Wild Fish Conservancy
NORTHWEST
SCIENCE EDUCATION ADVOCACY

February 21, 2020

Mr. Barry Thom, West Coast Regional Administrator
National Marine Fisheries Service
1201 NE Lloyd Boulevard, Suite 1100
Portland, OR 97232

Mr. Phil Anderson, Chair
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, OR 97220

RE: E.3 Southern Resident Killer Whale ESA Consultation

Dear Mr. Thom, Chair Anderson, and Council members:

Wild Fish Conservancy appreciates the efforts of the PFMC's ad-hoc Southern Resident Killer whale workgroup, which authored the Final Draft Risk Assessment Report (RA), and we are grateful for the opportunity to provide the following comments on the RA. Due to the limited time available to review the RA before the February 21 comment deadline, we confine ourselves to brief general comments on the approach taken in chapter 5 (RA pages 72-104). Given the considerable detail provided in chapter 5 as well as in preceding chapters, we do not offer a detailed critique. We intend to provide detailed comments on the RA when finalized and the appropriate public comment period provided, and we recommend the Council direct the workgroup to continue its task and develop for Council consideration a range of precautionary conservation measures to minimize risk and help these orcas recover.

For completeness, we attach our previous comments, submitted to the Council in September and December 2019. In light of our review of the RA we believe that our previous comments retain their relevance as concerns both the urgency of the plight of Southern Resident Killer Whales (SRKW) and the need to reconfigure and reduce Chinook salmon harvests in Council fisheries as well as in fisheries north of the Council area managed pursuant to the Pacific Salmon Treaty.

Most important, we still find that the approach taken in the RA places an unreasonable burden of proof on SRKW and their advocates to show with high probability that harvest of Chinook salmon in Council and other fisheries is a proximate cause of a significant portion of the decline in abundance and demographic structure of the SRKW population over the past twenty or more years. The RA estimates and broadly describes many aspects of the

uncertainties regarding the likely effect on SRKW demography and survival of particular levels and locations of Chinook harvest, uncertainties that should not prevent actions to preserve and restore SRKW populations. In light of declining SRKW population, and concerns about SRKW genetic diversity, a precautionary approach would require evidence that the status quo is *not* harming SRKWs, rather than requiring a high degree of confidence in the precise assessment of harvest's effect on SRKW demographics.

Unfortunately, the RA does not identify (estimate) precautionary threshold limits to the abundance of specific Chinook populations and stock aggregates required to assure SRKW a high probability of recovering the vital rates necessary to a) prevent the population from further losses, b) stabilize population numbers in the very near term, and therefore c) preserve a high probability of rebuilding and recovering in the longer term. By failing to do this the RA fails to comply with the second part of the Workgroup's charge to recommend "conservation measures or management tools to limit PFMC fishery impacts on Chinook salmon prey availability for SRKW." It is in the nature of circumstances, like the one at hand, in which the precautionary approach applies for there to be considerable uncertainty in available data, appropriate models and statistical tools with which to analyze the data, and appropriate values for model parameters. In the context of an appropriately risk-averse statistical analysis, these uncertainties should support management procedures that err strongly on the side of the at-risk resource—in this case the severely endangered SRKW. We still find that the RA falls significantly short of adopting this approach. To the contrary, it appears that the uncertainties described in Chapter 5 tend to be characterized in such a way as to emphasize the uncertainty of a beneficial effect on SRKW of any reductions in particular Council Chinook fisheries.

As noted in our previous comments to the workgroup (attached), we recommend explicitly incorporating an analysis of social values into the risk assessment. While other approaches may allow this approach, one widely-adopted framework for such analyses would be a Bayesian Population Viability Analysis (PVA). Such a framework could output probability distributions of the demographic rates of SRKW from a suite of harvest control rules on Council Chinook fisheries intended to increase the availability and abundance of Chinook salmon to SRKW in particular areas and times of the year. The degree to which a specific management measure (harvest control rule) may contribute to increasing SRKW vital rates and demographics (expressed as a posterior probability of a Bayesian PVA analysis) would reflect the value that harvest managers (the Council) and associated regulators (NMFS) place on preserving the SRKW population. The RA as it stands lacks this kind of transparency with regard to the social values that underlie the management of Council Chinook salmon fisheries.

We recommend that the Workgroup adopt and/or modify one of the recent SRKW PVA's (Lacy, *et al.* 2017 or Clark-Murray, *et al.* 2019; see citations in the attached "Submission to NOAA on Protective Regulations for Southern Resident killer whales, December 2019") and incorporate all or an informative subset of the analyses in Chapter 5 of the RA into the PVA framework.

Finally, we note the glaring absence of an analysis of the impact on Chinook abundance, size, and age structure of harvest of (and more generally encounters with) immature Chinook salmon in non-terminal marine mixed-stock salmon fisheries in both Council and non-Council, northern PST managed Chinook fisheries. We do appreciate the authors of the RA explicitly acknowledging this (RA pages 90, 92, 97). As the authors observe, SRKW are not only

Chinook specialists, they are specialists on large Chinook. In addition to changes in abundance of Chinook, SRKW populations could be expected to vary based on availability of Chinook from the largest (and therefore oldest) age classes. SRKW evolved in a context where Chinook weighing over 100 pounds were commonplace in the Columbia River, Elwha River, and other major Chinook rivers of origin. It is not hard to see that it would take many times more energy and time to catch 100 pounds of 10-20 pound salmon than it would have taken to feed on a single 100-pound salmon then. Nor is it hard to envision the effects on SRKWs complex social structure when so much time must be taken away from social interaction simply to maintain caloric intake. It would hardly be surprising to find that this decrease in social interaction makes it harder to maintain pregnancies and sustain newborn orcas. The status quo of harvest management has driven this decline in Chinook sizes, and harvest management will be key to restoring SRKW prey quality, as well as quantity.

We recommend that analyses of the impact of harvest (including non-landed encounters) of immature Chinook salmon in Council fisheries be undertaken and included in a revised PVA-based RA. In addition, we recommend that annual monitoring/research directed at estimating the proportions, ages, and sizes of immature Chinook salmon be developed and implemented in future Council Chinook fisheries. Such research would likely require robust sampling of the landed catch throughout the season in several if not all areas in which Council Chinook fisheries are conducted. These analyses will help the Council (and NMFS) identify the fishery and the conservation benefits for Chinook and SRKW of reducing if not altogether eliminating coastal mixed-stock fisheries and moving Chinook fisheries to terminal areas as well as shifting terminal fisheries to selective gears and practices capable of releasing unharmed non-target (especially wild, ESA-listed Chinook) stocks.

