

# Long Term Underwater Noise Management Plan



SUMMER 2019

 **BC Ferries**



## 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).

We have been taking action. We have engaged scientists to make baseline measurements of our ship's key URN characteristics, loudness, duration and tonal spectrum relative to modes of operation. 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 generally 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 going to be a long process. We build our ships to operate for decades, more than 50 years in some cases. New, quieter ships will therefore arrive gradually in the Salish Sea. However there are opportunities coming soon, such as the replacement of our older C-Class vessels, which will be built between 2022 and 2030. BC Ferries will do all it 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 our ships operate according to the "Mariners Guide to Whales, Dolphins and Porpoises" a copy of which you will find in every wheelhouse. By next spring, 100% of our bridge teams will have completed "Whales in our Waters" training. We continue to work with scientists and whale researchers 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 Raven along with her sister ships, the Salish Eagle and Salish Orca are the quietest vessels in BC Ferries' fleet.*

# Introduction and Background

Until very 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 condition 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.”<sup>1</sup>

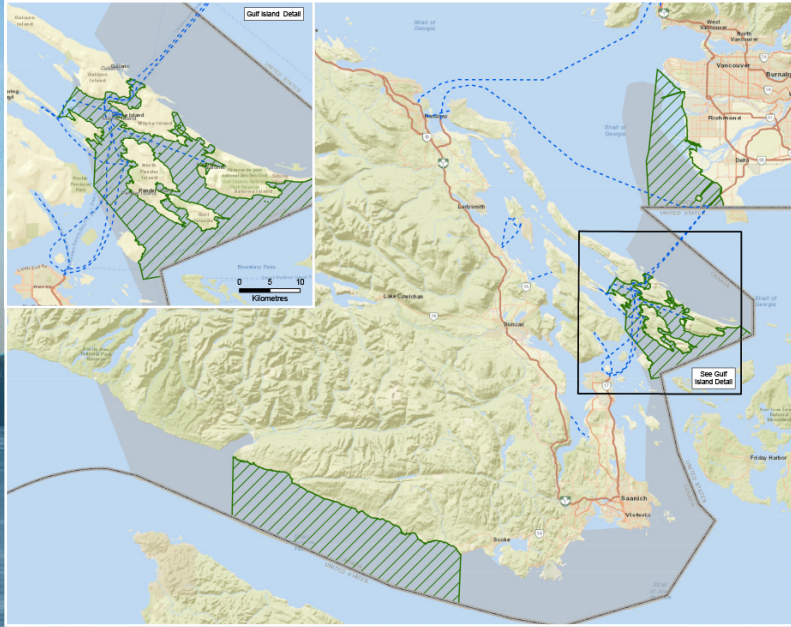
The BC Ferries fleet is a significant contributor to URN in the Canadian Salish Sea due to sheer number of vessels, time on the water, vessel configuration and modes of operation. A ferry at service speed is typically emitting URN at a broadband sound intensity of 185 dB. The quantitative studies within the science community 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 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.***



## 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



*The Queen of Cumberland at Village Bay terminal on Mayne Island, 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.

BC Ferries has advanced the following initiatives independently and in collaboration:

2015

- In May **2015**, BC Ferries conducted a full URN trial measurement of a Coastal Class ferry, including at reduced speeds
- In **2015**, developed a Marine Mammal policy and best practices for vessel operation
- From **2015** to **2017**, increased BC Ferries fleet participation 300% in the established BC Cetacean Sighting network administered by the Coastal Ocean Research Institute

2016

- In **2015**, completed DFO hydrophone installations within approaches to BC Ferries terminals (Tsawwassen, Sturdies Bay) for mammal detection and research.
- In **2016** to **2018**, installed more DFO hydrophones (Comox, Powell River)
- From October **2016** to June **2017**, seven BC Ferries vessels were measured and analyzed within the ECHO program

2017

- In August **2017**, BC Ferries conducted URN measurement of eight vessels in the Swanson Channel study, including at reduced speeds
- BC Ferries has contributed to the development of the following:

- Mariner's Guide to Whales, Dolphins and Porpoises
- Marine Mammal policies of other ferry operators
- Whales in our Waters Tutorial
- Whale Report Alert System (WRAS)
- Green Marine Certification Performance Indicator for URN
- Class Notation Guides for URN

2018

- In **2018**, URN targets were incorporated into the BCF Fleet Master Plan and into new vessel construction contracts in **2019**, and

2019

- In **2019**, BC Ferries is entering into a partnership with a URN specialist to support a noise control program for all new construction and retrofit projects on existing vessels.

