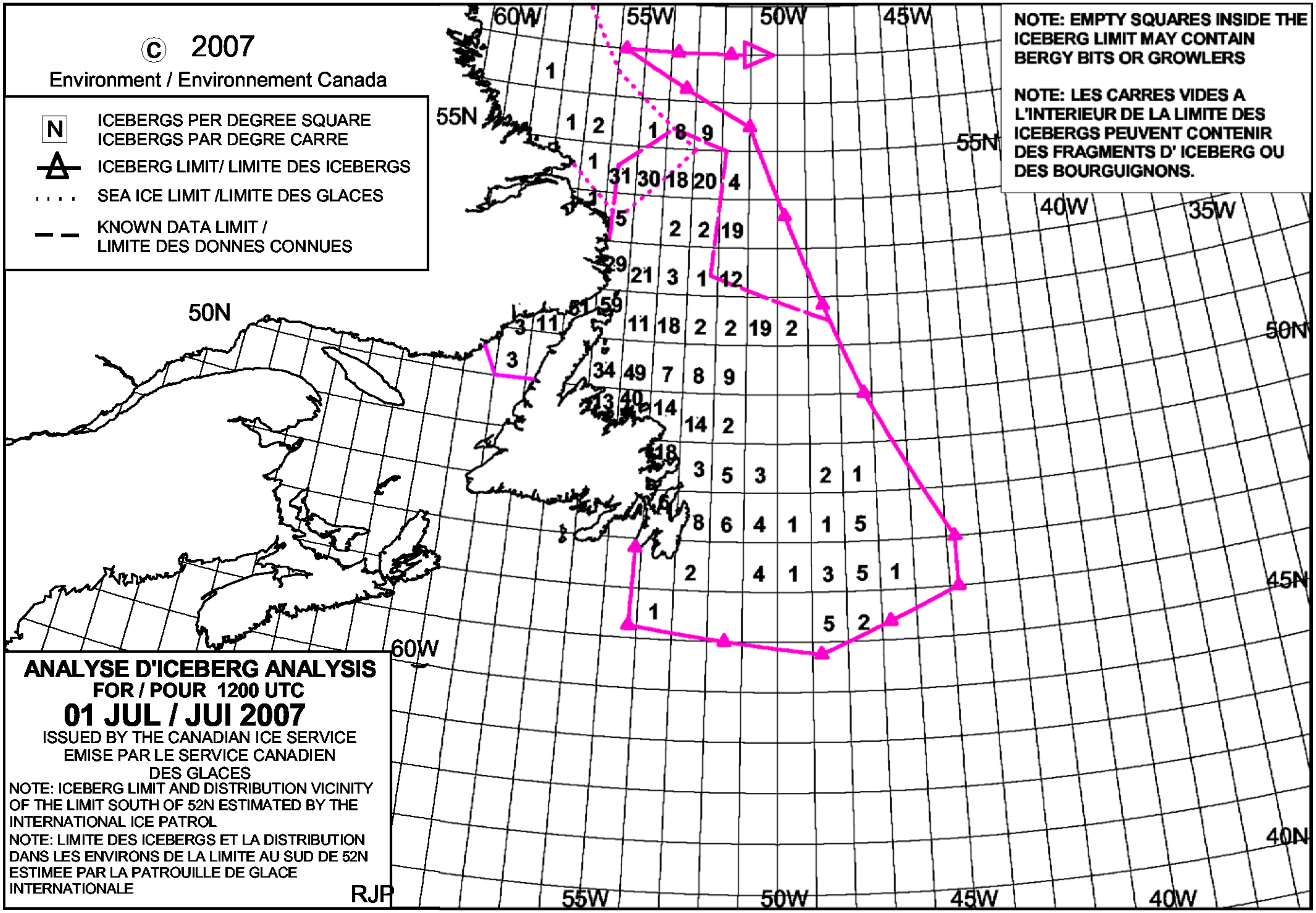
A SURVEY REGARDING IIP'S SERVICES IS AVAILABLE
AT WWW.USCG.MIL/LANTAREA/IIP/HOME.HTML
INTERNATIONAL ICE PATROL
ICEBERG ANALYSIS
FOR 1200 UTC
01 JUL 2007
ISSUED BY THE US COAST GUARD
INTERNATIONAL ICE PATROL
LIMIT OF ALL KNOWN ICE
SEA ICE LIMIT
AREA OF MANY ICEBERGS
ICEBERG
GROWLER
RADAR TARGET
JS
CHART NOT INTENDED FOR NAVIGATION



