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MARINE POLLUTION SPILLS

CANADIAN ENVIRONMENTAL SUSTAINABILITY INDICATORS

Canada

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CANADIAN ENVIRONMENTAL SUSTAINABILITY INDICATORS

MARINE POLLUTION SPILLS

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Table of contents

List of Figures

List of Tables

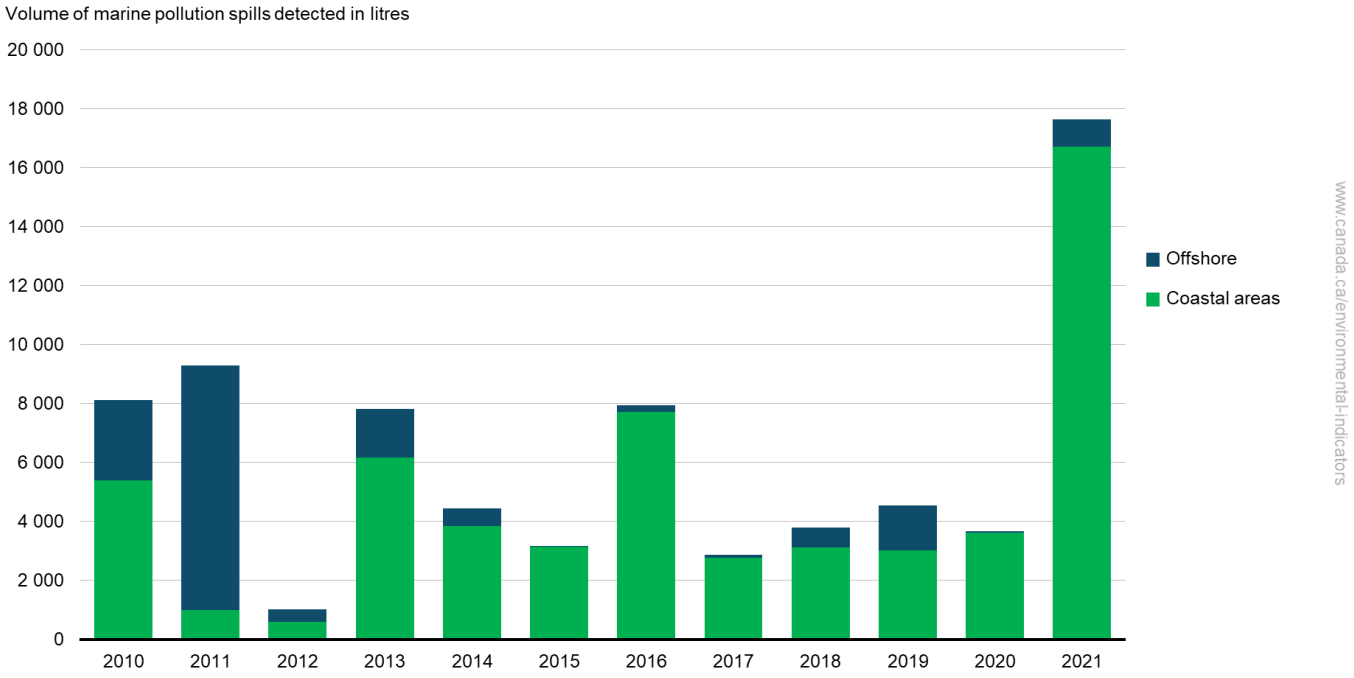
Marine pollution spills

The Government of Canada actively monitors ships in Canadian waters to help prevent pollution in our oceans and coasts as significant marine pollution spills (more specifically, hydrocarbon-based spills) can have long-term negative environmental and economic consequences. This indicator reports the volume of marine pollution spills detected by aerial surveillance.

Key results

- From 2010 to 2020, the total volume of marine pollution spills detected each year varied between 1 014 litres and 9 296 litres
- In 2021, a record high of 17 651 litres of marine pollution spills were detected, 95% of which was observed in coastal areas[1]
- The volume of marine pollution spills was typically greater in coastal areas than in offshore areas
- Since 2015, offshore spills have generally accounted for 5% or less of the volume of the spills detected each year, except in 2018 and 2019 where they accounted for 18% and 33%, respectively

Figure 1. Volume of marine pollution spills detected offshore and in coastal areas from aerial surveillance, Canada, 2010 to 2021



Data for Figure 1

Note: For the year 2021, spills over 10 litres only are reported. Year refers to fiscal year, which runs from April 1 to March 31. The year 2021 therefore refers to April 1, 2020 to March 31, 2021.
Source: Transport Canada (2021) Marine Safety and Security Directorate.

