



Underwater noise management plan

Vancouver Fraser Port Authority

December 2023



Canada

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Purpose

This plan sets out the Vancouver Fraser Port Authority's approach to understanding, managing, and mitigating the effects of port-related underwater noise on marine mammals, especially at-risk whales. The purpose of this plan is to guide decisions and actions by port authority employees and provide resources to assist port tenants and users in managing and mitigating the impacts of underwater noise from their activities.

The port authority will review and update this plan annually to report progress on our planned actions and targets and incorporate any significant changes in our approach.

Our goal

To achieve a measurable reduction in underwater noise from port-related activities, in order to reduce adverse effects on marine mammals, especially at-risk whale species

Our objectives

- Increase the port authority's knowledge of the effects of underwater noise on marine mammals
- Raise awareness with port users and tenants of the effects of underwater noise on marine mammals
- Reduce underwater noise from port-related activities within the port authority's jurisdiction and throughout the southern coast of British Columbia

About the Vancouver Fraser Port Authority and the Port of Vancouver

Vancouver Fraser Port Authority

The Vancouver Fraser Port Authority is the federal agency responsible for the stewardship of the Port of Vancouver. Like all Canada Port Authorities, we are accountable to the federal minister of transport, and operate pursuant to the *Canada Marine Act* with a mandate to enable Canada's trade through the Port of Vancouver, while protecting the environment and considering local communities.

The port authority has control over the use of port land and water, which includes more than 16,000 hectares of water, over 1,500 hectares of land, and approximately 350 kilometres of shoreline.

Guided by our vision to be the world's most sustainable port, we work with government, industry, Indigenous peoples and local communities to shape the future of the port for the benefit of all Canadians.

Port of Vancouver

Located on the southern coast of British Columbia in Canada, the Port of Vancouver extends from Roberts Bank and the Fraser River up to and including Burrard Inlet, bordering 16 municipalities and intersecting the traditional territories and treaty lands of several Coast Salish First Nations.

The Port of Vancouver is Canada's largest port, and third largest in North America in terms of annual tonnes of cargo. Positioned on the southwest coast of British Columbia, the port is home to 27 major marine cargo terminals, three Class 1 railroads, and offers a full range of facilities and services to the Canadian and international shipping community.

Many different enterprises operate in the port. Goods arrive and depart by sea on ships owned and operated by global shipping companies, and supported by tugboats, shipyards, shipping agents and freight forwarders. Terminals are operated and managed by independent third-party operators. Railways and trucking companies move goods to and from terminals by land. Goods are sorted, stored and transferred by companies at facilities and warehouses, and inspected by the Canada Border Services Agency on terminal or at facilities across the region.

Learn more about the port and its activities at portvancouver.com.

Our mission

To enable Canada's trade objectives, ensuring safety, environmental protection and consideration for local communities

Our vision

To be the world's most sustainable port

Our definition of a sustainable port

A sustainable port delivers economic prosperity through trade, maintains a healthy environment, and enables thriving communities through meaningful dialogue, shared aspirations and collective accountability

Vancouver Fraser Port Authority
Underwater noise management plan



Vancouver Fraser Port Authority jurisdiction map

Underwater noise at the Port of Vancouver

Why is underwater noise a concern?

Underwater noise in the north Pacific Ocean is increasing and is estimated to have doubled in intensity every decade for the past 60 years.¹ Commercial shipping is one of the main contributors to this increase, and vessel traffic and volumes are expected to increase alongside growth in Canada's trade volumes and population.

Underwater noise from ships has been shown to interfere with marine mammals' ability to perform key functions such as navigating, communicating, hunting prey, and avoiding danger.

Several cetacean species are found within the port authority's navigational jurisdiction. Most have [special conservation status under Canada's Species at Risk Act](#) (SARA). Seals and sea lions are also found in port waters at certain times of the year.

The table below provides an overview of the marine mammals present in or around Port of Vancouver waters, their conservation status, and when and how often they are found.