© 2007
Environment / Environnement Canada
N ICEBERGS PER DEGREE SQUARE
ICEBERGS PAR DEGRE CARRE
ICEBERG LIMIT/ LIMITE DES ICEBERGS
SEA ICE LIMIT /LIMITE DES GLACES
KNOWN DATA LIMIT /
LIMITE DES DONNES CONNUES
NOTE: EMPTY SQUARES INSIDE THE ICEBERG LIMIT MAY CONTAIN BERGY BITS OR GROWLERS
NOTE: LES CARRES VIDES A L'INTERIEUR DE LA LIMITE DES ICEBERGS PEUVENT CONTENIR DES FRAGMENTS D' ICEBERG OU DES BOURGUIGNONS.
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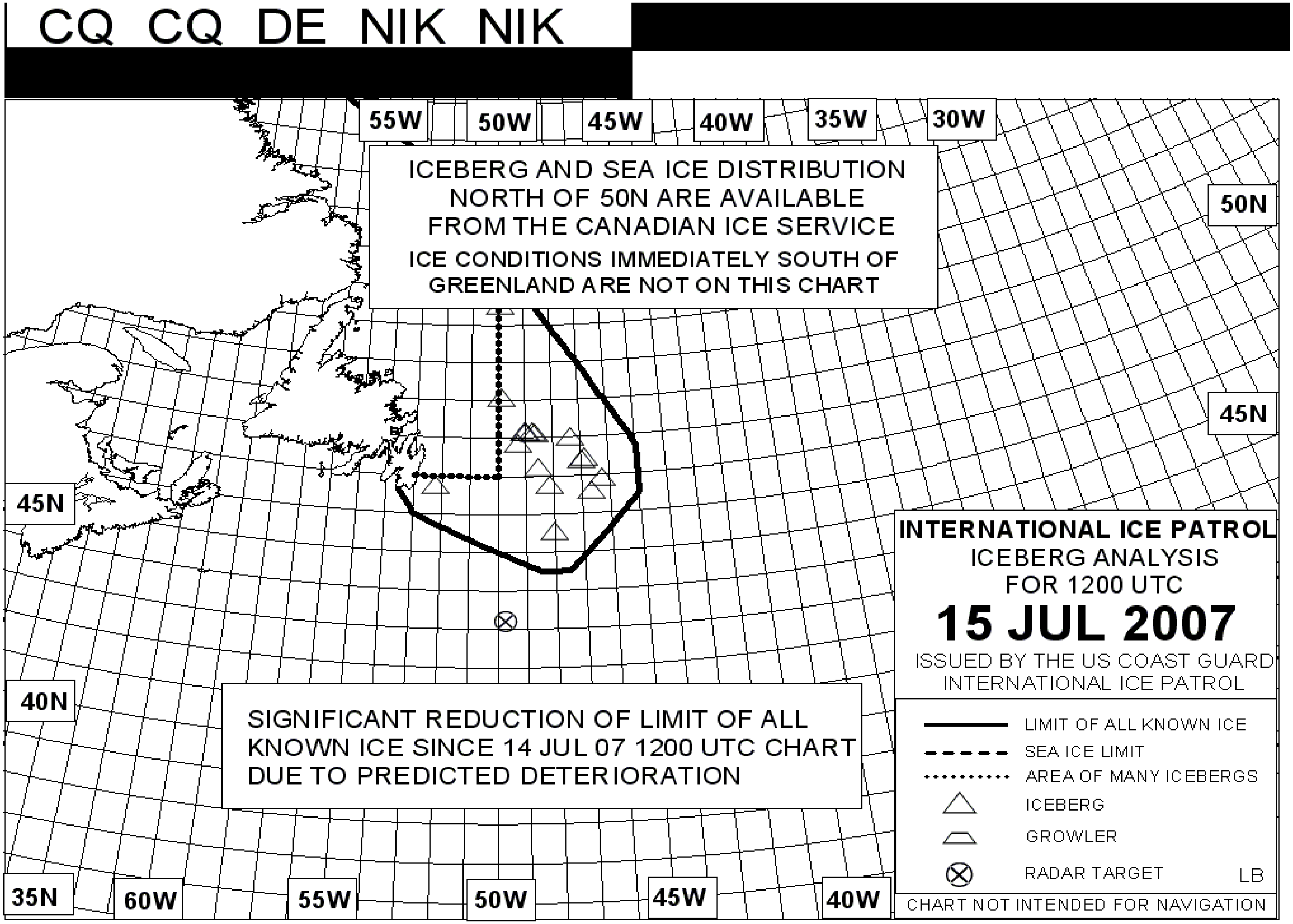
ANALYSE D'ICEBERG ANALYSIS
FOR / POUR 1200 UTC
01 JUL / JUI 2007
ISSUED BY THE CANADIAN ICE SERVICE
EMISE PAR LE SERVICE CANADIEN
DES GLACES
NOTE: ICEBERG LIMIT AND DISTRIBUTION VICINITY OF THE LIMIT SOUTH OF 52N ESTIMATED BY THE INTERNATIONAL ICE PATROL
NOTE: LIMITE DES ICEBERGS ET LA DISTRIBUTION DANS LES ENVIRONS DE LA LIMITE AU SUD DE 52N ESTIMEE PAR LA PATROUILLE DE GLACE INTERNATIONALE
RJP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ICEBERG AND SEA ICE DISTRIBUTION
NORTH OF 50N ARE AVAILABLE
FROM THE CANADIAN ICE SERVICE
ICE CONDITIONS IMMEDIATELY SOUTH OF
GREENLAND ARE NOT ON THIS CHART
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INTERNATIONAL ICE PATROL
ICEBERG ANALYSIS
FOR 1200 UTC
15 JUL 2007
ISSUED BY THE US COAST GUARD
INTERNATIONAL ICE PATROL
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SIGNIFICANT REDUCTION OF LIMIT OF ALL
KNOWN ICE SINCE 14 JUL 07 1200 UTC CHART
DUE TO PREDICTED DETERIORATION
LIMIT OF ALL KNOWN ICE
SEA ICE LIMIT
AREA OF MANY ICEBERGS
ICEBERG
GROWLER
RADAR TARGET
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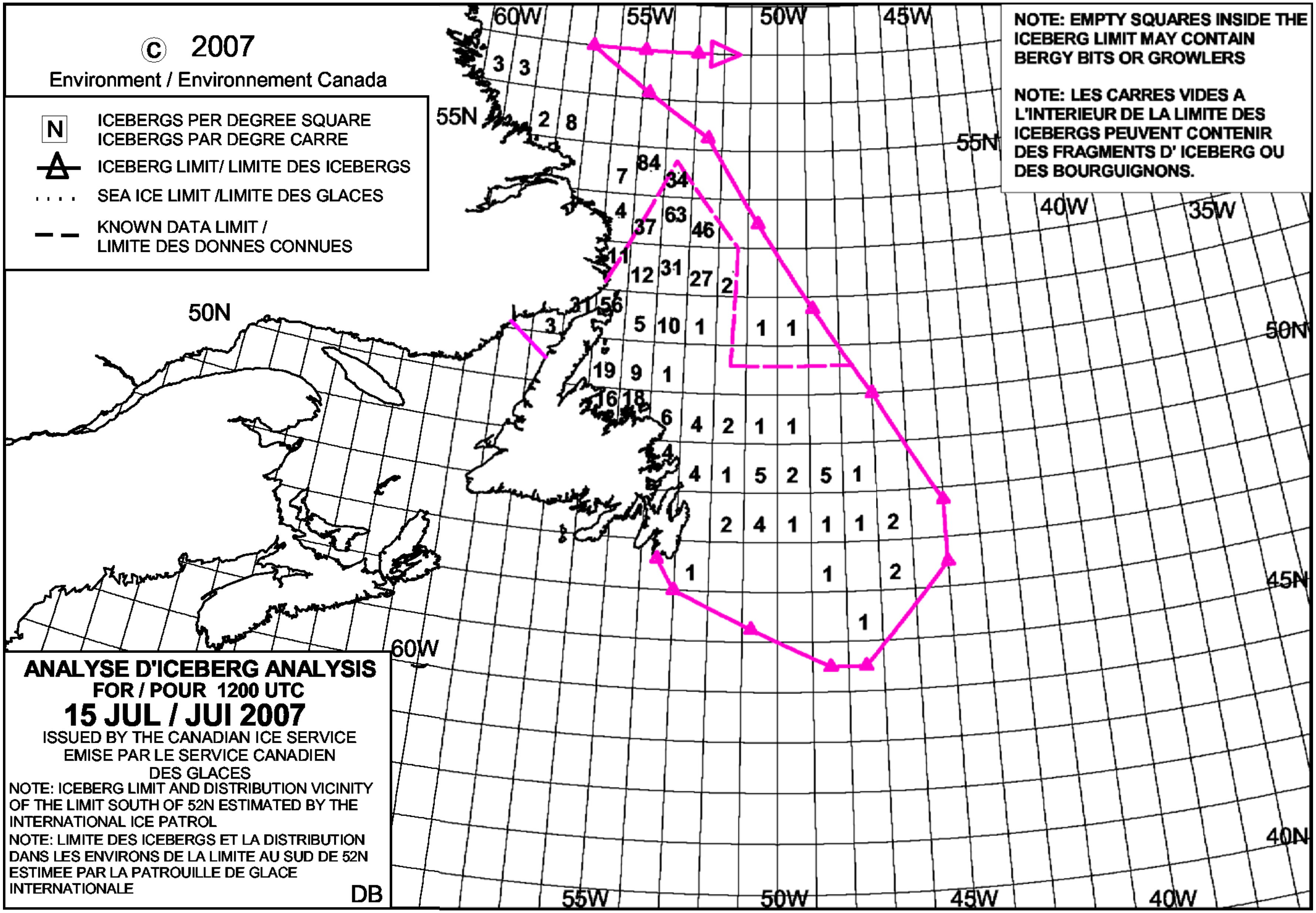
CHART NOT INTENDED FOR NAVIGATION



