Salish Sea Ecosystem Conference | 2018 Salish Sea Ecosystem Conference (Seattle, Wash.)

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Commercial ship versus whale watch boat noise: relative effects on Southern Resident killer whales

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Commercial ship versus whale watch boat noise: relative effects on Southern Resident Killer Whales

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1. SMRU Consulting North America
2. Hemmera Envirochem
3. Jasco Applied Sciences
4. Vancouver Fraser Port Authority. Enhancing Cetacean Habitat and Observation (ECHO) Program

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Noise Effects on Marine Mammals

- Significant progress and evolution on noise effects studies in the last decade

- Assessing chronic (cumulative) noise disturbance (e.g., masking) remains a significant challenge

- Noise exposure models able to integrate temporal – spatial - spectral overlap. Robust, standardized <u>metrics</u> needed **and** <u>linking these to effect</u> key step

Project Background

- Southern Resident Killer Whales (SRKW) critical habitat overlaps inshore waters around Vancouver and Seattle.

- ~10,000 commercial vessel (bulkers, containers, ferries, tugs, tankers) per year ply Salish Sea, significant numbers of whale watching and fishing boats

- 2012: Proposed new container terminal expansion near Vancouver (<260 calls/year)

- 2013-16: Led to development of SRKW-Noise Exposure simulation model (assess baseline, 'delta' effect of increased vessel numbers and mitigation efficacy)

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How the SRKW-Noise Exposure Model Works

COLLABORATORS

- **SRKW Sightings (10 yr)**
BCCSN – Van. Aquarium
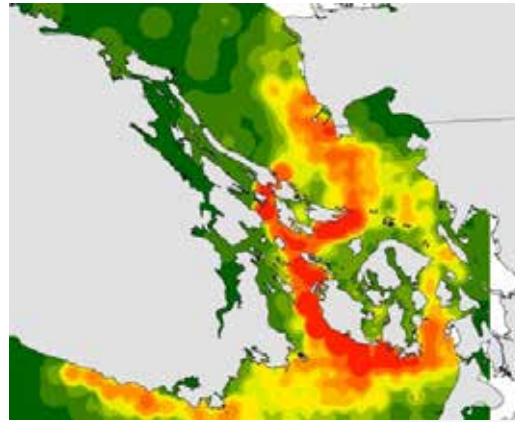The Whale Museum
SMRUC + Hemmera

- **Vessel Noise / Ambient**
JASCO
Veirs, Veirs, Wood
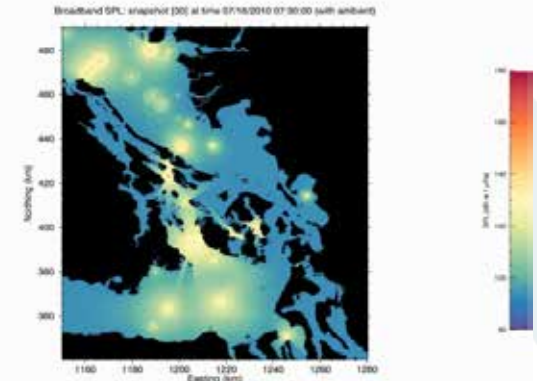SMRUC
University of Dalhousie

- **Dose Response**
DFO – Deeke (Dtag)
SMRUC (PAM)
Williams et al. 2014 (Obs.)
Univ. of St Andrews
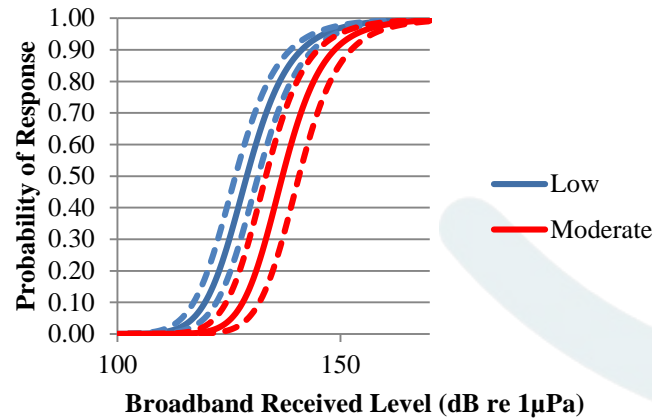Click Masking: Au (2004)

