Data and Modelling for Shipping Risks

Summary of Challenges Faced in Canada

Experience with Marine Risk Assessments

Transport Canada – Area Risk Assessment (ARA)

- Developed a framework to **assess the risk of ship-source oil spills in Canadian waters**
- Piloted in four areas of Canada: Southern BC, St. Lawrence, Bay of Fundy and Chedabucto Bay

Transport Canada – Regional Risk Assessment for Northern Shelf Bioregion

- Revised the ARA based on comments from public and peer reviewers.
- **Piloted methodology** for the Northern Shelf Bioregion

Transport Canada – Risk Assessment for Ship-Source HNS Releases

- Completed an international literature review on HNS Risk Assessment and spill/accident databases
- **Estimated the likelihood of a ship-source HNS spill in Canadian waters**

Clear Seas – Special Coastal Areas

- **Identified special coastal areas** as part of Clear Seas – Marine Transportation Corridors project

What is Risk?
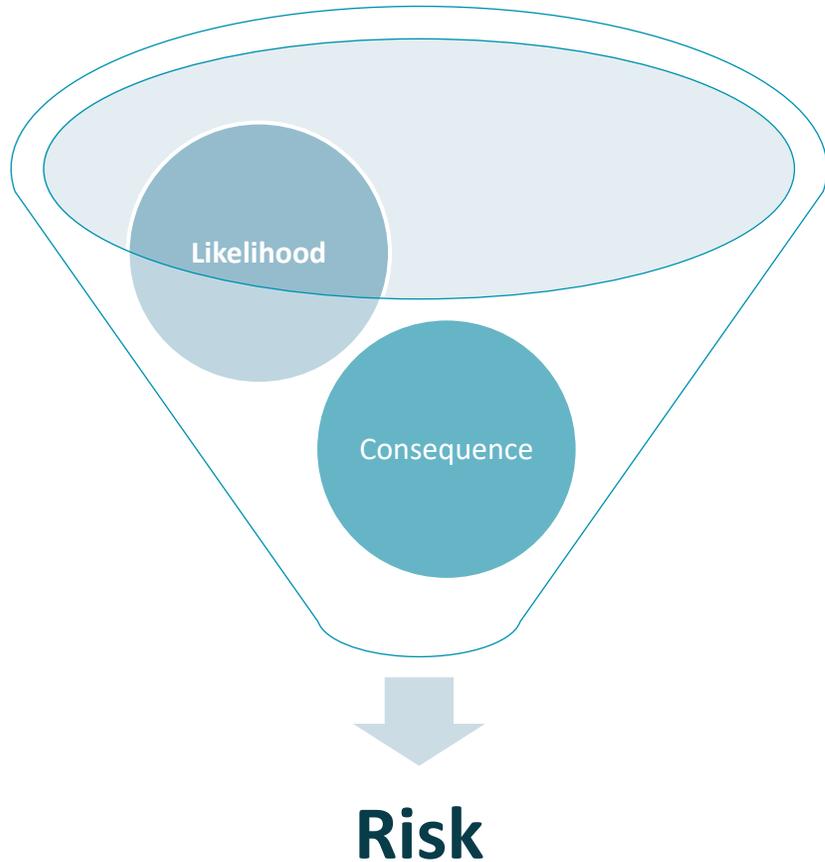
Likelihood
- Incident Rates
- Amount of Product Shipped
- Distribution of Product Across Vessel Types
- Vessel Traffic Density
- Nautical Miles travelled by Vessels
- Quality of Navigational Data

Consequence
- Incident Location
- Remedial Efforts Response
- Presence of Receptors
- Sensitivity of Receptors
- Tidal Patterns
- Types of Products (characteristics, packaging, mixing and quantity)

