Long Term Underwater Noise Management Plan

SUMMER 2021

BCFerries

Message from the CEO

As a stakeholder in the Salish Sea, BC Ferries has a responsibility to understand how our activities may affect whales in general and the southern resident killer whale (SRKW) in particular. BC Ferries has been an early and active participant in efforts to understand and mitigate the effects of underwater radiated noise (URN) from our fleet.

We have been taking action. We have engaged scientists and URN specialists to make baseline measurements of our ship's key URN characteristics, loudness, duration and tonal spectrum relative to modes of operation. Actively engaging in research gives us a better understanding of URN and we share our learnings with the international community. Knowing what we are emitting is helping us form the solutions to address it.

BC Ferries is actively reducing our URN. Each new class of ship we build is quieter than the ships before it. We do this through improvements in hull design to reduce noise from wave making, using alternative propeller styles that are less prone to cavitation, and by placing ship's equipment on resilient mounts to reduce structure-borne noise. Taken together, these features can significantly reduce loudness and frequency.

This is a long process. We build our ships to operate for decades, more than 50 years in some cases. New, quieter ships are arriving in the Salish Sea. By 2022, six new battery-electric hybrid Island Class vessels will be in service. In the future, we look forward to replacing our older C Class vessels and we will do all we can to make those the quietest large vessels we have ever built.

Our deck crews are always on the lookout for whales and have standing permission to deviate away from whales at the captain's command when safe to do so. Vessels can also slow down, especially if course deviation is not possible in confined waters. Not all vessels grow quieter when they slow down but slowing down can be beneficial for some.

All of our bridge teams are trained in the Whales in our Waters: Safe Navigation in the Presence of Whales online tutorial, a program BC Ferries developed collaboratively with the Port of Vancouver, DFO, Ocean Wise, and NOAA. We voluntarily report cetacean sightings with the BC Cetacean Sightings Network, and we continue to work with regulators and scientists to identify new ways in which we can operate our ships to protect whales while still meeting our obligations to the communities we serve.

Reducing our environmental footprint through continued investment in leading-edge practices related to environmental stewardship is a top priority for BC Ferries. Our environmental, social and economic impacts are central to our business decisions.

Mark Collins
BC Ferries' President & CEO

The Salish Orca along with her sister ships, the Salish Raven and Salish Eagle are among the quietest vessels in BC Ferries' fleet.

Introduction and Background

Until recently, underwater radiated noise ("URN") has not been a measured vessel performance parameter in the commercial marine sector. At this time, there is no limiting standard for URN emissions from Transport Canada (TC) or the International Maritime Organization (IMO). URN is one of several factors contributing to the at-risk status of the SRKW population inhabiting certain waters in which BC Ferries operates. The Government of Canada has fast tracked the development of mitigation measures in Canadian waters of the Salish Sea including the implementation of Conservation agreements with industry. The SRKW habitat extends south of the Canada/U.S. border where Washington State executive order EX-18-02 requires the development of "strategies for quieting state ferries in areas most important to Southern Residents."[1]

The BC Ferries fleet is a significant contributor to URN in the Canadian Salish Sea due to sheer number of vessels, time on the water, vessel configuration and modes of operation. A ferry at service speed is typically emitting URN at a broadband sound intensity of 185 dB. Quantitative studies indicate that vessels operating at sound intensity above 175 dB are the candidates for reducing overall noise levels in the SRKW critical habitat.

URN impact from shipping on the marine ecosystem has, within a short timeframe, been acknowledged in global marine forums as a matter needing significant attention. Having an international reputation for leadership, BC Ferries undertook the first development of an Underwater Noise Management Plan in 2017-18 and continues to refine the approach to this urgent challenge. We are guided by the latest available science and engineering support locally and from the international marine community.

