

**Prepared by the North American Ice Service**

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

**2 December 2005**

**Seasonal Outlook  
Great Lakes  
Winter 2005-2006**



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Great Lakes

WINTER 2005-2006

Introduction

This outlook of the expected pattern, timing, and the extent of ice growth attempts to identify areas and periods where conditions should be more or less favourable than normal. It has been developed through an analysis of the oceanographic and meteorological parameters for the summer and the fall proceeding the ice season. These conditions are compared with earlier years, the December wind and temperature forecasts plus the seasonal temperature outlook. A prediction of the ice regime is then produced. **It should be noted that significant variations of these conditions will have an impact on the timing and extent of ice formation.**

Throughout the winter, this outlook will be updated by a twice monthly issue of 30-day forecasts. These forecasts will also indicate the beginning of the spring break-up process throughout the area. Daily radio broadcasts of ice charts and forecasts will be made to support ongoing operations in the various areas where ice affects marine activity. For more information regarding the broadcast schedule, please consult the following Canadian Coast Guard web site (Appendix B - General information from the Canadian Coast Guard).

<http://www.ccg-gcc.gc.ca/mcts-sctm/ramn/docs/aa.ae/index.htm#part5>.

## **General Seasonal Outlook**

The summer and fall of 2005 was characterized by unusually mild weather. In particular, the month of June had temperatures that were almost 4°C above normal in the central portion of the Great Lakes. A similar pattern occurred in September where temperatures were 3°C warmer than the norm around Lake Superior and northern Lake Michigan area. Overall, temperatures were about 2 to 3°C above normal for the entire period.

The mean 100mb pressure chart for November 2005 is shown in Figure 1. The chart indicates a ridge of high pressure over the Carolinas and extended into Texas. Meanwhile a low pressure system was located over the southern portion of Davis Strait. The net effect was to generate a westerly circulation over the Great Lakes region. Hence, temperatures were above normal over the entire area for the month of November. Above normal temperatures ranged from 0.6°C above at Gore Bay to 1.9°C at Duluth.

The surface water temperature anomalies over the Great Lakes on November 23 are depicted in Figure 2. In general water temperatures were near normal over most lakes except for Lake Erie where water temperatures were slightly above normal. The figure shows that temperatures ranged from 1.5 to 2.0°C above normal over southern Lake Erie to 0.5 to 1°C below normal in central Lake Michigan.

At the end of November, generally ice free conditions prevailed over most of the Great Lakes except in north-western Lake Superior and Saginaw Bay where some new and thin lake ice has formed.

The forecast for December is for below normal air temperatures for the Great Lakes region. Freeze-up over the Great Lakes will occur earlier than normal.