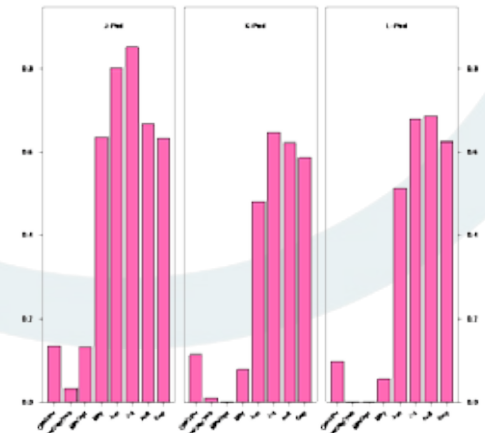SRKW – Pod spatial use

Effort corrected

Vessel noise (AIS)

24 Hour – Fine scale
(200m, 1 min interval)

Dual severity dose response

50% Moderate BR 137 dB, Low BR
129 dB. If NO response –
Click masking within 50 kHz band

SRKW – temporal (month)

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SRKW-Noise Exposure: Study Implications

1. Key conclusions:

Baseline regional levels high – cumulative noise effect 'significant'

Local project area 'delta' effect relatively 'small' (e.g., PCOD lite)

2. Vancouver Fraser Port Authority: Next Steps

Underwater Noise Management and Mitigation plan

Recognised noise baseline was a multi-stakeholder issue– created new Enhancing Cetacean Habitat and Observation (ECHO) Program (2014) to address cumulative vessel issues.

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ECHO Noise Study: Effect of Shipping vs. Whale Watch Noise on SRKW

- SMRU Consulting to revisit SRKW noise exposure simulation model
- Focus on summer (May-Sept) when most whale watch effort occurs.
- First cut assessment
- Identify key sensitivities of the model
- Make recommendations

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Study Assessment Area

- Study confined to inshore study area (red box) where SRKW habitat use best understood
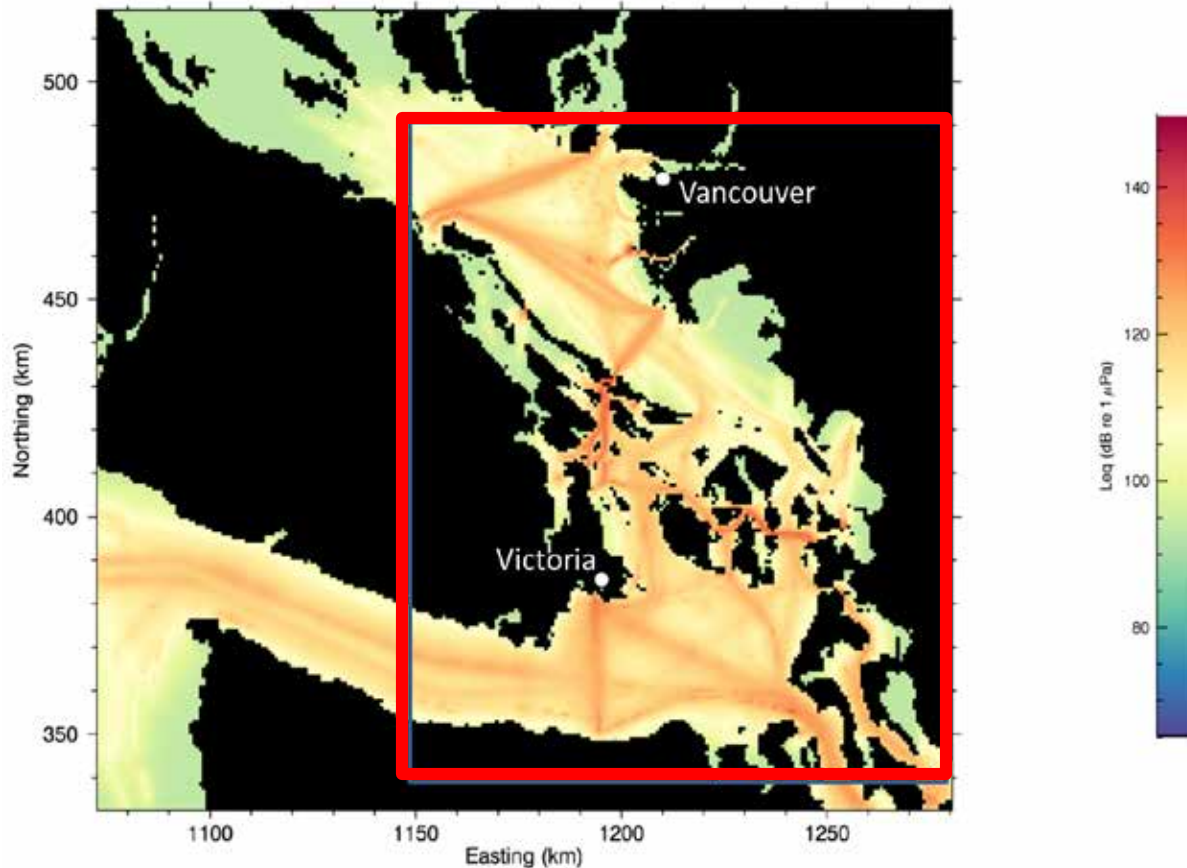
Average Leq noise level for AIS-enabled vessels in July (JASCO)

