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Portage Creek Chinook Conservation and Enhancement

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Prepared for:

Fish and Wildlife Compensation Program

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Prepared for the Fish and Wildlife Compensation Program on behalf of its program partners: BC Hydro, Fisheries and Oceans Canada, and St'át'imc Eco-Resources Ltd.

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EXECUTIVE SUMMARY

Portage Creek Chinook are classified under the Government of Canada's Wild Salmon Policy as a vulnerable single site Conservation Unit. This stock has had diminishing returns for approximately 20 years. The current adult Chinook returns are likely insufficient to maintain the population. Fisheries and Oceans Canada (DFO) anticipates that this population will become extinct over the next two generations (ten years) without intervention, resulting in the loss of a genetically unique Conservation Unit. With support from BC Hydro's Fish and Wildlife Compensation Program (FWCP), DFO proposed strategic enhancement of this stock for a minimum of one generation (five years) to support preservation and rebuilding of this population and its unique genetics, while further investigating the limiting factors contributing to the population decline. This project is aligned with FWCP's Bridge-Seton Watershed Action Plan priority action BRG.ALL.SB.04.02: Implement high priority habitat and/or species-based actions for fish and/or wildlife.

DFO staff from Tenderfoot Creek Hatchery, in collaboration with St'at'imc Eco-Resources Ltd., conducted broodstock collection activities from October 13th through October 30th, 2020, which resulted in the second consecutive year of successful spawning of Portage Creek Chinook. A total of 6 females and 11 males were spawned, for a total egg take of 27,020 eggs and an average fecundity of 4,503 eggs/female.

Disease screening by the DFO Fish Health Diagnostics Lab revealed favourable results, with all females showing negative or low level detection for *Renibacterium salmoninarum* (the causative agent for Bacterial Kidney Disease). As such, all 2020 brood on hand will be reared to yearling smolt and released in spring 2022.

The remaining 47,066 Portage Creek Chinook on hand (as of January 2021) from the 2019 brood year were successfully marked and coded-wire tagged and will be released as yearling smolts on May 5th and 6th, 2021. The smolts will be released into Portage Creek, near the outlet of Anderson Lake.

INTRODUCTION

Canada's Policy for Conservation of Wild Pacific Salmon (WSP) identifies Seton-Portage Chinook as a unique, isolated, and single-site Conservation Unit. Conservation Units (CUs) have been defined by the WSP as a group of wild salmon sufficiently isolated from other groups that, if extirpated, is very unlikely to recolonize naturally within an acceptable timeframe. Under the WSP, CUs have two roles: first as units of biodiversity, and second as accounting units for

documenting the progress of achieving WSP goals (Holtby and Ciruna 2007). Portage Creek Chinook are the only population within the Seton-Portage Chinook CU.

Portage Creek Chinook escapement has been declining for approximately two decades, with only 12 adults estimated in 2016 (Figure 1). Since records started in 1977 the peak escapement estimate was 445 in 2002. The cause(s) of the population decline is currently unknown. Chinook stocks have been declining precipitously throughout the Fraser region, and in general across the Pacific Northwest in recent years. These declines have been attributed to various causes including, but not limited to: poor ocean conditions, loss or degradation of freshwater rearing habitat, over-fishing, increases in predation (e.g., pinnipeds), changes in water chemistry, and climate change (e.g., increased frequency of droughts, higher stream temperatures resulting in increase pre-spawn mortality, and "the blob" – the large mass of abnormally warm water located in the Pacific Ocean). Although the specific causes for the population decline of Portage Creek Chinook are currently unknown, enhancement can be used to increase egg-to-smolt survival rates, resulting in greater adult returns. The objective of this project is to preserve this genetically unique salmon population (a single-site CU) through enhancement, while the reasons for their decline are examined and addressed.

