

Port-operated systems for automated vessel underwater noise measurements



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JASCO Applied Sciences
UNOLS Green Boats and Ports Workshop,
Portland, August 30, 2018



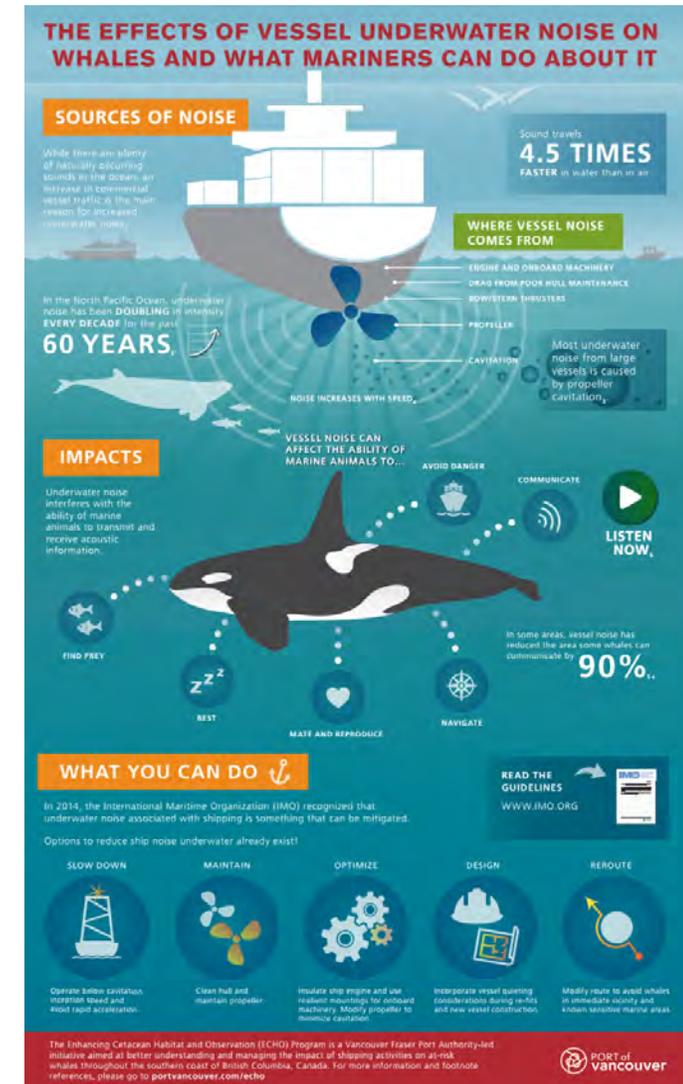
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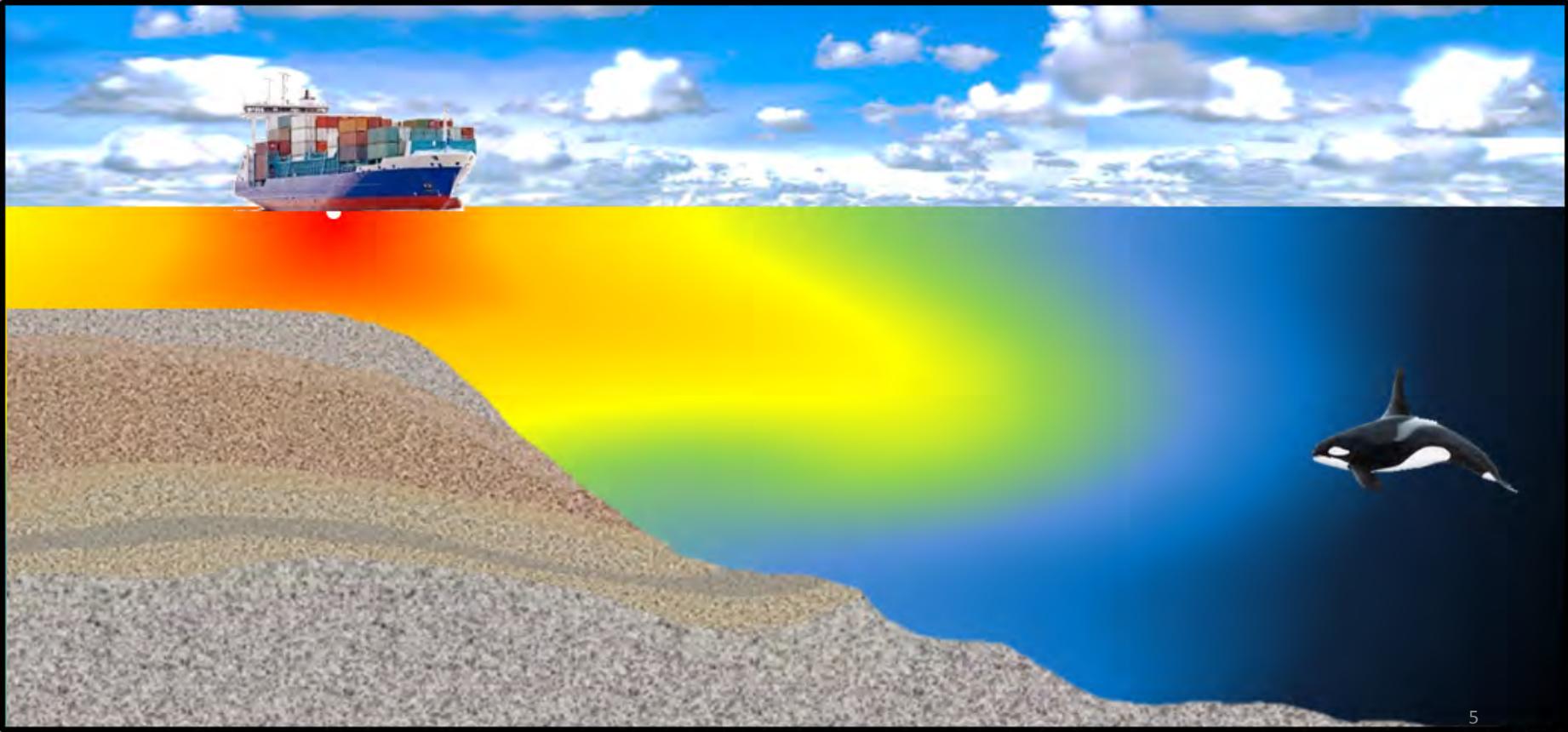
Overview

