

LOWER SNAKE RIVER COMPENSATION PLAN:
Oregon Spring Chinook Salmon Evaluation Studies
2024 Annual Progress Report



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Northeast-Central Oregon Research and Monitoring

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Photo cover: Unspawned female Chinook Salmon recovered from Hurricane Creek, September 2023: Photo by Joseph Feldhaus.

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Preface

This annual progress report provides summary information for the Lower Snake River Compensation Plan (LSRCP) spring Chinook Salmon programs operated by the Oregon Department of Fish and Wildlife (ODFW) in the Imnaha and Grande Ronde River basins for calendar year 2024 per data availability. Also included in this report are summaries of data collected at Chinook Salmon broodstock collection facilities operated by co-managers, the Nez Perce Tribe (Lostine River) and the Confederated Tribes of the Umatilla Indian Reservation (Catherine Creek and Upper Grande Ronde River) and funded by the Bonneville Power Administration. These ongoing monitoring and evaluation programs provide technical, logistical, and biological information to managers charged with maintaining viable natural Chinook Salmon populations and managing hatchery programs and recreational and tribal fisheries in northeast Oregon.

Data in this report serves as the basis for assessing the success of meeting management objectives and were derived from hatchery inventories, standard databases, through standard sampling techniques, or provided by other agencies. As such, specific protocols are usually not described. When possible, data obtained from different sources were cross-referenced and verified. In cases where expansions of data or unique methodologies were used, protocols were described in more detail.

Coded-wire tag (CWT) data collected from 2022–2024 returns was used to evaluate smolt-to-adult survival rates, harvest, straying, escapement, and specific information on experimental results. In addition, much of the data discussed in this report will be used in separate and specific evaluations of ongoing supplementation and research programs for Chinook Salmon in the Imnaha and Grande Ronde River basins. Salmon culture evaluations began in 1983 and have improved many practices. Progress for work completed in previous years is presented in annual progress reports available at the [LSRCP library](#) and the [ODFW Data Clearinghouse](#).

In this report, data are organized into nine priority monitoring and evaluation objectives. Results presented for objective are used to inform the four primary management goals of recovering natural populations, ensuring a high probability of population persistence, restoring sport and tribal fisheries, and minimizing the risk of potential negative effects of artificial production. Additionally, results are used to gauge success in meeting LSRCP hatchery mitigation goals for smolt releases and mature (age 3-6) salmon returns.

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EXECUTIVE SUMMARY

In 2024, weirs were operated in the Grande Ronde and Imnaha River basins from May to mid-September to trap returning spring-summer Chinook Salmon for broodstock and to manage the number of hatchery fish spawning in nature. The Oregon Department of Fish and Wildlife operated weirs in the Imnaha River and Lookingglass Creek. The Confederated Tribes of the Umatilla Indian Reservation operated weirs in Catherine Creek and the Upper Grande Ronde River. The Nez Perce Tribe operated a weir in the Lostine River.

Collectively across all five hatchery programs at Lookingglass Fish Hatchery (LFH) 326 hatchery females and 78 natural females were spawned, resulting in estimated collections of 1,478,634 green eggs. For the Imnaha program, 102 hatchery and 27 natural females were spawned and yielded 498,332 green eggs. In Catherine Creek, 38 hatchery and 9 natural females were spawned which produced 169,981 green eggs. The Upper Grande Ronde River program included 72 hatchery and eight natural females resulting in 259,991 green eggs. In Lookingglass Creek, 67 hatchery and seven natural females were spawned and produced 238,406 green eggs. In the Lostine River program, 47 hatchery and 27 natural females were spawned and produced 311,924 green eggs.

A total of 1,342,583 brood year 2022 smolts were released in their destined release stream in 2024. On 29 March 2024, a liberation truck leaving LFH with an estimated 102,702 Imnaha River smolts crashed into Lookingglass Creek. It was estimated that 25,529 were recovered as morts. The remaining 77,173 smolts were un-accounted for and presumed to have made it to Lookingglass Creek. Green egg-to-smolt survival rates ranged from 76.0% to 111.3%, and 97.3% to 100% of smolts were identifiable as hatchery origin through either an adipose fin clip (AD clip) or an internal coded-wire tag (CWT). The mean survival rate from release to Lower Granite Dam (LGD) across all smolt groups was 49.9%, with a range of 35.7% to 79.2%. The mean survival rate for Imnaha River smolts was 51.6%. In the Grande Ronde Basin, mean survival rates were 42.6% for Catherine Creek, 47.8% for the Upper Grande Ronde River, 56.0% for Lookingglass Creek, and 46.0% for the Lostine River. For 77,173 smolts accidentally released into Lookingglass Creek, mean survival rate was 26.5%, with a range of 24.7% to 28.4%.

The total return goal for Imnaha hatchery-origin Chinook Salmon to the Columbia Basin is 16,050 returns. In 2024, an estimated 1,739 mature (age 3–5) fish returned to the Columbia River, achieving 10.8% of the goal. Of the total returns, 1,637 were estimated to have returned above LGD, achieving 51.1% compensation area goal of 3,210 returns. We estimated that 1,624 hatchery and 447 natural-origin Chinook Salmon returned to the Imnaha River. No sport fishery was conducted in 2024. Tribal fisheries harvested 90 hatchery and 3 natural-origin salmon.

The total return goal for Grande Ronde Basin hatchery-origin Chinook Salmon to the Columbia Basin is 29,100 returns. In 2024, an estimated 3,253 hatchery-origin Chinook Salmon returned, achieving 11.2% of this goal. Above Lower Granite Dam (LGD), an estimated 3,061 hatchery-origin Chinook Salmon from the Grande Ronde Basin returned achieving 52.6% of the compensation area goal of 5,820 returns.

At the tributary level, estimated returns of Chinook Salmon varied by location. In Catherine Creek, an estimated 611 hatchery-origin and 185 natural-origin returned to the spawning grounds. Lookingglass Creek had 1,206 hatchery-origin and 126 natural-origin returns. In the Lostine River, 709 hatchery-origin and 261 natural-origin Chinook salmon returned. Finally, the Upper Grande Ronde River had an estimated 512 hatchery-origin and 58 natural-origin returns.

In 2024, a sport fishery opened in Lookingglass Creek, resulting in the harvest of 172 hatchery-origin Chinook Salmon. Combined tribal harvest by CTUIR and NPT totaled 364 hatchery-origin and six natural-origin Chinook Salmon. No tribal fisheries occurred on Catherine Creek or the Upper Grande Ronde River. Tribal fishers in the Lostine River harvested 49 hatchery-origin and one natural origin Chinook Salmon.

In the Imnaha River, brood year (BY) 2019 recruits-per-spawner (R:S) ratios were 3.4 for the hatchery program and 0.37 for naturally spawning Chinook Salmon. In the Grande Ronde Basin, R:S ratios for the conventional hatchery program (CHP) component during the same brood year are 3.7 in Catherine Creek, 5.7 in Lookingglass Creek, 8.6 in the Lostine River, and 2.3 in the Upper Grande Ronde River. The natural component R:S values are 0.52 in Catherine Creek, 0.25 in Lookingglass Creek, 0.82 in the Lostine River, and 2.55 in the Upper Grande Ronde River. In the Minam and Wenaha rivers, for BY 2019 R:S ratios are 1.06 and 0.75, respectively.

In the Imnaha River basin, a total of 281 redds and 68 carcasses were recorded in 2024. The proportion of hatchery-origin spawners in nature, including jacks (pHOSij), is 62% while the proportionate natural influence (PNI) is 30%. The estimated pre-spawn mortality in 2024 above the Imnaha River weir is 0% and 28.6% below the weir.

In the Grande Ronde Basin, 749 redds and 501 carcasses were recorded in 2024. Estimated pHOSij values in hatchery-supplemented populations ranged from 65% in the Lostine population to 88% in the Upper Grande Ronde River. Grande Ronde Basin PNI values ranged from 11% to 36%. The percentage of pre-spawn female mortality where ≥ 20 females had egg retention estimates ranged from 0% to 38.5%. In the Minam River, 121 redds and 13 carcasses were recorded. In the Wenaha River, 102 redds and 30 carcasses were recorded. Zero hatchery-origin carcass were recovered in the Minam River. In the Wenaha River, one hatchery-origin carcass from the Lostine Conventional program was recovered during the same period.

Introduction

This annual progress report summarizes spring-summer Chinook Salmon monitoring data collected by the Oregon Department of Fish and Wildlife (ODFW) for the Lower Snake River Compensation Plan (LSRCP) in calendar year 2024. This report documents and evaluates spring-summer Chinook Salmon culture performance for hatchery programs and achievement of management objectives in the Imnaha and Grande Ronde River basins. Included in this report are summaries of the associated broodstock monitoring data collected at weirs in the Grande Ronde Basin operated by co-managers, the Nez Perce Tribe (NPT; Lostine River) and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR; Catherine Creek and Upper Grande Ronde River). The CTUIR and NPT have specific objectives for Chinook returns to Catherine Creek, the Upper Grande Ronde River, Lookingglass Creek, and the Lostine River that are discussed and evaluated in separate reports prepared by each co-management agency. Overall, these data are used to adaptively manage salmon culture practices to optimize egg-to-smolt survival rate, smolt quality, smolt-to-adult survival rate, the recruits-per-spawner (R:S) ratio, and to monitor spawning in nature by hatchery-reared salmon.

This report provides information on rearing and release operations for brood year (BY) 2022 juvenile Chinook Salmon smolts, numbers and characteristics (e.g., age composition) of mature Chinook Salmon in the 2024 return year, the collection of eggs and the BY2024 spawning year at Lookingglass Fish Hatchery (LFH) and in nature, and survival information (e.g., SAR, R:S) for BY2019. These metrics document the success of these programs in meeting the LSRCP goals and objectives for Chinook Salmon returning to the mitigation area above Lower Granite Dam (LGD) and for harvest below LGD. To avoid confusion around whether jacks (age 3) are included with adult metrics, the convention that “adults” refer to ages 4 and 5 and “total” or “mature salmon” include all sexually mature salmon ages 3–5 is used in this report.

Program Goals

The LSRCP hatchery program consisting of hatcheries in Oregon, Washington, and Idaho was developed to compensate for the salmon and steelhead mortality caused by the construction and operation of the four lower Snake River dams. A total estimated loss of 48% of spring- and summer-run Chinook Salmon smolts was attributed to the four lower Snake River dams by applying a 15% smolt mortality rate at each of the four dams (Corps of Engineers 1975). The assumption was that the remaining 52% of adult production would be achieved by naturally spawning Chinook Salmon populations. The expected production loss contributed to dam construction (i.e., 48%) was multiplied by the estimated average return of 122,200 spring/summer Chinook Salmon adults to the Snake River from 1959-1961 (pre-dam construction) to estimate an annual average loss of 58,677 spring and summer Chinook Salmon. The loss estimate became the annual escapement goal of 58,677 spring- and summer-run Chinook Salmon (50,677 spring-run and 8,000 summer-run) to the project area (Herrig 1990).

For Oregon LSRCP hatchery programs in the Grande Ronde and Imnaha basins, age 3-6 Chinook Salmon production and smolt-to-adult return (SAR) compensation area goals represent the required performance to the area above LGD (USFWS 2020). Based on an assumed SAR rate of 0.65%, the total LSRCP mitigation goal for Oregon is 9,070 returning mature hatchery salmon to the compensation area, with hatchery production expected to consist of 3,210 from the Imnaha River Basin and 5,860 from the Grande Ronde Basin (Table 1). The LSRCP smolt production release goals are 900,000 and 490,000 in the Grande Ronde and Imnaha River basins,

respectively (Table 1). Over time, those smolt release goals have varied (Carmichael et al. 2010 a, b; [Feldhaus et al. 2023](#)). Co-managers for the Grande Ronde and Imnaha programs use a $\pm$ 10% threshold to evaluate success in achieving smolt release goals. In the Grande Ronde Basin, current release goals are 150,000 smolts per year for Catherine Creek and 250,000 smolts per year for each of the Lookingglass Creek, Upper Grande Ronde River, and Lostine River populations (Table 2). The Catherine Creek smolt release goal was originally established at 250,000 and then changed in 2006 when co-managers agreed to reduce the goal to 150,000 and shift production to increase releases into Lookingglass Creek.

The total smolt-to-adult survival (SAS) rate goal, which comprises all age 3-6 returns below and above LGD, is 3.25% (Table 2). Additionally, an assumed 4:1 ratio of catch downstream of LGD (commercial catch 3:1 and sport catch 1:1) in the Columbia River System and the Pacific Ocean to above LGD was used to estimate an additional loss of 234,777 mature salmon in the coastwide commercial, tribal, and recreational fisheries downstream of the project area. These combined catch and escapement estimates resulted in total mitigation of 293,454 adults produced annually for the entire LSRCP program. For facilities operated by ODFW, this equates to 45,350 mature hatchery salmon—12,840 from the Imnaha River Basin and 23,440 from the Grande Ronde Basin.

Table 1. Lower Snake River Compensation Plan mitigation goals for Oregon’s spring Chinook Salmon in the Grande Ronde and Imnaha River basins. Adult and survival goals are expressed for returns to the compensation area and total catch plus escapement goals below Lower Granite Dam.

	Grande Ronde Basin	Imnaha Basin
<i>Compensation Area (i.e., above Lower Granite Dam)</i>		
Annual smolt goal	900,000	490,000
Annual production (Lbs.)	45,000	24,500
Annual adult goal	5,820	3,210
Brood year smolt-to-adult return rate	0.65%	0.65%
<i>Total Catch and Escapement below Lower Granite Dam (4:1 harvest objective)</i>		
Annual adult goal	29,100	16,050
Brood year smolt-to-adult survival	3.25%	3.25%

Table 2. Mitigation goals specific to the Grande Ronde and Imnaha River spring/summer Chinook Salmon populations. Adult and survival goals are stated for returns to the compensation area and total catch plus escapement goals below Lower Granite Dam.

	Smolts	Smolt size (fish/lb)	Compensation Area adult returns	SAR (%)	Coastwide harvest objective (4:1)	Total Adults Produced	SAS (%)
Grande Ronde Basin							
Catherine Creek	150,000	20-25	970	0.65	3,880	4,850	3.25
Upper Grande Ronde	250,000	20-25	1,617	0.65	6,468	8,085	3.25
Lookingglass Creek	250,000	20-25	1,617	0.65	6,468	8,085	3.25
Lostine River	250,000	20-25	1,617	0.65	6,468	8,085	3.25
<i>Sub-total</i>	900,000	--	5,821 ^a	--	23,284 ^b	29,105 ^c	--
Imnaha Basin							
Imnaha River	490,000	20-25	3,210	0.65	12,840	16,050	3.25

^a Calculation rounding errors resulted in 5,821 adults instead of the agreed to mitigation goal of 5,820 returns.

^b Due to rounding errors, the calculation produced 23,284 returns, below the LSRCP mitigation goal of $\geq 23,400$.

^c Due to rounding errors, the calculation produced 23,284 returns, below the LSRCP mitigation goal of $\geq 29,100$.

Management Goals and Evaluation objectives

The overall management goals for the LSRCP hatchery programs revolve around the principle that these programs should be operated to meet both mitigation (e.g., adult returns and harvest) and conservation goals (i.e., ensuring population persistence and enhancement). To operate the Oregon hatchery programs, co-managers in the Grande Ronde and Imnaha basins are guided by four primary management goals: recover natural populations, ensure a high probability of population persistence, restore sport and tribal fisheries, and minimize risk of potential negative effects of artificial production. The implementation has been guided by nine priority management objectives:

- 1) Prevent extinction of the Grande Ronde and Imnaha basin salmon populations.
- 2) Establish adequate broodstock to meet annual production needs.
- 3) Establish an annual return to the mitigation area of 5,820 Grande Ronde Basin hatchery spring Chinook and 3,210 Imnaha Basin spring-summer Chinook.
- 4) Provide a demographic foundation to rebuild from after the key limiting factors and threats are addressed.
- 5) Maintain and enhance natural production while maintaining long term fitness.
- 6) Maintain genetic and life history characteristics of the natural population.
- 7) Operate the hatchery program so that the genetic and life history characteristics of hatchery fish mimic wild fish.
- 8) Re-establish historical tribal and recreational fisheries.
- 9) Maintain endemic wild populations of spring Chinook Salmon in the Minam and Wenaha rivers.

A comprehensive research, monitoring, and evaluation (RM&E) program has been underway since 1984. The RM&E objectives are:

- 1) Document and assess fish culture and hatchery operation practices and performance.
- 2) Determine optimum rearing and release strategies

- 3) Determine total catch and escapement, smolt survival, smolt-to-adult survival, and assess if adult production meets mitigation goals
- 4) Compare recruits-per-spawner (R/S) for hatchery and natural origin fish
- 5) Assess response in natural population abundance and productivity (adult R/S, smolts-per-spawner) to supplementation.
- 6) Assess and compare life history characteristics (age structure, run timing, sex ratio, smolt migration, fecundity) of hatchery and natural fish.
- 7) Determine the success of maintaining genetic integrity of endemic wild spring Chinook Salmon in the Minam and Wenaha rivers.
- 8) Assess success in restoring fisheries.
- 9) Coordinate project activities and disseminate results.

Sliding scales

Variably allocating natural and hatchery fish to broodstock, natural production and harvest via a “sliding scale” manages the levels of integration and interaction between hatchery and natural populations. The sliding scale management framework is based on the theory that at low population levels, the greatest risk to population persistence is demographic. At low population levels, fewer constraints are placed on the genetic risks imposed by hatchery program because the short-term goal is population persistence, and the desire is to rapidly boost population levels. As population levels increase, the demographic risks are of less concern, and more constraints are placed on the hatchery program to control potential genetic risks of artificial propagation. For example, when the Grande Ronde Endemic Supplementation Program (GRESPP) program in the Grande Ronde Basin was developed in the 1990’s (Carmichael et al. 2010a), captive broodstock were viewed as higher risk than conventional broodstock so captive broodstock progeny were not used for broodstock.

Each year, managers monitor stock specific in-season run development using PIT tag derived population estimates at mainstem Columbia and Snake River dams in concert with basin-wide weekly coordination meetings to inform sliding scale management. The sliding scale is not used in the upper Grande Ronde River where a very aggressive level of supplementation is applied. Sliding scales for Catherine Creek, the Lostine River, and Imnaha river programs have varying levels of complexity (for example, [ODFW et al. 2020](#), pages 34-36).

Methods

In 2024, spring Chinook Salmon from BY 2022 produced from the Conventional Hatchery Program (CHP) were released into the Imnaha River, Catherine Creek, the Upper Grande Ronde River, Lookingglass Creek, and the Lostine River. Chinook Salmon from complete BY 2019 and partial BYs 2020 – 2021 returned to spawn and some of these returns were collected from each population to use as broodstock to create offspring for BY 2024 CHP production. All Chinook Salmon were reared at LFH. Coded-wire-tag (CWT) recoveries from Chinook Salmon were used to assess the success of achieving mitigation goals and management objectives. Spawning ground surveys were used to assess the number of hatchery and natural Chinook Salmon spawning in nature, to estimate total returns, stray rates of hatchery salmon into wilderness populations, and to evaluate the effectiveness of weirs in managing salmon returns.

Juvenile Disease Monitoring

The ODFW fish health lab routinely monitors disease at LFH. The monitoring plan and disease treatments are outline in Appendix B of the Annual Operating Plan (e.g., [ODFW et al. 2024](#)). Fish health screens each female used in broodstock for *R. salmoninarum* the causative agent for bacterial kidney disease (BKD). To reduce the incidence of BKD in Chinook Salmon offspring, the ODFW Fish Health recommends that eggs from female Chinook Salmon with enzyme-linked immunosorbent assay (ELISA) optical density values ≥ 0.2 should be culled. Significant disease outbreaks and results for egg culling to control for BKD are discussed in subsequent sections of this report.

Escapement Monitoring

Escapement estimation for Catherine Creek, the Imnaha River, Lookingglass Creek, the Lostine River, and the Upper Grande Ronde is comprised of several components. A more complete description of methods used to estimate total escapement is described in [Feldhaus et al. 2017](#) Appendix B. Briefly, weir data is used to enumerate the number and origin (i.e., hatchery or natural) of Chinook removed at each weir or released back into nature. Then, tributary escapement above each weir is derived using the Chapman (1951) modification of the Petersen recapture estimator calculated as:

$$\tilde{N} = \frac{(M + 1)(C + 1)}{R + 1} - 1$$

This estimate is possible because every Chinook passed upstream of a weir is marked in either the left or right opercular plate with a hole punch. On the Chinook spawning ground surveys, surveyors examine each carcass to record the presence or absence of the operculum mark. For each river with a weir, the number of fish passed upstream (M), the number of OP marked carcasses (R) and the number of carcasses found without an OP mark are used to estimate the above weir salmon escapement.

Below weir abundance estimates for each population are determined using an annual spawner/redd estimate multiplied by the total number of redds found below each weir. The above weir spawner/redd estimate is derived from the above weir population estimate adjusted by estimates of pre-spawn survival. The adjusted above weir spawner/redd estimate is then divided by the above weir redd count. Total return to each river is the sum of the above weir estimate, the number of fish removed at each weir (e.g., broodstock, foodbank), the number of fish spawning below each weir, and the estimated number of fish harvested in sport and tribal fisheries. Redds are expanded below the weir by 3.2 fish/red if it is not possible to derive an above weir spanner/redd estimate (note: fish/redd includes jacks).

Spawning Ground Surveys

Spring and Summer Chinook Salmon spawning ground surveys were conducted from early August to mid-September in streams in the Imnaha and Grande Ronde Basin. The spatial extent and temporal timing of Index, Extensive, and Supplemental surveys is structured around methods described in [Tranquilli et al. 2004](#). Surveys were conducted on foot in a downstream direction with one or more surveyors. Stream specific index surveys were scheduled to take place following peak spawning. Extensive area surveys occur on the same day as the index survey and cover nearly all possible Chinook Salmon spawning areas. Supplemental surveys were

completed two or more times at approximately one-week intervals following the index survey in the same locations as the index and extensive areas. Surveys completed prior to the index date are referred to as pre-index surveys.

On each survey, surveyors recorded the number of new redds observed, the number of live Chinook Salmon observed, and the number of Chinook carcasses encountered in each survey section. On each survey, new redds were numbered and marked with colored flagging, and the location of each redd was recorded using a GPS device. Flagging was removed on the last supplemental survey. Data obtained from each carcass encountered included: sex, length, fin marks, degree of spawning (females only), and presence of opercle marks. In addition, approximately 10 scales or the dorsal fin rays were removed from some carcasses for ageing purposes, each carcass is interrogated for a PIT tag code or a CWT. Snouts from each carcass with a CWT are removed from each carcass and individually labeled. To avoid repeat sampling on subsequent surveys, the caudal peduncle of every carcass is severed after sampling.

Pre-spawn Mortalities

Female Chinook Salmon carcasses sampled on the spawning grounds are classified as a pre-spawn mortality (PSM) if $\geq 50\%$ of the eggs were retained and spawned if $< 50\%$ of the eggs were retained. If egg retention for a female carcass was undetermined, it was excluded from PSM calculations. Spawning success for male carcasses is not estimated and assumed that PSM rates for males are the same as females. The PSM rate is calculated by dividing the number of PSM females by the total number of identifiably spawned and unspawned females.

For streams with weirs (i.e., hatchery supplementation programs), PSM rates above and below weirs are estimated separately. If < 20 female are recovered above or below a weir, above and below weir recoveries are combined to calculate a single PSM rate estimate for the stream. For the Wallowa-Lostine populations (i.e., the Lostine River, Bear Creek, Hurricane Creek, and Wallowa River), a combined annual PSM rate estimate was calculated. In the Minam and Wenaha rivers, two wilderness streams in North East Oregon, pre-spawn mortality is assumed to be $\leq 10\%$ due to low female carcass recoveries.

Age composition

All Chinook Salmon (ages 3–5) returning to the Grande Ronde and Imnaha river basins of Northeast Oregon are assigned an age to determine their contribution to each brood year. For a portion of returning salmon, an individual's known age can be determined using CWTs, PIT tags, by determining a genetic age through genetic analysis, or through age analysis of hard structures (e.g., scales, fin rays) to derive an age. Briefly, scales were mounted on gummed cards and acetate impressions were made using a heat press. Scale age was determined by counting the winter annuli and adding one. Dorsal fin rays were dried, cleaned, and placed in an epoxy following methods described by Copeland et al. 2008. After the epoxy is dry, a thin sliver of the fin ray is cut, an image of the cross-section is taken using a digital camera and a microscope, and the number of annuli were counted. Snouts were removed from all adipose fin marked carcasses with a CWT. The recovery and decoding of coded wire tags was conducted by the ODFW CWT Laboratory. After compiling known age data, population specific age-length keys are used to assign individual ages to all fish lacking a known age.

Pre-release sampling

Each year, adipose (AD) fin clip and CWT and mark application success are evaluated by checking 350-550 (depending on mark type) juvenile Chinook Salmon from each raceway at LFH for marking success. Smolts are typically sampled at two different time periods a minimum of 30 days after marking because the ponding plan at LFH resulted in smolts marked with only an Ad clip being mixed with AD CWT-marked smolts. To accurately represent the proportion of smolts marked with an AD CWT, sampling occurs in early October before the AD marked salmon are mixed with the AD CWT-marked salmon. The goal is for each raceway with CWT-marked smolts to receive a unique code, but because of ponding logistics to balance raceway densities, some raceways received multiple CWT codes.

Additionally, length and weight measurements are taken on a random sample of ≥ 150 smolts per raceway prior to release, within approximately one week prior to the final release of each smolt group.

