PROJECT PROPOSAL

TUCANNON RIVER SPRING CHINOOK CAPTIVE BROODSTOCK PROGRAM

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.

Name: Michael Gallinat
Email: Michael Gallinat@dfw.wa.gov
Phone: 509-382-4755

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, 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 specific project would re-initiate a captive broodstock program at LFH, with the intent to rear and spawn adequate numbers of captive adults to provide ~150,000 smolts, in addition to the 225,000 from the LSRCP program, both released into the Tucannon River annually. Based on average smolt-to-adult survival from the LSRCP program, ~350 adults should return on average to contribute to natural spawning 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 re-initiate a captive broodstock program (this proposal). WDFW previously operated a captive broodstock program for this population from 1997-2009 (Gallinat 2009), with the intent to provide a demographic boost to the population following a period of low returns from 1994-1999. Results from that effort were less than desired, but they did provide a small demographic boost. Lessons learned from other captive broodstock programs conducted at roughly the same time in the Snake River basin should increase our ability to get better results if implemented again.

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).

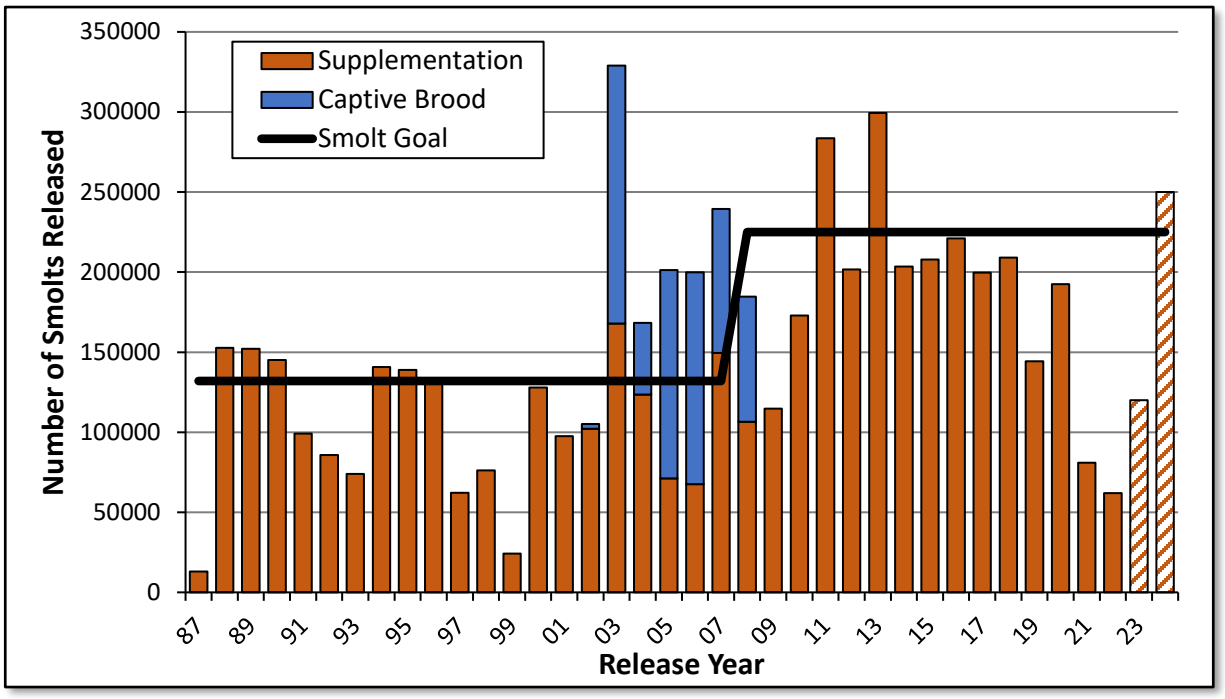

Figure 1. Number of smolts produced by brood year for both the conventional hatchery supplementation and captive broodstock programs. Diagonal slash years are estimated smolts that will be released based on current production at LFH.

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).

