

Petition for an Emergency Order for the Southern Resident Killer Whales under s. 80 of the Species at Risk Act

To the Honourable Dianne LeBouthillier, Minister of Fisheries and Oceans Canada, and the Honourable Steven Guilbeault, Minister of Environment and Climate Change

On behalf of David Suzuki Foundation, Georgia Strait Alliance, Living Oceans Society, Natural Resources Defense Council, Raincoast Conservation Foundation and World Wildlife Fund Canada
(the “Petitioners”)

Prepared by Ecojustice



NOAA/Ocean Wise Photo – Lance Barrett-Lennard

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I Introduction

“...[Southern Resident Killer Whale] recovery will require aggressive actions to protect and restore their habitat, which includes mitigating effects to both [the killer whales] and their primary prey...” –Williams et al, 2024¹

The Petitioners ask the the Minister of Fisheries, Oceans and the Canadian Coast Guard and the Minister of Environment and Climate Change (the “Ministers”)² to recommend, and the Governor in Council to issue, an emergency order pursuant to s. 80 of the *Species at Risk Act*, SC 2002, c. 29 (“SARA”) to protect the endangered Southern Resident Killer Whales (“Southern Residents”).

The Southern Residents are in crisis. This population of genetically and culturally distinct salmon-eating killer whales has declined to 74 individuals.

In 2018, the Ministers issued an Imminent Threat Assessment for the Southern Residents (“2018 ITA”).³ The 2018 ITA identified that the Southern Residents face three primary threats: a lack of prey (primarily larger, older Chinook salmon), acoustic and physical disturbance from vessels, and environmental contaminants. Each of these threats continues to intensify, and they act synergistically, exacerbating the others. The 2018 ITA determined that, given the effects of the threats, the Southern Residents faced imminent threat to their survival and recovery.

The Ministers also recommended that the Governor in Council issue an emergency order for the protection of the Southern Residents. The Governor in Council declined to issue such an order.

The Southern Residents’ conservation status has continued to worsen since the Governor in Council refused to issue an emergency order. New research since the 2018 ITA, from both the Department of Fisheries and Oceans (“DFO”) and independent scientists, has warned of accelerating decline in the Southern Residents’ population due to the impacts of lack of prey on their body condition and the severe effects of underwater noise on their ability to perform basic life functions. The most recently published population viability analysis (“PVA”) for the Southern Residents, from April 2024, warns that without intervention, extinction is looming for the population.⁴

The Southern Residents continue to face imminent threats to their survival and recovery, which are now being exacerbated by new oil tanker traffic from the Trans Mountain Expansion Project (“Trans Mountain”), as well as other further industrial development in the Salish Sea.

¹ Rob Williams et al., “Warning sign of an accelerating decline in critically endangered killer whales (*Orcinus orca*)” (2024), 5:173 *Nature: Communications Earth & Environment*, online: <<https://www.nature.com/articles/s43247-024-01327-5>> [Williams et al] at page 5.

² The Minister of Fisheries and Oceans is the competent minister under SARA for the Southern Residents. The Minister of Environment and Climate Change is engaged as portions of identified critical habitat are within Gulf Islands National Park Reserve and thus within his jurisdiction. Implementation of the recommended measures will also require collaboration with the Minister of Transport.

³ Fisheries and Oceans Canada, 2018, *Southern Resident Killer Whale Imminent Threat Assessment May 24, 2018*, Ottawa, online: <<https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/related-information/southern-resident-killer-whale-imminent-threat-assessment.html#toc8>> [2018 ITA].

⁴ Williams et al., *supra* note 1.

In approving Trans Mountain, the Governor in Council undertook to implement a list of 16 recommendations (“Recommendations”) issued by the Canadian Energy Regulator (“CER”) related to impacts from marine shipping. In a prior Memorandum of Understanding, the CER, DFO, and Transport Canada (“TC”) agreed to support the Government of Canada’s commitment to “more than mitigate the effects of [Trans Mountain]-related marine shipping on [the Southern Residents] before shipping from [Trans Mountain] begins”.⁵ However, the Governor in Council has failed to implement the Recommendations or otherwise mitigate the effects of Trans Mountain prior to the start of operations.

There are not sufficient measures currently in place that will collectively reduce the threats to the Southern Residents to the point of changing the Southern Residents’ imminent threat status.

The Petitioners propose the following specific emergency measures to protect the Southern Residents from the imminent threats to their survival and recovery. To summarize, the emergency order should:

- Institute a series of measures to reduce noise and disturbance from all vessels traveling in or near Southern Resident foraging areas. Key actions include expanding the current 200 metre approach distance to 1,000 metres to harmonize with Washington State legislation, requiring quiet vessel notations of Trans Mountain-associated vessels, and developing, adopting, and implementing meaningful underwater noise reduction targets and underwater noise management planning.
- Prohibit further increases in shipping from existing and new federally-approved industrial developments in the Salish Sea until a cumulative effects management plan for marine shipping that includes underwater noise is in place.
- Implement prey management strategies to rebuild wild Chinook salmon abundance. Key actions include initiating a transition from marine mixed-stock, interception fisheries to river-based terminal areas, establishing an emergency management plan for Chinook fisheries which contain minimum thresholds for Chinook abundance, limiting the total fishing-related mortality of at-risk Fraser River Chinook salmon to less than 5%, and establishing an emergency drought management plan.
- Implement measures to increase wild Chinook salmon accessibility, including extending the period of existing fishing closures in priority Southern Resident foraging areas.

⁵ *Memorandum of Understanding to advance measures to benefit the recovery of the Southern Resident Killer Whale through Trans Mountain Expansion Project Conditions*, between the Canadian Energy Regulator, Fisheries and Oceans Canada, and Transport Canada (October 2017), online: <<https://www.cer-rec.gc.ca/en/about/acts-regulations/other-acts/cooperative-agreements/memorandum-understanding-advance-measures-benefit-recovery-southern-resident-killer-whale-through-trans-mountain-expansion-project-conditions.html>> [Trans Mountain MOU] at preamble.

- Prohibit all vessels from discharging scrubber wastewater in internal waters and the territorial sea and prohibit operational discharge from any vessel in Southern Resident critical habitat or the territorial sea.

The emergency measures requested in this Petition are necessary, actionable, and based on best available science. These measures are also informed by and consistent with the Southern Resident Recovery Strategy (2018) and Action Plan (2017), the Review of Effectiveness of Recovery Measures (2017), and the 2018 ITA.⁶

The Petitioners recognize that Indigenous peoples have stewarded these lands since time immemorial, and that they have both inherent and constitutionally protected rights. The Petitioners do not believe the measures contained in this Petition would adversely impact Indigenous rights, and do not intend them to.

While longer-term measures are needed to address the full suite of threats to the Southern Residents, the whales cannot wait. The risk to Southern Residents from short term vessel disturbance and oil spills is acute and must be addressed now. Thus, we require a response to this petition, confirming that the Ministers have recommended an emergency order, by July 8, 2024.

II The Petitioners

The Petitioners are six conservation organizations with a longstanding interest in, and history of working to protect, the Southern Residents and Chinook salmon.

The David Suzuki Foundation (“DSF”) is a leading Canadian environmental non-profit organization whose combined digital channels engage upwards of one million people weekly. DSF collaborates with all people in Canada, including government and business, to conserve the environment and find solutions that will create a sustainable Canada through evidence-based research, public engagement and policy work. DSF has worked to improve the sustainability of Pacific salmon fisheries in Canada for more than 20 years, participating in planning processes and playing a key role in the design and implementation of Canada's Wild Salmon Policy. DSF has provided input into the Southern Residents’ recovery strategy and action plan for Southern Residents focused on restoring Chinook salmon abundance and accessibility as a primary food resource necessary for the recovery of these whales, along with recommendations on reducing noise and contaminant impacts. It also sits as a member of the Southern Resident Killer Whale Indigenous Multi-stakeholder Advisory Group and DFO-led Southern Resident Killer Whale Prey Technical Working Group. DSF has a long-standing commitment to protect Southern

⁶ Fisheries and Oceans Canada, 2018, *Recovery Strategy for the Northern and Southern Resident Killer Whales (Orcinus orca) in Canada, Species at Risk Act Recovery Strategy Series*, Ottawa [Recovery Strategy]; Fisheries and Oceans Canada, 2017, *Action Plan for the Northern and Southern Resident Killer Whales (Orcinus orca) in Canada, Species at Risk Act Action Plan Series*, Ottawa [Action Plan].

Residents, including as litigant before Canadian and American courts in cases concerning the legal protection of critical habitat for the Southern Residents.⁷

Georgia Strait Alliance (“GSA”) is a registered charity with extensive membership in British Columbia. GSA collaborates with individuals, businesses, and government in pursuit of its mission: to protect and restore the marine environment and promote the sustainability of Georgia Strait, its adjoining waters, and communities. This includes protecting the diversity of wildlife and their habitat. For nearly 30 years, GSA has been an advocate for protecting the habitat of Southern Residents from the negative impacts of pollution and the loss of their prey species, Chinook salmon. GSA has worked to secure the release of the final action plan (supported by over 800 GSA members who sent in letters), participated in the Federally led Indigenous Multi-stakeholder Advisory Group and the Technical Working Group on contaminants, and took a lead role at the 2017 DFO hosted Southern Resident killer whale symposium. GSA has been a litigant before Canadian and American courts in cases concerning the legal protection of critical habitat for the Southern Residents.⁸

Living Oceans Society (“Living Oceans”) is a non-profit organization incorporated in British Columbia dedicated to the sustainable management of Canada’s oceans to ensure the health of ocean ecosystems and coastal communities. Living Oceans intervened in the National Energy Board (now the CER) environmental assessment of the Trans Mountain Expansion Project (“Trans Mountain”) in order to raise questions and present expert evidence concerning risks to the marine environment from shipping related to the project. They presented evidence on, among other things, the potential impact of oil spills on key marine biota including Southern Resident Killer Whales and their prey species and habitat.

Natural Resources Defense Council (“NRDC”) is a not-for-profit membership organization, incorporated under the laws of the State of New York in the United States of America. They combine more than three million members and online supporters with the expertise of hundreds of scientists, lawyers, and policy advocates in the United States and across the globe. The NRDC works to safeguard the earth – its people, its plants and animals, and the natural systems on which all life depends. Their Oceans Division, which includes their work on the Southern Residents, fights to restore marine vitality by working to end overfishing, protect important marine areas, improve oceans governance, and combat emerging threats. For more than three

⁷ In the Federal Courts of Canada: *David Suzuki Foundation v Canada (Fisheries and Oceans)*, 2010 FC 1233; *Canada (Fisheries and Oceans) v David Suzuki Foundation*, 2012 FCA 40. In the United States District Court: *Inter Tribal Sinkyone Wilderness Council et al v National Marine Fisheries Service et al* (Northern District of California, Eureka Division, decided 25 September 2013).

⁸ In the Federal Courts of Canada: *David Suzuki Foundation v Canada (Fisheries and Oceans)*, 2010 FC 1233; *Canada (Fisheries and Oceans) v David Suzuki Foundation*, 2012 FCA 40. In the United States District Court *Center for Biological Diversity et al v Robert D Lohn et al* (Western District of Washington at Seattle, decided 17 December 2003); In the United States District Court: *Washington State Farm Bureau et al v National Marine Fisheries Service et al* (Western District of Washington at Seattle, decided 20 December 2006); *Inter Tribal Sinkyone Wilderness Council et al v National Marine Fisheries Service et al*. (Northern District of California, Eureka Division, decided 25 September 2013).

decades, through litigation, national and international advocacy, and science-based policy development, they have helped lead the environmental community in preventing and mitigating the impacts of ocean noise pollution on marine wildlife. With their partners in the Orca Salmon Alliance, they have worked in the United States to improve prey availability for the Southern Resident population.

Raincoast Conservation Foundation (“Raincoast”) is a charitable, non-profit organization comprised of scientists and conservationists who are empowered by their research to protect the lands, waters, and wildlife of British Columbia. Raincoast operates a research lab at the University of Victoria, a Conservation Genetics lab, a mobile water pollution lab, a field station, and research vessel. They collaborate with academic and government scientists to produce high-quality peer-reviewed publications that further scientifically sound conservation decisions. These publications include two recent peer-reviewed publications that evaluated threats to the Southern Residents and predict their long-term likelihood of recovery in the face of these threats.⁹ For more than a decade, Raincoast has used these tools to defend the critical habitat and lives of the Southern Residents. They have been a litigant before Canadian and U.S. courts in cases concerning the application of SARA to the Southern Residents, including the legal protection of critical habitat.¹⁰ They participated in the environmental assessment of Trans Mountain alongside Living Oceans. They participate in federal fisheries planning processes to manage and recover Chinook populations, challenge projects that harm Southern Resident critical habitat, and advocate for vessel regulations to reduce noise and disturbance. Raincoast scientists sit as members of the federal Southern Resident Killer Whale Technical Working Groups on prey, vessels, sanctuaries and contaminants. They also sit as a member of the Vancouver Fraser Port Authority’s Enhancing Cetacean Habitat and Observation (“ECHO”) program.

World Wildlife Fund Canada (“WWF”) is a registered charity and Canada’s largest international conservation organization, with the active support of hundreds of thousands of Canadians. WWF is committed to equitable and effective conservation actions that restore nature, reverse wildlife loss and fight climate change. We draw on scientific analysis and Indigenous guidance to ensure all our efforts connect to a single goal: a future where wildlife, nature, and people thrive. Regenerate Canada is WWF’s bold 10-year plan to expand habitats, reduce carbon in the atmosphere, lower industrial impacts and, as a result, reverse wildlife loss and fight climate change – prioritizing Indigenous-led and community-led conservation. WWF has been working on Southern Resident recovery for close to a decade and a half, primarily focused on efforts to reduce the threats of underwater noise and disturbance. We have advocated for, and sought to,

⁹ Robert C. Lacey et al., “Evaluating anthropogenic threats to endangered killer whales to inform effective recovery plans”, (2017) *Scientific Reports* 7:14119, available online <<https://www.nature.com/articles/s41598-017-14471-0>>; Williams et al., *supra* note 1.

¹⁰ In the Federal Courts of Canada: *David Suzuki Foundation v Canada (Fisheries and Oceans)*, 2010 FC 1233; *Canada (Fisheries and Oceans) v David Suzuki Foundation*, 2012 FCA 40; *Tsleil-Waututh Nation et al v Canada (Attorney General) et al*, decision pending. In the United States District Court: *Inter Tribal Sinkyone Wilderness Council et al v National Marine Fisheries Service et al* (Northern District of California, Eureka Division, decided 25 September 2013).

advance meaningful measures to reduce these threats consistent with the expectations of SARA. WWF-Canada had been involved in international efforts at the International Maritime Organization (“IMO”) to reduce underwater noise from commercial vessels as well as regional efforts in the Salish Sea to find collaborative solutions to reduce underwater noise from commercial shipping as part of the Advisory Working Group for the ECHO program.

III The 2018 SARA emergency order petition process

The facts concerning the Southern Residents, the threats to them, and their current situation are well-known to the Minister of Fisheries, Oceans and the Canadian Coast Guard’s department, DFO, which has produced a Recovery Strategy and an Action Plan for the species, and, in collaboration with other relevant departments including the Minister of Environment and Climate Change’s department, the 2018 ITA.¹¹

A 2024 PVA for Southern Residents published in peer-reviewed literature by 17 authors (Williams et al., 2024) provides the following concise summary:

Population assessment of Southern Resident killer whales (SRKW, *Orcinus orca*) is extremely data-rich compared with those of many other wild mammals. These whales represent the smallest of four separate, non-interbreeding, behaviorally, and culturally distinct, fish-eating ecotypes of killer whales in the eastern North Pacific Ocean. Every individual in the population has been censused annually by the Center for Whale Research and colleagues since the 1970s. Depleted in the 1960s and 1970s by an unsustainable live-capture fishery for aquaria displays, the population has failed to recover due to a combination of sublethal and lethal stressors, including reduced availability and quality of Chinook salmon (*Oncorhynchus tshawytscha*), its preferred prey; noise, which further reduces foraging efficiency; contaminant exposure, which is associated with decreased fecundity, increased calf mortality, and other adverse effects; and vessel strikes. The whales’ preferred prey, Chinook salmon, are themselves heavily depleted, and the ability of Chinook salmon stocks to support survival, let alone recovery of SRKW has been in question for over two decades. Years with low Chinook salmon abundance are temporally associated with low SRKW reproduction and survival. Ensuring recovery of SRKW and the salmon on which they depend hinges on explicit recognition of the costs and conflicts associated with recovery of predator and prey alike.¹²

The Southern Residents’ critical habitat, which has been identified as “necessary for [their] survival and recovery”¹³, occupies large portions of the Salish Sea and waters off Southwest

¹¹ Fisheries and Oceans Canada, 2018, *Recovery Strategy for the Northern and Southern Resident Killer Whales (Orcinus orca) in Canada, Species at Risk Act Recovery Strategy Series*, Ottawa [Recovery Strategy]; Action Plan, *supra* note 6.

¹² Williams et al., *supra* note 1 at page 2. The 2018 ITA notes that approximately 47 individuals were captured and removed for aquariums in the 1960s and 1970s (see 218 ITA, *supra* note 6, Section 3).

¹³ *Species at Risk Act*, SC 2002, c 29 [SARA] at s 2(1).

Vancouver Island. Critical habitat includes the attributes that make it useful for the Southern Residents, including adequate and available Chinook salmon, a quiet acoustic environment to allow for foraging and communication, and a level of pollution that does not cause harm to the population.¹⁴

1. The 2018 Imminent Threat Assessment established that the Southern Residents face imminent threats to their survival.

In 2018, the Ministers, received a petition from WWF, NRDC, GSA, Raincoast and DSF explaining that the Southern Residents faced imminent threats to their survival and recovery, and asking the Ministers to recommend to the Governor in Council an emergency order to provide for their survival and recovery. Under s. 80(2) of SARA, if the Ministers are of the opinion that a species faces imminent threats to its survival and recovery, they must make such a recommendation; under s. 80(1), the Governor in Council may then make an emergency order.

The 2018 ITA, developed by DFO with Environment and Climate Change Canada, TC, and the Parks Canada Agency, and issued by the Ministers to set out their opinion as to whether the Southern Residents were facing imminent threats to their survival and recovery, made the following findings.¹⁵

a. The Southern Residents are facing threats that might be impacting their survival and/or recovery.

The Southern Residents are listed as endangered in Schedule 1 of SARA. The population is small and declining, and at the time of the 2018 ITA comprised 76 individuals. As noted above, there are currently 74 individuals.

The Southern Residents are endangered due to their small population size, their low reproductive rate, and anthropogenic threats. The three primary threats to the population are 1) environmental contamination; 2) acoustic and physical disturbance; and 3) unavailability of their preferred prey, larger, older Chinook salmon.¹⁶ Each of these threats independently limits or undermines the recovery of the Southern Residents. These threats also act synergistically, exacerbating one another.¹⁷ The risk of oil spills is another significant threat.¹⁸ As articulated in the Recovery Strategy, oil spills not only pose an acute threat to whale health, but also have the potential to make areas of critical habitat uninhabitable for extended periods of time.¹⁹

The survival and recovery of the population is strongly linked to mature Chinook salmon abundance. The lack of suitable prey is exacerbated by acoustic and physical disturbances from

¹⁴ Recovery Strategy, *supra* note 11 at pages 51 – 52; *David Suzuki Foundation v Canada (Fisheries and Oceans)*, 2012 FCA 40 at para 32.

¹⁵ 2018 ITA, *supra* note 6.

¹⁶ 2018 ITA, *supra* note 6, Section 3.4.

¹⁷ 2018 ITA, *supra* note 6, Question 1.

¹⁸ 2018 ITA, *supra* note 6, Section 3.4

¹⁹ Recovery Strategy, *supra* note 11 at page 54.

vessels.²⁰ The Southern Residents make extensive use of echolocation to locate and capture prey, and studies have shown that the distances at which the Southern Residents should be able to detect Chinook decrease as ambient underwater noise increases.

The Southern Residents continue to face the legacy of persistent organic pollutants, but new and emerging contaminants pose a threat to them and their prey.

The dominant source of underwater noise in the Salish Sea is from shipping, which produces significant amounts of higher frequency noise in the audible range of the Southern Residents (approximately 600Hz to 114kHz).²¹ At the time of the 2018 ITA, large commercial ships transited the Salish Sea at rates from 1-3 transits per hour, every hour, every day of the year.²² The dramatic increase in commercial shipping in previous years had increased the acute and chronic impacts to the Southern Residents. Chronic shipping noise prevents the Southern Residents from efficiently carrying out basic life functions, which carries a high ecological cost. The 2018 ITA therefore concluded that the species is currently facing threats that might be adversely impacting survival and/or recovery.

b. The effects of the threats will make survival of the Southern Residents unlikely or impossible.

For the Southern Residents to be considered more likely to survive and persist, the population must be stable or increasing, resilient, widespread (or having population redundancy), connected (i.e. not severely and unnaturally fragmented), and protected from anthropogenic threats.²³

The Southern Residents declined in abundance in the 10-15 years that preceded the ITA, leading to lower reproductive potential and contributing to increased likelihood of inbreeding, negatively affecting the population's ability to reverse its decline.²⁴ Other contributing factors affecting population viability include the fact that the Southern Residents do not interbreed with other populations of killer whales, have fewer post-reproductive females owing to changes in the population, age, and sex structures, and lack of protection from anthropogenic threats.²⁵ A PVA published around the time of the 2018 ITA indicated that the population is fragile with no growth projected, and further decline, if new or increased threats were imposed. Accordingly, threats to the survival of the Southern Resident could be considered imminent.²⁶

c. The effect of the threats will make recovery of the Southern Residents unlikely or impossible.

The recovery goal for the Southern Residents, as set out in their Recovery Strategy, is to “ensure the long-term viability of Resident Killer Whale populations by achieving and maintaining demographic conditions that preserve their reproductive potential, genetic variation and cultural

²⁰ Recovery Strategy, *supra* note 11 at page 24.

²¹ 2018 ITA, *supra* note 6, Section 3.4.

²² 2018 ITA, *supra* note 6, Section 3.4.

²³ 2018 ITA, *supra* note 6, Question 2.

²⁴ 2018 ITA, *supra* note 6, Question 2.

²⁵ 2018 ITA, *supra* note 6, Question 2.

²⁶ 2018 ITA, *supra* note 6, Question 2.

continuity.”²⁷ As noted, the Southern Resident population is small and declining. Small populations are particularly vulnerable to population-level effects from the loss of even one individual, and a review of research in 2017 concluded that there was strong evidence of the presence of poor body condition in Southern Residents.²⁸ As a consequence of their small population size, the low numbers of individuals contributing to reproduction, and the poor survival of neonates, it is unlikely the population will increase unless the body condition of the population improves. Therefore, the threat to the recovery of the Southern Residents is considered imminent.

d. The Southern Residents face imminent threats to their survival and recovery, and those threats require intervention.

Given the threats outlined, and the recognition that those threats and their adverse effects on the Southern Residents are increasing, the Ministers of Fisheries and Oceans and Environment and Climate Change Canada determined that the Southern Residents face “imminent threats” to their survival and recovery under current conditions.

2. The Governor in Council refused to issue an emergency order in 2018, citing equivalent measures.

Based on the above conclusions in the 2018 ITA, the competent Ministers recommended – as they were required to by s. 80(2) of SARA – that the Governor in Council issue an emergency order for the Southern Residents under s. 80(1). The Governor in Council declined in an Order in Council (“2018 Order in Council”).²⁹ In doing so, it cited measures taken or planned to be taken by the Government of Canada and other organizations related to the imminent threats of prey availability, acoustic and physical disturbance, and environmental contaminants that it said would “contribute to abating the threats to the survival and recovery of” the Southern Residents.³⁰

IV Since 2018, the Southern Residents have remained in a state of emergency and are facing worsening conditions.

Despite the measures cited in the 2018 Order in Council, the population has faced continued decline and degradation of critical habitat due to worsening imminent threats. While actions to mitigate threats and support recovery of the Southern Residents have been ongoing for many years, the efforts have yet to result in signs of recovery of the population. Mitigation measures

²⁷ Recovery Strategy, *supra* note 11 at page 36.

²⁸ 2018 ITA, *supra* note 6, Question 3. Science cited by the 2018 ITA includes Craig O. Matkin, Michael J. Moor, and Frances M.D. Guiland, *Review of Recent Research on Southern Resident Killer Whales (SRKW) to Detect Evidence of Poor Body Condition in the Population* (2017) Independent Science Panel Report to the SeaDoc Society, online:

<https://static1.squarespace.com/static/5b071ddea2772cebc1662831/t/5b29b197758d466e7e7db713/1529459096608/Matkin-Gulland-and-Moore-2017.-Independent-panel-review-of-SRKW-nutrition-FINAL.pdf>.

²⁹ *Order Declining to make an Emergency Order for the Protection of the Killer Whale Northeast Pacific Southern Resident Population*, SI/2018-102 [Order Declining to make an Emergency Order].

³⁰ *Order Declining to make an Emergency Order*.

that address critical habitat, prey availability, acoustic and physical disturbance, and environmental contaminants are not stopping the impact of those key threats.

In January 2018, the Southern Residents numbered only 76 individuals.³¹ At the time, this marked their lowest abundance in more than three decades.

As of December 2023, the population comprised 74 individuals: J pod (25 whales), K pod (15 whales) and L pod (34 whales).³² The most recent calf, in J pod, was born in late 2023 and was deceased by January 24, 2024.³³

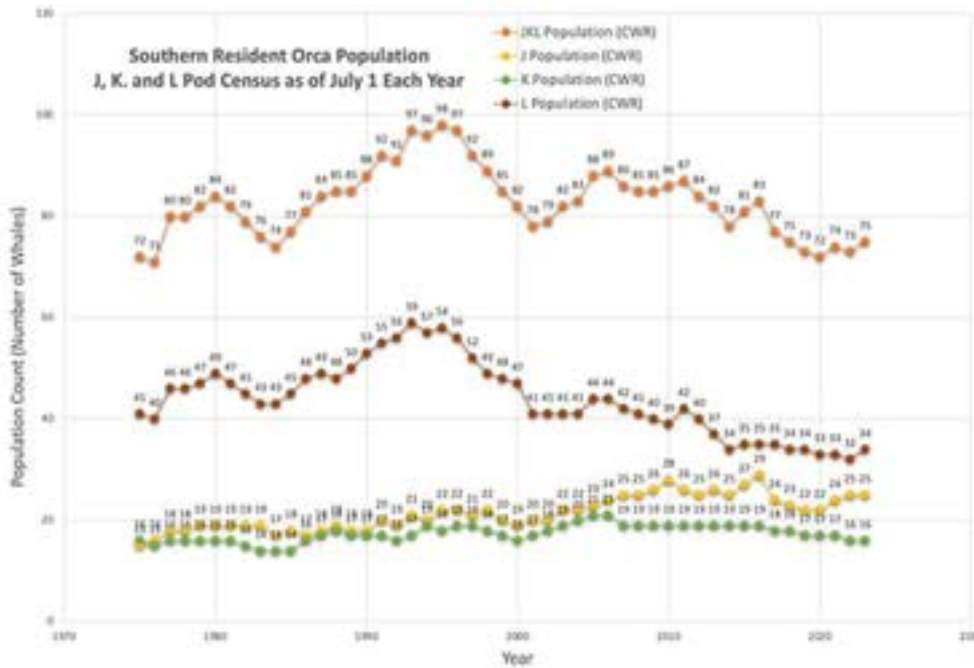


Figure 1. Southern Resident killer whale Population census of J, K and L Pods from 1976 – 2022, s of July 1 of each year.³⁴

1. New research since the 2018 ITA

a. Recent Canadian Science Advisory Secretariat research documents

DFO has produced new research about the threats to the Southern Residents since the 2018 ITA, which describes severe effects on the Southern Residents from current levels of vessel traffic.

³¹ “2017 SRKW Census-July1”, *Centre for Whale Research* (2017), online:

<<https://simplebooklet.com/publish.php?wpKey=HiPDDCYGTuXh2pyNPxHwB6#page=1>> [2017 Census].

³² “Southern Resident Orca Community Demographics, Composition of Pods, Births and Deaths since 1990”, *Orca Network* (accessed 23 May 2024), online: <<https://www.orcanetwork.org/births-and-deaths>>.

³³ The Canadian Press, “Christmas calf born to southern resident orca is missing, presumed dead” (30 January 2024), *CTV News*, online: <<https://bc.ctvnews.ca/christmas-calf-born-to-southern-resident-orca-is-missing-presumed-dead-1.6749110>>; “Encounter #8 – Jan 27, 2024”, *Center for Whale Research* (2024), online: <<https://www.whaleresearch.com/2024-8>>.

³⁴ 2023 SRKW Census, *supra* note 32.

In a 2022 research paper entitled “Areas of elevated risk for vessel-related physical and acoustic impacts in Southern Resident Killer Whale (*Orcinus orca*) critical habitat”, DFO scientists assessed the effects of vessel noise and presence on Southern Resident’s communication and echolocation, including providing “quantitative evidence for impacts of vessel noise on both the echolocation and communication ranges of [the Southern Residents]” under current conditions.³⁵ Using data from 2018-2020, the authors found “significant loss of both echolocation and communication range” due to large commercial vessels.³⁶

In particular, with respect to effects on echolocation, they stated that:

The persistence in the documented range loss, often over 50% of the time in both foraging and travelling locations, suggests that SRKW dependence on echolocation could be significantly hindered in high use areas of their critical habitat, especially if using echolocation to locate prey at depth. For instance, all three travelling sites were generally characterized by echolocation ranges that were less than half of those under minimum ambient conditions for more than 50% of the time. A shorter effective signal range while travelling may have repercussions on the whales’ navigation capacity.³⁷

One deeply concerning finding concerned impacts of vessel noise on echolocation where the distance between the whale and prey target increased:

In these cases, when the whale is echolocating from 10 m to a prey at 100 m depth, the range at which echolocation could be successfully used was reduced to 0 to 20% of that available under minimum ambient conditions when in areas of highest (90%) frequency of occurrence (Figure 13-14). These extreme conditions of nearly complete compromised echolocation range prevailed over more than 40%, and sometimes 75% (September) of these high-use habitats (Figure 14).³⁸

In another 2022 research paper, DFO scientists warned that “[t]he enduring presence of [the Southern Residents] in areas of elevated vessel traffic should not necessarily be taken as evidence of tolerance of, or acclimation to disturbance, but instead as a measure of the vital importance of these locations to the needs of the population.”³⁹ In other words, the Southern Residents’ critical habitat is so important to their survival that they are staying despite untenable conditions.

Other researchers have confirmed since the 2018 ITA that the imminent threats to survival and recovery persist and continue to worsen.

³⁵ Department of Fisheries and Oceans Canada, *Areas of elevated risk for vessel-related physical and acoustic impacts in Southern Resident Killer Whale (*Orcinus orca*) critical habitat (Research Document)* (Ottawa: DFO Can. Sci. Advis. Sec. Res. Doc. 2022/058, 2022) online: < <https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/41072698.pdf> > [Acoustic Impacts Report] at p 11.

³⁶ Acoustic Impacts Report at page vi.

³⁷ Acoustic Impacts Report at page 11-12.

³⁸ Acoustic Impacts Report at page 9.

³⁹ Department of Fisheries and Oceans Canada, *Southern Resident Killer Whale (*Orcinus orca*) summer distribution and habitat use in the southern Salish Sea and the Swiftsure Bank area (2009 to 2020)*. (Ottawa: DFO Can. Sci. Advis. Sec. Res. Doc. 2022/037) online <<https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/41072340.pdf> > [Summer Distribution and Habitat Use Report] at page 15.

b. “Requirements and availability of prey for Northeastern Pacific Southern Resident killer whales”, Couture et al., 2022

In a June 2022 paper examining prey requirements and availability for the Southern Residents, and using data up to 2020, Couture et al. developed a model for evaluating how changes in Chinook salmon capture have influenced the Southern Residents’ food consumption.⁴⁰ They found that:

- The Southern Residents experienced an 18.4% decrease in Chinook salmon consumption between 2015 and 2020.
- The Southern Residents had their lowest Chinook consumption in 2018.
- The Southern Residents were in an energetic deficit for six of the years in the study period, including the most recent three years of the study: 1983, 2008, 2012, 2018, 2019, and 2020.
- From 2018-2020, the average energetic differential was a reduction equivalent to 16.7% of the average adult killer whale “daily prey energetic requirement”. The average deficit is 17% of the daily energy required for an adult killer whale.

The model suggested that the Southern Residents had a higher birth rate and net population gain, and a lower mortality rate, in years where their daily prey energetic requirement was met, and that nutritional stress could influence reproductive ability and survival during years of low prey abundance. Although high death rates also occurred in years when the Southern Residents did meet their daily prey energetic requirement (including, most recently, 2016), some of those adult individual deaths appeared to be due to unrelated factors (e.g. to J34’s death by blunt force trauma and L95’s death from a satellite tag infection). There was a high calf mortality rate (50% or more in the first year of life) and/or low birth rate in most of the years when the Southern Residents did not meet their daily prey energetic requirement. These findings were not statistically significant due to the realities of the small Southern Resident population size.

The authors noted that the model could only account for prey abundance, and not prey accessibility, when considering the Southern Residents’ prey intake rate.

c. “Survival of the fattest: Linking body condition to prey availability and survivorship of killer whales”, Steward et al., 2021

The 2021 paper “Survival of the fattest: Linking body condition to prey availability and survivorship of killer whales” demonstrated that fluctuations in the Southern Residents’ body condition can in some cases be linked to Chinook salmon abundance.⁴¹ Using data from 2008 – 2019, the authors found elevated probability of mortality in Southern Residents experiencing

⁴⁰ Fanny Couture et al., “Requirements and availability of prey for northeastern pacific southern resident killer whales” (June 2022) 17:6 *PloS ONE* e0270523, online: <<https://doi.org/10.1371/journal.pone.0270523>>.

⁴¹ Joshua D Stewart et al., “Survival of the fattest: linking body condition to prey availability and survivorship of killer whales” (August 2021) 12:8 *Ecosphere* e03660, online: <<https://esajournals.onlinelibrary.wiley.com/doi/epdf/10.1002/ecs2.3660>>.

poor body condition, which is reflection of depleted fat reserves. The probability was two to three times higher in whales with poor body condition than for whales in more robust condition.

The study specifically linked the body condition in J pod to the abundance of Fraser River Chinook salmon. The likelihood of decline in J pod body condition increases as Chinook abundance declines. Only with an abundance of more than 1.1 million Fraser River Chinook salmon does the probability of decline in J pod's body condition reach zero.

This research provides further evidence that body condition can be linked to Chinook salmon abundance, and that poor body condition results in increased probability of mortality.

The presence of poor body condition was identified in the 2018 ITA, supported by multiple lines of evidence, and led to the conclusion that, “[g]iven the small population size and low number of individuals contributing to reproduction, poor survival of neonates, it is unlikely the population will increase unless the body condition of the SRKW population improves”.⁴²

d. Recent research by Holt et al., 2021

In two papers published in 2021, Holt et al. examine vessel impacts on foraging behavior of the Southern Residents. In the first paper, “Effects of Vessel Distance and Sex on the Behavior of Endangered Killer Whales”⁴³, Holt et al. characterize subsurface killer whale behavioral states and identify vessel effects on foraging behavior. The study found that close vessels reduced the likelihood of foraging-related behaviors in the whales and determined a difference in response to close vessels between females and males, with females more likely to forego foraging completely in the presence of close vessels.

The authors highlight significant concern with the impact of vessel distance on females, which “could have cascading effects on the ability to meet energetic requirements to support reproductive efforts”, a problem in an endangered population that continues to decline.

In the second paper, “Vessels and their sounds reduce prey capture effort by endangered killer whales (*Orcinus orca*)”⁴⁴, Holt et al. provides empirical evidence of an interaction between prey abundance and vessel disturbance that limits the ability to successfully capture prey. The authors found that vessel distance, speed, noise, and echosounders could all change the behavior of Southern Residents as they tried to capture their prey. Southern Resident killer whales had a lower probability of capturing fish when the estimated abundance of their preferred prey was lower and when nearby vessel speed increased.

Consequences of reduced food intake include adverse effects on the whales' ability to meet their energetic requirements to support key life functions, including growth and reproduction. The study advances the understanding of the negative consequences of vessel sounds including echo

⁴² 2018 ITA, *supra* note 6, Question 3.

⁴³ Marla M. Holt et al., “Effects of vessel distance and sex on the behavior of endangered killer whales”, (2021) 7:582182 *Frontiers in Marine Science*, online: <https://www.frontiersin.org/articles/10.3389/fmars.2020.582182/full> [Holt et al 2021a].

⁴⁴ Marla M. Holt et al., “Vessels and their sounds reduce prey capture effort by endangered killer whales (*Orcinus orca*)” (2021), 170: art 105429 *Marine Environmental Research*, online: <https://www.sciencedirect.com/science/article/pii/S0141113621001859> [Holt et al 2021b].

sounders, disturbance and prey abundance on foraging behavior and confirms the prey-disturbance threat interaction in endangered Southern Residents

The authors state that these findings “underscore the importance of...efforts to increase salmon abundance and amend existing vessel regulations within an adaptive management framework”.

e. “Warning sign of an accelerating decline in critically endangered killer whales (*Orcinus orca*)”, Williams et al., 2024

The most recently published PVA for the Southern Residents, from April 2024, shows that the Southern Resident population is declining faster than previously predicted.⁴⁵ Under current conditions, there is a 74% probability that the population will decline to 30 individuals within 30 years, and a 77% probability that it will reach functional extinction (less than 30 individuals) within 100 years.⁴⁶ The prediction does not take into account the worsening threats that the Southern Residents face because of ongoing development in the Salish Sea, such as the increase in tanker traffic resulting from Trans Mountain.

This PVA introduced a new concept called “bright extinction”.⁴⁷ Extinction events that occur in undocumented and poorly studied species are known as “dark extinctions”. In contrast, bright extinction is the process by which “data-rich species” are “declining toward extinction in plain sight.”⁴⁸ In other words, the Southern Residents’ decline is happening despite its well-understood and documented threats and known status.

⁴⁵ Williams et al., *supra* note 1.

⁴⁶ Williams et al., “Supplementary methods & results for Southern Resident killer whale Population Viability Analysis” (2024), online: <https://static-content.springer.com/esm/art%3A10.1038%2Fs43247-024-01327-5/MediaObjects/43247_2024_1327_MOESM2_ESM.pdf> at page 7.

⁴⁷ Williams et al., *supra* note 1 at page 1.

⁴⁸ Williams et al., *supra* note 1 at page 1.

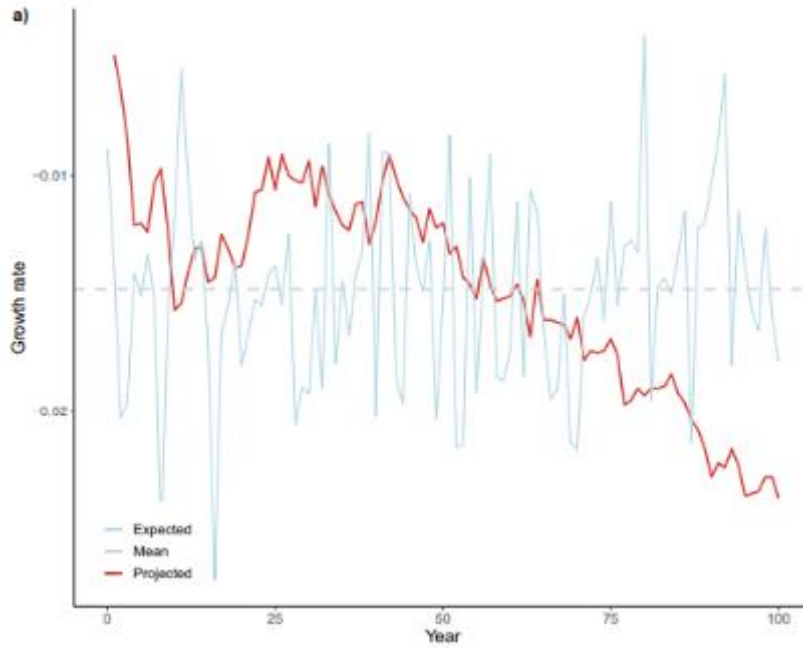


Figure 2. Southern Resident killer whale population growth over time. The expected growth rate is in blue, the projected decline is in red, and the horizontal dashed line represents the mean rate. Note the bifurcation around 50 years (two killer whale generations) indicative of an accelerating decline, even without accounting for increasing threats.⁴⁹

⁴⁹ Williams et al., *supra* note 1 at page 2, Fig 1.

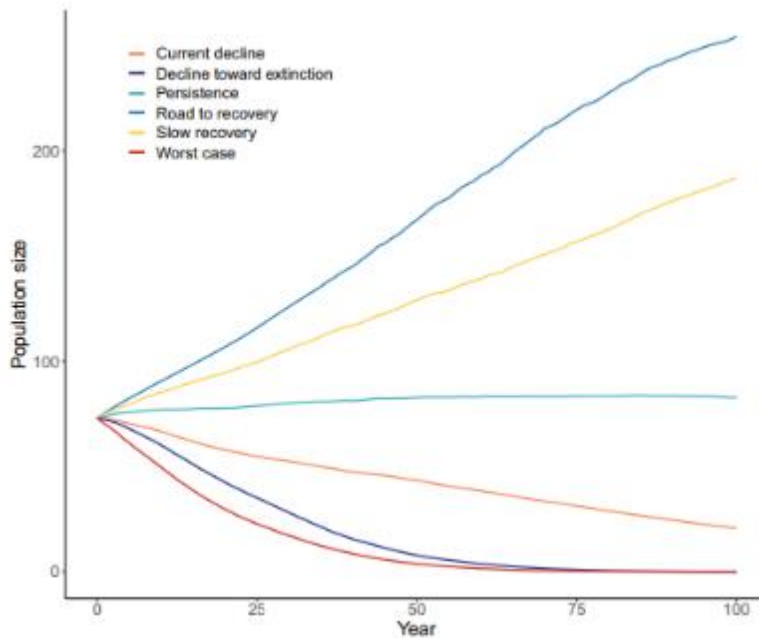


Figure 3. Southern Resident killer whale population size projected 100 years in the future. Projections of SRKW population size, averaged across 1000 iterations for six scenarios that range from optimal to pessimistic. “Road to recovery” (in blue) assumes direct and indirect human impacts on the whales and their habitats removed (1.5× Chinook, no climate change effects, no noise, human-caused mortalities prevented, no PCBs or other contaminants). “Slow recovery” (in yellow) assumes lesser but still considerable improvements to threats (1.3× Chinook, no climate change, no noise, no human-caused mortalities, environmental PCBs reduced with 25-year half-life). “Persistence” (in light blue) assumes each threat reduced to half as much as in “Slow recovery”. “Current decline” (in orange) represents the present Baseline. “Decline toward extinction” (in dark blue) adds further threats (8% reduction in prey size, climate change decimating Chinook salmon stocks, total contaminants 1.67× PCB, a low probability of oil catastrophic spills). “Worst case” (in red) adds further plausible increases in threats (0.7× Chinook, noise disturbance 100% of time, oil spills at higher frequency).⁵⁰

The analysis concludes that the Southern Residents are on a path to bright extinction, but importantly, that preventing extinction is still possible.⁵¹ However, the greater the time lag between knowledge and action, the higher the risk that harm reduction actions might not work.⁵² Recovery of the Southern Residents will “require aggressive actions to protect and restore their

⁵⁰ Williams et al., *supra* note 1 at page 3, Fig 4.

⁵¹ Williams et al., *supra* note 1 at page 1; see also Recovery Strategy, *supra* note 11 at viii.

⁵² Williams et al., *supra* note 1 at page 6.

habitat, which includes mitigating effects to both the Southern Residents and their primary prey, Chinook salmon”.⁵³

2. Significant new developments since the 2018 ITA

a. Trans Mountain

The Recovery Strategy states the Southern Residents are “at risk of exposure to an oil spill” from existing oil tanker traffic and from “the proposed expansion of tanker traffic along the coast of BC”, namely, the expanded Trans Mountain oil pipeline. Trans Mountain will increase the number of oil tankers departing the Westridge Marine Terminal in Burnaby sevenfold, from approximately 5 per month without the Project to approximately 34 per month.⁵⁴

The tankers’ route through the Salish Sea to the open ocean transects the Southern Residents’ critical habitat.⁵⁵ This traffic will lead to an increase in both physical and acoustic disturbance and oil spill risk in habitat that is essential to the whales’ basic life functions and their survival and recovery.

According to the DFO Recovery Strategy for the species, an oil spill would have a “potentially catastrophic” impact.⁵⁶ Oil spills not only pose an “immediate and acute risk to the health of” the Southern Residents, but also have “the potential to make critical habitat areas uninhabitable for an extended period of time.”⁵⁷

The increase in tanker traffic will significantly increase the impact to the Southern Residents from existing noise and physical disturbance. The CER found in 2016 that the “increase in marine vessels associated with the Project would further contribute to cumulative effects that are already jeopardizing the recovery of the Southern resident killer whale” and the effects of the vessels would be “high magnitude” and result in “significant adverse effects”.⁵⁸ It reiterated these conclusions in 2018.⁵⁹ Further, recent modeling illustrates that Trans Mountain will reverse or eliminate many of the benefits of the measures that other sectors have undertaken through the ECHO program. (This is discussed in more detail in Section VI (2).

⁵³ Williams et al., *supra* note 1 at page 5.

⁵⁴ National Energy Board, *National Energy Board Report - Trans Mountain Expansion Project - OH-001-2014* (19 May 2016), online: <https://docs2.cer-rec.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/548311/956726/2392873/2969696/2969867/A77045-1_NEB_-_Report_-_Trans_Mountain_-_Expansion_Project_-_OH-001-2014.pdf?nodeid=2969681&vernum=-2> [Trans Mountain Expansion Project Report] at page 2.

⁵⁵ National Energy Board, *Reconsideration of aspects of its OH-001-2014 Report as directed by Order in Council P.C. 2018-1177 – MH-052-2018* (February 2019), online: <https://docs2.cer-rec.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/548311/956726/2392873/3614457/3751789/3754555/A98021-1_NEB_-_NEB_Reconsideration_Report_-_Reconsideration_-_Trans_Mountain_Expansion_-_MH-052-2018_-_A6S2D8.pdf?nodeid=3754859&vernum=-2> [Reconsideration Report], Figure 26, at page 399. For the identification of critical habitat, Recovery Strategy, *supra* note 11 at pages 46, 48, 50. For the legal protection of critical habitat, see SARA, *supra* note 13, s. 58(1) and *Critical Habitat of the Killer Whale (Orcinus orca) Northeast Pacific Southern Resident Population Order*, SOR/2018-278.

⁵⁶ Recovery Strategy, *supra* note 11 at 35.

⁵⁷ Recovery Strategy, *supra* note 11 at 54.

⁵⁸ Trans Mountain Expansion Project Report, *supra* note 54 at page 350.

⁵⁹ Reconsideration Report, *supra* note 55 at pages 417 – 418.

Trans Mountain officially opened at the beginning of May, and marine shipping from Westridge Marine Terminal began on May 23, 2024.⁶⁰ In light of the threats to the Southern Residents, it is critical that measures to mitigate the project’s added impacts on underwater noise and the risk of oil spills be implemented immediately. Indeed, this should have happened before shipping began.

b. Roberts Bank Terminal 2

The Roberts Bank Terminal 2 Project (“RBT2”) was approved under the *Canadian Environmental Assessment Act, 2012* on April 20, 2023.⁶¹ The project involves construction of a marine terminal in Southern Resident critical habitat, and associated container vessel traffic. RBT2 would destroy Southern Resident critical habitat due to acoustic and physical disturbance from vessels in the terminal area (a location in the Fraser River estuary that is frequently used by the Southern Residents) and impacts on juvenile Chinook salmon from two populations that are key components of the Southern Residents’ diet.⁶²

The Minister of Environment found that the project would therefore have “significant adverse environmental effects” on Chinook salmon and on the Southern Residents; the Governor in Council deemed these effects “justified in the circumstances”.⁶³ The proponent is currently seeking permits under the *Fisheries Act*, RSC 1985, c F-14 and SARA.⁶⁴ The proponent is proposing to “offset” underwater noise impacts through participation in ECHO, using the net benefit gained from actually mandating participation of terminal-associated vessels instead of relying on their voluntary engagement at lower participation rates.⁶⁵

⁶⁰ Canada Energy Regulator, News Release, “CER issues final authorization for Trans Mountain Expansion Project to operate” (30 April 2024), online: <<https://www.cer-rec.gc.ca/en/about/news-room/news-releases/2024/cer-issues-final-authorization-for-trans-mountain-expansion-project-to-operate.html>>; Trans Mountain, “Trans Mountain Announces Milestones of Commercial Service for Expanded System” (1 May 2024), online:

<<https://www.transmountain.com/news/2024/trans-mountain-announces-milestones-of-commercial-service-for-expanded-system>>; Brett Jang, “Tanker departs B.C. after becoming first to load oil from TMX pipeline” (23 May 2024) *The Globe and Mail*, online: <<https://www.theglobeandmail.com/business/article-tanker-departs-bc-after-becoming-first-to-load-oil-from-tmx-pipeline/>>.

⁶¹ Impact Assessment Agency of Canada, “Government of Canada Approves Key Roberts Bank Terminal 2 Project in British Columbia, subject to strict conditions to protect the local environment” (20 April 2023), online: <<https://www.canada.ca/en/impact-assessment-agency/news/2023/04/government-of-canada-approves-key-roberts-bank-terminal-2-project-in-british-columbia-subject-to-strict-conditions-to-protect-the-local-environment.html>>; Minister of the Environment and Climate Change “Decision Statement for the Roberts Bank Terminal 2 Project” (20 April 2023), online: <<https://iaac-aeic.gc.ca/050/documents/p80054/147356E.pdf>> [RBT2 Decision Statement].

⁶² Review Panel for the Roberts Bank Terminal 2 Project, *Review Panel Report for the Roberts Bank Terminal 2 Project* (March 27, 2020), online: <<https://iaac-aeic.gc.ca/050/documents/p80054/134506E.pdf>>, [RBT2 Review Panel Report] at pages 214-216.

⁶³ RBT2 Decision Statement, *supra* note 61 at page 2; *Order Deciding that the Environmental Effects of the Proposed Roberts Bank Terminal 2 Project are Justified*, Order in Council P.C. 2023-0330.

⁶⁴ RBT2 Review Panel Report, *supra* note 62 **Error! Bookmark not defined.** at page 5.

⁶⁵ See Appendix A at pages 328 – 330.

c. Tilbury Marine Jetty

The Tilbury Marine Jetty (“Tilbury”) project received approval from the Province of British Columbia on March 27, 2024.⁶⁶ Given the increased shipping capacity resulting from this expansion, marine traffic is expected to significantly increase. The Tilbury assessment acknowledged that this project will have cumulative impacts on marine mammals and fish species, particularly on the Southern Residents. The proponent was asked to do a stand-alone Marine Shipping Assessment, and the British Columbia Environmental Assessment Office’s conclusion on the impacts from shipping were that:

...cumulative underwater noise from existing levels of shipping is expected to exceed established underwater sound behavioural disturbance thresholds and cause the masking of important marine mammal vocalizations and echolocation signals (which is used for navigation and finding prey). [Tilbury]-related vessels could contribute incrementally to this impact, even with the proposed mitigation measures.⁶⁷

To address concerns regarding impacts to the Southern Residents, British Columbia Environmental Office has recommended that, “where possible and operationally and/or economically feasible”, the proponent participate in regional management measures such as the federal government’s Oceans Protection Plan and Whales Initiative, and the ECHO program.⁶⁸

Tilbury was assessed under a federal government-approved substitution of the provincial environmental assessment process. It is currently awaiting a final certificate decision from the federal government. Given that marine shipping issues fall under federal jurisdiction, the way in which the decision addresses impacts to the Southern Residents will require particularly close scrutiny.

