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SEA ICE IN CANADA

CANADIAN ENVIRONMENTAL SUSTAINABILITY INDICATORS

Canada

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CANADIAN ENVIRONMENTAL SUSTAINABILITY INDICATORS

SEA ICE IN CANADA

February 2025

Table of contents

Sea ice in Canada 5

Key results 5

Regional sea ice 7

Key results 7

Multi-year sea ice 9

Key results 9

Regional multi-year sea ice 10

Key results 10

Sea ice area in Canada's Northwest Passage 11

Key results 11

Canada's Northwest Passage 13

About the indicators 14

What the indicators measure 14

Why these indicators are important 14

Related initiatives 14

Related indicators 14

Data sources and methods 14

Data sources 14

Methods 16

Caveats and limitations 16

Resources 17

References 17

Related information 18

Annexes **19**
Annex A. Data tables for the figures presented in this document 19

List of Figures

Figure 1. Average summer sea ice area, Northern Canadian Waters, 1968 to 2024 5
Figure 2. Sub-region summer sea ice area trends, Northern Canadian Waters, 1968 to 2024 7
Figure 3. Sub-region September sea ice area decadal trends, Canadian Arctic domain, 1968 to 2024 8
Figure 4. Average summer multi-year sea ice area, Canadian Arctic domain, 1968 to 2024 9
Figure 5. Sub-region summer multi-year sea ice area trends, Canadian Arctic domain, 1968 to 2024 10
Figure 6. Sub-region September multi-year sea ice area decadal trends, Canadian Arctic domain, 1968 to 2024 11
Figure 7. Average total and multi-year summer sea ice area, Canada's Northwest Passage, 1968 to 2024 12
Figure 8. Canada's Northwest Passage 13
Figure 9. Sea ice sub-regions of the Northern Canadian Waters 15

List of Tables

Table A.1. Data for Figure 1. Average summer sea ice area, Northern Canadian Waters, 1968 to 2024 19
Table A.2. Data for Figure 2. Sub-region summer sea ice area trends, Northern Canadian Waters, 1968 to 2024 20
Table A.3. Data for Figure 3. Sub-region September sea ice area decadal trends, Canadian Arctic domain, 1968 to 2024 24
Table A.4. Data for Figure 4. Average summer multi-year sea ice area, Canadian Arctic domain, 1968 to 2024 26
Table A.5. Data for Figure 5. Sub-region summer multi-year sea ice area trends, Canadian Arctic domain, 1968 to 2024 27
Table A.6. Data for Figure 6. Sub-region September multi-year sea ice area decadal trends, Canadian Arctic domain, 1968 to 2024 29
Table A.7. Data for Figure 7. Average total and multi-year summer sea ice area, Canada's Northwest Passage, 1968 to 2024 31

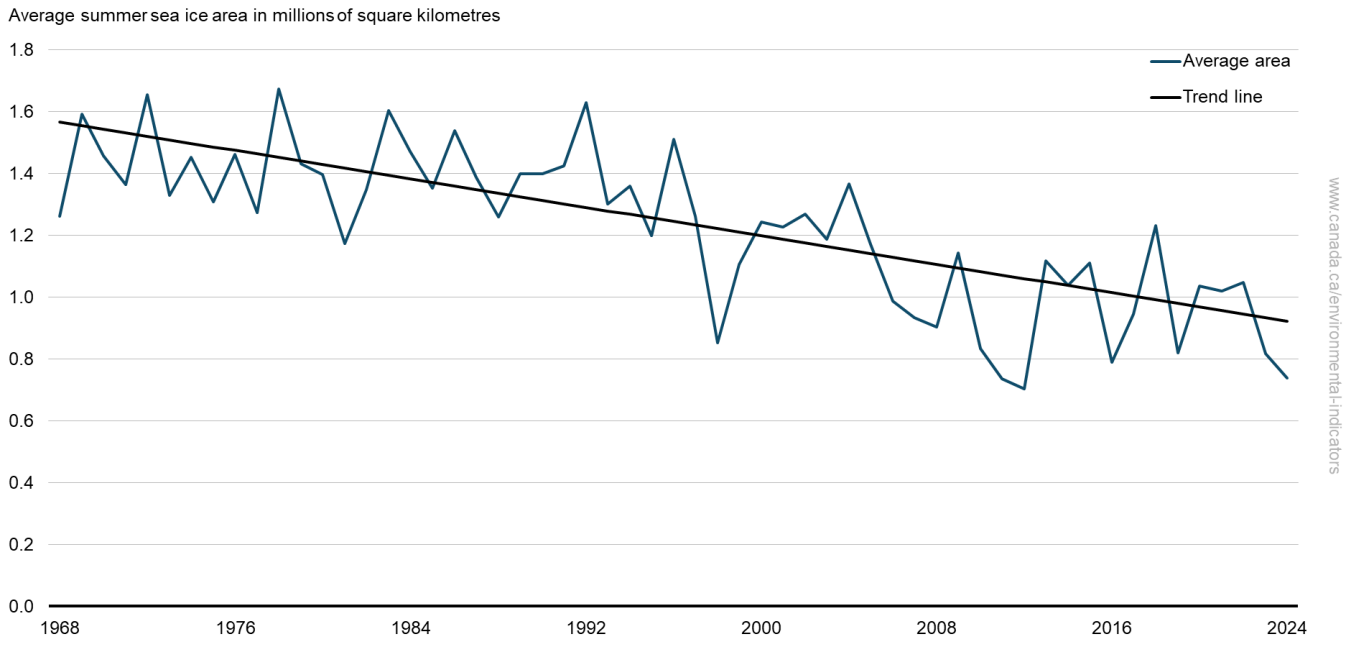
Sea ice in Canada

Sea ice is a prominent feature in the Northern Canadian Waters which are comprised of the Canadian Arctic domain and the Hudson Bay domain. It consists of seasonal ice that forms and melts each year (referred to as first-year ice) and ice that has persisted through at least one melt season (referred to as multi-year ice). This indicator reports on the sea ice area during the summer season. The amount and type of sea ice present, and the total minimum area it covers during the summer season, impact human activity and biological habitat. Additionally, sea ice is an indicator of how the climate is changing.[1]

Key results

- In 2024, the summer sea ice area in the Northern Canadian Waters reached a low of 0.74 million square kilometres (km^2), representing 19.6% of the total area (3.76 million km^2)
- Over the period from 1968 to 2024, the lowest summer sea ice area occurred in 2012 at 0.70 million km^2
- Over the period from 1968 to 2024, summer sea ice area in the Northern Canadian Waters declined at a rate of 7.2% per decade

Figure 1. Average summer sea ice area, Northern Canadian Waters, 1968 to 2024



Data for Figure 1

Note: Sea ice area is measured during the summer season. The summer season is defined as the period from June 19 to November 19 for the Hudson Bay domain and from June 25 to October 15 for the Canadian Arctic domain. A statistically significant trend is reported when the Mann-Kendall test indicates the presence of a trend at the 95% confidence level.
Source: Environment and Climate Change Canada (2024) Climate Research Division.

[1] Trewin B, Cazenave A, Howell SEL, Huss M, Isensee K, Palmer MD, Tarasova O and Vermeulen A (2021), Headline indicators for global climate monitoring, Bulletin of the American Meteorological Society, 102, 1, E20–E37. Retrieved on November 25, 2024.

Sea ice area decline in the Northern Canadian Waters is the result of a combination of factors. Human-induced warming from greenhouse gas emissions and the influence of natural climate variability has resulted in a loss of sea ice over the last 50 years that is unprecedented over the past millennia.[2,3]

Arctic sea ice is very sensitive to climate change because of the sea ice-albedo feedback that influences how much solar radiation is absorbed into the sea ice-ocean system. As sea ice area declines due to warming temperatures, more dark ocean surfaces that readily absorb sunlight (solar radiation) are exposed, in turn causing more sea ice to melt. This feedback cycle is an important factor in amplifying Arctic temperatures. Research has shown that the loss of Arctic sea ice is a very significant contributor to the recent amplification of Arctic temperature change compared to the global average.[4]

Changes in the amount of sea ice, the location of ice edges and the timing of seasonal ice formation and melt have complex, cascading ecosystem impacts.[5] Sea ice declines result in a loss of wildlife habitat, as it serves as hunting platforms for polar bears and as resting grounds and nursery areas for walruses and seals. Algae that grow on the underside of sea ice are also important to the marine food supply. These changes also have an impact on the safety of northerners who use sea ice as a transportation route and platform for hunting and fishing.

[2] Notz D and Stroeve J (2016) Observed Arctic sea-ice loss directly follows anthropogenic CO2 emission. *Science* 354, 747–750. Retrieved on November 25, 2024.

[3] Kinnard C, Zdanowicz CM, Fisher DA, Isaksson E, de Vernal A and Thompson LG (2011) Reconstructed changes in Arctic sea ice over the past 1,450 years. Nature 479(7374):509 to 512. Retrieved on November 25, 2024.

[4] Screen J and Simmonds I (2010) The central role of diminishing sea ice in recent Arctic temperature amplification. Nature 464(7293):1334 to 1337. Retrieved on November 25, 2024.

[5] Barber DG, Asplin MG, Papakyriakou TN, Miller L, Else BGT, Iacozza J, Mundy CJ, Gosslin M, Asselin NC, Ferguson S, Lukovich J V, Stern GA, Gaden A, Pucko M, Geilfus NX and Wang F (2012) Consequences of change and variability in sea ice on marine ecosystem and biogeochemical processes during the 2007-2008 Canadian International Polar Year program. Climatic Change 115(1):135 to 159. Retrieved on November 25, 2024.

