



“Next” Not “Best” Practices

Transboundary Collaboration between
Ferry Services Addressing Species at Risk
by Kevin Bartoy, Leslie James, and Greg Peterson

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Introduction

As the two largest ferry services in North America and among the top five in the world, BC Ferries (BCF) and Washington State Ferries (WSF) have taken an active role in better understanding and addressing the impacts of underwater radiated noise (URN) from vessels and shore-based activities on at-risk whales. Working together in a variety of forums, BCF and WSF have made efforts to mitigate their impacts through engineered and operational solutions, and have participated in studies and regulatory processes that are leading efforts to address URN in the maritime industry. This transnational collaboration has helped to move both organizations from working on “best” practices to forging “next” practices for the industry.

Background of Both Ferry Operators

WSF began operations in 1951 with the purchase and reflagging of the assets of the Puget Sound Navigation Company, also known as the Black Ball Line, by the State of Washington for approximately \$5 million. Currently, WSF employs almost 2,000 people, who help to operate a fleet consisting of 22 vessels, 20 terminals, and one shipyard (Figure 1). In 2018, WSF carried almost 25 million passengers and nearly 11 million vehicles, making it the second largest ferry system in the world for vehicles carried.

BCF’s operations began in 1960, with two ships, two terminals, and 200 employees, and has since grown into one of the largest ferry operators in the world, with a fleet consisting of 35 vessels, 47 terminals, a shipyard, and around 5,000 employees (Figure 2). BCF carries more than 22 million passengers, 8.9 million vehicles, and approximately \$8 billion of cargo in coastal British Columbia on more than 174,000 sailings each year.

Setting the Stage – the Salish Sea and the SRKW

BCF and WSF operate their vessels in the Salish Sea, an inland sea comprised of the Puget Sound, the San Juan Islands, and

the Straits of Juan de Fuca and Georgia (Figure 3). The Salish Sea encompasses a 16,925-square-kilometre area from Olympia, Washington, in the south, Campbell River, British Columbia, in the north, and Neah Bay, Washington, in the west, with over 7,470 kilometres of coastline and 419 islands. The area includes the major metropolitan cities of Vancouver, British Columbia, and Seattle, Washington, and a human population of approximately 8 million.

The Salish Sea is also home to the Southern Resident killer whale (SRKW), one of three eco-types of killer whales found in the coastal waters of British Columbia and Washington State. SRKWs are a distinct population segment of killer whales that are listed as endangered under the *Endangered Species Act* (ESA) in the United States and under the *Species at Risk Act* (SARA) in Canada. Currently, SRKWs are one of the most endangered marine mammals in North America, with their population consisting of less than 80 individuals.

Scientific consensus has identified three primary causes for the decline of the species:

- Availability of prey, primarily Chinook salmon which have many distinct population segments also listed as endangered or threatened under ESA and SARA;
- Presence of contaminants and toxics in the environment; and,
- Physical and acoustic disturbance caused by vessels.

While physical disturbance by vessels (i.e., ship strike) is an obvious threat, acoustic disturbance has become a new focus of concern. SRKWs echolocate for prey and navigation at frequencies between 8,000 and 80,000 Hz, and they communicate with whistles and calls at frequencies between 500 and 30,000 Hz. URN from ferries, which spans 2 to 30,000 Hz, can interfere with or mask both echolocation and communication.

