The Orca Food Security Program

A Strategic Chinook Salmon Enhancement Initiative

Recommendation Paper

Summary Document

VERSION - 9 JANUARY 2019

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Program Supporters

A list of First Nations, individuals, groups and companies who have provided support for existing projects or the Sooke Chinook Enhancement Initiative or the Orca Food Security Program …

T'sou-ke First Nations
Sci'aneu First Nations
Huu-ay-aht First Nations
Maa-nulth First Nations
Tseshaht First Nations
Hupacasath First Nations

Thomas and Betty Cole
Fred Welter
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Leigh Garrod
Glen Varney
Roy Carver
John Chau
Pacific Salmon Foundation
Tourism Victoria
Sidney Anglers Association
Sooke Salt Water Series Fishing Derby
Consultants Invitational Fishing Derby
Oak Bay Marine Group
Juan de Fuca Fishing Derby
Juan de Fuca Salmon Restoration Society
Sooke Charter Boat Association
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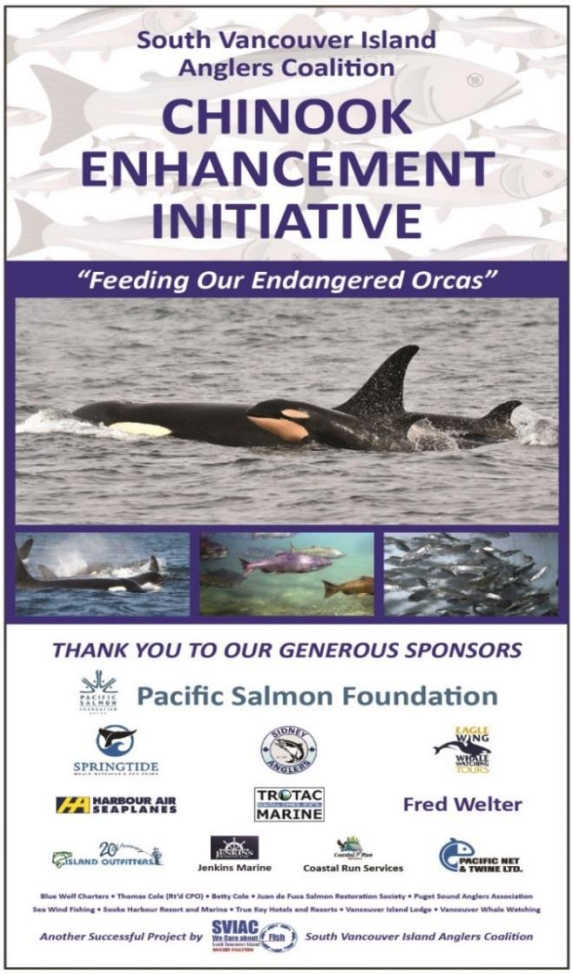


Prince of Whales Whale Watching
Five Star Whale Watching
Vancouver Whale Watching
Island Whale Watching Adventures
Jenkins Marine
Last Chance Fishing Adventures
Blue Wolf Fishing Charters
Seawind Fishing Adventures
Mark Grant Fishing Charters
Williams Scrap Iron and Steel
Springtide Charters

Rebuilding BC's WILD Chinook salmon to optimum abundance by restoring freshwater and estuarine habitats is, undoubtedly, the best long-term solution to help the environment and save the Southern Resident Killer Whales.

FOREWORD

How Did We Get Here? The ***Orca Food Security Plan (OFSP) 'Recommendation Paper'*** summarizes the growth of a small idea which began four years ago at Sooke, BC to "*Grow More Chinook*" initiated by Chris Bos of the South Vancouver Island Anglers Coalition working cooperatively with T'Sou-ke First Nations and the Community of Sooke.

In 2018, a unique collaborative process began, stimulated by a greater urgency to increase Chinook prey availability for the Southern Resident Killer Whales, and to prevent the economic collapse of BC's communities that depend on fisheries remaining open, and vibrant eco-tourism opportunities.

This process resulted in this OFSP Recommendation Paper which identifies possible private-public partnerships to "*Grow More Chinook*" and is intended to offer new or expanded plans to stakeholders who are considering strategies for enhancing depleted Chinook stocks.

Where to From Here? Chinook 'Stocks of Concern' have become an urgent issue, and how best to support the enhancement of these Chinook populations requires effective engagement of governments and 'Communities of Interests'. The people acknowledged in the Orca Food Sustainability Plan assisted in the discussion of 'where to from here'.

The emerging crisis of starvation facing the Orcas amplified the need to quickly grow an abundance of Chinook prey as an alternative to closing fisheries and devastating local economies. This plan requires a farther reaching, coordinated planning framework than currently employed by the Department of Fisheries, Oceans and Canadian Coast Guard (DFO) that could engage the resources of citizens, corporations and all levels of governments in BC and Canada.

