



Seasonal Summary

Eastern Canada

Winter 2021-2022

By



Canadian Ice Service
Le service canadien des glaces



Summary for the East Coast

The 2021-2022 East Coast ice season followed normal seasonal ice cover trends. The ice season started on time in early December and ended a week earlier than normal in late June. For most of the weeks during this season, ice cover fell below the climatological normal except for two weeks at the end of February and early March, during peak ice cover, which were above. Despite spending nearly the entire season below the median, the 2021-2022 ice season fell into the near normal range based on the most recent climatology, though at the bottom edge of normal.

The ice season started in early December with ice forming in Lake Melville and along the Labrador coast as well as in small bays around the Gulf of St. Lawrence. This ice formed during a brief period of near to below normal air temperatures in what was otherwise a warm above normal December. Sea ice slowly grew throughout the East Coast through the rest of December in response to these above normal temperatures and ice cover began to fall behind the climatological normal by the end of December.

In early January, air temperatures cooled across the central and western Gulf as well as along the Labrador coast. This allowed ice to start to grow at a more typical pace for early winter. Sea ice began expanding along the Labrador coast and in the Estuary. Moderate ice growth progressed through January and the first half of February. Sea ice began to fill in the western and southern Gulf, the Strait of Belle Isle, the Labrador coast and finally in small bays around Newfoundland by then end of January. In early February, sea ice had drifted south from the Labrador coast to the northeast coast of Newfoundland. At this time, sea ice also began forming around the Magdalen Islands in the Gulf. Ice growth occasionally stalled as winter storms worked their way across the East Coast, bringing warm temperatures and strong winds that destroyed new and grey ice.

Average air temperatures cooled even further in mid-February. Below normal temperatures covered the northern half of the East Coast with near normal temperatures to the south. This led to rapid ice growth in the second half of February and into the first week in March. Sea ice covered most of the Gulf, the northeast coast of Newfoundland and the Labrador coast. Ice cover for the East Coast peaked during the first week in March at 21.7%. The 2021-2022 ice cover peak was about normal, barely exceeding the climatological peak of 20.1% and it occurred two weeks later than normal.

During the second week in March, two low-pressure systems ushered in warm temperatures and generated strong winds over the East Coast causing a sudden drop in ice cover and marked the beginning of the spring ice melt. Above normal average air temperatures persisted until mid-April allowing the break-up to progress anywhere from one to four weeks ahead of normal.

By mid-April, air temperatures returned to near normal; however, by this time, nearly all of the ice in the Gulf had melted and ice cover in the Strait of Belle Isle, northeast Newfoundland and the Labrador coast had been significantly reduced. These near normal air temperatures accompanied by generally light winds dramatically slowed the ice melt in the areas where ice still remained and even led to occasional increases in ice coverage as the ice pack was allowed to expand along the Labrador coast in late April and again in mid-May.

Warm above normal air temperatures began pushing north at the beginning of June and covered much of the Labrador coast by late June. These warm temperatures are what led to the final decline in ice coverage in the final days of June, bringing an end to the 2021-2022 ice season on the East Coast one week earlier than normal. The season TAC (Total Accumulated Ice Coverage) for the 2021-2022

season was 5.3%, double the TAC from last season. This is the 8th lowest TAC since the 1968-1969 season.

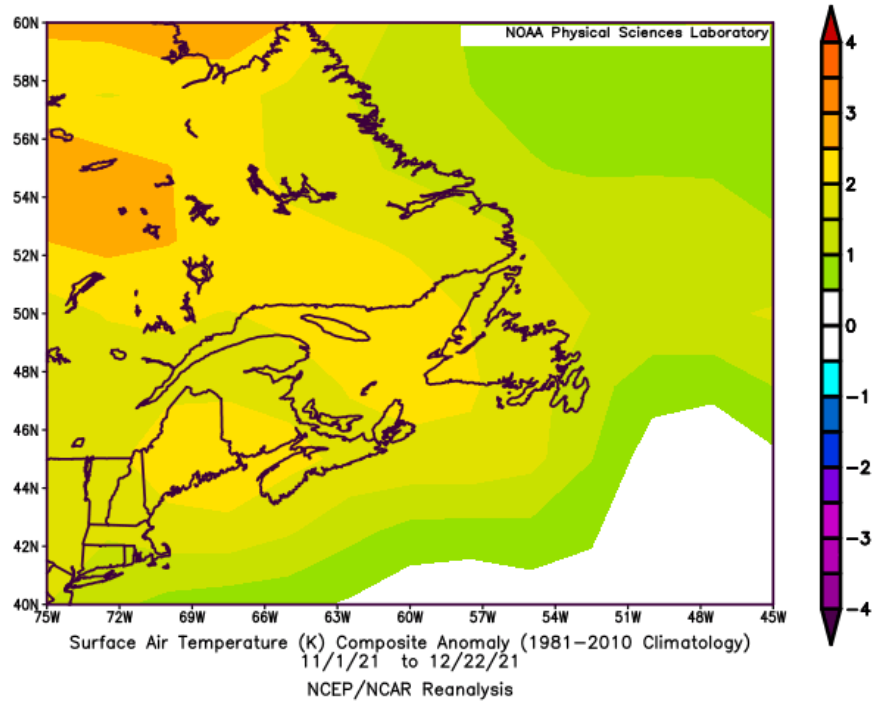


Figure 1: Surface Air Temperature Anomaly - November 1, 2021 to December 22, 2021.

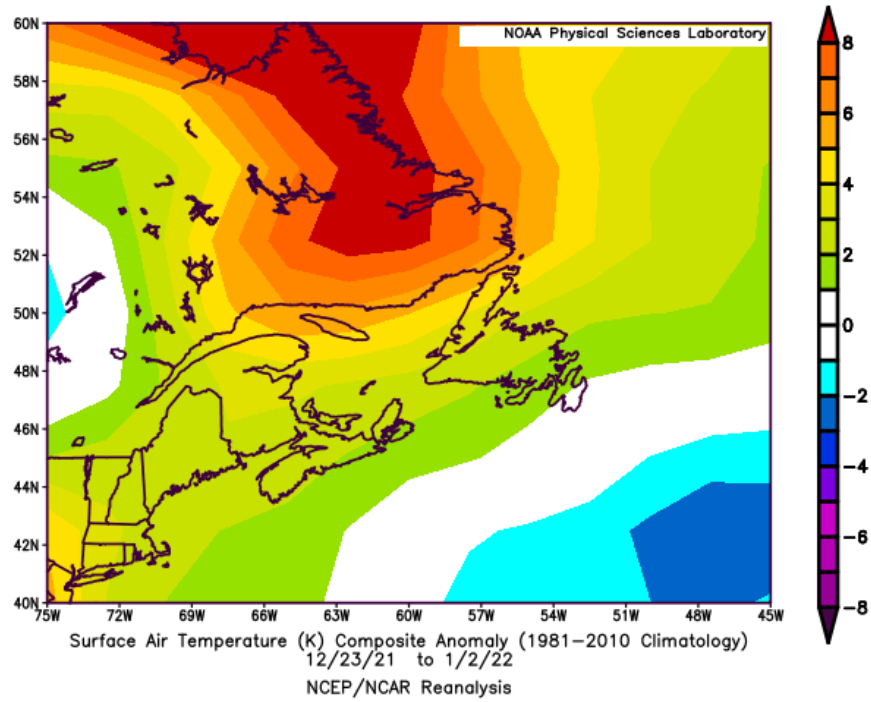


Figure 2: Surface Air Temperature Anomaly – December 23, 2021 to January 2, 2022.

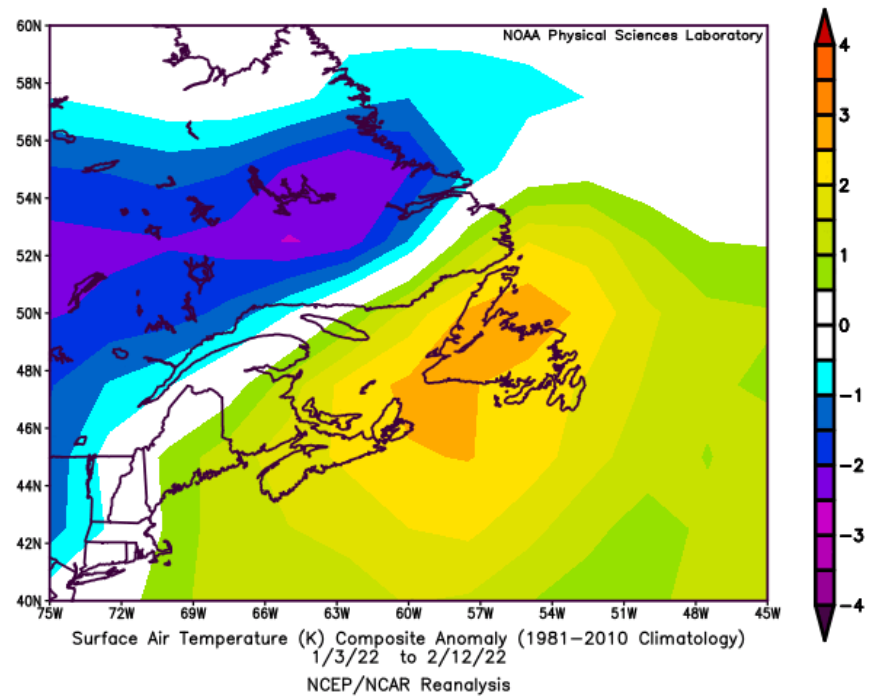


Figure 3: Surface Air Temperature Anomaly - January 3, 2022 to February 12, 2022.

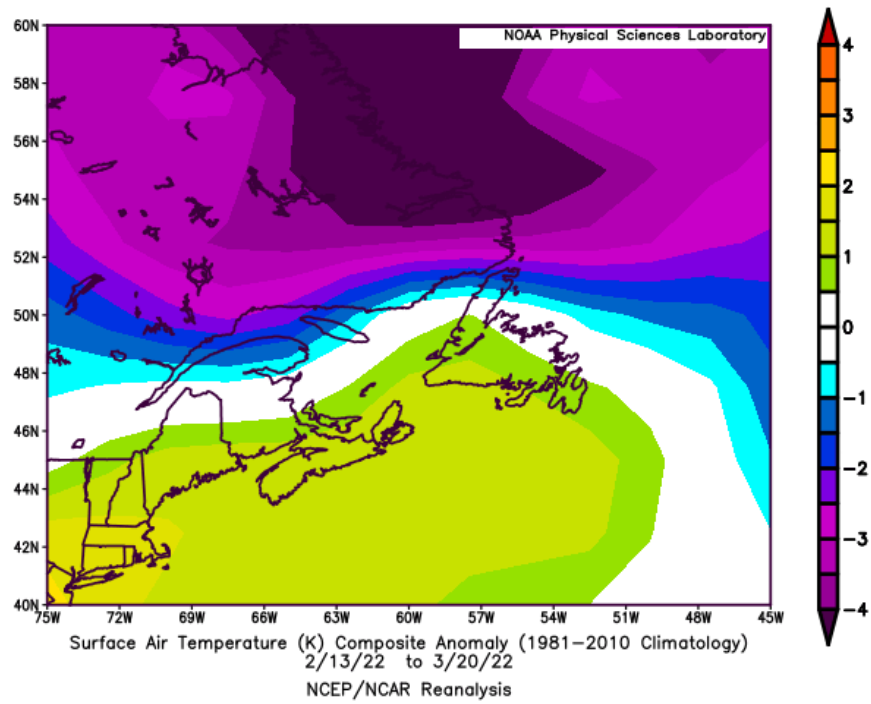


Figure 4: Surface Air Temperature Anomaly – February 13, 2022 to March 20, 2022.