© 2007
Environment / Environnement Canada
ICEBERGS PER DEGREE SQUARE
ICEBERGS PAR DEGRE CARRE
ICEBERG LIMIT/ LIMITE DES ICEBERGS
SEA ICE LIMIT /LIMITE DES GLACES
KNOWN DATA LIMIT /
LIMITE DES DONNES CONNUES
NOTE: EMPTY SQUARES INSIDE THE ICEBERG LIMIT MAY CONTAIN BERGY BITS OR GROWLERS
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ANALYSE D'ICEBERG ANALYSIS
FOR / POUR 1200 UTC
15 JUL / JUI 2007
ISSUED BY THE CANADIAN ICE SERVICE
EMISE PAR LE SERVICE CANADIEN DES GLACES
NOTE: ICEBERG LIMIT AND DISTRIBUTION VICINITY OF THE LIMIT SOUTH OF 52N ESTIMATED BY THE INTERNATIONAL ICE PATROL
NOTE: LIMITE DES ICEBERGS ET LA DISTRIBUTION DANS LES ENVIRONS DE LA LIMITE AU SUD DE 52N ESTIMEE PAR LA PATROUILLE DE GLACE INTERNATIONALE
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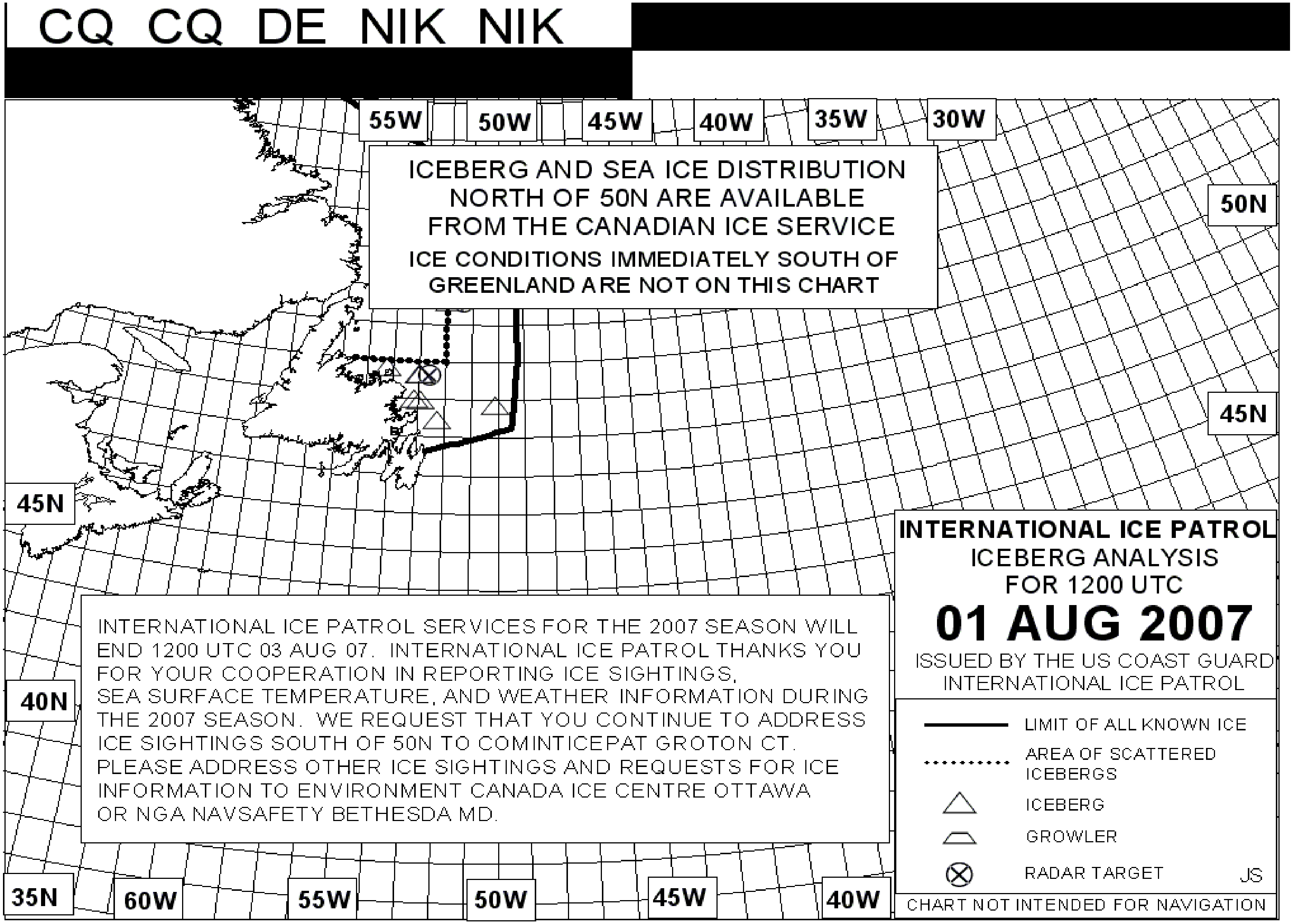
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ICEBERG AND SEA ICE DISTRIBUTION
NORTH OF 50N ARE AVAILABLE
FROM THE CANADIAN ICE SERVICE
ICE CONDITIONS IMMEDIATELY SOUTH OF
GREENLAND ARE NOT ON THIS CHART
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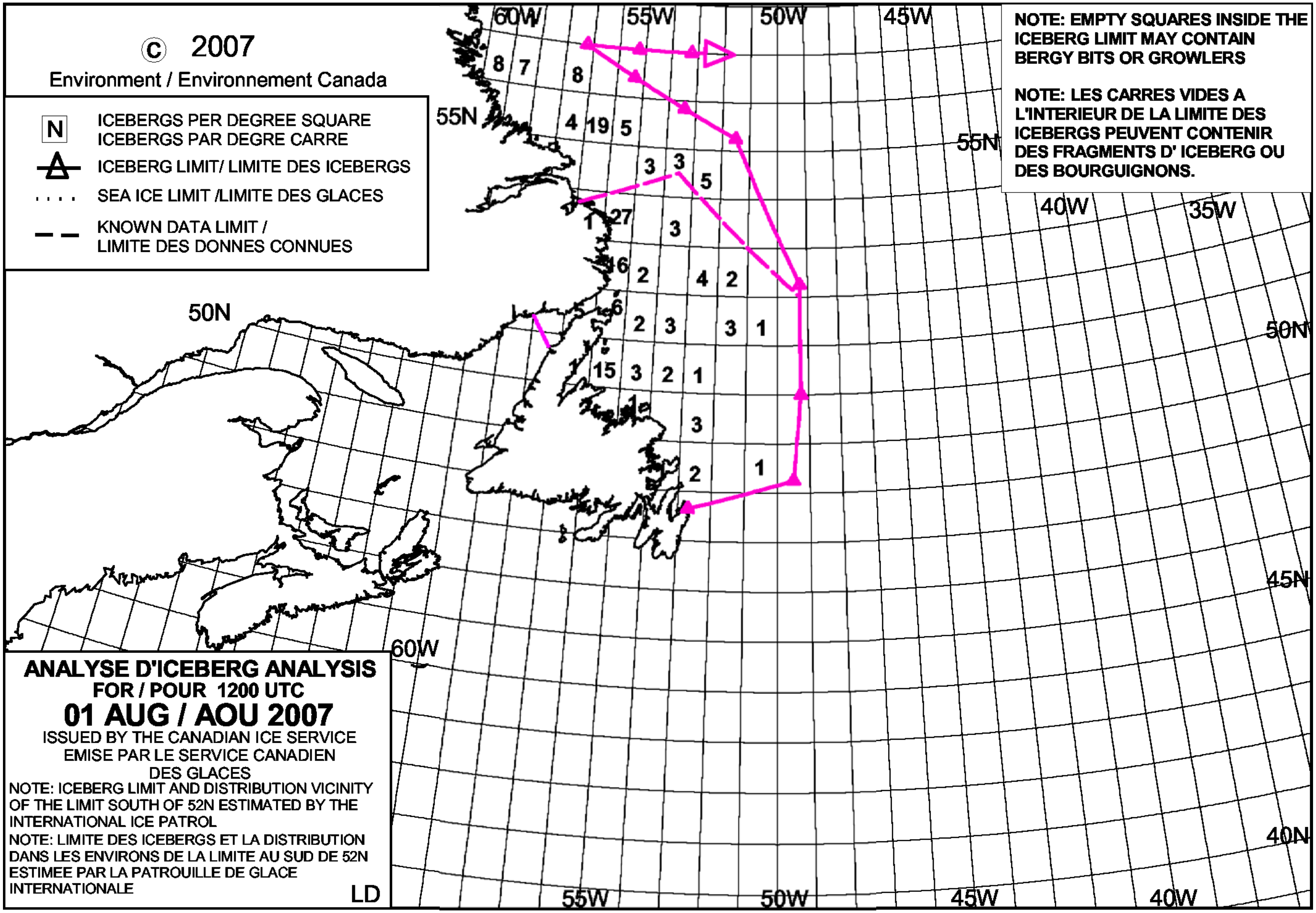
40W
INTERNATIONAL ICE PATROL SERVICES FOR THE 2007 SEASON WILL END 1200 UTC 03 AUG 07. INTERNATIONAL ICE PATROL THANKS YOU FOR YOUR COOPERATION IN REPORTING ICE SIGHTINGS, SEA SURFACE TEMPERATURE, AND WEATHER INFORMATION DURING THE 2007 SEASON. WE REQUEST THAT YOU CONTINUE TO ADDRESS ICE SIGHTINGS SOUTH OF 50N TO COMINTICEPAT GROTON CT. PLEASE ADDRESS OTHER ICE SIGHTINGS AND REQUESTS FOR ICE INFORMATION TO ENVIRONMENT CANADA ICE CENTRE OTTAWA OR NGA NAVSAFETY BETHESDA MD.
INTERNATIONAL ICE PATROL
ICEBERG ANALYSIS
FOR 1200 UTC
01 AUG 2007
ISSUED BY THE US COAST GUARD
INTERNATIONAL ICE PATROL
LIMIT OF ALL KNOWN ICE
AREA OF SCATTERED ICEBERGS
ICEBERG
GROWLER
RADAR TARGET
JS
CHART NOT INTENDED FOR NAVIGATION