Marine mammals in or around port authority jurisdiction

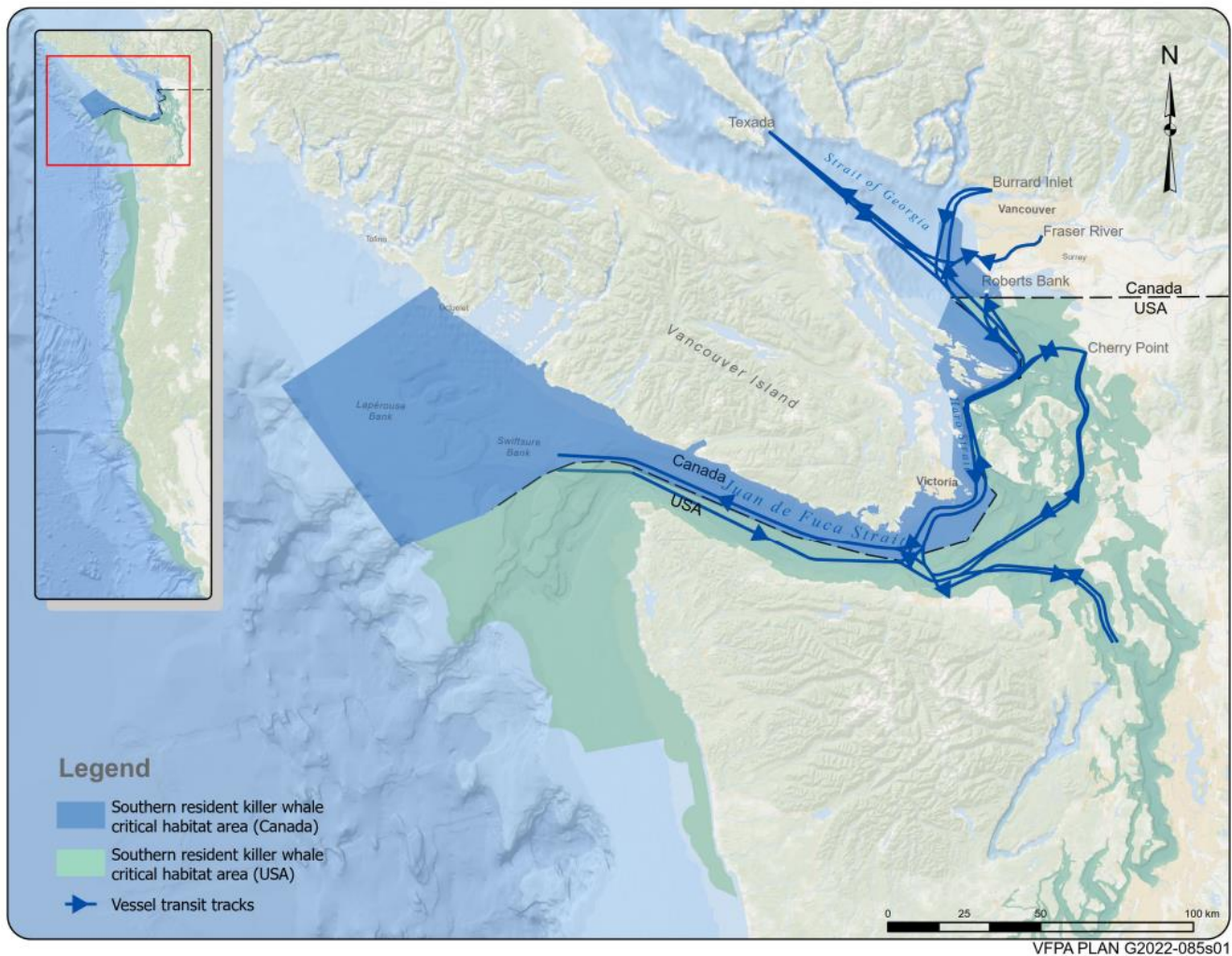
Marine mammal species	SARA status	Relative abundance	Area most frequented near/in port jurisdiction	Seasonal occurrence
Bigg's (transient) killer whale	Threatened	Occasional	Strait of Georgia, reported occasionally in Burrard Inlet	Year-round
California sea lion	n/a	Rare to occasional	Strait of Georgia	October to May
Dall's porpoise	n/a	Occasional	Strait of Georgia	Year-round; primarily January to June
Grey whale	Special concern	Occasional	Strait of Georgia	Primarily January to June
Harbour porpoise	Special concern	Common	Strait of Georgia, reported occasionally in Burrard Inlet	Year-round; primarily April to October
Harbour seal	n/a	Abundant	All areas, including some occurrences in the Fraser River	Year-round
Humpback whale	Special concern	Occasional	Strait of Georgia, reported occasionally in Burrard Inlet	May to late-October
Pacific white-sided dolphin	n/a	Occasional	Strait of Georgia	Year-round
Resident killer whale	Endangered	Common	Strait of Georgia, particularly critical habitat at mouth of the Fraser River	Primarily May to October
Steller sea lion	Special concern	Occasional	All	Year-round