WSDOT Ferries Division – Nation's Largest Ferry System

Ridership statistics

Ridership numbers are based on 2018 statistics

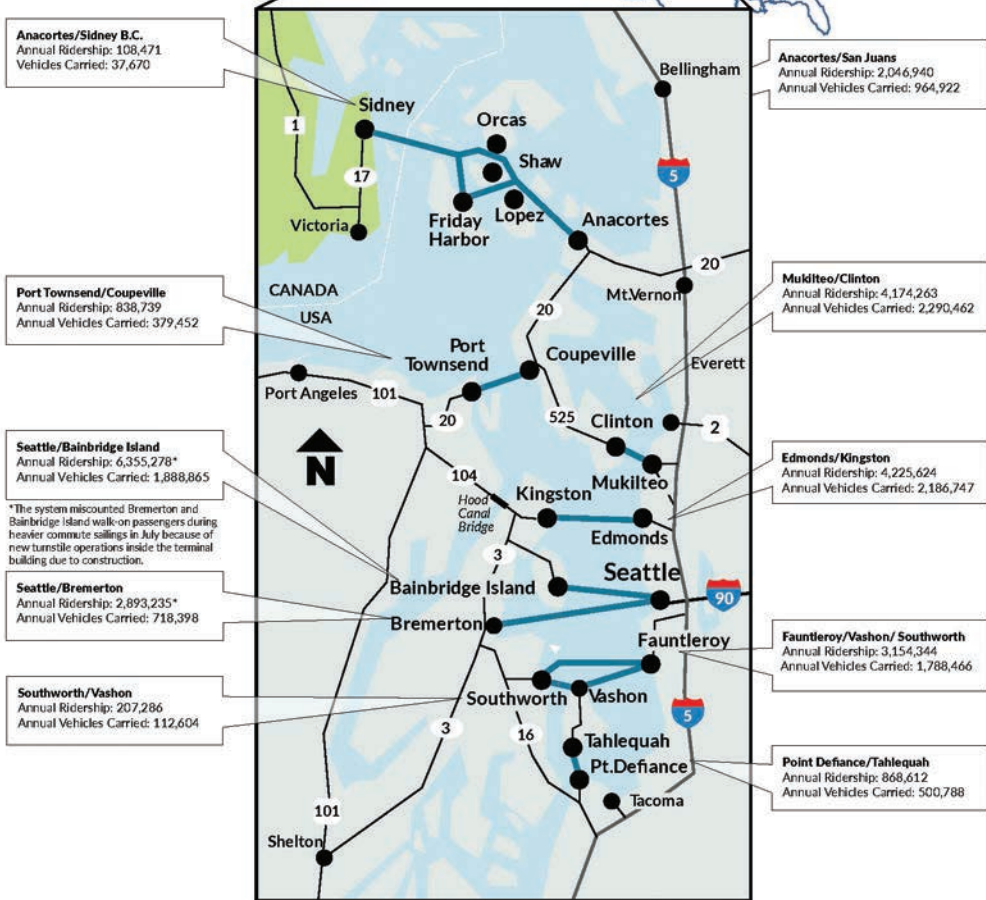


Figure 1: Washington State Ferries route map.



The precarious situation of the SRKWs has led to immediate actions on the part of the federal government in Canada and state government in Washington. In Washington State, Governor Jay Inslee issued Executive Order 18-02 (EO 18-02) in March 2018. EO 18-02 created a task force to focus on solutions to the three primary threats to SRKWs and specifically directed WSF to “develop strategies for quieting state ferries in areas most important to Southern Residents.” The Governor’s SRKW Task Force met in the summer and fall

of 2018, producing recommendations endorsed by the Governor in November of 2018. These recommendations subsequently informed legislative proposals during the State of Washington’s legislative session in early 2019. The legislature passed several new laws and earmarked funding for several efforts related to the recommendations, including increased separation distances and reduced speeds for vessels operating in the presence of SRKWs, and funding for WSF to conduct a fleetwide baseline noise study.