Spills are mainly detected within Canada's coastal areas, including the Canadian Great Lakes. Coastal areas have higher traffic and are at a greater risk of accidents, such as ships running aground. An aircraft can detect spills of less than 1 litre. Most spills are usually considered small (less than 10 litres). For the year 2021, only spills larger than 10 litres were reported. The spills detected in 2021 are represented in Figure 2.

[1] Coastal areas refer to areas extending 12 nautical miles from coastal baselines and to the Great Lakes.

Figure 2. Marine pollution spills detected, Canada, 2021

Note: For the year 2021, spills over 10 litres only are reported. Year refers to fiscal year, which runs from April 1 to March 31. The year 2021 therefore refers to April 1, 2020 to March 31, 2021.
Source: Transport Canada (2021) Marine Safety and Security Directorate.

The volume of marine pollution spills varies from year to year, and a single major spill can drastically affect the total volume. For example, in 2016, an oil spill from the ship M/V Marathassa accounted for 3 419 litres, which represents 44% of the total volume detected that year. The large increase observed in 2013 can be attributed to 2 ship-source spills that accounted for 5 098 litres (83% of the total volume detected).

In 2021, the volume of marine pollution spills was almost twice as much as the previous record year (9 296 litres in 2011). Three (3) separate spills amounted to 11 800 litres, which represents 67% of the total volume detected (17 651 litres).

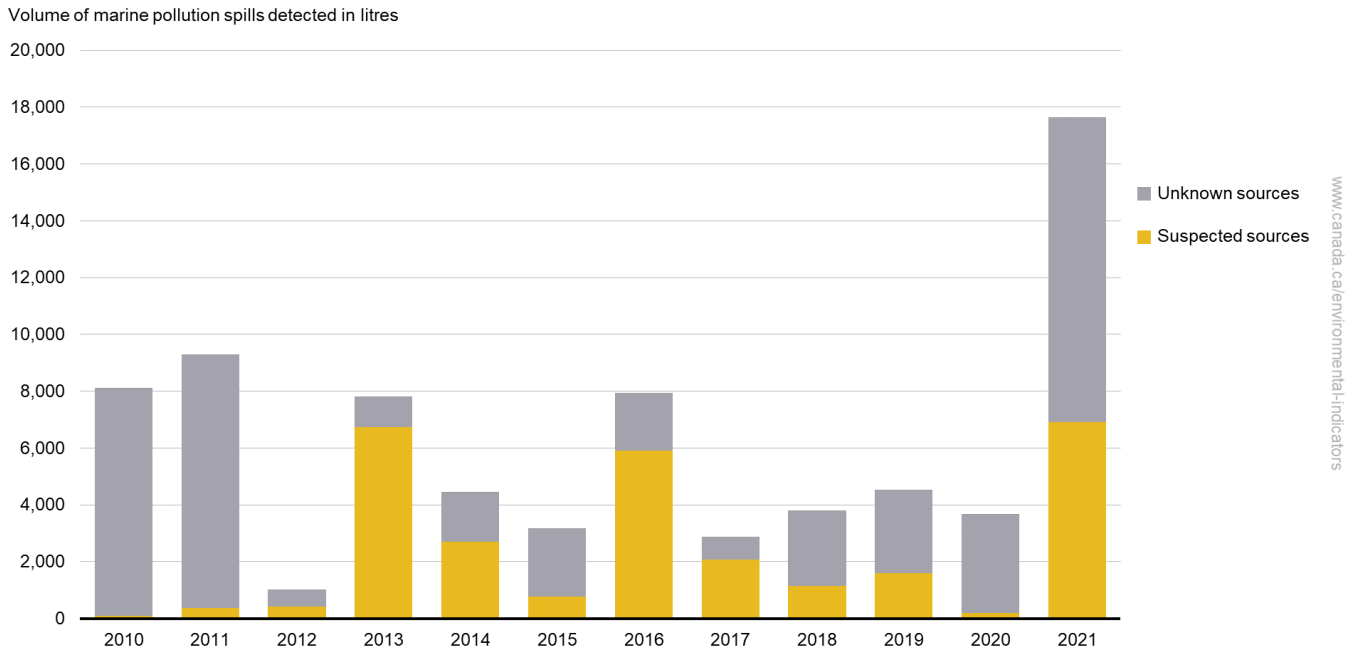
In 2021, 83% (14 688 litres) of the total volume detected originated from vessels, while spills caused by sunken vessels, oil platforms, land-based spills accounted respectively for 8% (1 414 litres), 5% (890 litres) and 4% (659 litres).

