PROJECT PROPOSAL

RELEASE OF TUCANNON RIVER SPRING CHINOOK FROM KALAMA FALLS FISH HATCHERY

PART I. COVER PAGE - Basic Project Information

a. Project number: New Project

b. Project title: Increase Tucannon Spring Chinook Abundance

☐ Is this a proposed title change, different than the official project title?

c. Sponsor organization (submitting the proposal): Washington Dept. of Fish and Wildlife

d. Other sponsor organizations (list partners): Click or tap here to enter text.

e. Primary contact: Michael Gallinat

The primary contact is the person who creates this proposal. This individual will need to be available over the next several months to field questions from proposal reviewers. The primary contact will also receive email notifications as their proposal advances through the review process.

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f. Proposal short description (500 words)

In 1985, the Tucannon spring Chinook hatchery program was initiated under the Lower Snake River Compensation Plan (LSRCP). The run stabilized for a while, but ultimately were ESA listed as "threatened" in 1993 as part of the Snake River Spring/Summer Chinook ESU. The run experienced a dramatic drop in the mid-1990's, which prompted managers to take aggressive steps (initiation of a short-term captive broodstock program) with the goal to maintain and rebuild the population to more sustainable levels. The population rebounded in the mid-2000's because of improved ocean conditions but has since returned to critically low levels (<150 on average over the last 4 years (2019-2022), and only 100 are expected to return in 2023). The 2022 Status Review (NMFSWCR 2022) rated the population at "high risk" for abundance/productivity and "moderate risk" for spatial structure/diversity.

The recent limited number of adult returns means that fishery managers are forced to collect and hold at Lyons Ferry Hatchery (LFH) all or most adults returning as broodstock, or to safeguard against pre-spawn mortality. The result is that almost no natural spawning has occurred within the Tucannon River in the past 4 years. The long-term decline in the overall abundance of Tucannon River spring Chinook has generated a multitude of efforts to stop and reverse the decline by fishery managers and scientists

within the Snake basin. Efforts to improve freshwater habitat, modify hydro operations, improve hatchery rearing and release strategies, implement a captive brood program, and a myriad of other small tweaks to the program have not resulted in measurable changes to the overall abundance of spring Chinook in the Tucannon River.

Monitoring of the hatchery and natural returns of spring Chinook in the Tucannon River under the LSRCP program has determined that in most years natural-origin fish are below replacement, while hatchery-origin fish are above replacement. As such, WDFW and the co-managers believe, and NOAA Fisheries (per the ESA) insist, that the hatchery program be kept to maintain this unique ESA-listed population within the Snake River basin, and the Lower Snake MPG. Over the years, managers have used data from the LSRCP monitoring to adaptively change the hatchery program to improve performance (program size, smolt size at release, release locations, etc…), in addition to providing fish distribution and survivals to guide habitat restoration within the Tucannon River to improve natural fish survival.

WDFW is proposing to revamp our management of Tucannon spring Chinook by taking a multi-pronged approach to recovery. Included in this approach are; 1) adjusting smolt release and transport strategies, 2) acclimating and releasing Tucannon River smolts and recovering adults from Kalama Falls Fish Hatchery (KFFH), and 3) restarting a captive brood program. If survival and adult returns increase using these strategies, enough adult fish should be obtained to satisfy hatchery brood needs, but more importantly reinstitute efforts to return adult fish to the Tucannon River to spawn naturally.

This project would take a portion (50,000) of the standard (250,000) LSRCP production of Tucannon River spring Chinook from LFH to WDFW's KFFH. Transfer of juveniles would occur in the fall to provide 5-6 months of acclimation at KFFH before release. Returning Tucannon origin fish (uniquely marked) would be trapped at KFFH, sorted, and transported back to LFH for holding. Adults could then be used for broodstock if needed, or outplanted into the Tucannon River. Based on moderate smolt-to-adult survival from spring Chinook released from KFFH, ~500 adults could return on average to contribute to rebuilding efforts in the Tucannon River. Increasing the number of fish available for natural spawning in the Tucannon River is the ultimate goal of this program.

PART II. PROJECT PROPOSAL

This part of the template is arranged into the following sections, which are described in detail below.

1. PROBLEM STATEMENT

Spring Chinook in the Snake River: The Snake River spring/summer Chinook *Oncorhynchus tshawytshca* Evolutionary Significant Unit (ESU) was listed under the Endangered Species Act (ESA) as threatened in 1992. The Snake River spring/summer Chinook includes numerous populations in the Snake River Basin located above Ice Harbor Dam, of which the Tucannon River is one of these populations. Currently, most spring/summer Chinook salmon populations in the ESU remain at high overall risk of extinction, with a low probability of persistence within 100 years. For the Tucannon River, the population is rated at high risk for abundance/productivity and moderate risk for spatial structure/diversity, with an overall rating of high risk (NMFSWCR 2022). The viability of this population is limited by hydropower projects, predation, harvest, hatchery effects, degraded tributary habitat, and degraded estuary habitat (NOAA 2008), low abundance and productivity (NOAA 2017a), and tributary overshoot (SRSRP 2011).

Hatcheries are one of the main tools that have been used to mitigate for salmon and steelhead losses caused by the construction and operation of the Snake River hydropower system (USACE 1975). Historically, the goal of most hatcheries was simply to provide more fish for harvest. However, since numerous salmonid populations have been listed under the ESA, the intent of many of these hatchery programs changed from harvest mitigation to conservation/rebuilding natural populations. As a result, hatcheries are a large component of most conservation/recovery programs, particularly for populations in the interior Columbia River basin. However, the use of hatcheries to conserve salmonid populations is controversial because numerous studies have suggested that standard hatchery practices cause morphological, behavioral, physiological, and genetic changes in hatchery fish relative to wild fish. In particular, managers are concerned about the potential for genetic impacts to wild populations resulting from hatchery propagation. Genetic risks associated with hatcheries include the potential for increased inbreeding depression (Ryman and Laikre 1991; Ryman et al. 1995; Wang and Ryman 2001), outbreeding depression (e.g., Gharrett and Smoker 1991), and domestication selection (Ford 2002). The potential implications of these phenomena are reinforced by studies showing that hatchery fish often reproduce poorly in natural conditions when compared to wild fish (Christie et al. 2014). Heritability of this reduced fitness from hatchery fish has been indicated in recent studies (Araki et al. 2009 and Ford et al. 2016). Identical risks may be exacerbated even more (e.g. epigenetic effects; Luyer et al. 2017)when applying more extreme uses of hatcheries (i.e. captive broodstock programs).

Since 1985, there has been hatchery spring Chinook propagation for the Tucannon River, funded under the Lower Snake River Compensation Plan (LSRCP), and operated by the Washington Department of fish and Wildlife (WDFW). The hatchery program was initiated by trapping wild origin adults from the Tucannon River, and natural origin fish have been included in the broodstock annually. Performance of this hatchery program since 1985 has been well below pre-program expectations, and in recent years has experienced very low returns (both hatchery and natural origin). As such, WDFW, and the tribal co-managers, have had numerous discussions on how to quickly increase hatchery origin returns to maintain/rebuild the total population to more sustainable levels.

One suggested strategy would be to transport a portion of the current hatchery production (e.g. 50,000 smolts) down to a lower Columbia River hatchery, acclimate them for 5-6 months, and then collect them as returning adults (this proposal). The adults would then be transported back to LFH and/or the Tucannon River to supplement broodstock needs or for natural spawning. This strategy, will in theory, yield additional adults that wouldn't normally be obtained if they were released in the Tucannon River because of the mortality normally incurred to reach the lower Columbia River. This same strategy was done in the 1970's for Snake River Fall Chinook Salmon and helped maintain the genetic integrity of that stock while hatchery facilities in the Snake River could be built. However, since that time, nearly every lower Columbia River basin has ESA listed populations present and minimizing the risk of this proposed action needs to be carefully considered before moving forward.

Significance to Fish and Wildlife Program and other regional plans:

Spring Chinook are identified as a focal species in the Council's 2014 Columbia River Basin Fish and Wildlife Program and 2020 addendum (NPCC 2020), in NOAA's Snake River spring/summer Chinook and Summer Steelhead Recovery Plan (NOAA 2017a), the Snake River Salmon Recovery Plan for SE Washington (2011), and the Tucannon River subbasin plan (NPCC 2004). Hatchery production, and the monitoring of that production, plays a key role in meeting both mitigation and conservation goals in these plans. However, the ISAB and ISRP identified critical uncertainties in the effects of hatchery propagation on wild populations, e.g., "are current propagation efforts successfully meeting harvest and conservation objectives while managing risks to natural populations?" (NPCC 2017). Other regional plans or guiding documents specific for Tucannon River spring Chinook include hatchery production identified for the LSRCP program (USACE 1975 – page 13), and the Tucannon River spring Chinook Salmon Hatchery and Genetic Management Plan (WDFW 2013), and in the recently updated 2018-2027 US v Oregon Management Agreement (Table B1, page 97). A monitoring and evaluation program was put in place under the LSRCP in 1985, and was initiated to provide the basic monitoring tools that could be used to assess hatchery program performance, and status and trend monitoring for both natural and hatchery origin Tucannon River spring Chinook.

2. PROGRESS TO DATE

The Water Resources Act of 1976 authorized the establishment of the LSRCP to replace adult salmon and steelhead lost by construction and operation of the Snake River hydroelectric dams.

From that, a spring Chinook hatchery mitigation program was initiated for the Tucannon River by trapping natural origin adults for broodstock in 1985. Hatchery propagation would occur at Lyons Ferry Hatchery (LFH) and Tucannon Fish Hatchery (TFH). The LSRCP program goal is for 1,152 hatchery adults and 1,248 natural adults (2,400 total) to the Tucannon River. The original program was sized at 132,000 yearling smolts, released at 15 fish/lb. Beginning with the 2006 brood year, the program goal was increased to 225,000 smolts, and in 2011 the release size was increased to 12 fish/lb, both actions implemented to increase hatchery adult returns. For a variety of reasons smolt production goals have not always been met (Figure 1). In more recent years, this has been problematic as the lack of adequate hatchery production has limited our ability to investigate other alternatives to increase hatchery returns/performance, and ultimately return more fish to increase the number of fish spawning naturally. In addition, a short-term captive broodstock was initiated in 1997 to supplement the standard production of smolts following very low returns in the mid-1990's (Figure 1).

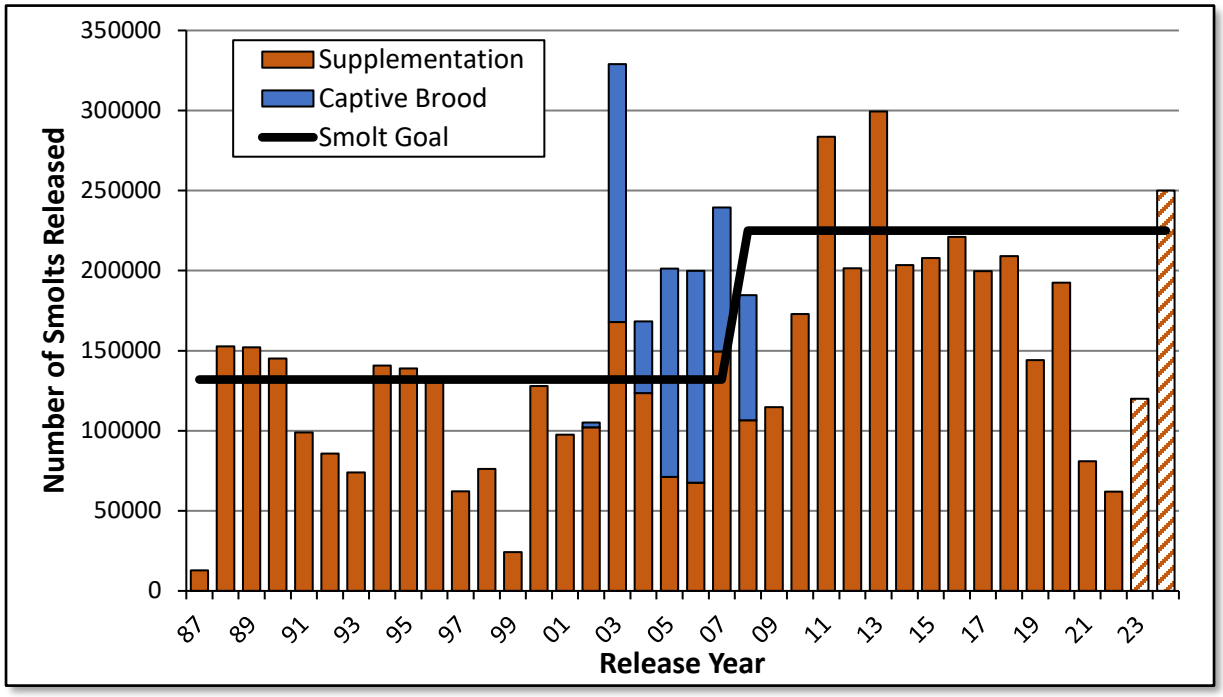

Figure 1. Number of smolts produced by brood year for both the conventional hatchery supplementation and captive broodstock programs. Diagonal slash years are estimated smolts that will be released based on current production at LFH.

Prior to implementation of the hatchery program (pre-1985), estimated spawning escapement based on redd counts in an index area in the upper Tucannon River indicated that the population was in slow decline, similar to other spring/summer Chinook population in the Snake River. While overall returns have come close to meeting goals during years with good ocean conditions, the program has yet to meet hatchery goal of 1,152 (Figure 2). From 2008-2015, natural origin returns had been increasing and making progress towards reaching natural origin goals, but have decreased in recent years (2016-2022), primarily due to poor ocean conditions (Figure 2).