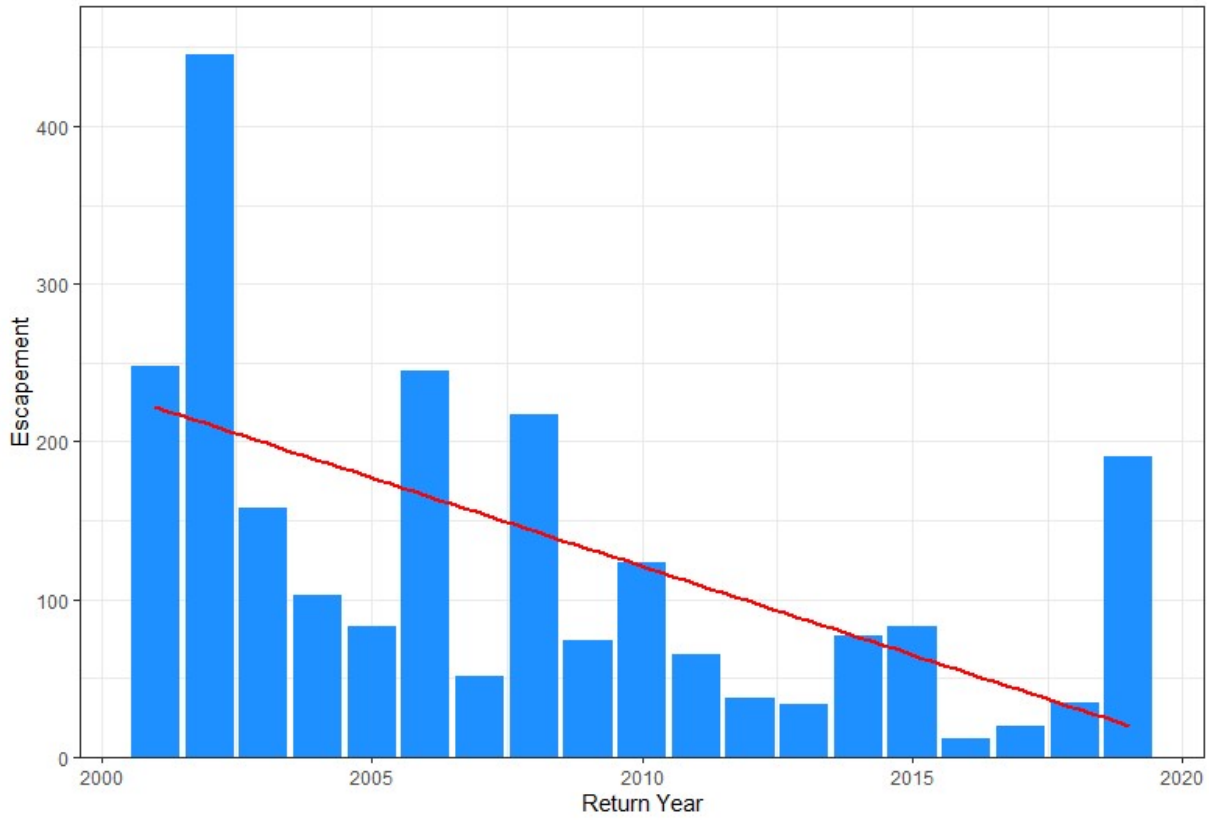

Figure 1. Portage Creek Chinook escapement estimates with linear trend line, 2001-2019 (NuSEDS Database).

PROJECT AREA

Project Coordinates: 50.70638889, -122.28194444

Portage Creek is an approximately 2.9 km long stream that connects Anderson Lake to Seton Lake and is the only known spawning area of Portage Creek Chinook. Seton Lake is impounded by the Seton Dam and ultimately discharges into the Fraser River. The Seton Dam was completed in 1956, which raised the height of Seton Lake by approximately 2 m. Seton Lake receives water from Portage Creek, discharge from the Bridge River generating station and discharge from the diversion of Cayoosh Creek. The impacts of these developments and the Seton Dam on Chinook salmon cannot be quantified as we do not have accurate accounts of Portage Creek Chinook escapement prior to or recently after dam construction. Anderson Lake, the headwater of Portage Creek, is fed by Gates Creek, as well as by smaller, mountain run-off tributaries. Both Gates and Portage Creek support major sockeye spawning populations, among other salmonid populations such as coho.