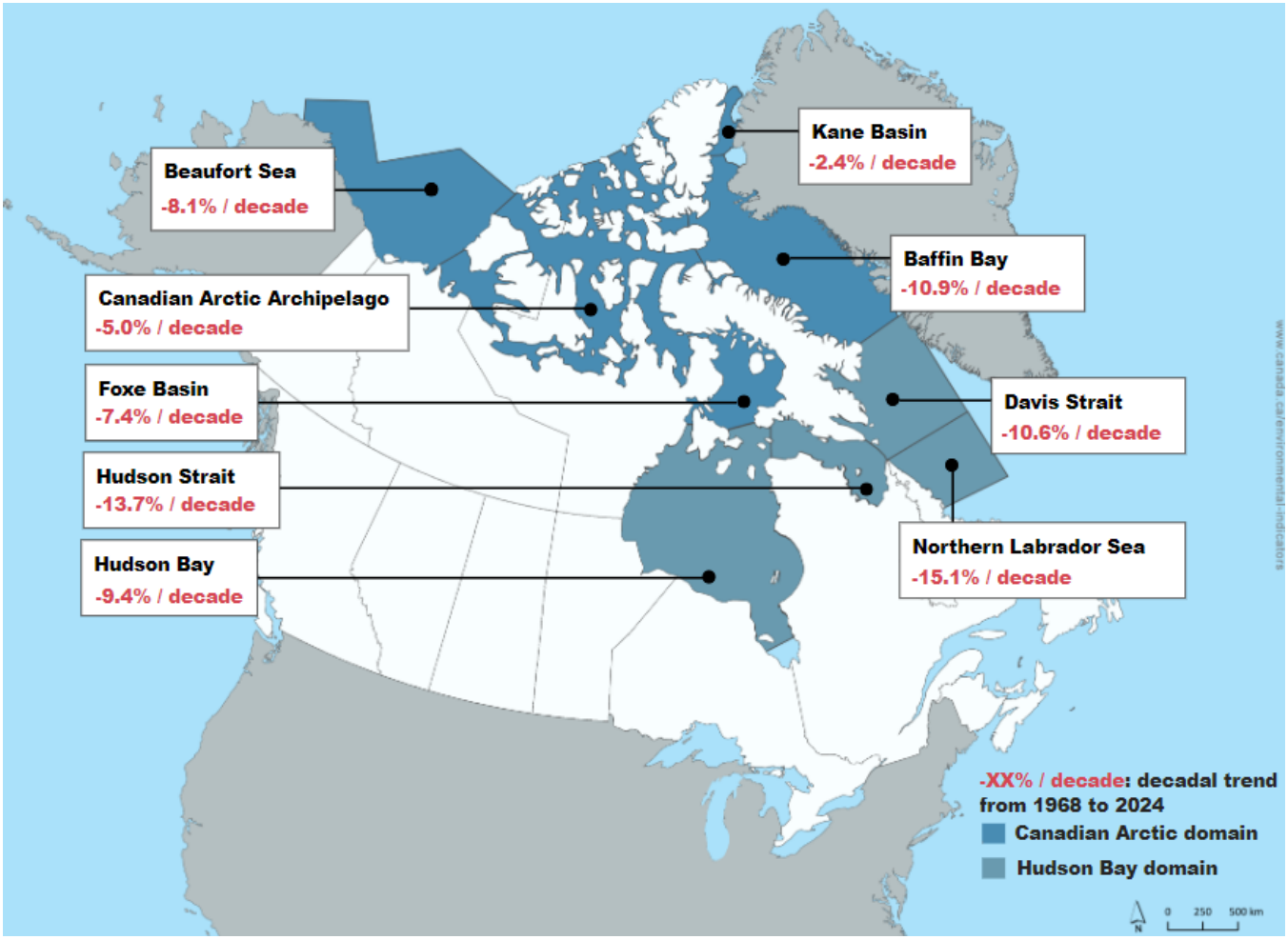
Regional sea ice

In the Northern Canadian Waters, the summer sea ice area varies by sub-region. Five (5) sub-regions make up the Canadian Arctic domain (Kane Basin, Foxe Basin, Baffin Bay, the Beaufort Sea and the Canadian Arctic Archipelago) and 4 sub-regions comprise the Hudson Bay domain (Hudson Bay, Hudson Strait, Davis Strait and the Northern Labrador Sea). The Canadian Arctic Archipelago, Beaufort Sea and Kane Basin sub-regions usually remain covered by ice in the summer because they contain a mix of multi-year and first-year ice. The 4 sub-regions of the Hudson Bay domain are typically free of sea ice in summer.

Key results

- All sub-regions exhibit statistically significant decreasing trends in summer sea ice area over the 1968 to 2024 period, ranging from a 2.4% decrease per decade in the Kane Basin to a 15.1% decrease per decade in the Northern Labrador Sea

Figure 2. Sub-region summer sea ice area trends, Northern Canadian Waters, 1968 to 2024



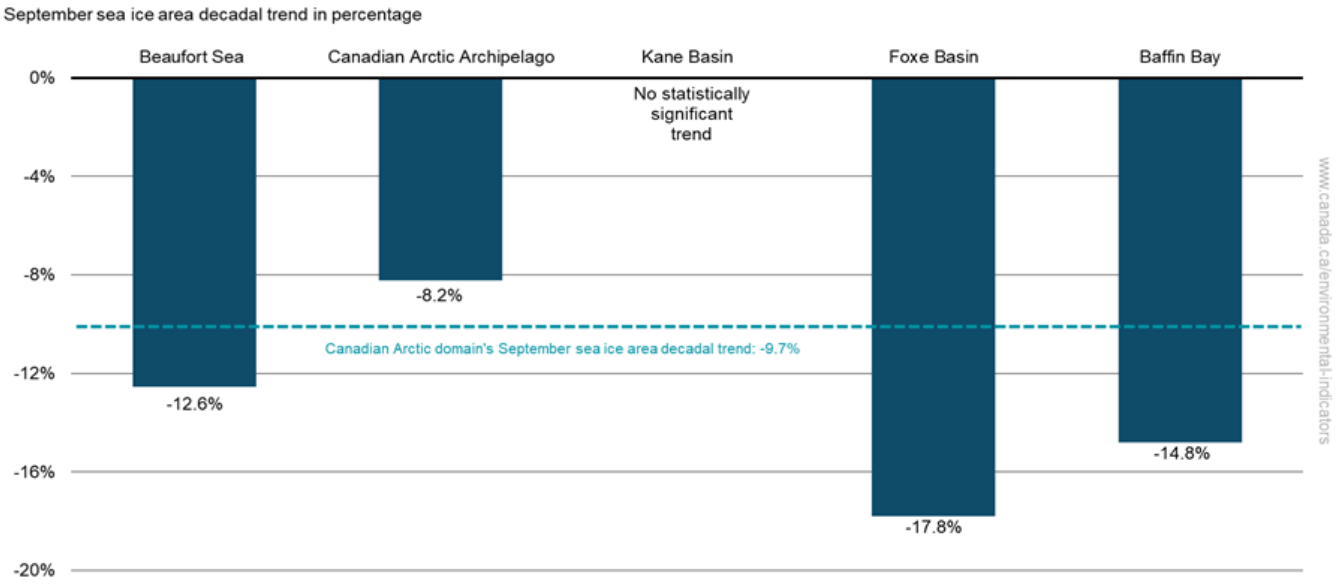
Data for Figure 2

Note: Sea ice area is measured during the summer season. The summer season is defined as the period from June 19 to November 19 for the Hudson Bay domain and from June 25 to October 15 for the Canadian Arctic domain. A statistically significant trend is reported when the Mann-Kendall test indicates the presence of a trend at the 95% confidence level. To access annual summer sea ice areas for each sub-region, please refer to Sea ice in Canada: Interactive chart.
Source: Environment and Climate Change Canada (2024) Climate Research Division.

In absolute terms, the largest summer sea ice area loss over the 1968 to 2024 period has occurred in the Beaufort Sea sub-region, where approximately 214 000 km^2 of sea ice was lost (which corresponds to almost 4 times the land area of Nova Scotia). The Canadian Arctic Archipelago, Baffin Bay and Hudson Bay sub-regions also lost a large amount of sea ice area over the same period, of approximately 167 000 km^2, 104 000 km^2 and 78 000 km^2, respectively.

Each year, the minimum sea ice area is observed during the month of September. At this time of the year, all the sea ice in the Hudson Bay domain has melted. The Canadian Arctic domain's sub-regions present statistically significant decreasing trends in average September sea ice area over the 1968 to 2024 period, except for the northernmost site, the Kane Basin, where no statistically significant trend was reported. In the Canadian Arctic, a decrease of 9.7% per decade has been observed for the September sea ice area, which is lower than the 12.1% decadal decrease observed for the entire Arctic sea ice extent.[6,7]

Figure 3. Sub-region September sea ice area decadal trends, Canadian Arctic domain, 1968 to 2024



Data for Figure 3

Note: The trends presented correspond to the decadal trend over the period from 1968 to 2024. The September sea ice area trend is calculated based on the average sea ice area during the month of September for each year from 1968 to 2024. A statistically significant trend is reported when the Mann-Kendall test indicates the presence of a trend at the 95% confidence level.
Source: Environment and Climate Change Canada (2024) Climate Research Division.

Climate model projections suggest that a nearly sea ice-free summer is possible for the Arctic Ocean by the middle of the 21st century, although sea ice may persist longer in the Canadian Arctic Archipelago region.[8]

[6] National Snow and Ice Data Center (2024) The new abnormal. Retrieved on November 25, 2024.

[7] Note that the Canadian Arctic domain trend was calculated using data for the period from 1968 to 2024, whereas the data from the National Snow and Ice Data Center for the entire Arctic cover the period from 1979 to 2024.

[8] Derksen C, Burgess D, Duguay C, Howell SEL, Mudryk L, Smith S, Thackeray C and Kirchmeier-Young M (2019) Changes in snow, ice, and permafrost across Canada; Chapter 5 in Canada's Changing Climate Report, (ed.) E. Bush and D.S. Lemmen; Government of Canada, Ottawa, Ontario, p.194–260. Retrieved on November 25, 2024.

