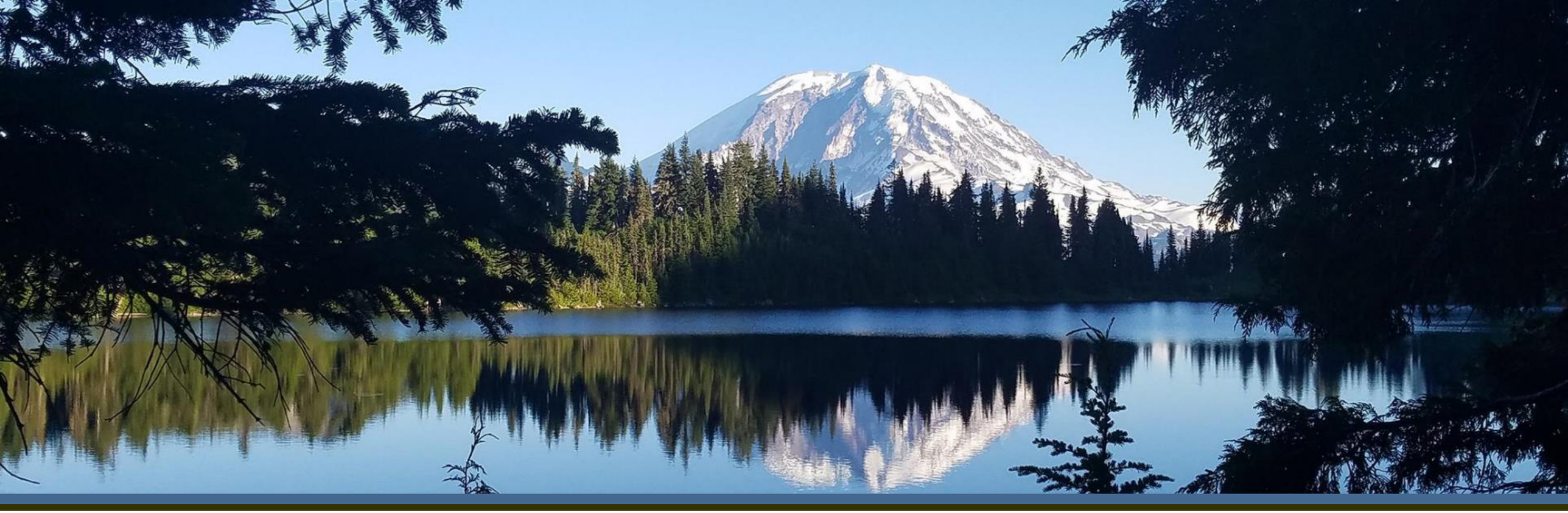

Analysis of an Additional Emergency Response Towing Vessel

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DEPARTMENT OF ECOLOGY
State of Washington

September 29, 2023

Today's agenda

1. Introduction
2. Outreach and Consultation Timeline
3. Model and Analysis Review
4. ERTV Analysis Results
5. Questions and Comments

Model Analysis Projects

Tug Escort Analysis

"To inform rule making, the Board of Pilotage Commissioners must conduct an analysis of tug escorts using the model developed by the Department of Ecology" (RCW 88.16.260) (Final Report)

ERTV Analysis

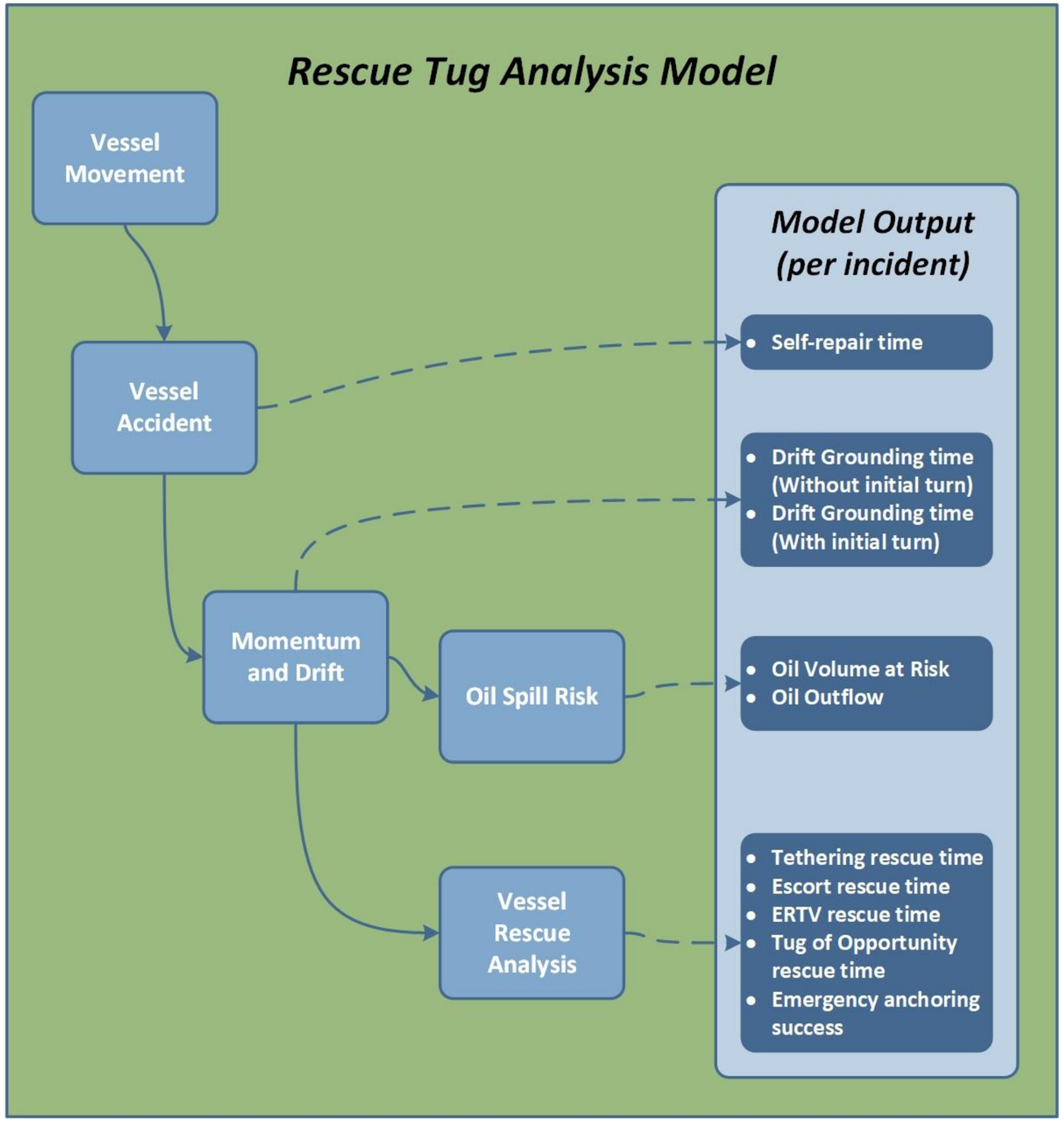
"Quantitatively assess whether an emergency response towing vessel serving Haro Strait, Boundary Pass, Rosario Strait, and connected navigable waterways will reduce oil spill risk" (RCW 88.46.250) (Final Report)

Outreach and Consultation Timeline

Model Development Summer 2020 – Spring 2022	**Outreach and Model Runs** Fall 2021 – Spring 2023	**Report Writing** Spring 2023 – Summer 2023	**Communication of Results** Fall 2023 – Ongoing

- 19 webinars to discuss model development
  -
- 4 webinars to discuss the development, structure, and results of the analyses
- 225 individual attendees affiliated with 163 different entities
- Answered over 300 questions over the course of this outreach effort

Model and Analysis Review



Analysis Approach

Focused on Loss of Propulsion Events

Includes Internal Interventions

- Initial turn
- Self repair
- Anchoring

Includes External Interventions

- ERTV rescue
- Tug of Opportunity rescue

Not Evaluated

- Firefighting
- Salvage support

Image: https://gcaptain.com/the-amazing-race-to-save-the-modern-express-in-photos/

Inputs and Assumptions

1. **Loss of Propulsion Probabilities**
   - Based on loss of propulsion reports in the local area from 2002-2019

2. **Self Repair Distribution**
   - Based on a review of 98 reports detailing what happened after a local loss of propulsion event

3. **Emergency Anchoring Potential**
   - Ships must be under 3 knots, at least 500m plus own length from hazards

4. **Momentum and Drift Parameters**
   - Ships drift at max draft & displacement, using historical weather for the location

5. **Escort/Assist Tug Dispatching**
   - Escorts and assists dispatched based on historical transits to and from rendezvous locations

6. **Ladenness of Tank Vessels**
   - Ladenness is assigned based on whether observed transits were escorted or not, and additional assumptions

Oil Spill Risk Metrics

Drift Grounding Metric

- The drift grounding metric is designed to represent the likelihood of drift groundings. It is weighted by incident likelihood and the overall number of drift groundings identified in model outputs.

Oil Volume at Risk Metric

- Oil volume at risk is designed to represent risk of a maximum potential spill. It is based on the fuel and oil cargo capacity of an involved vessel. It is calculated by multiplying the maximum possible volume of oil (in gallons) aboard a simulated vessel, against the incident likelihood.

Oil Outflow Metric

- The oil outflow metric is designed to represent risk of an average potential spill. It doesn't produce specific outflows for individual events. It is based on the historical averages of spill size, and the historical probability of spills per incident, per vessel type. It is calculated by multiplying the average historical spill volume (in gallons) for a vessel type, against the spill probability per incident, against the incident likelihood.