BC Ferries Route Map



Routes, Destinations and Terminals

- 1 Tsawwassen – Metro Vancouver (Tsawwassen) to Victoria – Vancouver Island (Swartz Bay)
- 2 West Vancouver – Metro Vancouver (Horseshoe Bay) to Nanaimo – Vancouver Island (Departure Bay)
- 3 West Vancouver – Metro Vancouver (Horseshoe Bay) to Gibsons – Sunshine Coast (Langdale)
- 4 Fulford Harbour – Salt Spring Island (Fulford Harbour) to Victoria – Vancouver Island (Swartz Bay)
- 5 Victoria – Vancouver Island (Swartz Bay) to Southern Gulf Islands
- 6 Vesuvius Bay – Salt Spring Island (Vesuvius) to Crofton – Vancouver Island (Crofton)
- 7 Earls Cove – Sunshine Coast (Earls Cove) to Powell River – Sunshine Coast (Saltery Bay)
- 8 West Vancouver – Metro Vancouver (Horseshoe Bay) to Bowen Island – Metro Vancouver (Swig Cove)
- 9 Tsawwassen – Metro Vancouver (Tsawwassen) to Southern Gulf Islands
- 10 Port Hardy – Vancouver Island (Bear Cove) to Prince Rupert – North Coast (Prince Rupert)
- 11 Discovery Coast Connector Service [McLoughlin Bay (Bella Bella), Ocean Falls, Bella Coola, Shearwater]
- 12 Prince Rupert – North Coast (Prince Rupert) to Skidegate – Graham Island (Skidegate)
- 13 Brentwood Bay (Brentwood Bay) to Mill Bay – Vancouver Island (Mill Bay)
- 14 Gibsons – Sunshine Coast (Langdale) to New Brighton – Gambier Island (New Brighton) to Keats Landing – Keats Island West (Keats Landing)
- 15 Powell River – Sunshine Coast (Westview) to Comox – Vancouver Island (Little River)
- 16 Powell River – Sunshine Coast (Westview) to Blubber Bay – Texada Island (Blubber Bay)
- 17 Nanaimo – Vancouver Island (Nanaimo Harbour) to Descanso Bay – Gabriola Island (Descanso Bay)
- 18 Chemainus – Vancouver Island (Chemainus) to Thetis Island (Pheedy Harbour) to Penelakut Island (Penelakut Island)
- 19 Denman Island West (Denman Island West) to Buckley Bay – Vancouver Island (Buckley Bay)
- 20 Denman Island East (Gravelly Bay) to Hornby Island (Shingle Spit)
- 21 Campbell River – Vancouver Island (Campbell River) to Quathiaski Cove – Quadra Island (Quathiaski Cove)
- 22 Heriot Bay – Quadra Island (Heriot Bay) to Whaletown – Cortes Island (Whaletown)
- 23 Port McNeill – Vancouver Island (Port McNeill) to Sointula – Malcolm Island (Sointula) to Alert Bay – Cormorant Island (Alert Bay)
- 24 Skidegate – Graham Island (Skidegate) to Alliford Bay – Moresby Island (Alliford Bay)
- 25 Port Hardy – Vancouver Island (Bear Cove) to Bella Coola – Central Coast (Bella Coola) Seasonal Direct Summer Service
- 26 Tsawwassen – Metro Vancouver (Tsawwassen) to Nanaimo – Vancouver Island (Duke Point)



Figure 2: BC Ferries route map.



Figure 3: Map of the Salish Sea and surrounding basin.

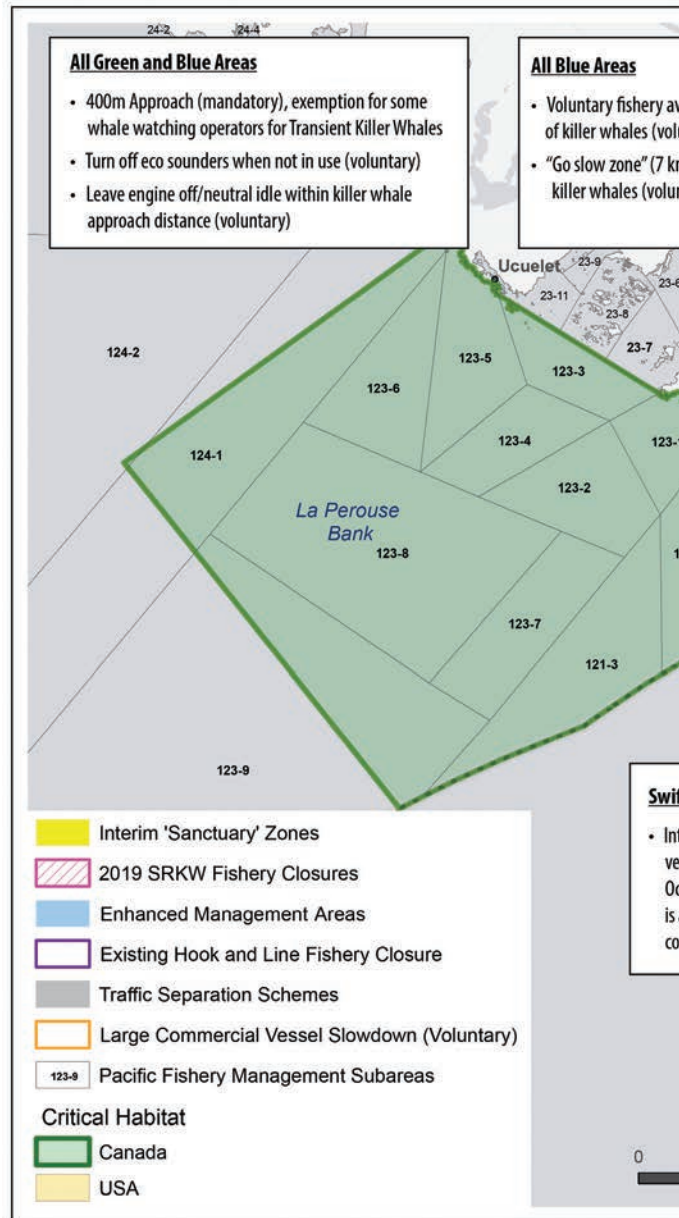
In November 2016, the Canadian government released the Oceans Protection Plan (OPP) to address threats to at-risk whales, including belugas, North Atlantic right whales, and SRKWs. Building on the OPP, in November 2018, the “Whales Initiative” was introduced as part of a five-year plan to protect Canada’s iconic whale populations. Similar to actions taken by Washington State, the Whales Initiative focused on management solutions to the primary threats to at-risk whale populations. Additional action was taken in June 2019 when the “Interim Order for the Protection of Killer Whales (*Orcinus orca*) in the Waters of Southern British Columbia” was released. The interim measures included separation distances required for vessels, SRKW fisheries closures, and interim sanctuary zones (Figure 4).

