Beyond the Horizon: Role of Technology in Mitigating Shipping Risk

Collecting vessel traffic data using aerial surveys to inform shipping risk assessments

Presented by:

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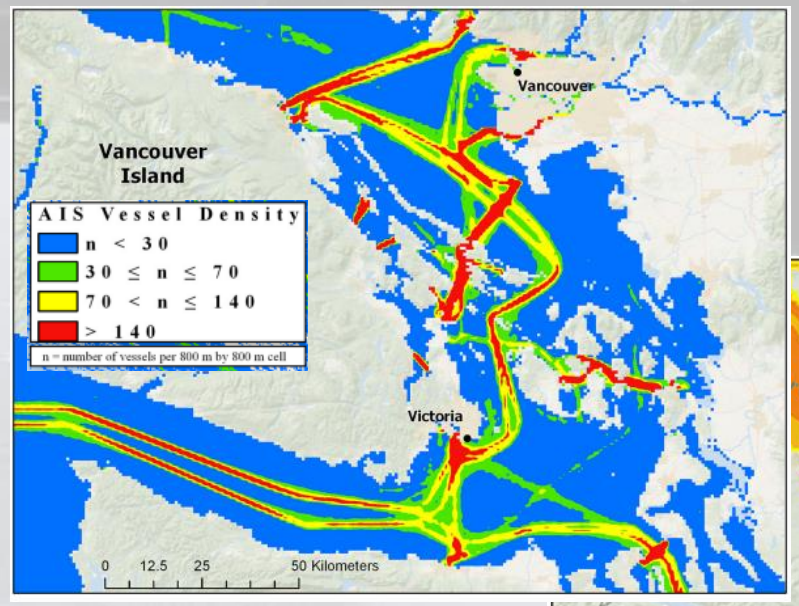
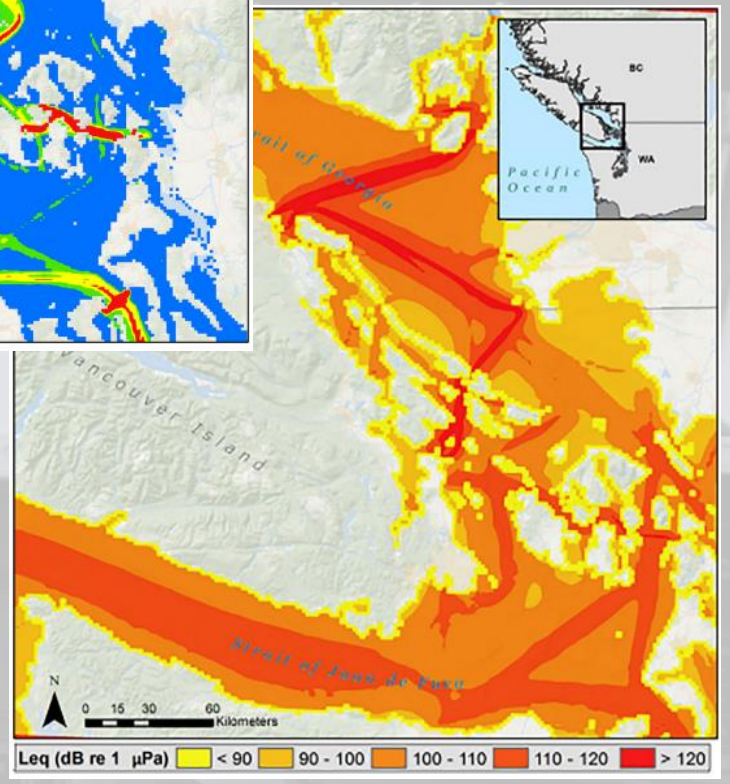
Canada

Context

- AIS data alone does not capture all vessel traffic in an area
- AIS is required only on:
  - ✓ Vessels 20 m or more in length
  - ✓ Passenger vessels 8 m or more in length
- Relying on AIS data without understanding its limitations can lead to incomplete understanding of actual risks and threats that vessel activities pose to the marine environment.



AIS vessel density for the month of July 2015



Cumulative noise model based on AIS vessel traffic on July 2015

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Source: Cominelli et al., 2017. https://doi.org/10.1016/j.marpolbul.2018.08.050