V There are no measures in place that are equivalent to the requested emergency order for the purposes of s. 81 of SARA.

As stated above, the Southern Residents are listed as endangered under Schedule 1 of SARA. Additionally, their identified critical habitat is protected from destruction by s. 58(1) of SARA, through the operation of the *Critical Habitats of the Northeast Pacific Northern and Southern Resident Populations of the Killer Whale (Orcinus orca) Order*, SOR/2009-68. DFO has prepared a Recovery Strategy and Action Plan for the species. Notwithstanding these protective provisions under SARA and the existence of the Recovery Strategy and Action Plan, both of

⁶⁶ Minister of Environment and Climate Change Strategy and Transportation and Infrastructure, *Ministers’ Reasons for Decision: Tilbury Marine Jetty Project* (27 March 2024), online: <https://projects.eao.gov.bc.ca/api/public/document/6604818734f3c20022682699/download/Reasons%20for%20Ministers%20Decision%20-%20Tilbury%20Marine%20Jetty%20-%2020240327.pdf> [Tilbury Reasons] at page 10.

⁶⁷ British Columbia Environmental Assessment Office, *Summary Assessment Report for Tilbury Marine Jetty Project (TMJ)*, (7 October 2022), online: <https://projects.eao.gov.bc.ca/api/public/document/65fcf93fe5fecc00226dcc8b/download/Summary%20Assessment%20Report%20-%20Tilbury%20Marine%20Jetty%20-%2020221007.pdf> at page 18.

⁶⁸ Tilbury Reasons, *supra* note 66 at page 10.

which were prepared before the 2018 ITA, the Southern Residents continue to face imminent threats to their survival and recovery.

The 2018 ITA was based on status quo conditions in May 2018 in the Salish Sea. As described above, the situation has worsened since that time and will continue to degrade with increasing commercial vessel traffic.

As articulated in the sections above, the conditions for the Southern Residents have worsened since 2018. Neither the alternative measures identified in the 2018 Order in Council and adjustments to those measures since 2018 nor any other measures promised or currently in place are sufficient reduce threats to change the Southern Residents' imminent threat status. These measures will also not address the impacts to the population from new projects such as Trans Mountain, RBT2, and Tilbury.

1. Trans Mountain Recommendations undertaken by the Governor in Council are not sufficient and have not been implemented.

When the CER recommended that the Governor in Council re-approve Trans Mountain after a reconsideration review of the Project in 2018, its February 2019 reconsideration report included a list of conditions that would be attached to the Project approval and binding on the proponent, as well as 16 Recommendations to the Governor in Council related to the impacts of marine shipping.⁶⁹

In its Order in Council approving the Trans Mountain, issued in 2019, the Governor in Council said: “the Governor in Council, having reviewed the Recommendations of the [CER] to the Governor in Council contained in the Reconsideration Report, undertakes to implement all the Recommendations.”⁷⁰

Further, DFO, TC and the CER had previously entered into a Memorandum of Understanding wherein the three agreed to “supporting the Government of Canada’s commitment to more than mitigate the effects of [Trans Mountain]-related marine shipping on [the Southern Residents] before shipping from [Trans Mountain] begins.”⁷¹ (emphasis added)

The Recommendations that are relevant to Trans Mountain’s impacts on the Southern Residents and related to noise, vessel strikes, and oil spill risk include:

- Recommendation 1: “The Governor in Council should develop and implement a regional cumulative effects management plan. This plan should assess the overall environmental state of, and cumulative effects on, the Salish Sea (including the Strait of Juan de Fuca and out to the 12-nautical-mile territorial sea limit), and should include a long-term strategy for managing those cumulative effects. ... This plan should include, but not be limited to: a. ...consideration of...the impacts of all vessel traffic...; c. development of

⁶⁹ Reconsideration Report, *supra* note 55; For just the recommendations, see Government of Canada, “Conditions and Recommendations Overview – Trans Mountain Expansion Project Reconsideration Report” (accessed 17 May 2024), online: <<https://www.cer-rec.gc.ca/en/applications-hearings/view-applications-projects/trans-mountain-expansion/conditions-recommendations-overview-trans-mountain-expansion-project-reconsideration-report.html>>.

⁷⁰ Order in Council P.C. 2019-0820, (2019), C Gaz I, 153 [Order in Council P.C. 2019-0820].

⁷¹ Trans Mountain MOU, *supra* note **Error! Bookmark not defined.**

short-, medium-, and long-term targets for addressing cumulative effects, including consideration of the feasibility of reducing total underwater noise, strike/collision risk of vessels with marine species, and key contaminant levels over time, and feasible and effective measures for achieving those targets; and d. monitoring...”

- Recommendation 5: “The Governor in Council should develop an Offset Program to offset both the increased underwater noise and the increased strike risk posed to Species at Risk Act -listed marine mammal and fish species (including Southern resident killer whale) due to Project-related marine shipping, at each relevant section of the marine shipping route (i.e., Strait of Georgia, Boundary Pass, Haro Strait, Strait of Juan de Fuca, and out to the 12-nautical-mile territorial sea limit), and at the relevant times of year. Each offset measure should apply to all appropriate vessels for that measure (i.e., not limited to Project-related vessels)... There should be periodic public reporting that provides, at the appropriate times, the information necessary to demonstrate a robust Offset Program. This should include measured or estimated underwater noise and strike risk due to Project-related marine shipping, and the extent over time to which that additional noise and strike risk has been offset in each section of the route, including the monitoring/modelling used to demonstrate that.”
- Recommendation 6: “As part of the Offset Program in Recommendation 5, the Governor in Council should further consider each of the following specific measures, each applicable to all appropriate vessels (i.e., not limited to Project-related vessels), and publicly report on the feasibility and likely effectiveness of each...: a. Slowdowns in each section of the marine shipping route (i.e., Strait of Georgia, Boundary Pass, Haro Strait, Strait of Juan de Fuca , and out to the 12-nautical-mile territorial sea limit). ... e. Further incentives and requirements for quiet vessel design and refits to address underwater noise over the long term, including maximal participation in relevant initiatives and committees of the International Maritime Organization.”
- Recommendation 7: “The Governor in Council should review and update federal marine shipping oil spill response requirements. This review should include consideration of the following: ... c. response planning for Species at Risk Act -listed species, including marine mammals...”

These measures will not be sufficient even when implemented. Recommendations 5 and 6 will not reduce the current levels of chronic underwater noise or mitigate the consequences of that noise on the Southern Residents. The proposed actions will only incrementally reduce the noise contribution of each new vessel associated with Trans Mountain.

Further, the Governor in Council should have met these obligations before the start of Trans Mountain operations but has failed to do so.

A summary of the Recommendations on a Government of Canada webpage, last modified in December 2021, suggests that it had not made much or any progress at that time.⁷²

Relevant government websites do not provide any further information about progress towards implementation of the Recommendations. The terms of reference for a March 12 – 14, 2024 Canadian Science Advisory Secretariat meeting about Recommendations 5 and 6 suggest that at that time, fundamental questions about the very concept of offsetting vessel noise remained unanswered.⁷³

On February 2 and 9, 2024, a subset of the Petitioners submitted two environmental petitions through the Office of the Auditor General seeking answers regarding the implementation status of the Recommendations. The Petitioners have not yet received an answer.

On March 7, 2024, the same subset of Petitioners wrote to the Ministers of Natural Resources; Fisheries, Oceans and the Canadian Coast Guard; Environment and Climate Change; and Transport requesting confirmation of their intention to implement the Recommendations before Trans Mountain operations commenced.

On May 23, 2024, the Petitioners received a response from the Minister of Natural Resources that acknowledged the importance of the Recommendations and indicated that the Assistant Deputy Minister of Natural Resources would provide a general description of the Government of Canada’s work regarding the Recommendations.

On May 24, 2024, the Petitioners received further communication from the Assistant Deputy Minister of Natural Resources (“ADM”) which stated that “[p]rogress is being made on all recommendations, and some have been completed. Others are near completion, while still others...will be ongoing into the future.” The ADM did not provide details as to which Recommendations have been completed or whether any completed Recommendations are among the ones applicable to the Southern Residents. The ADM committed to providing a detailed overview of the implementation of the Recommendations to the Petitioners by July 10, 2024, and to sharing updated information about the implementation of the Recommendations to the public through the Trans Mountain website.⁷⁴

Given that Trans Mountain is operational and that tankers are already calling at Westridge Marine Terminal, and in light of the ADM’s concession that at least some of the Recommendations have not been implemented, the Petitioners believe that the Governor in Council has broken its undertaking to implement the Recommendations.

Moreover, given the recent start-up of operations and the fact that the Recommendations call for comprehensive approaches to address cumulative effects that require longer-term assessments of

⁷² Government of Canada, “Canada Energy Regulator 16 Recommendations”, online:

<https://www.canada.ca/en/campaign/trans-mountain/what-is-tmx/the-decision/backgrounder12.html>.

⁷³ Government of Canada, “Terms of Reference”, online: < https://www.dfo-mpo.gc.ca/csas-sccs/Schedule-Horraire/2024/03_12-14-eng.html >.

⁷⁴ Government of Canada, “Trans Mountain Expansion Project” (accessed 27 May 2024), online: <<https://www.canada.ca/en/campaign/trans-mountain.html>>. At the time of writing, this website had not been updated since 2021.

focused impacts, the Recommendations cannot be characterized as equivalent measures under section 81 of SARA such that the Governor in Council may refuse to issue an emergency order.

2. ECHO is a voluntary program and is meant to mitigate the impacts of existing levels of commercial shipping, not new shipping.

The 2018 Order in Council declining to issue an emergency order cited “voluntary slow-downs of commercial vessels in Haro Strait and other zones” and “voluntary trial lateral displacement of commercial vessels within the shipping lanes in the Strait of Juan de Fuca away from foraging areas” as existing measures addressing acoustic and physical disturbance.⁷⁵ These are references to initiatives of the ECHO program, which has been implementing voluntary offsets and lateral displacements in some form since 2017.

Provisions of emergency orders are mandatory. In contrast, the ECHO program cannot be considered to be a protective measure that will be taken under ss 81 of SARA because its continuation and vessels’ participation in it are voluntary. Further, ECHO’s targets are not based on the foraging needs of the Southern Residents, nor was ECHO ever intended to mitigate or offset future vessel traffic. ECHO was intended to help address the existing problems of underwater noise.

ECHO has a “long-term goal” of reducing cumulative effects of shipping on whales; it is not targeted at any specific external projects.⁷⁶ Since 2017 it has coordinated annual, voluntary measures, focused on seasonal vessel slowdowns and lateral displacement within shipping lanes. Vessel participation, and the program itself, is voluntary; the Port Authority is not obligated to continue with this or any equivalent program.

ECHO’s measures are aimed at reducing underwater noise, but they are not biologically informed noise reduction targets, nor are they designed to be meaningful to the Southern Residents. The measures set thresholds based on considerations such as operational feasibility, safety, economic costs for participants and maximizing stakeholder participation.

ECHO was intended to respond to existing underwater noise, not to create new acoustic space that can be filled by new terminals and more shipping. The current level of underwater noise is already posing imminent threats to the survival and recovery of the Southern Residents.

ECHO was not intended to create noise reductions that can be used or taken up by shipping from new industrial developments. It is therefore inappropriate to rely on measures meant for existing and unsustainable noise impacts from vessels, such as ECHO, as mitigation or offsetting for new, additional impacts imposed by new projects such as Trans Mountain.

Moreover, Trans Mountain is set to erase most of the noise reductions attained by ECHO. Underwater noise modelling of existing and future ship noise scenarios, completed by JASCO Applied Sciences for the Vancouver Port Authority’s ECHO program, indicate that most noise

⁷⁵ *Order Declining to make an Emergency Order*, *supra* note 29.

⁷⁶ “Enhancing Cetacean Habitat and Observation (ECHO) Program” *Vancouver Port Authority*, online: <<https://www.portvancouver.com/environmental-protection-at-the-port-of-vancouver/maintaining-healthy-ecosystems-throughout-our-jurisdiction/echo-program/>>.

reductions gained from ECHO slowdowns in Haro Strait and Boundary Bay will be largely lost due to vessels calling at Trans Mountain (see Figure 4).⁷⁷

Exceedance Percentile	S1: Baseline (2022)	S2: Slowdown (2022)	S3: Slowdown Min	S4: Future Baseline	S5: Future Slowdown	S8: Future 100% UVNRT Baseline
5%	121.0	119.8	119.2	121.8	120.6	119.4
25%	111.4	110.6	110.2	112.2	111.6	111.0
50%	106.0	105.6	105.4	107.0	106.6	106.2
75%	99.6	99.8	99.6	100.8	100.8	100.2
95%	93.0	93.0	93.2	93.2	93.4	93.2
L_{eq}	119.7	118.7	118.2	120.1	119.1	118.2



Figure 4. Table and graph showing the changes in modelled underwater noise levels from existing slowdowns and potential future vessel scenarios in Haro Strait and Boundary Pass. Table columns S4 and S5 show changes in modelled noise levels with Trans Mountain vessels relative to baseline conditions and ECHO slowdowns from 2022 (S1). (Same source as above.)

Despite the problems with relying on ECHO as mitigation for specific projects, proponents continue to promote its application to offset noise from vessels associated with future projects. As stated earlier, the Vancouver Fraser Port Authority already plans to rely on the ECHO program’s voluntary slowdowns as “offsets” for noise from RBT2 operations.⁷⁸ ECHO has also been suggested as mitigation for the significant impacts to the Southern Residents from Tilbury. The Government of Canada’s and proponents’ claims on ECHO therefore exceed the noise reductions it is capable of producing.

3. Annual measures under the Whales Initiative are inadequate to address the impacts to the Southern Residents.

The 2018 Order in Council cited measures including fisheries closures in specified places at specified times as measures that “will contribute to abating the imminent threats to the survival and recovery of the [Southern Residents]”.⁷⁹ These closures, and other measures, have been implemented annually in some form since 2018.

⁷⁷See Appendix B at page 20.

⁷⁸ See Appendix A at pages 328-330.

⁷⁹ Order Declining to make an Emergency Order, *supra* note 29.

For 2024, the mandatory measures include the following measures related to acoustic and physical disturbance⁸⁰:

- Interim Sanctuary Zones in specified areas in the southern Gulf Islands, outside of the shipping lanes used by large vessels from June through November;
- Speed restricted zones in the Swiftsure Bank area, outside of the shipping lanes used by large vessels from June through November⁸¹; and
- A 400 metre approach distance for killer whales in Southern Resident critical habitat, not applicable to “a vessel in transit”.⁸²

These measures will not address Trans Mountain’s additional impacts to the Southern Residents’ acoustic habitat because they are inapplicable to large commercial vessels such as oil tankers.⁸³

The prey availability measures for 2024 consist of fishing closures at specified times (between May or later and November) and locations. These are characterized by the following shortcomings:

- Closures do not include the full scope of time that the Southern Residents use and forage in critical habitat;
- Closures exclude areas identified as key foraging areas⁸⁴, to accommodate ongoing fishing in high value areas. Such actions undermine the extent and effectiveness of foraging areas; and
- Closure areas do not include any precautionary geographic buffers to account for uncertainty in coverage and to provide a buffer for sound propagation from vessels fishing on the edge of the foraging areas.

These measures are not established based on the full extent of the Southern Residents’ needs and implementation is not based on the best available science. They are influenced by stakeholders’ concerns and complaints. For example, in planning the measures for 2024, Fisheries and Oceans Canada conducted surveys of stakeholders and the general public about each year’s potential

⁸⁰ Transport Canada, *Interim Order for the Protection of the Killer Whale (Orcinus orca) in the Waters of Southern British Columbia* (30 May 2024), online: <<https://tc.canada.ca/en/interim-order-protection-killer-whale-orcinus-orca-waters-southern-british-columbia>> [Killer Whale Interim Order].

⁸¹ This measure is challenging to enforce, as the majority of small vessels are not mandated to carry an automatic identification system (AIS), and so cannot be surveilled or monitored for speed violations.

⁸² Government of Canada, “2024 management measures to protect Southern Resident killer whales” (last modified 8 May 2024), online: <<https://www.pac.dfo-mpo.gc.ca/fm-gp/mammals-mammiferes/whales-baleines/srkw-measures-mesures-ers-eng.html>>; Government of Canada, “Overview of 2024 management measures to support Southern Resident killer whale recovery” (accessed 14 May 2024), online: <<https://www.pac.dfo-mpo.gc.ca/fm-gp/mammals-mammiferes/whales-baleines/docs/srkw-measures-mesures-ers/2024-srkw-ers-overview-apercu-eng.html>>. Killer Whale Interim Order, *supra* note 80.

⁸³ Transport Canada, Management Measures to protect Southern Resident Killer Whales (13 June 2023), SSC No. 13/2023, online: <<https://tc.canada.ca/en/marine-transportation/marine-safety/ship-safety-bulletins/protecting-killer-whales-orcinus-orca-waters-southern-british-columbia-2023-ssb-no-13-2023>>.

⁸⁴ Summer Distribution and Habitat Use Report, *supra* note 39.

measures.⁸⁵ While consultation with stakeholders is not inherently detrimental, that consultation should not be guiding technical working groups or the actions of scientists.

Finally, as annual measures, these measures are vulnerable to changes in policy or government. The Government of Canada is not obligated to continue any of these initiatives in future years.

4. Other initiatives under the Oceans Protection Plan and the Whales Initiative fail to address the impacts to the Southern Residents.

The broad regional initiatives under the umbrella of the Oceans Protection Plan and Whales Initiative should not be considered “equivalent measures” for the purposes ss. 80 and 81 of SARA. The Oceans Protection Plan and the Whales Initiative are voluntary and cannot be relied upon to mitigate cumulative effects or any specific project’s effects on the Southern Residents. The Oceans Protection Plan and Whales Initiative do not impose any binding obligations on the Government of Canada or any future Government.

The Oceans Protection Plan is a broad program that applies to all of Canada’s oceans.⁸⁶ It is largely aimed at research and data collection in support of identifying potential future measures.⁸⁷ It lacks concrete measures for Trans Mountain’s impacts on the Southern Residents or their critical habitat that are in place or are planned to be in place by any specified time.

The Whales Initiative is a time-limited tranche of funding under the Oceans Protection Plan.⁸⁸ It was initially funded for 2018-2023, and funding was renewed for 2023 – 2026. It focuses not only on the Southern Residents but three SARA-listed whale species: the Southern Residents, the North Atlantic right whale, and the St. Lawrence Estuary beluga whale.⁸⁹ Its key program relevant to the Southern Residents consists of the above-described temporary measures which are established annually.⁹⁰

⁸⁵ Government of Canada, “Survey on potential 2024-2025 management measures to support Southern Resident killer whales recovery” (accessed 14 May 2024), online: <<https://www.pac.dfo-mpo.gc.ca/consultation/fm-gp/srkw-eprs/2024-srkw-survey-sondage-ers-eng.html>>; Government of Canada, “Summary of input provided on management measures to address key threats to Southern Resident killer whales” (accessed 14 May 2024), online: <<https://www.pac.dfo-mpo.gc.ca/consultation/fm-gp/srkw-eprs/index-eng.html>>.

⁸⁶ Impact Assessment Agency of Canada, “Government Response to the Review Panel Recommendations for the Proposed Roberts Bank Terminal 2 Project”, online: <<https://tc.canada.ca/en/campaigns/oceans-protection-plan> and <https://iaac-aeic.gc.ca/050/documents/p80054/147354E.pdf> at p 23> [RBT2 Response].

⁸⁷ RBT2 Review Panel Report, *supra* note 62 **Error! Bookmark not defined.** at page 468.

⁸⁸ Transport Canada, Whales Initiative: Protecting the Southern Resident Killer Whale (accessed 14 May 2024), online: < <https://tc.canada.ca/en/initiatives/oceans-protection-plan/whales-initiative-protecting-southern-resident-killer-whale>>.

⁸⁹ Government of Canada, “The Government of Canada takes immediate action to protect endangered whales through the Oceans Protection Plan” (June 22, 2018), online: <<https://www.canada.ca/en/transport-canada/news/2018/06/the-government-of-canada-takes-immediate-action-to-protect-endangered-whales-through-the-oceans-protection-plan.html>>.

⁹⁰ Transport Canada, Whales Initiative: Protecting the Southern Resident Killer Whale (accessed 14 May 2024), online: < <https://tc.canada.ca/en/initiatives/oceans-protection-plan/whales-initiative-protecting-southern-resident-killer-whale>>; RBT2 Response, *supra* note 86 at page 23.

As described by the Government of Canada in the context of RBT2, these programs' initiatives are primarily research and data gathering to help "identify measures" in the future and establish frameworks for "future assessments" of major projects.⁹¹

5. The remaining measures cited in the 2018 Order in Council declining an emergency order are not equivalent measures.

The other "measures" cited in the 2018 Order in Council declining an emergency order are also not equivalent to the protection requested in this emergency order, have not been implemented as described, and/or are failing to protect the Southern Residents.⁹²

As explained in detail in Appendix C, some of the "measures" cannot be equivalent measures because they do not themselves require things that protect, or prohibit things that harm, the Southern Residents or their critical habitat. Some measures purport to prohibit certain actions but are not preventing them in practice. Some measures are simply not in place, and other measures are ongoing but are insufficient or even counterproductive in relation to the imminent threats to the Southern Residents' survival and recovery.

VI An emergency order is appropriate and required in these circumstances.

In the face of a looming "bright extinction", the existing measures addressed above are insufficient to stabilize, let alone recover, the Southern Residents. In a declining population, the longer the lag time between knowledge and action, the more severe recovery actions must become and the higher the risk that they will not work.⁹³ The task before the Government of Canada is already harder than it would have been if it took serious action sooner.⁹⁴

As threats to the Southern Residents continue to worsen, bold and immediate action is needed. The competent Ministers must recommend that the Governor in Council make an emergency order to provide for the protection of the Southern Residents if they are of the opinion that the Southern Residents face imminent threats to their survival and recovery.

The Petitioners submit that the only reasonable conclusion to be drawn from the above facts is that the Southern Residents face imminent threats to their survival or recovery, such that the requirements of s. 80(2) are met and the Ministers must recommend an emergency order.

1. Emergency orders are required when there is an imminent threat to either the recovery or survival of a species.

As confirmed by the Federal Court, SARA "was enacted because some wildlife species in Canada are at risk...many are in a race against the clock as increased pressure is put on their critical habitat, and their ultimate survival may be at stake."⁹⁵

⁹¹ RBT2 Response, *supra* note 86 at pages 4, 5, 14, 15, 20, 22, 23.

⁹² *Order Declining to make an Emergency Order*, *supra* note 29.

⁹³ Williams et al., *supra* note 1 at page 6.

⁹⁴ Williams et al., *supra* note 1 at page 6.

⁹⁵ *Skibsted v. Canada (Environment and Climate Change)*, 2021 FC 416 at para 101.

SARA is intended to prevent extinction of wildlife species and provide for their recovery. The purposes of SARA as set out in s. 6 is as follows:

The purposes of this Act are to prevent wildlife species from being extirpated or becoming extinct, to provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity and to manage species of special concern to prevent them from becoming endangered or threatened.

SARA expressly recognizes the Southern Residents' intrinsic value along with their aesthetic, cultural, spiritual, recreational, educational, historical, economic, ecological and scientific value.⁹⁶

SARA is also intended to implement Canada's commitment to the world to conserve biological diversity and do its part to halt the trend towards species extinction.⁹⁷ SARA includes many tools to protect and recover species including the power to issue an emergency order for the protection of a listed wildlife species, including emergency orders.

Section 80(1) provides that "The Governor in Council may, on the recommendation of the competent minister, make an emergency order to provide for the protection of a listed wildlife species." Section 80(2) provides that "[t]he competent minister must make the recommendation if he or she is of the opinion that the species faces imminent threats to its survival or recovery."

The emergency order power provided for in SARA may act as a "safety net" when existing measures are insufficient to protect a species from imminent threats to its survival.⁹⁸

Section 80(4) sets out what an emergency order may include:

The emergency order may

(a) in the case of an aquatic species,

- (i) identify habitat that is necessary for the survival or recovery of the species in the area to which the emergency order relates, and
- (ii) include provisions requiring the doing of things that protect the species and that habitat and provisions prohibiting activities that may adversely affect the species and that habitat.

As stated in s. 80(2), the Ministers "must" recommend an emergency order if they are of the opinion that the Southern Residents face imminent threats to their survival or recovery. The phrase "of the opinion" does not confer discretion on the competent Ministers to decline to make such a recommendation in a case where the Ministers are, or reasonably should be, of the opinion that the species faces imminent threats to its survival or recovery.

⁹⁶ SARA, *supra* note 13, preamble, s. 6.

⁹⁷ SARA, *supra* note 13, preamble; *Environmental Defence Canada v Canada (Fisheries and Oceans)*, 2009 FC 878, at para 38.

⁹⁸ *Groupe Maison Candiac Inc. v. Canada (Attorney General)*, 2018 FC 643 (aff'd 2020 FCA 88) at para 104.

This decision must be made in light of the purposes of SARA: to prevent species from becoming extinct and to provide for their recovery.

A generous interpretation of SARA’s terms and provisions is warranted given its “status as remedial legislation” and in the context of its “environmental conservation and habitat protection objectives, which are repeatedly mentioned in its recitals” (emphasis added).⁹⁹

The Federal Court has confirmed, based on the plain meaning of SARA, its preamble, and its legislative history, that “subsection 80(2) is triggered by threats to recovery or survival, or both”, and that “imminent threats need not be guaranteed to materialize.”¹⁰⁰

The terms “survival” and “recovery” are not defined in SARA itself. The goal of the Recovery Strategy is to “[e]nsure the long-term viability of resident killer whale populations by achieving and maintaining demographic conditions that preserve their reproductive potential, genetic variation, and cultural continuity.”¹⁰¹

The Recovery Strategy identifies four objectives to achieve its goal:

- 1) to ensure an adequate and accessible food supply to allow recovery;
- 2) to ensure that pollutants do not prevent recovery;
- 3) to ensure that disturbance from human activity does not prevent recovery; and
- 4) to protect critical habitat and identify additional areas for critical habitat designation and protection.¹⁰²

The Federal Court has held that recovery objectives identified in a Recovery Strategy “are relevant factors that should be considered by the Ministers in reaching an opinion under subsection 80(2).”¹⁰³

The proposed government policy on survival and recovery is also relevant to the Ministers’ task in advising on emergency orders.¹⁰⁴

The proposed policy states that “[t]he competent minister(s) will consider that a species at risk has an acceptable chance for **survival** in Canada” when it surpasses each of a set of criteria referred to as the “survival threshold”, including the following criteria relevant to the Southern Residents:

- Stable or increasing over a biologically relevant timeframe; and
- Resilient: sufficiently large to recover from periodic disturbance and avoid demographic and genetic collapse; and [...]

⁹⁹ *Western Canada Wilderness Committee v. Canada (Environment and Climate Change)*, 2024 FC 167 at para 98.

¹⁰⁰ *Adam v Canada (Environment)*, 2011 FC 962 at paras 38-39.

¹⁰¹ Recovery Strategy, *supra* note 5 at pages vi, 47.

¹⁰² Recovery Strategy, *supra* note 5 at pages vi, 48-51.

¹⁰³ *Adam*, *supra* note 100 at para 42.

¹⁰⁴ Fisheries and Oceans Canada, 2016, *Policy on Survival and Recovery [Proposed]*, *Species at Risk Act Policies and Guidelines Series*, Ottawa, online:

<http://www.sararegistry.gc.ca/virtual_sara/files/policies/Survival%5Fand%5FRcovery%5FEN1%2Epdf > at page 4 [DFO Policy on Survival and Recovery 2016].

- Protected from anthropogenic threats: non-natural significant threats are mitigated.¹⁰⁵

The proposed policy also provides a succinct definition of “survival”: “The achievement of a stable (or increasing) state where a species exists in the wild in Canada and is not at significant risk of extirpation or extinction as a direct or indirect result of human activity.”¹⁰⁶

The proposed policy identifies a “minimum recovery threshold” as follows:

- The criteria for survival are met and/or exceeded; and
- There is representation addressing the historical Canadian distribution of the species, endeavouring to capture the full range of its ecological and generic diversity;
- The condition of the species is improved over when it was first assessed as at risk [...]; and
- Once achieved, perpetuation of the recovered state is not reliant on significant, direct and ongoing intervention to maintain populations.¹⁰⁷

Further, with respect to the meanings of “survival” and “recovery”, the Federal Court has held that:

[...] it is important not to confuse the “survival” of a species with its “recovery”, as they are two separate concepts. The concept of “recovery” goes well beyond that of the “survival” of a species. Although there is no statutory definition of the term “recovery”, Environment Canada adopted a definition in the amended *Recovery Strategy for the Roseate Tern (Sterna dougallii)*, which indicates that “recovery is the process by which the decline of an endangered, threatened, or extirpated species is arrested or reversed and threats are removed or reduced to improve that likelihood of the species’ persistence in the wild”. Under that definition, the recovery of a species therefore includes a halt to or reversal of the decline of its population.¹⁰⁸

The Federal Court has relied on this definition, which it also summarizes as “halting or reversing the decline of a species.”¹⁰⁹

2. A precautionary and urgent approach must be taken to protect the Southern Residents.

SARA and Federal Court jurisprudence require a precautionary approach.

The Preamble to SARA states that:

[...] the Government of Canada is committed to conserving biological diversity and to the principle that, if there are threats of serious or irreversible damage to a

¹⁰⁵ DFO Policy on Survival and Recovery 2016 at page 2.

¹⁰⁶ DFO Policy on Survival and Recovery 2016 at page 8.

¹⁰⁷ DFO Policy on Survival and Recovery 2016 at page 3.

¹⁰⁸ *Centre Québécois du droit et de l’environnement v Canada (Environnement)*, 2015 FC 773 [*Centre Québécois*] at para 23.

¹⁰⁹ *Centre Québécois* at para 80.

wildlife species, cost-effective measures to prevent the reduction or loss of the species should not be postponed for lack of full scientific certainty.

This is in keeping with the Supreme Court’s articulation of the precautionary principle: “Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.”¹¹⁰

The purpose of the precautionary principle is to ensure that a lack of full scientific certainty will not bar necessary action if there is a risk of serious or irreversible damage to a species. The Federal Court has held that in the context of decision-making under SARA, “the perfect should not become the enemy of the good”, because “endangered species do not have time to wait for [the competent ministers] to ‘get it right’.”¹¹¹ This is even more true in the case of emergency orders under s. 80. The Federal Court has held that the precautionary principle applies to determinations made under SARA, including under s. 80(2).¹¹² It has further held, in the context of s. 80(2), that “inaction is not permitted due to a lack of full scientific certainty.”¹¹³

To the extent that there is a lack of full scientific uncertainty with respect to any of the specific measures sought in this petition, a lack of full certainty as to the best or most effective specific measures or as to the details of those measures is not a reason to postpone action – and there is no uncertainty as to the need for action. The Ministers must act according to the best available science at this time.

There is an abundance of information about the Southern Residents, the decline in their population, and the threats that they face, much of which has been detailed by the 2018 ITA and emphasized in the updated research that the Petitioners provide above. The Southern Residents are running out of time in the face of increased threats from expanded development in the Salish Sea, including and projects like Trans Mountain. The urgency of the situation necessitates immediate action. Any uncertainty should be addressed not by refusing to make an emergency order but rather by making an emergency order containing provisions that are informed by the best available science, and amending those provisions as necessary, guided by monitoring of their effectiveness as well as any relevant developments in the science.

The Government of Canada has also recently committed to new targets under the Global Biodiversity Framework, Target 4 of which requires governments to “ensure urgent management actions to halt human induced extinction of known threatened species and for the recovery and conservation of species, in particular threatened species, to significantly reduce extinction risk”.¹¹⁴ (emphasis added) These are binding commitments for the Government of Canada and the need for urgent management actions applies to the protection of Southern Residents.

¹¹⁰ *114957 Canada Ltée (Spray-Tech, Société d’arrosage) v Hudson (Ville)*, 2001 SCC 40 at para 31.

¹¹¹ *Western Canada Wilderness Committee v Canada (Fisheries and Oceans)*, 2014 FC 148 at paras 71 – 73; see also *Davud Suzuki Foundation v Canada (Fisheries and Oceans)*, 2010 FC 1233 at para 66.

¹¹² *Centre Québécois*, *supra* note 108 at para 76.

¹¹³ *Adam*, *supra* note 100 at para 38.

¹¹⁴ *Decision Adopted by the Conference of the Parties to the Convention on Biological Diversity: Kunming-Montreal Global Biodiversity Framework, CBD/COP/DEC/15/4* (19 December 2022), online: <<https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-04-en.pdf>> at page 9.

3. The recommended actions below are consistent with the Recovery Strategy.

The actions the Petitioners recommend, which are outlined below, are consistent with the strategies DFO has identified to achieve the Recovery Strategy's goal and recovery objectives.

Strategies to achieve the third recovery objective (disturbance) include “Develop and implement regulations, guidelines, sanctuaries and other measures to reduce or eliminate physical and acoustic disturbance or resident killer whales.”¹¹⁵

Strategies to achieve the fourth recovery objective (critical habitat) include “[p]rotect the access of resident killer whales to their critical habitat,” “[p]rotect critical habitat areas through assessment and mitigation of human activities that result in contamination, and physical disturbance,” and “[e]nsure the sufficient prey is available to killer whales in their critical habitat.”¹¹⁶

The Recovery Strategy does not identify a numerical target for the population, and states that this will be “revisited as new information becomes available”.¹¹⁷ This has not been done. The Recovery Strategy identifies demographic conditions to be used as short-term measures of recovery success, including an increasing population size.¹¹⁸ As can be seen in Figure 1 on page 10, the population size has moved in the opposite direction.

As stated above, Recovery Strategy objectives are relevant to a determination under s 80(2).¹¹⁹ The new research detailed in this petition demonstrates accelerating decline, and the increase in development projects in the Salish Sea since 2018 highlights that the Southern Residents are facing worsening threats that are severely impacting their survival and recovery. Despite these identified measures, Recovery Strategy objectives are not being met. Given the failure to meet the Recovery Strategy objectives, and the resulting and continued decline of the Southern Residents, the Petitioners submit that this consideration must weigh in favour of recommending an emergency order under s. 80(2).

The measures the Petitioners recommend below are consistent with the above objectives and strategies. Furthermore, they echo the priority actions identified in DFO's 2017 review of the effectiveness of recovery actions for the Southern Residents.¹²⁰

In the context of the imminent threats to the Southern Residents, exacerbated by Trans Mountain and lack of progress on the Recommendations that the Governor in Council undertook to implement for Trans Mountain, and by the approvals of other development projects in the Salish

¹¹⁵ Recovery Strategy, *supra* note 6 at 50.

¹¹⁶ Recovery Strategy, *supra* note 6 at page 51.

¹¹⁷ Recovery Strategy, *supra* note 6 at page 36.

¹¹⁸ Recovery Strategy, *supra* note 6 at page 37.

¹¹⁹ *Adam*, *supra* note 100 at para 42.

¹²⁰ Fisheries and Oceans Canada, 2017, *Southern Resident Killer Whale: A science-based review of recovery actions for three at-risk whale populations – Summary Report*, Ottawa, online: <<https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/40680022.pdf>>.

Sea, an emergency order is needed, and can be understood as a tool to implement these, and other, urgently needed measures.

4. The competent Ministers are legally obligated to recommend an emergency order.

The Petitioners submit that the Ministers must recommend to the Governor in Council that it make an emergency order for the protection of the Southern Residents, consistent with their statutory duty under s. 80 of SARA.

The Petitioners submit that the only reasonable opinion the Ministers can form in this case is that the Southern Residents face imminent threats to their survival and recovery. In this case, in addition to the 2018 ITA, there is subsequent clear and indisputable evidence of ongoing and worsening imminent threats to the survival of the Southern Residents, which has been assessed and evaluated through peer-reviewed scientific studies. This evidence shows that the Southern Residents face imminent threats to their survival and recovery. The state of Fraser Chinook salmon and the expansion of commercial shipping, as described above, indicate that, without intervention, the threats to survival and recovery will continue to increase, further reducing their chances of survival and recovery. Furthermore, “equivalent measures” have not been taken for the purposes of s. 81. Therefore, the Ministers have a mandatory duty under s. 80(2) to recommend that the Governor in Council make an emergency order to protect the Southern Residents as soon as possible.

Given the imminent threat to the Southern Residents’ survival and recovery, refusal to recommend that the Governor in Council make an emergency order would be unlawful, unreasonable, and inconsistent with SARA, its stated purpose, s. 80 and the intent of Parliament in enacting s. 80, and the precautionary principle.

VII Actions requested

The Petitioners require that the Ministers recommend an emergency order under s. 80(2) of SARA to protect the Southern Residents and the habitat necessary for their survival and recovery, and the emergency order must include some or all of the following measures, under s. 80(4)(a).

The Petitioners recognize that Indigenous peoples have stewarded these lands since time immemorial, and that they have both inherent and constitutionally protected rights. The Petitioners do not believe the following measures would adversely impact Indigenous rights, and do not intend them to. This Petition demands that the Ministers recommend an emergency order to the Governor in Council, which is required by law if they are of the opinion that the Southern Residents face imminent threat. When making the decision whether to issue an emergency order under s. 80(1) of SARA, the Governor in Council must fulfil its duty to consult and take into consideration any impact that these measures have on Indigenous rights.

The measures below are actionable, necessary, consistent with the best available science, and in furtherance of the objectives set forth in DFO’s Recovery Strategy and Action Plan. They are also consistent, where noted, with commitments that the Governor in Council made in the 2018

Order in Council on denying the Ministers' recommendation for an emergency order, and that it made in 2019, in the Order in Council approving Trans Mountain, as well as other government actions.

1. Measures to avoid physical and acoustic disturbance

Emergency action is needed to reduce disturbance of Southern Residents and their critical habitat from vessel traffic and other human activity.

As discussed above, physical and acoustic disturbance remain a leading threat to the whales' survival and recovery, with the latest science showing a significant decline in their ability to forage and capture prey. While the government has taken some steps to reduce disturbance, the advent of Trans Mountain-associated vessels in the Salish Sea this summer will reduce or eliminate most of the conservation benefit gained through voluntary operational measures for commercial ships, as discussed above.¹²¹

All disturbance measures should be in place year-round due to year-round presence of the Southern Residents.¹²²

(a) Prohibit vessels from approaching within 1,000 metres of a killer whale within the habitat of the Southern Residents, as vessels and habitat are defined in the Minister of Transport's 2024 Interim Order for the Protection of the Killer Whale in the Waters of Southern British Columbia.¹²³

Research published since 2018 indicates the adverse effects of vessel noise and disturbance on Southern Resident killer whales at distances well beyond the 400-metre approach distance that is presently applied through the Interim Order.¹²⁴ For example, tagging studies documented a substantial decline in the whales' prey-capture success when vessels traveled at any speed in the whales' vicinity, *i.e.*, within 1,500 metres.¹²⁵ In consideration of these results, the Washington State Legislature amended its whale-protection statute in 2023 to establish a 1,000-yard vessel exclusion area around the whales. (The measure, voluntary until now, will come into full effect in January 2025.) Expanding the current avoidance distance to 1,000 metres would align Canada more

¹²¹ See Appendix D, Forest M.C. Stothart et al "ECHO modelling of existing and potential future ship noise scenarios: Haro Strait and Boundary Pass Slowdown Areas (2023) (tech. report by JASCO Applied Sciences for Vancouver Fraser Port Authority) [Stothart et al]; See also Appendix B at page 20.

¹²² Monika W. Shields, "2018-2022 Southern Resident killer whale presence in the Salish Sea: continued shifts in habitat usage" (2023) PeerJ 11:e15635, online: <<http://doi.org/10.7717/peerj.15635>>; Olivia Murphy et al., *Analysis of SRKW Whale Management Measures Surrounding Saturna Island*, (2023), SFU Faculty of Environment. Report prepared for Whale Protection Policy - West Coast Transport Canada, online: <https://www.sfu.ca/~rjoy/SaturnaAnalysisOfMeasures_SFU.pdf> .

¹²³ Killer Whale Interim Order, *supra* note 80. The definition of vessels should contain the same exceptions as s. 3(2) of the Killer Whale Interim Order, and habitat should reflect the locations in Schedule 1 of the Killer Whale Interim Order.

¹²⁴ Killer Whale Interim Order, *supra* note 80.

¹²⁵ Holt et al 2021b, *supra* note 44; See also Holt et al 2021a, *supra* note 43. Success rates fell as speed increased from 0 knots.

closely both with the best available science and with Washington State law now coming into effect in the U.S. Salish Sea portion of the whales' critical habitat.

(b) Within six months, establish and operationalize a pilot program for underwater noise management planning for vessels using the Salish Sea, to implement the noise output targets for individual vessel classes identified in the report of Transport Canada's national advisory committee on Underwater Vessel Noise Reduction Targets.

Canada has long recognized the need to quiet vessels along our shores, including in the Salish Sea. In declining to issue an emergency order in 2018, the Governor in Council expressly noted the “development of noise management plans with industry for quieting the marine environment” and “research on technical solutions for quieting ships” as measures already taken or in progress that helped obviate an emergency order at that time.¹²⁶

The government has taken a number of significant, preliminary actions along these lines. It amended the *Canada Shipping Act* in 2018 to broadly allow for regulations “respecting the protection of the marine environment from the impacts of navigation and shipping activities,” and for interim ministerial orders of similar scope.¹²⁷ It launched a Quiet Vessel Initiative, at Transport Canada, to promote advances in quiet vessel design and engineering. And it established a technical committee to identify feasible, empirically based targets for individual ships, to be used in underwater noise management planning. (Those targets were published in a report last January.)¹²⁸ In early May 2024, the government entered into a new Conservation Agreement for the Southern Residents that included, in its first year, work towards “a regional pilot project in underwater noise management planning as defined by [recent International Maritime Organization (IMO) guidelines].”¹²⁹ This work is intended as part of Canada's contribution to a critical, three-

¹²⁶ *Order Declining to make an Emergency Order*, *supra* note 29.

¹²⁷ *Shipping Act*, SC 2001, s 10.1, 35.1. The Governor in Council's 2018 decision declining to issue an emergency order cited the government's then-recent Shipping Act amendments, and particularly its expanded authorities to regulate the impact of vessels on the marine environment, as among the measures the government had taken to address acoustic and physical disturbance of Southern Resident killer whales.

¹²⁸ Transport Canada, *Underwater Vessel Noise Reduction Targets (UVNRT) Working Group Final Report* (2024).

¹²⁹ A Species at Risk Act section 11 conservation agreement to support the recovery of the Southern Resident Killer Whale, (10 May 2019) online: <https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/conservation-agreements/southern-resident-killer-whale-2019.html>. A 2024 renewal of the conservation agreement was announced on June 3, 2024 but it has not been posted to the Species at Risk Act Public Registry: Transport Canada, News release, “Government of Canada announces new measures and funding to protect Southern Resident killer whales” (3 June 2024), online: <https://www.canada.ca/en/transport-canada/news/2024/06/government-of-canada-announces-new-measures-and-funding-to-protect-southern-resident-killer-whales.html>.

year, experience-building phase at IMO,¹³⁰ which this government's leadership helped establish.

But Canada has not yet put such a pilot quieting program in place, and the Conservation Agreement it recently signed is silent as to budget and timeline, and which targets the program will apply. In effect, this measure asks for a clear and expeditious commitment to bring this central effort in underwater noise management to fruition in the Salish Sea.

(c) Require that, within one year, all vessels associated with Trans Mountain and using the Westridge Marine Terminal will have received a quiet vessel notation from an IACS-member ship classification society.

Minimizing underwater noise from the tankers serving Trans Mountain should be a priority for this government. As noted elsewhere in these comments, the noise from project-associated tankers is expected to reduce or eliminate the conservation benefits achieved through existing, industry-wide slowdowns in Southern Resident habitat, which the ECHO program has pursued since 2017.¹³¹ And minimizing the acoustic output from these vessels would correspondingly reduce the offsets needed to compensate for their noise contribution, within the offset program that the Governor in Council, in approving Trans Mountain, committed to develop.¹³²

Tankers, although among the “loudest” vessel types recorded in the Salish Sea, are also among those for which slowdown measures are less effective, due to their relatively slow speeds.¹³³

To minimize their noise and disturbance, the government should ensure that the tankers servicing Trans Mountain are among the quieter vessels in their class. Most of the industry's leading classification societies now offer Quiet Vessel Notations for large commercial ships.¹³⁴ The Vancouver Fraser Port Authority, through its EcoAction program, accords its highest level of berthing fee reductions to vessels that have received

See IMO, Revised guidelines for the reduction of underwater radiated noise from shipping to address adverse impacts on marine life (2023) (MEPC.1/Circ.906), online: [https://www.wcdn.imo.org/localresources/en/Documents/MEPC.1-Circ.906%20-%20Revised%20Guidelines%20For%20The%20Reduction%20Of%20Underwater%20Radiated%20NoiseFrom%20Shipping%20To%20Address...%20\(Secretariat\).pdf](https://www.wcdn.imo.org/localresources/en/Documents/MEPC.1-Circ.906%20-%20Revised%20Guidelines%20For%20The%20Reduction%20Of%20Underwater%20Radiated%20NoiseFrom%20Shipping%20To%20Address...%20(Secretariat).pdf) .

¹³⁰ IMO, *Report of other Subcommittees: Urgent matters emanating from SDC 10*, at Annex 1 at 2 (2024) (MEPC 81/WP.10).

¹³¹ Stothart et al, *supra* note 121.

¹³² Reconsideration Report, *supra* note 55, at pages 45-46 (Recommendations 5 and 6).

¹³³ Alexander O. MacGillivray et al, “Slowing deep-sea commercial vessels reduces underwater radiated noise” (2019), 146: 340-51 *Journal of the Acoustical Society of America*, online: <https://pubs.aip.org/asa/jasa/article/146/1/340/994124/Slowing-deep-sea-commercial-vessels-reduces> .

¹³⁴ Quiet vessel notations are available from the following major classification societies: American Bureau of Shipping, Bureau Veritas, China Classification Society, Der Norske Veritas, Korean Register, Lloyd's Register, and Registro Italiano Navale.

them.¹³⁵ Alternatively, the government could use its own infrastructure to achieve a similar result: requiring that Trans Mountain-associated tankers meet or exceed the vessel class target identified by Transport Canada’s technical committee (referenced at (b) above), as measured by Transport’s Underwater Listening Station in Boundary Pass or by other means. In any case, this is an achievable, important measure.¹³⁶

(d) Limit development approvals until long-overdue measures to address cumulative effects of shipping including noise in the Salish Sea are in place.

As explained above, the first recommendation put forward by the CER on reconsidering the Trans Mountain project, which the Governor in Council undertook to implement in the 2018 Order in Council, was for a regional cumulative effects management plan. Specifically, the Governor in Council was requested to develop and implement a plan that included “a long-term strategy for managing those cumulative effects” and that would “be used to inform the consideration of future proposed projects.”¹³⁷ Listed among the plan’s elements were “short-, medium-, and long-term targets” for addressing underwater noise, along with a few other named environmental stressors.¹³⁸ In approving Trans Mountain, the Governor in Council undertook “to implement all the [CER’s] recommendations.”¹³⁹

This measure was essentially a promise to the region: a commitment to establish a means of preventing further degradation of the Salish Sea from future development and of systematically restoring our marine habitat. As explained above with reference to the status of the Recommendations, the government has not implemented a cumulative impacts management plan, nor, to our knowledge, has it made substantial progress over the last five years in developing one. With respect to underwater noise, the recent analysis by JASCO illustrates how a single development project, Trans Mountain, can reduce or eliminate the conservation benefit gained through high-participation, cross-sectoral initiatives, like the vessel slow-downs initiated by ECHO.¹⁴⁰ For these reasons, we petition the government to:

¹³⁵ Port of Vancouver, Infographic: EcoAction, available at <https://www.portvancouver.com/wp-content/uploads/2024/01/2024-01-03-Infographic-EcoAction.pdf> (accessed May 23, 2024) (indicating highest level award, “platinum,” for quiet vessel notations from ship-classification societies).

¹³⁶ The United Nations Convention on the Law of the Sea does not restrict what measures States can adopt as a condition of entry to its internal waters, including ports. See *The United Nations Convention on the Law of the Sea*, 10 December 1982, 1833 UNTS 397 (entered into force 1 November 1994) Arts. 25(2) and 211(3). See also Erik Jaap Molenaar, Coastal State Jurisdiction Over Vessel-Source Pollution (The Hague: Kluwer Law International, 1998), at page 632 and Jeremy Firestone and Christina Jarvis, “Response and responsibility: Regulating noise pollution in the marine environment,” (2007) *Journal of International Wildlife Law and Policy* 10: 109-152 at pages 128 – 129.

¹³⁷ Reconsideration Report, *supra* note 55 at page 45.

¹³⁸ Reconsideration Report, *supra* note 55 at page 45.

¹³⁹ Order in Council P.C. 2019-0820, *supra* note 70. The NEB framed as recommendations those measures that it believed lay outside its own authority to mandate, but within the authority of the Governor in Council. Reconsideration Report, *supra* note 55, at page 44.

¹⁴⁰ Stothart et al, *supra* note 121.

(d.1) Prohibit further increases in shipping from existing and new federally-approved industrial development projects that would increase vessel traffic within the critical habitat of the Southern Residents until a regional cumulative effects management plan has been adopted, consistent with Recommendation 1 of the 2019 Trans Mountain Expansion Project Reconsideration Report.

We also petition the government to move forward expeditiously with regional “short-, medium-, and long-term” targets for underwater noise, while the broader effort to establish a cumulative effects management plan is pending. Last year, at the request of its multi-stakeholder Advisory Working Group, the ECHO program began facilitating the development of regional noise targets in support of recovery of the Southern Residents; but that effort will soon require separate funding and agency commitment to advance. Development of these targets lies within the ambit of DFO, pursuant to its authority under the *Oceans Act*, SC 1996, c 31 to adopt Marine Environmental Quality guidelines.¹⁴¹ We therefore petition the government to:

(d.2) Require that DFO, in collaboration with Transport Canada and with government and non-government stakeholders, and building on the effort facilitated by the Port of Vancouver’s ECHO Program under the 2019 and 2024 Conservation Agreements for the recovery of the Southern Residents, develop and adopt within 18 months a set of underwater noise targets for the Salish Sea that are consistent with Southern Resident survival and recovery; and put in place measures to implement and assess progress toward those targets.

A meaningful underwater noise target that is consistent with Southern Resident survival and recovery must bring underwater noise below the current unsustainable baseline in the Salish Sea.

2. Measures to increase availability of preferred prey in critical habitat

Studies show the Southern Residents preferentially target large Chinook salmon that are 4-6 years old with a mean body mass of 8-13 kg.¹⁴² For the last century, Chinook populations in the Northeast Pacific have been subjected to anthropogenic activities, including fishing and hatcheries, that have decreased size at age, age at maturity, fecundity and productivity in

¹⁴¹ *Oceans Act*, SC 1996, c 31, s 32(d). While guidelines adopted through this provision are not in themselves legally binding, they can be prescribed through regulation under para. 52.1(a) of the *Oceans Act* or incorporated into permitting and other decisions through the *Impact Assessment Act* or other laws.

¹⁴² Depending on the age and size of the whale, the age and size of Chinook, and the percent of Chinook in the diet; Department of Fisheries and Oceans Canada, *Chinook salmon abundance levels and survival of resident killer whales* (Ottawa: DFO Can. Sci. Advis. Sec. Res. Doc. 2009/075), online: <<https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/340360.pdf>>; Action Plan, *supra* note 6.