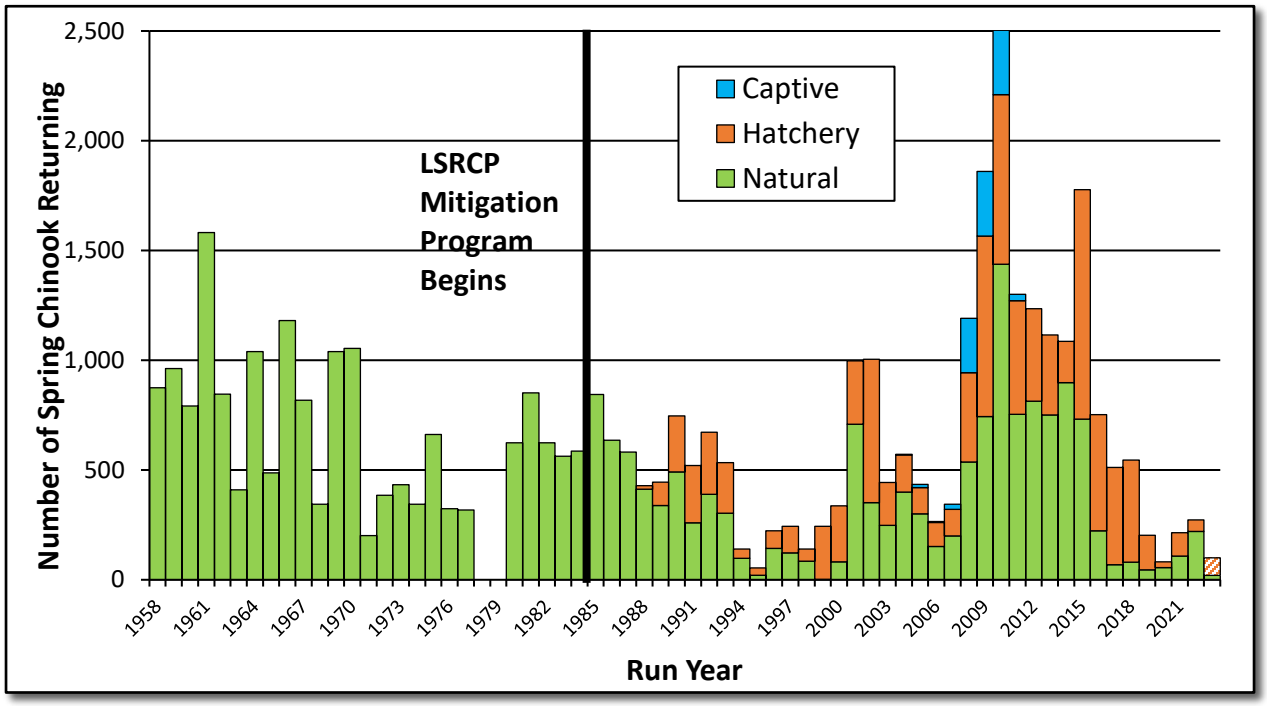

Figure 2. Total escapement by origin for Tucannon River spring Chinook Salmon for the 1985-2022 return years. The values shown for the 2023 returns are forecasted based on juvenile smolt trapping estimates, and recent release and performance of hatchery origin juveniles.

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 A), 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).

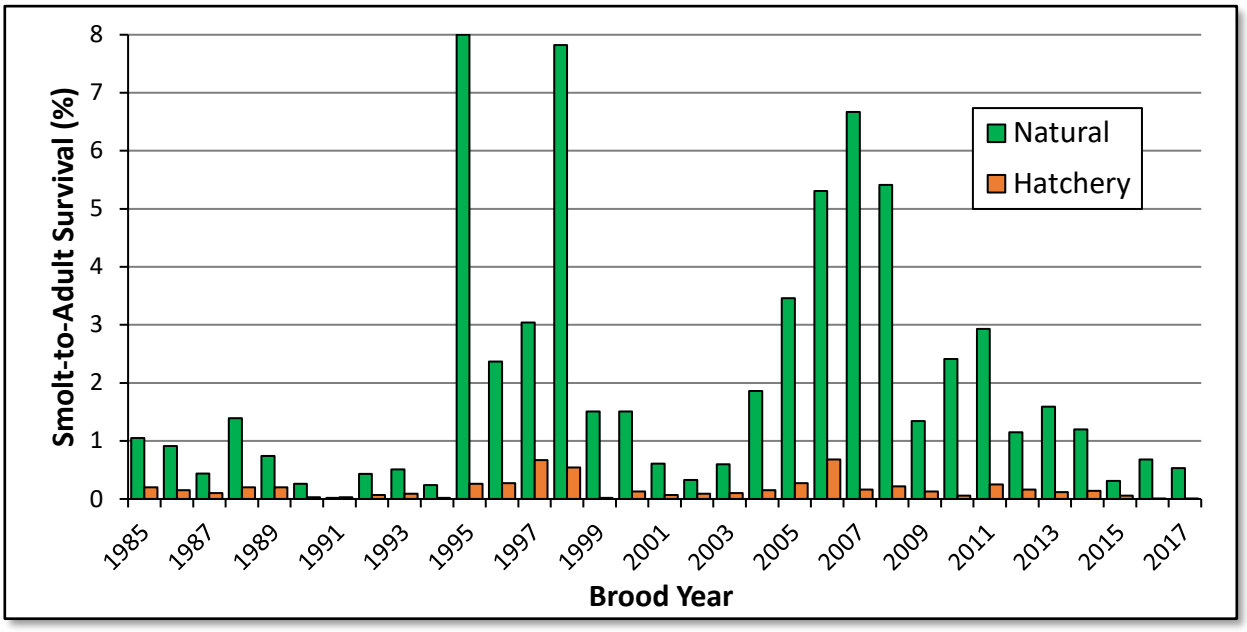

Figure 3. Comparison of smolt-to-adult returns (SAR) of hatchery and natural origin Tucannon River spring Chinook Salmon for the 1985 to 2017 brood years (jacks excluded). (2017 incomplete brood year).