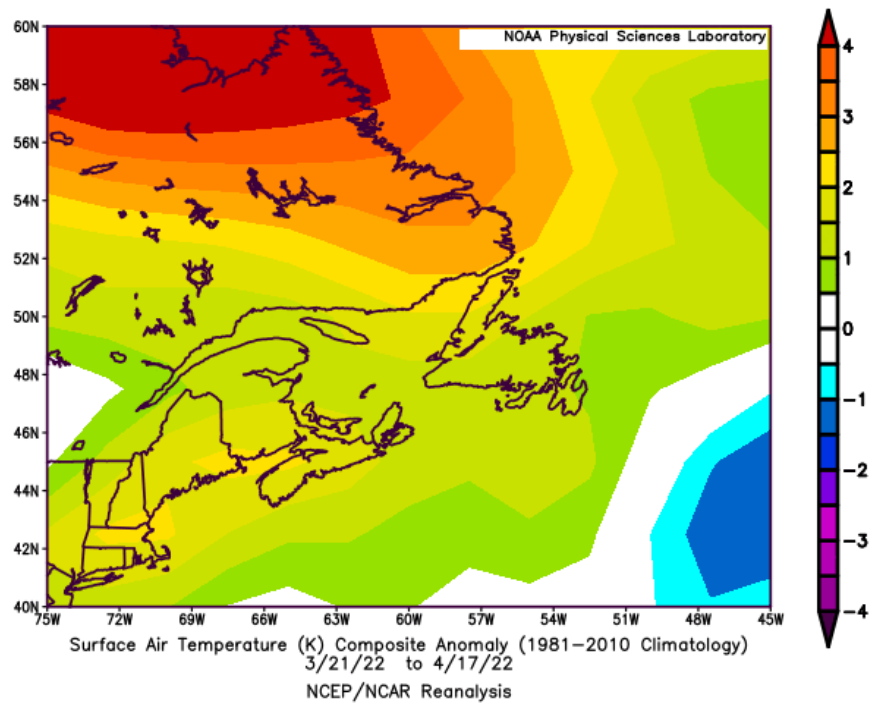


Figure 5: Surface Air Temperature Anomaly - March 21, 2022 to April 17, 2022.

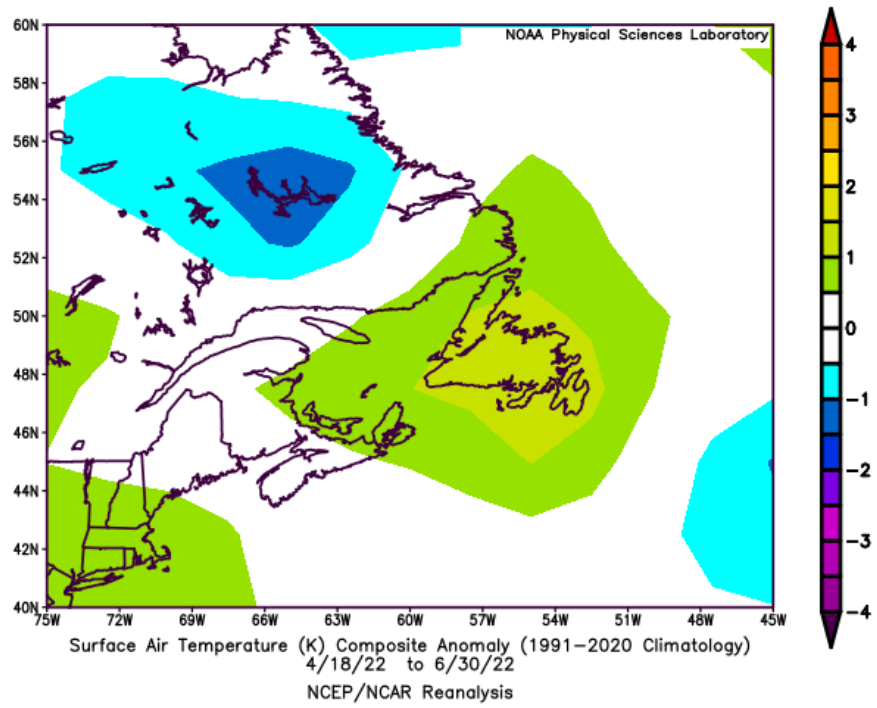


Figure 6: Surface Air Temperature Anomaly - April 18, 2022 to June 30, 2022.

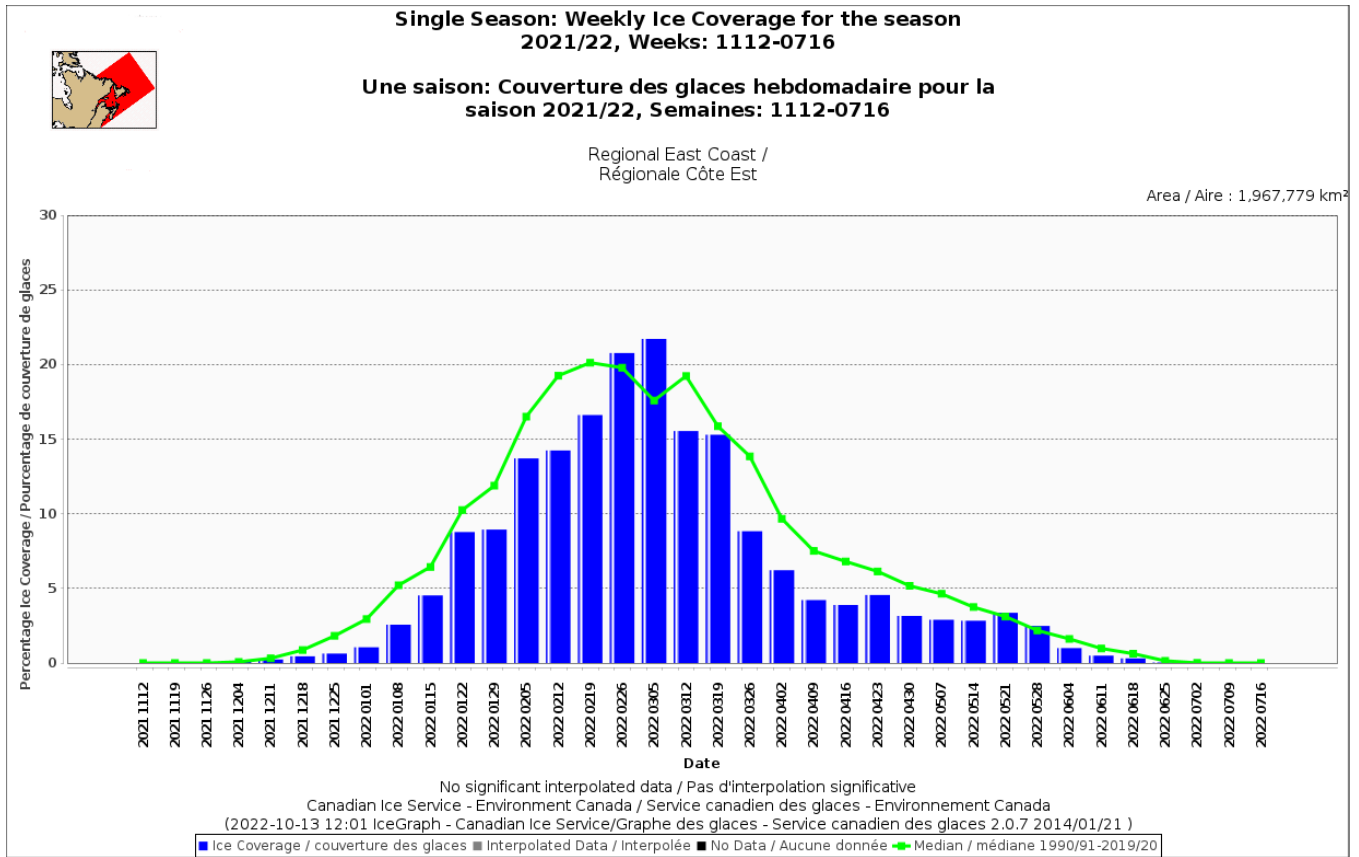


Figure 7: Weekly Ice Coverage for the 2021-2022 Season for the East Coast.