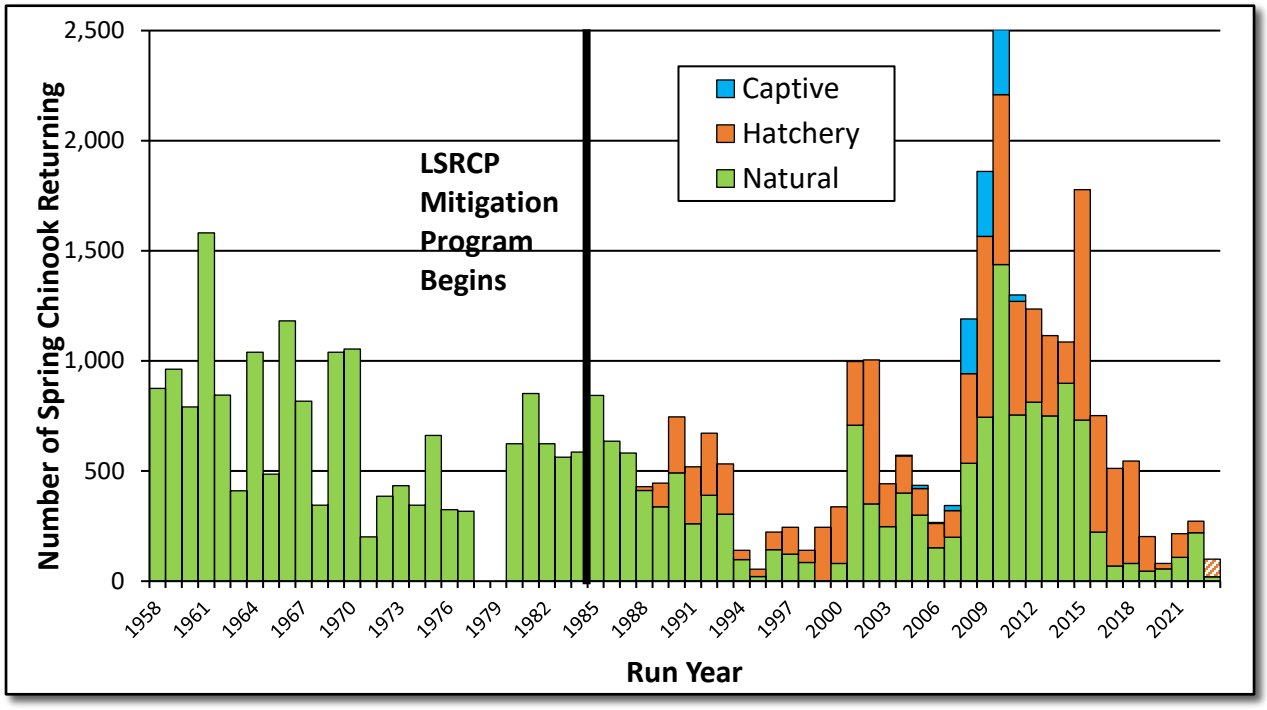

Figure 2. Total escapement by origin for Tucannon River spring Chinook Salmon for the 1985-2022 return years. The values shown for the 2023 returns are forecasted based on juvenile smolt trapping estimates, and recent release and performance of hatchery origin juveniles.

Natural origin smolt-to-adult return (SAR) have consistently been higher than hatchery origin returns (Figure 3). The mean natural origin SAR for the 1985-2017 Brood Years (BY) was 2.19 with jacks included (2.07 without jacks) and the mean hatchery origin SAR was 0.23 with jacks (0.18 without jacks) over the same time period (Figure 3). Based on the current mean hatchery SAR of 0.23% it would take a hatchery program of over 500,000 smolts to meet the mitigation goal of 1,152 hatchery fish.

Overall survival of hatchery salmon to return as adults has been higher than for naturally reared fish because of the early-life stage survival advantage in the hatchery. Based on adult returns from the 1985-2017 brood years (Figure 4), naturally reared salmon produced only 0.63 adults for every spawner, while hatchery reared fish produce 1.81 adults (based on geometric means). As such, and because the hatchery fish overall survive better than the natural fish, during periods of low returns the decision has been to collect every fish at the weir to fulfill broodstock needs – an extreme action that is not at all desired. Why the natural origin fish are typically not replacing themselves, even with higher SARs compared to the hatchery fish, is one of the most pressing questions for this population since extinction appears likely for this population should the hatchery program be discontinued.

Because of the continued low adult returns to the Tucannon River due to adverse environmental conditions (e.g., poor ocean conditions, drought, floods, hydrosystem migration corridor, habitat, etc.) and resulting hatchery production that has been well below program goals, WDFW and the co-managers are currently looking at three different hatchery rearing and release strategies to increase adult returns and improve survival. These three strategies are: 1) Tucannon River Releases and Barging Comparison (see brief summary below, and in Appendix B), 2) a Captive

Broodstock Program (proposed), and 3) a Hatchery Release below Bonneville Dam at WDFW's Kalama Falls Fish Hatchery (proposed). One strategy has already been implemented; the Tucannon River Releases and Barging Comparison was started with the 2022 release year (see brief summary of the study design and first year results to date below).

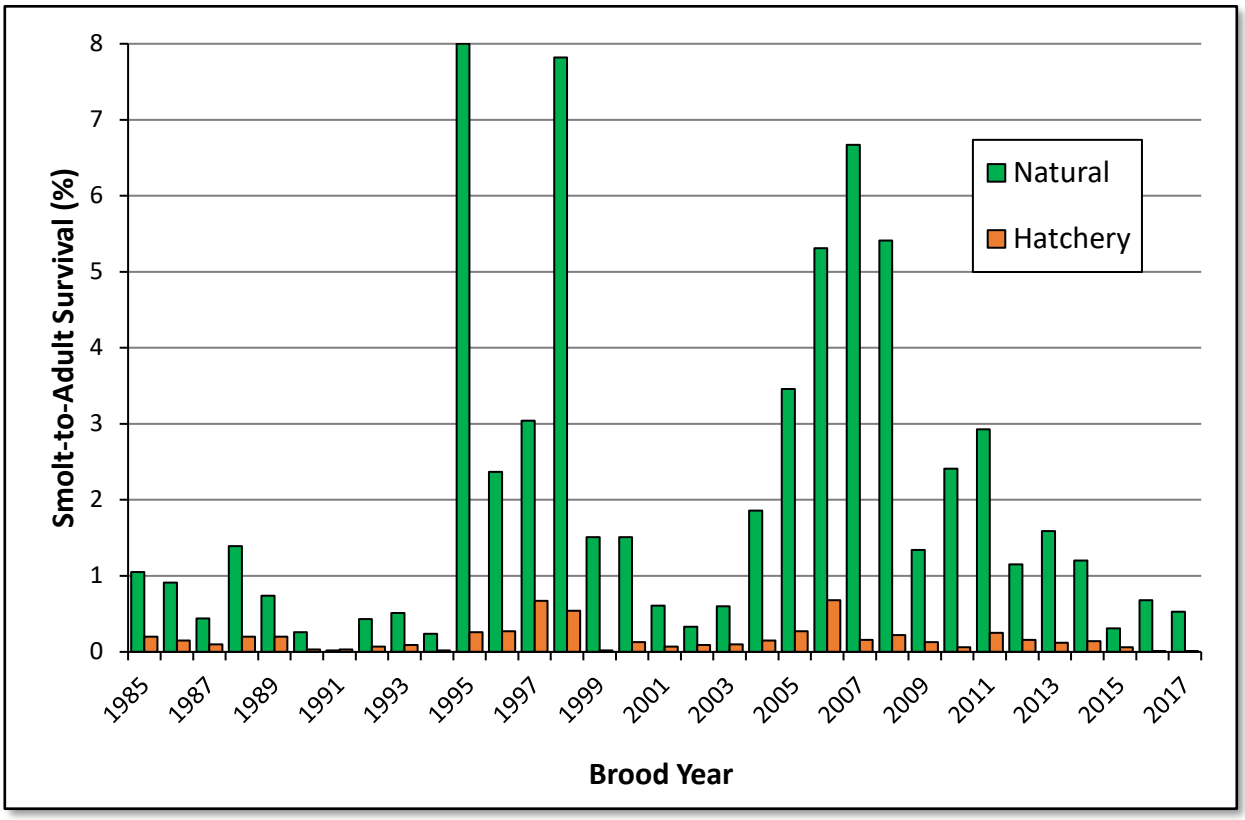

Figure 3. Comparison of smolt-to-adult returns (SAR) of hatchery and natural origin Tucannon River spring Chinook Salmon for the 1985 to 2017 brood years (jacks excluded). (2017 incomplete brood year).

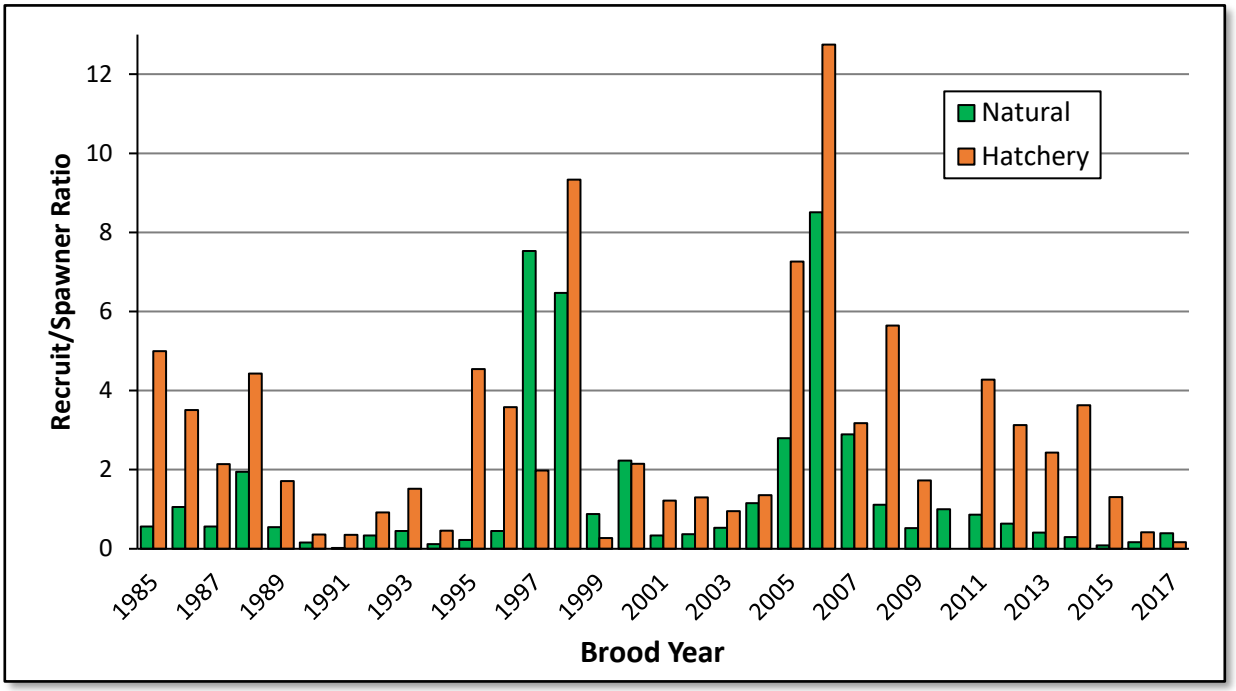

Figure 4. Returns per spawner (with replacement line) for the 1985-2017 brood years (2017 incomplete brood year).

Tucannon River Releases and Barging Comparison Study

Previous survival estimates from the point of release Juvenile downstream survival from the point of release to detection at Lower Monumental Dam (62 miles) shows potential for improvement. Survival to Lower Monumental Dam from either Curl Lake Acclimation Pond or TFH has averaged less than 60% based on DART PIT tag survival estimates. Over the next few years when sufficient hatchery production is available, we will examine three different release strategies (Direct Stream Release at TFH, Direct Stream Release at the Mouth, and Barge Transportation) by PIT tagging a minimum of 15,000 fish per group to determine if significant improvements in adult returns can be achieved. The study will be conducted for a minimum of three BYs with PIT tag detections from returning adults used to determine significant differences among the release groups.

Fish used for this study will be transferred from LFH to TFH in October. This is to ensure that all groups will be treated similarly over the fall/winter months prior to PIT tagging and allow for ample imprinting time to Tucannon River water to minimize straying of adults. The potential shift to future releases lower in the river, or from barging, could have unforeseen consequences (survival, adult trapping, and spawning distributions) that are not fully understood at this time, hence the study. Barging salmonids has been shown to affect homing abilities (Keefer and Caudill 2014). Management actions to account for some of these (hauling returning adults upstream, additional trapping locations for broodstock collection/hauling, etc.) may have to be implemented in the future.

For the 2022 release, due to the limited hatchery production available, we partially implemented this study by releasing fish at TFH and at the mouth of the Tucannon River. Both groups were over-wintered at TFH as described above, and each group received 20,000 PIT tags for evaluation. Based on DART PIT tag survival estimates to downstream locations from the 2002 release, the release at the mouth appears to have performed better (Figure 5). However, the real determination will be with overall adult returns and their return spatial distribution within the Tucannon River. Releases in 2023 and 2024 will incorporate all three release groups.