Marine pollution spills from suspected sources

Key results

- From 2010 to 2021, the proportion in volume of marine pollution spills from suspected sources[2] varied between 1% and 86%
- In 2021, 6 915 litres of spills detected were from suspected sources, which represents 39% of the total volume detected
- Since 2010, the volume of marine pollution spills from suspected sources was typically lower than from unknown sources, representing 39% of the total volume of marine pollution spills detected

Figure 3. Volume of marine pollution spills detected from suspected and unknown sources, Canada, 2010 to 2021



Data for Figure 2

Note: For the year 2021, spills over 10 litres only are reported. Year refers to fiscal year, which runs from April 1 to March 31. The year 2021 therefore refers to April 1, 2020 to March 31, 2021.
Source: Transport Canada (2021) Marine Safety and Security Directorate.

In 2021, the National Aerial Surveillance Program overflew 48 175 vessels in 3 877 patrol hours. Out of the 59 marine pollution spills detected that were over 10 litres, 16 (27%) were linked to a suspected source.

[2] A source is considered "Suspected" when the spill can be directly linked to a vessel at the time of the observation. If not, the source is defined as unknown.

Figure 4. Marine pollution spills from suspected sources, Canada, 2021

Note: For the year 2021, spills over 10 litres only are reported. Year refers to fiscal year, which runs from April 1 to March 31. The year 2021 therefore refers to April 1, 2020 to March 31, 2021.
Source: Transport Canada (2021) Marine Safety and Security Directorate.

About the indicator

What the indicator measures

The indicator reports the volume of marine pollution spills detected from 2010 to 2021 in coastal areas and offshore, as well as the volumes of spills linked to suspected sources.

Why this indicator is important

Canada has the world's longest coastline, with 243 000 kilometres along the Pacific, Arctic and Atlantic oceans, as well as the Great Lakes. Canada also has some of the most difficult waters to navigate due to extreme conditions, strong currents and frigid waters. Marine activity is growing in Canada, with total tonnage of cargo handled by Canada's port system increasing by 2.2% per year between 2010 and 2019.

Canada's National Aerial Surveillance Program monitors ships transiting waters under Canadian jurisdiction. The information gathered is used to enforce the provisions of Canadian legislation applicable to illegal discharges from ships. The indicators provide an understanding of how active surveillance impacts the occurrence of marine pollution spills. Spills come from ship operations, intentional dumping and accidents. Aerial surveillance is widely

adopted worldwide and is considered to be the most effective method for detection of marine pollution spills. The presence of surveillance aircraft acts as a deterrent by discouraging illegal discharges of pollutants at sea.

Most spills are small but over time, with many small spills, there are potential impacts on the marine environment. A large spill can lead to long-term environmental and economic consequences, especially on coastal communities. The harm to the marine environment includes impacts on fisheries, wildlife and recreation.

Contact with oil affects the insulation of mammal's fur and bird's feathers, exposing them to risks of hypothermia, and can cause birds to drown. Ingestion or inhalation of oil can lead to poisoning, reduced growth, deformities or reproduction impairment of sea mammals, birds, shellfish, fish or other small organisms, such as plankton. Oil spills on coastal areas can also have impacts on shoreline habitats, sediments, and breeding grounds.

Healthy coasts and oceans

This 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.

Related indicators

The Monitoring disposal at sea indicator reports on the number of disposal sites that show no evidence of pollution in order to determine whether marine disposal site activities have an environmental impact.