During 2018, Bob Cole and Brian Tutty assisted the business advisory firm G-Force Advisors Inc. (G-Force) to create a dialogue between key people and groups interested in improving Chinook salmon stocks and drawing key resources and relationships together in a '*Collaborative Process*'. This group included particularly Chris Bos (South Vancouver Island Anglers Association), and discussions with Dr. Brian Riddell (The Pacific Salmon Foundation), and advice from key DFO staff, Dr. Dick Beamish (DFO scientist), interested First Nations, key organizations, Not-for-Profit Chinook Enhancement groups, potential private sector funding sources, and business leaders.

The result of this informal Collaborative Process has resulted in an initial 'Chinook Enhancement Initiative' framework with a goal of "*Grow More Chinook*" summarizing some existing, and some new chinook enhancement projects. This process has identified projects on the East and West Coasts of Vancouver Island, and possibly the Fraser River that, together, offer opportunities for rapid development to, indeed, "*Grow*

More Chinook". This was done expeditiously these past several months in order to provide an immediate menu of projects that can be discussed, and some launched quickly using previously proven, or potentially effective, methods utilizing existing organizations and resources in hand or already in the field.

A Call to Action by the Affected Voter? The Orca situation dictates that time is of the essence to engage a broadly linked government, NGO and private funded 'Chinook Enhancement Program' that "*Grow More Chinook"*! This plan should integrate science, best practices, and private sector business thinking so that a 'Made in Canada' approach which can engage government, NGOs, private funders, and businesses that, together, will support a renewed BC 'Chinook Enhancement Initiative'.

In the long term, thoughtful monitoring and on-going assessments are required to ensure best practices are identified, employed and maintained. Knowledge about our changing climate and ocean conditions that affect the survival of the Chinook and Orcas and our 'communities of interests' will be necessary for their survival.

General Limitations and Caveats This Report summarizes information received from a wide variety of sources including scientists, biologists, DFO staff, First Nations groups, Not-for-Profit groups and others mentioned in the Report. It included assumptions and estimates which we have not verified for the purposes of this Report. The main purpose of the Report is to create a focus for discussion and decision by key stakeholders on immediate actions that can be taken to enhance the declining Chinook stock and increase the food supply for the Southern Resident Killer Whales. By their nature, any findings, estimates and projections involve significant subjective judgments and analyses and accordingly, no representation or

assurance is made as to their attainability by the authors. Further work will be required by key stakeholders on any specific project to tailor strategies, work plans, evaluation criteria and monitoring activities suited to that project. Success will depend upon the experience of the specialist resources utilized and the effective project management, evaluation and strategies employed.

DESCRIPTION

Helping feed BC's endangered **Southern Resident Killer Whales (SRKWs)** and restoring our wild Chinook salmon stocks back to optimum abundance is a formidable challenge. The '**Orca Food Security Program (OFSP) Recommendation Paper'** is a bold Chinook enhancement framework that, if fully implemented, could quickly increase Chinook salmon SRKW prey abundance. This would allow watershed production plans for Chinook, such as the Cowichan's successful example, more time for wild Chinook in those watersheds to recover. The OFSP Recommendation Paper's successful implementation would also assist in maintaining important salmon fisheries during these uncertain times. In so doing, the small coastal communities of Southern BC that rely on the ocean and its economic vitality will be less impacted by previously announced, and expected, fisheries closures. The Recommendation Paper offers hope that some of the socio-economic consequences of implementing the Species at Risk Act can be minimized.

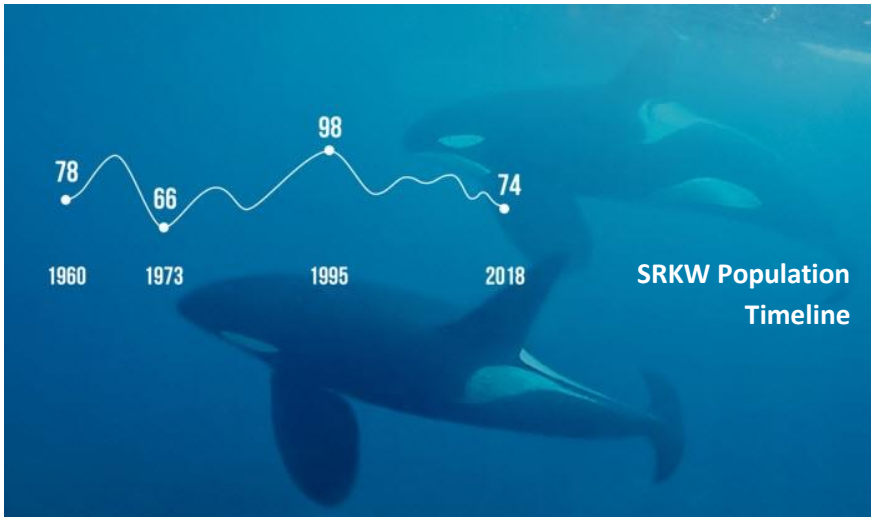
It is unnecessary to close most of First Nations and BC's public fisheries and diminish BC's Super Natural tourism industry if these Recommendations are fully implemented.