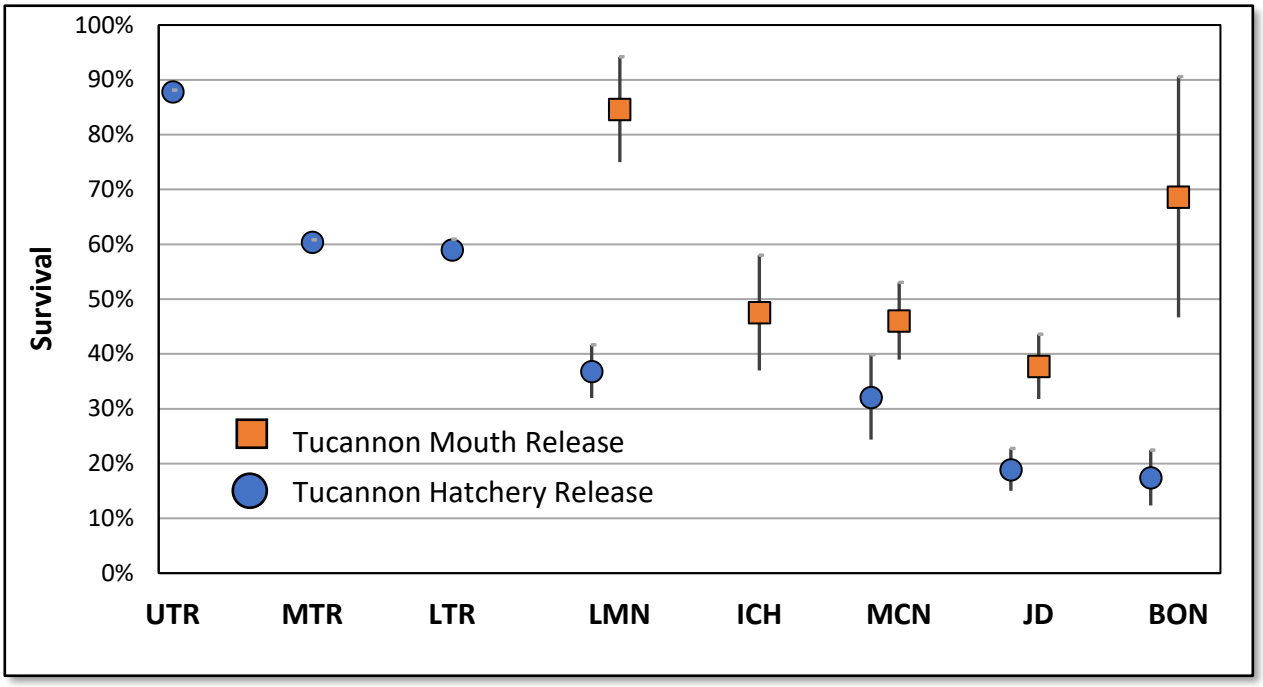

Figure 5. Juvenile survival estimates (using DART) to downstream locations from the 2022 release of hatchery origin Tucannon River spring Chinook. Detection sites are: UTR – Upper Tucannon River, MTR – Middle Tucannon River, LTR – Lower Tucannon River, LMN – Lower Monumental Dam, ICH – Ice Harbor Dam, MCN – McNary Dam, JD – John Day Dam, BON – Bonneville Dam.

3. GOALS AND OBJECTIVES

As discussed in Section 1, hatchery supplementation has been a common tool used to mitigate for salmonid losses due to alterations of their natural habitat. Concerns regarding hatchery effects on natural populations were briefly highlighted earlier. However, due to recent low returns of Tucannon spring Chinook, the managers believe more aggressive hatchery intervention is required to maintain this ESA listed population. See Quantitative Biological and Quantitative Implementation Objectives (Actions and Monitoring Actions) for Goal 1 in Table 1, respectively.

Goal 1: Implement acclimation/smolt releases of 50,000 Tucannon River origin spring Chinook from Kalama Fall Fish Hatchery in the Lower Columbia River to return 500 adults annually. Collect and transport returning adults back to Lyons Ferry for broodstock or adult outplanting in the Tucannon River to assist in the recovery/rebuilding of NOR spring Chinook in the Tucannon River.

Table 1. Quantitative Biological and Implementation Objectives by project goal.

#	Quantitative Biological Objectives	Quantitative Implementation Objectives (Actions)	Quantitative Implementation Objectives (Monitoring Actions)

Goal 1	Return 500 hatchery spring Chinook annually from Tucannon stock smolt releases at KFFH. Return at least 750 Tucannon River natural origin spring Chinook annually (ICTRT Recovery Goal).	Mark (externally clip) ~50,000 Tucannon stock from the standard hatchery production (October). Transfer ~50,000 annually to KFFH in late October/early November. Release smolts from KFFH in late March/early April. Trap returning adults at KFFH adult fish ladder/trap. Sort by external marks and hold separately at KFFH. Transport all identified Tucannon stock back to LFH for holding during the summer. Supplement hatchery broodstock needs (if needed) and/or outplant in the upper Tucannon River for natural spawning.	Obtain estimated smolt release number from KFFH. Compile all hatchery records of spring Chinook returns (by mark) to KFFH. Estimate smolt-to-adult survival by release year. Compile records of all transported adults back to LFH, and their final disposition (spawned at LFH, died while holding, or outplanted). Obtain records from spawning ground surveys in the Kalama River basin, or other nearby basins, and any recoveries of Tucannon stock fish in those areas (WDFW Region 5 Staff). Estimate contribution of outplanted fish in the Tucannon River to natural spawning through redd surveys and carcass recoveries.

4. METHODS

Kalama Falls Fish Hatchery (KFFH) Release Program – This proposed strategy, will in theory, yield additional adults that wouldn't normally be obtained if they were released in the Tucannon River basin because of the mortality normally incurred to reach the lower Columbia River. As an example of why this strategy should work, refer to the preliminary results obtained from the 2022 Release Strategy Study initiated by WDFW (Section 2), showing that juvenile downstream survival appears to be higher as those that were released at Tucannon FH (37 miles upstream). The Tucannon FH is 425 miles upstream of the mouth of the Columbia, and fish have six dams to navigate through, while the KFFH is 82 miles from the mouth of the Columbia, with no dams to navigate. The basic monitoring for the program consists of documenting the number juveniles released from KFFH, returning adults trapped, and documenting 1) the number any returning adults that aren't trapped that remain in the Kalama River, 2) or other nearby river systems (Cowlitz River, Lewis River). Note: these last two items are routinely determined by sampling conducted by WDFW Region 5 monitoring staff in the Lower Columbia River and separate from the request included within this proposal.

Juvenile Release from KFFH: The managers will release ~50,000 juvenile Tucannon River spring Chinook from KFFH. Juveniles will be transported from LFH annually in late October/early November for ~5-6 months of acclimation on Kalama River water (to maximize imprinting time and minimize straying). All Tucannon spring Chinook salmon juveniles are currently 100% coded-wire tagged, but not adipose clipped. All Tucannon spring Chinook taken to KFFH fish will be 100% externally marked with a maxillary or ventral fin clip to distinguish them from Kalama River Chinook when they return as adults. No PIT tagging is being proposed.

Adult Trapping at Kalama Falls Fish Hatchery: Returning adults will be trapped at the KFFH adult fish ladder/trap. Collected fish will be sorted when trapped, with externally marked Tucannon stock held in a separate holding pond/raceway. On a weekly basis, or more frequently as needed, all Tucannon River stock spring Chinook captured at KFFH will be transferred back to LFH. Depending on the collection of fish at the Tucannon River adult trap annually, returning Tucannon stock fish from KFFH will be used to supplement broodstock needs, or used for outplanting in the Tucannon River to supplement natural spawning.

Overall performance of this strategy will be determined from the number of adults trapped at KFFH (by age class) per juvenile release each year. Adaptive management "trigger" points have been proposed (See attached DRAFT Proposed Action for NOAA Fisheries – Appendix A) and will act as a guide to alter or cease this program as needed.

5. PROJECT EVALUATION AND ADJUSTMENT PROCESS

Kalama

The management of the KFFH release will incorporate benchmarks/critical risk thresholds that will signal changes to the numbers of fish acclimated/released from KFFH. WDFW determined that an average of 650 returning adults to KFFH over three consecutive years would prompt a re-evaluation of the program, leading to a reduction of fish released from KFFH, thus reducing risk to lower Columbia River populations. Along with that benchmark, it was acknowledged that as a greater number of fish returning to the Kalama will also increase the numbers of fish failing to recruit to KFFH trap, or potentially stray into neighboring populations (Lewis, Cowlitz, etc..). Maintaining the number that fail to recruit to the KFFH trap at <100 fish is an objective of this program as well, with planned reductions to KFFH release numbers if the three-year average exceeds 100 fish. At <100, it was determined by WDFW staff their contribution would be of limited impact to the local Kalama River population. While these two benchmarks are based on three-year averages, WDFW Region 5 and Region 1 staff will coordinate annually on returns and take appropriate action sooner if warranted.

6. POTENTIAL CONFOUNDING FACTORS

The WDFW sees the greatest obstacle to the success of the current Tucannon River spring Chinook hatchery program, and efforts to conserve the natural population within the Tucannon River, has

been the low post-release performance of the hatchery fish, and that the natural population has been below replacement in most years (data to demonstrate both of these are provided in Section 2). Both of these have contributed to the overall lack of fish on the spawning grounds. Efforts to improve the low post-release performance of the hatchery fish has been on-going since program inception, with new release strategies currently underway to address this. Efforts to allow the naturally produced fish to improve their replacement rate to stable levels are also ongoing (Habitat Restoration activities in the Tucannon, continued improvements to hydro-system operations) but both require more time before changes can be fully realized. Additional adult fish produced from the proposed program would therefore help re-seed the system with available spawners, and ultimately return more naturally produced fish.

The potential impacts of global climate change are recognized at national and international levels (Beamish 1995). Likely changes in temperature, precipitation, wind patterns, ocean acidification, and sea level height have implications for survival of Snake River spring/summer Chinook salmon and steelhead in their freshwater, estuarine, and marine habitats (NOAA 2017a). Many of the Pacific Northwest regional climate models project changes in snowpack, stream flows, and stream temperatures, with subsequent increases in wildfire occurrence. The greatest risk to the program should climate change occur will directly affect the rearing and spawning habitats for spring Chinook in the Tucannon River. Warmer stream temperatures and reduced stream flows from reduced snowpack will decrease the area available for adult spring Chinook spawning and juvenile rearing, which could decrease survival of the population overall. Drought conditions may become more prevalent, and stream flow patterns will likely be altered to earlier in the spring months which would likely negatively affect spring Chinook egg/alevin/fry survival. Warmer temperatures during incubation may accelerate egg development and result in earlier emergence and dispersal, which could be either beneficial or detrimental. Warmer temperatures will increase metabolism, which may increase or decrease juvenile growth rates and survival, depending on the available food source. Smolt out-migration may be altered due to a modified timing of the spring freshet, which could create a mismatch with estuary and ocean conditions, predators, and predation.

Some of these climate changes could also have a direct effect on the hatcheries involved in production (infrastructure damage from wildfire, water temperature changes,). However, Lyons Ferry is a 100% well water facility and water temperatures remain relatively constant year-round (52-53 ^{o}F). It's unknown if the large underground aquifer that provides the main source of water LFH will be impacted by climate change (volume, or temperature). Therefore, impacts expected from climate change while the standard supplementation Tucannon spring Chinook fish are reared at LFH should therefore be minimal. Juvenile spring Chinook are final reared at TFH during the fall/winter/early spring. Water temperatures during this time are not expected to increase dramatically or affect the rearing of hatchery fish. At the TFH adult trap, there is more a risk to the facility from wildfire since it resides in a heavily wooded area. However, the adult trap area has been adequately cleared of trees/vegetation to reduce the risk of fire damage to operation buildings. The intake building and utility shed are covered with metal siding and roofs and the entire trap area is surround by a chain link fence, all of which should reduce the chance of major losses.

It's anticipated that these climate change effects will also apply to the Kalama River basin, though likely in different ways. However, since the proposed plan only involves the acclimation and release of smolts during the winter/early spring, the water quality at KFFH is not anticipated to be affected much by climate change. Returning adults are not anticipated to be severely impacted either, as run timing to the Kalama Basin will be in late March/early April, with the intent that all returning Tucannon origin hatchery fish will be capture and taken back to LFH for holding over the warmer summer months.

7. TIMELINE

To better illustrate the next coming years, a Gantt chart has been developed to demonstrate project implementation between FY2024-2026 for the Kalama River option (Table 7-1). Years past 2026 would be the same activities if everything else remained the same and the program was not altered in any fashion. Further, this table does not contain every aspect of monitoring that occurs on the Tucannon River spring Chinook program (other activities funded by LSRCP, e.g. adult trapping, smolt trapping).

Table 7-1. Gantt chart to illustrate when major activities are accomplished annually for the proposed Kalama River release program.