- Context: underwater ship noise effects on marine fauna
- Automated Underwater Listening Stations
- Data transmission and processing
- Vessel Noise Measurements
- How measurements can be used by ports for managing vessel noise

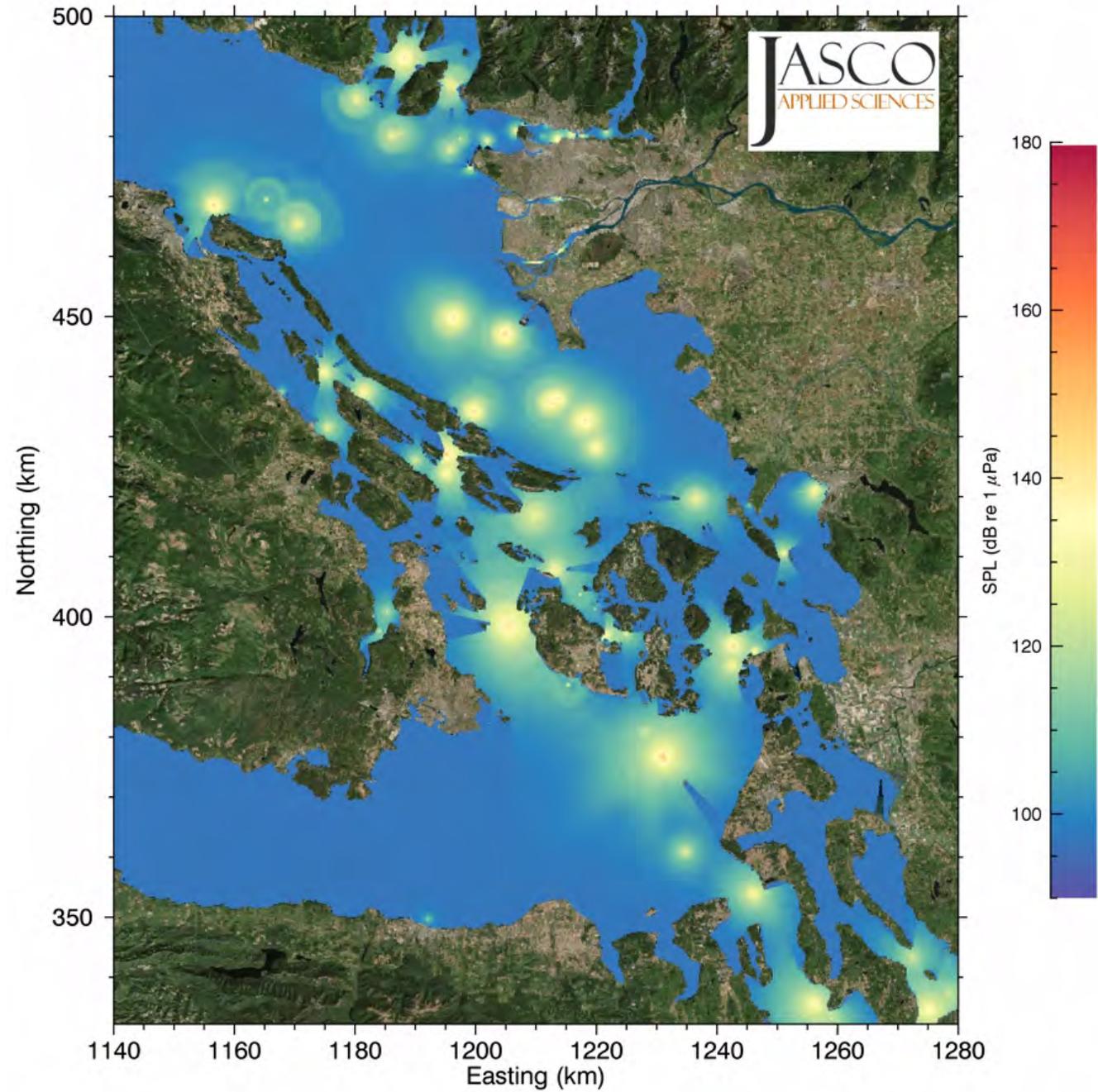


<https://www.portvancouver.com/wp-content/uploads/2016/04/ECHO-Program-Underwater-Noise-Infographic-April-2016.pdf>