The new foundation of the OFSP strategy is a Private-Public Partnership model that brings together First Nations, stakeholders, volunteers and motivated individuals, organizations and businesses and all governments to collaboratively deliver this program as discrete stand-alone projects but in a cooperative manner. The OFSP recommends the following Chinook salmon projects. A variety of enhancement strategies at each location are designed to be jointly planned, launched and managed by the local community. These **recommendations** provide new directions; they are flexible and support a hopeful series of Chinook enhancement initiatives. An OFSP support team is recommended to assist and coordinate infrastructure for each project and to help select their best and most viable strategies. The support team will help with communication, consultation, planning, authorization, securing funding as required, implementation and project monitoring.

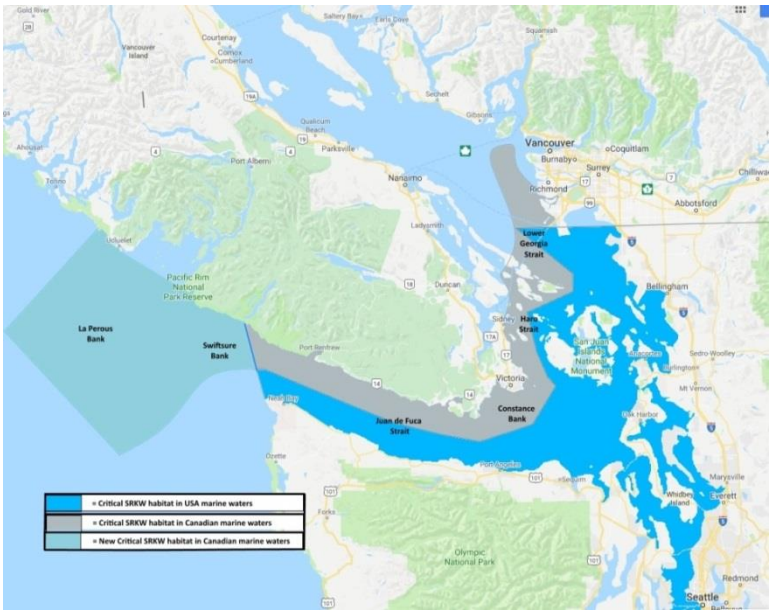
BACKGROUND

Southern Resident Killer Whales (SRKWs) are currently listed as '*Endangered*' in both Canada and the USA. This Orca population, in three pods, has declined to 74 individuals from 98 in 1999. Currently, there are two of the remaining SRKWs showing visible signs of malnutrition and are expected to die later this year.

While noise and pollution are identified as additional challenges affecting the Orcas, the most impactful problem is their lack of food. The Orca's preferred prey is large Chinook salmon, which compose ~75% of their diet [5]. Scientific studies show a direct correlation between Orca health and stable population when compared to Chinook salmon abundance[1].



Due to pollution, SRKWs are known to contain high toxin levels. Those toxins are stored inactively in their blubber, but when there is insufficient food available for the Orcas, they consume their high calorie fat to survive. In so doing, the toxins are mobilized into their bloodstream and reduce their natural immune systems, and increase their risk of other diseases and mortality.



Over the past two decades, Southern BC has experienced a considerable decline in abundance of certain key Chinook stocks, especially those large 30 pound plus 'Tyee' stream-type populations from the mid and upper Fraser River. These fish are important to SRKWs as prey when SRKWs are in their Canadian critical habitat areas between May and September each year [6].