¹ Hildebrand, J. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Marine Ecological Progress Series 395: 5-20.

Spotlight: Southern resident killer whales

Southern resident killer whales, one of the most iconic species in B.C. waters, are listed as endangered under both Canada's *Species at Risk Act* and the U.S. *Endangered Species Act*. As of July 1, 2023, the population was at 75 individuals². Fisheries and Oceans Canada and the National Oceanic and Atmospheric Administration have designated critical habitat for the endangered southern resident killer whale in both Canadian and U.S. waters. This critical habitat overlaps partially with the waters within port jurisdiction near the mouth of the Fraser River and with most of the shipping lanes leading into the Port of Vancouver.

Fisheries and Oceans Canada's recovery strategy for southern resident killer whales identifies disturbance—including underwater noise from ships—as a current threat. Learn more about the effects of ship noise on whales and our collective approach to reducing underwater noise from commercial shipping on our [website](#).



Southern resident killer whale critical habitat and shipping lanes for the Port of Vancouver

² The Center for Whale Research, whaleresearch.com

Port-related sources of underwater noise

There are two primary port-related sources of underwater noise that can affect marine mammals: vessel movement and development on port lands and waters, including in-water construction work. The effects of this noise will vary depending on the sound intensity, its characteristics—including sound frequency, range and duration—and whether it is continuous or intermittent. Both the source and the cumulative effects of underwater noise must be managed to mitigate impacts.

Vessel movement

Vessel movement is the primary source of underwater noise in and around the port. Thousands of ocean-going vessels call at the Port of Vancouver every year, with a variety of deep sea and commercial vessels transit to and from the port's 29 major terminals and 28 anchorages on a daily basis.

The most common types of vessels active in the Port of Vancouver include:

- Large commercial vessels
- Harbour tugs
- Harbour Patrol vessels
- Ferries and other small commercial vessels
- Dredging vessels
- Recreational vessels

Underwater vessel noise is primarily generated from a ship's propeller, which creates vapour filled bubbles as it spins (an effect known as cavitation), the collapse of these bubbles causes "noise" underwater. This normally occurs at the main propeller but can also originate from bow/stern thrusters. In addition to cavitation noise, the engine and other onboard machinery can also provide significant contributions to the underwater noise generated by a ship. The underwater noise produced will vary depending on vessel type, design characteristics, operational conditions such as speed and draft, vessel maintenance and other factors..

Development and construction on port lands and waters

Infrastructure maintenance, construction and development is ongoing within the port. Some of this work may include in-water activities that generate underwater noise that has the potential to affect marine mammals and other marine life. Construction activities that produce high-intensity, impulsive sounds are more likely to cause direct injury to marine mammals—if present in close proximity—than lower intensity, continuous sounds, which can cause various other effects at different ranges.³ Some activities will contribute to temporary increases in local ambient underwater noise levels, which may also affect marine mammals in the area by masking sounds used for feeding and communicating. These effects can occur at considerable distances from the source activity.

³ Verfuss, U.K. 2018. Comparing methods suitable for monitoring marine mammals in low visibility conditions during seismic surveys. Marine Pollution Bulletin 126, 1-18.