The SRKW Workgroup has done important and essential work here to address the risks posed to SRKWs by the status quo of Chinook harvest in Council-area fisheries. This is a timely and crucial assessment, and the comments above are offered in hopes of strengthening that important work. The dramatic declines observed in SRKW populations, and the high likelihood of the population's extinction in this and other assessments, demand a more precautionary approach to SRKW management. Prey abundance and prey quality are central threats facing the SRKW population. An assessment of the risks posed by Council-area fisheries should not impose unreasonable burdens of proof before taking measures to ensure adequate prey for SRKWs, and the Council should consider precautionary measures that might trigger regional or coast-wide fisheries closures in response to evidence of low prey abundance or low prey quality. This risk assessment provides an important foundation for those measures.

Sincerely,

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Submission to NOAA on Protective Regulations for Southern Resident killer whales

December 2019

Summary points

- The marine waters of the North East Pacific that provide critical habitat to SRKWs are undergoing rapid changes to their structure (ex. stratification, trophic composition), function (ex. role of carbonate ions) and processes (ex. pH buffering, nutrient cycling, primary production), which the whales have not evolved with, but must recover within.
- These changes include shifts in the population demographics and structure of Chinook salmon, including run timing, genetic diversity, abundance, maturation rates, size at age, age at return, and fecundity.
- These changes are largely driven by fisheries that select for larger salmon and catch immature Chinook, but also include climate change, excessive hatchery production and potential size selective predation by other resident killer whales.
- Southern Resident killer whales selectively forage on large, older Chinook salmon estimated to represent less than 15% of the Chinook abundance within the Salish Sea.
- Hatcheries, and corresponding Mark Selective Fisheries, have direct and indirect interactions with wild Chinook that undermine their fitness, population structure, abundance and conservation. They are produced to subsidize commercial and sport fisheries from Alaska to California and have failed to recover wild Chinook populations.
- Closing marine mixed stock Chinook fisheries and moving fisheries to terminal areas would increase abundance of mature Chinook within SRKW foraging grounds.
- Significant reductions in Chinook hatchery production must be implemented to rebuild Chinook population structure and SRKW food supply.
- Vessel management measures in US SRKW critical habitat should be harmonized with Canada's 2019 measures to reduce vessel disturbance and improve salmon accessibility.
- These steps offer the best, and perhaps only, chance to restore reproductive potential and improve survival for endangered SRKWs.

Recovery plans for endangered Southern Resident killer whales have been in place in the US and Canada since 2008. Despite the listings and recovery plans, these whales have failed to show any signs of population stabilization, a reversal in their declining trend, or recovery. The most recent Population Viability Analysis (PVA) completed by Canada's Department of Fisheries and Oceans (DFO, Clark-Murray et al. 2019) in August 2019 shows ongoing population decline with a 26% probability of quasi-extinction (one sex) within 75-97 years (SAR: https://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2019/2019_030-eng.html; Clarke-Murray et al. 2019).

DFO's PVA examined the known primary threats (abundance of primary prey, Chinook salmon, vessel noise and disturbance, and contaminants) from an individual and cumulative threat perspective. When considered individually, the modeled effects of individual threats did not replicate the observed population trend in SRKWs over the period 2000-2017. When the threats were considered together (Chinook salmon abundance, vessel noise/physical disturbance, vessel strike and PCB contamination), the output of the PVA model closely replicated the observed population trends for Southern (and Northern) Resident killer whale populations. The authors conclude that Chinook salmon abundance and its interactions with vessel noise and PCBs strongly influenced modelled killer whale population dynamics. Importantly, this PVA follows previous DFO (Velez-Espino *et al.* 2014 a, b) and independent (Lacy *et al.* 2017) viability analyses that show declining trajectories with a 25% to 49% risk of functional extinction (less than 30 individuals) by the end of the century depending on the threats considered.

Despite minor efforts to reduce threats and implement precautionary measures for SRKWs, these actions have not improved declining trends nor have they improved estimated extinction probabilities. This failure has placed the region in the position of having to undertake drastic actions to arrest the decline in Southern Resident population numbers and preserve reproductive potential. Past reductions in Chinook salmon fisheries, including those in the recently renewed Pacific Salmon Treaty, have at best simply followed declining stocks down, rather than making significant precautionary reductions and/or implement closures that would get ahead of population declines and facilitate genuine rebuilding. Herein, we propose actions to be taken immediately to halt the decline and preserve the possibility of recovery of these iconic whales.

Despite high profile attention and proclamations for bold recovery actions by governments in the past few years, the SRKW population has only declined. Absolute population numbers are at critically low levels (73 individuals across the three pods with J pod consisting of 22 members, K pod of 17, and L pod of 34; CWR https://www.whaleresearch.com/orca-population). Extensive analysis has been presented to US authorities on the Task Force and to NOAA, describing the population's precarious biological condition. There should be no disputing the demographic information that shows a dramatic reduction in successful births, declining matriarch and breeding females, skewed sex ratios, in-breeding concerns, disrupted age structure, and destabilized population structure that likely has social, as well as biological, implications. The issue at hand is not whether urgent action is warranted, but the adequacy of the measures needed to reverse this dangerous decline and stabilize the population so as to preserve the possibility of recovery (population rebuilding).

A rapidly changing ocean

Underpinning the historical presence, distribution, and resilience of Resident killer whales are evolutionary ecological processes that support ecosystem function and services. As these processes are disrupted or destroyed, the complex ecological webs that underlie the diversity, abundance, and productivity of Chinook salmon and SRKW (among many other components of Pacific Northwest marine and freshwater ecosystems) unravel. Mixed-stock coastal marine salmon fisheries and large-scale salmon hatchery production are contributing causes of this unraveling.