Multi-year sea ice

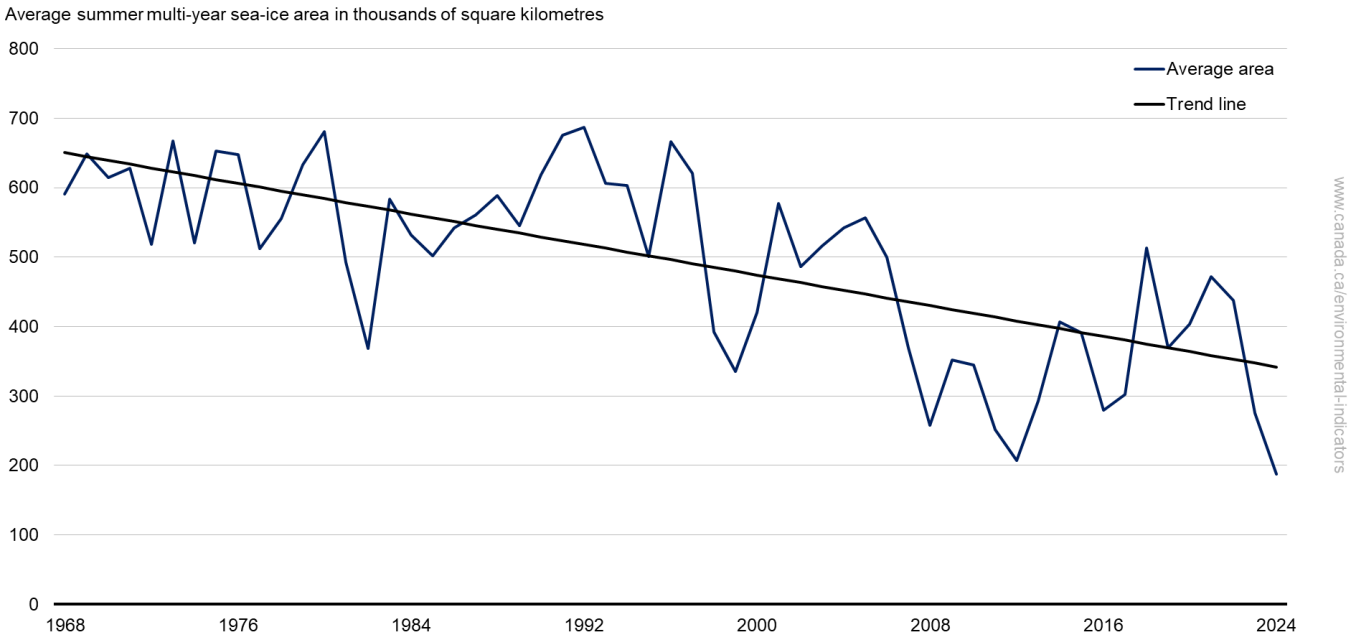
Multi-year sea ice corresponds to ice that has survived at least one summer's melt. Multi-year sea ice contains less salt and is usually thicker than first-year sea ice, making it harder and more difficult for icebreakers to navigate and clear. Considering that the sub-regions from the Hudson Bay domain are first-year ice regions that are free of multi-year ice during summer, the indicators focus on summer multi-year sea ice in the Canadian Arctic domain.

Key results

In the Canadian Arctic domain:

- Over the period 1968 to 2024, multi-year ice in the summer season made up between a low of 25% to a high of 51% of the total summer sea ice area
- The summer multi-year sea ice area has declined by 8.3% per decade over the period from 1968 to 2024
- In 2024, the average summer multi-year sea ice area reached 187 000 km^2, the lowest area over the entire record from 1968 to 2024

Figure 4. Average summer multi-year sea ice area, Canadian Arctic domain, 1968 to 2024



Data for Figure 4

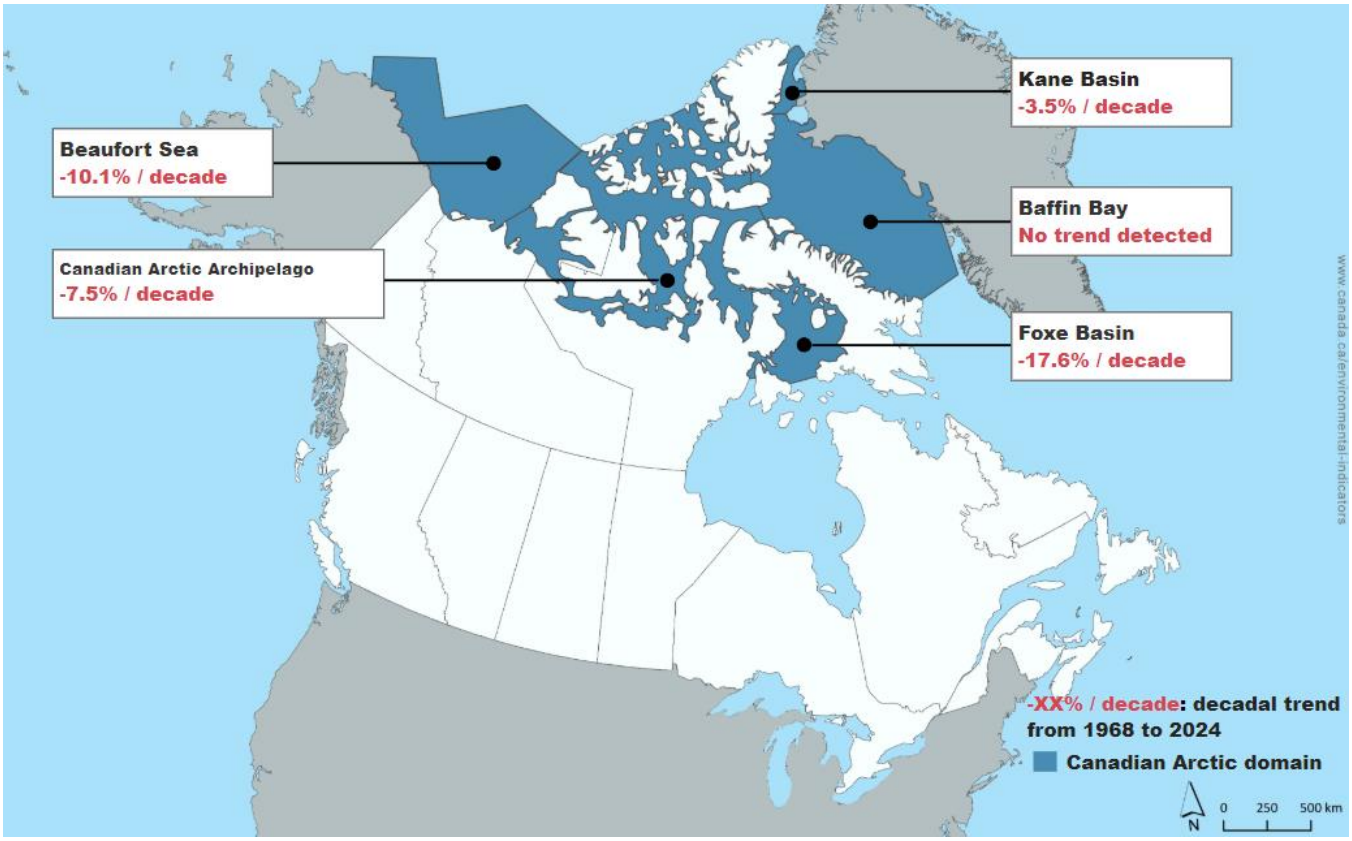
Note: Multi-year sea ice area is measured during the summer season. The summer season is defined as the period from June 25 to October 15 for the Canadian Arctic domain. A statistically significant trend is reported when the Mann-Kendall test indicates the presence of a trend at the 95% confidence level.
Source: Environment and Climate Change Canada (2024) Climate Research Division.

Regional multi-year sea ice

Key results

- In the Canadian Arctic domain, statistically significant decreasing trends in the average multi-year sea ice during the summer season, were found for the Foxe Basin, Kane Basin, Beaufort Sea and Canadian Arctic Archipelago sub-regions
- Over the 1968 to 2024 period, summer multi-year sea ice in the Canadian Arctic had an average reduction of 8.3% per decade
- The Baffin Bay sub-region showed no trend in summer multi-year sea ice area from 1968 to 2024

Figure 5. Sub-region summer multi-year sea ice area trends, Canadian Arctic domain, 1968 to 2024

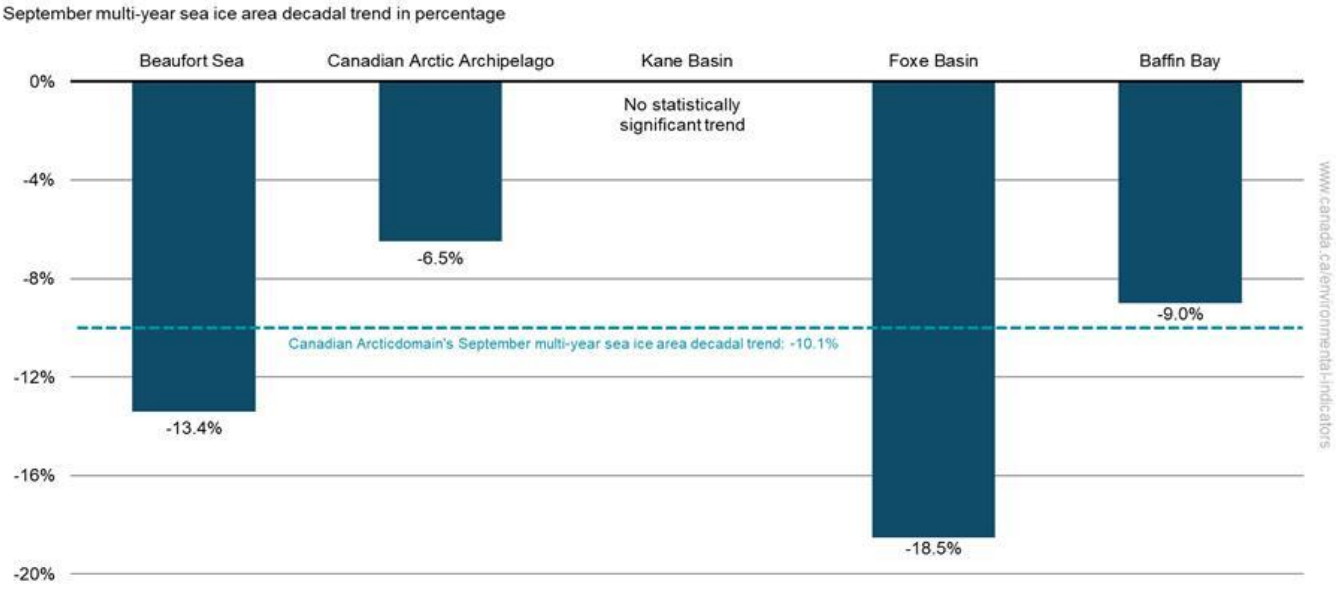


Data for Figure 5

Note: Multi-year sea ice area is measured during the summer season. The summer season is defined as the period from June 25 to October 15 for the Canadian Arctic domain. A statistically significant trend is reported when the Mann-Kendall test indicates the presence of a trend at the 95% confidence level. To access annual summer multi-year sea ice areas for each sub-region in the Canadian Arctic domain, please refer to Sea ice in Canada: Interactive chart.
Source: Environment and Climate Change Canada (2024) Climate Research Division.