Construction- and development-related in-water activities and associated effects

Activity	Sound intensity	Activity duration	Occurrence	Potential effect on marine mammals
<ul style="list-style-type: none"> Impact pile driving 	High	Short	Frequent	<ul style="list-style-type: none"> Altered behaviour Injury, such as temporary or permanent hearing loss
<ul style="list-style-type: none"> Underwater blasting Explosions Seismic surveys 	High	Short	Rare	<ul style="list-style-type: none"> Altered behaviour Injury, such as temporary or permanent hearing loss
<ul style="list-style-type: none"> Dredging Vibro-densification of sediments Vibratory pile installation Drilling 	Low	Short to medium	Frequent	<ul style="list-style-type: none"> Altered behaviour Interference with communication, feeding and breeding patterns

Our approach to managing and reducing underwater noise

Collaboration

As a Canada Port Authority, we do not have direct control over the majority of port-related activities generating underwater noise within our jurisdiction and beyond port boundaries. We therefore take a collaborative approach to tackling underwater noise, championing coordinated management approaches and working with port tenants and users as well as the broader port community to increase their understanding and help them take action to reduce underwater noise.

Programs and processes

The Vancouver Fraser Port Authority leads and supports environmental initiatives and programs to maintain a healthy environment, focusing on healthy ecosystems, climate action and responsible practices.

Two of these programs—the [Enhancing Cetacean Habitat and Observation \(ECHO\) Program](#) and [EcoAction program](#)—are helping to manage and mitigate underwater noise from vessel movement in and around the port. Our [Project and Environmental Review \(PER\) process](#) helps us manage and mitigate underwater noise effects from development and construction projects on port lands and waters.

We regularly update our programs and processes based on the results of our ongoing research, monitoring, and emerging best practices.

Spotlight: ECHO Program

The [Enhancing Cetacean Habitat and Observation \(ECHO\) Program](#) is a port authority-led collaborative initiative aimed at reducing the cumulative effects of shipping activities on at-risk whales throughout the southern coastal waters of British Columbia.

The geographic scope of the port authority's jurisdiction is limited. Consequently, a larger regional-scale collaborative approach is required to adequately address the cumulative threats posed by commercial vessel activities in this growing international trade gateway. The ECHO Program is a [collaboration](#) between government agencies, marine industry, conservation and environmental groups, Indigenous communities, and scientists, and guided by the advice and input of an advisory working group and associated technical committees. The program continues to raise awareness regionally, nationally and internationally on the effects of shipping, including underwater noise, on marine mammals, with a long-term goal of quantifiably reducing threats from commercial marine vessel-related activities to endangered whales.

In May 2019, the Government of Canada entered into a first-of-its-kind *Species at Risk Act*, Section 11 [conservation agreement](#) for marine aquatic species with Vancouver Fraser Port Authority, Pacific Pilotage Authority and five marine transportation industry association partners. The agreement is a five-year commitment by government and industry to continue to work together through the ECHO Program to reduce threats from marine shipping and support the recovery of the southern resident killer whales. The agreement is anticipated to be renewed in 2024 for another five-year term.



Photo credit: Jeanne Hyde

Management strategies

Our management strategies to reduce the impacts of underwater noise from port-related activities on marine mammals—particularly at-risk-whales—are focused in three key areas.

Research and innovate

Through the ECHO Program, we are working to increase our understanding of underwater noise from vessel movement and its effect on marine mammals. This includes collecting, analyzing and evaluating underwater noise data both at the vessel source and in the surrounding habitat. Computer modelling of underwater vessel noise is conducted to predict sound levels throughout the region, understand the ways in which different vessel types contribute noise in different areas, and evaluate the potential benefits of noise reduction measures implemented by the program, such as vessel slowdowns or changes to vessel traffic patterns.

A number of research studies have been conducted including (reports available upon request):

- An evaluation of the key factors influencing ambient underwater noise in the Salish Sea
- An analysis of correlations between vessel design characteristics and underwater radiated noise, including the development of [a model to estimate underwater noise emissions](#)
- A study on the underwater noise emissions of whale watching boats and other small vessels
- Ongoing monitoring of underwater noise in Burrard Inlet
- A study to better understand the contributions of various vessel types to underwater noise
- An evaluation of vessel noise reduction design, technology and maintenance options
- An analysis of the effects of vessels on humpback whale calls
- A case study on BC Ferries quiet vessel ferry design
- A series of workshops aimed at aligning the measurement and analysis procedures for international ship classification societies quiet ship notations
- An assessment of whether acoustic descriptors could be used to evaluate a vessels cavitation inception speed
- A study on the [co-benefits of slowdowns in the context of air emissions and whale strike](#) risk

Educate and engage

We work to raise awareness of underwater noise and its impacts on marine mammals within the local port community, as well as with regional and international stakeholders.