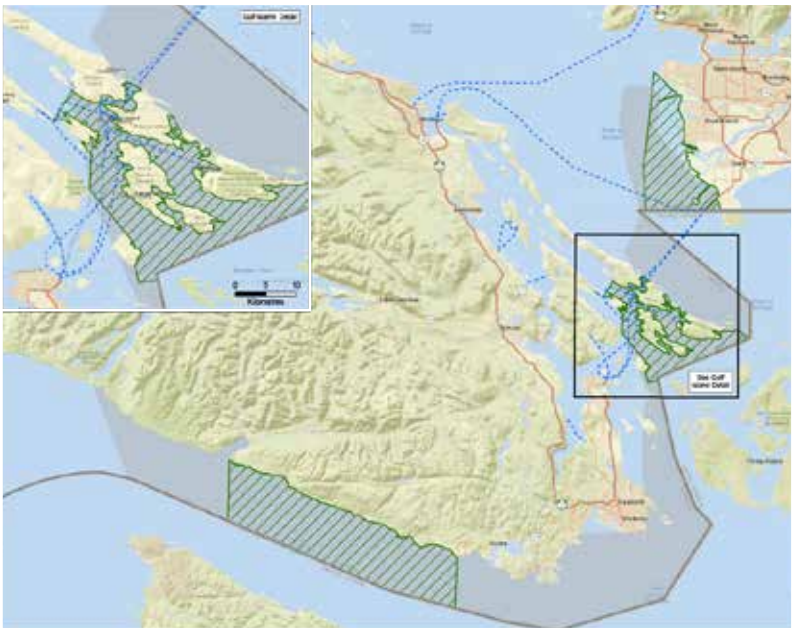
Similar to air quality management, it is both the point source and the accumulative effects of URN that must be managed to mitigate impacts. Vessel point sources of URN are propellers, thrusters, hull drag, engines and on board machinery.

The goal for BC Ferries URN Management plan is:

To reduce underwater radiated noise while maintaining safe, reliable and sustainable operations and to strive for a 50 per cent reduction of overall URN which is consistent with global targets.

[1] https://www.governor.wa.gov/sites/default/files/exe_order/eo_18-02_1.pdf

Southern Resident Killer Whale Critical Habitat and Potential Foraging Areas and BC Ferries Routes



BC Ferries Route

Canada/U.S.A. Border

DFO Fisheries Closures for SRKW Management

SRKW Critical Habitat

Otter Bay terminal on Pender Island is one of the many terminals connecting south coast communities on the Salish Sea.

Undertakings

In April 2014 IMO issued a noise reduction guideline MEPC.1/Circ.833 which proposes measurement standards, elements of vessel design and speaks to vessel speed. In September 2014, BC Ferries became a founding member of the Port Vancouver Enhancing Cetacean Habitat and Observation (ECHO) program advisory working group.

	First 5 Years: 2014 to 2018	2019 to Present

Conservation/ Operational Measures	• Developed a Marine Mammal policy and best practices for vessel operation. This policy has been shared with other ferry operators and Green Marine to assist other members of industry in developing their own policies.
	• Installed hydrophones as part of DFO's Whale Tracking Network at BC Ferries
	• Terminals: Tsawwassen, Sturdies, Comox and Powell River.
	• BC Ferries fleet increased participation 300% in the established BC Cetacean Sighting network administered by the Coastal Ocean Research Institute.
	•Contributed to the development of the Mariner's Guide to Whales, Dolphins and Porpoises.
		• Co-developed the Whales in our Waters Tutorial and use Whale Report Alert System (WRAS).
		• Added hydrophones to the DFO Whale Tracking Network at:
		  • Campbell River
		  • Descanos Bay
		• Shared our experiences through contributions to the summer (Marine Education) and fall (Anthropogenic Noise) 2019 issues of the Journal of Ocean Technology.
		• BC Ferries, with support from DFO and in collaboration with Ocean Wise, added Whale Trail signage at terminals: Langdale, Comox (Little River), Tsawwassen, Texada Island (Blubber Bay) and Campbell River.