Broodstock collection and hatchery spawning

Adult broodstock collection numbers are determined annually by co-managers during the Annual Operations Plan (AOP) meetings. The ESA section 10 permits numbers which guide broodstock collections are as follows: Upper Grande Ronde River (permit #18033), Catherine Creek (permit #18034), Lookingglass Creek (permit #18035) and Lostine River (permit #18036). Broodstock collection strategies are subject to change in-season depending on run performance. Co-managers use weekly in-season run updates developed between April and July to track return performance of spring and summer Chinook Salmon migrating up the Columbia River, Snake River, and their tributaries using a combination of dam counts, and PIT tag expansions and conversion rates. Ultimately, both pre-season and in-season updates are used to determine fisheries allocations, broodstock collection strategies, and sliding scale management criteria.

The typical spawning practice at LFH is to spawn two males with two females in a 2x2 matrix. At the end of a spawn day other matrices can be used if ripe females are still available. Other common matrices used to spawn Chinook Salmon at LFH are: 3 females x 2 males and 1 female x 2 males. Also, for programs spawned at LFH, males are sometimes live spawned and returned to the holding pond for subsequent spawning events. Occasionally, some live spawned males are returned to their natal river. For all stocks spawned at LFH, the current practice is to use jacks (i.e., age 3 males) the same as adult (i.e., assumed age 4-5) males.

Fecundity

Beginning in 2019, a three-year rolling average of fecundity, egg-to-smolt survival, and in-hatchery pre-spawning mortality rates has been used to determine the number of females needed for collection and spawning to meet egg-take goals for each stock. Prior to 2019, a five-year rolling average was used. The number of males collected is paired with the number of females. Managers adopted this change to better account for annual variation in the size and fecundity of returning females."

Proportion of Natural Origin broodstock (pNOB)

Across all LSRCP hatchery programs, low productivity in nature has created challenges in collecting natural origin broodstock. Repeated use of individual males during hatchery spawning

events can alter the estimated proportion of natural-origin broodstock (pNOB). The pNOB calculations include spawned age 3 males (i.e., jacks), and account for males used multiple times. The observed origin (i.e., hatchery or natural) is based on the best available information for an individual fish at the time it was handled (e.g., presence of a CWT, adipose fin clip, genetic determination, etc). A fish's final origin is subject to change for several months post-spawning because of processing delays in compiling CWT and genetic PBT data.

Proportionate Natural Influence (PNI)

Proportionate natural influence (PNI) is calculated as $PNI = pNOB / (pNOB + pHOS_{ij})$. pNOB is defined as successful age 3-5 spawners at LFH. To calculate pNOB, unmarked hatchery fish using PBT genotype results are corrected, and age 3-5 males spawned multiple times are accounted for. The $pHOS_{ij}$ is the estimated proportion of hatchery origin spawners in nature including jacks.

Juvenile survival to Lower Granite Dam

Smolt migration success is based on survival from release to LGD for all stocks. Annually, 55,000 hatchery smolts are PIT tagged at LFH in October, 5-6 months prior to release. PIT tag detection data stored in the Pacific States PTAGIS database is used to compile release-recapture and travel time information for PIT-tagged smolts from each raceway. For each release group, Cormack-Jolly-Seber survival probabilities (rates) to LGD are determined by using a single release-recapture model. The PTAGIS release site codes and release dates are used to identify smolt releases from each acclimation facility or direct stream release.

Weir operations

The adult salmon weirs in the Grande Ronde and Imnaha basins are operated collaboratively by co-managers for the purpose of hatchery supplementation and distributing fish according to needs and the sliding scale. Typically, fish handled at weirs are either collected for broodstock, released to spawn naturally, recycled to fisheries, or, in the case of hatchery-origin returns, sacrificed and distributed to tribal and state food banks to help limit the number of hatchery fish spawning in the wild. Additionally, weirs enable managers to capture other data on populations such as run timing, return to river estimates, length and age data, and allow managers to mark fish released above weirs for mark recapture analysis. Specifically, weirs enable managers to better compare hatchery and natural runs

For Chinook trapping, the lead agency for the Imnaha River and Lookingglass Creek weir is ODFW. However, the NPT assist with Imnaha trap operations and CTUIR assists with Lookingglass Creek trap operations. The CTUIR operates the Catherine Creek and Upper Grande Ronde weirs (BPA project # [199800703](#)) and the NPT operate the Lostine River weir (BPA project # [199800702](#)).

Notable changes to weir operations have since 2009 are briefly described below.

1. Upper Grande Ronde: In 2010, managers agreed to remove the Upper Grande Ronde weir when the daily maximum water temperature exceeds 68° F (20° C). This decision has led to the weir being removed before the run is complete. Therefore, missing data limits the ability to accurately represent run timing and total returns to the weir site, which may lead to additional errors in escapement estimates.

2. Lookingglass Creek: the main ladder and trap, referred to as the “upper trap”, is upstream of the main hatchery facility, is adjacent to the water intake facility, and remains open throughout the trapping season.
 - A second trap entrance adjacent to LFH called the “lower trap” relies solely on attraction flow to lure fish into the trap. The lower trap operation began in 2018 and is typically opened when tribal fishing seasons have concluded.
 - A new fish ladder and trap was built and installed in 2005
3. Lostine River: permanent hydraulic weir installed in 2010.
4. Imnaha River: A new bridge style weir was installed by LSRCP in the summer of 2015 and was operational for the 2016 return.

Weir efficiency

For each population, weir efficiency is calculated as the number of Chinook Salmon that were trapped at the weir divided by the total number of Chinook that arrived at the weir location. Trapped fish include those that were removed (e.g., broodstock, sacrificed) or passed above the weir to spawn naturally. The number of Chinook that arrived at the weir location is a composite of fish handled plus an estimate of the number that escaped past the weir without being handled. Weir efficiency calculations are typically limited to adult fish which correspond to ≥ 600 mm fork length (FL) on Catherine Creek, the Upper Grande Ronde, and Lookingglass Creek, and ≥ 630 mm FL on the Lostine and Imnaha rivers. Fish below those size criteria are managed as jacks. Managers purposefully limit the number of jacks spawning in nature.

Genetic monitoring

Both CTUIR and NPT are collaborating on Relative Reproductive Success (RRS) studies. Brief summaries for existing projects are summarized below.

- Lookingglass Creek: The CTUIR partnered with CRITFC project 2009-009-00 to evaluate the re-introduction of spring Chinook into Lookingglass Creek. This is a multi-year study to test the presumption that natural origin adults derived from natural spawning of hatchery adults descended from the Catherine Creek captive broodstock hatchery program would demonstrate improved productivity, estimated by comparison within brood years of average juvenile recruits-per-spawner of natural origin versus hatchery origin adults spawning naturally. Progress to date for the genetic study is detailed in (Nuetzel et al. 2021, Nuetzel et al. 2022).
- Catherine Creek: As part of a multi-year project, CTUIR has partnered with NOAA fisheries on a relative reproductive success (RRS) study that spans the entire reintroduction period (i.e, late 1990’s to present). Relevant results are presented in Berntson et al. 2013.
- Lostine River: The NPT partnered with NOAA fisheries to evaluate the Lostine River hatchery program. The RRS study had some setbacks from 2001–2008 due to data integrity issues and several years of relatively low weir capture efficiency. Therefore, inference from the RRS evaluation is limited because only three complete brood years have sufficient data for analysis (Berntson et al. 2020).
- Parentage-based tagging (PBT). The ODFW, NPT, and CTUIR have been collecting genetics samples for Chinook Salmon spawned at LFH to be used in the PBT baseline since 2008 (Steele et al. 2019).

Recruits per spawner

Recruit per spawner (R:S) ratios, sometimes referred to as progeny to parent ratios, are used to compare productivity of fish spawning in nature and at the hatchery. Ratios >1 represent populations exceeding replacement. R:S ratios are reported to StreamNet for naturally spawning populations three different ways: 1) spawner to spawner; 2) return to river: spawner, and 3) smolts: spawner. The spawner-to-spawner ratios differ from return to river ratios because spawners are first adjusted for population specific annual rates of pre-spawn mortality. Return to river is total escapement of salmon to the population before adjusting for pre-spawn mortality. Return to river estimates include salmon permanently removed from the population via harvest, broodstock collection, out planting and food-banking efforts. The spawner-to-spawner estimates represent salmon remaining in the river to spawn after adjusting for pre-spawn mortality.

Calculating mitigation goals

Coded wire tag recoveries

Hatchery salmon from most raceways at LFH were marked with a CWT to provide basic information on survival, harvest, escapement, and straying, as well as specific information on experimental groups, if any. Recovery information for each CWT group was obtained from the Regional Mark Information System (RMIS) CWT recovery database maintained by the Pacific States Marine Fisheries Commission (PSMFC). The CWT recoveries and estimated recovery rates from RMIS are used to estimate harvest and stray rates above and below LGD.

Observed and estimated numbers of hatchery salmon from each CWT group recovered in ocean and Columbia River fisheries, as well as strays collected in and out of the Snake River Basin were compiled. Estimated CWT recoveries in the RMIS database were expanded from observed recoveries based on sampling efficiencies at some recovery locations, but not for recoveries at weirs in the Imnaha and Grande Ronde River basins. Therefore, total CWT-marked hatchery salmon from each code group (observed from weir collections and spawning ground recoveries) returning to the Imnaha River, Upper Grande Ronde River, Lookingglass Creek, Catherine Creek, and Lostine River were estimated based on total escapement to each stream, sampling rate, and the proportion of each cohort marked with CWTs. For some stocks, excess hatchery Chinook Salmon were outplanted to nearby streams. The CWTs for stocks recovered in outplant streams were not considered strays and were included in escapement calculations for the natal stream. Methods to estimate hatchery and natural escapement to the Imnaha River and Grande Ronde Basin streams are described in [Feldhaus et al. 2017](#) Appendix B.

In both the Imnaha and Grande Ronde basins, the exception to the CWT expansion method is when there were no CWT recoveries for a particular brood year, but weir data indicated salmon from that brood year had returned. In these cases, the total number of returning salmon by age class was estimated. If the returning salmon from the brood year were potentially comprised of more than one tag group, the estimated CWT returns into individual code groups based on the relative proportion of tag group recoveries from the previous year's return was partitioned.

Compensation area returns (SAR)

To assess LSRCP success in achieving mitigation goals and management objectives, total numbers of hatchery salmon from each stock are estimated based on those caught in fisheries,

those that escaped to the stream of release, and those that strayed within or outside the Snake River Basin. The return rate to the LSRCP Compensation Area, defined as the Snake River Basin above LGD for programs within the State of Oregon, is determined by summing all estimated escapement above LGD. Estimated returns to the compensation area include the sum of tributary estimates and CWT-derived estimates for salmon recovered above LGD but outside the Grande Ronde and Imnaha basins. For each brood year, the number of age 3–6 returns over LGD is divided by the number of smolts released and multiplied by 100 to calculate a smolt-to-adult return (SAR) rate.

Total catch and escapement (SAS)

Total catch and escapement are the estimated compensation return plus the CWT derived stray and harvest rates below LGD, and ocean harvest. Therefore, the estimated total production for age 3-6 returns is used to define the smolt-to-adult survival (SAS) rate. For each brood year, the total estimated number of age 3-6 salmon divided by the number of smolts released and multiplied by 100 to calculate a smolt-to-adult survival (SAS) rate.

Terminal Fisheries

Planning for fisheries begins with the pre-season run estimates that determine abundance-based sliding scales to set annual fishery impacts. In-season run monitoring of PIT tagged salmon migration upstream over Bonneville and Lower Granite dams and subsequent tributary detection at in-stream interrogation sites allows for stock-specific run-updates.

Overall, sport and recreational fisheries management in the Grande Ronde and Imnaha basins is a collaborative effort between state and tribal co-managers. A complete description of the fisheries management is described in [Bratcher et al. 2016](#). Briefly, co-managers within each basin have a sharing agreement that provides tribal fisheries with a larger portion of the natural origin impacts to reflect the non-selective nature of traditional fishing techniques. Recreational fisheries are provided with a larger portion of the hatchery harvest such that all available impacts (hatchery and natural collectively) are shared equally. Harvest is curtailed when hatchery run size does not exceed the number of adults identified for broodstock and supplementation needs as described by population specific sliding scale management plans for each hatchery program. Surplus is generally defined as the adult hatchery run projection less hatchery adults needed for broodstock.

Results and Discussion

Objective 1. Document and assess fish culture and hatchery operation practices and performance.

2024 Trapping and spawning

Imnaha River

The Imnaha River weir was operated by ODFW Lookingglass Fish Hatchery staff from 17 June 17 to 6 September 2024. After accounting for unmarked hatchery returns, a total of 1,072 hatchery and 246 natural-origin Chinook Salmon were captured (Table 3). Of these, 226 hatchery and 68 natural-origin salmon were retained for broodstock. Thirty-two hatchery-origin salmon were released below the weir, 34 were outplanted to Big Sheep Creek, and 17 were outplanted to Lick Creek. Three hundred and forty-one hatchery-origin and five natural-origin salmon were killed at the weir for stream enrichment in Big Sheep and Lick Creek. Two hundred nine hatchery-origin salmon were distributed to foodbanks and trap mortalities totaled 11 hatchery-origin and five natural-origin fish. The remaining 195 hatchery-origin and 168 natural-origin salmon were passed above the weir. The age composition of hatchery-origin salmon captured at the weir was 42.9% age-3, 54.0% age-4, and 3.1% age-5 fish (Table 3). Natural-origin returns consisted of 8.1% age-3, 84.1% age-4, and 4.4% age-5 fish.

A total of 102 hatchery and 27 natural-origin females were spawned with 113 unique hatchery and 35 unique natural-origin males (Table 4). After accounting for multiple use males, and correcting origins using PBT results, pNOB was 0.37 (Table 5; Figure 1). The PBT data identified three males and one female spawned as natural-origin were unmarked hatchery fish. Spawning operations yielded 498,332 green eggs, with a 7.4% mortality rate through shocking, resulting in 461,420 eyed eggs and a mean fecundity of 3,863 eggs (Table 4). Zero eggs were culled to control for BKD.

Catherine Creek

The Catherine Creek weir was operated by CTUIR from 3 March 3 to 5 August 2024. After adjusting for unmarked hatchery returns, a total of 582 hatchery and 176 natural-origin Chinook Salmon were captured (Table 3). Of these, 75 hatchery and 26 natural-origin salmon were retained for broodstock. A total of 154 hatchery salmon were sacrificed for tribal distribution, 30 hatchery salmon were outplanted to Indian Creek, and three hatchery-origin salmon died in the trap. The remaining 320 hatchery and 150 natural-origin salmon were passed above the weir. The age composition of hatchery-origin salmon captured at the weir was 25.3% age-3, 73.5% age-4, and 0.8% age-5 (Table 3). Natural origin returns were comprised of 6.8% age-3, 92.1% age-4, and 1.1% age-5.

A total of 38 hatchery and 9 natural females were spawned with 32 unique hatchery and 16 unique natural-origin males (Table 4). After accounting for multiple use males, pNOB was 0.37 (Table 5; Figure 1). The PBT data indicated that observational origins determined at spawning for all Chinook Salmon were correct. Spawning operations produced 169,981 green eggs, with a 8.1% mortality rate through shocking. This resulted in 156,166 eyed eggs with a mean fecundity of 3,617 eggs (Table 4). Zero eggs were culled to control for BKD.

Upper Grande Ronde River

The CTUIR operated the Upper Grande Ronde weir from 6 May to 22 June 2024. After adjusting for unmarked hatchery returns, a total of 398 hatchery and 44 natural-origin Chinook Salmon were captured (Table 3). Of these, 172 hatchery and 19 natural origin salmon were retained for broodstock. Fifty-four hatchery-origin salmon were sacrificed for tribal distribution, and one died in the trap. The remaining 171 hatchery-origin and 25 natural-origin salmon were passed above the weir. Age structure of hatchery-origin Chinook Salmon captured at the weir was 16.9% age-3, 82.1% age-4, and 1.0% age-5 (Table 3). Natural-origin age structure was 13.6% age-3, 86.4% age-4, and 0.0% age-5.

Seventy-two hatchery and nine natural females with 89 unique hatchery origin males and nine unique natural origin males were spawned (Table 4). After accounting for multiple use males, and correcting origins using PBT results, pNOB was 0.11 (Table 5; Figure 2). The PBT data indicated that one male and three females spawned as natural origin were unmarked hatchery origin Chinook Salmon. Spawning operations resulted in 259,991 green eggs, with a 6.6% mortality rate at shocking, yielding 242,938 eyed eggs and a mean fecundity of 3,250 eggs (Table 4). Zero eggs were culled to control for BKD.

Lookingglass Creek

The Upper Lookingglass Creek weir was operated from 1 March 1 to 13 September 2024. The Lower Trap was operated from 26 June to 13 September 2024. After adjusting for unmarked hatchery returns, a total of 494 hatchery and 99 naturally produced Chinook Salmon were captured between the two traps (Table 3). Of these, 170 hatchery and 16 natural-origin salmon were kept for Lookingglass broodstock and nine Upper Grande Ronde hatchery swim-ins (i.e., in-basin strays) were retained for Upper Grande Ronde broodstock. A total of 80 hatchery-origin salmon were distributed to foodbanks, and 29 hatchery-origin salmon were killed for stream enrichment. A total of 154 hatchery and 83 natural-origin salmon were passed above the weir. Age structure of hatchery Chinook Salmon captured at the weir was 23.9% age-3, 74.1% age-4, and 2.0% age-5 (Table 3). Natural origin age structure was 12.1% age-3, 87.9% age-4, and 0.0% age-5.

A total of 67 hatchery and seven natural-origin females were spawned with 78 unique hatchery and seven unique natural-origin males (Table 4). After accounting for multiple use males, and correcting origins using PBT results, pNOB was 0.12 (Table 5; Figure 2). The PBT data indicated that one male spawned as natural-origin were unmarked hatchery origin Chinook Salmon. A total of 238,406 green eggs were collected and the mortality rate to shocking was 5.6%. This resulted in 224,940 eyed eggs with a mean fecundity of 3,222 eggs (Table 4). Zero eggs were culled to control for BKD.

Lostine River

The Lostine River Weir was operated by the NPT from 13 June to 2 October 2024. After adjusting for unmarked hatchery returns, a total of 492 hatchery- and 99 natural-origin Chinook Salmon were captured (Table 3). Of these, 113 hatchery and 48 natural-origin salmon were kept for broodstock, and 51 hatchery-origin salmon were sacrificed for tribal distribution. Of the adults collected for broodstock, one hatchery and two natural-origin salmon were returned to the Lostine River unspawned. A total of 142 hatchery-origin salmon were outplanted to the Wallowa River, four from Lower Diamond road and 138 from the Sunrise road bridge.. The remaining 186

hatchery and 237 natural origin salmon were passed above the weir. Age composition of hatchery-origin Chinook Salmon captured at the weir was 25.0% age-3, 70.5% age-4, and 4.5% age-5 (Table 3). Natural origin returns were comprised of 17.5% age-3, 79.6% age-4, and 2.8% age-5.

A total of 47 hatchery and 27 natural-origin females were spawned with 37 unique hatchery and 12 unique natural-origin males (Table 4). After accounting for multiple use males, and correcting origins using PBT results, pNOB was 0.36 (Table 5; Figure 2). The PBT data indicated that one female spawned as natural origin was an unmarked hatchery origin Chinook Salmon. A total of 311,924 green eggs were collected with a 7.6% mortality rate to shocking, resulting in 288,305 eyed eggs and a mean fecundity of 4,215 eggs per female (Table 4). Zero eggs were culled to control for BKD.

3-year average: Fecundity, age structure, and pNOB

Over the last three spawn years (i.e., 2022–2024), an average of 134 Imnaha River females were spawned, with a mean fecundity of 4,865 eggs (Table 4). In the Grande Ronde Basin, the three-year average for the Catherine Creek program, which has a smolt production goal of 150,000 smolts, was 50 females with an average fecundity of 3,512 eggs. The Upper Grande Ronde, Lookingglass Creek, and Lostine River smolt production goal is 250,000. Over the last three years, the average number of spawned females was 79 for the Upper Grande Ronde River, 84 for Lookingglass Creek, and 73 for the Lostine River. The three-year mean fecundities were 3,091, 3,367, and 4,114 for the Upper Grande Ronde, Lookingglass Creek, and Lostine River programs, respectively.

The proportion of age-5 females over the last three years have comprised 0.102, 0.040, 0.021, 0.029, 0.041 of the Imnaha River, Catherine Creek, Upper Grande Ronde, Lookingglass Creek, and Lostine River broodstock, respectively (Figure 2). The low percentage of age-5 females present in the broodstock is concerning because Chinook Salmon fecundity is typically a function of size and age. Larger females tend to produce more eggs; hence older females tend to produce more eggs. Therefore, female fecundity directly affects both hatchery broodstock collection strategies and the number of fish produced in nature. Lower fecundities result in a higher number of females collected at weirs for broodstock to meet smolt release goals and can also impact natural production because the number of eggs per female is directly related to the number of potential offspring. In 2024, ten age-5 females were spawned in the Imnaha River broodstock, two in the Catherine Creek broodstock, and four in each of the Upper Grande Ronde, Lookingglass Creek, and Lostine River broodstock.

After adjusting for males used multiple times and correcting origin with PBT data, Catherine Creek had the highest average proportion of natural-origin broodstock over the past ten years at 0.36, while Lookingglass Creek had the lowest at 0.15 (Figure 1, Table 5). In 2024, pNOB values were 0.27 in the Imnaha River, 0.37 in Catherine Creek, 0.11 in the Upper Grande Ronde River, 0.12 in Lookingglass Creek, and 0.36 in the Lostine River. These low pNOB values indicate that natural-origin Chinook Salmon contributed only a small portion of the broodstock.

Table 3. Numbers and dispositions, by origin, age, and sex of age 3-5 spring Chinook Salmon returning to northeast Oregon in 2024. Numbers of Chinook trapped were adjusted to account errors in origin using genetic and coded-wire-tag data from spawning at Lookingglass Fish Hatchery. Due to errors in identifying sex at time of capture, the numbers of male and female salmon kept for broodstock in the weir data may not match the number reported here. UGR = Upper Grande Ronde; LKG = Lookingglass

Stock Disposition	Hatchery							Natural							Grand Total
	Age 3		Age 4		Age 5		Total	Age 3		Age 4		Age 5		Total	
	M	F	M	F	M	F		M	F	M	F	M	F		
<u>Imnaha River</u>															
Trapped	456	4	300	279	14	19	1,072	20	0	124	83	5	6	246	1,318
Passed above weir	3	3	80	94	7	8	195	27	0	86	50	1	4	168	363
Released below weir	5	0	18	9	0	0	32	0	0	0	0	0	0	0	32
Kept for broodstock ^b	7	0	117	96	4	9	226	1	0	34	27	4	2	68	301
Trap mortality	2	0	4	5	0	0	11	0	0	1	4	0	0	5	16
Foodbank	113	1	49	43	2	1	209	0	0	0	0	0	0	0	209
Stream Enrichment	326	0	11	4	0	0	341	0	0	3	2	0	0	5	346
Outplants	0	0	21	28	1	1	51	0	0	0	0	0	0	0	51
Weir comp. (%)	42.5	0.4	28.0	26.0	1.3	1.8	100	8.1	0.0	50.4	33.7	2.0	2.4	100	
<u>Catherine Creek</u>															
Trapped ^a	147	0	160	268	3	2	582	12	0	82	80	2	0	176	758
Passed above weir	1	0	103	212	2	2	320	10	0	68	71	1	0	150	470
Kept for broodstock ^b	0	0	33	39	1	2	75	2	0	14	9	1	0	26	101
Trap mortality	1	0	1	1	0	0	3	0	0	0	0	0	0	0	3
Foodbank	145	0	9	0	0	0	154	0	0	0	0	0	0	0	154
Outplants	0	0	14	16	0	0	30	0	0	0	0	0	0	0	30
Weir comp. (%)	25.3	0.0	27.5	46.0	0.5	0.3	100	6.8	0.0	46.6	45.5	1.1	0.0	100	
<u>Upper Grande Ronde^c</u>															
Trapped ^a	66	1	112	215	0	4	398	6	0	16	22	0	0	44	442
Passed above weir	5	1	19	145	0	1	171	6	0	6	13	0	0	25	196
Kept for broodstock ^b	8	0	91	70	0	3	172	0	0	10	9	0	0	19	191
Trap mortality	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1
Foodbank	53	0	1	0	0	0	54	0	0	0	0	0	0	0	54
Weir composition (%)	16.6	0.3	28.1	54.0	0.0	1.0	100	13.6	0.0	36.4	50.0	0.0	0.0	100	

Stock Disposition	Hatchery							Natural							Grand Total
	Age 3		Age 4		Age 5		Total	Age 3		Age 4		Age 5		Total	
	M	F	M	F	M	F		M	F	M	F	M	F		
<u>Lookingglass Creek</u>															
Trapped ^a	116	2	164	202	4	6	494	12	0	43	44	0	0	99	593
Passed above weir	2	0	51	98	1	2	154	12	0	35	36	0	0	83	237
Kept for broodstock ^b	11	1	82	73	1	2	170	0	0	8	8	0	0	16	186
UGR Swim-ins ^e	2	0	3	2	1	1	9	0	0	0	0	0	0	0	9
Foodbank	69	0	11	0	0	0	80	0	0	0	0	0	0	0	80
Killed at weir	26	0	1	2	0	0	29	0	0	0	0	0	0	0	29
Weir comp. (%)	23.5	0.4	33.2	40.9	0.8		100	12.1	0.0	43.4	44.4	0.0	0.0	100	
<u>Lostine River^d</u>															
Trapped ^a	123	0	170	177	11	11	492	49	1	128	99	6	2	285	777
Passed above weir	0	0	81	95	5	5	186	49	1	112	69	5	1	237	423
Kept for broodstock ^b	6	0	51	46	4	6	113	0	0	16	30	1	1	48	161
Foodbank	19	0	16	15	1	0	51	0	0	0	0	0	0	0	51
Outplant	98	0	22	21	1	0	142	0	0	0	0	0	0	0	142
Weir comp. (%)	25.0	0.0	34.6	36.0	2.2	2.2	100	17.2	0.4	44.9	34.7	2.1	0.7	100	

^a The number trapped was adjusted to account for final origin, age, and sex structure of Chinook Salmon retained for broodstock.