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Incorporating Whale Watch Boat Noise

Multi-step, back-calculation approach

1. "With whale" probability combines sightings and effort (Hemmera 2014, Soundwatch 2012)

2. Number of boats per hour (Soundwatch 2012)

3. Boat noise (SPL – Holt et al. 2009, PSD – Hunt 2007, Jensen 2009)

4. Whale – boat proximity (Giles 2014, Pod dispersed/clustered)

5. Noise levels input into SRKW-Noise Exposure simulation model in isolation (only WW boats) and combined with AIS vessel noise

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Number of Behavioral Responses (BR) per Whale

- Overall BRs dominated (>90%) by AIS vessel noise
- WW boats infrequently trigger dose response thresholds
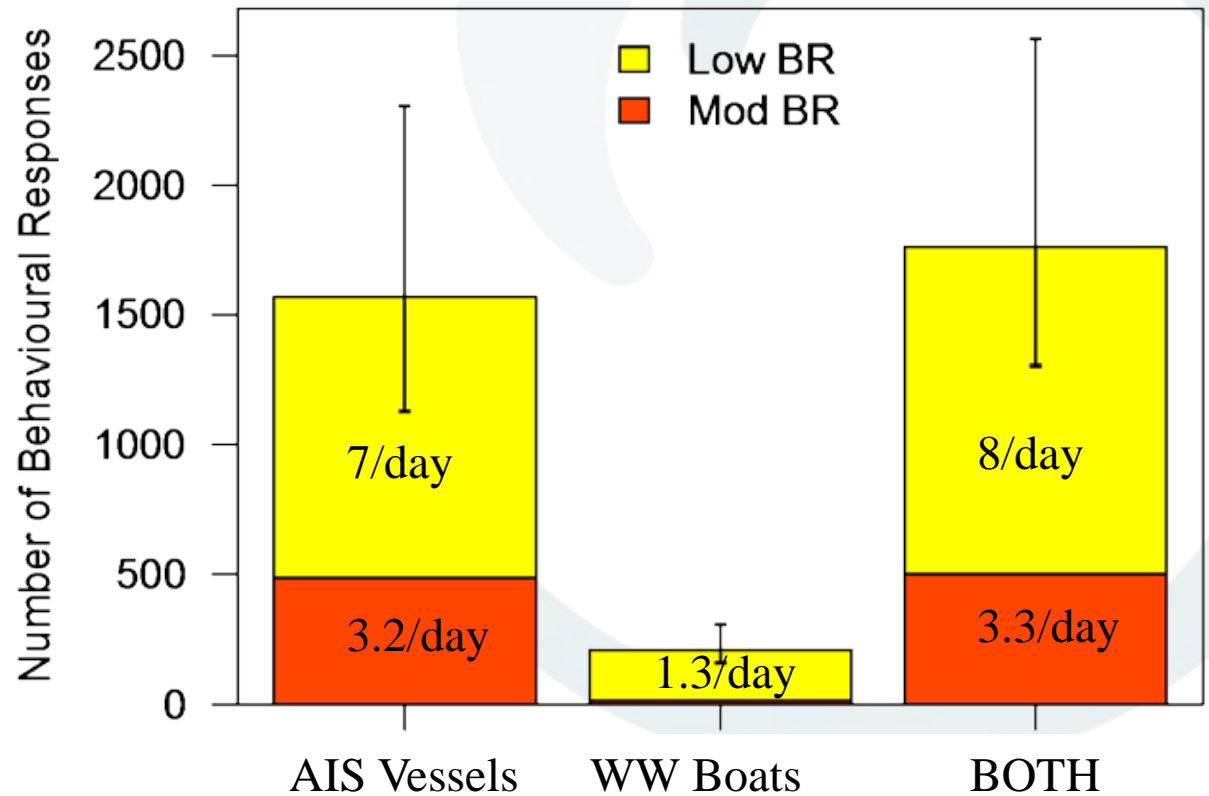
Legend:
AIS: Automatic Information System (Commercial vessels > 60 feet)
WW: Whale watch boats
Error bars: 95% confidence intervals – 500 simulations