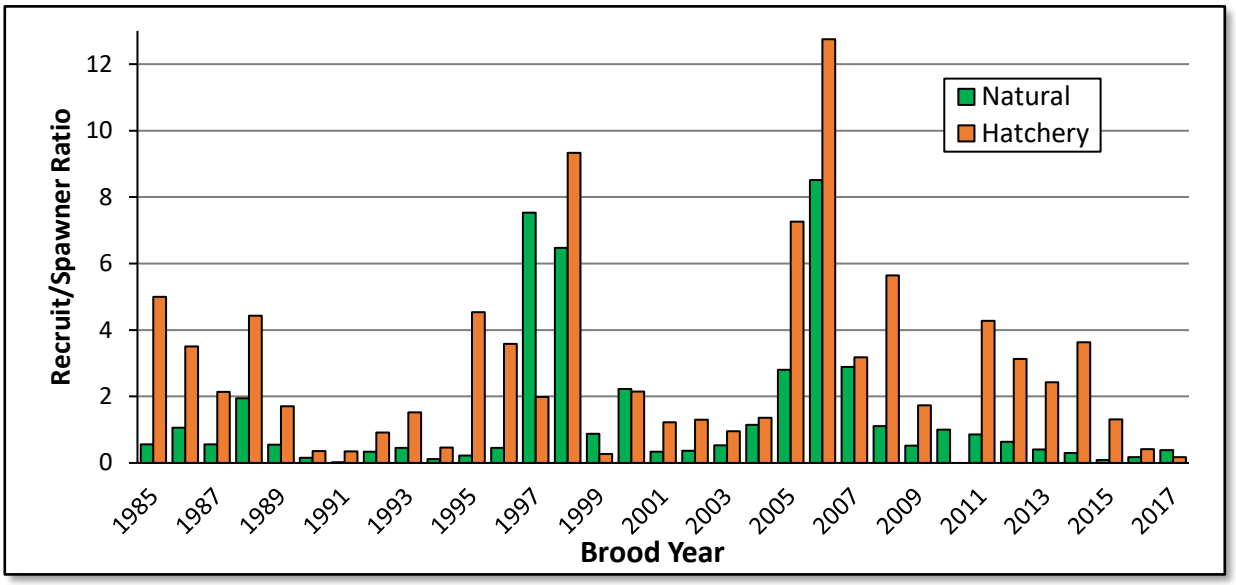

Figure 4. Returns per spawner (with replacement line) for the 1985-2017 brood years (2017 incomplete brood year).

Tucannon River Releases and Barging Comparison Study – Brief Summary

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.

