Regional Risk Assessment

Northern B.C. Pilot & Next Steps

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Government of Canada
Gouvernement du Canada

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Objectives

- Provide objectives and basics of Regional Risk Assessments
- Outline the approach and main results from the Northern B.C. Risk Assessment
- Provide a way forward on risk assessments
  - Potential future projects using risk assessment software and methodology

Overview

Background

- What is an RRA
- Objectives

Northern BC Risk Assessment

- Methodology
  - Probability Analysis
  - Scenario Selection & Trajectory Modelling
  - Consequences & Risk Scores

Considerations

- Advantages
- Limitations
- What we heard
- Applicability

Next Steps

What is a Regional Risk Assessment?

- A comprehensive, detailed approach to assess the risks of **ship-source oil spills** in a specific study area.
- The purpose is to determine the most vulnerable areas in the chosen marine environment, by taking into account:
  - Ship traffic volumes
  - Local geography/oceanography
  - Environmental sensitivities (biological, physical environment, and socio-economic factors)
  - Indigenous traditional knowledge and expertise, as well as localized/coastal community insights
  - Existing spill preparedness and response activities
- Designed to be evergreen and to provide response planners with information on the likely locations for oil spills and their potential environmental and socio-economic impacts. Future iterations will allow for comparing risk results over time as new information becomes available and mitigation measures are put in place.

TSEP Recommendations

In 2013, the Tanker Safety Expert Panel (TSEP) made several recommendations related to response planning, including that:

- TC should regularly review & update the national risk assessment for oil spills
  - TC should designate new Areas of Response based on the national risk assessment
- Using a consistent methodology, TC should perform regional risk assessments for each Area of Response and make the results public
  - The resident capacity that ROs maintain within their Area of Response should be based on Probable Spill Scenarios, developed as part of the RRA process and should represent all of the scenarios that could occur within the Area of Response

In response to the TSEP recommendations, TC engaged an outside consulting firm to:

- Develop a draft methodology for consistent comprehensive risk assessments of marine ship-source oil spills across Canada
- Complete four pilot risk assessments for the St. Lawrence (QC), Bay of Fundy (NB), Port Hawkesbury (NS), and Southern BC.

Northern B.C. Risk Assessment

In 2018, in support of the Regional Response Planning initiative under OPP, TC set out to:

1. Identify risks to the marine environment in northern B.C. in the event of marine ship-source oil spills, taking into consideration existing spill prevention, preparedness and response activities.
2. Work with Indigenous partners, coastal communities, local stakeholders and industry experts to fill knowledge gaps, improve current risk assessment methodology, and test draft results.
3. Obtain the tools to build capacity within TC to conduct risk analysis.

Risk Assessment process

In January 2018, TC contracted Dillon Consulting Ltd to carry out the risk assessment for northern B.C.:

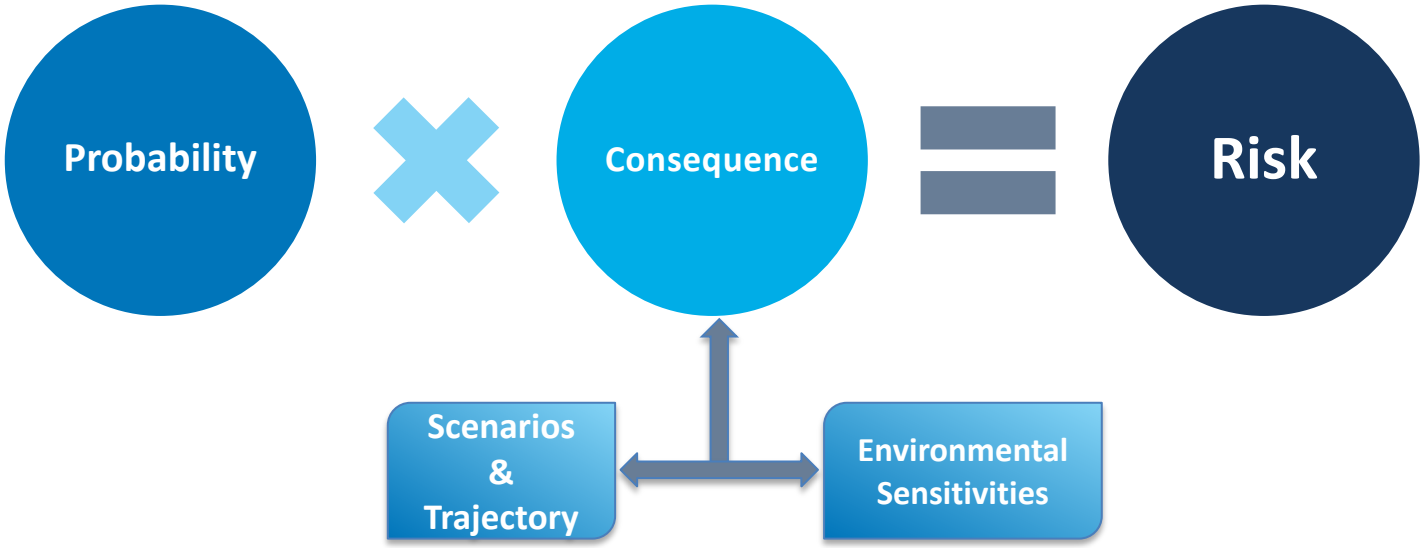
- Dillon was tasked with delivering multiple engagement activities, revising the methodology by incorporating stakeholder feedback, and carrying out the risk assessment.
- Their subcontractors included:
  - **MARIN** (Maritime Research Institute of the Netherlands) – delivered Probability modeling and analysis, and provided TC with software and training for probability analysis *(SAMSON and Showroute)*
  - **Tetra Tech** – delivered Trajectory modeling, and provided TC with software and training for trajectory analysis *(Spillcalc)*