Landslide and debris flow events affecting Anderson Lake and Portage Creek and the avulsion of Whitecap Creek in 2015 are believed to have caused damage to the salmon habitat in Portage Creek (Figure 2). Landslides and stream avulsions can dramatically increase egg and alevin mortality. Salmon deposit their eggs in gravels; these eggs require clean, flowing, and well-oxygenated water. The sediment from landslides and alike can fill in the gravel interstices (space between gravels) cutting off the supply of stream flow and oxygen to eggs, as well as limit the ability of emerging juvenile salmon to exit the gravel once hatched. It is believed incubating eggs and alevin in 2015 and, to a lesser extent, 2016 brood years were severely impacted by these events. The habitat has since recovered significantly, though additional restorative efforts would likely be of value.

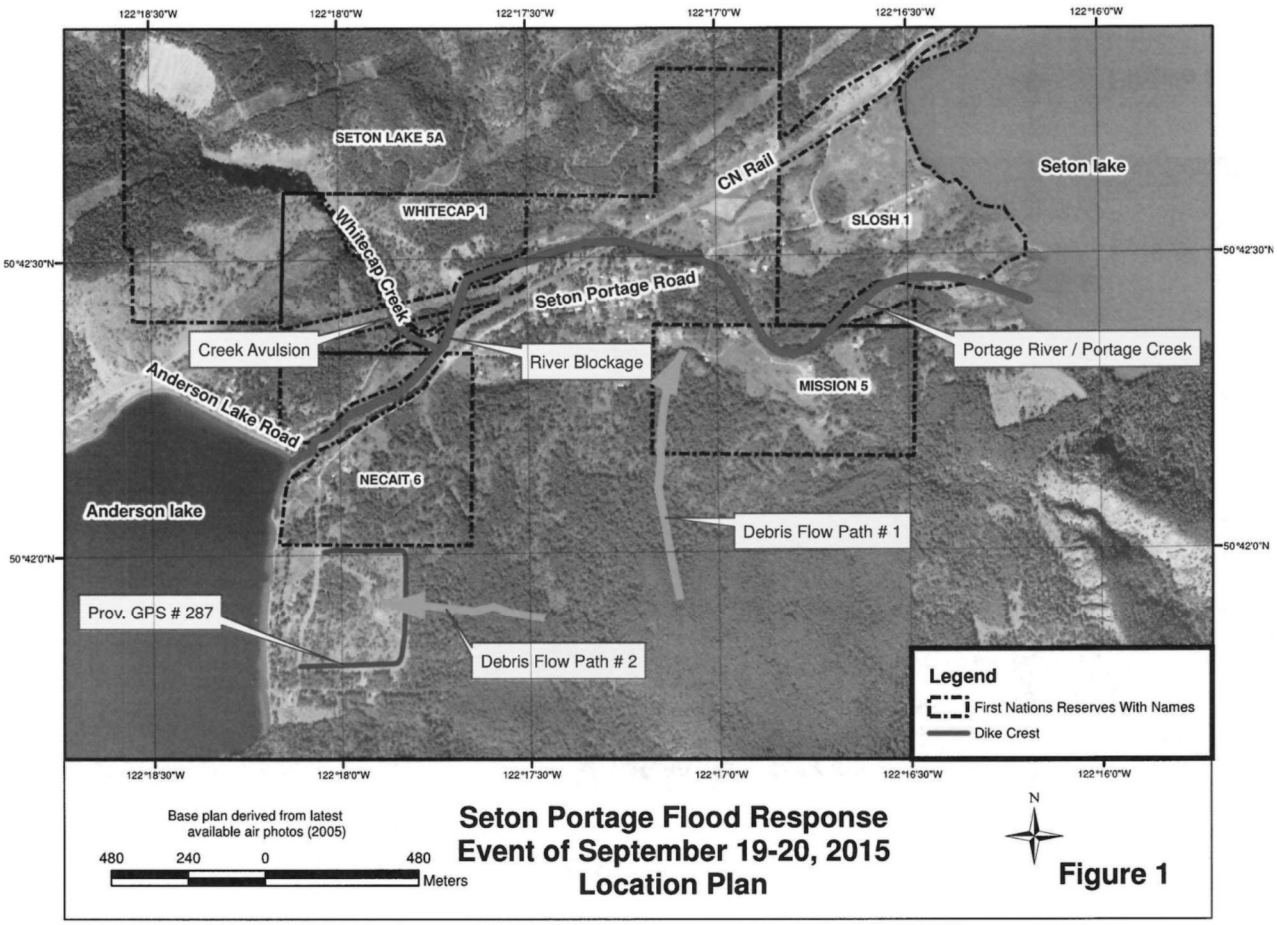

Figure 2. Visual depiction of landslides/debris flows which affect Portage Creek (BC Government Situation Report – Southwest Provincial Operations Centre 2015).