It is within this context of urgency that BCF and WSF have continued to build on their individual and collaborative efforts to address the emerging issue of URN.

Underwater Radiated Noise and SRKWs

Until very recently, underwater radiated noise (URN) had not been a measured vessel performance parameter in the commercial maritime sector. Although noise aboard ships and its negative impacts to human health has been recognized and, since 2012, regulated by the International Maritime Organization (IMO) through the International Convention for Safety of Life at Sea (SOLAS), URN and its effects on the marine environment have not been similarly addressed through regulatory mechanisms.

The IMO first recognized the issue in 2004, but not until 2008 did the IMO Marine Environment Protection Committee (MEPC) agree to develop non-mandatory guidelines to address the issue. In April 2014, IMO issued those guidelines as MEPC.1/Circ.833, which proposes measurement standards and elements of vessel design, and addresses the relationship between URN and vessel speed. In April 2018, the MEPC noted the increased interest in URN

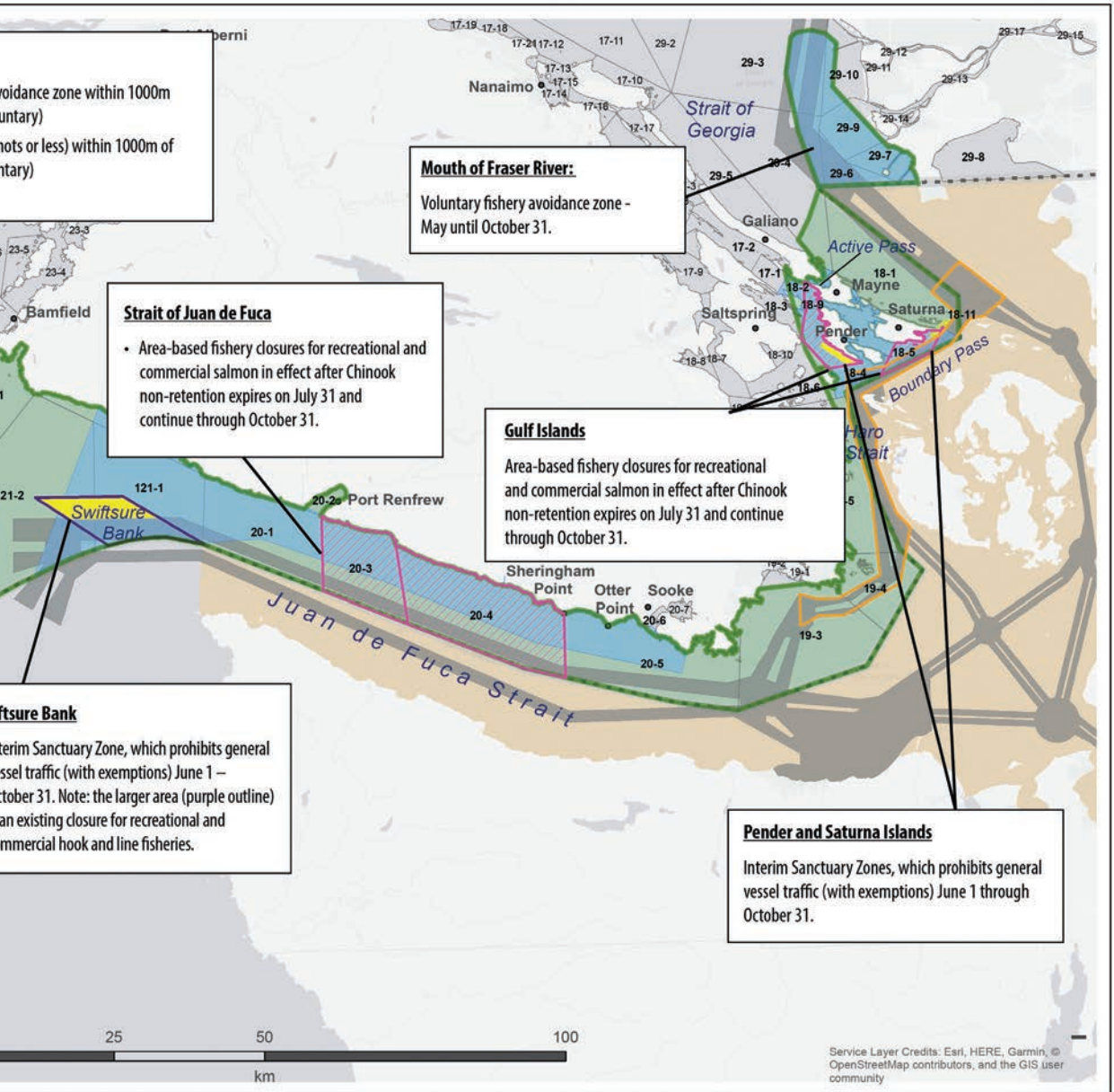


Overview of 2019 management measures

Figure 4: Southern Resident killer whale management areas.

and many member states stressed the need for more research on the issue.

Similar to air quality management, URN produces both point source and cumulative effects that must be managed to mitigate impacts (Figure 5). Vessel point sources of URN are propellers, thrusters, hull drag,



Closures to protect Southern Resident killer whales



FISHERIES AND OCEANS CANADA WWW.DFO-MPO.GC.CA/TERMS-CONDITIONS-AVIS-ENG.HTM

engines, and onboard machinery. Through the sheer number of vessels and transits, BCF and WSF are significant contributors to URN in the Salish Sea. A ferry at service speed is typically emitting URN at a broadband sound intensity of 185 dB. The quantitative studies within the scientific community indicate that vessels operating at sound intensity above 175 dB are