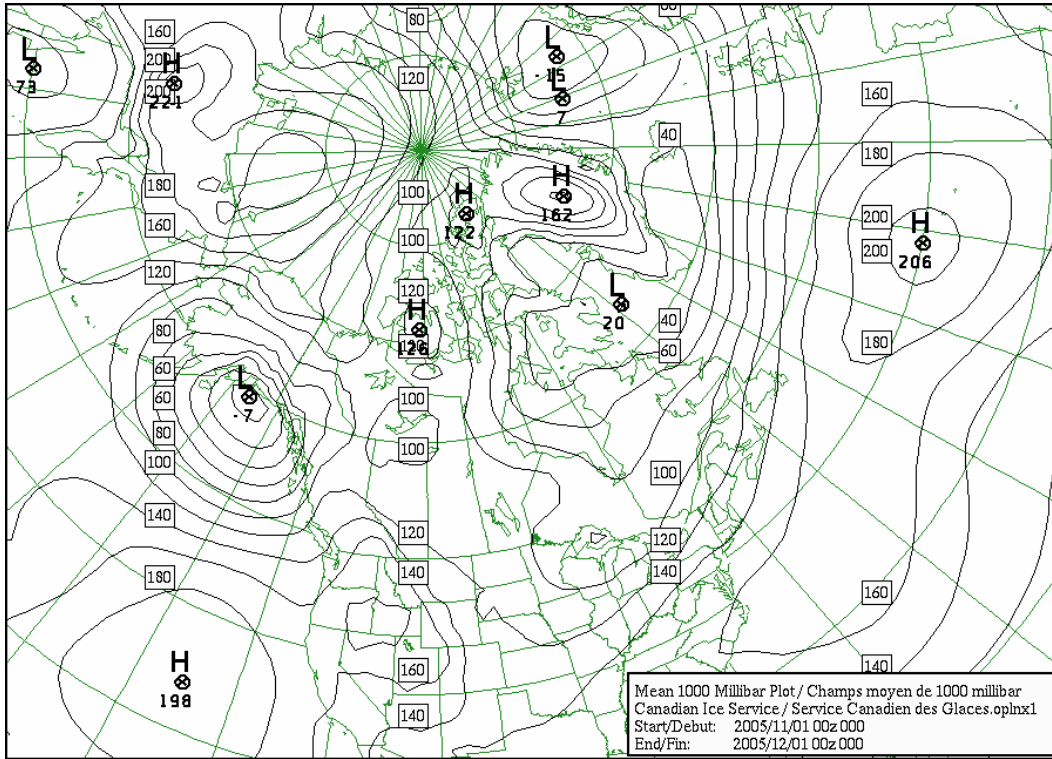


Figure 1: 1000 mb pressure pattern - November 2005

	Normal Temperatures	Observed	Departure
Duluth	-2.4	-0.7	1.7
Thunder Bay	-2.9	-1.6	1.3
Gore Bay	1.6	2.6	1.0
Sault Ste Marie	0.5	1.4	0.9
Chicago	4.4	5.9	1.5
Wiarnton	2.6	3.9	1.3
Windsor	4.6	6.5	1.9
Buffalo	4.6	6.2	1.6
Toronto	3.1	5.1	2.0
Trenton	2.5	4.2	1.7
Average	1.9	3.4	1.5

Table 1: Departure from Normal Temperatures - November 2005

SST Anomaly 23 nov 2005

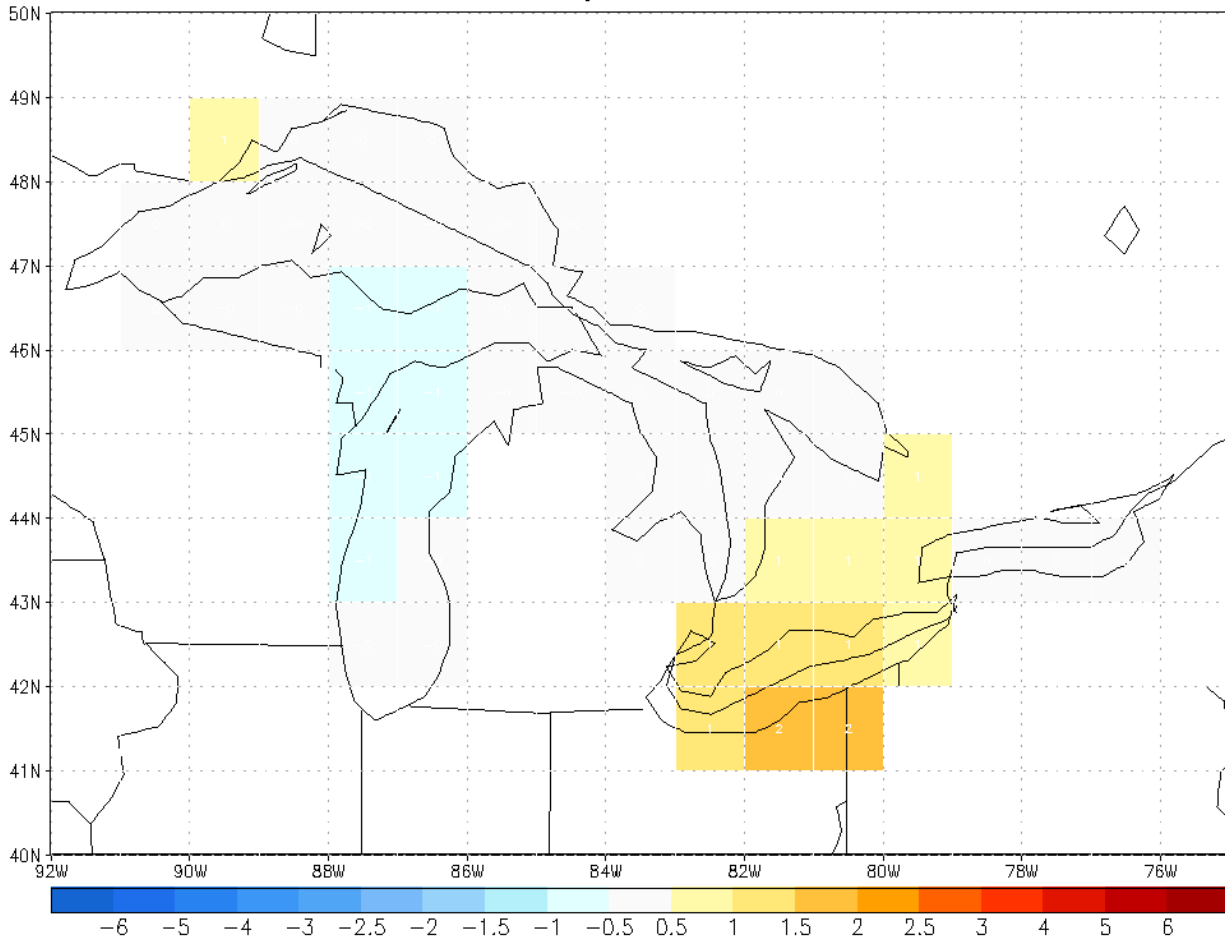


Figure 2: Sea surface temperature anomalies - 23 November 2005 (NCEP)