The diet, biological and cultural traits of Southern Residents have evolved over 250 thousand years into an ecotype that is highly specialized on the geographic distribution, run timing, and size and abundance of Chinook salmon, as well as other seasonally abundant species of the larger Pacific salmon. They also evolved with an acoustic environment that supported their use of sound to meet social and biological life requisites.

The quality of the marine environment (warming, acidification, oxygen loss, nutrient cycling and primary production) along with the spatial, temporal and biological structure of Chinook populations that SRKWs rely on, has changed significantly within the last century, especially so in the last 30-40 years.

Today, the rates, scales, kinds, and combinations of regional and global ecosystem change differ from those at any other time in history. For example, heatwaves from El Nino, the blob, and steady warming in the North Pacific Ocean increases salmon metabolism, food consumption and stress. More importantly, warming temperatures change zooplankton composition and distribution (changing food quality), increase vertebrate and invertebrate predators, drive algae blooms, change historic hydrologic patterns, increase ocean stratification, weaken upwelling processes, and change the base of the salmon food web.

Surface waters are not just warmer, they are more acidic. With higher acidity, sound wave absorption is lowered, making ocean noise louder. More CO_2 uptake has consequences for zooplankton at the base of the food web that use carbonate minerals for shells and skeletons. Models predict that large parts of the Arctic will start to cross a carbonate under-saturation threshold in a decade, with forecasts that most Arctic waters will lack adequate aragonite for shell-building organisms by the 2080s (AMAP 2018).

Other ecosystem changes come from disease, invasive species, contaminants, competition, and a multitude of altered freshwater conditions. Sudden leaps in aberrant ecosystem behaviour are also being observed, with changes often occurring faster than we can understand them. Coupled with this is still a fundamental lack of understanding of the functions and processes that underpin natural systems. This understanding is often a prerequisite to link species decline with threat reduction and conservation action. Its absence allows resource managers to stay the course of conventional management and abdicate demonstrating burden of proof of ecosystem harm.

The take home message from this is that both killer whales and Chinook salmon must now recover in an environment that is vastly different from the one in which they evolved. Their ability to recover is unlikely unless significant measures are taken to stop threats and encourage, rather than undermine, their resilience.

Recommendations

1. **NOAA must reform Chinook harvest in AABM and ISBM fisheries**

SRKWs evolved with the spatial and temporal run timing of Chinook salmon that matured between four and eight years of age (and an increasing percentage of females with age). These

salmon returned across the months and seasons to select rivers within the range of SRKW. SRKW are highly selective on mature large (70cm+), old (4 yrs +), and increasingly rare Chinook salmon (for example, 4 and 5 yr old Chinook made up less the 15% of the abundance estimate for 2-5 year old Chinook in the 2018 FRAM pre-season abundance model, Chinook older than this are so rare they are not even factored into models). Unless the historic population structure and run timing of Chinook is restored, SRKWs cannot recover.

Chinook salmon abundance trends show synchronous declines throughout BC, the Transboundary rivers, the Yukon, and Southeast Alaska, with declines in Chinook survival reported from Oregon to Alaska (Grant et al. 2019). Declining Chinook abundance is exacerbated by decreases in Chinook size at age, age at return, age at maturity, and reproductive potential, including reductions in egg size and the numbers of eggs per female, especially among age 4 (ocean age 3) and older females, largely due to the reduction in size-at-age (Grant et al. 2019, Ohlberger et al. 2018, 2019). These changes in population structure are perpetuated by Chinook fisheries that target the largest, oldest salmon, and coastal mixed-stock Chinook fisheries that encounter immature Chinook (Riddell et al. 2013). They are also perpetuated by competition when food supply is limited, competition that is exacerbated by releases of large numbers of hatchery Chinook.

As spawning Chinook return younger and smaller, this affects their spawning success. Large female Chinook have the size and strength to bury their fertilized eggs in course gravel and cobble below the typical scour force of the river. In this way, few are crushed or washed away under typical conditions. As female Chinook decline in size, so does their ability to build adequate redds (nests), leading to lower survival in the fewer, smaller eggs that are deposited. In addition, high quality spawning habitats that can only be utilized by larger Chinook go unused, further depressing population productivity, abundance, and diversity and distorting assessment of the effects of habitat preservation and recovery efforts.

Benefits from a coast-wide marine recreational and commercial Chinook closure

Within two generations of Chinook salmon (8-10 years), the elimination of mixed stock fisheries that encounter and kill mature and immature Chinook can be expected to begin rebuilding an older age structure to many Chinook populations that are critical to SRKW, providing more and larger Chinook to these whales. Estimates in Hilborn et al. (2012) show that the probable effects

of full marine fishery closures (US and Canada) would increase total abundance (numbers) of mature age 4 and 5 yr old Chinook to the Salish Sea by about 20% for all stocks combined (Puget Sound, Fraser early, Fraser late, and Lower Georgia Strait). Increases in terminal abundance of this magnitude were shown by Lacy et al. (2017) to stop the declining trend of SRKWs. When combined with vessel management actions to reduce noise and disturbance, such increases in abundance could bring about positive growth rates.

Elimination of marine mixed-stock fisheries is not a no fishing scenario. Terminal and in-river fisheries employing selective fishing gears and methods whose harvests are managed for ecosystem benefits (i.e. by setting egg deposition and adult spawner escapement targets that maximize smolt production (Forseth et al. 2013, Gayeski et al. 2018) can provide salmon to First Nation and Tribal needs. Such fisheries are designed to occur after whales have had access and after component stocks that are currently encountered in mixed stock fishery areas have diverged to their rivers of origin. Fisheries targeting and otherwise affecting populations down the Pacific Coast as far as Monterey Bay, will likely need to be reconfigured in similar ways to those conducted on migrations routes between Alaska and the Salish Sea.