National Aerial Surveillance Program or **NASP**

Image source: Norma Serra-Sogas

Equipment primarily used **during vessel surveys**

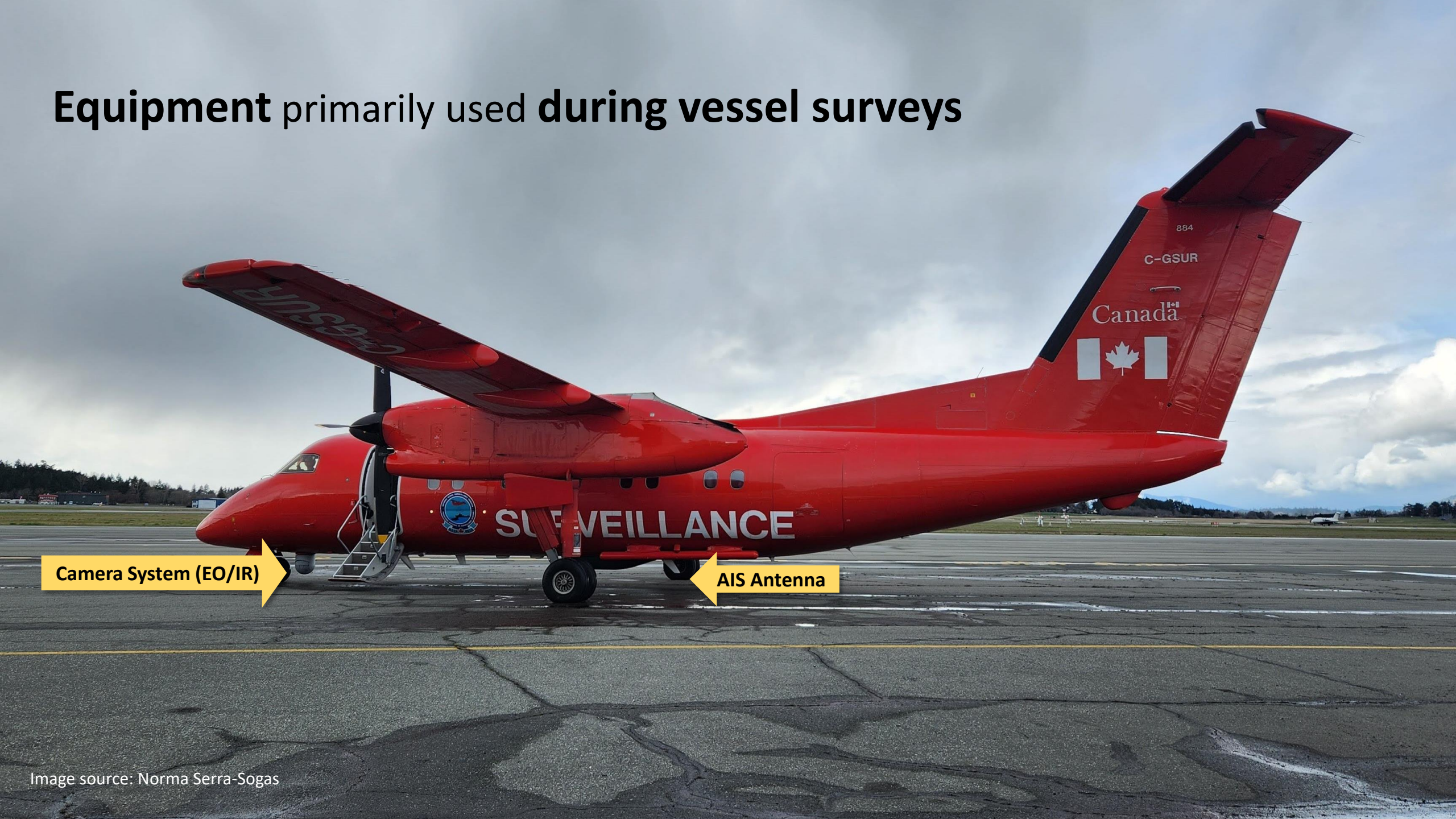
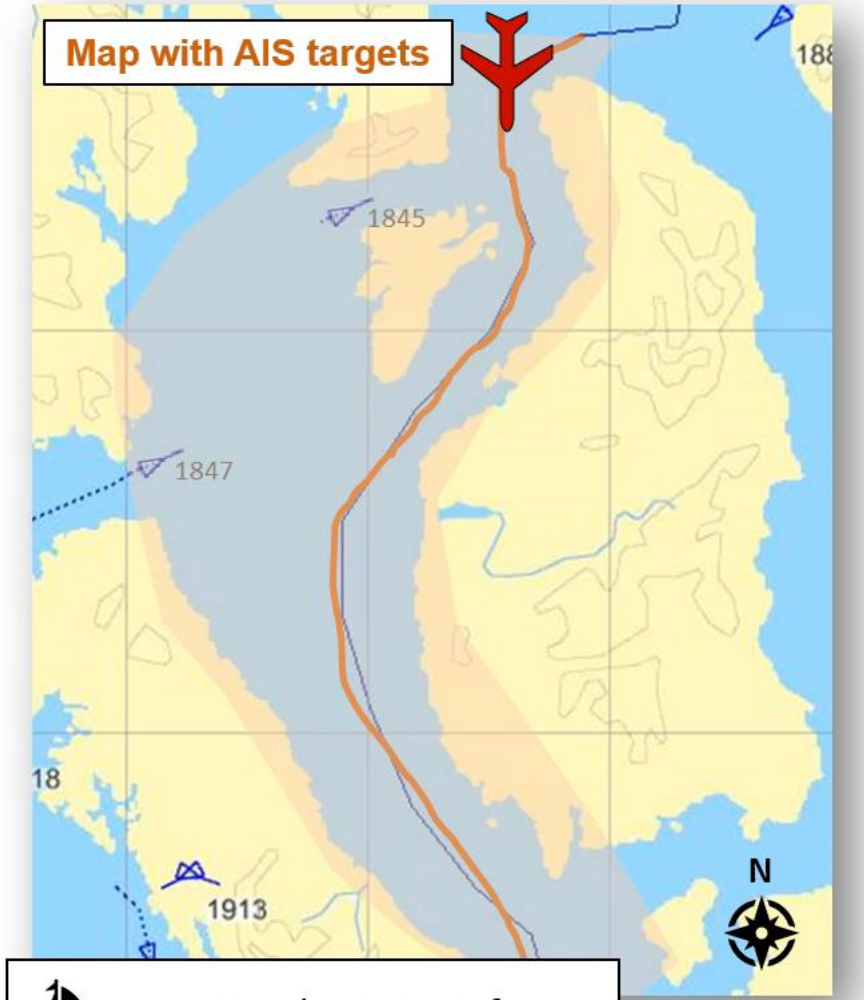


Image source: Norma Serra-Sogas

How are the aerial vessel surveys conducted?