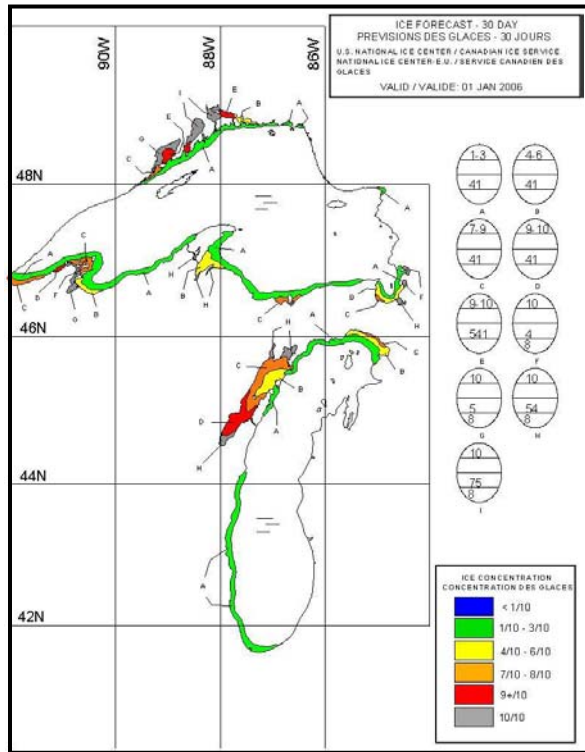


Figure 3: Expected ice Conditions - Western Great Lakes - 1 January 2006

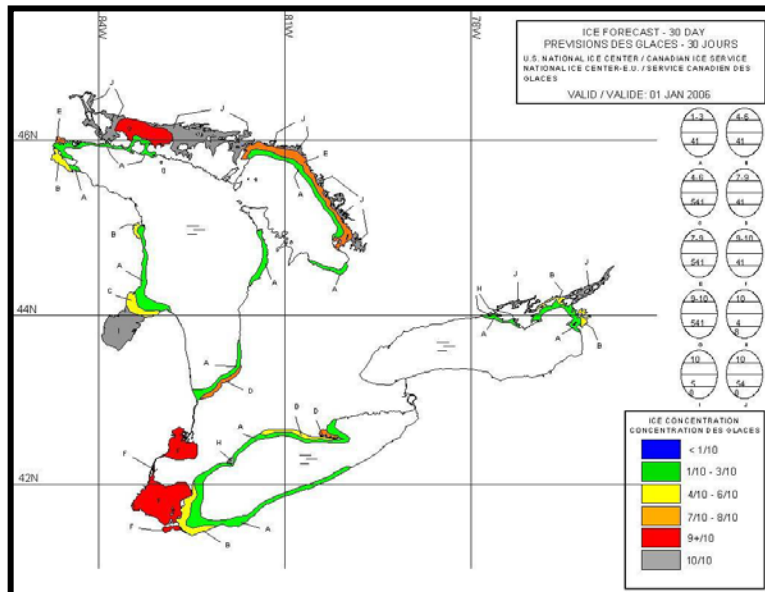


Figure 4: Expected ice Conditions - Eastern Great Lakes - 1 January 2006

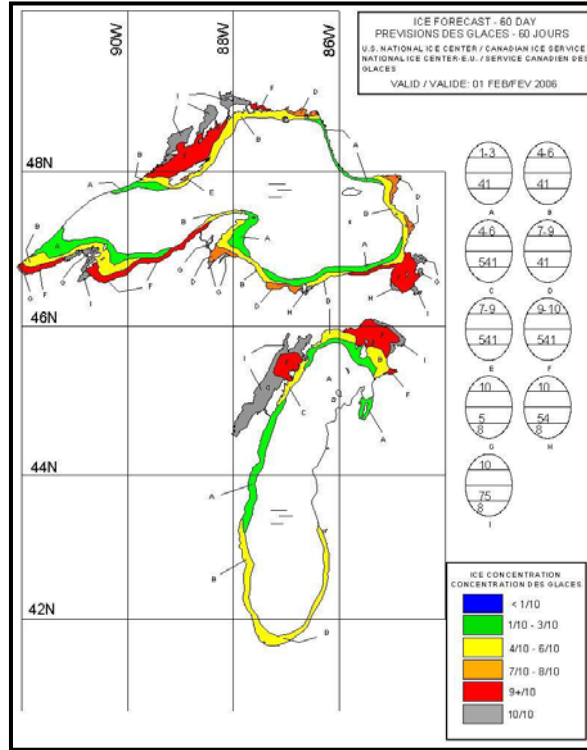


Figure 5: Expected ice Conditions - Western Great Lakes - 1 February 2006

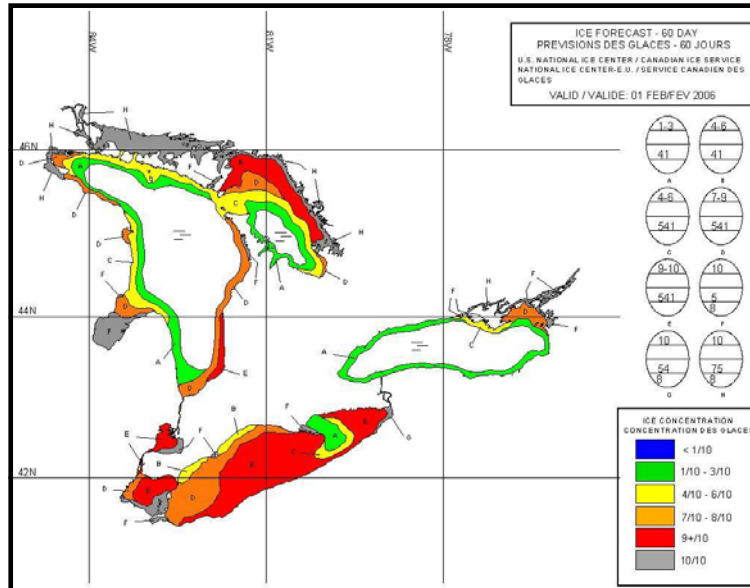


Figure 6: Expected ice Conditions - Eastern Great Lakes - 1 February 2006