Understanding/ Mitigating our URN	• BC Ferries conducted a full URN trial measurement of a Coastal Class ferry through its operating speed range. • Another seven BC Ferries vessels were measured and analyzed within the ECHO program. • BC Ferries conducted URN measurement of eight vessels in the Swanson Channel study through each vessels operating speed range. • In 2018, URN targets were incorporated into the BCF Fleet Master Plan.	• URN targets established into new vessel construction contracts in 2019BC Ferries entered into a partnership with an URN specialist to support a noise control program for all new construction and retrofit projects on existing vessels. • Eliminated of the anomalous noise peak on Spirit Class vessels propellers at their midlife upgrades.

Contributions to the Management of URN Internationally	• BC Ferries has contributed to the development of the Green Marine Certification Performance Indicator for URN.	• Contributed to Class Notation Guidelines for URN
		• Working with the Government of Canada BC Ferries undertook two projects:
		  • Optimizing the propeller design for the Coastal Class and Spirit Class vessels; and
		  • Covering the hull of the Queen of Oak Bay with a special low friction coating
		• Participated in an URN Measurement in Shallow Water Trial to help develop ISO standards to determine reliable methodology for measuring source levels of vessels in shallow water.

BC Ferries has supported the international work of Transport Canada through the IMO MEPC and in the numerous industry working groups of Transport Canada, Department of Fisheries & Oceans, and Environment & Climate Change Canada. BC Ferries is also undertaking a formalized agreement with the federal government for the recovery of the SRKW.

What's Next?

- By **2022**, hydrophones installed at:
  - Hornby Island (Shingle Spit)
  - Texada Island (Blubber Bay)
  - Cortes Island (Whaletown)
- Whale trail signage at Haida Gwaii (Skidegate) terminal in **2022**
- Whales in our Waters Tutorial refreshed with new content **2021/2022**

Current Situation

The SRKW population ranges on a seasonal basis from the Salish Sea south to the coastline of California. SRKW presence in the waters in which BC Ferries operates typically coincides with the summer peak operational period.

We have baselined the radiated noise levels ("RNL") for every BC Ferries vessel operating in the most frequented waters of SRKW habitat and those vessels that may be deployed in this SRKW critical habitat. Vessels that are not deployed into SRKW critical habitat are assigned a lower strategic priority but when retired will be replaced with quieter vessels.

BC Ferries URN Profile by Vessel Class and Deployment

							RNL Values		
Vessels Count	Class Name	Life (45 yrs)	Speed	Length	Ends	Propellers	Broad-bd 10Hz - 64kHz	Comm-bd 500Hz - 15kHz	Echo-bd 15kHz to 64kHz
Deployed into SRKW Critical Habitat									
6	**New Major Class**	pre-design		170	TBD	TBD	**tbd**	tbd	tbd
2	**Spirit Class**	mid life	19.5	168	Single	CPP	**183**	176	166
3	**Coastal Class**	early life	23.0	160	Double	CPP	**185**	178	168
5	**C-Class**	end of life	20.5	140	Double	CPP	**189**	179	168
1	**V-Class**	end of life	20.0	130	Single	CPP	**190**	183	172
3	**Salish**	early life	15.5	107	Double	Azimuth	**183**	179	168
2	**Capilano**	mid life	12.5	96	Double	Azimuth	**183**	180	168
Likely to be Deployed into SRKW Critical Habitat									
3	**Bowen**	end of life	14.5	85	Double	Azimuth	**185**	179	165
2	**Island Class**	early life	14.0	82	Double	Azimuth	**177**	171	160
Not Deployed into SRKW Critical Habitat									
2	Northern	early life	20.5	115	Single	CPP	These vessels do not service routes within the SRKW critical habitat.		
1	Century	mid life	17.0	110	Double	Azimuth			
2	Q-Class	late life	12.0	87	Double	Azimuth			
1	Cable	early life	8.5	79	Double	None			
1	Northern	early life	20.0	62	Single	Fixed			
4	K-Class	late life	10.0	60	Double	Azimuth			
2	T-Class	late life	12.5	50	Single	Fixed			

Our fleet profile is descriptive of the current situation in which planning will prioritize vessels with the greatest remaining life and the likelihood of deployment into SRKW critical habitat. The predominance of large double-ended vessels with constant speed, controllable pitch propellers ("CPP") propellers has been a design preference and it is also evident that the newer vessels and smaller vessels are generally quieter.