Remove the burden of proof placed on the SRKW

Until now, advocates for SRKW recovery have been made to bear the burden of proof when proposing conservation measures at the expense of other stakeholders and interests. This must change. The burden of Chinook harvest reductions that may be undertaken to attempt to halt the decline of the SRKW DPS must fall on fisheries. The April 2019 NMFS Biological Opinion concerning the Consultation on the Delegation of Management Authority for Specified Salmon Fisheries to the State of Alaska makes it clear that NMFS considers Treaty Chinook fisheries as configured pursuant to the 2019 Pacific Salmon Treaty to jeopardize ESA-listed Puget Sound Chinook and SRKW[1]. NMFS's finding that there is a need to further mitigate the effects of

[1] The 2019 BiOP admittedly does not explicitly use the term 'jeopardy'. The exact language is "… the status of Puget Sound Chinook salmon and SRKWs have declined in recent years. A key objective of the U.S. Section during the negotiating process for a new Agreement was therefore to achieve harvest reductions to help address ongoing conservation concerns for Puget Sound Chinook and coincidentally provide benefits for SRKWs", and continues "Further reductions [in Chinook harvest in PST fisheries] are proposed in conjunction with the 2019 Agreement, but there was a practical limit to what could be achieved through the bilateral negotiation process. As a consequence, and in addition to the southeast Alaska, Canadian, and SUS fishery measures identified in the 2019 PST Agreement, the U.S. Section generally recognized that more would be required to mitigate the effects of

Chinook harvest beyond what is provided for in the Treaty is tacit admission that, absent the proposed mitigation measures, NMFS would have had to conclude jeopardy. Regardless of the proposed mitigation measures (which are conjectural and dependent on uncertain future funding), the Biological Opinion makes it clear that Chinook harvest poses jeopardy to SRKW, and since Treaty harvest measures have therein been given ESA take coverage, the burden for further necessary modifications in US coastal Chinook fisheries falls on the Council fisheries.

2. Significantly reduce, not increase, Chinook hatchery production

Hatchery Chinook salmon are produced to subsidize commercial and sport fisheries from Alaska to California. The production of Chinook from Washington, Oregon and California hatcheries has failed to recover Chinook salmon, contributed to overfishing of wild, threatened and endangered populations, contributed to the changes in population structure and run timing, and likely exacerbated competition with wild Chinook in a food limited environment of the North Pacific. Further, the public funds spent on these hatchery programs and facilities takes scarce funding away from wild population monitoring and recovery actions. Continuing to pursue a hatchery strategy will not change this situation. It is likely to undermine recovery efforts for wild Chinook and the needed rebuilding of their age structure, their run-timing, their diversity, their productivity and their abundance. Restoring these attributes is not the objective of production hatcheries. There is also concern that increased hatchery production from Puget Sound will come at a cost to natural production in the Fraser River.

Further, hatchery Chinook are largely late-timing ocean-types. Some of the most endangered Chinook populations, and potentially some of the most important runs for SRKW, are early-timed stream-types and the few remaining winter runs.

At current levels of hatchery production, the proportion of hatchery origin Chinook on wild salmon spawning grounds (pHOS: proportion of hatchery origin spawners) in most Washington rivers exceeds "biologically acceptable" levels recommended by the independent Hatchery Scientific Review Group (HSRG 2009, 2015, WDFW Score/Chinook). This is especially true of most Puget Sound Chinook populations.

harvest and other limiting factors that contributed to the reduced status of Puget Sound Chinook salmon and SRKWs" (pp. 9-10).

The rush to focus on a conjectural quick fix in the form of increased Chinook hatchery production is symptomatic of the failure of current management to address past mismanagement of Chinook populations coast-wide and the hope that an industrial-technological solution will somehow solve a complex ecological problem. Reliance on this failed industrial tool to address the complex ecological issues facing SRKW and wild Chinook is destined to fail both of them. Such an approach simply repeats the current "placeless" management of salmon that fails to recognize that their great diversity and abundance is rooted in their strong attachment to place: i.e. the rivers of their origin (Gayeski *et al.* 2018). SRKW are an integral component of the Salish Sea ecosystem and any solution to the Chinook crisis affecting them should also be place-based.

Fisheries managers responsible for Chinook salmon and SRKW have ignored the significant harvest issues, perpetuated by hatcheries, that are responsible for a large part of the decline and failure for Chinook to rebuild (Gayeski *et al.* 2018).

3. The role of Pinnipeds

Canadian studies examining the consumption of Chinook by seals and sea lions since pinnipeds numbers have recovered to near historical levels in the last 20+ years, shows that Chinook salmon represent a small percentage of pinniped diet (less than 10% with a mean across all pinnipeds of 0 - 4.4%; DFO 2019). Juvenile, immature and mature salmon have many predators beyond pinnipeds including Humboldt squid, great blue herons and other piscivorous birds, harbour porpoise, Pacific white-sided dolphins, Pacific hake, river lamprey, salmon sharks, sturgeon, tuna, northern fur seals, and other Northeast Pacific Resident killer whales. Relationships that assume single lines between the abundance of prey and a specific predator oversimplify complex marine food webs. A proper appreciation of these food web dynamics and the extent of additive versus compensatory mortality that exists between pinnipeds and their salmon prey make it extremely difficult to predict how the system will react to removal of a predator.

There is also a host of other factors that affect the rate at which salmon are preyed upon. A 2019 workshop (Trites and Rosen *ed*.) identified the extent of kelp forests, habitat complexity, water temperature, stream water height and flow, man-made obstructions to fish passage (bridge, dam,

etc.), proximity to pinniped haul outs, alternative prey availability, fishing efforts, and hatchery fish as some of many factors that may be affecting predation. As such, beliefs that a pinniped cull would aid Chinook survival are not supported by available science.

4. **Harmonize U.S. vessel management measures with Canadian measures**

In the spring of 2019, Transport Canada issued an Interim Order prohibiting vessels from approaching any killer whale within 400 metres while in Canadian SRKW critical habitat. Transport Canada also entered into an agreement with identified members of the Pacific Whale Watch Association (PWWA) to avoid and not follow SRKWs.[2] The Transport Canada agreement also enabled listed members of the PWWA to approach Transient/Biggs killer whales to 200 m. Preliminary reports of 2019 vessel compliance with the Order for SRKWs in Canadian waters indicate a good level of compliance and low number of commercial and private whale watch vessel interactions with SRKWs.

5. **Restore access to historical Chinook habitat.**

The rebuilding of wild runs in naturally flowing rivers throughout the historic geographical range of Chinook salmon is a necessary long term goal to give wild salmon the best possibility to recover their population structure, run timing, diversity and abundance. As such, the removal of the Snake River and other dams should be considered part of the long term recovery strategy. Benefits to the recruitment of affected Chinook populations and foraging SRKW would begin to accrue one or more Chinook generations (4+ years) after dam removal. These fish would be available for foraging from southwest Vancouver Island to California and within critical habitat in the Salish Sea.