Each year, the minimum multi-year sea ice area is observed during the month of September. A decrease in the average September multi-year sea ice in the Canadian Arctic was observed over the 1968 to 2024 period, with a reduction of 10.1% per decade. All sub-regions of the Canadian Arctic domain exhibited statistically significant decreasing September multi-year sea ice trends, except Kane Bassin.

Figure 6. Sub-region September multi-year sea ice area decadal trends, Canadian Arctic domain, 1968 to 2024



Data for Figure 6

Note: The trends presented correspond to the decadal trend over the period from 1968 to 2024. The September multi-year sea ice area trend is calculated based on average multi-year sea ice area during the month of September for each year from 1968 to 2024. A statistically significant trend is reported when the Mann-Kendall test indicates the presence of a trend at the 95% confidence level.
Source: Environment and Climate Change Canada (2024) Climate Research Division.

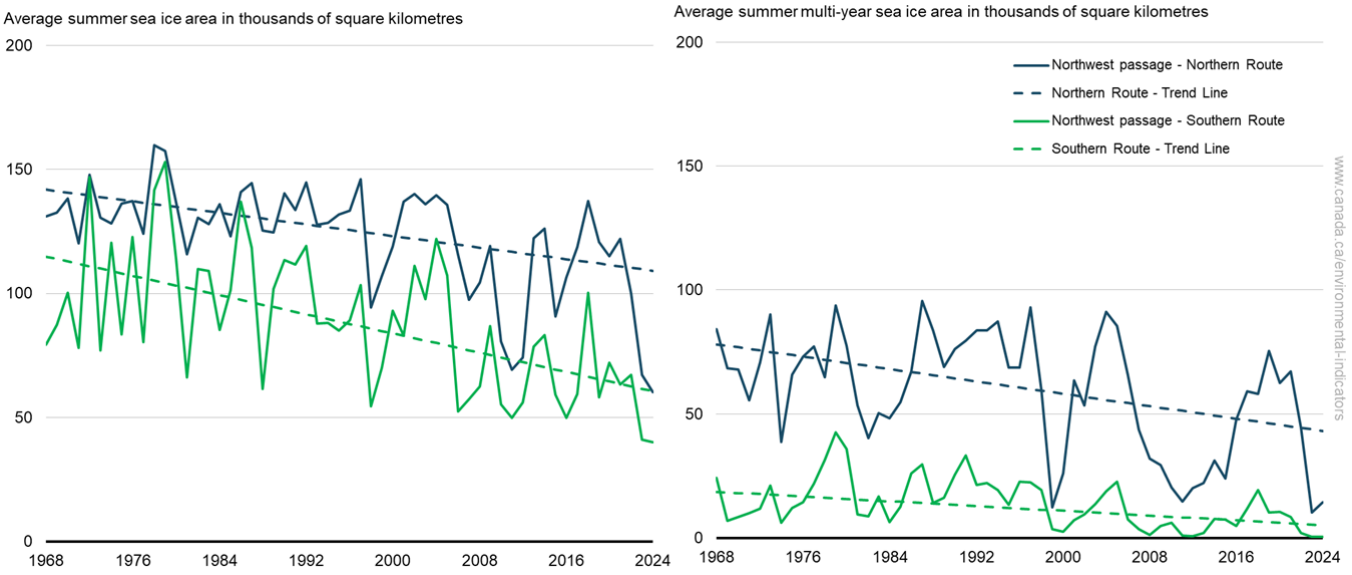
Sea ice area in Canada's Northwest Passage

Canada's Northwest Passage is a system of gulfs, straits, sounds and channels in the Canadian Arctic Archipelago that connects the Atlantic and Pacific Oceans. There are 2 main navigation paths through the Northwest Passage: a northern route and a southern route (see Figure 8).

Key results

- Over the 1968 to 2024 period, statistically significant decreasing trends were detected for both the total sea ice and multi-year sea ice areas in the summer season
    - Decreases of 4.0% and 8.3% per decade were detected for the summer sea ice areas of the northern and southern routes of the Northwest Passage, respectively
    - For summer multi-year sea ice, a decreasing trend of 7.9% per decade was detected for the northern route, while a decreasing trend of 12.6% per decade was detected for the southern route
- Over the period from 1968 to 2024, the lowest summer ice area was observed in 2024 for both the northern route (60 000 km^2) and the southern route (40 000 km^2)
- Over the period from 1968 to 2024, the lowest summer multi-year sea ice area was observed in 2023 for both the northern route (10 000 km^2) and the southern route (430 km^2)

Figure 7. Average total and multi-year summer sea ice area, Canada's Northwest Passage, 1968 to 2024



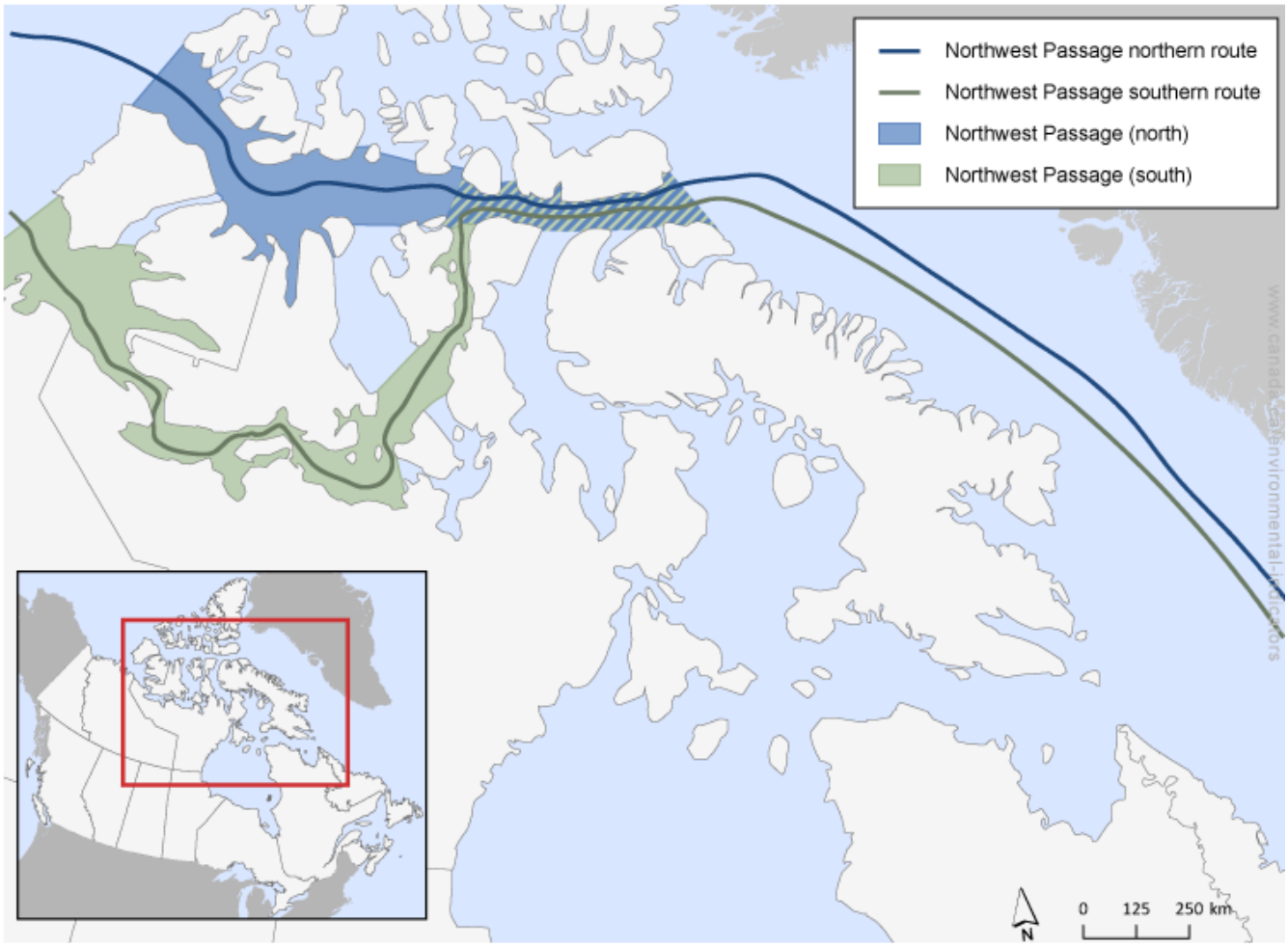
Data for Figure 7

Note: Sea ice area is measured during the summer season. For the Canadian Arctic domain, the summer season is defined as the period from June 25 to October 15. A statistically significant trend is reported when the Mann-Kendall test indicates the presence of a trend at the 95% confidence level.
Source: Environment and Climate Change Canada (2024) Climate Research Division.

Canada's Northwest Passage

Canada's Northwest Passage presents a potential deep-water Arctic shipping route between the northern Pacific and Atlantic regions that is much shorter than routes through the Panama or Suez canals. The Northwest Passage is covered by sea ice for most of the year, making it a navigation obstacle for ice-breaking ships and a safety hazard for non-ice-strengthened ships.