With the completion of this contract, TC has acquired internal capacity to carry out future risk assessments

Methodology

This risk assessment has three main components:

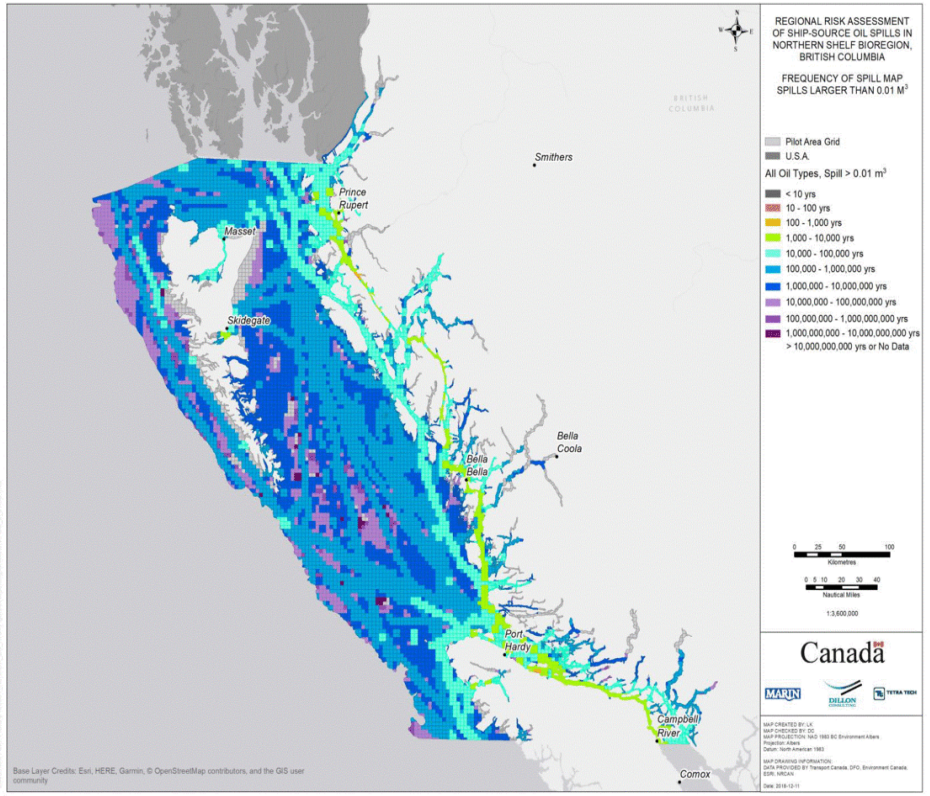
1. Calculate the likelihood / probability of an Oil Spill
2. Use spill scenarios and trajectory modelling to determine the consequences of a spill
3. Calculate the relative risk score for modelled scenarios



Methodology: 1. Probability Analysis

- Automatic Information System (AIS) data is used to analyze vessel traffic, and interactions with other vessels and the environment.
- This predicts the likelihood and location of potential incidents based on:
  - Vessel Type
  - Type of Accident (e.g. grounding, sinking)
  - Oil Spill Volume
  - Oil Type (e.g. cargo or bunker oil)
  - Environmental information (e.g. local wind, currents and bathymetry)
- National and international incident statistics are used to help calculate accident rates.
- The probability model also takes into account any preventative measures in place (such as pilotage or traffic separation schemes) to reduce the probability of an incident.

Frequency of Spill map for spills from >0.01 to 100,000 m³



- These results can be presented visually (above) and to show likely hot spots for incidents of different spill sizes, as well as providing potential scenarios for further analysis.