Data and Modelling for Shipping Risk - Challenges

Quality of Data

Lack of Systematic Reporting of Marine Accidents

Limitations of Ship Accident Models

Data and Modelling for Shipping Risks

Quality of Data

Database Consistency and Availability

- Data collected and reported differently in different regions of Canada
- Difficult to obtain information on exact volumes and types of products transported
- Detailed product data is collected but not available to be used
- Difficult to distinguish between bulk and containerized products
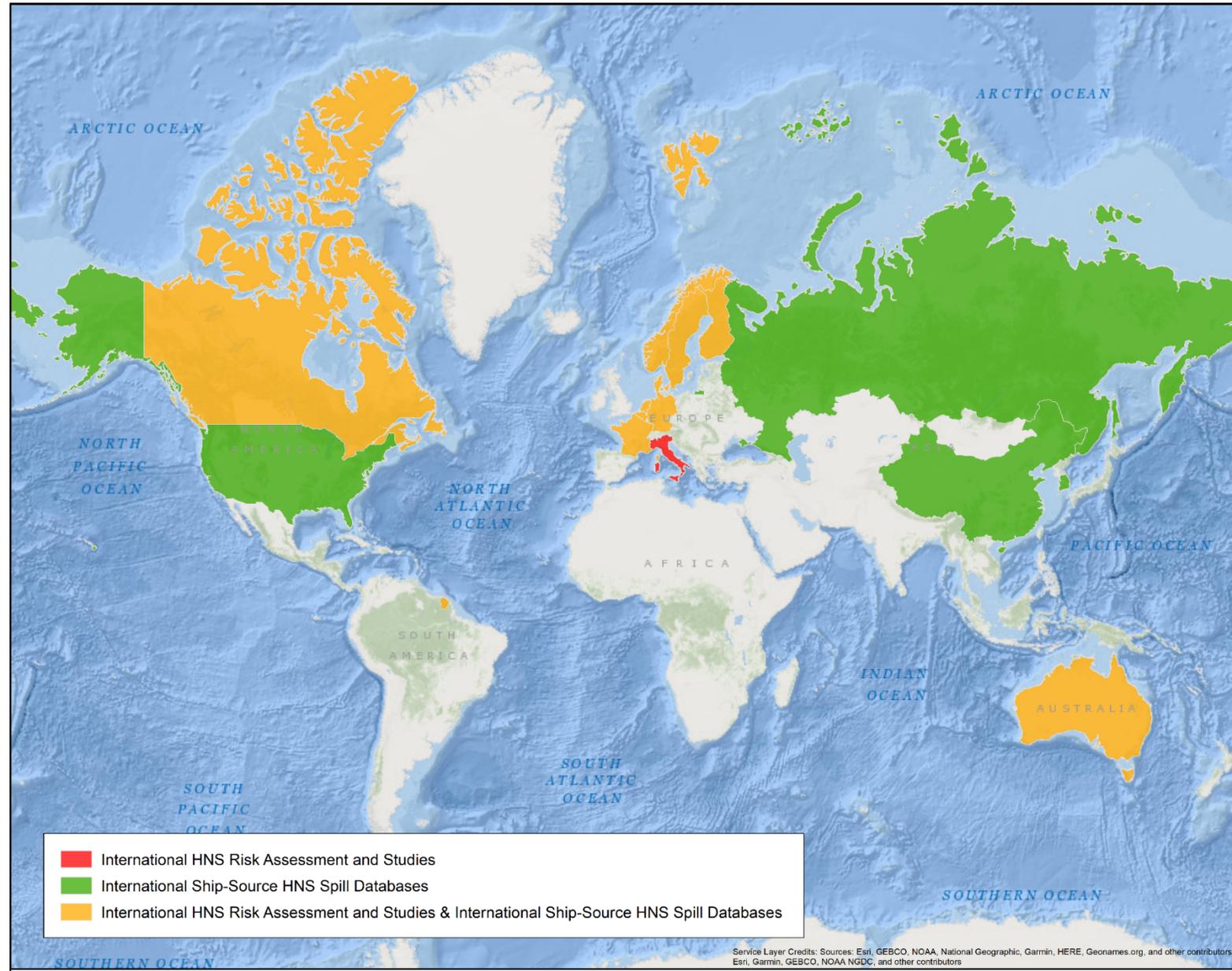
AIS Data

- Not available in necessary format and frequency in all places in Canada
  - AIS data in the arctic can be limited.
- Fishing vessels not required to carry AIS
  - yet FV responsible for over 50% of marine incidents in Atlantic Canada

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Lack of Systematic Reporting of Marine Accidents

As part of the Ship-Source HNS Risk Assessment reviewed international Risk Assessments and incident database:

- Reviewed 14 different International HNS Risk Assessments and studies
- Reviewed 12 different incident databases for incidents related to ship-source HNS spills

Data and Modelling for Shipping Risks

Legend:
- International HNS Risk Assessment and Studies
- International Ship-Source HNS Spill Databases
- International HNS Risk Assessment and Studies & International Ship-Source HNS Spill Databases

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Lack of Systematic Reporting of Marine Accidents

