Environment and Climate Change Canada
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# PLASTIC PARTICLES IN THE NORTHERN FULMAR

## CANADIAN ENVIRONMENTAL SUSTAINABILITY INDICATORS

Canada

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# CANADIAN ENVIRONMENTAL SUSTAINABILITY INDICATORS

# PLASTIC PARTICLES IN THE NORTHERN FULMAR

## May 2025

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# Plastic particles in the northern fulmar

Plastics have become part of everyday life in Canada and around the world. Poor waste management and improper disposal have led to significant plastic pollution. In Canada, it is estimated that about 1% of plastic waste makes its way into the environment, amounting to roughly 40 400 tonnes in 2020.[1] This plastic waste can be unintentionally ingested by seabirds, such as the northern fulmar (*Fulmarus glacialis*), which feed at the ocean's surface. Sampling plastic in the stomachs of seabirds provides information on plastic pollution on the surface of Canada's oceans.

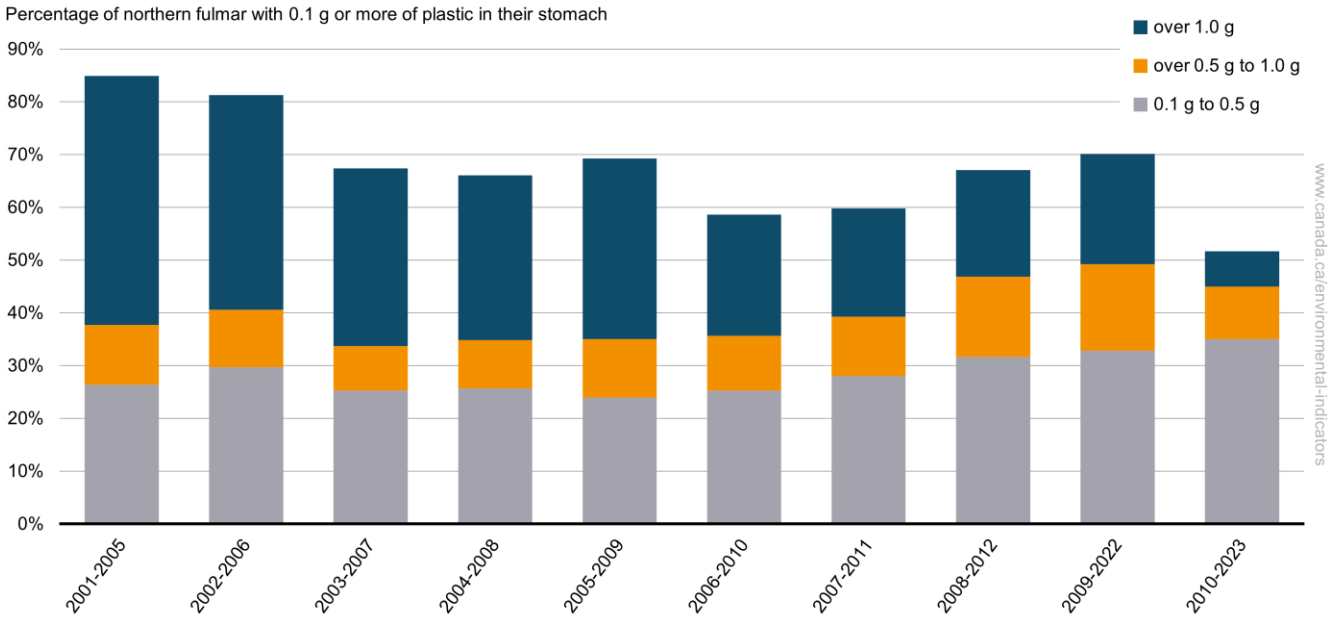
This indicator reports the percentage of northern fulmars obtained through opportunistic collection that had 0.1 gram (g) or more of plastic in their stomach.[2] This reporting was developed to mirror the long term goal for the North-East Atlantic under the OSPAR convention.