Chinook salmon.¹⁴³ Between 1975 and 1993, up to a 45% decline in the average mass of Chinook salmon was observed in 9 populations from British Columbia to California.¹⁴⁴ Thus, the Chinook that are caught today have less energy value (size and lipid content¹⁴⁵) than Chinook caught in the early part of the 20th century. The average weight of Chinook salmon outside the Columbia River is now under 7 kg¹⁴⁶ and below 4 years of age; a size not big enough for targeting by the Southern Residents.

Equally important is the decline in the proportion of their preferred (age 4+) Chinook salmon, within the overall abundance of wild and hatchery Chinook. Contributors to this trend of smaller, younger Chinook are fisheries (discussed in 2c) and the increase in Chinook released from hatcheries. Hatchery domesticated salmon increase competition among salmon for limited resources that suppresses growth, fecundity, productivity and survival in both the wild and hatchery fish. Through ecological, genetic and fishery interactions these processes also drive fish to spawn at younger ages.

Measures to address the management of Chinook salmon, fisheries, population structure, and number of larger older Chinook in Southern Resident critical habitat are vital to the survival and recovery of endangered killer whales.

While the below measures are implemented, the federal government should establish a minimum threshold of Chinook abundance within critical habitat that would ensure prey requirements of a growing population of Southern Residents that is met across years and seasons. Such a threshold would identify the proportion of preferred prey (4+ years) within the total Chinook abundance

- (a) Limit the total fishing-related mortality of at-risk stream-type Fraser River Chinook salmon to less than 5% consistent with the Chinook harvest reduction objective set by the Minister of Fisheries and Oceans in 2019. This includes summer 52 Chinook salmon, which have yet to reach mortality below 10%.**

¹⁴³ W.E. Ricker, “Changes in the average size and average age of Pacific salmon” (1981), *Can. J. of Fish & Aquat. Sci.* 38: 1636-1656 [Ricker 1981]; W.E. Ricker, “Causes of the decrease in age and size of Chinook salmon (*O. tshawytscha*)” (1980), *Can. Tech. Rep. Fish. & Aq. Sci.* no. 944 [Ricker 1980]; Jan Oglberger et al., “Demographic changes in Chinook salmon across the Northeast Pacific Ocean” (2018), 19 *Fish & Fisheries* 533 – 546, online: <<https://onlinelibrary.wiley.com/doi/10.1111/faf.12272#:~:text=Our%20results%20show%20that%20wild,younger%20fish%20has%20typically%20increased>>; Yi Xu et al., “Climate effects on size-at-age and growth rate of Chinook salmon (*O. tshawytscha*) in the Fraser river, Canada” (2020) 29 *Fish. Oceanog.* 381 – 395, online: <https://www.researchgate.net/publication/341542558_Climate_effects_on_size-at-age_and_growth_rate_of_Chinook_Salmon_Oncorhynchus_tshawytscha_in_the_Fraser_River_Canada>.

¹⁴⁴ Brian S. Bigler, David W. Welch and John H. Helle, “A review of size trends among North Pacific salmon (*Oncorhynchus spp.*)” (1996), 53(2) *Can. J. of Fish & Aquat. Sci.* 455-465, online: <<https://www.noaa.gov/sites/default/files/legacy/document/2020/Oct/07354626432.pdf>> [Bigler, Welch and Helle].

¹⁴⁵ Sandra M. O’Neill, Gina M. Yilato and James E. West, “Energy content of Pacific salmon as prey of northern and southern resident killer whales” (2014), 25(3) *Endangered Species Research* 265-281, online: <https://www.int-res.com/articles/esr_oa/n025p265.pdf>; Jacob E. Lerner and Brian P. V. Hunt, “Seasonal variation in the lipid content of Fraser River Chinook Salmon (*O. tshawytscha*) and its implications for Southern Resident Killer Whale (*Orcinus orca*) prey quality” (2023), 13(1) *Scientific Reports* 2675, online: <<https://www.nature.com/articles/s41598-023-28321-9>>.

¹⁴⁶ Bigler, Welch and Helle, *supra* note 144.

Studies on the spring and summer diet of Southern Residents show they pursue Chinook salmon from the Upper, Middle, and Lower regions of the Fraser River, including the Thompson watershed. The abundance of the early runs of 4- and 5-year-old stream-type Fraser Chinook are particularly important to the whales due to their early season presence (March -August) and their high fat content. Spring and summer runs of Fraser Chinook have up to 30% more lipid content than their fall counterparts. However, early stream-type Chinook have declined substantially from their historic abundance and are all considered by the Committee on the Status of Endangered Wildlife in Canada (“COSEWIC”) to be at-risk populations. Protecting the abundance of these fish, along with a foraging period for killer whales to catch them, is vitally important for Southern Resident recovery. Fraser stream-type threatened and endangered Chinook populations listed under COSEWIC must be adequately protected and recovered by holding mortality below 5%.

(b) Within six months, establish an emergency management plan for Chinook fisheries with minimum thresholds for Chinook abundance or Southern Resident body condition that trigger Chinook fishing closures in areas 1, 2, 11-21, and 102-127.

When Chinook abundance is low, fishery managers are poorly prepared to respond with special management actions to increase Chinook salmon availability and reduce competition. Potential actions such as closing fishery areas, shortening fishery openings, reducing quotas and/or bag limits, or expanding the boundaries of Southern Resident fishery management zones, need to be planned in advance.

A scenario of very poor body condition as fisheries open describes the situation in July 2023 for 11 Southern Residents. These circumstances prompted the Washington Department of Fish and Wildlife to issue an emergency regulation. However, no such emergency regulation was issued in Canada. Combining Southern Resident body condition and/or Chinook abundance in an emergency management plan will facilitate effective in-season fisheries management intervention when there is heightened risk to the whales.

If poor Southern Resident body condition should co-occur with low Chinook abundance before or during the salmon fishing season, fishery managers are not equipped with the tools to quickly implement special management actions to increase salmon availability.

(c) Initiate a transition for marine mixed-stock Chinook fisheries that occur on the migration routes and rearing grounds of Chinook salmon, to river-based terminal areas. Such a transition would apply commercial and recreational fisheries that intercept migrating Chinook returning to Southern BC.

The declining proportion of larger and older Chinook, and the concurrent decline in Chinook fecundity and productivity, is perpetuated by marine Chinook fisheries that

occur on the rearing grounds of immature (growing) Chinook.¹⁴⁷ Harvesting immature Chinook can skew the population structure towards younger and therefore smaller individuals, and perpetuate declines in Chinook productivity.¹⁴⁸ Modeling has shown that ending the marine harvest of immature Chinook, and moving harvest to river based terminal fisheries, can allow these fish to regain a more historic population structure and rebuild productivity, within a few decades.¹⁴⁹ Transitioning marine mixed stock, interception Chinook fisheries to terminal areas has an immediate benefit and an accruing benefit over time. First, more mature Chinook are immediately available to endangered Southern Residents in their critical habitat (because fisheries capturing preferred prey are moved off of their migration routes) and second, ending the harvest of immature fish allows the demographic and genetic effects caused by immature harvest to reverse with each generation.

While the transition to river-based terminal Chinook fisheries is pursued, implement fisheries independent monitoring in all times and areas where non-terminal, marine recreational and commercial fisheries catching Chinook are open. Fisheries independent monitoring should meet the standards achieved in non-salmon fisheries utilizing a combination of independent observer coverage and reference/test fisheries.

(f) Extend the period of existing fishing closures. To increase prey accessibility of Chinook in critical habitat, fishing closures of priority Southern Resident foraging areas within critical habitat should occur from March 1 to November 30.

The time and area closure for Chinook salmon fisheries is inadequate to protect both endangered killer whales and their endangered prey. Fishing closures should begin in March to protect migrating endangered spring stream type Chinook.

Fishing closures of Southern Resident foraging areas within critical habitat should include all areas demonstrated to be key foraging areas and have a precautionary buffer of 1 km. A buffer should be established around the key Southern Resident foraging areas that prevents boats and fisheries from occurring on the edge of foraging areas and reducing the effectiveness of the are protected foraging areas.

(g) In addition to the DFO’s considerations for Environmental Conditions and Drought Management outlined in the 2024/25 Salmon Integrated Fisheries Management Plans, the Federal Government must establish an emergency management plan that addresses drought in spawning and freshwater rearing grounds of threatened and endangered Fraser stream-type Chinook.

¹⁴⁷ Nick Gayeski et al., “Productivity and resilience of Chinook salmon compromised by ‘Mixed-Maturation’ fisheries in marine waters”. *In review*. Preprint available at:

<<https://www.biorxiv.org/content/10.1101/2024.04.25.591098v1>> [Gayeski et al.].

¹⁴⁸ Ricker 1980, *supra* note 143; Ricker 1982, *supra* note 143.

¹⁴⁹ Gayeski et al., *supra* note 147.

This includes addressing restoration, hydrology and flow regime, water withdrawal, land use, and drought management strategies that integrate in-season management measures for both habitat and fisheries.

3. Measures relating to contaminants

Protection of both the Southern Residents and their critical habitat from environmental contaminants is critical to their survival and recovery. Contaminants in Southern Resident habitat, and that of their prey, come from numerous sources, underscoring the need for concerted and seamless work among agencies and organizations. Immediate action must be taken to mitigate the risks to the Southern Residents and their prey from environmental contamination.

Outside of the below requested measures, the Government of Canada should establish a permanent multilateral task force to regularly identify, review and share a list of contaminants of past, present, emerging and future concern in salmon and Southern Resident habitat. Many contaminants have been found to present risks of adverse health effects or death in salmon, and are contributing to the degradation of Southern Resident habitat. Given the concern for healthy urban and near-urban waters for fish, people, and whales; the complex emissions profiles for different pollutants from different sectors; and the complex nature of regulatory or jurisdictional oversight, there is an urgent need for a table to bring together expertise from federal, provincial, regional, municipal and First Nations in a manner that fosters priority setting and problem mitigation. The latter may be in the form of chemical regulations, discharge permits, bylaws, and/or best practices, as well as new candidate Environmental Quality Guidelines.

(a) Prohibit the release of scrubber wastewater, and the discharge of bilge and greywater, from cruise ship vessels in inland waters, including in and adjacent to the Southern Residents' critical habitat.

The goal of this measure is to phase out the use of high sulphur fuels and eliminate the use of scrubbers while vessels are operating within the territorial sea or the inland waters of the Salish Sea.

In June 2023, Transport Canada issued mandatory measures to address waste from cruise ships, through the Interim Order Respecting the Discharge of Sewage and the Release of Greywater by Cruise Ships in Canadian Waters¹⁵⁰ (“Cruise Ship Interim Order”), pursuant to Section 10.1(1) of the *Shipping Act*, SC 2001, c 26. The Cruise Ship Interim Order is not only time-limited, expiring June of 2024, but it fails to adequately protect the Southern Resident killer whales.

¹⁵⁰ Transport Canada, “Interim Order Respecting the Discharge of Sewage and the Release of Greywater by Cruise Ships in Canadian Waters” (June 9, 2023), online: <<https://tc.canada.ca/en/ministerial-orders-interim-orders-directives-directions-response-letters/interim-order-respecting-discharge-sewage-release-greywater-cruise-ships-canadian-waters>>.

The Cruise Ship Interim Order accentuates the “toilet bowl” phenomenon, where vessels hold their waste until they enter the increasingly focal areas where they are still allowed to discharge that waste. The lengthy list of exceptions contained in the Cruise Ship Interim Order allows vessels to discharge sewage and greywater within 12 nautical miles of the shore.

The Cruise Ship Interim Order contains no provisions for scrubber wastewater (Exhaust Gas Cleaning Systems), which represents the bulk volumetric discharge from large vessels. Scrubber wastewater contains contaminants removed from the airborne emissions of highly polluting, high sulphur content fuels. Scrubbers have been installed aboard many vessels as a cheaper means of reducing air pollution, compared to the more costly purchase of low sulphur fuels. This means that liquid waste discharges from vessels with scrubbers include very acidic contents with high concentrations of metals and hydrocarbons. The Port of Vancouver has determined that such discharges exceed Environmental Quality Guidelines set forth by the Canadian Council of Ministers of the Environment for the protection of aquatic life.¹⁵¹ The result is a continued and troubling release of contaminants directly into and adjacent to the waters of the Southern Residents’ critical habitat while vessels are under power.

(b) Prohibit the release of scrubber wastewater in internal waters and the territorial sea, including in and adjacent to the Southern Residents’ critical habitat.

Scrubber wastewater must not be released from any vessel during transit through Southern Resident critical habitat and adjacent waters within 12 nautical miles of shore (the territorial sea). The use of scrubber technologies as a low-cost measure to reduce airborne sulphur emissions must remain a temporary short-term solution, with low-sulphur content fuels being required for all vessels.

(c) Prohibit operational discharges from all vessels in Southern Resident critical habitat or in the territorial sea.

VIII Timing of the Ministers’ recommendation

The time for action is now; Canada must take the right steps over the course of the coming months to ensure the survival and recovery of the Southern Resident killer whales.

The Southern Residents are at a crossroads. Without serious, urgent efforts to change their trajectory away from a “bright extinction”, they are on track to accelerate their decline after two generations and become functionally extinct during this century.¹⁵² The Government of Canada has a choice: continue status quo measures, even as it approves new projects like Trans

¹⁵¹ Port of Vancouver, “Restrictions on discharge of scrubber wash water take effect” (1 March 2022), online: <<https://www.portvancouver.com/about-us/information-updates/restrictions-on-discharge-of-scrubber-wash-water-take-effect/>>.

¹⁵² Williams et al, *supra* note 1 at page 2 and page 3 Fig 4.

Mountain, and document the likely extinction of an iconic species – or take urgent, meaningful actions of the scale required to stabilize, and eventually recover, the Southern Residents. Granting this request for an emergency order would be a step in the latter, positive direction.

In light of the imminent threats to their survival and recovery, the Petitioners require that the Ministers recommend an emergency order to the Governor in Council under s. 80(2) no later than July 8, 2024. In the absence of a response, the Petitioners will have to consider whether legal action is necessary to address this urgent situation.

Appendix A

Excerpt of Access to Information Response DFO
A-2023-0085

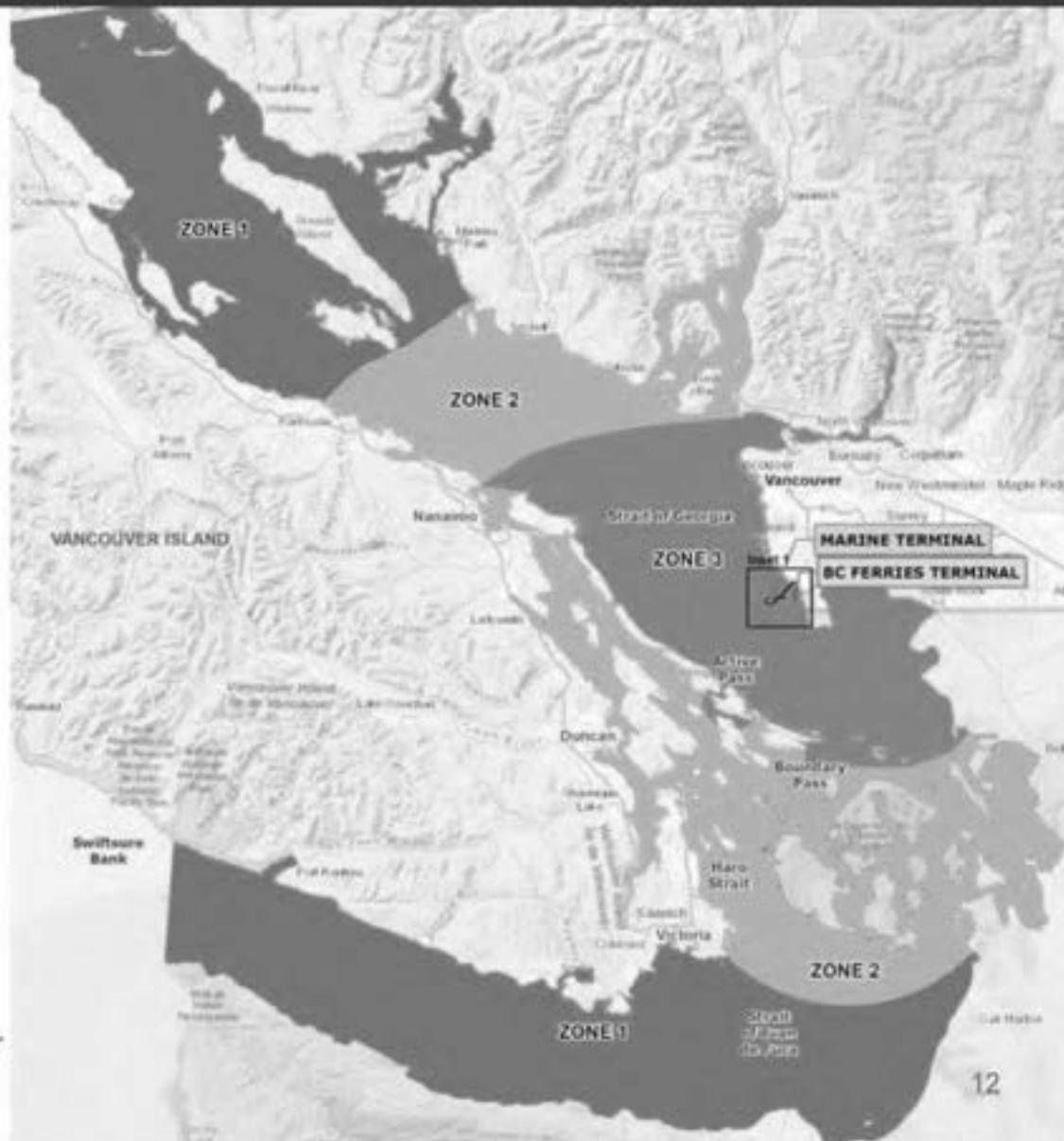
Early detection and phased notification system

- The early detection system will provide the marine mammal detection team with any available information on the presence of SRKW in the **Salish Sea**
- Objective:
 1. Leverage the **network** of SRKW detection sources to track their whereabouts
 2. Inform the need to adjust the location and number of **MMOs**
 3. Allow the contractor to make **informed** decisions regarding planned underwater noise-generating construction activities



Early detection and phased notification system

- Three zones with pre-determined actions
- SRKW warning levels
- “Stop light approach”
- Pre-determined construction management action



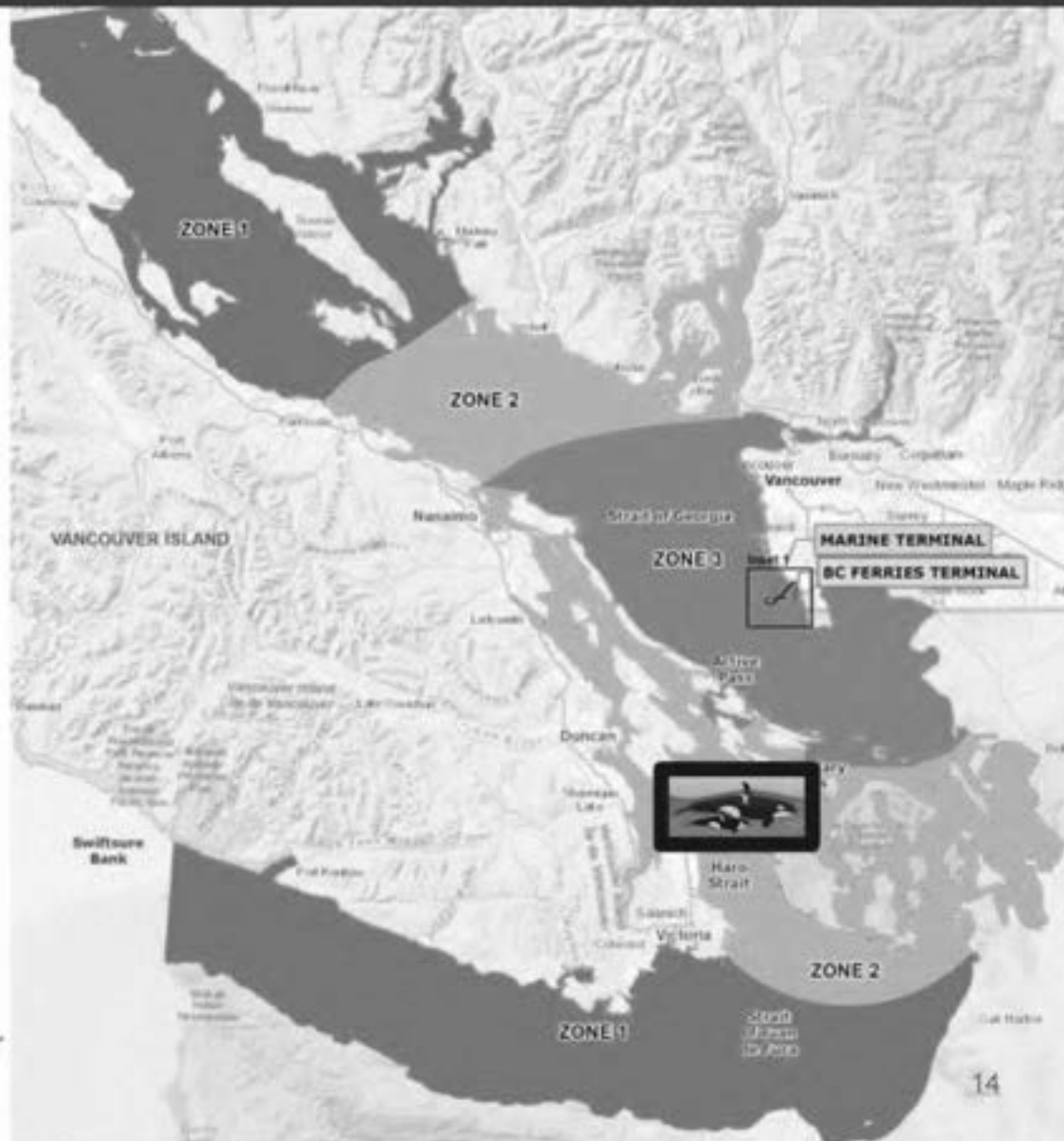
Example scenario: SRKW in Zone 1 (raise awareness)

- SRKW sighted in Juan de Fuca Strait by **early detection system** (e.g., reported on Whale Report Alert System)
- Detection team **communicates** information to contractor
- Contractor proceeds with activities but is **aware** of the detection



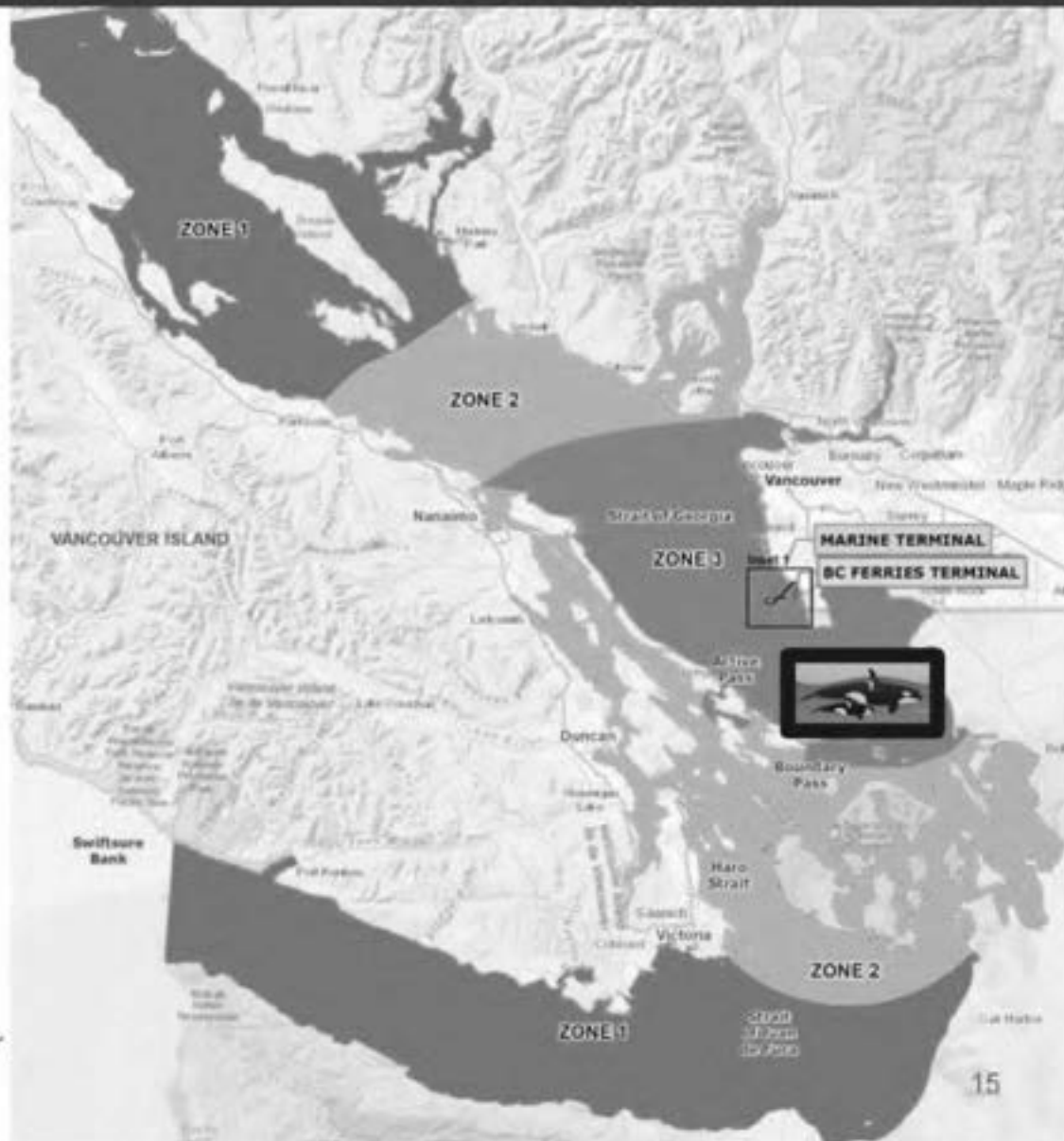
Example scenario: SRKW in Zone 2 (prepare)

- SRKW sighted in Haro Strait
- Detection team communicates information to contractor
 - **Prepares** to adjust MMOs to ensure coverage
- Contractor proceeds with activities but is aware of the detection
 - **Ready** to modify activities if needed

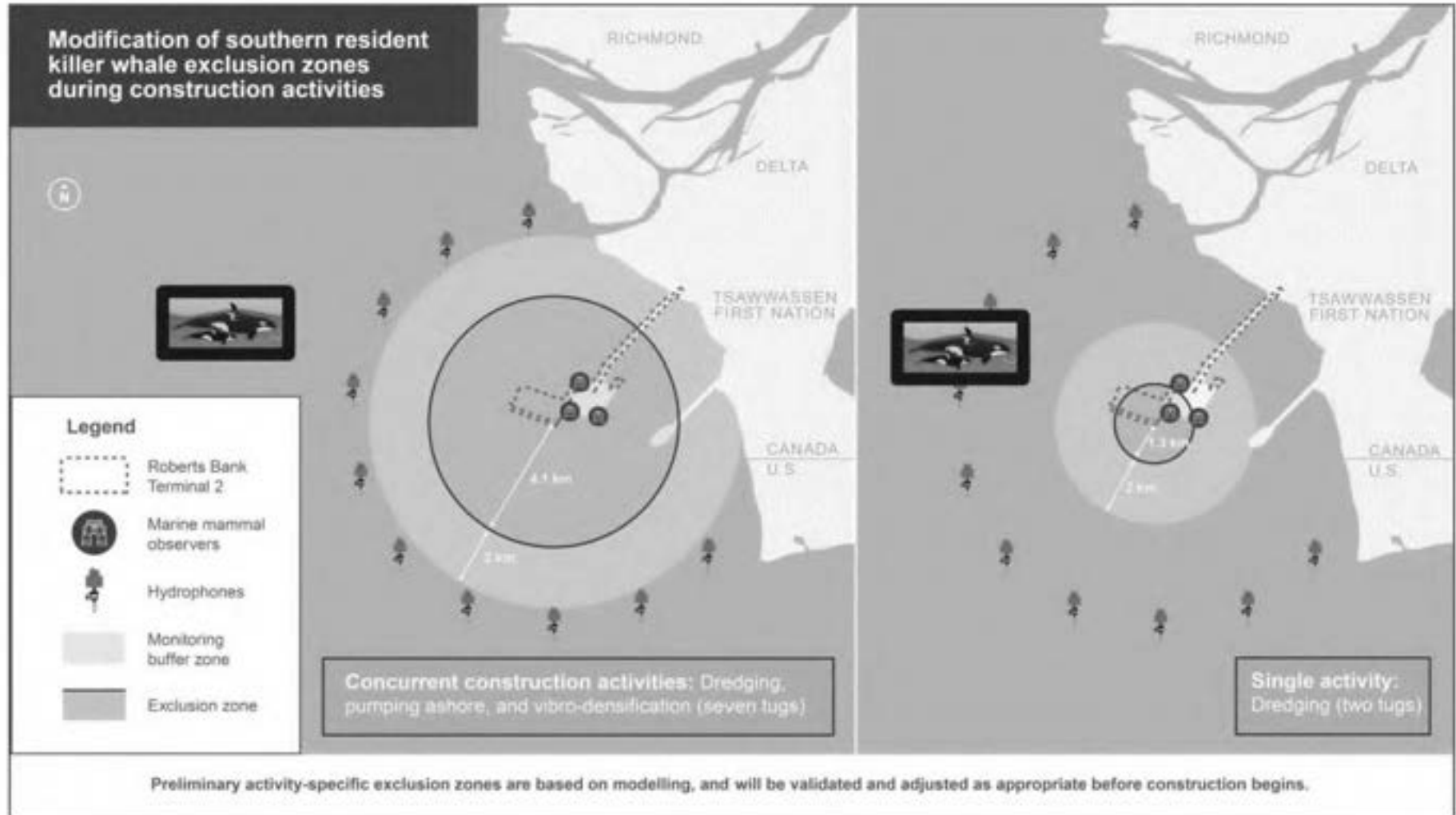


Example scenario: SRKW in Zone 3 (modify activities)

- SRKW sighted in southern Strait of Georgia, outside monitoring buffer
- Detection team:
 - Communicates sighting to contractor
 - **Adjusts MMOs** to ensure coverage
- Contractor **modifies activities** to reduce the size of exclusion zone
 - Ensures coverage and effective monitoring



SRKW in Zone 3 (modify activities)



Questions

Questions

- From the list of **early detection sources** shared, are there any other sources or efforts that should be considered to provide early notification of SRKW presence in the Salish Sea, e.g., community groups detecting and recording the presence of SRKW?
- From your knowledge of SRKW habitat use and movement, are the **extents** of the early notification zones appropriate?
 - Are there any other factors that should be considered in selecting the **boundaries** of the notification zones?

Marine mammal observers (MMO)

- Year-round visual monitoring by MMOs during in-water activities to determine if killer whales are approaching an exclusion zone
- Marine mammal monitoring team will be comprised of First Nation monitors
- MMOs will **monitor** for SRKW, **confirm** exclusion zones, **communicate** information to contractor
- MMOs will be trained for NOAA survey protocols



Passive acoustic monitoring (PAM)

- Implemented to effectively complement visual detection
- Will be especially important at night, poor visibility, and when exclusion zones are large and cannot be monitored visually
- Will use multiple nodes, e.g., large surface buoys, each with one or more hydrophones to detect calling SRKW
- Proposed to use large surface buoys, place hydrophones near the seafloor as far as practical from shipping lanes, and use detection range results for summer conditions (most conservative)

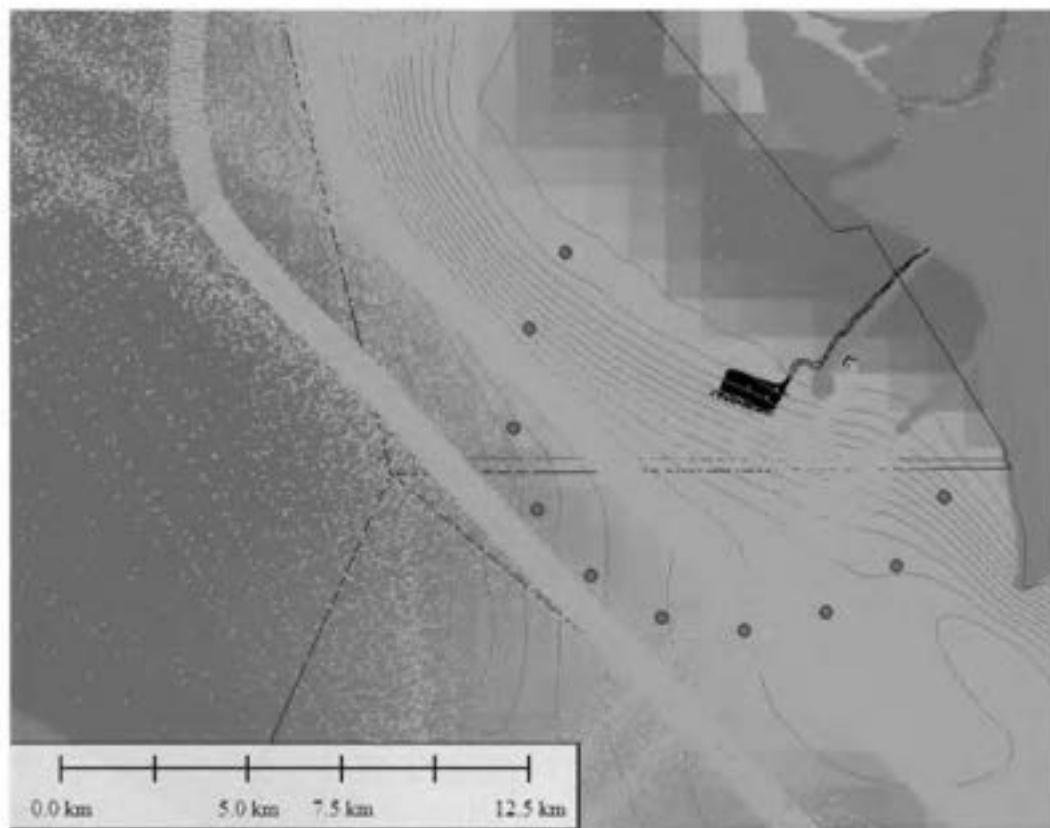


Passive acoustic monitoring (PAM)



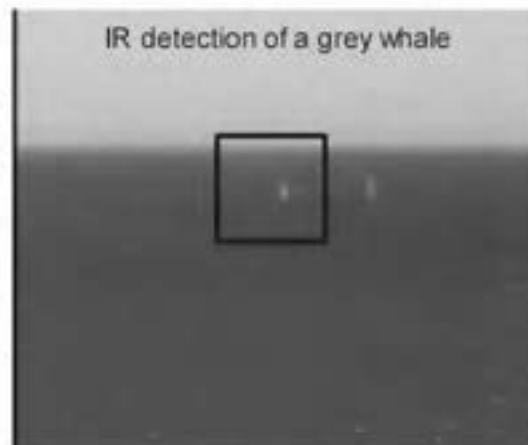
Passive acoustic monitoring (PAM): proposed configuration

- Buoys preferentially placed to avoid **vessel** traffic (grey) but overlap high **SRKW** use (pink)
- A semi-circular perimeter of 10 nodes, extending ~6.1 km from terminal, which provides ~75% detection probability

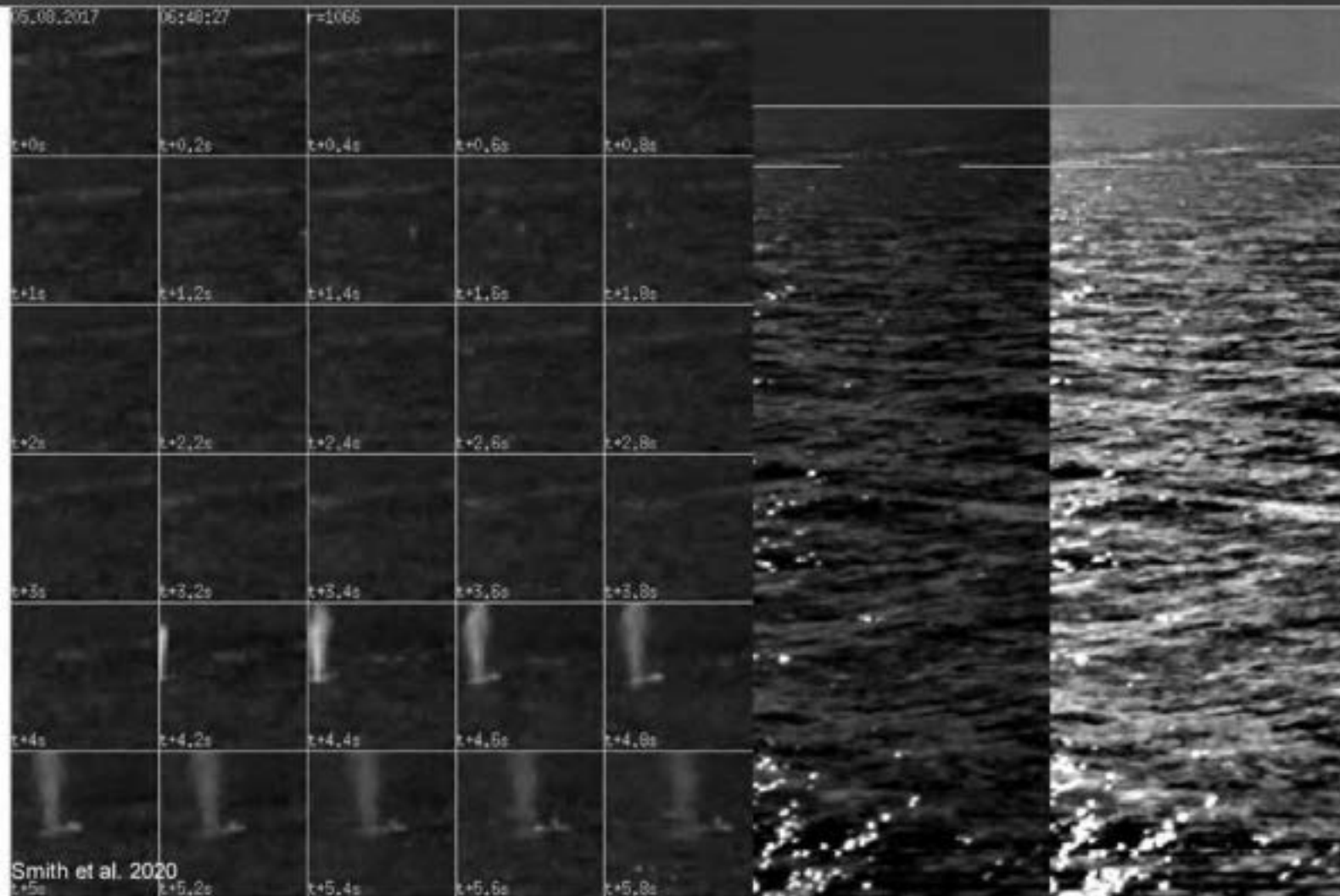


Other feasible detection technologies (conditions #8.2.7.3, 8.2.7.4)

- Other **innovative detection** technologies will be used if they can improve SRKW detection and are technically and economically feasible, e.g., **Infrared (IR)** cameras can detect whales at night/low visibility
- The feasibility of emerging detection technologies will continue to be evaluated
- The implementation of any new feasible detection measures will be determined in consultation with DFO and First Nations



Other feasible detection technologies



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Vessel-based IR detection on the east coast

Questions

Questions

- Are you aware of any examples where a particular **detection method** worked effectively? If so, what contributed to its success?
- What **other** detection methods/approaches should be considered?

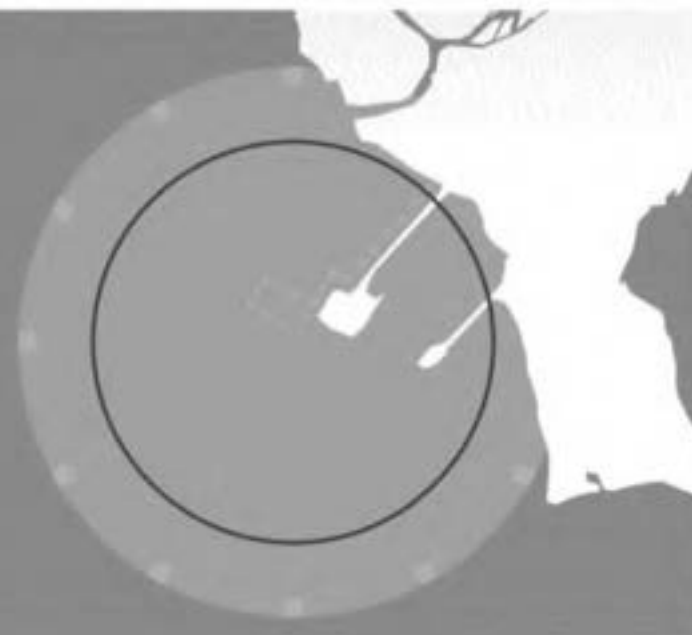
Stop work procedures: to be implemented before SRKW enter exclusion zone

- Procedures will describe who has stop work authority, the **communication protocols** between the marine mammal detection team and the contractor, and the process for stopping and starting work
 - The marine mammal detection team will have the authority to initiate stop work procedures
 - These procedures will be developed in consultation with First Nations and DFO

Roberts Bank Terminal 2 Construction

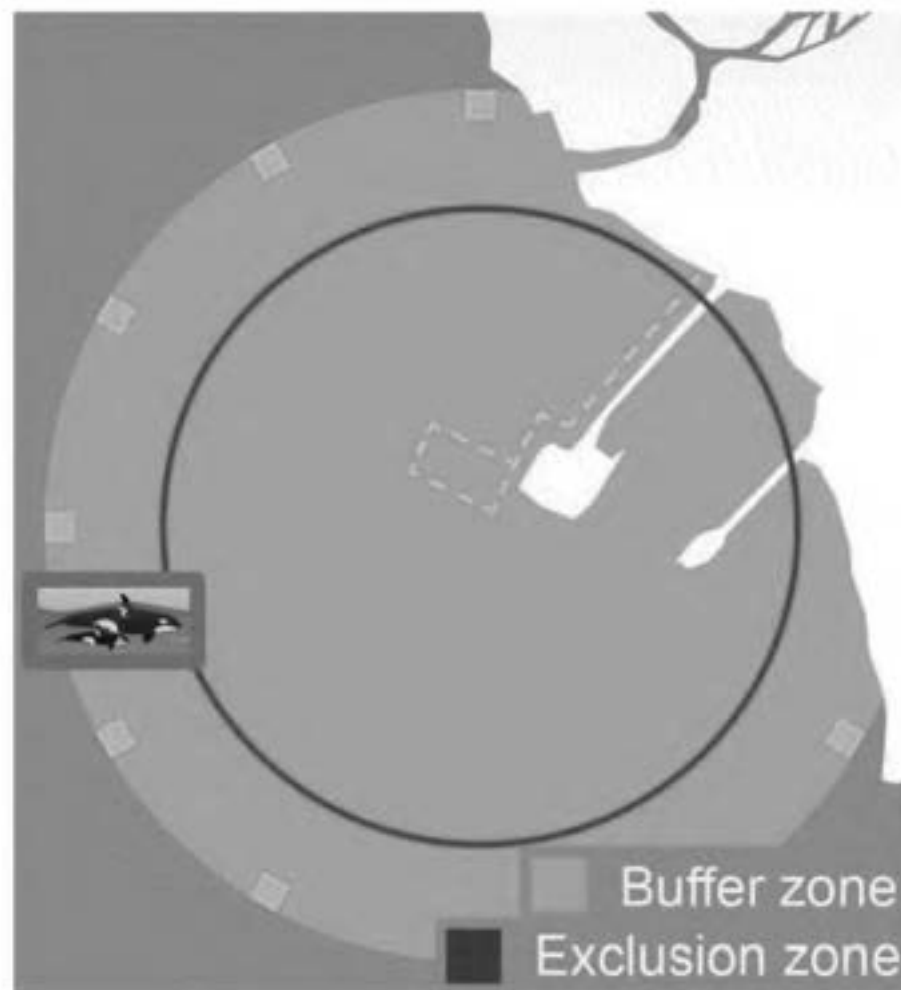
The marine mammal detection methods will detect killer whales before they enter the exclusion zone

- Exclusion zone
- Hydrophones
- Buffer zone
- Roberts Bank Terminal 2



SRKW in monitoring buffer (stop work)

- SRKW sighted in monitoring buffer by MMO
- Detection team immediately notifies contractor to initiate stop work procedures
- Contractor initiates stop work procedures
- Work does not restart until SRKW:
 - Have left monitoring buffer or
 - Have not been detected for >30 mins in monitoring buffer



Questions

Questions

- Are there any **other steps** that should be considered as part of the proposed approach presented on SRKW modified work and **stop work procedures** during project construction?
- From your experience, what contributes to **successful** stop work procedures?
- Do you have any examples of good **communication plans** or approaches during project construction? What are the factors that contributed to this success?

Snack and refreshments break

SARA-FAA application: Volume 3 Section 7

Volume 1

Sections 1 to 5
Project description and avoidance

Volume 2

Fisheries Act content (related to fish and fish habitat, including marine mammals)

Section 6
Consultation

Section 7
Establish existing conditions

Section 8
Identify potential effects

Sections 9 and 10
Avoid, mitigate, and monitor

Section 11
Determine residuals

Sections 12 and 13
Offset residuals

Section 14
Consider cumulative effects

Volume 3

Species at Risk Act content (related to southern resident killer whales)

Sections 1 and 2
Introduction and consultation, alternatives assessment

Section 3
Establish existing conditions

Section 4
Identify potential effects

Sections 5 and 6
Avoid, mitigate, monitor

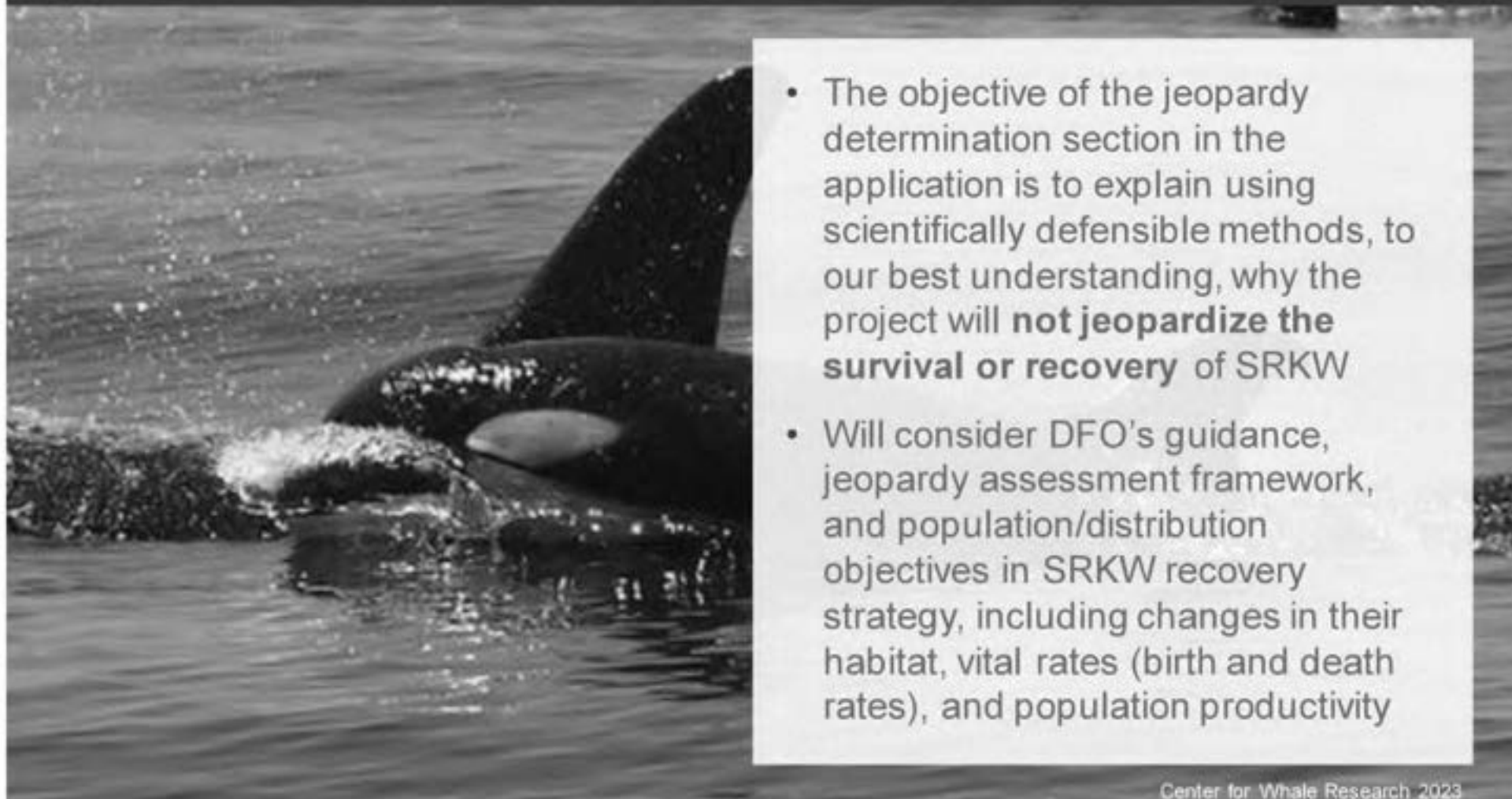
Section 7
Determine jeopardy: remaining effects, offsetting & regional factors

Overview of approach to determining jeopardy for southern resident killer whales

Objectives of today's session

- Provide an overview of the **objective of the jeopardy determination** section of the SARA compliant FAA application
- Describe **the key content/topics** that will be considered as part of the jeopardy determination
- Discuss and seek feedback on list of current **regional initiatives** that have been identified and should be considered by the port authority

SRKW jeopardy determination objective



- The objective of the jeopardy determination section in the application is to explain using scientifically defensible methods, to our best understanding, why the project will **not jeopardize the survival or recovery** of SRKW
- Will consider DFO's guidance, jeopardy assessment framework, and population/distribution objectives in SRKW recovery strategy, including changes in their habitat, vital rates (birth and death rates), and population productivity

Center for Whale Research 2023

SRKW jeopardy determination approach

- The port authority's approach is based on:
 - Work undertaken during the federal **environmental assessment** including input from First Nations during consultation
 - Guidance provided on the jeopardy assessment framework and other SARA permitting guidance documents
 - Supplemental **technical work** which:
 - Considers recent guidance within the jeopardy assessment framework
 - Increases certainty related to offsetting acoustic effects to SRKW from operation
- Considers the potential threats and relevant critical habitat features for SRKW: **prey** availability, **acoustic** environment, **contaminants**, and **strike** risk

SRKW jeopardy determination: key content

- **Mitigation**
 - For prey, underwater noise, contaminants, and strike risk
 - Avoidance e.g., timing windows, project design, fill characterization; and mitigation e.g., underwater noise reduction, detection, stop work
- **Offsetting**
 - For prey (Chinook) and underwater noise (slowdowns)
- **Marine shipping and other pressures on SRKW**
 - Effects of other current and future projects and activities e.g., commercial fishing, TMX
 - Consideration that SRKW are currently cumulatively affected and the ecosystem it relies on
 - Examination of the pressures on prey availability, acoustic environment, contaminants, and strike risk



SRKW jeopardy determination: key content

- **Regional initiatives**
 - Focused on SRKW recovery
 - Aimed to address:
 - prey availability
 - reduce underwater noise
 - manage contaminants
 - reduce strike risk



Key regional initiatives

- Oceans Protection Plan (Marine Environmental Quality, SRKW Noise Research, Whale Detection and Avoidance Initiative, Cumulative Effects of Marine Shipping)
- Whales Initiative
- SRKW Management Measures
- Transport Canada Quiet Vessel Initiative, Underwater Listening Station
- CCG Marine Mammal Desk, Marine Communications and Traffic Services
- ECHO Program, Conservation Agreement
- DFO Whale Tracking Network, Pacific Salmon Strategy Initiative
- ECCC Pollutants Affecting Whales and their Prey Inventory Tool, Contaminants Technical Working Group



Questions

Questions

- Are there any SRKW regional initiatives missing from the list shared?
- Based on your experience with the various regional initiatives aimed at SRKW recovery, which do you think is being implemented most effectively and why?
 - What are some of the success factors?
 - What makes an effective partnership/initiative?