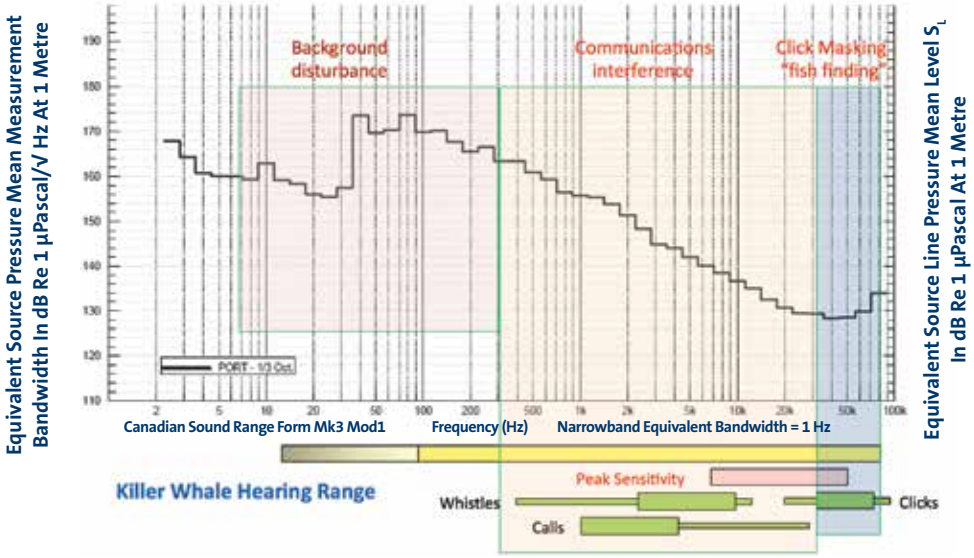
The primary objective of our UNMP, to build a quieter vessel, will be further enhanced by our intent to adapt technical solutions specifically to SRKW sensitivities.

SOUND INTENSITY AND DISTANCE THROUGH WATER

The Killer Whale's communicating call has a sound intensity ranging up to 140 dB. If a ferry at service speed is emitting URN into the same frequency range as these calls, separated distance between the vessel and the whale is important in reducing the noise interference with whale to whale communications. URN sound intensity (185 dB @ 1m RNL) of a ferry can drown out communications between SRKW individuals within 250 m of the vessel. URN dissipation with distance under water is dependent on various factors including the frequency range of the source noise. A combination of sound intensity reduction and ensuring sufficient operational stand-off distance are means to mitigate interference with the nearby whales.

SRKW SENSITIVE FREQUENCY RANGES

To find prey and to navigate the SRKW make echolocation clicks (@ 8,000–80,000Hz). Vocal communication for hunting and social interaction is done with whistles and calls (@ 500–30,000Hz). Ferry radiated noise (@ 2-100,000Hz) can interfere with or mask SRKW communications and fish finding vocalizations.



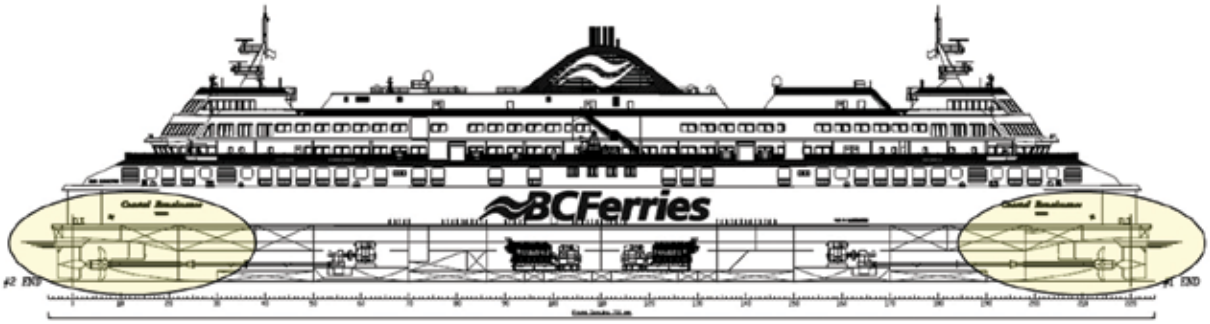
BC Ferries URN policy provides special consideration to this at risk population by setting defined sensitivity ranges in technical specifications and in vessel specific operational measures. Measured URN data collections shall include these ranges.