Figure 8. Canada's Northwest Passage



Source: Environment and Climate Change Canada (2018) Climate Research Division

Reduced sea ice is increasing opportunities for shipping, tourism, resource exploration and industrial activities in the North. However, these activities bring new risks of marine accidents from a changing sea ice cover that can put people and ecosystems at risk and place additional stress on limited search and rescue and disaster response capacity.[9,10,11]

[9] Mudryk L, Dawson JP, Howell SEL, Derksen C, Zagon T and Brady M (2021) Impact of 1°, 2°, and 4°C of global warming on ship navigation in the Canadian Arctic. *Nature Climate Change*. Retrieved on November 25, 2024.

[10] Cook, A., J.D. Dawson, S.E.L. Howell, J. Holloway, and M. Brady (2024), Sea ice choke points reduce the length of the shipping season in the Northwest Passage, *Communications Earth and Environment*, 5, 362. Retrieved on December 20, 2024.

[11] Howell, S.E.L., D.G. Babb, J. Landy, and M. Brady (2023). Multi-year ice conditions in the Northwest Passage: 1968-2020, *Atmosphere-Ocean*, 61:4, 202-216. Retrieved on December 20, 2024

About the indicators

What the indicators measure

The Sea ice in Canada indicators provide information on the area of sea in Canada covered by ice during the summer season. Sea ice area represents the portion of marine area covered by ice. The area is evaluated using the Canadian Ice Service Digital Archive and is expressed in thousands or millions of square kilometres. The Sea ice in Canada indicators are provided for the Northern Canadian Waters, by sub-region and for the Northwest Passage. The indicators also present trends in total sea ice area and multi-year sea ice area. Multi-year sea ice is defined as sea ice that has survived at least one summer's melt.

Why these indicators are important

Sea ice is an indicator of how the climate is changing. It is a critical component of our planet because it influences the Arctic and global climate, ecosystems, and people who live in the polar regions. Sea ice influences the climate through the sea ice–albedo feedback effect (or reflectivity of the Earth's surface). Changes in sea ice can also affect ocean currents and the exchange of heat and water vapour from the ocean to the atmosphere.

Sea ice affects marine transportation, commercial fishing, offshore resource development, the hunting and fishing patterns of Indigenous peoples, and tourism and recreation. Understanding how Canada's climate is changing is important for developing adaptive responses. The Sea ice in Canada indicators provide a way to communicate to Canadians how the coverage of Canada's Arctic sea ice has changed.

The Intergovernmental Panel on Climate Change and the World Meteorological Organization use sea ice, among several other variables, to assess long-term changes in climate. Sea ice is considered by the World Meteorological Organization's Global Climate Observing System to be an Essential Climate Variable.

Related initiatives

These indicators support the measurement of progress towards the following 2022 to 2026 Federal Sustainable Development Strategy Goal 13: Take action on climate change and its impacts.

In addition, the indicators contribute to the Sustainable Development Goals of the 2030 Agenda for Sustainable Development. They are linked to Goal 13, Take urgent action to combat climate change and its impacts.

Related indicators

The Temperature change in Canada indicator measures yearly and seasonal surface air temperature departures in Canada.

The Precipitation change in Canada indicator measures annual and seasonal precipitation departures.

The Snow cover indicators provide information on spring snow cover extent and annual snow cover duration in Canada.

Data sources and methods

Data sources

Sea ice data used in these indicators were provided by Environment and Climate Change Canada's Climate Research Division. The sea ice area data were computed from the weekly sea ice charts (Canadian Ice Service Digital Archive) produced by Environment and Climate Change Canada's Canadian Ice Service.

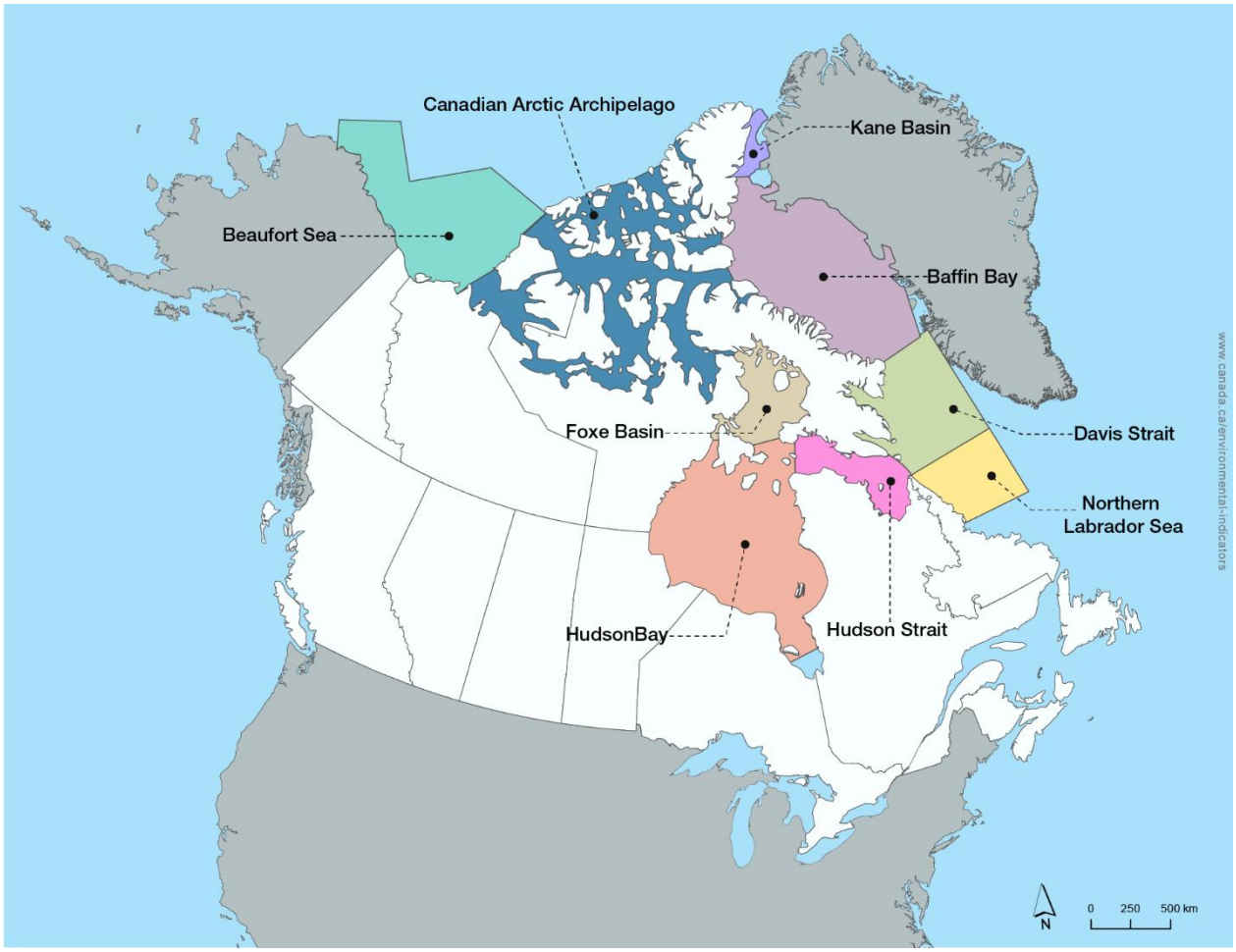
More information

Spatial coverage

The indicators provide coverage for the Northern Canadian Waters which are comprised of the Canadian Arctic domain and the Hudson Bay domain. Five (5) sub-regions make up the Canadian Arctic domain (Kane Basin, Foxe Basin, Baffin Bay, the Beaufort Sea and the Canadian Arctic Archipelago) and 4 sub-

regions comprise the Hudson Bay domain (Hudson Bay, Hudson Strait, Davis Strait and the Northern Labrador Sea).

Figure 9. Sea ice sub-regions of the Northern Canadian Waters



Source: Environment and Climate Change Canada (2018) Climate Research Division

Temporal coverage

The indicators are calculated using data for the summer sea ice season for the years 1968 to 2024. The summer sea ice season is defined as the period from June 25 to October 15 for the Canadian Arctic domain and from June 19 to November 19 for the Hudson Bay domain. These intervals correspond to the summer shipping season of each domain, a period during which the Canadian Ice Service produces weekly regional sea ice charts.

Data completeness

The data for these indicators are compiled by the Canadian Ice Service and grouped into time series by the Climate Research Division to ensure comparability. The data incorporate information from many different sources such as satellite data, surface observations, airborne and ship reports, and model results, along with the expertise of experienced ice forecasters. The Canadian Ice Service provides the authoritative Canadian record for sea ice in Canada.

Data timeliness

The data used in the Sea ice in Canada indicators are current up to 2024.

Methods

The Sea ice in Canada indicators are based on the sea ice area data provided by Environment and Climate Change Canada's Climate Research Division.

For each region and sub-region, an average sea ice area is calculated from the summer season weekly sea ice charts for each year, from 1968 to 2024.

A statistical analysis is carried out using the Mann-Kendall and Sen's methods (Kendall-tau) to identify the presence of statistical linear trends at the 95% confidence level.

More information

The Sea ice in Canada indicators use the weekly sea ice charts produced by the Canadian Ice Service. Weekly sea ice charts are primarily produced using imagery from RADARSAT-1 (since 1996), RADARSAT-2 (2008 to 2020) and RADARSAT Constellation Mission (since 2020) satellites. Other remote sensing data sources are also used, such as the National Oceanic and Atmospheric Administration's Advanced Very High Resolution Radiometer and Moderate-Resolution Imagine Spectrometer imagery. Where possible, the interpretation of satellite data is verified using observations from the Canadian Ice Service specialists onboard dedicated aircraft and Canadian Coast Guard ships.[12]

The Canadian Ice Service ice charts indicate the ice concentration in tenths[13] and its stage of development. They also list the mean and normal 1981 to 2010 temperatures of some of the region's stations, which give an indication of one of the factors contributing to current ice conditions. Ice information is presented using the World Meteorological Organization's terminology. For more information about how the Canadian Ice Service produces weekly sea ice charts and maps, consult the Regional Ice Charts or the Manual of Standard Procedures for Observing and Reporting Ice Conditions.

The weekly sea ice charts are compiled into time series by the Climate Research Division for each region and sub-region. The sea ice area for a given year corresponds to the average area calculated from the weekly sea ice charts of the summer season.