Data sources and methods

Data sources

Transport Canada’s Marine Safety and Security (MSS) Directorate and Aircraft Services Directorate (ASD) work seamlessly to deliver all the National Aerial Surveillance Program (NASP; the program) surveillance activities. MSS is responsible for the governance of the program and develop NASP requirements for program delivery. The ASD is responsible for the leadership, oversight, and implementation of the program.

The indicator includes data from 2010 to 2021. All data is compiled by fiscal years, therefore the year 2021 refers to April 1, 2020 to March 31, 2021. Data are gathered at the end of each month and analyzed by surveillance analysts at Transport Canada. Suspected source spills also include spills from oil rigs, sunken vessels and land-based incidents. Coastal areas refer to both areas which extend 12 nautical miles from coastal baselines and the Great Lakes.

More information

The program monitors ships transiting waters under Canadian jurisdiction. Evidence gathered by the program is used to enforce legislation applicable to illegal discharges from ships.

The program's aerial surveillance fleet consists of 4 specialized aircraft located across the country. One (1) aircraft is based in Moncton, another is in Vancouver, and 2 are based in Ottawa and relocate to other regions as required to provide aerial services. One of the 4 aircrafts is currently undergoing modifications and will be operational by fall 2022. They monitor shipping activities in all regions of Canada.

Aircraft contracted by other government departments are also used for surveillance. Through an agreement with Fisheries and Oceans Canada, Transport Canada uses Provincial Airlines Limited aircraft for pollution patrols over waters off Newfoundland and Labrador.

Transport Canada also uses satellite surveillance from Environment and Climate Change Canada's Integrated Satellite Tracking of Pollution program to detect illegal discharges at sea. It searches for oil-like signatures (anomalies) on the ocean's surface. This information helps direct the program's aircraft to locations of potential spills in near real time. The aircraft crew then examines anomalies to confirm if oil is present, identify the source if possible and gather evidence for prosecution. The source is considered "Suspected" when the spill can be directly linked to a vessel at the time of the observation. If not, the source is defined as unknown.

Surveillance data gathered by the program serve many additional purposes beyond marine pollution spills detection, including ice patrol, bird and whale surveys, marine security, environmental enforcement and awareness.

Transport Canada regulations and standards, under the *Canada Shipping Act, 2001* and the *Arctic Waters Pollution Prevention Act*, combined with international conventions and standards established by the International Maritime Organization, provide the framework for the department's comprehensive marine safety, pollution prevention, enforcement and oil spill preparedness and response programs.

Methods

The National Aerial Surveillance Program (NASP) provides data on the number of spills observed annually as well as a spill counts and the corresponding estimated volumes for each spills. Spill volumes are estimated by multiplying the area of the slick by its varying thickness. An airborne maritime surveillance system (MSS6000) calculates the area of a slick[3] based on a polygon drawn manually by the surveillance officer around the oil observed on the remote sensed imagery of the ocean surface. Surveillance officers estimate the oil thickness by assessing the visual characteristics of the oil slick to determine the varying thicknesses in the slick and apply a formula to calculate the volume.

More information

There is a thickness appearance relationship of oil on the water that uses the visual characteristics of the oil to classify it into categories each with an associated thickness value.

Spills are generally heterogeneous in terms of thickness. Surveillance officers determine the percentage of each oil category observed in the polygon. The volume for each oil category is calculated by the following formula:

Volume (oil category) = Total area covered in oil x Percentage of the total area covered by each category x Category Thickness Value

and

Total volume = Sum of the volumes for each oil category observed

Visual characteristics of oil are used to globally estimate volumes of thin films of oil on the ocean surface. The oil categories used in Canada are based on scientific studies that establish a direct relationship between slick thickness and visual characteristics that is valid for all oil types for films up to 3 microns (3 000 nanometres). For film thicknesses greater than 3 microns, the inherent color of the oil starts to dominate and the thickness appearance relationship breaks down. In these cases, the oil film is likely many times greater than 3 microns but cannot be discerned from aerial surveillance. This is why, when dealing with thick oil, the volume estimations made by the program should be considered as conservative estimates. This practice has been adopted in Canada as the NASP's main mandate of monitoring for and enforcement of the pollution regulations. When a pollution case goes to court or a tribunal, NASP provides an estimated minimum quantity of oil observed on the surface.

