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PLASTIC PARTICLES IN THE NORTHERN FULMAR

CANADIAN ENVIRONMENTAL
SUSTAINABILITY INDICATORS



Canada 

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Environment and Climate Change Canada
Public Inquiries Centre
12th Floor Fontaine Building
200 Sacré-Coeur Blvd
Gatineau QC K1A 0H3
Telephone: 1-800-668-6767 (in Canada only) or 819-938-3860
Fax: 819-938-3318
Email: ec.enviroinfo.ec@canada.ca

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CANADIAN ENVIRONMENTAL SUSTAINABILITY INDICATORS

PLASTIC PARTICLES IN THE NORTHERN FULMAR

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Plastic particles in the Northern Fulmar

Plastics have become part of the everyday lives of Canadians and populations around the world. Poor waste management, as well as improper disposal, have resulted in large amounts of plastic waste entering the environment as plastic pollution. Globally, it is estimated that about 8 million tonnes of plastic pollution enter the oceans every year. This plastic waste can be unintentionally ingested by seabirds, such as the Northern Fulmar (*Fulmarus glacialis*), which feed at the surface of the oceans. Sampling plastic in the stomachs of seabirds provides information on plastic pollution on the surface of Canada’s oceans. The indicator described here reports the percentage of Northern Fulmars with 0.1 gram (g)¹ or more of plastic in their stomachs at a national and a regional level.

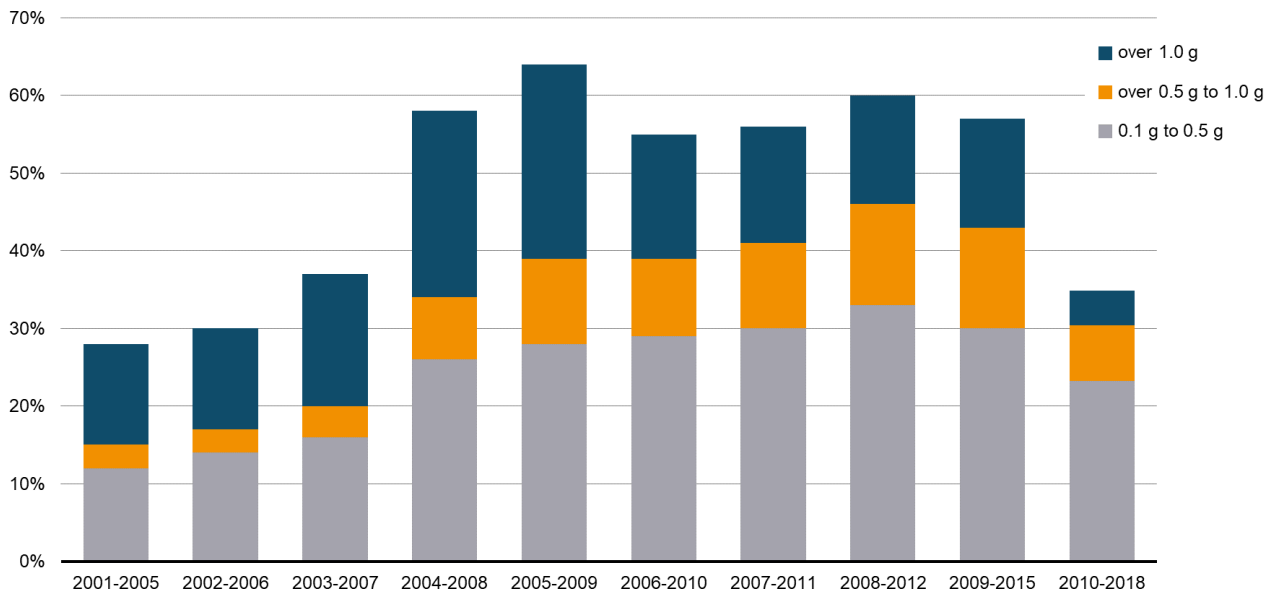
Key results

For the time-periods between 2001 and 2018:

- Between 28% and 63% of Northern Fulmars had 0.1 gram (g) or more of plastic in their stomach
- The proportion of Northern Fulmars with 0.1 g to 0.5 g of plastic in their stomach increased from 12% to 23%, with a peak at 33% for the 2008 to 2012 time-period
- The proportion of Northern Fulmars with 0.5 g to 1.0 g of plastic in their stomach increased from 3% to 7%, with a peak at 13% for the 2008 to 2012 and 2009 to 2015 time periods

Figure 1. Northern Fulmars with 0.1 g or more of plastic in their stomachs, Canada, 2001 to 2018

Percentage of Northern Fulmars with 0.1 g or more of plastics in their stomach



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[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 (2009 to 2015 and 2010 to 2018) correspond to 5 sampling years as no samples were collected in 2013, 2014, 2016 and 2017.