Name	Region	Origin	Period*	Incidents / Accidents Considered	Number of Incidents**	Number of HNS Accidents
CEDRE	World	France	1917 - 2016	Ship-sourced pollution releases	212	102
CIIMAR	World	Portugal	1973 - 2017	HNS release accidents	119	119
GISIS	World	IMO	1990 - 2018	Casualties and incidents	9,980	-
NOWPAP	China, Japan, Korea, Russia	NOWPAP	1997 - 2011	Incidents	52	-
MERRAC			2011 - 2018	Oil and HNS releases	212	-
Lloyd's List	World	United Kingdom	2016 - 2018	Causalities and incidents	1258	-
MEDGIS-MAR	Mediterranean	Europe	1977 – 2018	Incidents	980	35
Queensland Marine Spills	Queensland Australia	Queensland Australia	2002 - 2016	Incidents	845	-
EMCIP	Mediterranean	EMSA	2011- 2018	Incidents	980	-
MISLE Pollution	USA	US Coast Guard	1999 – 2015	Pollution incidents	192	-
NORDREG	Canada North of 60 degrees latitude	Canada	2008 - 2018	Incidents	393	2
TSB	Canada	Canada	2004 – 2018	Incidents	11,108	40 (10)

Lack of Systematic Reporting of Marine Accidents

What are the general conclusions of what we found?

- There are marine accident databases and marine spill databases and not are all linked.
- Databases define differently what is an incident and what is an accident
- Marine spill databases contain mainly oil spill and minimal other spill information, only 2 of them had HNS spills.
- The same incidents occurs in several databases, regions are overlapping
- Very difficult to obtain meaningful statistics on accident rates or spill rates from the databases.
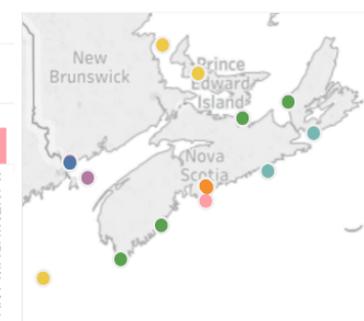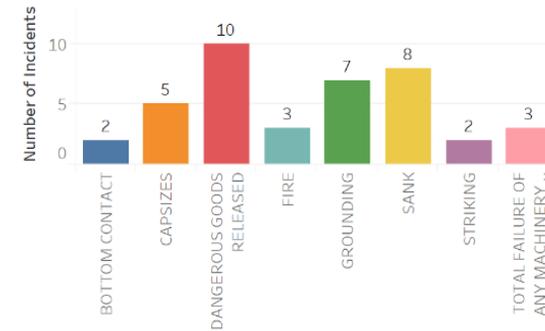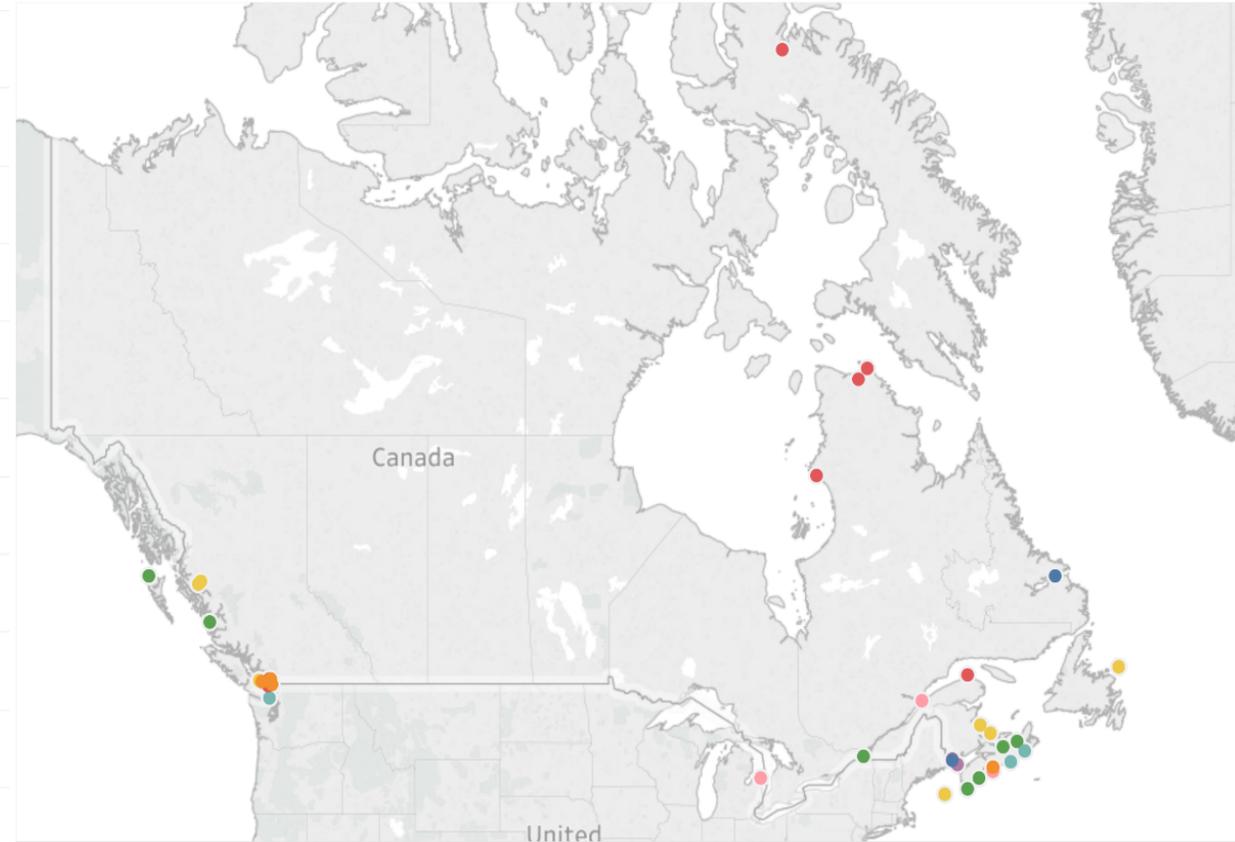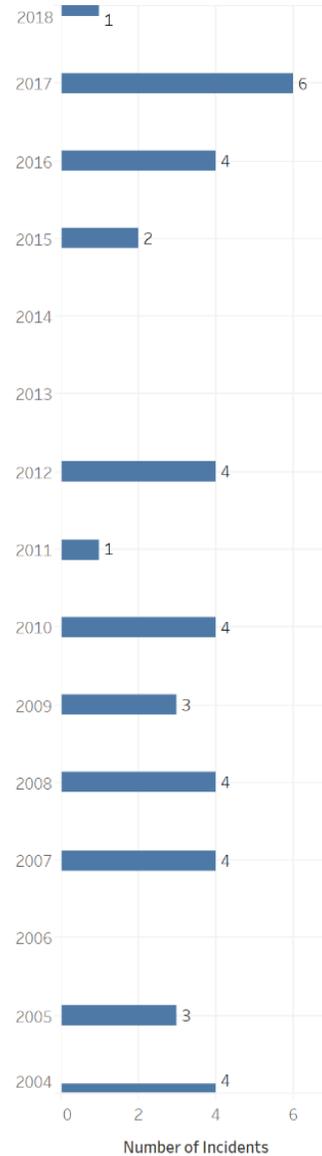
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Lack of Systematic Reporting of Marine Accidents