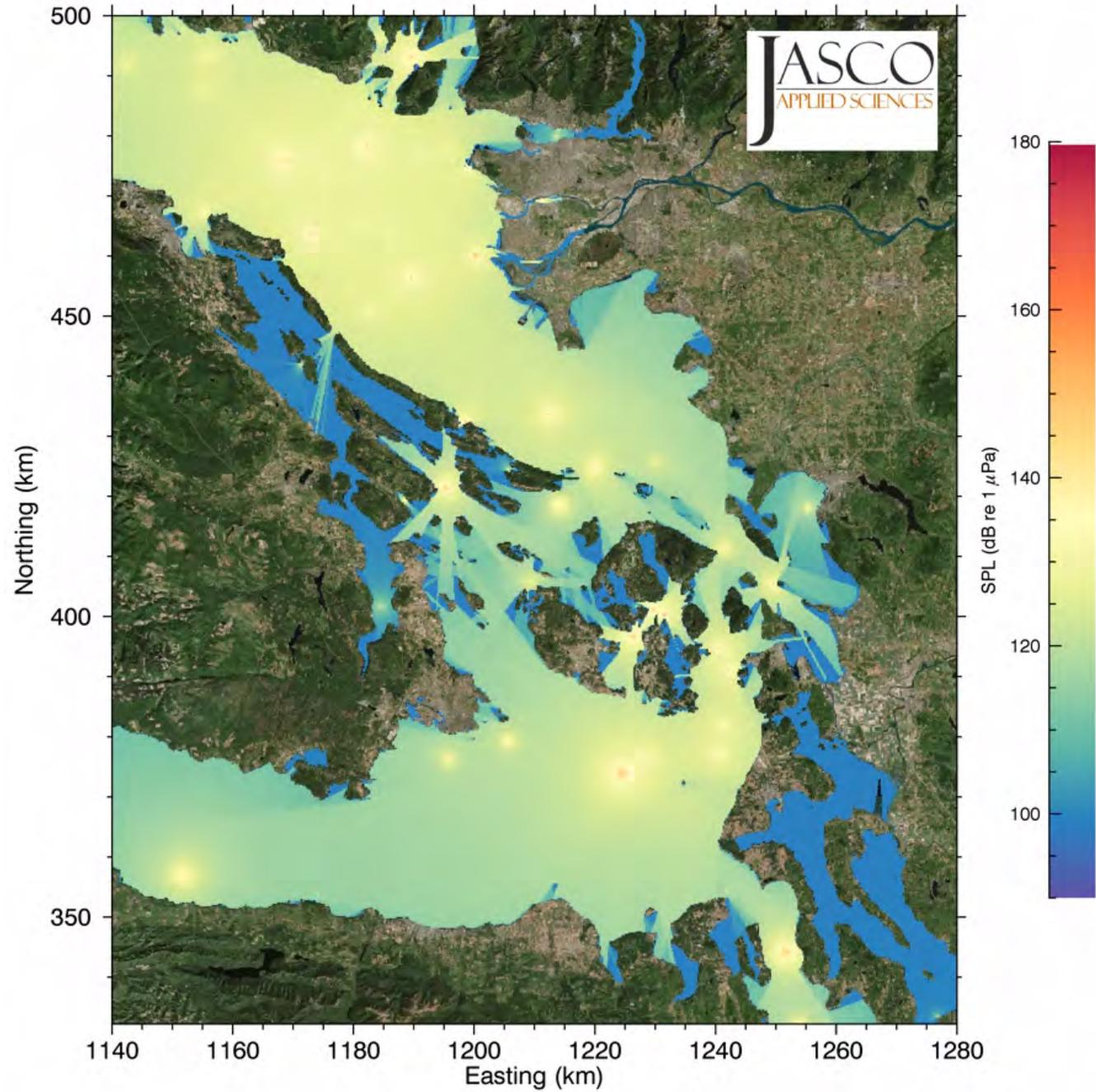


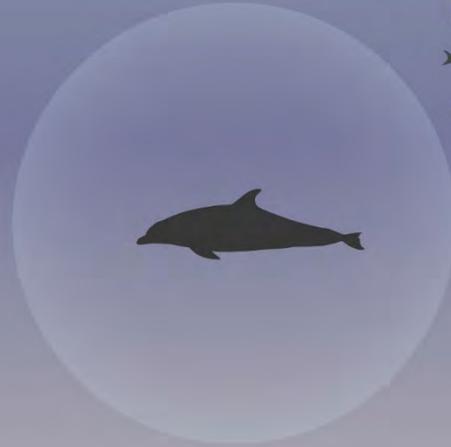


Broadband SPL: snapshot [000001] at time 07/30/2015 00:00:00



Broadband SPL: snapshot [000001] at time 01/31/2015 00:00:00





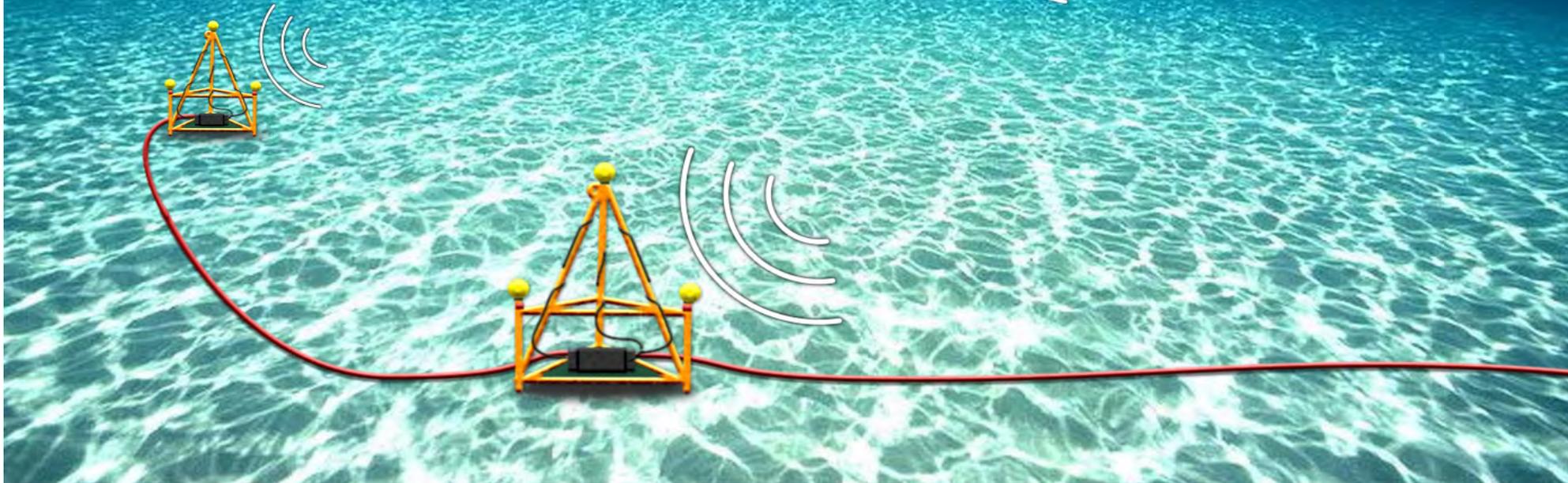
Listening space reduced by making noise

Managing Underwater Shipping Noise

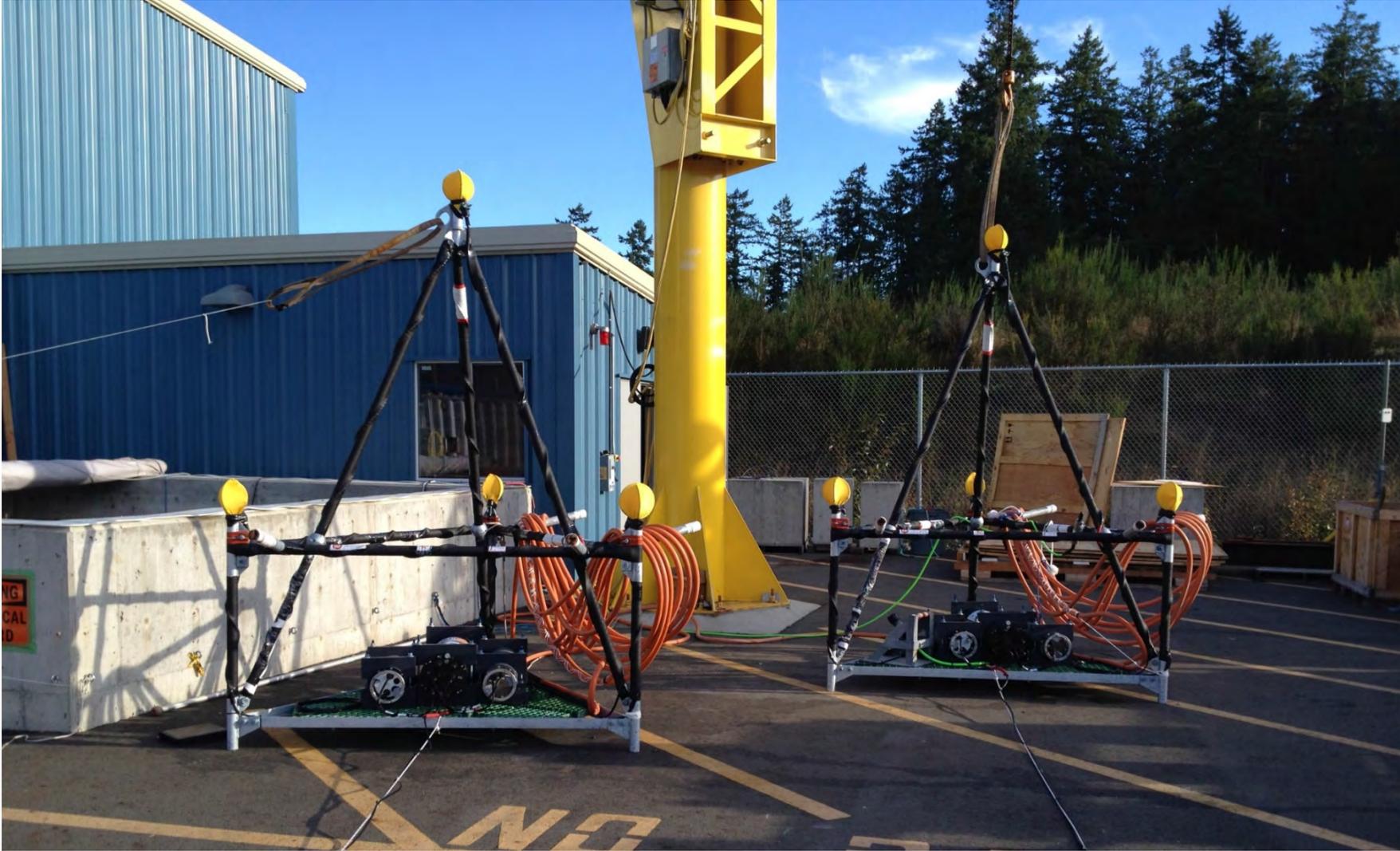
1. Understand its spatial and temporal distribution
2. Determine when/where sensitive fauna may be exposed
3. Develop regulations (or preferably incentives) to influence noisy vessels to become quieter
4. Implement mitigation measures to reduce exposures, e.g.:
 - slow vessels when animals are present
 - move shipping lanes to avoid sensitive areas
 - implement no-go periods to create quiet times