Source: Environment and Climate Change Canada (2020) Ecotoxicology and Wildlife Health Division.

Between 2001 and 2018, 69% of the Northern Fulmars collected from across Canada had plastic particles in their stomach.

¹ 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 stomachs.

The proportion of seabirds with 0.1 g or more of plastic in their stomach increased slightly during the first 3 time-periods (from 28% to 37%). This proportion increased to 58% in the 2004 to 2008 time-period and has remained higher until the 2010 to 2018 time-period where it decreased to 35%.² The lower proportions observed for the first 3 time-periods and the last time-period (2010 to 2018) may be influenced by a sampling bias since a high proportion (between 41% to 73%) of the birds analyzed during these time-periods were collected in the Arctic region, which is considered less exposed to plastic pollution.

Regional differences in plastic particles in the Northern Fulmar

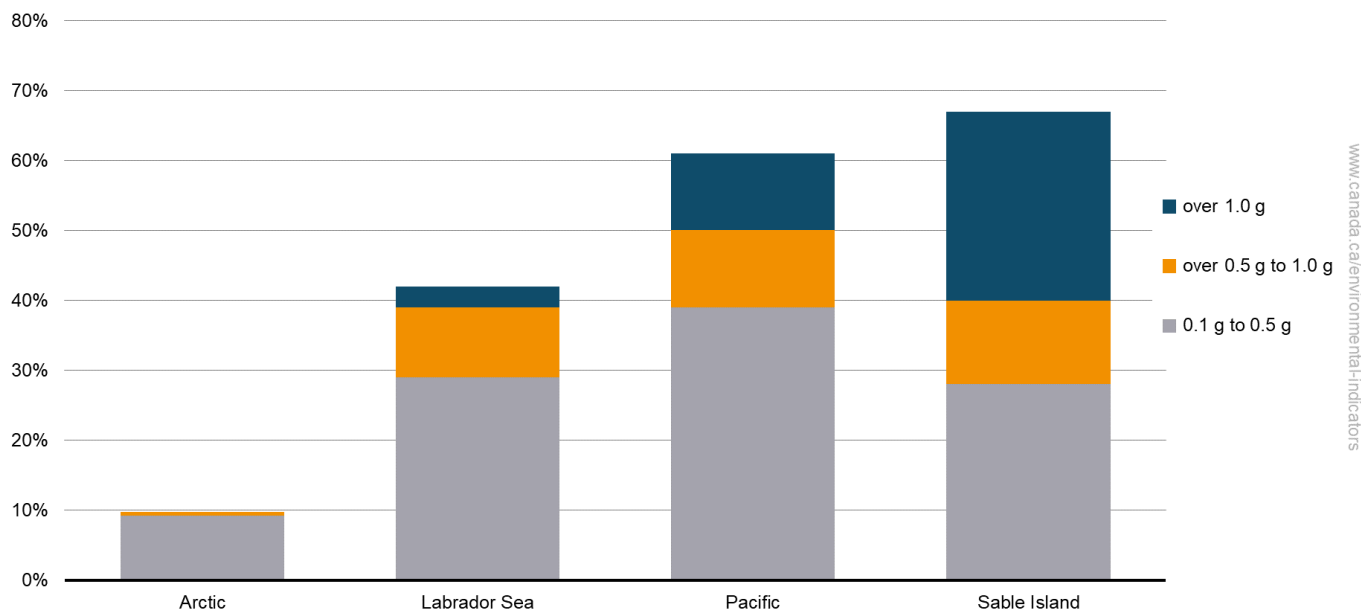
Key results

For the 2001 to 2018 period:

- The Arctic region had the lowest proportion (10%) 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 (67%) of Northern Fulmars with 0.1 g or more of plastic in their stomach
- Sable Island also had highest percentage (27%) 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, 2001 to 2018

Percentage of Northern Fulmars with 0.1 g or more of plastics in their stomach



[Data for Figure 2](#)

Note: No samples were collected in 2013, 2014, 2016 and 2017.

Source: Environment and Climate Change Canada (2020) Ecotoxicology and Wildlife Health Division.

The proportion of Northern Fulmars having between 0.1 g and 1.0 g is similar for the Labrador Sea, the Pacific and Sable Island sample locations.

² Calculation was made using unrounded data. Value differs from data presented on Figure 1 and its corresponding data table.

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 seabird that feeds exclusively on the surface (top 1 metre) in the open ocean. The indicator reports the proportion of birds with 0.1 g or more of plastic in their stomachs and gives an overview of the situation at the national and the regional levels.

Why the indicator is important

Plastic pollution is one of the largest global environmental challenges. Over 300 million tons of plastic are produced every year, half of which is used to produce single-use items such as shopping bags, cups and straws.⁴

Globally, it is estimated that about 8 million tonnes of plastic pollution enter the oceans every year. Waste plastic 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. In recognition of the importance and urgency of the issue, Canada signed the [Ocean Plastics Charter](#) to move toward a more sustainable approach to producing, using and managing plastics.