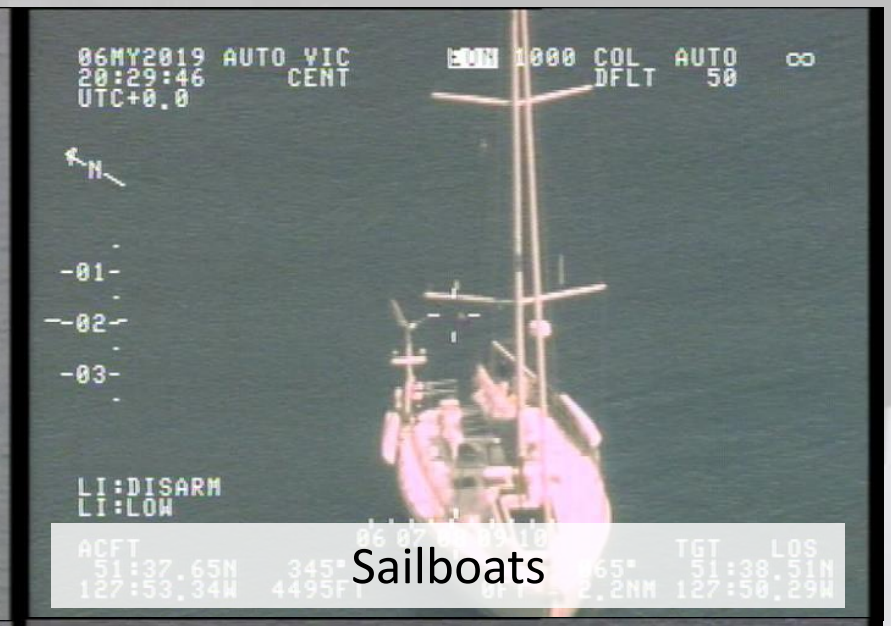
Image source: Norma Serra-Sogas

NASP vessel survey in Squally Channel (BC North Coast)