candidates for reducing overall noise levels in SRKW habitat. Currently, there is no limiting standard for URN emissions through the IMO or any of its member states.

While the study of URN and its effects on the marine environment is an emerging field in the maritime industry, the scientific

THE EFFECTS OF VESSEL UNDERWATER NOISE ON WHALES AND WHAT MARINERS CAN DO ABOUT IT

SOURCES OF NOISE

While there are plenty of naturally occurring sounds in the ocean, an increase in commercial vessel traffic is the main reason for increased underwater noise.

In the North Pacific Ocean, underwater noise has been **DOUBLING** in intensity **EVERY DECADE** for the past

60 YEARS

Sound travels
4.5 TIMES
FASTER in water than in air.

WHERE VESSEL NOISE COMES FROM

- ENGINE AND ONBOARD MACHINERY
- DRAG FROM POOR HULL MAINTENANCE
- BOW/STERN THRUSTERS
- PROPELLER
- CAVITATION

NOISE INCREASES WITH SPEED.

Most underwater noise from large vessels is caused by propeller cavitation.

IMPACTS

Underwater noise interferes with the ability of marine animals to transmit and receive acoustic information.

VESSEL NOISE CAN AFFECT THE ABILITY OF MARINE ANIMALS TO...

AVOID DANGER

COMMUNICATE

LISTEN NOW

FIND PREY

REST

MATE AND REPRODUCE

NAVIGATE

In some areas, vessel noise has reduced the area some whales can communicate by **90%.**

WHAT YOU CAN DO

In 2014, the International Maritime Organization (IMO) recognized that underwater noise associated with shipping is something that can be mitigated.

READ THE GUIDELINES

WWW.IMO.ORG



Options to reduce ship noise underwater already exist!

SLOW DOWN



Operate below cavitation inception speed and avoid rapid acceleration.

MAINTAIN



Clean hull and maintain propeller.

OPTIMIZE



Insulate ship engine and use resilient mountings for onboard machinery. Modify propeller to minimize cavitation.