Conclusion

U.S. government authorities have generally denied the risks of hatchery production to the preservation and recovery of wild Chinook salmon and excluded meaningful discussion of fisheries management issues that perpetuate the decline of wild Chinook salmon. This is a failure to openly and fully consider all factors leading to the current dire condition of the Southern Resident Killer Whale population. There is no credible scientific justification for this. Reductions

[2] See Appendix I "Sustainable Whale Watching Agreement to support the Recovery of Southern Resident Killer Whales"

of Chinook harvest are, with high probability, the most likely tangible action that can provide SRKWs with immediate relief from the major stresses that have been threatening the population with extinction for the past decade or more.

Closing mixed-stock marine commercial and recreational fishing, and significantly reducing hatchery production are required now. Closing such fisheries will ensure they are managed to prioritize the returns of mature Chinook to SRKW foraging refuge areas. The longer this kind of action is postponed, the lower the likelihood that the decline of SRKW can be halted, much less reversed, and the more drastic harvest reductions and other remedial actions will have to be in order to have any chance of success. Absent the actions we advocate, we expect the state of SRKW to get worse, not better, and thus continue the declining trend in the coming few decades, if not sooner.

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Appendix I

SUSTAINABLE WHALE WATCHING AGREEMENT TO SUPPORT THE RECOVERY OF THE SOUTHERN RESIDENT KILLER WHALE

Between:

The Minister of Transport, responsible for the Department of Transport (TC)
(Hereinafter referred to as the Minister)

And

The Membership of the Pacific Whale Watch Association, as represented by their Board of Directors
(Hereinafter referred to as PWWA
(Hereinafter referred to as the "Parties")

SUSTAINABLE WHALE WATCHING AGREEMENT TO SUPPORT THE RECOVERY OF THE SOUTHERN RESIDENT KILLER WHALE

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PREAMBLE:

A. **Whereas** the Southern Resident Killer Whale (SRKW) is a species which has been listed as Endangered under part 2, Schedule 1 of the federal *Species at Risk Act, 2002* (SARA);

B. **And whereas** Canada is committed to the long-term conservation, survival and recovery of aquatic species at risk to ensure the long-term viability of species and to enhance their survival in the wild;

C. **And whereas** the Parties recognize that a key threat to the SRKW is acoustic and physical disturbance from vessels;

D. **And whereas** on May 24, 2018 the Minister of Fisheries, Oceans and the Canadian Coast Guard and the Minister of Environment and Climate Change Canada, as the Minister responsible for Parks Canada Agency, as competent ministers for the SRKW announced that they were of the opinion that the SRKW population faced imminent threats to its survival and recovery;

E. **And whereas** TC has jurisdiction over maritime traffic, has a mandate to promote efficient, environmentally responsible and safe transportation, and has a responsibility to address the environmental impacts of maritime transportation including the mitigation of acoustic and physical disturbance on endangered marine mammals;

F. **And whereas** the PWWA is committed to education and conservation while advocating responsible whale watching, and is also committed to direct conservation, using their extraordinary access to these sensitive populations of marine mammals to help protect them for generations to come;

G. **And whereas** the Parties wish to cooperate in the taking of measures to support the survival and recovery of the SRKW as aligned with the recovery goal and objectives in the Recovery Strategy and recovery measures in the Action Plan, as well as in any future recovery documents prepared in accordance with SARA legislative requirements;

H. **And whereas** the critical habitat of SRKW is currently defined to include coastal waters off British Columbia;

I. **And whereas** the Minister has issued an Interim Order prohibiting vessels from approaching within 400 metres of a killer whale within SRKW critical habitat;

J. **And whereas** members of the PWWA have specialized knowledge and experience to determine whale ecotypes through observation of their behaviour, activity, and appearance;

K. **And whereas** the Minister may authorize a vessel, or a person operating or navigating a vessel, to approach to approach between 200m and 400m of a killer whale, other than a SRKW, for commercial whale-watching purposes, while within the critical habitat of the SRKW, if the person or vessel is subject to an agreement with the Minister related to whale watching and intended to reduce the risk of physical and acoustic disturbance to SRKW;

L. **And whereas** the members of the PWWA are welcome to leverage this agreement to help educate and raise awareness among their clients of the plight of the SRKW and the reasons these actions are being taken.

M. **Now therefore**, the Parties commit to the following:

1. DEFINITIONS

1.1. The following terms defined hereunder and used in this Agreement, when capitalized, will have the following meaning:

1.1.1. **"2019 season"** refers to the months during 2019, specifically June 1st – October 31st, when SRKW are expected to return to their critical habitat in increasing numbers.

1.1.2. **"Acoustic disturbance"** means anthropogenic noise that interferes with SRKW life functions including feeding and foraging, reproduction, socializing, and resting, such that the marine environment cannot support effective acoustic social signaling and echolocation and results in loss of habitat availability and/or function

1.1.3. **"Best available information"** includes relevant scientific, technical, navigational safety, operational, commercial and economic data, community and Indigenous traditional knowledge;

1.1.4. **"Effective Date"** means the date of the last signature affixed to this Agreement;

1.1.5. "**Physical disturbance"** means the physical presence and proximity of vessels to individual SRKW that impedes functions such as feeding, foraging, reproduction, socializing or resting, which may affect SRKW at both the individual and population level;

1.1.6. **"PWWA vessels"** means a vessel operated by a Pacific Whale Watch Association member for the purposes of whale watching and ecotourism business.

2. GOAL AND PURPOSE

2.1. The goal of this agreement is to reduce the risk of physical and acoustic disturbance to Southern Resident killer whales from PWWA vessels for the 2019 season.