Type of non-AIS vessels observed by NASP in Pacific region

Fishing vessels

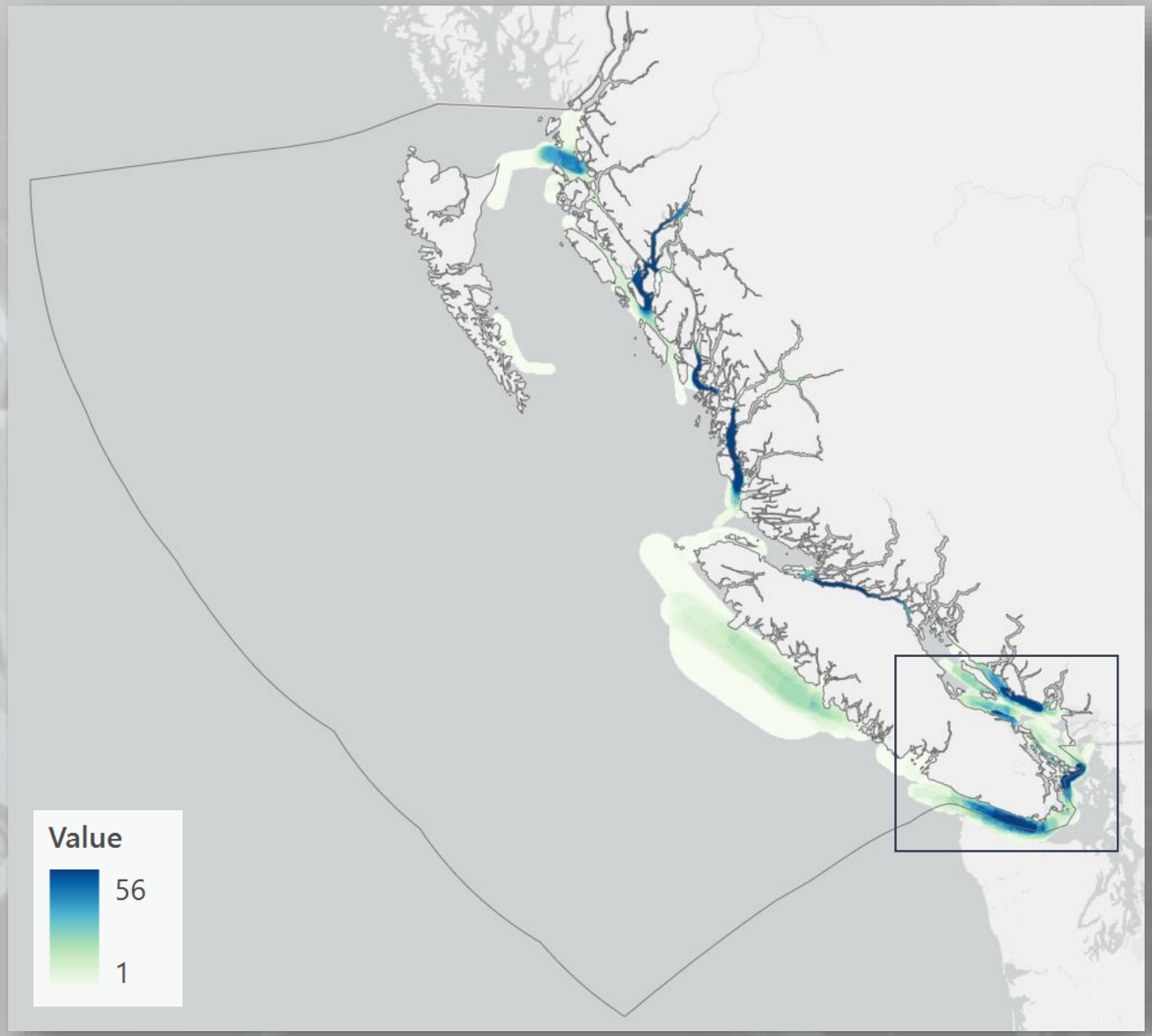


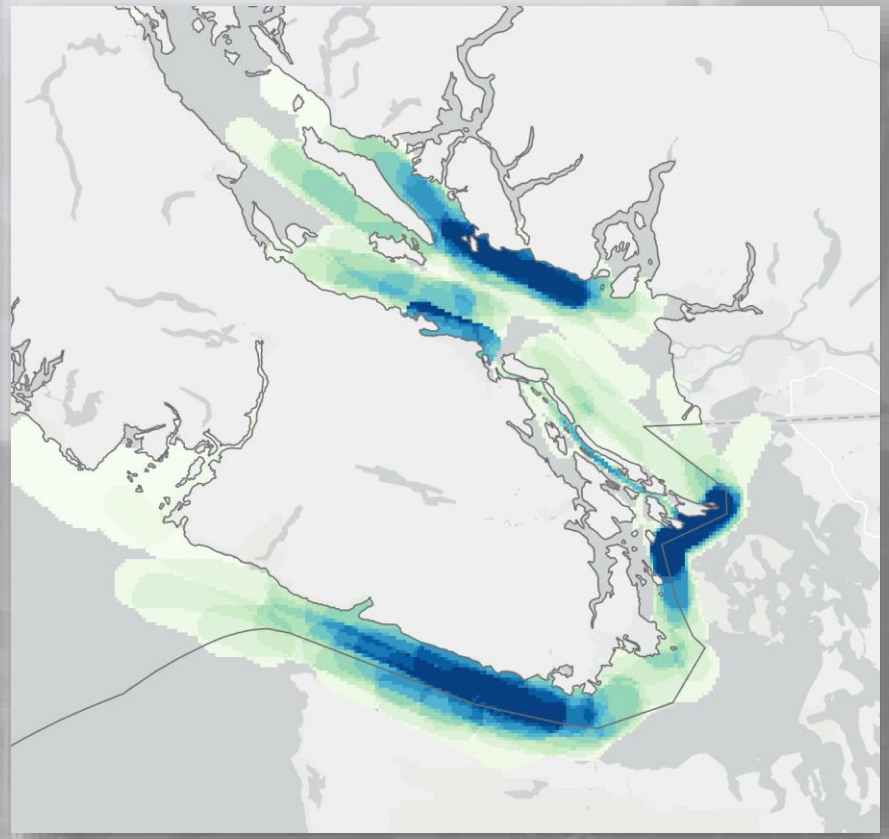
Sailboats

Small Tugs

Pleasure crafts

NASP surveys
Coverage and frequency
(2015 – 2022)





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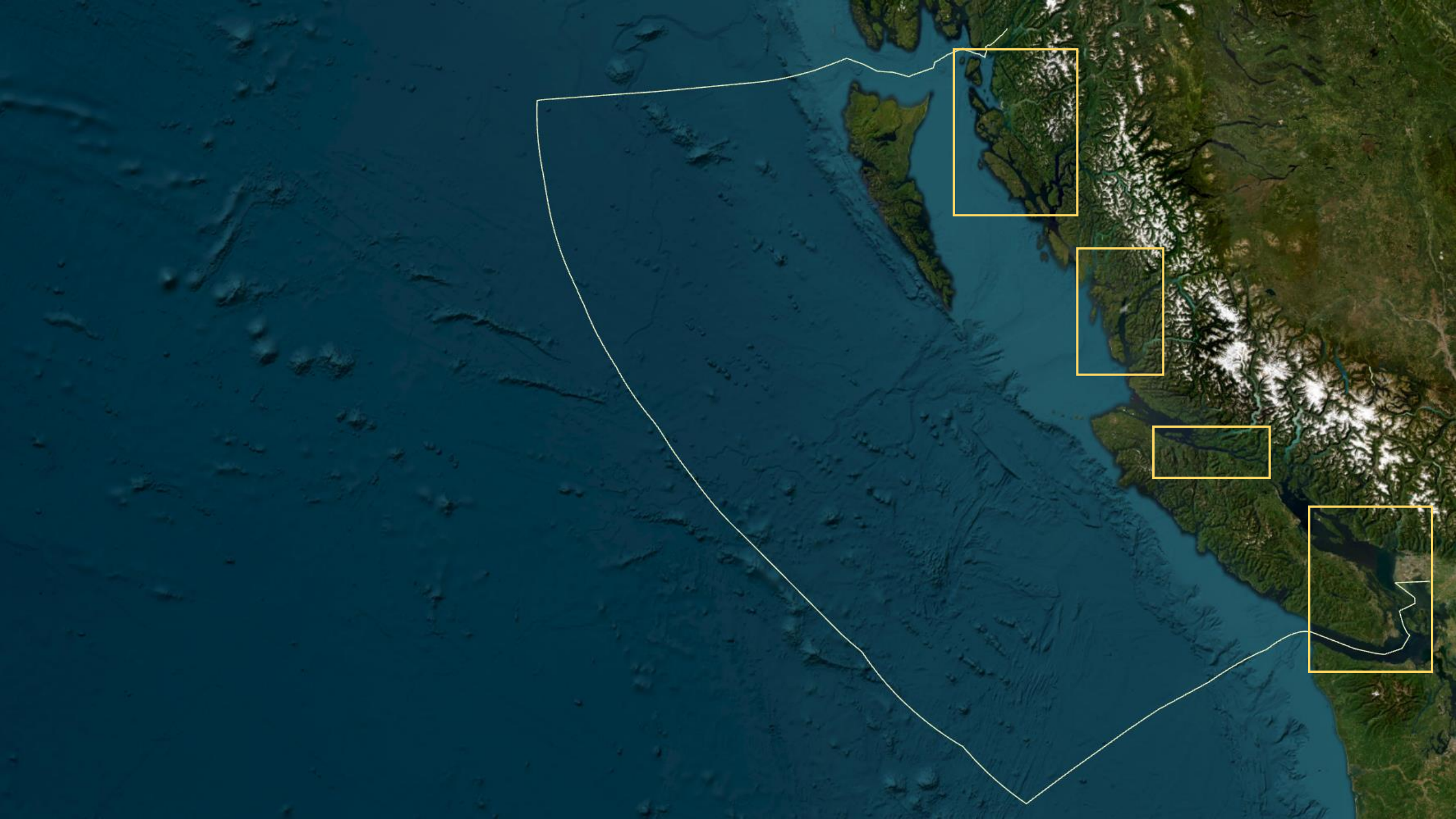
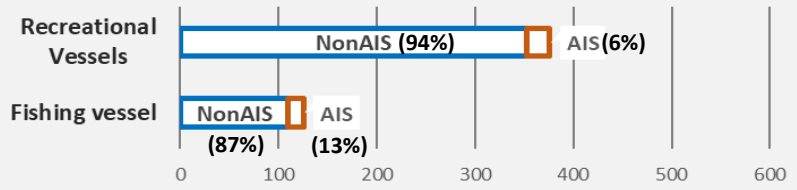
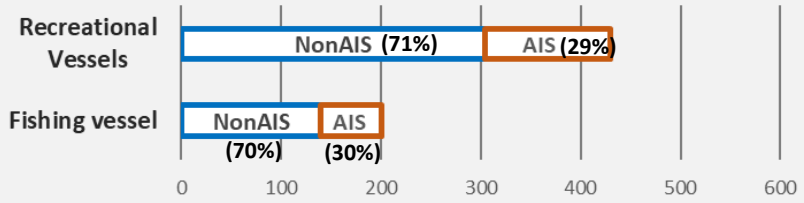