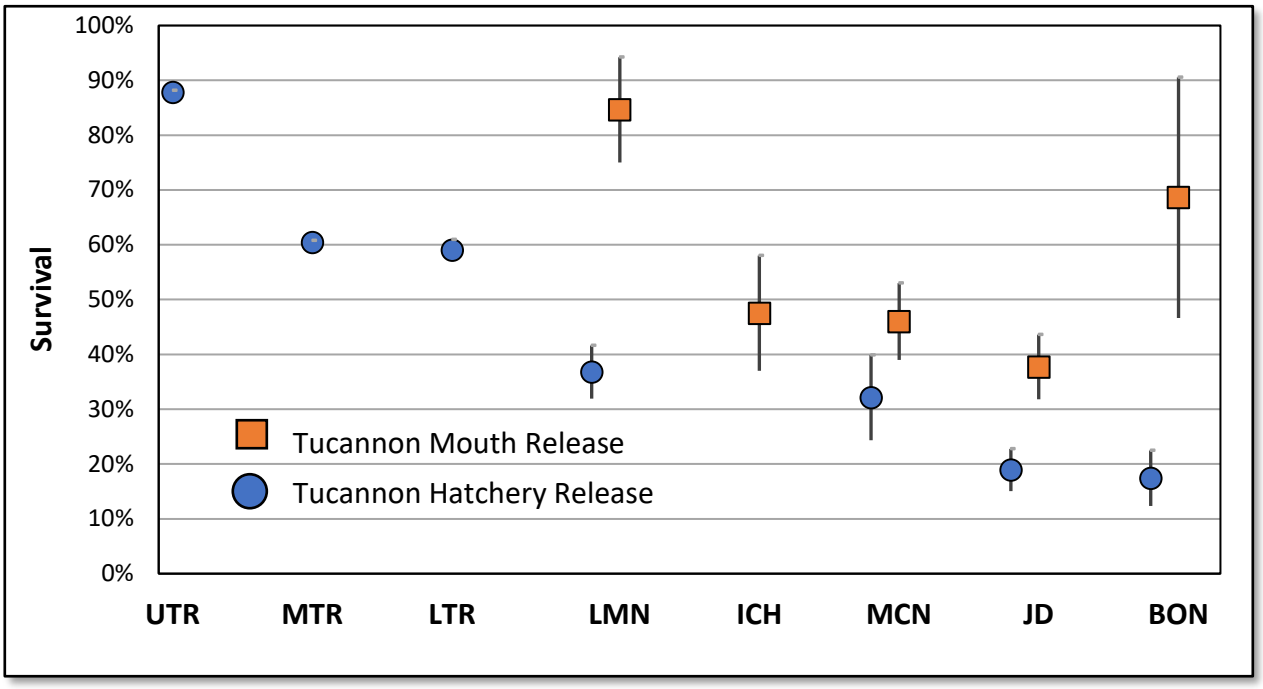

Figure 5. Juvenile survival estimates (using DART) to downstream locations from the 2022 release of hatchery origin Tucannon River spring Chinook. Detection sites are: UTR – Upper Tucannon River, MTR – Middle Tucannon River, LTR – Lower Tucannon River, LMN – Lower Monumental Dam, ICH – Ice Harbor Dam, 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 a captive broodstock program at Lyons Ferry Hatchery. Raise, spawn, and rear resultant juveniles (150,000) to return 350 adults annually 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 350 hatchery adults annually from progeny produced from the Captive Broodstock (CB) program at LFH. Return at least 750 Tucannon River natural origin spring Chinook annually (ICTRT Recovery Goal).	Purchase and Install 8, 20' circular rearing tanks at LFH. Annually remove 1,200 juveniles (rep. of 15 family units) from the standard hatchery production. Once at size, PIT and VIE tag 30/family unit for CB production. Rear up to 450 CB juveniles/tank, sort annually during the summer to extract maturing adults. Archive monthly hatchery records for CB mortalities, disease incidence, growth information, etc… Transfer mature CB adults to holding raceway, spawn all mature CB fish following spawning protocols from late August into October. Sample spawned CB fish, determined CB family groups from tags, assign matings, collect tissue samples for PBT database. Raise resultant CB progeny. Archive monthly hatchery records for incubation/rearing of progeny (e.g. fecundity, monthly mortalities, disease incidence, etc…). Externally mark, coded-Wire and PIT tag CB progeny prior to release, collect Pre-release samples, release up to 150,000 CB smolts in the Tucannon River.	Estimate survival of CB (by age class). Estimate survival of CB progeny within the hatchery prior to release. Estimate downstream migrant success and travel time metrics for CB progeny. Monitor CB progeny adult returns via PIT tag detections and externally marked fish returning to Tucannon FH. Conduct spawning ground surveys and estimate total returns of CB progeny fish to the Tucannon River.

4. METHODS

Captive Broodstock Program – The basics for the program include estimating metrics at various points in the life cycle.

Captive Broodstock Selection and Rearing: A subset of juveniles (~80/family unit) will be collected from the standard supplementation program annually. At swim up, these will be reared in 15 individual small rearing tanks at LFH. Once large enough, ~30 from each family unit will be PIT tagged and Visual Implant Elastomer (VIE) alpha numeric tagged. Following tagging, they will be combined into a single large circular rearing tank (20') where they will remain until mature. Fish will be fed an appropriate brood diet, but with minimal sampling/handling. During the summer, fish will be sorted for maturation, with mature fish transferred to an adult holding pond at LFH.

Captive Broodstock Spawning, Incubation, Rearing and Release: Hatchery and evaluation staff will examine all broodfish weekly in late August through September (same time as the standard supplementation program spawning). Ripe females and males will be killed, and the eggs/semen collected. Semen collected from the spawning of natural origin or hatchery supplementation males may also be used since spawn time is expected to overlap. Biological data and samples will be collected from all spawned fish (length, marks/tags, and scales). All parental crosses will be recorded (via PIT or VIE tags so sibling crosses are avoided) and a tissue sample will be collected from all spawned fish for Parental Based Tagging tracking efforts of the hatchery populations in the Snake River. Each egg lot is disinfected following WDFW Disease Protocols and individual lots are incubated in standard heath trays. Fecundity (by female) will be estimated at eye-up from a weight sample. Eyed eggs will be combined in ~5,000 egg lots, substrate added, and placed back into heath trays until hatched. Fry are then ponded outside to standard concrete raceways and reared in those until release ~1-year later. Mid-way through the rearing cycle, captive brood progeny will be coded wire tagged (CWT) as needed per monitoring group, with a portion also receiving a PIT tag just prior to release. All CWT and PIT tag information will be uploaded to the Pacific States Marine Fisheries Commission CWT or PIT Tag databases (RMIS or PTAGIS) following release. Target release size is 12 fish/lb, the same as the standard supplementation program. A sub-sample (200-300) juveniles will be collected before release with a mean length, mean weight, K-factor, coefficient of variation (CV) of length determined, and the percent precocity estimated by visual inspection (per Hatchery BiOp and Section 10 reporting requirements). Methods and locations of release of captive broodstock progeny will be similar to the standard supplementation group.