Initial Review of Analysis Results

Exclusion of Initial Turn Results

- Based on our evaluation of outputs, we determined that the Initial Turn function was not working as expected. The hazard identification rules captured too many hazards and led to more initial turns than anticipated. As a result, we did not include initial turn results in the analysis.

Removal of Car Ferry Results

- The overwhelming volume of car ferry traffic in our simulated outputs put us at risk of missing important patterns for vessel types of interest. This discussion section only reviews the portion of the results that excluded car ferry traffic. Results with ferry traffic included will be available for review in report appendices.

Emergency Response Towing Vessel Analysis

To quantitatively assess whether an emergency response towing serving Haro Strait, Boundary Pass, Rosario Strait and connected navigable waterways will reduce oil spill risk from covered vessels.

ERTV Analysis
Study Area

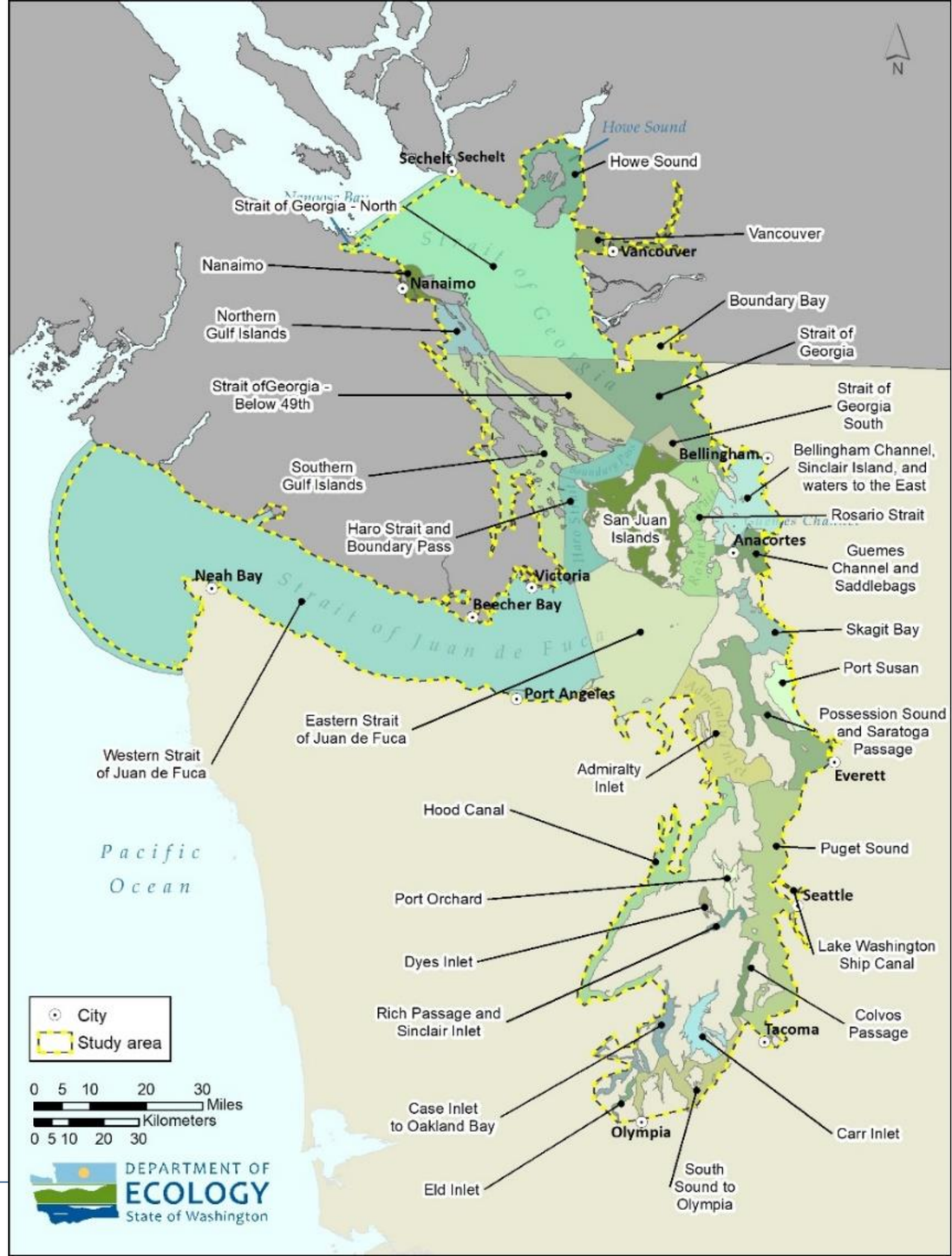
The study area is bounded on the west by an arc approximately 20 nautical miles past Buoy JA, and to the north with a line from Nanoose Bay to Sechelt.

Interior waterways within the ports of Seattle and Vancouver, such as the Fraser River, portions of the Duwamish River, and Lake Washington, are not included in the study area.

The study area also does not include upper Howe Sound due to a lack of consistent vessel traffic data in that area.

ERTV Analysis Geographic Zones

- Admiralty Inlet
- Bellingham Channel, Sinclair Island, and waters to the East
- Carr Inlet
- Case Inlet to Oakland Bay
- Colvos Passage
- Dyes Inlet
- Eastern Strait of Juan de Fuca
- Eld Inlet
- Guemes Channel and Saddlebags
- Haro Strait and Boundary Pass
- Hood Canal
- Howe Sound
- Lake Washington Ship Canal
- Nanaimo
- Northern Gulf Islands
- Port Orchard
- Port Susan
- Possession Sound and Saratoga Passage
- Puget Sound
- Rich Passage and Sinclair Inlet
- Rosario Strait
- San Juan Islands
- Skagit Bay
- South Sound to Olympia
- Southern Gulf Islands
- Strait of Georgia
- Strait of Georgia – Below 49th
- Strait of Georgia – North
- Strait of Georgia – South
- Vancouver
- Western Strait of Juan de Fuca



Potential ERTV Locations

We selected seven potential ERTV locations for evaluation:

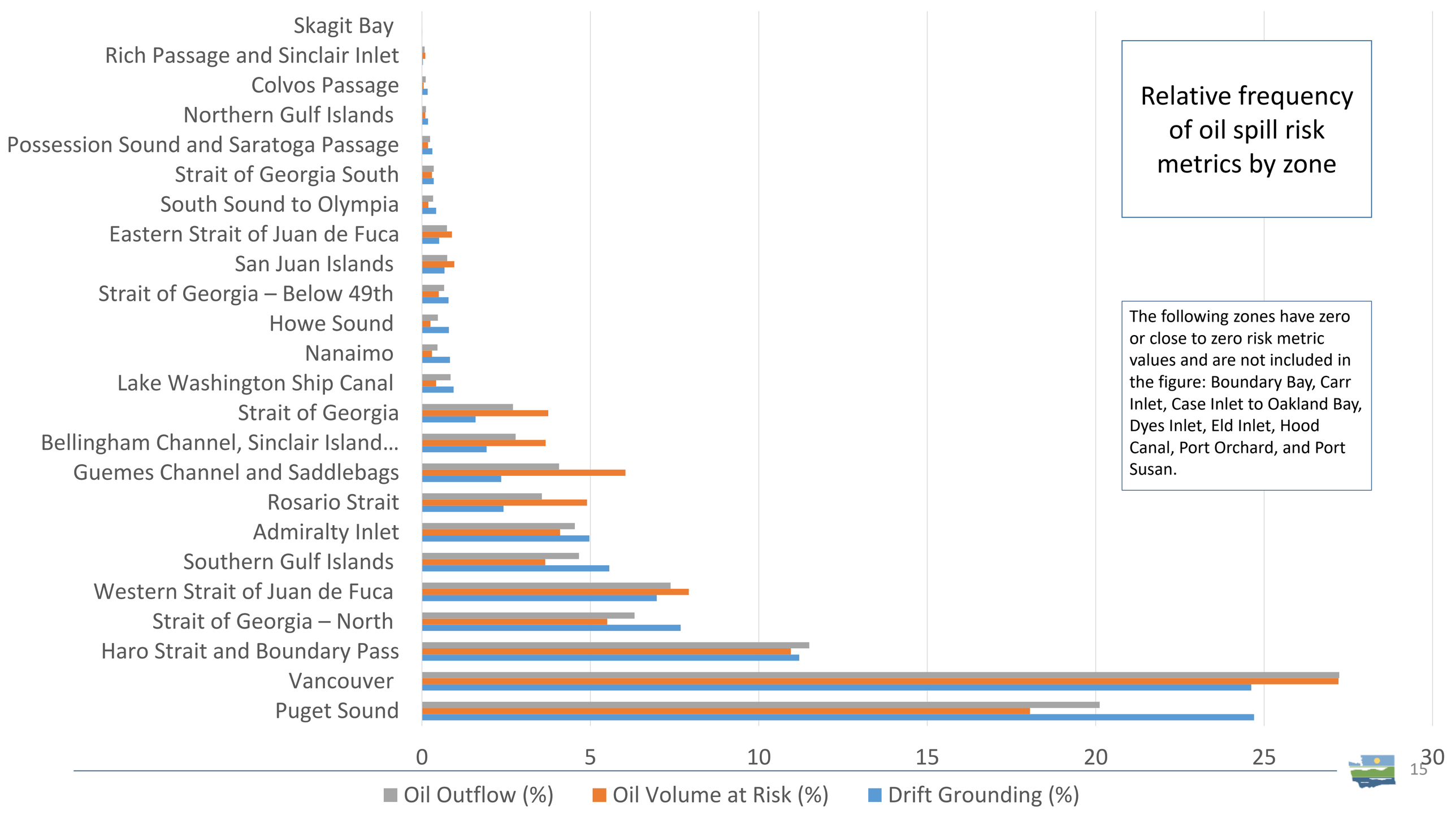
- Anacortes, Washington
- Deltaport, British Columbia
- Port Angeles, Washington
- Port Townsend, Washington
- Roche Harbor, Washington
- Sidney, British Columbia
- Victoria, British Columbia

Each location could potentially serve the waters of Haro Strait, Boundary Pass, Rosario Strait, and connected waters.