	TASK	Description	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
FY2024	Task 1	Externally mark Tucannon Stock)												
	Task 2	Transfer to, and Acclimate fish at KFFH												
	Task 3	Release smolts from KFFH												
	Task 4	Trap returning adults at KFFH												
	Task 5	Transport returning adults to LFH												
	Task 6	Spawn adults with Tucannon Brood												
	Task 7	Outplant Adults to Tucannon River												
	Task 8	Spawning Ground Surveys (Tucannon)												
FY2025	Task 1	Externally mark Tucannon Stock)												
	Task 2	Transfer to, and Acclimate fish at KFFH												
	Task 3	Release smolts from KFFH												
	Task 4	Trap returning jacks at KFFH												
	Task 5	Transport returning jacks to LFH												
	Task 6	Spawn adults with Tucannon Brood												
	Task 7	Outplant Adults to Tucannon River												
	Task 8	Spawning Ground Surveys (Tucannon)												
FY2026	Task 1	Externally mark Tucannon Stock)												
	Task 2	Transfer to, and Acclimate fish at KFFH												
	Task 3	Release smolts from KFFH												
	Task 4	Trap returning adults and jacks at KFFH												
	Task 5	Transport returning adults and jacks to LFH												
	Task 6	Spawn adults with Tucannon Brood												
	Task 7	Outplant adults and jacks to Tucannon River												
	Task 8	Spawning Ground Surveys (Tucannon)												

8. RELATIONSHIPS TO OTHER PROJECTS

The current hatchery conservation program is funded by the LSRCP (USACE 1975). Proposed actions stated within would still contribute to the overall LSRCP adult spring Chinook goals for Washington, satisfy WDFW conservation goals and priorities for ESA listed salmon populations, and contribute to fisheries (Tribal and non-tribal) in the Columbia River Basin (US v Oregon Management Agreement (2018)). The LSRCP currently funds all Tucannon spring Chinook hatchery production (trapping, spawning, and rearing, and all associated costs with those (staff time, feed, water pumping costs, tagging, transportation, etc...), and nearly all aspects of the monitoring and evaluation. BPA Project 2010-050-00 does provide 7,500 PIT tags annually (in addition to 7,500 tags provided by LSRCP) that are inserted into the hatchery spring Chinook production to 1) provide information on juvenile out-migration, 2) provide in-season estimates of return, and 3) documentation of overshoot past the Tucannon River mouth to areas upstream (e.g. Lower Granite Dam) – Gallinat et al 2021. Requests within this proposal would secure the additional funding needed to either 1) implement/operate a full captive broodstock program at LFH for this threatened population, or 2) provide additional funding for activities associated with taking a portion of the annual juvenile production to KFFH in the lower Columbia River.

In addition to the LSRCP mitigation program, or PIT tags provided by BPA project 2010-050-00, there is linkage to other non-hatchery programs on the Tucannon River. Beginning in the mid-1990s, habitat restoration efforts within the Tucannon River were initiated to address factors limiting salmonid productivity (BPA# 1994-018-06: Tucannon Stream and Riparian Restoration). Following up on that project, there has been the completion of the Tucannon Model Watershed Plan (1997), the Tucannon River Limiting Factors Analysis (Kuttle 2002), the NPCC Tucannon Sub-basin Plan (2004), and the Salmon Recovery Plan for Southeast Washington (2005, updated in 2011), all directed at ways to improve salmonid habitat and ultimately survival and productivity in the Tucannon River. Fish and Wildlife Program projects that followed the development of the Salmon Recovery Plan for Southeast Washington (2005, updated in 2011) are: BPA# 2007-125-00 - Restore Tucannon River Watershed – Nez Perce Tribe, BPA# 2008-202-00 - Protect and Restore Tucannon Watershed (Confederated Tribes of the Umatilla Indian Reservation), and BPA# 2010-077-00 - Tucannon Habitat Programmatic Habitat Project. Since 2011, these projects combined, and in conjunction with State of Washington Salmon Recovery Funding have completed multiple large scale restoration projects leading to a more complex and diverse river habitat. Local WDFW fish monitoring staff coordinate frequently with habitat biologists from all agencies, review habitat restoration projects, and have provided information on salmonid rearing and distributions within the basin that have helped guide and prioritize the restoration efforts (Tucannon Basin Habitat Restoration Geomorphic Assessment & Restoration Prioritization (Anchor QEA 2021)). While frequently asked, determining a direct, improved fish response, from these habitat restoration activities is challenging and not possible in most cases given the current scope of funding directed at the collection of biological data from salmonids within the Tucannon River basin.

9. RESPONSE TO PAST COUNCIL RECOMMENDATIONS AND ISRP REVIEWS

The proposed plan to take a portion of the Tucannon River spring Chinook hatchery production to KFFH, release them, and transport back returning adults is a new program (if implemented) and has not been previously reviewed by the ISRP.

10. REFERENCES

Provide a list of only the references and technical documents *cited in the proposal*, including sufficient information to allow reviewers to retrieve the documents (e.g. URLs or weblinks).

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11. KEY PERSONNEL

Michael Gallinat (WDFW) Fish and Wildlife Biologist 3 – 22 years' experience with WDFW; Fisheries Management Program Director - 12 years' experience with Red Cliff Band of Lake Superior Chippewa; Bachelor of Science (Fisheries and Wildlife Management) Lake Superior State University, 1985; Master of Science (Fisheries) Ball State University, 1987.
Project Time/Year (Intermittent – 3 months)

Michael is the project lead biologist. His primary role is to plan, direct, manage, conduct, and communicate research, monitoring, and evaluation activities on the effectiveness of spring Chinook Salmon hatchery mitigation in SE Washington. He independently develops and implements research studies focused on key scientific uncertainties associated with hatchery mitigation on spring Chinook for the LSRCP program.

Relevant Publications

Gallinat, M. P., J. R. Bence, L. S. Miller, and L. A. Ross. 2022. Determining optimum size at release for hatchery-origin Tucannon River spring Chinook Salmon Using PIT Tags. North American Journal of Aquaculture https://doi.org/10.1002/naaq.10269

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Joseph Bumgarner (WDFW) Fish and Wildlife Biologist 4 – 30 years' experience
Bachelor of Science (Fisheries), Master of Science (Fisheries) University of Washington, 1987, 1993
Joe is the current LSRCP Monitoring and Evaluations Project Leader for the Washington programs.

Ace Trump (WDFW) Lyons Ferry/Tucannon Operations Manager – 30+ years' experience within WDFW at multiple hatchery facilities.

Other Staff – Seasonal or other Permanent WDFW staff will be used primarily during spawning or tagging activities, fish health sampling, fish transport, and data summaries/reporting.

12. APPENDICES

Appendix A: Proposed Action to NOAA Fisheries – Release of Tucannon spring Chinook Salmon at Kalama Falls Fish Hatchery in the lower Columbia River (Working DRAFT – 11/5/2022)

Proposed Action: Alternative Release Strategy (Lower Columbia River release at Kalama Falls Fish Hatchery) for Tucannon Spring Chinook Hatchery Salmon

Working Draft (11/5/2022)

1. INTRODUCTION

The underlying activity that drives this Proposed Action is the operation and maintenance of a single hatchery program (Tucannon Spring Chinook), and a rearing/release alternative proposed within (a Kalama River release). Due to the very low abundance of the Tucannon spring Chinook population, this extreme action is being proposed. While the Tucannon spring Chinook program has been reviewed and approved by NOAA fisheries through submittal of an HGMP, the Biological Opinion for NEOR/SEWA hatchery programs, and have received a Section 10 Permit (#18024), none of these documents cover this Proposed Action, and therefore requires additional consultation by NOAA Fisheries.

The Tucannon River spring Chinook salmon (*Onchohynches tshawytscha*) population was originally listed as "endangered" under the Endangered Species Act (ESA) on April 22, 1992 (FR 57 No. 78: 14653). The listing status was changed to "threatened" in 1995 (April 17, 1995; FR 60 No. 73: 19342). The listing was reviewed again in 1999 (FR 64 (57): 14517-14528) with the population remaining listed as "threatened" as part of the Snake River Spring/Summer Chinook Salmon evolutionary significant unit (ESU). Snake River Fall Chinook and summer steelhead (*Onchorhychus mykiss*) in the Tucannon River were ESA listed in 1993 and 1997, respectively. The Tucannon spring Chinook hatchery program is operated by the Washington Dept. of Fish and Wildlife (WDFW) with funding provided by the USFWS through the Lower Snake River Compensation Plan (LSRCP). Co-managers of the Tucannon spring Chinook hatchery program include the Nez Perce Tribe and the Confederated Tribes of the Umatilla Indian Reservation. This program has been described in detail in a Hatchery and Genetic Management Plan (HGMP), the SEWA/NEOR Biological Opinion, and Section 10 Permit #18024.

This Proposed Action incorporates actions and activities related to hatchery production of Tucannon River spring Chinook salmon and the associated analysis will evaluate the effects from this hatchery program on ESA-listed species in the Kalama River basin, and other lower Columbia River basins if needed. In the Kalama River, ESA listed salmonids include: steelhead (winter and summer run) which were listed as "threatened" in 1998; Lower Columbia River Chinook (spring and fall run) were listed as "threatened" in 1999; Lower Columbia River coho (*Oncorhynchus kisutch*) were listed in 2005; and Columbia River chum (*Oncorhynchus keta*) were listed in 1999. Kalama River eulachon (*Thaleichthys pacificus*) were also ESA listed in 2010 under the Southern DPS for that species.

Background: The Spring Chinook Salmon population returning to Tucannon River has declined significantly during the last several years. In 2019 and 2020 only 203 and 81 total fish returned, respectively. Based on previous performance of hatchery and natural origin spring Chinook in the Tucannon River, management decisions led to all fish captured at the Tucannon Fish Hatchery (TFH) adult trap to be collected as hatchery broodstock, resulting with only 11 and 14 redds documented in the river in 2019 and 2020. Additionally, a 30-year flood in 2020 essentially eliminated all natural production from the 2019 spawn year while the hatchery cohort struggled with BKD throughout the rearing cycle, which led to poor downstream migrant performance post-release. In 2021, more fish returned (215 total estimate), but (89 fish) 41% of the return was determined to be strays, with coded-wire tag recoveries suggesting that the strays originated from the Umatilla River spring Chinook program. Additionally, post-release emigration success to Lower Monumental Dam has been poorer than desired (~40-50% mortality on average) based upon PIT tag observations, the source of these losses is unknown.

With low natural and hatchery production in the Tucannon River, the Proposed Action described here for releasing a portion of the Tucannon River spring Chinook at a lower Columbia River hatchery and collecting and transporting the returning adults to LFH for spawning provides a level of certainty that a) it can be accomplished as described and b) will provide the increased number of adult broodstock necessary to enable the development of other alternatives that ultimately decrease the reliance on a lower Columbia River hatchery release of this out-of-basin population in the future, and c) it does not negatively impact the Tucannon River spring Chinook population in the Snake Basin or listed species in the Kalama River, or other lower Columbia River basins.

Multiple hatchery sites (above and below Bonneville Dam), but all outside the Snake River Spring/Summer Chinook ESU were originally considered for this strategy, of which WDFW operates two (Kalama Falls and Washougal). Washougal Hatchery was another top choice for this program and may have posed fewer risks associated with introgression with other 'at-risk' Chinook Salmon populations in the lower Columbia River. However, Kalama Falls Fish Hatchery (KFFH) was ultimately selected by WDFW as the superior alternative due to infrastructure and hatchery operation limitations at Washougal Hatchery that interfered with the collection of returning adults at Washougal Hatchery. Finally, there are data illustrating that a

Kalama River releases strategy has worked in providing an increased number of broodstock as alternative strategies are developed. During the 1980s the Snake River Fall Chinook egg bank program released cohorts of juvenile fall Chinook Salmon from KFFH while Lyons Ferry Hatchery was being constructed. In this instance the Kalama River release was responsible for contributing 25-62% of the egg take for Lyons Ferry production (Bugert and Hopley 1989), and contributed to the preservation of the Snake River fall Chinook salmon run.

This Proposed Action will be operating in concert with the development of a suite of alternatives designed to enhance overall returns of broodstock and fish remaining in the river for natural spawning of the Tucannon spring Chinook population. We (WDFW and the co-managers) have informed NOAA Fisheries of these plans (email and Proposed Release Strategy Document [Attachment 2] was sent to Brett Farman (NOAA Fisheries) on 8/19/2020) describing approaches to mitigate documented juvenile mortality from release to Lower Monumental Dam. The efficacy of these alternatives (barging and/or releases at the mouth of the Tucannon River) is uncertain and straying and failure to recruit adults to the Tucannon River or the adult trap are among the possibilities that need to be ruled out during ongoing evaluations before full implementation would occur. The current numbers of broodstock and the low numbers of progeny produced limit the number of treatment groups to be deployed. In addition to modifications to the release strategy, a captive brood program for this population is being considered. However, the implementation of a captive brood program exceeds current funding levels and had not been resolved at this time. Regardless, WDFW will take the initial steps to separate some family units from the 2022 brood year to initiate a captive broodstock program if funding can be secured in the next year. A captive broodstock program for Tucannon spring Chinook was previously implemented from 1997-2009 (Gallinat 2009). Poor survival of the progeny from the captive brood compared to the standard supplementation program was observed (Gallinat et al, 2022). We intend to build upon recent developments for maintaining captive brood, but prior observations create uncertainty surrounding the ability of captive brood to increase adult numbers for broodstock and natural spawning to levels necessary to sustain this population. Thus, this Proposed Action (release of smolts from KFFH) will operate with the development of other practices to produce the necessary number of adults to meet hatchery program goals (250,000 smolts) and return adults to the Tucannon River for natural spawning. Finally, a re-introduction of spring Chinook Salmon into Asotin Creek has been identified in the Snake River Spring/Summer Chinook Recovery Plan. If numbers of returning adults are in excess of the number required for the Tucannon River, then smolts or adult outplants would be considered for Asotin Creek. However, given all the uncertainties in adult returns from this Proposed Action, or other actions being considered, a program in Asotin Creek is likely more than 10 years away.