DESIGN



Incorporate vessel quieting considerations during re-fits and new vessel construction.

REROUTE



Modify route to avoid whales in immediate vicinity and known sensitive marine areas.

The Enhancing Cetacean Habitat and Observation (ECHO) Program is a Vancouver Fraser Port Authority-led initiative aimed at better understanding and managing the impact of shipping activities on at-risk whales throughout the southern coast of British Columbia, Canada. For more information and footnote references, please go to portvancouver.com/echo



Figure 5: The effects of vessel underwater noise on whales and what mariners can do about it.



community currently has much debate and little consensus in regards to the setting of actual noise reduction targets to mitigate the effects of URN on marine species. This issue is further compounded by the fact that specific species have different frequencies of concern. For SRKWs, there is even greater complexity in that URN is only one of three threats to the species. There appears to be consensus that the reduction of URN would not serve as a “silver bullet” for the species to recover. The sole peer-reviewed article on the subject of recovery targets for SRKWs suggests that a decrease in ambient sound levels in the Salish Sea by 50% and an increase in prey availability by 15% would allow the population of SRKWs to attain a recovery target of 2.3% annual population growth.

The challenge for BCF and WSF is how to best work together to attempt to achieve a 50% reduction target. Fortunately, both organizations have been leaders in the field for a number of years.

BCF and WSF Efforts to Address Noise to Date

For WSF, URN produced from shoreside infrastructure projects, primarily through pile driving, first brought to the forefront the issue of the effects of noise on the marine environment. As part of regulatory compliance with ESA and the *Marine Mammal Protection Act*, WSF has become a leader in both research and mitigation of effects in the field of URN as generated by shoreside infrastructure. Given the regulatory environment in the United States, there was never a similar emphasis on URN as generated by vessels.

Regulatory compliance in Canada followed a different tack with less emphasis on URN generated by shoreside infrastructure but instead a focus on vessel-generated URN. In the spirit of collaboration, BCF reached out to WSF and the two organizations began their first attempts to address the effects of vessels on cetaceans by developing and incorporating parallel cetacean policies into their Safety

Management Systems. While not addressing vessel-generated URN specifically, the policies followed the regulatory guidance from Canada and the United States in respect to travel speeds, vessel distances, and vessel interactions, including sightings reporting, with cetaceans.

In 2014, BCF became a founding member of the Vancouver Fraser Port Authority’s Enhancing Cetacean Habitat and Observation (ECHO) Program, and, on the recommendation of BCF, WSF was invited to join the ECHO Program early in 2015. Since that time, the ECHO Program has become an international leader in research to better understand and mitigate the effects of shipping activities on cetaceans, particularly SRKWs. The long-term goal of the ECHO Program is to develop mitigation measures for shipping activities that will lead to quantifiable results for the recovery of the species. As part of the ECHO Program, WSF has participated in a trial study and subsequent voluntary efforts to slow vessels and thus reduce noise in critical SRKW habitat in transboundary waters. BCF’s collaboration through the ECHO Program included the development of the recently released “Whales in Our Waters” online tutorial, which is accessible and available for anyone to use via the ECHO web site. BCF has committed to having all of its deck and bridge crews trained with this tool by early 2020 and WSF has included the training as part of its orientation for new mates as well as ordinary seaman training.

In addition to ECHO, BCF and WSF are also members of Green Marine, the leading voluntary environmental certification program for the North American maritime industry. BCF has been a member since 2015 and, in 2018, WSF became the first ferry service in the United States to join. As members, BCF and WSF have helped to inform discussions on the URN performance indicator, which has become mandatory for ship owners to report as of 2018.

To date, the most important efforts taken to better understand and address vessel-generated URN by BCF and WSF have been fleetwide

noise baseline studies. BCF was first in commissioning such studies, which allowed for the classification of noise levels generated by each vessel class in the BCF fleet. WSF has since followed suit and is currently engaged in a study that will provide baseline noise measurements for each vessel class. These studies are fundamental to identifying sources and source levels of concern within a fleet, so that vessel operators can set reduction targets and put measures in place to achieve those targets. Although expensive and time intensive, these studies are the essential first step for any vessel operator to grapple with URN.

