

CLEARWATER RIVER- SPRING/SUMMER CHINOOK SALMON HATCHERY PROGRAM REVIEW

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Introduction and background

The Clearwater River Chinook Salmon hatchery program funded through the Lower Snake River Compensation Plan (LSRCP) was established to provide mitigation for losses of spring/summer Chinook Salmon associated with the construction and operation of the four lower Snake River hydroelectric dams (Lower Granite, Little Goose, Lower Monumental, and Ice Harbor). Hatchery production funded by LSRPC in the Clearwater River basin includes fish reared at Clearwater Fish Hatchery, Dworshak National Fish Hatchery, and Nez Perce Tribal Hatchery. Additional juvenile spring Chinook Salmon hatchery production in the Clearwater basin is funded through the Bonneville Power Administration’s (BPA) Fish and Wildlife Program at Nez Perce Tribal Hatchery and through the US Fish and Wildlife Service (USWFS) at Kooskia National Fish Hatchery (Figure 1, Table 1). Clearwater Fish Hatchery is operated by the Idaho Department of Fish and Game (IDFG). The Dworshak, Kooskia, and Nez Perce Tribal facilities are all operated by the Nez Perce Tribe (NPT).

Table 1. Rearing facilities, funding source, and juvenile production targets for the spring and summer Chinook Salmon in the Clearwater River basin.

Rearing Facility	Funding Source	Juvenile Lifestage at Release	2010 Juvenile Release Target	Current Juvenile Release Target
Clearwater Fish Hatchery	LSRCP	Smolt	2,835,000	3,749,000
Dworshak NFH	LSRCP	Smolt	1,050,000	1,650,000
Nez Perce Tribal Hatchery	LSRCP	Smolt	0	400,000
Nez Perce Tribal Hatchery	BPA	Smolt	0	200,000
Nez Perce Tribal Hatchery	BPA	Parr and Pre-Smolt	625,000	225,000
Kooskia National Fish Hatchery	USFWS	Smolt	600,000	650,000

Total Juvenile Releases	5,110,000	6,874,000
Total LSRCF Funded Releases	3,885,000	5,799,000

Since the last Independent Scientific Review Panel (ISRP) program review in 2010, there has been a concerted effort among co-managers in the Clearwater River basin to operate all hatchery facilities in a more coordinated manner as more of a hatchery complex rather than as individual programs which is consistent with the programmatic recommendations from the Hatchery Scientific Review Group (HSRG) in 2009. These facilities include Nez Perce Tribal Hatchery, Dworshak National Fish Hatchery, Clearwater Fish Hatchery, and Kooskia National Fish Hatchery. This has resulted in a more effective and efficient use of trapping, spawning, and rearing capacity in the Clearwater basin and has allowed managers to increase the number of juveniles produced annually from 5,110,000 in 2010 to 6,874,000 currently (Table 1).

This high level of coordination between facilities and co-managers is maintained primarily through the development of Annual Operating Plans (AOPs) and weekly coordination calls (i.e., Webinars) that occur from April-November. The AOPs establish plans for hatchery operations and highlight any anticipated deviations from normal operations. All normal operations are captured in a Standard Operating Procedures (SOP) document that is reviewed annually. The weekly conference calls are used to track and update the adult returns (via PIT tags) for estimating allowable harvest shares for the tribal and non-tribal fisheries and to develop contingency plans if it appears we will not have sufficient adult returns at some or all trapping facilities to meet production targets. This process helps to maximize the beneficial use of adult Chinook Salmon that are in excess of broodstock needs, ensure that enough adults are trapped and spawned to meet production targets at all facilities in the Clearwater basin, and ensure a timely and coordinated response for unanticipated events or conditions.