Through the ECHO Program, we also collaborate on the development and distribution of educational resources for mariners to help them better recognize whales in the region and provide them with navigational best practices to help minimize the potential for physical and acoustic disturbance.

Resources released to date include:

- [Mariner's Guide to Whales, Dolphins and Porpoises of Western Canada](#)
- [ECHO Program infographic: The effects of vessel underwater noise and what mariners can do about it](#)
- [ECHO Program infographic: You are making a difference for the whales](#)
- [Whales in our Waters tutorial](#)
- [WhaleReport Alert System](#)

Plan and take action

We have implemented environmental programs and initiatives to encourage quieter vessels and to help manage and reduce underwater noise from port-related activities, including large vessel movement and in-water development and construction.

Our [EcoAction](#) program offers discounts on harbour dues to vessels meeting voluntary environmental best practices that reduce emissions, underwater noise and other environmental impacts. Incentives to reduce

underwater vessel noise were first included in EcoAction in 2017. The program is intended to encourage shipping companies to design quieter vessels and add underwater noise-quieting technologies to their fleets. Vessels using approved technologies to reduce underwater noise, receiving a quiet notation from a ship classification society, or achieving level five in underwater noise reduction through the [Green Marine certification program](#) are awarded reduced harbour dues through this program. [Our Blue Circle Awards](#) recognize shipping lines with the greatest fleet-wide participation in the EcoAction program.




The [Project and Environmental Review](#) (PER) process enables the port authority to meet our obligations under the *Canada Marine Act* as well as relevant federal environmental legislation within the *Impact Assessment Act*, *Species at Risk Act*, and *Fisheries Act*. We require proponents of projects on federal lands and waters to apply for permits for proposed physical works and activities. This includes projects led by port tenants and the port authority itself. Through the PER process, we review project applications and determine the potential environmental impacts, including effects on marine mammals from underwater noise. We will not authorize or allow a proposed project to proceed if it is likely to result in significant adverse environmental effects. If a project is approved, the permit will include conditions designed to reduce or avoid potential impacts.

The ECHO Program works closely with commercial ship operators to identify the underwater noise emissions of their fleet and leads voluntary measures to reduce vessel noise impacts in southern resident killer whale critical habitat, including:

- [The Haro Strait and Boundary Pass voluntary ship slowdown](#)
- The lateral displacement of inshore tug traffic in the [Strait of Juan de Fuca to](#) shift away from important southern resident killer whale habitat along the south west coast of Vancouver Island
- The Swiftsure [Bank voluntary ship slowdown](#) at the mouth of the Strait of Juan de Fuca, an important area for southern resident killer whales and many other whale species

Planned targets and actions for 2021–2024

Legend:

-  Action complete and target met
-  Action partially complete or target partially met
-  Action incomplete or target not met

Program	Project / initiative	Description	Planned actions / targets			
			2021	2022	2023	2024
Research and monitoring						
ECHO	Burrard Inlet underwater noise monitoring	Monitor total ambient underwater noise, as well as particular port activities (such as vessels on shore power) using multiple hydrophone locations within Burrard Inlet and English Bay	Analyze data and reevaluate monitoring plan. Hydrophones deployed in five locations in 2021	Analyze data and reevaluate monitoring plan	Continue to monitor total ambient underwater noise, using multiple hydrophone locations to determine soundscapes in Burrard Inlet	Analyze 5 years of collected hydrophone data and cetacean presence in Burrard inlet in an effort to determine trends and correlations.
ECHO	Boundary Pass underwater listening station	Use the underwater listening station installed and funded by Transport Canada to measure vessels calling the Port of Vancouver, working with operators to better understand and minimize their underwater noise emissions. Total ambient underwater noise and marine mammal detections will also be measured.	Monitor, analyze and share data from the underwater listening station. Help regional operators understand noise emissions of their fleet	Monitor, analyze and share data from the underwater listening station	Monitor and analyze data from the underwater listening station including marine mammal detections, ambient noise and vessel source levels. Share appropriate data with stakeholders and regional operators, supporting noise reduction efforts	Monitor and analyze data from the underwater listening station including marine mammal detections, ambient noise and vessel source levels. Share appropriate data with stakeholders and regional operators, supporting noise reduction efforts
ECHO	Vessel noise correlations study	Identifying key vessel characteristics driving underwater noise using the extensive ECHO Program vessel noise database	Evaluate study findings and determine whether testing with additional external datasets could further advance findings. External database testing verified utility of model	Publish results		