Underwater Listening Stations:

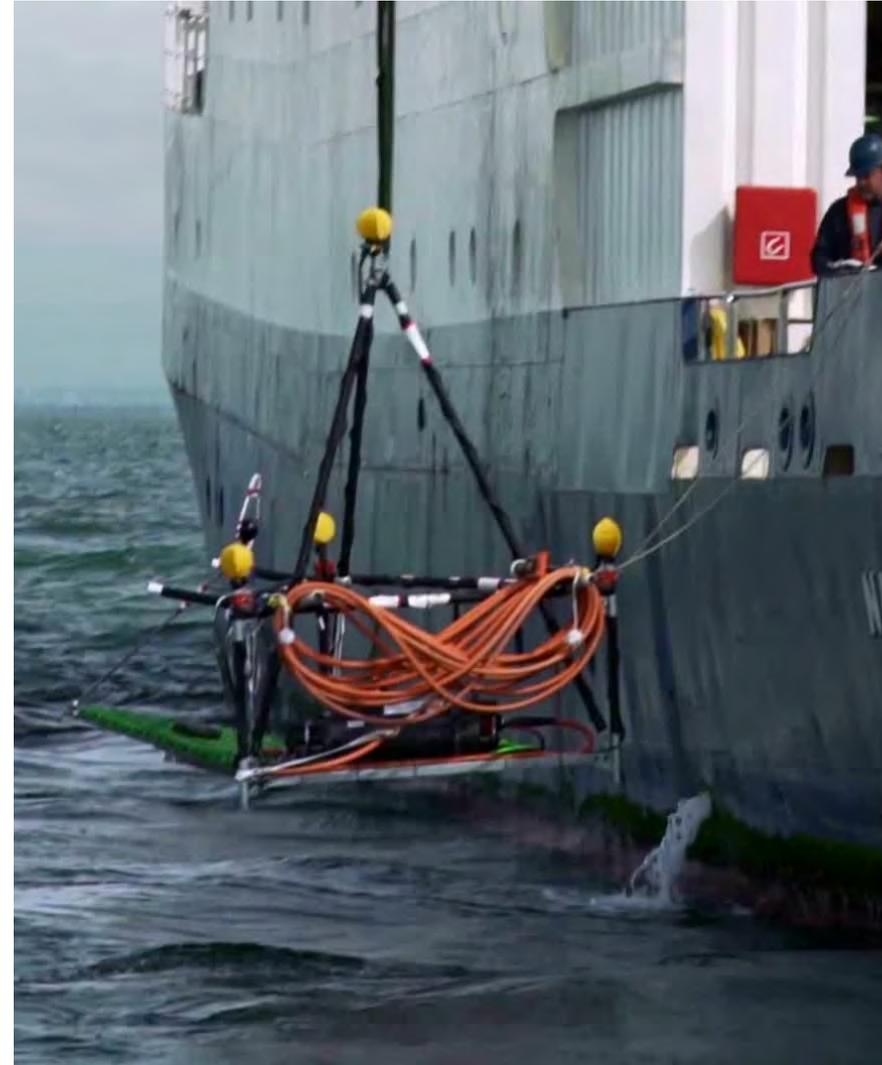
- Monitor trends in underwater noise
- Detect marine mammals near shipping lanes
- Measure noise emissions of individual ships
- Measure effectiveness of mitigations



Underwater Listening Station arrays deployed by JASCO for Port of Vancouver's ECHO Program

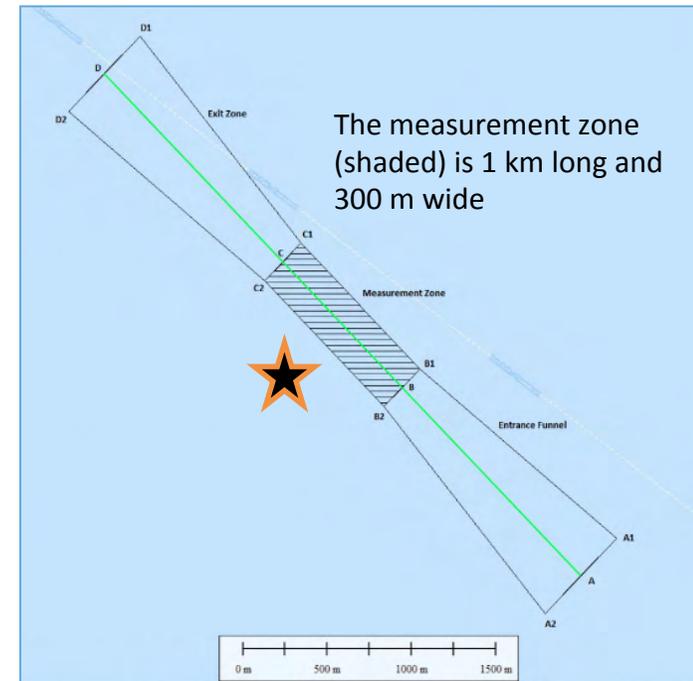
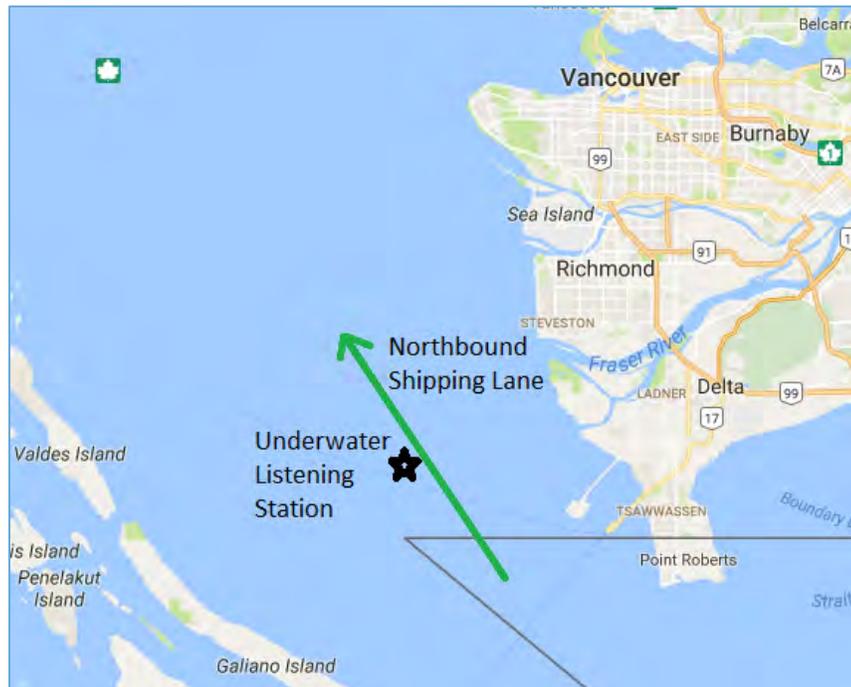