BC Ferries will use such vessel noise "footprints" in combination with real-time SRKW sightings to provide vessel crews with the situational awareness and guidance to slow or alter course to lessen the "footprint" and thus potential ill effects in the encounters.

Quiet Design and Operations

The design challenge is significant both for vessel technical specification and for operational implementation. The ferry routes that interface with SRKW critical habitat, have the largest customer demand and require transit times of less than 2 hours, which has led us to be strategic with allocating resources to the vessels operating on these routes. The configuration of a large ferry that will load and unload vehicles and passengers and maintain sailing schedules in an economical manner has little in common with the research, military or even cruise ships that have achieved low noise modes of operation.

There are no "ferry ready" solutions on the market to achieve the URN reduction targets necessary for our longer term goal. Expert guidance from noise control specialists and an innovative approach shall be necessary.



By having invested in the high resolution measurements of our operating fleet we are able to now direct the design work towards these primary challenges:

- Innovating a "quiet mode" that can be safely commanded in the event of marine mammal encounters;
- Eliminating the characteristic negative noise vs speed trend (our vessels get noisier when they slow down);
- Enabling quieter operation with minimal sacrifice of fuel efficiency and the subsequent higher GHG emissions in overall operations; and
- Building or retrofitting quieter vessels without substantially increasing the cost of operating and maintaining our fleet assets (due to a need to rely on high value, specialized technology)

Simple but effective solutions will combine technology with operational measures in support of our overall reduction goals and commitment to operate with full respect of marine life in the shared Salish Sea ecosystem.

Guiding Policy and Strategic Objectives

Within the Salish Sea the SRKW species is iconic and valued by our Coastal First Nations and the people of British Columbia. The guiding policy is to craft a relationship with the SRKW that promotes understanding of the species and is continually mindful of their plight.

Strategic Objectives:

- Vessel bridge teams are enabled with operational awareness of SRKW proximity alerts to apply impact mitigation options in daily voyage planning
- Vessel bridge teams understand the vessel specific URN characteristics and use this knowledge when navigating in the presence of SRKW to minimize impact
- Build quieter vessels within a sustainable fleet renewal program
- Reduce noise from shore side infrastructure in operations, maintenance and construction
- Reduce overall contribution of URN into the SRKW critical habitat against a 2016 baseline
- Take action on vessel design and operational strategies