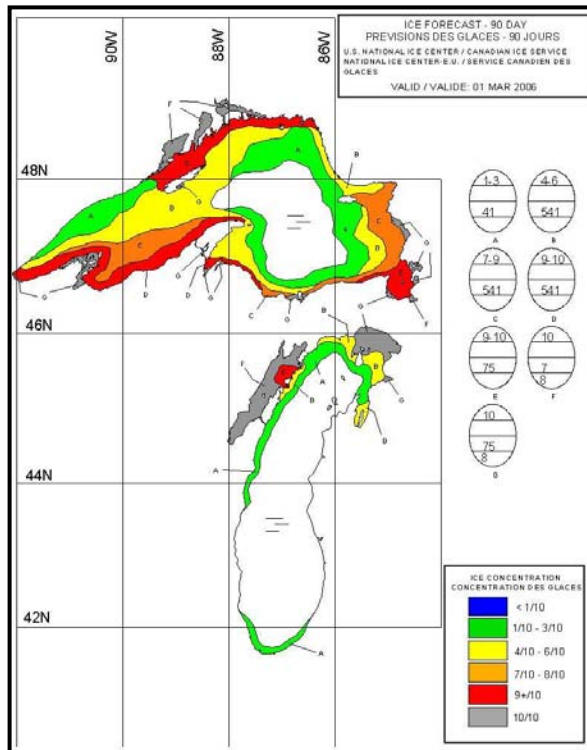


Figure 7: Expected ice Conditions - Western Great Lakes - 1 March 2006

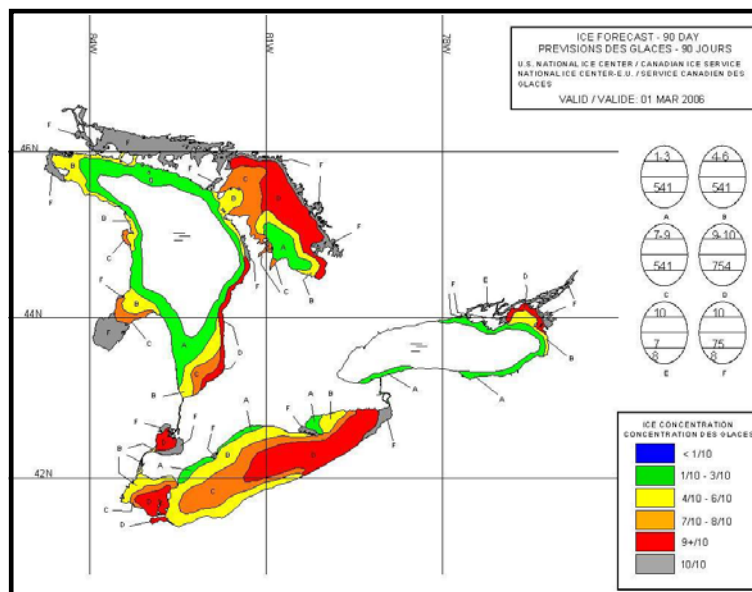


Figure 8: Expected ice Conditions - Eastern Great Lakes - 1 March 2006

## Lake Superior

Water temperatures were generally near normal over the entire lake. Air temperatures will average generally below normal over the entire lake during the month of December.