■ Finfish/salmon closure areas
▨ Killer whale foraging areas
← Area of lateral displacement within the outbound shipping lane*
▨ Slowdown zone

Transport Canada 2023

Underwater noise offsetting and emerging underwater noise reduction technologies, e.g., quiet tugs

Objectives of today's session

- Provide an overview and seek input on the underwater noise offsetting approach for project operation
- Provide an update and seek input on emerging underwater noise reduction technologies, e.g., quiet tugs (condition #8.3)



Project operation noise offsetting

- The port authority leads the ECHO Program in collaboration with the Government of Canada, First Nations, and others
 - Better understand and reduce the cumulative effects of commercial shipping on at-risk whales
 - Develop and implement initiatives that result in a quantifiable reduction in threats to whales as a result of shipping activities, such as vessel slowdowns
- Vessel slowdowns reduce underwater noise from container vessels and associated predicted disturbance to SRKW



Project operation noise offsetting

- Acoustic exposures from operation will be offset (**counterbalanced**) by requiring RBT2-bound container vessels to participate in ECHO Program vessel slowdowns, or future equivalent (condition #8.7)
- Approach to noise offsetting will include models developed for IR2020-3
 - SRKW acoustic footprint overlap/exposure approach (additional 15% of RBT2-bound vessels reduce speed)
- Investigate/incorporate additional noise metrics where feasible to evaluate offsets



Project operation noise offsetting: additional analysis

- Additional analysis using DFO SRKW summer habitat use data
- Estimates of offsetting effectiveness can vary depending on the underlying habitat data
- Compare intensity of SRKW occurrence and resulting offset ratios in terminal operation acoustic footprint with vessel acoustic footprints in slowdown areas

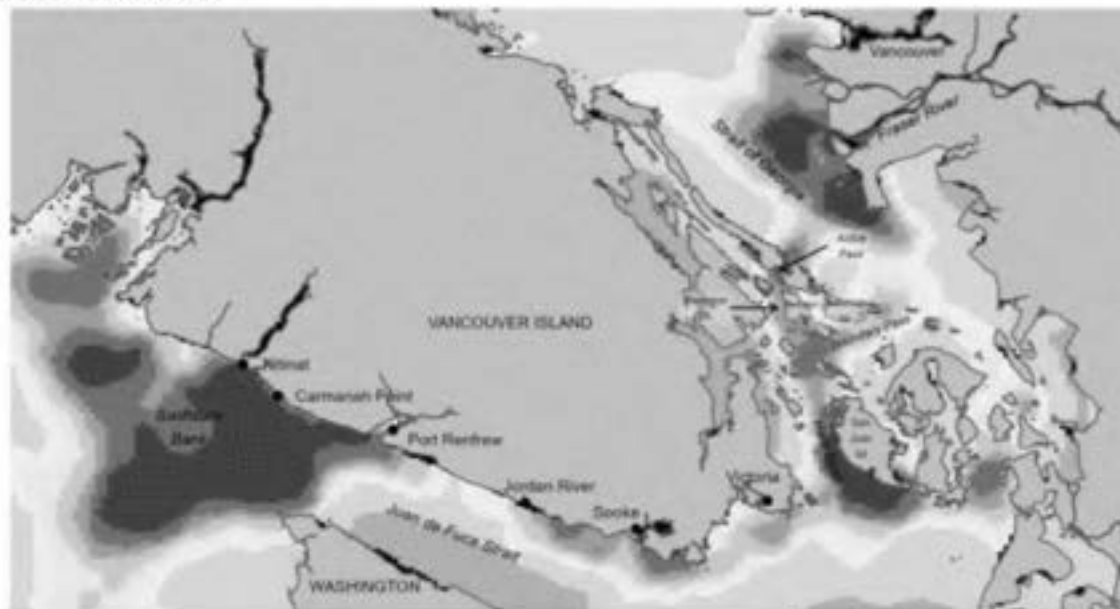
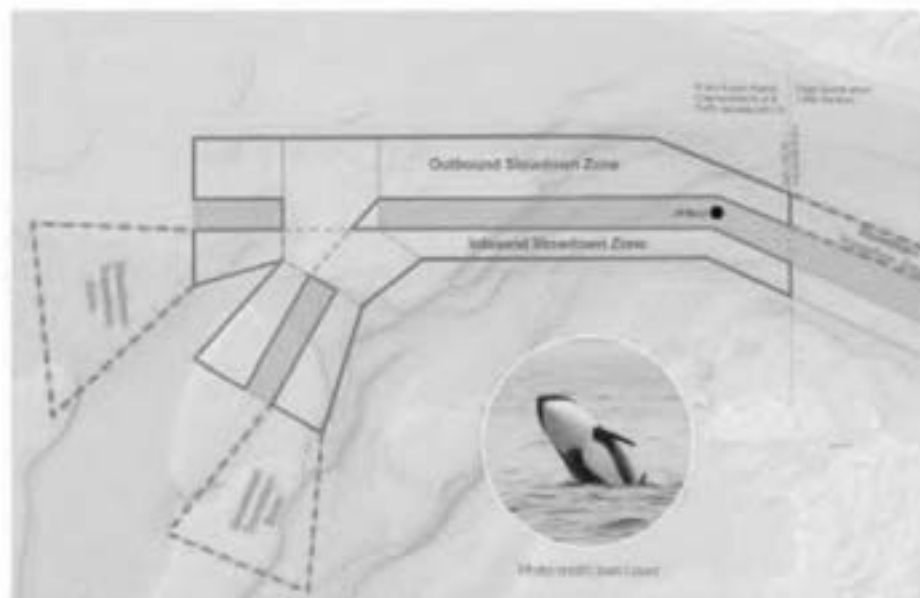


Figure from Thornton et al. (2022)

Project operation noise offsetting: additional offsets

- Assess the value of slowdowns in Swiftsure Bank region
- Consider:
 - SRKW habitat use and exposure durations along slowdown corridors (biological meaningfulness)
 - Potential additional noise offsets from slowdowns at Swiftsure Bank



2023 Swiftsure Bank voluntary ship slowdown area

Emerging underwater noise reduction technologies

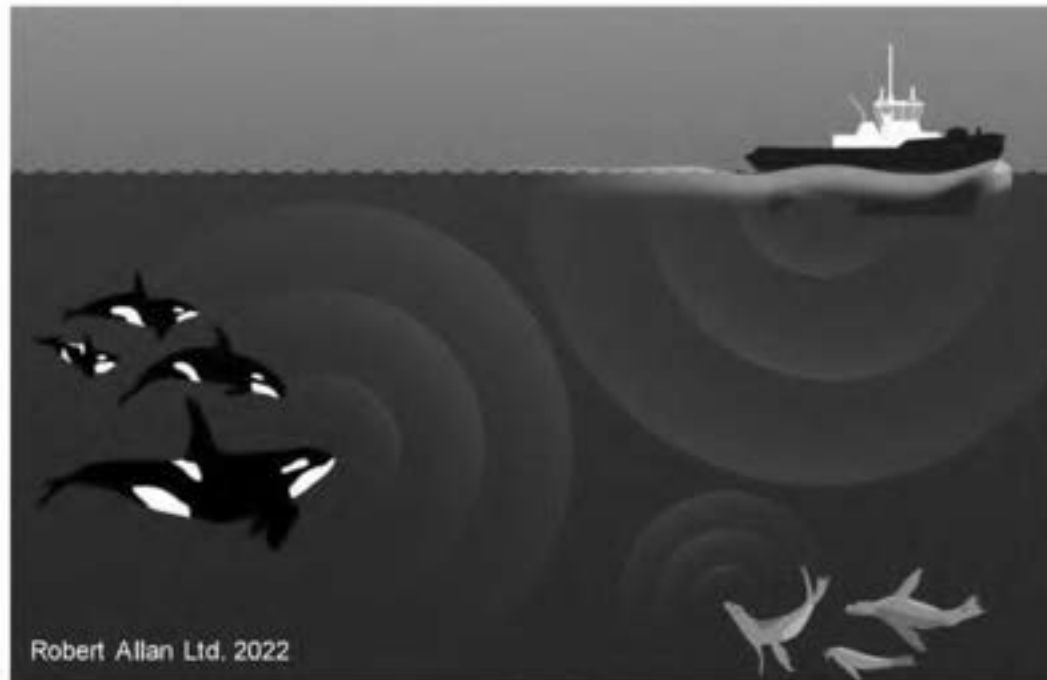
- Technologies to **reduce underwater noise** associated with berthing activities (e.g., electric tugs) will be evaluated and implemented once **feasible and effective** (condition #8.3)
- HaiSea Marine recently announced a partnership to design, build, and operate new **battery-powered and low emissions tugs** that will be used for the LNG Canada Project in Kitimat
- Robert Allan Ltd., SAAM Towage Canada, and SANMAR Shipyards have announced they will add two new state-of-the-art **battery electric tugs** to their operations in Vancouver
- Will continue to monitor advancements in quiet tug technology, including work undertaken through Transport Canada's Quiet Vessel Initiative



Robert Allan Ltd. 2022

Questions

- Are you aware of any **emerging technology(ies)** that are being implemented or tested to reduce underwater noise from vessels/tugs, e.g., in other jurisdictions?



Robert Allan Ltd, 2022

Thank you

Appendix B

Vancouver Fraser Port Authority Webinar Slide Deck



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Webinar: Modelling of existing and future ship noise scenarios

Krista Trounce, ECHO Program Research Manager
Alex MacGillivray, Principal Scientist, JASCO Applied Sciences Ltd.

January 17, 2024

Canada

Modelling of existing and future ship noise scenarios

Webinar agenda

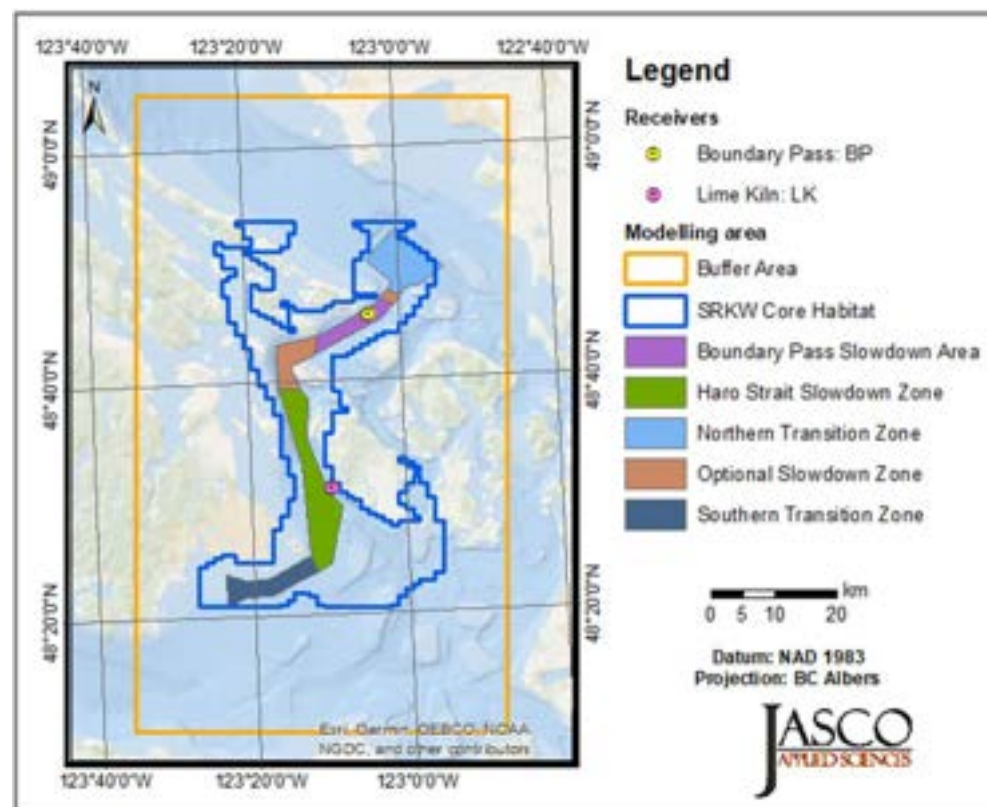


10:00 – 10:05	Welcome
10:05 – 10:15	Project description and rationale
10:15 – 10: 20	Model description
10:20 – 10:45	Overview of modelling results
10:45 – 11:00	Q & A

Modelling of existing and future ship noise scenarios

Project description and rationale

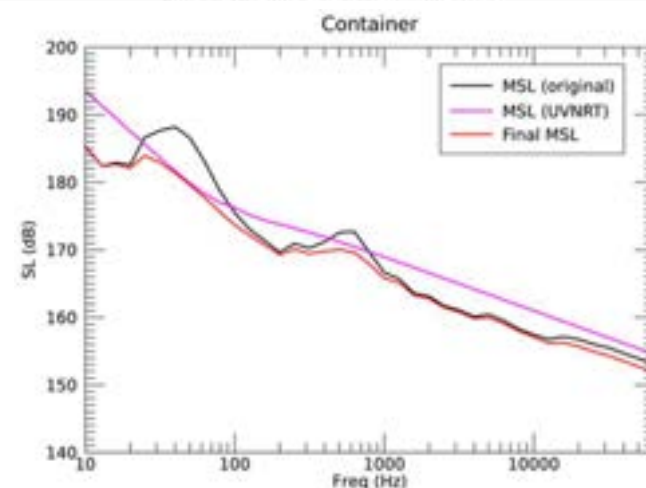
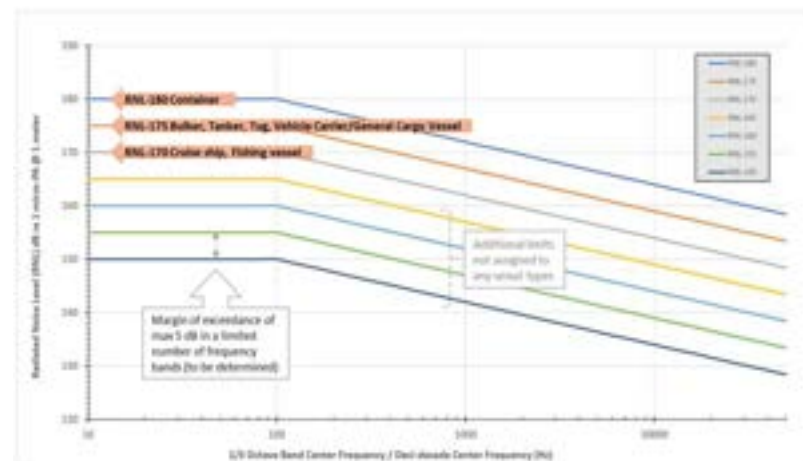
- Evaluating ship noise differences due to slowdowns
- Can be used to evaluate changes for other traffic conditions (i.e. future traffic increases such as TMEP, UVNRT*)
- Fine scale modelling of noise emissions
- Focus on Haro Strait and Boundary Pass slowdown area
- Considers high SRKW 70%** occurrence area (as per DFO) coinciding with the slowdown/ model area – called core habitat for this project



Modelling of existing and future ship noise scenarios

What is UVNRT?

- UVNRT = Underwater vessel noise reduction targets
- Transport Canada initiative started in 2021
- Recommends a series of radiated noise levels (RNL) for different vessel classes
 - RNL-180: Container
 - RNL-175: Bulker, Tanker, Tug, Vehicle Carrier, General Cargo
 - RNL-170: Cruise and Fishing
- Some future traffic modelling scenarios include consideration of vessels meeting UVNRT levels



Modelling of existing and future ship noise scenarios

Scenario descriptions

#	Scenario	Description
1	Baseline	Baseline vessel counts and speeds for a 14-day period
2	ECHO S2022	2022 slowdown data (speeds and participation percentages)
3	ECHO SMin	2022 participation percentages, all vessels target 11 knots
4	Future 1B	Include max TMEP tankers & tugs at baseline speeds
5	Future 1S	Include max TMEP tankers & tugs under slowdown speeds
6	Future 2B	50% of vessels meet UVNRT* levels under baseline speeds
7	Future 2S	Vessels meeting UVNRT* levels (50%) do not slowdown
8	Future 3B	100% of vessels meet UVNRT* levels under baseline speeds

Modelling of existing and future ship noise scenarios

Modelled vessel transits

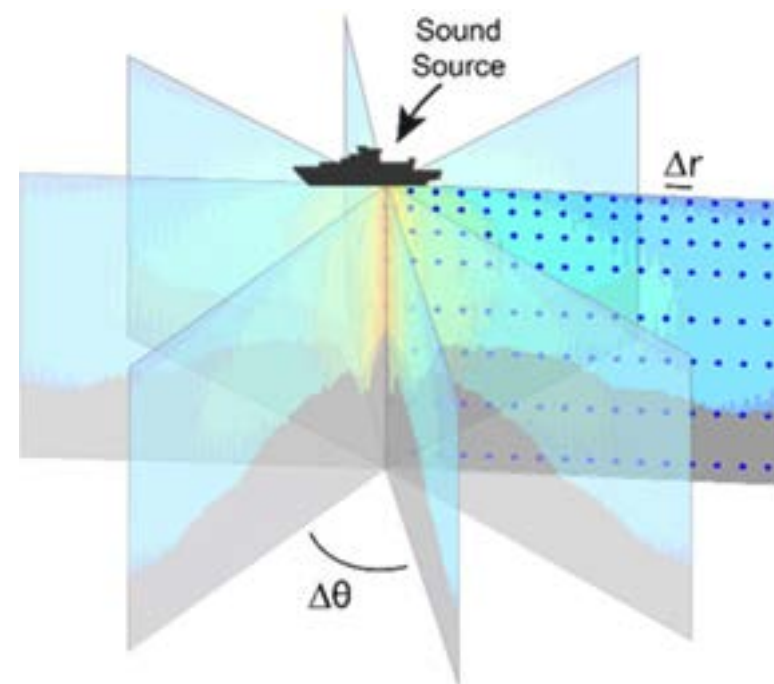
Type	Participation rate	# of transits in 2022 model	# transits in future TMEP model
Bulk Carrier	93%	123	123
Car Carrier	86%	14	14
Container	96%	45	45
Passenger	96%	8	8
Tanker	91%	14	14
Future TMEP Tanker (max)	100%	0	28
Future TMEP Escort tug (max)	50%	0	28
Total transits in 14-day model		204	260

Model description

Modelling of existing and future ship noise scenarios

Model description

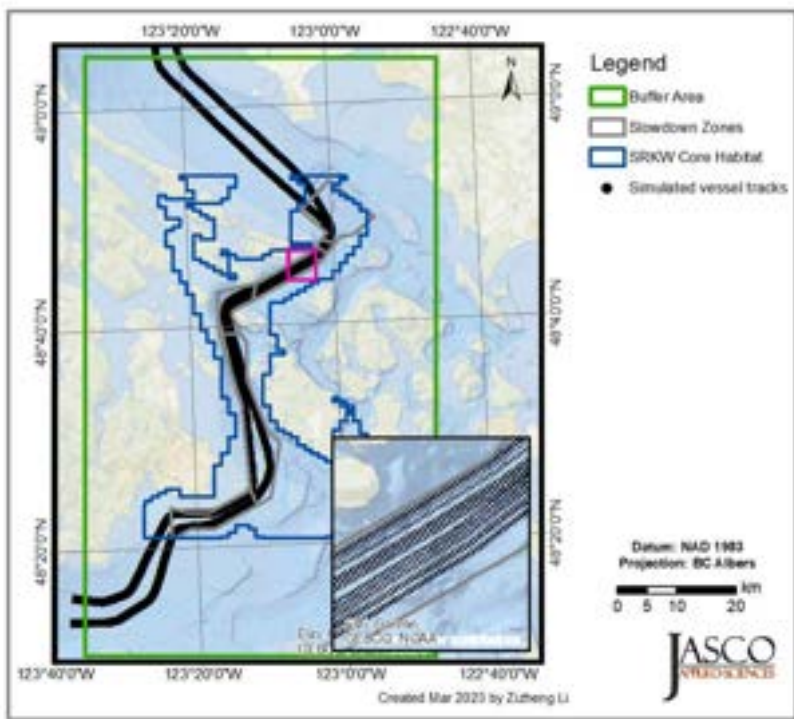
- Fine-scale acoustic simulations carried out using JASCO ARTEMIA model
- ARTEMIA simulates minute-by-minute sound pressure level (SPL) from shipping and ambient
 - **14-day simulation period**
 - **200 m × 200 m spatial resolution**
 - **1 minute temporal resolution**
- Model inputs include:
 - Vessel tracks (simulated and AIS)
 - Vessel source levels and speed trends (ECHO)
 - Bathymetry (CHS)
 - Water sound speed profiles (DFO)
 - Propagation loss curves (wave-equation model)
 - Time-dependent wind speed for ambient (ECCC)



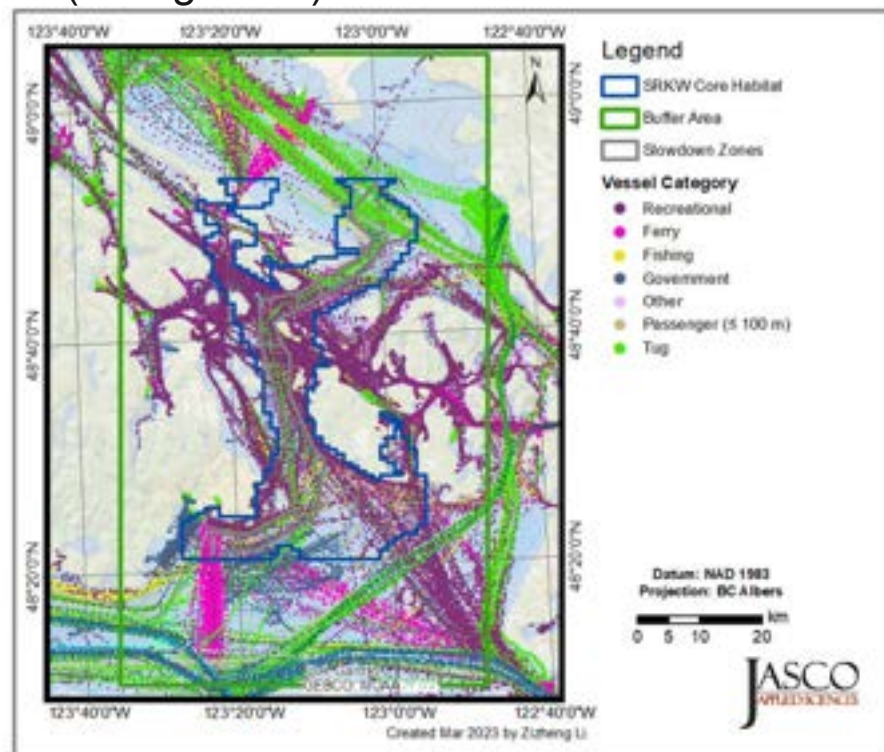
Modelling of existing and future ship noise scenarios

Vessel tracks

Deep sea vessels - simulated vessel tracks (by scenario)

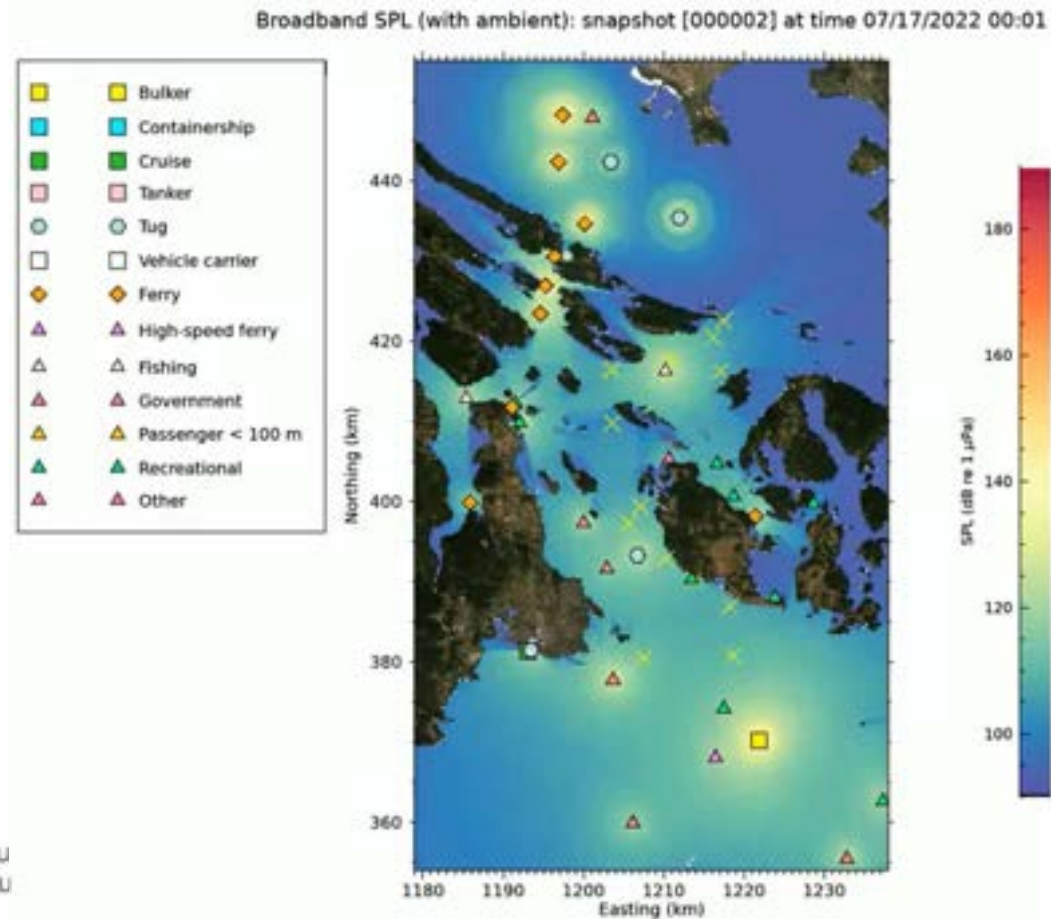


Non-deep sea vessels - AIS vessel tracks (background)



Modelling of existing and future ship noise scenarios

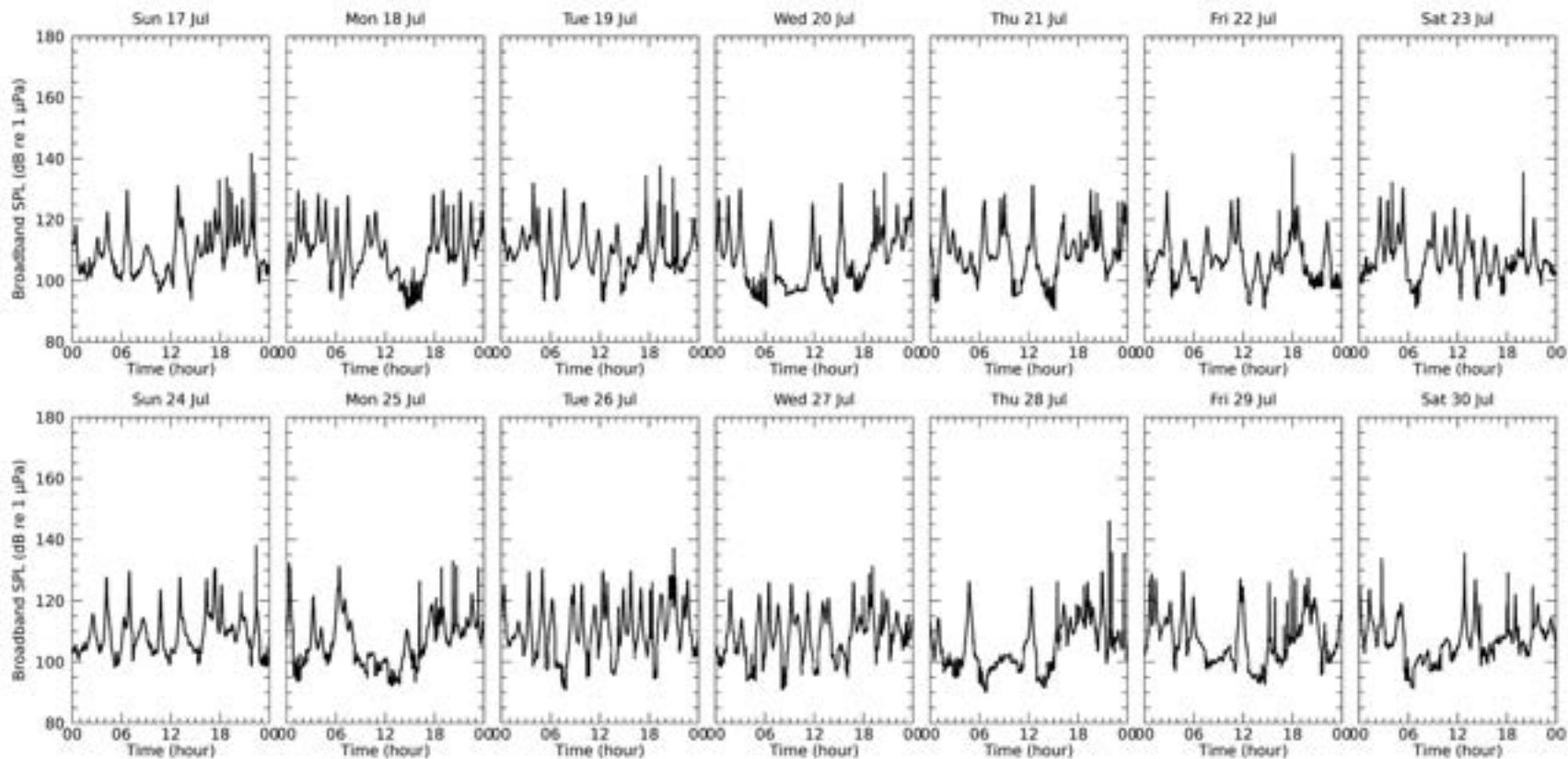
Model animation



Modelling results

Modelling of existing and future ship noise scenarios

Sound levels at Lime Kiln

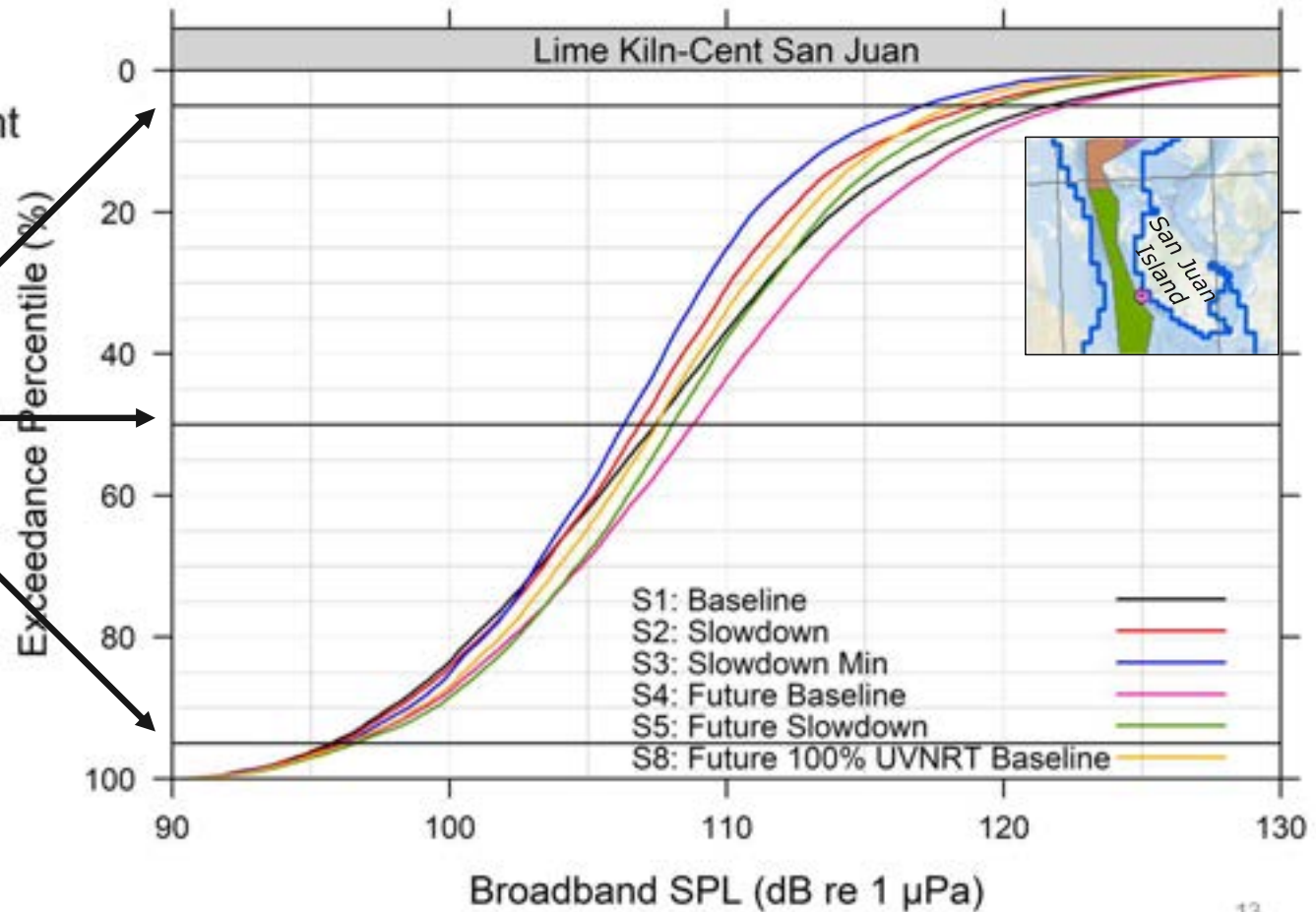


SPL versus time at Lime Kiln receiver (S1: Baseline)

Modelling of existing and future ship noise scenarios Exceedance levels at Lime Kiln

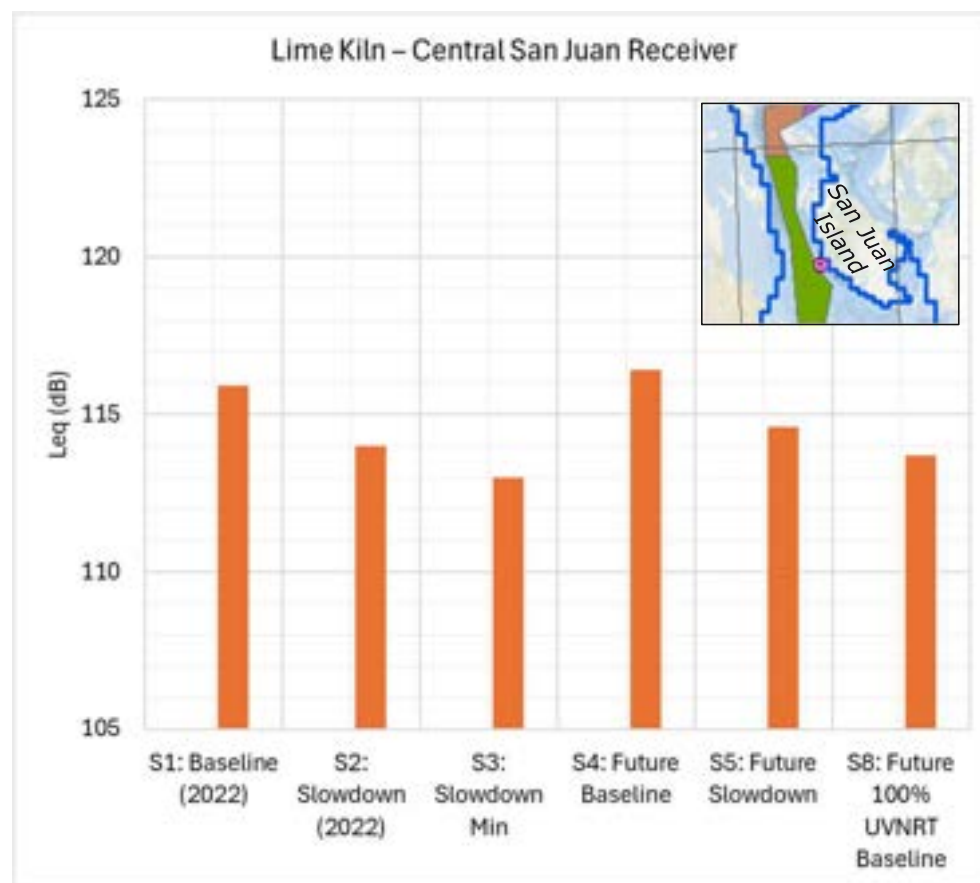
- Exceedance percentiles represent time above SPL

Exceedance Percentile	Description	SPL (dB) (S1: Baseline)
5% (L_5)	Loudest	121.6
50% (L_{50})	Median	107.4
95% (L_{95})	Quietest	95.7



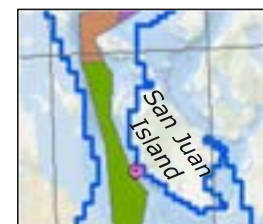
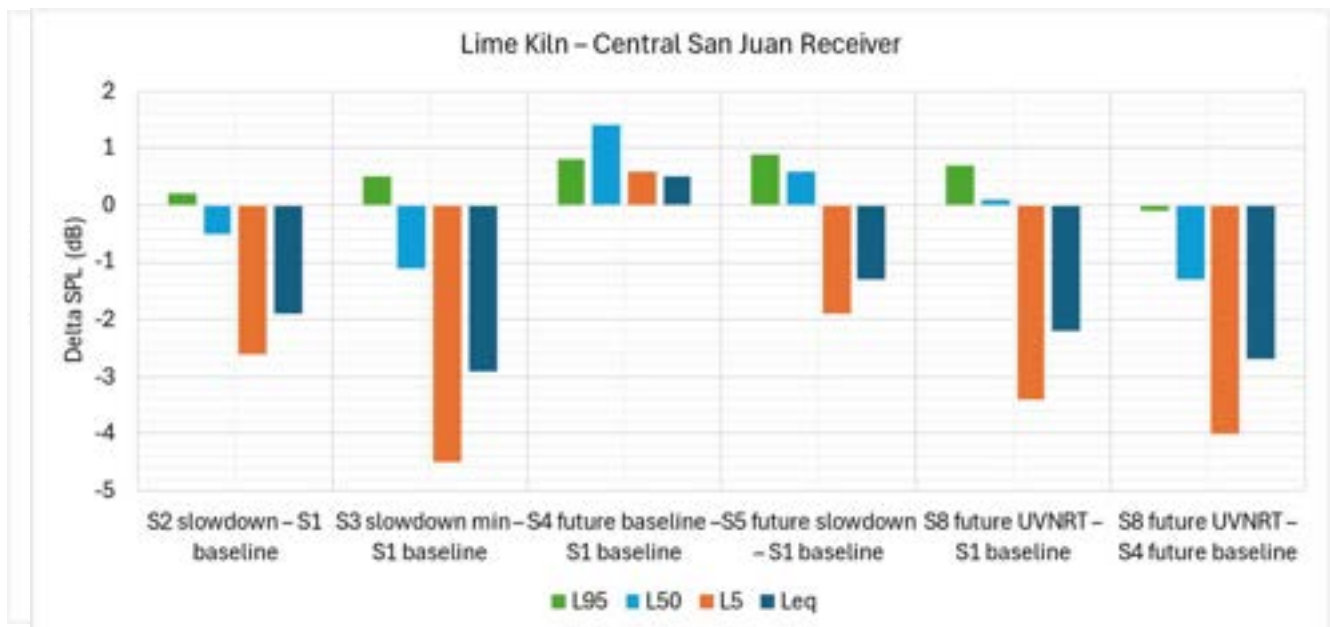
Modelling of existing and future ship noise scenarios Leq results at Lime Kiln

- Leq is “time-averaged equivalent SPL”
- Leq is proportional to **total sound energy over 14-day duration**
- Leq is useful because sound energy from different sources is additive (i.e., it can represent a noise “budget”)
- A reduction in Leq is associated with a reduction in overall sound emissions



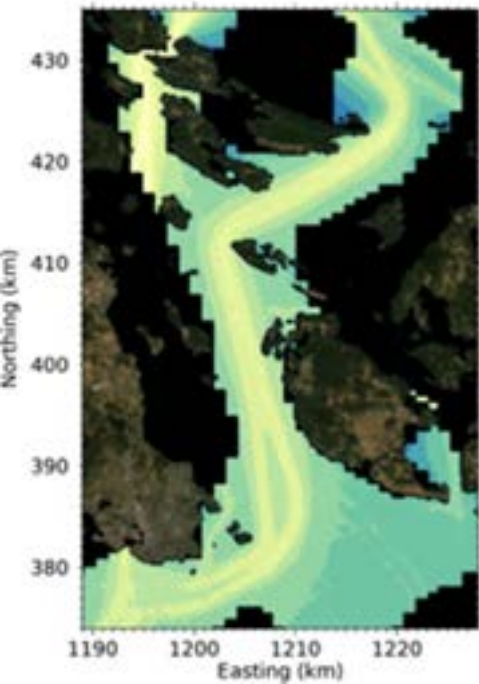
Modelling of existing and future ship noise scenarios

Scenario deltas at Lime Kiln

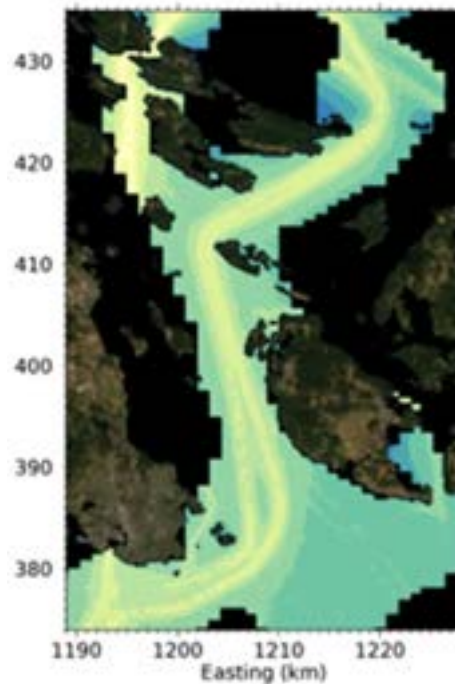


Modelling of existing and future ship noise scenarios Leq Maps

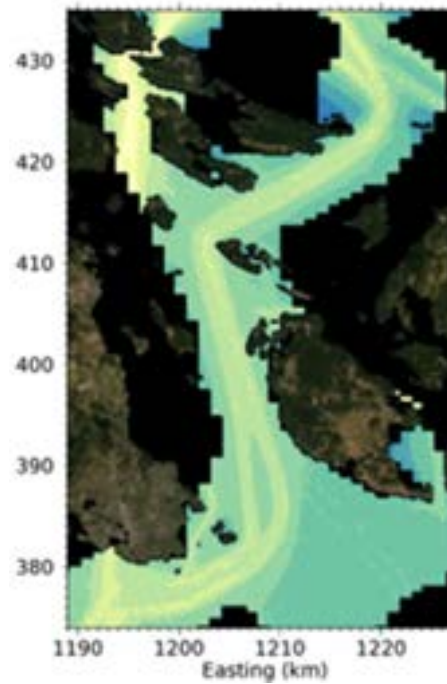
S1 Baseline



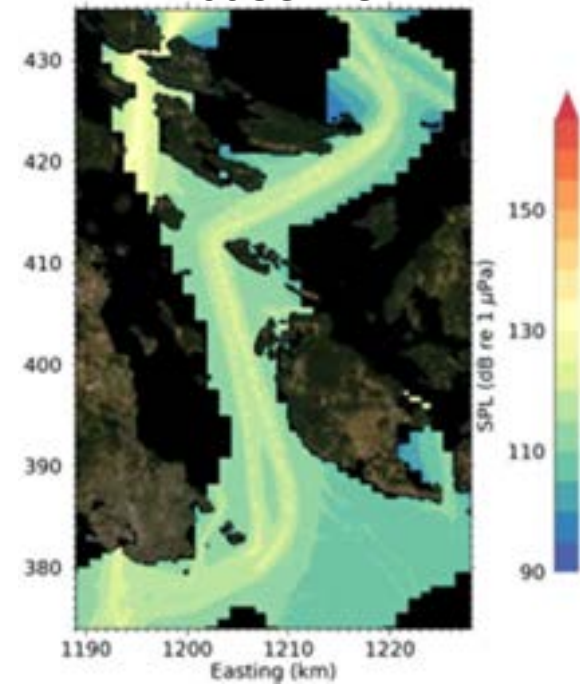
S2 Slowdown



S3 Slowdown min



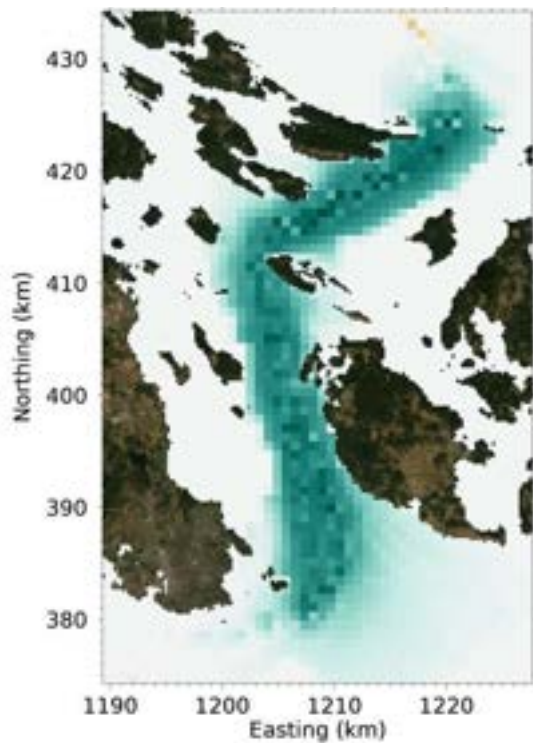
S8 Future UVNRT
baseline



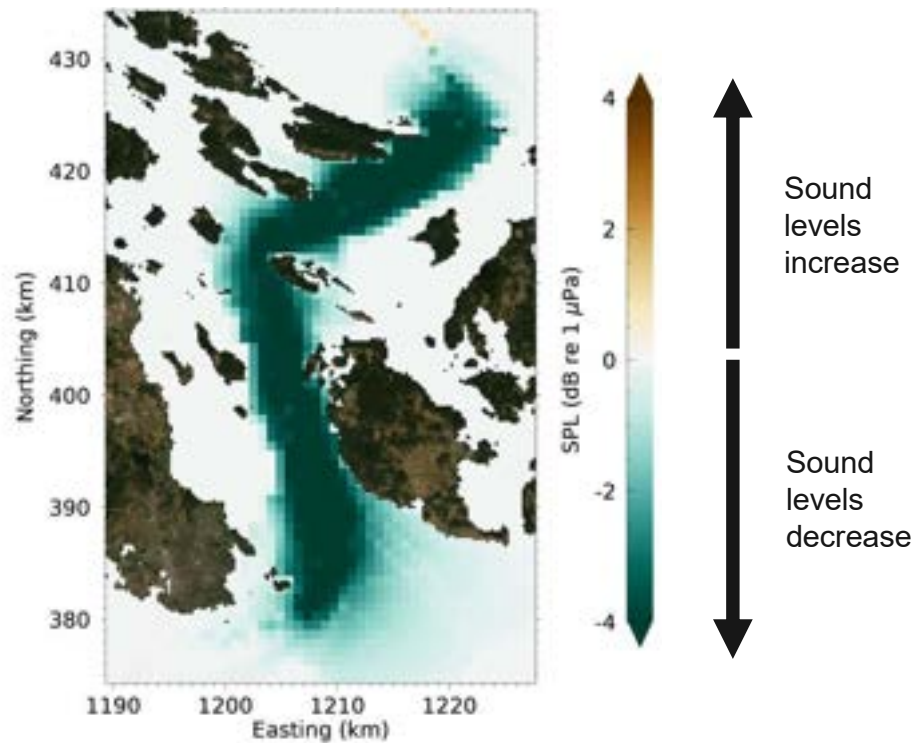
Modelling of existing and future ship noise scenarios

Leq differences

S2 Slowdown – S1 Baseline



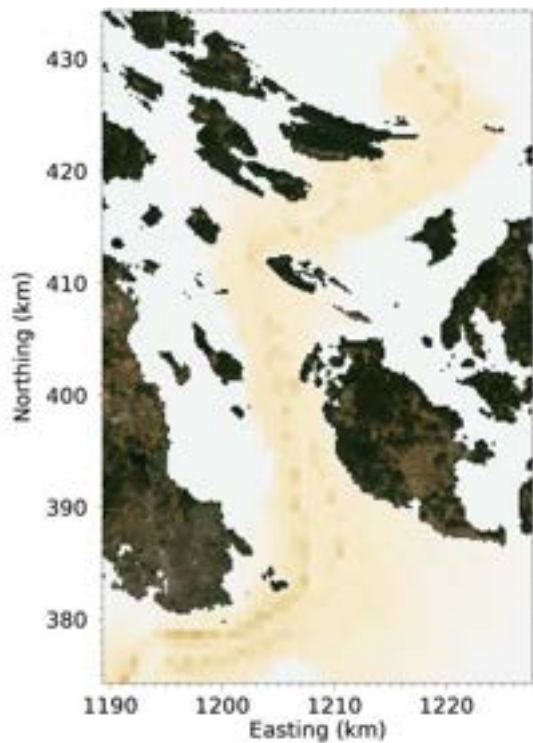
S3 Slowdown min – S1 Baseline



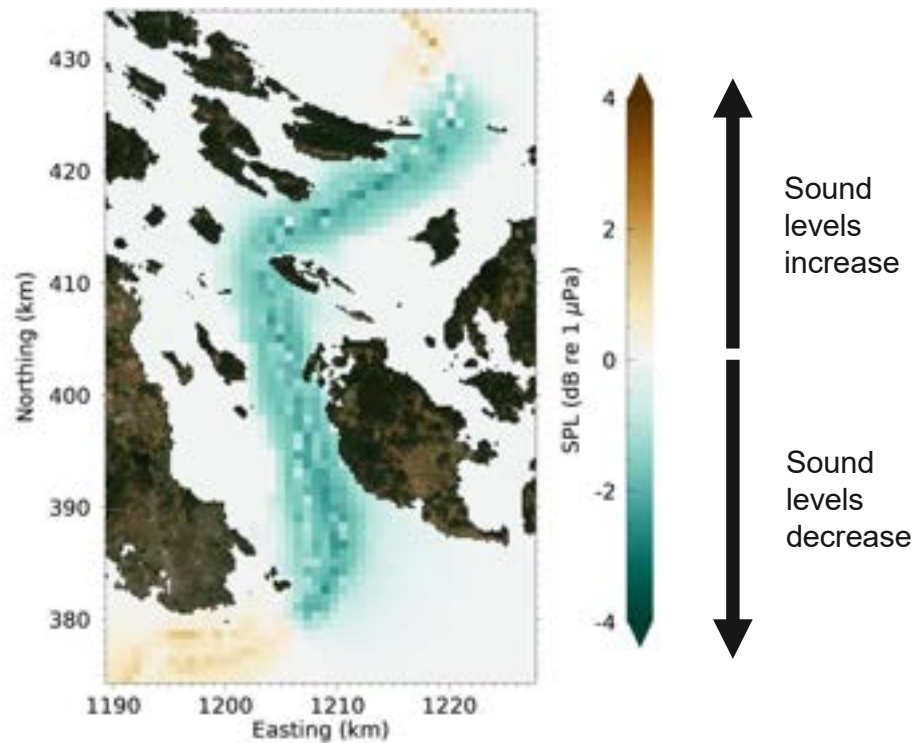
Modelling of existing and future ship noise scenarios

Leq differences

S4 Future baseline – S1 Baseline



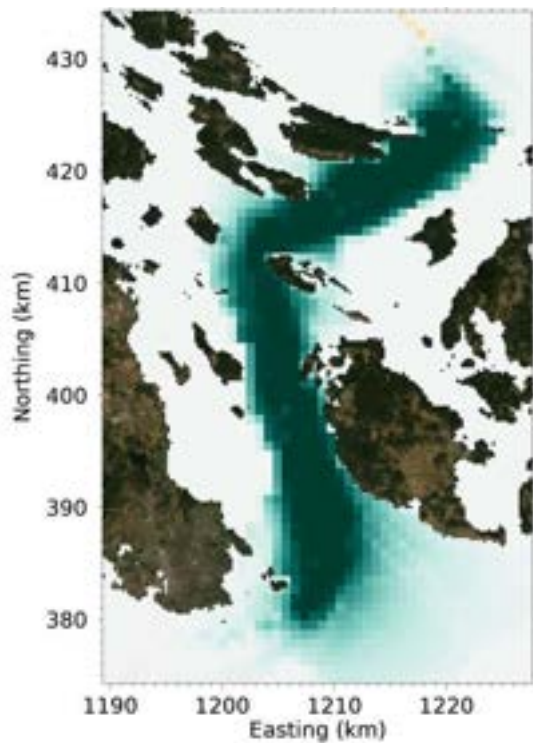
S5 Future slowdown – S1 Baseline



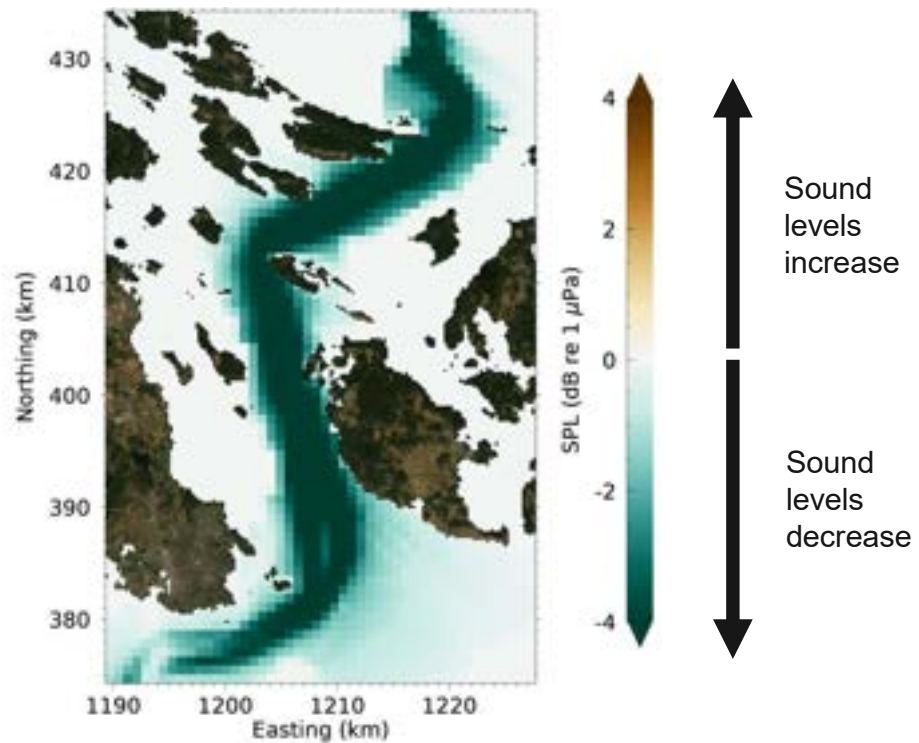
Modelling of existing and future ship noise scenarios

Leq differences

S3 Slowdown min – S1 Baseline



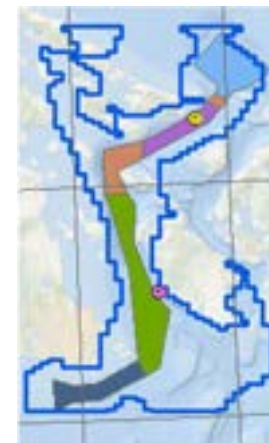
S8 Future UVNRT – S4 Future baseline



Modelling of existing and future ship noise scenarios

Modelling results over the SRKW core habitat

Exceedance Percentile	S1: Baseline (2022)	S2: Slowdown (2022)	S3: Slowdown Min	S4: Future Baseline	S5: Future Slowdown	S8: Future 100% UVNRT Baseline
5%	121.0	119.8	119.2	121.8	120.6	119.4
25%	111.4	110.6	110.2	112.2	111.6	111.0
50%	106.0	105.6	105.4	107.0	106.6	106.2
75%	99.6	99.8	99.6	100.8	100.8	100.2
95%	93.0	93.0	93.2	93.2	93.4	93.2
L_{eq}	119.7	118.7	118.2	120.1	119.1	118.2



Modelling of existing and future ship noise scenarios

Modelling results summary

Key findings

- Additional TMEP traffic increases overall noise through SRKW core habitat, as expected
- Increased traffic due to TMEP reduces but does not negate benefits of slowdowns
- All traffic slowing to 11 knots provides most acoustic benefit considering existing vessel type, composition and slowdown participation rates
- 100% of vessels meeting UVNRT targets in future will have similar benefits to 11 knot slowdown, benefits seen even outside slowdown area and year-round
- Most acoustic benefit observed in and proximate to shipping lanes
- When statistics done over SRKW core habitat, acoustic benefit is lessened as habitat area includes places acoustically shaded from shipping lanes

Full technical report available upon request to ECHO@portvancouver.com

Modelling of existing and future ship noise scenarios

Summary and next steps

Phase II includes evaluating potential effects to SRKW

- Refining area to exclude acoustically shaded parts of habitat
- Evaluating against animal-based metrics such as:
 - Time above a specific sound pressure level (SPL) important to SRKW*
 - Area above a specific SPL important to SRKW*
 - Changes in available communication and echolocation space (masking, quiet times etc.)