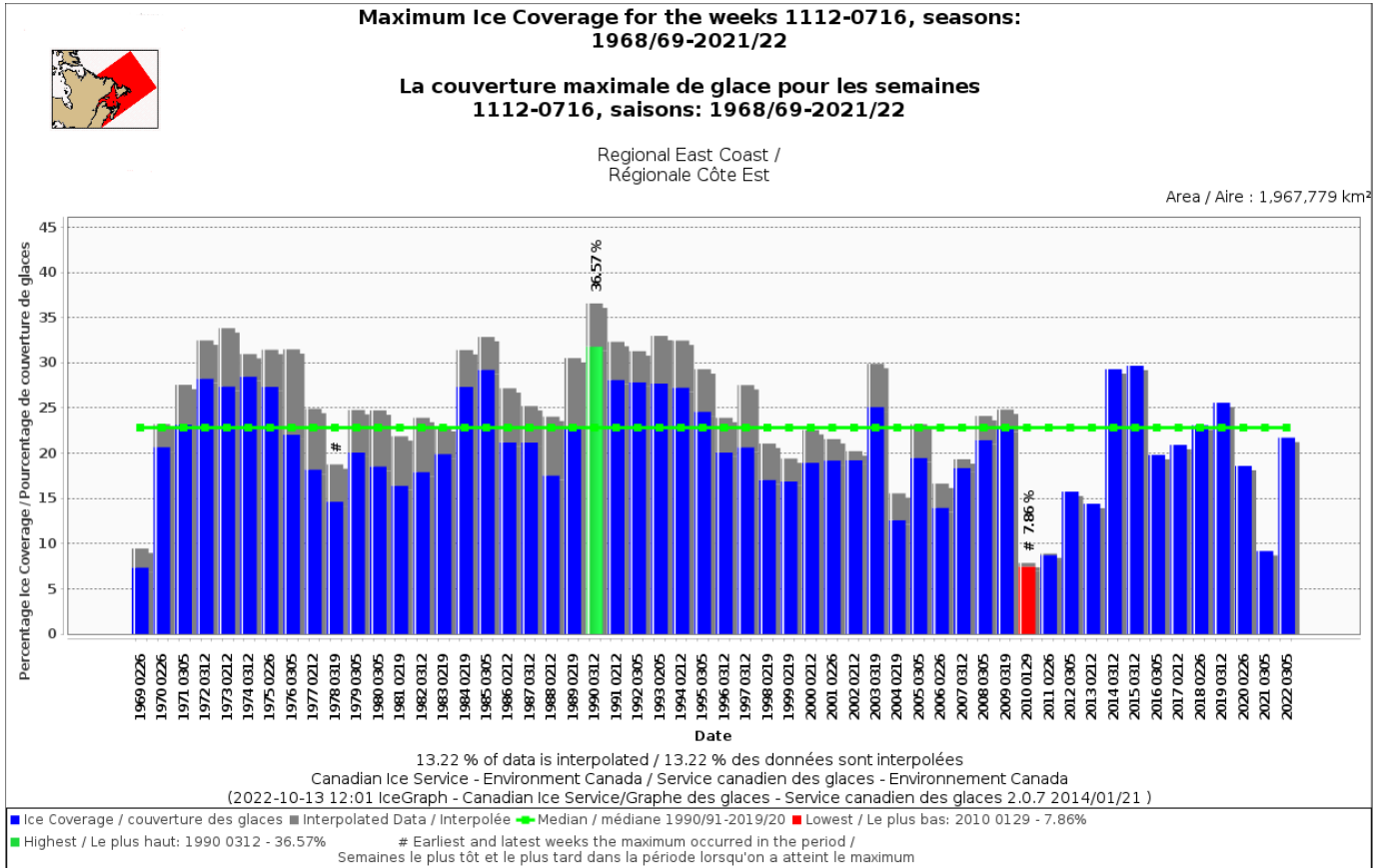


Figure 8: Maximum Ice Coverage for the East coast by Season, 1968-2022

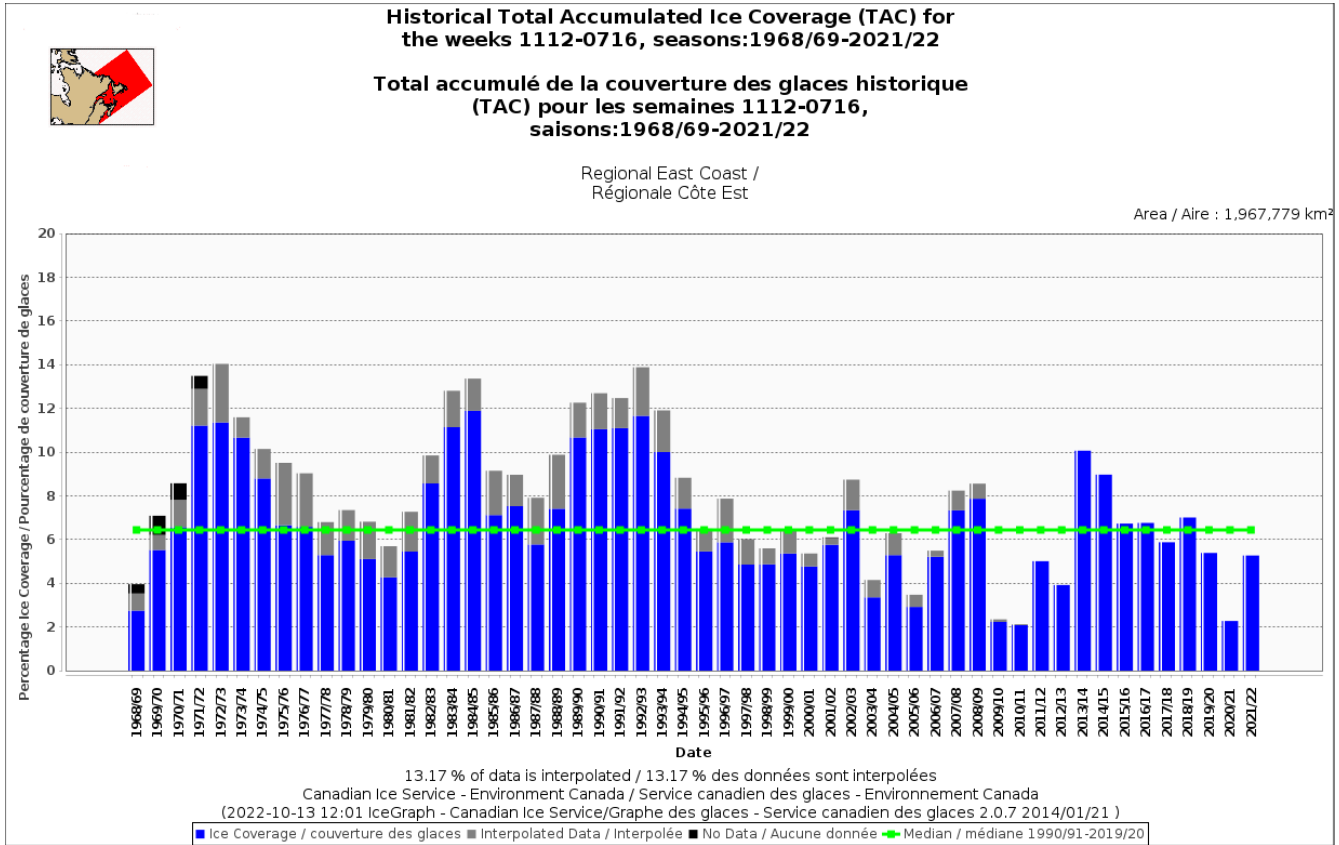


Figure 9: Historical Total Accumulated Ice Coverage for the East Coast of Canada by Season, 1968-2022

Gulf of St Lawrence

2021-2022 Season temperature: November to May

November started out the 2021-2022 ice season with above normal average air temperatures for the Gulf of St. Lawrence. Peak surface air temperature anomalies were 3-4 degrees Celsius above normal and moved around the Gulf through the month, first in the northwest Gulf for the first half of the month and in the northeast Gulf for the second half of the month.

In December, average air temperatures cooled to near normal values for the entire Gulf, except for the Estuary and northwestern Gulf, where below normal average air temperatures were recorded. This trend lasted for the first ten days of the month before temperatures warmed and returned to above normal. For the remainder of the month, average surface air temperatures were once again 3-4 degrees Celsius above normal in the western Gulf and Estuary, while anomalies were closer to 1-2 degrees Celsius above normal in the eastern Gulf.

In early January, surface air temperatures quickly cooled across the Gulf to near normal values, lasting until mid-January. The exception to this was in the Estuary and along the Lower North Shore of Quebec, where temperatures cooled even further and dropped to below normal temperatures. In particular, north and west of Anticosti Island, with anomalies of 3-5 degrees below normal. This temperature pattern stretched on through the rest of January and rotated slightly, moving the below normal air temperatures from the north to the west and the above normal temperatures from the south to the east. The areas with below normal temperatures included the Estuary and Chaleur Bay, while the eastern and northeast Gulf and Cabot Strait were above normal. The rest of the area was near normal.

The magnitude of the temperature anomalies weakened in the first week of February. Average air temperatures returned to near normal across most of the Gulf, except for the southeastern Gulf where air temperatures remained slightly above normal. Air temperatures warmed significantly during the second week of February, generating anomalies of over 10 degrees Celsius above normal across the region. This warm air allowed temperatures to rise above the freezing point over the entire Gulf at various points during that week. Air temperatures were quick to cool following the nearly weeklong warm spell. This led to below normal air temperatures blanketing the Gulf, except for once again, the southeastern Gulf, which returned to near normal. This trend lasted through to the end of February.

March began with further cooling of air temperatures, sparked by the passage of a low-pressure system, setting up a persistent northerly wind over the Gulf. Anomalies dropped to 3-4 degrees Celsius below normal across the entire Gulf. The cold spell was initially broken at the beginning of the second week of March when a low-pressure system brought generally above normal temperatures to the area. These warm temperatures were rapidly followed by a few days of cold, below normal temperatures. This trend carried on through to mid-April of above and below normal temperatures driven mainly by the arrival and departure of low-pressure systems. Averaged over this period from early-March to mid-April air temperatures were 1-2 degrees Celsius above normal. The anomaly was slightly higher in Northumberland Strait at 2-2.5 degrees Celsius above normal.

In the second half of April, the Gulf entered a period of near normal air temperatures that lasted for the rest of the month. Early-May brought reduced air temperatures as calm, cool weather, fueled by northerly winds set in over the region. Air temperature anomalies were generally restrained to 1-2 degrees Celsius below normal across the Gulf for this period. For the rest of May, the Gulf was split between near normal temperatures for the northern half and above normal for the southern half.

December Ice Conditions

Sea ice first formed around the Gulf of St. Lawrence on December 2nd, 2021, with new ice forming along the shores of the Estuary, the Lower North Shore and Anticosti Island. This represented a start to the 2021-2022 ice season one week earlier than normal. New ice expanded quickly around the Gulf due to near to below normal average air temperatures. By December 11th, ice filled most of the sheltered bays along the shores of Quebec, New Brunswick, Prince Edward Island and even the northern shore of Nova Scotia from New Brunswick to Pictou. After the first third of the month, with temperatures warming, some of the new ice did melt, though small concentrations of new and grey ice remained in many of the same sheltered bays. During the first three weeks of December, total ice coverage remained at less than 1%, varying only slightly even with the above normal temperatures. By the end of the month, as average air temperatures continued to cool, new and grey ice continued to fill bays, especially along the New Brunswick and Prince Edward Island shores, and the western sections of the Estuary. December ended with 1.1% ice coverage, which was very close to the long-term median of 1.3%.

January Ice Conditions

Ice slowly began to accumulate in the beginning of January as air temperatures finally started to cool across the Gulf after a relatively warm December. Ice growth was mainly limited to the western Gulf, along the shore of New Brunswick, Northumberland Strait, Chaleur Bay and in the Estuary. This new and grey ice was easily melted and broken under the effects of a low-pressure system in the first week of the month. By the end of this first week, ice coverage had increase slightly, to 1.4% and started to noticeably lag behind climatology, which was 5.6% for that same period.

More substantial ice growth began in the middle part of January. New and grey ice filled most of central and western Northumberland Strait, along the New Brunswick coast and into Chaleur Bay. Sea ice remained patchy in the Estuary; however, it was a noticeable increase from the beginning of the month. At this time, sea ice also began to form in the Northeast Arm of the Gulf, along the Quebec shore. Some of this ice had also drifted in from the Strait of Belle Isle. The first trace of sea ice began forming around the Magdalen Islands and along the northern shore of Prince Edward Island. Ice coverage had more than quadrupled by mid-month from the previous week, to 8.1%, but this was still not enough of an increase to raise it to the long-term median of 11.5%.

Air temperatures cooled further in the end of January, resulting in a continued increase in ice accumulation. Sea ice thickened in Northumberland Strait to be predominantly grey-white ice. Prevailing winds pushed ice east, away from the New Brunswick shore allowing new ice to form in behind it. By the end of the month, most of the Estuary was full of grey and grey-white ice, as well as along most of the Lower North Shore of Quebec and the northern half of the Northeast Arm of the Gulf. January finished the month at 14% ice covered; however, this continued the trend of below normal conditions in the Gulf since the season began. Typical ice coverage would be close to 21% by the end of January.

February Ice Conditions

The first week in February was marked by the passage of another low-pressure system. Ice growth ebbed and flowed with the cold temperatures before and after the storm and the strong winds during the storm. By the end of the first week, first-year ice had developed in Northumberland Strait, Chaleur Bay and long the Gaspé Peninsula in the Estuary. Grey and grey-white ice covered the western half of

the Gulf, the Estuary, along the Lower North Shore Quebec and surrounded the Magdalen Islands. Ice coverage had risen from the end of January, to 21.6%, but still remained below the median, lagging behind the typical winter freeze-up by 1 week.

The following two weeks of the month unraveled in much the same way, ice pulsing with the passage of each storm. Air temperatures over this period were generally near to above normal for the central and southern portions of the Gulf and near to below normal for the northern section and the Estuary. These temperatures prevented large-scale ice growth that would typically occur during the first half of February. While ice coverage did not increase much during this time, ice did continue to thicken. Ice pack in the western Gulf was now predominantly grey-white with low concentrations of first-year ice mixed in. Northumberland Strait was a nearly even mix of grey-white and first-year ice. The Estuary and along the coast of the Lower North Shore remained a mix of grey and grey-white ice. At the end of the third week, ice coverage increase slightly, to 24.8%. However, the gap continued to widen between climatology, which peaked in this same week at 38.5%, and the current seasons trend.

In the last week of the month, cold air moved into the region. The entire Gulf was covered with below normal temperatures, save for Cabot Strait. This led to a rapid increase in both ice cover and thickness. Predominant westerly winds pushed ice to the eastern extent of the Gulf and even into Cabot Strait for the first time of the season. Sea ice surrounded Anticosti Island and increased its coverage of the Northeast Arm of the Gulf. The only areas of open water that remained were along the western coast of Newfoundland and from the eastern tip of Anticosti to the northern end of Cabot Strait. Over this period, ice coverage rose to 33.2%, a significant increase from the week before. Albeit, still below the post-peak long-term median of 37.7%

March Ice Conditions

Ice coverage increase in the first week of March, this was counter to the climatological descending trend. The increase was mainly driven by the expansion of cold below normal temperatures further south and eastward, penetrating into Cabot Strait and covering Nova Scotia. These cold temperatures increased ice thickness across the Gulf. Predominant areas of first-year ice were found in Northumberland Strait, Chaleur Bay, along the Gaspé Peninsula in the Estuary and in the Strait of Belle Isle. Sea ice was a mix of grey-white and first-year ice through the bulk of the Gulf, while still a mix of grey and grey-white along the Lower North Shore. Ice coverage grew to 35.7% and for the first time during the season, surpassed the climatological normal of 31.6%. This also represented the peak ice coverage for the Gulf for the 2021-2022 ice season. The peak coverage was just below the climatological peak of 38.5% and occurred two weeks later than normal.