Proposed Federal Action

For consultation, "Federal action" means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal Agency (50 CFR 600.910). "Action," as applied under the ESA, means all activities, of any kind, authorized, funded, or carried out, in whole or in part, by Federal agencies. While it's still uncertain at this time, monetary support for this Proposed Action could come from two Federal agencies.

For this Proposed Action, there is one action agency involved:

- **U.S. Fish and Wildlife Service:** The funding of the operation and maintenance and monitoring and evaluation of the Tucannon spring Chinook program through the LSRCP from the Bonneville Power Administration, which was approved by the Water Resources Development Act of 1976, (Public Law 94-587, Section 102, 94th Congress) to offset losses of anadromous fish in the Snake River Basin caused by the four dam and navigation lock projects in the Lower Snake River. This program has previously been described in the ESA documents (HGMP, NEOR/SEWA Biological Opinion, Section 10

Permit #18024) identified above.

- **Bonneville Power Administration (BPA)**: Provides pass through funding to the U.S. Fish and Wildlife Service for administration of the Lower Snake River Compensation Program. BPA would not be the action agency responsible for this proposed action but is linked through this process due to funding origin and for effects from the development and operation of the Federal Columbia River Power System (FCRPS) on fish and wildlife in the mainstem Columbia River and its tributaries under the Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Northwest Power Act) (16 USC section 839n(h)(10)(A)).

Some actions outlined within will be funded by the USFWS via the LSRCP program and other actions would be considered for Bonneville Power Administration funding. These funded actions would be allocated by the USFWS-LSRCP and BPA and existing funding opportunities that either BPA or USFWS-LSRCP have related to the purposes of their programs.

NOAA Fisheries describes a hatchery program as a group of fish that have a separate purpose and that may have independent spawning, rearing, marking, and release strategies (NMFS 2008). The operation and management of every hatchery program is unique in time, and specific to an identifiable stock and its native habitat (Flagg et al. 2004). NMFS defines integrated hatchery programs as those that are reproductively connected or "integrated" with a natural population, promote natural selection over selection in the hatchery, contain genetic resources that represent the ecological and genetic diversity of a species, and are included in a salmon ESU or steelhead DPS. When a hatchery program actively maintains distinctions or promotes differentiation between hatchery fish and fish from a native population, then NMFS refers to the program as "segregated" (also referred to as "isolated"). In general, isolated programs may promote domestication or selection in the hatchery over selection in the wild and culture a stock of fish with phenotypes (e.g., different ocean migrations and spatial and temporal spawning distribution) different from the natural population. The Tucannon spring Chinook program is an integrated hatchery program and has been since its inception in 1985.

One objective of this document is to document the determination of likely effects on ESA-listed salmon and their designated critical habitat resulting from LSRCP/BPA funding of this proposed action. This document demonstrates that the actions proposed by the operators comply with the provisions of Section 7(a)(2) of the ESA. The duration of this Proposed Action will contain the adult returns from five successive release groups from KFFH. After which the efficacy of the Proposed Action would be determined, and the continuation of the program would be reconsidered at this time through consultation with NOAA Fisheries. Factors considered would include meeting targets of adult returns and an absence of evidence of introgression determined by on-going M&E activities in the Kalama River. Additionally, managers have identified adult return targets and upper thresholds from the Proposed Action which would lead WDFW to scale back/eliminate efforts in the Kalama River. For example, a maximum number of 650 fish collected from KFFH collected annually for three consecutive years would prompt the reduction in the size of the KFFH release group. More information on the management of each program follows in the description below.

1.1.1. Proposed hatchery broodstock collection

The Tucannon spring Chinook program is located in the Snake River basin (Figure 1) Broodstock have been collected annually at the TFH adult trap since 1985. Currently, up to 170 adults can be collected annually at the trap (Table 1). The Proposed Action, will in theory, yield additional broodstock that would be collected at KFFH (Figure 2) as the Tucannon River origin spring Chinook (uniquely marked to differentiate them from Kalama River spring Chinook) start returning there. All Tucannon River stock spring Chinook captured at KFFH would be retained and transferred back to Lyons Ferry Hatchery (LFH). Collection of fish for

broodstock at either facility (Tucannon FH, or KFFH) will be managed as one stock, with fish in excess of normal Tucannon River spring Chinook Salmon broodstock needs to be used for outplanting in the Tucannon River to supplement natural spawning. Mating protocols for adults collected from KFFH and transported back to LFH will incorporate a strategy to limit the number of pairings with both parents derived from KFFH returns without sacrificing the needs of the program.

Table 1. Broodstock collection plans for the Tucannon Spring Chinook hatchery program.

Program	Origin	Collection Location	Collection Method	Collection Number	Collection Duration	pNOB
Tucannon Spring Chinook	Tucannon River Stock	TFH	Fish Ladder and Trap	170	Late-April to Early-September	Per Tucannon Sliding Scale
Tucannon Spring Chinook	Tucannon River Stock	KFFH	Fish Ladder and Trap	Unlimited (Tucannon Stock Uniquely Marked)	April-August	0

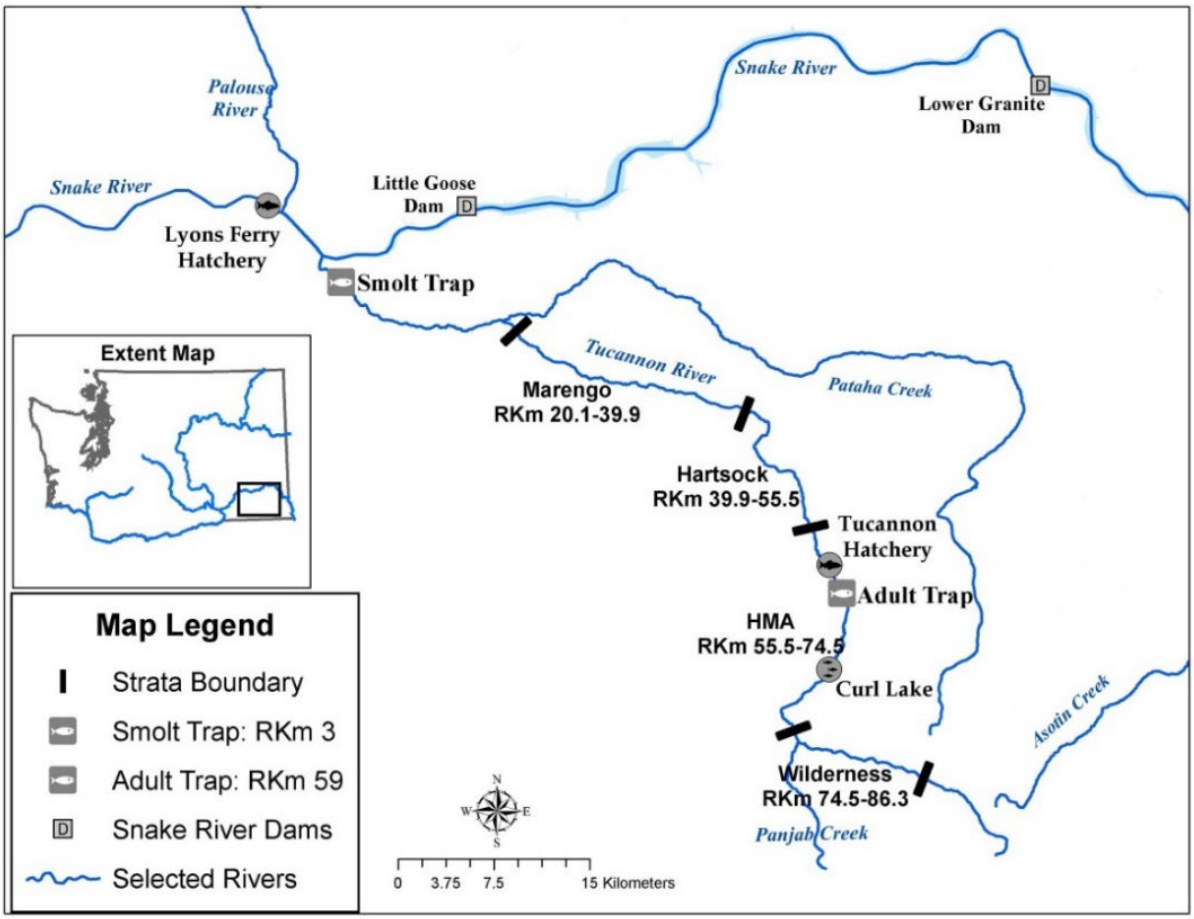

Figure 1. Location of spring Chinook salmon facilities used in the Proposed Action – Tucannon River basin (courtesy of WDFW).

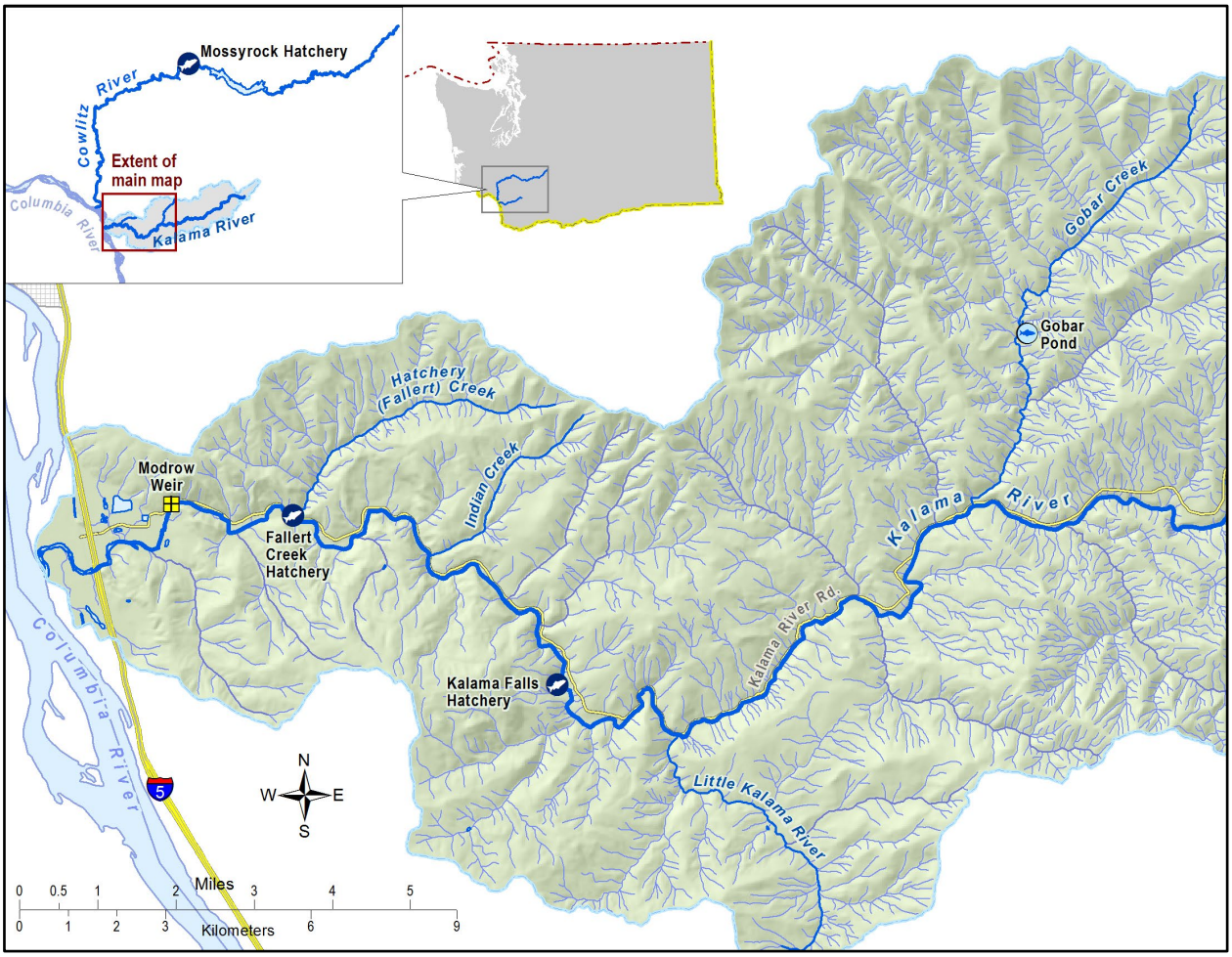

Figure 2. Location of spring Chinook salmon facilities used in the Proposed Action – Kalama River basin (courtesy of WDFW).

Weirs/Trapping Locations

Tucannon Fish Hatchery (TFH)

Trapping of adult spring Chinook salmon for broodstock occurs at the TFH fish ladder/adult trap at river kilometer (RKM) 59.0 of the Tucannon River (Figure 1). Fish collected at the trap for broodstock are transported to LFH for holding, spawning, incubation, and rearing through the pre-smolt stage (typically October/November each year). Since 2016, all returning fish captured at the TFH weir have been held at LFH, with fish not needed for broodstock outplanted in late summer for natural spawning when possible. High pre-spawning mortality documented by WDFW (beginning around 2012) prompted this initial action, and low numbers of adult returns in recent years, has impeded the ability to evaluate if high pre-spawn mortality is still an issue. Given the unknowns surrounding pre-spawn mortality issue from the past, and whether it might still occur, WDFW developed a sliding scale based on returns the TFH trap that would allow fish to be passed upstream immediately after capture, with the ability to do the appropriate evaluations to determine if there is still a pre-spawn mortality issue. The TFH adult trap operates from February through September for summer steelhead and spring Chinook salmon broodstock collections

annually. The trap is operated 24 hours, 7 days a week for the entire trapping period. See Tucannon spring Chinook HGMP (Section 10 Permit #18024) and Tucannon summer steelhead HGMP (Section 10 Permit #18025) for more details of trap operations.