* An SKRW-specific SPL of effects is not yet defined



Questions?



Photo credit: Olivia Murphy

Appendix C

Information concerning measures listed in Order Declining to make an Emergency Order for the protection of the Killer Whale Northeast Pacific Southern Resident Population, SI/2018-102

Prepared by: Misty MacDuffee, Raincoast Conservation Foundation; Michael Jasny, Natural Resources Defense Council; Hussein Alidina, World Wildlife Fund Canada

Some of the “measures” cannot be equivalent measures because they do not themselves require things that protect, or prohibit things that harm, the Southern Residents or their critical habitat:

- Recovery Strategy for the Northern and Southern Resident Killer Whales (*Orcinus orca*) in Canada¹: The Recovery Strategy identifies the area and attributes of critical habitat, so that the prohibition in s. 58(1) of SARA (addressed below) applies. It identifies the main threats to the Southern Residents, and sets out a recovery goal for the species. However, critical habitat continues to be degraded and destroyed, threats to the Southern Residents continue to worsen, and the Southern Residents are on a path to extinction, not recovery.
- Action Plan for the Northern and Southern Resident Killer Whale (*Orcinus orca*) in Canada²: The Action Plan sets out a broad plan for actions to implement the Recovery Strategy but does not create corresponding obligations to carry out the actions.
- Multi-species Action Plan for Gulf Islands National Park Reserve of Canada³: This document does not add any actions for the Southern Residents.
- Conservation agreements or memoranda of understanding with key stakeholder groups on vessel noise mitigation measures to formalize and expand on voluntary measures: The multi-party Conservation Agreement does not itself create measures or require any measures, it simply documents parties’ intentions to continue voluntary efforts. It also allows for parties to exit the agreement.⁴
- Seeking of new expanded legislative authorities under the *Canada Shipping Act, 2001* to regulate the impacts of vessels on the marine environment: This was implemented in the new s.10.1, which allows the Minister of Transport to make interim orders related to the

¹ Fisheries and Oceans Canada, 2018, *Recovery Strategy for the Northern and Southern Resident Killer Whales (Orcinus orca) in Canada, Species at Risk Act Recovery Strategy Series*, Ottawa.

² Fisheries and Oceans Canada, 2017, *Action Plan for the Northern and Southern Resident Killer Whales (Orcinus orca) in Canada, Species at Risk Act Action Plan Series*, Ottawa.

³ Fisheries and Oceans Canada, 2018, *Multi-species Action Plan for Gulf Islands National Park Reserve of Canada, Species at Risk Act Action Plan Series*, Ottawa.

⁴ A Species at Risk Act section 11 conservation agreement to support the recovery of the Southern Resident Killer Whale, (10 May 2019) online: <https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/conservation-agreements/southern-resident-killer-whale-2019.html>. A 2024 renewal of the conservation agreement was announced on June 3, 2024 but it has not been posted to the Species at Risk Act Public Registry: Transport Canada, News release, “Government of Canada announces new measures and funding to protect Southern Resident killer whales” (3 June 2024), online: <https://www.canada.ca/en/transport-canada/news/2024/06/government-of-canada-announces-new-measures-and-funding-to-protect-southern-resident-killer-whales.html>.

marine environment.⁵ However, a tool to create measures that prohibit or require actions is not itself a measure that prohibits or requires actions.

- Development of noise management plans with industry for quieting the marine environment: According to a Transport Canada webpage, noise management plans are voluntary.⁶ As noted below, this measure also has not been implemented thus far.
- The “measures” related to research or gathering baseline data do not require or prohibit anything and therefore are not measures.

Some measures purport to prohibit certain actions but are not preventing them in practice:

- Section 32 of SARA, which prohibits harm, harassment, and killing of Southern Residents, enables rare prosecutions of individuals who contravene s. 32, but fails to address Government of Canada action and inaction. In spite of this provision, the Southern continue to be harmed by inadequate Chinook salmon prey and vessel noise, harassed by vessels, and killed, both directly by vessel strikes and cumulatively by a combination of inadequate prey, excessive acoustic and physical disturbance, and environmental contamination.
- Section 58(1) of SARA and the Critical Habitats of the Northeast Pacific Southern Resident Population Order legally prohibit critical habitat being destroyed. However, critical habitat continues to be destroyed by the cumulative effects of underwater noise, lack of Chinook salmon availability, and marine contamination, from ongoing and increasing development and other human activity. The prohibition fails to address Government of Canada action and inaction.

Other measures have not been implemented, or not been fully implemented, thus far:

- Proposal to extend existing requirements for automatic identification systems to smaller commercial vessels to improve safety and collision avoidance while also strengthening the ability of government to better target dynamic management measures based on traffic density: The Petitioners are not aware of any dynamic management measures that have since been taken for smaller vessels, at least not for purposes of Southern Resident protection. In addition, the vast majority of smaller vessels are not mandated to have automatic identification systems (AIS). This renders measures directed toward these vessels such as the speed restricted zones as unable to be monitored or assessed for their effectiveness.
- Improvements to whale detection tools and alerting procedures: The government has alerting procedures to some degree, through its Whale Desk. Information flowing through its Whale Desk has not yet been passed along to mariners (the Petitioners believe this is still in progress) but is made available to BC Ferries, in support of their dynamic management system for the Southern Residents. The government did improve whale

⁵ *Canada Shipping Act, 2001*, SC 2001, C 26 at s. 10.1(1).

⁶ Transport Canada, “Whales Initiative: Protecting the Southern Resident Killer Whale”, online: <https://tc.canada.ca/en/initiatives/oceans-protection-plan/whales-initiative-protecting-southern-resident-killer-whale> (accessed 27 May 2024) [Whales Initiative].

detection by adding Southern Resident monitoring to its aerial vessel navigation overflights. The Petitioners do not know if these systems are actively used.

- Development of noise management plans with industry for quieting the marine environment: BC Ferries is the only fleet that has voluntarily adopted a noise management plan so far.⁷ Earlier this month, the government entered into the new Conservation Agreement for the Southern Residents referenced above that includes, in its first year, work towards “a regional pilot project in underwater noise management planning as defined by [recent International Maritime Organization (IMO) guidelines].”⁸
- Reductions in total fishery removals for Chinook salmon: As the graph below, prepared by Raincoast Conservation Foundation, illustrates, retained catch and total mortalities of Chinook salmon have increased since 2018. Salmon fishing in critical habitat remains significant, and catches of Chinook salmon remain high enough to be of concern to at risk Chinook stocks while also not attempting to increase availability of Chinook prey for Southern Residents.

⁷ Whales Initiative.

⁸ See IMO, Revised guidelines for the reduction of underwater radiated noise from shipping to address adverse impacts on marine life (2023) (MEPC.1/Circ.906), online:

[https://www.wcdn.imo.org/localresources/en/Documents/MEPC.1-Circ.906%20-%20Revised%20Guidelines%20For%20The%20Reduction%20Of%20Underwater%20Radiated%20NoiseFrom%20Shipping%20To%20Address...%20\(Secretariat\).pdf](https://www.wcdn.imo.org/localresources/en/Documents/MEPC.1-Circ.906%20-%20Revised%20Guidelines%20For%20The%20Reduction%20Of%20Underwater%20Radiated%20NoiseFrom%20Shipping%20To%20Address...%20(Secretariat).pdf) .

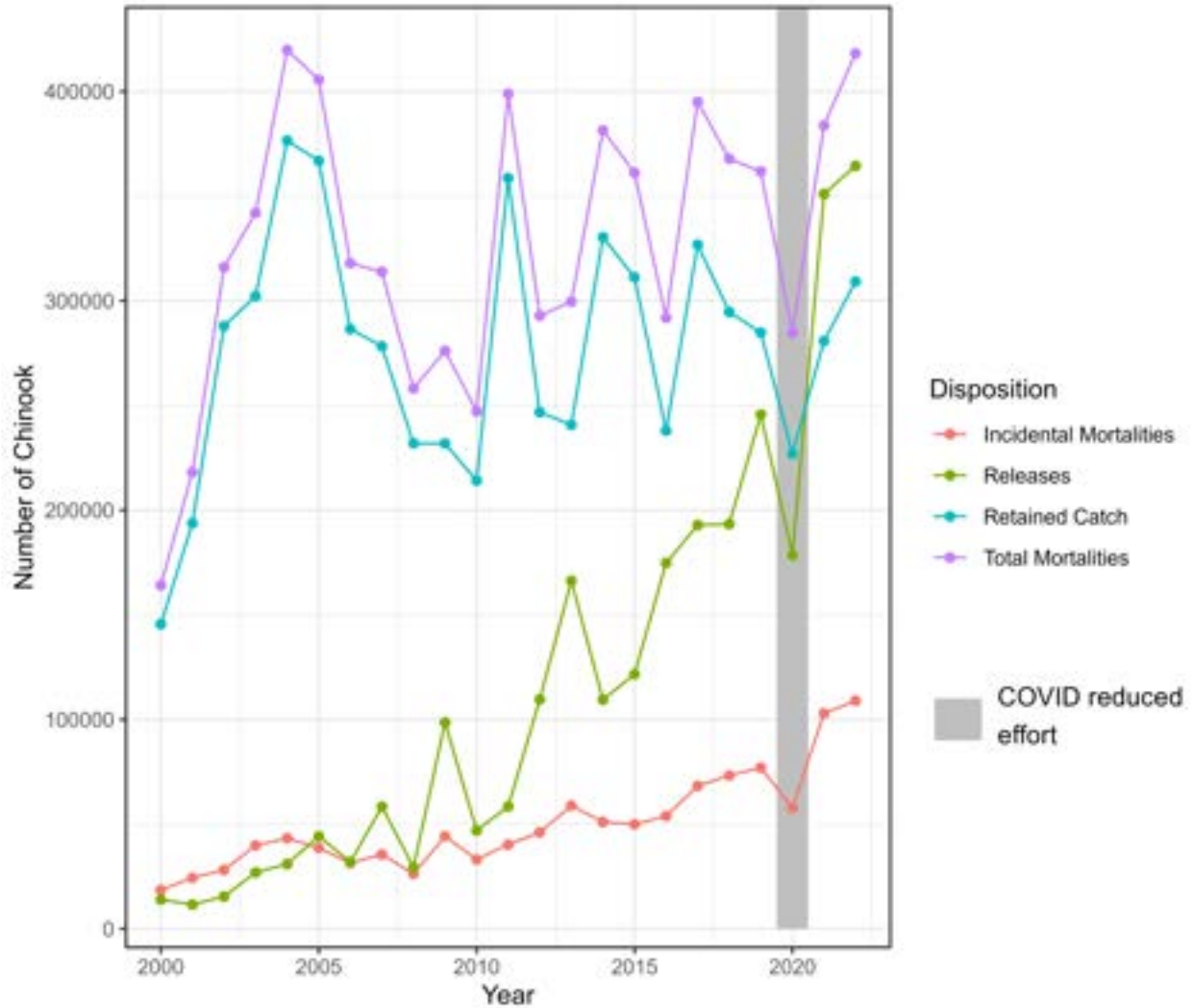


Figure 1. Components of Chinook salmon harvest in all marine (i.e. not Fraser River) fisheries (commercial, sport and First Nations) in Fisheries and Oceans Canada’s Southcoast Pacific region in years 2000-2022. Fisheries from the Fraser River are not included. Components of fisheries harvest include retained (landed) catch (light blue), sub-legal and super-legal Chinook released in compliance with minimum and maximum slot limits (green), and PSC Incidental Mortality (orange) calculated on released and escaped Chinook that die from injury, stress, or predation due to temporary capture. Total mortality (purple) is the sum of all fish that die from encountering the fishery; it is the sum of retained catch and Incidental Mortality. The vertical grey shading in 2020 indicates constraints during COVID-19 measures that temporarily reduced fisheries. Since 2010, there has been no overall decline in Chinook harvest. Total mortalities since 2010 fluctuated between 250,000 and 400,000 Chinook annually. Since 2010, releases have increased sevenfold to over 350,000 in 2022, resulting in substantially increased Incidental Mortality. Data source: The Pacific Salmon Commission’s Chinook Technical Committee.

Other measures are in place or ongoing but insufficient or even counterproductive:

- Amendments to the Marine Mammal Regulations, SOR/93-56 to establish 200 metres as the minimum approach distance for killer whales in all Canadian fisheries waters in the Pacific Ocean and British Columbia, which came into force on June 22, 2018, are insufficient, hence the 400m limit in the annual measures, and they do not apply to vessels in transit.
- Habitat restoration to increase Chinook productivity:
 - Habitat restoration has been occurring in important Chinook salmon habitats including places like the Fraser River and Vancouver Island estuaries. However, this progress has been far outstripped by the extensive loss of Chinook salmon habitat throughout other parts of these watersheds and elsewhere. Even within the Fraser River estuary, 70% of tidal marsh habitats are still lost or inaccessible to the juvenile salmon that rely on them.⁹
 - Logging of watersheds has strongly influenced the survival of salmon species that require year-round freshwater habitat (Chinook, sockeye, coho and steelhead). Increases in cumulative areas logged have been associated with a 97% or greater decline in freshwater productivity.¹⁰ Unsustainable land use activities from urban, industrial and agricultural development are routine throughout salmon watersheds and these activities reduce streamflow and increase water temperatures in the summer, and increase scouring and flooding in the winter, all of which reduce survival of salmon.
 - Unsustainable land use throughout the province is significantly compounding the effects of wildfires, floods, and droughts from climate change. These effects cause severe hydrological shifts in salmon streams through long-term reductions in snowpack, earlier spring melts, increased frequency of heat waves, atmospheric rivers and flood events, and increased drought frequency. These impacts create conditions unsuitable for wild salmon to recover and thrive.
- Aerial coverage of the Southern Residents and their critical habitat and increased enforcement capacity, for both the Marine Mammal Regulations and SARA:
 - As noted above, the Marine Mammal Regulation approach distances exempt vessels in transit, meaning that any increased enforcement would not apply to vessels in transit.
 - The government has added Southern Resident monitoring to its aerial vessel navigation overflights. However, enforcement capacity continues to be insufficient.
- Development of the Southern BC Chinook Strategic Planning Initiative to support the recovery and rebuilding of the Chinook salmon population: The southern BC Chinook

⁹ Finn, R. J. R., L. Chalifour, S. E. Gergel, S. G. Hinch, D. C. Scott, and T. G. Martin. 2021. Quantifying lost and inaccessible habitat for Pacific salmon in Canada's Lower Fraser River. *Ecosphere* 12(7):e03646. 10.1002/ecs2.3646.

¹⁰ Wilson, K. L., Bailey, C. J., Davies, T. D., & Moore, J. W. (2021). Marine and freshwater regime changes impact a community of migratory Pacific salmonids in decline. *Global Change Biology*, 00, 1–14. <https://doi.org/10.1111/gcb.15895>.

Strategic Planning Initiative ended and though some actions were taken to reduce Chinook harvest starting in 2018, there has not been a coordinated effort to implement recovery and rebuilding plans for Committee on the Status of Endangered Wildlife in Canada (COSEWIC) listed Chinook salmon populations. Even under other initiatives such as the Pacific Salmon Strategy Initiative or rebuilding plans under the Strategic Planning Framework of the Fisheries Act, no rebuilding plans for Chinook salmon are in place. At the current pace, it will be more than a decade before rebuilding plans are in place for stocks of concern.

- Finalization of a renegotiated Chinook chapter of the Pacific Salmon Treaty: This has been completed with some nominal reductions in Chinook harvest. The treaty remains a key driver for ongoing marine harvest of Chinook salmon at levels unsustainable for a range of threatened and endangered populations needed by the Southern Residents. The treaty also fails to address the declining size and loss of historic run timing of Chinook.
- Increased hatchery production: The decision to enhance Lower Fraser fall run-timing Chinook salmon was made with no assessment of the implications of the addition of one million Chinook juveniles on the Fraser Estuary rearing capacity, the estuary's declining quantity and quality as a rearing environment, or competition with wild fry from the Harrison River or elsewhere, or the benefit from more fall Chinook to Southern Resident killer whales. Scientific and fishery management concerns flag the potential negative hatchery-wild fish ecological interactions, outcomes, issues and risks associated with this action to Harrison Chinook. Analysis undertaken by Fisheries and Oceans Canada on the relationship between hatchery production and Chinook survival shows a density-dependent pattern of decreasing survival in the Harrison Chinook as hatchery production in the Lower Fraser increases. They found a significant negative relationship between the survival of age 2 Harrison River Chinook smolts and hatchery production in the Lower Fraser. Other concerns include the marginal benefits to Southern Resident killer whales provided by more fall Chinook given their abundance and low fat content relative to high priority Chinook salmon from the middle and upper portions of the Fraser River watershed.

Finally, the status of the following measures is unknown to the petitioners:

- Regulatory measures governing the release of deleterious or toxic substances under the Metal and Diamond Mining Effluent Regulations, the Pulp and Paper Effluent Regulations, the Wastewater Systems Effluent Regulations and the Prohibition of Certain Toxic Substances Regulations, 2012
- Strengthening of regulatory controls for five persistent organic pollutants, including two flame retardants (polybrominated diphenyl ethers (PBDEs) and hexabromocyclododecane (HBCD)) and three oil and water repellents (perfluorooctane sulfonate and its salts and precursors (PFOS), perfluorooctanoic acids and its salts and precursors (PFOA) and long chain perfluorocarboxylic acids and their salts and precursors (LC-PFCAs)), as outlined in a notice of intent published in October 2018, with publication of the proposed regulatory amendments in Part I of the Canada Gazette anticipated for winter 2020, subject to consultations

- Upgrades to wastewater treatment with the construction in Victoria and Vancouver of two new wastewater treatment plants expected to be operational by January 1, 2021 and a third in Vancouver expected to be operational by January 1, 2031

Appendix D

Information concerning measures listed in *Order Declining to make an Emergency Order for the Protection of the Killer Whale Northeast Pacific Southern Resident Population, SI/2018-102*

ECHO Modelling of Existing and Potential Future Ship Noise Scenarios

Haro Strait and Boundary Pass Slowdown Areas

JASCO Applied Sciences (Canada) Ltd

11 December 2023

Submitted to:

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Contract 23-0220

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P001776-001
Document 03246
Version 2.0

Suggested citation:

Stothart, F.M.C., L. Zizheng, and A. O. MacGillivray. 2023. ECHO Modelling of Existing and Potential Future Ship Noise Scenarios: Haro Strait and Boundary Pass Slowdown Areas. Document 03246, Version 2.0. Technical report by JASCO Applied Sciences for Vancouver Fraser Port Authority.

Report approved by:

<i>Version</i>	<i>Role</i>	<i>Name</i>	<i>Date</i>
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1. Introduction

The Enhancing Cetacean Habitat and Observation (ECHO) Program is a multi-stakeholder initiative, led by the Vancouver Fraser Port Authority. The program exists with the goal of reducing the impacts of shipping on whales within the waters surrounding Vancouver, British Columbia. To this end, since 2017 the ECHO program has facilitated voluntary seasonal vessel slowdowns with the goal of reducing anthropogenic vessel traffic noise in Southern Resident Killer Whale (SRKW) critical habitat. Underwater noise from vessel traffic can affect SRKW and their habitats in several ways, including changes to behaviour in the presence of noise and masking of important acoustic signals used for communicating and foraging.

During 2017–2020, a probabilistic SRKW-noise exposure model, focusing on behavioural response and echolocation click masking, was used to assess the efficacy of seasonal slowdowns (Joy et al. 2019, Joy et al. 2020, Gryba et al. 2021). In 2021, a new approach based on the concept of acoustic listening space was employed to examine auditory masking due to vessel traffic in two frequency bands relevant to SRKW communication and echolocation. The new approach demonstrated that voluntary slowdowns successfully reduced lost listening and echolocation space due to vessel noise (JASCO and SMRU 2021). Following this work, a new expanded study was undertaken for 2022 using a cumulative vessel noise model with an increased simulation period of 2 weeks compared to previous periods of 24 hours, with analysis focused on newly updated SRKW habitat preference maps (JASCO and SMRU 2023).

The current study aims to expand upon the 2022 work by analyzing cumulative vessel noise in the Haro Strait and Boundary Pass slowdown areas under six new scenarios representing possible present and future traffic conditions. The six new scenarios evaluate potential changes in underwater noise in SRKW core habitat due to anticipated increases in oil tanker and escort tug traffic, the effectiveness of future slowdowns, and the potential implementation of Underwater Vessel Noise Reduction Targets (UVNRT) (Table 1). Analysis of the modelling results was confined to the composite area constituting the intersection of the previously modelled SRKW focus area for Haro Strait and Boundary Pass and areas with greater than 70% intensity of SRKW occurrence (Thornton et al. 2022), referred to in this report as the SRKW core habitat.

The effects of each of the different scenarios is presented as analysis of broadband sound pressure level (SPL) over time, maps of exceedance percentile levels within the SRKW core habitat area, and maps of delta differences in percentile exceedance levels from baseline (i.e., 2022 no slowdown). Section 2 of this report details the methods used to model vessel traffic for each scenario, Section 3 presents the most significant results, and Section 4 discusses the results and offers context for their interpretation.

Table 1. Existing and potential future vessel traffic modelling scenarios.

Scenario number	Scenario name	Description
1	Baseline	Baseline 2022 Haro-Boundary traffic conditions for 2-week period at typical vessel speeds
2	ECHO S2022	2022 slowdown speeds and participation percents
3	ECHO SMin	2022 participation percents with all vessels transiting at 11 knots
4	Future 1B	Baseline scenario with addition of anticipated increase in number of TMEP tankers with tug escort
5	Future 1S	Future 1B scenario but vessels follow 2022 participation percents and speeds
6	Future 2B	Future 1B scenario but 50% of vessels meet UVNRT targets (by category) under typical vessel speeds
7	Future 2S	Future 2B scenario but vessels meeting UVNRT targets do not participate in slowdown (i.e., maintain typical vessel speeds during slowdown); vessels not meeting UVNRT targets participate in slowdown
8	Future 3B	Future 1B scenario but 100% of vessels meet UVNRT targets (by category) under typical vessel speeds

2. Methods

Underwater sound levels from vessels and wind-driven ambient for the study eight scenarios were calculated using JASCO's Acoustic Real-Time Exposure Model Incorporating Ambient (ARTEMIA) model. The model simulations were based on 2022 vessel traffic conditions in Haro Strait and Boundary Pass. The main output of the model was a collection of 1-minute snapshots of SPL over time within the study area. Sound levels produced by the model were then analyzed within the SRKW core habitat area and at two sample receivers, one in Boundary Pass and one in Haro Strait, to compute maps and sound level statistics. Model results were compared to the baseline scenario to assess changes in sound levels associated with the different model scenarios.

2.1. ARTEMIA Model

JASCO's ARTEMIA is a cumulative noise exposure and noise mapping model that accurately simulates underwater sound levels generated by large ensembles of vessels (and other marine sound sources) on a regional scale. The model combines information from several sources, including vessel tracks (e.g., via AIS), vessel source levels, meteorological, and environmental data to predict underwater environmental noise originating from ship traffic and ambient sources.

The underwater sound from each vessel is determined according to a set of mean source level curves for 15 categories of vessels in conjunction with pre-computed propagation loss curves for the study area (MacGillivray et al. 2018). The mean source level curves are based on a large database of vessel source levels collected by the ECHO Program and are adjusted according to vessel transit speed (MacGillivray et al. 2019). To simulate time-dependent sound levels, ARTEMIA represents the study area on a computational grid, using either projected or geographic coordinates. When run in time-lapse mode, the model generates sequences of 2-dimensional (2-D) maps, or snapshots, of the dynamic sound field, yielding sound pressure level (SPL) as a function of easting (x), northing (y), frequency, and time. All model calculations are frequency dependent. The modelled frequency range for the current study was 10 to 64,000 Hz in decade frequency bands.

ARTEMIA was used to calculate underwater sound level contributions from vessels and ambient sources at a temporal resolution of 1-minute, during a simulated 14-day period in the ECHO Haro Strait and Boundary Pass slowdown area. The computational grid in this study employed a BC Albers coordinate reference system, with a 200 × 200 m spatial resolution. This acoustic model was used previously to analyze the benefits of slowdowns in terms of vessel noise levels and lost foraging time over a 24-hour period (Joy et al. 2019), and to assess impacts to available listening space and available echolocation space in SRKW core habitat under baseline and slowdown vessel speed conditions (JASCO and SMRU 2023).

2.2. Model Area

The model area includes the entirety of the Haro Strait and Boundary Pass 2022 slowdown areas, plus a buffer area to account for noise from vessel traffic adjacent to the slowdown zones (Figure 1). The model area is identical to the one assessed for the 2019–2021 SRKW-noise exposure model (e.g., (JASCO Applied Sciences and SMRU Consulting 2020) and the 2022 acoustic listening space analysis (JASCO and SMRU 2023). There are two slowdown zones, one in Boundary Pass and one in Haro Strait, each with a transition zone within which participating vessels reduce speed. During 2022, vessels within these slowdown zones were requested to restrict their speeds to the following limits from June to October 2022:

- 14.5 knots through water for Container, Vehicle carrier, and Passenger (cruise) ships, and
- 11 knots through water for Bulk carrier, General cargo, and Tanker ships.

Actual transit speeds, both for participating and non-participating vessels, were logged during the 2022 slowdown period.

Within the modelled area is the smaller SRKW core habitat area used for analyzing the sound levels. The SRKW core habitat area is the intersection of two regions. The first is the focus area used in previous models to assess sound levels during previous vessel slowdowns. The second is a group of areas representing the 70% polygon of intensity of occurrence of SRKWs, defined as the expected number of SRKW sightings per unit search effort within the relevant period (Thornton et al. 2022).

The model includes simulated receivers at the locations of two long-term hydrophone monitoring stations, one in Boundary Pass (at the Underwater Listening Station) and the other in Haro Strait (at Lime Kiln). They are positioned to sample modelled levels throughout the modelling period at vital points for further analysis.

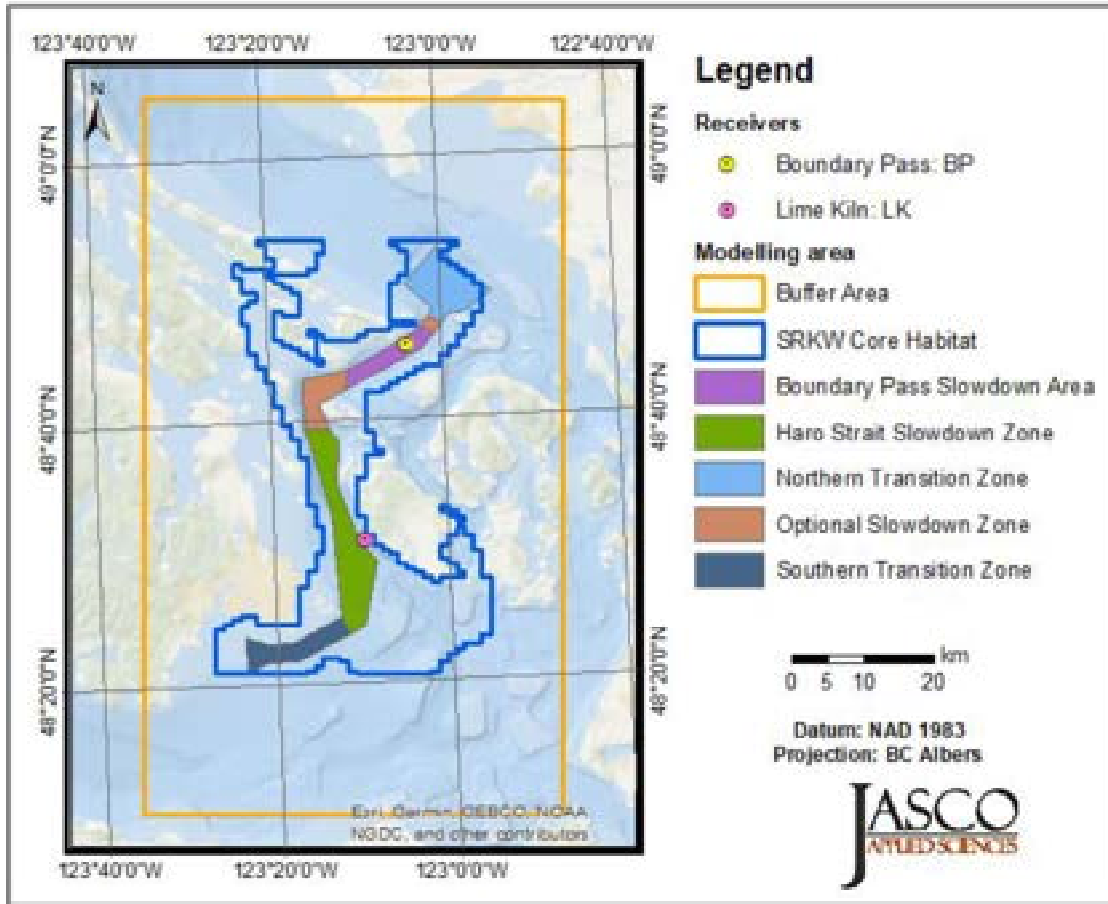


Figure 1. Map of the model area for the study and 2022 slowdown zones. The overall model area (orange) incorporates a substantial buffer to account for sound originating from vessels transiting outside the Southern Resident Killer Whale (SRKW) core habitat area used for analysis (blue).

2.3. Model Scenarios

This study investigated the effects of voluntary slowdowns on underwater sound using two weeks of simulated and historical vessel track data for the model area (see Figure 1). Two model scenarios, referred to as Baseline and ECHO Slowdown 2022 (ECHO S2022), respectively, were previously used to simulate vessel traffic conditions for the 2022 season for the purpose of acoustic listening space analysis (JASCO and SMRU 2023).

The Baseline and ECHO 2022 slowdown scenarios were once again used in this study for the sake of comparison, and the model follows the same methodology as the 2022 listening space analysis model. Note, however, that the vessel transit numbers were increased for the present study, following a review of the 2022 Pacific Pilotage Authority (PPA) records, which showed that the previous model underestimated the total number of vessel transits by approximately 20%. The Baseline scenario considered baseline conditions with no vessel slowdowns, and the ECHO S2022 scenario considered slowdown conditions according to actual participation rates and speeds observed during 2022. In both scenarios, movements of potential slowdown participants were simulated to reproduce actual vessel behaviour during 2022 and the number of slowdown transits in the model was chosen to match, as realistically as possible, the actual overall participation rate, subject to the restriction that the model must consider whole numbers of vessel movements. Potential participants included all piloted vessels in five categories that transited through the slowdown zones:

1. Bulker (including General cargo),
2. Containership,
3. Passenger (over 100 m),
4. Tanker, and
5. Vehicle Carrier.

For both model scenarios, the number of simulated vessels was based on trip data collected from the PPA during the 2022 season (Table 2).

In both scenarios, the time of departure and the choice of inbound or outbound route were randomly selected for each simulated vessel movement. The mean frequency of departure for each category was based on the average number of bi-weekly inbound and outbound transits logged by PPA during the 2022 slowdown. Total numbers of daily transits were the same for both scenarios. For each transit, vessel speeds were randomly drawn from actual data collected during the 2022 season, according to the following procedure:

- Speeds of participants were selected by randomly drawing from actual transits of participating vessels, recorded during the Slowdown period (Jun–Oct 2022), and applying their mean speed through water (STW) to the simulated vessel tracks in Haro Strait and Boundary Pass.
- Speeds of Baseline vessels and non-participants were selected by randomly drawing from actual STW data, recorded in Haro Strait and Boundary Pass during the Baseline period (April to May 2022), and applying them to the simulated vessel tracks.

Actual vessel transit data were grouped according to slowdown zone, vessel category, and transit direction (i.e., inbound versus outbound). Outside the slowdown zones, vessel speeds were set to mean speeds derived from historical AIS data. A minimum speed limit of 8.5 knots was applied to the simulated vessel tracks. Acceleration and deceleration times in the transition zones were assigned on a category-specific basis, in consultation with the BC Coast Pilots (MacGillivray et al. 2018). Participating vessels were assumed to maintain their slower speeds through the optional slowdown zone between Haro Strait and Boundary Pass, based on observed vessel behaviour during 2022. Each simulated trip was randomly displaced from the centre of the route to more realistically represent the observed distribution of traffic along the traffic routes.

Scenarios 3–8 build upon these two basic scenarios to explore the following other possible conditions:

- **Scenario 3**, ECHO SMin, expands the ECHO S2022 slowdown simulation by changing slowdown speeds. The same transit numbers and participation rates are used as in the ECHO S2022 simulation, but participant speeds in this scenario are not selected from actual transits of participating vessels. Instead, it is assumed that all participating vessels transiting through the slowdown area reduce speed to 11 knots for the entirety of the transit through the slowdown area before returning to regular transiting speeds upon exiting.
- **Scenario 4**, Future 1B, builds upon the 2022 Baseline. All methods and specifications of the 2022 baseline model were used, but the number of vessels transiting was altered to match expected increases in tanker traffic associated with the Trans Mountain Expansion Project (TMEP). It is expected that oil tankers transiting to the Port of Vancouver in the future will increase in number by a maximum of 29 round trips per month. In addition to the increase in oil tankers, tugs will be used to escort each of the laden outbound tankers south to the Strait of Juan de Fuca, passing through the Haro Strait and Boundary Pass slowdown zones. The tugboats will be stationed at Beecher Bay, west of Victoria, and will transit to Vancouver, through the inbound shipping lane, to collect the laden tankers prior to departure before returning south while escorting the tanker. For the 2 weeks modelled in this study 14 oil tankers inbound and 14 oil tankers outbound were added to the scenario. In addition, 14 inbound tugs which depart 12 hours prior to each added outbound tanker and 14 outbound tugs which travel with each added outbound tanker, were added to the simulation to simulate expected increases in tugboat traffic.
- **Scenario 5**, Future 1S, alters Future 1B to model voluntary vessel slowdowns with the increased traffic. All vessels other than the added tankers and tugboats follow the slowdown participation rates and speeds from the 2022 slowdown scenario. The added tankers are all expected to participate in slowdowns and are modelled with 100% participation, at speeds randomly drawn from 2022 slowdown participant speeds. Tugboats do not participate in voluntary vessel slowdowns, so the added tugboats transiting northbound through the slowdown regions were modelled following typical vessel speeds. Tugboats returning southbound escort laden oil tankers and were simulated to follow associated tanker speeds.
- **Scenario 6**, Future 2B, alters Future 1B such that 50% of all piloted vessels that transit the slowdown area have source levels that meet UVNRT sound level targets for their category (see Figure 5). All other variables of the simulation are unchanged.
- **Scenario 7**, Future 2S, modifies Future 2B so that the 50% of piloted vessels that do not meet UVNRT targets participate in the vessel slowdowns in Haro Strait and Boundary Pass. Speeds for the 50% of vessels that participate are randomly drawn from the 2022 slowdown transits.
- **Scenario 8**, Future 3B, alters Future 1B such that 100% of piloted vessels meet UVNRT sound level targets for their category. All other variables of the simulation are unchanged.

Table 2. Total simulated transits of potentially participating vessels in Haro Strait and Boundary Pass for 2022 Baseline and Slowdown model scenarios. Vessel transits per 14 days were derived from bi-weekly average PPA vessel counts.

Vessel category	Reported 2022 participation rate (%)	Northbound transits (ships per 14 days)			Southbound transits (ships per 14 days)		
		Non-Participant	Participant	Total	Non-Participant	Participant	Total
Bulker ¹	93	5	63	68	4	51	55
Car Carrier	86	1	6	7	1	6	7
Container	96	1	22	23	1	21	22
Passenger	96	0	3	3	0	5	5
Tanker	91	1	6	7	1	6	7
TMEP Tanker (S4-S8)	100	0	14	14	0	14	14
Escort Tug (S4-S8)	50	14	0	14	0	14	14
Total	n/a	22	114	136	7	117	124

¹ Includes both Bulk carriers and General cargo vessels.

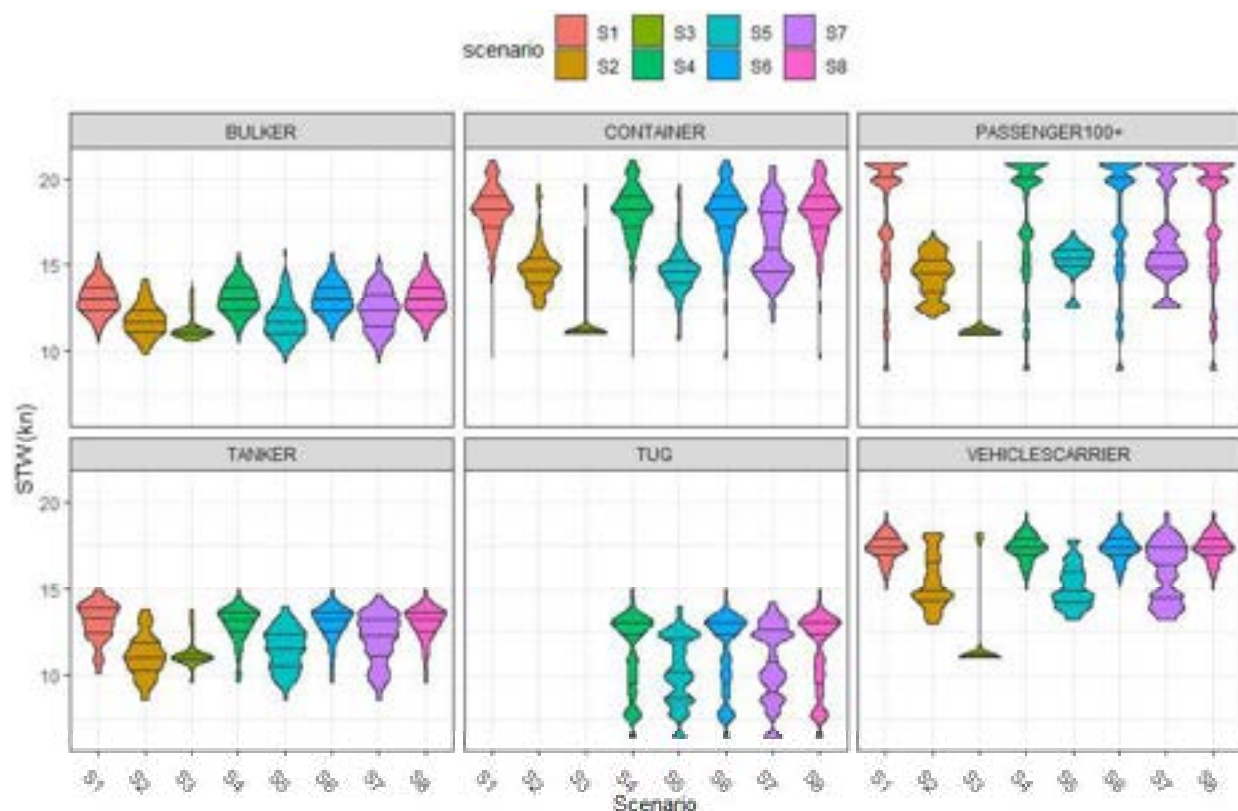


Figure 2. Violin plots showing empirical distributions of simulated STW by scenario and vessel category. Horizontal lines indicate the 25th, 50th, and 75th percentiles of the data. S1 = Baseline, S2 = Slowdown, S3 = Slowdown Min, S4 = Future Baseline, S5 = Future Slowdown, S6 = Future 50% UVNRT Baseline, S7 = Future 50% UVNRT Slowdown, S8 = Future 100% UVNRT Baseline.

Movements of vessels not affected by the voluntary slowdowns (i.e., vessels that were not potential participants, which include non-piloted vessels and piloted vessels bound to and from the USA not transiting the slowdown area) were simulated based on historical AIS data for the study area, previously obtained from MarineTraffic for 17–30 Jul 2015 (MacGillivray et al. 2018). This data set was previously used for the 2022 acoustic listening space analysis (JASCO and SMRU 2023), and it was assumed that the 2015 data set still accurately represents number and movements of vessels unaffected by the slowdown (see Figures 3 and 4. Further details of the data set can be found in the report for that study. The data set remained unchanged from the 2022 work for all modelled scenarios.

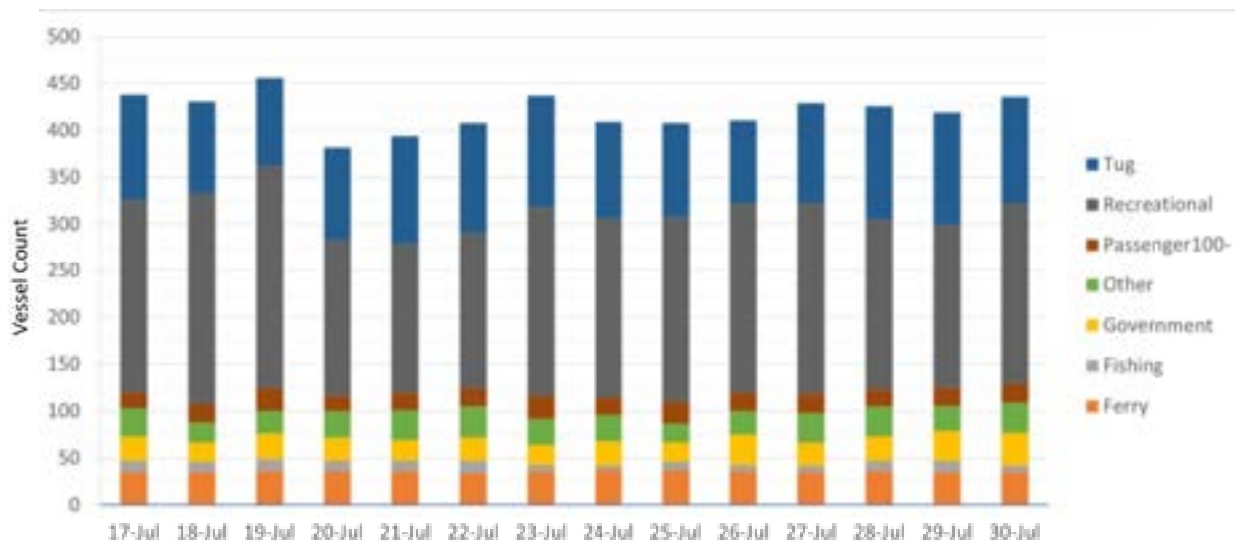


Figure 3. Unique vessels per day in the full model area (i.e., inside the buffer area, see Figure 1) for non-participating vessels from 17–30 Jul 2022, based on 2015 AIS data. This includes all unique MMSI numbers for vessels transiting inside the buffer area.

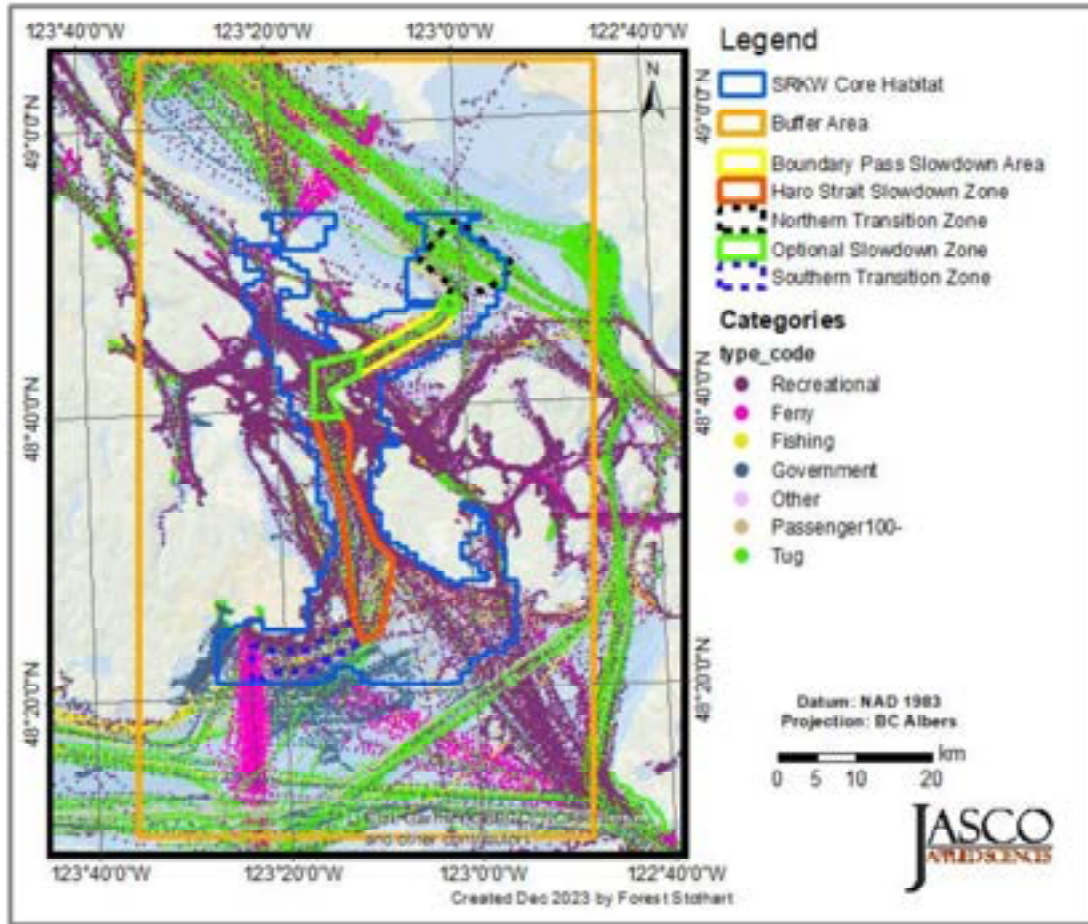


Figure 4. Non-participant vessel traffic included in the model, based on Automated Information System (AIS) vessel tracks for 17–30 Jul 2015. Each point on the map represents a time-stamped vessel position report.

