

Southern Resident Killer Whale Recovery: Recommendations for 2018 Chinook and Vessel Management Actions

Prepared by: Salmon Committee of the Pacific Marine Conservation Caucus, January 2018

Abstract

Southern Resident killer whales (SRKW) are recognized as endangered under Canada's Species at Risk Act. As of Jan 2018, a population of 76 individuals has had no successful births since 2015. A 2017 study on their fecundity found nearly 70 per cent of detected pregnancies failed due to nutritional stress associated with lack of prey. Population viability assessed by government and independent scientists indicates SRKWs have a 25 to 50 per cent risk of extinction by the end of the century under status quo conditions.

Actions required for recovery have been identified in Canada's Resident killer whale Recovery Plan (2011), Canada's Action Plan for Northern and Southern Resident killer whales (2016) and Southern Resident killer whale: a science based review of recovery action (2017). The primary threats identified in these documents are insufficient Chinook prey (abundance and accessibility), vessel noise and disturbance, and contaminant exposure.

We identify and recommend coast-wide Chinook and vessel management actions for 2018 consistent with the 'immediate' actions recommended in the 2017 Science Review to address lack of Chinook, vessel noise and disturbance. These actions are designed to increase Chinook abundance to, and accessibility within, habitat identified or proposed as critical to SRKW by Canada's Species at Risk Act (SARA). We recommend:

1. Implement SRKW Feeding Refuges that will allow SRKWs to successfully forage in critical feeding habitats without noise and disturbance from recreational fishing and whale watching activities.
2. Implement commercial and recreational fishing restrictions to increase the terminal abundance of Chinook in habitats identified as critical to SRKW, other important SRKW feeding areas, and of other Chinook populations known to be important in the diets of SRKWs.
3. Manage Chinook in accordance with the above fishing restrictions until relationships between Chinook indices (forecasts, pre-season, in-season) and indicators of SRKW health (photogrammetry, pregnancies, hormones, vital rates or other proxies) are determined, and can be incorporated into management decisions.
4. Implement recovery plans consistent with Canada's *Guidance for the Development of Rebuilding Plans under the Precautionary Approach Framework* that will rebuild B.C. Chinook populations (i.e. Conservation Units below their Maximum Sustainable Yield) with the objective of maximizing Chinook Recruitment to terminal areas and spawning grounds (R_{max}) within two generations.

Introduction

Importance of Chinook to SRKWs

The abundance of Chinook salmon influences SRKW birth, survival, and mortality rates and is linked to their level of nutritional and physiological stress (Ward *et al.* 2009, Ford *et al.* 2010, Vélez-Espino *et al.* 2013, Vélez-Espino *et al.* 2014, Ayers *et al.* 2012, Lacy *et al.* 2017, Wasser *et al.* 2017). Unusually high mortality has followed periods of reduced or low Chinook abundance. In addition, the probability of calving is 50 per cent higher following years of higher Chinook abundance (Ward *et al.* 2009).

Nutritional stress associated with lack of prey is considered the prime causes of late pregnancy failure and a key stressor in 69 per cent of the failed pregnancies that occurred 24 times in 12 SRKWs between 2008 and 2014 (Ayres *et al.* 2012, Wasser *et al.* 2017). Hormone stress levels in SRKW that correlate with early Fraser River and Columbia River Chinook abundance support prior relationships established between SRKW vital rates and Pacific Salmon Commission (PSC) Chinook indices. For example, the end of 2007 through 2008 was a period of poor nutritional condition as measured by stress hormones. This period corresponded with the highest number of deaths and lowest number of births and surviving calves observed between 2006 and 2008. Eight whales went missing from December 2007 through October 2008, two of which were reproductive age females and included a visually emaciated pregnant female (Ayres *et al.* 2012).

Aerial photogrammetry further provides information on body condition. Researchers have observed disproportionate declines in body condition of reproductive age females (who have higher energetic demands) compared with other age classes. Documented declines in body condition of six reproductive females preceded their deaths in 2008, 2013, and 2016 (Matkin *et al.* 2017). Because the loss of individual fetuses, calves, and mature whales to malnutrition has population-level consequences, the SRKW population can be characterized as ‘food stressed’.

The Federal Action Plan (2017) identified the following actions as likely to improve Chinook abundance and accessibility for resident killer whales;

- (#6) Account for both seasonal (acute) and cumulative (chronic) effects of poor returns for Chinook and other important prey species on Southern Resident killer whales when managing fisheries.
- (#7) Investigate the benefits of strategic salmon fishery planning approaches and management actions to reduce competition with resident killer whales for prey in specific feeding areas (e.g. modeling, retention limits, fishery area boundary adjustments or closures), and implement where appropriate.