## Key results

For northern fulmars collected at Sable Island in the Atlantic for the time periods between 2001 and 2023:

- The proportion of northern fulmars with 0.1 gram (g) or more of plastic in their stomach had a peak of 85% for the 2001 to 2005 time period and a low of 52% for the 2010 to 2023 time period
- The proportion of northern fulmars with 0.1 g to 0.5 g of plastic in their stomach stayed relatively consistent for all time periods, ranging between 24% and 35%
- The proportion of northern fulmars with 0.5 g to 1.0 g of plastic in their stomach also stayed relatively consistent for all time periods, ranging between 8% and 16%

**Figure 1. Northern fulmars with 0.1 g or more of plastic in their stomach, Sable Island, Canada, 2001 to 2023**




[1] Statistics Canada (2024) Table 38-10-0150-01 Physical Flow Account for Plastic Material, by product category. Retrieved March 1, 2025.

[2] The use of 0.1 g of ingested plastic as the baseline was determined from the 2008 Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention) Ecological Quality Objective (EcoQ). OSPAR has a long-term goal of less than 10% of northern fulmars exceeding a level of 0.1 g of plastic in their stomach.

Data for Figure 1

**Note:** A 5-year moving average is used to normalize the large variability between years. The last 2 time periods presented correspond to 5 sampling years as no samples were collected at Sable Island between 2013 and 2021. Only the Sable Island location is presented in the above figure due to having the most complete time series (14 years of sampling data).
**Source:** Environment and Climate Change Canada (2025) Ecotoxicology and Wildlife Health Division.

The difference observed from the 2001 to 2005 time period to the 2010 to 2023 time period can be attributed to a decrease in northern fulmars that were found to have more than 1 g of plastic in their stomach. The proportion of northern fulmars with more than 1 g of plastic in their stomach decreased from a high of 47% for the 2001 to 2005 time period to a low of 7% for the 2010 to 2023 time period.

Between 2001 and 2023, of all northern fulmars collected across Canada for which the number of plastic particles were recorded, 69% had at least 1 plastic particle in their stomach. One (1) bird collected off of Vancouver Island in 2009 contained 454 pieces of plastic.

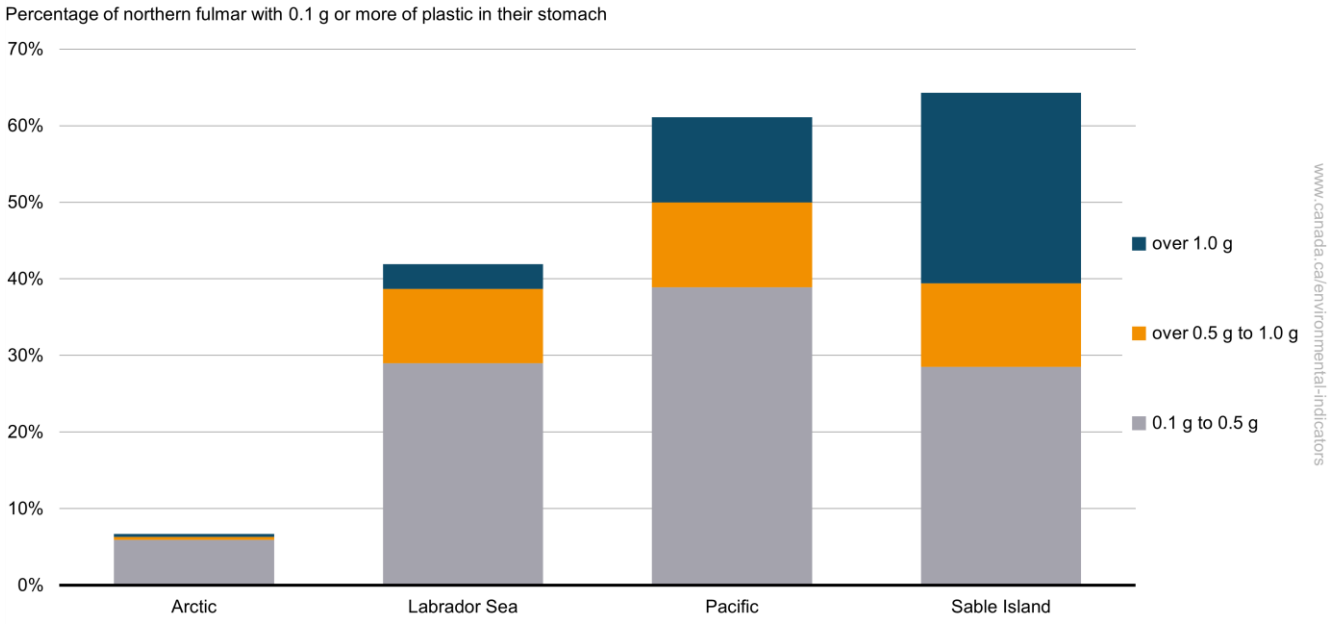
# Regional differences in plastic particles in the northern fulmar