The summer season was chosen because it represents the time when the sea ice reaches its minimum area, which is widely utilized within the scientific community as a measure of climate variability. It is also the time period when the most visible changes in sea ice occur. Historically, sea ice charts have been generated to support the shipping season, which is most active during the summer.

Non-parametric statistical tests were carried out on temporal sea ice area data to detect the presence of a linear trend and, if present, to determine the orientation (positive or negative) and magnitude of the rate of change (slope). The standard Mann-Kendall trend test was used to detect trend presence and orientation, while the Sen's pairwise slope method was used to estimate the slope. A trend was reported when the Mann-Kendall test indicated the presence of a trend at the 95% confidence level.

Caveats and limitations

Care should be taken when using these indicators as proxies of the actual sea ice area change in specific locations. Sea ice area change could vary considerably within a sub-region, the smallest unit of analysis in these indicators.

[12] Environment and Climate Change Canada (2022) Ice climate normals for the northern Canadian waters 1991 to 2020.

[13] Ice concentration describes the relative amount of area covered by ice, compared to a reference area and can be reported in tenths (0/10 to 10/10) or as a percentage.

Resources

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Annexes

Annex A. Data tables for the figures presented in this document

Table A.1. Data for Figure 1. Average summer sea ice area, Northern Canadian Waters, 1968 to 2024

Year	Northern Canadian Waters (millions of square kilometres)
1968	1.26
1969	1.59
1970	1.46
1971	1.37
1972	1.66
1973	1.33
1974	1.45
1975	1.31
1976	1.46
1977	1.27
1978	1.67
1979	1.43
1980	1.40
1981	1.17
1982	1.35
1983	1.60
1984	1.47
1985	1.35
1986	1.54
1987	1.39
1988	1.26
1989	1.40
1990	1.40
1991	1.43
1992	1.63
1993	1.30
1994	1.36
1995	1.20
1996	1.51
1997	1.26
1998	0.85
1999	1.11
2000	1.24
2001	1.23
2002	1.27
2003	1.19
2004	1.37
2005	1.17
2006	0.99
2007	0.93
2008	0.90
2009	1.14
2010	0.83
2011	0.74
2012	0.70
2013	1.12
2014	1.04
2015	1.11
2016	0.79
2017	0.94
2018	1.23
2019	0.82
2020	1.03
2021	1.02
2022	1.05
2023	0.82
2024	0.74

Note: Sea ice area is measured during the summer season. For the Northern Canadian Waters, the summer season is defined as the period from June 19 to November 19 for the Hudson Bay domain and from June 25 to October 15 for the Canadian Arctic domain. A statistically significant trend is reported when the Mann-Kendall test indicates the presence of a trend at the 95% confidence level.
Source: Environment and Climate Change Canada (2024) Climate Research Division.

Table A.2. Data for Figure 2. Sub-region summer sea ice area trends, Northern Canadian Waters, 1968 to 2024

Year	Foxe Basin (thousands of square kilometres)	Kane Basin (thousands of square kilometres)	Baffin Bay (thousands of square kilometres)	Beaufort Sea (thousands of square kilometres)	Canadian Arctic Archipelago (thousands of square kilometres)	Hudson Bay (thousands of square kilometres)	Hudson Strait (thousands of square kilometres)	Davis Strait (thousands of square kilometres)	Northern Labrador Sea (thousands of square kilometres)
1968	73.11	26.13	130.45	336.75	550.68	93.52	21.28	24.80	4.88
1969	79.44	34.54	168.36	485.60	569.13	190.95	24.82	33.67	4.93
1970	70.62	30.82	195.68	391.68	570.29	129.96	18.86	38.38	11.79
1971	68.82	32.42	170.56	402.00	512.13	109.45	29.53	30.85	9.35
1972	113.63	33.00	159.80	355.21	658.75	210.50	42.40	66.86	15.24
1973	61.83	35.42	137.35	371.77	519.99	122.94	29.70	46.30	4.50
1974	52.46	32.69	99.97	484.81	570.15	154.03	27.42	24.07	6.72
1975	52.14	33.61	79.60	478.63	508.57	107.11	16.21	25.10	7.51
1976	76.25	33.91	136.49	448.68	592.63	111.38	18.12	38.48	6.81
1977	71.28	35.35	209.44	298.25	514.03	83.98	14.99	40.95	5.53
1978	106.48	30.42	208.42	421.66	645.95	191.10	28.97	34.26	7.23
1979	75.19	33.04	138.59	337.03	656.95	126.80	21.91	35.68	6.01
1980	60.40	31.80	146.37	432.88	574.92	107.61	15.46	25.06	2.49
1981	40.42	29.96	125.09	366.65	465.25	102.84	14.24	27.35	2.32
1982	61.01	30.80	157.46	313.67	557.03	139.75	23.72	57.38	5.98
1983	87.57	35.10	185.45	476.13	532.30	157.83	36.10	81.29	11.94
1984	63.67	30.56	123.40	454.87	525.21	160.70	41.65	55.52	14.37
1985	54.57	30.20	84.07	479.68	510.72	132.87	26.59	24.18	9.60

Year	Foxe Basin (thousands of square kilometres)	Kane Basin (thousands of square kilometres)	Baffin Bay (thousands of square kilometres)	Beaufort Sea (thousands of square kilometres)	Canadian Arctic Archipelago (thousands of square kilometres)	Hudson Bay (thousands of square kilometres)	Hudson Strait (thousands of square kilometres)	Davis Strait (thousands of square kilometres)	Northern Labrador Sea (thousands of square kilometres)
1986	71.74	32.23	178.47	407.17	620.05	162.81	20.64	42.10	2.98
1987	84.31	26.39	185.68	288.11	583.46	154.69	25.56	32.15	6.67
1988	63.83	24.38	120.19	402.51	486.88	109.41	21.12	25.36	5.09
1989	77.60	30.71	174.29	397.88	526.48	139.30	19.03	27.85	5.04
1990	77.37	22.91	142.52	381.94	579.22	125.49	28.85	35.11	6.66
1991	67.90	29.75	102.97	482.53	550.04	120.44	26.73	32.88	12.18
1992	78.95	37.68	139.83	465.97	608.02	207.91	31.40	53.05	6.43
1993	66.74	31.33	210.43	260.68	524.38	141.04	21.33	41.19	3.82
1994	55.59	28.62	140.12	454.15	509.50	116.08	18.93	31.17	5.73
1995	56.03	24.95	169.40	298.74	528.64	94.50	11.51	14.08	0.25
1996	60.60	34.66	258.34	446.44	536.42	118.90	20.63	28.22	6.10
1997	46.80	34.68	156.27	319.12	570.46	101.39	15.00	15.68	2.70
1998	51.79	31.84	137.78	166.00	391.34	53.48	8.84	11.25	0.87
1999	56.79	30.36	143.40	343.83	456.78	35.82	7.72	26.37	4.50
2000	41.10	31.80	91.29	420.49	502.09	119.01	9.84	25.14	3.18
2001	56.33	34.00	101.71	442.20	518.80	50.06	5.30	16.70	0.63
2002	56.61	33.64	77.18	367.81	562.12	122.08	13.74	25.53	8.97
2003	50.88	30.11	73.10	356.58	552.82	96.86	8.00	17.00	2.06
2004	60.22	31.91	100.99	320.42	596.01	212.96	20.02	23.73	0.88

Year	Foxe Basin (thousands of square kilometres)	Kane Basin (thousands of square kilometres)	Baffin Bay (thousands of square kilometres)	Beaufort Sea (thousands of square kilometres)	Canadian Arctic Archipelago (thousands of square kilometres)	Hudson Bay (thousands of square kilometres)	Hudson Strait (thousands of square kilometres)	Davis Strait (thousands of square kilometres)	Northern Labrador Sea (thousands of square kilometres)
2005	39.85	30.17	111.37	358.71	547.77	62.53	10.03	9.37	0.87
2006	26.78	27.34	60.94	375.75	431.73	46.15	3.94	12.41	1.47
2007	54.18	24.01	96.13	243.96	407.38	75.61	9.79	17.63	5.41
2008	58.80	24.58	91.43	162.79	435.38	93.41	13.69	23.31	0.08
2009	51.56	18.95	68.65	312.92	504.39	137.17	16.12	27.85	5.53
2010	38.84	25.92	79.14	237.22	406.28	33.68	2.99	8.18	0.49
2011	44.44	22.03	73.02	191.78	336.66	58.63	3.00	5.67	0.02
2012	51.31	26.21	43.00	135.42	350.75	73.34	6.38	17.88	0.12
2013	56.76	32.35	67.00	347.26	500.83	83.53	8.61	16.60	4.95
2014	60.40	22.01	51.82	268.38	519.08	86.04	12.13	12.66	4.93
2015	64.90	32.05	127.31	265.33	417.10	138.71	17.01	43.48	3.49
2016	42.25	27.38	57.49	149.11	399.32	78.85	12.10	22.10	1.96
2017	43.21	28.34	96.14	199.28	472.03	60.97	8.73	35.63	0.45
2018	59.06	32.06	97.74	332.68	533.19	123.17	17.29	32.60	4.48
2019	28.99	20.42	47.41	162.15	424.35	111.84	7.00	17.41	0.62
2020	47.83	26.16	55.51	312.95	444.80	107.85	11.83	24.01	4.04
2021	51.82	30.59	63.40	338.03	464.25	58.21	6.54	6.31	0.07
2022	43.69	31.91	126.52	303.20	426.05	76.53	6.62	31.26	1.24
2023	45.25	32.82	108.90	207.81	344.45	46.05	9.74	17.13	5.28

Year	Foxe Basin (thousands of square kilometres)	Kane Basin (thousands of square kilometres)	Baffin Bay (thousands of square kilometres)	Beaufort Sea (thousands of square kilometres)	Canadian Arctic Archipelago (thousands of square kilometres)	Hudson Bay (thousands of square kilometres)	Hudson Strait (thousands of square kilometres)	Davis Strait (thousands of square kilometres)	Northern Labrador Sea (thousands of square kilometres)
2024	38.76	32.57	107.14	153.86	325.98	59.99	5.40	14.59	0.43
1968 to 2024 decadal trend	-7.4%	-2.4%	-10.9%	-8.1%	-5.0%	-9.4%	-13.7%	-10.6%	-15.1%