- ULS deployed in 170 m water depth on inbound shipping lane
- Subsea fibre optic data cables plugged into a subsea network operated by Ocean Networks Canada (ONC)
- Acoustic data are transmitted to shore in real-time and processed immediately by JASCO's automated analysis systems



Ship measurements geometry

- Approximately meets ANSI S12.64 Vessel Noise Measurement Standard, which is similar to ISO 17208-1
- Pilots have control of vessels, allowing systematic passes through a prescribed measurement zone
- Other vessels are able to use this system



Automated Acoustic Data Analysis

JASCO PortListen

An integrated component-based solution for marine noise applications, designed for Ports

AMAR - G4

Autonomous or real-time marine acoustic recorder



Observer

Advanced real-time observatory for acquiring and analyzing acoustic and oceanographic data



PortListen®

Raw Acoustic Data Archive



Acoustic Data Products Database



PortListen® Web-Interface

Secure user access system



ShipSound

ISO-compliant vessel noise source level measurements with report generation



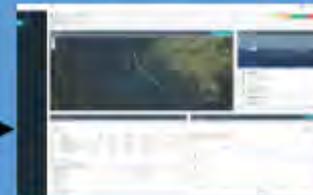
AmbientView

Interactive ambient noise spectral and time series viewer for one to hundreds of stations



PAMView

Passive Acoustic detection and classification of marine mammals, vessels, sonars and impulsive sources



ShipSound: Vessel Noise Emission Measurement System

Vessel Name here (PENDING)

Project: Port Metro Vancouver Underwater Listening Station
 Status: PENDING (Depth: 255 m)
 Date & Time: Nov 31, 2016 4:23 AM

VESEL TRACK | Show vessels in area

VESEL INFORMATION

Vessel Name: (Vessel Name removed)
 MMSI & IMO: (MMSI and IMO removed)
 Vessel Flag: Cyprus
 Vessel Home Port: N/A
 Vessel Type: BULK CARRIER
 Vessel Length: 229 meters
 Vessel Breadth: 31 meters

MEASUREMENTS DETAILS

Route information

Measurement	Average	Minimum	Maximum	Range Span	Standard Dev
Speed over Ground (kn)	15.0	13.6	16.0	2.4	0.6
Rate of Turn (deg/min)	31	0.0	26.8	26.8	87
Course over Ground (deg)	243.4	1.0	357.4	356.4	136.1
True Heading (deg)	314.0	314.0	314.0	0.0	0.0

Navigation data

Navigation status	At anchor
Position accuracy	HIGH (< 10 m)
Special maneuver	N/A
Shaft rate (rpm)	N/A
Actual vessel draft (m)	8.1
Speed through Water (kn)	N/A
Percent Power (%)	N/A

ACOUSTIC ANALYSIS

Third Octaves

Monopole Source Level - 1/3 Octaves
 Broadband Source Level: 154.0 dB re 1 µPa @ 3m

Source Level (dB re 1 µPa @ 3m)

Frequency (Hz)

Certificate of Vessel Underwater Acoustic Source Level Measurement

This Certificate of Vessel Underwater Acoustic Source Level Measurement is provided as a free service by Port of Vancouver for the limited purpose of understanding approximate underwater noise emission levels of vessels. This certificate and the measurements reported herein cannot be used to affirm or disavow any claim of adherence to or exceedance of legislated noise emission standards in any jurisdiction. Port Metro Vancouver shall not be liable for any claim arising from the use of this certificate for any purpose whatsoever.