Kalama Fall Fish Hatchery (KFFH)

Trapping of adult spring Chinook salmon for broodstock occurs at the KFFH fish ladder/adult trap at RKM 16.1. Tucannon stock spring Chinook (uniquely marked) will be collected at the KFFH trap, held for a short period (a few days) at KFFH and then transported back to the LFH for holding until they are spawned, or used for adult outplanting in the Tucannon River. If total adult returns were to exceed a maximum considered necessary for hatchery broodstock and reflective of carrying capacity limit for the Tucannon River, (N = 1,200 adults) an option includes outplanting in Asotin Creek. Current numbers of progeny available make this latter option extremely unlikely and it has yet to be agreed upon by the co-managers. Adult outplanting in the Tucannon River would most likely occur in areas above the TFH weir given cooler water temperatures and perceived better habitat. If any adult outplants occurred in Asotin Creek, they would likely be targeted for the North Fork Asotin Creek. Disposition of adults brought back from KFFH to LFH are described in Section 1.1.3. The KFFH adult trap operates from 365 days/year, 24 hours, 7 days a week. Fish volitionally enter the trap via a step and pool ladder at KFFH. Adults are transferred from the trap via overhead brail into a 1,500 gallon tanker truck and moved to the sorting pond. See KFFH species specific hatchery program HGMPs for further details of trap operations.

1.1.2. Hatchery Rearing and Juvenile Release Locations

Lyons Ferry Fish Hatchery (LFH)

Progeny of Tucannon spring Chinook will be incubated and reared at LFH in standard sized raceways. Rearing at LFH occurs from incubation in August/September and continues until the following fall (late October/early November) when they are transferred to TFH for overwinter acclimation and imprinting on Tucannon River water. During rearing at LFH, and at any of the possible acclimation facilities (Curl Lake, TFH, or KFFH), regular fish health inspections are conducted. If disease agents are suspected or identified, more frequent inspections will be conducted. Recommendations for treating specific disease agents comes from the WDFW Fish Health Division. Prior to transfer of pre-smolts to KFFH, a fish health inspection will be conducted. All fish production is conducted according to Pacific Northwest Fish Health Protection Committee (PNFHPC), and Integrated Hatchery Operations Team (IHOT) policies and guidelines.

Tucannon Fish Hatchery (TFH)

The managers will release juvenile Tucannon River spring Chinook Salmon consistent with the numbers, stages, release locations, and markings described in Table 2. Juvenile release levels from the Tucannon River as shown in Table 2, and as mentioned in the background, are dependent on obtaining adequate returns for broodstock, adequate facility rearing space at all facilities, adequate smolt production levels, co-manager agreement on which releases will occur, and funding. WDFW will keep NOAA Fisheries informed on a yearly basis on the numbers of fish release from all release strategies.

Kalama Fall Fish Hatchery (KFFH)

The managers will release juvenile Tucannon River spring Chinook salmon from KFFH as described in Table 2. Annual juvenile release levels at KFFH will likely vary annually and will be dependent on obtaining adequate returns of broodstock, adequate facility rearing space at KFFH, and funding of this portion of the program. Juvenile Tucannon River spring Chinook will be released as smolts directly into the Kalama River from KFFH. Juveniles will be transported from LFH annually in late October/early November for an approximate 5-6 months of acclimation on Kalama River water (to maximize imprinting time and minimize straying). All Tucannon spring Chinook salmon juveniles are currently 100% coded-wire tagged, but not adipose clipped. All Tucannon spring Chinook taken to KFFH fish will be 100% uniquely marked with a

maxillary clip to distinguish them from Kalama River Chinook Salmon when they return as adults. The selection of this mark is based on its clear visibility on a returning adult as these fish need to be quickly identified during sorting and during ongoing monitoring of the proposed action in the form of spawning ground surveys. Alternatives that included ventral fin clips and multiple body locations for coded wire tags were discussed among WDFW fish managers. Each of the alternatives to the maxillary clip was considered less desirable due to the perceived difficulty in identifying fish during collection at the trap or efficiency in identification of these fish in ongoing spawning ground surveys. While widely applied successfully, the use of maxillary clip, along with any other external mark is frequently cited as a bias when interpretating of results on adult returns (Schroeder et al. 2001) but short-term impacts to survival appear low in some salmonids (Wellenkamp et al. 2018) while data on any long-term impacts of the maxillary clips are sparse. While commercial aquaculture is not a proxy for natural rearing, no reduction in growth rate or survival was observed in maxillary clipped Rainbow Trout held for 18 months in net pens (Gjerde and Refstie 1988).

Table 2. Proposed annual release protocols from the Tucannon program and from the Proposed Action of releasing fish from Kalama Falls. AD=adipose fin clip; CWT = coded-wire tag; PIT = passive integrated transponder tag. LFH=Lyons Ferry Fish Hatchery; TFH=Tucannon Fish Hatchery; KFFH=Kalama Falls Fish Hatchery. The total number of smolts available impact the totals released at all locations and the number of different locations of release from the TFH program.

Program	Life Stage, Size and Number	Marking and Tagging[1]	Rearing Location	Acclimation Site; Duration	Release Location	Release Time
TFH	Up to 225,000; 12 fpp	No AD; 100% CWT; 15,000 PIT tags	LFH/TFH	Reared at TFH 5-6 months on Tucannon R. water	TFH	Early to Mid-April
					Tucannon River Mouth	Mid-April
					Below Bonneville (from barge)	Mid-April
KFFH	Up to 100,000; 15 fpp	No AD; 100% CWT; 100% Maxillary Clip	LFH/KFFH	KFFH; 5-6 months	KFFH	Late March/Early April

[1] All marking (CWT and PIT tagging levels) may change based on budgets, evaluations needed, and cooperator agreement into the future. Changes for *US v OR* production will be approved through the process established in that forum, which includes coordination with NOAA Fisheries as a party to the agreement.

1.1.3. Disposition of excess juvenile and adult hatchery fish

Excess juveniles (smolts) are not anticipated from this Proposed Action. Should they occur, options for the disposition of excess juveniles are described in the Tucannon River Spring Chinook HGMP. However, the Proposed Action (releasing of smolt from KFFH) is intended to produce more adults for the Tucannon River than the current program has been providing. Collection of adults from KFFH will be in addition to the adults that return TFH, and could be used to fulfill different program needs. Disposition of excess adults from KFFH would be used in the following order of options per co-manager agreement:

- Backfill broodstock shortages to meet the existing smolt program goals for release (225,000 smolts).
- Outplanting into the upper Tucannon River to supplement natural production.
- If the first two bullet points are fulfilled, adults resultant from this Proposed Action in combination with other ongoing actions (see background) could be used as adult outplants, or as hatchery broodstock to initiate a juvenile release program, in Asotin Creek. At present, this is not considered

likely and co-manager agreement for such an action has yet to be reached. However, this potential future action (a reintroduction) has been identified in the Snake River Spring/Summer Chinook Recovery Plan (NMFS 2017).

- Provided to NPT or CTUIR for subsistence and ceremonial use.

1.1.4. Proposed research, monitoring, and evaluation (RM&E)

Research, monitoring and evaluations for the Tucannon spring Chinook program has been provided in the HGMP. Alternative release strategies from the Tucannon Program that have been listed here in addition to the Proposed Action (direct release at the Tucannon River mouth and/or a barge release) are not currently listed in the HGMP, but have been communicated with NOAA Fisheries (email to Brett Farman on 8/18/2020, with Attachment 2) and were determined to have no additional effect. WDFW has initiated one of these strategies in the spring 2022 releases (release at the mouth of the Tucannon River). In the Kalama River, no additional RM&E activities are planned to evaluate this Proposed Action. However, because natural-origin spring and fall Chinook, and steelhead exist in the Kalama River, the hatchery fish within this Proposed Action has the potential to add additional risk to these populations and therefore need to be considered. Genetic samples are collected from all Tucannon Origin spawned adults for the hatchery program for PBT analysis for Snake River basin spring/summer Chinook populations and serve as a baseline for this population. Long term fitness of salmon populations is assumed to be related to maintaining the genetic integrity of populations that Tucannon spring Chinook Salmon have the potential to interact with Kalama River spring and fall Chinook returns. Estimates of any Tucannon spring Chinook Salmon remaining on the spawning grounds will be compared to the projections generated in our risk assessment; the presence of the readily identifiable maxillary clip will aide in this effort. Additionally, tissue samples will also be collected from all salmon carcasses recovered from spawning ground surveys that will aide in the determination of changes in allelic frequency from an established baseline resultant from this Proposed Action.

Additional adverse effects to spring and fall Chinook salmon and steelhead in the Kalama River basin resulting from the monitoring and evaluation activities (Table 3) as a result of this Proposed Action at KFFH or TFH/LFH are unlikely to occur. All of the proposed RM&E actions in each basin/facility have previously been addressed in Biological Opinions from NOAA Fisheries for these programs in the past.

Table 3. Ongoing RM&E for the Tucannon spring Chinook program at TFH/LFH or KFFH. Incidental takes for steelhead and spring or fall Chinook salmon are identified per activity below.

Activity	Associated Program
Captured adults at KFFF are measured and examined for gender, various clips, tags, and marks, then designated as broodstock fish or for natural release.	KFFH
Captured adults at TFH are measured and examined for gender, various clips, tags, and marks, then designated as broodstock fish or for natural release.	TFH/LFH
Redd counts (spawning ground surveys) and carcass surveys are conducted to estimate number of redds and composition of spawners.	KFFH, Kalama River Redd Surveys
Redd counts (spawning ground surveys) and carcass surveys are conducted to estimate number of redds and composition of spawners.	TFH/LFH, Tucannon River Redd Surveys

Monitoring of survival metrics for all life stages in the hatchery from spawning to release.	TFH and KFFH
PIT tagging representative groups of juvenile Chinook salmon to estimate migration timing, outmigration survival rate, and adult returns. Adult PIT detections in the mainstem Columbia River and Lower Snake River dams will be used to inform the release strategies (TFH release, mouth release, barge release).	TFH/LFH
Genetic samples are collected from all Tucannon Origin spawned adults for the hatchery program to be included in the PBT baseline for the Snake River basin spring/summer Chinook populations. Tissue samples are also collected for genetic monitoring from carcasses recovered from spawning ground surveys (Tucannon River and Kalama River).	TFH/LFH, Tucannon River, Kalama River

1.1.5. Proposed action, implementation and consideration of risk and benefit

Spawning and the production of juvenile fish for the Tucannon spring Chinook program will continue to occur at LFH and TFH into the future. Following standard marking and tagging, a separate group of fish marked with a maxillary clip (number to be transferred will be dependent on available rearing space at KFFH determined annually) and transported to the KFFH facility. Production goals for the Tucannon program total 225,000 smolts. The size of the KFFH release group will be capped at no greater than 50% of this total, or up to 100,000 total smolts, whichever is less. Due to low abundance of expected adults returning to the Tucannon trap in the next few years, and the current available rearing space at KFFH, the number of smolts released at KFFH will initially fall in the range of ~30,000-50,000 smolts annually. The maximum number of smolts (100,000) is contingent upon broodstock numbers, available space at KFFH, available funding, and the ongoing assessments of risk (straying to other Lower Columbia River populations, and the critical threshold of Tucannon origin spawners left in the Kalama River – see below under Adaptive Management) to lower Columbia populations of Chinook salmon.

Characterization of risks and benefits associated with the KFFH release group: Scenarios characterizing the risks and benefits of a lower Columbia River acclimation/adult trap site were developed based on estimates of Smolt-to-Adult Returns (SARs), anticipated straying based CWT analysis from past Kalama River spring Chinook Salmon releases, and capture efficiency of the KFFH trap (Table 5).

Table 4. Parameters used to characterize risks and benefits of the KFFH release location in deterministic approaches to pessimistic (P), moderate (M), and optimistic (O) expectations for SAR, age at return, stray rates, and failure to recruit to the KFFH adult trap.

Parameter	Percent
SAR	0.2% (P), 0.5% (M), 1.0% (O)
Return as Age 3 (Percent of Total Adults)	24.7
Return as Age 4 (Percent of Total Adults)	70.6
Return as Age 5 (Percent of Total Adults)	4.8
Straying Total (Outside of Kalama River Basin) [a]	6.2%
Straying Cowlitz	0.2%
Straying Lewis	5.6%
Straying Other	0.3%
Failure to recruit to KFFH trap (remain below)	12%

[a] Estimates of straying outside of the Kalama River basin were based on CWT recoveries from Kalama River Basin spring Chinook releases from 1989-2015 (pooled averages). Estimates are considered conservative because fish that were called "strays" included captures from fisheries, and

it's unknown if these fish might have returned to the Kalama River Basin. Removal of fishery recoveries reduces the average stray rate to about ½ of what's provided in the table.