At the beginning of December, generally open water to ice free conditions will prevail over most of the lake except for some new and thin lake ice in Black and northern Nipigon Bays. During the first week of December, some new lake ice will begin to form in north-eastern Thunder Bay. Some patches of new lake ice will begin to form along the north-western shore of the lake. By the middle of the month, the northern half of Thunder Bay will be covered with thin and new lake ice. Patches of new and thin lake ice will cover the St Mary's River while Black and Nipigon Bays will thicken to consolidated thin and medium lake ice. The remainder of the lake will be ice free except for open water within 1 to 4 miles of the coast or ice edge. The third week of December will see some new ice begin to form around the Apostle Islands as well as near the Duluth area. By the end of December, most of Thunder Bay will be covered with consolidated medium lake ice except for the southern entrance and the central portion of the bay where mostly thin and medium lake ice will prevail. The consolidated ice in Black and Nipigon Bays will thicken to thick lake ice. Some ice will begin to consolidate around the Apostle Islands as well as the shallow bays of Whitefish Bay. The St Mary's River will be mostly consolidated with thin and medium lake ice. Areas of new lake ice will begin to form along the southern shore and continue in the area between Grand Marais and Marathon along the north-western shore of the lake. The remainder of the lake will be ice free except for an area of open water within 2 to 7 miles of the coast or ice edge. At the end of December, the forecast ice extent will be slightly greater than normal. The expected ice cover for January 1<sup>st</sup> is illustrated in Figure 3.

The seasonal temperature outlook for January and February indicates that temperatures will be near to above normal over Lake Superior. However periods of below normal temperature can be expected. Hence, ice growth will be somewhat slower than normal. By the middle of January, most of Thunder Bay will have medium and thick consolidated lake ice with the south-central part of the bay remaining mobile. The north-western portion of the lake from Grand Marais to the entrance to Nipigon Bay and within 4 to 12 miles of the shore will have thin and new lake ice. The ice along the southern shore will continue to expand slowly northwards with areas of consolidated medium lake ice around the Apostle Islands as well as in the Duluth area. Whitefish Bay will be covered with thin and medium lake ice while most of the St Mary's River will be consolidated with medium and thick lake ice. Some areas of thin and new ice will develop along the shore from Whitefish Bay northwards to Michipicoten Bay. By the end of the month, Thunder, Black and Nipigon Bays will remain completely consolidated with medium and thick lake ice. The ice along the north-western shore from Grand Marais to Marathon as well as the southern and eastern shore will continue to have thin and new with some medium lake ice however concentrations will drop off somewhat from mid-month. Mostly medium lake ice will cover Whitefish Bay with some consolidated thick lake ice in the smaller bays. The remainder of the lake will be ice free except within 3 to 10 miles of the shore and ice edge where open water condition will prevail. The expected ice cover for February 1<sup>st</sup> is illustrated in Figure 5.

The ice extent will increase during the first half of February. By mid-February, the coastal area from Grand Marais to Marathon will be covered with a 10 to 20 miles wide band of thin

lake ice with some medium lake ice. Some new and thin lake ice growth will occur along the south-eastern portion of Isle Royale during the first few weeks of February. The area from the Apostle Islands westward will be covered with thin and medium lake ice. The area near Duluth will be consolidated with medium lake ice while the Apostle Islands will be encased in medium and thick lake ice. East of the Apostle Island and within 10 to 20 miles of the shore, ice will be mostly medium and thin lake ice. Whitefish Bay will to be covered with medium and thick lake ice. The remainder of the lake will be mostly open water with ice free conditions in the east central portion of the lake. The ice along the shore north of Whitefish Bay to Michipicoten Bay will continue to expand toward the west between 10 and 20 miles from the shore. At the end of February, no significant change will occur in terms of ice extent. The ice thickness will vary from thin and medium lake ice in the southern portion of the lake to medium and thick lake ice in the north. The area along the southern shore will have mostly thick lake ice occasionally under pressure. The expected ice cover for March 1<sup>st</sup> is illustrated in Figure 7.

With generally below normal temperatures forecast for the spring, the ice extent will most likely increase somewhat during the first two weeks of March. Hence clearing of Lake Superior will occur later than normal.

### **Lake Michigan**

Water temperatures over Lake Michigan were about 1.2°C to 1.8°C above normal over the entire lake. The temperature for the month of December will be generally below normal over the entire region.