ECHO	Class society alignment for quiet vessel notations	Look to align underwater noise measurement within class societies			Publish " Recommended procedures for Measuring Underwater Radiated Noise Emissions of Ships, for Quiet Ship Certification ". Encourage uptake and integration of recommended procedures to class society notations.	Continue to encourage uptake and integration of recommended procedures to class society notations.
ECHO	Underwater vessel noise target recommendations	Work together with industry, Transport Canada and other interested non-government agencies to consider the identification and selection of vessel noise targets			Report on potential vessel noise targets and modelling of noise from future vessel traffic in the relevant regions of the Salish Sea	Working with Transport Canada, update noise modelling of different noise contributors in the Salish Sea
Education and awareness						
ECHO	Whales in our Waters tutorial	Online training module for professional mariners to help them identify whales, reduce vessel related threats and safely navigate in their presence	Undertake enhancements to the tutorial and increase number of target users	Conducts promotional activities to increase target users	Undertake enhancements to the tutorial and increase number of target users	Conduct promotional activities to increase target users
ECHO	Educate and encourage uptake of quiet vessel design, technology and incentive programs	The ECHO Program working with the Government of Canada raises awareness and promotes uptake of quiet vessel technology and design, and	Convene or participate in 5 meetings per year on vessel quieting.	Convene or participate in 5 meetings per year on vessel quieting.	Convene or participate in 5 meetings per year on vessel quieting.	Convene or participate in 5 meetings per year on vessel quieting.

		encouraging other ports to incentivize quieter vessels	Engage with at least 4 Canadian or international ports each year.	Engage with at least 4 Canadian or international ports each year.	Engage with Canadian port authorities and/or international ports on quiet vessel incentive programs.	Engage with Canadian port authorities and/or international ports on quiet vessel incentive programs.
Underwater noise reduction measures						
ECHO	Voluntary vessel slowdown	Seasonal voluntary vessel slowdowns in key southern resident killer whale feeding areas (e.g., Haro Strait and Boundary Pass and Swiftsure Bank)	Underwater noise reduction from slowdown meets or exceeds the ambient noise reduction goals set by the ECHO Program AWG annually in both slowdown zones	Underwater noise reduction from slowdown meets or exceeds the ambient noise reduction goals set by the ECHO Program AWG annually. Trial the addition of an inbound slowdown at Swiftsure Bank.	Reduce ambient underwater noise in Haro Strait and Boundary Pass by ~2-3dB compared to a baseline non-slowdown period. Achieve a modelled acoustic benefit of ~2-3dB when compared to a representative non-slowdown period in Swiftsure Bank. Note: 2023 acoustic benefit will be available in March 2024	Reduce ambient underwater noise in Haro Strait and Boundary Pass by ~2-3dB compared to a baseline non-slowdown period Achieve a modelled acoustic benefit of ~2-3dB when compared to a representative non-slowdown period in Swiftsure Bank.
ECHO	Strait of Juan de Fuca lateral displacement	Seasonal voluntary displacement of tugboats away from key southern resident killer whale feeding areas in the inshore area of Strait of Juan de Fuca	Underwater noise reduction from lateral displacement meets or exceeds the ambient noise reduction goals set by the ECHO Program AWG annually (>80% participation)	Underwater noise reduction from lateral displacement meets or exceeds the ambient noise reduction goals set by the ECHO Program AWG annually	Achieve voluntary displacement participation percentages of greater than 85% for tugs operating in the Strait of Juan de Fuca	Achieve voluntary displacement participation percentages of greater than 85% for tugs operating in the Strait of Juan de Fuca