Following the peak, strong winds and the passage of several low-pressure systems battered the Gulf and the sea ice contained within. These low-pressure systems also brought warm above normal temperatures to the Gulf. The strong winds cleared most of the ice in the Estuary, leaving low concentrations of young ice along with a thin ribbon of first-year ice along the Gaspé Peninsula. A stretch of open water was created from near Sept-Îles to Port aux Basques and along the northern shore of Prince Edward Island. As younger ice types were destroyed in the central Gulf, the bulk of the remaining sea ice became first-year. Some areas of grey and grey-white ice were still present in high concentrations north of Anticosti Island and along the Lower North Shore east of Natashquan. The resulting reduction in sea ice signalled the beginning of the spring melt season and started 1 week earlier than normal. The sea ice extent was reduced to 25.9%.

The warm above normal and often above freezing temperatures continued through the last half of March, reducing sea ice coverage week over week for the rest of the month. The period from March

20th to 23rd resulted in one of the most significant reductions of the spring melt when a strong, slow moving low-pressure system brought persistent strong winds to the Gulf. By the end of the storm, most of the ice in the northern half of the Gulf was destroyed, leaving only a few small areas of strips and patches of first-year ice scattered around. Sea ice in the central Gulf had been driven into the southern half and much of the grey-white ice that had been in it was melted. The winds continued to push sea ice through Cabot Strait with some grey-white and first-year ice drifting south and east of Sydney, Nova Scotia. More ice than normal drifted through the Strait of Belle Isle into the northeast Gulf as a result of this storm.

At the end of the month, sea ice remained in two main areas, in the southeastern quadrant of the Gulf and the Northeast Arm of the Gulf. Ice in both of these spots was predominantly first-year ice with small amounts of grey-white ice mixed in. Consolidated first-year ice still remained in many bays and inlets along the New Brunswick coast, around Prince Edward Island and along the Lower North Shore Quebec. Ice coverage had dropped to 7.2%, less than half of the climatological normal of 19.5% and leading the normal spring melt by 1.5 weeks.

April Ice Conditions

The above normal temperature trend carried on into the beginning of April, aiding in the accelerated spring ice melt throughout the Gulf. The mobile sea ice in the southern half of the Gulf continued to deteriorate and melt during the first week of the month, leaving small areas of moderate to high concentrations of ice around the Magdalen Islands, Cape Breton Island and along the eastern shore of Chaleur Bay. Contrary to the ice reduction in the southern Gulf, the ice extent increased in the Northeast Arm. Persistent northerly winds acted to enhance the flow of ice from the Strait of Belle Isle into the Northeast Arm. This local increase in ice extent, however, was not significant enough to counteract the melt in the southern half of the Gulf and total ice coverage dropped to 3.1%. This was just one third of the long-term median coverage of 9.7% and advanced the spring melt to two weeks ahead of normal.

Ice melt in the Gulf continued until mid-April when the last of the mobile ice around the Magdalen Islands melted around April 15th. Following this, ice coverage hovered near 1-2% for the rest of the month and more closely follow the long-term median. Air temperatures moderated in the second half of April and trended towards normal. The consolidated ice that filled many bays and inlets around the Gulf was slow to melt and break up due to its sheltered nature. The bulk of the mobile ice that was left in the Gulf was in the Northeast Arm. While the ice melted along its southern edge, it was being replenished in the north as ice continued to stream into the area from the Strait of Belle Isle.

As April progressed, the rest of the consolidated ice in the southern and western ends of the Gulf fracture and melted before the end of the month. Sea ice continued to drift into the Northeast Arm of the Gulf, though at a slower rate than earlier in April. At the end of April, thin and medium first year ice packed along the Quebec coast of the Northeast Arm, blanketing the consolidated first-year ice found in the bays behind it. The month finished at 1.3% ice covered, which was up slightly from the week before.

May Ice Conditions

In the beginning of May, the transport of ice from the Strait of Belle Isle into the Northeast Arm of the Gulf was cut off. With no new imports of sea ice into the region for the rest of the season, the remaining ice slowly melted over the following two weeks. The last of the ice, located just east of Natashquan, melted on May 17th, bringing an end to the 2021-2022 ice season in the Gulf of St. Lawrence. Despite the slower than normal melt at the end of April and early-May, the ice season came to an end two

weeks early. The TAC for the 2021-2022 Gulf of St. Lawrence ice season was 6.9%, over triple the TAC of last year, but still below the long-term median of 9.2%. This places the 2021-2022 ice season as 44th lowest on record since the 1968-1969 season.

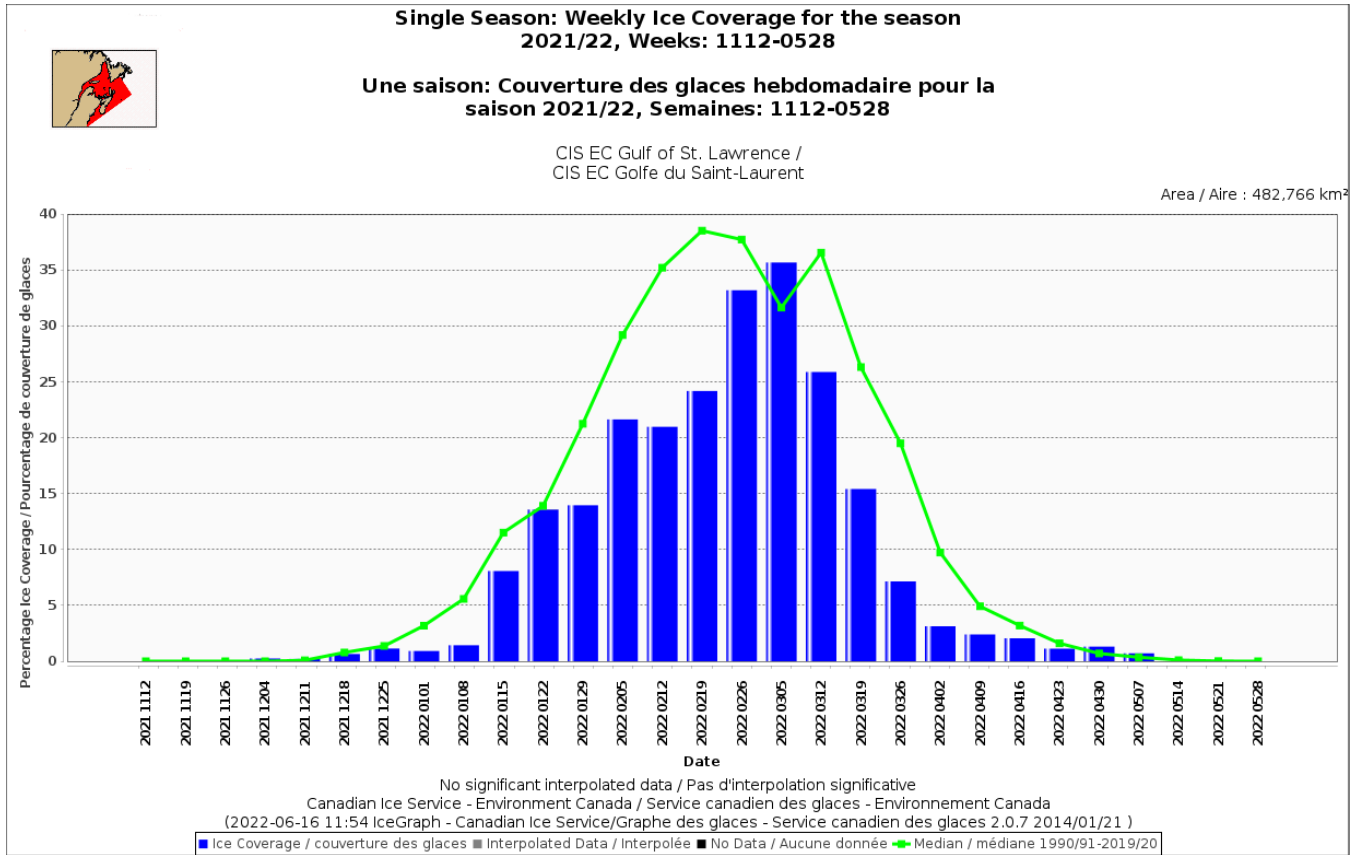


Figure 10: Weekly Ice Coverage for the 2021-2022 Season in the Gulf of St. Lawrence

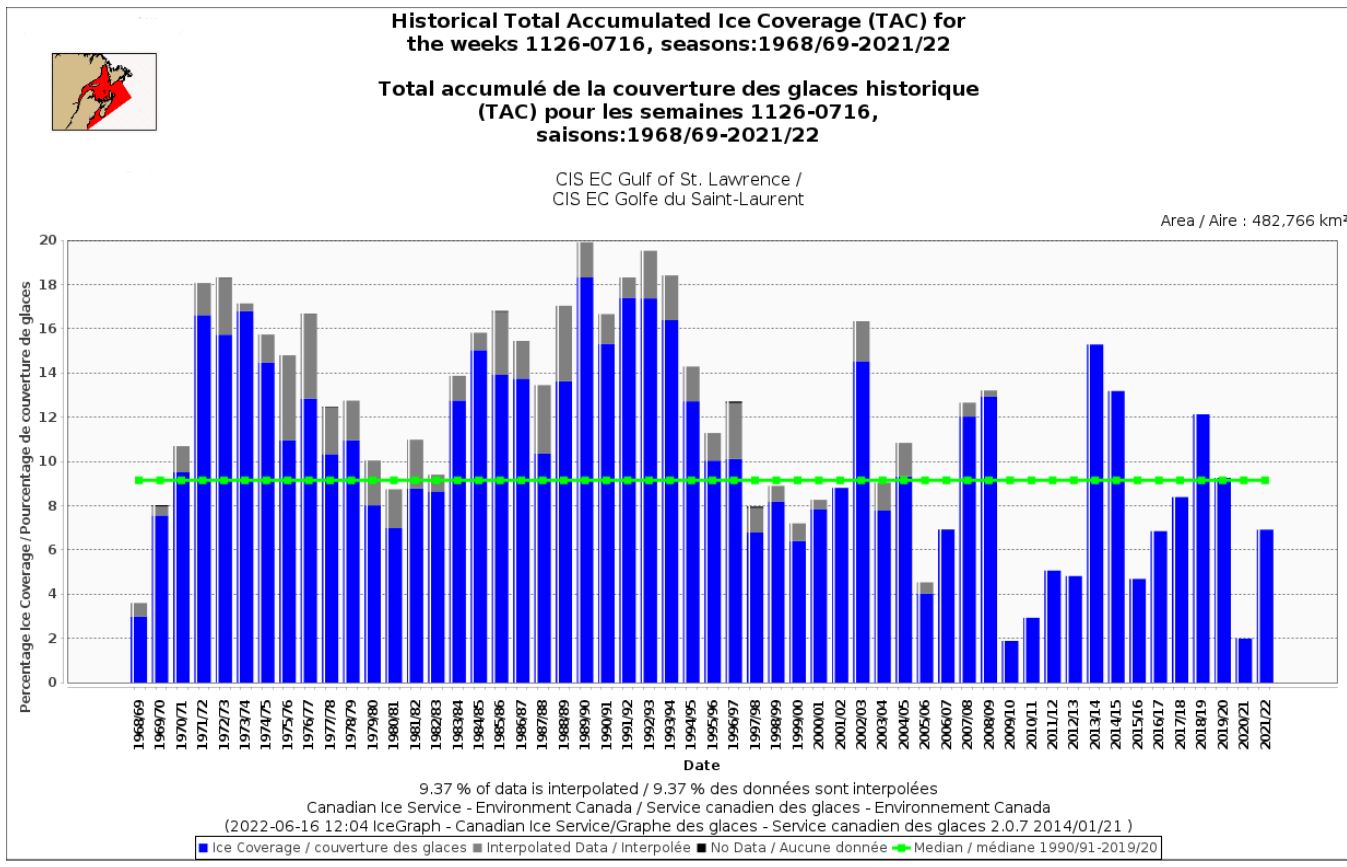


Figure 11: Historical Total Accumulated Ice Coverage for the Gulf of St. Lawrence by Season, 1968-2022