Total number of behavioral responses per whale (May-Sept.)

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Residual Click Masking (50 kHz): Range Reduction
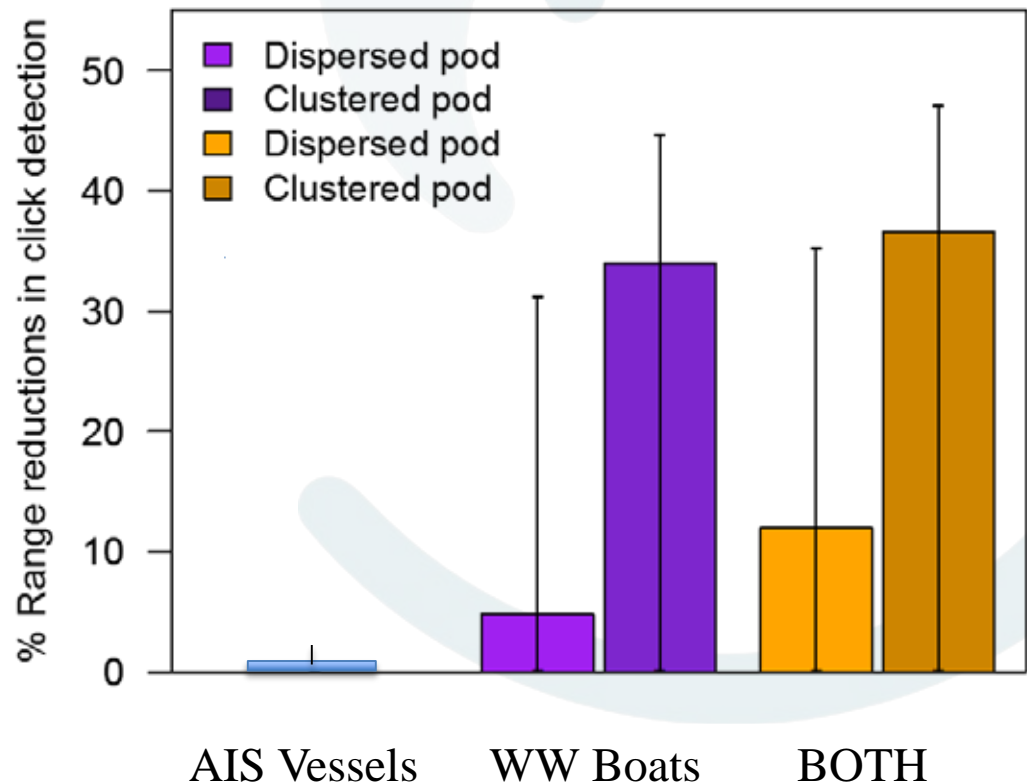
- Whale Watch (WW) boats dominate click masking
- Highly sensitive to input PSD parameters (esp. whale-boat proximity, vessel SL-speed selection)