At the end of November, no significant ice had begun to form however during the first week of December; some areas of new ice will begin to form in the Little and Big Bay de Noc as well as the southern portion of Green Bay. At mid-December, there will still not be any significant ice growth except in the Little and Big Bay de Noc as well as the southern portion of Green Bay where some patches of new and thin lake ice will persist. Some patchy coastal ice could develop along the shore from the northern entrance to Green Bay north-eastward to the Straits of Mackinaw. By the end of December, the Little and Big Bay de Noc as well as the southern portion of Green Bay will be covered with consolidated thin and medium lake ice. The central portion of the bay will have new and thin lake ice. A band of thin and new lake ice will extend about 5 to 10 miles from the shore from the entrance to Green Bay north-eastward to the Straits of Mackinaw. Patches of new lake ice will begin to form along the western shore south of the entrance to Green Bay all the way to the southern portion of the Lake. Elsewhere, ice free conditions will prevail except open water near the shore and ice edge. The expected ice cover for January 1<sup>st</sup> is illustrated in Figure 3.

The seasonal temperature forecast indicates generally near to above normal temperatures for the month of January and February. However periods of below normal temperatures will also occur especially during the first half of January. During the first two weeks of January significant ice growth will occur in the northern portion of the lake as well as along the western shore. By mid-month, the areas of consolidated ice in Green Bay will increase except for the northern-central portion of the Bay which will remain mobile with medium and thick lake ice. Bands of new and thin lake ice along the western and south-eastern

shore will widen to about 5 to 15 miles from the shore. Some areas of consolidated ice will form just west of the Straits of Mackinaw while the area from about 10 miles south of Beaver Island northward will be covered with thin and medium lake ice. By the end of the month, most of Green Bay will remain consolidated with thick lake ice however the north-central portion of the bay will remain mobile. The area of ice along the western and southern shore will retreat somewhat to about 5 to 10 miles. Mostly thin and new ice will prevail in this area. The area of ice in the northern portion of the lake will also retreat. From just south of Beaver Island north-eastward will continue to be covered with medium and thick lake ice with consolidated ice in the approaches to the Straits of Mackinaw. The remainder of the lake will be ice free to open water. The expected ice cover for February 1<sup>st</sup> is illustrated in Figure 5.

For the first half of February little change is expected. By mid-February, most of Green Bay will be consolidated with thick lake ice except for the north-eastern entrance where the ice will remain mobile. The ice edge along the western and south-eastern shore will be patchy and located within 2 to 5 miles from the shore and be comprised of mostly medium and thin lake ice. The eastern shore of the lake will be covered with thin and medium lake ice located within 3 to 8 miles of the shore while Grand Traverse Bay will be frozen over with medium and thin lake ice. The north-eastern portion of Lake Michigan will be covered with thin and medium lake ice from about 5 to 10 miles southwest of Beaver Island north-eastward. Consolidated medium and thick lake ice will extent from the Straits of Mackinaw along the northern shore. By the end of the month, little change is expected except for the coastal ice along the western, southern and eastern shore which should melt during the period. The expected ice cover for March 1<sup>st</sup> is illustrated in Figure 7.

With generally below normal temperatures forecast for the month of March, ice melt will be slower than normal.

### **Lake Huron and Georgian Bay**

Water temperatures ranged from 0.5 to 1.0°C above normal over the southern part of the lake to near normal over the remainder of the lake. Air temperatures will average below normal over the entire lake during the month of December.

At the beginning of December, mostly ice free conditions will prevail over Lake Huron and Georgian Bay. During the first week of December, some patches of new lake ice will form along the shore of Saginaw Bay. By the second week, some new and thin lake ice will begin to form in the shallow bays of the North Channel and Georgian Bay. Most of Saginaw Bay will be covered with new and thin lake ice. During the third week the ice in the North Channel and the north-eastern shore of Georgian Bay will be covered with new and thin lake ice. Some consolidated thin lake ice will begin to form in the smaller bays. Some patches of new lake ice will form along the shore of Lake Huron. The southern section of Saginaw Bay will be consolidated with thin and medium lake ice while the northern portion will be covered with thin and new lake ice. By the end of the month, the North Channel will be covered with thin and medium lake ice with consolidated medium and thin lake ice in the eastern and western end of the channel. The shore adjacent to the Straits of Mackinaw will have some new and thin lake ice forming with some consolidated thin and medium lake ice along the shore. Patches of new

and thin lake ice will form along the western shore of the lake from Thunder Bay southward to Saginaw Bay. The consolidated ice in Saginaw Bay will thicken to medium lake ice. Some patches of new and thin lake ice will form along the eastern shore of Lake Huron. As for Georgian Bay, the entire north-eastern shore will be frozen over with thin and medium lake ice extending about 5 to 10 miles from the shore. The shallow bays will have consolidated medium lake ice. The remainder of the lake will be open water near the shore to ice free towards the central part of Lake Huron and south-western Georgian Bay. The expected ice cover for January 1<sup>st</sup> is illustrated in Figure 4.