Vessel Information		Measurement Information	
MMSI:	000000000	Measurement Date (UTC):	March 31, 2015
IMO:	00000000	Closest Approach Time (UTC):	8:23:10
Name:	GENERIC NAME	Closest Approach Distance (m):	485.2
Flag:	Cyprus	Water ground Speed (kn):	15.0
Vessel DWT (TEU):	81031.0	Sail Direction over ground (deg):	243.4
Port/Starboard Vessel Type:	Bulker	Vessel Water Speed (kn):	15.2
Length (m):	223.0	Shaft rate (rpm):	40
Beam (m):	31	Vessel Percent Power/Power:	55
Maximum Draft (m):	8.1	Actual Vessel Draft max (m):	8.2
Engine Power (KW):	12069	Monopole Source Depth (m):	4.1
Number of Shafts:	2	Monopole Source Level (dB/µPa):	194.0
Prop Diameter (m):	4.8	Radical Noise Level (dB/µPa):	192.5

The presented 1/3-octave frequency band vessel source levels are in units of:

- Radical Noise Level - as defined in ANSI S12.54-2009 (R2014) measurement standard, and
- Monopole Source Level - considers sound energy at originating from a point location, most suitable for use by acoustic that independently account the surface and seabed reflections

Source Level (dB re 1 µPa @ 3m)

Frequency (Hz)

Vessel Noise Emission Levels - Frequency Weighted by Species Group

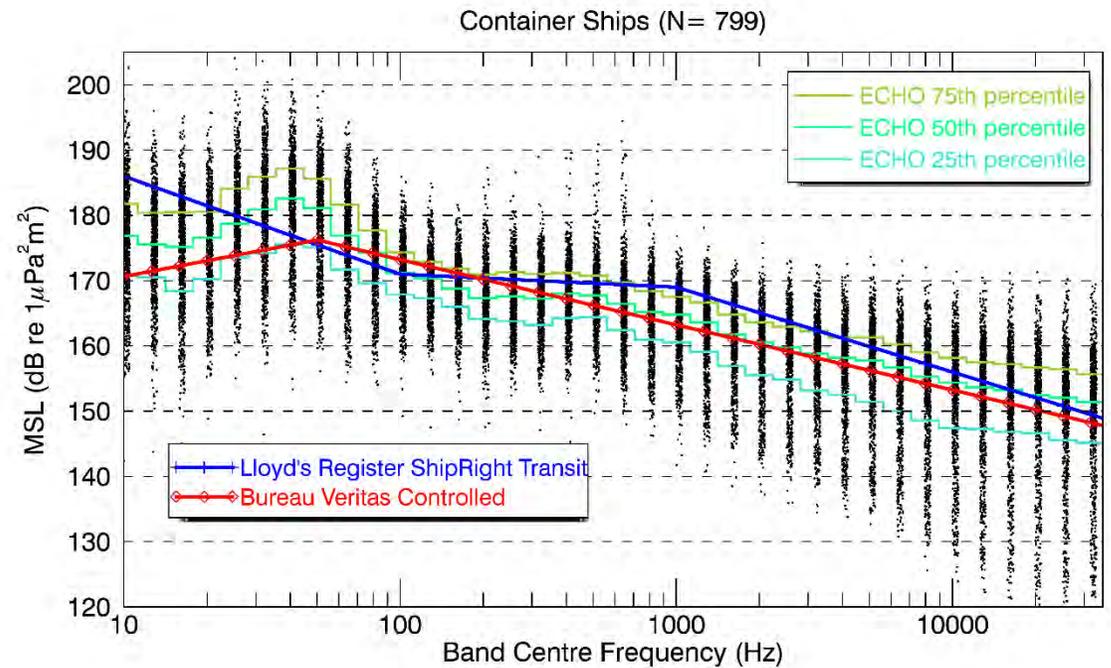
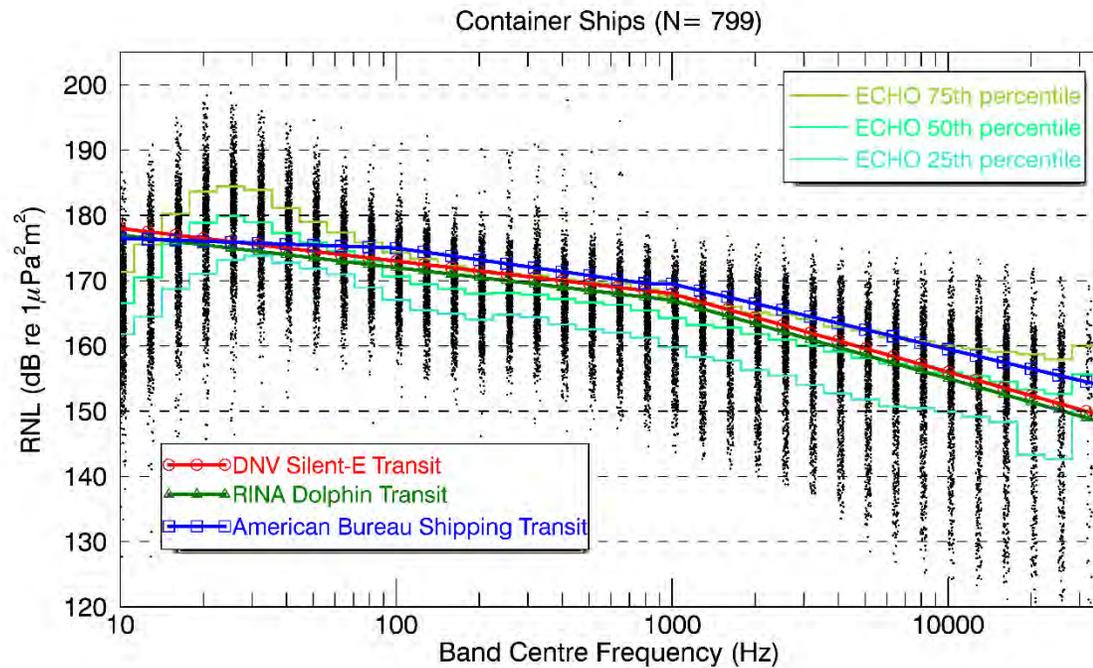
HFC: 179 dB
 MFC: 181 dB
 LFC: 184 dB