They are shown in Figure 1, along with the location of the existing ERTV in Neah Bay.

ERTV Analysis Results

- Distribution of oil spill risk metrics
- Changes in oil spill risk with addition of an ERTV
- Oil spill risk changes by geographic zone for a Roche Harbor ERTV and a Sidney ERTV
- How different tug escort requirements affect the utility of different ERTV locations
- How the exclusion of tugs of opportunity affects the utility of different ERTV locations
- How escort traffic from the Trans Mountain Expansion Project (TMEP) affects the utility of different ERTV locations


Skagit Bay
Rich Passage and Sinclair Inlet
Colvos Passage
Northern Gulf Islands
Possession Sound and Saratoga Passage
Strait of Georgia South
South Sound to Olympia
Eastern Strait of Juan de Fuca
San Juan Islands
Strait of Georgia – Below 49th
Howe Sound
Nanaimo
Lake Washington Ship Canal
Strait of Georgia
Bellingham Channel, Sinclair Island…
Guemes Channel and Saddlebags
Rosario Strait
Admiralty Inlet
Southern Gulf Islands
Western Strait of Juan de Fuca
Strait of Georgia – North
Haro Strait and Boundary Pass
Vancouver
Puget Sound
0
5
10
15
20
25
30
Oil Outflow (%)
Oil Volume at Risk (%)
Drift Grounding (%)
Relative frequency of oil spill risk metrics by zone
The following zones have zero or close to zero risk metric values and are not included in the figure: Boundary Bay, Carr Inlet, Case Inlet to Oakland Bay, Dyes Inlet, Eld Inlet, Hood Canal, Port Orchard, and Port Susan.

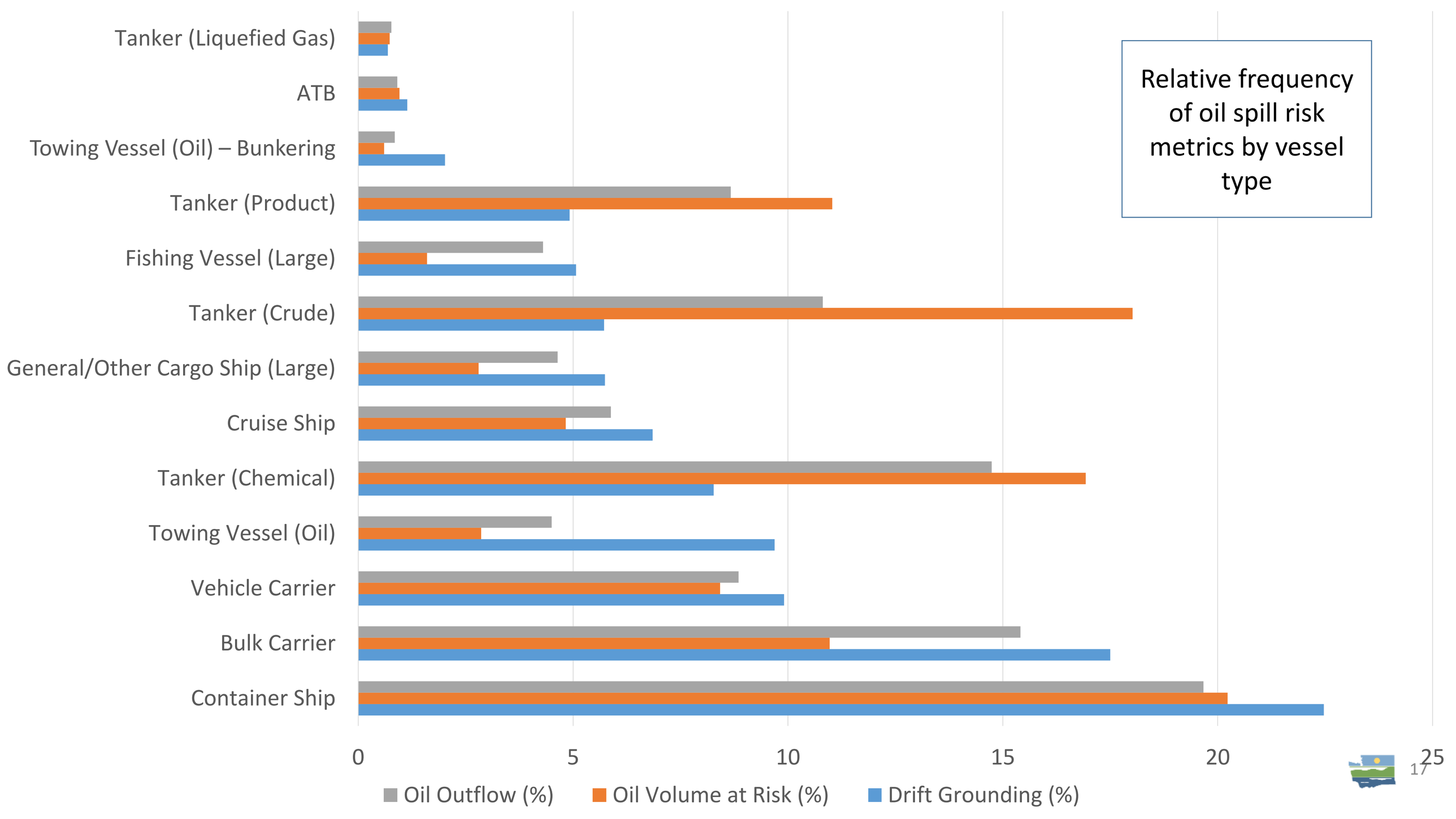
Distribution of Oil Spill Risk Metrics by Zone

Three zones account for substantially less risk that might be expected based on their operational minutes.

- Western Strait of Juan de Fuca makes up 38% of the simulated traffic but accounts for 7-8% of the oil spill risk
- Strait of Georgia North makes up 13% of the simulated traffic but accounts for 6-8% of the oil spill risk
- Eastern Strait of Juan de Fuca makes up 4% but accounts for 1% of the oil spill risk

Five zones account for more risk than their operational minutes would suggest.

- Vancouver makes up 8% of the simulated traffic, but accounts for 25-27% of the risk.
- Puget Sound makes up 13% of the simulated traffic, but accounts for 18-25% of the risk.
- Haro Strait and Boundary Pass makes up 6% of the simulated traffic, but accounts for 11-12% of the risk.
- Guemes Channel and Saddlebags and Bellingham Channel and waters to the East each make up 1% of the traffic and 2-6% and 2-4% of the risk, respectively.


Relative frequency of oil spill risk metrics by vessel type
Tanker (Liquefied Gas)
ATB
Towing Vessel (Oil) – Bunkering
Tanker (Product)
Fishing Vessel (Large)
Tanker (Crude)
General/Other Cargo Ship (Large)
Cruise Ship
Tanker (Chemical)
Towing Vessel (Oil)
Vehicle Carrier
Bulk Carrier
Container Ship
0
5
10
15
20
25
Oil Outflow (%)
Oil Volume at Risk (%)
Drift Grounding (%)

Distribution of Oil Spill Risk Metrics by Vessel Type

Some vessel types account for less risk than one would expect given their share of overall operational minutes:

- ATBs make up 7% of the simulated traffic and account for only 1% of the oil spill risk.
- Towed oil barges make up 21% of the traffic and 3-10% of the oil spill risk.
- Bulk carriers account for 28% of the simulated traffic, but only 11-18% of the risk.

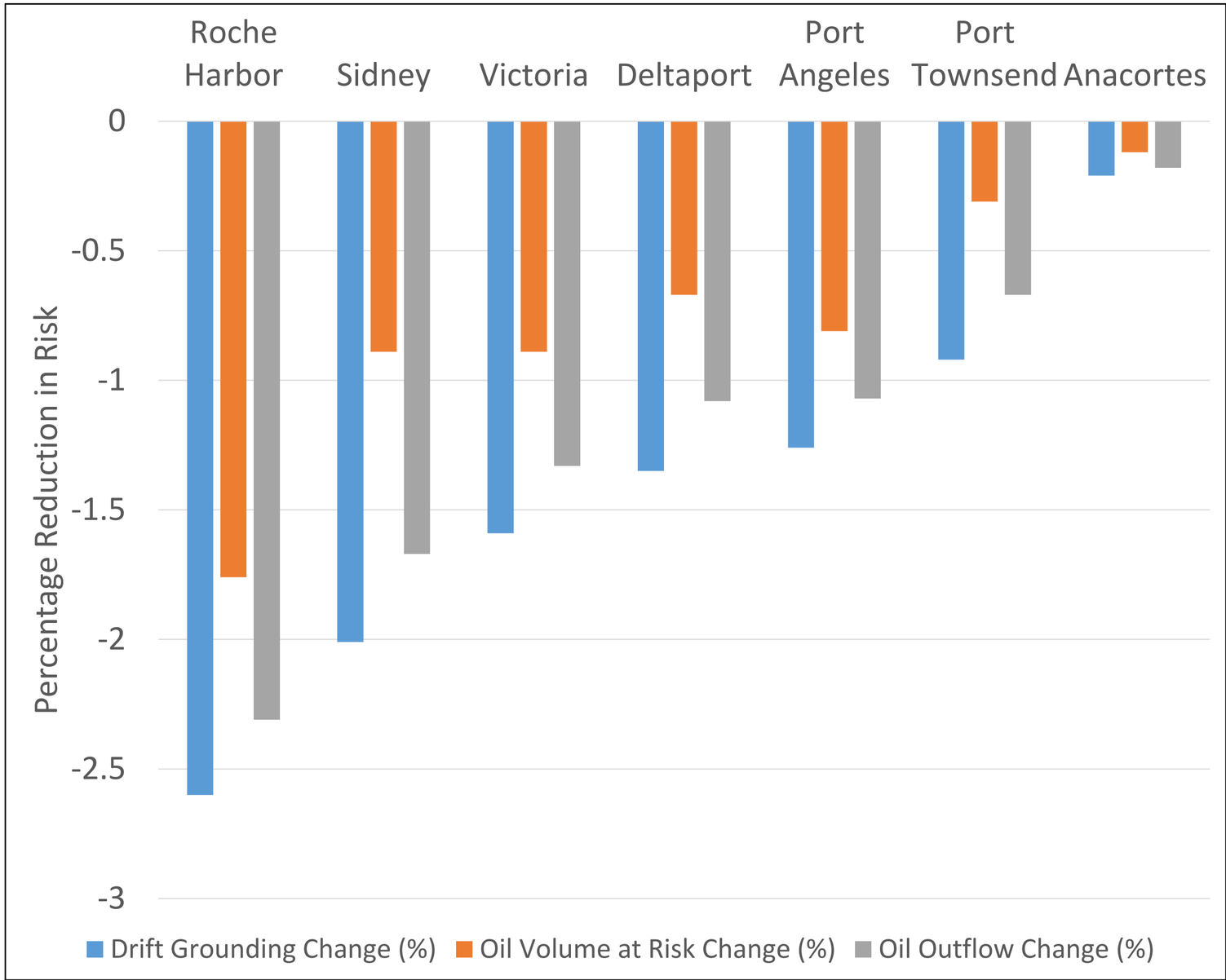
Other vessel types account for more risk than one would expect given their share of overall operational minutes:

- Vehicle carriers make up 5% of the total simulated traffic but account for 8-10% of the oil spill risk.

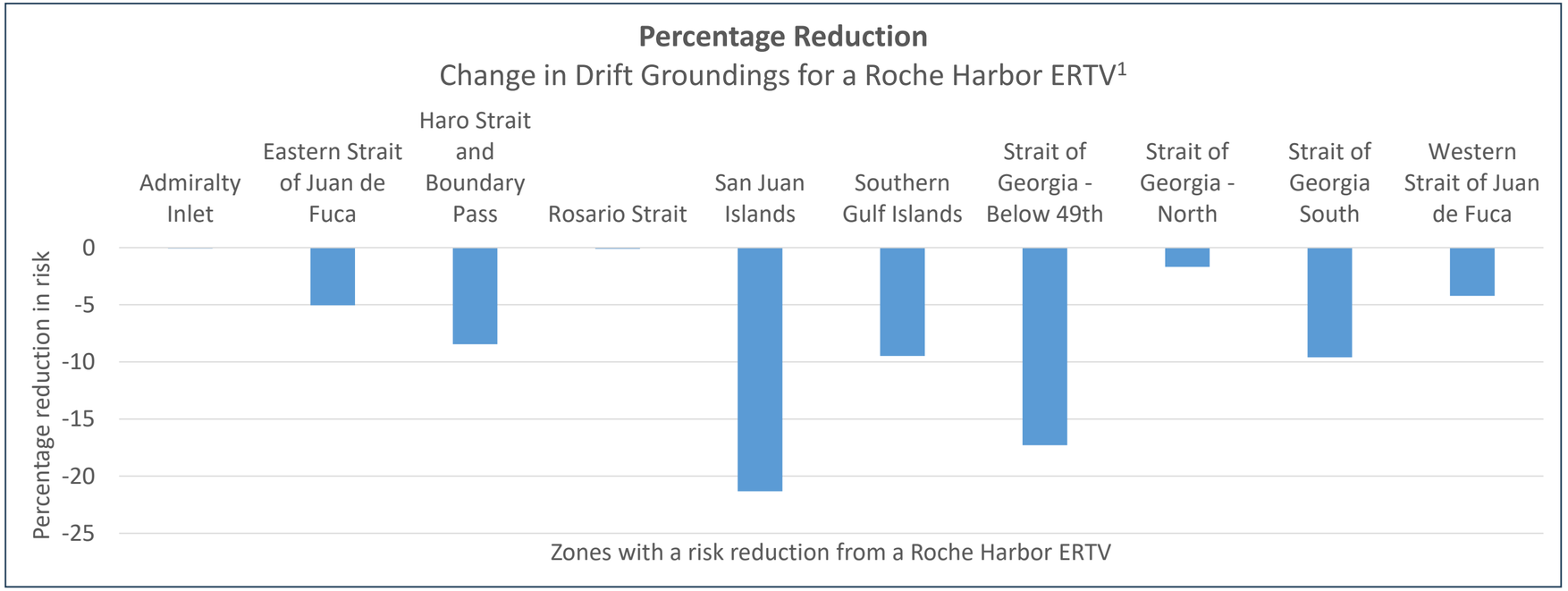
Changes in oil spill risk from addition of an ERTV

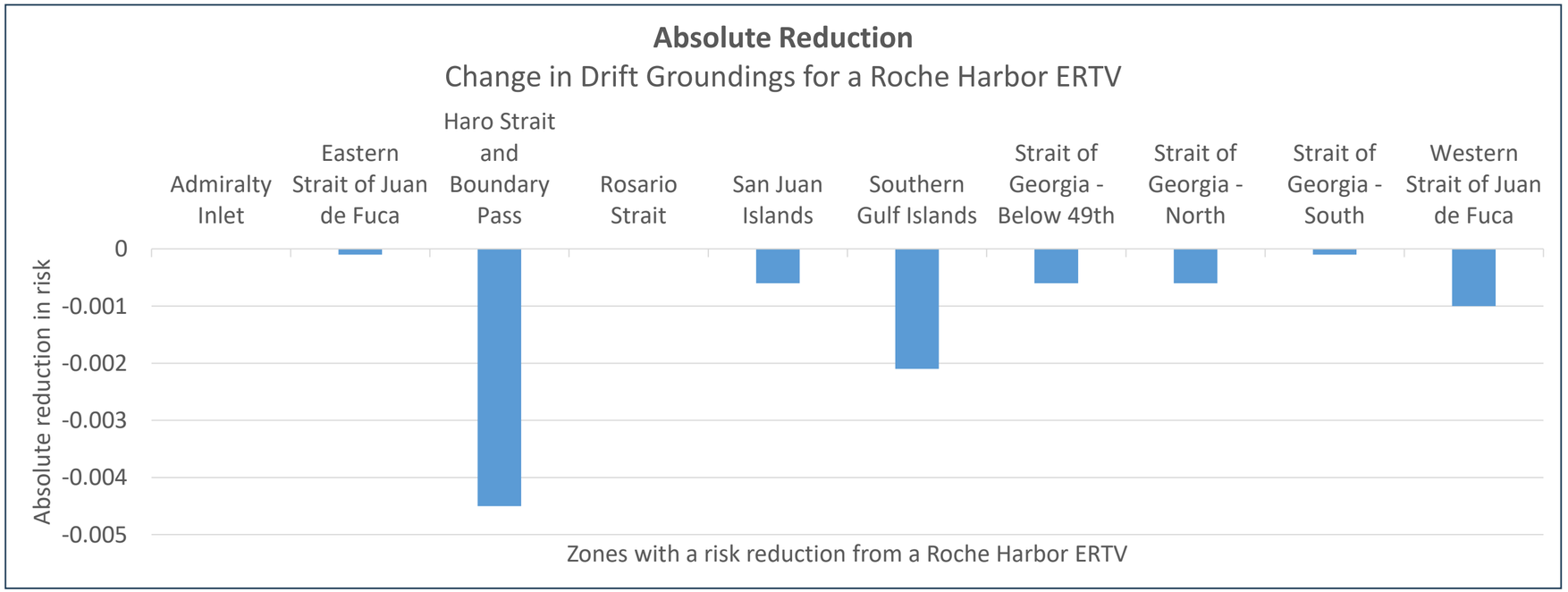
No potential ERTV location produced a large reduction in oil spill risk metrics, but every location provided some benefit.