While it is somewhat difficult to decouple all operations within the highly coordinated efforts that occur in the Clearwater program, this report, to the extent practicable, only includes information specific to the component of the program that occurs at Clearwater Fish Hatchery and its satellite facilities

The Clearwater Fish Hatchery and satellite facilities are operated by IDFG, and all production at Clearwater Fish Hatchery is funded by LSRCF. Infrastructure includes a rearing hatchery and three satellite facilities. The Clearwater Fish Hatchery is the rearing facility and is located on the North Fork Clearwater River in Ahsahka, Idaho. Construction of this facility was completed in 1992. The Powell satellite facility is located on the upper Lochsa River and was completed in 1989. It is used for adult trapping and spawning. All eggs from this facility are transferred to CFH for incubation and final rearing. The Red River satellite facility is located on Red River, a tributary to South Fork Clearwater River and was completed in 1976 as part of the Columbia River Fisheries Development Program and was updated in 1986 as part of the LSRCF mitigation program. This facility is used for trapping and temporary holding of adults. All adults trapped and held for broodstock are transferred to CFH for spawning, incubation and final rearing. The Crooked River satellite facility is located on Crooked River in the South Fork Clearwater River drainage and was completed in 1989. Historically this facility was used to trap adults associated with a juvenile release that occurred near the adult trap in Crooked River. This juvenile release was discontinued in 2013 due to poor conversion rates of returning adults back to the trapping facility. Facility locations for the hatchery and three satellite facilities are displayed in Figure 1.

The LSRCP adult mitigation goal for the Clearwater Fish Hatchery is 11,915 adult Chinook Salmon above the Project Area (Lower Granite Dam) and 47,660 adults available for downriver (Columbia and lower Snake rivers) harvest. The original smolt release target of 1.37 million yearling smolts was based on an assumed smolt-to-adult survival rate (SAR) of 0.87% back to the project area and a smolt-to-adult survival rate (SAS) of 4.35% back to the Columbia River mouth (Table 2).

Table 2. Adult return goals for LSRCP funded Chinook Salmon reared at Clearwater Fish Hatchery.

Run	Project Area Goal	Downstream of Project Area Goal	Total Adult Goal
Spring	9,882	39,528	49,410
Summer	2,033	8,132	10,165
Total	11,915	47,660	59,575

and 640K summer Chinook Salmon (Table 3). Releases occur at five locations throughout the Clearwater basin with the intent to provide a diversity of fishing opportunities for both tribal and non-tribal fisheries (Figure 1).

Table 3. Smolt production targets and release locations for Clearwater Fish Hatchery spring and summer Chinook Salmon. All releases are yearling smolts.

Run	Release Site	Target Release Number
Spring	N.Fk. Clearwater River	709,000
Spring	Red River	1,280,000
Spring	Clear Creek	720,000
Spring	Selway River	400,000
Summer	Powell	640,000
Total		3,749,000

ESA status and consultation history

Natural populations of spring Chinook Salmon in the Clearwater River were extirpated and current natural spring Chinook Salmon are not part of the listed Snake River ESU.

Through consultation with NOAA fisheries and the USFWS, two Biological Opinions (WCR-2017-7303; 01EIFW00-2017-F-1143) were completed in 2017 that established take limitations for ESA listed species (including spring/summer Chinook Salmon, fall Chinook Salmon, steelhead, and Bull Trout) that are impacted by operation of the spring/summer Chinook Salmon hatcheries in the Clearwater basin. The non-tribal fishery is operated in accordance with IDFG’s Fishery Management and Evaluation Plan (IDFG 2011).

Broodstock history

Spring Chinook Salmon

The construction and operation of the Lewiston Dam from 1927 to 1973 on the Clearwater River, four miles upstream of the mouth, led to the extirpation of natural populations of Chinook Salmon in the Clearwater basin. Lewiston Dam was removed in 1973. Reintroduction efforts began in the 1950’s and ramped up in the 1970’s. These reintroductions consisted primarily of Rapid River stock but also included some Dworshak, Kooskia, Middle Fork Salmon R., Carson, and Leavenworth stocks. Since the early 1990’s, the majority of brood have been collected from Clearwater basin adult returns. Returns of spring Chinook Salmon adults to all trapping locations (NPTH, N.F. Clearwater R., Clear Cr., Red R., and Crooked R.) in the Clearwater basin are managed as a single stock. Adult returns to each trapping location are prioritized for the juvenile releases at those locations to take advantage of any local adaptation that may occur. However, in years when there are not enough returns to meet juvenile production targets at particular release locations, backfilling occurs from other trapping locations within the Clearwater basin and may also include fish from Rapid River Fish Hatchery. During the 1990s, the average percent of the broodstock for fish reared at Clearwater Fish Hatchery was 65%