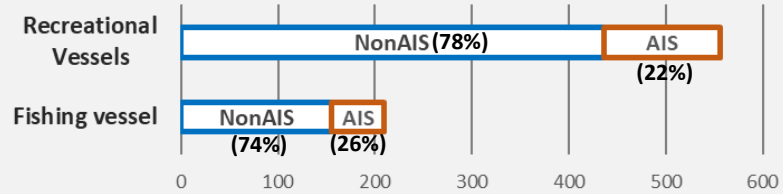
North Coast
Surveys: 63 from 2018 to 2022



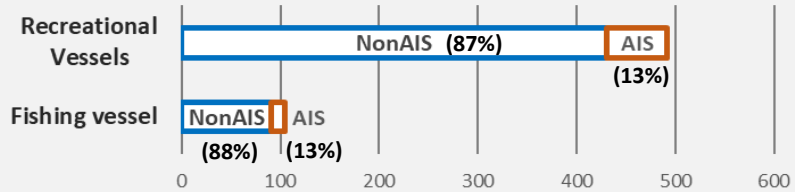
Central Coast
Surveys: 96 from 2018 to 2022



North Vancouver Island
Surveys: 54 from 2018 to 2022



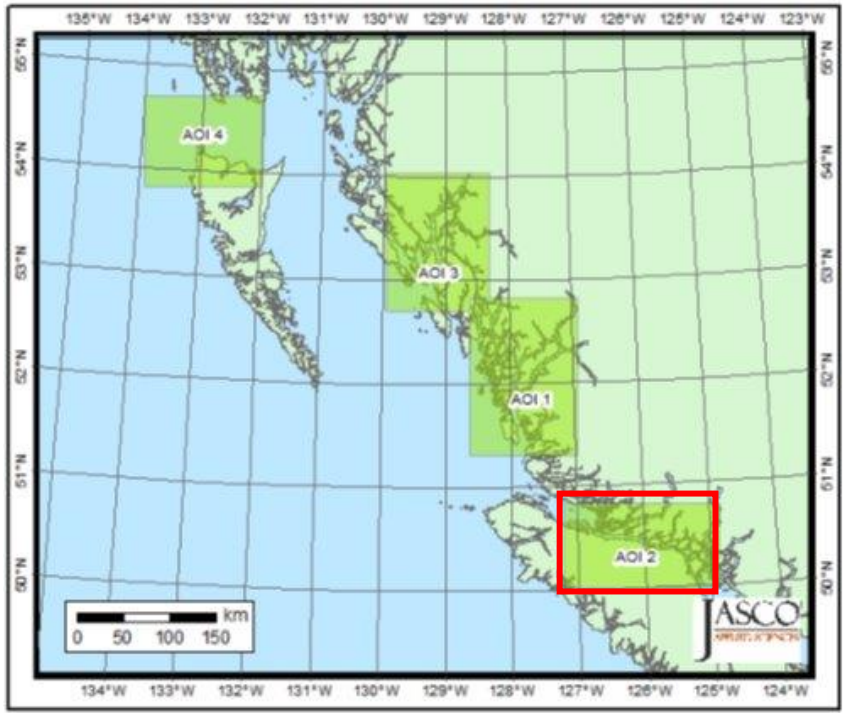
South Vancouver Island
Surveys: 89 from 2015 to 2019



Applying NASP data to model underwater noise from vessel traffic in the Northern British Columbia to inform Cumulative Effects of Marine Shipping assessments.

Learn more about Transport Canada's Cumulative Effects of Marine Shipping initiative at: https://tc.canada.ca/en/campaigns/protecting-our-coasts-oceans-protection-plan/better-protected-coastal-ecosystems/assessing-cumulative-effects-marine-shipping

Acoustic model Areas of Interest (AOIs)