Note: Sea ice area is measured during the summer season. For the Northern Canadian Waters, the summer season is defined as the period from June 19 to November 19 for the Hudson Bay domain and from June 25 to October 15 for the Canadian Arctic domain. A statistically significant trend is reported when the Mann-Kendall test indicates the presence of a trend at the 95% confidence level.
Source: Environment and Climate Change Canada (2024) Climate Research Division

Table A.3. Data for Figure 3. Sub-region September sea ice area decadal trends, Canadian Arctic domain, 1968 to 2024

Year	Foxe Basin (thousands of square kilometres)	Kane Basin (thousands of square kilometres)	Baffin Bay (thousands of square kilometres)	Beaufort Sea (thousands of square kilometres)	Canadian Arctic Archipelago (thousands of square kilometres)	Canadian Arctic domain (thousands of square kilometres)
1968	30.51	19.33	30.84	273.27	454.84	808.79
1969	13.48	30.86	66.49	473.89	436.54	1021.27
1970	21.77	25.94	76.23	340.54	427.87	892.35
1971	10.06	31.61	30.21	341.69	329.23	742.81
1972	60.03	31.47	67.19	254.82	567.51	981.03
1973	15.69	33.70	28.86	276.30	373.08	727.63
1974	7.77	30.42	9.61	416.02	413.86	877.69
1975	0.92	33.06	17.23	511.91	395.75	958.87
1976	30.25	30.00	17.12	376.08	464.00	917.44
1977	20.98	36.54	73.21	200.32	403.16	734.22
1978	53.34	27.98	49.60	294.43	556.56	981.92
1979	18.55	28.93	17.71	208.27	545.27	818.72
1980	5.83	28.32	7.08	433.66	469.66	944.55
1981	0.48	24.82	14.21	288.55	322.10	650.16
1982	6.59	32.61	40.67	222.33	414.27	716.46
1983	56.17	33.72	57.13	464.53	329.90	941.44
1984	9.97	27.37	14.74	393.44	392.18	837.69
1985	5.29	30.73	2.80	429.14	334.11	802.08
1986	15.04	30.67	34.30	305.14	493.79	878.92
1987	40.79	25.03	28.95	254.21	434.40	783.38
1988	14.11	20.06	4.47	362.35	389.96	790.96
1989	18.94	32.23	25.73	297.99	359.81	734.70
1990	27.91	30.06	27.07	316.14	483.03	884.21
1991	27.17	23.78	9.07	461.34	394.43	915.78
1992	33.49	37.38	37.23	413.37	508.50	1029.97
1993	24.33	34.44	91.47	168.81	387.62	706.67
1994	4.77	26.52	19.16	382.54	361.78	794.76
1995	6.33	26.31	34.21	231.32	456.17	754.34
1996	7.75	34.55	106.57	401.08	427.45	977.40
1997	3.30	35.30	32.98	206.12	507.72	785.42
1998	4.30	34.70	18.60	106.70	170.81	335.10

Year	Foxe Basin (thousands of square kilometres)	Kane Basin (thousands of square kilometres)	Baffin Bay (thousands of square kilometres)	Beaufort Sea (thousands of square kilometres)	Canadian Arctic Archipelago (thousands of square kilometres)	Canadian Arctic domain (thousands of square kilometres)
1999	6.45	31.15	40.92	196.03	246.05	520.61
2000	1.09	32.75	17.04	272.55	295.34	618.77
2001	10.06	32.14	17.86	302.24	374.32	736.63
2002	5.46	32.03	13.55	217.86	387.87	656.77
2003	1.37	31.79	9.04	274.33	449.54	766.06
2004	10.80	30.24	13.86	226.21	487.82	768.93
2005	1.42	27.25	11.33	273.09	396.04	709.13
2006	0.43	23.67	10.80	270.39	266.12	571.41
2007	5.18	21.82	15.50	135.77	217.82	396.09
2008	7.03	25.49	11.78	104.73	268.10	417.14
2009	0.74	28.72	10.03	249.44	337.03	625.96
2010	0.14	29.09	16.22	131.90	240.48	417.82
2011	2.34	16.12	4.07	113.24	145.77	281.54
2012	4.77	22.47	2.77	18.84	149.71	198.56
2013	4.07	36.16	16.34	247.53	362.30	666.39
2014	5.07	18.04	3.66	196.50	385.01	608.29
2015	11.01	33.85	26.65	103.48	201.87	376.87
2016	0.03	25.88	7.32	32.05	237.71	302.99
2017	0.58	31.51	17.59	115.43	340.13	505.24
2018	11.14	29.61	15.87	221.93	398.15	676.70
2019	0.00	13.00	2.25	95.42	259.86	370.53
2020	0.24	25.09	4.46	201.48	302.29	533.57
2021	4.65	27.17	5.73	213.69	367.76	619.01
2022	0.58	28.56	19.86	172.43	215.98	437.41
2023	1.97	30.71	17.70	71.77	152.01	274.17
2024	0.93	31.92	14.75	6.60	159.63	213.83
1968 to 2024 decadal trend	-17.8%	No trend	-14.8%	-12.6%	-8.2%	-9.7%

Note: The trends presented correspond to the decadal trend over the period from 1968 to 2024. The September sea ice area trend is calculated based on average sea ice area during the month of September for each year from 1968 to 2024. A statistically significant trend is reported when the Mann-Kendall test indicates the presence of a trend at the 95% confidence level.
Source: Environment and Climate Change Canada (2024) Climate Research Division.

Table A.4. Data for Figure 4. Average summer multi-year sea ice area, Canadian Arctic domain, 1968 to 2024

Year	Canadian Arctic domain (thousands of square kilometres)
1968	590.85
1969	648.44
1970	614.58
1971	627.90
1972	518.20
1973	667.50
1974	520.32
1975	653.31
1976	648.15
1977	511.79
1978	555.45
1979	632.75
1980	681.08
1981	492.39
1982	368.76
1983	583.48
1984	532.20
1985	501.69
1986	541.86
1987	561.17
1988	588.99
1989	545.08
1990	618.66
1991	675.77
1992	686.78
1993	606.10
1994	603.15
1995	501.08
1996	665.89
1997	620.48
1998	392.47
1999	334.86
2000	420.63
2001	577.49
2002	486.33
2003	515.97
2004	541.87
2005	556.75
2006	499.41
2007	369.57
2008	257.48
2009	351.38
2010	345.00
2011	251.59
2012	207.17
2013	292.44
2014	406.49
2015	390.92
2016	279.02
2017	302.12
2018	513.08
2019	369.51
2020	403.85
2021	471.93
2022	438.21
2023	275.35
2024	187.11

Note: Multi-year sea ice area is measured during the summer season. For the Canadian Arctic domain, the summer season is defined as the period from June 25 to October 15. A statistically significant trend is reported when the Mann-Kendall test indicates the presence of a trend at the 95% confidence level.
Source: Environment and Climate Change Canada (2024) Climate Research Division.

Table A.5. Data for Figure 5. Sub-region summer multi-year sea ice area trends, Canadian Arctic domain, 1968 to 2024

Year	Foxe Basin (thousands of square kilometres)	Kane Basin (thousands of square kilometres)	Baffin Bay (thousands of square kilometres)	Beaufort Sea (thousands of square kilometres)	Canadian Arctic Archipelago (thousands of square kilometres)
1968	1.66	7.60	5.58	299.96	276.05
1969	0.46	16.74	23.19	335.35	272.70
1970	0.46	15.64	24.52	301.55	272.41
1971	0.72	21.87	15.74	346.97	242.59
1972	4.04	20.47	10.09	211.50	272.10
1973	0.96	25.02	10.44	302.53	328.54
1974	0.20	13.92	6.63	301.08	198.49
1975	0.46	16.21	5.32	393.87	237.45
1976	2.46	17.65	9.22	370.87	247.94
1977	0.16	14.18	15.14	188.05	294.26
1978	4.18	14.55	9.31	242.39	285.02
1979	5.88	15.00	9.71	216.73	385.42
1980	0.26	17.60	8.23	300.26	354.74
1981	0.35	16.47	18.11	220.11	237.35
1982	0.22	11.42	16.10	140.68	200.34
1983	3.91	20.43	44.00	260.94	254.20
1984	0.57	13.84	15.80	291.50	210.48
1985	0.43	12.56	1.89	280.35	206.46
1986	1.09	11.25	9.35	267.88	252.29
1987	0.77	12.98	8.03	194.50	344.89
1988	0.66	9.78	8.08	262.56	307.90
1989	0.24	17.11	9.71	245.29	272.73
1990	0.79	16.99	51.00	261.90	287.99
1991	1.74	6.45	7.02	347.54	313.02
1992	1.49	27.75	12.33	327.38	317.83
1993	1.41	24.44	60.13	192.63	327.50
1994	3.85	19.86	13.46	287.80	278.18
1995	0.65	17.06	42.59	208.51	232.27
1996	0.67	18.55	48.25	339.10	259.33
1997	0.23	22.16	22.05	256.63	319.42
1998	0.02	17.57	31.56	104.10	239.23
1999	0.40	13.23	13.27	205.62	102.34
2000	0.16	15.15	8.39	246.64	150.29

Year	Foxe Basin (thousands of square kilometres)	Kane Basin (thousands of square kilometres)	Baffin Bay (thousands of square kilometres)	Beaufort Sea (thousands of square kilometres)	Canadian Arctic Archipelago (thousands of square kilometres)
2001	0.03	16.95	12.39	316.17	231.94
2002	0.00	17.99	10.18	229.99	228.17
2003	0.11	13.62	7.52	232.23	262.50
2004	0.25	18.09	16.41	213.78	293.34
2005	0.39	13.98	6.52	240.78	295.08
2006	0.25	13.16	12.03	266.22	207.75
2007	0.00	12.75	26.60	162.88	167.35
2008	0.03	11.67	16.96	79.69	149.12
2009	0.06	8.59	10.40	164.05	168.29
2010	0.02	13.51	27.03	135.45	168.99
2011	0.00	11.56	8.94	110.85	120.24
2012	0.10	13.16	4.09	84.01	105.81
2013	0.17	11.78	5.13	146.29	129.07
2014	0.22	10.53	4.59	179.27	211.87
2015	0.13	15.33	12.25	191.00	172.21
2016	0.00	14.52	3.28	88.33	172.88
2017	0.04	15.82	14.15	57.38	214.73
2018	0.51	16.95	20.92	233.62	241.09
2019	0.13	12.84	17.06	100.61	238.87
2020	0.00	9.72	1.33	194.89	197.91
2021	0.06	12.57	3.57	232.25	223.48
2022	0.40	15.09	31.89	199.41	191.42
2023	0.00	14.67	29.73	108.89	122.05
2024	0.00	17.40	13.84	53.85	102.02
1968 to 2024 decadal trend	-17.6%	-3.5%	No trend	-10.1%	-7.5%

Note: Multi-year sea ice area is measured during the summer season. For the Canadian Arctic domain, the summer season is defined as the period from June 25 to October 15. A statistically significant trend is reported when the Mann-Kendall test indicates the presence of a trend at the 95% confidence level.
Source: Environment and Climate Change Canada (2024) Climate Research Division.