- (#10) Investigate the benefits of management actions (e.g. protected areas, fishery area boundary adjustments or closures) to protect important foraging and beach rubbing locations such as Robson Bight and other identified areas, and implement where appropriate.

Marine Conservation Caucus Recommendations for Actions Required in 2018

We have used the actions identified in the Federal Action Plan (2017) and Science Review (2017) as the foundation for developing immediate mitigation measures. We are recommending four management actions beginning in 2018 to reduce immediate threats to SRKW survival and recovery.

These are 1) establish protected SRKW Feeding Refuges that restrict noise and disturbance from small vessel traffic within preferred feeding areas, 2) IFMP fisheries restrictions and Pacific Salmon Treaty allowances for SRKWs that will increase terminal run abundance, 3) manage Chinook in accordance with the fishing restrictions in 1) and 2) until relationships between Chinook indices and SRKW health indicators can be incorporated into management decisions, and 4) implement Chinook rebuilding plans for weak (red zone) Chinook populations consistent with Canada's *Guidance for the Development of Rebuilding Plans under the Precautionary Approach Framework* (DFO 2013).

Recommendation #1

Establish protected SRKW Feeding Refuges in priority feeding areas (Fig. 1) to enable SRKWs to forage without interference, noise and disturbance from small vessel traffic, particularly recreational salmon fishing and whale watching activities, between May 01 and November 30.

These SRKW Feeding Refuges lie within habitat identified as critical for SRKW recovery by Canada's SARA or is proposed as critical habitat by DFO. These areas include the southwestern shoreline of Vancouver Island, Boundary Pass to SW North Pender Island and to East Point on Saturna Island, and approaches to the Fraser River. In the U.S., key foraging areas established for SRKWs reflect the work of Ashe *et al.* (2010) who identified priority feeding areas near southwest San Juan Island, salmon bank and Stewart Island, and the consideration of a whale protection zone within these feeding areas near southwest San Juan Island.