Methodology: 1. Probability Analysis

Shipping traffic

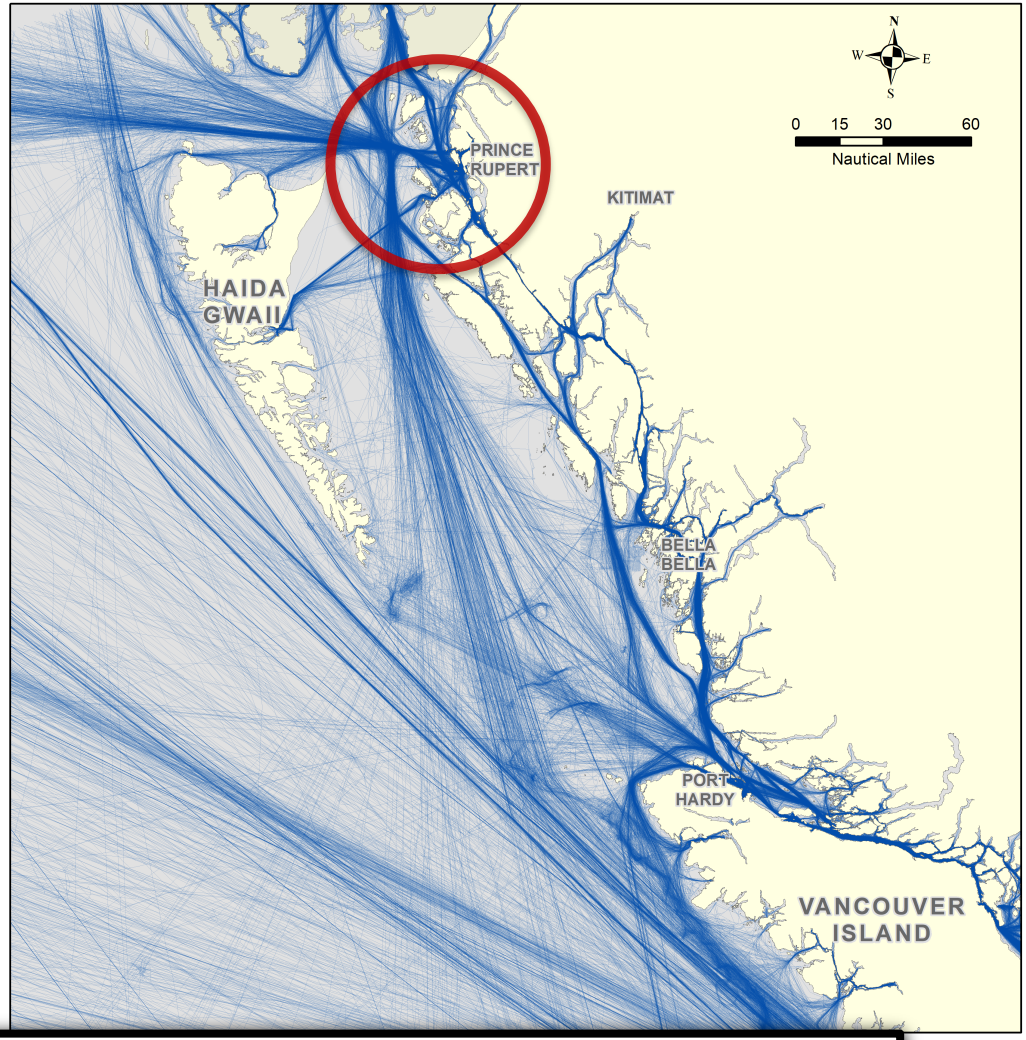
In 2015, the four vessel types with the most nautical miles (nm) sailed within the study area were:

(1) Passenger vessels
(475,000 nm)

(2) Fishing vessels
(370,000 nm)

(3) Cargo/container vessels
(300,000 nm)