## Key results

For the 2001 to 2023 period:

- The Arctic region had the lowest proportion (7%) of northern fulmars with 0.1 gram (g) or more of plastic in their stomach
- Sable Island, located in the Atlantic, had the highest proportion (64%) of northern fulmars with 0.1 g or more of plastic in their stomach, followed by the Pacific region with 61%
- Sable Island also had the highest proportion (25%) of fulmars with more than 1.0 g of plastic

**Figure 2. Northern fulmars with 0.1 g or more of plastic in their stomach, Canadian sampling locations, select years, 2001 to 2023**




Data for Figure 2

**Note:** No samples were collected from any location in 2014, 2016, 2017, 2019 and 2020. The years in which samples were obtained from each location are as follows: Arctic: 2002 to 2004, 2008, 2013, 2018 and 2021; Labrador Sea: 2015; Pacific: 2009; Sable Island: 2001 to 2012, 2022 and 2023.
**Source:** Environment and Climate Change Canada (2025) Ecotoxicology and Wildlife Health Division.

The proportion of northern fulmars having between 0.1 g and 1.0 g of plastic is similar for the Labrador Sea and Sable Island sample locations. The Labrador Sea, Pacific region and Sable Island locations all had a similar proportion of northern fulmars with 0.5 g to 1.0 g of plastics.

Previous studies have shown that the presence of plastic particles in northern fulmars is lower for birds collected at higher latitudes.[3] Arctic regions are more remote from shipping and industrial activities, and less exposed to the Atlantic north-flowing ocean currents, all of which could bring plastic debris into the bird's foraging range.

# About the indicator

## What the indicator measures

The Plastic particles in the northern fulmar indicator provides information on the mass of plastic found in the northern fulmars' stomach in birds collected in Canada. The northern fulmar is a widespread seabird that feeds exclusively on the surface (top 1 metre) in the open ocean, making them a useful indicator species for plastic debris in the marine environment. The indicator reports the proportion of birds with 0.1 g or more of plastic in their stomach and gives an overview of the situation at the national and the regional levels.

## Why the indicator is important

Plastics are widely used today in almost all aspects of our lives. In Canada, more than 3 million tonnes of plastic waste is thrown away every year, with only 9% of it being recycled. The remaining plastic waste ends up in landfills, facilities that convert waste to energy and the environment. The poor management of plastic waste has led plastics to be widely found throughout the environment. In Canada, it is estimated that about 1% of plastic waste makes its way into the environment, amounting to roughly 40 400 tonnes in 2020.[4] Plastic pollution has been found on shorelines, in surface waters, sediment, soil, groundwater, indoor and outdoor air, drinking water, food and the digestive tracts of animals.

This extensive pollution harms marine wildlife such as seabirds, whales, fish and turtles, which can mistake plastic waste for prey and/or suffer from lacerations, infections, reduced ability to swim, and internal injuries. It can also compromise food security, human health, and coastal tourism. The quantity of litter ingested and found in animal stomachs or intestines, in particular persistent materials such as plastics, reflects the abundance of marine litter and the associated harm to wildlife and the marine ecosystem. The ability to monitor the presence of plastics in this species of birds will inform science-based policy and regulatory decisions related to plastic pollution.

Globally, it is estimated that only about 30% of all plastics ever produced are still in use. This means that about 6 300 million tonnes of plastic pollution was created between 1950 and 2015.[5] Plastic waste makes up 80% of all marine litter and has been detected on shorelines around the world. Floating plastic debris currently makes up the most abundant items of marine litter. Under Canada's G7 presidency in 2018, Canada championed the development of the Ocean Plastics Charter to move toward a more sustainable approach to producing, using and managing plastics.

## Related initiatives

The indicator is used for reporting progress on Target 7 of Canada's 2030 Nature Strategy: Pollution and biodiversity. This target is related to the Kunming-Montreal Global Biodiversity Framework Target 7: “Reduce pollution risks and the negative impact of pollution from all sources, by 2030, to levels that are not harmful to biodiversity and ecosystem functions and services, considering cumulative effects, including: reducing excess nutrients lost to the environment by at least half including through more efficient nutrient cycling and use; reducing

[3] Baak JE et al. (2020) Plastic ingestion by four seabird species in the Canadian Arctic: Comparisons across species and time. Marine Pollution Bulletin 158: 111386.