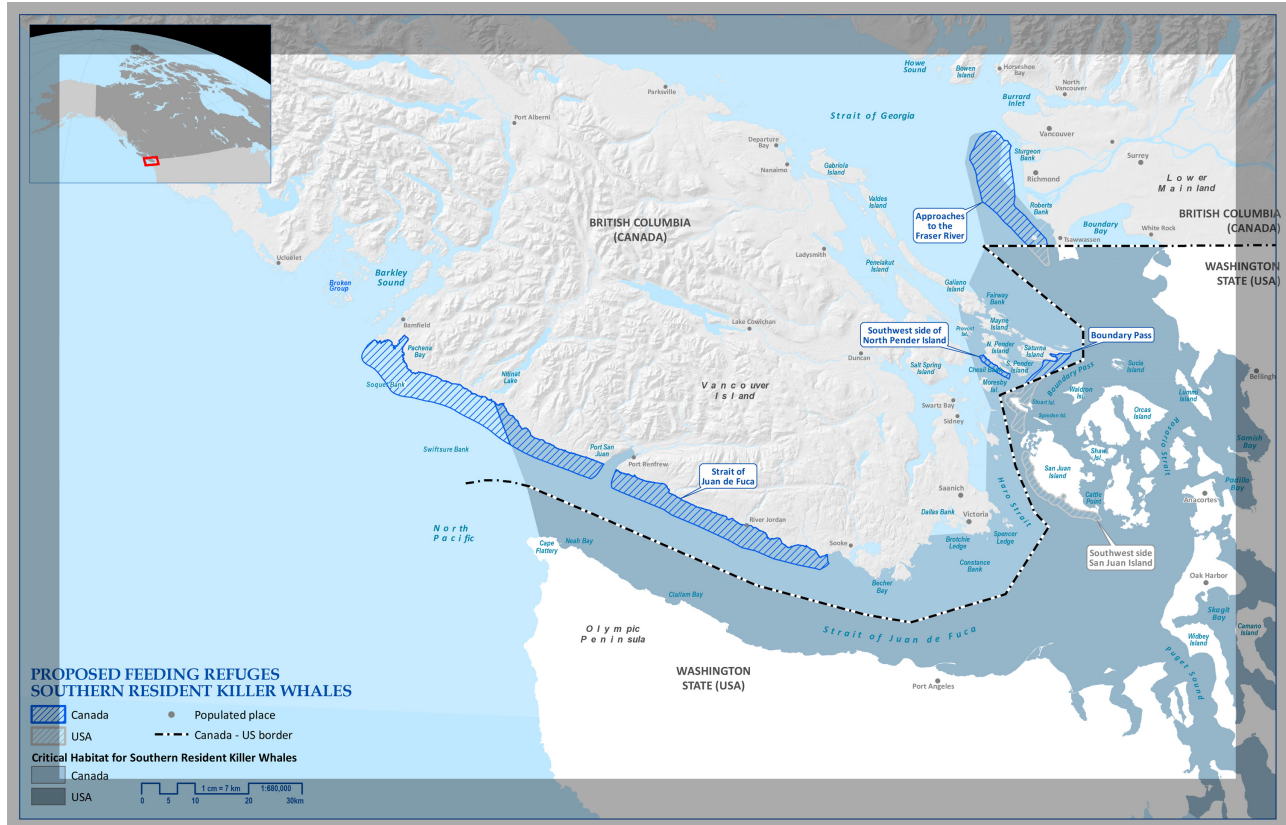


Figure 1. Proposed Southern Resident Killer Whale feeding refuges. SRKW feeding refuges recommended for protection that would enable SRKWs to forage without interference, noise and disturbance from recreational salmon fishing and whale watching activities between May 01 and November 30. Feeding refuges in Canada should include the southwestern shore of Vancouver Island, Boundary Pass to East Point on Saturna Island, SW side of N. Pender Island, and approaches to the Fraser River.

Rationale

DFO's science-based review (2017) identified the high priority need to establish greater access to Chinook salmon within key foraging habitats. Measures were identified for greater access to prey through reduced competition from fishers, and reductions in physical and acoustic disturbance from vessels. The review states that areas should be identified and protected for periods of time to provide improved access to Chinook salmon by SRKWs (DFO 2017b).

SRKWs use the Salish Sea more frequently in the late spring to fall when they target Chinook salmon migrating as spring, summer and fall aggregates to the Fraser River, Georgia Strait, Puget Sound, and other Salish Sea rivers (Ford *et al.* 1998; Ford and Ellis 2005, Ford *et al.* 2010a; Ford *et al.* 2010b, Hanson *et al.* 2010; Ford *et al.* 2017). SRKWs also use Swiftsure Bank and the southwestern shoreline of Vancouver Island through the Strait of Juan de Fuca to Sooke, when

pursuing inbound migrating Chinook, southbound migrating Chinook destined for WA, OR and CA, or resident Chinook rearing on the coastal shelf.

Whales pursuing Chinook in these locations during the spring and summer have a high likelihood of being in the presence of vessel traffic, particularly whale watching vessels, but also recreational fishing vessels. Over the last two decades, 14 to 28 boats routinely followed SRKWs in the summer months, with peak numbers exceeding 70 boats (see Ashe *et al.* 2010, Soundwatch 2016). Recreational fishing effort has also increased in the months from May through September. In the last 2 years, more than 55,000 recreational fishing trips occurred annually within Fishing Management Areas 121, 21, 20, 18, and 29 where feeding refuges are proposed (DFO, 2017c).

The presence and noise from these vessels can invoke significant reductions in foraging activity and limit food acquisition (Lusseau *et al.* 2009, Noren *et al.* 2009, Williams *et al.* 2014, Lacy *et al.* 2017, Holt *et al.* 2017). Vessel traffic and noise is known to increase the duration and amplitude of SRKW calls (Foote *et al.* 2004; Holt *et al.* 2009; 2011) and is likely to adversely affect SRKWs by masking and altering vital communication calls and induce chronic stress. Closing all recreational salmon fishing (and not just Chinook) in the shoreline feeding refuges addresses disturbance, noise, and interference from the recreational salmon fleet in regions where there is an absence of enhanced monitoring and compliance as required by the *Strategic Framework for Fishery Monitoring and Catch Reporting*.

Lacy *et al.* (2017) showed that when noise and disturbance from vessels are reduced in concert with improved Chinook abundance, a 50 per cent reduction in vessel noise and disturbance coupled with a 15 per cent increase in coast-wide Chinook abundance could reverse the population's negative growth rate and enable SRKWs to achieve a 2.3 per cent annual growth rate.

Recommendation #2

Implement commercial and recreational fishing restrictions to increase the terminal abundance of Chinook in habitats identified as critical to SRKW, other important SRKW feeding areas, and of other Chinook populations known to be important in the diets of SRKWs.