<p>EcoAction</p>	<p>EcoAction incentives for underwater noise reduction</p>	<p>Our EcoAction program offers reduced harbor dues to vessels with quiet ship notations, using technologies to reduce noise, or meeting Green Marine Level 5 underwater noise reduction criteria</p>	<p>Review new and existing underwater noise incentives, add and improve measures where appropriate</p>	<p>Review new and existing underwater noise incentives, add and improve measures where appropriate</p>	<p>Review new and existing underwater noise incentives, add and improve measures where appropriate</p>	<p>Re-evaluate and update the EcoAction incentives for underwater noise reduction technologies based on emerging science</p>
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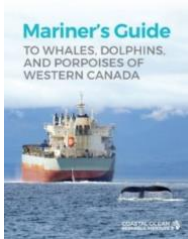
¹partially drafted the underwater noise assessment guidelines. It is anticipated to be finalized and implemented in 2022.

We will annually update our progress against these targets and objectives within this plan and in the [ECHO Program Annual Report](#).

Underwater noise management resources

Resources for port users: vessel owners, operators and mariners

Mariners play an important role in minimizing underwater noise from vessel movement and helping to protect at-risk whales in our waters. There are a number of resources available to help mariners familiarize themselves with marine mammals in west coast waters and learn about options to reduce underwater noise. Visit portvancouver.com/echo for more information on these resources.



Mariner's Guide to Whales, Dolphins, and Porpoises of Western Canada

Developed for mariners in collaboration with the Vancouver Aquarium/Ocean Wise, Prince Rupert Port Authority, and the ECHO Program.

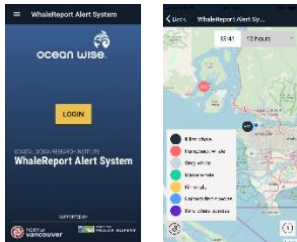
Review this guide before transiting B.C. waters to identify marine mammals, their seasonal occurrence in areas along the west coast, and ways to reduce potential interactions.



Underwater noise infographics

Developed and distributed by the ECHO Program to help mariners understand the effects that underwater noise generated by vessels can have on whales, and how their participation in voluntary slowdowns helps reduce that noise and supports the recovery of at-risk whales.

The infographics can be printed and posted on the bridge or in other crew areas.



WhaleReport Alert System

Developed by the Ocean Wise Sightings Network and made possible with funding and project support from the Prince Rupert Port Authority and the ECHO Program. This app is intended for regional commercial vessel operators, and users are verified before receiving access.

Commercial mariners are encouraged to download the app to receive real-time alerts when whales are in proximity. Alerts can help mariners decide to take adaptive measures such as slowing down or altering course, in order to reduce the risk of physical or acoustic disturbance.



Whales in our Waters online tutorial

Developed for mariners by the ECHO Program and BC Ferries with the support of Ocean Wise. The tutorial takes approximately 90 minutes to complete.

Take this tutorial to build awareness of local whale species, how to identify them, and best practices to implement when navigating vessels in their presence.



International Marine Organization guidelines

In 2023, the International Marine Organization issued [revised guidelines](#) for ship designers, builders and operators on actions they can take to reduce the impacts of underwater noise from commercial shipping.

Resources for port tenants

Port tenants play an important role in minimizing underwater noise from in-water development and construction activities. As part of the port authority's Project and Environmental Review process, we have developed guidelines to help port tenants minimize the potential underwater noise impacts of projects and implement appropriate mitigation measures. Visit portvancouver.com/per for more information on these resources.

Habitat assessment guidelines

Assists port tenants in assessing potential habitat and wildlife impacts associated with works and activities, including those that generate underwater noise and affect marine life.

Construction environmental management plan guidelines

Assists port tenants in identifying construction-related impacts of proposed project activities—including underwater noise—and planning appropriate and adequate mitigation measures to address them.