[4] Statistics Canada (2024) Table 38-10-0150-01 Physical Flow Account for Plastic Material, by product category. Retrieved March 1, 2025.

[5] Environment and Climate Change Canada (2020) Science assessment of plastic pollution. Retrieved March 1, 2025.

the overall risk from pesticides and highly hazardous chemicals by at least half including through integrated pest management, based on science, taking into account food security and livelihoods; and also preventing, reducing, and working towards eliminating plastic pollution."

In addition, the indicator contributes to the Sustainable Development Goals of the 2030 Agenda for Sustainable Development. It is linked to the 2030 Agenda's Goal 12, Life below water, and Target 14.1, "By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution."

### Related indicators

The Solid waste diversion and disposal indicator reports on the total quantity and quantity per person of non-hazardous solid waste diverted and disposed by municipal governments and businesses in the waste management industry. The indicator also reports the types of materials diverted, including plastics.

## Data sources and methods

### Data sources

Data on plastic ingestion in the northern fulmar used in this indicator were provided by Environment and Climate Change Canada's Ecotoxicology and Wildlife Health Division in the Wildlife and Landscape Science Directorate. Plastic mass data were computed from volunteer reporting and scientific studies.

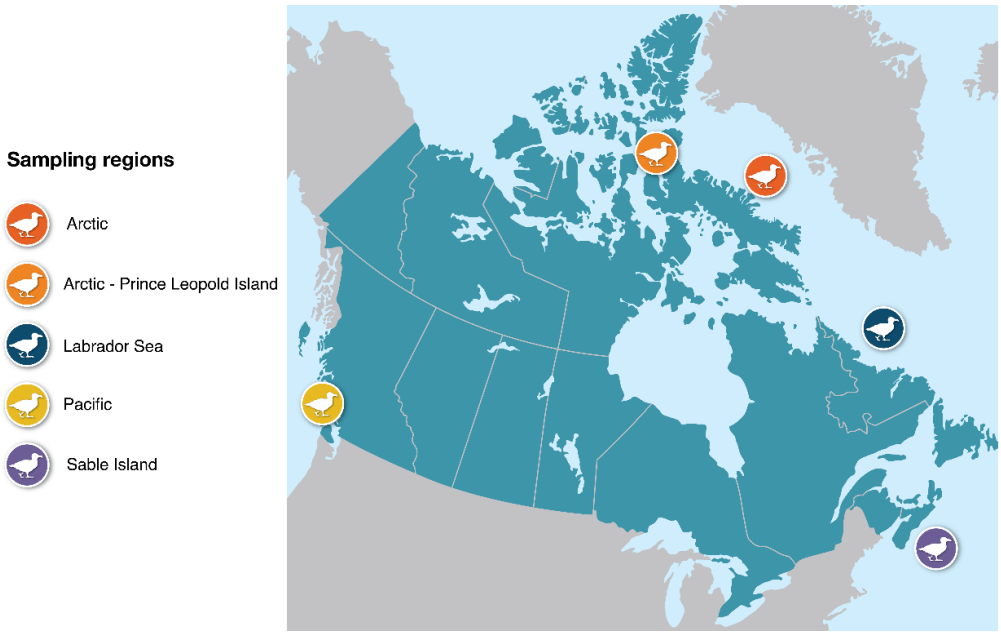
#### More information

Environment and Climate Change Canada's Ecotoxicology and Wildlife Health Division compiled information from a variety of networks which include beached birds, fisheries by-catch, ship strikes, rehabilitation centres, collaboration with hunters, and scientific research collection. The data were collected opportunistically and are not the result of monitoring programs.

#### Spatial coverage

The indicator provides coverage for 4 sampling regions: the Labrador Sea, Sable Island, the Pacific region and the Arctic region (which includes samples collected at Prince Leopold Island). Those regions are representative of the northern fulmar's distribution over the northern Atlantic, Pacific, and Arctic oceans.

**Figure 3. Northern fulmar sampling regions**




### Temporal coverage

The indicator is calculated using data for the years 2001 to 2023. Since the data gathering is opportunistic, data were not available for each year in each sampling region. No data were reported from any sample location for the years 2014, 2016, 2017, 2019 and 2020.