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.



Healthy coasts and oceans

The indicator supports the measurement of progress towards the following [2019 to 2022 Federal Sustainable Development Strategy](#) long-term goal: Coasts and oceans support healthy, resilient and productive ecosystems.

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."

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.

³ Baak JE et al. (2020) [Plastic ingestion by four seabird species in the Canadian Arctic: Comparisons across species and time](#), Marine Pollution Bulletin, Volume 158, 2020. Retrieved on July 20, 2020.

⁴ International Union for Conservation of Nature (2020) [Issues Brief: Marine plastics](#). Retrieved on July 20, 2020.

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 four sampling regions: the Labrador Sea, Sable Island, Pacific and the Arctic region (which includes samples collected in 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 2018. Since the data gathering is opportunistic, data were not available for each year in each sampling region. No data were reported for the years 2013, 2014, 2016 and 2017.

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.

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 2009 to 2015 time period includes data from the years 2009, 2010, 2011, 2012 and 2015.

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, Pacific 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 2018.

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 were used in recent years.

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 2018 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, Mallory ML (2020) [Plastic ingestion by four seabird species in the Canadian Arctic: Comparisons across species and time](#), Marine Pollution Bulletin, Volume 158, 2020. Retrieved on July 20, 2020.

BirdLife International (2020). [Species factsheet: *Fulmarus glacialis*](#). Retrieved on July 20, 2020.

International Union for Conservation of Nature (2020) [Issues Brief: Marine plastics](#). Retrieved on July 20, 2020.

Environment and Climate Change Canada and Health Canada (2020) [Draft science assessment of plastic pollution](#). Retrieved on July 20, 2020.

OSPAR Commission (2008). Background document for the EcoQO on plastic particles in stomachs of seabirds. Biodiversity Series Publication Number: 355/2008. OSPAR, London, 18pp. Retrieved on July 20, 2020.

OSPAR Commission (2017). [OSPAR Intermediate Assessment 2017 - Plastic particles in fulmar stomachs in the North Sea](#). Retrieved on July 20, 2020.

Provencher JF, Gaston AJ, Mallory ML (2009) [Evidence for increased ingestion of plastics by Northern Fulmars \(*Fulmarus glacialis*\) in the Canadian Arctic](#). Marine Pollution Bulletin 58(7): 1092-1095. Retrieved on July 20, 2020.

Provencher JF, Bond AL, Mallory ML (2015). [Marine birds and plastic debris in Canada: a national synthesis and a way forward](#). Environmental Reviews, 2015, 23:1-13. Retrieved on July 20, 2020.

Provencher JF, Borrelle SB, Bond AL, Lavers JL, van Franeker JA, Kühn S, Hammer S, Avery-Gomm S, Mallory ML (2019) [Recommended best practices for plastic and litter ingestion studies in marine birds: collection, processing, and reporting](#). FACETS 4, 111–130. Retrieved on July 20, 2020.

Related information

Canadian Council of Ministers of the Environment (2018) [Strategy on zero plastic waste](#).

Environment and Climate Change Canada (2020) [Ocean Plastics Charter](#).

National Oceanic and Atmospheric Administration (2020) [A guide to plastic in the ocean](#).

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 stomachs, Canada, 2001 to 2018

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	197	72	12	3	13
2002-2006	208	70	14	3	13
2003-2007	197	63	16	4	17
2004-2008	146	42	26	8	24
2005-2009	178	37	28	11	25
2006-2010	148	45	29	10	16
2007-2011	168	43	30	11	15
2008-2012	140	40	33	13	14
2009-2015	140	44	30	13	14
2010-2018	112	65	23	7	4

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 (2009 to 2015 and 2010 to 2018) correspond to 5 sampling years as no samples were collected in 2013, 2014, 2016 and 2017.

Source: Environment and Climate Change Canada (2020) 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, 2001 to 2018

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	206	90	9	1	0
Labrador Sea	31	58	29	10	3
Pacific	36	39	39	11	11
Sable Island	176	33	28	12	27

Note: For each sampling location, the sample size corresponds to the total number of birds collected and examined for the presence of plastics between 2001 and 2018. No samples were collected in 2013, 2014, 2016 and 2017.

Source: Environment and Climate Change Canada (2020) Ecotoxicology and Wildlife Health Division.

Additional information can be obtained at:

Environment and Climate Change Canada

Public Inquiries Centre

12th Floor Fontaine Building

200 Sacré-Coeur Blvd

Gatineau QC K1A 0H3

Telephone: 1-800-668-6767 (in Canada only) or 819-938-3860

Fax: 819-938-3318

Email: ec.enviroinfo.ec@canada.ca