PROJECT IMPLEMENTATION

OBJECTIVES & GOALS

Given recent escapement estimates, as well as a declining population trajectory spanning approximately 20 years (Figure 1), Portage Creek Chinook are at risk of extirpation without human intervention. The SEP objective for Portage Chinook is conservation. Conservation enhancement programs are generally initiated to assist in the recovery of a population that has declined to a level of concern (such as has been observed in the Portage Creek Chinook in the past decade). During the early phases of a conservation program, the primary goal is preventing extinction and minimizing loss of genetic diversity.

An initial visual assessment suggests that there is good quality spawning and rearing habitat in the creek, and that its capacity is not fully utilized (DFO Resource Restoration Unit pers. comm.). While the primary drivers of the observed population decline are still unknown, enhancement intervention will increase egg to yearling smolt survival, and in turn will help seed both underutilized spawning and rearing habitats. This is will help achieve the ultimate goal, which is for Portage Creek Chinook to be a self-sustaining population, free from the need for enhancement.

These goals and objectives align with FWCP's Bridge-Seton Watershed Action Plan priority action BRG.ALL.SB.04.02: Implement high priority habitat and/or species-based actions for fish and/or wildlife.

Performance Metrics

The US Hatchery Scientific Reform Group (HSRG) was initiated in 2000 in response to increased scientific information on the impact of gene flow between hatchery and wild fish on the fitness of fish spawning in natural environments. After several years of research and reviews of hatchery programs in Puget Sound, the HSRG recommended the implementation of the Proportionate Natural Influence (PNI) metric, which assesses the genetic risks of hatchery production on natural populations as an index of gene flow. The HSRG (2015) guideline outlines four conservation phases, from prevention of extirpation to a long-term stable state, with PNI targets for each (Table 1).

Table 1. Four phases of a conservation-based hatchery program and the associated genetic risk guidelines (adapted from HSRG 2015). PNI (Proportion of Natural Influence) is a metric used to measure the genetic contribution of hatchery production to wild populations.

Conservation phase	*PNI* target	Primary Objective
Preservation	None	Prevent extinction
Recolonization	None	Increase abundance
Local adaptation (or re-adaptation)	0.5	Increase fitness and local adaptation
Fully restored	0.67	Maintain viable population

This work by the HSRG initiated the development new Canadian genetic guidelines for Chinook salmon (Withler et al. 2018), which builds upon the HSRG definitions of a recovery program and the PNI metric. Following Withler et al. (2018), SEP has incorporated the PNI metric as a part

the Portage Creek Chinook enhancement plan. PNI is calculated by dividing the Proportion of Hatchery Origin Spawners (pHOS), by the Proportion of Natural Origin Brood (pNOB) combined with pHOS. The values derived from this equation provide the bases for the designation of natural populations in the context of recovery measures and the WSP (Table 2).

Table 2. Proposed designations for individual salmon populations that vary in the degree of influence of integrated hatchery programs and the proposed genetic guidelines for hatchery management (Withler et al. 2018). Under the Wild Salmon Policy (WSP), Pacific salmon are 'wild' if they and both their parents were born in the wild .

Designation	*PNI*	Comments
Wild	n/a	Designated wild populations that do not have hatchery programs (for at least two generations); strays from out-of-basin hatchery production are limited to <3% per year.
Wild-stray influenced	n/a	Population receives strays from an out-of-basin hatchery. A very large fraction of fish are wild but gene flow modelling suggests a long-term decline in *PNI* as the *pHOS* increases.
Integrated-wild	≥ 0.72	Hatchery production is managed to keep WSP wild fish >50%.
Integrated-transition	≥ 0.5 <0.72	*PNI* > 0.5 ensures natural-origin influence predominate but wild fish are in the minority
Integrated-hatchery	< 0.5	Net gene flow from hatchery environment and most fish are hatchery origin, < 25% of fish are WSP wild.