Table A.6. Data for Figure 6. Sub-region September multi-year sea ice area decadal trends, Canadian Arctic domain, 1968 to 2024

Year	Foxe Basin (thousands of square kilometres)	Kane Basin (thousands of square kilometres)	Baffin Bay (thousands of square kilometres)	Beaufort Sea (thousands of square kilometres)	Canadian Arctic Archipelago (thousands of square kilometres)	Canadian Arctic domain (thousands of square kilometres)
1968	0.01	3.12	6.42	258.20	245.25	513.01
1969	0.73	17.34	38.48	365.66	262.36	684.58
1970	0.04	10.89	24.77	282.58	234.34	552.61
1971	1.09	17.00	11.21	313.08	197.87	540.24
1972	0.00	18.13	8.05	184.25	207.69	418.12
1973	0.61	26.63	12.56	259.25	215.34	514.39
1974	0.29	10.71	6.33	296.26	181.75	495.34
1975	0.56	17.89	2.25	466.21	190.16	677.08
1976	0.22	14.78	6.81	356.11	219.01	596.93
1977	0.05	15.69	20.95	187.38	262.22	486.30
1978	0.15	11.20	6.95	231.11	249.86	499.27
1979	0.39	21.03	11.72	178.22	351.70	563.06
1980	0.00	14.71	2.69	332.98	311.90	662.28
1981	0.16	11.59	7.49	259.38	205.45	484.07
1982	0.08	17.81	20.55	131.48	182.18	352.09
1983	1.15	23.26	44.68	262.96	225.09	557.15
1984	1.00	15.34	10.77	243.58	182.80	453.49
1985	0.00	13.95	1.03	282.12	172.64	469.74
1986	0.00	11.38	6.05	231.16	219.65	468.24
1987	0.00	9.55	10.81	240.92	310.75	572.04
1988	0.29	7.74	1.45	267.30	275.69	552.48
1989	0.06	25.72	17.02	220.95	256.98	520.73
1990	0.00	23.27	23.73	237.79	257.35	542.15
1991	1.95	5.38	2.75	372.60	306.11	688.79
1992	0.00	23.70	16.55	328.69	282.40	651.34
1993	0.52	30.62	79.50	150.52	278.96	540.12
1994	0.04	21.65	14.38	302.28	271.46	609.82
1995	0.61	18.32	18.95	200.56	255.65	494.09
1996	0.39	20.58	29.02	363.15	280.30	693.43
1997	0.33	24.22	11.50	185.23	320.75	542.03
1998	0.00	21.22	13.09	93.67	145.50	273.48

Year	Foxe Basin (thousands of square kilometres)	Kane Basin (thousands of square kilometres)	Baffin Bay (thousands of square kilometres)	Beaufort Sea (thousands of square kilometres)	Canadian Arctic Archipelago (thousands of square kilometres)	Canadian Arctic domain (thousands of square kilometres)
1999	0.23	12.85	14.86	165.23	106.61	299.79
2000	0.00	16.67	7.86	210.36	154.06	388.95
2001	0.13	16.05	10.17	286.04	238.58	550.97
2002	0.01	13.58	5.40	172.69	223.57	415.25
2003	0.02	13.82	2.01	224.44	282.71	523.00
2004	0.11	16.61	6.22	155.64	297.03	475.60
2005	0.76	13.41	5.62	236.30	256.30	512.39
2006	0.36	15.11	8.93	222.05	210.17	456.61
2007	0.00	15.21	12.97	106.76	160.67	295.60
2008	0.00	13.21	7.56	59.56	143.70	224.02
2009	0.00	11.21	7.57	153.66	167.17	339.61
2010	0.03	16.51	9.59	95.92	155.67	277.72
2011	0.00	10.52	2.34	72.27	89.89	175.01
2012	0.00	10.46	0.30	16.48	96.89	124.14
2013	0.00	12.53	8.38	125.22	134.51	280.64
2014	0.04	10.71	2.78	162.89	193.72	370.13
2015	0.00	15.38	15.83	82.82	121.31	235.35
2016	0.00	13.88	3.19	16.66	184.19	217.91
2017	0.00	16.15	12.27	49.51	182.15	260.09
2018	0.01	16.61	7.78	186.91	226.24	437.56
2019	0.00	8.71	1.32	62.85	187.19	260.07
2020	0.00	9.33	0.83	153.80	187.58	351.55
2021	0.00	14.49	4.91	171.55	213.99	404.94
2022	0.28	15.98	14.81	128.33	147.66	307.06
2023	0.00	15.04	10.35	60.93	113.62	199.93
2024	0.00	16.02	5.81	4.88	89.58	116.29
1968 to 2024 decadal trend	-18.5%	No trend	-9.0%	-13.4%	-6.5%	-10.1%

Note: The trends presented correspond to the decadal trend over the period from 1968 to 2024. The September multi-year sea ice area trend is calculated based on average sea ice area during the month of September for each year from 1968 to 2024. A statistically significant trend is reported when the Mann-Kendall test indicates the presence of a trend at the 95% confidence level.
Source: Environment and Climate Change Canada (2024) Climate Research Division.

Table A.7. Data for Figure 7. Average total and multi-year summer sea ice area, Canada's Northwest Passage, 1968 to 2024

Year	Northwest Passage northern route total sea ice area (thousands of square kilometres)	Northwest Passage southern route total sea ice area (thousands of square kilometres)	Northwest Passage northern route multi-year sea ice area (thousands of square kilometres)	Northwest Passage southern route multi-year sea ice area (thousands of square kilometres)
1968	131.09	79.42	84.31	24.15
1969	132.57	87.41	68.47	7.00
1970	138.19	100.35	67.82	8.54
1971	120.24	77.99	55.59	10.00
1972	147.72	146.90	70.69	11.92
1973	130.47	77.12	90.17	21.22
1974	128.13	120.34	38.84	6.09
1975	136.30	83.43	65.76	12.16
1976	137.15	122.73	73.14	14.33
1977	124.04	80.48	77.16	21.91
1978	159.73	141.75	64.78	31.40
1979	157.32	152.98	93.69	42.56
1980	136.65	113.92	77.49	35.79
1981	115.87	66.16	53.56	9.64
1982	130.40	109.89	40.29	8.66
1983	127.89	109.10	50.24	16.88
1984	136.06	85.38	48.18	6.53
1985	122.99	101.40	54.71	12.68
1986	140.91	137.01	67.25	26.03
1987	144.48	118.41	95.58	29.73
1988	125.29	61.53	83.83	14.14
1989	124.51	101.75	69.02	16.19
1990	140.47	113.47	76.09	25.59
1991	133.59	111.59	79.56	33.24
1992	144.81	119.27	83.75	21.41
1993	127.70	87.99	83.65	22.15
1994	128.57	88.09	87.21	19.21
1995	131.81	84.97	68.60	13.40
1996	133.49	89.04	68.60	22.81
1997	145.99	103.26	92.89	22.40
1998	94.32	54.56	59.77	19.42
1999	106.94	70.09	12.35	3.62

Year	Northwest Passage northern route total sea ice area (thousands of square kilometres)	Northwest Passage southern route total sea ice area (thousands of square kilometres)	Northwest Passage northern route multi-year sea ice area (thousands of square kilometres)	Northwest Passage southern route multi-year sea ice area (thousands of square kilometres)
2000	118.78	92.95	26.04	2.61
2001	137.10	82.89	63.55	7.08
2002	140.06	111.22	53.36	9.63
2003	135.83	97.69	77.17	13.64
2004	139.67	121.87	91.28	18.71
2005	135.59	107.19	85.64	22.65
2006	115.49	52.52	65.70	7.45
2007	97.52	57.29	43.68	3.54
2008	104.35	62.64	31.93	1.13
2009	119.25	86.88	29.34	4.88
2010	80.58	55.27	20.27	6.02
2011	69.34	49.88	14.63	0.91
2012	74.11	56.19	20.07	0.85
2013	122.23	78.56	22.29	2.13
2014	126.24	83.29	31.17	7.61
2015	90.71	59.23	23.99	7.38
2016	106.43	49.75	47.85	4.89
2017	118.65	59.40	59.15	11.82
2018	137.33	100.29	58.00	19.36
2019	120.75	58.19	75.55	10.33
2020	115.12	72.09	62.51	10.48
2021	121.89	63.32	67.16	8.58
2022	100.05	67.26	44.29	2.08
2023	67.10	41.06	10.32	0.43
2024	60.11	39.93	14.35	0.51
1968 to 2024 decadal trend	-4.0%	-8.3%	-7.9%	-12.6%

Note: Sea ice area is measured during the summer season. For the Canadian Arctic domain, the summer season is defined as the period from June 25 to October 15. A statistically significant trend is reported when the Mann-Kendall test indicates the presence of a trend at the 95% confidence level.
Source: Environment and Climate Change Canada (2024) Climate Research Division.

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