The seasonal outlook for January and February will have generally near to above normal temperatures over the entire area. However occasional below normal temperatures can be expected during the period especially during the first half of January. The ice along the shore in the south-eastern and western section of the lake will continue to thicken. Consolidated ice in the eastern and western section of the North Channel will continue to expand towards the central part of the channel. The central portion of the North Channel will be covered with thin and medium lake ice. The north-eastern shore of Georgian Bay will become consolidated with thin lake ice during the first week of January. The approaches to the Straits of Mackinaw will have thin and medium lake ice. By mid-month, almost all of the North Channel will be consolidated with medium and thick lake ice while Saginaw Bay will have consolidated thin and medium lake ice. The coastal area of the remainder of the lake will have varying concentrations of thin and medium lake ice with some thick lake ice near the approaches to the Straits of Mackinaw. Thin and medium lake ice will cover the northern half of Georgian Bay. By the end of January, all of the North Channel will be consolidated with medium and thick lake ice while Saginaw Bay will have mostly consolidated medium lake ice. The ice extent along the Lake Huron shore will be about 8 to 15 miles. The north-eastern portion of Georgian Bay will be covered with thin and medium lake ice with only the south-western portion of the bay having some open water. The rest of the lake will be open water to ice free. The expected ice cover for February 1<sup>st</sup> is illustrated in Figure 6.

During the first half of February, the north-western portion of the lake east of the entrance to the Straits of Mackinaw will be covered with thin and medium lake ice with consolidated medium and thick lake ice near the entrance to the straits. The coastal area of the lake will continue to have a band of thin and medium lake ice 4 to 15 miles wide. The southern portion of the lake will be covered with thin and medium lake ice. Most of Georgian Bay will be covered with medium and thick lake ice with open water or new and thin lake ice in the south-western portion of the bay. By the end of February, some coastal ice will melt back except in the southern portion of the lake where mostly medium lake ice will cover the area. The ice in Georgian Bay will melt back or retreat north-eastward thereby developing more open water in the south-western section of the bay. The expected ice cover for March 1<sup>st</sup> is illustrated in Figure 8.

With generally below normal temperatures during the month of March, clearing of Lake Huron and area will occur later than normal.

## **Lake Erie and Lake St Clair**

The water temperatures ranged from 0.5°C above normal in the eastern and western end of the lake to 2.0°C in the central part of the lake during the latter part of November. Air temperatures will average below normal over the entire lake during the month of December.

At the beginning of December, generally open water to ice free conditions will dominate over Lake St Clair and Lake Erie. By the middle of December, some new lake ice will begin to form in the south-eastern portion of Lake St Clair with some patches of new lake ice in the Western Basin. Elsewhere, mainly open water to ice free conditions will persist. The coastal area of the Western Basin will have some new lake ice during the third week of December and expand to cover the entire basin by the end of third week. Some new ice will begin to form in Long Point Bay just after the middle of the month. All of Lake St Clair will be completely covered with thin and new lake ice by the end of the third week. By the end of the month Lake St Clair and the Western Basin will be covered with thin lake ice. Some ice will edge out of the Western Basin along the shores. Some areas of new and thin lake ice will form along the shore of Lake Erie east of the Western Basin. The remainder of Lake Erie will be open water. The expected ice cover for January 1<sup>st</sup> is illustrated in Figure 4.

The forecast temperatures over Lake Erie will be near to above normal for January and February. However periods of below normal temperatures will occur especially during the first half of January. Ice will expand outside of the Western Basin and along the shores. By mid-January, Lake St Clair will be consolidated with medium and thin lake ice. Most of Lake Erie will be covered with thin and new lake ice with some medium lake ice along the southern shore. Some areas of open water will still be present especially in the central portion of the lake. By the end of the month most of the lake will be covered with medium lake ice with looser conditions in the eastern portion of the lake. Some areas of consolidated ice will begin to form along the shore of the Western Basin as well as the south-eastern shore of Lake St Clair. The expected ice cover for February 1<sup>st</sup> is illustrated in Figure 6.

During the first half of February, the ice in Lake Erie not change significantly however occasional storms will cause some ice destruction and lead development. The thickest ice will be located in the eastern and southern portions of the lake as well as the Western Basin. Lake St Clair will remain consolidated with thick lake ice. By the end of February, some signs of break-up will appear mostly along the northern and western portion of the lake. Most of the ice will have reached the thick lake ice stage except for the area along the northern shore which could have some areas of thin and new lake ice. The expected ice cover for March 1<sup>st</sup> is illustrated in Figure 8.

With generally near to below normal temperatures for March, ice melt will be somewhat slower than normal.

## Lake Ontario

Water temperatures varied from near normal over the eastern and central portion of the lake to 1.0°C in the western section. Temperatures over Lake Ontario during the month of December will be generally below normal.

At the beginning of December, ice free conditions prevailed over the entire area. During the second week, new lake ice will begin to form in the Bay of Quinte. By the middle of December some new and thin lake ice will form in St Lawrence River while the Bay of Quinte will become consolidated with thin lake ice. By the end of December, most of the St Lawrence River will be consolidated with thin and medium lake ice. Some areas of thin and new lake ice will form along the shore of Lake Ontario. The expected ice cover for January 1<sup>st</sup> is illustrated in Figure 4.