Legend:
AIS: Automatic Information System (Commercial vessels > 60 feet)
WW: Whale watch boats
Error bars: 95% confidence intervals – 500 simulations

Legend:
- Dispersed pod
- Clustered pod
- Dispersed pod
- Clustered pod

AIS Vessels   WW Boats   BOTH

y-axis: % Range reductions in click detection

Masking of foraging clicks: % range reduction from 250m

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Link to Effect:
Need for a Common Metric

- Challenged to find a common "effect" metric
- Used Dtag data and simple assumptions to relate both BRs and masking to **time**

1. AIS-Vessels contributed ~60% and whale watch boats ~40%
2. Total time equated to 13-14.5% of each study day or 20-23% of each "whale present" day

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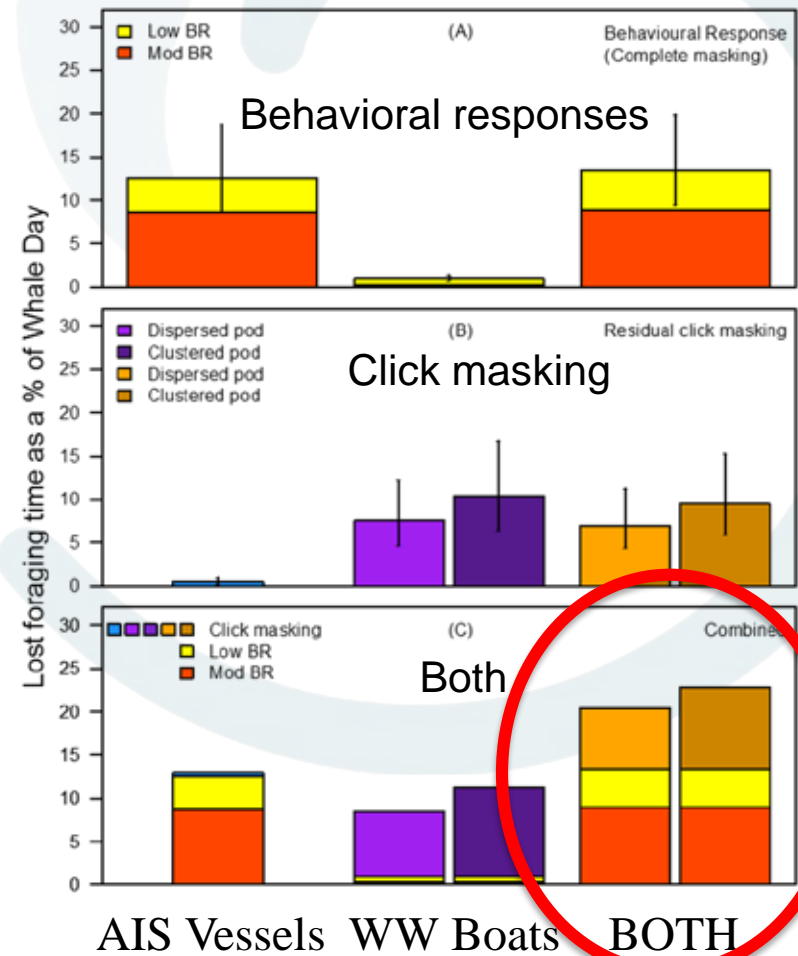
SMRU Consulting Thoughts in Implications / Mitigation

- Large vessels and whale watch boats trigger different noise effects, both have notable potential effects.
- **Mitigation measures**:
  - Whale watch boats (distance, boat speed or number regulations).
  - Large vessels (slow downs (when KW present?), lane shifts from hotspots, targeting "gross polluters", and clustering vessels. Incentives to design quiet vessels or adopting noise quietening management procedures important as a long-term solution
- For SRKW – increasing **salmon availability key**

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SMRU Consulting Thoughts on Model Improvements

- Recommend refining click masking model
  - Masking range, masking frequency
  - Noise inputs and assumptions
- Improve/expand habitat use layer
- Include assessment of quiet periods

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Thanks for listening

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Full report can be found on the ECHO website