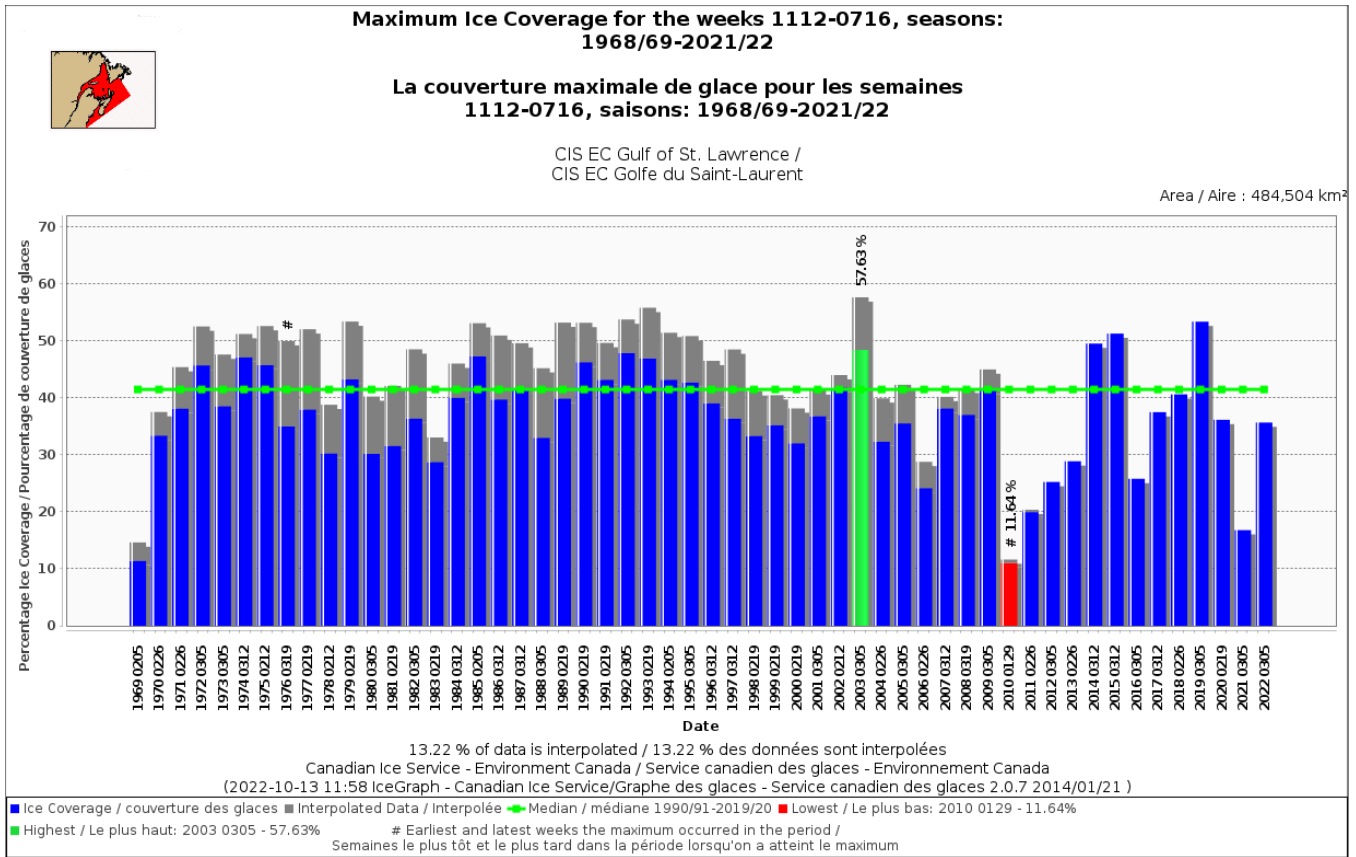


Figure 12: Maximum Ice Coverage in the Gulf of St. Lawrence by Season, 1968-2022

Newfoundland and Labrador Waters

2021-2022 Season temperature: November to June

November average air temperatures began the month near 1.5 degrees Celsius above normal along most of the Labrador Coast and the waters surrounding Newfoundland. This anomaly increased to 3-4 degrees Celsius by the end of November, lasting into early December.

Average surface air temperatures cooled after the first few days of December, enveloping the mid and southern Labrador Coast and Newfoundland in near normal temperatures. These temperatures remained in place until the third week of December, when average air temperatures increased significantly in the last week of month. Air temperature anomalies shot up to 6-8 degrees Celsius above normal along the Labrador Coast and 2-4 degrees Celsius above normal along the west coast and northeast coast of Newfoundland. This large spike in temperatures was brought on by a strong low-pressure system around Christmas and its effects slowly diminished through the end of the month.

The above normal temperatures carried on through January and the first half of February for Newfoundland and the southeastern part of Labrador. However, further north around the mid-Labrador coast, temperatures cooled and fell predominantly below normal for the month.

In mid-February, cold below normal air temperatures descended further down the Labrador coast reaching the Northern Peninsula of Newfoundland. This generated some of the coldest temperatures of the winter for the Northern Peninsula. The average air temperatures anomaly did decrease slightly for the rest of Newfoundland, dropping to near normal temperatures for the middle of the month. However, the cold air continued its slump southward, covering the rest of Newfoundland in late-February and early-March. Average air temperature anomalies ranged from 1-2 degrees Celsius below normal for the southern half of Newfoundland to 6-7 degrees Celsius below normal along the mid-Labrador coast and Lake Melville.

The below normal air temperatures were quick to recede in mid-March. Average air temperatures trended to above normal starting in the southern regions and reaching to the mid-Labrador coast and north by the third week in March. This marked a turning point for Newfoundland and Labrador where daily highs were predominantly above the freezing point as winter turned into spring.

The above normal temperatures carried into April across Newfoundland and Labrador. However, starting around the second week of April, average air temperature anomalies began to cool in the southern and eastern parts of Newfoundland. Temperatures continued to moderate through April, reducing to near normal for northern Newfoundland by mid-April and reaching to Labrador near the end of April.

The temperature pattern did not change much during the month of May. Average air temperatures remained near normal throughout the month where periods of above or below normal average air temperatures did not last for more than a few days at a time.

June began with cooler than normal temperatures covering Newfoundland and Labrador. This cool start lasted through the first week of the month. Average air temperatures quickly swung above normal across the province in mid-June and lasted through the rest of the month.

November/December Ice Conditions

The first ice began forming along the Newfoundland coast on December 20th in Hare Bay and Pistolet Bay. Shortly after, the ice continued to form in small bays along the Northeast Coast, first to Cape Freels, then into Bonavista Bay. The little bit of ice that had formed retreated slightly when a strong low-pressure system, bringing warm temperatures and strong winds, passed over the area around Christmas. At the end of the month, only a small patch of new and grey ice was located near Fogo Island. No measureable amount of ice was recorded in December for the east Newfoundland waters, which is typical for the time of year.

Sea ice first started forming in Lake Melville on November 23rd, 2021. The ice did not last long, however, melting just two days later as Labrador entered a sustained period of above normal temperatures. Small amounts of transient new ice continued to form and melt through the end of November. Permanent ice first formed in Labrador on December 1st in the western extremes of Lake Melville. Ice was quick to accumulate in early December as ice formed along the rest of the shore of Lake Melville and the covering many parts of the Labrador coast north of Cartwright by the end of the first week. As average air temperatures dropped, ice coverage continued to increase through mid-month. Lake Melville continued to fill with ice and thicken, while new and grey ice pushed outside of the bays and inlets along the coast. At the beginning of the fourth week of December, ice growth halted temporarily as a strong low-pressure system affected Labrador for several days. The storm brought warm temperatures and strong onshore winds, which significantly compressed the ice pack along the shore. After the passing of the low, a ridge moved over Labrador and with it, cold temperatures and calm winds, allowing ice to form once again. Ice coverage along the Labrador coast finished December at 1.2%, representing just one quarter of the typical ice coverage for that time of year.

January Ice Conditions

Ice coverage was slow to increase across Newfoundland in the beginning of January. Ice formed once again in Hare Bay, Pistolet Bay and a few other small bays along the Northeast Coast over the course of the first week in January. Ice coverage ebbed and flowed slightly in the following two weeks as temperatures remained generally above normal, continuing the trend of below normal ice coverage. It wasn't until the fourth week, under the influence of a broad ridge of high-pressure, that ice coverage began to increase further. The light winds and cool temperatures allowed ice to form and thicken east of the tip of the Northern Peninsula. Some grey and grey-white ice also drifted in from the southern Labrador Sea. These gains in ice coverage were reduced at the end of the month when strong winds and warm temperatures from an intense nor'easter passed just west and north of Newfoundland. Below normal ice coverage persisted through the month and finished January at 0.2% as opposed to the 1.9% of the long-term median.

Ice coverage began to rebound in the beginning of January from the slow, below normal growth of December. The waters along the Labrador coast entered a sustained period of below normal air temperatures and this temperature coupled with offshore winds aided in rapid ice growth the marked the first week of the month. Ice coverage nearly tripled from near 2.6% at the beginning of January to 7% by the end of the first week. This ice growth continued in the beginning of the following week as the ice continued to push out from the coast and thickening to be predominantly grey and grey-white ice. At the same time, the rest of Lake Melville fasted and transitioned to first-year ice. Fast ice continued

to fill in many of the bays and fiords along the mid-Labrador coast. However, much of the extent that had been gained was lost when a low-pressure system and associated strong winds compressed the ice along the shore. The ice growth was quick to bounce back in the wake of this weather system and under the continued influence of below normal air temperatures. Ice coverage ballooned to twice the size from the previous week, from 7.9% to 16.6% and neared the climatological normal, 18.3%, for the first time this season. In the last week of January, the first concentrations of mobile first-year ice drifted in from the Northwest Labrador Sea. The ice edge was once again compressed due to strong on-shore winds from a strong winter storm. This storm destroyed much of the new and grey ice that was along the coast leaving predominantly grey-white ice. January finished with an ice coverage of 17.1% and fell more behind the long-term median of 20%.

February Ice Conditions

In the wake of the low-pressure system at the end of January, cool and calm weather allowed ice to expand quickly near the tip of the Northern Peninsula. These cooler temperatures coupled with strong northerly winds pushed ice southward to cover most of the waters of the Northeast Coast. New ice had formed in most bays along the northern coast of Newfoundland from White Bay to Conception Bay. Ice coverage jumped to 2.8%; however, this was still not enough accumulation to reach the climatological mean of 5.2%. Ice coverage proceeded to shrink slightly in the second week in response to warm temperatures brought by two low-pressure systems that bookended the week. Following the departure of the last storm, persistent northerly winds pushed ice south from the Labrador Sea, filling much of the waters Northeast Coast with grey and grey-white ice. The winds shifted to the west towards the end of the third week and pushed the ice pack to the east of Cape Freels. These winds ushered in the first traces of first-year ice to the region and also allowed new and grey ice to quickly form along the eastern coast of the Northern Peninsula. Ice coverage nearly double from earlier in February, rising to 4.6%, still lagging behind of 8.1%. The last week of the month saw northwesterly winds continue, pushing the ice pack even further east, just east of 50°W and south of 49°N. As the ice continued to drift east, new and grey ice formed in the bergy water along the Northern Peninsula and Northeast Coast. Ice coverage nearly doubled once again at the end of February, reaching 8.7%, which matched the climatological normal for the first and only time of the 2021-2022 East Newfoundland Waters ice season.

Below normal air temperatures persisted into February, **allowed** ice to grow at an accelerated rate, much like early and mid January. Sea ice pushed even further east, away from the Labrador coast. Ice also continued thickening to grey-white and first-year ice in the central and eastern edge of the ice pack, while new and grey ice formed along the coast outside of the fast ice. By the end of the first week of the month, ice coverage surpassed the long-term median for the first time in the 2021-2022 ice season. The sea ice had expanded to cover 22.6%, just edging above the 22.2% median. Ice coverage grew once again in the second week of February and remained above the climatological median. This is the week when the climatological median reaches its peak of 23.6%; however, this season, ice coverage was 24.7%. In fact, sea ice continued to grow through the remainder of February. Sea ice grew slightly each week due to the continued below normal temperatures and more importantly, the lack of and significant or prolonged on-shore wind events. A few low-pressure systems passed over the area in the last half of the month; however, they were either weak, fast moving or passed far enough east that the winds remained offshore. This aided in the ice growth rather than the typical decay that would be seen in the end of February. The ice pack thickened to be predominantly first-year ice in the central and eastern section and a mix of grey-white and first-year ice along the coast. Ice coverage

along the mid and southern Labrador coast ended the month at 27.8%, surpassing the climatological median of 22.2% and marking a full month of above normal ice coverage.