- The placement of an ERTV in Roche Harbor provided the largest reduction in oil spill risk metrics (around 2%).
- The placement of an ERTV in Sidney provided the second largest reduction in oil spill risk metrics (around 1-2%).
- In terms of absolute values, an ERTV in Roche Harbor resulted in a
  - Decrease of 0.009 drift groundings
  - Decrease of 20,858.9 gallons in oil volume at risk
  - Decrease of 2.41 gallons in oil outflow



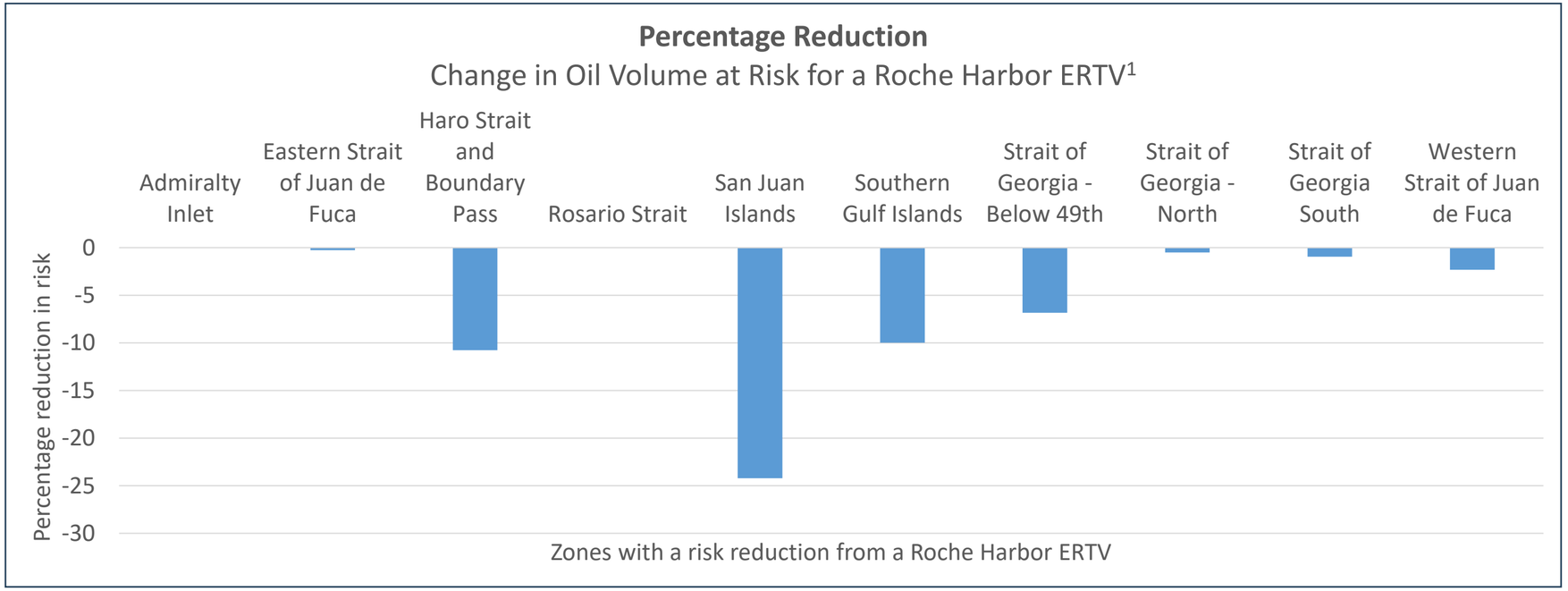
Changes by zone for an ERTV in Roche Harbor – Drift Groundings

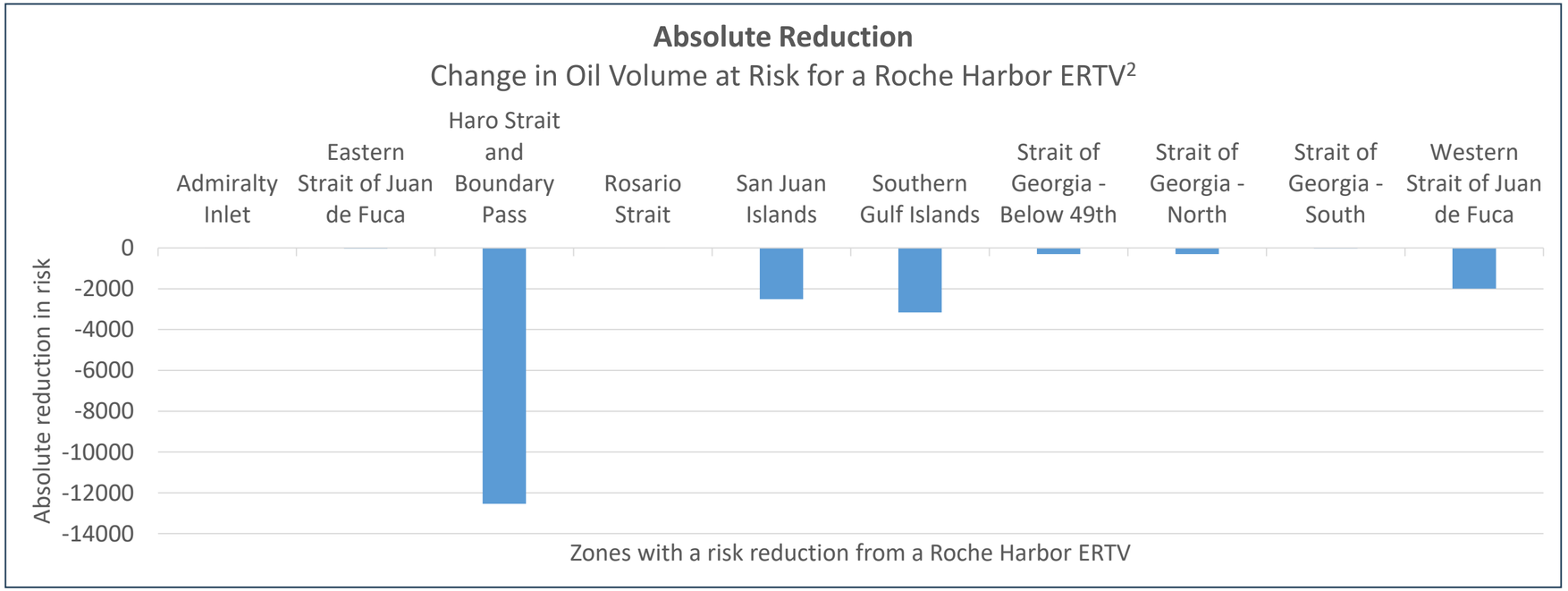




[1] Data is from Table A-72 (ERTV Report)
[2] Data is from Table A-71 (ERTV Report)

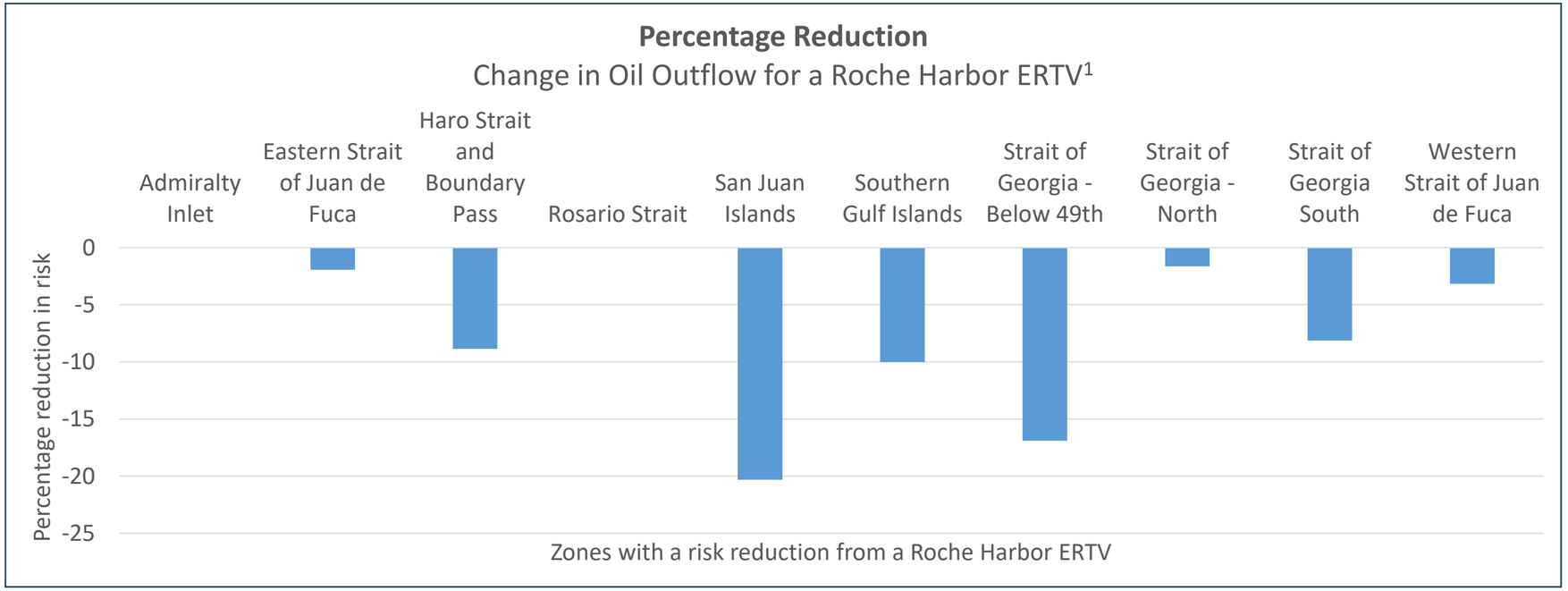
Changes by zone for an ERTV in Roche Harbor – Oil Volume at Risk