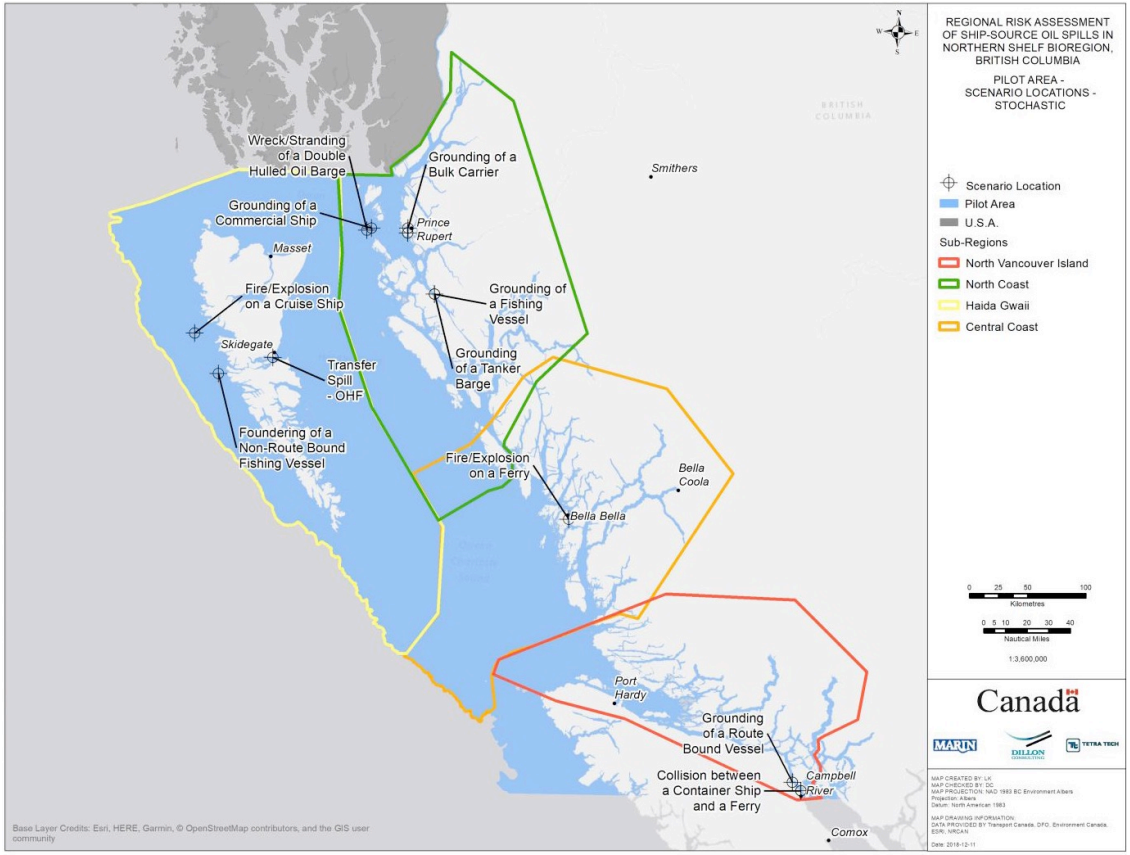
(4) Tug/barges
(245,000 nm)



Areas with greater vessel traffic show an increased probability of incidents.

Methodology: 2a. Scenario selection

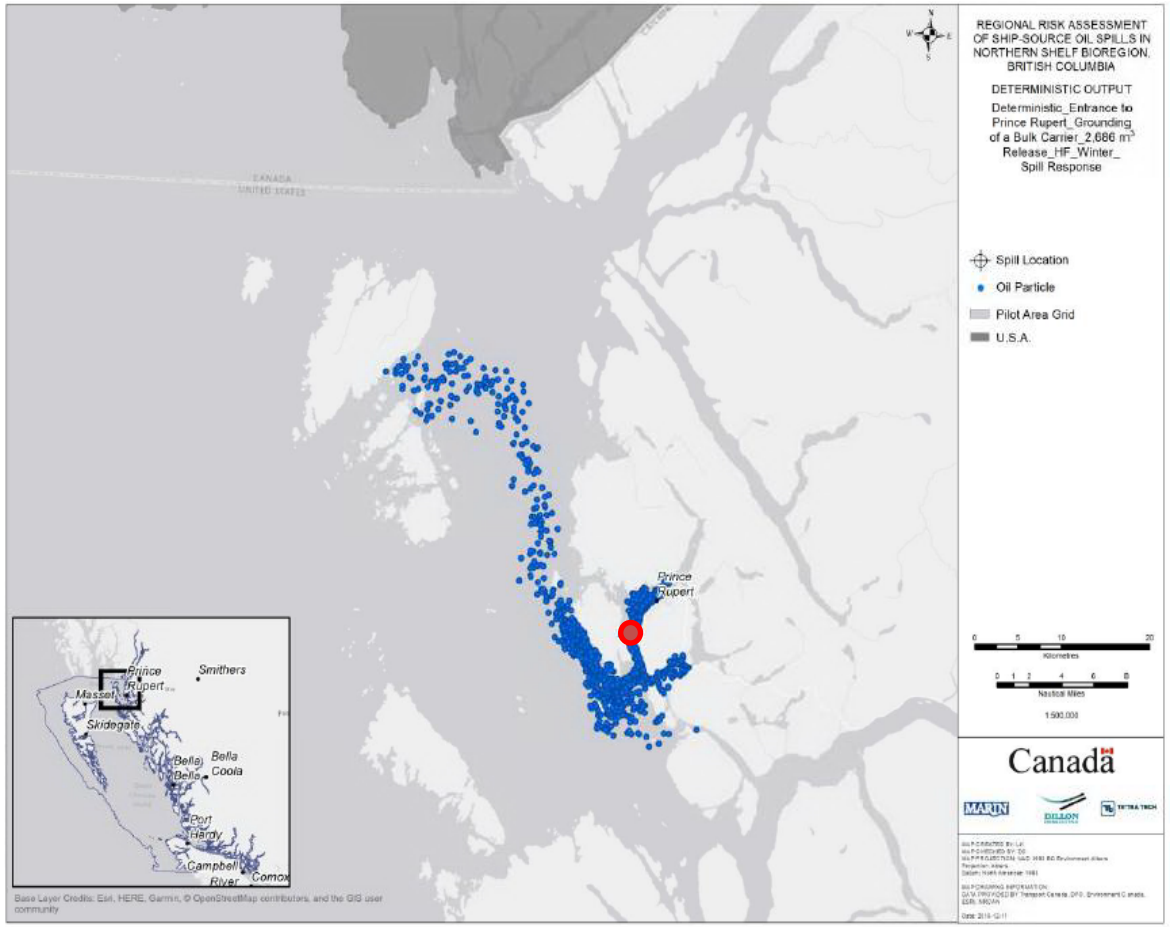
- Using the results generated by the probability analysis, different scenarios are selected for further study to determine where oil would move in given conditions
- Scenarios were selected based on:
  - Shipping traffic analysis
  - Predicted **likeliest locations** of an oil spill
  - Predicted **largest spill volume**
  - Predicted likelihood by spill size
  - **Engagement Feedback**
  - TC's input