© 2007
Environment / Environnement Canada
ICEBERGS PER DEGREE SQUARE
ICEBERGS PAR DEGRE CARRE
ICEBERG LIMIT/ LIMITE DES ICEBERGS
SEA ICE LIMIT /LIMITE DES GLACES
KNOWN DATA LIMIT /
LIMITE DES DONNES CONNUES
NOTE: EMPTY SQUARES INSIDE THE ICEBERG LIMIT MAY CONTAIN BERGY BITS OR GROWLERS
NOTE: LES CARRES VIDES A L'INTERIEUR DE LA LIMITE DES ICEBERGS PEUVENT CONTENIR DES FRAGMENTS D' ICEBERG OU DES BOURGUIGNONS.
ANALYSE D'ICEBERG ANALYSIS
FOR / POUR 1200 UTC
01 AUG / AOU 2007
ISSUED BY THE CANADIAN ICE SERVICE
EMISE PAR LE SERVICE CANADIEN DES GLACES
NOTE: ICEBERG LIMIT AND DISTRIBUTION VICINITY OF THE LIMIT SOUTH OF 52N ESTIMATED BY THE INTERNATIONAL ICE PATROL
NOTE: LIMITE DES ICEBERGS ET LA DISTRIBUTION DANS LES ENVIRONS DE LA LIMITE AU SUD DE 52N ESTIMEE PAR LA PATROUILLE DE GLACE INTERNATIONALE
LD
60W
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# Acknowledgements

Commander, International Ice Patrol acknowledges the following for providing information and assistance:

C-CORE
Canadian Coast Guard
Canadian Forces
Canadian Ice Service
Canadian Maritime Atlantic Command Meteorological and Oceanographic Center
Department of Fisheries and Oceans Canada
German Federal Maritime and Hydrographic Agency
National Geospatial-Intelligence Agency
National Ice Center
National Weather Service
Nav Canada Flight Services
Provincial Aerospace Limited
U. S. Coast Guard Air Station Elizabeth City
U. S. Coast Guard Atlantic Area Command Center
U. S. Coast Guard Atlantic Area Staff
U. S. Coast Guard Automated Merchant Vessel Emergency Response System
U. S. Coast Guard Communications Area Master Station Atlantic
U. S. Coast Guard Operations Systems Center
U. S. Coast Guard Research and Development Center
U. S. Naval Atlantic Meteorology and Oceanography Center
U. S. Naval Fleet Numerical Meteorology and Oceanography Center

It is important to recognize the outstanding efforts of the personnel assigned to the International Ice Patrol during the 2007 Ice Season:

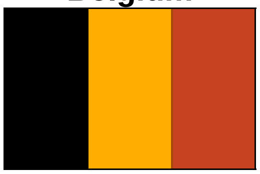
CDR M. R. Hicks
CDR S. D. Rogerson
LCDR B. D. Willeford
LCDR G. G. McGrath
Dr. D. L. Murphy
Mr. G. F. Wright
Mrs. B. J. Lis
LT W. C. Woityra
LTJG S. R. Houle
MSTCS J. M. Stengel
MST1 T. M. Davan
MST1 H. L. Brittle
YN1 D. C. Phillips
MST2 A. L. Rodgers
MST2 S. B. McClellan
MST2 J. N. Sherrill
MST3 N. G. Myers
MST3 S. J. Weitkamp
MST3 S. A. Baumgartner
MST3 S. P. Kasper
MST3 W. N. Moran