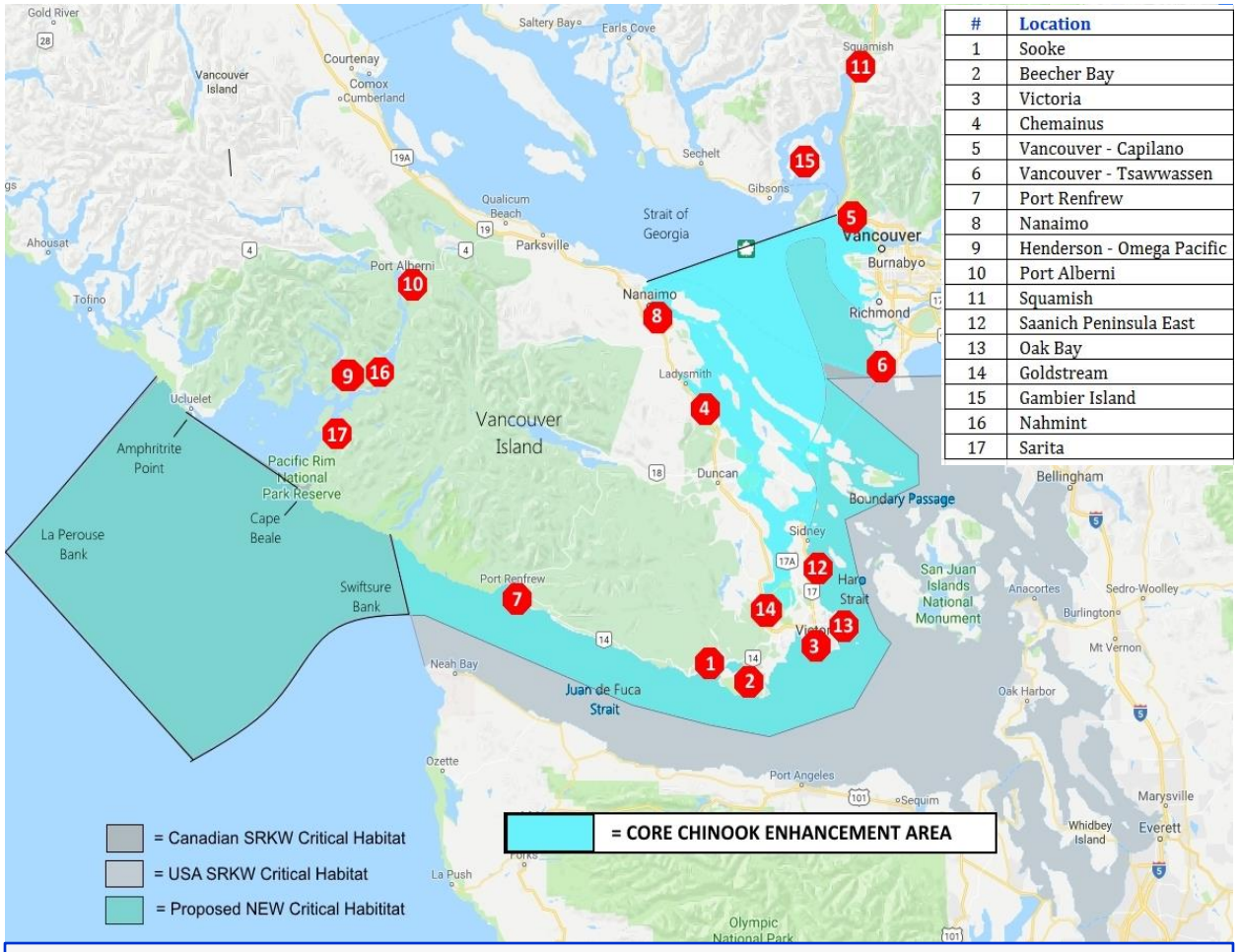
Currently, there is no federal government plan to significantly increase Southern BC Chinook stocks in Canada. In 2018, as a recovery action for SRKWs, the **Department of Fisheries, Oceans and Canadian Coast Guard (DFO)** immediate approach to increase the endangered Orcas food requirements was to implement designated SRKWs forage areas and quickly close them to interception fisheries. That plan was

[1] *Ford, John K.B. et al. 2010 "Linking killer whale survival and prey abundance: food limitation in the oceans' apex predator?"*

implemented to provide "extra" Chinook through fishery closures for the Orcas. In doing so, DFO closed recreational angling to critical areas around South Vancouver Island with limited science to support their action.

It takes time, investment and knowledge for long-term restoration of critical salmon habitat in watersheds. Also, habitat restoration and fisheries management actions alone may take a decade or more to rebuild Chinook populations currently experiencing low abundance. In addition, climate variation and adverse ocean rearing condition changes are negatively impacting wild Chinook salmon abundance and may greatly extend the time necessary to reach a successful recovery.

These OFSP 'Recommendations Paper' provides a quicker increase of Chinook abundance in the near term. Well-fed Orcas will not incur health challenges associated with consuming their own toxin-laden body fat as a means of survival due to the lack of Chinook prey.



#	Location
1	Sooke
2	Beecher Bay
3	Victoria
4	Chemainus
5	Vancouver - Capilano
6	Vancouver - Tsawwassen
7	Port Renfrew
8	Nanaimo
9	Henderson - Omega Pacific
10	Port Alberni
11	Squamish
12	Saanich Peninsula East
13	Oak Bay
14	Goldstream
15	Gambier Island
16	Nahmint
17	Sarita

Orca Food Security Program

Potential Chinook Temporary Marine Enclosure Out-Planting Site Map

Further Information available upon request at governor@shaw.ca or (778) 426-4141

THE ORCA FOOD SECURITY PROGRAM (OFSP)

A recovery action plan for SRKW must include sufficient food to maintain the existing population (74) as well as meet the recovery target population of approximately 120 individuals. Marine mammal experts have studied SRKW preferred prey requirements and propose the amount of large Chinook (>8.5kg) required to feed the existing population of 74 Orcas from May to September while in Canadian waters could be between 171,000 to 337,000 Chinook (C. Parken - Workshop Presentation, Ford et al. (2009)). Therefore, closing all Chinook fisheries in BC would not reach that goal, but would have a devastating socio-economic impact on BC coastal communities.