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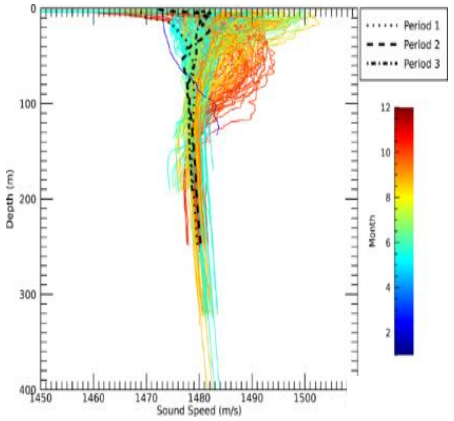
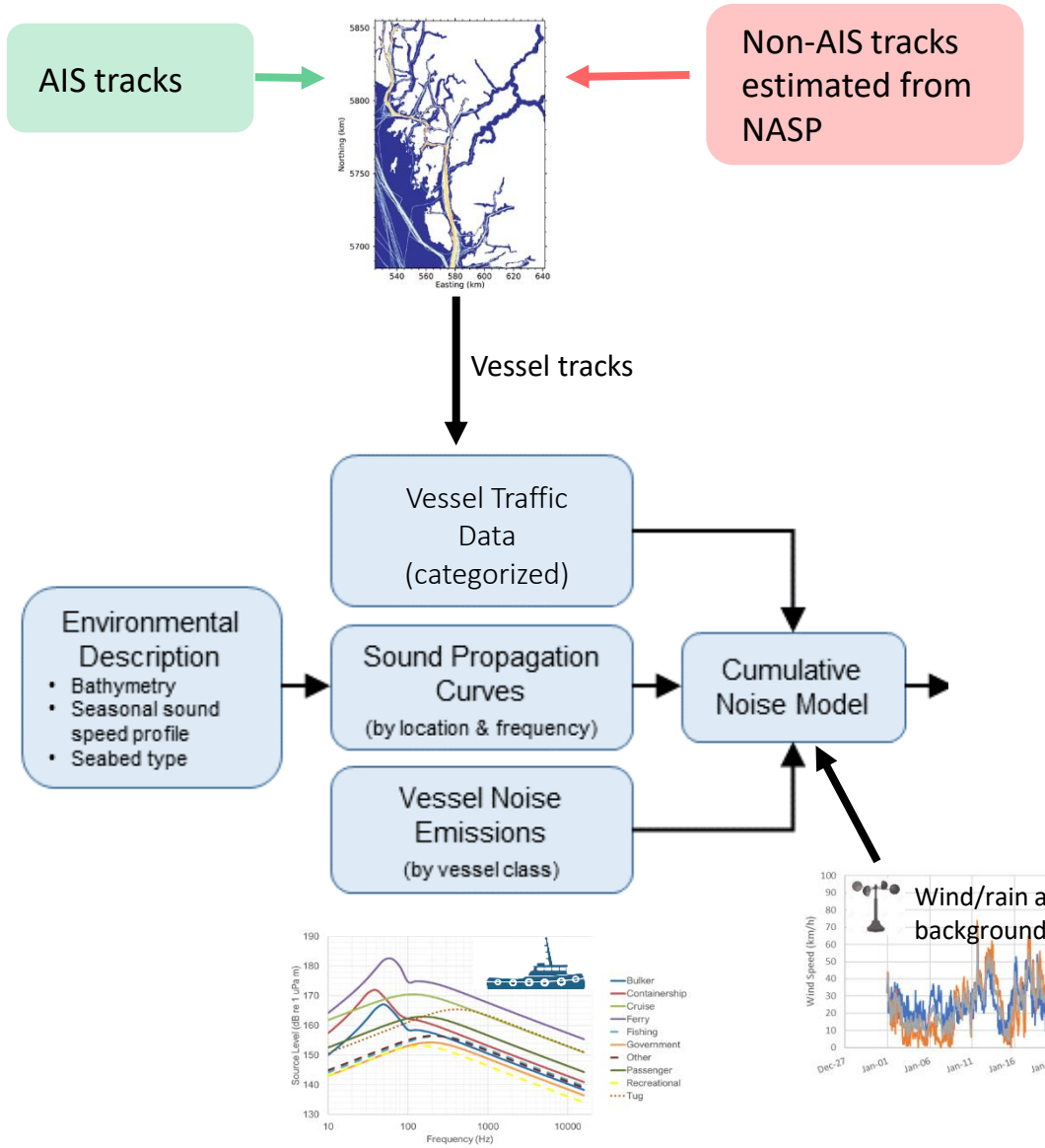
ARTEMIA Model

JASCO APPLIED SCIENCES





Source:

Ramsey, E., G.A. Warner, A.O. MacGillivray, Z. Li, and K.A. Kowarski. 2021. Hydroacoustic Modelling of Vessel Noise: British Columbia Northern Shelf Bioregion. Document 02505, Version 3.0. Technical report by JASCO Applied Sciences for Innovation Centre of Transport Canada.

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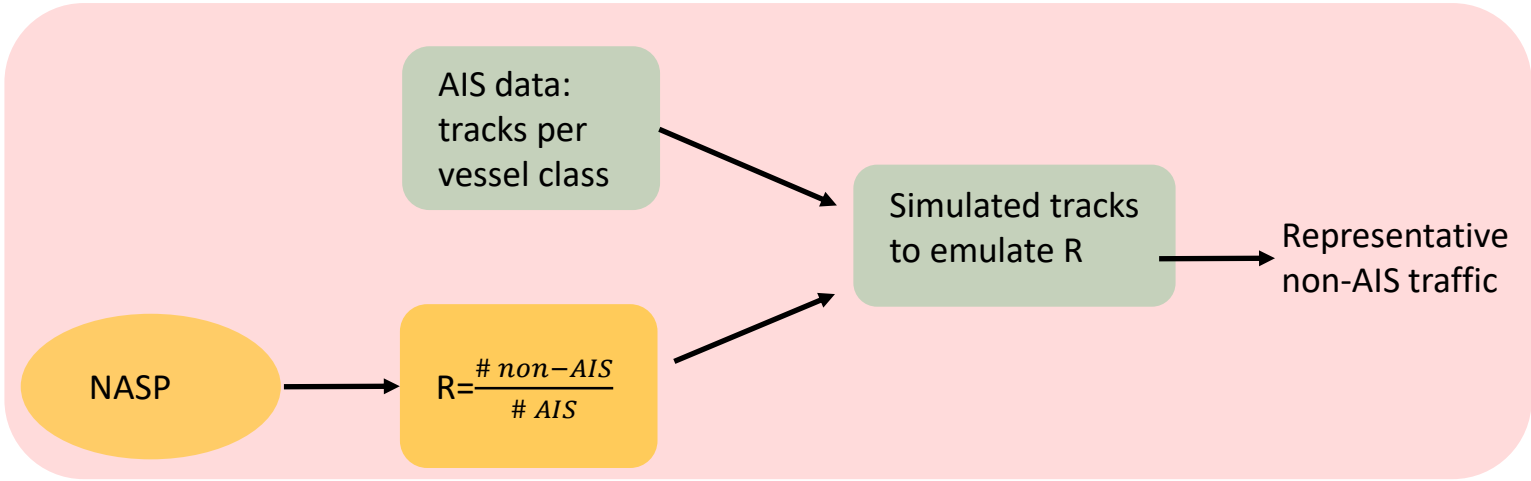
2019 ARTEMIA modelling study

- Larger vessels (150–500 gross tonnage) are well represented by AIS.
- Smaller vessels (Fishing, Recreational, Tugs) are underrepresented in AIS.
- Approach:
  - Use National Aerial Surveillance Program (NASP) data to estimate the ratio

    R= [# non-AIS vessels]/[# AIS vessels]
  - Use conventional AIS to generate simulated tracks for each vessel class, according to the ratio R.