March Ice Conditions

March began with below normal temperatures blanketing much of the province. Grey and grey-white sea ice covered most of the Northeast Coast, while first-year ice was predominant further north and east. The ice coverage at the end of the first week of March rose slightly to 9.2%. This marked the maximum ice coverage for the East Newfoundland Waters for the 2021-2022 ice season. This year's peak coincided with the climatological peak; however, it remained below normal of 9.8%. The second week of the month saw the passage of several low-pressure systems. The strong winds and warm temperatures associated with these depressions thinned the ice along the edges of the ice pack and displaced it to the northeast. The warm above freezing temperatures meant that new ice was not able to form in the bergy water along the coast. This led to a significant decrease in ice coverage in mid-March as ice was pushed out of the region. Coverage fell to 4.8%, nearly half of the coverage of the previous week. Relatively calm weather conditions followed for the next week, permitting the ice pack to drift south and east once again. Near to slightly below normal air temperatures also allowed new and grey ice to form throughout the ice pack, generally increasing the overall concentration of the ice pack. As a result of ice drifting back into the region, ice coverage rose sharply, surpassing 8%, though still slightly below normal. The end of March saw the tumultuous trend of fluctuating ice coverage continue. A sustained period of above normal temperatures settled over northern Newfoundland. These above normal temperatures frequently pushed daily high temperatures above the freezing point across the region, leading to another significant decrease in ice coverage. Much of the main ice pack was thinned, compared to the previous week, when all of the new and grey ice that had reformed in mid-March melted. Ice coverage fell to 4.5% and marked the start of the spring melt, one week earlier than normal.

Normally through March, sea ice continues its slow decline as winter winds down. The first week in March this year departed the typical trend and continued the ice growth that occurred through February. The first week in March saw a slight increase in sea ice over the last week of February, leading to the sea ice maximum for the Southern Labrador Sea for the 2021-2022 ice season. Sea ice coverage peaked at 24.7% and occurred three weeks later than the climatological peak. The second week in March saw a large drop in ice coverage when a strong low-pressure system brought strong onshore winds to the Labrador coast, driving the sea ice westward, reducing the overall ice extent. The westward movement of the sea ice crushed the grey-white ice that had been along the coast, leaving mainly first-year ice along the mid-Labrador coast. South of Groswater Bay, a small ribbon of grey-white and first-year ice remained; however, the bulk of the ice pack was first-year ice. In the wake of this low-pressure system, relatively calm weather followed. Over the course of the week, ice coverage was allowed to rebound slightly, rather than continuing the typical downward trend. The first traces of old ice drifted in from the Northwest Labrador Sea. During this same period, the below normal temperatures that plagued the Labrador coast since early-January finally came to an end. Average air temperatures quickly switched to above normal temperatures by the end of the third week in March. Despite this change in temperature regime, ice coverage climbed to 24.7%. It wasn't until the end of March that the effects of the above normal air temperatures were noticed in the ice coverage. A significant drop in ice coverage occurred due to daily high air temperatures began reaching above the freezing point and two low-pressure systems bringing strong onshore winds to the Labrador coast. These conditions thinned out the ice edge and compressed the pack ice along the Labrador coast. At

the end of the month, ice coverage had fallen to 16.1% and fell below the climatological normal of 19.2%, bring an end to a 7 week long period of ice coverage higher than the normal.

April Ice Conditions

The spring melt continued through the first half of April, spurred on by the continued above normal air temperatures, especially over the waters of the Northeast Coast. The central and eastern portions of the pack ice continued to reduce in concentration, though more highly concentrated first-year ice remained along the east side of the Northern Peninsula. By the end of the second week in April, after a few days of sustained northerly and northwesterly winds, much of the ice had been pushed along the coast from the eastern tip of the Northern Peninsula, south to White Bay and east to Cape Freels. The ice pack further north had also been compressed along the south Labrador coast, temporarily cutting off the flow of ice into the region from Labrador. In a typical year, the spring melt slows through mid-April, which did happen for the 2021-2022 ice season; however, the spring melt had accelerated to be 4 weeks ahead of schedule by the time it had slowed. This slow down meant that ice coverage did not change much through mid-month. The conditions that were seen in mid-April were more typical of mid-May, with ice coverage hovering near 0.8%. Through the end of April, air temperatures moderated slightly and returned to near normal. Despite the change in temperature regime, average daily air temperatures remained above the freezing point and so, ice continued to melt. By the end of April, ice was mainly concentrated along the Northern Peninsula and into Notre Dame Bay. Ice coverage had fallen to just 0.1%, perpetuating a season of below normal ice coverage, which for this time of year, should be 2.5%.

Above normal air temperatures continued over the Labrador Sea in the beginning of April allowing the accelerated spring ice melt to continue. Much of the sparse sea ice along the eastern edge of the pack melted over the course of the first week of the month, largely due to the warm temperatures and onshore winds. This left a ribbon of concentrated first-year ice along the Labrador coast; this also included a trace of old ice north of Groswater Bay. The continued spring melt saw ice coverage drop to 9.4% in early-April. Air temperatures moderated along the Labrador coast in mid-April and generally light winds over the region paused the spring melt. A few low-pressure systems passed over western Labrador through mid-month that also brought southwesterly winds to the Labrador coast. This allowed the ice pack to expand away from the coast, particularly north and east of Groswater Bay. These winds also kept the trace of old ice from moving south of Groswater Bay. South of Black Tickle, ice along the coast continued to thin. This weather pattern continued into late April, causing further expansion of the ice pack to the east. Ice coverage rose to 12.5%, surpassing the ice cover that was present at the beginning of the month, though still below the climatological normal of 13.4%. At the very end of April, a ridge over northern Labrador and a slow moving low-pressure system over the southern Maritimes generated several days of onshore winds. This once again compressed the ice pack along the Labrador coast and eroded the ice along the edge of the pack. This resulted in a reduction in ice coverage at the end of April, dropping to 8.8% ice covered, maintaining below normal ice coverage.

May Ice Conditions

The ice pack continued its accelerated decline in the first week of May. Much of the ice that had been in White Bay and Notre Dame Bay melted quickly, battered by strong winds in the first days of May. Through the second week of May, ice remained near the tip of the Northern Peninsula, continuing to drift in to the region from the north. This transport of ice from the north also brought the first trace old ice to the region for the 2021-2022 ice season. Through the rest of May, this first-year ice with a trace

of old ice never made it any further south than the tip of the Northern Peninsula, continually melting along the southern edge and constantly being replaced from the north. This cycle continued until May 24th when the flow of ice from the north was finally cut off, leaving the remaining ice to melt out in place. The last of the ice finally melted by May 31st, bringing an end to the 2021-2022 ice season for the East Newfoundland Waters, two weeks earlier than normal. The TAC for the 2021-2022 East Newfoundland ice season was 1.6%, over quadruple the TAC of last year, but still below the long-term median of 2.6%. This places the 2021-2022 ice season as 44th lowest on record since the 1968-1969 season.

Ice coverage in May along the Labrador coast followed a very similar trend to April, increasing slightly in the beginning and middle of the month, before dropping once again at the end. Air temperatures remained near normal along the Labrador Sea. Ice was mainly packed along the Labrador coast except for a broad ribbon of first-year ice including a trace of old ice circling around Hamilton Bank. During the first week, most of the low concentration ice along the eastern edge of the pack and Hamilton Bank melted. The trace of old ice finally started to drive south of Black Tickle at this time as well. Very little change in ice coverage occurred in mid-May despite average air temperatures that were mainly above the freezing point. This was mainly due to light winds over the Labrador Sea, permitting the ice pack to rebound and expand eastward, covering a large area. Lake Melville began fracturing on May 15th, one week earlier than normal. Ice coverage rose to 10.6% over the course of the first 3 weeks of May, rising above the climatological normal of 8.7%. This was the first time since mid-March that ice coverage rose above the median. The spring melt resumed in the end of May as air temperatures continued to rise. Winds remained generally light over the Labrador Sea through the end of May, allowing for a more broad, less concentrated ice pack. The larger ice pack meant there was more surface area for the warmer temperatures to more efficiently melt the ice pack. The warm temperatures also significantly reduced ice coverage in Lake Melville, leaving small areas of ice in the southern and eastern portions of the lake. This led to the first overall decrease in ice coverage for the entire month of May, dropping to 7.9%, just below where ice coverage began the month. However, coverage was still above the climatological normal of 6.5%.

June Ice Conditions

June began with a rapid reduction in sea ice coverage, driven by strong onshore winds, particularly over the south Labrador coast. Within the first few days of the month, all of the sea ice south of Black Tickle and in Lake Melville melted out. The ice north of Black Tickle was significantly reduced in size and compressed along the coast, while the fast ice along the mid-Labrador began to fracture. In the first week of the month, ice coverage dropped to 3.2% and once again returning to below the long-term median of 5.1%. Above normal average air temperatures moved over the southern Labrador coast in mid-June and sea ice continued to melt. Through mid-month, the fast ice along the mid-Labrador coast fully fractured, leaving a thin strand of mobile first-year and a trace of old ice along the coast down to Groswater Bay. This mobile ice was being replenished as ice from the Northwest Labrador Sea continually drifted south. Ice coverage was steady near 1-1.5% through the second and third weeks of June. Warm, above normal temperatures further north at the end of June, blanketing from the mid-Labrador coast and south. Sea ice continued to slowly melt along the mid-Labrador coast at the end of the month. The transport of sea ice from the north was finally cut off around June 23rd, meaning no new ice would enter the region for the rest of the season. By the end of June, only a small area of sea ice remained along the Labrador coast near Makkovik. This small area represented an ice coverage of just 0.1% at the end of the month, compared to the long-term median of 0.5%.

July Ice Conditions

The remaining strips of sea ice near Makkovik finally melted by July 6th bringing an end to the 2021-2022 ice season for the South Labrador Sea, one week earlier than normal. The TAC for the 2021-2022 South Labrador Sea ice season was 9.5%, nearly double the TAC of last year, but still below the long-term median of 10.1%. This places the 2021-2022 ice season as 39th lowest on record since the 1968-1969 season.