The OFSP is a focused and strategic initiative, already underway in some areas, which could address short-term and medium-term Orca food needs. Rebuilding wild Chinook salmon populations in rivers is a long-term objective; however, the reality today is key Southern BC Chinook populations are struggling at 'stock of concern' levels as are the Orcas. Upper Fraser River Stream-Type Chinook are especially problematic as they have not shown any rebuilding despite some habitat restoration and substantial harvest reductions.

Enhancement is the key factor to their recovery. The correlation between abundant Chinook populations, and a stable or rebuilding SRKW population, indicates the best strategy is to immediately commence a bold Chinook enhancement program.

To achieve this, the OFSP recommends using three separate 'Approaches' with four different smolt release strategies. The program is designed to increase the number of large adult Chinook within the Orcas' Critical Habitat off the Fraser River mouth, in the Lower Georgia, Saanich Inlet, Haro and Juan de Fuca Straits as well as off south west coast of Vancouver Island south of Tofino between May and early September each year.

Chinook Enhancement Methodology

The Orca Food Security Program recommends using four hatchery-based chinook smolt release strategies. The purpose of using multiple strategies is to increase juvenile to adult survival rates, and to increase the size of hatchery Chinook when they return as adults. In addition, these strategies enhance Chinook smolts that are more robust and will reduce the predation on juveniles at times of release. Those strategies are:

Strategy 1: - S0 (*ocean type*) – River release (April-May),

Strategy 2: - S0 (*ocean type*) – Fed in Temporary Marine Enclosures **(TMEs)** for 30 days (April-May),

Strategy 3: - S0 (ocean *type*) – Reared in cold temperature to delay growth - late release (early July),

Strategy 4: - S1 (*stream type*) – Reared in cold water for 1 year, released 7-10 days from TMEs (April).

Strategy 1 - S0 (ocean type) – River Release

S0 (ocean type) – **River Release** are Chinook that are incubated and reared in the hatchery from egg to smolt stage for ~6-7 months prior to release into the river. They are mainly released in April or May, depending on their size and development. *High early life history mortality is associated with this strategy and new modified methods are being developed.* This River Release strategy is currently the most commonly used by DFO hatchery release method in BC and there are on average ~26 million smolts released in BC each year pursuant to this strategy which produces the lowest survival rates (~.05%).

Strategy 2 - S0 (ocean type) Temporary Marine Enclosures (TME)

This strategy employing TMEs increases survival rates of Chinook stocks by holding the S0 smolts for 30 days prior to release. It costs more and takes effort! Juvenile Chinook are collected annually from wild brood stock and reared to S0 (ocean type) smolt stage in hatchery facilities. They are then transferred from the hatchery into TMEs in estuaries or embayments in the spring for a short 1-month growth period. The S0 (ocean type) TME reared Chinook avoid in-river predation, start their ocean life phase with an additional one-month of growth condition with improved immune systems, and enter the marine environment at a larger size. There is currently limited data available on survival rates however, preliminary indications of limited return data indicate a range of as low as 1.5% - 4+% with an expectation of 3% - 4+%.

An existing community-based pilot program, that uses this strategy, operates in the Sooke Basin and Somass estuary [***Sooke Chinook Enhancement Initiative*** **(SCEI)**] and is specifically designed to address Orca food supply.

Strategy 3 - S0 (ocean type) Cold-Water Reared (TME)

This strategy is in the most formative of stages, currently untried and hence no publishable data available. Nevertheless, this strategy which will seek to extend the freshwater development in cold water before introduction of the smolts to the natural river and marine environment in July. Chinook would be incubated and reared in a fresh water hatchery from egg to smolt stage for 10 months prior to release into the river or into a TME. (Refer later to OSFP Innovation on page 11.)

Strategy 4 - S1 (stream type) Cold-Water Reared (TME)

The S1 (stream type) Chinook smolts are reared in cold-water hatchery facilities. These juvenile Chinook remain in the hatchery for 18 months prior to transfer to the river or estuary, or into TMEs, for 7 – 10 days in March or April. S1 (stream type) Chinook are typically more robust, return as larger adults in their fifth year, and experience higher survival rates (4-5+%). The Omega Pacific Hatchery Inc. at Great Central Lake, Vancouver Island, has over 30 years of experience in spawning and rearing S1 smolts and 10+ years of tagged returns having achieved consistent tagged return survival rates of 4% to 5% and often significantly higher.