- Scenario selection generates locations, volumes and oil categories on which to perform fate and trajectory modeling to generate risk scores

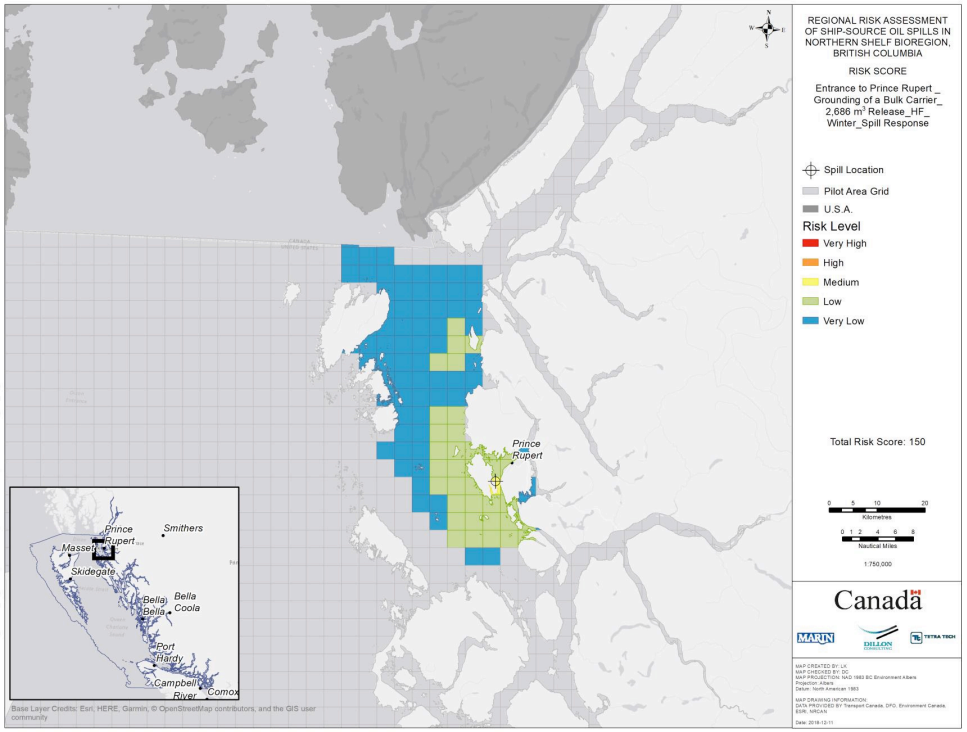
Methodology: 2b. Trajectory modelling

- For example, here's the predicted trajectory for the winter grounding of a 70K GT bulk carrier near the entrance to Prince Rupert harbour. In this scenario, a 2,700 m^3 of heavy bunker oil spill was modelled.
- This scenario was chosen because it is in an area of high traffic with multiple choke points which leads to a potentially higher probability of accidents.
- Running the modeling software for a specific set of conditions, we see how that threat would likely move south out of the channel, before moving north due to tides and currents.



Methodology: 3. Consequence Analysis

- Analyzing the presence and category of risk receptors that would be exposed to and/or impacted by oil within the Pilot Area to quantify the consequences of a spill
- Four Risk Receptor categories were included:
  - Biological Sensitivities
  - Physical Environment
  - Socio-Economic Factors
  - Indigenous and Local Aras of Interest *(new)*
- Overlaying this information with the trajectory maps from the previous step shows us which sensitive areas could be impacted