Estimates are provided here for illustration purposes to reflect values that represent a 50,000 smolt release, and the largest number of smolts (100,000) that could potentially be released by KFFH in this Proposed Action. (Table 5). A SAR of 0.20% for current Tucannon spring Chinook Salmon program is derived from recent Tucannon River annual monitoring and evaluation reporting (Gallinat et al, 2021) and represents a baseline for contrast for any release alternatives describe herein. The KFFH estimates for SAR, straying, and adult trap capture efficiency were developed from available coded-wire tag information on returns, spawning ground surveys in the Kalama River, and other insights on the fisheries and infrastructure. The provided scenarios describing risk and benefits include pessimistic, moderate, and optimistic expectations surrounding SAR from fish released at KFFH. Prior modeling of CWT data from returning lower Columbia River spring Chinook Salmon provided a moderate and optimistic expectations for SAR at 0.5% and 1.0%, respectively. A pessimistic expectation was based on current Tucannon program SAR and reflective of no improvement to the status quo. Straying percentages were based upon CWT recoveries of release groups from KFFH or associated programs within the Kalama River (Fallert Creek Hatchery or Gobar Springs). Based on WDFW redd survey and carcass recovery data in the Kalama River, an expectation that 12% (on average) of the adult Tucannon origin spring Chinook salmon returning to the basin will not recruit to the KFFH adult trap and remain below the trap and attempt to spawn in the Kalama River. In addition, it's estimated that 1-2% (Thomas Buehrens – WDFW – Region 5 Research Scientist, Personal Communication) of the fish that do recruit to the KFFH trap might pass the falls and spawn in the upper Kalama River basin.

In each of the scenarios provided (Table 5) we compared the projected outcome to a status quo scenario that represents no difference from the existing release strategy in the Tucannon River (releases in the upper Tucannon River basin). The total number of fish anticipated to return was then parsed into the numbers of ages 3-5 returning adults based on percentages derived from historical data from the Tucannon spring Chinook salmon program. Estimates for the total number of fish recovered as broodstock and the number of fish imposing genetic risk for releases of 50,000 from KFFH (current maximum) and 100,000 (possible maximum) are provided (Table 5). Under moderate SAR expectations, the total number of adults collected at KFFH could be increased by 38-46% above the status quo.

Adaptive management: The management of the Proposed Action will incorporate benchmarks/critical risk thresholds that will signal changes to the numbers of fish acclimated at, and released, from KFFH. WDFW determined that an average of 650 returning adults (returns to KFFH only – Attachment 1) over three consecutive years would prompt a re-evaluation of the Tucannon spring Chinook population status, leading to a reduction of fish released from KFFH, thus reducing risk to lower Columbia River populations. Along with that benchmark, it was acknowledged that as numbers returning to KFFH increase so will the numbers of fish failing to recruit to KFFH trap, or potentially stray into neighboring populations (Lewis, Cowlitz, etc..). Maintaining the number that fail to recruit to the KFFH trap at <100 fish (Tucannon origin fish naturally spawning in the Kalama River above and below the trap) is the goal of this program, with planned reductions to KFFH release numbers if the three-year average exceeds 100. At this level (<100), their likely contribution above and below the KFFH are thought to be of limited impact to the local Kalama River population. Under moderate SAR expectations, if 100,000 are released from KFFH (Table 5), the total number of adults returning will be near the 650 fish benchmark while not exceeding the 100 fish critical risk threshold for pHOS in the lower Kalama River. Thus, on-going monitoring and evaluation efforts in the Tucannon and Kalama rivers will work simultaneously to inform decisions surrounding the size of the KFFH release group, as well as the duration of this Proposed Action.

As identified previously (see background), WDFW and the co-managers are taking additional actions with the Tucannon River spring Chinook hatchery program. Depending on these other action implementation timelines, and if successful, these actions would bring back additional adults to the Tucannon River that have not been taken into consideration of this Proposed Action adult returns at this time because of the unknowns. However, these additional returns from these actions should be considered as another "trigger point" to the managers for when this Proposed Action (Kalama River releases) should be scaled back or is no longer needed, regardless if the above "trigger point" (650 adults to Kalama) has been met or not.

Table 5. Modeled returns at Pessimistic (P), moderate (M) and Optimistic (O) SARs and expected benefit to the Tucannon River spring Chinook population based on varied smolt releases at the Tucannon or from Lower Columbia River acclimation at KFFH. Note: the below scenarios assume all releases will occur at TFH, as there is not survival/return data from Tucannon River mouth or barge releases.

	Current Brood Year 2021 Smolt Production (140,000)			Maximum Smolt Production for Tucannon Program (225,000)		
Total Adult Returns to KFFH (#Smolts * SAR)						
	Expectation at 50,000 Smolt Release at KFFH			Expectation at 100,000 Smolt Release at KFFH		
	P	M	O	P	M	O
Total Number of Returning Adults	100	250	500	200	500	1000
Age 3	25	62	124	49	124	247
Age 4	71	177	353	141	353	706
Age 5	5	12	24	10	24	48
Risks from Total Returns to KFFH						
	Expectation at 50,000 Smolt Release at KFFH			Expectation at 100,000 Smolt Release at KFFH		
	P	M	O	P	M	O
Failure to Recruit (pHOS) [3]	12 (2.5%)	30 (6%)	60 (12%)	24 (5%)	60 (12%)	120 (24%)
Total Strays	6	16	31	12	31	62
Other Basins [4]	0	1	2	1	2	3
Cowlitz	0 (0%)	1 (0.1%)	1 (0.1%)	0 (0%)	1 (0.1%)	2 (0.3%)
Lewis	6 (1%)	14 (2.5%)	28 (5%)	11 (2%)	28 (5%)	56 (10%)
Total Return to the Tucannon River						
	90,000 Smolt Release from TFH Average SAR (0.2%)			125,000 Smolt Release from TFH Average SAR (0.2%)		
Total Number of Returning Adults	180			250		
Age 3	44			62		
Age 4	127			177		
Age 5	9			12		
Total Number of Broodfish Produced						
	Expectation at 50,000 Smolt Release at KFFH [1]			Expectation at 100,000 Smolt Release at KFFH [2]		
	P	M	O	P	M	O

Number of Adults	200	291	445	313	496	807
Number of Females	100	145	222	157	249	403
Relative Change from a status quo release at TFH	***-6%***	***38%***	***111%***	***-8%***	***46%***	***137%***

1 Compared to a 140,000 expected release group at TFH for the 2023 release year based on current hatchery production for the 2021 brood year.
2 Compared to 225,000 release group at TFH assuming full program production was available.
3 Percentage values are based on average escapement estimates from each listed basin where Tucannon origin fish could interact with the local population. Average returns used to make the calculations were: 500 (Kalama), 750 (Cowlitz), and 555 (Lewis).
4 The majority of "Other" strays were from harvest recoveries in the Willamette River. It's unknown if these fish would have remained, or returned to Kalama Basin, but were included to provide a conservative estimate of possible strays.

1.1.6. Emergency contingency plan for early releases

In the event of an emergency, such as flooding, water loss to raceways, epizootic outbreak, or vandalism that necessitates early release of spring/summer Chinook salmon to prevent catastrophic mortality at either TFH or KFFH, any such release shall be reported within 48 hours to NMFS.

1.2. Action Area

The "action area" means all areas to be affected directly or indirectly by the Proposed Action, in which the effects of the action can be meaningfully detected, measured, and evaluated (50 CFR 402.02). The action area resulting from this analysis includes the entire Tucannon River Basin downstream to its confluence with the Snake River and LFH. An additional action area includes the lower Columbia River acclimation site operated at KFFH, and includes the entire Kalama River basin. The action area includes locations where fish are captured, reared, and released, as well as areas where they may be monitored, or to which they may stray, and potentially other areas (primarily in tributaries off the Columbia River mainstem in close proximity to the Kalama River) where program fish may interact with other ESA listed species.

1.3. Fisheries

Fisheries are not part of this Proposed Action. Although tributary fisheries in the lower Columbia River will target hatchery-origin returns from this program, harvest frameworks are managed separately from hatchery production, and are not solely tied to production numbers. Additionally, production and fishery implementation are subject to different legal mandates and agreements. Because of the complexities in annual management of the production and fishery plans, fisheries in these areas are considered a separate action.

There are also existing mainstem Columbia River and ocean fisheries that may catch fish from this program. However, these mixed fisheries would exist with or without this program in the Kalama River, and have previously been evaluated in a separate biological opinion (NMFS 2008).

1.4. Facilities and Routine Maintenance

All facilities utilized under this Proposed Action, and any associated water withdrawals at intake diversions, fish ladders, effluent, or required routine maintenance have previously been described in the HGMP for this or other programs associated with those facilities and will be described again here. Please refer to previously submitted HGMPs for more detail.

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Attachment 1: Adult return goals for a lower Columbia River Release Program

Tucannon River Spring Chinook

Original LSRCP Hatchery Return Goal to Tucannon River	**1,152**	(Hatchery only)
Original LSRCP Hatchery Return Goal to Tucannon River	**2,400**	(hatchery and wild combined)
Lower River Goal (Evaluation Benchmark)	**650**	(Hatchery only)
Expected to Return (P1, P2, P3 (Asotin Juvenile))	**1,113**	(hatchery and wild combined)
Expected to Return (P1, P2, P3 (Asotin Adult OP 2))	**658**	(hatchery and wild combined)

Priorities Outlined Below DO NOT take into account what could come back to the Tucannon River on it's own from continued releases in the Tucanonn/Snake rivers (direct stream or barged) or from the initiation of a captive broodstock at some point in the future

Priority 1 - Broodstock Goal

Assumes 50:50 Male:Female, 3,000 eggs/female (100% hatchery origin)
Eggtake of 255,000, for planned smolt release of 225,000

R/S data from 2007-2015 Broods

		LOW R/S	Avg R/S	High R/S	Geomean R/S	
Adults	**170**	**1.2**	**2.9**	**5.6**	**2.6**	Set per current HGMP to reach production goal of 225K smolts
Generation 1 Exp Returns (Adults)		**204**	**493**	**952**	**442**	
		Stdev	1.4		**38.4%**	of original LSRCP hatchery Goal

Priority 2 - Adult Outplant Goal - Tucannon River

Assumes 50:50 Male:Female, 3,000 eggs/female (100% hatchery origin)
75% Outplant to Redd Success Rate **143** **Redds in Total**

R/S data from 2007-2015 Broods

			LOW R/S	Avg R/S	High R/S	Geomean R/S	
Adults	**380**	**Minimum***	**0.1**	**0.9**	**2.9**	**0.6**	
Generation 1 Exp Returns (Adults)			**29**	**257**	**827**	**171**	
			Stdev	0.8		**13.7%**	of original LSRCP wild return expectations

* This could be a trigger point to when fish would start going into Asotin Program (for Juveniles or Adult Outplants)

Assumes 50:50 Male:Female, 3,000 eggs/female (100% hatchery origin)
75% Outplant to Redd Success Rate **450** **Redds in Total**

R/S data from 2007-2015 Broods

			LOW R/S	Avg R/S	High R/S	Geomean R/S	
Adults	**1200**	**Maximum****	**0.1**	**0.9**	**2.9**	**0.6**	
Generation 1 Exp Returns			**90**	**810**	**2610**	**540**	
			Stdev	0.8		**43.3%**	of LSRCP wild return expectations

** This would be the maximum number of adults that would be outplanted should lots more fish return than expected and we could also fill in needs for Asotin Creek. Data would suggest that Natural Productivity may be reached at this point

Priority 3 - Asotin Creek Reintroduction Goal

Adults **100**

Asotin Option 1: Juvenile Hatchery Production

Assumes 50:50 Male:Female, 3,000 eggs/female (100% hatchery origin)

Average SAR of next lowest performing stock in LSRCP program (Dworshak) = 0.4% SAR, increased SAR due to benefits from barging at LGR, LGO and LMN

Eggtake **150000** **Smolts** **124950** **SAR=0.4%**

Generation 1 Exp Returns (Adults)	**500**	
	43.4%	of original LSRCP hatchery Goal

Asotin Option 2: Adult Outplants in mainstem and NF Asotin Creek

Assumes 50:50 Male:Female, 3,000 eggs/female (100% hatchery origin)

No information on R/S for naturally produced fish, use Tucannon Estimates - could be higher due to transportation at dams

R/S data from 2007-2015 Broods - Tucannon

75% Outplant to Redd Success Rate **38** **Redds in Total**

	LOW R/S	Avg R/S	High R/S	Geomean R/S	
	0.1	**0.9**	**2.9**	**0.6**	
Generation 1 Exp Returns	**8**	**68**	**218**	**45**	
				3.6%	of original LSRCP wild return expectations

Appendix B: Study Plans to Examine Alternative Release Strategies for Tucannon River Spring Chinook Hatchery Salmon. *(Note: The following plan was developed in 2019, but implementation of the release have been delayed due to BKD outbreaks and lack of hatchery production in recent years. This should only be used as a general reference for what was planned in 2019).*

Purpose

We propose examining three alternative hatchery release strategies to determine if significant improvements in survival rates can be achieved for Tucannon River hatchery spring Chinook.

Background

While the Tucannon River spring Chinook return has generally followed the same return trends as other Snake River stocks (Figure 1), the Tucannon hatchery program has never achieved the LSRCP assumed target smolt-to-adult return (SAR) goal of 0.87%. In fact, the LSRCP spring Chinook Salmon hatchery programs have only met the 0.87% SAR target approximately 20% of the time (ISRP 2014); prompting the question of whether changes in hatchery release practices could aid in achieving the target SAR?