## Methods

The Plastic particles in the northern fulmar indicator measures the proportion of northern fulmars in which a mass of plastics of 0.1 gram (g) or more has been found. This proportion is broken down into 3 categories, corresponding to different mass ranges:

- the mass of plastics is equal or greater than 0.1 g but equal or lower than 0.5 g
- the mass of plastics is greater than 0.5 g but equal or lower than 1.0 g
- the mass of plastics is greater than 1.0 g

The percentages are calculated by dividing the number of northern fulmars with a mass of plastics falling in the same mass category by the sample size (total number of birds collected and analyzed).

### More information

The reference level for the presence of plastics in the stomach of northern fulmars (or any marine organism) is 0. However, accepting that incidental losses are unavoidable, a baseline of 0.1 gram (g) of ingested plastic was established by the Oslo-Paris Convention (OSPAR) Commission as the Ecological Quality Objective (EcoQO) for its indicator on Plastic particles in fulmars. This reference value was also used more recently under the European Union's Marine Strategy Framework Directive (MSFD) and the MSFD Technical Group Marine Litter. It was determined from the data taken in the relatively unpolluted Canadian Arctic.

The plastic mass of each sample corresponds to the sum of the weight of all plastic pieces above 1 millimetre (mm) collected from the carcass.

Typically, once collected the birds are frozen until analysis. Bird carcasses are given an identification number. Dissection of carcasses is the most commonly used technique for assessing ingested plastics in seabirds. Dissection methods follow standard protocols developed specifically for northern fulmars. During the dissection, information is collected to help determine sex, age, breeding status, likely cause of death, origin, condition index and other issues. All plastic pieces over 1 mm are counted and recorded

individually for each individual. For each sample, the total number of ingested plastic pieces, as well as their mass (g) and size (length and width; mm) are recorded. Similar monitoring is performed by other countries, especially those bordering the North Sea.

**Northern fulmar**

Northern fulmars are seabirds that belong to the tube-nosed bird families of albatrosses and petrels. The seabird is the most widely studied taxa group when it comes to plastics research as seabirds are effective biological monitors for floating marine plastics. Northern fulmars do not forage on land or freshwater and only go ashore to breed. Northern fulmars feed and ingest plastic at the surface of the ocean where there is a high density of marine plastics. This makes northern fulmars a good indicator species of marine plastic pollution.

**Figure 4. A northern fulmar**

The global northern fulmar population is estimated at around 7 000 000 birds and the species has a wide distribution over the northern North Atlantic, Pacific, and Arctic Oceans. In Canada, important northern fulmar biodiversity areas include Bailarge Bay, Buchan Gulf, Cape Searle, Cape Vera, Hobhouse Inlet, Prince Leopold Island, Reid Bay, and Scott Inlet, which are all located in Nunavut.

Monitoring the stomach contents of the northern fulmar offers a relatively inexpensive strategy for monitoring plastic pollution as the birds provide information about spatial patterns and trends of plastic pollution over the area where they forage.

In addition, the northern fulmar is the only species that has a published and standardized plastic ingestion study protocol allowing the studies to be internationally comparable.

**Plastic particles in the northern fulmar**

As the data may vary between years and locations, the plastic particles in the northern fulmar are calculated using the samples from 5-year periods. The EcoQO for plastic particles in seabird stomachs developed by the OSPAR Commission recommends that the number of fulmars collected and analyzed should be between 50 to 100 over a period of 5 years.

When no data were available for a given year, a period of 5 sampling years was considered. For example, the 2011 to 2018 time period includes data from the years 2011, 2012, 2013, 2015 and 2018.

**Regional plastic particles in the northern fulmar**

The regional plastic particles in the northern fulmar indicator presents the percentage of fulmars that have 0.1 g or more of plastic in their stomach for 4 sampling locations (the Labrador Sea, Sable Island, the

Pacific region and the Arctic region). For each sampling location, the sample size corresponds to the number of individuals that have been collected and analyzed over the period from 2001 to 2023.

### Caveats and limitations

Sample collection, processing, plastic quantification and reporting methods may have not been consistent through all sampling years. However, standardized methods have been developed and all samples collected since 2007 use these standardized methods. The next update of the indicator will include information on the types of plastics found.