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. We have shared our experiences through contributions to the summer (Marine Education) and fall (Anthropogenic Noise) 2019 issues of the Journal of Ocean Technology.

# 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

Vessels Count	Class Name	Life (45 yrs)	Speed	Length	Ends	Propellers	RNL Values			Emitter Ranking
							Broad-bd 10Hz - 64kHz	Comm-bd 500Hz - 15kHz	Echo-bd 15kHz to 64kHz	
<b>Deployed into SRKW Critical Habitat</b>										
5	New Major Class	pre-design		170	TBD	TBD	tbd	tbd	tbd	
2	Spirit Class	mid life	19.5	168	Single	CPP	192	182	170	1
3	Coastal Class	early life	23.0	160	Double	CPP	185	178	168	5
5	C-Class	end of life	20.5	140	Double	CPP	189	179	168	3
1	V-Class	end of life	20.0	130	Single	CPP	190	183	172	2
3	Salish	early life	15.5	107	Double	Azimuth	183	179	168	7
2	Capilano	mid life	12.5	96	Double	Azimuth	183	180	168	6
<b>Likely to be Deployed into SRKW Critical Habitat</b>										
3	Bowen	end of life	14.5	85	Double	Azimuth	185	179	165	4
2	Island Class	construction	15.5	82	Double	Azimuth	tbd	tbd	tbd	
<b>Not Deployed into SRKW Critical Habitat</b>										
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				
4	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.

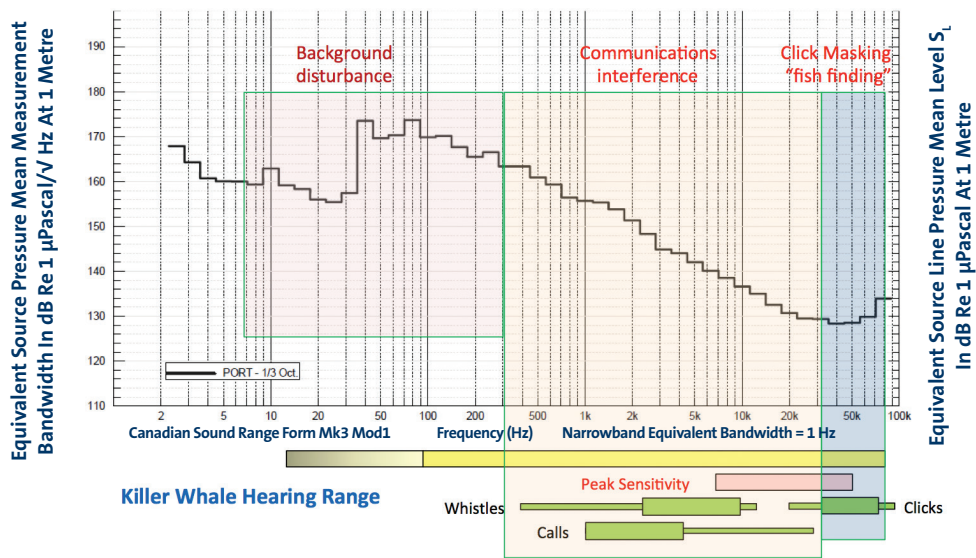
## SOUND INTENSITY AND DISTANCE THROUGH WATER

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 at a sound intensity of 185 dB, the separated distance between the vessel and the whale is important. 185 dB from a vessel source can dissipate to 143 dB at 128 m distance (6 dB for each doubling of distance) and to 125 dB at 1 km distance. The URN sound intensity (185 dB @ 1m RNL) of a ferry can drown out communications between SRKW individuals within 250 m of the vessel.

Sound Intensity	dB @ 1 m	175	180	185	190	195	200
travel distance from source	125 m	133	138	143	148	153	158
	250 m	127	132	137	142	147	152
	500 m	121	126	131	136	141	146
	1 km	115	120	125	130	135	140