The Portage Creek Chinook population is classified as wild, however with the initiation of this enhancement plan, the population will transition to an integrated population (a population comprised of some ratio of hatchery and wild individuals) for several generations, while the population is rebuilding. It is SEP's intention to cease enhancement once recovery targets are met, returning the population to a wild designation.

This enhancement plan employs guidelines and principles related to the four phases of a conservation-based hatchery program (Table 1) and the associated Canadian genetic guidelines for Chinook (Table 2), see Table 3. For each phase there are established biological targets that, when met, indicate a shift in conservation phase (Table 3). With these shifts will come a change in management priorities and goals. For example, in early phases of conservation, there is no target PNI as the primary goal is to increase abundance. Once the population and habitat reach pre-determined biological targets, a phase shift will be triggered and PNI targets will be

established (e.g., shift from recolonization to local adaptation). Such a shift could result in changes to the enhancement management plan. A four-year escapement average of ≥100 Portage Creek Chinook is required to trigger a transition from preservation (current phase) to recolonization (Table 3).

Table 3. Phase triggers and PNI targets that will guide management and enhancement decisions for Portage Creek Chinook.

Conservation Phase	Phase Trigger	Release Strategy
Preservation	4-year escapement average less than 100; No PNI Target	Yearling Smolts
Recolonization	4-year escapement average greater than 100; No PNI Target	Yearling Smolts
Local adaptation (or re-adaptation)	4-year escapement average greater than 150; PNI greater than 0.5	Fed Fry and Yearling Smolts
Fully restored	4-year escapement average greater than 200; PNI greater than 0.72	Fed Fry and Yearling Smolts

HSRG has listed conditions for success of conservation hatchery programs and the most relevant are paraphrased below:

- Develop clear, specific, and measureable goals for the integrated hatchery and natural population, that have a sound scientific basis.
- Identify biologically-based triggers for initiating a conservation program, and for moving between phases (Table 3).
- Implement a robust monitoring and evaluation program to evaluate progress in achieving goals, and continue information gathering (ongoing escapement estimates and coded-wire tag data, discussed above and below).
- Include hatchery programs as part of a larger strategy to address limitations to wild production or unsustainable exploitation (larger recovery strategy, discussed below).

All smolts will be coded wire tagged, as well as visually marked by way of an adipose fin clip (AFC). This will allow DFO to establish if and where Portage Chinook are caught in the fisheries, as well as determine the pHOS and pNOB through recoveries as part of broodstock collection and stock assessment activities. Similarly designed and sized programs have been initiated elsewhere (e.g. Cheakamus, Shovelnose, Mamquam, and Ashlu Rivers in the Squamish watershed), and DFO-SEP found that 50,000 tags provides sufficient detail for recovery and

conservation program assessment and analysis. Results from the aforementioned assessments will guide future enhancement decision-making and strategies.

For more information on the aforementioned conservation phases and Canadian genetically-based targets for Chinook salmon, the reader is referred to the Hatchery Scientific Review Group's 2015 report on the application of up-to-date science in management of salmon and Withler et al. (2018), respectively.

Enhancement Plan & Methods

This project seeks to increase the number of outmigrating juveniles, which is expected to increase the number of adult Chinook returning to Portage Creek. The ultimate goal is to help rebuild the population to a point in which it is self-sustaining (see section above). This will be achieved through strategic enhancement which will increase egg-to-smolt survival rates of Portage Creek Chinook offspring. We have proposed a minimum of one generation (5 years) of enhancement, with an annual release target of 50,000 yearling smolts to support the preservation and rebuilding of this stock, while further work is done to assess and address other factors limiting this population. The release target was selected to reflect the historical average escapement to Portage Creek. Based on expected survival and exploitation rates, 50,000 yearling smolts should result in approximately 200-500 returning adults. Given the relative size of the stream, it is likely unable to support a large Chinook population.