Vessel Design Strategies

A. FLEET MASTER PLANNING

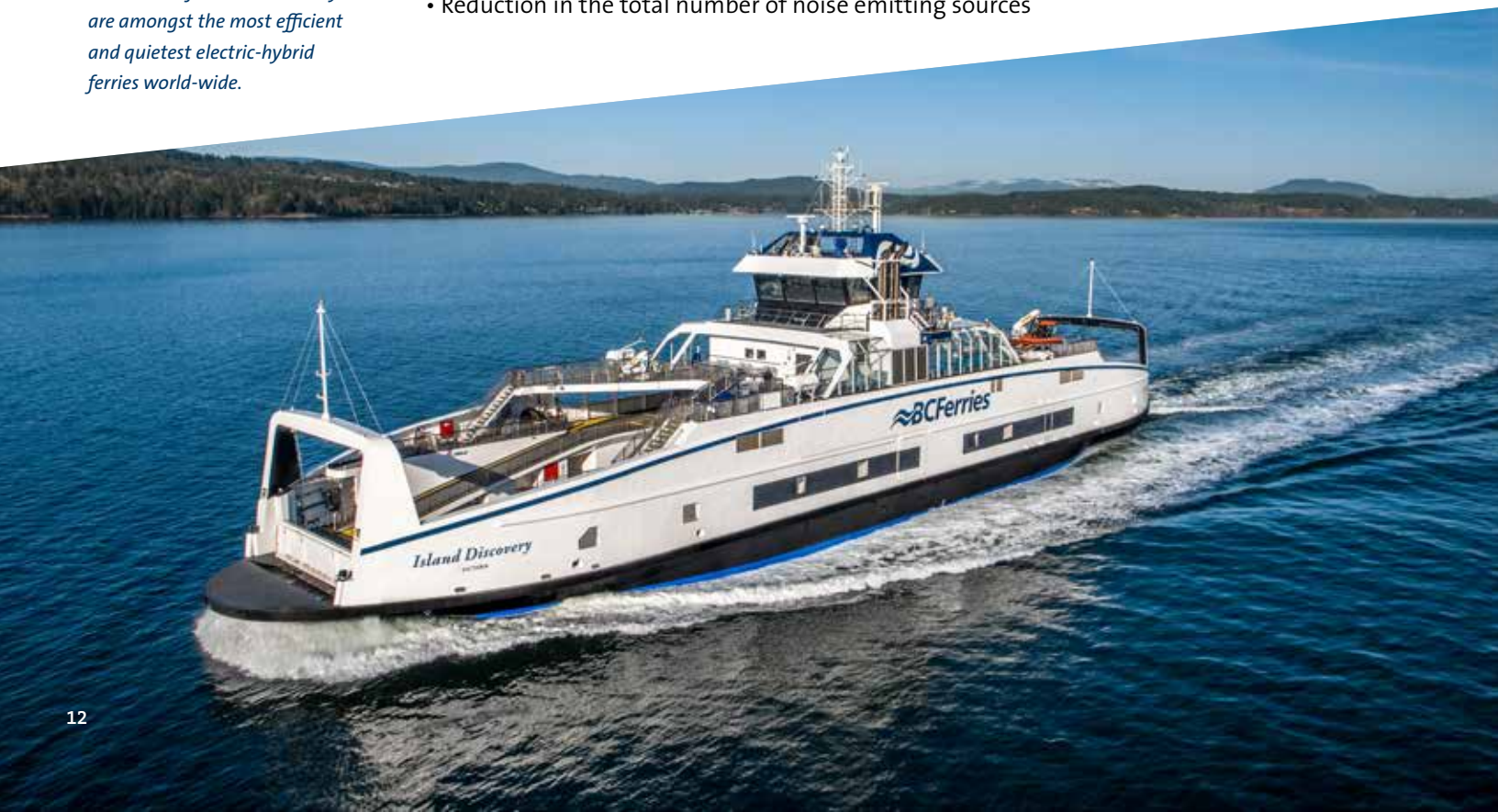
Objectives:

- Build quieter vessels within a sustainable fleet renewal program
- Reduce overall contribution of URN into the SRKW critical habitat against a 2016 baseline

Tactics:

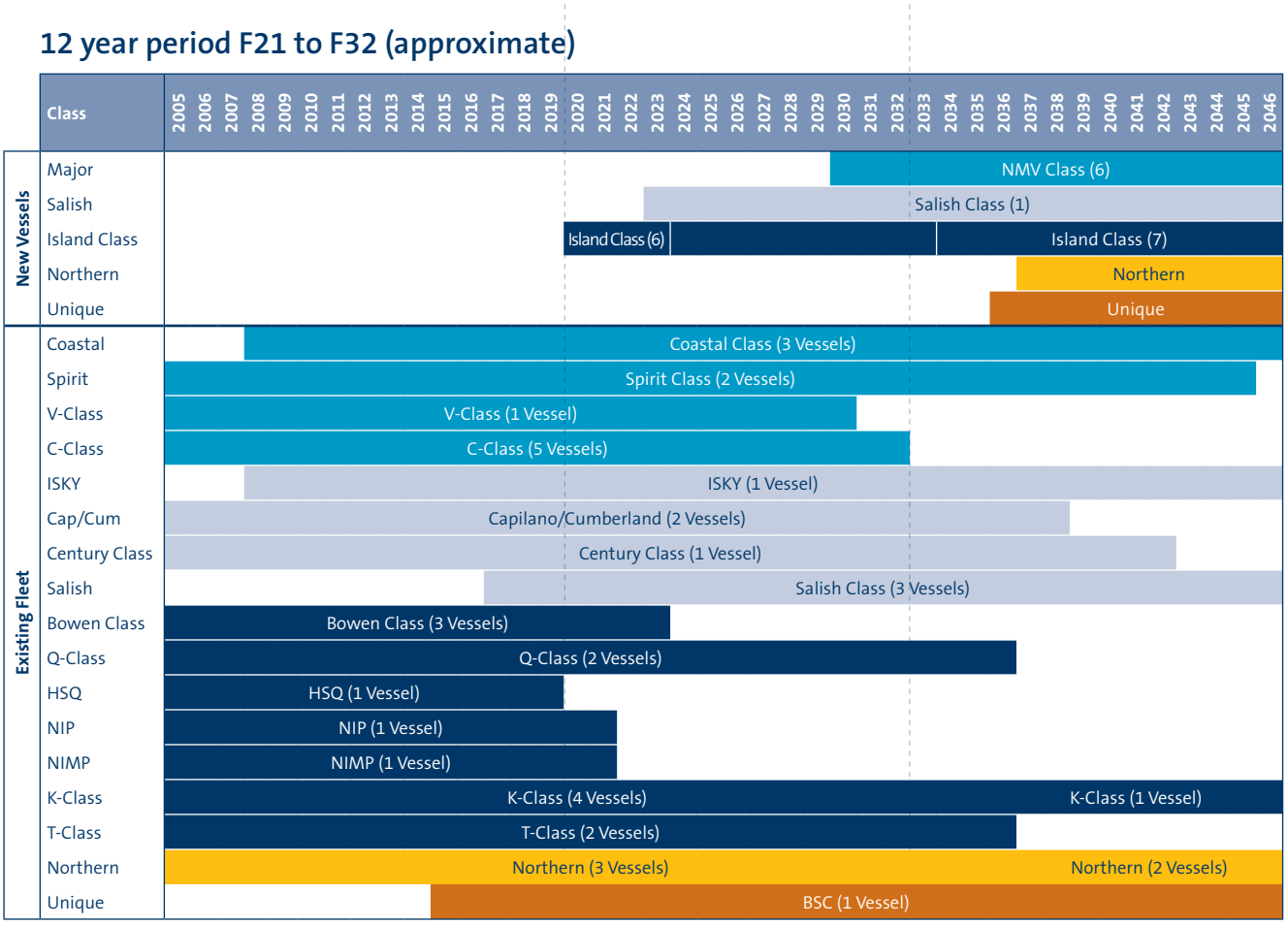
- New vessel construction standards are to include Class Notations for URN, IMO Resolution MSC.337(91): Code on Noise Levels on Board Ships and MEPC.1/Circ.833 7 April 2014 IMO - Guidelines for the Reduction of Underwater Noise From Commercial Shipping
- A contractual partnership with a URN specialist firm has been established to support a noise control program for all new construction and retrofit projects on existing vessels.
- Fleet Master Plan includes new vessel design targets for overall URN and project specific URN reduction plans in the design phase these include:
  - Reduced propeller cavitation in higher frequency
  - Propeller wake field improvement
  - Reduced hull noise including propeller wash, wake wash and slapping
  - Dampening of noise from engines, reciprocating and rotary machinery and shafts
  - Design of overboard discharges and cooling water circulation
  - Reduction in the total number of noise emitting sources

BC Ferries new Island Class entered the fleet in 2020. They are amongst the most efficient and quietest electric-hybrid ferries world-wide.