The temperature forecast for January and February will be generally near to above normal. However some periods of below normal temperatures can be expected during these two months especially during the first half of January. During the first week of January ice will spread south-westward from the St Lawrence River to about 3 to 8 miles from the shore. The lake ice will mostly be thin and new. New lake ice will continue to form in the bays along the Prince Edward county shore. By mid-January some narrow bands of new lake ice will form along the northern and southern shore. At the same time, the entire north-eastern section of the lake will be covered with thin and new lake ice. The entrance to the St Lawrence River will be consolidated with thin and medium lake ice. The rest of the lake will remain ice free with open water conditions prevailing within 3 to 6 miles of the shore or ice edge. By the end of January, the ice edge in the north-eastern part of the lake will extend 10 to 25 miles from the shore while elsewhere the ice edge will be 2 to 5 miles from the shore. Ice thicknesses will vary from medium and thin in the eastern section and around Prince Edward County to new and thin elsewhere along the shore. The central portion of the lake will be ice free with open water conditions within 2 to 5 miles of the ice edge and shore. The expected ice cover for February 1<sup>st</sup> is illustrated in Figure 6.

During the first half of February, the ice extent will stabilise for most of the lake. By mid-month the eastern section of the lake between Prince Edward County and the eastern shore of the lake will be almost completely covered with thin and medium lake ice. Elsewhere along the coast, patches of thin and new lake ice will prevail within 2 to 5 miles of the shore. The west-central portion of the lake will remain ice free with open water within 2 to 5 miles of the shore or ice edge. By the end of February, the ice edge will retreat north-eastward in the eastern section of the lake while the narrow bands of thin and new ice elsewhere along the shore will melt back somewhat. Ice thickness will be mostly medium and thick lake ice in the north-eastern portion of the lake. The expected ice cover for March 1<sup>st</sup> is illustrated in Figure 8.

With generally below normal temperatures during the month of March, ice melt will be somewhat slower than normal during the spring.

## **Appendix**

### **Appendix A - Stages of Development of Lake Ice.**

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

<http://ice-glaces.ec.gc.ca/App/WsvPageDsp.cfm?ID=11040&LnId=78&Lang=eng>

### **Appendix B - General information from the Canadian Coast Guard.**

General information regarding transmission times for bulletins and charts from various radio broadcast stations:

[http://www.ccg-gcc.gc.ca/mcts-sctm/ramn/docs/index\\_e.htm](http://www.ccg-gcc.gc.ca/mcts-sctm/ramn/docs/index_e.htm)

### **Appendix C - WMO (World Meteorological Organization) Colour Code**

Information regarding the ice chart colour code using the WMO standard.

<http://ice-glaces.ec.gc.ca/App/WsvPageDsp.cfm?ID=11500&LnId=19&Lang=eng>

### **Appendix D - Ice Services for Canadian Great Lakes Waters**

In Canada, ice services are provided to shipping, fishing and in-lake operators by a co-operative effort of Environment Canada and the Department of Fisheries and Oceans. Department of Fisheries and Oceans, through the Canadian Coast Guard, provides icebreaker services and operates a seasonal Ice Operations Office at Sarnia. Canadian Ice Service of the Atmospheric Environment Service (division of Environment Canada) is responsible for gathering and generating ice information services and forecasts.

#### **The following forecasts are issued:**

Great Lakes Ice Hazard Bulletin (FICN19): A general ice description of conditions in each of the Great Lakes and, if required, a warning of hazardous ice conditions for the next 36 hours.

Twice-a-week Ice Analysis Charts and Regional Ice Chart covering a larger area are issued by the North American Ice Service. The Great Lakes Ice Analysis Charts are issued in two sections: the western portion of the Great Lakes which includes Lake Superior and Lake Michigan and the eastern portion of the Great Lakes which includes Lake Huron, Lake St Clair, Lake Erie and Lake Ontario. In addition to the distribution outlined in Appendix B, ice forecasts and bulletins and the Seasonal Outlook are available from the Canadian Ice Service website (<http://ice-glaces.ec.gc.ca>) and the National Ice Center website <http://www.natice.noaa.gov/products/gl-ches/index.htm>. The seasonal outlook is issued once yearly then updated twice monthly by 30-day forecasts.

For further information concerning these services please contact Canadian Ice Service by phone (613) 996-1550, facsimile (613) 947-9160 or e-mail at: [cis-scq.client@ec.gc.ca](mailto:cis-scq.client@ec.gc.ca).

or

National Ice Center by phone (301) 394-3100, facsimile (301) 394-3200 or e-mail at: [liaison@natice.noaa.gov](mailto:liaison@natice.noaa.gov)