## 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.

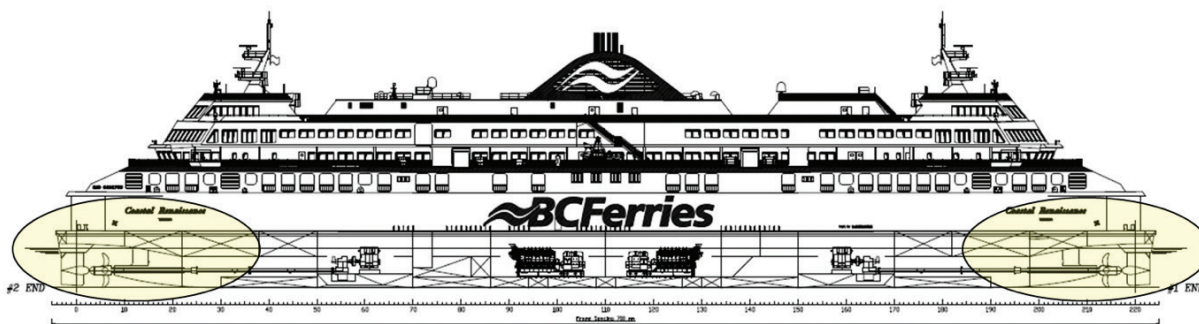
BCF will use such vessel noise “footprints” in combination with real-time SRKW sightings to provide vessel crews with the situational awareness and guidance to slow or alter course to lessen the “footprint” and thus potential ill effects in the encounters.



# Quiet Design and Operations

The design challenge is significant both for vessel technical specification and for operational implementation. Our ferry routes that interface with SRKW critical habitat also have the largest customer demand and require transit times of less than 2 hours with little freedom to adjust for marine mammal encounters. 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

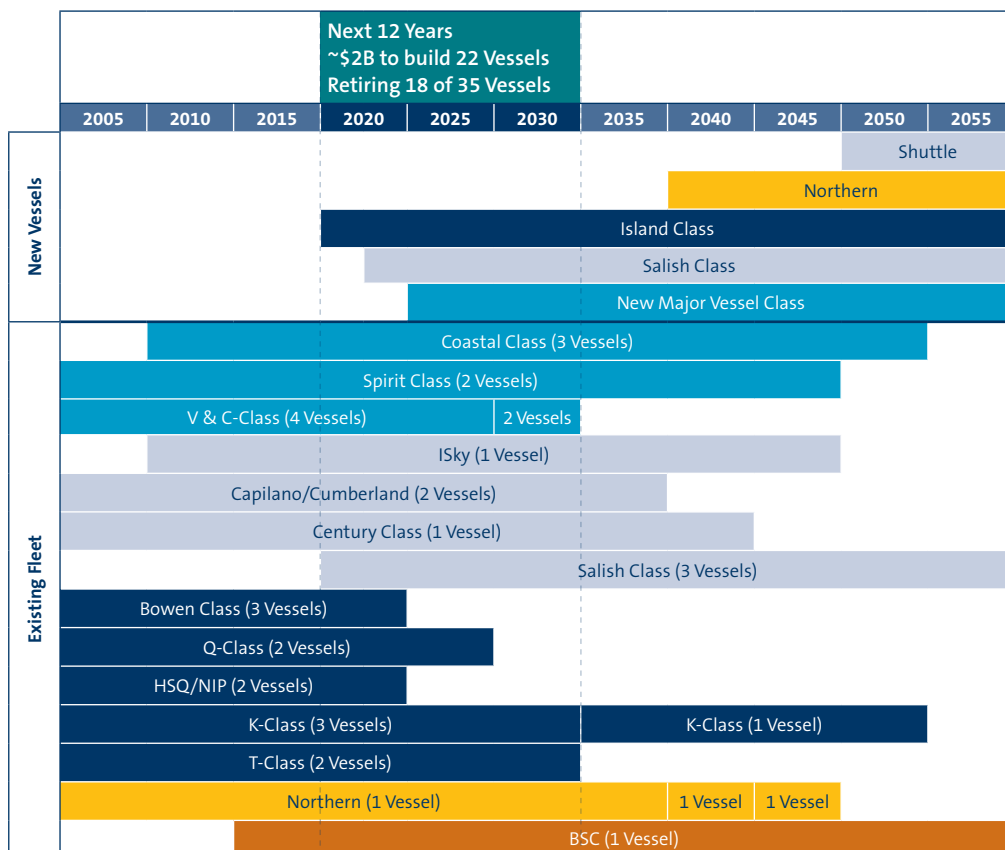
### Tactics:

- 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 shall be established to support a noise control program for all new construction and retrofit projects on existing vessels.
- Fleet Master Plan is to include new vessel design targets for overall URN and project specific URN reduction plans in the design phase that 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

**Preparing for launch:**  
BC Ferries new Island Class will enter the fleet in 2020. They will be amongst the most efficient and quietest electric-hybrid ferries world-wide.