from locally returning adults to the Clearwater basin with Rapid River making up the difference (Figure 2). Since 2000, the average broodstock composition has been 94% local returns to the Clearwater basin. In 2018 and 2019, production in the Clearwater basin included eggs from spring Chinook Salmon collected at Little White Salmon Fish Hatchery. For those two years, juveniles from the Little White Salmon were released into the Selway River where they are not expected to contribute to future brood collections. It is noteworthy that the present stock of spring Chinook Salmon at Little White Salmon FH is considered a derivative of Carson Stock (Little White Salmon HGMP, 2002). The Carson Fish Hatchery spring Chinook Salmon broodstock was founded from adult collections at Bonneville Dam from 1955-1964 and was believed to be a mixture of Snake River and upper Columbia River stocks (Carson FH HGMP, 2004).

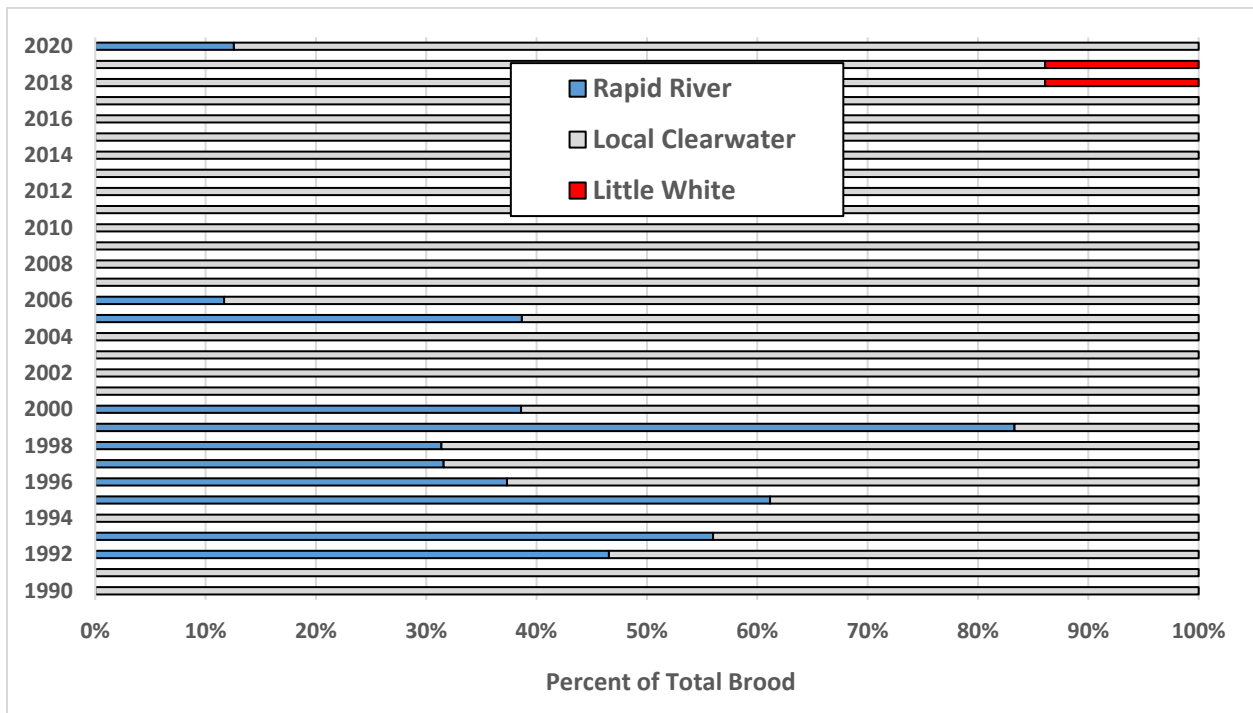


Figure 2. Broodstock composition of spring Chinook Salmon reared at Clearwater Fish Hatchery for brood years 1990-2020.