In Canada marine incidents and accidents are reported to the TSB:

- Shipping Accident vs Incident vs Accident Aboard Ship
- Limited analysis of root cause

Marine oil spills are reported to the Canadian Coast Guard and stored in the MPIRS database

- Reporting methodology varies across region
- Some spills are reported multiple times (1 spill has 52 reports in database)
- Standardized approach is required

Data and Modelling for Shipping Risks

Limitations of Ship Accident Models

Model Type	Examples	Advantages	Disadvantages
Volume of goods as proxy	Risk Assessment for Marine Spills in Canadian Waters (WSP 2014) Hazardous and Noxious Substance Risk Assessment along the Italian Coastline (Astiaso Garcia et al., 2013	• Proxy when don't have data to determine frequency • Requires minimal data and technical expertise to complete	• Does not use accident rates to determine likelihood, only based on volume. • Logically, most common or hazardous cargo will be considered riskiest.
Accident rate per unit distance travelled	Analysis of Risks to the Australian Marine Environment from Spills of Bulk Noxious Liquid Substances (Skinner and Hutchins, 2007) Analysis of International Accidents Involving Ship-Source HNS Releases (Dillon, 2019)	• Good for open ocean • Requires some analysis of the AIS data but do not need a detailed accident model.	• Does not include navigational challenges • Assumes same accident rate throughout the area
Comprehensive Accident Model (e.g. SAMSON)	A Qualitative Analysis of HNS Risk (MARIN, 2014) Area Risk Assessment (Dillon, 2015) RRA of Northern Shelf Bioregion (Dillon ,2019)	• Provides best estimate of likelihood of marine accidents	• Takes a long time to setup and run the model • Relies on having detailed accident statistics (not available in Canada)

Issues with consistency of the available data

AIS data

Quality of Data

Worldwide problem

Lack of root cause and useable spill database

Lack of Systematic Reporting of Marine Accidents

Depends on what accident model you are using and what results you want.

Limitations of Ship Accident Models