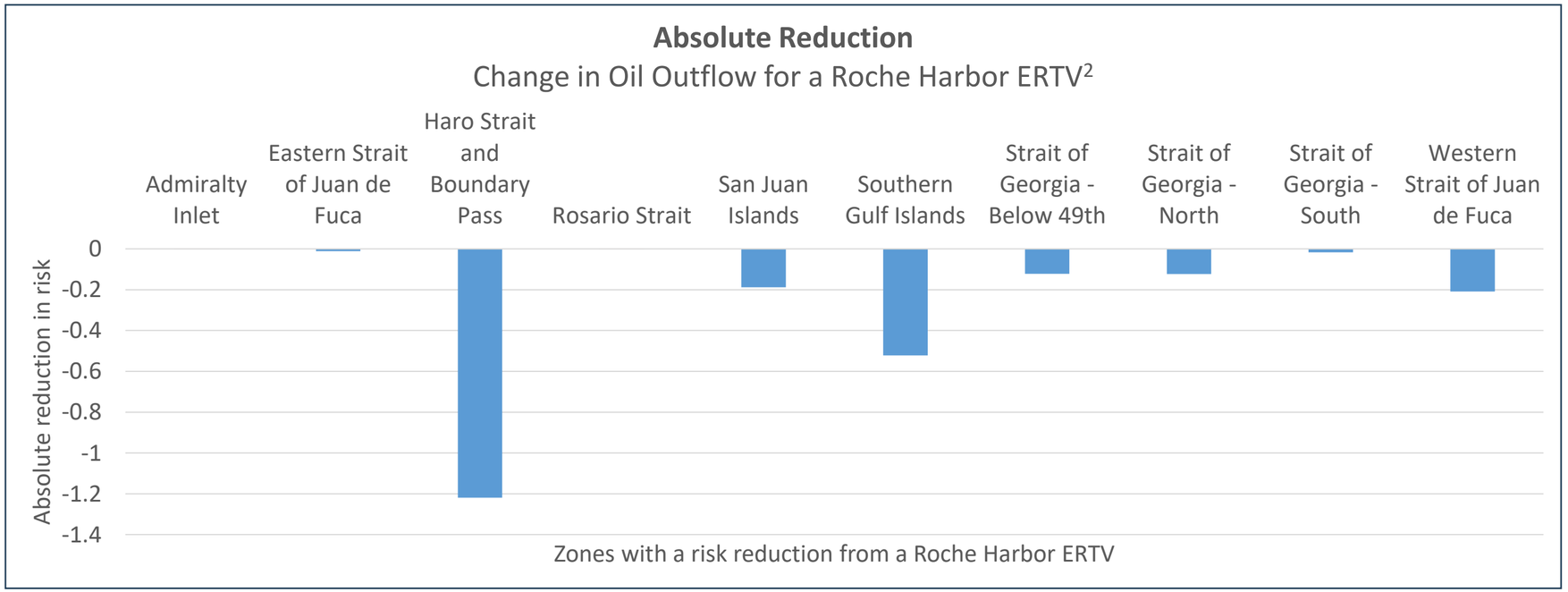




[1] Data is from Table A-74 (ERTV Report)
[2] Data is from Table A-73 (ERTV Report)

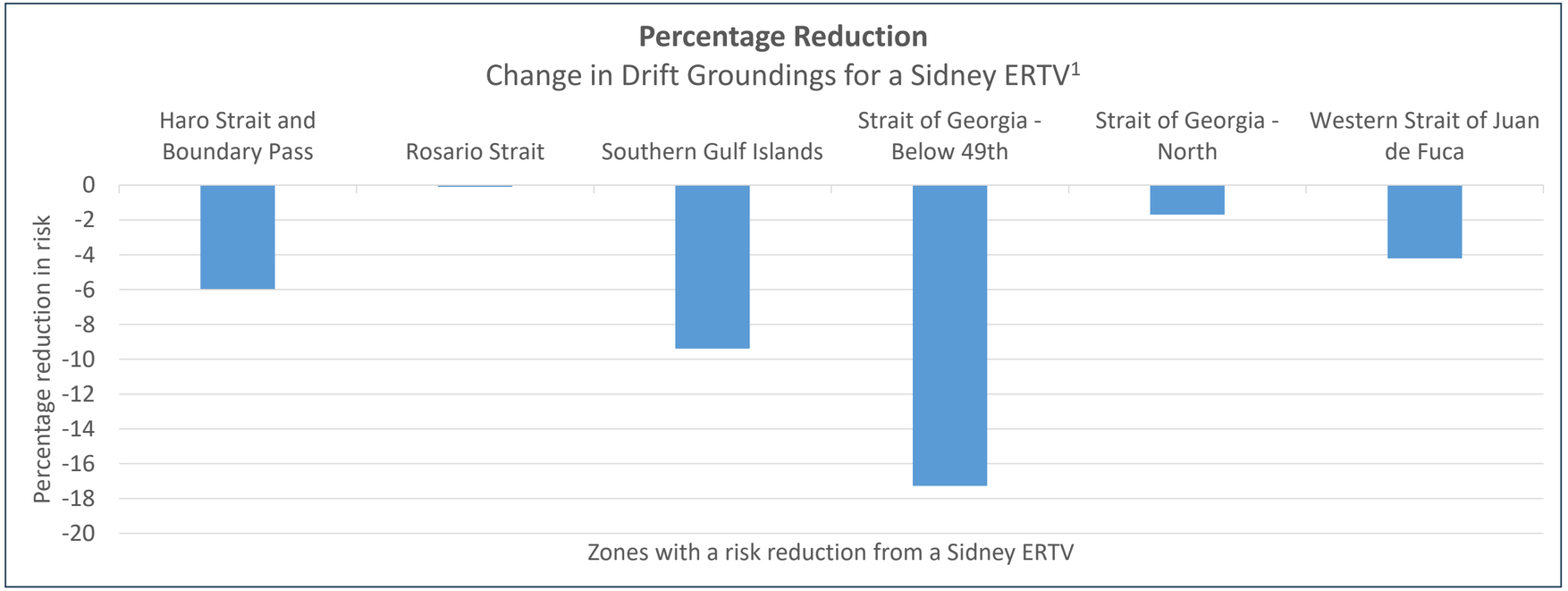
Changes by zone for an ERTV in Roche Harbor – Oil Outflow

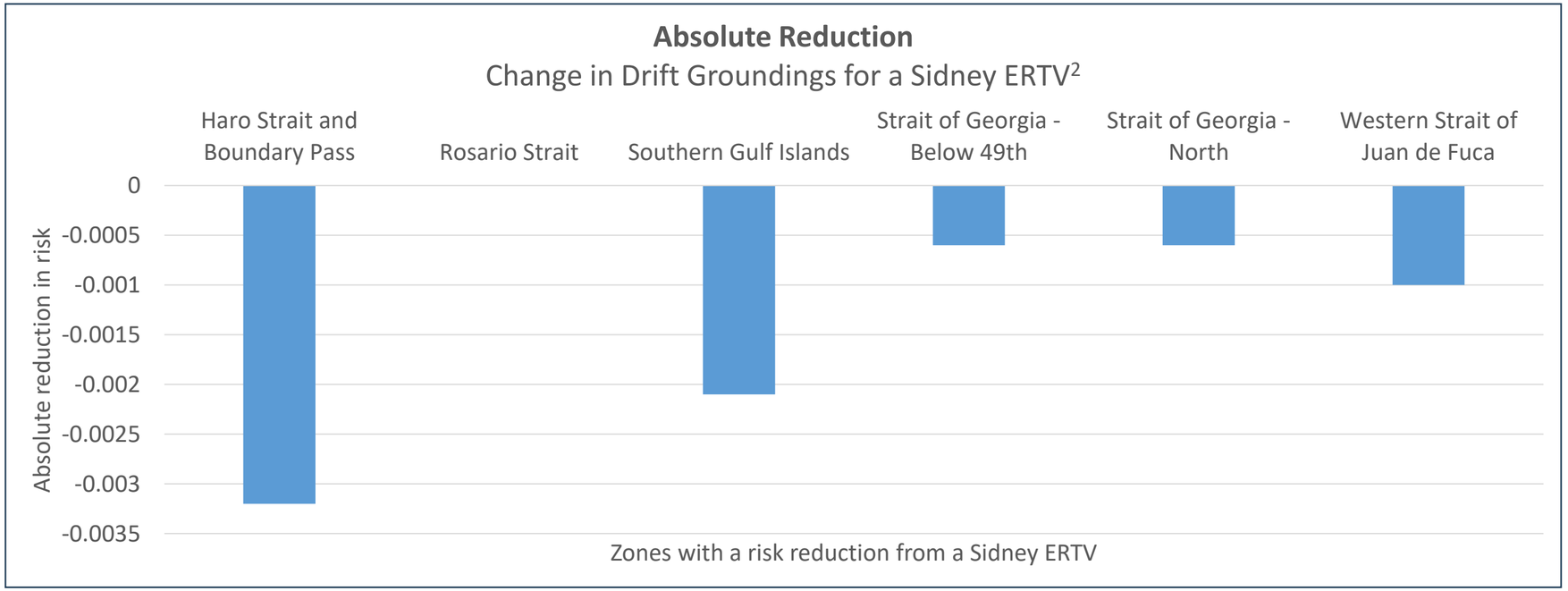




[1] Data is from Table A-76 (ERTV Report)
[2] Data is from Table A-75 (ERTV Report)

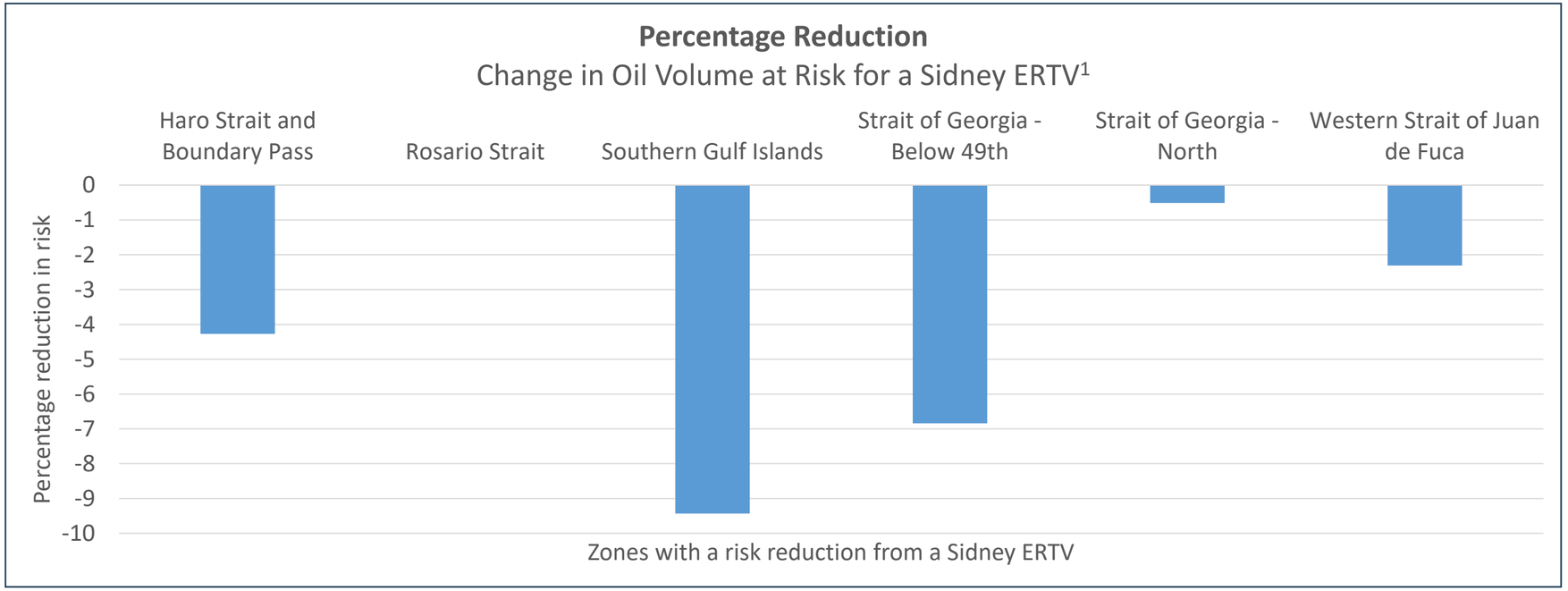
Changes by zone for an ERTV in Sidney – Drift Groundings