^b Numbers kept for broodstock were adjusted for origin, age, and sex structure using spawning records from Lookingglass Fish Hatchery.

^c Operated by Confederated Tribes of the Umatilla Indian Reservation (CTUIR). Data provided by Mike McLean (CTUIR).

^d Operated by Nez Perce Tribe (NPT). Data provided by Shane Vatland (NPT). Dispositions represent the final capture event.

^e Lookingglass staff assumes unclipped fish with a wire are from the Upper Grande Ronde stock.

Table 4. Spawning summaries of spring Chinook Salmon from the Conventional Hatchery Programs at Lookingglass Fish Hatchery for the Imnaha and Grande Ronde basins, spawning year 2024.

Stock	Number of parents						Number of green eggs collected	Mean fecundity	Number of eyed eggs	Percent mortality to shocking
	Hatchery			Natural						
	Females		Males ^a	Females		Males ^a				
	Unique	Unique	Multiple ^b	Unique	Unique	Multiple ^b				
Imnaha River	102	113	121	27	35	45	498,332	3,863	461,420	7.4
Catherine Creek	38	32	32	9	16	16	169,981	3,617	156,166	8.1
Upper Grande Ronde River	72	89	91	8	9	9	259,991	3,250	242,938	6.6
Lookingglass Creek	67	78	78	7	7	7	238,406	3,222	224,940	5.6
Lostine River	47	37	51	27	12	29	311,924	4,215	288,305	7.6

^a Male counts include jacks.

^b The number of male parents is greater than the number of unique males that were spawned and the number of unique males kept because some males were spawned more than once.

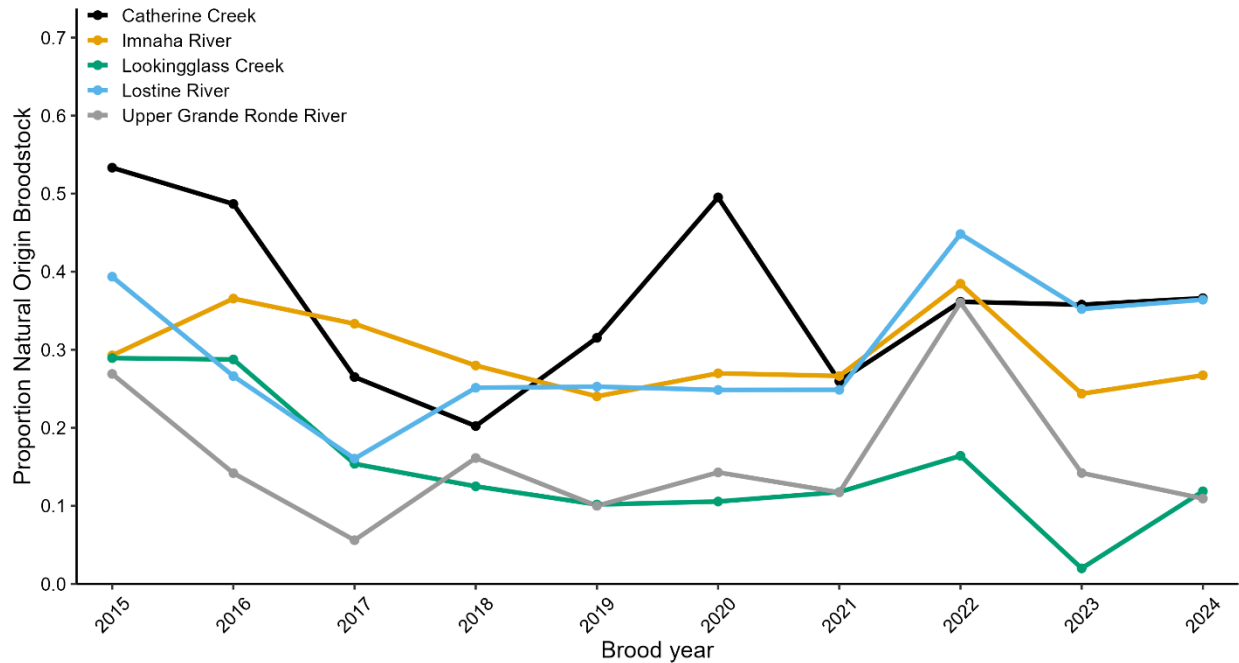


Figure 1. Proportion of natural-origin broodstock in the Catherine Creek, Imnaha River, Lookingglass Creek, Lostine River, and Upper Grande Ronde conventional hatchery programs, brood years 2015-2024.

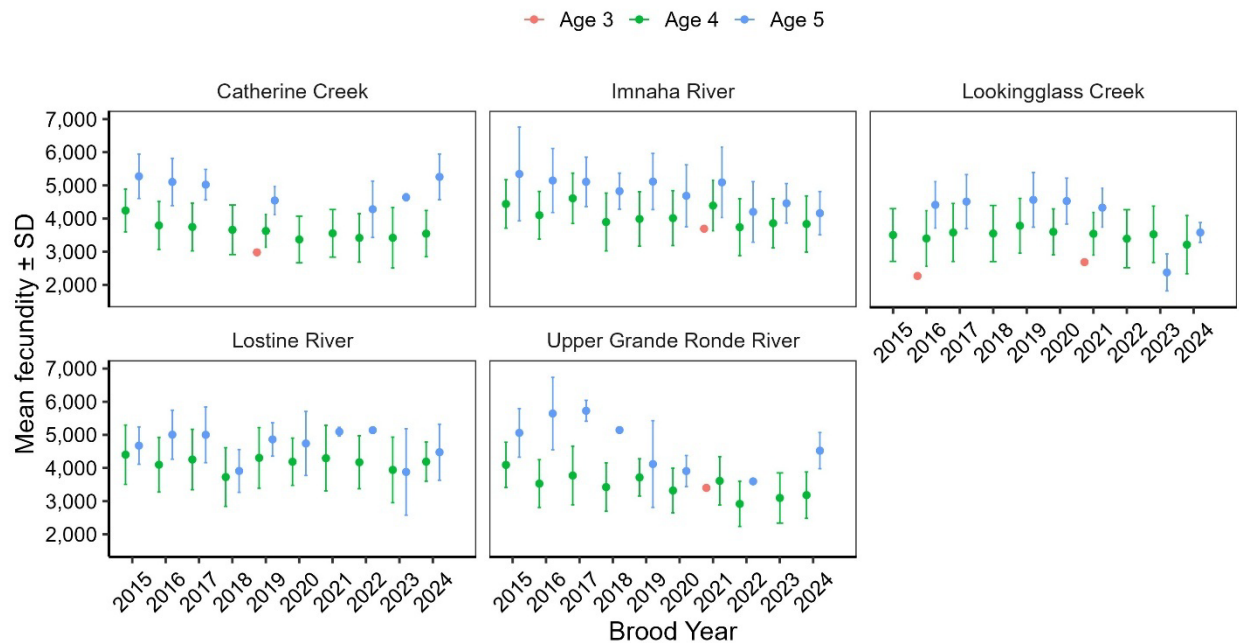


Figure 2. Mean fecundity (± 1 SD) for age 3-5 Chinook Salmon spawned at Lookingglass Fish Hatchery, brood years 2014 to 2024.

Table 5. Numbers of successfully spawned hatchery males (M) and females (F), mean fecundity, and proportion of natural-origin broodstock (pNOB) for conventional production at Lookingglass Fish Hatchery from brood years 2015–2024, by stock: Catherine Creek, Imnaha River, Lookingglass Creek, Lostine River, and Upper Grande Ronde River.

Stock	Brood Year	Hatchery			Natural			pNOB
		M ^a	F	Mean Fecundity	M ^a	F	Mean Fecundity	
<u>Catherine Creek</u>	2015	30	33	4,309	52	20	4,545	0.53
	2016	23	16	3,980	15	22	4,075	0.49
	2017	27	34	3,912	11	11	3,698	0.27
	2018	34	37	3,756	9	9	3,260	0.20
	2019	43	33	3,661	24	11	3,629	0.32
	2020	25	28	3,261	25	27	3,480	0.50
	2021	47	47	3,530	21	12	3,656	0.26
	2022	41	42	3,510	32	15	3,270	0.36
	2023	36	34	3,478	26	13	3,453	0.36
	<u>2024</u>	<u>33</u>	<u>38</u>	<u>3,691</u>	<u>32</u>	<u>9</u>	<u>3,303</u>	<u>0.37</u>
	Average	34	34	3,709	25	15	3,637	0.36
<u>Imnaha River</u>	2015	143	101	4,471	67	34	4,827	0.29
	2016	107	96	4,196	78	39	4,511	0.37
	2017	112	94	4,786	66	37	4,636	0.33
	2018	126	85	3,958	54	28	4,075	0.28
	2019	181	113	4,089	67	26	4,546	0.24
	2020	119	111	4,047	61	24	4,134	0.27
	2021	127	107	4,417	57	28	4,591	0.27
	2022	101	99	3,772	87	38	3,716	0.38
	2023	136	103	3,909	45	32	4,187	0.24
	<u>2024</u>	<u>131</u>	<u>102</u>	<u>3,851</u>	<u>58</u>	<u>27</u>	<u>3,910</u>	<u>0.27</u>
	Average	128	101	4,149	64	31	4,313	0.29
<u>Upper Grande Ronde R</u>	2015	78	66	4,120	34	19	4,567	0.27
	2016	71	62	3,698	15	7	3,850	0.14
	2017	67	68	3,831	4	4	4,263	0.06
	2018	60	70	3,471	18	7	3,201	0.16
	2019	91	71	3,737	15	3	4,046	0.10
	2020	65	73	3,423	14	9	2,828	0.14
	2021	66	77	3,617	12	7	3,515	0.12
	2022	46	64	2,878	47	15	3,129	0.36
	2023	96	67	3,144	17	10	2,743	0.14
	<u>2024</u>	<u>99</u>	<u>72</u>	<u>3,308</u>	<u>13</u>	<u>8</u>	<u>2,723</u>	<u>0.11</u>
	Average	74	69	3,523	19	9	3,486	0.16
<u>Lookingglass Creek</u>	2015	92	48	3,450	30	27	3,599	0.29
	2016	53	56	3,449	23	21	3,794	0.29
	2017	39	38	3,601	7	7	4,393	0.15
	2018	69	71	3,570	11	9	3,384	0.13
	2019	90	69	3,914	11	7	3,837	0.10
	2020	87	74	3,641	14	5	3,908	0.11

Stock	Brood Year	Hatchery			Natural			pNOB
		M ^a	F	Mean Fecundity	M ^a	F	Mean Fecundity	
	2021	87	78	3,540	16	6	3,682	0.12
	2022	89	74	3,335	22	10	3,824	0.16
	2023	106	91	3,523	1	3	2,426	0.02
	<u>2024</u>	<u>89</u>	<u>67</u>	<u>3,214</u>	<u>14</u>	<u>7</u>	<u>3,293</u>	<u>0.12</u>
	Average	80	67	3,524	15	10	3,614	0.15
<u>Lostine River</u>	2015	67	47	4,499	49	25	4,283	0.39
	2016	81	54	4,281	29	20	4,426	0.27
	2017	73	63	4,344	15	11	4,771	0.16
	2018	81	59	3,796	33	14	3,465	0.25
	2019	78	58	4,468	31	15	4,649	0.25
	2020	72	55	4,437	24	18	3,982	0.25
	2021	79	63	4,323	36	11	4,289	0.25
	2022	55	41	4,091	46	32	4,309	0.45
	2023	55	48	3,893	31	25	4,028	0.35
	<u>2024</u>	<u>56</u>	<u>47</u>	<u>4,335</u>	<u>32</u>	<u>27</u>	<u>4,007</u>	<u>0.36</u>
	Average	70	54	4,247	33	20	4,221	0.30

^a Totals account for age 3-5 live spawned males used multiple times.

Genetic monitoring

During each hatchery spawning event, individual Chinook Salmon are classified as hatchery or natural origin based on fin clips (e.g., adipose clips) or the presence of a CWT. The PBT data provided by the Eagle Fish Genetics Lab was used to verify and correct origin, quantify the number of broodstock that were successfully genotyped, derive genetic ages, and look for hatchery strays that were not identified using CWT data. The term observational origin is used to reference individual Chinook Salmon that were classified as hatchery- or natural-origin using CWT and fin clip information (i.e., origin was not corrected using genetic data). In the classification criteria, local broodstock refers to individuals within a stock that are genetically matched to parents from the same stock. Individuals that do not match parents in the baseline are assumed to be from the same stock or river in which they were collected (i.e., local broodstock).

For uniquely spawned Chinook Salmon at LFH in 2024, genotyping rates for fish observationally identified as hatchery-origin varied among stocks and years. Among salmon observationally identified as hatchery-origin and spawned at LFH, >91% of the Catherine Creek stock, >87% of the Imnaha stock, >81% of the Lookingglass Creek stock, >76% of the Lostine River stock, and >94% of the Upper Grande Ronde River stock were genetically assigned to the weir where their parents were collected (Figure 3). For fish observationally identified as natural-origin, PBT data revealed 10 were hatchery origin. Misidentifications by stock included: Catherine Creek (0), Imnaha River (4), Lookingglass Creek (1), Lostine River (1), and Upper Grande Ronde River (4) (Figure 3).

Overall, genetic data provided ages and origin for 615 individuals, compared to 354 ages obtained from CWT codes. PBT results also identified stocks for hatchery fish lacking CWTs and revealed out-of-stock and out-of-basin strays in several (Table 6; Figure 3). In the Catherine Creek broodstock, one Grande Ronde River stock salmon was identified. In the Imnaha River broodstock, 12 out-of-basin fish from Idaho's Rapid River stock and one Lookingglass Creek

salmon were detected. The Lookingglass Creek broodstock included three Catherine Creek salmon. One Imnaha River salmon was spawned in the Upper Grande Ronde River stock.

One explanation for variation in genotyping rates is that some males are used in multiple spawn events (i.e., live-spawned), but a genetic sample is not collected each time. If the original genetic sample for a male is lost or fails to genotype successfully, all male–female cross information for that fish is lost for every spawn event in which it was used. To improve genotyping success, one proposed solution is to collect a genetic sample each time a male is spawned. Another proposed solution is marking live spawned males with a PIT tag, taking the genetic sample the first time the fish is spawned, and using the unique PIT tag value to identify subsequent spawn events for that individual. Another factor affecting our ability to identify stock or origin is that if a fish is natural origin or from an unsampled hatchery parent, PBT data cannot determine its stock or origin. Known PBT origins can only be assigned to fish whose parents were sampled at a hatchery during spawning and whose genetic samples were successfully processed by the genetics lab.

Table 6. The genetic stock assignment for hatchery Chinook Salmon used for broodstock at Lookingglass Fish Hatchery for spawn year 2024. GRUW = Upper Grande Ronde stock, LSTW = Lostine River stock, IMNW = Imnaha stock, CTHW = Catherine Creek stock, LKGW = Lookingglass Creek stock.

Stock	Genetic Stock	Hatchery		Natural	
		Female	Male	Female	Male
<u>Imnaha River</u>	Local Broodstock	92	100	0	0
	No PBT Assigned	0	10	27	35
	Idaho: Stray	9	3	0	0
	<u>LKGW</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>
	sub-total	102	113	27	35
<u>Catherine Creek</u>	Local Broodstock	37	27	0	0
	Not assigned	1	4	9	16
	<u>GRUW</u>	<u>0</u>	<u>1</u>	<u>0</u>	<u>0</u>
	sub-total	38	32	9	16
<u>Lookingglass Creek</u>	Local Broodstock	58	60	0	0
	No PBT assigned	7	17	7	7
	<u>CTHW</u>	<u>2</u>	<u>1</u>	<u>0</u>	<u>0</u>
	sub-total	67	78	7	7
<u>Lostine River</u>	Local Brood	45	26	0	0
	<u>Not assigned</u>	<u>2</u>	<u>11</u>	<u>27</u>	<u>12</u>
	sub-total	47	37	27	12
<u>Upper Grande Ronde R.</u>	Local Broodstock	72	80	0	0
	No PBT assigned	0	8	8	9
	<u>IMNW</u>	<u>0</u>	<u>1</u>	<u>0</u>	<u>0</u>
	sub-total	72	89	8	9

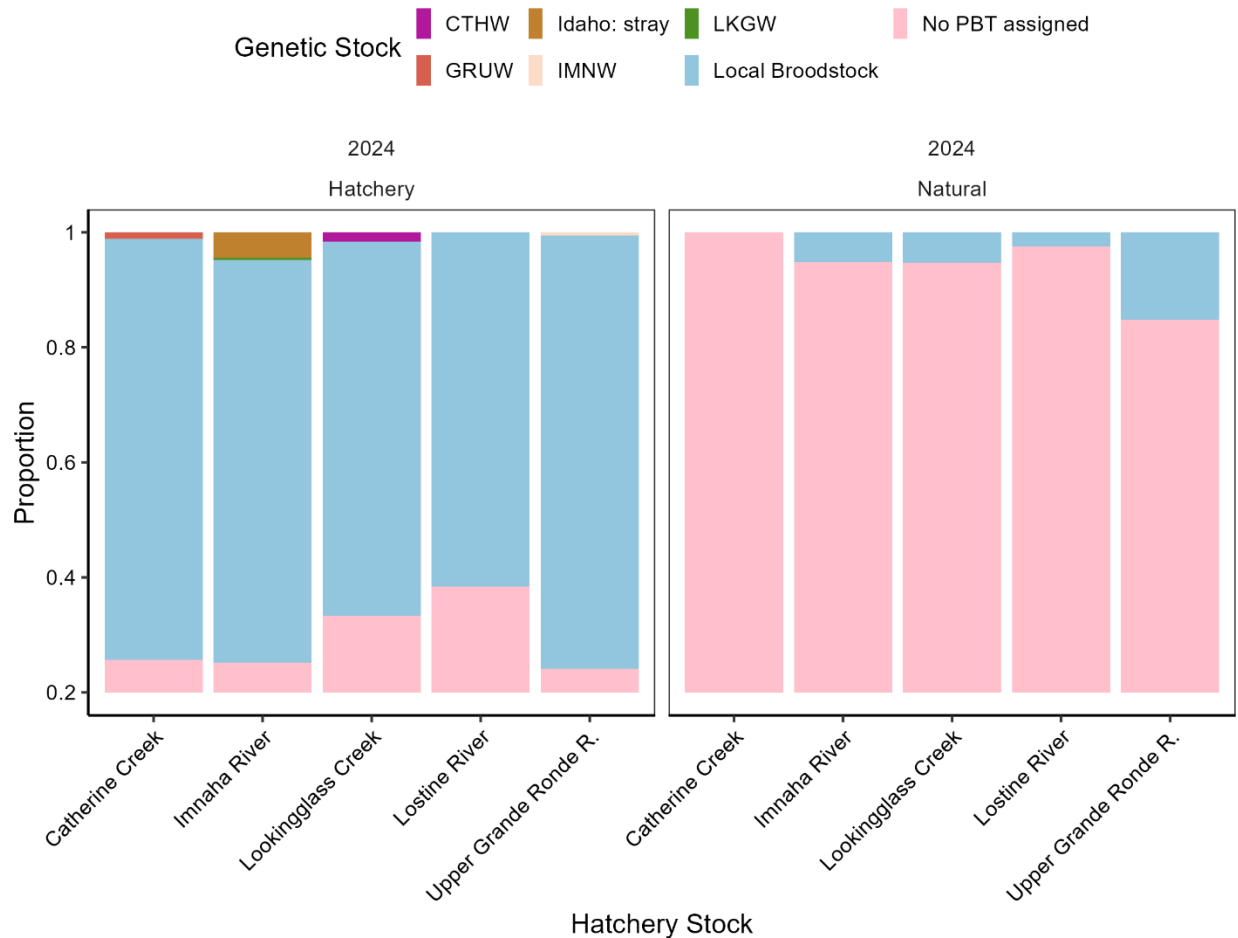


Figure 3. Broodstock at Lookingglass Fish Hatchery and the proportion of parentage-based tagging (PBT) stock assignments, spawn year 2024. Each panel reports observational origin and colors within each stock represent known origins corrected using PBT results. Abbreviations: CTHW = Catherine Creek, GRUW = Upper Grande Ronde River, IMNW = Imnaha River, LKGW = Lookingglass Creek, LSTW = Lostine River.

Green egg-to-smolt and marking

Over the last 10 complete brood years, green egg-to-smolt survival rates for hatchery Chinook Salmon at LFH were generally above 70% (Figure 4). Green egg-to-eyed egg and eyed egg-to-smolt calculations can exceed 100% due to accounting errors in the hatchery.

The green egg-to-smolt survival rate for BY 2022 Imnaha River smolts released in 2024 was 76.0% (93.2% green egg-to-eyed egg; 81.6% eyed egg-to-smolt; Table 7, Figure 4). Green egg-to-smolt survival rate for Catherine Creek was 83.4% (93.0% green egg-to-eyed egg; 89.7% eyed egg-to-smolt). For the Upper Grande Ronde River, the green egg-to-smolt survival rate was 111.3% (95.2% green egg-to-eyed egg; 116.9% eyed egg-to-smolt). For Lookingglass Creek, the green egg-to-smolt survival rate was 96.7% (94.8% green egg-to-eyed egg; 102.0% eyed egg-to-smolt). For Lostine River smolts, the green egg-to-smolt survival rate was 91.6% (94.5% green egg-to-eyed egg; 97.0% eyed egg-to-smolt). Green egg-to-smolt survival rates can exceed 100% when errors occur during green/eyed-egg counting and cannot be adjusted after the fact.

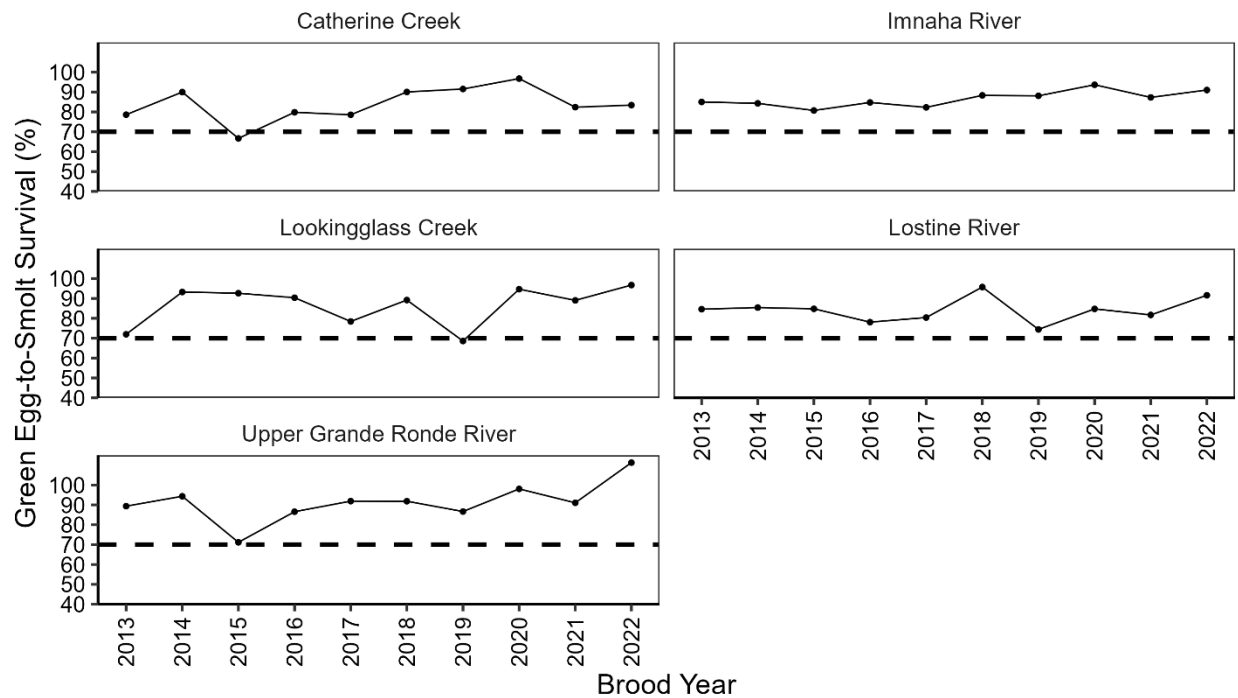


Figure 4. Green egg-to-smolt survival rates (%) for conventionally produced Chinook Salmon at Lookingglass Fish Hatchery, brood years 2013-2022. The dashed line is the green egg-to-smolt survival rate goal of 70%.

Table 7. Conventional hatchery production summaries for BY 2022 juvenile spring Chinook Salmon released into the Imnaha and Grande Ronde River basins, 2024.

Stock	Females spawned	Green eggs taken	Eyed eggs ^a	Eggs culled ^b	Percent Survival			Parr released	Total smolts released
					Green egg-to-eyed egg	Eyed egg-to-smolt ^b	Green egg-to-smolt ^b		
Imnaha River ^c	145	514,608	479,529	0	93.2	97.7	91.0	0	391,234
Catherine Creek	57	196,486	182,669	0	93.0	89.7	83.4	0	163,921
Upper Grande Ronde R. ^d	78	231,147	217,282	2,842	95.2	116.9	111.3	0	254,004
Lookingglass Creek ^d	84	285,016	269,462	877	94.8	102.0	96.7	0	274,868
<u>Lostine River</u>	72	282,233	266,622	0	94.5	97.0	91.6	0	258,556
Total/Means	436	1,509,490	1,415,564	3,719	94.1	100.7	94.8		1,419,756

^a Includes all eggs (embryos) that eyed up, even if culled, released, or transferred later.

^b Eggs were culled if enzyme-linked immunosorbent assay (ELISA) levels of female broodstock were > 0.2. Embryos culled from production, released as eyed eggs, transferred to another facility, and/or parr released or transferred, were not used in calculating green egg-to-smolt and eyed egg-to-smolt survival.