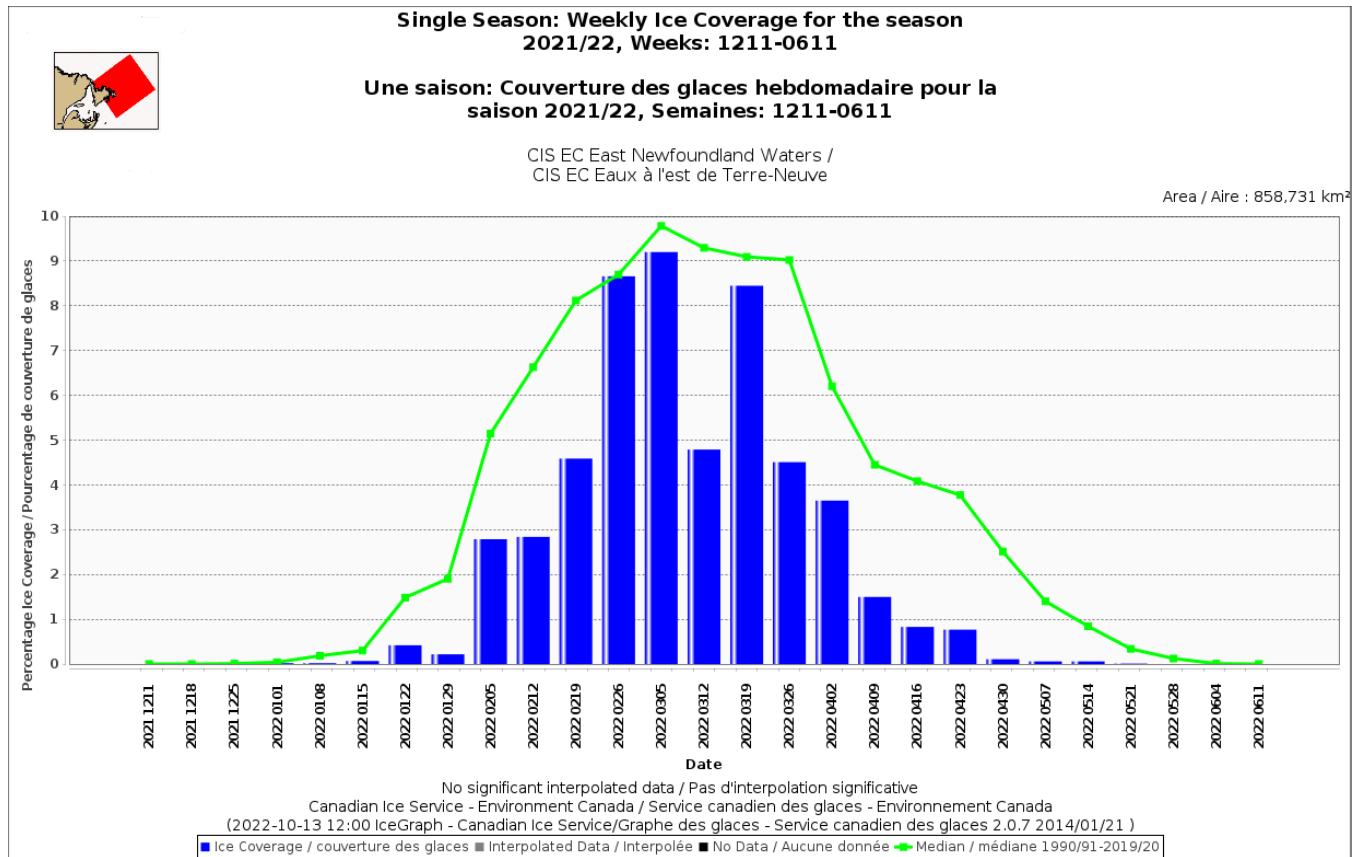


Figure 13: Weekly Ice Coverage for the 2021-2022 Season in Newfoundland



Historical Total Accumulated Ice Coverage (TAC) for the weeks 1112-0716, seasons:1968/69-2021/22

Total accumulé de la couverture des glaces historique (TAC) pour les semaines 1112-0716, saisons:1968/69-2021/22

CIS EC East Newfoundland Waters /
CIS EC Eaux à l'est de Terre-Neuve

Area / Aire : 858,731 km²

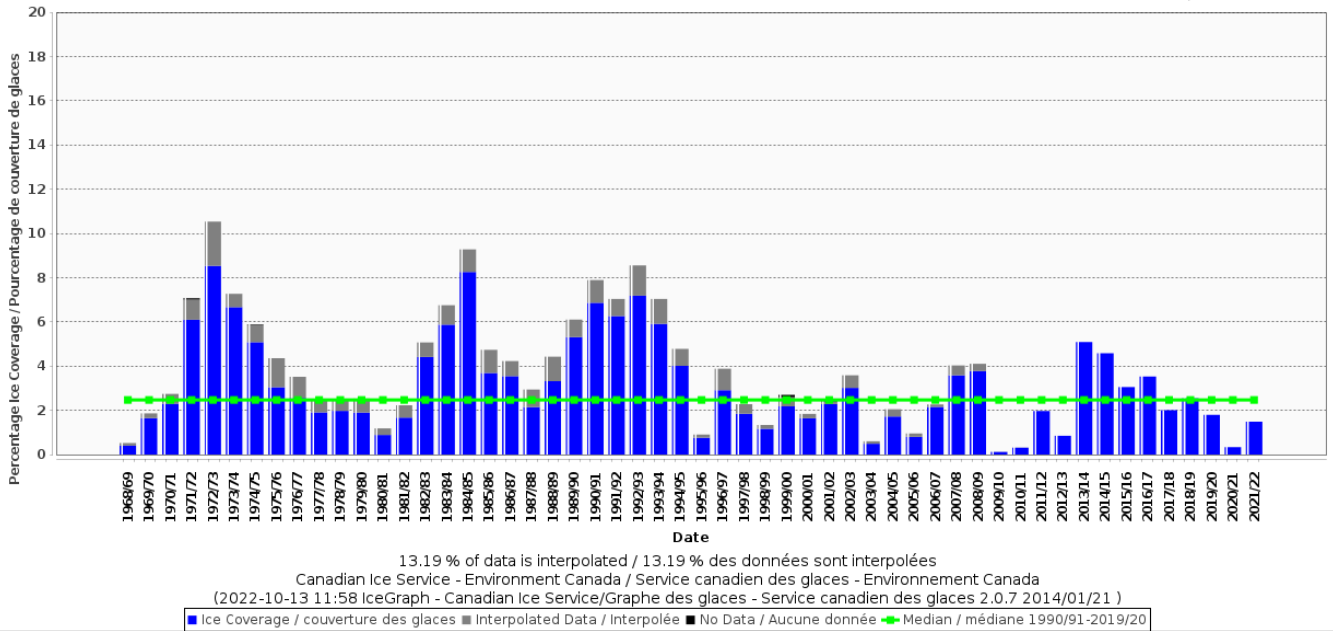


Figure 14: Historical Total Accumulated Ice Coverage Newfoundland Waters by Season, 1968-2022

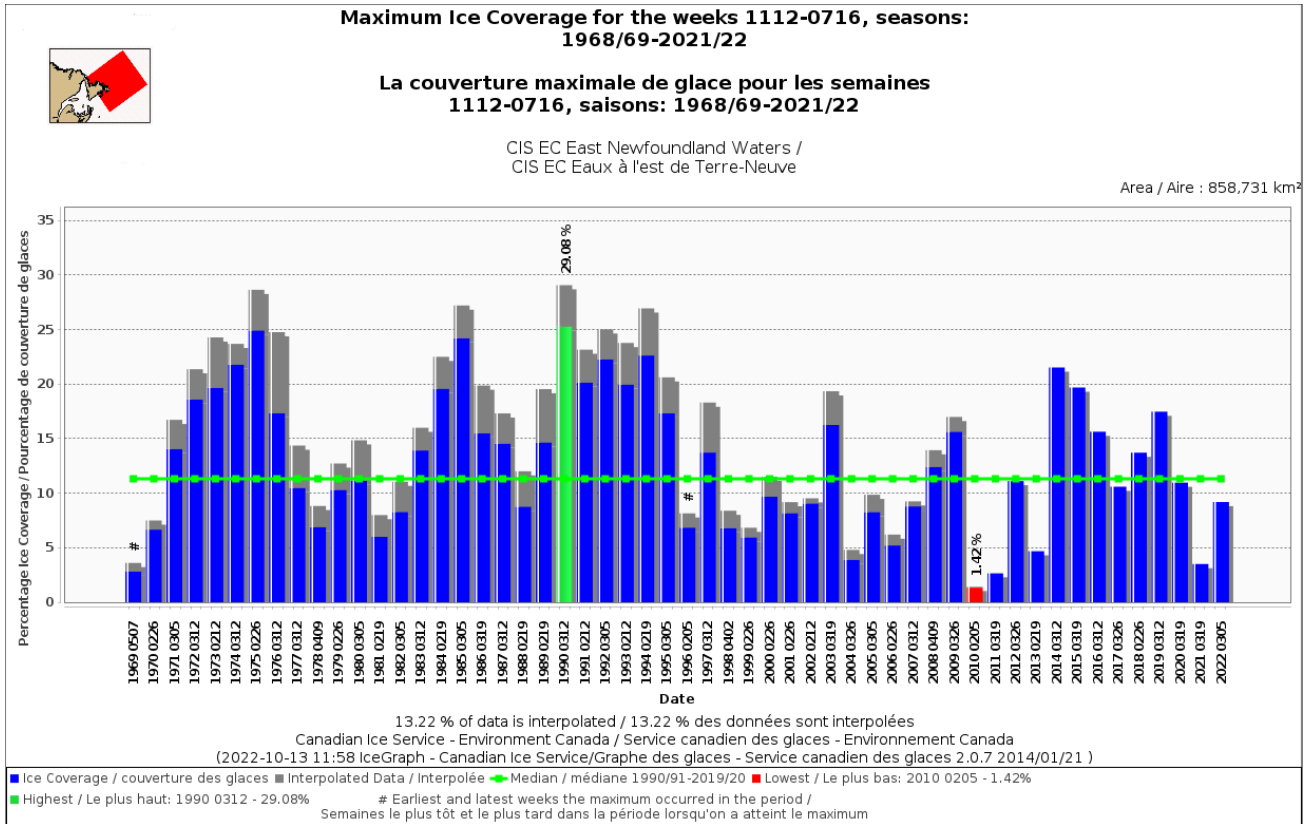


Figure 15: Maximum Ice Coverage in Newfoundland waters by Season, 1968-2022

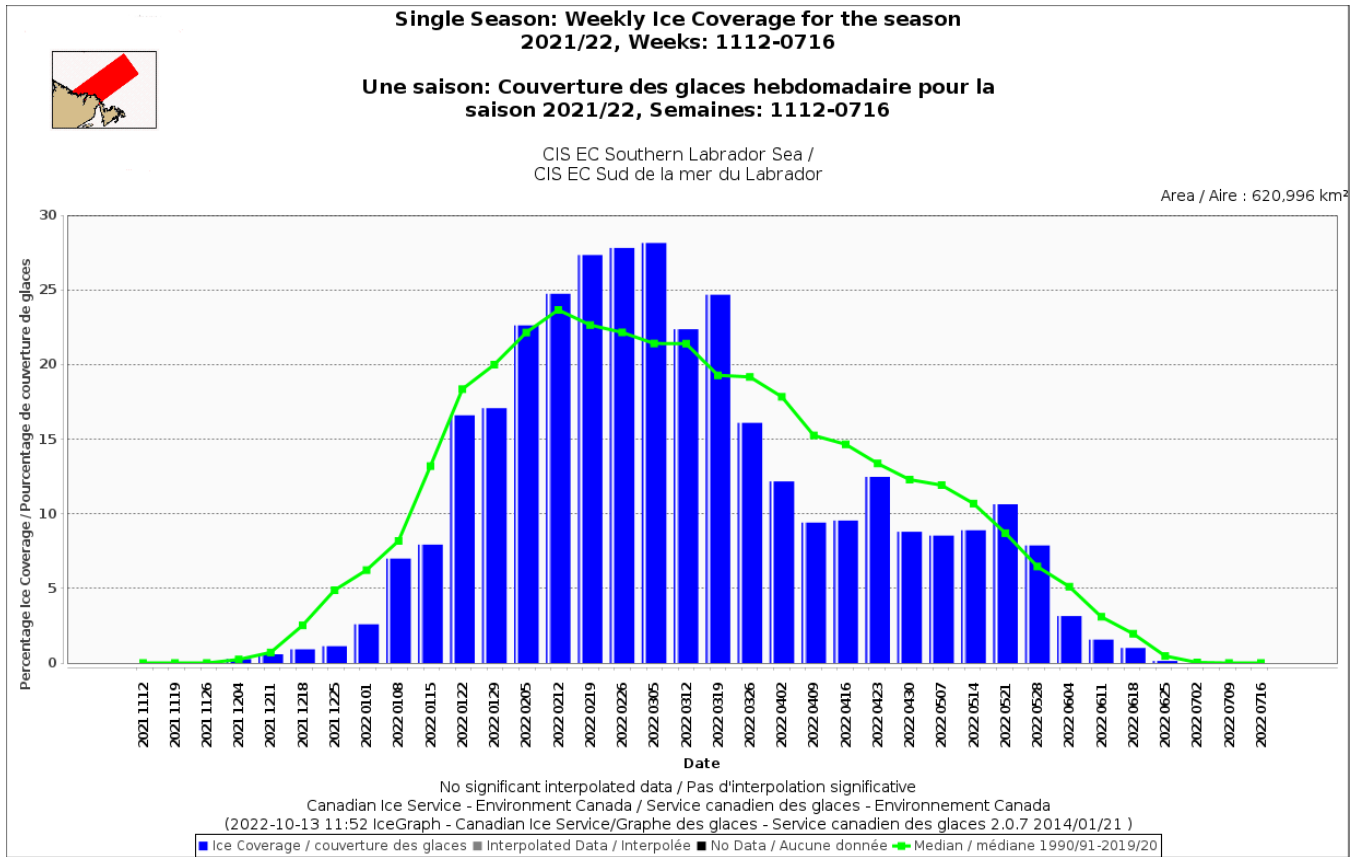


Figure 16: Weekly Ice Coverage for the 2021-2022 Season in the Southern Labrador Sea.