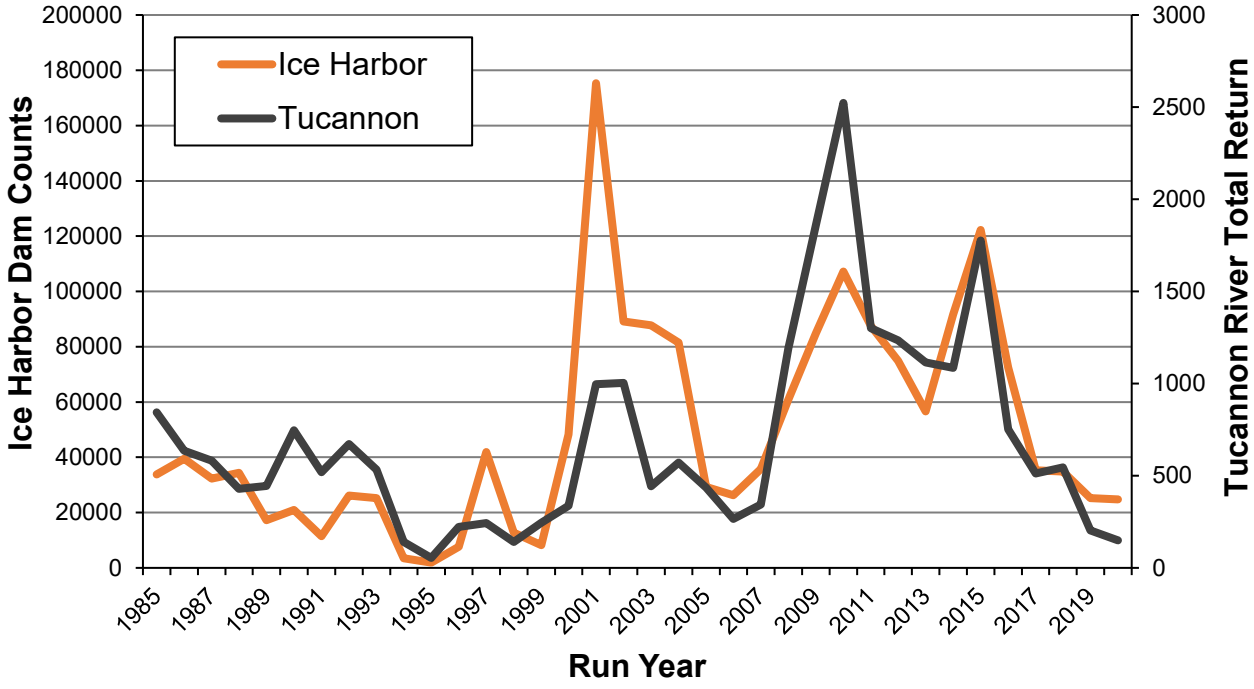

Figure 1. Comparison of Ice Harbor Dam counts of spring Chinook salmon to estimated total returns of Tucannon River spring Chinook. Provided here to give overall context that while the Tucannon SPCH returns are not great, they generally follow the overall patterns of spring Chinook returning to the Snake River basin.

Based on PIT tag analyses conducted by the Fish Passage Center from 2005-2017, the SAR survival of Tucannon River hatchery spring Chinook salmon from Lower Monumental to Bonneville Dam has been lower than the Lower Granite to Bonneville Dam SAR's for up-river hatchery stocks, even though the reach the Tucannon hatchery fish migrate through is shorter. It has been hypothesized that the up-river stocks

may have a survival advantage due to additional opportunities for barge transportation. While some studies have shown barging has affected homing abilities for both Chinook and steelhead (Keefer et al. 2008), evaluating the effect of transport on SARs of Tucannon River fish has not been possible with the available data. A more recent PIT tag analyses was completed by the Fish Passage Center (July 28, 2020) comparing smolt-to-adult survival of Tucannon River hatchery spring Chinook again with up-river stocks, but this time as a direct comparison of smolt-to-adult survivals from Lower Monumental to Bonneville Dam for all stocks. Results from this most recent work show that while Tucannon River hatchery spring Chinook generally track survival of other groups, they were consistently in the lowest tier of the distribution.

Historically, the default action for PIT tagged fish that are detected at transportation facilities has been to return them to the river. Beginning with the 2015 migration year, PIT tagged Tucannon hatchery spring Chinook salmon have been included in the Comparative Survival Study (CSS) whereby a portion of the tagged fish are returned to the river and a portion are barged. However, the effects of transportation on SARs on Tucannon hatchery fish to date has not been possible based on the low numbers of PIT tagged fish (15,000 total per year). Power Analysis performed by the Fish Passage Center has determined that the number of PIT tagged fish needed to find a significant difference in survival based on historical rates is approximately 15,000 fish/group. We currently have enough PIT tags on hand to tag 45,000 spring Chinook/year for three years.

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Note: The 2019 production of Tucannon spring Chinook are being treated for Bacterial Kidney Disease (BKD).

The high ELISA group has been treated twice and had not responded to the treatments, with low level mortality continuing to occur. WDFW (in agreement with co-managers) has decided to keep these fish at Lyons Ferry Hatchery (LFH) until release. The group is currently isolated from other groups and aren't expected to impact other production programs at LFH. These fish will be direct stream released in the spring of 2021 (release time and location to be determined later). At this time, no specific evaluation will occur on this group (i.e., PIT tags), but they have been CWT'd. Status quo mortality to date should result in a release of 10,000 -12,000 smolts.

The other remaining production group just recently was diagnosed with BKD, and treatments began during the last week of July. Should they respond well to the treatment, fish from this group will be used for the study. Should they ***not*** respond to the treatment, these fish will be sent to the Tucannon FH (TFH) for overwintering, and then released from TFH. A standard PIT tag group (15K) for standard monitoring would be applied.

Methods

The three proposed alternatives are provided in Table 1. Spring Chinook will be transferred from LFH to TFH in October 2020 and reared in the A-Pond. This is to ensure all groups will be treated the same over the fall/winter months prior to PIT tagging. PIT tagging at TFH will likely occur between the last week in February and second week of March (depending on evaluation staff availability and other PIT tagging needs at LFH). Fish will be removed from the A-Pond for tagging, with the TFH release group put back in the A-Pond, while groups #2 and #3 will be tagged and put in circular ponds for the remainder of their rearing. A

subsample of lengths/weights will be collected from all groups during PIT tagging. Length/weights will also be collected from each group just prior to release. PIT tags from the Tucannon FH release and the Direct Stream release groups will be removed from Monitor Mode at the dams and the CSS Study (to compare in-river vs. transported survival).

Table 1. Three release strategies for the Tucannon River Spring Chinook release strategy evaluation (2021-2023 release years).

Group Description	Brood Years	Min. PIT Tags/Year
1. Release @ Tucannon FH	2019-2021	15 K
2. Direct Stream Release (Actual Site to be determined later)	2019-2021	15 K
3. Barge Transportation @ LFH	2019-2021	15 K

Group 1: Release from Tucannon FH (Surrogate Control Group). Fish will be PIT tagged at TFH and put back in the A-Pond and then allowed to volitionally release to the outlet channel and to the river as was done in the past, or if that channel is not suitable for release, then fish would have to be pumped from the A-Pond to the Tucannon River a short distance away. If possible, the volitional release would begin in mid-April to coincide with the release timing of the other two groups (these fish to be at and/or slightly past the mouth of the Tucannon River when the other two releases occur). This group will also contain the remaining available production (CWT only fish).

Pros		Cons
Protected from predators while held at Tucannon FH		Some fish might not return as high as they have from Curl Lake releases
Released near the adult trap for future adult returns		Spawning distribution of returning hatchery fish may shift lower in the river
One less transfer/handling event (especially since fish have been diagnosed with BKD this year)		Will have to represent the control group to compare results with what we've seen historically (Curl Lake releases), but will not be a true control group
		Fish might try to return to the hatchery outlet channel. Will have to set up a temporary adult trap at the bar screen structure just in case
		Fish may have trouble exiting the release channel and/or could become concentrated and prone to predation [1]
		If fish have to pumped to the river from the A-Pond, ensure there is a suitable place to put them in that doesn't immediately wash them downstream.

[1] The release channel and/or bar screen needs to be evaluated by hatchery and evaluation staff prior to release.

Group 2: Direct Stream Release. Currently proposing that we release this group of fish at the Tucannon River access pullout at the mouth of the Tucannon River just before it enters the Snake River, or at the HWY 261 bridge. Both of these locations are below the Tucannon River smolt trap, and will therefore not impact operations of the smolt trap during the peak outmigration period. Fish will be removed from the A-pond, PIT tagged, and then put into a singular circular pond for final rearing prior to release. The release date of this group will coincide with the arrival of fish from the Tucannon FH release being near the mouth of the Tucannon River (based on PIT tag detections), and/or 1-2 days prior to the Barge Transportation group.

Pros		Cons
Protected from predators while held at Tucannon FH		Greater chance that these fish might stray past the Tucannon River upon adult return
Eliminate the mortality that's been estimated from the Curl Lake to the mouth of the Tucannon River in most years (30-50%)		Some fish might not return as high as they have from Curl Lake releases
		Spawning distribution of returning hatchery fish may shift lower in the river
		An extra transfer/handling event compared to the Control Group

Group 3: Barge Transportation Group. Fish will be removed from the A-pond, PIT tagged, and then put into a singular circular pond for final rearing prior to release. Arrangements will be made with the Corps of Engineers to have a barge available at LFH between 24-30 April (barging at Snake River Dams begins on 24 April). On the day the barge is scheduled to arrive at LFH, the fish will be loaded onto a transport truck at TFH, hauled to LFH, and put on the barge that same day.

Pros		Cons
Protected from predators while held at Tucannon FH		Greater chance that these fish might stray in general and/or stray past the Tucannon River upon adult return
Could greatly reduce the in-river mortality (Tucannon, Snake, Columbia) that could occur from predation, migratory conditions, etc…..		Some fish might not return as high as they have from Curl Lake releases
		Spawning distribution of returning hatchery fish may shift lower in the river
		Intermingling of multiple stocks of fish in the barges, possible greater disease transmission
		An extra transfer/handling event compared to the Control Group

****The use of Curl Lake has been an important part of the program in addressing survival and spawning distribution concerns of hatchery fish for this program over the years. Shifting to releases lower in the river could have consequences (survival, adult trapping, and spawning distributions) that are not fully**

appreciated at this time. Actions to account for some of these (hauling returning adults upstream after capture, additional trapping locations for broodstock collection/hauling, etc…) may have to be implemented. Options to re-use Curl Lake (depending on study results) should be considered in the future.

Literature Cited

ISRP (Independent Scientific Review Panel). 2014. Summary review of the Lower Snake River Compensation Plan 2011-2014. ISRP 2014-6.

Keefer, M. L., C. C. Caudill, C. A. Peery, and S. R. Lee. 2008. Transporting juvenile salmonids around dams impairs adult migration. Ecological Applications 18 (8): 1888-1900.

13. PROJECT BUDGET

Budget narrative: Please describe the use of the funds in each budget categories. Also describe any budget match or leverage opportunities. If holding a project budget to FY 2021 project budget levels makes it difficult to continue existing activities and meet project objectives, sponsors should describe the situation and indicate what aspects of the project may be compromised.

Since it was not specified how to address the rate of inflation, project sponsors assumed a 1% rate of inflation across the time period. We also assumed a 35% average Agency Overhead would be applied. Actual Agency Overhead rates could be lower or higher. Keeping this category value constant for FY 2024-2028 ignores increases out of the control of the project manager such as benefit rate increases and employee salary step increases. Accounting for these increases now will result in the project managers not having to reduce costs in other categories in the future, which would be primarily in the Supplies Category for this project.

As previously indicated, these two proposed strategies are directly integrated with current LSRCP hatchery production for spring Chinook in the Tucannon River. Overall, these projects benefit greatly from the existing hatchery monitoring and evaluation program in the Tucannon River funded by LSRCP, in addition to the infrastructure at LFH, KFFH, the Snake River Lab field office in Dayton (where monitoring and evaluation staff are stationed), and WDFW Region 5 staff that monitor the lower Columbia River.

Kalama Falls Budget

Personnel and fringe benefits would be used for LFH or KFFH hatchery staff to 1) supplement staff time for rearing juveniles at KFFH, 2) transport juveniles from LFH to KFFH for acclimation, and 3) for transporting adults back to LFH or the Tucannon River. Per discussions with NOAA Fisheries (if this option is approved), they have requested genetic analysis in the Kalama River to evaluate introgression of Tucannon stock genes into the Kalama Population, should not all Tucannon stock fish convert to the weir/trap and spawn naturally in the Tucannon River. WDFW just acquired funding to create a Lower Columbia River Chinook genetic baseline, which can then be used in future comparisons.

Kalama Falls Hatchery Release Budget

Item	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032	FY 2033	FY 2034	FY 2035	NOTES*
Personnel	12360	12484	12608	12735	12862	12990	13120	13252	13384	13518	13653	13790	
Fringe benefits	5596	5652	5708	5766	5823	5881	5940	6000	6060	6120	6181	6243	
Travel													
Supplies	2500	3000	3500	4000	4500	5000	5500	6000	6500	7000	7500	8000	
Equipment													
Land/Water Acquisitions													
Overhead	7160	7397	7636	7875	8115	8355	8596	8838	9080	9323	9567	9812	Assumes an average of 35% Overhead Rate
One-time budget needs										8000	8000	8000	For genetic analysis
Budget totals	**27,616**	**28,533**	**29,452**	**30,376**	**31,300**	**32,226**	**33,156**	**34,090**	**35,024**	**43,961**	**44,901**	**45,845**	