Summer Chinook Salmon

The summer-run hatchery program in the Clearwater basin was initiated in 2009 with the first juvenile releases occurring in 2011. Broodstock for this program was founded from hatchery-origin adults returning to the South Fork Salmon River (SFSR) that were in excess of brood needs for the South Fork program. The first locally returning summer-run adults in the Clearwater River occurred in 2013. Since then, locally returning summer run adults to the Clearwater Basin have been prioritized for brood but when returns are insufficient to meet production targets, adults from the SFSR are used to make up the shortage, when available. The composition (local vs. SFSR) of the summer brood has varied but since brood year 2014 has been composed of 74% from locally returning Clearwater adults (Figure 3).

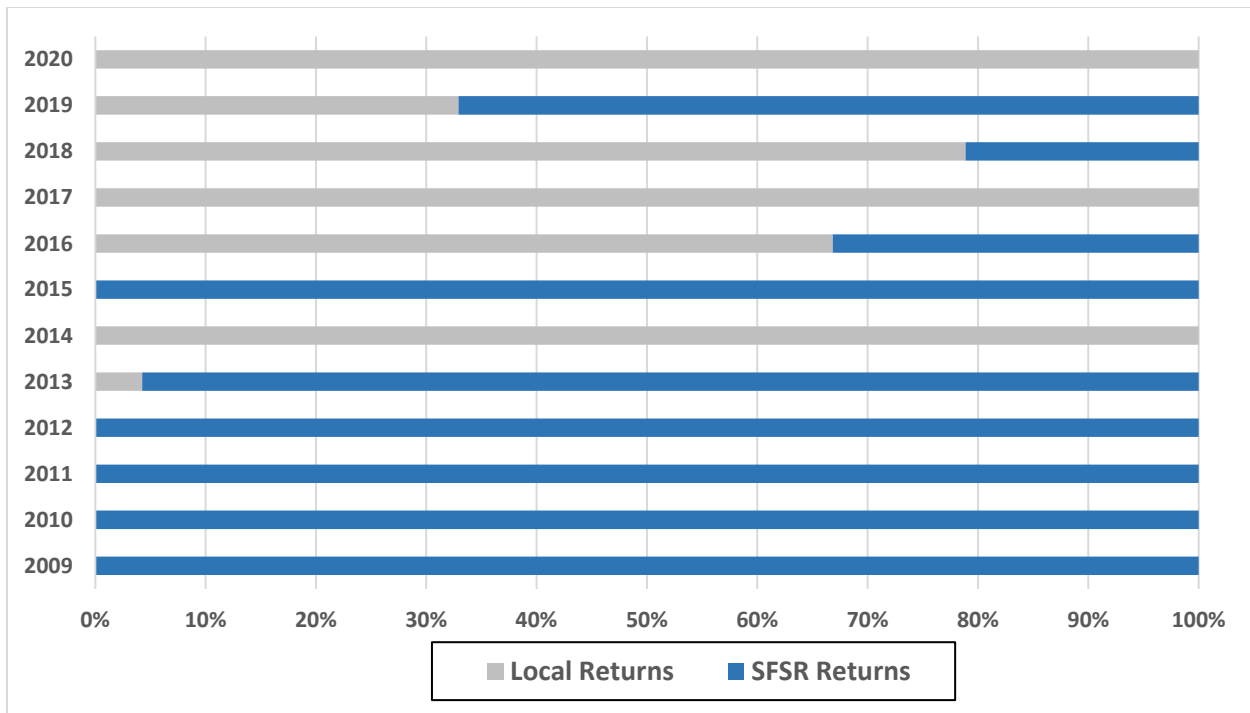


Figure 3. Broodstock composition of summer Chinook Salmon reared at Clearwater Fish Hatchery for brood years 2009-2020.