**International Ice Patrol staff produced this report using Microsoft® Word 2003 and Excel 2003.**

# Appendix A

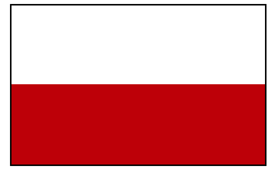
## Nations Currently Signatory to SOLAS

Belgium

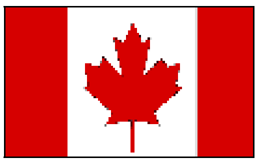


Greece

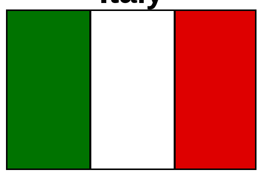
Poland



Canada



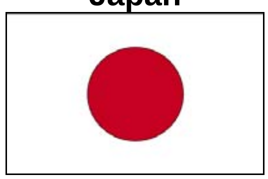
Italy



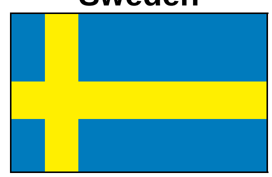
Spain

Denmark

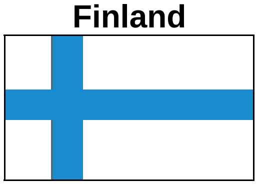
Japan



Sweden



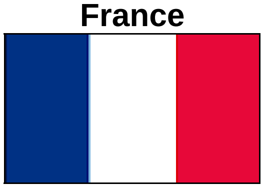
Finland



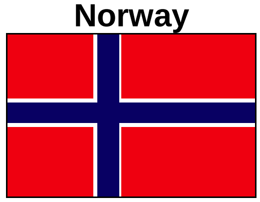
Netherlands

United Kingdom

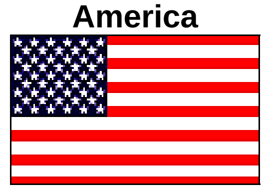
France



Norway

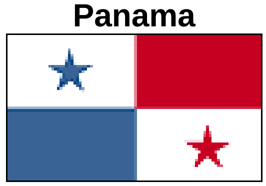


United States of America



Germany

Panama



# Appendix B

## Ship Reports for Ice Year 2007
## (Oct 1st, 2006 – Sep 30th, 2007)

| Ships Reporting By Flag | Reports |
|---|---|
| **ANTIGUA & BARBUDA** | |
| BBC MISSISSIPPI | 5 |
| BRUARFOSS | 2 |
| BW NICE | 10 |
| FEDERAL MATANE | 2 |
| **BAHAMAS** | |
| AFRICAN PUMA | 2 |
| ATLANTIC CARTIER | 22 |
| BAHAMAS SPIRIT | 18 |
| CMA CGM MATISSE | 5 |
| EVEREST SPIRIT | 15 |
| FEDERAL FIJI | 1 |
| INVIKEN | 1 |
| JAEGER ARROW | 2 |
| RIP HUDNER | 4 |
| UTVIKEN | 1 |
| WESTERN BRIDGE | 1 |
| **BERMUDA** | |
| CANMAR VICTORY | 1 |
| CP TRIUMPH | 1 |
| OTTAWA EXPRESS | 6 |
| **BRAZIL** | |
| CASTILLO DE SAN JUAN | 2 |
| **CANADA** | |
| ANN HARVEY | 2 |
| ARCTIC | 11 |
| ATLANTIC HAWK | 1 |
| ATLANTIC HURON | 5 |
| ATLANTIC KINGFISHER | 1 |
| BIRCHGLEN | 1 |

| Ships Reporting By Flag | Reports |
|---|---|
| **CANADA cont.** | |
| CAPE ROGER | 2 |
| DES GROSEILLIERS | 2 |
| GEORGE R. PEARKES | 15 |
| HEATHER KNUTSEN | 1 |
| HENRY LARSON | 8 |
| KATHRYN SPIRIT | 2 |
| LE QUEBECOIS | 1 |
| LEONARD J. COWLEY | 1 |
| LOUIS ST. LAURENT | 1 |
| MAERSK CHIGNECTO | 1 |
| MAERSK PLACENTIA | 2 |
| MARTHA L. BLACK | 3 |
| MATTEA | 89 |
| MATTHEW | 1 |
| NANTICOKE | 11 |
| NORTHERN ENTERPRISE | 1 |
| OCEANEX AVALON | 5 |
| OOCL BELGIUM | 1 |
| PIERRE RADISSON | 5 |
| SIR WILFRED GRENFELL | 3 |
| UMIAK I | 11 |
| VEGA DESGAGNES | 1 |
| VINLAND | 1 |
| WILFRED TEMPLEMAN | 5 |
| **CAYMAN ISLANDS** | |
| ICE CRYSTAL | 1 |
| ICE STAR | 34 |
| **CHINA, PEOPLES REPUBLIC** | |
| FEDERAL ASAHI | 6 |

| Ships Reporting By Flag | Reports |
|---|---|
| **CROATIA** | |
| ORSULA | 1 |
| **CYPRUS** | |
| ANTALINA | 2 |
| ATLANTIC PATROLLER | 2 |
| BALTIC COMMANDER I | 4 |
| BBC RUSSIA | 1 |
| CINNAMON | 2 |
| FEDERAL DANUBE | 1 |
| ISA | 2 |
| ISADORA | 21 |
| ISOLDA | 30 |
| **DENMARK** | |
| FREJA ATLANTIC | 1 |
| ICEBIRD | 9 |
| NORDKAP | 2 |
| TORM CAMILLA | 21 |
| **ESTONIA** | |
| ELDORG | 3 |
| **FINLAND** | |
| FENNICA | 11 |
| **GERMANY** | |
| BARMBEK | 2 |
| BONN EXPRESS | 2 |
| BRITISH ENSIGN | 2 |
| EDDYSTONE | 10 |
| FLOTTBEK | 3 |
| LS JACOBA | 1 |
| MARIA S. MERIAN | 5 |
| NATACHA C | 5 |
| REINBEK | 6 |
| VERONIKA | 2 |

| Ships Reporting By Flag | Reports |
|---|---|
| **GIBRALTAR** | |
| BBC ROMANIA | 9 |
| SANDON | 2 |
| TOFTON | 1 |
| **GREECE** | |
| ARIANNA | 9 |
| CAP DIAMANT | 59 |
| CAP LAURENT | 32 |
| CAP LEON | 13 |
| MSC SICILY | 1 |
| PONTOPOROS | 1 |
| TETIAN TRADER | 1 |
| **HONGKONG** | |
| AMAZONIA | 1 |
| FEDERAL AGNO | 2 |
| FEDERAL PROGRESO | 1 |
| FEDERAL SETO | 1 |
| FULL BEAUTY | 2 |
| GADWALL | 1 |
| HEBEI PIONEER | 3 |
| JOYOUS AGE | 1 |
| OOCL CHINA | 4 |
| OOCL MONTREAL | 2 |
| SAGA MONAL | 8 |
| SAGA SKY | 10 |
| SAGA WAVE | 1 |
| YONG TONG | 2 |
| **IRELAND** | |
| ARKLOW RESOLVE | 1 |
| **KERGUELEN ISLANDS** | |
| JEAN LD | 1 |
| **KOREA** | |
| HANJIN TACOMA | 1 |

| Ships Reporting By Flag | Reports |
|---|---|
| **LATVIA** | |
| OTTO | 1 |
| **LIBERIA** | |
| HEDWIG OLDENDORFF | 9 |
| HEINRICH OLDENDORFF | 10 |
| MCT ARCTURUS | 20 |
| RUTLAND | 1 |
| TIKHORETSK | 4 |
| ZIEMIA CIESZYNSKA | 7 |
| ZIEMIA LODZKA | 2 |
| **LITHUANIA** | |
| KAPITONAS A. LUCKA | 2 |
| MINDAUGAS | 1 |
| **LUXEMBOURG** | |
| CRYSTAL DIAMOND | 4 |
| **MALTA** | |
| GIANNI D | 3 |
| LYUBOV ORLOVA | 1 |
| PETER S. | 4 |
| SEABOXER II | 1 |
| **MARSHALL ISLANDS** | |
| LAKE ERIE | 2 |
| LAKE MICHIGAN | 3 |
| LAKE ONTARIO | 10 |
| OMEGA PRINCE | 3 |
| ROBERT RICKMERS | 7 |
| **NETHERLANDS** | |
| REYKJAFOSS | 4 |
| SPAARNEGRACHT | 1 |
| STADIONGRACHT | 1 |
| VICTORIABORG | 5 |