These plans need to maximize Chinook recruitment to terminal areas within SRKW critical habitat and on stocks known to be important in the diets of SRKWs. These initiatives need to be implemented within the IFMP and allowances for SRKW recovery need to be made within the Chinook Chapter of the Pacific Salmon Treaty. If Canada is unable to achieve improvements in the PST that benefit SRKW recovery, Canada would be accountable for all the required restrictions.

Rationale

DFO's Science-based review identified recovery measures that increase prey availability to be of paramount importance. Management of marine fisheries to maximize terminal Chinook Recruitment (to R_{max}) is expected to reduce nutritional stress, improve birth rates, improve survival and reduce mortality. Velez-Espino *et al.* (2013, 2014) modeled several scenarios using

Chinook data to 2011 in a document commissioned for the Pacific Salmon Commission where fishery closures improved vital rates of SRKWs (reversing their modelled decline of 0.09 per cent annually to achieve positive growth rates). Fishery restrictions that achieved this included:

- No marine harvest on various combinations of Puget Sound, Fraser Early, and Fraser Late.
- A 51% harvest reduction on the five large stocks of WCVI, Columbia Upriver Brights, Fraser Late, Oregon Coastal, and Puget Sound.

Lacey *et al.* (2017) further showed that a modeled 30 per cent increase in the coast-wide Chinook abundance above the 1979-2008 average could increase Southern Resident growth rate by as much as 1.9 per cent. This growth rate provides a high probability that the currently impaired population could survive at larger and more viable numbers into the future. Achieving this level of increased abundance in the short term, and initiating SRKW recovery solely by restricting fisheries, may be difficult. When noise and disturbance are addressed in concert with Chinook abundance, population viability modelling shows that a 15 per cent increase in the coast wide abundance coupled with a 50 per cent reduction in vessel noise and disturbance, can meet the US recovery target of 2.3 per cent annual growth (based on SRKW demographics to 2014, Lacy et al. 2017).

The 2018 domestic fishing plan must recognize and incorporate Canada's international commitments. If Canada does not achieve its rebuilding requirements under the new treaty, it must 'backfill' domestically. This may require closing all commercial and recreational Chinook directed fisheries until there is evidence that Chinook rebuilding, SRKW recovery, and First Nation's Section 35-1 requirements are likely to be achieved.

Canada should inform the US in the Pacific Salmon Treaty re-negotiations that all fisheries from SE Alaska through southern B.C. must accommodate the rebuilding of Fraser River and southern B.C. Chinook populations to meet their escapement objectives in two generations.

Recommendation #3

1. *Manage Chinook in accordance with the identified fishing restrictions until relationships between Chinook indices (forecasts, pre-season, in-season) and indicators of SRKW health (photogrammetry, pregnancies, hormones, vital rates or other proxies) are determined, and can be incorporated into management decisions. Chinook abundance indices should be considered relative to spawning targets under the rebuilding scenario in Recommendation 4. A review of the management initiatives incorporated in recommendations 1) and 2) should be conducted every five years.*

Rationale

At a SRKW prey workshop organized by Fisheries and Oceans Canada in 2017, scientists suggested there were likely ‘thresholds’ of Chinook abundance that would promote SRKW recovery. It was suggested that tools such as photogrammetry, pregnancies, vital rates or other measures of SRKW health could be employed as proxies. Additional research and science based management advice are required to identify and calibrate such proxies and indices, and assess the effectiveness of feeding refuges, and incorporate these findings into recovery measures. Because SRKW recovery is expected to take longer than one generation (25 years), reviews of the recommended management measures are unlikely to confirm the likelihood of recovery if conducted more frequently than once every five years.