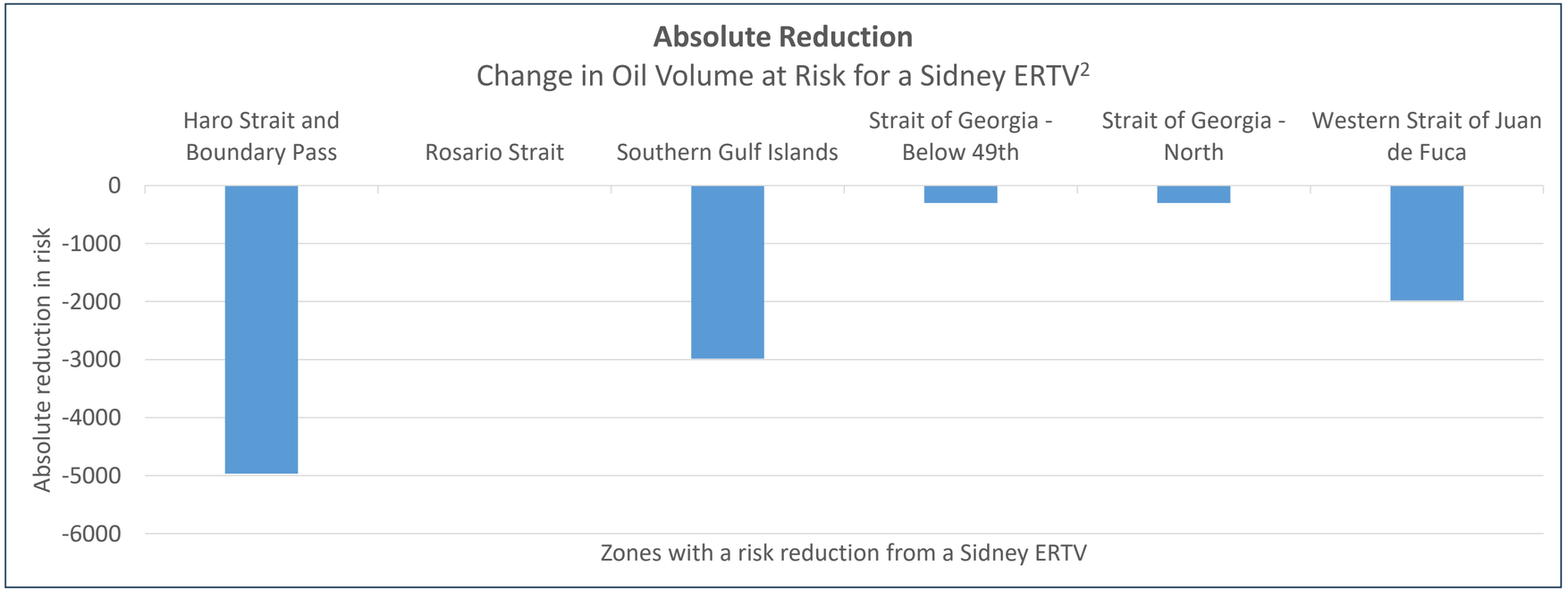




[1] Data is from Table A-72 (ERTV Report)
[2] Data is from Table A-71 (ERTV Report)

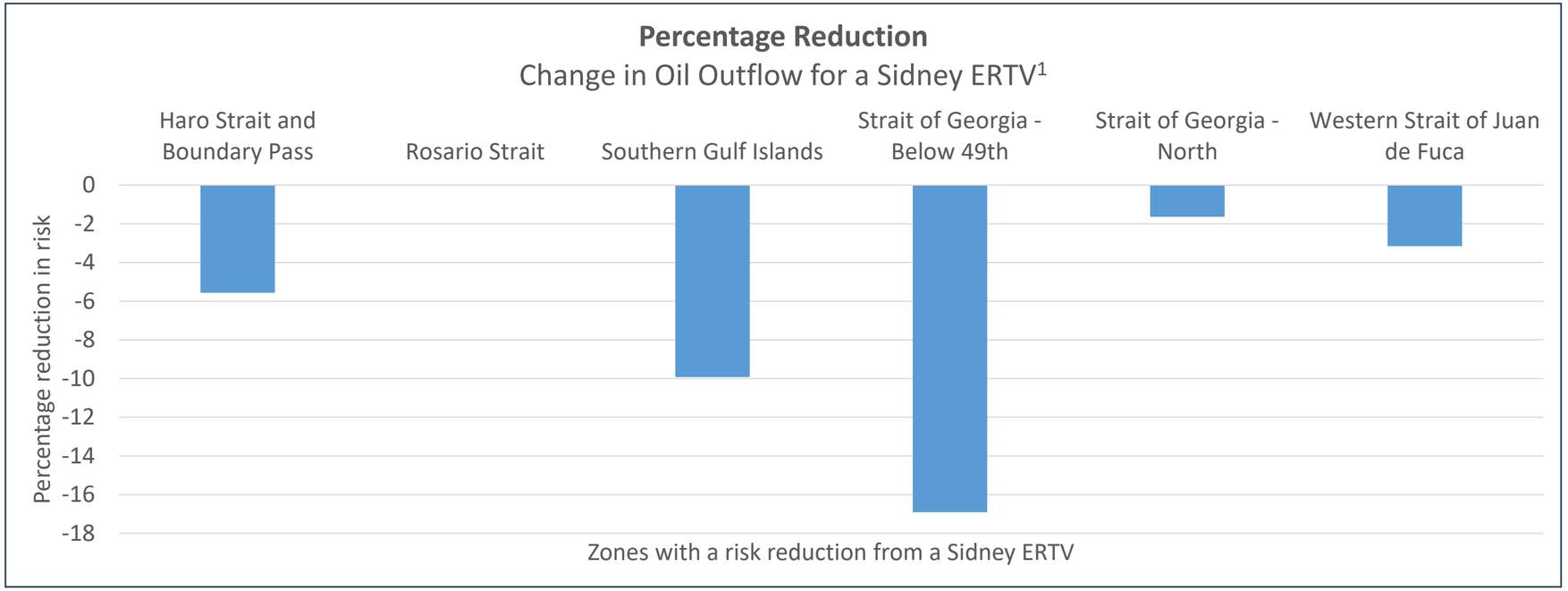
Changes by zone for an ERTV in Sidney – Oil Volume at Risk

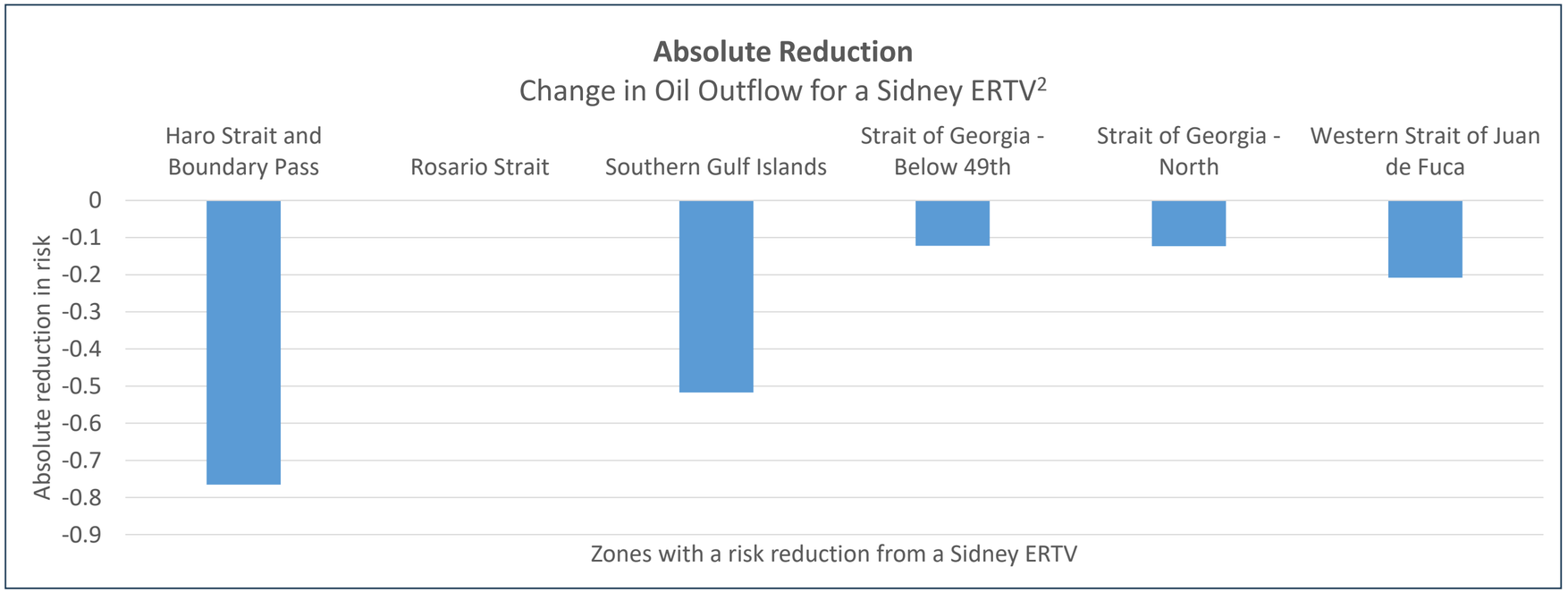




[1] Data is from Table A-74 (ERTV Report)
[2] Data is from Table A-73 (ERTV Report)