Broodstock goals

Broodstock collection targets are established annually through the AOP process for all facilities. A “Broodstock Calculator” is used to calculate the number of adults to be trapped and spawned based on a five-year running average of survival metrics (i.e. adult pre-spawn mortality, fecundity, eye-up rate, and eye-release survival). Current broodstock targets for the Clearwater Fish Hatchery include trapping 2,165 spring Chinook Salmon adults and 432 summer Chinook Salmon adults. All spring and summer Chinook hatchery production in the Clearwater basin utilize segregated hatchery broodstocks.

Management and monitoring and evaluation objectives

Management Objectives for the Clearwater River Chinook Salmon hatchery program are to meet the LSRCP adult mitigation objectives, to restore and maintain tribal and non-tribal fisheries in the Clearwater River basin, and reduce impacts of the hatchery program on the natural Chinook Salmon production in the Clearwater River.

The hatchery population in the Clearwater River basin is managed in a manner that reduces risk to the natural populations, and hatchery smolt release sites have been selected to allow for sanctuary areas which reduce hatchery and natural fish interactions. IDFG’s Fisheries Management Plan (IDFG 2019) specifies tributary habitats within the Clearwater basin that are prioritized for natural Chinook Salmon conservation. Consequently, hatchery smolt release sites are located in mainstem habitats with trapping facilities to capture returning adults with the exception of the Selway River release where there is no trapping site and supplementation is intentional. IDFG will continue to work cooperatively in the

Clearwater basin to improve habitat quality and monitor productivity of natural Chinook Salmon populations while reducing impacts of the hatchery program.

Monitoring and evaluation (M&E) objectives for the Clearwater River program include monitoring production, productivity, and life history characteristics of the hatchery and natural populations and to evaluate broodstock and rearing strategies to increase and maximize adult returns. M&E activities in the Clearwater R. basin are a cooperative effort between the Idaho Department of Fish and Game (IDFG), the Nez Perce Tribe (NPT), and the U.S. Fish and Wildlife Service. The monitoring and evaluation of the natural population consists of a comprehensive fish-in, fish-out monitoring program that follows fish from the cradle to the grave via sampling at screw traps, snorkel surveys, and spawning ground surveys in addition to juvenile and adult sampling at Lower Granite Dam. For IDFG, monitoring of natural populations in the Clearwater basin is funded through the BPA Fish and Wildlife program under project 1990-055-00.

In-Hatchery and Post-Release Performance

Adult pre-spawning mortality

Average pre-spawn mortality rates for male and female spring Chinook Salmon at Clearwater Fish Hatchery are generally low, with most years recorded at <10% (Figure 4). The exception was for brood year 2007, when 17% of adults died as part of an accidental fish kill. The most recent 10-year mean is 4% and over the entire time series is 6%. Summer Chinook Salmon pre-spawn mortality rates varied widely between years. Between 2009 and 2013, summer Chinook Salmon brood for Clearwater Hatchery was sourced exclusively from the SFSR fish trap which experienced several years of unusually high pre-spawn mortality and is described more thoroughly in the report for the SFSR program. The average pre-spawn mortality rate for brood years from 2009-2020 is 8% and since 2013 is 2%.