In summary, Strategies 2, 3, & 4 offer significant new opportunities for enhanced Chinook production.

Chinook Enhancement Approaches

Three short and medium-term Chinook enhancement approaches are described, and which could increase Chinook abundance. They are:

Approach A – Using multiple community-based Temporary Marine Enclosures (TMEs) projects,

Approach B – Increasing public and private hatchery production of Chinook salmon,

Approach C – Constructing a new S1 (stream-type) Chinook hatchery on the Willow River in the long term, and using any capable private chinook hatcheries in the interim such as Omega Pacific.

Implementing these Approaches would significantly increase the juvenile to adult survival rate from hatchery releases, which achieve ~.05% up to (1.5% to 4+%). The aggregate strategy could result in as many as 250,000 to 500,000 additional large adult Chinook annually when the program reaches maturity. However, such an enterprise won't be inexpensive, nor easy to do!

Approach A. Temporary Marine Enclosure (TME) Projects

The OFSP identifies 17 candidate project locations or watersheds that could be expanded or implemented immediately. Individual projects would be developed and managed within each local community with the support of First Nations, enhancement groups, angling clubs, businesses and volunteers. This is not an insignificant task and private-public-partnerships (*P3s*) of this kind are rare, but necessary for quick mobilization. The Sooke and Somass are examples of successful projects now underway that show others how to do it.

Using Temporary Marine Enclosures is a time-tested method, and does increase Chinook survival rates. Chinook eggs are collected annually from wild brood stock and reared at the appropriate hatchery. When the smolts reach the precise stage of maturity, they are transported to the TME for a 1 to 4 week holding period. The smolts are released according to the specific release strategy utilized.

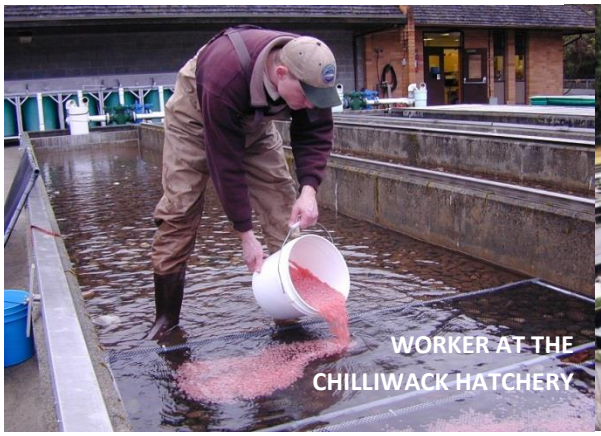
Using Strategy 2 - The S0 (ocean type) juveniles are reared in public and private hatchery facilities. They are transferred from the hatchery into TMEs in estuaries and embayments in the spring for a short 1-month growth period.

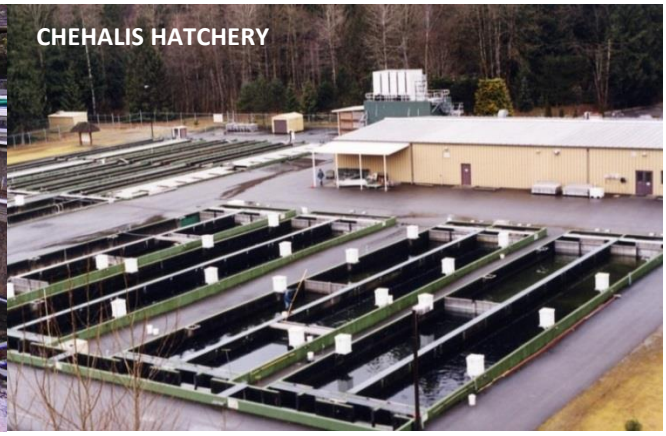
Using Strategy 4 - S1 (stream type) Chinook smolts are reared in cold-water hatchery facilities, (e.g. Omega Pacific at Great Central Lake, Vancouver Island). These juvenile Chinook remain in the hatchery for 18 months prior to transfer to the estuary, or into TMEs, for 7 – 10 days in March or April. S1 (stream type) Chinook are typically more robust, return as larger adults in their fifth year, and experience higher survival rates (4-5+%).

There are two TME projects that are operating as community-based pilot programs in the Sooke Basin [Sooke Chinook Enhancement Initiative (Sooke CEI), and the Somass River near Pt. Alberni (Somass CEI)].