Captive Broodstock Downstream Migration: Juveniles with PIT tags will be detected at in-stream arrays in the Tucannon River and at mainstem Snake and Columbia River dams. Travel days, migration speeds and survivals to various locations will be estimated via the Columbia River DART (Data Access in Real Time; http://www.cbr.washington.edu/dart).

Captive Broodstock Adult Return: Identical to the supplementation program, returning adults from the captive broodstock program will be tracked pre-season via PIT tags. For in-season estimation and broodstock management decisions, detections of PIT tags at mainstem dams (all

groups and by age class) are expanded to an estimated number of adults as determined by the juvenile tag rate.

Captive Broodstock Escapement Estimation and Smolt-to-Adult Survival: Estimates of adult returns (by origin) are calculated based on adult trapping records (sex ratio, fish collected for broodstock, fish passed upstream of the weir/trap, etc…), in conjunction with pre-spawn and spawning ground surveys and fish carcasses (determined as natural or hatchery origin based on the presence of CWTs) recovered from both above and below the TFH weir/trap.

5. PROJECT EVALUATION AND ADJUSTMENT PROCESS

Adaptive management via project results will occur yearly (or more frequently depending on the subject) and will involve all management (WDFW, NPT, CTUIR) and regulatory (USFWS and NOAA Fisheries) agencies involved. Project status updates will be provided annually to all managers during the Lyons Ferry Annual Operations Plan meeting since this proposed action is directly linked to the standard spring Chinook supplementation program on the Tucannon River funded by the LSRCP Program. Decisions to modify/adjust the program from what was originally planned will be thoroughly discussed, with modifications implemented to align with overall project goals. As provided previously under project goals, the goal of this proposed actions is to provide additional hatchery origin spring Chinook (Tucannon stock) adults to increase overall returns to the Tucannon River to more sustainable levels.

Captive Broodstock

For the proposed Captive Broodstock Program, production levels for each brood year, spawning protocols, rearing techniques, release strategies, etc., require a more task-oriented approach. As done previously, this will likely come in the form of a Captive Broodstock Technical Committee (CBTC), of which WDFW (evaluation, hatchery, fish management, and fish health personnel), NPT, and CTUIR will be represented. The CBTC will also coordinate certain activities with geneticists, and management and policy level personnel from each of the managers to assist in the decision-making process as necessary. If applicable, the CBTC will also coordinate with other agencies currently, or that previously, operated captive broodstock programs.

As an example of potential adaptive management that could occur with this program, would be if excess juveniles (captive broodstock progeny) are produced. A logical outlet for such an instance would be to plant the excess juveniles in Asotin Creek. According to the Snake River Recovery Plan (NMFS 2017a), re-introduction efforts in Asotin Creek should use Tucannon stock fish. Of course, discussion among all managers and regulatory agencies would occur before such plants were initiated.

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 fish are reared at LFH for the captive broodstock program 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.

7. TIMELINE

To better illustrate the next coming years, a Gantt chart has been developed to demonstrate project implementation between FY2023 – FY2029 for the Captive Broodstock Program (Table 7-1). Further, these tables do 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 Captive Broodstock program.