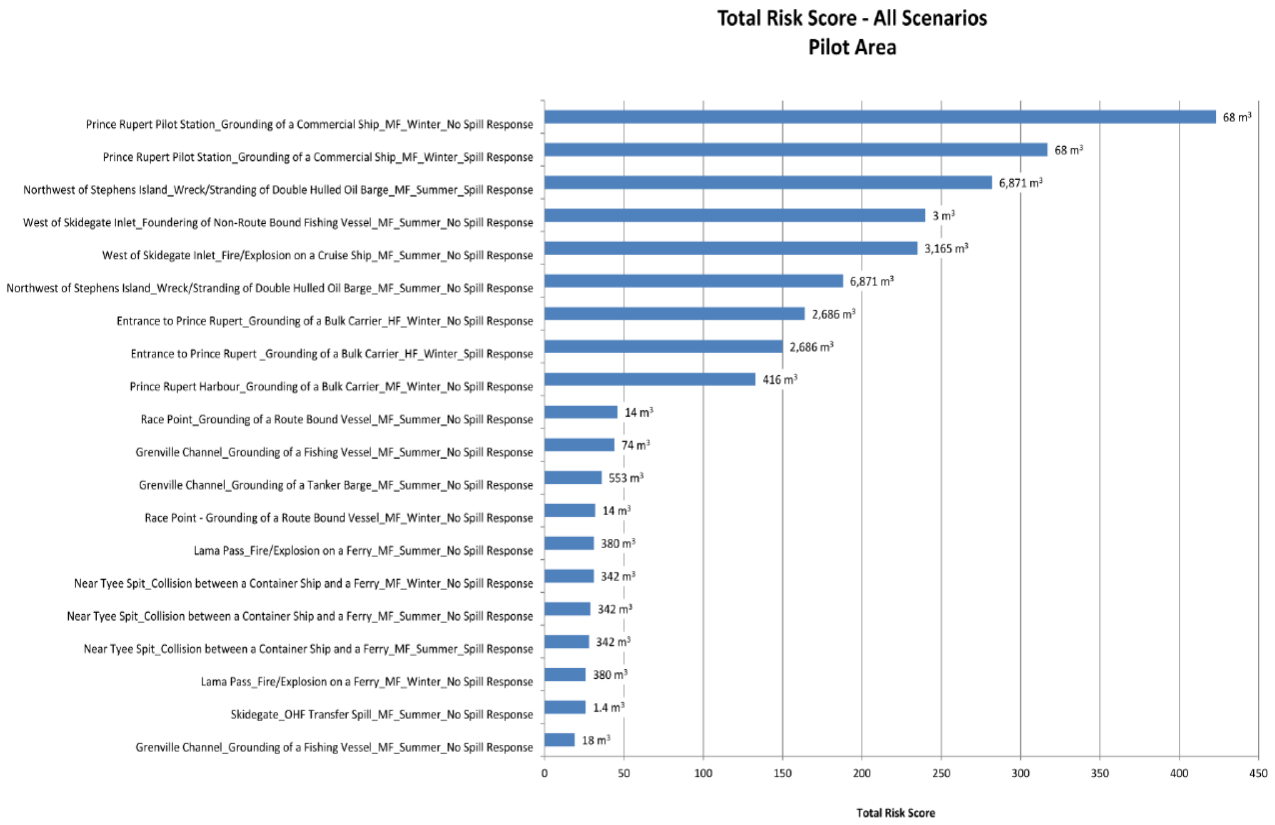


- These results can help us plan and prepare appropriately for more likely incidents
  - This helps identify how much and what types of equipment may be best suited for the area

Methodology: Risk Scores

- Total Risk Scores can be calculated for different scenarios to show **relative** levels of risk
- The most likely incidents with smaller spill volumes tend to have higher Risk Scores than unlikely higher volume spills despite larger impacts
- This is useful where relative risk needs to be considered across a larger area, such as regionally or nationally, to compare where the highest risks area located

Figure 102: Tornado Graph – Total Risk Scores for All Scenarios Analyzed in Pilot Area



Risk scores provide a means of measuring the impacts of potential scenarios and are therefore <u>representative</u>, rather than indicative of all risks in a given area.

Results: Northern B.C.

Most Likely / Highest Risk Shipping Oil Spills

- **Recreational & Fishing Vessels** (>100 t) have the highest likelihood of occurrence (1 in 10 years) but are relatively small (< 30 m^3). They are most likely to occur in Grenville Channel & Port McNeill
- **Medium Commercial Vessels and General Purpose/Medium Range Tankers** (e.g. tank barges) have the highest Risk Score due to their larger size (1000 – 5000 m^3) and higher likelihood (1 in 300 to 1000 years) than larger spills (e.g. Aframax). They are most likely to occur in the entrance to Prince Rupert Harbour, near the Triple Island Pilot Boarding Station, and in Grenville Channel

Incidents involving vessels without AIS data are known to occur more frequently, however the spills are smaller in size and tend to affect smaller areas.