Factoring in typical egg-to-smolt mortality in a hatchery setting, as well as potential Bacterial Kidney Disease (BKD) screening and other disease mitigation, a 60,000 -75,000 green egg target was set in order to achieve a 50,000 smolt release target. Successful collection and spawning of Portage Creek Chinook in 2019 and 2020 have provided us with an average fecundity estimate for this stock of 4,518 eggs/female (n=18). This estimate is believed to biased slightly low, as a small proportion of collected females were noted as "partials" (females believed to have lost some eggs due previous spawning activities, or other natural reasons). Future years of collection and spawning of this stock will help generate a more reliable average fecundity estimate, and ultimately a more precise number of female broodstock required to achieve a given egg target:

Eggs / Female	No. females required (for 70K eggs)
3000	24
4000	18
5000	14
6000	12

Tenderfoot Creek Hatchery (hereafter referred to as Tenderfoot) was identified as a suitable location for incubation and rearing of Portage Creek Chinook based on both logistics (e.g., adequate water supply and rearing space) and proximity. Tenderfoot also has a tagging facility on location to allow for marking and tagging of juveniles.

For this program, gametes will be collected from adults on site (i.e., no adults will be transported to the hatchery). The moving of adults for holding outside their native watershed is not supported, unless systems are in place at the receiving site for effluent decontamination prior to discharge to non-natal fish-bearing waters. Nested or factorial mating designs were deemed most appropriate for this stock. Nested mating designs typically involve crossing a member of one sex with two or more members of the other sex (Neff et al. 2011). For example, one female may be crossed independently with each of three males. Full factorial mating design, which is also known as the matrix mating design, involves crossing males and females in all possible combinations (Neff et al. 2011). Importantly, both nested and factorial mating schemes do not pool the milt, but instead perform separate fertilization events with each additional mate, thereby eliminating sperm competition and balancing reproductive contributions.

Egg segregation by female is required until adult screening results for vertically transmitted pathogens are available. Progeny from females testing positive for BKD will be reared as per the SEP BKD Control Plan recommendations (DFO 2016), with higher risk progeny released early (in the spring following hatching) or destroyed to avoid disease amplification through enhancement operations.

Looking Forward

Yearling smolts from the 2020 brood year will be transported to and released into Portage Creek in spring 2022 to ensure they imprint on their natal stream. While a mixed strategy of fry and yearling smolt releases might be preferable for purposes of reducing domestication effects and facilitating diversity in life histories (among other benefits), maximizing the survival and number of outmigrating smolts is the priority during Preservation and Recolonization phases of the program (HSRG 2015). In addition, yearling smolts have been demonstrated to provide the greatest release-to-adult survival rates. Lastly, consistent with the 2019 brood and the project's assessment and monitoring goals, all 2020 brood will be adipose fin clipped and coded wire tagged prior to release.

RESULTS AND OUTCOMES

2020 BROOD YEAR

Tenderfoot staff, with support from St'at'imc Eco-Resources Ltd., conducted broodstock collection activities from October 13th through October 30th, 2020. Unprecedented broodstock collection efforts resulted in a second consecutive year of successful spawning of Portage Creek Chinook. Gametes were collected from adults on site and transported back to Tenderfoot Creek Hatchery (i.e., no adults were transported to the hatchery), see Photo 1. A total of 6 females and 11 males were spawned, for a total egg take of 27,020 eggs and an average fecundity of 4,518 eggs per female. Due to a preponderance of males and the limited number of adults collected and on hand at any one time over the broodstock collection period, a nested mating design was used, whereby each female was crossed independently with two males.

Photo 1. Gametes (eggs and milt) from 2020 broodstock (safely transported from Portage Creek back to Tenderfoot Creek Hatchery) immediately prior to fertilization.

The primary location used for adult broodstock collection was the outlet of Anderson Lake (Figure 2). This location was originally suggested by DFO Science Branch Stock Assessment technicians who were experienced surveyors of Portage Creek. The vast majority of successfully collected Chinook broodstock to date have come from this location.