	TASK	Description	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
FY2023	Task 1	Select larger family units												
	Task 2	PIT/VIE Tag and reduce size of family units												
	Task 3	Rearing of Captive Brood												
	TASK	Description	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
FY2024	Task 1	Select larger family units												
	Task 2	PIT/VIE Tag and reduce size of family units												
	Task 3	Rearing of Captive Brood												
	TASK	Description	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
FY2025	Task 1	Select larger family units												
	Task 2	PIT/VIE Tag and reduce size of family units												
	Task 3	Rearing of Captive Brood												
	Task 4	Sort and Segregate Mature Fish												
	Task 5	Spawn Mature Captive Brood Adults												
	Task 7	CB Progeny Incubation												
	TASK	Description	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
FY2026	Task 1	Select larger family units												
	Task 2	PIT/VIE Tag and reduce size of family units												
	Task 3	Rearing of Captive Brood												
	Task 4	Sort and Segregate Mature Fish												
	Task 5	Spawn Mature Captive Brood Adults												
	Task 7	CB Progeny Incubation												
	Task 8	CB Progeny Rearing												
	Task 9	CB Progeny Marking/Tagging												
	TASK	Description	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
FY2027	Task 1	Select larger family units												
	Task 2	PIT/VIE Tag and reduce size of family units												
	Task 3	Rearing of Captive Brood												
	Task 4	Sort and Segregate Mature Fish												
	Task 5	Spawn Mature Captive Brood Adults												
	Task 7	CB Progeny Incubation												
	Task 8	CB Progeny Rearing												
	Task 9	CB Progeny Marking/Tagging												
	Task 10	Captive Brood Progeny Release												
	Task 11	Monitor Downstream Migration												
	TASK	Description	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
FY2028	Task 1	Select larger family units												
	Task 2	PIT/VIE Tag and reduce size of family units												
	Task 3	Rearing of Captive Brood												
	Task 4	Sort and Segregate Mature Fish												
	Task 5	Spawn Mature Captive Brood Adults												
	Task 7	CB Progeny Incubation												
	Task 8	CB Progeny Rearing												
	Task 9	CB Progeny Marking/Tagging												
	Task 10	Captive Brood Progeny Release												
	Task 11	Monitor Downstream Migration												
	Task 12	Monitor Returns (Jacks)												
	Task 13	Spawning Ground Surveys (Tucannon)												
	TASK	Description	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
FY2029	Task 1	Select larger family units												
	Task 2	PIT/VIE Tag and reduce size of family units												
	Task 3	Rearing of Captive Brood												
	Task 4	Sort and Segregate Mature Fish												
	Task 5	Spawn Mature Captive Brood Adults												
	Task 7	CB Progeny Incubation												
	Task 8	CB Progeny Rearing												
	Task 9	CB Progeny Marking/Tagging												
	Task 10	Captive Brood Progeny Release												
	Task 11	Monitor Downstream Migration												
	Task 12	Monitor Returns (Jacks and Adults)												
	Task 13	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 previous captive broodstock program for spring Chinook on the Tucannon River was reviewed and recommended for funding by the Council in 1997. The ISRP did not review or provide recommendations at that time. The Tucannon River spring Chinook captive broodstock program was implemented, and ended in 2009 (Gallinat et al, 2009).

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).

Anchor QEA, LLC. 2021. Tucannon Basin Habitat Restoration: Habitat Restoration Prioritization and Conceptual Restoration Plans. Prepared for: Columbia Conservation District. 92 pages. https://snakeriverboard.org/reports/tucannon-river-documents/

Araki, H., B. Cooper, and M. S. Blouin. 2009. Carry-over effect of captive breeding reduces reproductive fitness of wild-born descendants in the wild. Biology Letters 5: 621–4.

Beamish, R.J. [ed.] 1995. Climate change and northern fish populations. Can. Spec. Publ. Fish. Aquat. Sci. 127. 739 pages.

Buehrens, T. and N. Kendall. 2021. PART I: Status and Trends Analysis of Adult Abundance Data. Prepared in Support of Governor's Salmon Recovery Office 2020 State of Salmon in Watersheds Report. State of Washington, Department of Fish and Wildlife, Olympia, Washington. 22p.

Christie, M. R., M. J. Ford, and M. S. Blouin. 2014. On the reproductive success of early generation hatchery fish in the wild. Evolutionary Applications: 883-896.

Columbia Conservation District. 1997. Tucannon River Model Watershed Plan. Bonneville Power Administration.

Ford, Michael J. 2002. Selection in Captivity During Supportive Breeding May Reduce Fitness in the Wild. Conservation Biology 16: 515–525.

Ford, M. J., A. R. Murdoch, M. S. Hughes, T. R. Seamons, and E. S. LaHood. 2016. Broodstock history strongly influences natural spawning success in hatchery steelhead (Oncorhynchus mykiss). PLoS ONE 11(10): e0164801. Doi: 10.1371/journal.pone.0164801

Gallinat, M. P., and D. E. Kiefel. 2021. Tucannon River Spring Chinook Salmon Hatchery Evaluation Program: 2020 Annual Report to USFWS Lower Snake River Compensation Plan Office. FPA 21-03. 96 pp.

https://www.fws.gov/sites/default/files/documents/2020%20WDFW%20Tucannon%20Spring%20Chinook.pdf

Gallinat, M. P., J. D. Bumgarner, D. Maxey, S. Roberts, R. Rogers, L. Ross, and M. A. Varney. 2009. Tucannon River Spring Chinook Salmon Captive Broodstock Program: Final Project Completion Report (October 1,1999-September 30, 2009). U.S. Department of Energy, Bonneville Power Administration, P.O. Box 3621, Portland, OR 97283-3621. Project Nubmer 2000-019-00. 48 pp. https://www.cbfish.org/Document.mvc/Viewer/P113527

Gharrett, A. J., and Smoker, W. W. 1991. Two generations of hybrids between even- and odd-year pink salmon (Oncorhynchus gorbuscha): a test for outbreeding depression? Canadian Journal of Fisheries and Aquatic Sciences 48: 1749–1774.
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.

Kuttel, M. Jr. 2002. Salmonid habitat limiting factors, Water Resource Inventory Areas 33 (Lower) and 35 (Middle) Snake Watersheds and Lower Six Miles of the Palouse River. Washington State Conservation Commission, Olympia, Washington.