^d 77,173 smolts from the Imnaha River stock were accidentally released into Lookingglass Creek when a fish liberation truck tipped while leaving Lookingglass Fish Hatchery on 3/29/2024. 391,234 smolts were released into the Imnaha River.

^d Green egg-to-eyed egg and eyed egg-to-smolt calculations can exceed 100% due to accounting errors in the hatchery.

Table 8. The number of raceways, the Annual Operating Plan (AOP) coded-wire tag (CWT) marking objectives and estimates of percent adipose (AD) clip and CWT application success, brood year 2022.

Stock	Number of Raceways	AOP CWT marking obj.	% AD clip, with CWT	% AD clip, no CWT	% CWT, no AD clip	% no CWT, no AD clip	Total smolts released	Smolt release goal	% of goal
Imnaha River	6	245,000	45.5	52.7	0.5	1.2	391,234	490,000	79.8
Imnaha River ^a	2	245,000	56.6	42.3	0.2	0.9	77,173	NA	NA
Catherine Creek	2	100,000	58.9	41.1	0	0	163,921	150,000	109.3
Upper Grande Ronde R.	4	250,000	52.3	1	44	2.6	254,004	250,000	101.6
Lookingglass Creek	6 ^b	120,000	44.3	55.2	0.2	0.3	274,868	250,000	109.9
Lostine River	4	126,000	49.2	50.6	0	0.1	258,556	250,000	103.4
Total	24 ^a	841,000					1,342,583	1,390,000	96.6

^a 77,173 smolts from the Imnaha River stock were accidentally released into Lookingglass Creek when a fish liberation truck tipped while leaving Lookingglass Fish Hatchery on 3/29/2024. 391,234 smolts were released into the Imnaha River.

^b There are 18 traditional raceways at Lookingglass Fish Hatchery. Lookingglass Creek stock Chinook smolts were reared in two traditional raceway and four of the Adult Holding Ponds which were previously modified for smolt rearing.

Objective 2. Determine optimum rearing and release strategies

Production tagging and smolt releases

Hatchery-origin smolts reared at LFH are marked with an adipose fin clip (AD), a coded-wire tag (CWT), or both (AD CWT). Marking strategies vary by stock: all smolts except those from the Upper Grande Ronde are 100% AD-clipped, while Upper Grande Ronde smolts are 50% AD-clipped but 100% CWT-marked.

Smolts are reared at LFH and transported in late March or early April to acclimation facilities on Catherine Creek, the Upper Grande Ronde River, the Lostine River, and the Imnaha River, where they are released after acclimation using either volitional or forced methods. Lookingglass Creek smolts are released directly from LFH at rkm 3.7. The target smolt release size is 20–25 fish/lb (18–23 g), a standard established after evaluations in the 1990s found no differences in survival or straying between smaller (18–23 g) and larger (30–38 g) Imnaha smolts (Feldhaus et al. 2016).

Catherine Creek

The annual release goal for Catherine Creek is 150,000 smolts ($\pm 10\%$), with all fish AD-fin-clipped and a goal of marking 67% with a CWT. For brood year 2022, 163,921 smolts were released, achieving 109.3% of the production goal (Table 8; Table 9; Figure 6). Smolts were reared in two raceways at LFH, with each raceway assigned a unique CWT code. The Catherine Creek stock has a single acclimated release date each year. Smolts were transferred to acclimation on 10 April and released on 24 April (Table 9).

58.9% of released smolts were marked with both an AD clip and a CWT, 41.1% were AD-clipped only, 0.0% received a CWT without an AD clip, and 0.0% were unmarked (Table 8). Overall, 100% of Catherine Creek smolts were identifiable as hatchery origin. The average travel time to LGD was 19 days, with a median arrival date of 11 May, and the mean smolt survival was 42.6%, ranging from 42.4% to 42.8% (Table 9; Figure 8; Figure 9).

Imnaha River

The annual smolt release goal into the Imnaha River is 490,000 smolts ($\pm 10\%$), with all fish AD fin clipped and a goal to mark 50% with a CWT. For brood year 2022, 391,234 smolts were released into the Imnaha River, achieving 79.8% of the smolt production goal (Table 8; Figure 6). While leaving LFH on 29 March 2024, a liberation truck transporting 102,702 Imnaha River smolts crashed into Lookingglass Creek. Of these smolts, 25,529 were recovered as mortalities, and 77,173 were un-accounted for and presumed to have made it to Lookingglass Creek. Smolts were reared in six raceways at LFH, with four raceways assigned a unique CWT code. For BY's 2010–2020, annual smolt releases consisted of both acclimated and direct stream releases. Beginning BY 2021, managers shifted to using two acclimated releases. The BY2022 smolts were transferred to acclimation ponds on 29 March and 5 April and released on 4 and 10 May, respectively (Table 9).

Of the smolts released, 45.5% were ADCWT-marked, 52.7% were AD-clipped only, 0.5% received a CWT without an AD clip, and 1.2% were unmarked (Table 8). Overall, 98.7% of the Imnaha River smolts were identifiable as hatchery origin. Mean smolt survival to LGD was 51.6% and ranged from 44.2% to 60.8%, average travel time to LGD was 24 days with a median arrival date of 30 April (Table 9; Figure 8; Figure 9).

Upper Grande Ronde River

The annual smolt release goal for the Upper Grande Ronde River (UGR) program is 250,000 smolts ($\pm 10\%$), with 50% AD fin-clipped and all fish coded-wire-tagged (CWT). For brood year 2022, 254,004 smolts were released, achieving 101.6% of the production goal (Table 8; Figure 6). Smolts were reared in four raceways at LFH, with each raceway assigned a unique CWT code.

The Upper Grande Ronde stock has two acclimation periods and corresponding release dates. Transfers to acclimation occurred on 10 April and 23 April. The first group was released on 22 April, and the second group on 24 April.

Of the smolts released, 52.3% were marked with both an AD clip and a CWT, 1.0% were AD-clipped only, 44.0% received a CWT without an AD clip, and 2.6% were unmarked. Overall, 97.3% of smolts released into the Upper Grande Ronde River were identifiable as hatchery origin. Mean smolt survival to LGD was 47.8% and ranged from 36.0% to 63.0%, the average travel time to LGD was 21 days with a median arrival date of 12 May (Table 9; Figures 8 and 9).

Lookingglass Creek

The annual smolt release goal into Lookingglass Creek is 250,000 smolts ($\pm 10\%$), with 100% AD fin-clipped and a goal to CWT mark 48%. For brood year 2022, 274,868 smolts destined for Lookingglass Creek were released, achieving 99.7% of the smolt production goal (Table 8; Figure 6). The 77,173 Imnaha River smolts accidentally released into Lookingglass Creek are not included in this metric. One standard raceway and the four adult holding ponds were utilized, and two unique CWT codes were used to identify smolts. The Lookingglass Creek stock has one release date each year. Smolts were volitionally released from LFH between 1–15 April.

Of the Lookingglass Creek smolts released, 44.3% were ADCWT-marked, 55.2% were AD-clipped only, 0.2% received only a CWT, and 0.3% were released unmarked (Table 8). We estimated that 56.6% of the Imnaha River smolts accidentally released into Lookingglass Creek were ADCWT-marked, 42.3% were AD-clipped only, 0.2% received only a CWT, and 0.9% were released unmarked. Overall, 99.7% of the Lookingglass Creek smolts released in Lookingglass Creek and 99.1% of the Imnaha River smolts from the accidental release were identifiable as hatchery origin. For Lookingglass Creek smolts, the average travel time to LGD was 31 days, with a median arrival date of 30 April, and the mean smolt survival was 56.0%, ranging from 35.7% to 79.2%. (Table 9; Figure 8; Figure 9). The Imnaha River smolts accidentally released into Lookingglass, had an average travel time to LGD of 27 days, with a median arrival date of 27 April, and a mean smolt survival of 26.6%.

Lostine River

The annual smolt release goal for Lostine River is 250,000 smolts ($\pm 10\%$), with 100% AD fin clipped, and a goal to mark 50% of the releases with a CWT. For brood year 2022, 258,556 smolts were released, achieving 103.4% of the smolt production goals (Table 8; Figure 6). Smolts were raised in four raceways at LFH, with two unique CWT codes.

The Lostine River stock has two acclimation periods and corresponding release dates. Each release group received a unique CWT code (Table 9). Transfers to acclimation occurred on 21 March and 12 April. Release dates for the first transfer occurred from 10 - 12 April, and from 12 - 23 April for the second transfer.

Overall, 49.2% of released smolts were marked with both an AD clip and a CWT, 50.6% were AD-clipped only, 0.0% received a CWT without an AD clip, and 0.1% were unmarked (Table 8). Overall, 99.8% of Lostine River smolts were identifiable as hatchery origin. The average travel time to LGD was 20 days, with a median arrival date of 9 May, and the mean smolt survival was 46.0%, ranging from 43.0% to 48.6% (Table 9; Figure 8; Figure 9).

Table 9. Last release date, pre-release sampling date, mean size, total number of coded-wire-tagged smolts and total number of smolts, number PIT-tagged, and percent survival rate to Lower Granite Dam of BY 2022 spring Chinook Salmon smolts released into the Imnaha and Grande Ronde River basins, 2024. NA = Not applicable.

Imnaha and Grande Ronde River basins, 2022 WY - Not applicable.											
Stock		Last release	Size sample	Fork Length		Weight (SD)		Total CWT	Total smolts	Number PIT	Survival Rate
CWT code	Raceway	date	date	(mm)				smolts released	released	tagged	to Lower Granite Dam
				Mean	SD	Mean	SD				
<u>Imnaha River</u>											
092270	09	04/11/2024	03/26/2024	116.28	9.57	19.36	5.75	58,054	64,102	2,981	60.8%
092269	10	04/11/2024	03/26/2024	116.78	8.13	18.09	4.43	62,396	67,890	2,894	44.2%
092268	11	04/05/2024	03/18/2024	113.39	8.36	18.15	4.05	59,731	64,504	2,992	57.0%
Ad only	06	04/05/2024	03/18/2024	108.66	8.87	15.35	4.04	0	77,884	2,963	55.7%
Ad only	07	04/05/2024	03/18/2024	108.21	8.77	15.86	4.41	0	39,940	609	43.6%
Ad only	08	<u>04/11/2024</u>	<u>03/26/2024</u>	<u>112.52</u>	<u>9.99</u>	<u>16.64</u>	<u>4.76</u>	<u>0</u>	<u>76,914</u>	<u>2,950</u>	<u>48.1%</u>
Totals/Means:								180,181	391,234	15,389	51.6%
<u>Imnaha River in Lookingglass</u>											
Ad only	07	03/29/2024	03/18/2024	108.21	8.78	15.86	4.41	0	28,661	2,307	28.4%
<u>092267</u>	<u>12</u>	<u>03/29/2024</u>	<u>03/18/2024</u>	<u>111.33</u>	<u>9.73</u>	<u>16.54</u>	<u>4.60</u>	<u>43,836</u>	<u>48,512</u>	<u>2,724</u>	<u>24.7%</u>
Totals/Means								43,836	77,173	5,031	26.6%
<u>Catherine Creek</u>											
092194	13	04/24/2024	04/8/2024	114.24	11.08	20.04	5.16	50,123	82,522	10,404	42.8%
<u>092193</u>	14	<u>04/24/2024</u>	<u>04/8/2024</u>	<u>114.71</u>	<u>10.15</u>	<u>18.42</u>	<u>5.69</u>	<u>46,495</u>	<u>81,399</u>	<u>10,417</u>	<u>42.4%</u>
Totals/Means								96,618	163,921	20,821	42.6%
<u>Upper Grand Ronde R.</u>											
092198	15	04/24/2024	04/11/2024	116.85	7.63	21.16	4.16	67,082	67,216	499	36.0%
092197	16	04/24/2024	04/11/2024	115.08	9.49	18.14	4.96	65,910	68,386	497	43.7%
092196	17	04/22/2024	04/08/2024	116.59	12.57	21.11	7.42	54,953	57,790	500	63.0%
<u>092195</u>	<u>18</u>	<u>04/22/2024</u>	<u>04/08/2024</u>	<u>114.22</u>	<u>12.89</u>	<u>19.74</u>	<u>5.43</u>	<u>56,723</u>	<u>60,612</u>	<u>499</u>	<u>48.3%</u>
Totals/Means								244,668	254,004	1,995	47.8%

Stock CWT code	Raceway	Last release date	Size sample date	Fork Length (mm)		Weight (SD)		Total CWT smolts released	Total smolts released	Number PIT tagged	Survival Rate to Lower Granite Dam
				Mean	SD	Mean	SD				
<u>Lookingglass Creek</u>											
092266	01	04/15/2024	03/26/2024	113.30	7.06	17.35	3.62	41,142	85,443	1598	57.0%
092266	AHPD ^b	04/15/2024	03/26/2024	117.5	6.21	18.36	3.57	21,876	47484	899	79.2%
092265	AHPA ^b	04/15/2024	03/26/2024	117.07	9.75	19.54	5.54	19,764	47,352	800	35.7%
092265	AHPB ^b	04/15/2024	03/26/2024	114.95	8.09	18.72	4.38	19,767	47,385	899	50.5%
092265	AHPC ^b	04/15/2024	03/26/2024	115.04	8.77	19.77	4.76	19,695	47,204	797	57.8%
Totals/Means								122,244	274,868	4,993	56.0%
<u>Lostine River</u>											
092264	02	04/10/2024	03/18/2024	108.84	10.10	15.47	4.67	10,754	64,966	1,493	44.2%
092264	03	04/10/2024	03/18/2024	109.92	6.80	16.43	3.70	52,100	63,236	1,496	43.0%
092199	04	04/23/2024	04/08/2024	118.87	8.92	20.61	5.05	10,449	65,651	1,499	48.6%
092199	05	04/23/2024	04/08/2024	114.49	8.63	17.47	3.91	53,956	64,703	1,598	48.3%
Total/Means								127,259	258,556	6,086	46.0%

^a Direct Stream Release

^b Indicates Adult holding pond at Lookingglass Fish Hatchery

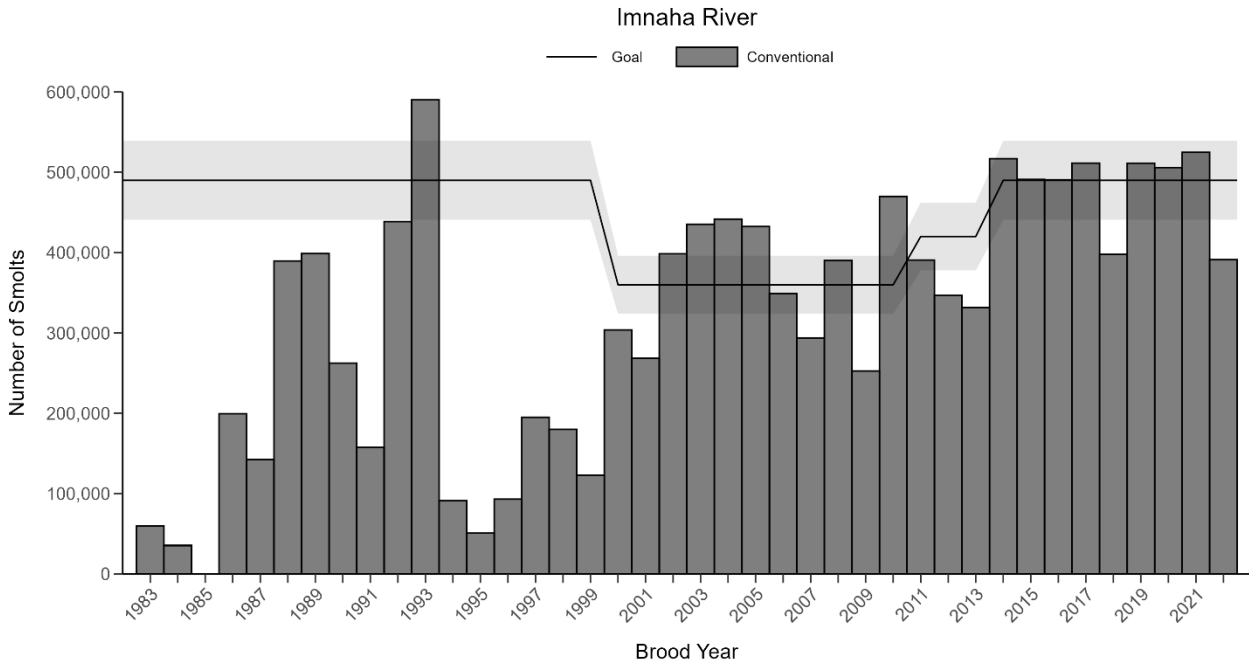


Figure 5. Hatchery spring Chinook Salmon smolt releases in the Imnaha River, 1983-2021 brood years. The shaded region around the smolt goal is $\pm 10\%$. Smolt release goals were 490,000 (BYs 1983-1999 and 2014-present), 360,000 (BYs 2000-2010), and 420,000 (BYs 2011-2013).

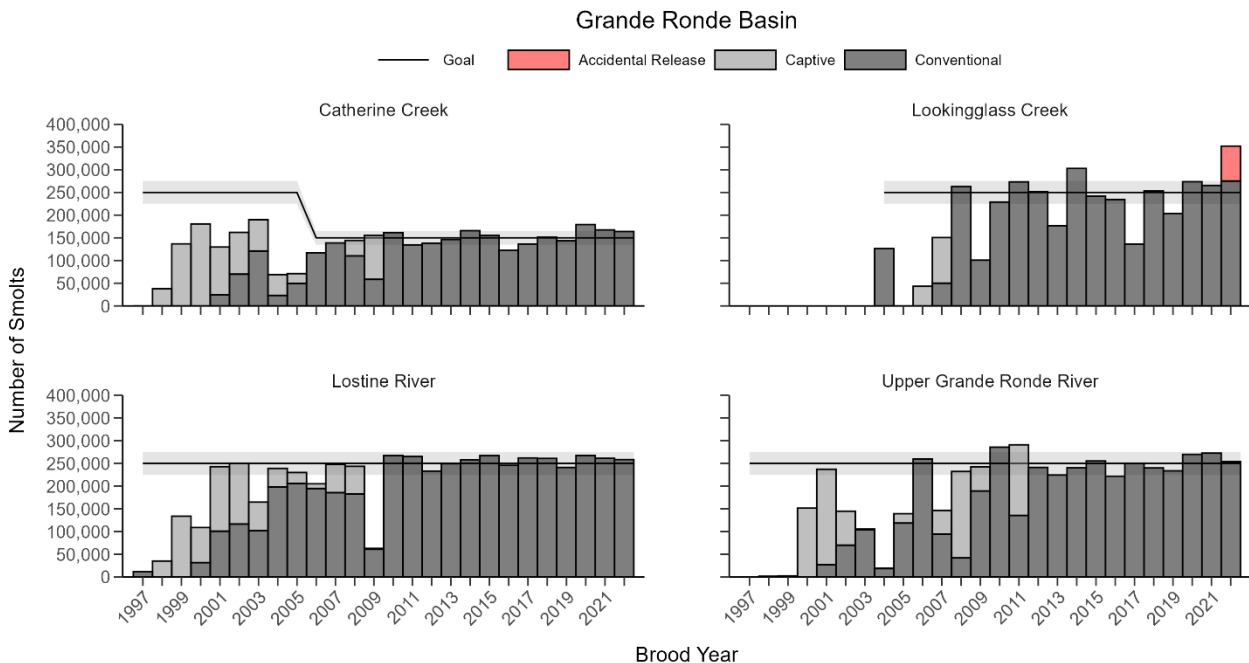


Figure 6. Hatchery spring Chinook Salmon smolts released in Catherine Creek, Lookingglass Creek, the Lostine River, and the Upper Grande Ronde River compared to smolt release goals, 1997-2022 brood years. The shaded region around the smolt goal is $\pm 10\%$.

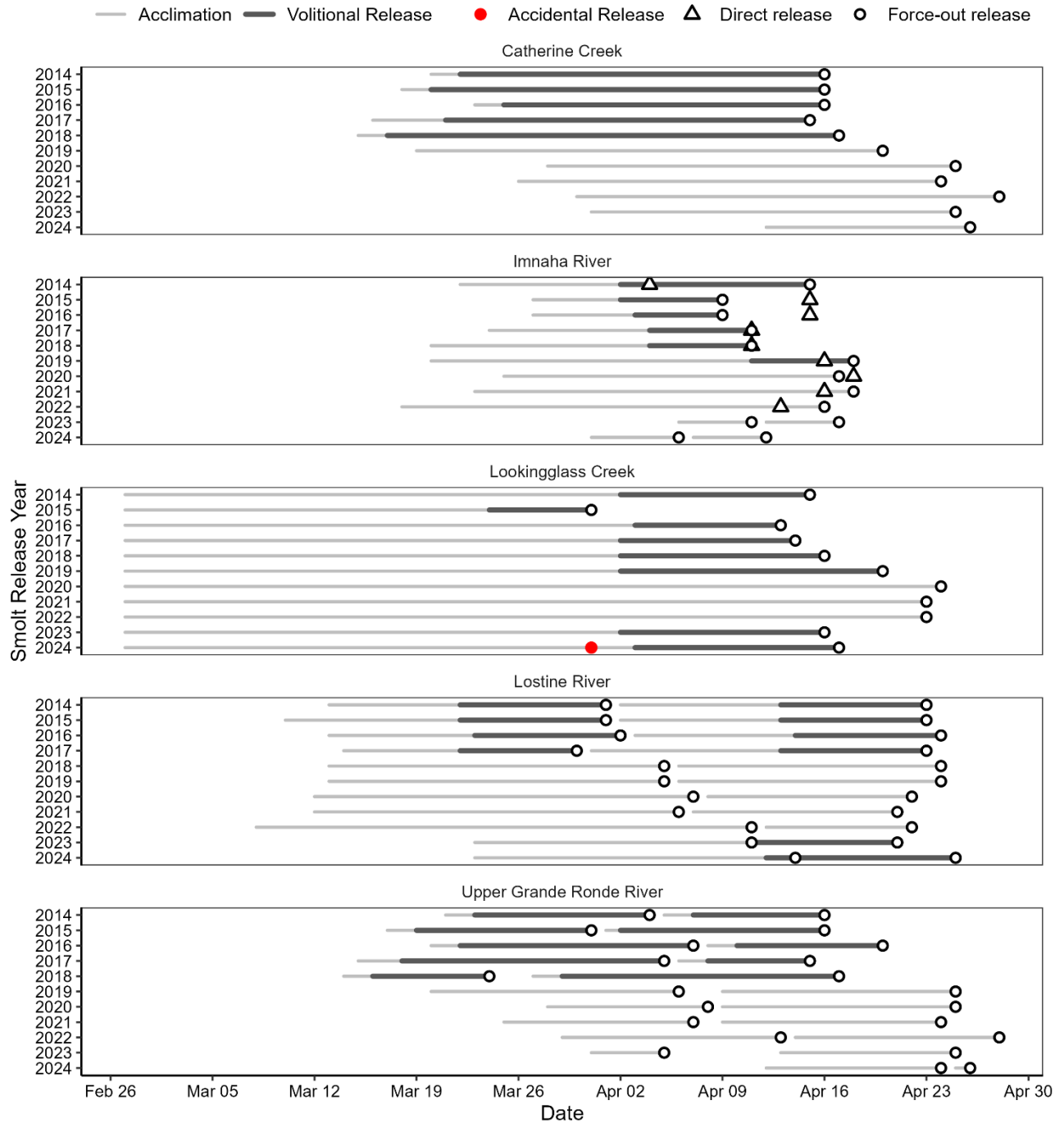


Figure 7. Release strategies and release dates for hatchery spring Chinook Salmon smolts released into Catherine Creek, the Imnaha River, Lookingglass Creek, the Lostine River, and the Upper Grande Ronde, release years 2014-2024. A total of 77,173 Imnaha River smolts were accidentally released into Lookingglass Creek when a fish liberation truck crashed leaving Lookingglass Fish Hatchery on 3/29/2024. A total of 391,234 smolts were released into the Imnaha River.

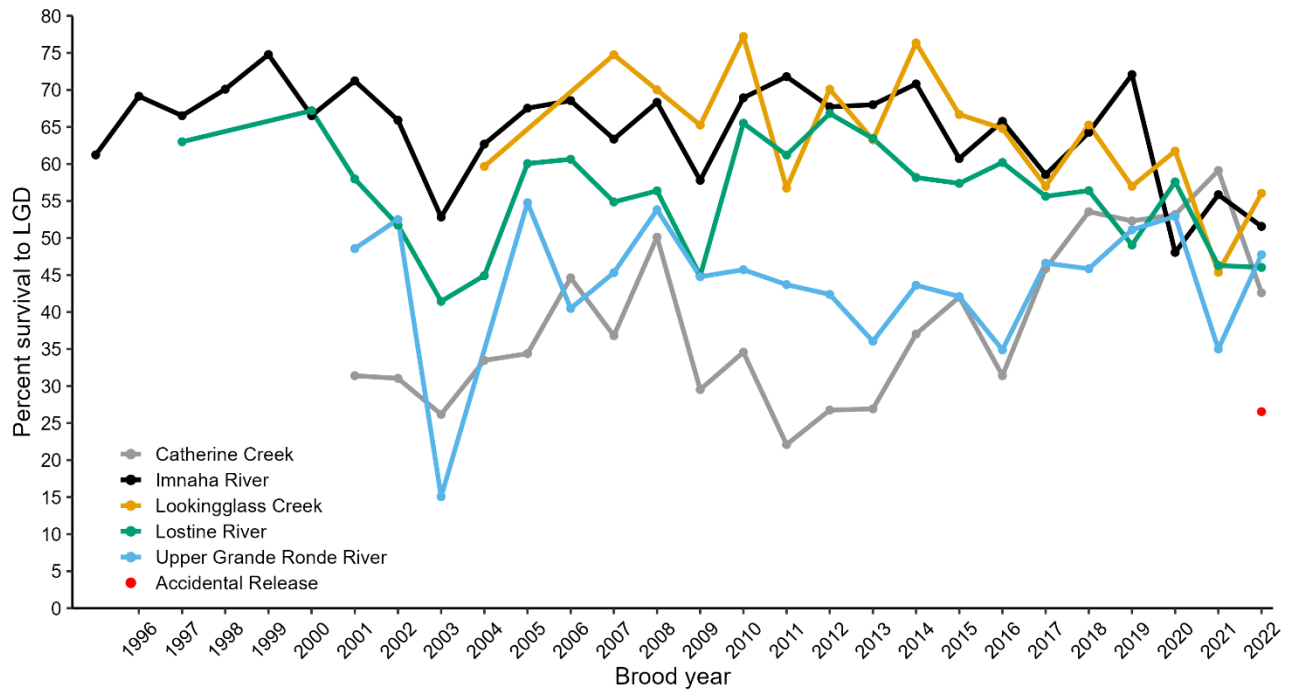


Figure 8. Mean apparent survival to Lower Granite Dam of PIT-tagged hatchery juvenile Chinook Salmon released into Catherine Creek, the Imnaha River, Lookingglass Creek, the Lostine River, and the Upper Grande Ronde River.