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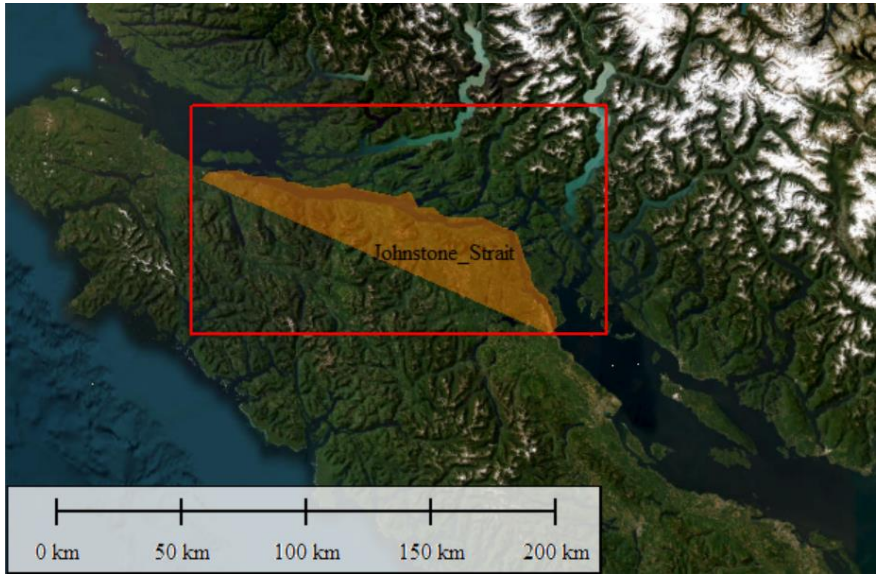
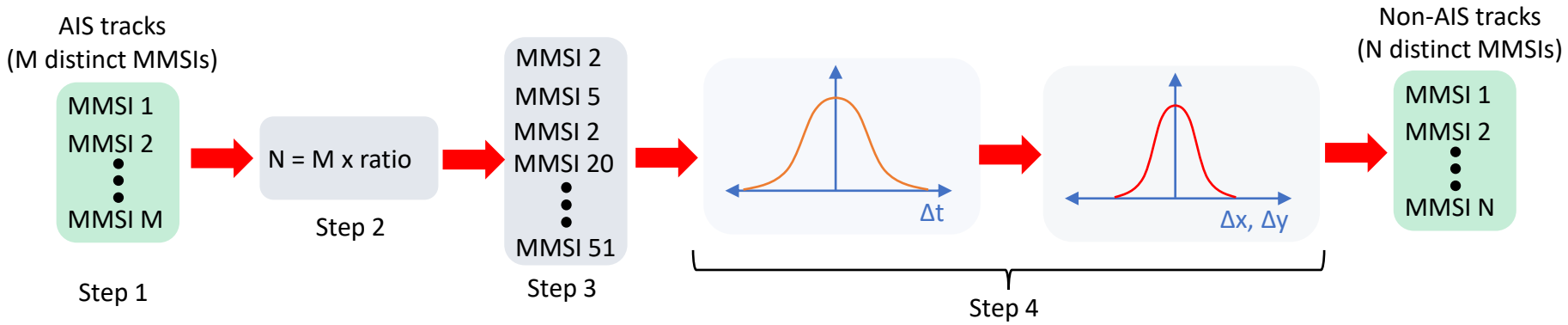
NASP ratios for the Johnstone Strait area



JASCO noise modelling period	Fishing			Recreational (does not include sport fishing)			Tugs		
	Non-AIS	AIS	Ratio (Non-AIS to AIS)	Non-AIS	AIS	Ratio (Non-AIS to AIS)	Non-AIS	AIS	Ratio (Non-AIS to AIS)
Summer (May to August)	42	16	**2.63**	69	27	**2.56**	17.00	23.00	**0.74**
Winter (September - April)	53	11	**4.82**	20	2	**10.00**	10.00	11.00	**0.91**

Source: Ramsey, E., G.A. Warner, A.O. MacGillivray, Z. Li, and K.A. Kowarski. 2021. Hydroacoustic Modelling of Vessel Noise: British Columbia Northern Shelf Bioregion. Document 02505, Version 3.0. Technical report by JASCO Applied Sciences for Innovation Centre of Transport Canada.

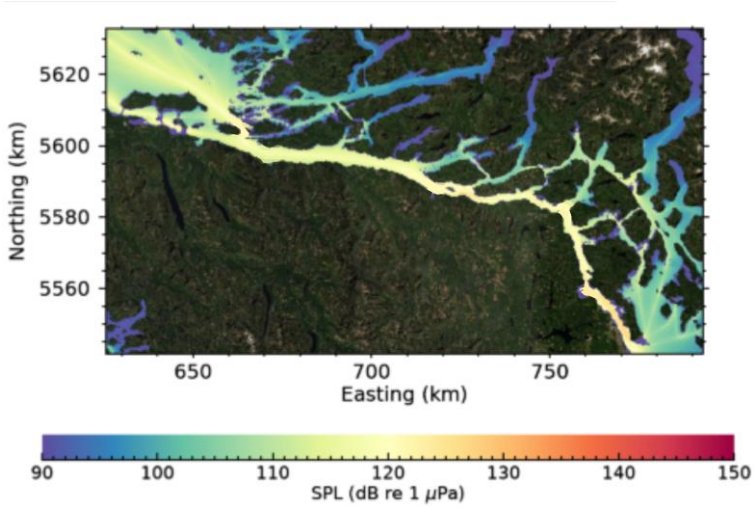
Generating non-AIS simulated tracks



- Step 1: Start with M distinct MMSIs (each one with multiple tracks).
- Step 2: Obtain # of new non-AIS instances, N.
- Step 3: draw ALL tracks from N MMSI instances.
- Step 4: For each track,
  - Apply a random perturbation to the time stamp (Normal, μ=0; Γ=0.5 days).
  - Apply a random perturbation to the x/y position (Normal, μ=0; Γ=50 meters).