2.2. The purposes of this agreement are to:

2.2.1. Set out the specific commitments from PWWA that will assist in achieving the stated goal;

2.2.2. Enable membership of the PWWA, including both Canadian and U.S. members, to fulfil the requirement of an agreement in order to receive authorization to approach between 200m and 400m of a killer whale, other than a SRKW, for commercial whale-watching purposes, while within the critical habitat of the SRKW;

2.2.3. Establish a mechanism for reporting and review with respect to PWWA commitments.

3. PRINCIPLES

3.1. The following principles will guide interpretation and implementation of this Agreement:

3.1.1. **Precaution**: The efforts of the PWWA are being taken in recognition of the need to act in a precautionary manner given the status of the SRKW;

3.1.2. **Adaptation/Adaptive Management**: The Parties recognize that monitoring the effectiveness of existing and future threat reduction measures to abate threats from PWWA vessels and adjusting approaches as necessary will be critical to success;

3.1.3. **Co-benefits**: The Parties will seek opportunities to implement threat reduction measures for SRKW that may also offer co-benefits to other species at risk;

3.1.4. **Transparency**: The Parties will make non-confidential information related to the development, implementation and monitoring of the Agreement and threat reduction measures publicly available subject to section 8.2 of this Agreement; and

3.1.5. **Engagement**: The Parties will seek opportunities for bilateral engagement on the implementation of the agreement.

4. INTERPRETATION

4.1. The preamble hereof and any appendices hereto form an integral part of this Agreement.

4.2. This Agreement is not intended to create any legally binding obligations, duties, commitments or liabilities (contractual or otherwise) on any of the parties. Nor does it create any new legal powers on the part of the Parties or affect in any way the powers, duties and functions of the Minister of Transport under the *Canada Shipping Act, 2001*, the *Canada Marine Act*, or any other federal legislation.

5. MEASURES UNDERTAKEN FOR THE PROTECTION OF SRKW BY THE MEMBERSHIP OF THE PACIFIC WHALE WATCH ASSOCIATION

5.1. The Parties acknowledge that:

5.1.1. Recovery of the SRKW population will require an ecosystem approach applied on a long-term basis that takes into consideration all three main threats to SRKW and will require additional measures to those undertaken by the Parties pursuant to this Agreement;

5.1.2. Other limiting factors that may affect SRKW survival and recovery are beyond the influence of the Parties, including but not limited to events occurring in SRKW critical habitat in US waters.

5.2. In support of the goal set out in section 2.1 and subject to section 9.1, the PWWA and its members commit to:

A) Continue to practice current PWWA guidelines, including travelling at no more than 7 knots when within 1 kilometre of a whale (all types), and turning

off sonar, depth sounders, fish finders and other underwater transducers when in the vicinity of a whale (all types);

B) Focus whale watching tours on populations of Bigg's killer whales (Transients), Northern Resident killer whales, Humpback, and other Baleen Whales, and will not intentionally offer, plan or promote excursions based on viewing of SRKW. When periodically encountering SRKW in the course of viewing other whales, PWWA vessels will focus on conservation and education of the SRKW, will not approach within 400 metres, will not follow SRKW, will continue following the go-slow-within-1km approach, and will continue transiting as soon as possible;

C) Ensure to respect the Interim Sanctuary Zones, as established under the Interim Order, which shall not be entered;

D) Carry any written authorization(s) received to approach between 200m and 400m of a killer whale, other than a SRKW, for commercial whale-watching purposes, on board and produce it on request;

E) Log (and report) any incidents involving unintentional approaches to within 400 metres of SRKW, either observed or experienced.

6. TERM, MODIFICATION, TERMINATION & RENEWAL

6.1. This Agreement takes effect on the date of the last signature affixed to this Agreement ("Effective Date").

6.2. This Agreement remains in force for the duration of the 2019 season, unless terminated earlier by one of the Parties or the Parties mutually agree to modify or terminate it.

6.3. The Agreement can only be modified by mutual consent of the Parties or their representatives.

6.4. The Parties may renew this Agreement or any part of it, and its duration may be extended with the mutual written consent of the Parties prior to the expiration of this Agreement.

7. GOVERNANCE

7.1. Should a member of the PWWA be found in violation of this agreement or of the mandatory applicable approach distance(s), the PWWA executive is expected to take appropriate action to ensure that the integrity of the agreement is not jeopardized and inform Canada of their approach to addressing violations.

7.2. The Minister retains discretion to suspend or revoke this agreement and revoke any authorization granted under the Interim Order, regardless of the action(s) taken by the PWWA with regard to addressing violations.

7.3. Monthly update calls between PWWA leadership and TC, represented by the Environmental Policy Group, shall be held to share information, discuss any issues that have arisen, and identify any on-going challenges.

8. MONITORING, RECORD KEEPING & REPORTING

8.1. The PWWA commits to providing the Minister with a list all its members along with the corporate address of their place of business, contact information and vessel information. The PWWA will ensure the list provided to the Minister is current.

8.2. The PWWA commits members to monitoring and keeping records of the progress on actions identified within the Agreement, specifically the implementation of those committed to in subsection 5.2.

8.3. By December 31, 2019, the Parties will review the Agreement against the agreed upon monitoring and record keeping and prepare and issue a report describing the implementation of measures undertaken as part of this Agreement.

9. INFORMATION SHARING

9.1. Each Party agrees, subject to any applicable data sharing agreements and legislative provisions that would prevent them from doing so, to provide the other Party access at no charge to available data and information relevant to the implementation of this Agreement.

9.2. Some data and information may require confidentiality or may have been obtained with an understanding of confidentiality. Data and information so identified by a Party, or a collaborator in programs and activities related to this Agreement, will be held confidential by the Parties to the extent permitted by any relevant legislation and related policies, procedures, and agreements.

10. DISPUTE RESOLUTION

10.1. Where a dispute arises under this Agreement, the dispute shall be resolved through consultations between the Minister's representatives and representatives of PWWA.

11. PARLIAMENT NOT FETTERED

11.1. Nothing in this Agreement shall prohibit, restrict or affect the right or power of the Parliament of Canada to enact any laws whatsoever with respect to any area of law for which the Parliament of Canada has legislative jurisdiction, even if the enactment of any such law affects this Agreement, its interpretation or the obligations of either party.

12. MINISTER NOT FETTERED

12.1. Nothing in this Agreement shall derogate or otherwise fetter the ability of the Minister to regulate, administer, manage, or otherwise deal with the protection of the marine environment from adverse vessel effects and all attendant matters thereto.

13. SIGNATURES

In witness whereof, the Parties have executed this Agreement.