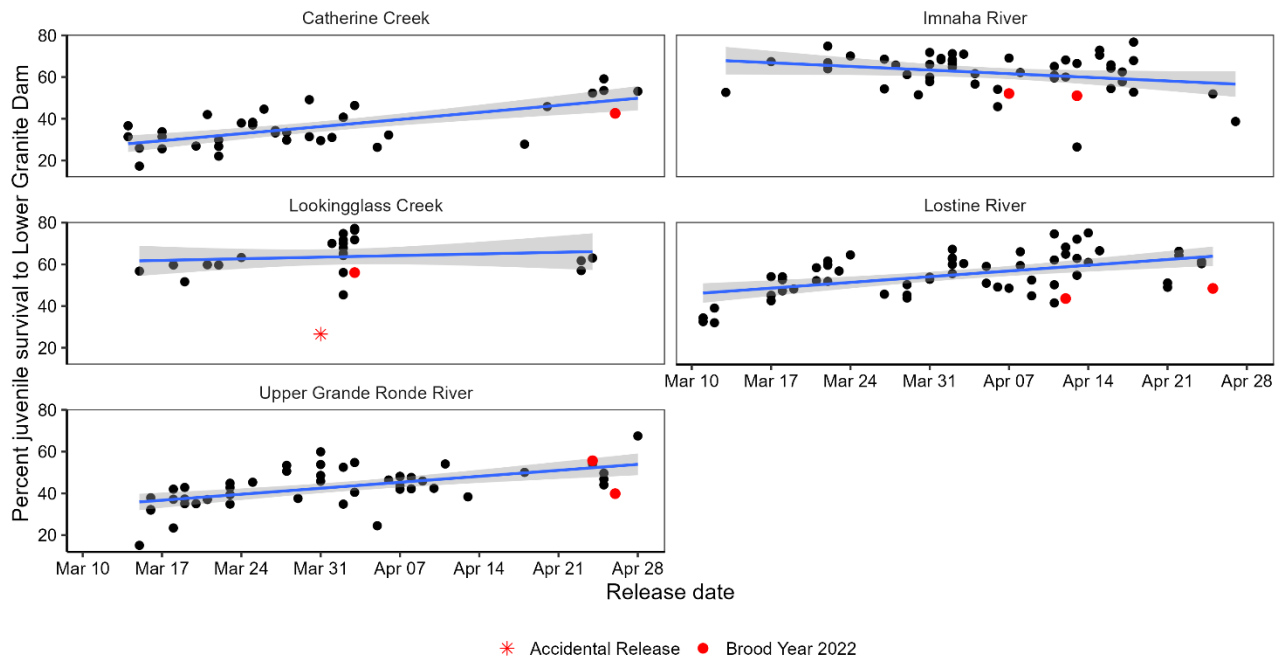


Figure 9. First release date compared to estimated juvenile survival rate (%) to Lower Granite Dam. Smolts were released into Catherine Creek and the Upper Grande Ronde River (BYs 1998-2022), the Imnaha River (BY 1991-2022), the Lostine River (BY 1997-2022), and Lookingglass Creek (BYs 2002-2004, 2006-2022). Red points are for BY 2022 smolt releases. The shaded area around the linear regression line is a 95% confidence interval.

Objective 3. Determine total catch and escapement, smolt survival, smolt-to-adult survival, and assess if adult production meets mitigation goals.

Catch and Escapement

The ODFW relies on CWT data from the Pacific States RMIS database to estimate catch and escapement of hatchery stocks downstream of terminal tributaries in the Grande Ronde and Imnaha basins. The data used to report SAR, SAS, and stray rate metrics was current through 3 February 2026. Estimated hatchery and natural Chinook Salmon escapement to each river is derived through a combination of tributary sport and tribal fishery estimates, weir recoveries, and spawning ground surveys to estimate the numbers of Chinook Salmon above and below weirs. In general, return year data is finalized, and the origin and age-structure estimate for hatchery and natural Chinook Salmon for each tributary are derived within one year of the Chinook Salmon's return to the system. It can take two or three years before the RMIS CWT recovery data is static. The disparate timelines for data availability between tributary escapements and CWT derived RMIS estimates is a consistent data reporting challenge that contributes to delays in finalizing catch distribution summaries as well as SAS and SAR rates.

Brood Year 2019

The age-5-year Chinook Salmon that returned to the Columbia Basin in 2024 completed returns for BY 2019 hatchery production for the five Chinook Salmon stocks reared and released from LFH. The estimated production of 3,842 age 3-5 Chinook Salmon from BY 2019 were comprised of estimated returns of 357 from Catherine Creek, 375 from the Upper Grande Ronde, 991 from Lookingglass Creek, 1,150 from the Lostine River, and 969 from the Imnaha River (Table 10, Figure 10).

In Ocean fisheries, the five hatchery stocks contributed to expanded estimates of zero Chinook Salmon (Table 10). For Columbia River fisheries, for these five stocks combined, it was estimated that 312 salmon were harvested, four in net fisheries, 272 in sport fisheries, and 36 in tribal fisheries.

In the Snake River, estimated total hatchery production from the five stocks reared at LFH contributed to harvest of five Chinook Salmon in sport fisheries and zero in tribal fisheries (Table 10). Below LGD, an estimated zero Chinook Salmon strayed.

Above LGD, an estimated 17 Chinook Salmon strayed, represented by 14 unique CWT recoveries (Table 10). None of these recoveries occurred outside the Grande Ronde Basin. Three Catherine Creek strays were recovered at the Lookingglass Creek trap. The four Upper Grande Ronde strays were represented by three unique CWT recoveries—two from the Lookingglass Creek trap and one from the Lookingglass Creek spawning grounds. Three Lookingglass Creek Chinook Salmon were recovered at the Upper Grande Ronde trap, one at the Imnaha River trap, and two on the Upper Grande Ronde spawning grounds which expanded to three fish. Additionally, one Lostine River salmon were recovered at the Lookingglass Creek trap, along with one on the Lookingglass Creek spawning grounds which expanded to two fish.

Overall, an estimated 3,508 Chinook Salmon (i.e., 91% of the total production) from BY 2019 returned to their natal hatchery programs. Within the Grande Ronde Basin, 347 mature Chinook Salmon returned to Catherine Creek, 355 returned to the Upper Grande Ronde River, 838 returned to Lookingglass Creek, and 1,071 returned to the Lostine River. An estimated 969 mature hatchery Chinook Salmon returned to the Imnaha River from BY 2019 production (Figure 10).

Table 10. Catch and escapement distribution of Catherine Creek, Upper Grande Ronde, Imnaha River, Lookingglass, and Lostine River spring/summer Chinook Salmon, complete brood year 2019.

	Catherine Creek.		Upper Grande Ronde River		Lookingglass Creek		Lostine River		Imnaha River	
Total smolts released	143,446		233,643		203,658		241,121		511,261	
% AD + CWT	67.7%		46.9%		62.8%		48.7%		46.0%	
	% of catch	Est. return	% of catch	Est. return	% of catch	Est. return	% of catch	Est. return	% of catch	Est. return
Ocean ^a	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Columbia River ^a										
Commercial Net	0.0	0	1.1	4	0.0	0	0.0	0	0.0	0
Sport	2.0	7	3.2	12	14.2	141	5.4	62	5.2	50
Tribal Net	0.0	0	0.0	0	0.0	0	1.2	14	2.3	22
Snake River ^a										
Sport ^b	0.0	0	0.0	0	0.5	5	0.0	0	0.0	0
Tribal ^b	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Stray Below LGD	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Stray Above LGD	0.8	3	1.1	4	0.7	7	0.3	3	0.0	0
Return to Comp. Area ^b	98.0	350	95.7	359	85.8	850	93.4	1,074	92.6	897
Return to River ^c	<u>97.2</u>	<u>347</u>	<u>94.7</u>	<u>355</u>	<u>84.6</u>	<u>838</u>	<u>93.1</u>	<u>1,071</u>	<u>92.6</u>	<u>897</u>
Total returns		357		375		991		1,150		969

^a Based on expanded CWT recoveries from the PSMFC RMIS database

^b Indicates areas within the LSRCP compensation area

^c Includes estimates of fish removed in tributary tribal and sport fisheries, fish removed at weirs (e.g., broodstock, foodbanks), and estimates of un-trapped fish above and below weirs.

Total adult production and compensation area returns

The escapement goal for the Grande Ronde Basin is 29,100 hatchery spring–summer Chinook Salmon. Estimated age-3 to age-5 hatchery production totaled 3,253 fish in 2024 (Figure 10), representing 11.2% of the goal, respectively. Above LGD, estimated adult returns were 3,061 fish, achieving 52.6% of the Grande Ronde Basin target of 5,820 returns.

In the Imnaha Basin, total hatchery production was estimated at 1,739 fish in 2024 (Figure 10), corresponding to 10.8% of the 16,050-fish production goal. Above LGD, adult returns were estimated at 1,637 fish, meeting 51.1% of the LSRCP mitigation target.

Neither the Grande Ronde nor the Imnaha Basin hatchery programs have achieved their total adult production goals (Figure 10). The Grande Ronde Basin programs have exceeded 5,820 returns only three times, and the Imnaha program has surpassed 3,210 returns seven times. Neither program has met its mitigation target since return year 2014 (Figure 11).

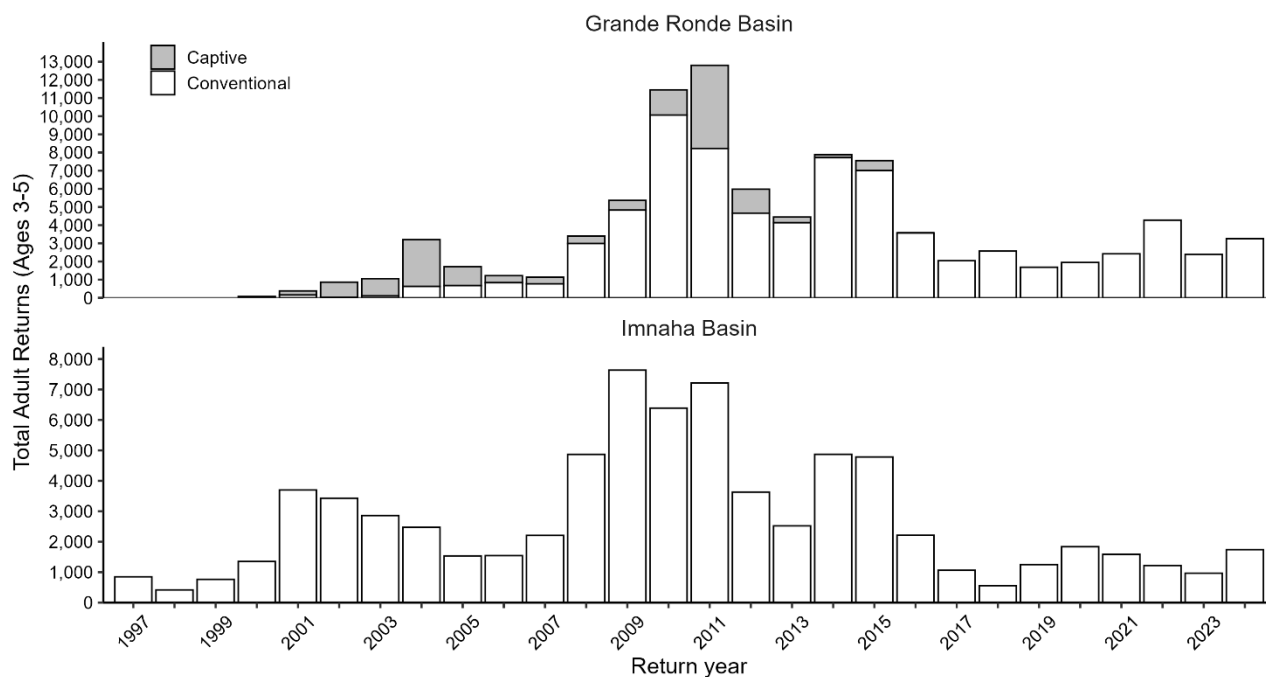


Figure 10. Total age 3-5 Chinook Salmon production from captive and conventional Grande Ronde basin and Imnaha basin hatchery programs, return years 1997-2024 The LSRCP total hatchery production goals are 29,100 Grande Ronde basin and 16,050 Imnaha basin returns.

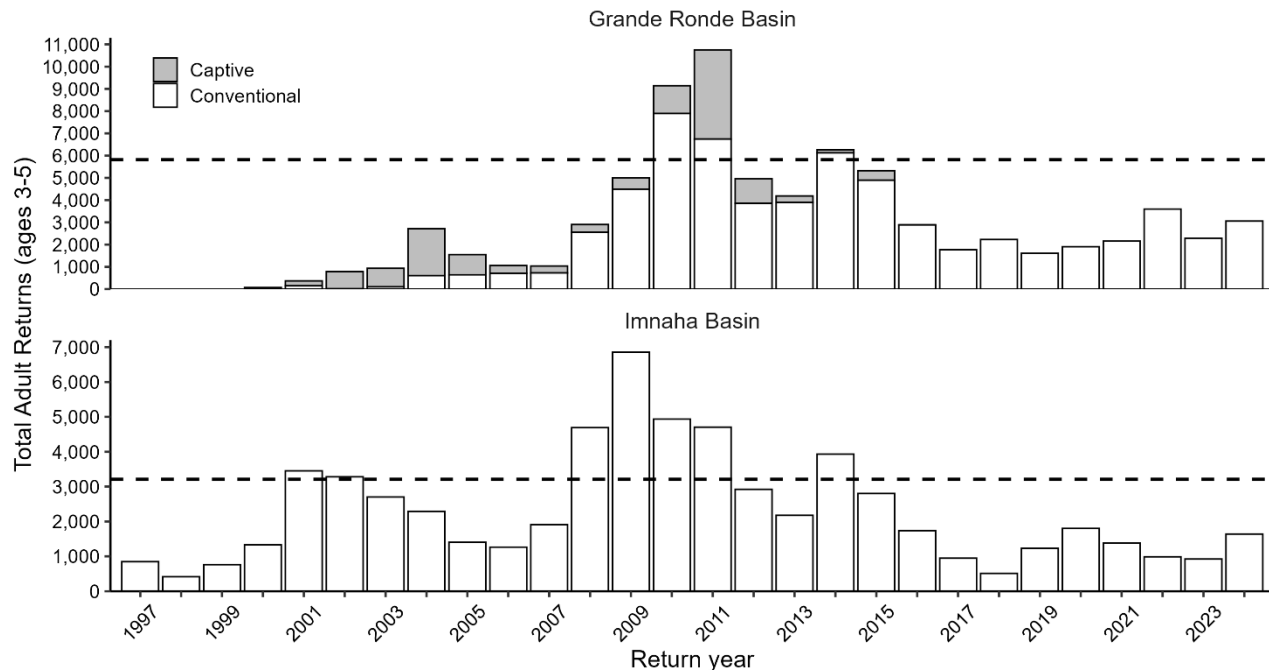


Figure 11. Total age 3-5 production of Chinook Salmon from captive and conventional Grande Ronde and conventional Imnaha River basin hatchery programs returning to the compensation area, run years 1997-2024. The black dashed lines represent mitigation goals of 5,820 and 3,210 mature salmon returns to the Grande Ronde and Imnaha basins, respectively.

Within the Grande Ronde Basin, each hatchery program has specific return goals that contribute to the overall LSRCF compensation goal of 5,820 adult Chinook Salmon. The goals are 970 adult returns for the Catherine Creek program and 1,617 returns each for the Lookingglass Creek, Lostine River, and Upper Grande Ronde River programs. None of the five hatchery stocks met their mitigation return goals during return year 2024 (Figure 12).

In 2024, estimated hatchery returns totaled 612, 1,226, 709, and 514 Chinook Salmon from the Catherine Creek, Lookingglass Creek, Lostine River, and Upper Grande Ronde programs, respectively. The Imnaha program produced 1,637 Chinook Salmon for the mitigation area in return year 2024.

Since 1997, the Catherine Creek program has met its mitigation goal of 970 adults twice, and the Imnaha program has exceeded its goal of 3,210 returns seven times. The mitigation goal of 1,617 adults has been reached twice in Lookingglass Creek, five times in the Lostine River, and once in the Upper Grande Ronde.

When comparing LSRCF mitigation estimates above LGD to total estimated returns for each river, the 2024 return estimates accounted for $\geq 99.0\%$ of mitigation returns for the Imnaha River, Catherine Creek, Upper Grande Ronde River, Lookingglass Creek, and the Lostine River.

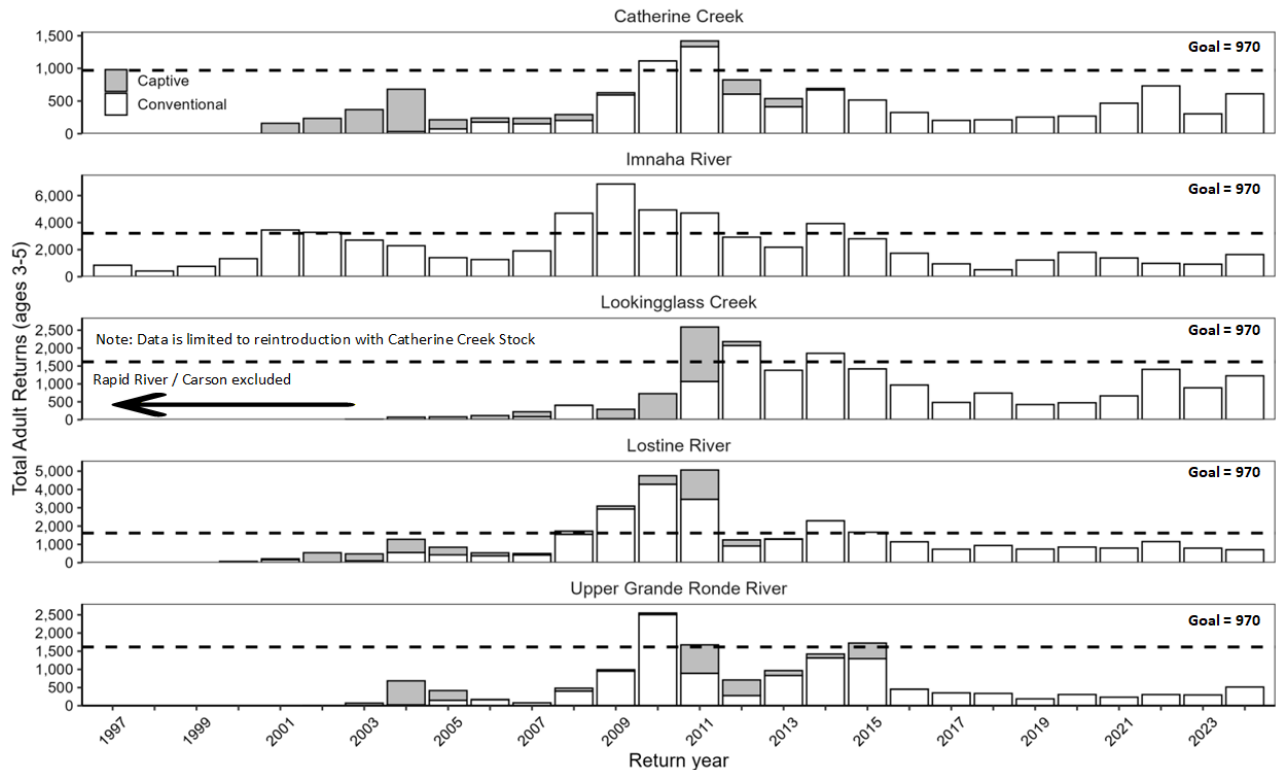


Figure 12. Age 3-5 returns to the compensation area of hatchery-origin Chinook Salmon produced by the Catherine Creek, Imnaha River, Lookingglass Creek, Lostine River, and Upper Grande Ronde stocks, run years 1997-2024. The black dashed line represents population specific mitigation goals for each hatchery stock.

Smolt-to-adult survival and return rates

The smolt-to-adult survival (SAS) rate goal for both the Grande Ronde and Imnaha River hatchery programs is 3.25%, a target that has never been achieved (Figure 13). For complete brood year 2019, SAS rates were 0.25% for Catherine Creek, 0.19% for the Imnaha River, 0.49% for Lookingglass Creek, 0.48% for the Lostine River, and 0.16% for the Upper Grande Ronde program.

Across the last five complete brood years (BYs 2014–2018), mean SAS rates were 0.29% for Catherine Creek, 0.28% for the Imnaha River, 0.38% for Lookingglass Creek, 0.38% for the Lostine River, and 0.12% for the Upper Grande Ronde. The highest SAS rates in program history were observed for brood year 2006—3.17% for the Imnaha River and 3.09% for the Lostine River. Between brood years 2006 and 2019, SAS rates for conventional hatchery production exceeded 1.0% only once for Catherine Creek, three times for the Imnaha River, twice for Lookingglass Creek, four times for the Lostine River, and once for the Upper Grande Ronde.

The LSRCP compensation area smolt-to-adult return (SAR) rate goal is 0.65%, and production has consisted of both captive and conventional hatchery programs (Figure 13). For complete returns from BY 2019, the SAR rate for Catherine Creek were 0.24%, 0.18% for the Imnaha River, 0.41% for Lookingglass Creek, 0.45% for the Lostine River, and 0.15% for the Upper Grande Ronde program. Over the last five complete BY's (i.e., 2015 to 2019), the 0.65% SAR rate has not been met with any of the five hatchery stocks.

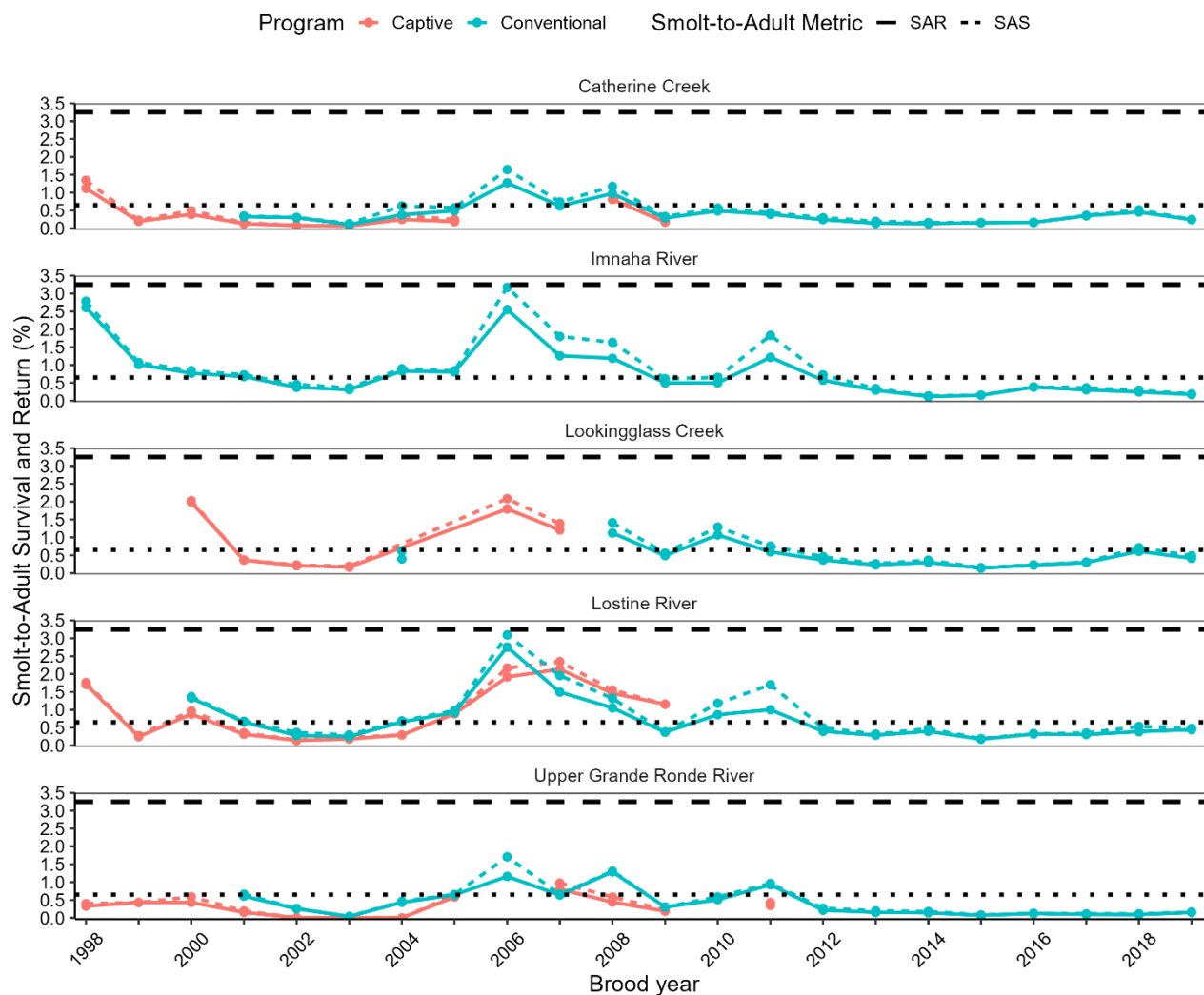


Figure 13. Smolt-to-adult survival (SAS) and return (SAR) rates for captive and conventional production programs, complete brood years 1998-2019. The LSRCP compensation SAS and SAR goal are 3.25% (dashed line) and 0.65% (dotted line), respectively. Note: Captive Broodstock program releases into Lookingglass Creek reflect reintroduction efforts.