Luyer, J. L., M. Laporte, T. D. Beacham, K. H. Kaukinen, R. E. Withler, J. S. Leong, E. B. Rondeau, B. F. Koop, and L. Bernatchez. 2017. Parallel epigenetic modifications induced by hatchery rearing in a Pacific salmon. PNAS 114: 12964-12969.

NOAA (National Oceanographic and Atmospheric Administration). 2008. Federal Columbia River Power System (FCRPS) Biological Opinion. NOAA's National Marine Fisheries Service, Northwest Region. https://www.salmonrecovery.gov/Files/BiologicalOpinions/2008/2008%20BiOp.pdf

NOAA (National Oceanographic and Atmospheric Administration). 2017a. ESA Recovery Plan for Snake River Spring/Summer Chinook Salmon (Oncorhynchus tshawytscha) & Snake River Basin Steelhead (Oncorhynchus mykiss). NOAA Fisheries – West Coast Region. https://media.fisheries.noaa.gov/dam-migration/final-snake-river-spring-summer-chinook-salmon-and-snake-river-steelhead-recovery-plan-2017.pdf

NPCC (Northwest Power and Conservation Council). 2004. Tucannon Subbasin Plan. https://www.nwcouncil.org/subbasin-plans/tucannon-subbasin-plan.
NPCC (Northwest Power and Conservation Council). 2017. Columbia River Basin fish and wildlife program 2017 research plan. NPCC, Document 2017-4, Portland, Oregon.
NPCC (Northwest Power and Conservation Council). 2020. 2014/2020 Columbia River Basin fish and wildlife program. NPCC, Document 2014-12, Portland, Oregon.

NMFSWCR (National Marine Fisheries Service – West Coast Region. 2022. 2022 5-Year Review: Summary and Evaluation of Snake River Spring/Summer Chinook Salmon. https://www.fisheries.noaa.gov/resource/document/2022-5-year-review-summary-evaluation-snake-river-spring-summer-chinook-salmon

Ryman, N., P. E. Jorde, and L. Laikre. 1995. Supportive Breeding and Variance Effective Population Size. Conservation Biology 9: 1619–1628.

Ryman, N., and L. Laikre. 1991. Effects of Supportive Breeding on the Genetically Effective Population Size. Conservation Biology 5: 325–329.

SRSRP (Snake River Salmon Recovery Plan). 2011. Snake River Salmon Recovery Plan for SE Washington. Prepared for Washington Governor's Salmon Recovery Office. https://snakeriverboard.org/wp-content/uploads/2019/06/Full-Version-SE-WA-recovery-plan-121211.pdf

United States v. Oregon Management Agreement. 2018. United States v. Oregon Management Agreement 2018-2027. https://www.fws.gov/lsnakecomplan/Reports/USvOregon/FINAL.2018-%202027%20USvOR%20Management%20Agreement%20with%20Signature%20Feb%202018%20.pdf

USACE (U.S. Army Corps of Engineers). 1975. Special Reports: Lower Snake River Fish and Wildlife Compensation Plan. Walla Walla, Washington. https://www.fws.gov/lsnakecomplan/Reports/LSRCP/Special%20Report%20June%201975/Special%20Report.PDF

Wang, J., and N. Ryman. 2001. Genetic Effects of Multiple Generations of Supportive Breeding. Conservation Biology 15: 1619–1631.

WDFW. 2013. WDFW Tucannon River Endemic Stock – Spring Chinook Supplementation Program. Hatchery and Genetic Management Plan (HGMP) submitted to NOAA Fisheries. 105 pages.

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

Gallinat, M. P., J. D. Bumgarner and L. A. Ross. 2022. Efficacy of a Short-Term Captive Broodstock Program Compared with Hatchery-Origin Spring Chinook Salmon Derived from the Same Population. North American Journal of Aquaculture. 84:4. Pages 454-468. **https://doi.org/10.1002/naaq.10259**

Gallinat, M. P., and D. E. Kiefel. 2021. Tucannon River Spring Chinook Salmon Hatchery Evaluation Program: 2020 Annual Report to USFWS Lower Snake River Compensation Plan Office. FPA 21-03. 96 pp. **https://www.fws.gov/sites/default/files/documents/2020%20WDFW%20Tucannon%20Spring%20Chinook.pdf**

Gallinat, M. P., J. D. Bumgarner, D. Maxey, S. Roberts, R. Rogers, L. Ross, and M. A. Varney. 2009. Tucannon River Spring Chinook Salmon Captive Broodstock Program: Final Project Completion Report (October 1,1999-September 30, 2009). U.S. Department of Energy, Bonneville Power Administration, P.O. Box 3621, Portland, OR 97283-3621. Project Nubmer 2000-019-00. 48 pp. **https://www.cbfish.org/Document.mvc/Viewer/P113527**

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: 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?