Comments on PFMC SRKW Workgroup Draft Risk Assessment of Sept 11 2019

Dr. Nick Gayeski, Wild Fish Conservancy

Misty MacDuffee, Raincoast Conservation Foundation

October 4, 2019

The SRKW workgroup has initiated an important review of PFMC Chinook fisheries and their implications for SRKW. However, the composition of the workgroup indicates that it is not an independent scientific group. It is composed principally of tribal and state fish and wildlife staff whose prime responsibilities are fisheries management. Only a few of the team members, principally NMFS science staff, have the strong technical capabilities in salmon and ecosystem modeling to produce a quantitative assessment of the risk PFMC (Council) Chinook salmon fisheries pose to the survival of the Southern Resident Killer Whale (SRKW) DPS. As such, there are constraints to receiving the products of the workgroup as appropriate to accomplishing this critical task.

The Draft Report (DR) provides a reasonable summary of the status of the SRKW population, its component pods (J, K, and L), and acknowledges the dependence of the population on Chinook salmon. Importantly, the DR acknowledges the evidence accumulated over the past decade that demonstrate significant correlations between various indices of annual Chinook salmon abundance and demographic vital rates of SRKW. Unfortunately, the authors of the DR prevaricate about the significance of this dependence due to inability of the analyses to establish a clear causal relationship between Chinook abundance and SRKW demography.

The DR needs a clear, strong statement regarding the critically endangered status of the SRKW DPS (see DFO's 2019 SAR and PVA model outputs that indicate ongoing population decline with a 26% probability of quasi-extinction (one sex) within 75-97 years https://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2019/2019_030-eng.html.) and the associated need for immediate management measures to arrest further decline.

The DR should be clear at the outset that this constitutes a conservation emergency. The benefit of the doubt regarding candidate management measures under the control of the Council must

favor the DPS in accordance with the priority that society places on ESA-listed endangered populations.

The DR's description of the management structure of the Council Chinook fisheries under the current Pacific Salmon Plan (PSP) reveals the shortcomings of the data. This applies to annual Chinook salmon abundance and distribution, and fishery impacts on Chinook stocks known or potentially important to foraging SRKW within their existing and proposed critical habitat.

Similarly, the DR provides evidence concerning the uncertainty of the relationship of various indices of Chinook salmon abundance to SRKW demographics. This uncertainty is due to two primary factors: uncertainties regarding the accuracy and appropriateness of the individual indices of Chinook abundance and distribution, and uncertainties concerning the strength of association between Chinook abundance or distribution indices and specific SRKW demographic parameters. Among the former uncertainties, are uncertainties regarding the age-distribution of Chinook, maturation rates, and the abundance and proportion of immature Chinook in the several stocks subject to Council fisheries. The latter uncertainties are due primarily to small sample sizes which themselves are due to the low population size of the SRKW population and its component pods. These uncertainties are further compounded by the interaction of lack of Chinook prey and other factors known to pose threats to the viability of the SRKW population, in particular vessel noise and toxics contamination. Inevitably, therefore, there is considerable noise in much of the demographic data pertaining to the relationships between SRKW demographics and indices of Chinook prey.

The decision to rely primarily on the results of the Shelton model (Shelton et al. 2018) to characterize coast-wide Chinook distribution seems reasonable, although it too, like FRAM, is compromised by having to rely nearly entirely on hatchery CWT data. However, Shetlon et al.'s results show that there is considerable uncertainty in the estimates of the annual abundance and spatial distribution of particular stocks or combinations of stocks that cannot be resolved without additional research and data acquisition. Even with such research, it is unclear that additional precision in estimates of stock-specific abundance and spatio-temporal distribution will resolve the issues surrounding fine-scale adjustments of Chinook harvest to the benefit of SRKW. This

highlights the importance of developing a value-of-information analysis as a component of the risk assessment, which is absent in the DR.

This reinforces the importance of emergency reductions in Council Chinook salmon fisheries that should not be delayed until additional research resolves these uncertainties. Such reductions would also be consistent with according SRKW the benefit of the doubt and appropriately placing the burden of proof on Chinook fisheries. Research and monitoring can be undertaken simultaneously with harvest reductions.

These uncertainties also provide evidence that there is a limit to the ability of stock assessment to provide the level of detailed information necessary to conservatively manage individual Chinook populations and stock aggregates in coastal mixed-stock fisheries. The current plight of the SRKW DPS provides clear evidence that this has, and will probably continue to be, the case.

In addition, there is lack of data and associated uncertainty regarding the age-structure and maturation rates of Chinook stocks in both the FRAM and the Shelton et al. model. The DR does acknowledge that SRKW prefer larger, older age 4+ Chinook salmon and notes that ocean mixed-stock Chinook fisheries encounter and harvest immature, particularly age 2 and 3 Chinook. But there is no effort made to consider addressing ocean fisheries as a means to rebuild an older, more historical age structure of Chinook populations within SRKW proposed or existing critical habitat. Given, the uncertainties noted, there seems good reason to doubt that restoring the historical age/size structure of Chinook can be undertaken while continuing with coastal mixed-stock Council (and more generally PST) Chinook fisheries. Thus, the DR should consider that the mixed-stock nature of these fisheries themselves pose a risk to the survival of the SRKW DPS.

All of this argues for a fully Bayesian risk assessment framework capable of providing probability distributions of the risks posed to SRKW by Council Chinook fisheries. Unfortunately, the risk assessment approach outlined in the DR does not adopt such an approach. The most probable outcome of this failure as the workgroup continues, is to significantly under-estimate the risk Council Chinook fisheries pose to SRKW.

The current model runs reported in section 5, page 47, should be reconfigured using a Bayesian framework so that the results of the regressions can be stated as posterior probability

distributions, and not uninformative and problematic frequentist p-values and associated confidence intervals (CIs). Such revised analyses would clearly and properly display the uncertainties of the analyses (and associated model assumptions) which is necessary to display the risk posed to SRKW by failing to appropriately revise Chinook harvest rules. This would also make transparent the burden of proof that is being placed on the SRKW.