Juvenile survival compared to smolt-to-adult return rates

There is a positive correlation between estimated juvenile survival to LGD and SAR rates among all five hatchery stocks (Figure 14). This relationship was significant for smolts released into Catherine Creek, Lookingglass Creek, the Lostine River, and the Upper Grande Ronde ($P < 0.05$), and inconclusive for smolts released into the Imnaha River ($P = 0.09$). For complete returns from BY 2019, none of the hatchery stocks achieved the LSRCP SAR rates goals of $\geq 0.65\%$. For all captive and conventional smolt releases within populations when juvenile survival rates are $\geq 50\%$, the 0.65% SAR goal was achieved in one of three smolt releases in Catherine Creek, 13 times out of 29 times in the Imnaha River, five out of 17 times in Lookingglass Creek, 15 out of 24 times in the Lostine River, and one out of six times in the Upper Grande Ronde. In contrast, when juvenile survival rates to LGD are below 50%, the SAR goals were achieved three times in

Catherine Creek, once in the Lostine River, three times in the Upper Grande Ronde, and zero times in the Imnaha River and Lookingglass Creek stocks.

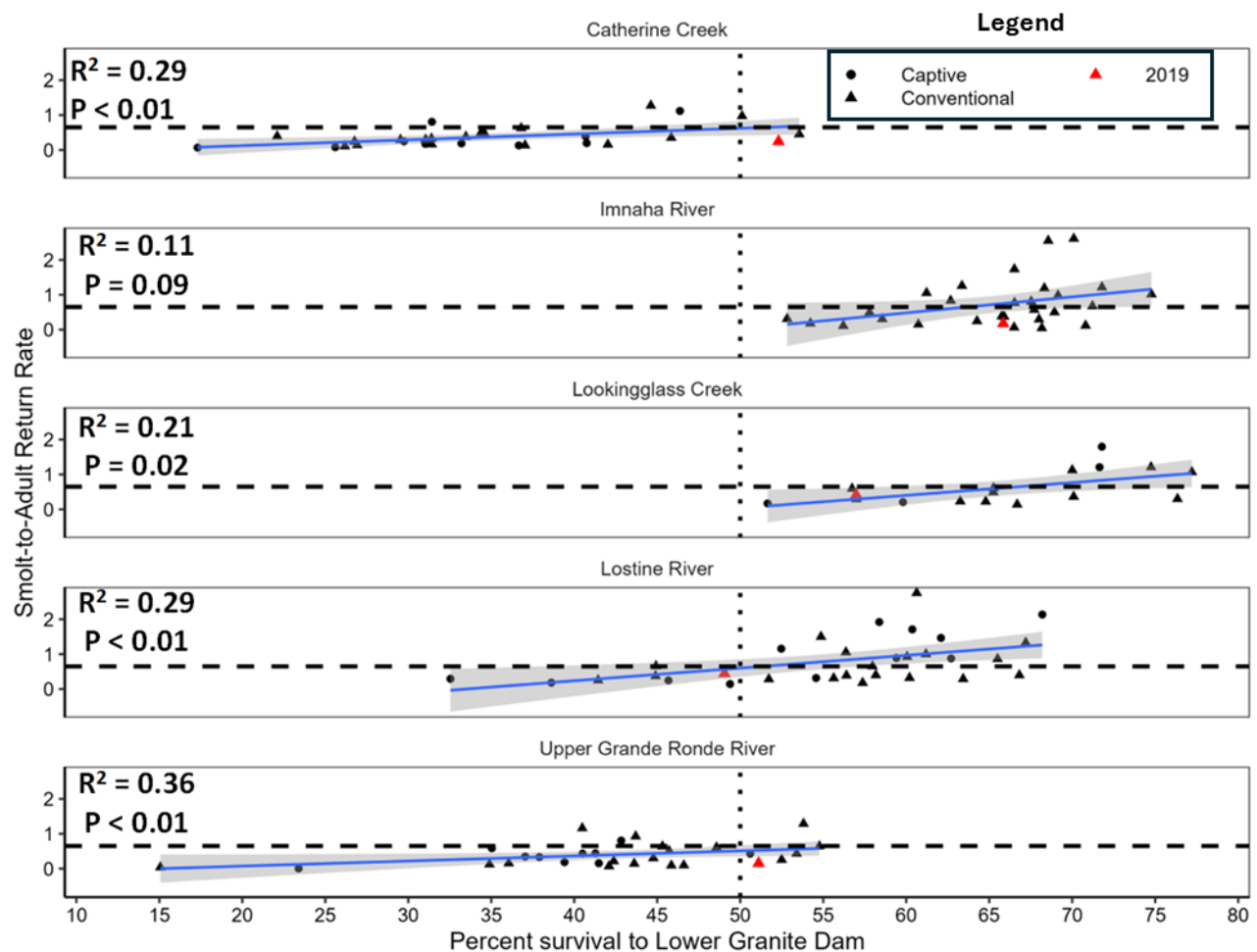


Figure 14. Estimated juvenile survival rate to Lower Granite Dam compared to smolt-to-adult return rates for captive and conventional program smolts. The colored triangles represent comparisons for BY 2019. The shaded area around the linear regression line is a 95% confidence interval. The horizontal dashed lines represent the 0.65% SAR goal and the dotted vertical line is 50% juvenile survival to Lower Granite Dam.

Objective 4. Compare recruits-per-spawner (R:S) for hatchery and natural origin fish.

Hatchery origin R/S

The return of age 5 adults in 2024 completed returns for BY2019. The return to river recruits per spawner (R:S) ratios for BY 2019 conventional hatchery program production ranged from 2.3–8.6, with 3.7 for Catherine Creek, 3.4 for the Imnaha River, 5.7 for Lookingglass Creek, 8.6 for the Lostine River, and 2.3 for the Upper Grande Ronde River, respectively (Figure 15).

The return to river R:S ratios for spring and summer Chinook Salmon spawned at LFH regularly exceed 1 and show considerable annual synchrony. Over program history, R:S ratios have only been <1 twice in the Imnaha River (BYS 1990 and 1992) and once in the Upper Grande Ronde (BY2003). For BYs 2015–2019, the mean R:S ratios were 4.5, 5.0, 5.3, 6.3, and 1.7 for the Catherine Creek, Imnaha River, Lookingglass Creek, Lostine River, and Upper Grande Ronde River, respectively.

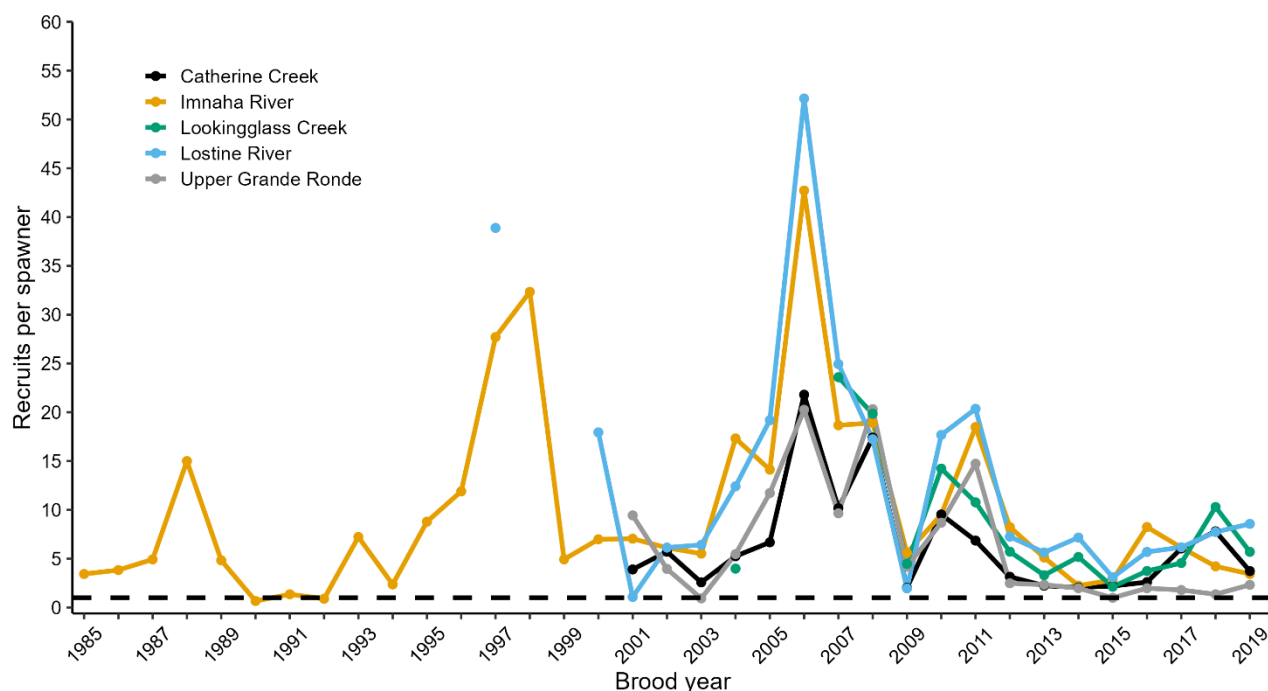


Figure 15. Total adult return to river recruits per spawner ratios for conventional hatchery production from Catherine Creek, Imnaha River, Lookingglass Creek, Lostine River, and Upper Grande Ronde, and Imnaha River populations, complete brood years (1985–2019). The dashed line represents the level necessary for population replacement (1:1). Lookingglass Creek was limited to reintroduction with Catherine Creek stock.

Natural origin R/S

For the supplemented populations, the R:S ratios for BY 2019 were 0.52 in Catherine Creek, 0.25 in Lookingglass Creek, 0.37 in the Imnaha River, 0.82 in the Lostine River, and 2.55 in the Upper Grand Ronde River (Figure 16). The BY 2019 R:S ratios in the Minam and Wenaha rivers were 0.94 and 0.95, respectively. R:S ratios for BY 2019 in the Upper Grande Ronde River may be incorrect due to poor adult and juvenile sampling within this BY.

For the last five complete BYs 2015–2019, the average R:S values were 0.73 for Catherine Creek, 0.45 for the Imnaha River, 0.25 for Lookingglass Creek, 0.58 for the Lostine River; and 0.89

for the Upper Grande Ronde River. In the two wilderness populations, the R:S values for BYs 2015-2019 were 1.06 and 0.75 in Minam and Wenaha rivers, respectively. The last time BY's for all population were >1 was BY2007. From BY2008-2019, R:S ratios exceeded one in the Imnaha River, Lookingglass Creek, and the Lostine River once, twice in Catherine Creek and the Upper Grande Ronde River, and four times in the Minam and Wenaha Rivers.

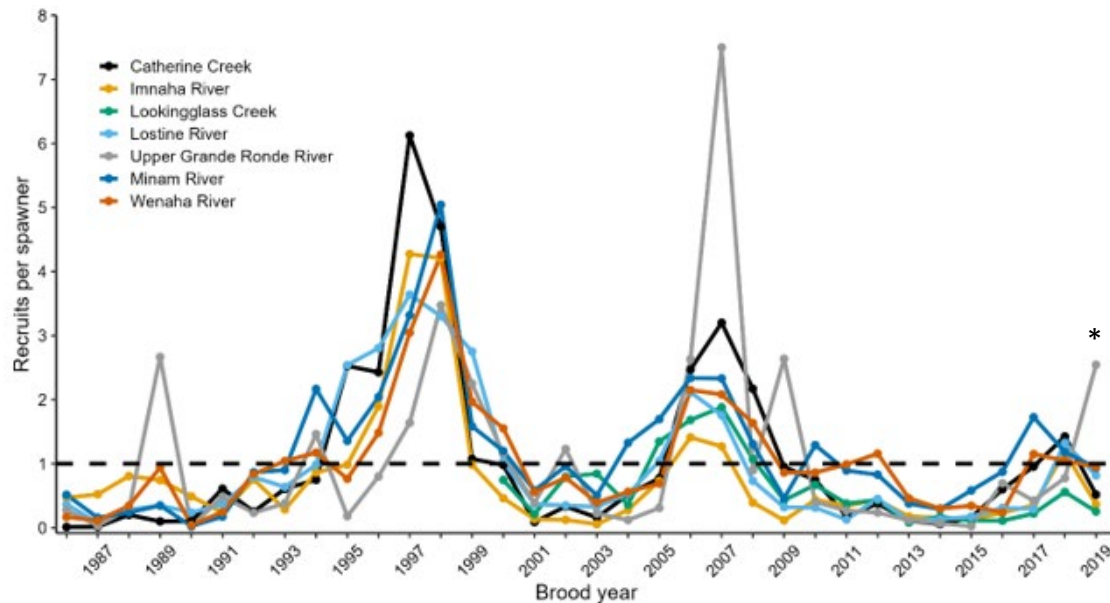


Figure 16. Total age 3–5 return to river recruits per spawner ratios for naturally produced populations of Catherine Creek, Imnaha River, Lookingglass Creek, Lostine River, and Upper Grande Ronde, Imnaha River, Minam River, and Wenaha River spring- summer Chinook Salmon populations. The dashed line represents the level necessary for population replacement (1:1).

Objective 5. Assess response in natural population abundance and productivity to supplementation.

2024 Chinook Spawning Ground Surveys

Annual spawning ground surveys in combination with data collected from weirs and hatchery spawning at LFH were used to evaluate the natural population response to supplementation. Data collected at weirs provide information on hatchery and natural return abundance, age structure, and run timing to a specific stream location. Spawning ground surveys inform pHOS estimates, in-basin hatchery straying, natural return estimates, and were used as a basis for determining natural spawner age structure. Results summarized from the 2024 spawning ground surveys were used to calculate natural return estimates, pHOS, and PNI.

Redd counts and Carcass recoveries

In the Imnaha Basin, a total of 281 unique redds were counted in Index and Extensive survey sections in 2024 (Table 13; Figure 17). In the Grande Ronde Basin, across 10 streams, 749 redds were observed in Index and Extensive survey section in 2024 (Table 13; Figure 17). The Minam and Wenaha rivers flow through designated Wilderness areas and are not supplemented with hatchery fish. In 2024, a total of 121 redds were counted in the Minam River and 102 redds were observed in the Wenaha River. All spawning ground surveys data from 2024 were collected electronically using Survey123 and Field Maps.

In the Imnaha Basin, 69 carcasses were recovered in 2024, with 78.1% identifiable as hatchery origin (Table 13). For all streams surveyed in the Grande Ronde Basin in 2024, 63.4% of the 501 carcasses recovered on Index or Extensive surveys, or found on weirs, were determined to be hatchery origin (Table 13). For the two Wilderness populations, the Minam and Wenaha rivers, we regularly experience difficulties recovering carcasses, presumably to scavenging by predators. In the Minam River, we recovered 13 carcasses and 30 in the Wenaha River. Carcass recoveries in the Wenaha River were much higher than in the last few years because we increased survey intensity as part of a two-year study to improve our understanding of potential effects of hatchery origin spawners (Treadway 2026).

In the five supplemented streams, from known origin carcasses, the percentage of known hatchery Chinook Salmon carcasses recovered on spawning ground surveys in 2024 were 70.8% in Catherine Creek, 87.0% in the Upper Grande Ronde River, 83.3% in Lookingglass Creek, 58.6% in the Lostine River, and 77.2% in the Imnaha River (Table 13). The composition of hatchery Chinook Salmon carcasses on the Minam River spawning grounds was 0.0% and 6.9% in the Wenaha River.

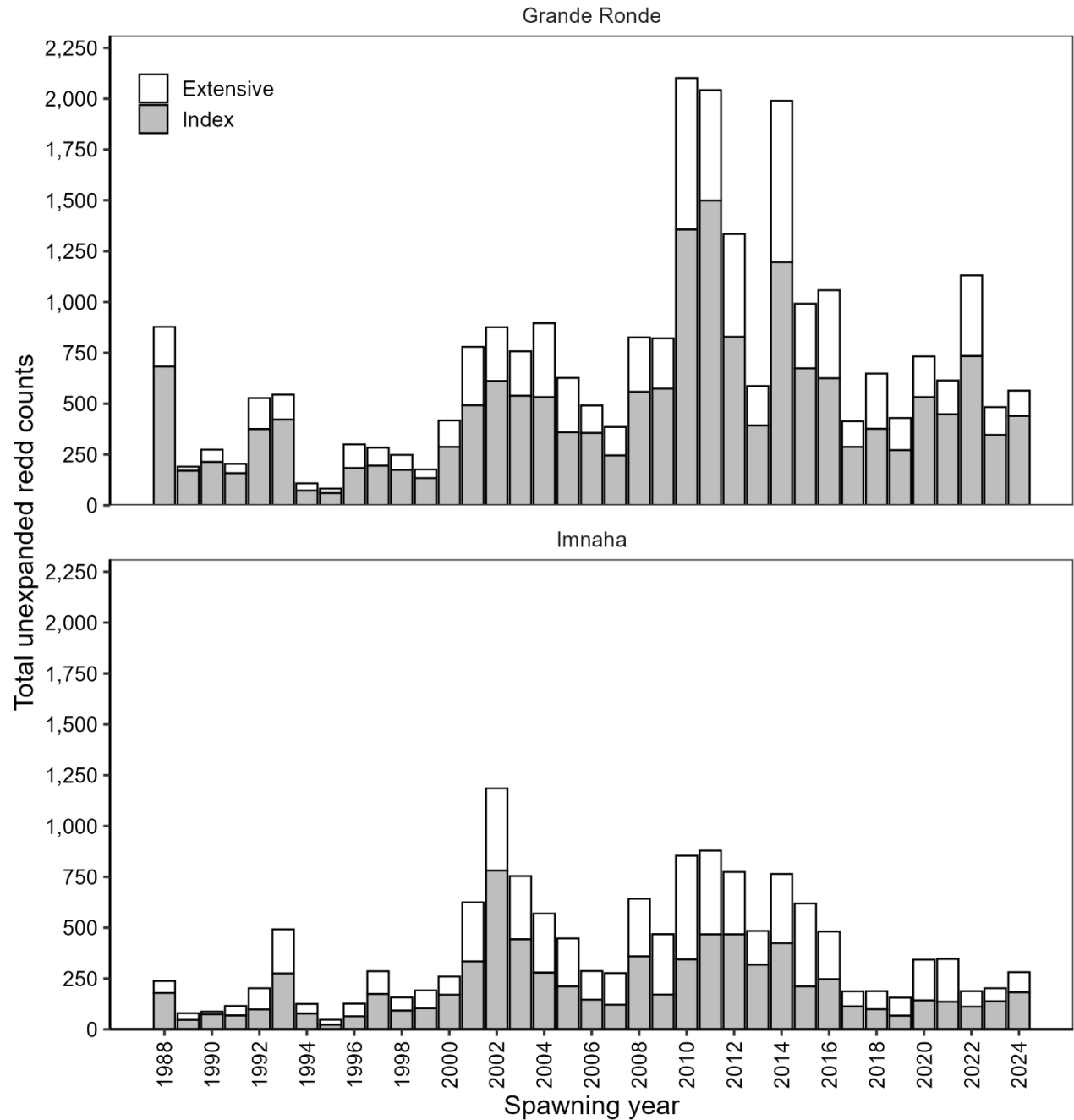


Figure 17. Total unexpanded Chinook Salmon redds counted in Index and Extensive survey reaches in the Grande Ronde and Imnaha River basins, 1988–2024.

Table 11. Summary of hatchery and natural origin Chinook Salmon total carcass and redd counts by stream in Index and Extensive survey sections the Imnaha and Grande Ronde River basins, 2024. NS = Not Surveyed.

Basin, stream	Carcasses			Percent hatchery ^a	Number of redds
	Hatchery	Natural	Unknown origin		
<u>Imnaha River Basin</u>					
Big Sheep Creek	1	1	0	50.0	6
Imnaha River	44	13	5	77.2	263
<u>Lick Creek</u>	<u>5</u>	<u>0</u>	<u>0</u>	<u>100.0</u>	<u>12</u>
Total	50	13	5	78.1	281
<u>Grande Ronde River Basin</u>					
Bear Creek	1	4	0	20.0	20
Catherine Creek	136	56	4	70.8	149
Hurricane Creek	31	23	1	57.4	50
Limber Jim Creek	0	0	0	0.0	0
Lookingglass Creek ^{b,c}	60	12	2	83.3	83
Lostine River ^d	51	36	17	58.6	200
Minam & Little Minam R.	0	13	0	0.0	121
Sheep Creek	0	0	0	0.0	0
Upper Grande Ronde R. ^e	20	3	1	87.0	24
Wallowa River	NS	NS	NS	NS	NS
<u>Wenaha River^e</u>	<u>2</u>	<u>27</u>	<u>1</u>	<u>6.9</u>	<u>102</u>
Total	301	174	26	63.4	749

^a Percent of known origin carcasses.

^b Data provided by CTUIR

^c Includes Little Lookingglass Creek.

^d Includes recoveries on the weir

^e Includes redd count data provided by J. Platz (U.S. Forest Service) in a 1.4 mile section of Vey Meadows near Limber Jim Creek.

^f To comply with the National Marine Fisheries Service (NMFS) ESA Section 10(a)(1)(A) Permit Number 18035; the ODFW, NPT, and CTUIR co-managers notified NMFS in a letter dated December 27, 2019 that spring Chinook from Lookingglass Hatchery (LKG) have composed, on a three-year running average, more than 5% of the spawners within the Wenaha River (Kyle Bratcher, ODFW, personnel communication).

Female pre-spawn mortality

Estimated pre-spawn mortality (PSM) rates based on female carcass recoveries from return year 2024 varied by stream (Table 14). For Imnaha River surveys, estimated PSM was 0% above the weir and 28.6% below. In the Grande Ronde Basin, Catherine Creek PSM was 8.8%, 2.4% in Lookingglass Creek, and 6.1% in the Lostine River. Fewer than 20 carcasses were recovered from other surveyed streams, preventing reliable PSM estimation for those locations.

In-basin and out-of-basin CWT recoveries

On the spawning grounds, a total of six CWTs were recovered in the Imnaha Basin 2024 and 115 in the Grande Ronde Basin (Table 15). Zero out-of-basin CWT-marked hatchery Chinook Salmon were recovered on the spawning grounds in 2024.

In 2024, two CWTs from the Lookingglass Creek program and one from the Lostine River program were recovered in Catherine Creek, while one CWT from the Catherine Creek program was recovered in Lookingglass Creek. Three CWTs from the Lookingglass Creek program were recovered in the Upper Grande Ronde. All CWT marked Chinook Salmon found in Hurricane Creek and Lick Creek had a hole punch in the opercle plate indicating prior handling at adult weirs. We do not classify recoveries of Lostine River Chinook Salmon with an OP punch recovered in Hurricane Creek as strays because the OP punch indicates that they were purposely transplanted into the Wallowa River from the Lostine River weir to reduce hatchery spawner numbers in the Lostine River. Similarly, we do not classify recoveries of Imnaha River Chinook Salmon marked with an OP punch in Lick Creek, as this signifies that they were purposely transplanted to Lick Creek from the Imnaha River adult weir. One CWT marked hatchery salmon from the Lostine River program was recovered in the Wenaha River.

Because we do not mark 100% of the Lookingglass Creek, Catherine Creek, or Lostine River Chinook Salmon releases with a CWT, it is possible that some of the hatchery salmon recovered without a CWT could be in-basin strays. To identify every hatchery salmon back to its release location, we need to either mark 100% of the releases with a CWT or take genetic samples from every hatchery salmon. If the genetic samples were sent to a genetics lab, it would be possible to take advantage of the PBT baseline to assign non-CWT marked hatchery salmon to their hatchery stock and release location.

Table 12. Numbers of female Chinook Salmon carcasses recovered on the spawning grounds that were classified as either a pre-spawn mortality, spawned, or unknown, and the pre-spawn mortality rates, 2024.

Recovery location	Pre-spawn mortality	Spawned	Unknown	% Pre-spawn females
<u>Imnaha River Basin</u>				
Big Sheep Creek	0	1	0	0.0
Imnaha River (above weir)	0	19	0	0.0
Imnaha River (below weir)	2	5	0	28.6
<u>Lick Creek</u>	<u>0</u>	<u>3</u>	<u>0</u>	<u>0.0</u>
Sub-total	2	28	0	7.1
<u>Grande Ronde River Basin</u>				
Bear Creek	1	3	0	25.0
Catherine Creek	8	83	0	8.8
Hurricane Creek	0	20	0	0
Lookingglass Creek ^a	1	40	3	2.4
Lostine River ^b	3	46	0	6.1
Minam River	0	7	0	0.0
Sheep Creek	0	0	0	0.0
Upper Grande Ronde R.	5	8	0	38.5
Wallowa River	NS	NS	NS	NS
<u>Wenaha River</u>	<u>0</u>	<u>12</u>	<u>5</u>	<u>0.0</u>
Sub-total	18	219	8	8.2

^a Data provided by CTUIR. Includes Little Lookingglass Creek.

^b Includes recoveries on the weir.

Table 13. Number of unique coded-wire-tags recovered on spawning ground surveys in 2024. For each stream surveyed, the hatchery program for each CWT recovery is identified.