Independent Peer Review

An independent peer review process was carried out to examine the strengths and weaknesses of the methodology, process and results. While it found it to be a comprehensive set of planning tools, there were some suggestions for improvements in the future:

- Involve local and Indigenous communities throughout process, including scenario selection process, and include additional knowledge that's not available using western science approaches
- Consider other time and spatial scales, including probability & oil dispersion time lengths
- When developing regionally-specific risk receptor sensitivities, incorporate broader consultations with local communities and a more extensive literature review of oil spill effects
- Include a forecasting element that allows for future changes in shipping frequency, volume of oil shipped, and changes to environmental sensitivities
- Include assessments of uncertainty in model predictions, especially for larger time periods and areas, and of the quantity and quality of data inputs to improve transparency

The peer review panel included a representative for B.C. First Nations who focused on how risk results might apply to response planning and other coastal protection measures

Advantages

Probability

- Identifies **hot spots** for ship-source oil spills based on frequency of occurrence and the volume & type of oil that would be released
- Can be layered with other geographical data, such as sensitivities or areas of concern for environmental emergency response planning (e.g. RRP) to ensure planning is geared towards areas of higher risk
- Can be used to **compare current and potential future prevention measures**
- Generates **risk maps** that highlight the level of risk within the Pilot Area at a local level

Trajectory

- Trajectory modeling simulates **how, where and when oil will move** using existing spill preparedness and response activities, local geography and environmental conditions
- Informs response approaches by predicting **how long oil will remain recoverable**
- Identifies which areas could be impacted during a spill incident

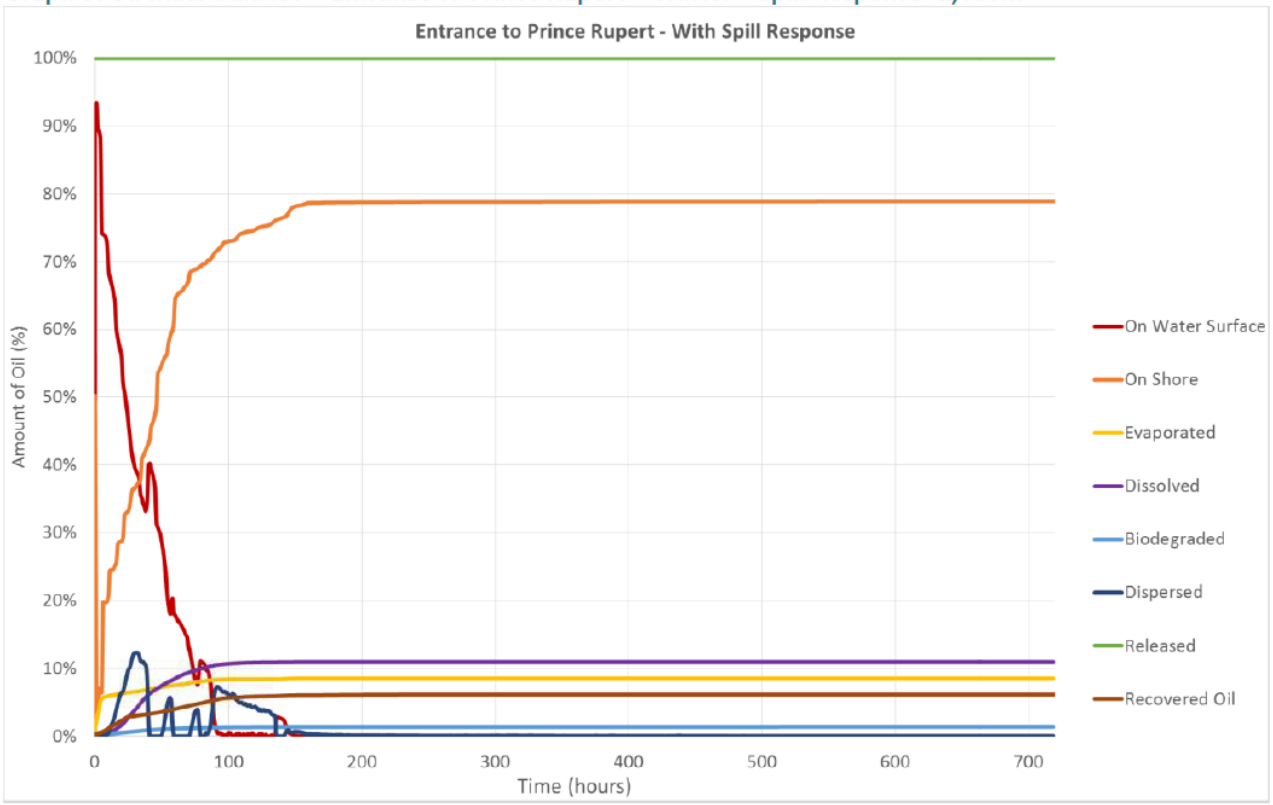
Comprehensive risk assessments performed at regular intervals have the potential to show the impact of prevention measures over time and relative risks nationally

Advantages (continued)

Trajectory:
Oil movement over time

- Trajectory software can show the **behaviour of oil** in water during a spill incident
- This type of analysis could potentially help inform response approaches by predicting **how long oil will remain recoverable**

Graph 3: Oil Mass Balance – Entrance to Prince Rupert – Winter – Spill Response- 2,686m^3



Window for response limited due to oil spill location, and mechanical recovery is <10%. Planners may want to consider preventative measures over response planning.