Recent changes

Since the last update, the terminology "known sources" has been changed to "suspected sources". The National Aerial Surveillance Program gathers evidence related to marine spills and identifies the suspected sources. Only after a prosecution process confirms a vessel's responsibility is a suspected source considered "known".

This indicator now presents the volumes of marine pollution spills resulting from both suspected and unknown sources, while previously it only presented the volumes from known sources. In addition, the ratio indicating the number of spills detected per patrol hour was removed as it reports on an operational performance rather than on an environmental aspect of marine spills.

[3] A slick corresponds to the film or layer of oil floating on water, specifically one that has leaked or been discharged from a ship.

Caveats and limitations

The indicator provides the volume detected by the National Aerial Surveillance Program. The data are collected for enforcement and deterrence purposes and are focused on commercial vessels. As a result, not all marine pollution spills are accounted for in this indicator. In addition, for the year 2021, NASP reported only the spills exceeding a volume of 10 litres.

Moreover, the volume of spills reported corresponds to the estimated volume at the time the spill is detected by NASP and does not necessarily capture the total volume of marine pollution released to the environment during a spill event. In addition, considering the difficulty to accurately estimate the thickness of the slicks, estimated volumes provided are conservative and are minimum quantities.

A number of additional factors may impact the volume estimate, including:

- Oil type, including whether it is persistent or non-persistent, and the speed at which is naturally disperses
- Environmental conditions such as wind speed, wave height, and visibility
- Delay between the oil release and the observation
- Observer experience

The volume of spills detected was not corrected for surveillance effort, as there is no way to differentiate the chance of detecting a large or small spill in a given hour of surveillance. Major accidents can cause large variations in the volume of spills each year, making it difficult to detect annual trends.

Resources

References

Transport Canada (2019) Report to Parliament 2011-2016 – Ship-Source Oil Spill Preparedness and Response Regime - TP 15418. Retrieved on May 3, 2021.

Transport Canada (2020) Transportation in Canada 2019 - Statistical Addendum. Retrieved on April 28, 2021.

Related information

Environmental Response Systems

International Convention for the Prevention of Pollution from Ships (MARPOL)

International Convention on Oil Pollution Preparedness, Response and Cooperation (OPRC)

National Aerial Surveillance Program

National Oil Spill Preparedness and Response Regime

Annex

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

Table A.1. Data for Figure 1. Volume of marine pollution spills detected offshore and in coastal areas from aerial surveillance, Canada, 2010 to 2021

Year	Volume of spills detected in coastal areas (litres)	Volume of spills detected offshore (litres)	Total volume of spills detected (litres)
2010	5 396	2 714	8 110
2011	1 001	8 294	9 296
2012	597	417	1 014
2013	6 172	1 642	7 813
2014	3 857	596	4 453
2015	3 146	27	3 173
2016	7 731	211	7 942
2017	2 775	103	2 878
2018	3 120	676	3 796
2019	3 029	1 505	4 534
2020	3 617	53	3 670
2021	16 723	928	17 651

Note: For the year 2021, spills over 10 litres only are reported. Year refers to fiscal year, which runs from April 1 to March 31. The year 2021 therefore refers to April 1, 2020 to March 31, 2021.
Source: Transport Canada (2021) Marine Safety and Security Directorate.

Table A.2. Data for Figure 3. Volume of marine pollution spills detected from suspected and unknown sources, Canada, 2010 to 2021

Year	Number of spills from suspected sources	Number of spills from unknown sources	Volume of spills from suspected sources (litres)	Volume of spills from unknown sources (litres)	Total volume of spills detected (litres)
2010	21	88	87	8 023	8 110
2011	11	73	374	8 922	9 296
2012	16	119	415	599	1 014
2013	14	83	6 735	1 078	7 813
2014	44	170	2 694	1 759	4 453
2015	37	285	760	2 413	3 173
2016	50	330	5 913	2 029	7 942
2017	26	220	2 071	807	2 878
2018	48	410	1 156	2 640	3 796
2019	31	598	1 603	2 931	4 534
2020	32	599	196	3 474	3 670
2021	16	43	6 916	10 735	17 651

Note: For the year 2021, spills over 10 litres only are reported. Year refers to fiscal year, which runs from April 1 to March 31. The year 2021 therefore refers to April 1, 2020 to March 31, 2021.
Source: Transport Canada (2021) Marine Safety and Security Directorate.

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