| Ships Reporting By Flag | Reports |
|---|---|
| **NETHERLANDS cont.** | |
| VIRGINIABORG | 1 |
| **NETHERLAND ANTILLES** | |
| ARCTIC SUNRISE | 1 |
| LOOTSGRACHT | 4 |
| NS SPIRIT | 2 |
| SCHELDEGRACHT | 3 |
| SINGELGRACHT | 2 |
| SLOTERGRACHT | 2 |
| SPUIGRACHT | 1 |
| **NORWAY** | |
| BERGE ATLANTIC | 53 |
| BERGE NORD* | 139 |
| BRANNSPROEYTA | 1 |
| BREMON | 1 |
| JO MAPLE | 5 |
| SPAR GARNET | 1 |
| SPAR SCORPIO | 1 |
| SYNNOVE KNUTSEN | 2 |
| **PANAMA** | |
| ATLANTIC BRIDGE | 4 |
| BULK INDIA | 1 |
| CALIFORNIAN HIGHWAY | 2 |
| ESCOUMINS | 1 |
| GULF PACIFIC | 2 |
| KENT MARINER | 3 |
| MSC JEANNE | 6 |
| MSC JORDAN | 42 |
| MSC MEDITERRANEAN | 6 |
| MSC SABRINA | 2 |
| PRIDE | 2 |
| RENUAR | 2 |
| SPRING PEACOCK | 1 |

| | |
|---|---|
| **POLAND** | |
| ZIEMIA CHELMINSKA | 1 |
| **SINGAPORE** | |
| IKAN PROGRESO | 3 |
| STAR IKEBANA | 18 |
| **SWEDEN** | |
| ADA GORTHON | 1 |
| MARIA GORTHON | 3 |
| STENA PRIMORSK | 2 |
| **SWITZERLAND** | |
| MCT MONTE ROSA | 3 |
| **TURKEY** | |
| ALMA ATA | 5 |
| **UKRAINE** | |
| OCEAN STARLET | 1 |
| **UNITED KINGDOM** | |
| BISHOP ROCK | 1 |
| BRITISH EXCELLENCE | 1 |
| CMA CGM UTRILLO | 5 |
| HANNE KNUTSEN | 4 |
| HUNTESTERN | 1 |
| JEAN CHARCOT | 1 |
| MAERSK PATRAS | 1 |
| **UNKNOWN** | |
| ANY SHIP | 89 |

*Denotes 2007 Carpathia Award Winner

# Appendix C

## Customer Outreach Program

### LCDR Gabrielle G. McGrath

Customers are the focal point of the International Ice Patrol (IIP) mission: to provide the limit of all known ice (LAKI) to the maritime community. To achieve this mission, Ice Patrol's customers must view IIP ice warnings as both accurate and on time.

## Identifying and Understanding IIP Customers

In order to ensure that customers' needs are being met, the first step is to identify IIP's key customer groups. The International Convention for the Safety of Life at Sea (SOLAS) treaty agreement mandates that dictate and guide the International Ice Patrol mission make identification of the primary customer base fairly obvious — **ships transiting the region of icebergs**. While this constituency is easily defined, understanding and meeting their needs is often a daunting task: attempting to reach independent ships, all over the ocean. Additionally, there are many other clients using IIP's iceberg information that are not so clearly mandated, nor so easily identified.

International Maritime Organization
International Convention for the Safety of Life at Sea
Chapter V, Safety of Navigation

Regulation 6

Ice Patrol Service

The Ice Patrol contributes to safety of life at sea, safety and efficiency of navigation and protection of the marine environment in the North Atlantic. **Ships transiting the region of icebergs guarded by the Ice Patrol during the ice season are required to make use of the services provided by the Ice Patrol…**

**FLAG STATES SUPPORTING THE INTERNATIONAL ICE PATROL**

| | |
|---|---|
| Belgium | Japan |
| Canada | Netherlands |
| Denmark | Norway |
| Finland | Panama |
| France | Poland |
| Germany | Spain |
| Greece | Sweden |
| Italy | United Kingdom |
| United States of America | |

Figure 1: Excerpt from the SOLAS Agreement (left) and flag states considered "Contracting Governments" under these regulations (right).

*1. Ships Transiting the Region of Icebergs*

This is an expansive customer base that includes ships making international voyages across the North Atlantic as well as all other vessels in the vicinity, including fishing fleets, government vessels, coastal shipping (vessels whose voyages often start and end within ice covered waters), and oil rigs involved in offshore oil production on or near the Grand Banks of Newfoundland. Ice Patrol shares an unusual customer/provider relationship with these vessels. They not only use IIP warnings, but they also help create them through their observation reports of weather, sea surface temperature (SST), and icebergs. Their primary requirements are that the IIP warnings are accurate and on time.

While there are only 17 contracting governments that are signatory to SOLAS and, as such, are responsible to provide funding for IIP operations, ships flying more than 50 different flags utilize IIP warnings each year. During the 2007 ice season, more than 152 vessels were identified in or near the IIP operational area. All of IIP warnings, including the Announcement of Services, safety broadcasts, and bulletins, request that the mariner provide observations when transiting our operational area. When a mariner responds to this request, IIP is able to include that particular vessel as an active customer at sea. In 2007, these 152 ships provided nearly 900 reports. In addition to identifying specific customers, these reports are used to passively monitor how the mariner is using our warning.

Additional ships are identified when they voice specific requests, identify service problems and errors, or send annotated copies of ice charts, customer survey forms and other correspondence to IIP. A far larger, passive customer group never provides input or feedback to IIP at all. These ships' radio call signs appear on weather charts and in vessel management reports in and around the LAKI. This "passive" customer group is a silent majority of IIP customers. IIP wishes to reach out to these customers to improve understanding of their needs. In 2002, a brief statement on IIP's fax charts and bulletins reminded all mariners of the recent change to SOLAS making use of the Ice Patrol's services mandatory.

This effort prompted many previous non-reporting vessels to provide iceberg and environmental reports, expanding direct contact with the IIP customer base. In 2005, IIP arranged a meeting with representatives of the offshore fishing industry in St. John's, Newfoundland. This meeting resulted in a better understanding of the fishing vessels' needs and a dramatic increase in the number of iceberg reports received from the fishing fleet. IIP is presently tracking this reporting data to develop an even better understanding of this sector of North Atlantic mariners.

In addition to these direct methods of identifying customers, IIP began a new passive monitoring system, the SailWx system, in 2006 to detect potential customers. This web-based system, accessed through the Internet at www.sailwx.info, locates all vessels operating in a set region with a set resolution, both inputted by the user. The IIP Duty Watchstander reviews a snapshot of the vessels transiting through IIP's operational area every Monday, Wednesday, and Friday. One of these snapshots is included as Figure 2. Using this system greatly assists IIP in understanding customer needs.


Figure 2: Example snapshot of vessel data retrieved from www.sailwx.info.

*2. SOLAS Contracting Governments/Member Nations*

The member nations are both stakeholders and customers. They are stockholders because, as countries signatory to SOLAS, they are required to contribute funding in support of the North Atlantic Ice Patrol (NAIP). However, they are also customers, expecting safe and efficient maritime transport for their nation's vessels while they transit the North Atlantic when the danger of collision with icebergs exists. This annual report describing the Ice Patrol's activities is actually required by SOLAS for preparation and distribution to these governments.

IMO's Maritime Safety Committee (MSC) administers the SOLAS convention and those provisions that provide for the support, funding, and operation of the International Ice Patrol. As part of the periodic review of this treaty in 1998, representatives from the 17 signatory countries supporting IIP reviewed the operation, administration, and funding of the Ice Patrol and brought issues relating to IIP before the MSC. Economic benefits and cost recovery were topics of significant interest. Data provided by IIP and the State Department indicate that IIP services cost only $0.02 per ton. After reviewing the operational and economic performance of the IIP, the MSC members agreed that that an ice patrol should continue due to its effectiveness in the preservation of life and protection of the marine environment. The MSC endorsement was a strong statement of customer satisfaction by the 17 signatory nations.