Limitations

Source and Type of Oil Spills

- Limited to evaluating the risks of marine oil spills from vessels equipped with AIS, as well as OHFs during fueling operations when a vessel is present
- Land-based oil spills and Hazardous and Noxious Substances are not included

Consequences of Oil Spills

- Limited by data availability, use and accessibility rights
- Calculations do not always reflect abundance or significance of present sensitivities

Results

- Final risk scores are the most subjective within the risk assessment and are not well received by most stakeholders and partners

Comprehensive risk assessments take time to develop, process, and ensure input and support by end users

Engagement

TC engaged with RRP partners (federal, Indigenous communities, Province of BC) as well as coastal communities, stakeholders and industry

- Round One sought feedback on the methodology and overall approach
  - Changes were made to the Methodology wherever possible
- Round Two presented draft results and checked whether they approximate reality
  - Feedback will be used in future iterations

Challenges to Engagement

- Due to a delay in the signing of the RFA, and the prioritization of other OPP initiatives by B.C. First Nations, engagement for this risk assessment was delayed as well as reduced in scope to avoid increasing engagement fatigue and to not cause delays to the contract with Dillon.
- This limited the amount of data and feedback that First Nations, coastal communities, local and stakeholders were able to provide
- TC kept First Nation representatives on the RRP working group informed of risk assessment progress during their regular RRP meetings

What we heard

Feedback on results

- The scenarios that were selected were well accepted
- Frequency results were seen by some viewers to underestimate reality
- The exclusion of non-carrying AIS vessels was noted as a significant gap
- Participants were interested in seeing probability results with more recent AIS data
  - Some more recent projects and changes to marine transportation were not captured in this iteration
- The severity of impacts to sensitive areas was not considered to be adequately depicted

Future risk assessments will likely focus less on quantifying Consequences and Risk Scores and more on Probability and Scenarios for predicting movement of oil spills.

Applicability

Prevention

- Comprehensive risk assessments can be used to suggest potential prevention measures with the goal of reducing probabilities to as low as reasonably possible (pilotage, escorts tugs, waivers, traffic separation schemes, etc.)

Planning

- Probability analysis shows hotspots which can be used for prioritizing areas for developing operational plans or decision-making on location and type of equipment in caches
- Scenario selection and trajectory modelling can be used for exercises (includes types and volume of oil spills moving over time)

Preparedness

- Layered with areas of concern and other relevant data, comprehensive risk assessments provide information on likely trajectories and weathering, thereby informing areas to protect (boom off), type of recovery equipment needed, duration of recovery phase and areas likely to require remediation

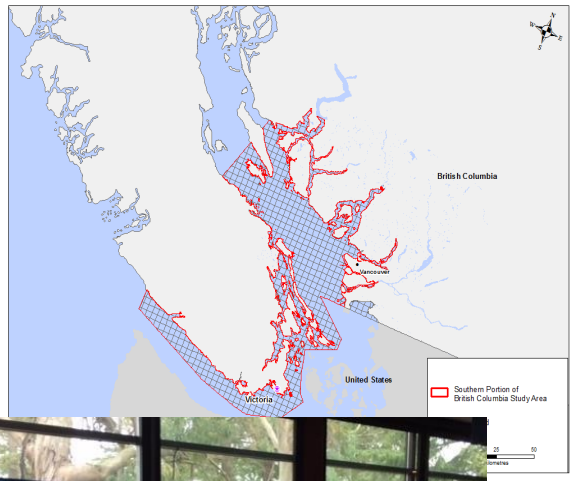
Monitoring

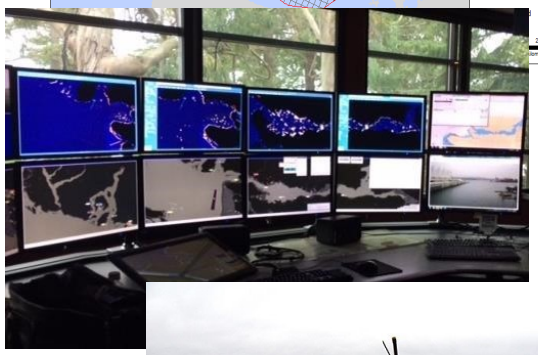
- Comparing risk levels over time can help determine whether prevention and mitigation strategies are reducing risks

This risk assessment provides risk-based information for consideration in the Northern B.C. Regional Response Planning initiative.

Next Steps

1. **Publicly release the Northern B.C. Risk Assessment**
   - Currently only made available to RRP partners
2. **Test newly acquired risk assessment tools and capabilities**
   - Run small scale probability and modelling analyses within one-year contracted technical support period
3. **Update RRA for Southern B.C. (FY 2019-2020)**
   - Rerun the probability analysis to include current (2018 data) and projected traffic
4. **Provide advice to other groups in TC on risk analyses**
   - e.g. Pilotage, EMSA, MSS-QC, TERMPOL, Vessels of Concern, Geographic Response Plans
5. **Review national risk picture**





While there are times when a comprehensive risk assessment is appropriate, we continue to develop and use more nimble analyses when less specificity is required