## Vessel Replacement Schedule



## 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

### 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

# 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 operations making use of resources including Mariner's Guide to Whales, Dolphins and Porpoises and the Whale Report Alert System (WRAS) under development (complete)
- 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:

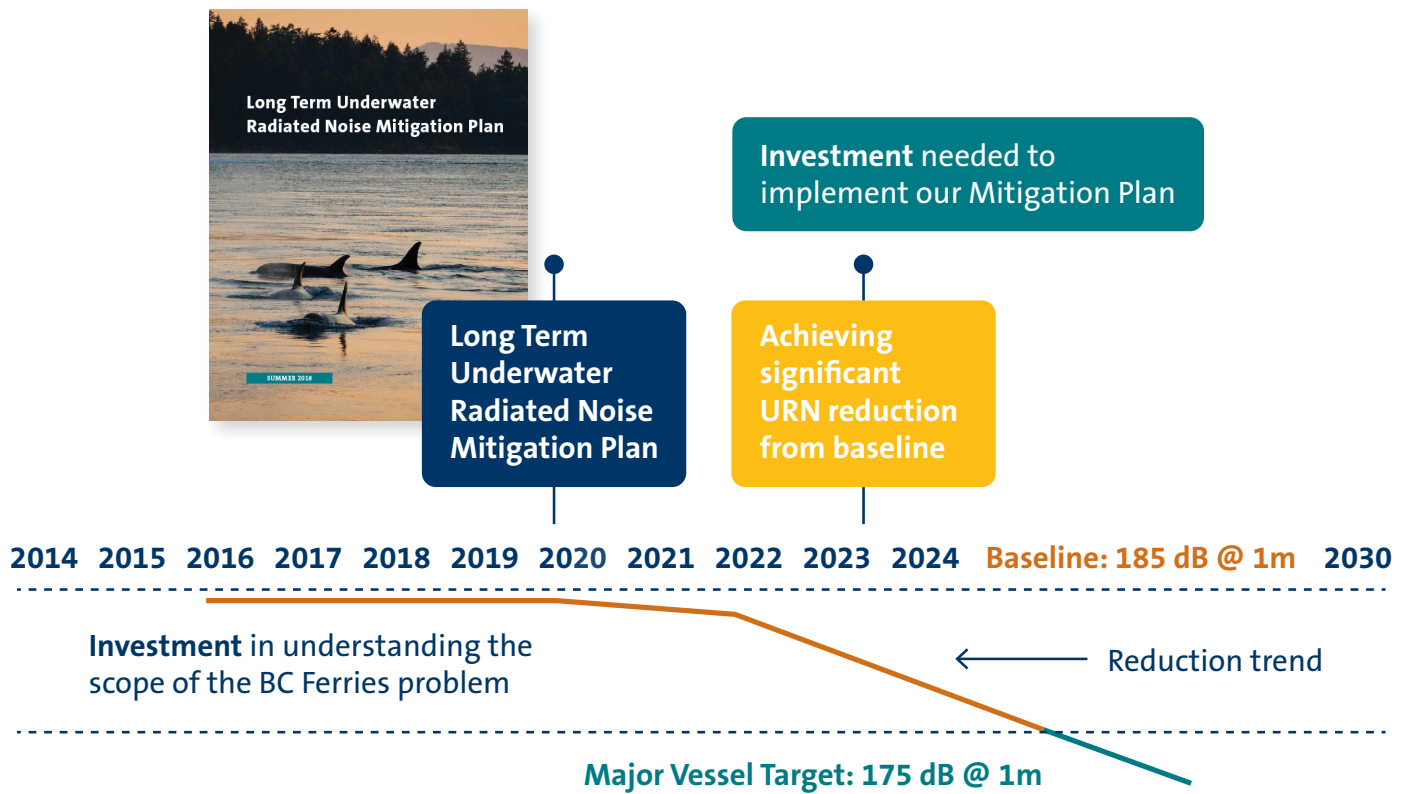
- Vessel bridge teams understand the vessel specific URN characteristics and use this knowledge when navigating in the presence of SRKW to minimize impact
- Reduce noise from shore side infrastructure in operations, maintenance and construction
- Reduce overall contribution of URN into the SRKW critical habitat against a 2016 baseline

### Tactics:

- Continue to develop educational partnerships
- Engage and support initiatives fostering knowledge sharing, innovation and promotion of best practice between industry, Indigenous Communities', government, and science and research communities
- Educate BC Ferries personnel on the means and benefits of URN mitigations


# 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.



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.



The image features a large teal background on the left side, which is cut diagonally to reveal a photograph of a whale's head and back breaking the surface of the ocean. The water is a deep blue, and the sky is a lighter blue. The whale's head is dark, and its back is visible above the waterline.

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