2.4. Source Levels

The underwater sound from each vessel is determined according to a set of mean source level curves for 16 categories of vessels. The mean source level curves are based on measurements of vessel source levels collected by the ECHO Program that were adjusted according to vessel transit speed (MacGillivray et al. 2019). Source levels for vessel categories that do not participate in slowdowns (Figure 6) or those that are not modelled as meeting UVNRT targets are unmodified and are the same as those used in the 2022 slowdown acoustic listening space study. For modelling of Scenarios 6–8, it was necessary to modify the source levels of potential participant vessels to conform to UVNRT targets.

First, the UVNRT targets which are provided in terms of 1/3-octave-band radiated noise level (RNL), had to be converted to monopole source level (MSL; L_S). This calculation was performed using equations given by ISO standard 17208-2:

$$L_S = L_{RN} + \Delta L \quad (1)$$

$$\Delta L = -10 \log_{10} \left(\frac{2(kd_s)^4 + 14(kd_s)^2}{14 + 2(kd_s)^2 + (kd_s)^4} \right) dB \quad (2)$$

where $k = 2\pi f/c$ is the acoustic wavenumber in rad/m, f is the central frequency of the one 1/3-octave-band being converted (base 10) in Hz, c is the sound speed in water in m/s, and d_s is the nominal source depth from which the sound is considered to originate, in m.

For the conversion, the sound speed in water was taken to be 1500 m/s. The nominal source depth varies based on vessel class and was taken from the original source model.

The mean source level curves were then recomputed by taking the original gaussian distribution of source levels used for computation (MacGillivray et al. 2022) and generating a distribution of appropriate source levels that were then limited by the MSL UVNRT thresholds and used to recompute a mean source level (Figure 5).

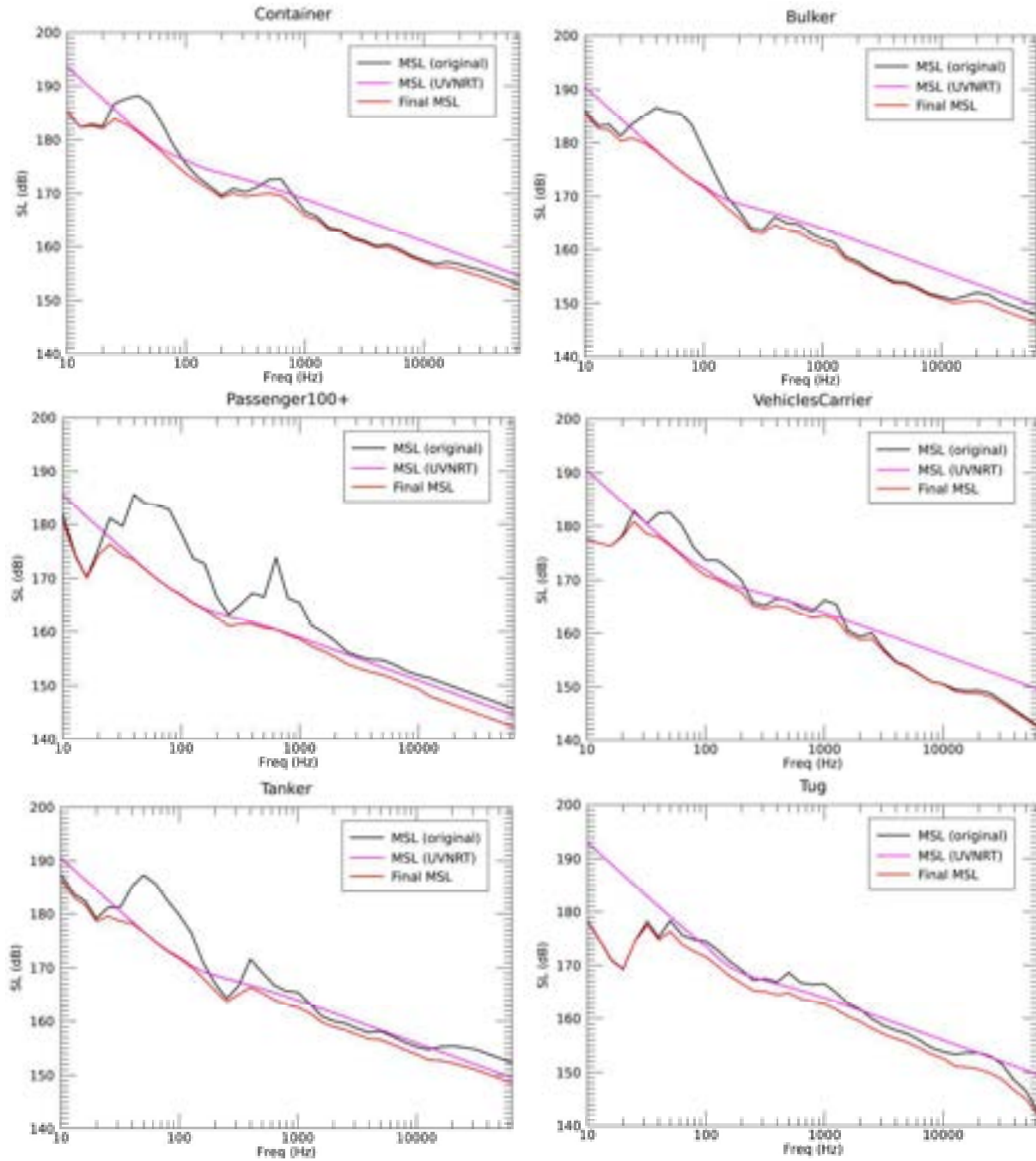


Figure 5. Comparison of original MSL for participant vessels, the associated UVNRT MSL, and the final modified MSL for the participant categories used for modelling.

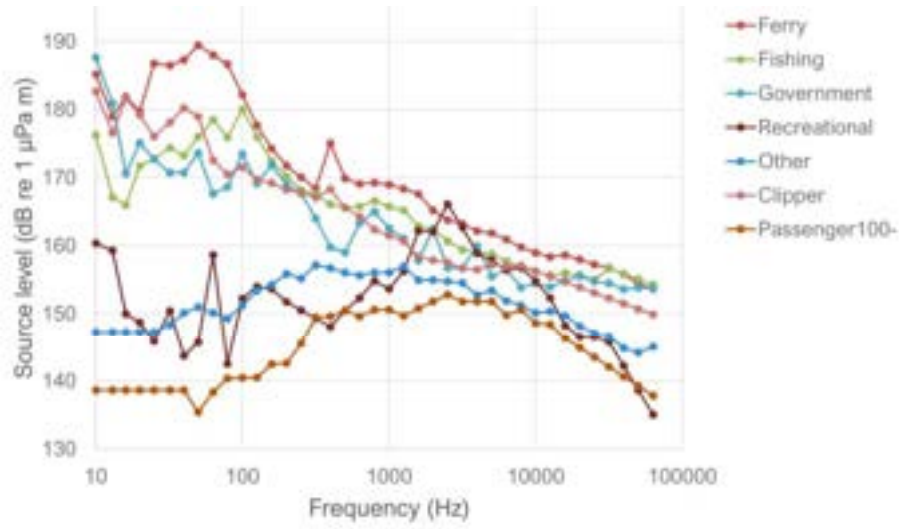


Figure 6. Mean decidecade band vessel source level by category for non-participant vessels from 10 Hz to 64 kHz.

3. Results

3.1. Lime Kiln and Boundary Pass Receivers

For each modelled scenario, a set of time-dependent snapshots of sound pressure level (SPL) were produced at a 1-minute temporal resolution over the entirety of the 14-day modelling period. These snapshots of the SPL are sampled at the Boundary Pass and Lime Kiln receiver locations to produce plots of time evolution of broadband SPL across the modelling period for each of the eight scenarios (Figures 7 and 8).

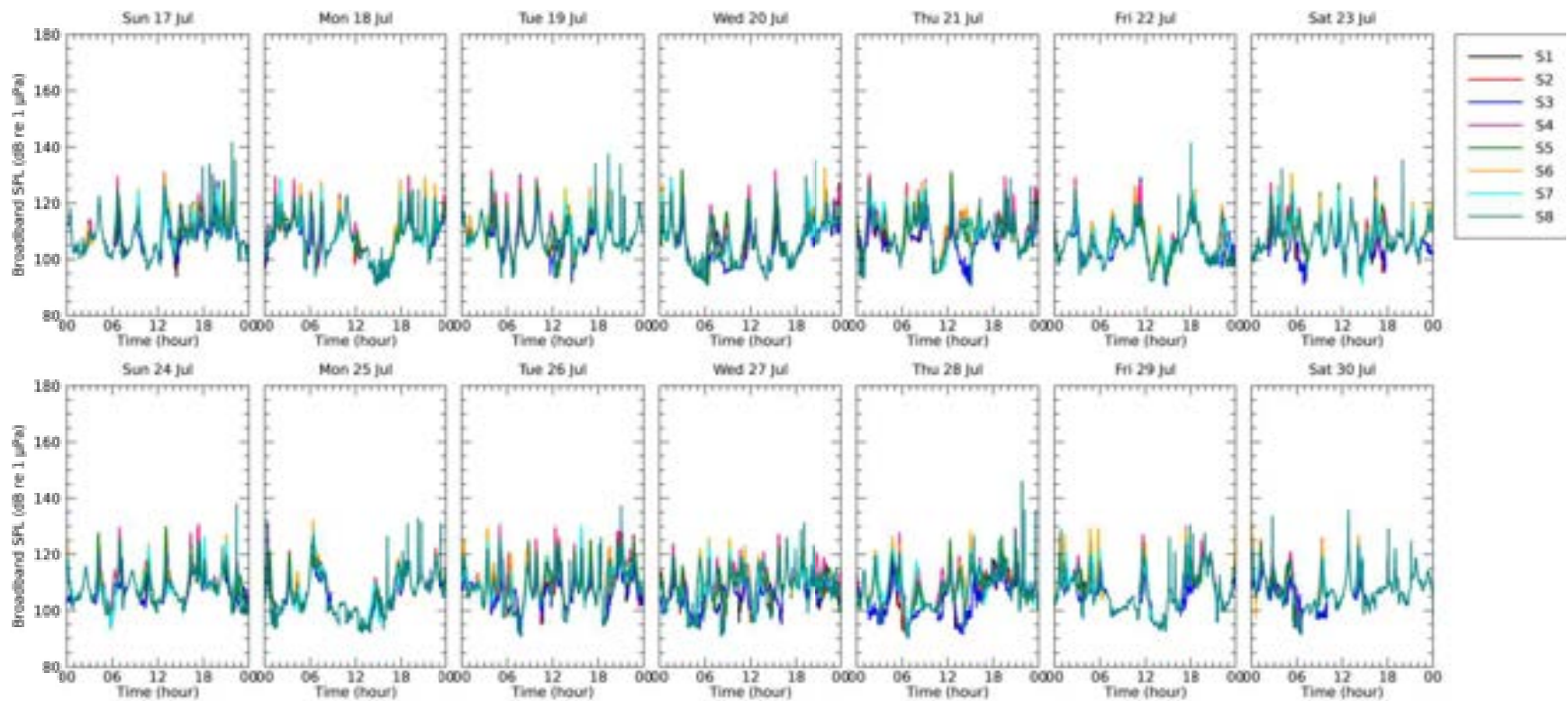


Figure 7. Modelled broadband sound pressure level (SPL) versus time at Lime Kiln-Central San Juan receiver. S1 = Baseline, S2 = Slowdown, S3 = Slowdown Min, S4 = Future Baseline, S5 = Future Slowdown, S6 = Future 50% UVNRT Baseline, S7 = Future 50% UVNRT Slowdown, S8 = Future 100% UVNRT Baseline.

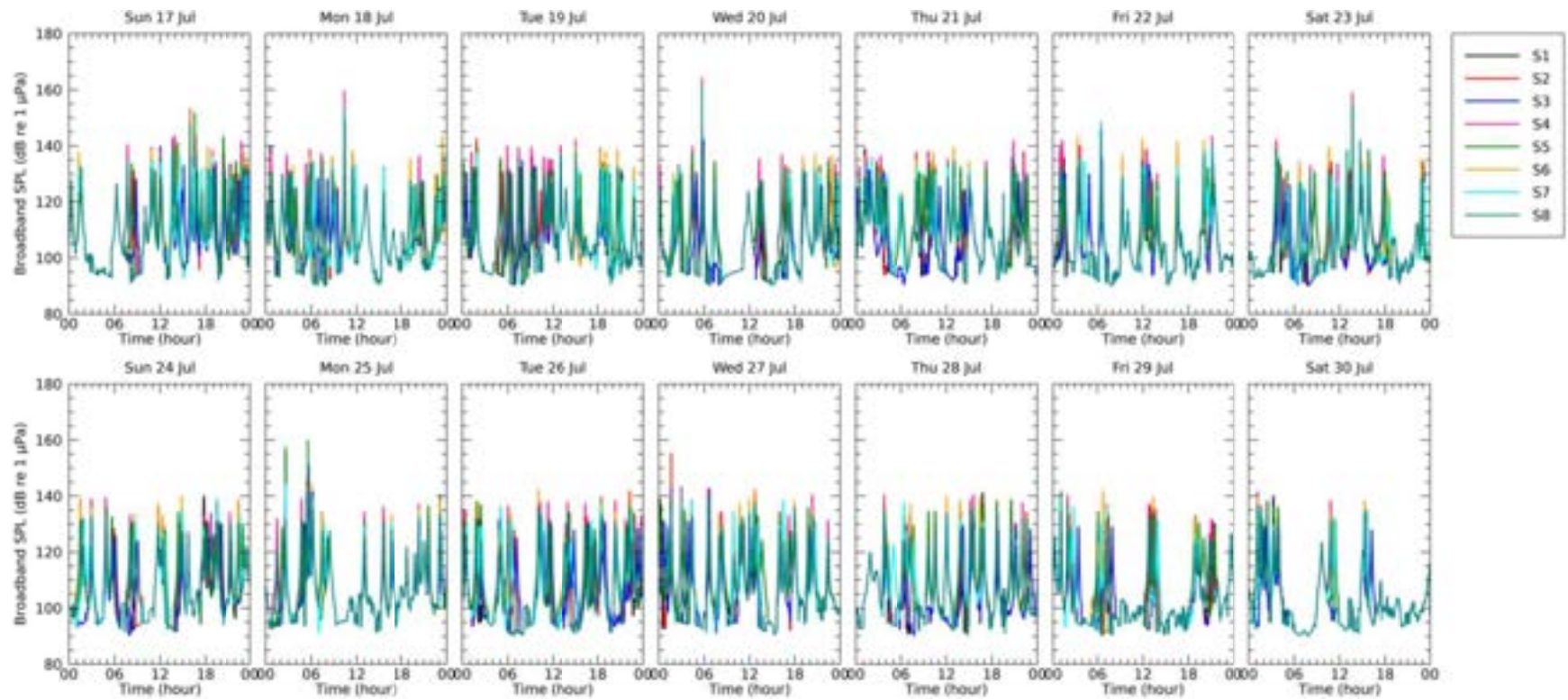


Figure 8. Modelled broadband sound pressure level (SPL) versus time at Boundary Pass receiver. S1 = Baseline, S2 = Slowdown, S3 = Slowdown Min, S4 = Future Baseline, S5 = Future Slowdown, S6 = Future 50% UVNRT Baseline, S7 = Future 50% UVNRT Slowdown, S8 = Future 100% UVNRT Baseline.

To further explore these results, a statistical analysis of the time dependent levels at the two receivers was performed. Figures 9, 10, and 11 compare exceedance levels across the eight modelled scenarios in broadband (10 Hz to 64 kHz for this study), an SRKW communication band (0.5–15 kHz), and an SRKW echolocation band (15–64 kHz). The exceedance percentiles represent the percent of minutes that levels exceed a specified threshold at each receiver.

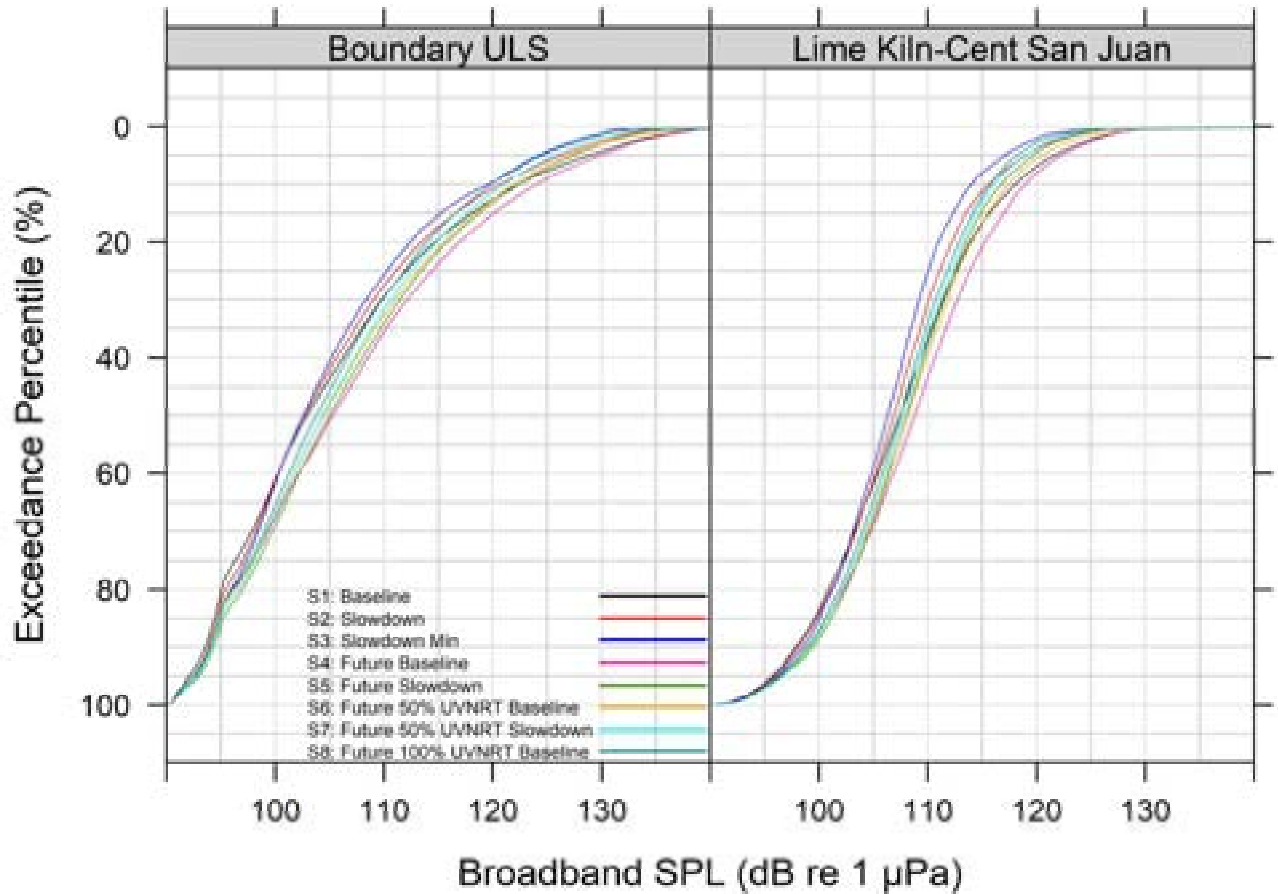


Figure 9. Broadband: Exceedance curves of time-dependent sound pressure level (SPL) at receiver locations.

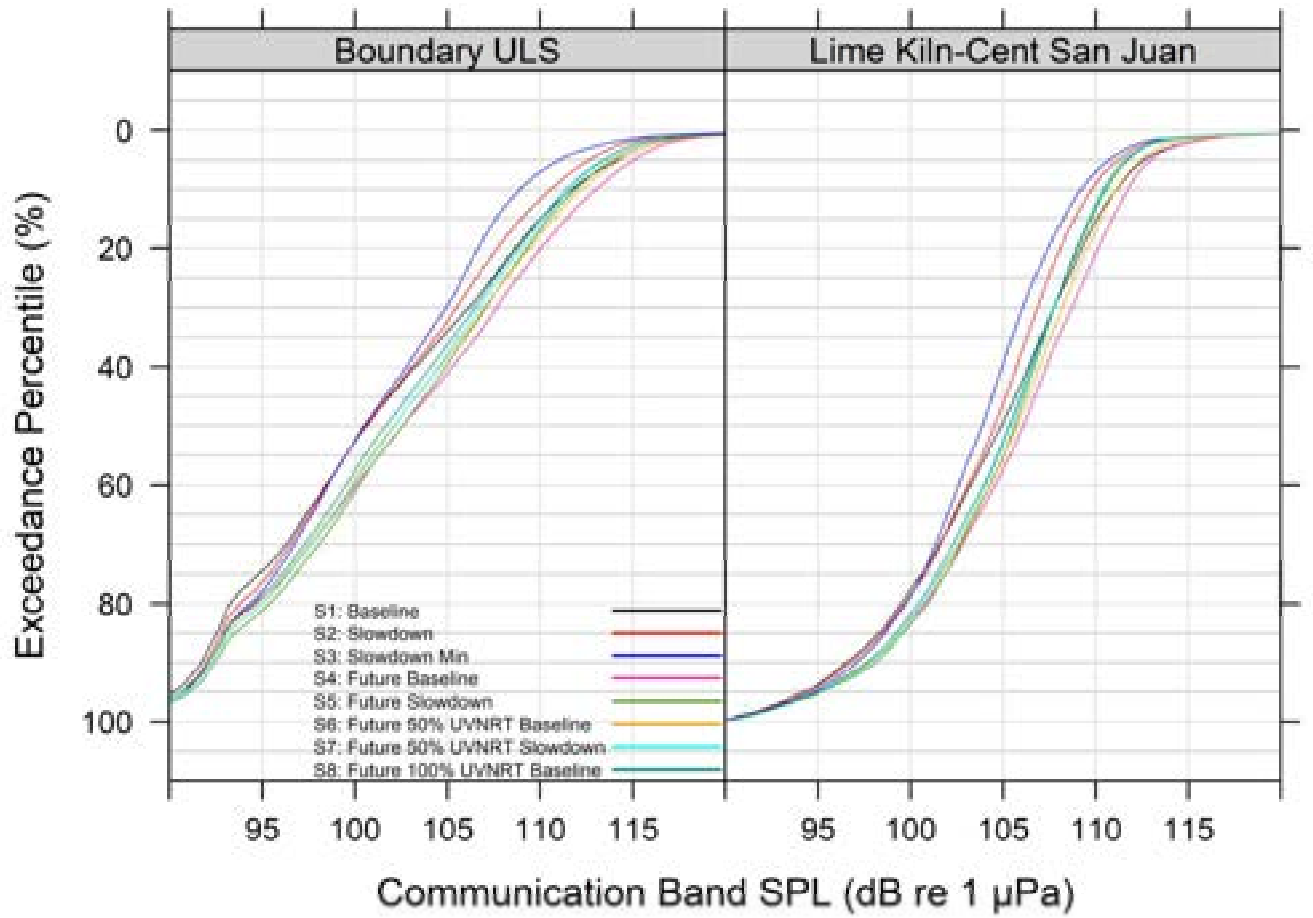


Figure 10. Communication band: Exceedance curves of time-dependent sound pressure level (SPL) at receiver locations.

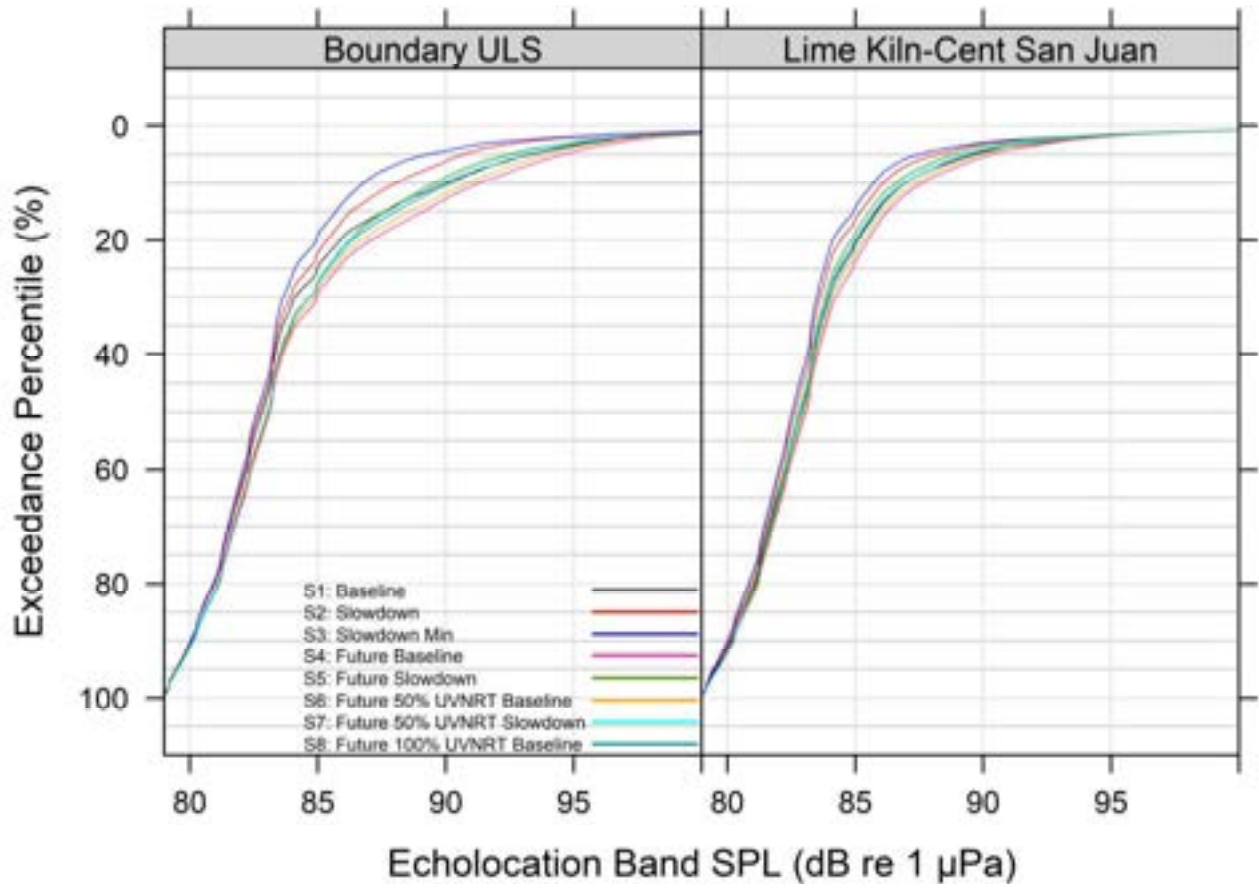


Figure 11. Echolocation band: Exceedance curves of time-dependent sound pressure level (SPL) at receiver locations.

Further analysis of the results at the two receiver locations is performed to show the L_{eq} and 5th, 25th, 50th, 75th, 95th quantiles for SPL at the two receivers as well as the differences in broadband SPL relative to the Scenario 1 baseline (Tables 3 and 4). These results show that differences in exceedance percentiles tend to be concentrated at higher SPL, which are associated with times when vessels transit close to the receivers.

Table 3. Exceedance percentiles of broadband modelled sound pressure level (SPL; dB re 1 μ Pa) at Lime Kiln-Central San Juan and Boundary Pass receivers.

SPL exceedance level (dB)	S1: Baseline (2022)	S2: Slowdown (2022)	S3: Slowdown Min	S4: Future Baseline	S5: Future Slowdown	S6: Future 50% UVNRT Baseline	S7: Future 50% UVNRT Slowdown	S8: Future 100% UVNRT Baseline
Lime Kiln – Central San Juan Receiver								
L_5	121.6	119.0	117.1	122.2	119.7	120.5	119.1	118.2
L_{25}	112.6	111.1	110.0	113.9	112.5	112.8	112.2	111.8
L_{50}	107.4	106.9	106.3	108.8	108.0	108.1	107.8	107.5
L_{75}	102.1	102.3	102.3	103.6	103.6	103.3	103.3	102.9
L_{95}	95.7	95.9	96.2	96.5	96.6	96.5	96.6	96.4
L_{eq}	115.9	114.0	113.0	116.4	114.6	115.2	114.1	113.7
Boundary Pass Receiver								
L_5	128.8	126.2	124.5	129.9	127.4	127.1	125.7	124.1
L_{25}	112.0	111.1	110.3	114.4	113.4	113.1	112.5	111.9
L_{50}	102.9	102.7	102.6	105.3	105.0	104.4	104.3	103.8
L_{75}	96.3	97.0	97.3	98.0	98.4	97.9	98.0	97.7
L_{95}	92.0	92.5	92.8	92.4	92.9	92.5	92.8	92.4
L_{eq}	126.4	121.4	119.5	126.7	123.5	123.4	121.7	121.7

Table 4. Delta differences of broadband sound pressure level (SPL; dB) exceedance percentiles, relative to baseline (S1) conditions, at Lime Kiln-Central San Juan and Boundary Pass receivers. The labels indicate the scenario that the baseline is subtracted from. Negative Values indicate a reduction in sound level relative to scenario 1 (2022 baseline).

SPL exceedance level (dB)	S2–S1: Slowdown (2022)	S3–S1: Slowdown Min	S4–S1: Future Baseline	S5–S1: Future Slowdown	S6–S1: Future 50% UVNRT Baseline	S7–S1: Future 50% UVNRT Slowdown	S8–S1: Future 100% UVNRT Baseline
Lime Kiln – Central San Juan Receiver							
L_5	-2.6	-4.5	0.6	-1.9	-1.1	-2.5	-3.4
L_{25}	-1.5	-2.6	1.3	-0.1	0.2	-0.4	-0.8
L_{50}	-0.5	-1.1	1.4	0.6	0.7	0.4	0.1
L_{75}	0.2	0.2	1.5	1.5	1.2	1.2	0.8
L_{95}	0.2	0.5	0.8	0.9	0.8	0.9	0.7
L_{eq}	-1.9	-2.9	0.5	-1.3	-0.7	-1.8	-2.2
Boundary Pass Receiver							
L_5	-2.6	-4.3	1.1	-1.4	-1.7	-3.1	-4.7
L_{25}	-0.9	-1.7	2.4	1.4	1.1	0.5	-0.1
L_{50}	-0.2	-0.3	2.4	2.1	1.5	1.4	0.9
L_{75}	0.7	1.0	1.7	2.1	1.6	1.7	1.4
L_{95}	0.5	0.8	0.4	0.9	0.5	0.8	0.4
L_{eq}	-5.0	-6.9	0.3	-2.9	-3.0	-4.7	-4.7

3.2. SPL Percentile Maps

Statistics of sound levels were analyzed across all 1-minute snapshots to produce spatial maps of exceedence levels within the SRKW core habitat. Note that the SRKW core habitat contains regions that extend well beyond the bounds of the slowdown areas, but are nonetheless included in the analysis. Maps of exceedence percentiles are presented in this section for the L_{eq} as well as 5th and 95th exceedence percentile levels for the full broadband frequency range. Appendix A contains maps of percentiles not shown here.

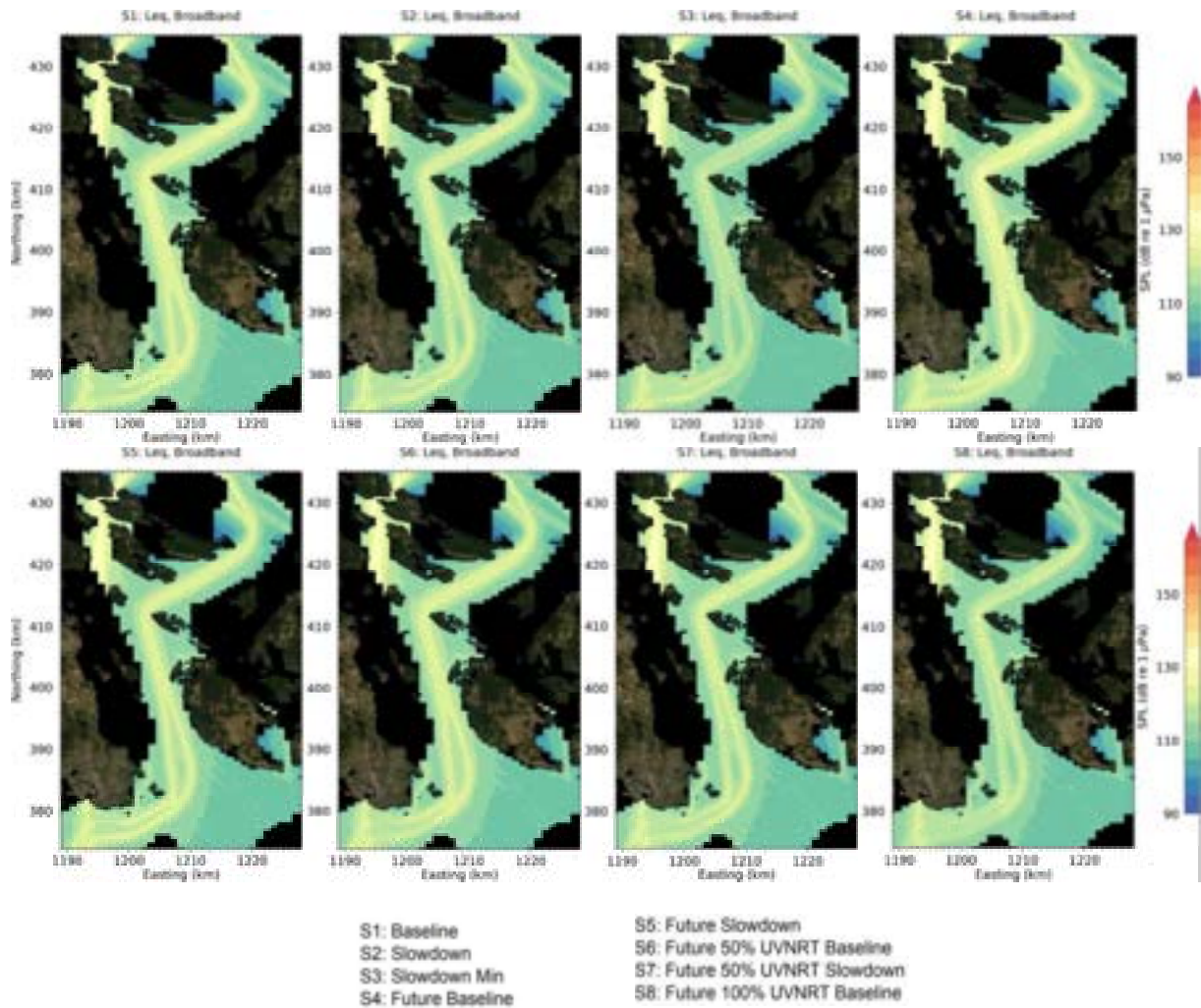


Figure 12. Maps of L_{eq} within SRKW core habitat. Receiver depth is 10 m. Grid cell size is 200 m.

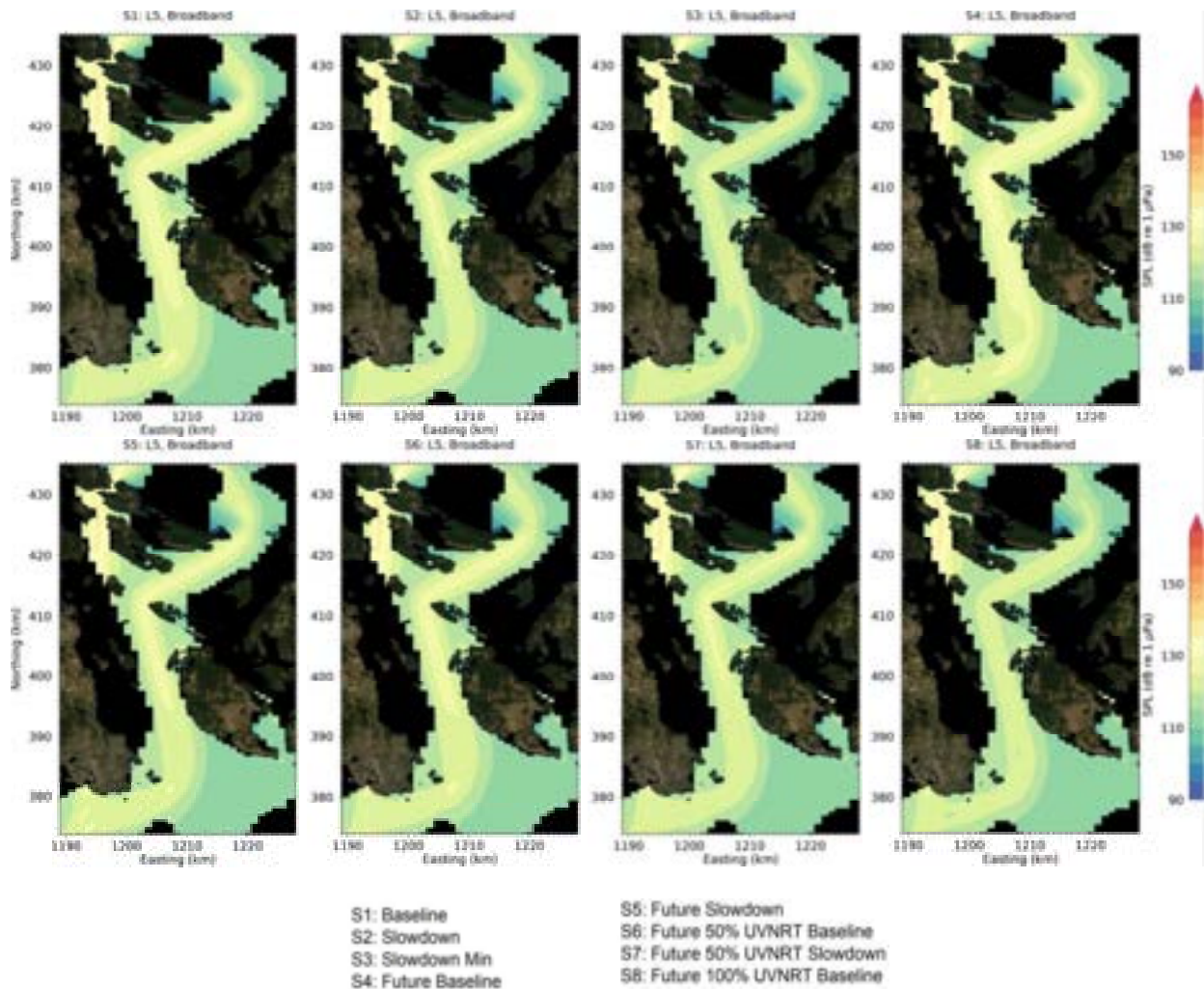


Figure 13. Maps of 5th percentile exceedance level (L_5) within SRKW core habitat. Receiver depth is 10 m. Grid cell size is 200 m.

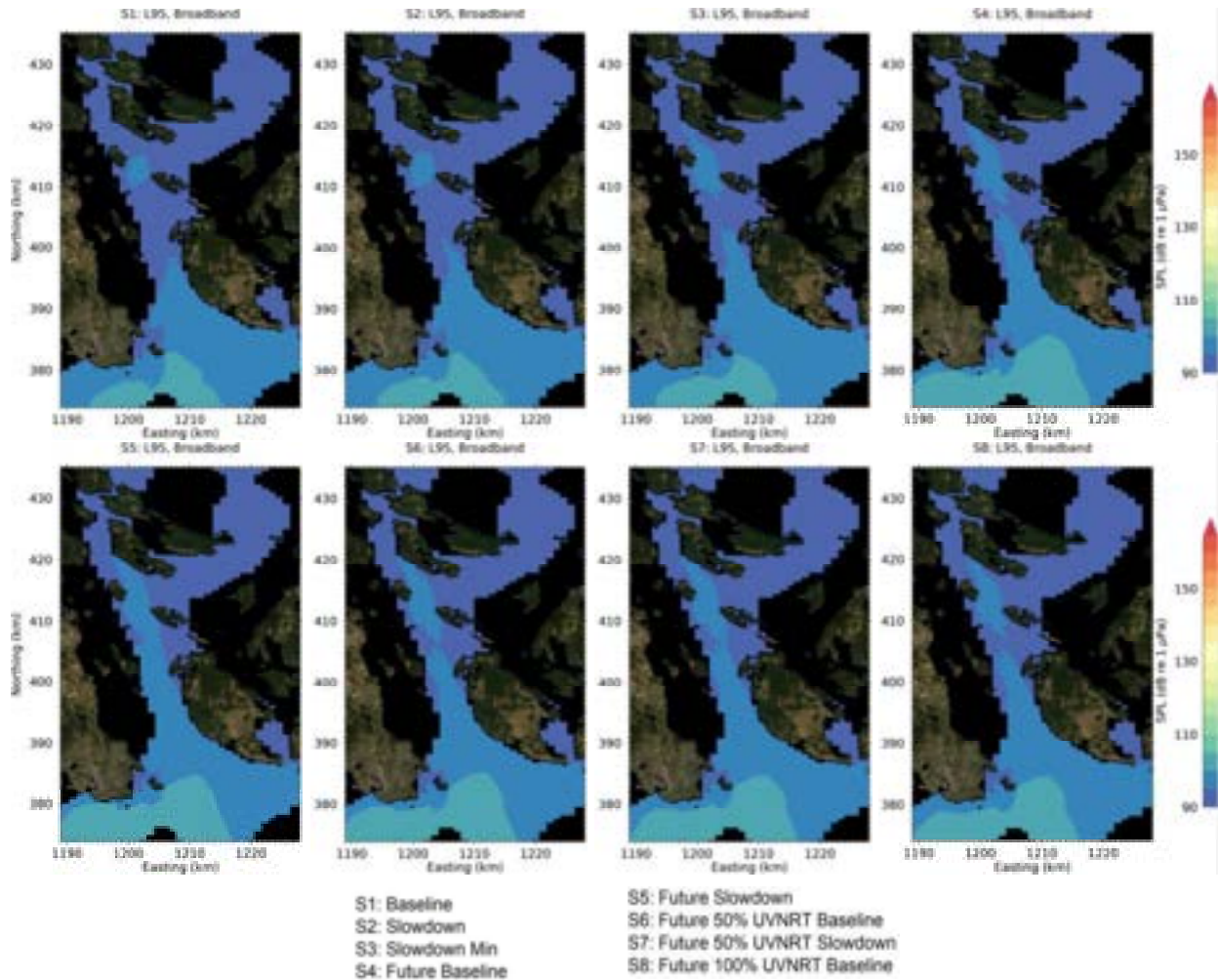


Figure 14. Maps of 95th percentile exceedance level (L_{95}) within SRKW core habitat. Receiver depth is 10 m. Grid cell size is 200 m.

3.3. SPL Difference Maps

Subtracting maps of exceedance percentiles for the different scenarios (Figures 12 to 14) can be used to visualize where the changes between modelled scenarios are greatest. Figures 15 to 17 show the differences in L_{eq} , 5th percentile, and 95th percentile broadband SPL, within SRKW core habitat, when Scenario 1 (baseline) is subtracted from each of the modelled scenarios. The difference maps show that the magnitude of the changes is greatest for receivers close to the shipping lane. The last panel of each figure shows the differences in L_{eq} , 5th percentile, and 95th percentile broadband SPL, within SRKW core habitat, when Scenario 4 (future traffic baseline) is subtracted from scenario 8 (future 100% UVNRT compliance). The results also show the following when comparing different scenarios:

- Additional traffic tends to increase sound levels across all percentiles compared to the 2022 baseline conditions.
- Slowdowns tend to reduce sound levels at the higher exceedance levels (L_5 and L_{eq}), due to lower overall vessel noise emissions, but tend to slightly increase sound levels at the lowest exceedance levels (L_{95}), due to longer transit times compared to the 2022 baseline.
- Due to the presence of land masses creating acoustic shielding from the shipping lanes, the portions of SRKW core habitat in the Gulf Islands remain largely unaffected by slowdowns, TMEP traffic increases, or vessels meeting UVNRT limits at higher noise levels.
- UVNRT limits tend to reduce sound levels across all percentiles, when compared to future baseline conditions, since transit times remain unchanged compared to baseline speeds. They also provide reductions in sound outside of the slowdown zones.
- When comparing to the 2022 baseline, the effects of increased vessel traffic tend to outweigh the impact of UVNRT limits at higher percentiles despite UVNRT limits contributing to reductions in overall vessel noise emissions.

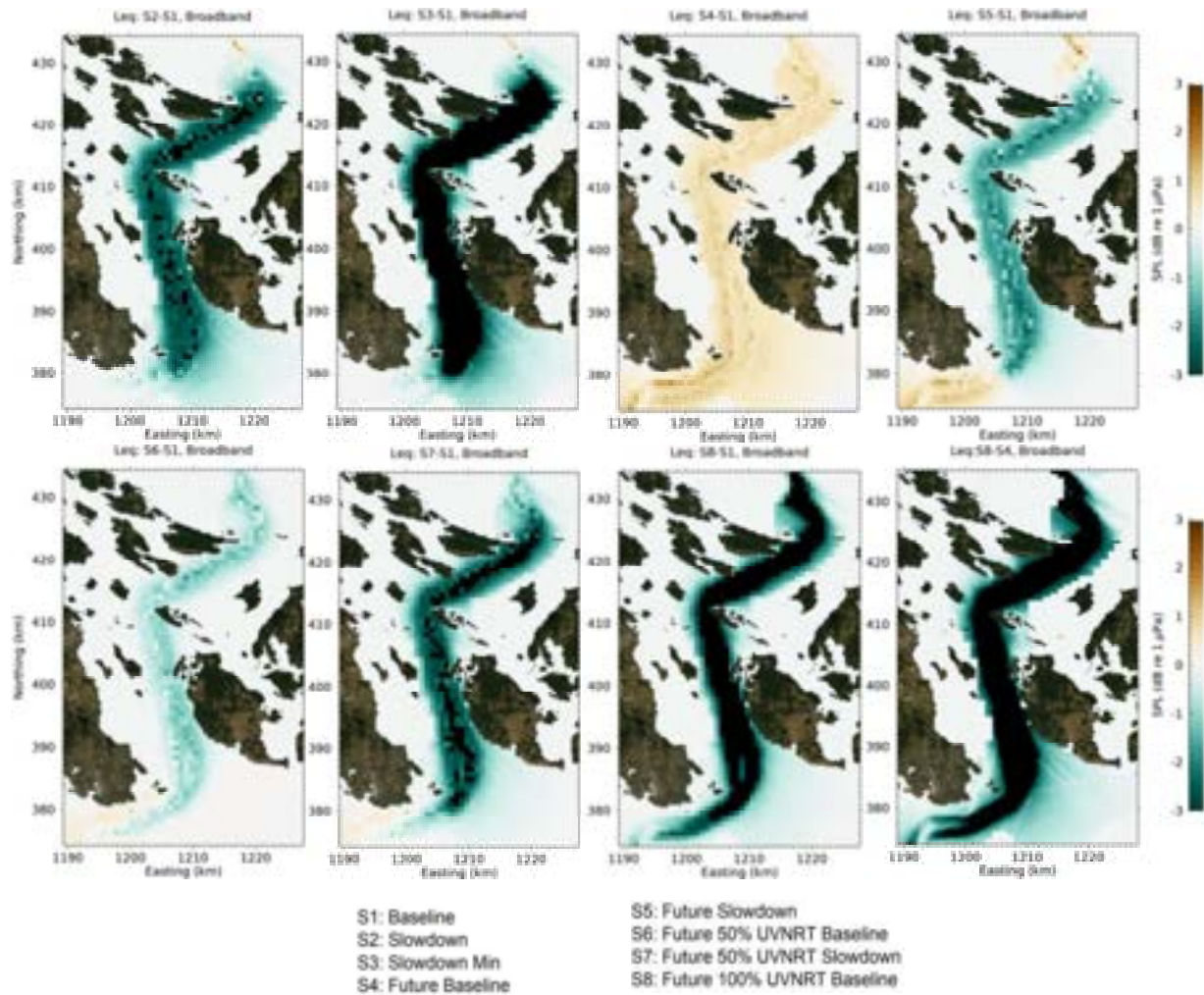


Figure 15. Difference in broadband L_{eq} relative to baseline (S1 and S4) conditions within SRKW core habitat. Receiver depth is 10 m. Grid cell size was averaged to a spatial resolution of 800 m prior to differencing, to smooth the difference maps.

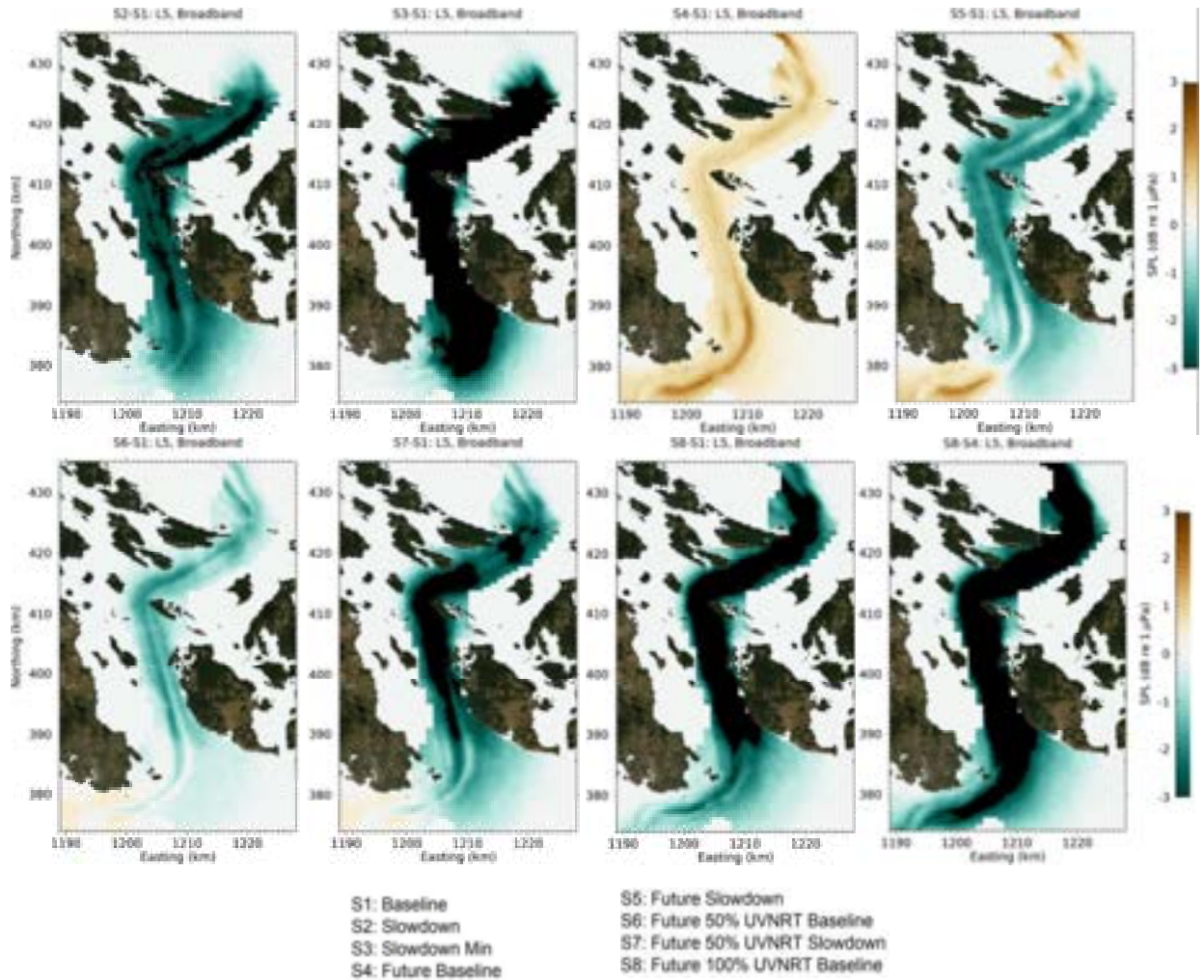


Figure 16. Difference in broadband 5th percentile exceedances levels relative to baseline (S1 and S4) conditions within SRKW core habitat. Receiver depth is 10 m. Grid cell size is 200 m.