Keeping with previously observed behaviours, Portage Creek Chinook exhibited what appeared to be a bi-modal pattern of peak spawning, with one peak occurring in mid-October, and another around October 28th, with limited episodes of spawning in between. In 2020, this second peak of spawning was distinctly observed on October 26th and 27th. This narrow and consistent window of peak spawn timing, while interesting, is perhaps however not that surprising. Portage Creek Chinook spawn in an environment considered highly stable (i.e., lake outlet / lake-buffered stream) relative to other salmon spawning habitats (e.g., highly mobile, lower river reaches). As such, selective forces appear to have acted towards a more contracted spawning period, rather than protracted one, the latter of which might be more beneficial in less stable spawning habitats (as a means of "bet hedging"). It is possible however that the apparent peaks and valleys of spawning activity are simply more pronounced in low abundance years (which has been the case throughout the duration of this program).

Daily attendance, multiple sets across all hours of the day, and crews of four to five (three trained in field operations) were again instrumental to this year's success. These Chinook exhibit a unique behavior where they hold in Anderson Lake until they are ripe (physiologically ready to spawn), drop down from Anderson Lake into Portage Creek, and spawn in a matter of hours, or even minutes. If staff are not on site for the majority of the spawning period (second half of October) to watch and wait for these fish to drop down, a great deal of broodstock collection opportunities can easily be missed.

Overall poor weather, low Chinook abundance, and dynamic Chinook behaviour made broodstock collection particularly challenging this year. Frequently reoccurring episodes of wind, snow, and rain heavily impeded the ability of staff to sight fish. Sighting fish as a means to guide set timing, location, and strategy is a critical component to successful capture. Low Chinook abundance was also a contributing factor to this year's elevated capture difficulty. Based on daily assessments over the course of the program, Tenderfoot hatchery staff estimated that a total of 35 Chinook were in the system (not included those removed for broodstock). This estimate was similar to the preliminary escapement estimate provided by DFO Stock Assessment: 26 Chinook. Lastly, this year staff did not observe Chinook holding in any great numbers in what is referred to as the 'upper slot' (Photo 2). The 'upper slot' is located on the shelf of the right-bank shoreline, immediately downstream of the Anderson Lake outlet, which is just in reach of net setting capabilities. Instead, the Chinook held further off the shoreline and deeper into the lake (out of reach of nets) and would only drop down into the

river to test dig and spawn. Staff attributed this skittish behaviour to the low Chinook abundance (i.e., a reduction in the "safety in numbers" effect). Despite all these challenges, Tenderfoot staff remained successful in their broodstock collection efforts, which they directly attributed to nuanced collection strategies and increased field effort. A conservative estimate of average daily field time over the course of the broodstock collection program was 12 hours, per person, per day, with an average crew size of four.

Genetic sampling conducted by DFO Science confirmed that all Chinook collected and spawned were of Portage Creek origin (i.e., no strays were collected) and their collective genetic diversity, as determined by a family analysis on the genotypes, was deemed favourable as founders in a conservation program. Disease screening by the DFO Fish Health Diagnostics Lab revealed favourable results, with all females showing negative or low level detection for Renibacterium salmoninarum (the causative agent for BKD). As such, all 2020 brood on hand will be reared to yearling smolt and released in spring 2022.

Photo 2. The area circled in yellow denotes an optimal broodstock collection location know as the 'upper slot'. The 'upper slot' is described as a shelf of the right-bank shoreline, immediately downstream of the Anderson Lake outlet, which is just in reach of net setting capabilities.

2019 Brood Year

Offspring from the low positive BKD female (approximately 4,000 fish) were released as fry on Feb 19th, 2020. All fry were transported and released safely in healthy condition. The release was coordinated with, and attended by St'át'imc (photos 3-6). The release event was posted by St'át'imc Eco-Resources Ltd. on their Facebook page: https://m.facebook.com/story.php?story_fbid=3012379615473697&id=1684183528293319

The remaining 47,066 Portage Creek Chinook on hand (as of January 2021) were successfully marked (AFC) and coded-wire tagged and will be released as yearling smolts on May 5th and 6th, 2021. A ceremonial release is currently being coordinated between DFO and St'at'imc, and will occur on one of these days. The smolts will be released into Portage Creek, near the outlet of Anderson Lake. Recovery of these individuals in future fisheries (through visual identification of AFC) will provide valuable data, which will aid in future planning and management of this stock.