Overall Performance Rank: 60

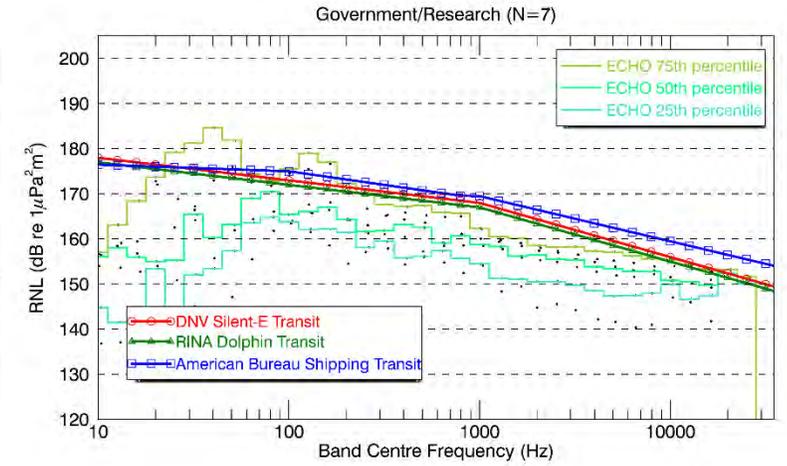
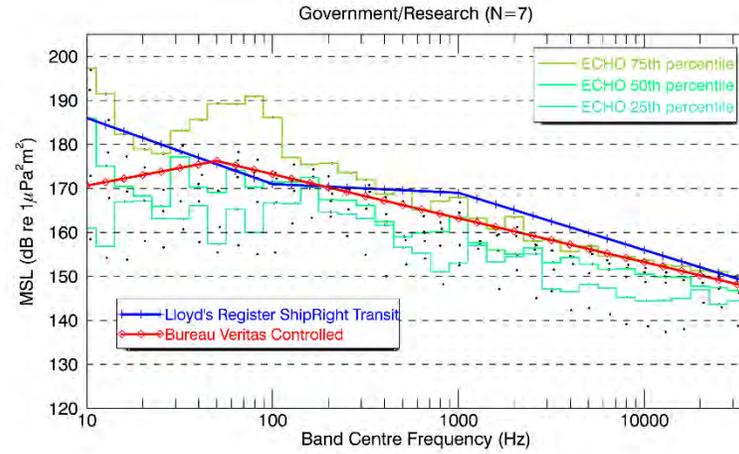
NOT ENOUGH DATA

This vessel's underwater noise rating is better than 36.0% of other vessels in class Undefined measured at Port Metro Vancouver, scaled for operating parameters. This rating is based on currently accepted, published scientific criteria and is relative to the measurements of comparable vessels received by this system. The rating value reported for a given vessel can therefore change over time as the statistics evolve and/or new scientifically accepted criteria are introduced. Details of the rating procedures are provided on the attached sheet.

Comparisons of ULS measurements (black dots and percentile lines) with Noise Certification Organization Thresholds (heavier red, green and blue lines)



Note: RNL=Radiated Noise Level, MSL=Monopole Source Level



Research Vessels

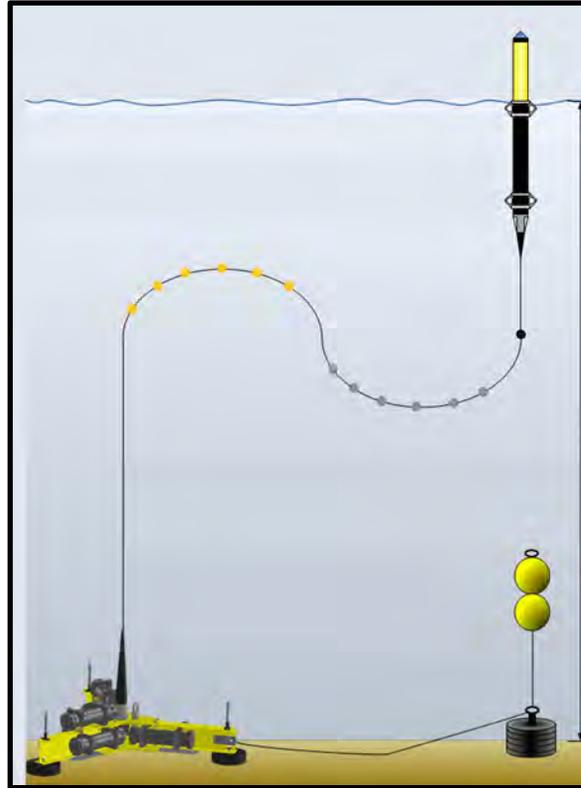
Port of Vancouver's use of these measurements



http://seattletimes.nwsourc.com/html/localnews/2018025831_orcas20m.html

- The ECHO Program's ULS has acquired more than 7000 accepted vessel measurements since September 2015
- ECHO offers the reports to vessel owners for free, and these can be used by the owners to meet requirements of certification organizations such as Green Marine
- A key plan for this system is to rank the noise emissions of vessels visiting the Port. The intention is to incentivize vessels that are quieter by providing rebates on port fees

Telemetered Acoustic Station (does not need a cable)







Thank You!
Questions are welcome

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