Through investment in high resolution measurements, BCF has been able to direct design work towards these primary challenges:

- Initiating a “quiet mode” that can be safely engaged in the presence of marine mammals;
- Problematizing the characteristic negative noise vs speed trend, demonstrating that some vessels get noisier when they slow down;
- Enabling quieter operation with minimal sacrifice of fuel efficiency and the subsequent higher greenhouse gas emissions in overall operations; and,
- Building or retrofitting quieter vessels without substantially increasing the cost of operating and maintaining vessels (due to a need to rely on high value, specialized technology).

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

At this time, there are no “ferry ready” solutions on the market to achieve the necessary URN reduction targets. The design challenge is significant both for vessel technical specification and for operational implementation. For BCF, ferry routes that interface with SRKW critical habitat also have

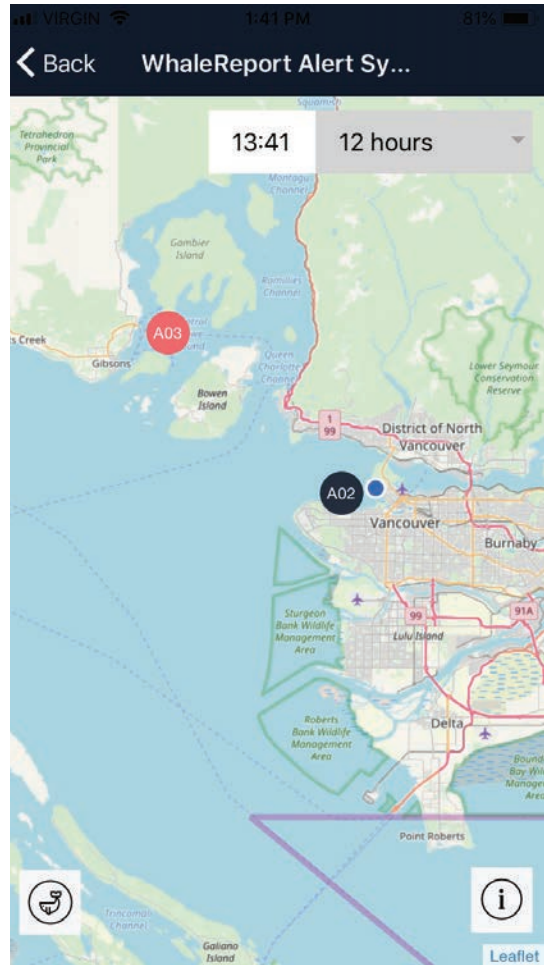


Figure 6: Whale Report Alert System screen shot.

BC FERRIES

the largest customer demand and require transit times of less than two 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 cruise ships that have achieved low noise modes of operation.

Relying on fleetwide noise baseline studies, BCF has developed a long-term plan to address URN by setting strategic objectives that can be realized through engineered and operational mitigation measures. Implementation of the plan has also led BCF to hire a specialist solely focused on the issue of URN to provide expert guidance and innovative approaches. Both



Figure 7: Whale Report Alert System in use in Washington State Ferries Operations Center.

BCF and WSF intend to use their baseline studies to develop engineered URN-reduction measures for new vessels as well as potentially retrofitting the existing fleet. In addition, BCF and WSF will also use their baselines to generate vessel noise “footprints” that can be used in combination with real-time cetacean sightings to provide crews with situational awareness as well as the capability to slow or alter courses to lessen their “footprint” and thus potential effects on cetaceans.

The potential for real-time active management of URN would not be possible without the collaboration that BCF and WSF have had with the Coastal Ocean Research Institute (the research body under the Ocean Wise Conservation Association) and ECHO to develop the WhaleReport Alert System (WRAS), currently active for all commercial mariners in Canadian waters (and more limited

United States waters) of the Salish Sea (Figure 6). Launched in October 2018, the WRAS leverages real-time cetacean observations reported to the B.C. Cetacean Sightings Network via their WhaleReport App. These sightings provide real-time SMS notifications to commercial mariners when a cetacean sighting occurs within 10 nautical miles of their location. Vessel operators with operations centres, such as BCF and WSF, also have access to a desktop version of the WRAS that allows watch supervisors to monitor cetacean presence and provide reports to affected vessels (Figure 7). Currently, WSF is working with the Coastal Ocean Research Institute to expand the WRAS for use in Puget Sound.

Conclusion

All efforts by BCF and WSF to date have been enriched and, in some instances, made possible through the development of trusted



Figure 8: Orcas and BC Ferry.