Approach B. Increase Hatchery Production of Chinook

This approach uses Strategy 1 - S0 (ocean type) River Release strategy. DFO's Capilano, Chehalis and Chilliwack Hatcheries on the Lower Fraser River could assist with Orca food supply. The Chilliwack hatchery has proven to realize a 4% survival rate of river released Chinook smolts. These hatcheries on the Lower Fraser are currently raising predominantly Harrison origin fall run (ocean type) Chinook and could be structured or upgraded to produce more juvenile Chinook without incurring major expenses. There are other small private or Community Economic Development Hatcheries that could also assist.


WORKER AT THE CHILLIWACK HATCHERY


CHEHALIS HATCHERY

Increasing annual output to 5,500,000 river-released smolts would improve future adult Chinook abundance in the Salish Sea during key SRKW foraging periods. Harrison Chinook are a 'resident' (*or Georgia Strait*) ecotype of salmon that remain in the marine waters around Vancouver Island during the ocean phase of their lives, making them a viable species to enhance for SRKW recovery. With this component of the OFSP fully implemented, the result of approximately 220,000 adult Chinook at the right time and place for the Orcas.

Approach C. A stream-type Chinook Hatchery on the Willow River in the Upper Fraser

Most Fraser River stream-type Chinook from the mid and upper tributaries are experiencing exceptionally low abundance. On average, the 2018 adult returns of the spring and summer 5-2 stocks were approximately 40 - 50% of parental brood year. Depressed parental escapements, low productivity and unfavourable marine and freshwater rearing conditions are all considered to be causing these persistent declines. There is currently no hatchery in the area of the mid or upper Fraser available to service the enhancement needs for Chinook salmon.

The Willow River enters the Fraser River near Prince George and rises in Jack-of-Clubs Lakes near Wells and Barkerville. Siting a new fish hatchery on the Willow River may be a wise, but long-term decision for several reasons. The Willow River is approximately 170 kilometres long also and has the advantage of being home to a native population of stream-type Spring and Summer 5-2 Chinook salmon. The water quality is excellent and coursing mainly through forested land the river temperatures are stable and cool. There is good access by road and highway plus certain locations have electricity available.


WILLOW RIVER

As a long-term solution, a Willow River hatchery would be a Chinook facility with state-of-the-art design employing advanced culture techniques and practises. The facility could be operated and funded through a private-public partnership. However, in the short-term, a conscientious effort should be made to utilize the expertise and facilities of the private Omega Pacific Hatchery for S1 strategies for priority rivers where Chinook are at risk, or "*Grow More Chinook*" projects can add additional production using its services. This can be arranged through a collaborative process involving private-public partnership and community interests as set out in the G-Force Report (draft 9 Jan. 2019) [17].

The Willow River hatchery would operate on a year-round basis and serve several key Rivers with stock assessment and conservation functions to include:

(i) Enhancing the abundance of 5-2 stream-type Chinook by producing 500,000 to 1,000,000 yearling smolts (S1) annually from wild caught progeny. State-of-the-art broodstock collection, selection and DNA-based mate pairing protocols to protect genetic integrity of these stream-type fish would be essential. Collection location and brood gathering timing protocols would also be instituted and followed by the hatchery. Release strategies designed to optimize survival of the S1 yearlings would also be utilized;

(ii) Implementing a fin-clipping, Coded Wire Tag (CWT) and otolith marking program, as currently there is no CWT Indicator Stock for Fraser Spring and Summer stream-type Chinook[2]. The Willow River hatchery would deliver this much needed Canadian stock assessment requirement as well as provide biologists and fisheries managers with improved data about the plight of these wild stocks of concern, their timing and movements. In addition, improved stock assessment data from marked Willow River hatchery Chinook would benefit the Southern BC Chinook Strategic Planning Initiative decision process. It would also provide superior information to the Pacific Salmon Commission and future Chapter 3 aspects of the Pacific Salmon Treaty negotiations regarding Fraser River salmon. As part of a best management practice protocol, although costly, all hatchery production should be marked via Otolith, CWT, and adipose fin clipped- some pit tagging could also be utilized;

(iii) Utilizing the hatchery as a conservation enhancement operation, where specific Fraser 5-2 Chinook stocks are at critically low levels or on the verge of falling below viable levels; and,

(iv) COSEWIC and SARA Recovery Enhancement: should any of the Fraser 5-2 Chinook stocks fall to abundance levels triggering a COSEWIC review or a SARA listing, this hatchery could become a recovery facility for those fish. The facility could also serve to maintain a living Gene Bank for any specific endangered stream-type Chinook demes.

OFSP INNOVATION REVIEW

The entire OFSP program, from brood collection, to smolt release, through to monitoring returns, and risk assessment, must be held to the highest standards using approved enhancement techniques. In addition, careful consideration must be given to any risks and assessment measures required to evaluate the program's success.