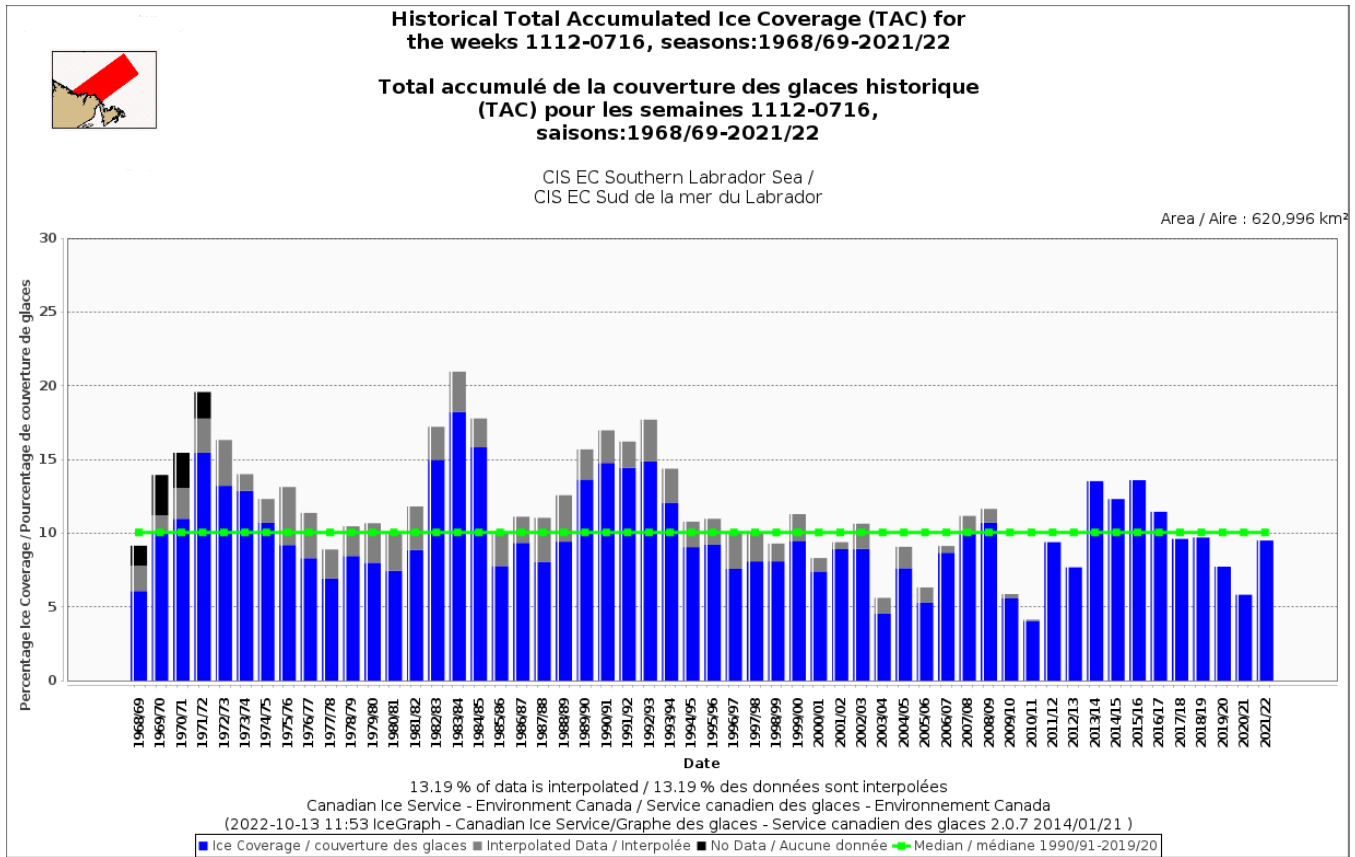


Figure 17: Historical Total Accumulated Ice Coverage for the Southern Labrador Sea by Season, 1968-2022

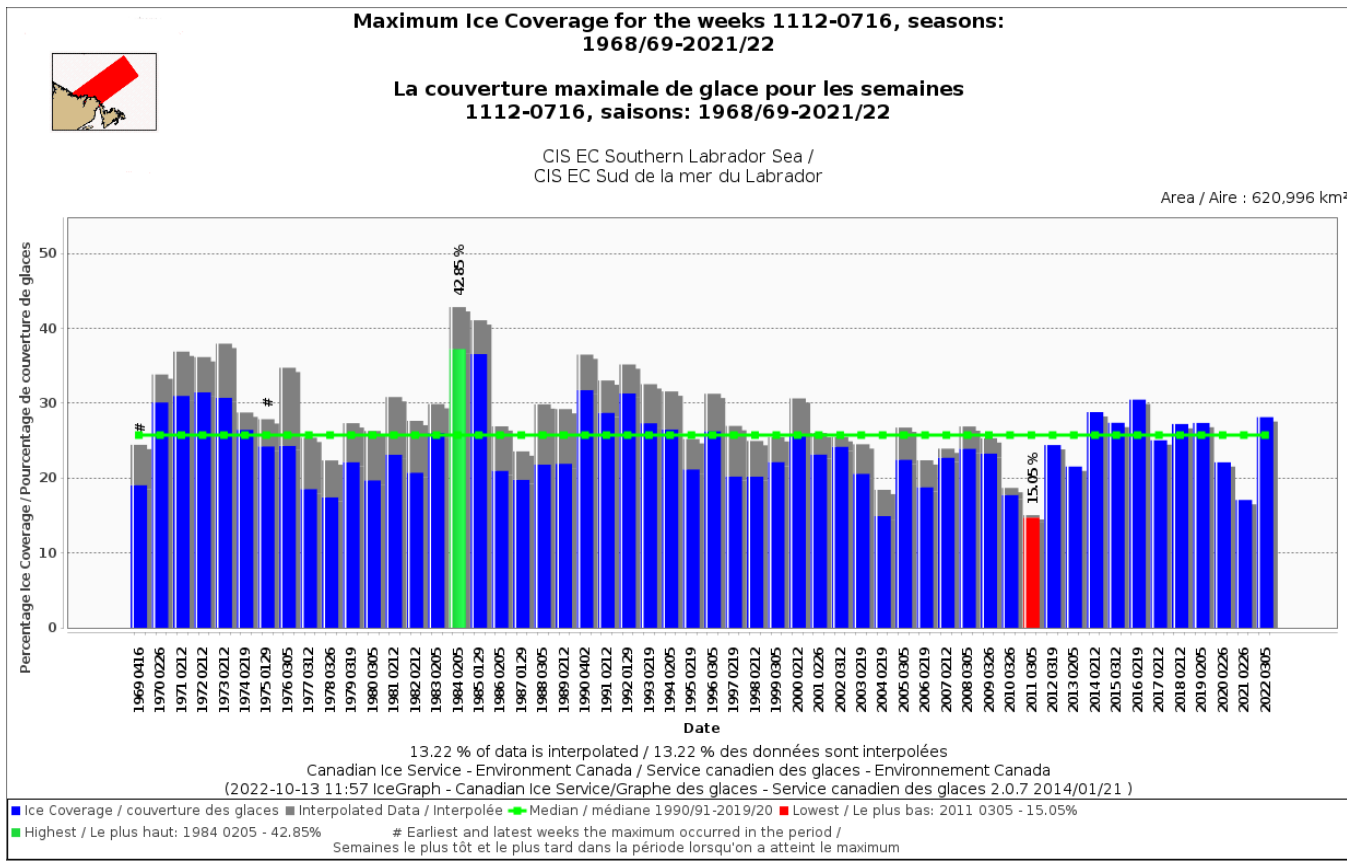


Figure 18: Maximum Ice Coverage in the Southern Labrador Sea by Season, 1968-2022

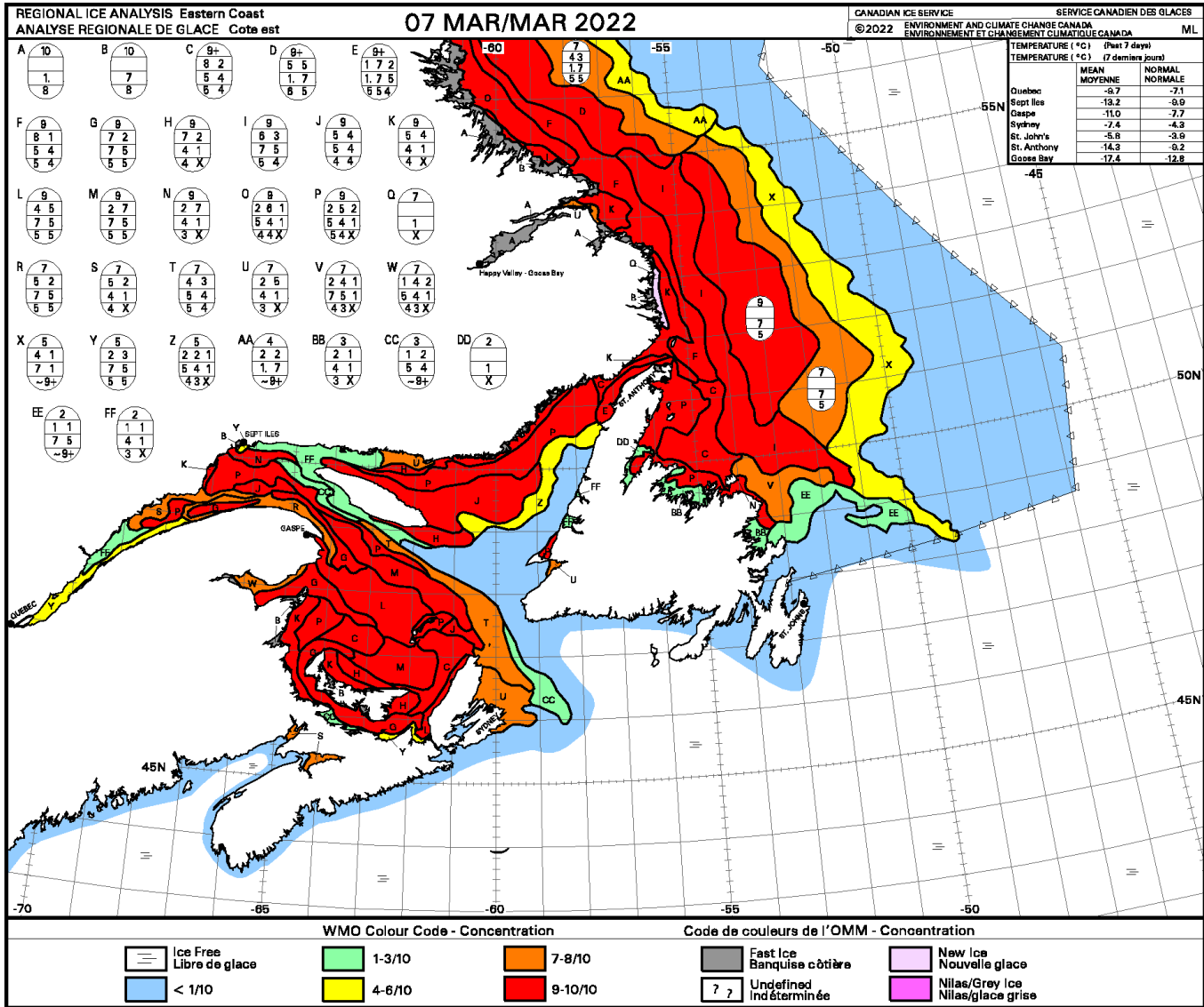


Figure 19: Maximum Ice Cover, Eastern Coast Regional Ice Chart – March 7, 2022.