*3. Ship routing services, both commercial and military.*

This is a small but important group that help ships plan ocean voyages. They require accurate LAKI warnings that are timely, but they are not as sensitive to the on time delivery of warnings as the ships themselves. Although the routing services receive IIP safety broadcasts via standard communication networks, immediate delivery is not important to these customers.

*4. Government, academic and private research organizations.*

As part of its operations, Ice Patrol chronicles ice and oceanographic conditions in the North Atlantic. Various research organizations use these data to study conditions in the North Atlantic Ocean, such as to help in identifying risks to oil drilling operations and other maritime activities.

## Methods for Identifying Customer Needs

Because of the importance of customer relations to the Ice Patrol, IIP established the Customer Relations Natural Working Group to identify IIP's primary and secondary customers and to coordinate efforts for gathering input from them. This group is led by the Customer Relations Petty Officer (CRPO) who is responsible for collating customer feedback and distributing customer information to unit personnel, for initiating customer surveys via direct mailings, Automated Mutual-Assistance Vessel Rescue (AMVER) bulletins, or any other practicable means.

In May of 2007, IIP launched an intense effort to distribute and collect a survey to assess how well IIP is serving its customers. The Department of Homeland Security, Office of Management and Budget (OMB) approved this survey for distribution through May of 2010. The goal of this survey is to capture actionable information for use in exceeding customers' and stakeholders' expectations. An average response rate of 50 percent is expected from all of the vessels identified in the customer base described above. IIP advertises this survey on its Internet website, as well as on all ice warnings distributed from the Operations Center.

## Customer Requirements

Although the different customer groups have slightly different timelines for IIP warnings, the key requirements for each of the groups remain:

- *Accurate and timely ICE BULLETINS and ICE CHARTS defining the LAKI.*
- *Immediate SAFETY BROADCASTS of iceberg and stationary radar target information near or outside the limit of all known ice.*

In order to accomplish these requirements, IIP sets targets for the accuracy and timeliness of warnings. For example, the target for the accuracy of Limit of All Known Ice (LAKI) warnings is greater than 95% for the number of accurate warnings divided by the number of warnings created. For safety bulletins, IIP sets a target of 30 minutes from notification of the iceberg to the transmission of the safety bulletin.

IIP warnings are generated using requirements determined through the customer surveys program, interviews with mates and masters, and feedback from shipping companies and commercial ship routing companies. Evolving requirements center on warning delivery and format. Modern, computer based communications are shifting most vessels from HF voice or SITOR broadcasts to automated NAVTEX and INMARSAT systems. Many vessels continue to rely on older technology, and the most popular IIP warning continues to be the HF facsimile ice chart. An emerging trend is the use of Internet connectivity at sea. IIP posts ice bulletins and charts on the Internet daily, and several research vessels reported that this is their primary method of obtaining IIP information.

Most of IIP's smaller customer groups discussed previously, such as shipping companies, commercial ship routers, government organizations (ice, oceanographic and weather agencies), academic institutions, and research centers access IIP warnings via the Internet. Their requirements are often less stringent than those of ships at sea. In fact, IIP's annual reports often meet their needs.

The offshore oil industry is emerging as a significant IIP customer. Several multi-billion dollar oil drilling and production rigs are being erected on the Grand Banks of Newfoundland in or near "Iceberg Alley." The environmental extremes (harsh winter storms, icebergs and sea ice) are of significant concern to the oil industry. Prior to positioning, this industry carefully scrutinizes IIP data to minimize the likelihood of danger or damage. IIP works extensively with the commercial provider of ice management services to the oil exploration/exploitation industry to provide near-real time ice information to help protect their structures.

The worldwide concern for both safety and security, amplified by the events of September 11$^{th}$ 2001, drastically hastened the IMO's implementation of SOLAS carriage requirements for Automated Identification Systems (AIS) on the merchant fleet. AIS provide information, including the ship's identity, type, position, course, speed, navigational status and other safety-related information, automatically to appropriately equipped shore stations, other ships, and aircraft. Regulation 19 of SOLAS Chapter V requires AIS to be fitted aboard all ships equal to or greater than 300 gross tons engaged on international voyages, cargo ships equal to or greater than 500 gross tons not engaged on international voyages, and all passenger ships irrespective of size. The requirement became effective for all ships by 31 December 2004. All IIP reconnaissance flights now deploy with an AIS receiver as part of the sensor suite to help discern between vessels and icebergs when a target is detected by radar alone.

## Customer Relationships and Satisfaction

Information gathered through the previously described customer surveys is used by IIP to determine customer satisfaction. Large surveys were conducted in 1995, 1996, 1998, and 2003, as well as the current on-going survey effort from 2007 through 2010.

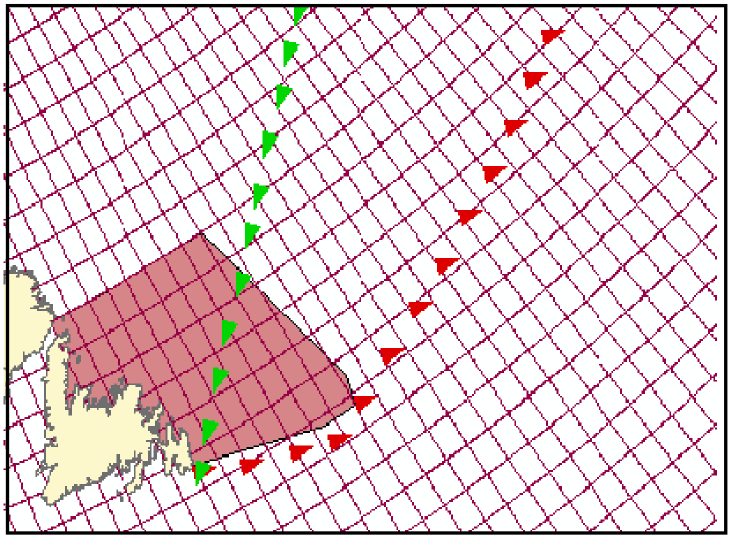
In addition to IIP's periodic customer survey, IIP constantly requests feedback from customers. When reports are received from mariners in the Operations Center, IIP responds immediately with an e-mail thanking the vessel for the report and requesting specifically whether or not IIP's warnings are meeting the mariner's navigational needs. IIP contact information is listed on the IIP website and the annual announcement of services. Mariners are invited to contact IIP at any time with questions or input. In 2007, IIP established a toll-free telephone number that was published on the website and on all warnings to provide an additional contact means for customers. Comments from the 1998 season included recommendations to enhance the latitude and longitude labels on ice charts. Another suggestion, which was implemented in 1999, increased the reception area for INMARSAT broadcasts. Using a second satellite over the Eastern Atlantic Ocean, vessels now receive IIP information in European ports or immediately after they depart for North America. This improvement allows masters to make smaller course adjustments to circumnavigate ice limits, saving time and money. In response to input from customers, IIP also improved the bulletins by utilizing shorter and clearer text to ensure better understanding by non-English speaking mariners and by adjusting the order of the information listed in the bulletins, concentrating the most important information at the top, to ensure that the mariner receives the most critical information in the event that the bulletin is truncated during transmission.