Photos 3-6. Portage Creek Chinook fry release, Feb 19th, 2020.

2020 Recommendations and Further Considerations

High sockeye abundance in Portage Creek can make Chinook broodstock capture efforts difficult. In 2018, Portage Creek saw the second largest sockeye escapement on record, with an estimated total of 35,548 spawners returning to the system. The peak of the run occurred from October 25th to 30th, which directly overlapped with Chinook broodstock collection efforts. Each time a net was set, hundreds of sockeye were caught that needed to be picked out of the net immediately for their safe release. This was labour-intensive and very challenging for the staff. This however was not an issue in 2019 and 2020 given the extremely poor returns of sockeye to the system.

A key recommendation that came from 2018 broodstock efforts was the need to have increased and continuous on-site presence during the Portage Creek Chinook peak spawning window (second half of October). These Chinook exhibit unique behavior where they hold in Anderson Lake until they are ripe (physiologically ready to spawn), drop down from Anderson Lake into Portage Creek, and spawn in a matter of hours, or even minutes. If staff are not on site for the majority of the spawning period to watch and wait for these fish to drop down, a great deal of broodstock collection opportunities can easily be missed.

In both 2019 and 2020, SEP put into action this recommendation and spent 14 and 18 days, respectively, in Seton-Portage. These unprecedented broodstock collection efforts have resulted in back-to-back years of successful collection and spawning of Portage Creek Chinook. Tenderfoot staff also implemented a new broodstock collection technique, which proved very effective. In previous years, a “set net” approach was used, whereby a net was placed at the outlet of the Anderson Lake to intercept Chinook leaving the lake for lake-outlet and downstream spawning areas. Since 2019, Tenderfoot staff have taken a more active approach and implement a modified beach seine tactic (see photos 7 and 8 for comparative imagery of the two methods). This involves a two person operated raft deploying the tangle net around fish holding near the outlet of the lake (also referred to as the ‘upper slot’), followed by walking the net down stream for 20 - 40 m. The net is then brought to shore and fish are rapidly removed from the net. Throughout the entire process, fish in the net remain completely submerged in water, resulting in only 2 - 4 seconds of air exposure as fish are either transferred by hand from the net to individual fish bags for temporary holding prior to spawning (Photo 9), or released (in the case of bycatch or unripe Chinook). Lastly, critical to the continued broodstock collection success has been the Tenderfoot staff’s critical thinking abilities and adaptiveness, leading to constant recalibration of their capture techniques. In summary, daily attendance, multiple sets across all hours of the day, implementation and constant recalibration of the modified beach seine approach, and crews of four to five (three trained in field operations) were believed to instrumental to this year’s repeated success.

Photos 7 and 8. Images comparing the different broodstock collection methodologies, with photo 7 (top) depicting the set net method used in 2018, and photo 8 (bottom) capturing the highly successful modified beach seine method used in 2019 and 2020.

Photo 9. A freshly captured Portage Creek Chinook male being transferred from the tangle net to a broodstock bag for temporary holding prior to on-site gamete collection, October 2020.

Also crucial to this year's success and logistical feasibility was FWCP's ancillary contribution to help secure adequate accommodations. Due to health and safety concerns surrounding the COVID-19 pandemic, BC Hydro accommodations were heavily restricted and not available to DFO staff. With all hotels fully booked, the only adequate option to ensure that the project could proceed successfully was securing trailers at a local campground. Thanks to FWCP, this was made possible. The accommodations provided adequate sleeping quarters for a required field crew of four to five, as well as a fridge-freezer unit, which was imperative for safely storing the numerous tissue samples that were collected until they could be shipped to the Fish Health Diagnostics Lab in Nanaimo for analysis. As such, a similar broodstock collection effort of two week's time in the second half of October and the securement of similar accommodations with fridges and freezers are likely required to ensure repeated program success in 2021.

Lastly, as there may be limiting factors not yet identified, enhancement is considered to be only one component of the recovery plan. Additional factors, such as fisheries management, hydro operations, and habitat must be considered and addressed in order to support rebuilding of this stock. A meeting with multiple DFO sector representatives has been scheduled for March 2nd, 2021 to discuss this and identify next steps.

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