Rearing Strategies That Mimic Nature's Success

A new idea: Rearing Chinook grown in cold water combined with a delayed release early July – Why? "The Thompson River chinook is a stock that is stable and has not demonstrated the population declines in comparison to other Fraser River chinook stocks. This may be related to the Thompson River's colder habitat, and its ocean type life history that results in an estuary arrival during July which is later than other stocks. In so doing, the juveniles may have less predation factors, and have more abundant and less competition for food availability than the spring migrating cohorts. A cold-water chinook rearing strategy that causes a slower growth of an S0 cohort in specialized cold-water hatchery situations could be developed for release in July and would model the Thompson chinook life-history. This may be an experimental approach that could increase chinook survivals. (Dr. D. Beamish recently recommended a hatchery strategy to model the

[2] ***Dome Creek Hatchery*** *was closed and the last year of CWT release was 2006. No further CWT data on Mid or Upper Fraser 5-2 Chinook since that time.*

chinook growth to mimic the only Fraser population that is stable/growing population such as the Thompson chinook which reach the Fraser estuary in July)."

Addressing Risk Factors Using Available and New Technology

i) Straying is currently judged to be a risk factor for wild Chinook salmon in neighbouring rivers and streams. Another technique of using a homing chemical such as Morpholine or Phenethyl-Alcohol can address this potential risk by artificially inducing a homing response to an exact location (an artificial river if there isn't one!). Employing these techniques under carefully controlled conditions could provide better spatial availability of large adult Chinook returns for SRKWs, reduce straying to neighbouring Chinook river systems, and provide terminal fishery opportunities when and where Chinook returns concentrate.

ii) Risks Associated with Cross-Breeding Between Wild and Hatchery Chinook Another strategy used by BC hatcheries (*Freshwater Fisheries Society of BC*) is to render freshwater trout fish sterile (or triploid) and could be deployed with hatchery raised Chinook salmon. This technique could be used to reduce undesired cross-breeding between wild and hatchery origin Chinook.

Administration

Coordination and management of the OFSP should be carried out by a small group of professional paid public and private staff (an OFSP Support Team). Their responsibility would be to organize, develop and co-manage, if required, the day-to-day functions of the OFSP annual operations. A critical element is engaging the 'Communities of Interests' to assist and support each local project. Project funding support could be handled by the Pacific Salmon Foundation, which has a charitable status, so each local project can seek funding under a grant approval process once that project plan has met necessary criteria, and has received approvals.

Summary: The Orca Food Security Program

Currently, the health, abundance and fate of the endangered Southern Resident Orcas are in jeopardy. So, too, are the First Nations, public recreational and commercial Chinook salmon fisheries and their associated economies. The Wild Salmon Policy does not support large, single purpose, enhancement hatcheries. However, a bold and innovative intervention strategy such as described in this OFSP Recommendations Paper is offered as a viable, cost effective, short to medium term solution to address declining Chinook abundance while wild chinook rebuild.

A combined strategy of enhancing specific Chinook stocks can be achieved through increased hatchery production via the DFO Salmon Enhancement Program in combination with state-of-the-art OFSP husbandry techniques as described in public and private partnerships. The Orca Food Security Program has been designed specifically to address the abundance of Chinook, and if successful, will benefit the Orcas, and also help restore declining wild Chinook stocks. In doing so,

their recovery will provide opportunity for First Nations, recreational and commercial harvest with the associated economic benefit to all of BC and Canada. This is an alternative to complete fisheries closures which are currently being contemplated by the federal government.

IMPORTANT NOTE: Any increased production outlined in this recommendation summary would be considered temporary or short-to-mid-term, while wild Southern BC Chinook are permitted to naturally rebuild in abundance, especially the Spring and Summer Fraser stream-type Chinook. A more comprehensive document on this three phased enhancement approach with estimated costs is available upon request.

APPENDIX ONE

OFSP Referenced Document List

1) Relationship Between Chinook And Chum Salmon Abundance And SRKW Population Dynamics
Author – Ford, Ellis and Olesiuk et al.
https://www.westcoast.fisheries.noaa.gov/publications/protected_species/marine_mammals/killer_whales/esa_status/ford-relationship.pdf

2) The Effects of Salmon Fisheries on Southern Resident Killer Whales – Final Report of The Independent Science Panel
Author: Hilborn, R., S.P. Cox, F.M.D. Gulland, D.G. Hankin, N.T. Hobbs, D.E. Schindler, and A.W. Trites. (2012)
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3) Action Plan for the Northern and Southern Resident Killer Whale (Orcinus orca) in Canada
Fisheries and Oceans (2017)
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APPENDIX TWO

Sooke Chinook Enhancement Initiative

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APPENDIX THREE

Omega Pacific Hatchery Chinook Enhancement Initiatives Supporting Orca Food Sustainability

G-Force Advisors Inc. G. Powroznik et. al. (G-Force, Draft 9 Jan. 2019)

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