	Hatchery Program						
River	Catherine Creek	Imnaha River.	Lookingglass Creek	Lostine River	Upper Grande Ronde R.	Out- of- basin	Total
<u>Imnaha River Basin</u>							
Big Sheep Cr.	0	0	0	0	0	0	0
Imnaha R.	0	5	0	0	0	0	5
<u>Lick Cr.</u>	<u>0</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>
Sub-total	0	6	0	0	0	0	6
<u>Grande Ronde Basin</u>							
Catherine Cr.	53	0	1	0	1	0	54
Hurricane Cr.	0	0	0	6	0	0	0
Lookingglass Cr.	2	0	21	0	3	0	26
Lostine R.	1	0	0	13	0	0	14
Minam River	0	0	0	0	0	0	0
Upper Grande Ronde R.	0	0	0	0	14	0	14
Wallowa R.	NS	NS	NS	NS	NS	NS	NS
<u>Wenaha River</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>
Subt-total	56	0	22	20	17	0	115

Hatchery and Natural Origin Tributary Returns

Mature Chinook Salmon returns to the supplemented Imnaha and Grande Ronde basin populations have been dominated by hatchery returns (Figure 18). For return year 2024, an estimated total of 2,071 mature Chinook Salmon returned to the Imnaha River, 21.6% (447) were natural origin and 78.4% (1,624) were hatchery origin. In the Grande Ronde Basin, an estimated total return of 796 mature Chinook Salmon returned to Catherine Creek, 23.2% (185) were natural origin and 76.8% (611) were hatchery origin. An estimated total of 570 mature Chinook Salmon returned to the Upper Grande Ronde River where 10.2% (58) were natural origin and 89.8% (512) were hatchery origin. An estimated total of 970 mature Chinook Salmon returned to the Lostine River where 26.9% (261) were natural origin and 73.1% (709) were hatchery origin. An estimated total of 1,332 mature Chinook Salmon returned to Lookingglass Creek where 9.5% (126) were natural origin and 90.5% (1,206) were hatchery origin.

Adult hatchery Chinook Salmon returns to the Imnaha River have exceeded natural returns for the last 28 consecutive years and 33 of the last 40 return years. In Grande Ronde Basin, hatchery Chinook Salmon have comprised $\geq 50\%$ of the returns in 21 of the last 28 return years in Catherine Creek, 21 of the last 28 return years in the Upper Grande Ronde River, 23 of the last 28 return years in the Lostine River, and 20 of the last 21 years in Lookingglass Creek.

Proportionate Hatchery Origin Spawners

The proportion of mature Chinook Salmon including jacks (pHOSij) has consistently exceeded 0.5 across all five hatchery supplemented populations (Figure 19). In 2024, pHOSij values were 0.67 for Catherine Creek, 0.62 for the Imnaha River, 0.76 for Lookingglass Creek, 0.65 for the Lostine River, and 0.88 for the Upper Grande Ronde. Natural- and hatchery-origin return estimates represent total escapement, while pHOSij reflects only natural spawning. The consistently high pHOS values indicate that weirs effectively limit hatchery fish on the spawning grounds and that sliding-scale management is functioning as intended. However, the lack of variation in pHOS among populations makes it difficult to evaluate supplementation effects, and adjustments to sliding-scale strategies may be needed if assessing these effects is a priority.

Natural adult returns remain low and fall short of NOAA recovery goals (Figure 20). The 2017 NOAA Recovery Plan sets minimum abundance thresholds of 1,000 adults for the Wallowa-Lostine, Upper Grande Ronde, and Imnaha populations, and 750 adults for Catherine Creek, the Minam River, and the Wenaha River. Lookingglass Creek, considered functionally extinct, has a goal of 500 natural adults. Catherine Creek and the Upper Grande Ronde have never met their thresholds, and Lookingglass Creek has never met its goal. Since 1994, the Imnaha population has exceeded its threshold only four times (2001–2003 and 2011). The Wallowa-Lostine population has surpassed 1,000 adults only in 2010–2012, 2014, and 2022. Although the non-supplemented Minam and Wenaha Rivers consistently produce more natural Chinook Salmon than Catherine Creek, Lookingglass Creek, and the Upper Grande Ronde, they still fail to meet NOAA's minimum abundance requirements.

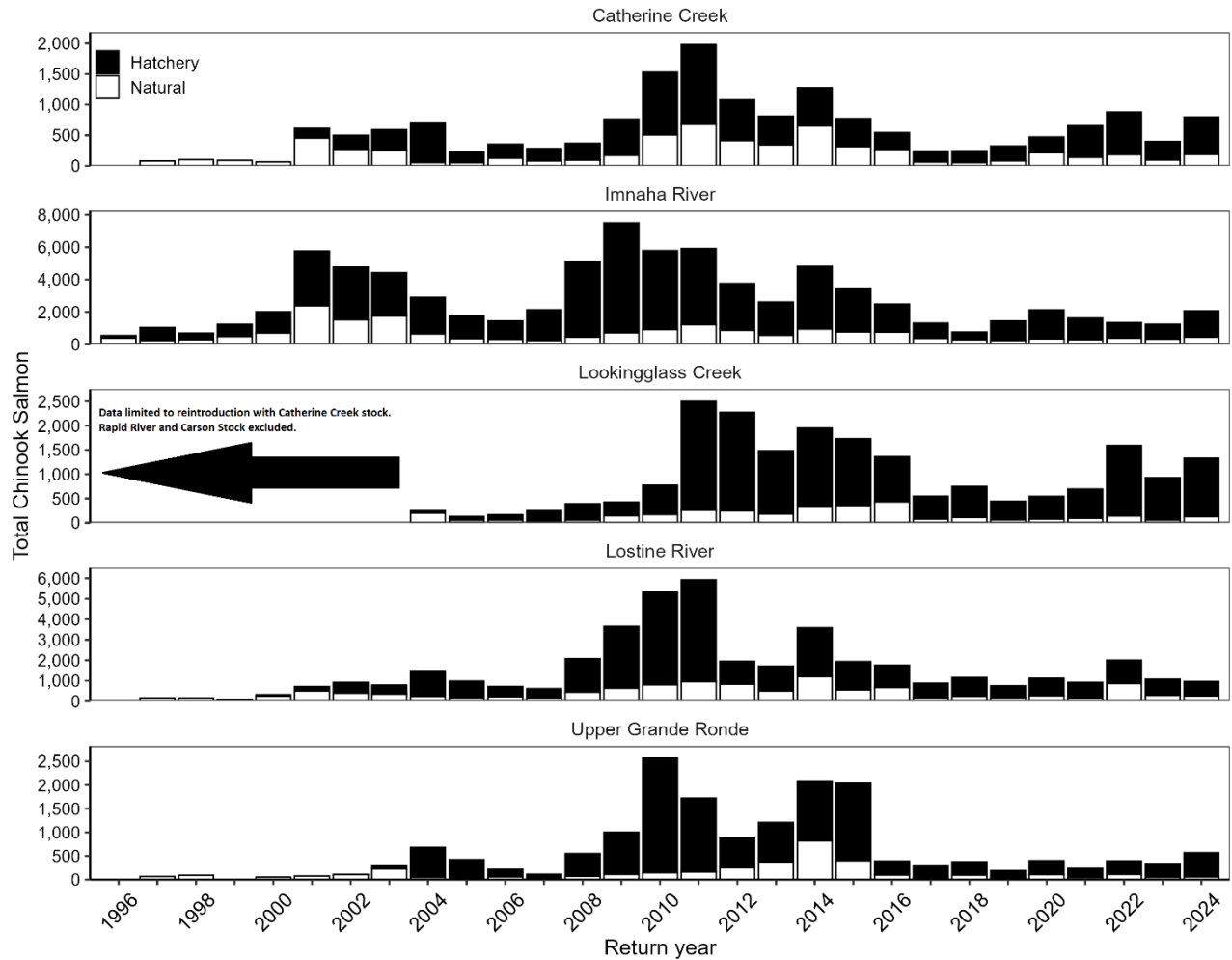
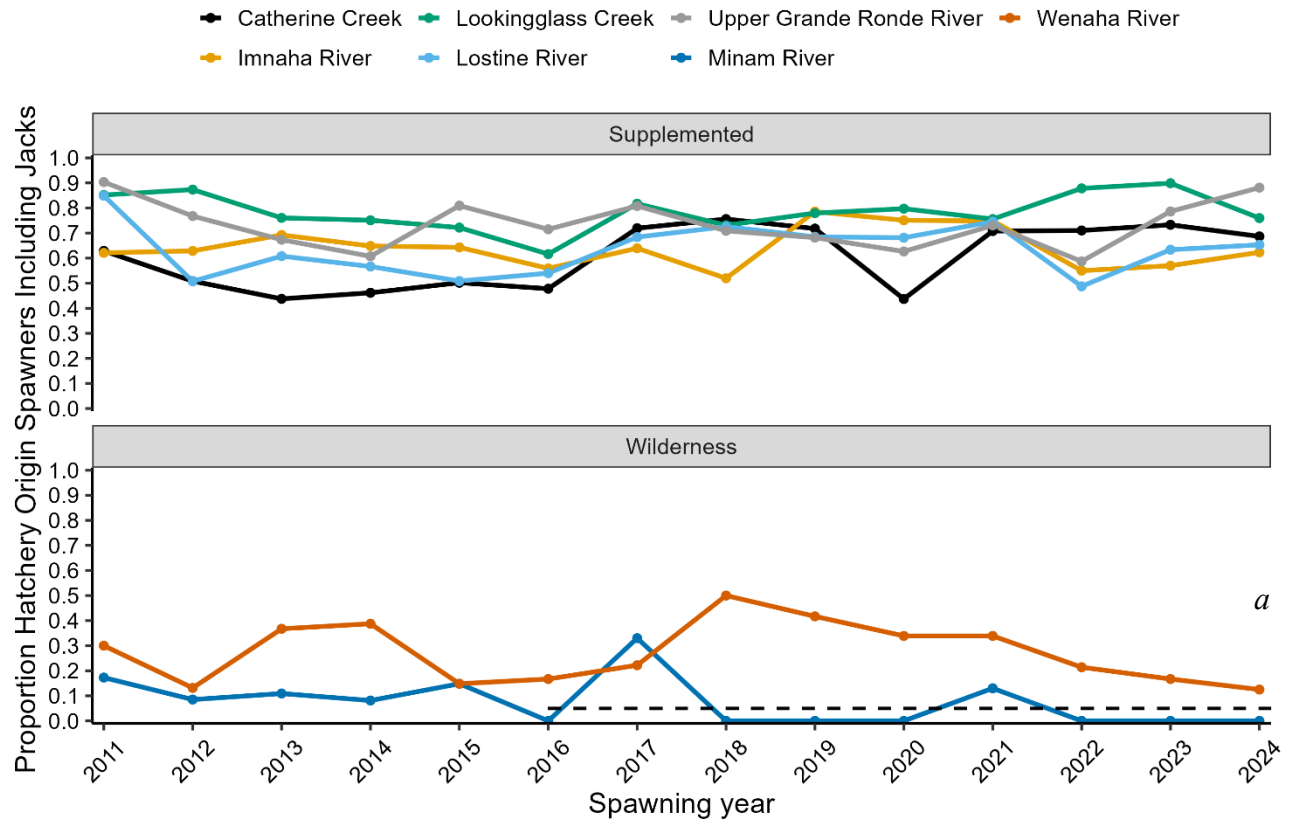


Figure 18. Total returns of age 3–6 hatchery and natural origin Chinook Salmon to supplemented populations in Catherine Creek, the Imnaha River, Lookingglass Creek, the Lostine River, and Upper Grande Ronde River, return years 1996-2024. Data for Lookingglass Creek are limited to the period after the Catherine Creek reintroduction.



^a The 2020 pHOS estimate is based on a five year average (i.e., years 2014, and 2016-2019).

Figure 19. Proportion hatchery origin spawners including jacks in the five supplemented and two wilderness populations, spawning years 2011-2024. The horizontal black dashed line represents ESA Section 10 permit requirements to keep hatchery stray rates into the Minam and Wenaha Rivers $\leq 5\%$ (3-year running average).

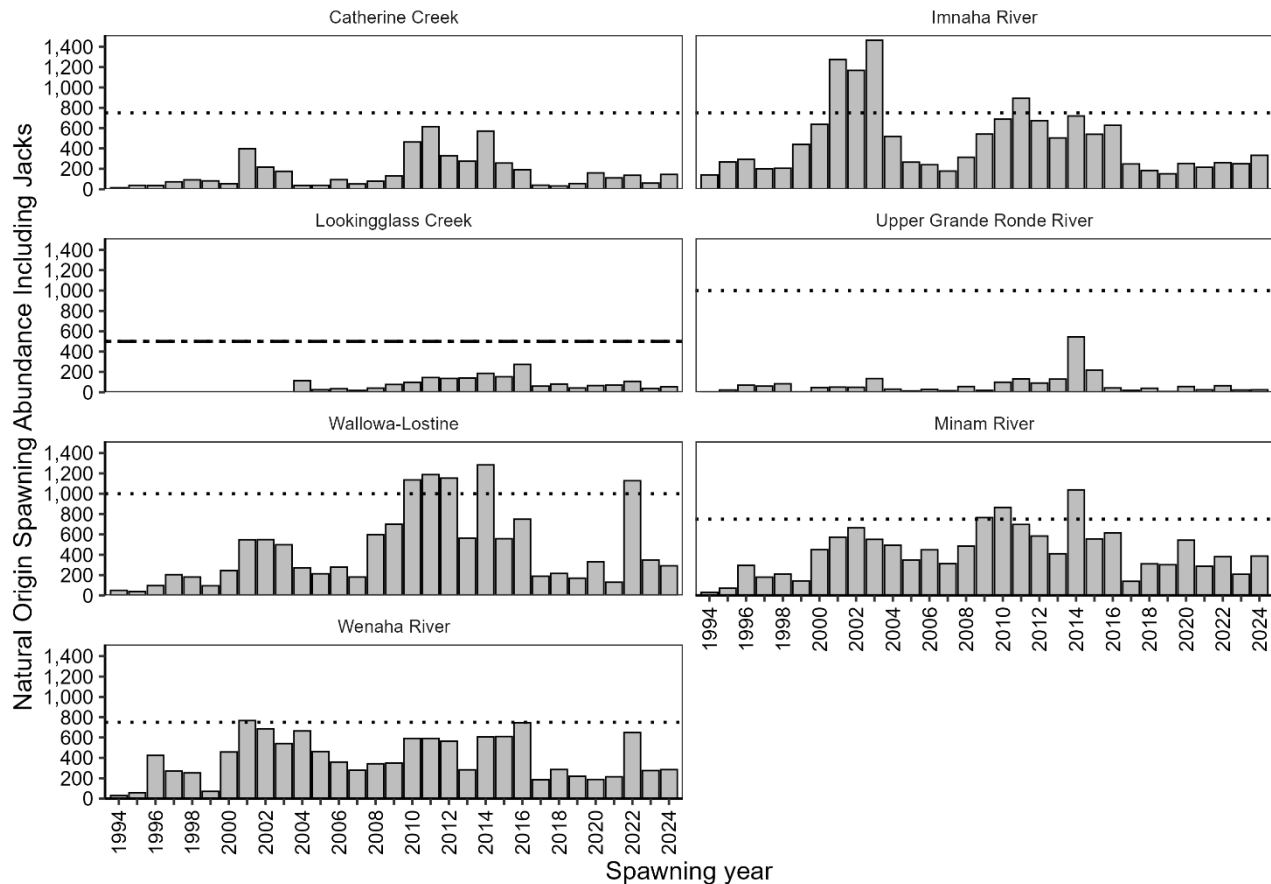


Figure 20. Estimated total number of age 3–6 natural origin Chinook Salmon in each of the Independent Populations of Snake River Chinook Salmon, spawning years 1994 to 2024. Chinook Salmon populations were compared to NOAA’S 2017 Recovery Plan minimum abundance thresholds (dotted line). Note: returns to Lookingglass Creek are limited to returns after 2003 and the dashed line represents the management goal.

Proportionate Natural Influence

The 2009 Hatchery Scientific Review Group (HSRG) proposed that a key to controlling genetic and ecological risks due to straying and fitness loss is to manage hatchery broodstock and natural spawning escapement in a way that allows the natural habitat, not the hatchery, to drive adaptation and productivity (HSRG 2009). The HSRG recommended designating the Catherine Creek, Imnaha River, and Lostine River programs as primary populations and the Lookingglass Creek and Upper Grande Ronde populations as stabilizing. For integrated populations, the HSRG indicated that pNOB should exceed the proportion of hatchery origin spawners in nature (pHOS) by a factor of two, corresponding to a proportionate natural influence (PNI) of ≥ 0.67 . For contributing populations, the recommendation was to maintain $PNI \geq 0.50$. For both Primary and Contributing populations, the recommended pHOS in nature was < 0.3 . The HSRG did not develop PNI criteria for stabilizing populations.

For spawn year 2024, PNI values were, 0.35, 0.30, 0.14, 0.36, and 0.11 for the Catherine Creek, Imnaha River, Lookingglass Creek, Lostine River, and Upper Grande Ronde populations,

respectively (Figure 21). Over the last 10 years, the PNI goal of ≥ 0.67 for Primary populations has never been met for the Catherine Creek, Imnaha River, or Lostine River populations. The ten-year (2015-2024) mean PNI (± 1 SD) values were 0.37 (± 0.11), 0.32 (± 0.06), 0.17 (± 0.09), 0.32 (± 0.09), and 0.19 (± 0.09) for the Catherine Creek, Imnaha River, Lookingglass Creek, Lostine River, and Upper Grande Ronde River populations, respectively. Low numbers of natural returns used in the broodstock and a high proportion of hatchery spawners in nature hampers efforts to achieve HRSR PNI recommendations.

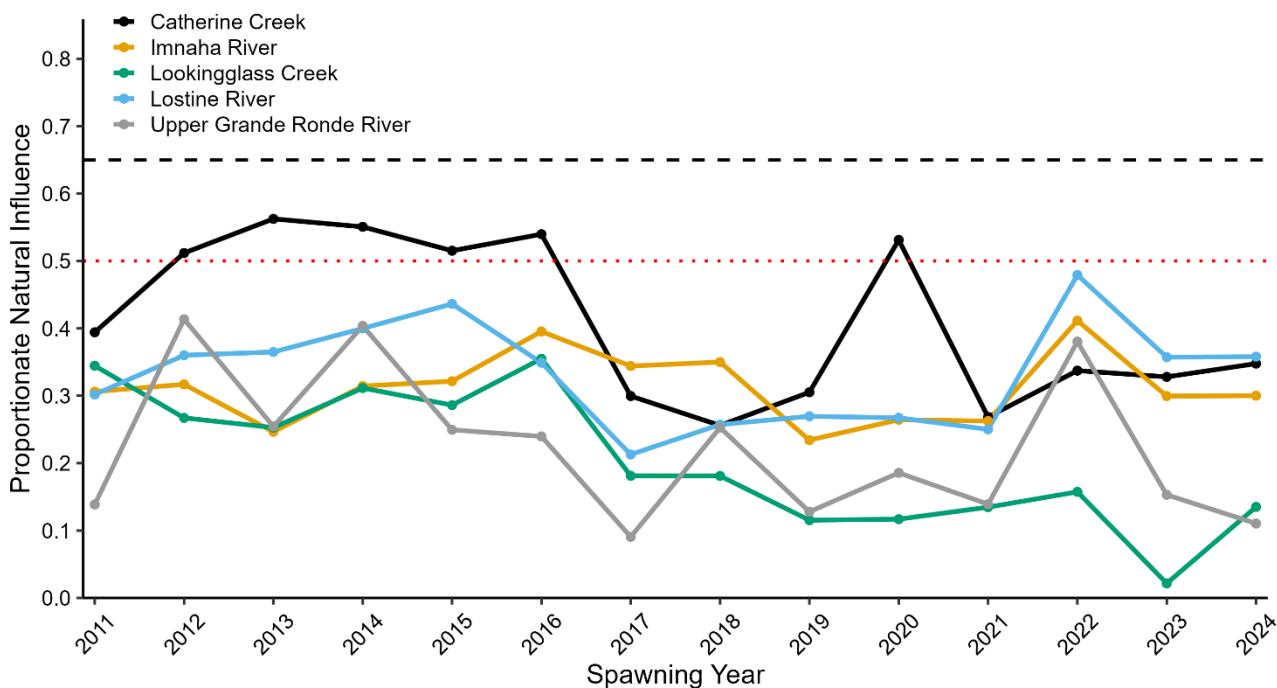


Figure 21. Proportionate natural influence (PNI) for the Catherine Creek, Imnaha River, Lookingglass Creek, Lostine River, and Upper Grande Ronde River populations, return years 2011 to 2024. The HSRG recommended PNI ≥ 0.67 (black dashed line) for Primary populations and >0.5 (red dashed line) for Contributing populations.

Objective 6. Assess and compare life history characteristics (smolt migration, run timing, age structure, sex ratio, fecundity) of hatchery and natural fish.

Hatchery smolt releases vs natural smolt out-migrants

A trend observed across all hatchery releases, is that when compared to natural spring migrants, the arrival time at LGD for hatchery smolts is more truncated than the arrival time of natural emigrants (Figure 22). Median travel days from release to LGD for hatchery smolts ranged from 17 to 29 days for migration year 2024.

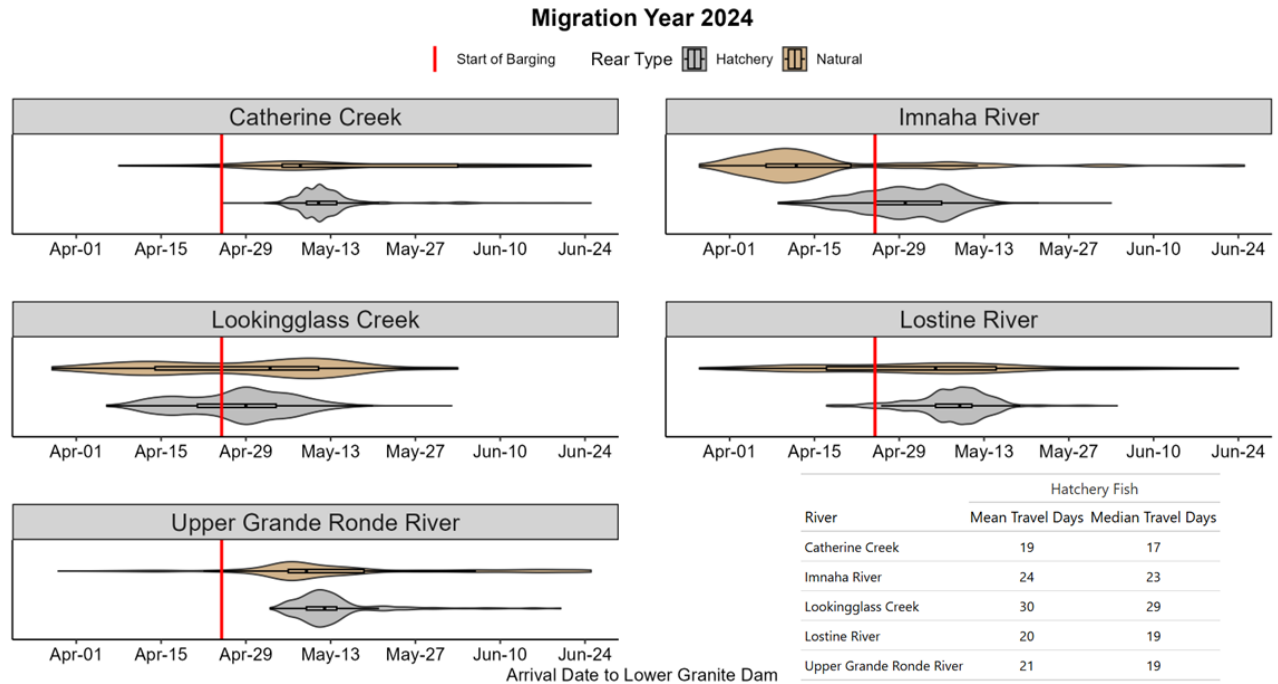


Figure 22. Arrival time at Lower Granite Dam of hatchery and natural Chinook Salmon smolts emigrating from the Grande Ronde and Imnaha basins, travel metrics, and the proportion subject to barging for migration year 2024. Mean and median travel time for hatchery smolts is shown in the lower right corner. The start of barging is assumed to be 21 April.

The disparate arrival times at LGD between hatchery and natural smolts also results in a differential proportion of smolts being available to barge (Figure 22, Table 16). If the goal of hatchery smolt releases is to mimic the emigration patterns of natural fish, the data suggests that current management actions are not meeting this objective. Reconsideration of both release dates and release strategies (e.g., volitional vs. forced releases) may be warranted, particularly for the Imnaha River stock, where the greatest disparities in LGD arrival times are observed. The truncated arrival patterns of hatchery smolts could limit the ability of hatchery populations to adapt to climate driven changes in river migration corridors, affect estuarine and ocean arrival time, or limit their ability to capitalize on inter-annual variation in the timing of productive ocean conditions.

Table 14. Proportions of hatchery and natural Chinook Salmon smolts emigrating from the Grande Ronde and Imnaha basins detected at Lower Granite Dam after smolt barging begins for migration year 2024.

Migration Year	Release River	Rear Type	Proportion	Mean arrival date	Median arrival date
			After Barging		
2021	Catherine Creek	Hatchery	0.99	12 May	11 May
2021	Catherine Creek	Natural	0.93	17 May	09 May
2021	Imnaha River	Hatchery	0.72	30 Apr	30 Apr
2021	Imnaha River	Natural	0.26	20 Apr	12 Apr
2021	Lookingglass Creek	Hatchery	0.64	27 Apr	29 Apr
2021	Lookingglass Creek	Natural	0.59	28 Apr	03 May
2021	Lostine River	Hatchery	0.95	07 May	09 May
2021	Lostine River	Natural	0.68	04 May	05 May
2021	Upper Grande Ronde River	Hatchery	1.00	13 May	12 May
2021	Upper Grande Ronde River	Natural	0.93	15 May	09 May

Adult run timing to the tributaries

For the 2024 return year, estimated weir efficiencies was 100% in Catherine Creek and Lookingglass Creek, 85% for the Imnaha River, 84% for the Lostine River, and 78% for the Upper Grande Ronde River (Figure 23). A 5-year average return timing (i.e., 2019–2023) was used to compare adult return timing from 2024 to examine patterns of hatchery and natural adults arriving at weirs in the Grande Ronde and Imnaha River basins (Figure 24). In return year 2024, hatchery and natural fish had similar median trap dates except for Catherine Creek and Lookingglass Creek (Table 17).