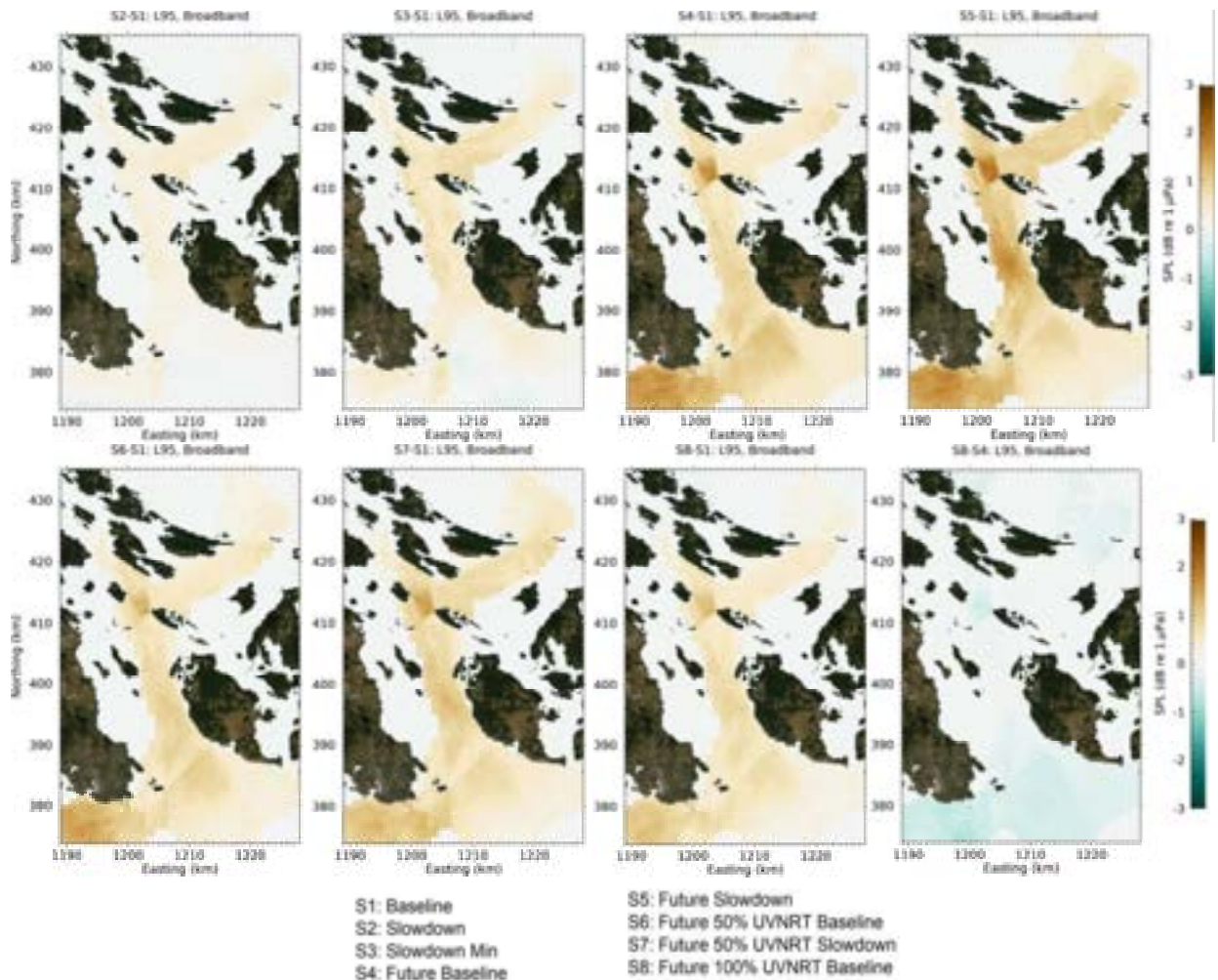


Figure 17. Difference in broadband 95th percentile exceedance levels relative to baseline (S1 and S4) conditions within SRKW core habitat. Receiver depth is 10 m. Grid cell size is 200 m.

3.4. SPL Statistics

Exceedance percentile curves for broadband SPL were computed for all receivers inside the SRKW core habitat area for all eight scenarios (Figure 18). In addition, plots of sound level statistics versus time were computed for all scenarios for broadband daily L_{eq} (Figure 19), broadband daily 5th percentile SPL (Figure 20), and broadband daily 95th percentile SPL (Figure 21). Broadband SPL exceedance percentiles (Table 5), and SPL differences between each scenario and Scenario 1 (Table 6) were likewise computed for all receivers within the core habitat area. Differences between scenarios are smaller in magnitude than for the two receiver stations (see Section 2.4), since the core habitat area includes locations outside the voluntary slowdown area, such as Active Pass and the area surrounding San Juan Island.

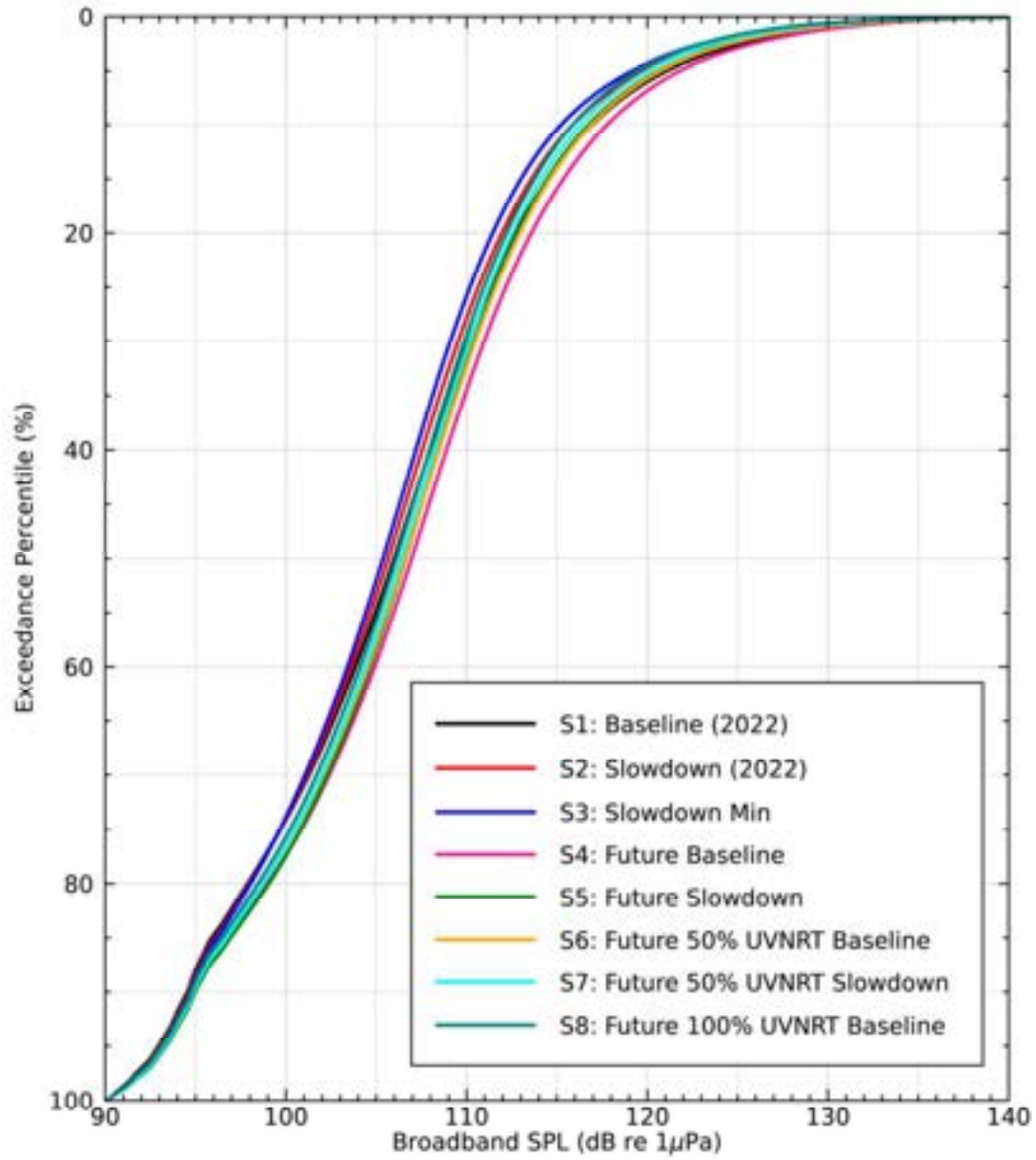


Figure 18. Exceedance percentiles of broadband SPL throughout SRKW core habitat.

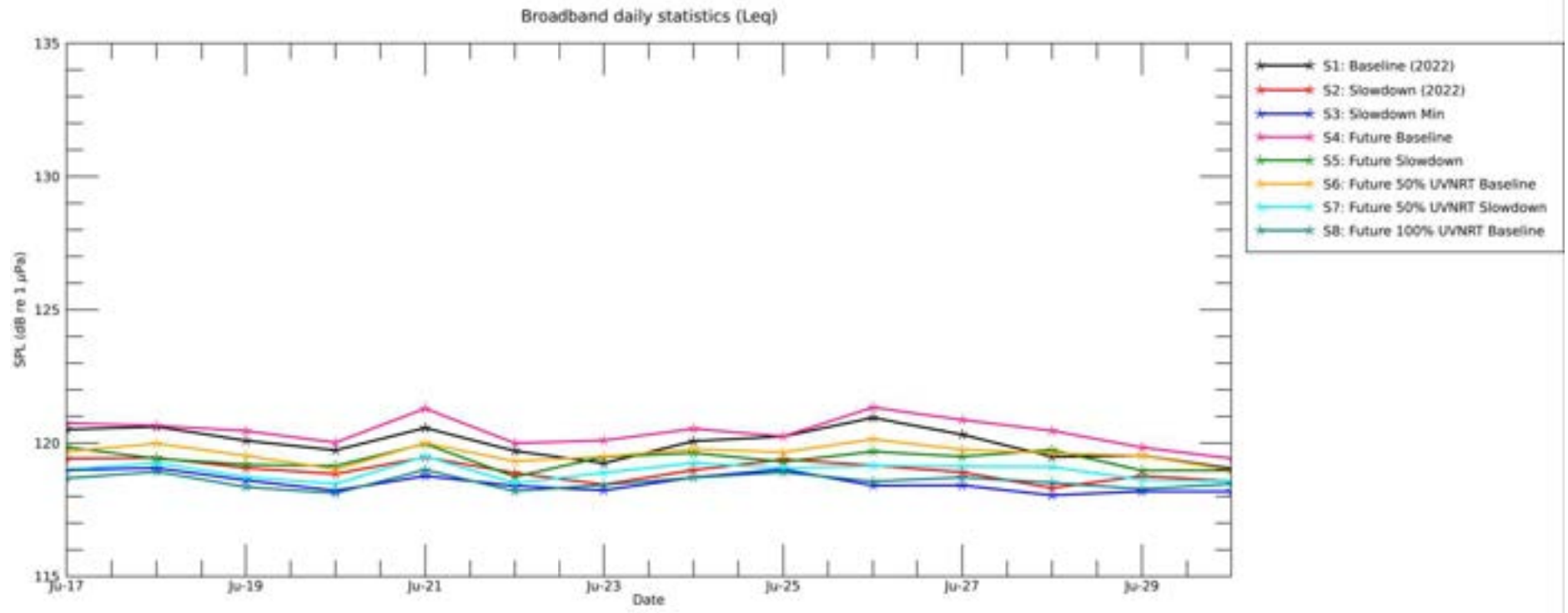


Figure 19. Plot of daily L_{eq} for all receivers and snapshots within SRKW core habitat.

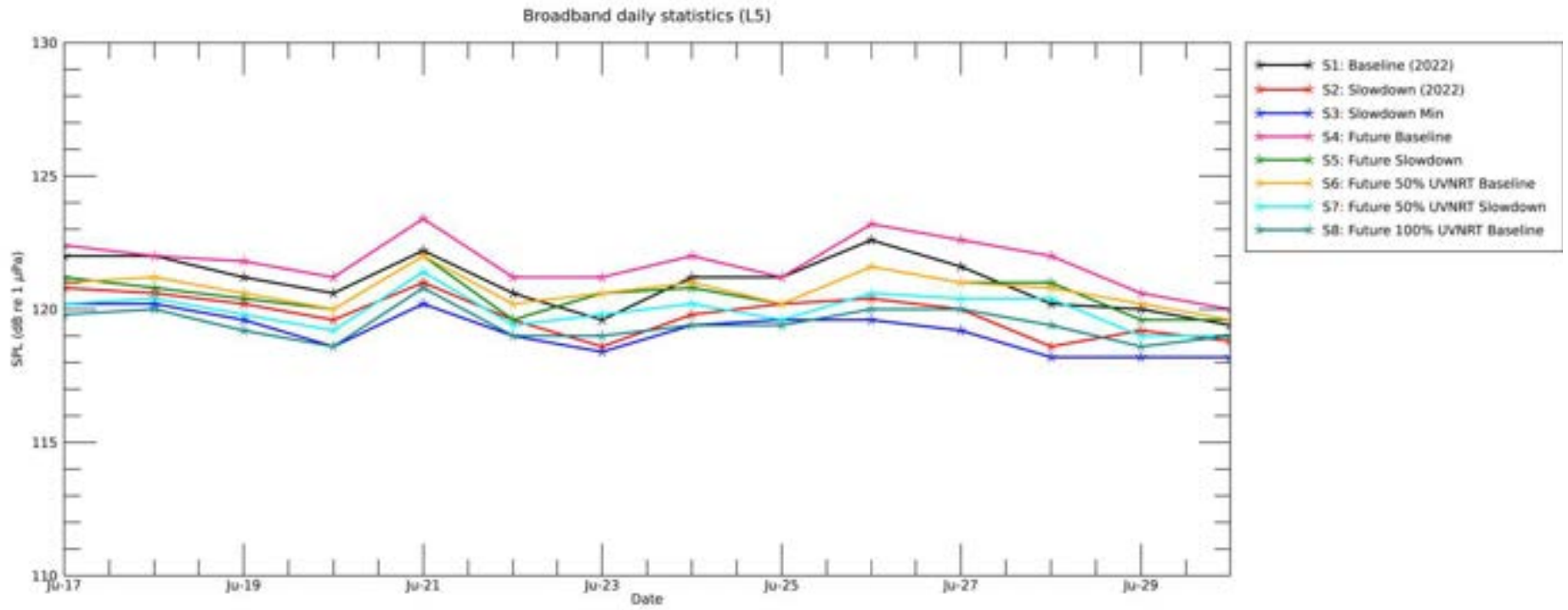


Figure 20. Plot of daily 5th percentile exceedance level for all receivers and snapshots within SRKW core habitat.

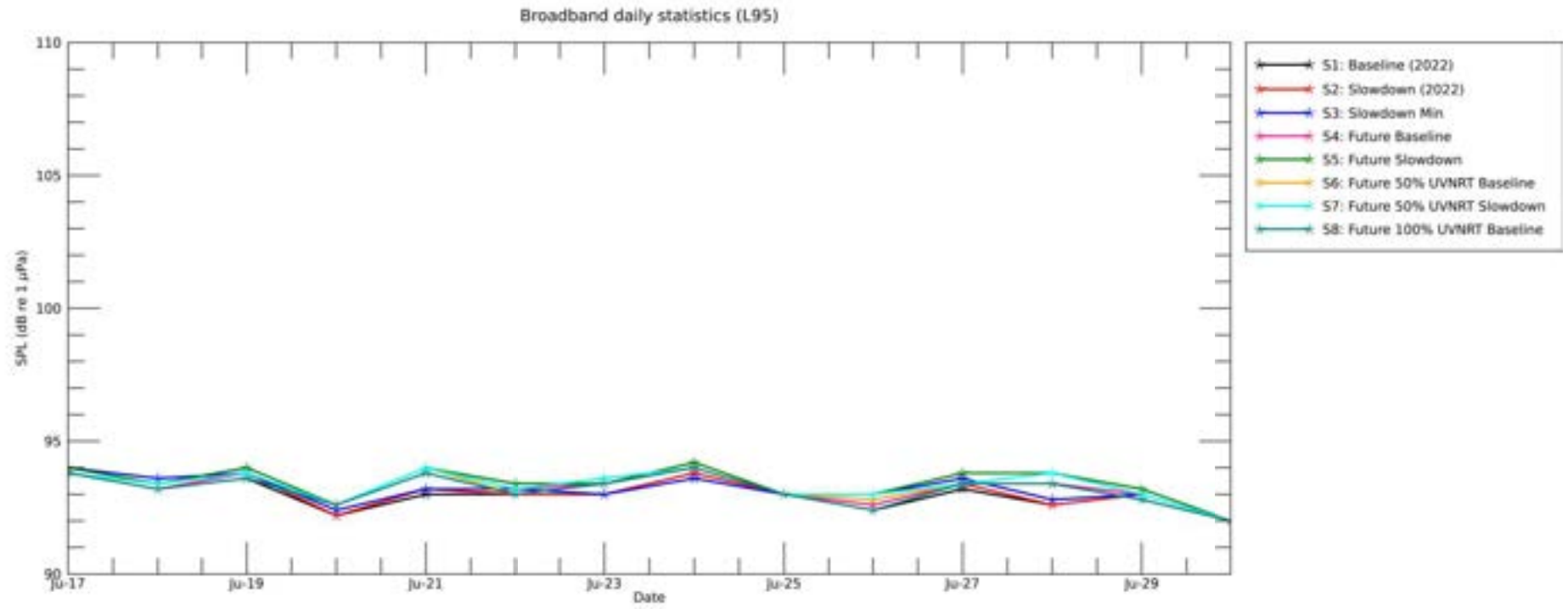


Figure 21. Plot of daily 95th percentile exceedance level for all receivers and snapshots within SRKW core habitat.

Table 5. Statistics of broadband SPL (dB) for all receivers and snapshots within SRKW core habitat.

Exceedance percentile	S1: Baseline (2022)	S2: Slowdown (2022)	S3: Slowdown Min	S4: Future Baseline	S5: Future Slowdown	S6: Future 50% UVNRT Baseline	S7: Future 50% UVNRT Slowdown	S8: Future 100% UVNRT Baseline
L_5	121.0	119.8	119.2	121.8	120.6	120.8	120.0	119.4
L_{25}	111.4	110.6	110.2	112.2	111.6	111.6	111.2	111.0
L_{50}	106.0	105.6	105.4	107.0	106.6	106.6	106.4	106.2
L_{75}	99.6	99.8	99.6	100.8	100.8	100.6	100.4	100.2
L_{95}	93.0	93.0	93.2	93.2	93.4	93.2	93.2	93.2
L_{eq}	119.7	118.7	118.2	120.1	119.1	119.3	118.6	118.2

Table 6. Delta differences of broadband sound pressure level (dB), relative to baseline (S1) conditions, for all receivers and snapshots within SRKW core habitat. Negative values indicate a reduction in broadband SPL.

Exceedance percentile	S2-S1	S3-S1	S4-S1	S5-S1	S6-S1	S7-S1	S8-S1
L_5	-1.2	-1.8	0.8	-0.4	-0.2	-1.0	-1.6
L_{25}	-0.8	-1.2	0.8	0.2	0.2	-0.2	-0.4
L_{50}	-0.4	-0.6	1.0	0.6	0.6	0.4	0.2
L_{75}	0.2	0.0	1.2	1.2	1.0	0.8	0.6
L_{95}	0.0	0.2	0.2	0.4	0.2	0.2	0.2
L_{eq}	-1.0	-1.5	0.4	-0.6	-0.4	-1.1	-1.5

4. Discussion and Conclusions

This study expanded upon the new modelling approach first employed in 2022 to analyze the effects of potential future traffic conditions on the ECHO Program's voluntary seasonal slowdowns in Haro Strait and Boundary Pass. An expanded set of six new scenarios (Scenario 3 to Scenario 8) was used to assess the impact of different vessel traffic and voluntary slowdown conditions on underwater noise in SRKW core habitat. The two original scenarios (Scenario 1 and Scenario 2) were also revised to use more accurate vessel traffic estimates for 2022. Possible future scenarios considered by this study included reduction of all participating vessel slowdown speeds to an 11-knot limit, anticipated future maximum increases in oil tanker and tugboat traffic associated with TMEP, and the potential that transiting vessels may meet UVNRT noise levels.

Differences in modelled sound levels between scenarios were greatest within the vessel slowdown areas, close to the shipping lane, as anticipated. When compared to 2022 baseline conditions, increases in tanker traffic associated with TMEP increased overall sound levels within SRKW core habitat, across all percentiles (Scenario 4). Differences in L_{eq} across the SRKW core habitat for 2022 vessel slowdown speeds and participation rates with increased TMEP traffic (Scenario 5) offered a reduction of only -0.6 dB (Scenario 5–Scenario 1) relative to the 2022 baseline, compared to the reduction of -1.0 dB (Scenario 2–Scenario 1) for the 2022 slowdown period. This suggests that, while the increased TMEP vessel traffic would not entirely offset the benefits of voluntary speed reductions, it does diminish the magnitude of those benefits relative to the 2022 baseline. The reductions achieved by the slowdowns with increased TMEP traffic in Scenario 5 were also explored in the maps of percentiles (Figures 13 and 14). Evaluating the effects of slowdowns with increased TMEP traffic at the 95th (the quietest levels) through 25th exceedances percentiles, indicates increases across the SRKW core habitat relative to the baseline (Figure 17, Table 6), but there remain reductions in sound level at the 5th percentile (Figure 16). These results indicate that increased vessel traffic from TMEP will increase sound levels during quieter times, but that voluntary slowdowns can still be effective in reducing overall sound energy (L_{eq}) and sound levels during the loudest periods (L_5), relative to baseline conditions.

Scenarios 5–8 all consider possible mitigations of increased future vessel noise. Of these three scenarios, Scenario 8, with 100% of large commercial vessels meeting UVNRT levels while travelling at baseline (non-slowdown) speeds, is the most effective at reducing sound levels; this is exemplified in Figures 15 and 16, with an area-wide reduction of broadband L_{eq} relative to the 2022 baseline of -1.5 dB (Table 6) within the SRKW core habitat. However, if UVNRT level compliance is reduced to only 50% without other mitigations (Scenario 6) the achieved sound reduction is less than each of the other mitigated future scenarios with a change in broadband L_{eq} relative to the 2022 baseline of -0.4 dB within the SRKW core habitat. With 50% of future vessel traffic complying with UVNRT levels and following 2022 baseline speeds, and 50% participating in slowdowns with 2022 slowdown speeds (Scenario 7), a moderate improvement in sound reduction (compared to slowdowns alone: Scenario 5, -0.4 dB L_{eq} or 50% UVNRT compliance alone: Scenario 6, -0.4 dB L_{eq}) was modelled.

The greatest reduction in L_{eq} within the SRKW core habitat was achieved by Scenarios 3 and 8, which both had a modelled difference of -1.5 dB L_{eq} relative to the baseline scenario. Scenario 3 simulates 2022 traffic levels with all participating vessels reducing slowdown speed to 11 knots. Scenario 8 simulates future traffic with all vessels meeting UVNRT levels. Scenario 3 did, however, have greater noise reductions overall than Scenario 8, with percentile metrics achieving better noise reductions than UVNRT targets. Note, however, that Scenario 3 (all vessels travelling at 11 knots) was conducted under current traffic conditions.

Overall, the model indicates that increasing traffic in the SRKW core habitat will lead to an increase in sound levels in the region and a decreased effectiveness of voluntary vessel slowdowns, relative to 2022 baseline conditions; there will, however, continue to be benefit to the voluntary slowdowns in terms of quantifiable sound reduction, especially in the loudest periods. These benefits are variable based on speeds achieved during slowdown conditions and levels of participation in voluntary slowdowns. When mitigating future increased traffic, the most effective form of mitigation in the model is vessel compliance with UVNRT levels, although the effectiveness of this mitigation is closely related to the percent of vessels meeting targets. For example, 100% compliance with UVNRT provides acoustic benefits generally on-par with a slowdown to 11 knots for all potential slowdown participants.

Glossary of Acoustics Terms

Unless otherwise stated in an entry, these definitions are consistent with ISO 18405 (2017).

Light blue text indicates related terms that might be in this glossary. Dark blue text indicates clickable links to related terms in this glossary

1/3-octave

One third of an [octave](#). A 1/3-octave is approximately equal to one [decidecade](#) ($1/3 \text{ oct} \approx 1.003 \text{ ddec}$).

1/3-octave-band

[Frequency](#) band whose [bandwidth](#) is one [1/3-octave](#). The bandwidth of a 1/3-octave-band increases with increasing centre frequency.

acoustic noise

[Sound](#) that interferes with an acoustic process.

ambient sound

[Sound](#) that would be present in the absence of a specified activity (ISO 18405:2017). It is usually a composite of sound from many sources near and far, e.g., shipping vessels, seismic activity, precipitation, sea ice movement, wave action, and biological activity.

background noise

Combination of [ambient sound](#), [acoustic self-noise](#), and, where applicable, sonar reverberation (ISO 18405:2017) that is detected, measured, or recorded with a signal.

bandwidth

A range within a continuous band of frequencies. Unit: [hertz \(Hz\)](#).

broadband level

The total [level](#) measured over a specified [frequency](#) range. If the frequency range is unspecified, the term refers to the entire measured frequency range.

cetacean

Member of the order Cetacea. Cetaceans are aquatic mammals and include whales, dolphins, and porpoises.

decade

Logarithmic [frequency](#) interval whose upper bound is ten times larger than its lower bound (ISO 80000-3:2006). For example, one decade up from 1000 Hz is 10,000 Hz, and one decade down is 100 Hz.

decibel (dB)

Unit of [level](#) used to express the ratio of one value of a power quantity to another on a logarithmic scale. Especially suited to quantify variables with a large dynamic range.

decidecade

One tenth of a [decade](#). Approximately equal to one third of an octave ($1 \text{ ddec} \approx 0.3322 \text{ oct}$), and for this reason sometimes referred to as a [1/3-octave](#).

decidecade band

[Frequency](#) band whose [bandwidth](#) is one [decidecade](#). The bandwidth of a decidecade band increases with increasing centre frequency.

frequency

The rate of oscillation of a periodic function measured in cycles per unit time. The reciprocal of the period. Unit: [hertz \(Hz\)](#). Symbol: f . 1 Hz is equal to 1 cycle per second.

hertz (Hz)

Unit of [frequency](#) defined as one cycle per second. Often expressed in multiples such as kilohertz (1 kHz = 1000 Hz).

knot (kn)

Unit of vessel speed equal to 1 nautical mile per hour.

level

A measure of a quantity expressed as the logarithm of the ratio of the quantity to a specified [reference value](#) of that quantity. For example, a value of [sound pressure level](#) with reference to $1 \mu\text{Pa}^2$ can be written in the form $x \text{ dB re } 1 \mu\text{Pa}^2$.

masking

Obscuring of [sounds](#) of interest by other sounds at similar frequencies.

median

The 50th percentile of a statistical distribution.

monopole source level (MSL)

A [source level](#) that has been calculated using an acoustic model that accounts for the effect of the sea-surface and seabed on [sound](#) propagation, assuming a [point source](#) (monopole). Often used to quantify source levels of vessels or industrial operations from measurements. See also [radiated noise level](#).

N percent exceedance level

The [sound level](#) exceeded N % of the time during a specified time interval. See also [percentile level](#).

octave

The interval between a [sound](#) and another sound with double or half the [frequency](#). For example, one octave above 200 Hz is 400 Hz, and one octave below 200 Hz is 100 Hz.

percentile level

The [sound level](#) not exceeded N % of the time during a specified time interval. The N th percentile level is equal to the $(100-N)$ % exceedance level. See also [N percent exceedance level](#).

propagation loss (PL)

Difference between a [source level](#) (SL) and the level at a specified location, $PL(x) = SL - L(x)$.

Unit: [decibel \(dB\)](#).

radiated noise level (RNL)

A [source level](#) that has been calculated assuming [sound pressure](#) decays geometrically with distance from the source, with no influence of the sea-surface or seabed. Often used to quantify source levels of vessels or industrial operations from measurements. See also [monopole source level](#).

reference value

Standard value of a quantity used for calculating underwater [sound level](#). The reference value depends on the quantity for which the level is being calculated:

Quantity	Reference value
Sound pressure	$p_0^2 = 1 \mu\text{Pa}^2$ or $p_0 = 1 \mu\text{Pa}$
Sound exposure	$E_0 = 1 \mu\text{Pa}^2 \text{s}$
Sound particle displacement	$\delta_0^2 = 1 \text{pm}^2$
Sound particle velocity	$u_0^2 = 1 \text{nm}^2/\text{s}^2$
Sound particle acceleration	$a_0^2 = 1 \mu\text{m}^2/\text{s}^4$

sound

A time-varying disturbance in the pressure, stress, or material displacement of a medium propagated by local compression and expansion of the medium. In common meaning, a form of energy that propagates through media (e.g., water, air, ground) as pressure waves.

sound pressure

The contribution to total pressure caused by the action of [sound](#) (ISO 18405:2017). Unit: pascal (Pa).

Symbol: p .

sound pressure level (SPL), rms sound pressure level

The [level](#) (L_p) of the time-mean-square [sound pressure](#) (P_{rms}^2) in a stated [frequency](#) band and time window: $L_p = 10\log_{10}(P_{\text{rms}}^2/P_0^2) = 20\log_{10}(p_{\text{rms}}/p_0)$, where rms is the abbreviation for root-mean-square.

Unit: [decibel \(dB\)](#). [Reference value](#) (P_0^2) for [sound](#) in water: $1 \mu\text{Pa}^2$. SPL can also be expressed in terms of the root-mean-square (rms) with a [reference value](#) of $p_0 = 1 \mu\text{Pa}$. The two definitions are equivalent.

source level (SL)

A property of a [sound](#) source equal to the [sound pressure level](#) measured in the [far field](#) plus the [propagation loss](#) from the acoustic centre of the source to the receiver position. Unit: [decibel \(dB\)](#).

[Reference value](#): $1 \mu\text{Pa}^2 \text{m}^2$.

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Appendix A. Additional Figures

A.1. Additional Exceedance Percentile Maps

A.1.1. Broadband Exceedance Percentile Maps

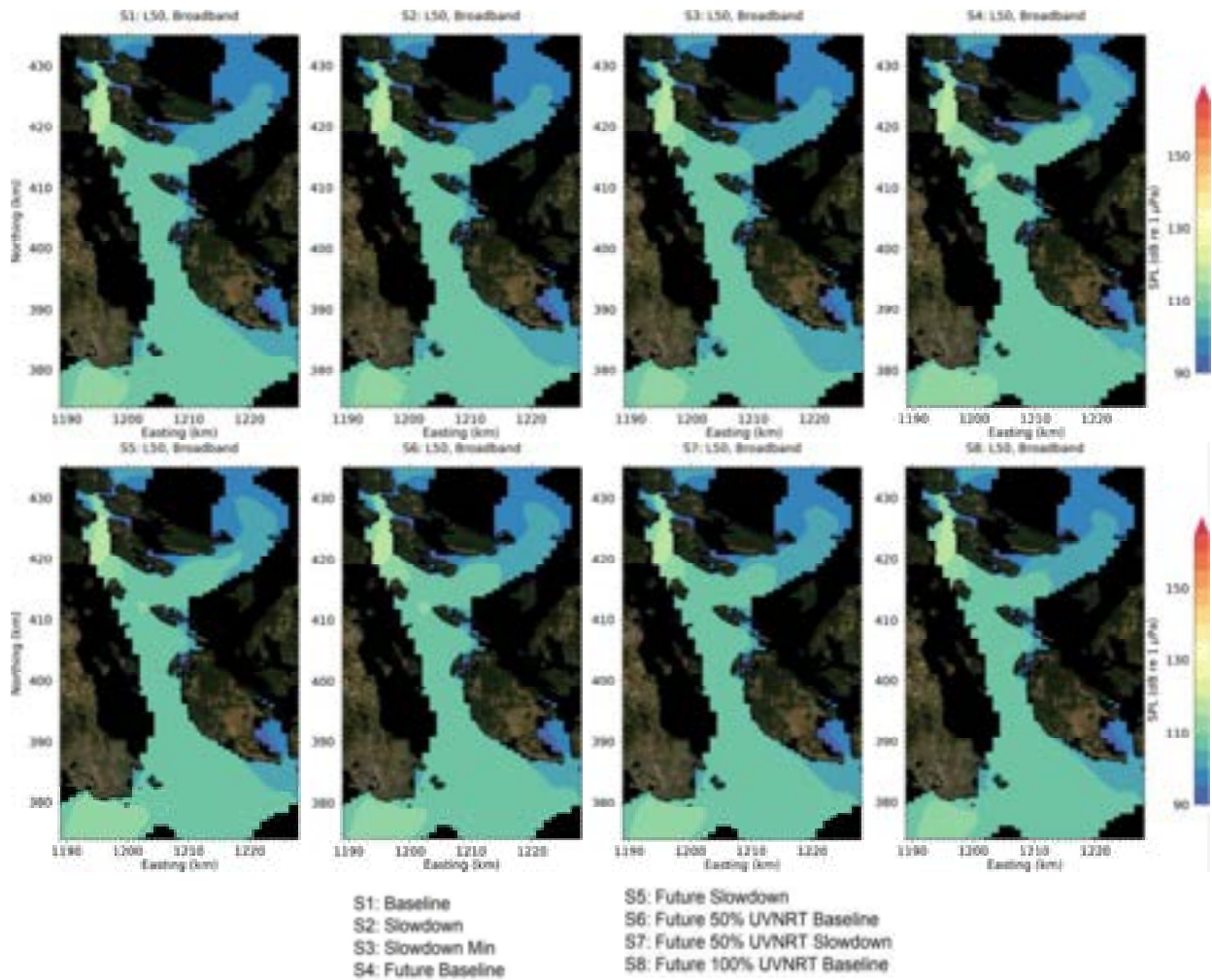


Figure A-1. Maps of 50th percentile exceedance level (L_{50}) within SRKW focus area. Receiver depth is 10 m. Grid cell size is 200 m.

A.1.2. SRKW Communication Band Exceedance Percentile Maps

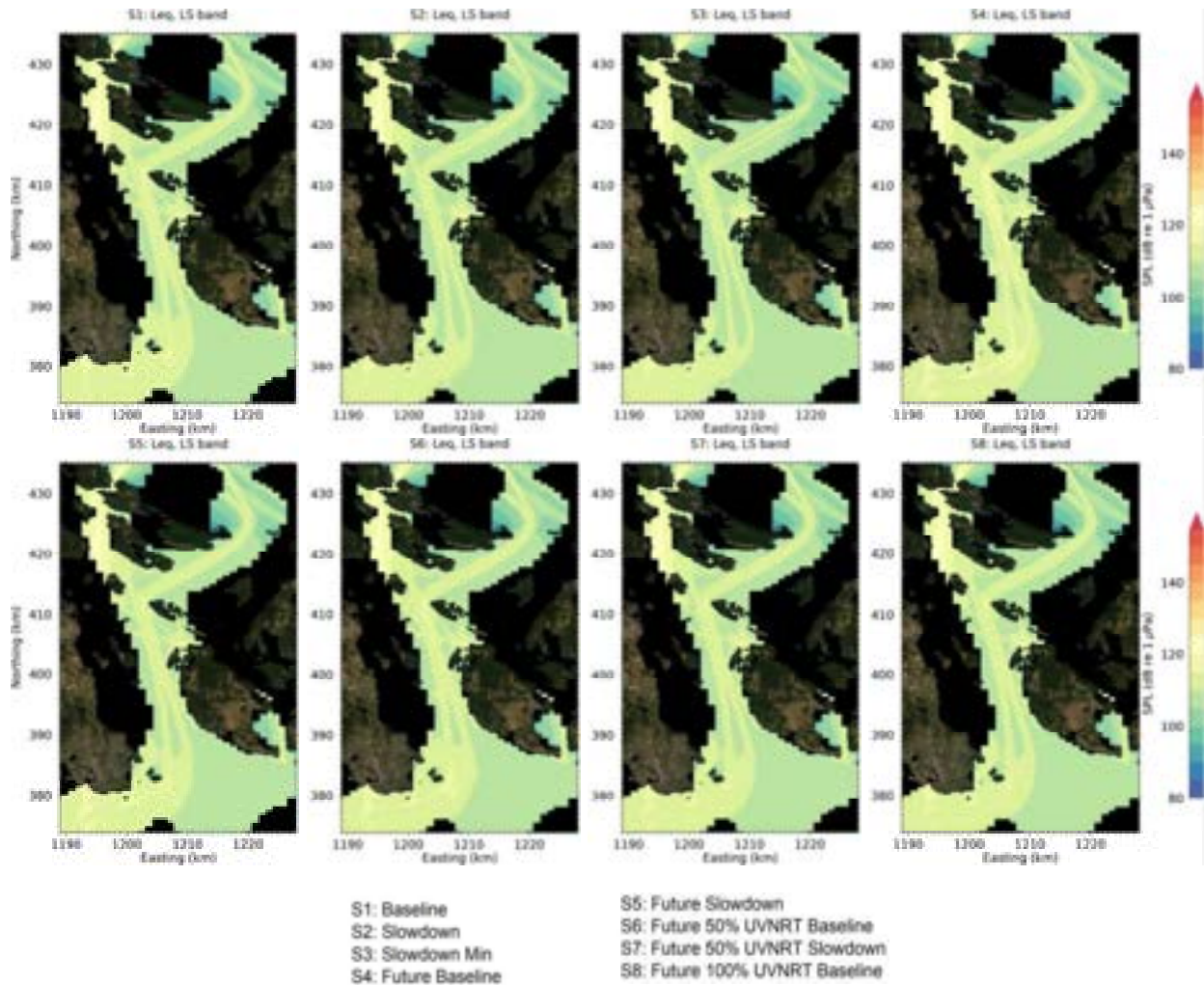


Figure A-2. Maps of SRKW communication band (0.5–15 kHz) L_{eq} within SRKW core habitat. Receiver depth is 10 m. Grid cell size is 200 m.

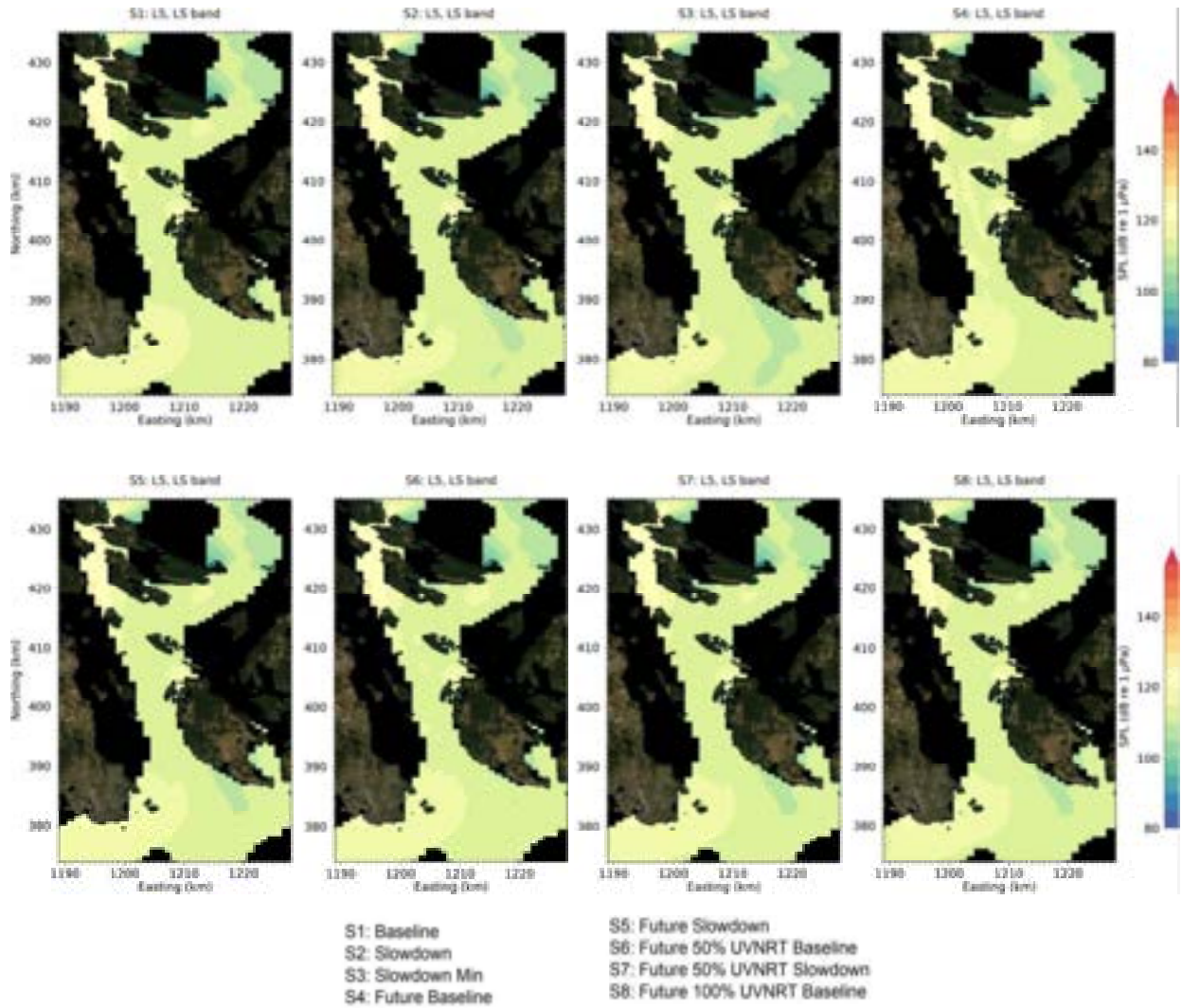


Figure A-3. Maps of SRKW communication band (0.5–15 kHz) 5th percentile exceedance level (L_5) within SRKW focus area. Receiver depth is 10 m. Grid cell size is 200 m.

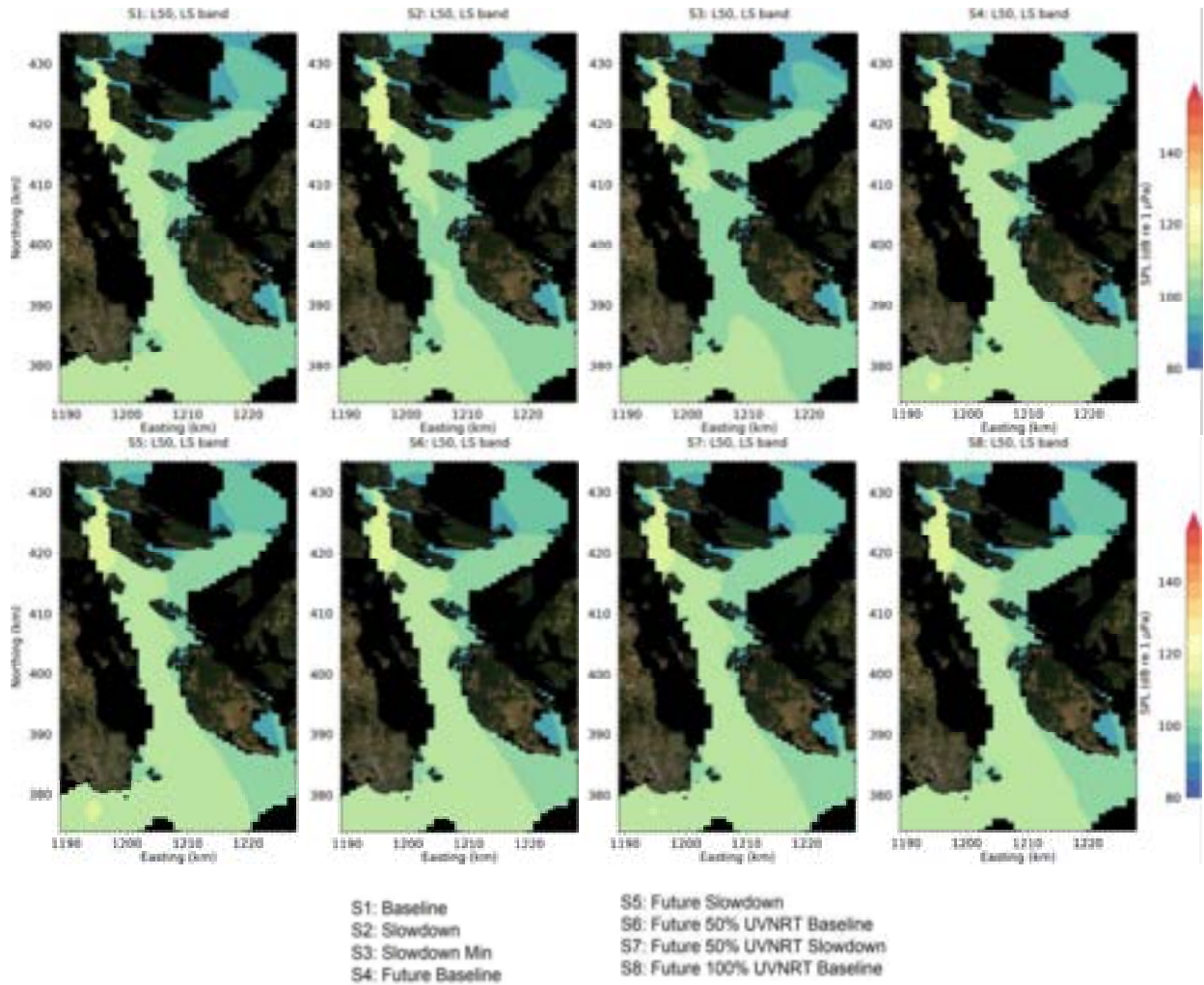


Figure A-4. Maps of SRKW communication band (0.5–15 kHz) 50th percentile exceedance level (L_{50}) within SRKW focus area. Receiver depth is 10 m. Grid cell size is 200 m.

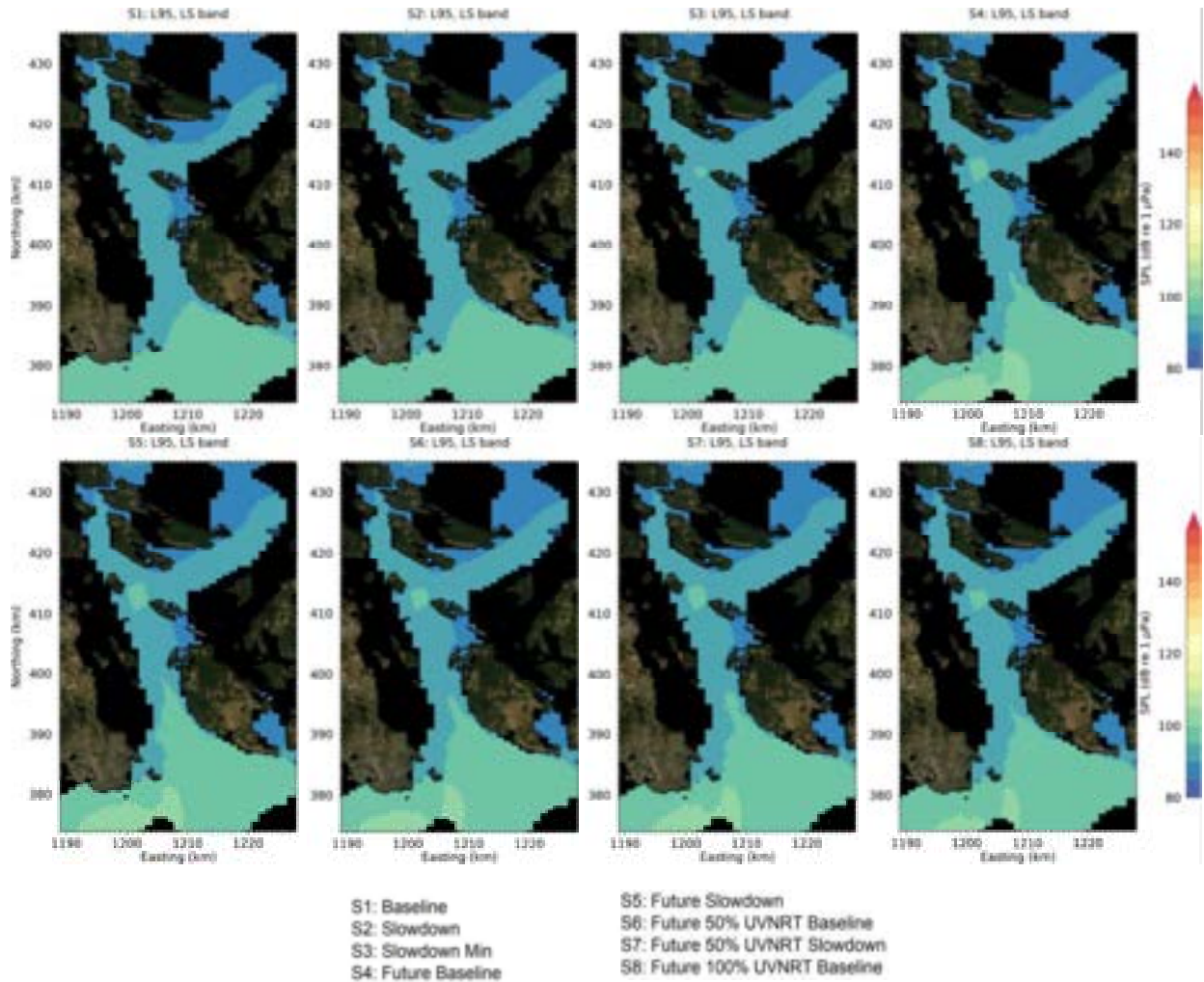


Figure A-5. Maps of SRKW communication band (0.5–15 kHz) 95th percentile exceedance level (L_{95}) within SRKW focus area. Receiver depth is 10 m. Grid cell size is 200 m.