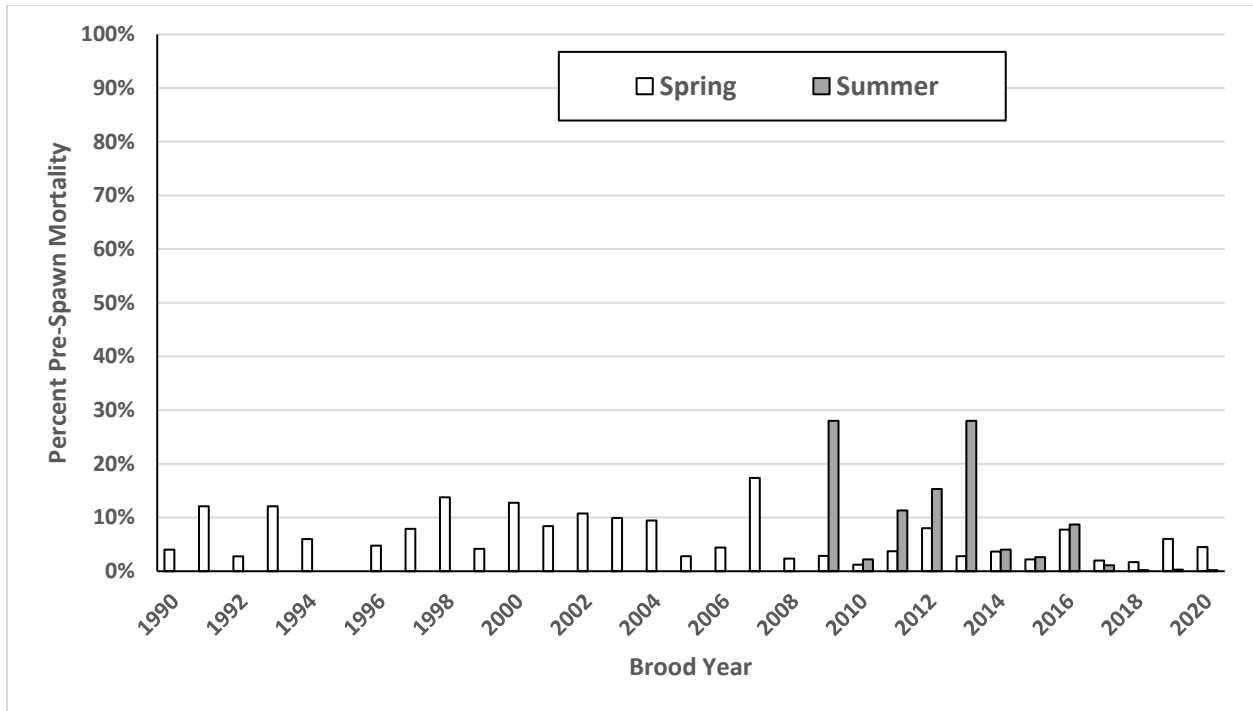


Figure 4. Pre-spawn mortality rate of spring and summer Chinook Salmon at Clearwater Fish Hatchery, 1990-2020.

Egg to smolt survival

Average survival from eyed-egg to release at Clearwater Fish Hatchery for spring Chinook Salmon is 85% over the entire time series and 86% for the most recent 10 years (Figure 5). For summer Chinook Salmon, the average survival for brood years 2009-2020 is 82%.