Vessel Replacement Schedule

12 year period F21 to F32 (approximate)



Between F2020 and F2032
12 of 35 vessels retiring
Introduction of 13 new Vessels to the fleet
Defer build of 8 new vessels due to impact of pandemic
cancel additional NMV due to impact of pandemic

B. RESEARCH AND DEVELOPMENT

Objectives:

- Build quieter vessels within a sustainable fleet renewal program
- Reduce overall contribution of URN into the SRKW critical habitat against a 2016 baseline
- Develop better understanding of the tradeoff between low noise and loss of efficiency

Tactics:

- Engage in research and development partnerships with commercial vendors that:
  - Support propeller/thruster suppliers in quieting commercial-grade propellers
  - Seek adaptation of quiet military and seismic designs
  - Support research of quiet hull and machinery designs
- Enable necessary science and technology validations through universities, governmental and industry institutes
- Explore readily available/cost effective opportunities to reducing URN

Operational Strategies

A. ROUTE SERVICE OPERATIONS

Objectives:

- Vessel bridge teams are to be enabled with operational awareness of SRKW proximity alerts to apply impact mitigation options in daily voyage planning
- Vessel bridge teams understand the vessel specific URN characteristics and use this knowledge when navigating in the presence of SRKW to minimize impact
- Reduce noise from shore side infrastructure in operations, maintenance and construction
- Reduce overall contribution of URN into the SRKW critical habitat against a 2016 baseline

Tactics:

- Develop and enhance operational procedures specific to vessel route operation making use of available resources such as the Mariner's Guide to Whales, Dolphins, and Porpoises, WRAS and the Whale Desk.
- Develop communications protocol with DFO Whale Operations Center to enhance real-time mitigation physical and acoustic disturbance threats to nearby SRKW.

- Establish a 2016 baseline for average overall source radiated noise levels ("RNL") at service speed (complete)
- Establish ready access to URN measurement resources: high quality acoustic station equipment, data storage, analysis and reporting
- Measure and retain a report of source radiated noise levels ("RNL") at service speed for any vessel deployed strategically to operate in designated critical habitat
- Frequency specific (tonal) noise source "peak" levels is to be used to track and mitigate if possible specific noise emission sources on board

B. EDUCATION AND COMMUNICATIONS

Objectives:

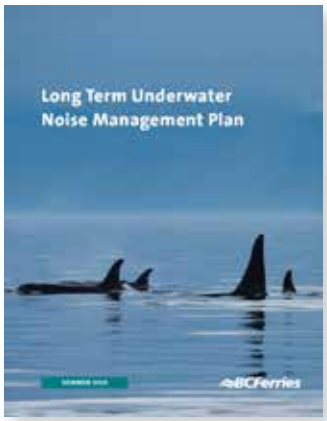
- Vessel bridge teams understand the vessel specific URN characteristics and use this knowledge when navigating in the presence of SRKW to minimize impact
- Reduce noise from shore side infrastructure in operations, maintenance and construction
- Reduce overall contribution of URN into the SRKW critical habitat against a 2016 baseline
- Contribute to better understanding of URN nationally and internationally to encourage the development and application of commercially viable technology

Tactics:

- Educate BC Ferries personnel on the means and benefits of URN mitigations
- Continue to develop educational partnerships and support government outreach efforts
- Engage and support initiatives fostering knowledge sharing, innovation and promotion of best practice between industry, Indigenous Communities, government, and science and research communities
- Foster information sharing/lessons learned on URN globally through industry publications

Implementation and Monitoring

BC Ferries has implemented policies into the vessel replacement and retrofit programs that have ensured that the measurement of URN is a deliverable at the close out phase of these projects. Data collected to date indicates a reduction trend is being achieved with the newer vessels in the fleet. Advancing the rate of this URN reduction through design and engineering will require supplemental investment.



Investment needed to implement our Mitigation Plan

Achieving significant URN reduction from baseline

2014 2015 2016 2017 2018 2019 2020 2021 2022 2030 Reduction trend

Baseline: 185 dB @ 1m

Investment in understanding the scope of the BC Ferries problem

Major Vessel Target: 175 dB @ 1m

Progress towards our objectives is actively monitored with periodic management review and the continual updating arising from our substantial commitments to industry and governmental advisory working groups.

Connecting coastal communities as a sustainable transportation provider on the Salish Sea.

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Photo: Destination BC, Andrew Strain