Recommendation #4

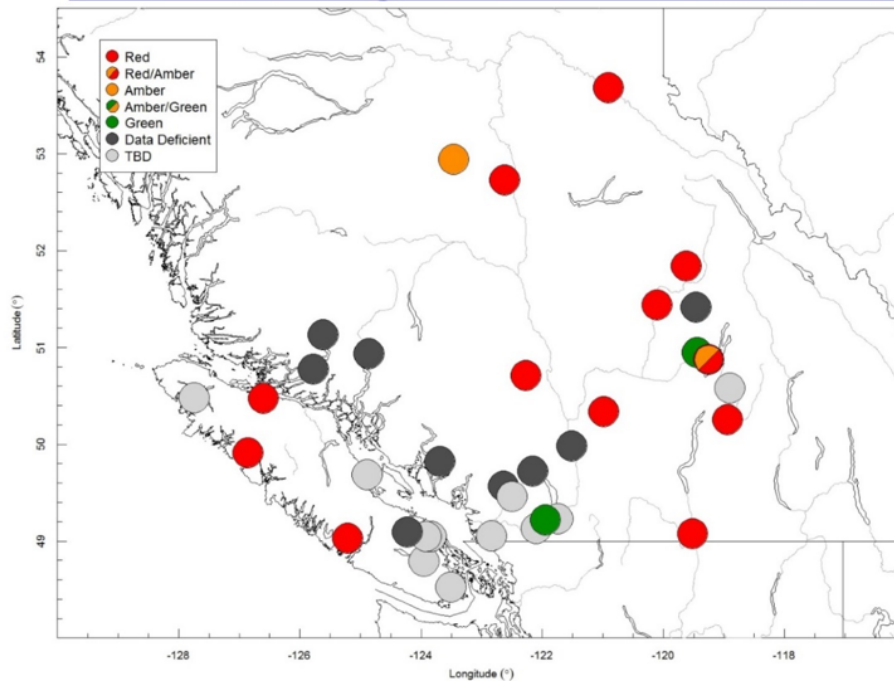
Implement Chinook recovery plans consistent with Canada’s Guidance for the Development of Rebuilding Plans under the Precautionary Approach Framework (2013) that will rebuild Chinook Conservation Units below their Spawner MSY (S_{msy}) abundance with the objective of maximizing Chinook Recruitment to terminal areas (R_{max}) and spawning grounds within two generations.



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WSP Biological Status Assessment



- 2 **Green** CUs (although 1 is provisional and is flagged for closer monitoring)
- 1 **Amber** CU
- 1 **Amber/Red** CU
- 11 **Red** CUs
- 9 **Data Deficient** CUs (not enough data of sufficient quality to make an assessment)
- 11 **To Be Determined** CUs (pending clarification of enhanced contributions)

Figure 2. Assessment and status of 35 Chinook Conservation Units in southern British Columbia as determined under Canada's Wild Salmon Policy. Of the 15 populations with an assessed status, two are in the 'green' zone, two are in the 'amber' zone, and 11 are in the 'red' zone. Map: DFO 2016

Ongoing fishing on less productive Chinook populations is contributing to their failure to rebuild. Management of marine Chinook fisheries with the objective of maximizing terminal recruitment (R_{max}) would increase spawner abundance in accordance with rebuilding objectives, addressing First Nations constitutionally protected access to Chinook, and increasing terminal abundance for SRKWs.

Rebuilding plans must be implemented that accommodate conservation, SRKWs, and First Nation Section 35-1 Rights of the Constitution, before potential commercial and recreational harvest

opportunities are allocated. Rebuilding plans would establish recovery-based escapement objectives from which harvest control rules can be developed.

As such, in-season management of Fraser spring and summer stream-type Chinook be changed to maximize terminal recruitment (R_{max}) and rebuilding objectives. The current management zone approach is not consistent with meeting rebuilding objectives or achieving explicit escapement goals.

Incorporating Fishery Related Incidental Mortality (FRIM) is critical in determining total fishery impacts on weak populations. Expansion of Chinook non-retention fisheries obligates DFO to incorporate its own science and policy advice when producing defensible estimates of total mortalities in Chinook retention and non-retention fisheries

Conclusion

Our recommendations are anchored in SRKW literature, science reviews, recovery plans and Canadian policy. We believe these measures will produce immediate benefits for both Chinook and SRKWs. Our recommendations are supported by Canada's Resident Killer Whale Recovery Plan (2011), Canada's Action Plan for Northern and Southern Resident killer whales (2016) and Southern resident killer whale: a science based review of recovery action (2017), along with Canada's Rebuilding and Wild Salmon Policies.

In addition, we urge the federal government to direct DFO to work with the U.S. National Oceanic and Atmospheric Administration (NOAA), to establish a Salish Sea terminal abundance target that maximizes recruitment of Fraser River, Georgia Strait and Puget Sound Chinook populations to the Salish Sea. This will also increase Chinook abundance in the approaches to the Juan de Fuca, improving availability to SRKWs in habitats beyond those identified as critical.

Now is the time for action, if we are to ensure the survival of Southern Resident killer whales. The government of Canada must make the right decisions over the course of the next six months if future generations of Canadians are to experience the wonder of these whales.

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