A.1.3. SRKW Echolocation Band Exceedance Percentile Maps

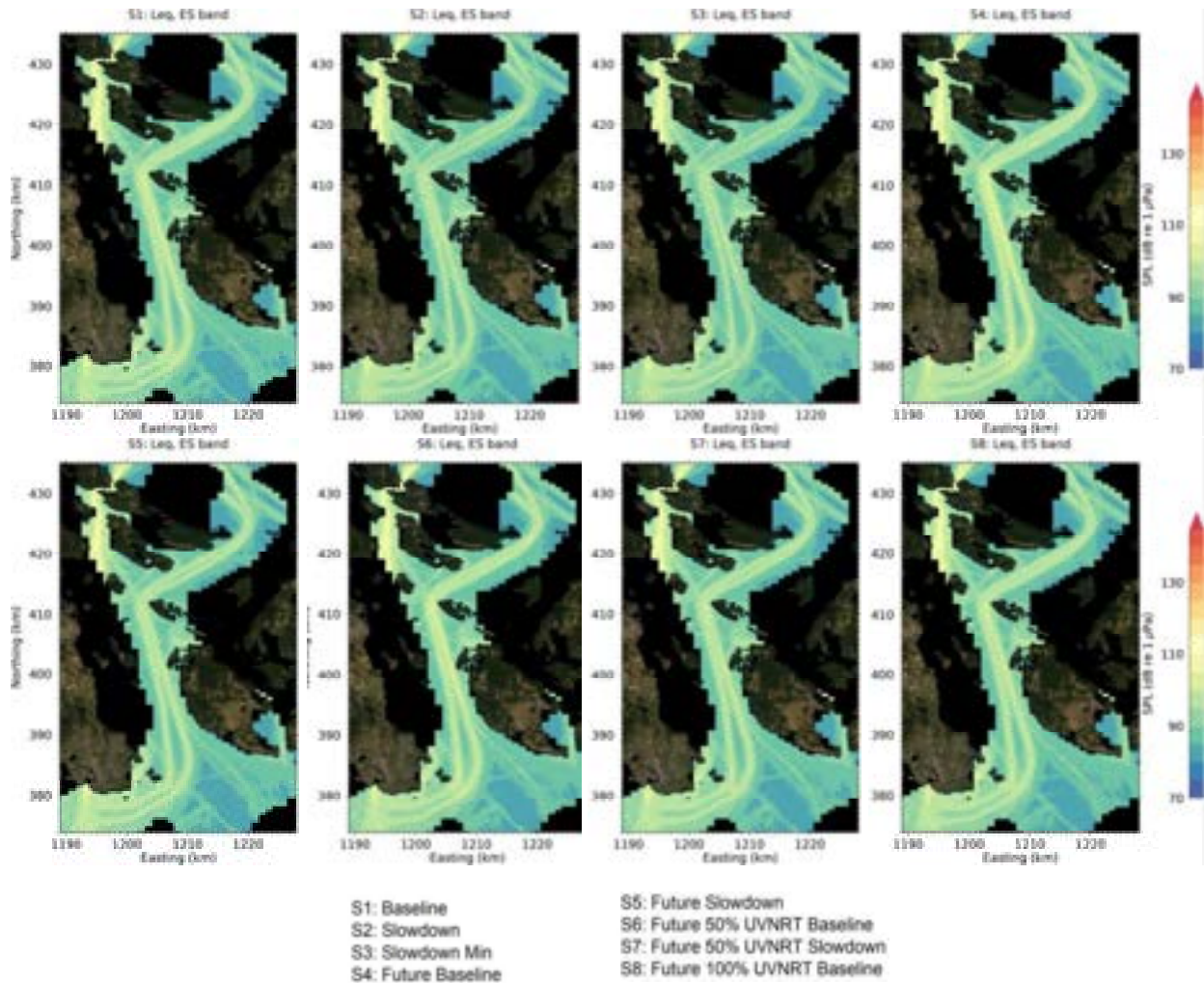


Figure A-6. Maps of SRKW echolocation band (15–64 kHz) L_{eq} within SRKW core habitat. Receiver depth is 10 m. Grid cell size is 200 m.

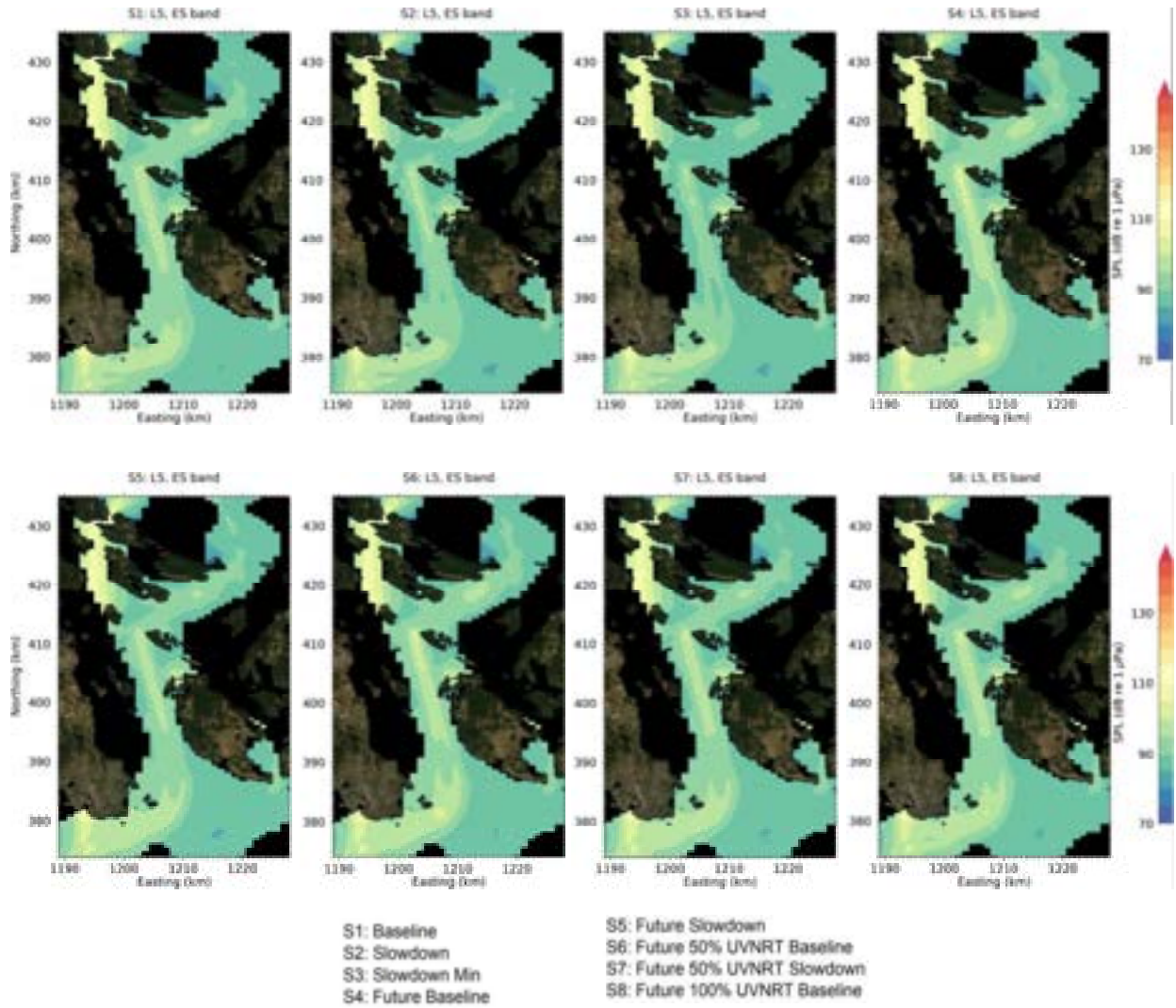


Figure A-7. Maps of SRKW echolocation band (15–64 kHz) 5th percentile exceedance level (L_5) within SRKW focus area. Receiver depth is 10 m. Grid cell size is 200 m.

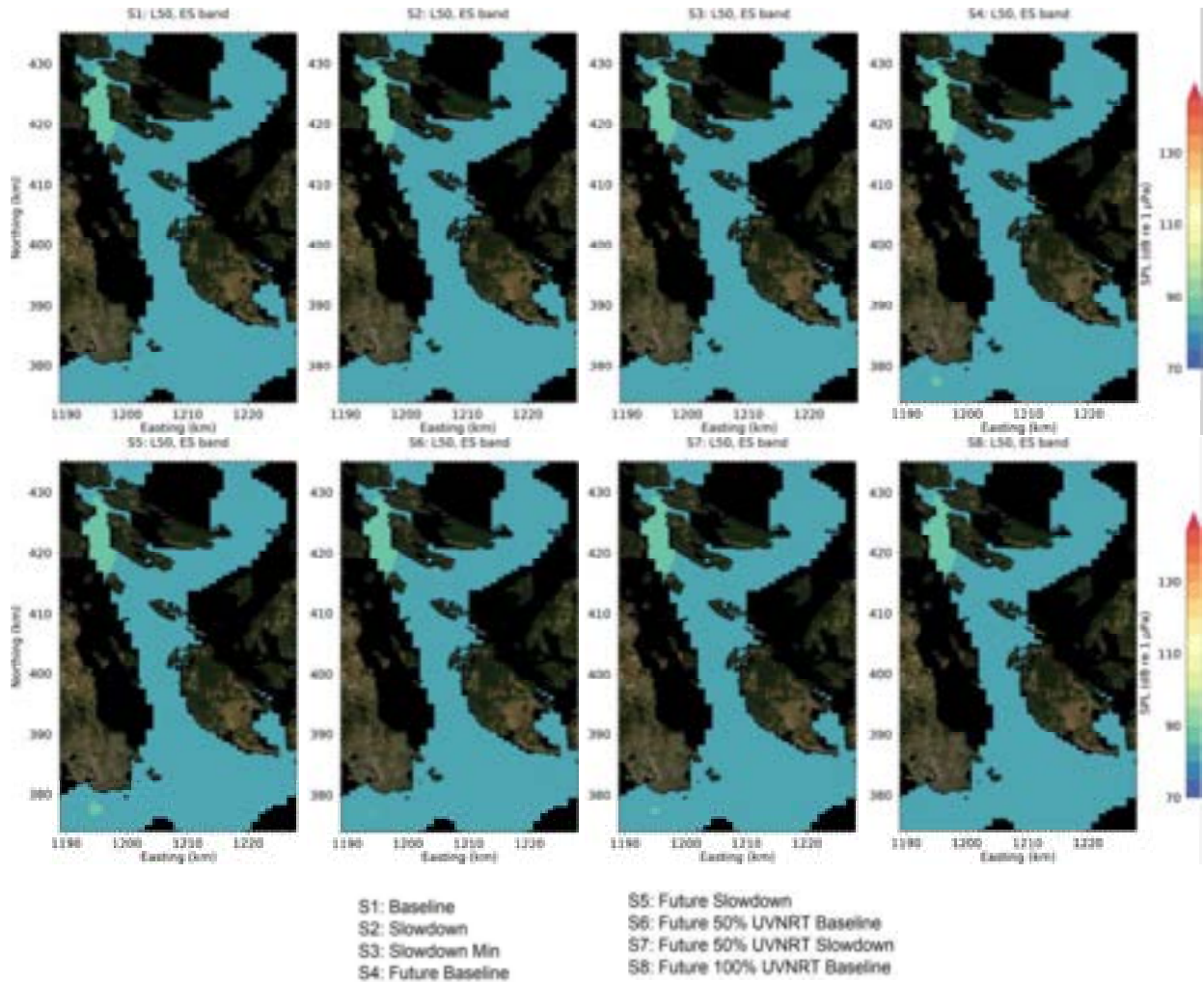


Figure A-8. Maps of SRKW echolocation band (15–64 kHz) 50th percentile exceedance level (L_{50}) within SRKW focus area. Receiver depth is 10 m. Grid cell size is 200 m.

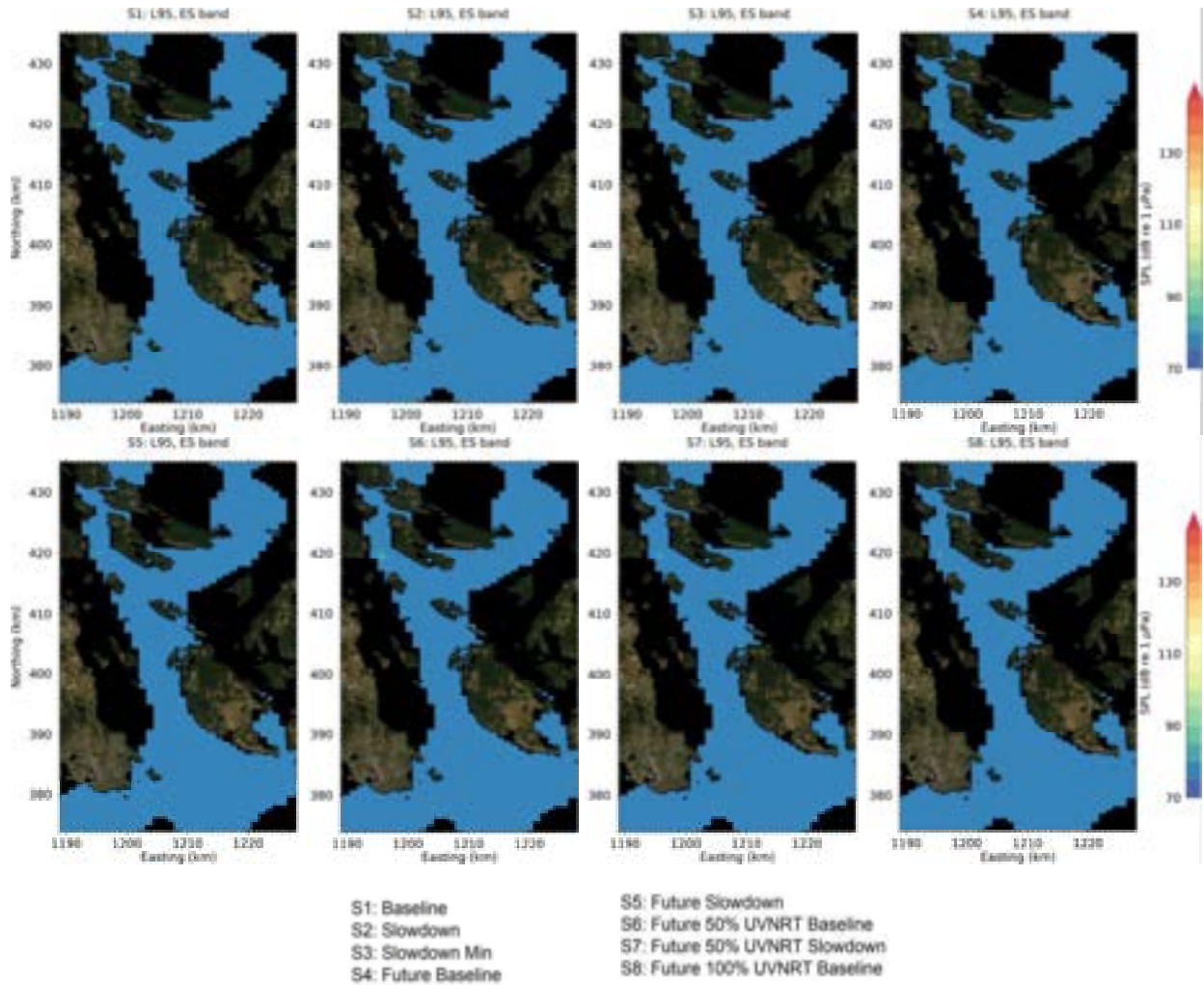


Figure A-9. Maps of SRKW echolocation band (15–64 kHz) 95th percentile exceedance level (L_{95}) within SRKW focus area. Receiver depth is 10 m. Grid cell size is 200 m.

A.2. Additional Exceedance Percentile Difference Maps

A.2.1. Broadband Exceedance Percentile Difference Maps

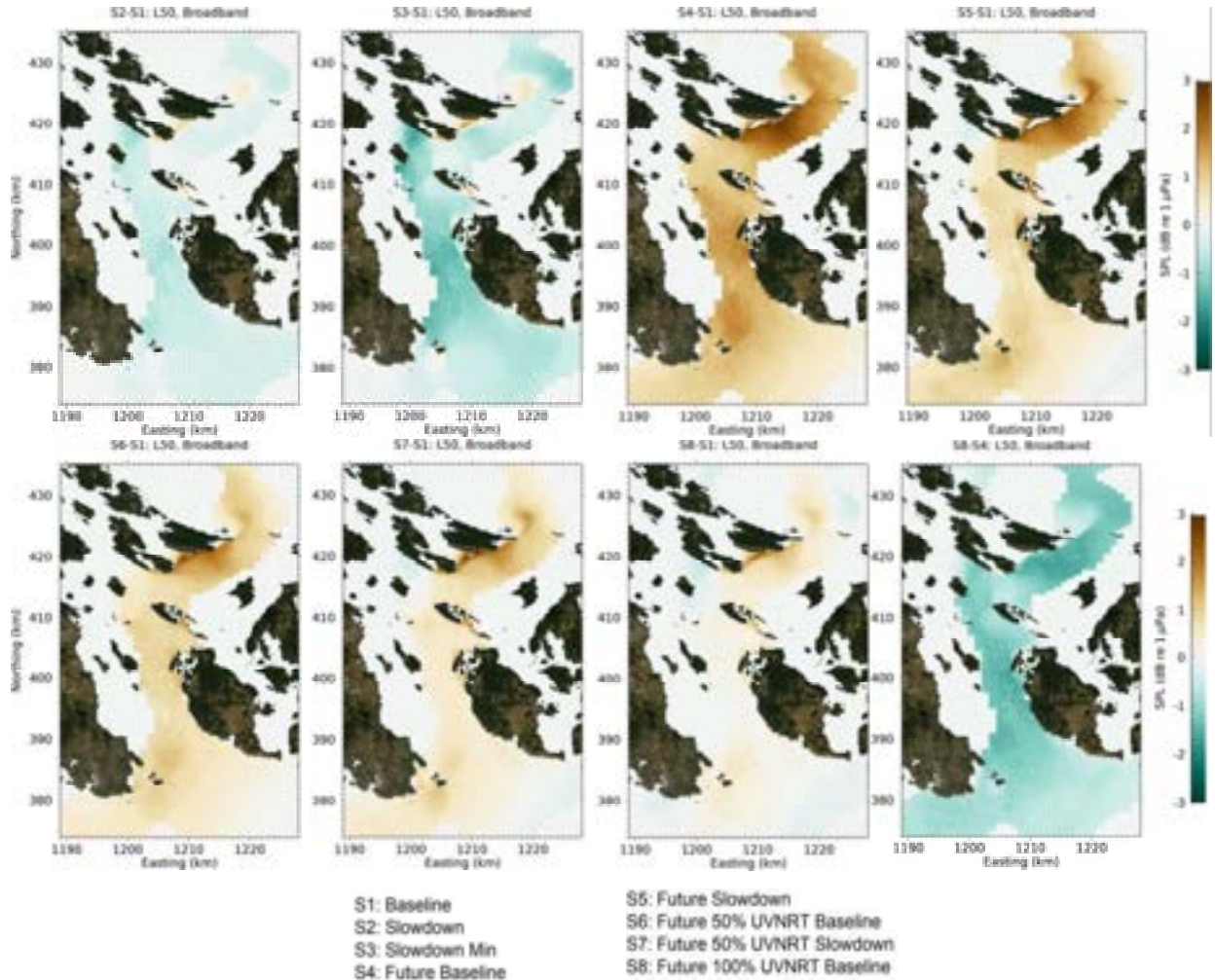


Figure A-10. Difference in 50th percentile exceedances levels relative to baseline (S1) conditions within SRKW focus area. Receiver depth is 10 m. Grid cell size is 200 m.

A.2.2. SRKW Communication Band Exceedance Percentile Difference Maps

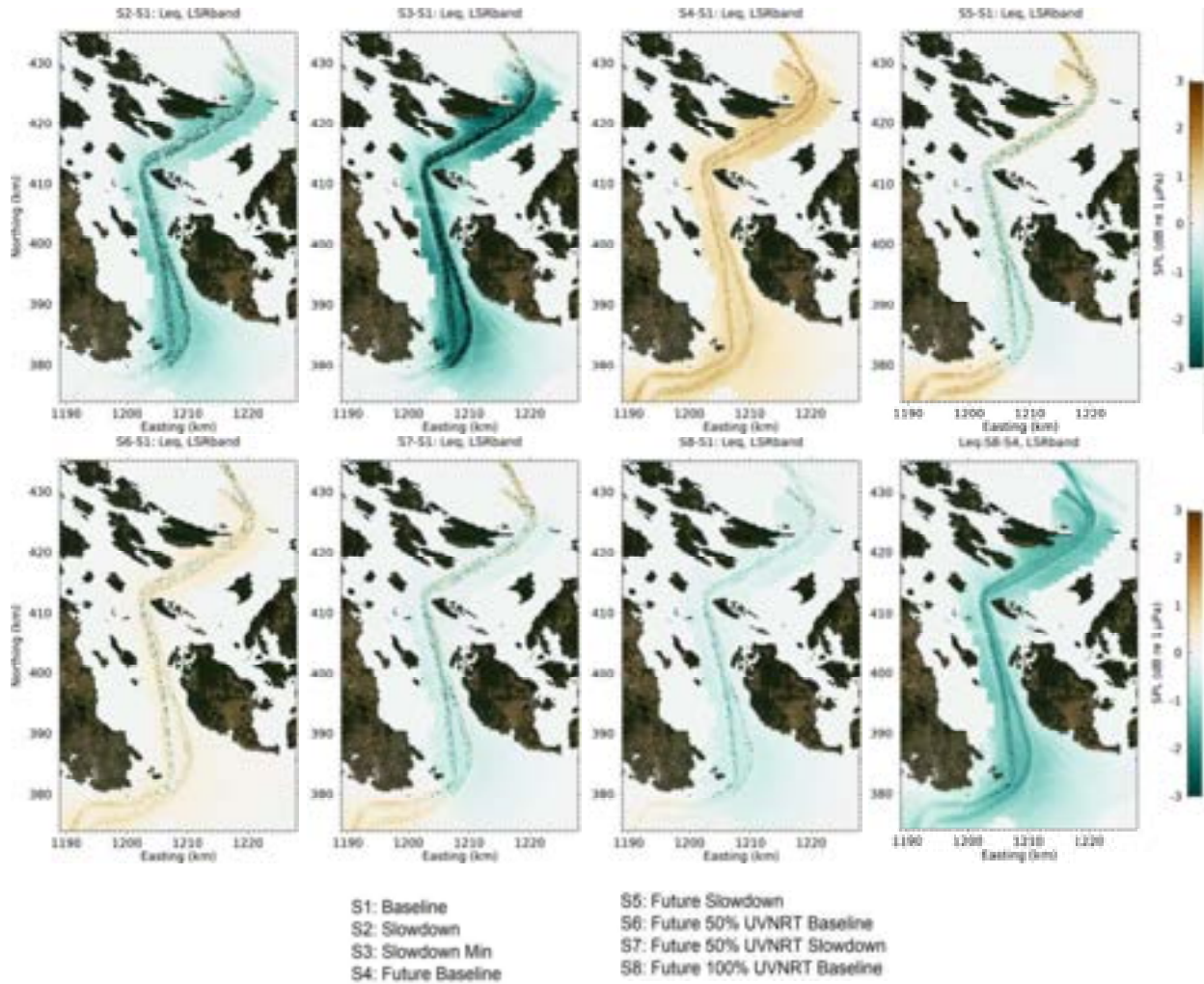


Figure A-11. Difference in SRKW communication band (0.5–15 kHz) L_{eq} relative to baseline (S1) conditions within SRKW focus area. Receiver depth is 10 m. Grid cell size is 200 m.

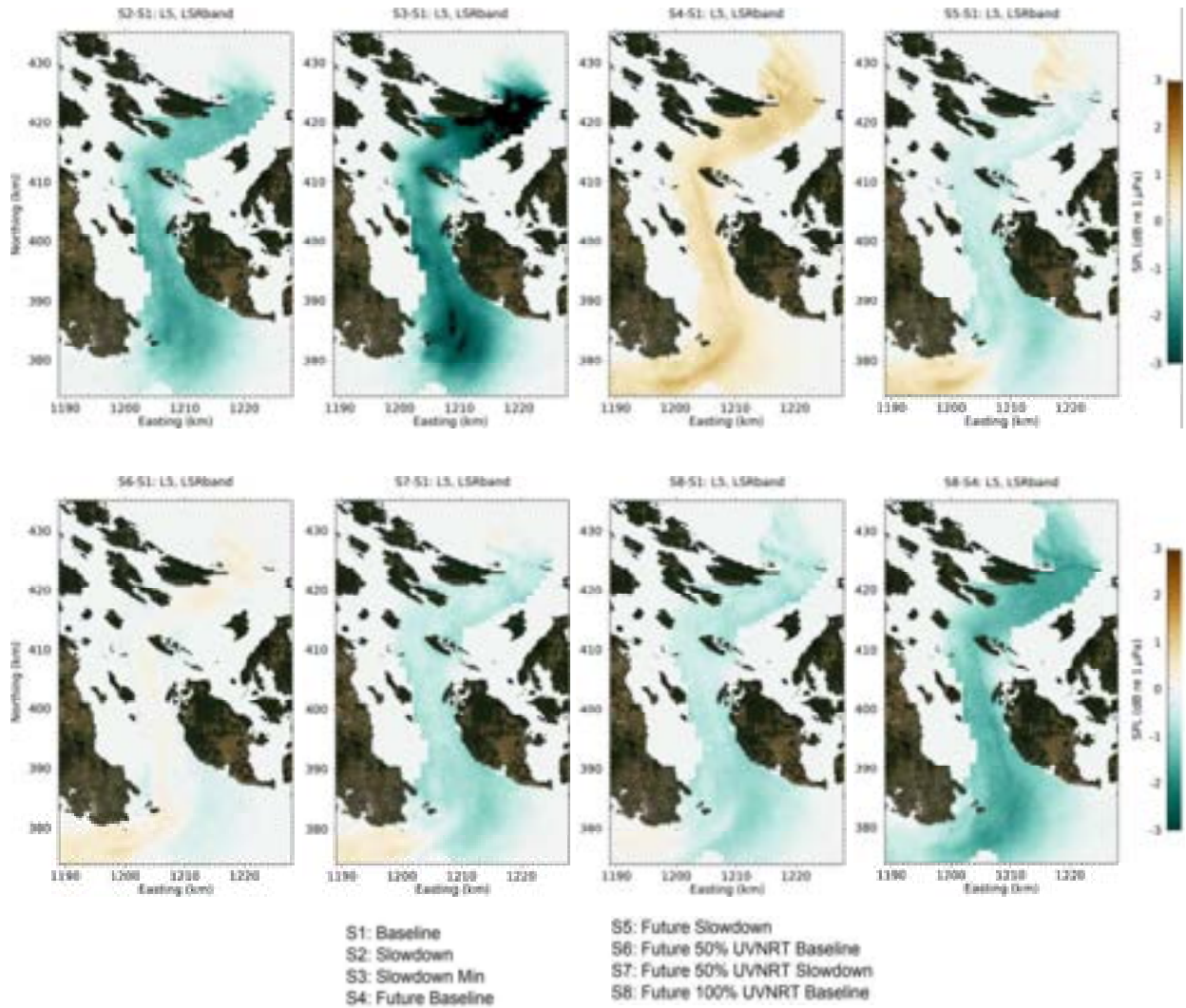


Figure A-12. Difference in SRKW communication band (0.5–15 kHz) 5th percentile exceedance levels relative to baseline (S1) conditions within SRKW focus area. Receiver depth is 10 m. Grid cell size is 200 m.

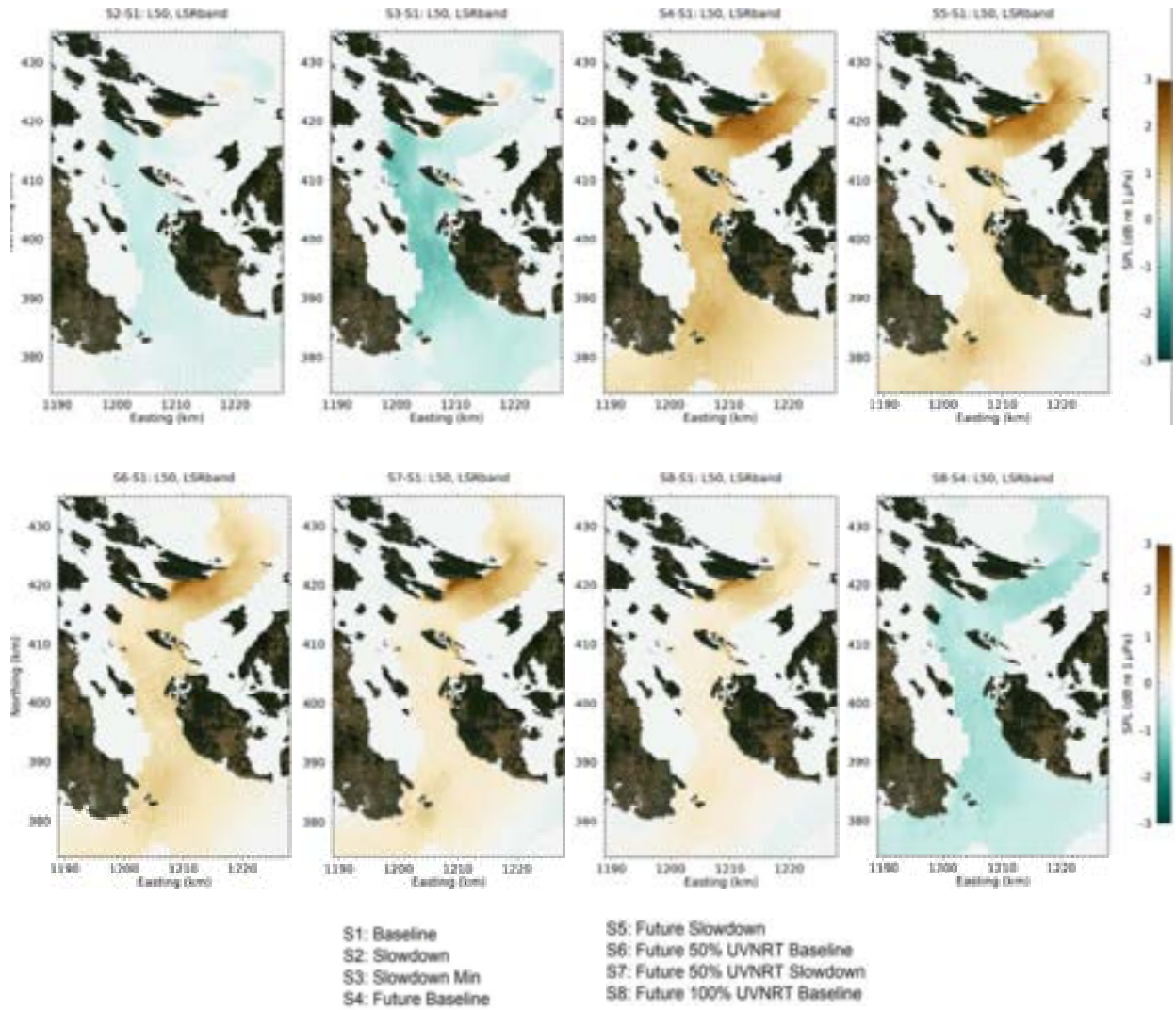


Figure A-13. Difference in SRKW communication band (0.5–15 kHz) 50th percentile exceedance levels relative to baseline (S1) conditions within SRKW focus area. Receiver depth is 10 m. Grid cell size is 200 m.

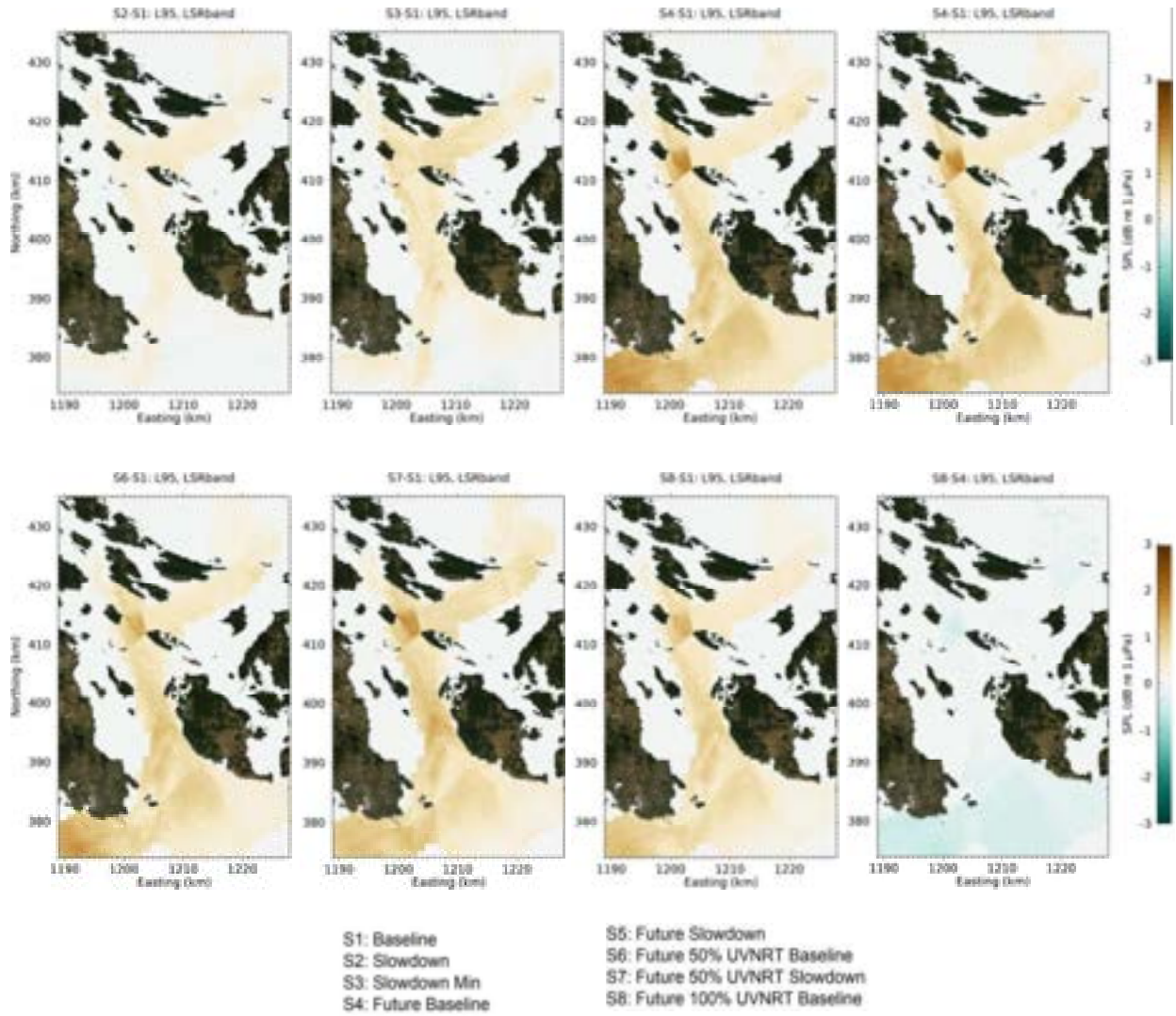


Figure A-14. Difference in SRKW communication band (0.5–15 kHz) 95th percentile exceedance levels relative to baseline (S1) conditions within SRKW focus area. Receiver depth is 10 m. Grid cell size is 200 m.

A.2.3. SRKW Echolocation Band Exceedance Percentile Difference Maps

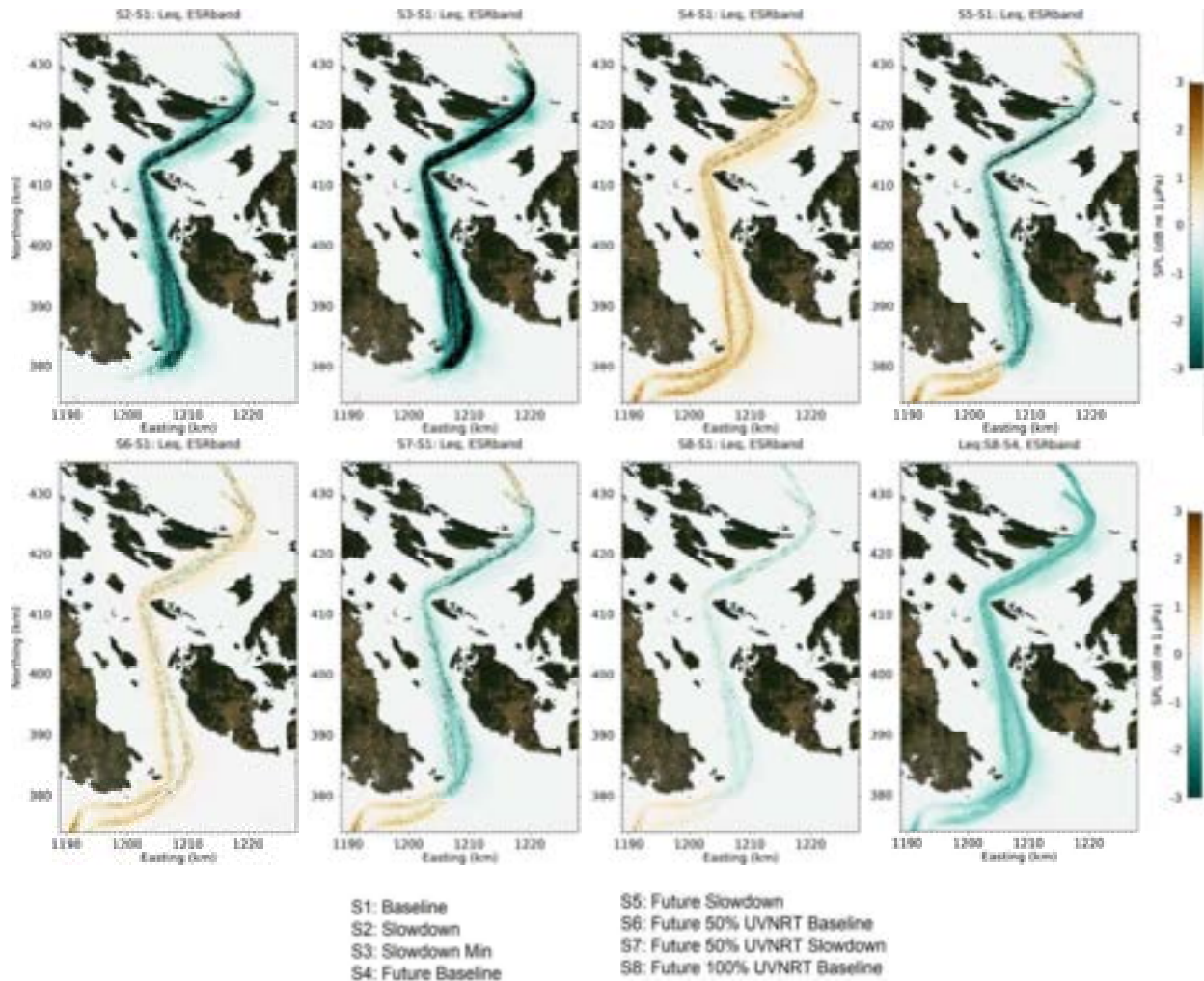


Figure A-15. Difference in SRKW echolocation band (15–64 kHz) L_{eq} relative to baseline (S1) conditions within SRKW focus area. Receiver depth is 10 m. Grid cell size is 200 m.

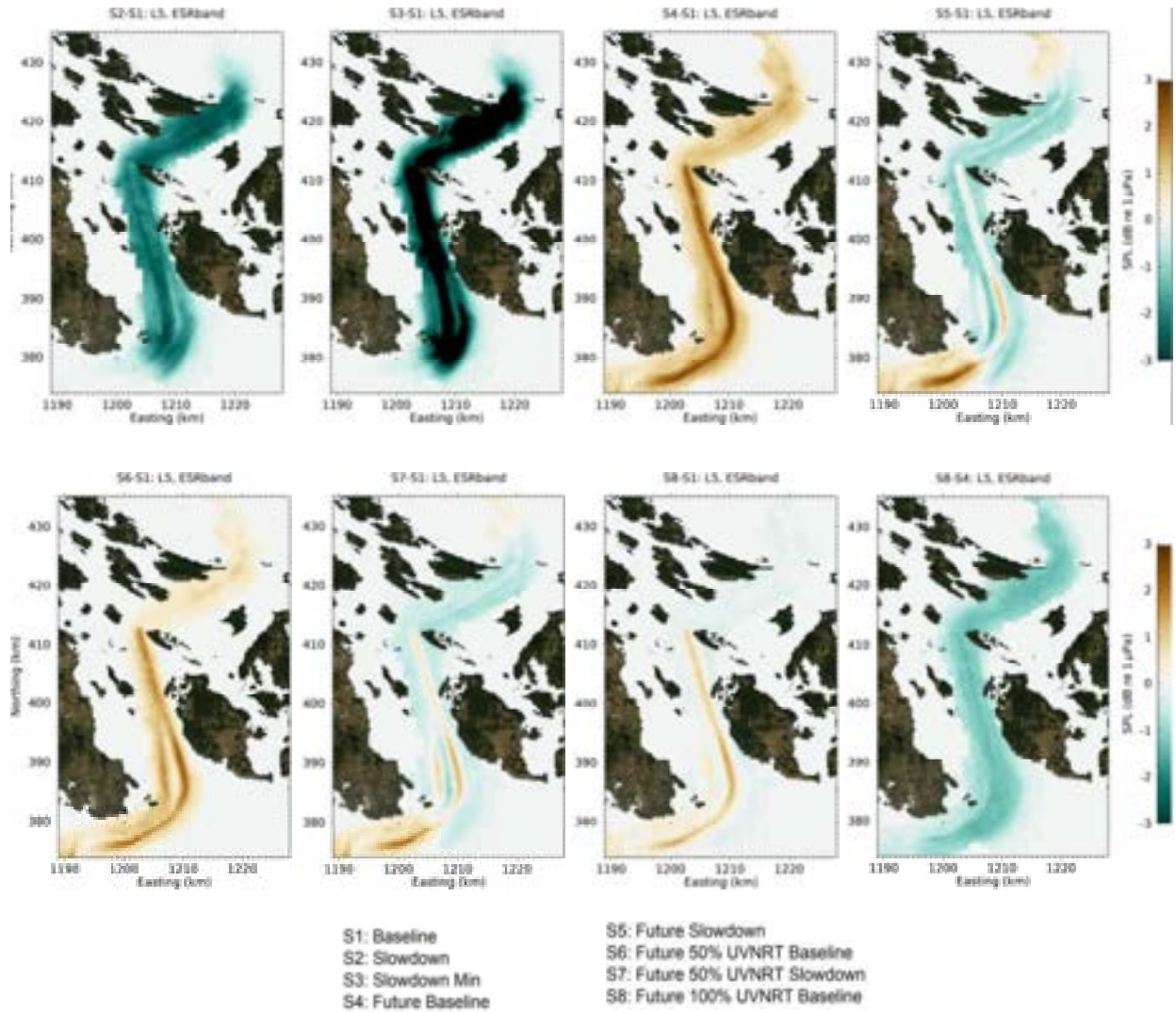


Figure A-16. Difference in SRKW echolocation band (15–64 kHz) 5th percentile exceedance levels relative to baseline (S1) conditions within SRKW focus area. Receiver depth is 10 m. Grid cell size is 200 m.

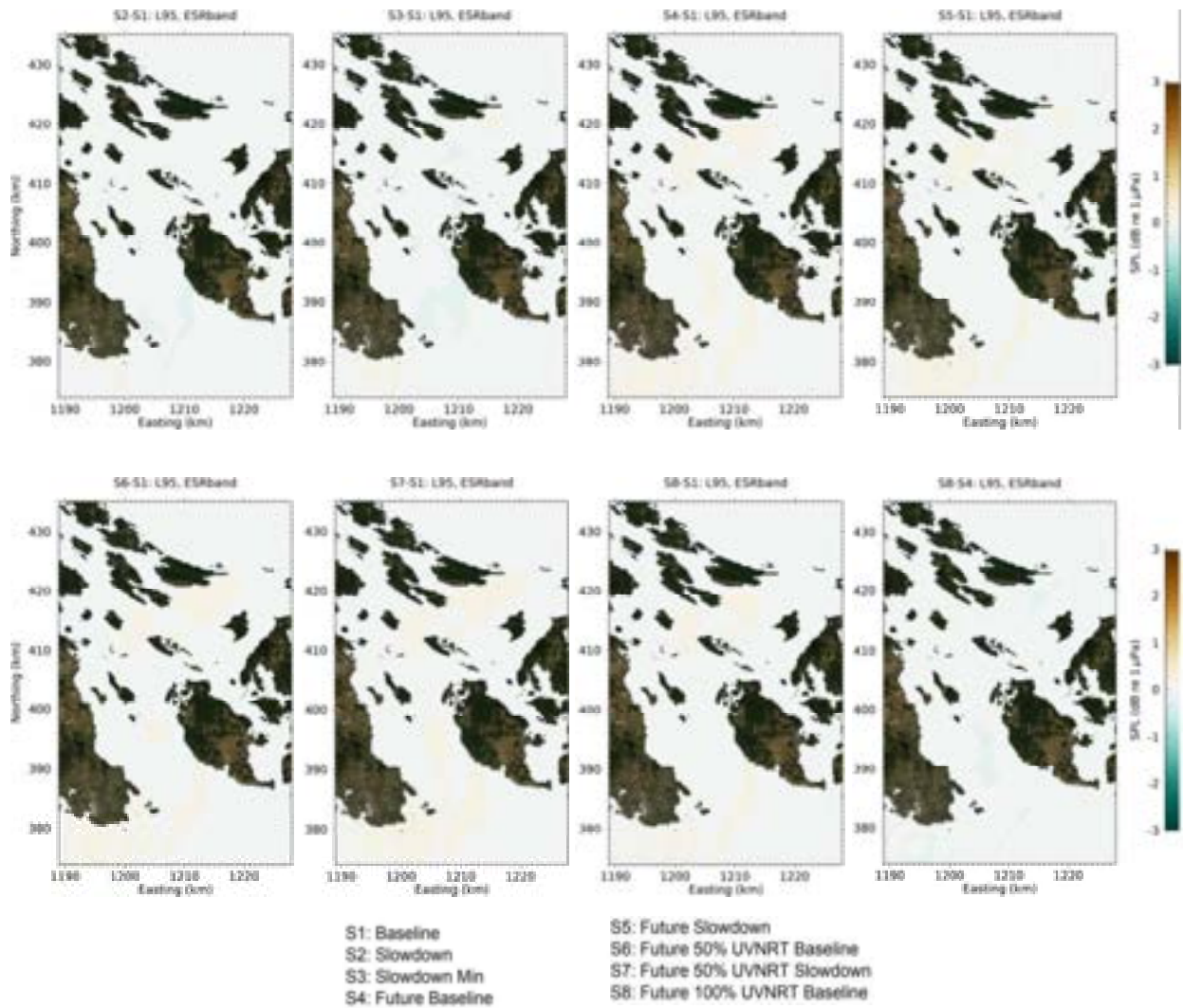


Figure A-18. Difference in SRKW echolocation band (15–64 kHz) 95th percentile exceedance levels relative to baseline (S1) conditions within SRKW focus area. Receiver depth is 10 m. Grid cell size is 200 m.

Appendix B. Additional Tables

B.1. SRKW Communication Band and Echolocation band Exceedance Percentiles

Table B-1. SRKW Communication Band (0.5–15 kHz) exceedance percentiles of modelled sound pressure level (SPL; dB re 1 µPa) at Lime Kiln-Central San Juan and Boundary Pass receivers.

SPL exceedance level (dB)	S1	S2	S3	S4	S5	S6	S7	S8
Lime Kiln – Central San Juan Receiver								
<i>L</i> ₅	112.6	111.2	110.7	112.9	111.7	112.4	111.6	111.6
<i>L</i> ₂₅	108.5	107.4	106.7	109.4	108.4	108.8	108.4	108.3
<i>L</i> ₅₀	104.9	104.5	103.9	106.1	105.6	105.7	105.4	105.3
<i>L</i> ₇₅	100.6	100.8	100.7	101.9	101.9	101.6	101.6	101.4
<i>L</i> ₉₅	94.2	94.6	94.9	95.0	95.2	95.1	95.1	95.0
<i>L</i> _{eq}	110.8	110.3	110.1	111.1	110.6	110.8	110.6	110.6
Boundary Pass Receiver								
<i>L</i> ₅	114.2	112.6	111.0	115.1	113.8	114.3	113.5	113.4
<i>L</i> ₂₅	107.4	106.5	105.8	108.8	108.1	108.2	107.8	107.5
<i>L</i> ₅₀	100.6	100.6	100.5	102.6	102.6	102.1	102.1	101.7
<i>L</i> ₇₅	94.8	95.4	95.7	96.4	96.8	96.3	96.4	96.1
<i>L</i> ₉₅	90.2	90.6	90.9	90.6	91.1	90.7	90.9	90.6
<i>L</i> _{eq}	114.0	110.6	109.2	114.3	112.4	112.9	112.2	112.8

Table B-2. SRKW Echolocation Band (15–64 kHz) exceedance percentiles of modelled sound pressure level (SPL; dB re 1 µPa) at Lime Kiln-Central San Juan and Boundary Pass receivers.

SPL exceedance level (dB)	S1	S2	S3	S4	S5	S6	S7	S8
Lime Kiln – Central San Juan Receiver								
<i>L</i> ₅	89.6	88.2	87.5	90.3	88.8	89.9	89.1	89.4
<i>L</i> ₂₅	84.4	83.9	83.8	84.9	84.2	84.7	84.3	84.5
<i>L</i> ₅₀	82.9	82.6	82.5	83.1	82.8	83.0	82.8	82.9
<i>L</i> ₇₅	81.3	81.3	81.2	81.5	81.4	81.4	81.4	81.4
<i>L</i> ₉₅	79.5	79.5	79.4	79.6	79.6	79.6	79.6	79.6
<i>L</i> _{eq}	92.8	92.7	92.7	92.9	92.7	92.8	92.8	92.8
Boundary Pass Receiver								
<i>L</i> ₅	93.3	90.7	89.3	94.6	92.4	94.0	92.7	93.2
<i>L</i> ₂₅	85.0	84.6	84.1	85.8	85.3	85.6	85.3	85.4
<i>L</i> ₅₀	82.8	82.7	82.6	83.1	83.1	83.1	83.1	83.0
<i>L</i> ₇₅	81.3	81.3	81.2	81.4	81.4	81.4	81.4	81.4
<i>L</i> ₉₅	79.4	79.4	79.5	79.5	79.5	79.5	79.5	79.5
<i>L</i> _{eq}	99.0	93.3	91.4	99.3	95.1	98.0	97.0	98.1

Table B-3. Statistics of SRKW communication band (0.5–15 kHz) SPL (dB) for all receivers and snapshots within SRKW core habitat.

Exceedance percentile	S1	S2	S3	S4	S5	S6	S7	S8
L_5	115.2	114.4	114.2	115.6	115.0	115.2	114.8	114.8
L_{25}	108.8	108.2	107.8	109.4	109.0	109.0	108.8	108.8
L_{50}	104.2	104	103.6	105.2	104.8	104.8	104.6	104.4
L_{75}	97.8	97.8	97.8	99.0	99.0	98.8	98.6	98.4
L_{95}	90.8	91.0	91.0	91.2	91.2	91.2	91.2	91.0
L_{eq}	111.3	110.8	110.6	111.7	111.2	111.4	111.1	111.0

Table B-4. Statistics of SRKW echolocation band (15–64 kHz) SPL (dB) for all receivers and snapshots within SRKW core habitat.

Exceedance percentile	S1	S2	S3	S4	S5	S6	S7	S8
L_5	93.0	92.4	92.0	93.6	93.0	93.4	93.0	93.2
L_{25}	84.6	84.2	84.0	84.8	84.6	84.8	84.6	84.6
L_{50}	82.6	82.6	82.6	82.8	82.8	82.8	82.8	82.8
L_{75}	81.2	81.2	81.0	81.2	81.2	81.2	81.2	81.2
L_{95}	79.2	79.2	79.2	79.4	79.4	79.4	79.4	79.4
L_{eq}	95.4	94.8	94.6	95.7	95.1	95.5	95.2	95.3