In 2005, the Ice Patrol initiated a formal program to recognize the ship that made the most reports of weather, sea surface temperature (SST), and icebergs. Named after the CARPATHIA, which came to the aid of the victims of the TITANIC disaster, the CARPATHIA Award is presented annually to the ship that makes the most information reports. In 2007, the M/V BERGE NORD, home ported in Stavanger, Norway, was the recipient, with 139 reports of weather, SST, and icebergs. M/V MATTEA, home ported in Arnold's Cove Station, Newfoundland, won the award in both 2005 and 2006. The recipient of this prestigious award is also recognized in the widely distributed *Mariners Weather Log* publication in order to inform mariners of this recognition. Figure 3 illustrates the CARPATHIA at the site of the TITANIC disaster on April 15, 1912. This picture was displayed on cover of the *Mariners Weather Log,* Volume 50, Number 2 in August 2006. All program participants are listed in Appendix B of this report.


Figure 3: The CARPATHIA was the first vessel on scene to respond to the TITANIC disaster on April 15, 1912. IIP honors this vessel through the CARPATHIA Award. This award is given to the vessel providing the most reports of weather, sea surface temperature, and icebergs to IIP in a given ice year.

IIP also monitors a variety of other data sources to passively discern customer satisfaction. By reviewing marine weather charts, IIP can determine if and how ships avoid the LAKI. From synoptic charts, hard data on customer behavior including location, time, course and speed can be derived. Figure 4a-b illustrates how vessels respond when a LAKI is established in our operational area. These vessels' tracks during periods when a LAKI is and is not present clearly illustrate that mariners are heeding IIP's warnings. IIP views the vessel tracks over the course of an entire season for an overview of ship behavior with regard to the position of the LAKI. Particular ship voyage routes and names are not utilized or maintained.

a.



b.

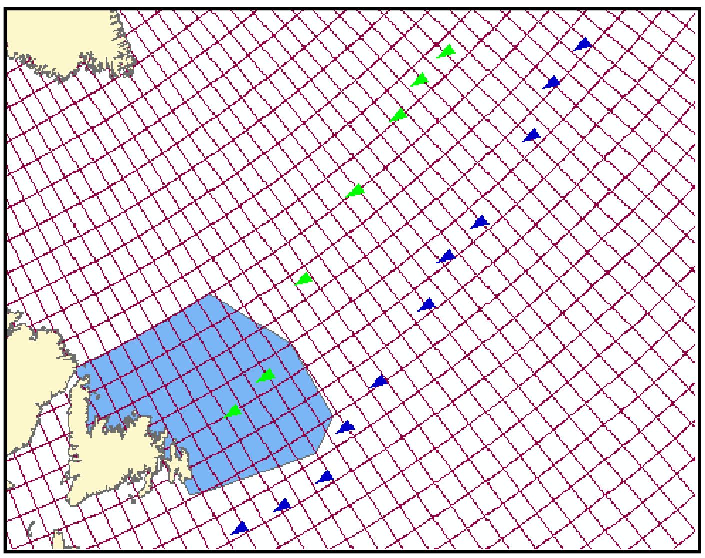


Figure 4: Examples of our passive customer monitoring efforts. Figure 4a. shows two tracks of the same vessel at two different periods of time. The green track illustrates the vessel's path as it transits into the IIP OPAREA during early April 2004 when there was no IIP LAKI. The red track illustrates the same ship's voyage out of the area two weeks later when there was an IIP LAKI (burgundy contour). Figure 4b. shows the tracks of another vessel through the OPAREA in May 2004 (blue tracks) when a LAKI (light blue contour) existed and in May 2005 (green tracks) when there was no LAKI.

IIP also asks that ships using the ice charts provide annotated copies for additional analysis. In recent years, nearly 200 charts were mailed to IIP with positions and transit routes indicated. These charts also give IIP an opportunity to evaluate the quality of warnings received at sea since HF radio facsimile reception quality varies with location and atmospheric conditions.

## Complaint Procedures

Although IIP receives very few complaints from customers, it is important for customers to realize that IIP immediately receives, responds, and resolves all complaints. IIP has numerous communication methods available, including the toll-free telephone number, standard telephone number, e-mail, facsimile, and website that customers can utilize to state their concerns. The IIP Duty Watchstander immediately logs any complaint received and forwards it directly to the Commander, IIP for resolution.

## Vessel of Opportunity Observation Program (VOOP)

In 2007, IIP revived and improved a program that began nearly 10 years ago to distribute handouts to customers with information on how to report ice, weather, and sea surface temperature observations and where to receive IIP warnings. This program, the Vessel of Opportunity Observation Program (VOOP), was originally designed of a simple handout and was handed out at Port Days and other outreach events. This year, IIP launched a new effort to distribute packets including a cover letter from the Commander of IIP, an updated version of the original VOOP form, and one of IIP's OMB-approved customer surveys. This wide-scale distribution effort required that IIP build new partnerships both within and outside the U. S. Coast Guard.

IIP has engaged the U. S. Coast Guard's Prevention community. IIP contacted each of the Sector offices from Portland, Maine south to Baltimore, Maryland in an attempt to target those ports most likely to serve vessels transiting through IIP's area of operational responsibility. A Sector is a shore-based operational unit responsible for the execution of all Coast Guard missions within its Area of Responsibility (AOR) with operational support from Coast Guard Cutters and Air Stations. Incorporated into the Coast Guard's organization in 2004, Sectors replaced Coast Guard Groups, Marine Safety Offices (MSO), Activities, and Vessel Traffic Services (VTS). Ice Patrol distributed 1,200 VOOP packets to the Sector offices in:

- Baltimore, Maryland
- Philadelphia, Pennsylvania
- New York, New York
- New Haven, Connecticut
- Providence, Rhode Island
- Boston, Massachusetts
- Portland, Maine

Qualified Coast Guard Marine Inspectors from these offices distribute the VOOP packets to mariners during annual vessel inspections. IIP personnel conducted training at these Sector offices in the fall of 2007 on the IIP mission and the goals of this outreach project. Inspectors now document the distribution of these packets to vessels within the Coast Guard's Marine

Information for Safety and Law Enforcement database to ensure that there is no duplication of efforts between the Sector offices.

Continuing this cooperation with the Sectors, IIP gathered lists of vessel agents that each of the Sector offices work with in their respective ports.  Commander, IIP prepared a letter to these agents requesting their assistance in distributing VOOP packets to vessels that are not due for an annual inspection by the U.S. Coast Guard.  These vessel agents are now distributing over 200 VOOP packets to vessels all along the northeast coast of the United States.

Because many of IIP's customers use Canadian ports, IIP also engaged with Transport Canada and the Shipping Federation of Canada for distribution of the VOOP packets in Canadian ports.

Similar to the U. S. Coast Guard's efforts, Transport Canada's Regional Office of Marine Safety for the Atlantic Region utilized their Port State Control (PSC) Officers to distribute the packets during foreign vessel inspections. In the Atlantic Region, there are 11 Marine Safety Offices, four of which do the bulk of PSC inspections.  These four offices, namely Halifax, St. John's, Port Hawkesbury, and Saint John did over 97% of the 560 vessels inspected in the Atlantic region in 2005.  IIP disseminated 300 VOOP Packets to Transport Canada for further distribution to these Marine Safety Offices and eventually to the mariner at sea.

The Shipping Federation of Canada maintains contacts with every ship company and vessel agent throughout Quebec, Nova Scotia, Newfoundland, and New Brunswick.  An additional 300 VOOP packets were disseminated to this organization for eventual distribution throughout all of the major Canadian ports.

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