BC FERRIES

collaboration not only with each other but with several other organizations, specifically ECHO, Green Marine, and the other members of those organizations. The formation of these relationships has provided for a solid foundation as the governments of Canada and the State of Washington have more recently taken action towards addressing the dire situation of the SRKWs in the Salish Sea. Although URN is only one of the primary threats to SRKWs, the early attention to the issue by BCF and WSF has placed both organizations ahead of the curve in terms of regulations and on the cutting edge in terms of the technology and science.

In collaboration with groups and organizations in the public, private, and not for profit sectors, BCF and WSF have helped forge a framework upon which future actions may be taken. At a regional level, the State of Washington is moving quickly to implement new initiatives and potential regulations, and looks to WSF as a leader in this endeavour.

At a national level, the federal government of Canada has begun large scale investment in SRKW recovery and looks to BCF to help inform the decision making and regulatory processes. At an international level, the IMO and its member states are beginning to recognize a need to address URN and are looking to groups like ECHO and Green Marine to inform these efforts.

We often think that the status quo represents the safest path forward while we seek more data to make better informed decisions. However, in the case of the SRKWs, the status quo represents the riskiest path: to do nothing at this point could very well mean the extinction of this distinct population segment of a species. Mere compliance and best practices are no longer options. To be leaders, we cannot sit back and wait to be directed by regulations. The maritime industry has the unique knowledge, skills, and resources to do what is necessary and what is right to help lessen the impacts of shipping on the marine environment.

Hopefully, in doing so, we will also do our part to protect and recover endangered and threatened marine species. As the two major ferry services operating in the Salish Sea, BCF and WSF intend to set a new global standard on managing URN (Figure 8). ~



BC Ferries' Clean Futures Plan
www.bcferries.com/files/AboutBCF/2019-bc-ferries-clean-futures-plan.pdf

BC Ferries Underwater Radiated Noise Long Term Mitigation Plan
www.bcferries.com/files/AboutBCF/2019-bc-ferries-underwater-noise-mitigation-plan.pdf

Whales in our Waters
<https://echolearn.portvancouver.com>

Washington State Ferries Sustainability Plan
www.wsdot.wa.gov/sites/default/files/2019/04/22/washington-state-ferries-sustainability-action-plan.pdf

Executive Order 18-02 "Southern Resident Killer Whale Recovery and Task Force"
www.governor.wa.gov/sites/default/files/exe_order/eo_18-02_1.pdf

Interim Order for the Protection of Killer Whales (*Orcinus orca*) in the Waters of Southern British Columbia
www.tc.gc.ca/eng/mediaroom/interim-order-protection-killer-whales-waters-southern-british-columbia.html

Ocean Protections Plan
www.tc.gc.ca/en/campaigns/protecting-coasts.html

Whales Initiative
www.tc.gc.ca/en/campaigns/whales-initiative-protecting-southern-residen-killer-whale.html



Kevin Bartoy has worked for the Washington State Department of Transportation (WSDOT) since 2009 and is currently the Environmental Stewardship and Sustainability Program Manager for Washington State Ferries. He was previously a Cultural Resources Lead for WSDOT.

Prior to working for WSDOT, Mr. Bartoy worked in cultural resources management in the private, academic, and not for profit sectors. He holds a BA in history from the University of Oregon, an MA in anthropology with an emphasis in historical archaeology from the College of William and Mary in Virginia, and is a doctoral candidate in anthropology from the University of California at Berkeley.



Leslie James has been the Manager of Environment Sustainability for BC Ferries since 2013. She has over 15 years of experience in the marine and science fields and in 2018 received a Conservation Award from Ocean Wise. Her career has been divided between

Canada and the United States. In Canada, she worked in the private sector as well as two federal government departments. During her time with the federal government as an environment officer, she developed and implemented a national compliance monitoring program. In the United States, she worked with two state universities and the United States Geological Survey-Biological Resource Division in eel grass ecosystem research.



Greg Peterson is the Director of Engineering Services for BC Ferries; he has been with BC Ferries for 29 years first as a Chief Engineer and the past 20 years as a technical manager in the Engineering Department. He began his career in the marine industry with the Canadian Coast Guard where he took officer training as a Marine Engineer. Mr. Peterson has played a vital role in helping BC Ferries develop baseline information on its fleets' key underwater radiated noise (URN) characteristics and has contributed to the development of the Class Notation Guides for URN.