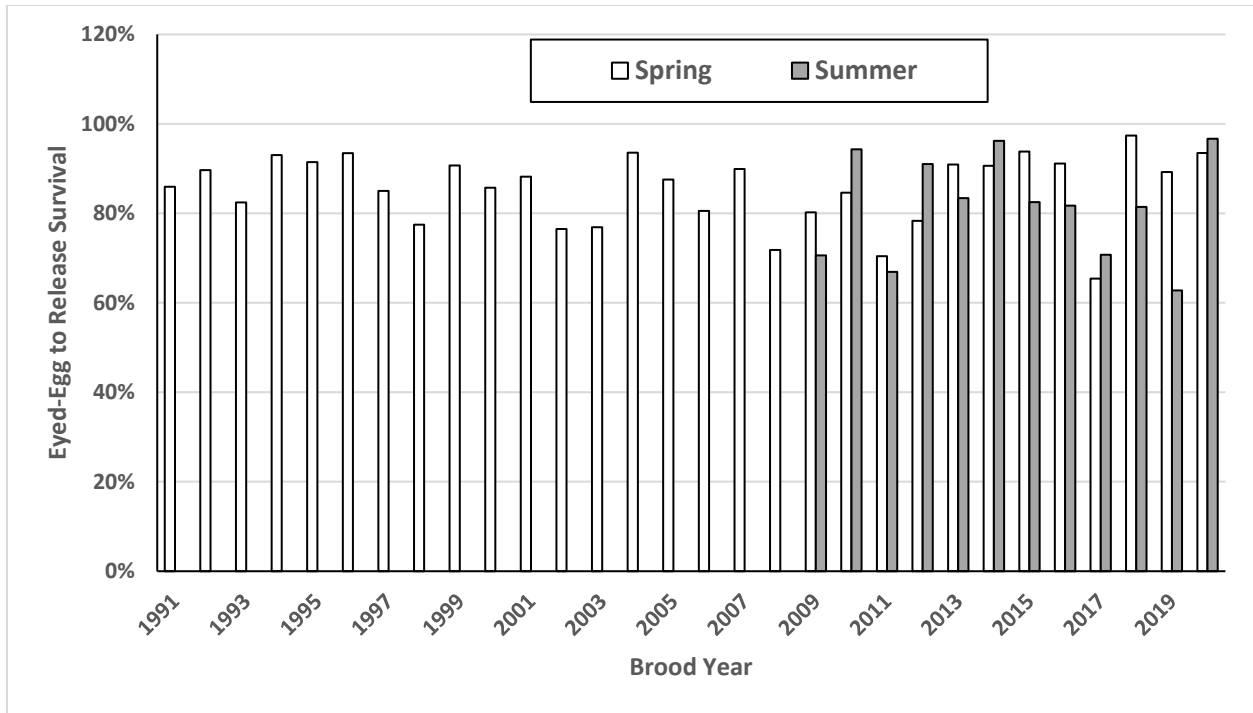


Figure 5. Eyed egg to release survival of Clearwater Fish Hatchery spring (1991-2020) and summer Chinook Salmon smolts, 2009-2020.

Juvenile releases

Production targets for juvenile releases of spring and summer Chinook Salmon from Clearwater Fish Hatchery have increased incrementally over the last twenty years in an effort to achieve the adult mitigation goals (Figure 6). Likewise, due to the relatively poor post-release performance of sub-yearling releases, all sub-yearling releases were phased out and since brood year 2012, all production at Clearwater Fish Hatchery has been composed of yearling smolt releases (Figure 7). Early in the Clearwater Fish Hatchery program, release targets were routinely underachieved due to low adult returns. Since 2000, juvenile release targets have largely been met (Figure 6).