In commenting on the statistical significance of the fitted regressions (based on a traditional frequentist statistical approach) the DR acknowledges that "especially when the data are noisy or confounding variables are not accounted for, it is possible for a real effect to be present despite the data having a pattern no more extreme than one that could be explained by chance alone (large p-value). Given the lack of statistical significance, the results should be interpreted with caution. Nevertheless, in almost all cases the fitted relationships were of the expected sign (i.e. survival and fecundity increased with increasing Chinook abundance while occurrence of peanut-head decreased with increasing Chinook abundance)" (p. 47).

Bayesian regression analyses would produce probability distributions of the fitted relationships (instead of dubious p-values and CIs) and require that threshold probabilities be identified for concluding that no action on Chinook harvest is warranted. More appropriate still, is to embed such regression analyses in a broader Bayesian population viability analysis (PVA) that would provide a probability distribution of time to extinction or quasi-extinction. This would reflect the manner in which the Chinook indices-SRKW demographic indices regression contribute to the overall extinction risk, and hence how managers are weighting the risk that Chinook abundances and distributions pose to SRKW persistence. In view of the fact that three PVAs on SRKW have been published (Velez-Espino et al. 2014, Lacy et al. 2017, Clarke-Murray et al. 2019) it is surprising and disappointing that neither the workgroup or NMFS have incorporated their findings or undertaken an 'official' PVA themselves. Such considerations could provide guidance on the critical decision facing the workgroup.

The ESA accords the greatest benefit of the doubt to populations listed as endangered. In particular, in any jeopardy evaluation, the burden is to show that the proposed action will not jeopardize the continued existence of the listed population(s). It is clear from the recent history of the SRKW DPS and the management of Chinook salmon harvest under the PST and PSP (which govern Council Chinook fisheries) that the current fishing regimes remove prey from a

food-stressed SRKW DPS. The only uncertainties concern which fisheries adversely affect which Chinook salmon stocks and by how much, when and where, with respect to the prey requirements of foraging SRKW. The burden of these uncertainties must fall on the fisheries, not on endangered whales. This is especially so in the current context, where the immediate management emergency is to take actions that have the greatest probability of bounding the SRKW DPS away from its decline toward extinction. This requires stabilizing the population growth rate, which is currently negative (lambda ~ 0.99, equal to an annual decline in DPS abundance of 1% per year (Velez-Espino et al. 2014, Lacey et al. 2017, Clarke-Murray et al. 2019).

Further, in light of the renewal of the PST, the burden of Chinook harvest reductions that may be undertaken to attempt to halt the decline of the SRKW DPS must fall on the Council fisheries. The April 9 2019 NMFS Biological Opinion concerning the Consultation on the Delegation of Management Authority for Specified Salmon Fisheries to the State of Alaska makes it clear that NMFS considers Treaty Chinook fisheries as configured pursuant to the 2019 Pacific Salmon Treaty to jeopardize ESA-listed Puget Sound Chinook and SRKW[1]. NMFS's finding that there is a need to further mitigate the effects of Chinook harvest beyond what is provided for in the Treaty is tacit admission that, absent the proposed mitigation measures, NMFS would have had to conclude jeopardy. Regardless of the proposed mitigation measures (which are conjectural and dependent on uncertain future funding), the BiOp makes it clear that Chinook harvest poses jeopardy to SRKW, and since Treaty harvest measures have therein been given ESA take coverage, the burden for further necessary modifications in US coastal Chinook fisheries falls on the Council fisheries.

[1] The 2019 BiOP admittedly does not explicitly use the term 'jeopardy'. The exact language is "… the status of Puget Sound Chinook salmon and SRKWs have declined in recent years. A key objective of the U.S. Section during the negotiating process for a new Agreement was therefore to achieve harvest reductions to help address ongoing conservation concerns for Puget Sound Chinook and coincidentally provide benefits for SRKWs", and continues "Further reductions [in Chinook harvest in PST fisheries] are proposed in conjunction with the 2019 Agreement, but there was a practical limit to what could be achieved through the bilateral negotiation process. As a consequence, and in addition to the southeast Alaska, Canadian, and SUS fishery measures identified in the 2019 PST Agreement, the U.S. Section generally recognized that more would be required to mitigate the effects of harvest and other limiting factors that contributed to the reduced status of Puget Sound Chinook salmon and SRKWs" (pp. 9-10).

Accordingly, the risk assessment to be undertaken (or completed) by the working group must identify changes to Council fisheries that, in conjunction with PST Chinook fisheries beyond the control of the Council, alleviate jeopardy to the SRKW. This requires, as already noted, that the risk assessment be framed as a population viability analysis (PVA) that produces SRKW population trajectories and associated extinction probabilities under the current conditions and under candidate management changes to Council Chinook fisheries, starting with a default complete closure of Council Chinook fisheries for a minimum period of time based on SRKW demography. This will likely be at least 5 and more reasonably 10 years, if not more.

Further, the criterion for the target response by SRKW needed to avoid jeopardy should not be a population growth rate of 2.3% /yr. for 28 years required under the SRKW Recovery Plan. This growth rate is inappropriate to a declining small population on the verge of an extinction vortex. Rather, the issue is to arrest the decline and preserve the reproductive potential of SRKW. This suggests that the target short-term annual population growth rate should be on the order of 1% over the next 10 to 20 years. An annual growth rate of one-half of one percent (0.005) would succeed in stabilizing the SRKW at slightly above the current number (73), provided the variance in that growth rate can be made sufficiently small. A steady average annual population growth rate of 0.005 would result in an average SRKW population of 81 individuals at the end of 20 years (compared to the current population of 73). A growth rate of 0.01 would achieve this population size in 10 years and a population size of 89 in 20 years. Modest as this would be, it is a significant step in the right direction compared to the recent negative population trend. An annual population growth rate in the range of one-half to one percent (0.005 to 0.01) appears to have a high probability of being achieved by the termination of all council directed Chinook fisheries. This also indicates that analyses (e.g., Hilborn et al. 2012, and Velez-Espino et al. 2014) that have concluded that further reduction or even closures of coastal Chinook fisheries are unlikely to achieve (in the near term at least) the NMFS SRKW Recovery Plan target annual population growth rate of 2.3% are misleading, if not misguided. The emergency conservation issue is not how to achieve an immediate annual growth rate of 2.3%, but rather the more urgent and appropriate goal to arrest the recent decline, stabilize the population and facilitate its slow rebuilding.

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