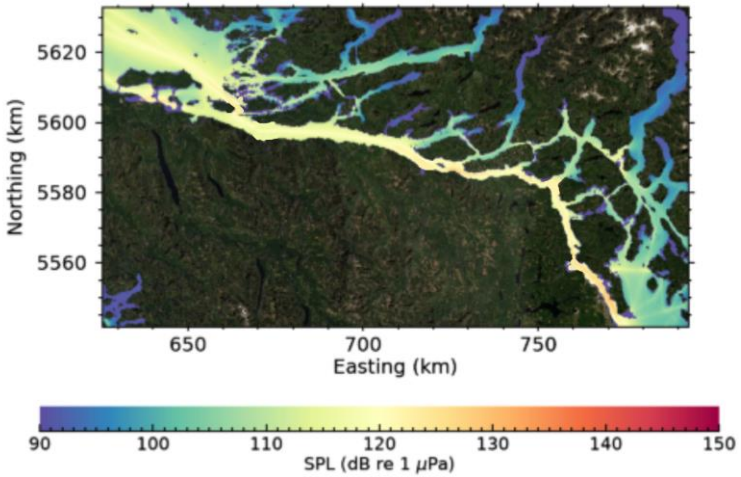
Source: Ramsey, E., G.A. Warner, A.O. MacGillivray, Z. Li, and K.A. Kowarski. 2021. Hydroacoustic Modelling of Vessel Noise: British Columbia Northern Shelf Bioregion. Document 02505, Version 3.0. Technical report by JASCO Applied Sciences for Innovation Centre of Transport Canada.

Simulated broadband sound pressure level: AIS vs non-AIS



Non-AIS traffic:
Fishing, recreational, and tugs

Levels for non-AIS vs AIS are similar, which suggests non-AIS has strong contribution in the area.



AIS traffic:
All vessel categories, but dominated by Tugs, Fishing, Recreational, and Other.

Source: Ramsey, E., G.A. Warner, A.O. MacGillivray, Z. Li, and K.A. Kowarski. 2021. Hydroacoustic Modelling of Vessel Noise: British Columbia Northern Shelf Bioregion. Document 02505, Version 3.0. Technical report by JASCO Applied Sciences for Innovation Centre of Transport Canada.

Summary

- What did we learn so far?
  - Non-AIS vessel traffic is dominated by recreational boating and fishing vessel traffic
  - Proportions of non-AIS/AIS vessels are not the same across coastal areas of BC
  - Majority of non-AIS vessels traffic is observed during the summer months (~80%)
  - Data is collected near shore, with important data gaps in offshore areas, west coast of Vancouver Island and Haida Gwaii

- Using aerial surveys to collect vessel traffic information:

<u>Advantages</u>

- ✓ Able to collect vessel traffic information regardless of AIS carriage requirements
- ✓ Large spatial coverage
- ✓ Survey remote and difficult to access areas

<u>Limitations</u>

- ✓ Provide a snapshot in time
- ✓ Data collection is weather dependent
- ✓ Very expensive without stablished agreements

- Showcase how NASP vessel traffic data can be used to better understand threats from vessel activities (e.g., underwater noise), particularly from small vessels like recreational vessels.

Thank you

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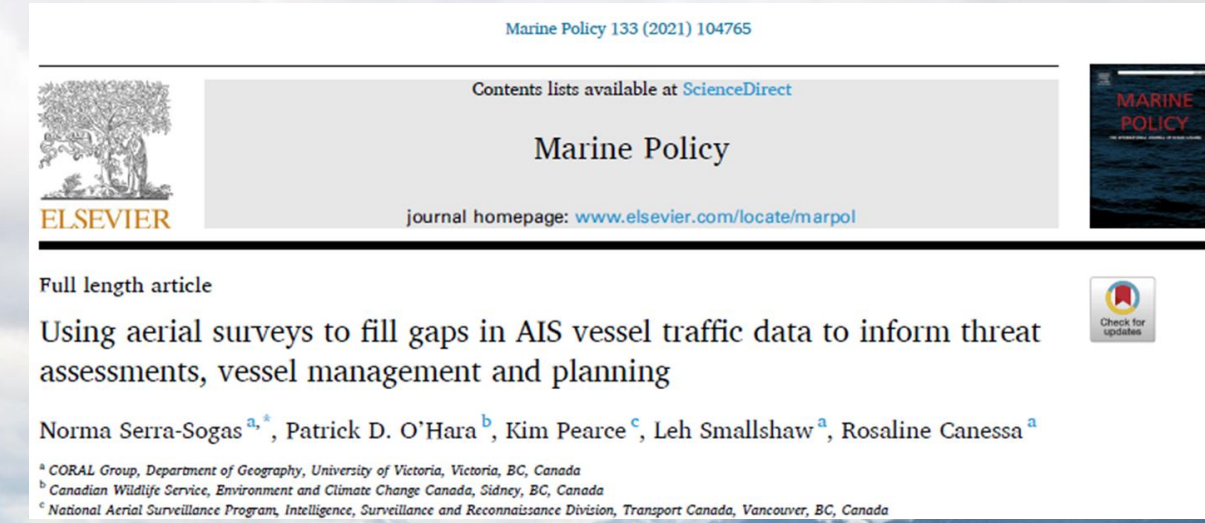

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Full length article

Using aerial surveys to fill gaps in AIS vessel traffic data to inform threat assessments, vessel management and planning

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Environnement et Changement climatique Canada

Note: The work presented here was carried out in part while Norma Serra worked as a Research Associate with the CORAL Group at University of Victoria, BC