Two important functions of weirs are to collect broodstock for subsequent in-hatchery spawning and to manage the number of hatchery salmon allowed to spawn in nature. Since spawning and migration timing are heritable, variability in capturing broodstock creates potential risk of divergence from the natural population, if the full breadth of phenological characteristics cannot be consistently incorporated into the hatchery population. Consequently, the weir location and the efficiency of that weir in capturing returning salmon throughout the entire return are important considerations in how salmon populations are managed.

Notable factors that have directly influenced weir efficiency over the last ten years were operation of the Imnaha River Bridge Weir in 2016 and the requirement that the Upper Grande Ronde weir is removed when water temperatures are $\geq 20^{\circ}\text{C}$. In the Imnaha river, the previously operated picket weir could only be safely installed when river discharge was $< 28 \text{ m}^3/\text{s}$ and weir efficiency for the picket weir ranged from 30 to 100%. However, a challenge that is still present in the Imnaha River is that up to 50% of the spawning can occurs below the weir (ODFW, unpublished data). The temperature operating limits for the Upper Grande Ronde were implemented in 2010 to prevent mortality of adult salmon trapped below the weir. This was in response to the death of approximately 300 Chinook Salmon documented below the weir in 2009 that was attributed to thermal stress. One result of the early weir removal is the inability to trap a representative proportion of the entire run. By only collecting adults from the beginning of the run, it is possible that we might be selecting for early returning adults which could alter run timing.

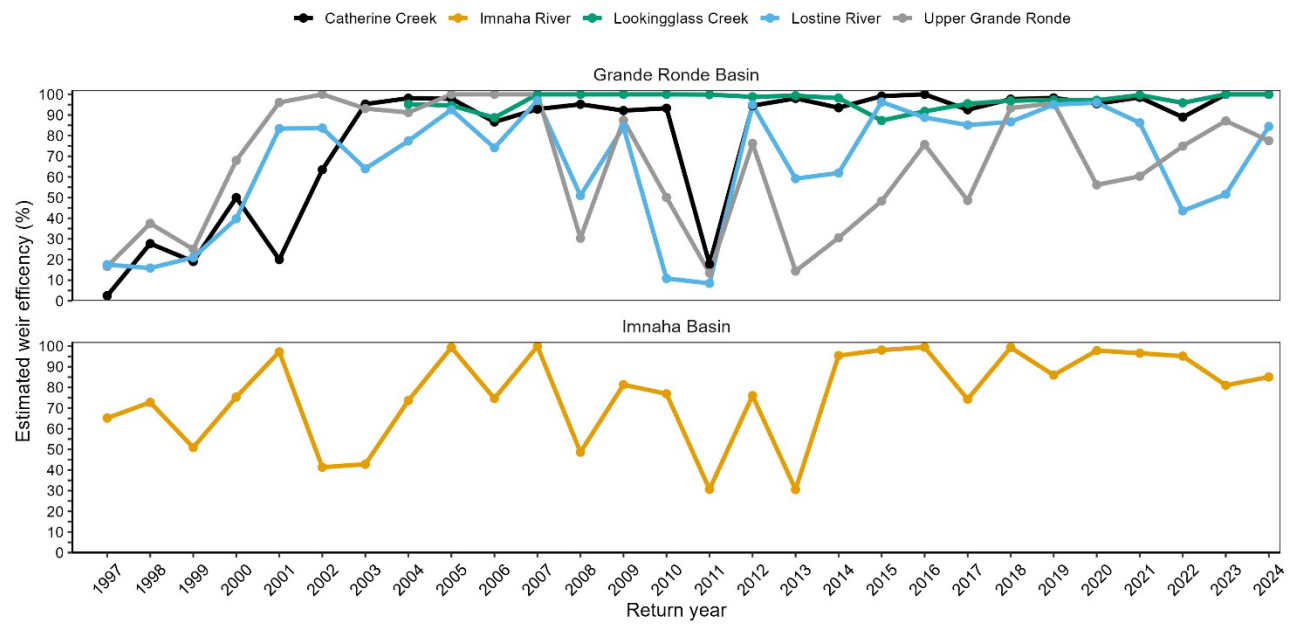


Figure 23. Annual estimated weir efficiency for streams in the Grande Ronde and Imnaha basins, 1997–2024.

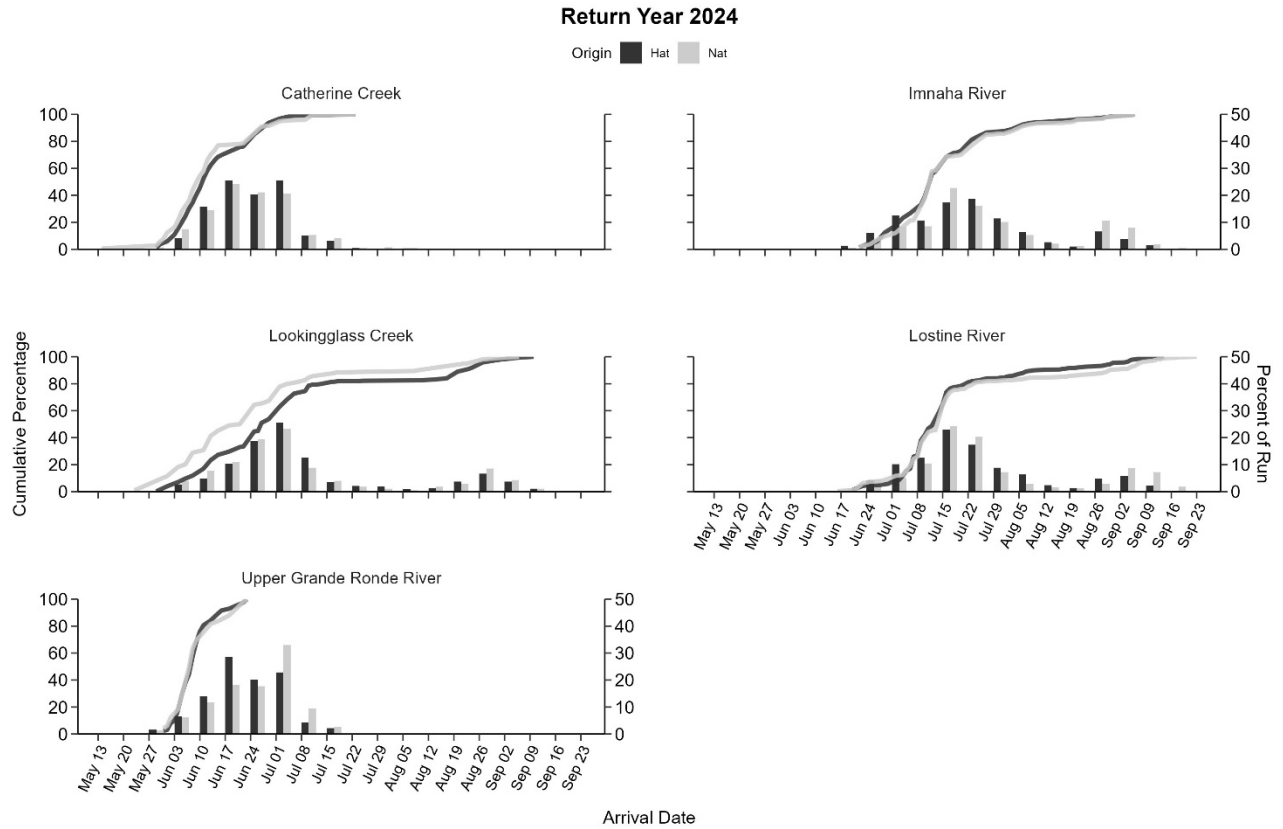


Figure 24: Return years 2024 cumulative arrival date of age 3–5 hatchery and natural Chinook Salmon trapped at weirs on Catherine Creek, Imnaha River, Lookingglass Creek, Lostine River, and the Upper Grande Ronde River. Bars are the five-year average percentage of the run trapped at each adult weir grouped by week of the year.

Table 15. Return year 2024 mean and median trap dates of age 3–5 hatchery and natural Chinook Salmon trapped at weirs on Catherine Creek, Imnaha River, Lookingglass Creek, Lostine River, and the Upper Grande Ronde River.

River	Hatchery		Natural	
	Mean Trap Date	Median Trap Date	Mean Trap Date	Median Trap Date
Catherine Creek	12 Jun	10 Jun	11 Jun	09 Jun
Imnaha River	14 Jul	11 Jul	15 Jul	11 Jul
Lookingglass Creek	03 Jul	26 Jun	24 Jun	22 Jun
Lostine River	16 Jul	13 Jul	18 Jul	13 Jul
Upper Grande Ronde River	07 Jun	07 Jun	08 Jun	07 Jun

Objective 7. Determine the success of maintaining genetic integrity of endemic wild spring Chinook Salmon in the Minam and Wenaha rivers.

The National Marine Fisheries Service (NMFS) Section 10 permits for the Grande Ronde Basin Hatchery programs require monitoring for hatchery-origin strays into the Minam and Wenaha rivers. Annual spawning ground surveys are conducted to determine whether any hatchery program contributes more than 5% of the total spawners in either river. The stray rate is evaluated using a three-year running average that began in 2016. If this threshold is exceeded, program co-managers must notify NMFS. We use both CWT and genetic samples to determine the hatchery program.

In the Minam River, zero hatchery-origin Chinook Salmon carcass were recovered in 2024 (Table 13; Table 18). In the Wenaha River, two hatchery-origin carcasses were recovered in 2024, one was traced to the Lostine River conventional program via CWT and the other to the Lookingglass Creek conventional program via genetic analysis. Overall, carcass recoveries in both the Minam and Wenaha rivers remain low, likely due to the high abundance of scavengers in these wilderness systems.

From 2011–2023, the proportion of hatchery-origin spawners, including jacks ((pHOS_{ij})), in the Minam and Wenaha Rivers ranged from 0%–33% and 0.12%–50%, respectively (Figure 19). Years with zero pHOS are likely due to low carcass recovery probability rather than true inter-annual variation. Testing this hypothesis would require substantially more surveys—and more staff—during July–September in these wilderness streams. The current pHOS estimates rely entirely on carcass recoveries, and low sample sizes create considerable uncertainty. Wildfires have also regularly interfered with surveys. For example, the 2015 Grizzly Ridge Complex Fire burned most of the Wenaha River drainage and destroyed over 80% of the trail system, while the 2019 Granite Gulch Fire curtailed surveys in the upper Minam River. If we are unable to improve our carcass recovery rates, pHOS estimates in these wilderness streams may not yield precise estimates. To complement the existing survey methods (i.e., two ground-based surveys/year), we need to explore alternative approaches, such as observing holding adults—which avoids scavenger-related issues and can occur before fire season—or having a greater reliance on PIT tag detections at in-stream interrogation sites (e.g., WEN, MR1). Another option to consider exploring is genetic sampling of juveniles to determine if one or both grandparents were hatchery- or natural-origin. Implementing alternative monitoring strategies will likely require additional personnel and funding.

As an alternative method to estimate pHOS, we queried the PTAGIS database for adult Chinook Salmon PIT tags detected at the Minam River (MR1) and Wenaha River (WEN) interrogation sites. At MR1, 114 adult tags were detected in 2024. These detections included one hatchery-origin fish, five unknown-origin fish, and 105 natural-origin fish, which would result in a pHOS estimate of 0.94 percent if all detected adults were Minam River spawners. At WEN, the array was not functional in 2024 and only two natural-origin tags were detected. Four temporary antennas located upstream of WEN detected 31 unique adults, including 28 natural-origin fish and two of unknown origin. No hatchery-origin fish were detected at any of the five sites in 2024 (Treadway 2026). A PIT tag–based pHOS estimate was not provided for 2024 because estimation requires both the WEN array and the upstream sites to be operational.

These results should be interpreted with caution. It is unclear whether all adults detected at the interrogation sites actually spawned in these systems or were temporary “dip-ins” seeking cooler water. The estimates also assume complete detection at the arrays. In practice, the WEN array often experiences equipment failures, and its antennas frequently break during the spring Chinook migration, so complete detection is unlikely.

Table 16. Hatchery and natural origin carcasses found in the Minam and Wenaha rivers over the last ten spawning years, 2014–2024. Hatchery and natural origin determinations were based on fin clips, coded-wire tags, or through genetic analysis.

River / Spawning Year	Hatchery population							Natural Origin	Total
	Catherine Cr.	Imnaha R.	Lookingglass Cr	Lostine R.	Upper Grande Ronde R.	Out- of- Basin	Unk Hatchery		
Minam R.									
2014	0	0	1	4	0	0	5	115	125
2015	0	0	2	1	0	0	1	23	27
2016	0	0	0	0	0	0	0	23	23
2017	0	0	0	0	0	0	1	2	3
2018	0	0	0	0	0	0	0	9	9
2019	0	0	0	0	0	0	0	6	6
2020	0	0	0	0	0	0	0	12	12
2021	0	0	0	0	0	0	1	7	8
2022	0	0	0	0	0	0	0	5	5
2023	0	0	0	0	0	0	0	4	4
2024	0	0	0	0	0	0	0	13	13
Wenaha R.									
2014	0	0	17	0	0	1	15	50	83
2015	0	0	1	0	0	0	0	8	9
2016	0	0	1	0	0	1	7	45	54
2017	0	0	1	0	0	0	1	5	7
2018	0	0	5	0	0	0	6	11	22
2019	0	0	2	0	0	0	3	7	12
2020	0	0	0	0	0	0	0	2	2
2021	0	0	0	0	0	0	0	2	2
2022	0	0	1	0	0	0	2	11	14
2023	0	0	0	0	0	0	1	5	6
2024	0	0	1	1	0	0	1	27	29

Objective 8: Assess success in restoring fisheries.

One sport fishery took place in Lookingglass Creek in 2024 (Figure 25; Lance and Bratcher 2024). Sport anglers harvested 172 hatchery-origin Chinook Salmon.

Tribal fisheries also occurred in 2024. The NPT tribal harvest data was shared by e-mail communication with ODFW by Jack Yearout and the CTUIR harvest data was shared by Preston Bronson. In the Imnaha River, tribal anglers harvested 90 hatchery-origin and three natural-origin Chinook Salmon (Figure 25). In Lookingglass Creek, tribal anglers harvested 364 hatchery-origin and six natural-origin Chinook Salmon. In the Lostine River, tribal anglers harvested 49 hatchery-origin and one natural-origin Chinook Salmon.

Since the 2000 return year, terminal harvest opportunities have been limited (Figure 25). The Imnaha River, Lookingglass Creek, and Lostine River have provided the most consistent opportunities for both tribal and sport fisheries. In contrast, only one sport fishery has occurred in Catherine Creek (in 2012), which resulted in an estimated harvest of 24 hatchery-origin and 7 incidental natural-origin spring Chinook Salmon. No sport fisheries have occurred in the Upper

Grande Ronde. Although tribal harvest is authorized for most years in both Catherine Creek and the Upper Grande Ronde, low adult returns have resulted in minimal reported harvest.

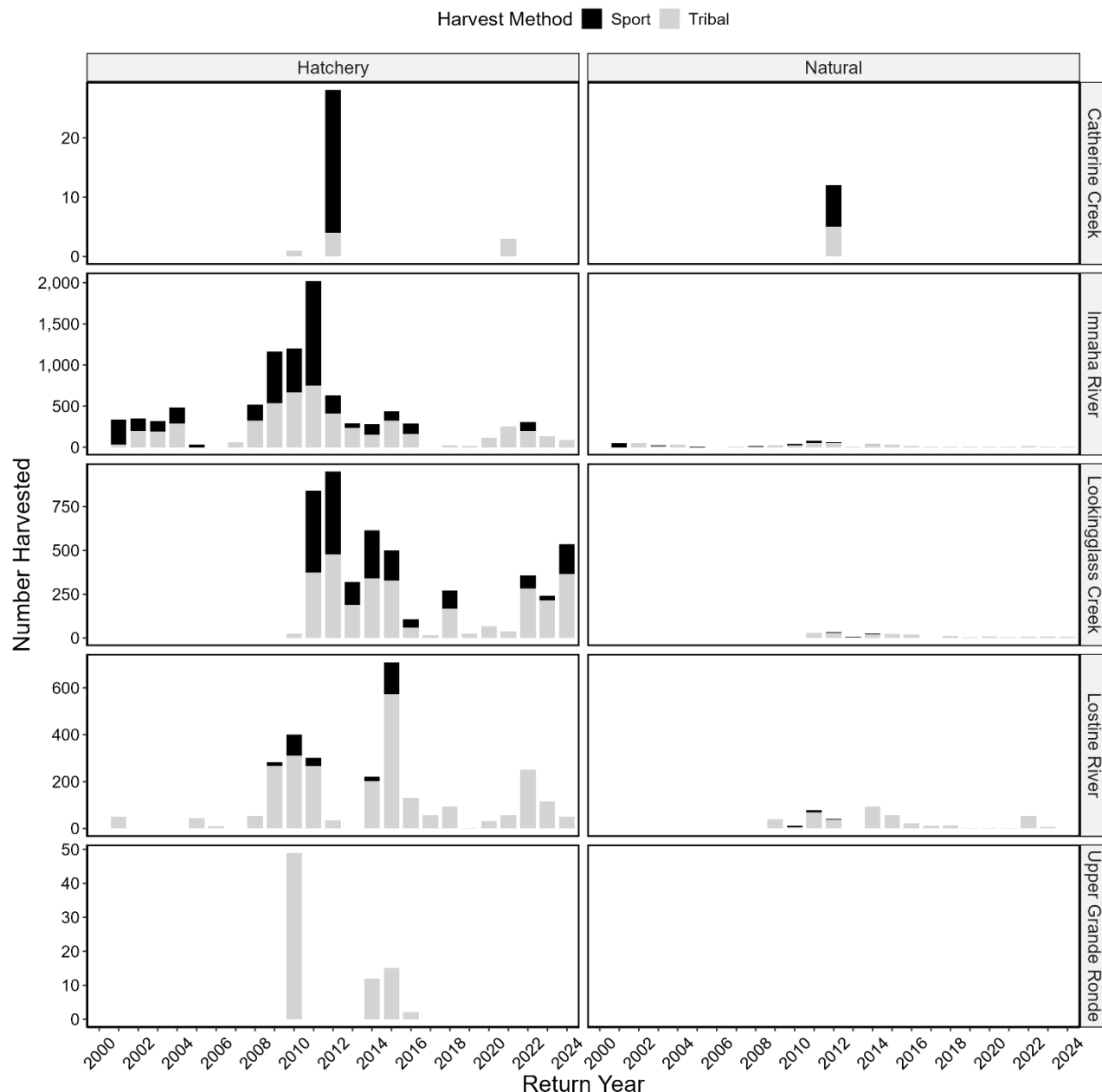


Figure 25. Total Chinook Salmon harvested by origin and fishing method (Sport or Tribal) in sport and tribal fisheries in Catherine Creek, the Imnaha River, Lookingglass Creek, the Lostine River, and the Upper Grande Ronde River, return years 2000-2024.

Objective 9: Coordinate project activities and disseminate results

The Grande Ronde and Imnaha River hatchery programs are complex and require significant collaboration to collect data within the co-management structure and across agencies. Successful project coordination, data management, and reporting of results to fisheries managers occurs

regularly at various scales and levels of complexity (Table 16). The ODFW, CTUIR, and NPT M&E projects rely on a combination of online databases, in-house access databases, and annual reports provided to BPA and the LSRCP office to archive and report findings. Key data collection and reporting metrics are summarized in Table 20.

Table 17. Timeline of key production, research, and collaboration activities in a normal calendar year.

Project Activities	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Production												
Catherine Creek: Chinook trapping												
Upper Grande Ronde: Chinook trapping												
Lookingglass Creek: Chinook trapping												
Lostine River: Chinook trapping												
Imnaha River: Chinook trapping												
Chinook spawning at LFH												
Fin clipping and CWT marking												
Egg shocking												
Egg hatching												
Acclimate and release juvenile Chinook												
Research												
Trapping QA-QC with co-managers												
Chinook spawning ground surveys												
Adult radio tracking												
Hatchery juvenile PIT tagging												
Pre-release hatchery juvenile sampling												
Fin clip and CWT retention checks												
PIT array operations and maintenance												
Pre-season run projections												
In-season run monitoring												
Upload PIT tag data to PTAGIS												
Submit annual report to the LSRCP office												
Submit statement of work to LSRCP office												
Joint												
Annual Operating Plan development												
Local and regional coordination												
Data sharing among co-managers												
ESA reporting to NOAA & USFWS												
Reporting to Coordinated Assessments												

Table 18. Key data collection, reporting metrics, and data storage locations. Data is reported by the Oregon Department of Fish and Wildlife (ODFW), the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), and the Nez Per Tribe (NPT). HMS = ODFW's Hatchery Management System. CDMS = Central Data Management System.

Key data collection or reporting metric	Where data is stored or reported
Chinook Salmon trapping and broodstock collection	a) CTUIR stores data for the Catherine Creek, Upper Grande Ronde, and Lookingglass Creek in CTUIR's CDMS system. Catherine Creek and Upper Grande Ronde trapping data is also reported to FINS. b) NPT stores Lostine River Chinook trapping data in 1) NPT's CDMS system, and 2) FINS. c) ODFW stores Imnaha and Lookingglass trapping data in FINS. d) The Fish Research Office stores copies of all trapping records in in-house access databases where records are supplement with age data derived from CWTs, scales, PIT tags, and genetic data. e) Chinook trapping data for all traps is reported to the ODFW's HMS. f) ODFW annual reports submitted to LSRCP. g) Individual reports by NPT and CTUIR to BPA.
Egg Collection Numbers	a) ODFW's HMS. b) ODFW Fish Research in-house access database. c) ODFW annual reports submitted to LSRCP. d) Individual reports by NPT and CTUIR to BPA.
Hatchery broodstock spawning records	a) ODFW's HMS b) ODFW Fish Research in-house access database. c) ODFW annual reports submitted to LSRCP. d) CTUIR CDMS system for Lookingglass Creek, Upper Grande Ronde, Catherine Creek.
Chinook spawning ground surveys	a) ODFW in-house access database. b) portions of the data are uploaded to NPT and CTUIR CDMS systems. c) Redd counts and carcass data StreamNet (www.streamnet.org).
Genetic samples	a) Starting in 2008, genetic samples for the parentage-based tagging baseline (BPA # 201003100; Steele et al. 2019) have been collected from all Chinook Salmon spawned at Lookingglass Fish Hatchery for all five hatchery programs. b) Relative reproductive success evaluations on Catherine Creek and Lookingglass Creek (BPA # 198909600). c) Relative reproductive success study in Lookingglass Creek (BPA #200900900).
Juvenile release numbers, number of CWT-marked releases, release locations	a) ODFW's HMS. b) ODFW annual reports submitted to LSRCP. c) Individual reports by NPT and CTUIR to BPA. d) Pacific States Reginal Mark Processing Center (rmcp.org).
Coded-wire-tagged fish recoveries	a) ODFW's HMS. b) ODFW annual reports submitted to LSRCP. c) Pacific States Reginal Mark Processing Center (rmcp.org).
PIT tagged hatchery releases	a) ODFW annual reports submitted to LSRCP. b) PTAGIS.org
PIT tag detections (in-stream or adult ladders and traps).	Both ODFW, NPT, and CTUIR collaborate to operate and maintain PIT tag equipment to monitor streams and fish ladders, and to scan individual adults at Chinook traps in the Grande Ronde and Imnaha basins. All data is submitted to PTAGIS. Efforts support BPA Project #201005700.
Harvest Monitoring	a) In-season harvest sport and tribal harvest information is shared during weekly meetings with co-managers. b) For sport fisheries, data is provided in ODFW annual reports submitted to LSRCP.

Key data collection or reporting metric	Where data is stored or reported
Smolt-to-Adult-Survival (SAS) and Smolt-to-Adult Return (SAR) rates	c) CTUIR and NPT complete independent harvest monitoring efforts. Harvest data is shared via e-mail and in annual reports. a) Hatchery SAR/SAS rates are in ODFW annual reports submitted to LSRCP for all five hatchery programs. b) Hatchery SAR rates: NPT and CTUIR provide in reports to BPA. c) Natural SAR estimates. ODFW reports Catherine Cr, Upper Grande Ronde, Lostine R, Minam R to https://cax.streamnet.org. CTUIR reports natural SAS and SAR to LSRCP and data is stored on the CTUIR CDMS system.
Outmigration juvenile survival rates	a) ODFW annual reports submitted to LSRCP b) Individual reports by NPT and CTUIR to BPA and LSRCP. c) Natural origin Chinook outmigrant estimates: StreamNet Coordinated Assessments https://cax.streamnet.org
Stray-rates (in-basin and out of basin)	a) ODFW annual reports submitted to LSRCP
Recruit:Spawner ratios	
1. Spawner:Spawner	a) ODFW and CTUIR annual reports submitted to LSRCP
2. Return to river: spawner	b) StreamNet Coordinated Assessments https://cax.streamnet.org
3. Smolts:spawner	
Proportion of natural influence (PNI)	a) ODFW annual reports submitted to LSRCP
Percent Hatchery Origin Spawners (PHOS)	a) For Grande Ronde and Imnaha basin populations, including Minam and Wenaha rivers: StreamNet Coordinated Assessments https://cax.streamnet.org
Natural Origin Spawner Abundance (NOSA)	a) For Grande Ronde and Imnaha basin populations, including Minam and Wenaha rivers: StreamNet Coordinated Assessments https://cax.streamnet.org

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