Changes by zone for an ERTV in Sidney – Oil Outflow





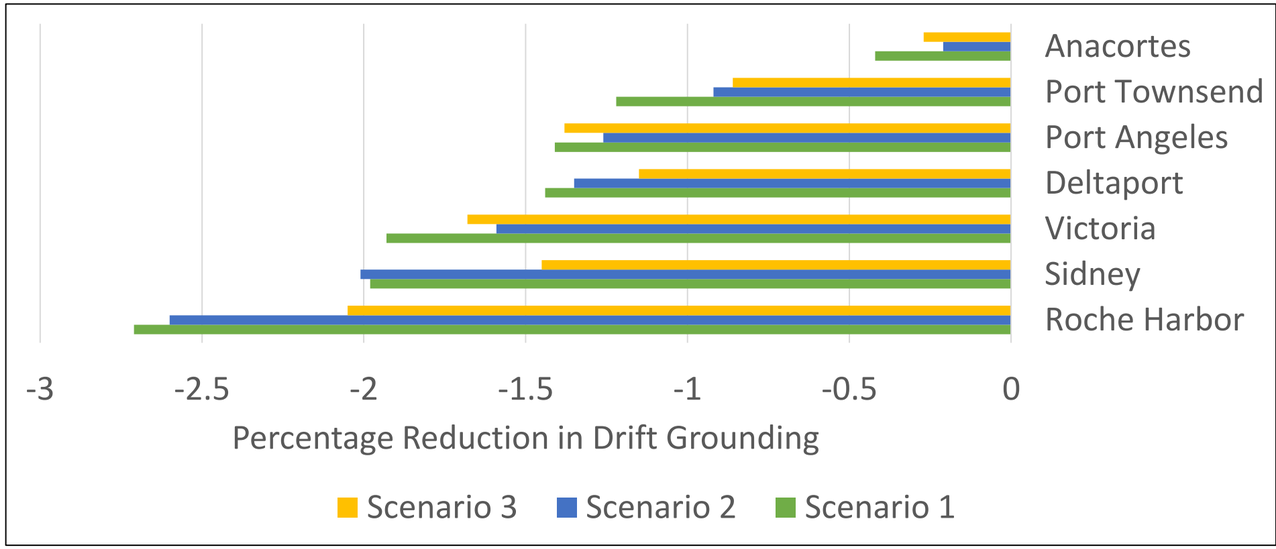
[1] Data is from Table A-76 (ERTV Report)
[2] Data is from Table A-75 (ERTV Report)

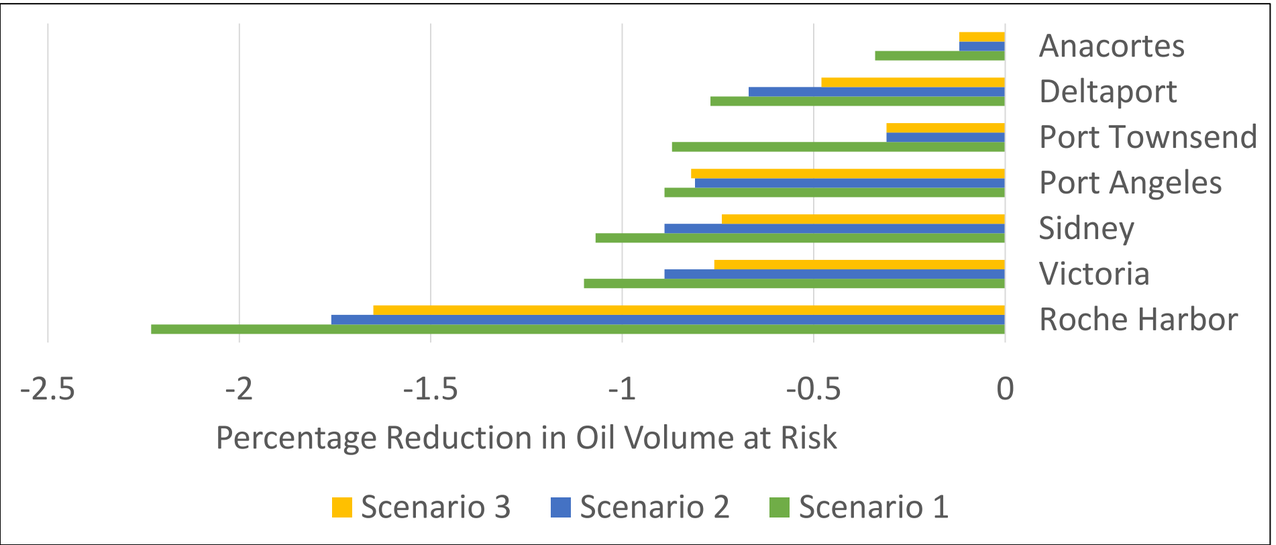
How tug escort requirements affect utility of ERTV locations

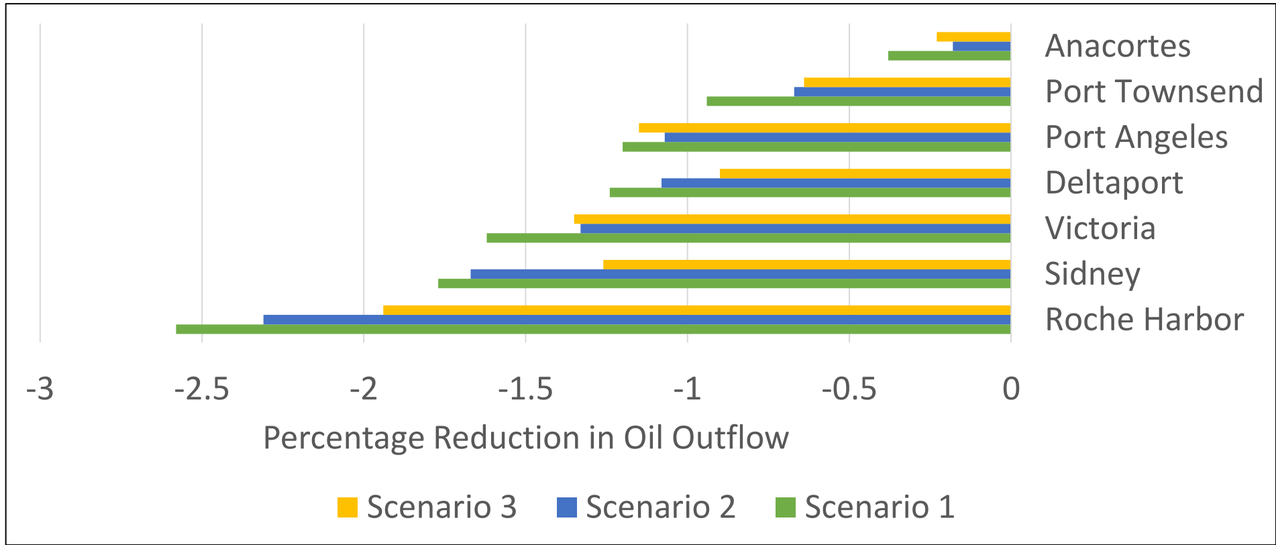
Different tug escort requirements produce different distributions of potential tugs of opportunity.

Do tug escort scenarios change which ERTV location provided the highest oil spill risk reduction benefit?

- Roche Harbor remains the most beneficial ERTV location regardless of tug escort scenario.







How exclusion of tugs of opportunity affects utility of ERTV locations

We also evaluated each ERTV location without allowing tugs of opportunity to intervene.

- We found that Roche Harbor remains the most beneficial location for an ERTV, with or without the potential for tugs of opportunity to intervene.

Credit: Sherwood411 Source: https://www.flickr.com/photos/sherwood411/7983287293

How escort traffic from TMEP affects utility of ERTV locations

We modeled safety measures associated with the TMEP. This increased the number of potential tugs of opportunity on the waterways and added a new rescue tug at Beecher Bay.

- Overall the benefit of the increase is either complementary to the ERTV benefits (as in the case of Anacortes and Port Townsend), or more redundant (as in the case of Roche Harbor).
- From our results, Roche Harbor is still the most beneficial locations for ERTVs even with the additional safety measures associated with TMEP.

Source: https://www.kotugcanada.ca/application/files/8516/3835/4403/291121_KOTUG_TM_fact_sheet.pdf

Next Steps

Opportunities for additional discussion:

Webinar on Tug Escort/ERTV Analysis Results
Nov/Dec, 2023 – Date/Time TBD

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