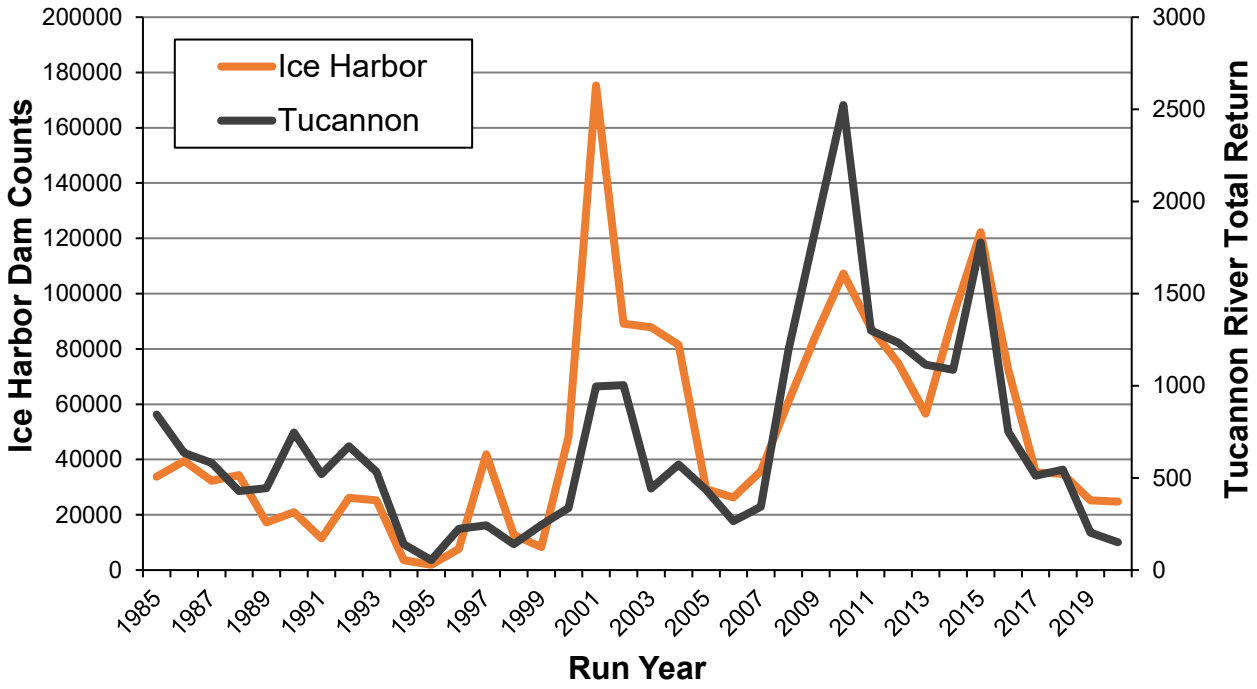

Figure 1. Comparison of Ice Harbor Dam counts of spring Chinook salmon to estimated total returns of Tucannon River spring Chinook. Provided here to give overall context that while the Tucannon SPCH returns are not great, they generally follow the overall patterns of spring Chinook returning to the Snake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

_____

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

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.

Captive Broodstock Budget

For the Captive Broodstock, personnel and fringe benefits are used for any staff time related to the project and includes the time of evaluation staff to assist with hatchery spawning and other hatchery sampling events, and the marking/tagging (both coded-wire, PIT, and adipose fin clipping) of program fish. Time is also allocated for fish health sampling, annual reporting writing, contract management, data summaries and analysis, and sharing of information about the captive broodstock program, and overall status of spring Chinook returns to the Tucannon River, etc… across the region, or at local meetings. Supplies for the Captive Broodstock program include the annual cost of marking/tagging captive broodstock progeny, PIT and coded-wire tags. There is a one-time budget need to implement the captive broodstock program at Lyons Ferry (8, 20-foot circular tanks are needed), located where the previous captive broodstock program was implemented. Existing water supply and drain lines can be used, but a solid concrete pad to support the new metal rearing tanks will be required.

Captive Broodstock 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	27,367	27,641	30,113	30,414	30,718	31,026	31,336	31,649	31,966	32,285	32,608	32,934	Bio3@3mo., Tech@2mo., FH@0.25mo.
Fringe benefits	10,549	10,654	11,438	11,552	11,668	11,785	11,902	12,021	12,142	12,263	12,386	12,510	
Travel	0	0	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	Fish Health Expense
Supplies	7,250	15,000	32,750	78,998	79,595	91,849	80,795	81,398	82,003	82,611	83,220	96,249	Includes pumping cost, feed, CWT and PIT tags, and FH sampling
Equipment													
Land/Water Acquisitions													
Overhead	15,808	18,653	26,425	42,758	43,113	47,551	43,832	44,194	44,559	44,926	45,295	50,013	Assumes an average of 35% Overhead Rate
One-time budget needs	500000												For 20' Circular Tanks at Lyons Ferry, concrete pad, minor plumbing parts
Budget totals	**560,974**	**71,948**	**101,926**	**164,922**	**166,294**	**183,411**	**169,065**	**170,462**	**171,870**	**173,285**	**174,709**	**192,906**	