The data are obtained through opportunistic carcass collection or specific (non-monitoring) studies limited in spatial and temporal coverage. These sampling methods create large temporal gaps in some regions and does not ensure representative sample sizes. It can influence the results of temporal and regional analyses.

Notably, the number of fulmar carcasses collected over the period from 2001 to 2023 in the Pacific and Labrador Sea regions were, respectively, 36 and 31. These sample sizes do not meet the OSPAR Commission's recommendations of 50 to 100 fulmars collected over a period of 5 years.

Plastic mass data used in the indicator does not differentiate the age of the birds collected. Results could be influenced by the proportion of juveniles or the breeding status of adults.

The protocols for assessing plastic particles in fulmars is restricted to pieces greater than 1 mm, therefore while some smaller pieces may be reported, this indicator is limited to patterns in plastic pollution over the 1 mm size.

## Resources

### References


Baak JE, Provencher JF and Mallory ML (2020) Plastic ingestion by four seabird species in the Canadian Arctic: Comparisons across species and time, Marine Pollution Bulletin 158: 111386.

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### Related information

A guide to plastic in the ocean

Canada's Zero Plastic Waste Agenda

Ocean Plastics Charter

Strategy on zero plastic waste

# Annex

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

**Table A.1. Data for Figure 1. Northern fulmars with 0.1 g or more of plastic in their stomach, Sable Island, Canada, 2001 to 2023**

| Sample period | Sample size | Proportion of northern fulmars with less than 0.1 g of plastic (percentage) | Proportion of northern fulmars with 0.1 g to 0.5 g of plastic (percentage) | Proportion of northern fulmars with more than 0.5 g to 1.0 g of plastic (percentage) | Proportion of northern fulmars with more than 1.0 g of plastic (percentage) |
|---|---|---|---|---|---|
| 2001-2005 | 53 | 15 | 26 | 11 | 47 |
| 2002-2006 | 64 | 19 | 30 | 11 | 41 |
| 2003-2007 | 95 | 33 | 25 | 8 | 34 |
| 2004-2008 | 109 | 34 | 26 | 9 | 31 |
| 2005-2009 | 117 | 31 | 24 | 11 | 34 |
| 2006-2010 | 87 | 41 | 25 | 10 | 23 |
| 2007-2011 | 107 | 40 | 28 | 11 | 21 |
| 2008-2012 | 79 | 33 | 32 | 15 | 20 |
| 2009-2022 | 67 | 30 | 33 | 16 | 21 |
| 2010-2023 | 60 | 48 | 35 | 10 | 7 |

**Note:** Totals may not add up due to rounding. A 5-year moving average is used to normalize the large variability between years. The last 2 time-periods presented correspond to 5 sampling years as no samples were collected between 2013 and 2021. Only the Sable Island location is presented in the above table due to having the most complete time series (14 years of sampling data).
**Source:** Environment and Climate Change Canada (2025) Ecotoxicology and Wildlife Health Division.

**Table A.2. Data for Figure 2. Northern fulmars with 0.1 g or more of plastic in their stomach, Canadian sampling locations, select years, 2001 to 2023**

| Sampling location | Sample size | Proportion of northern fulmars with less than 0.1 g of plastic (percentage) | Proportion of northern fulmars with 0.1 g to 0.5 g of plastic (percentage) | Proportion of northern fulmars with more than 0.5 g to 1.0 g of plastic (percentage) | Proportion of northern fulmars with more than 1.0 g of plastic (percentage) |
|---|---|---|---|---|---|
| Arctic | 236 | 93.2 | 5.9 | 0.4 | 0.4 |
| Labrador Sea | 31 | 58.1 | 29.0 | 9.7 | 3.2 |
| Pacific | 36 | 38.9 | 38.9 | 11.1 | 11.1 |
| Sable Island | 193 | 35.8 | 28.5 | 10.9 | 24.9 |

**Note:** Totals may not add up due to rounding. No samples were collected from any location in 2014, 2016, 2017, 2019 and 2020. The years in which samples were obtained from each location are as follows: Arctic: 2002 to 2004, 2008, 2013, 2018 and 2021; Labrador Sea: 2015; Pacific: 2009; Sable Island: 2001 to 2012, 2022 and 2023.
**Source:** Environment and Climate Change Canada (2025) Ecotoxicology and Wildlife Health Division.

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