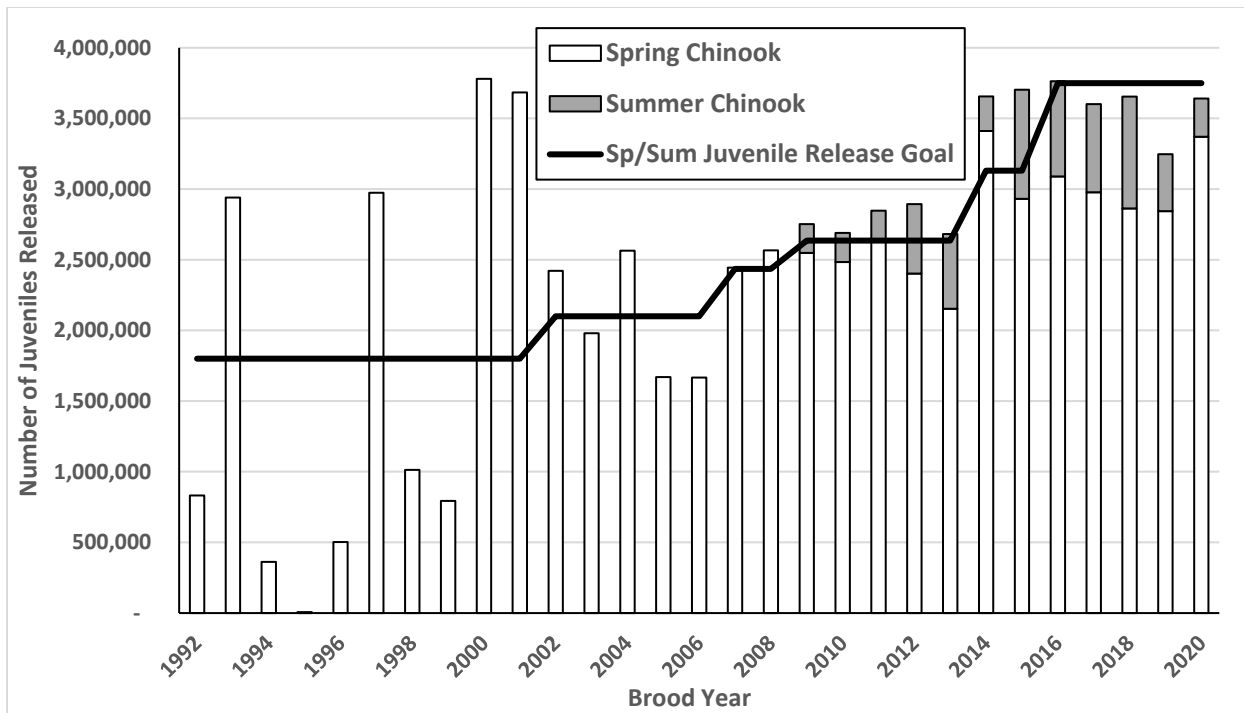


Figure 6. Release target and actual number of juvenile spring and summer Chinook Salmon released from Clearwater Fish Hatchery, 1992-2020.

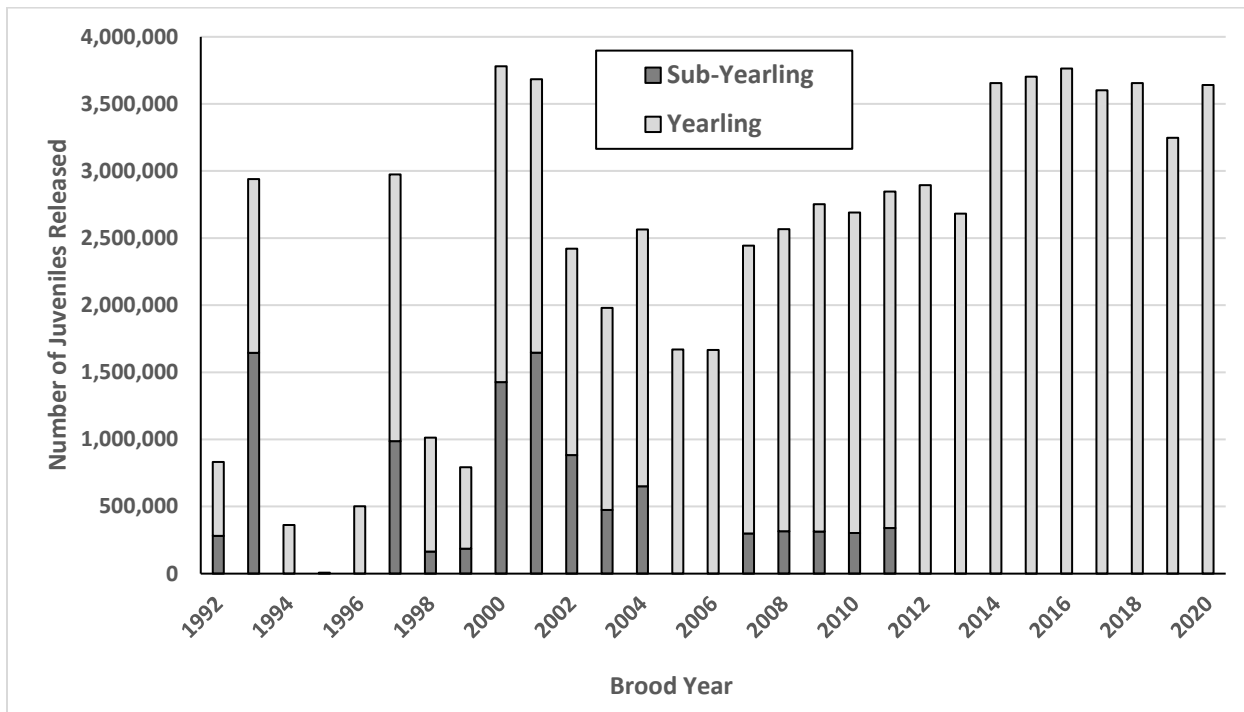


Figure 7. Number of sub-yearling and yearling spring/summer Chinook Salmon released from Clearwater Fish Hatchery, 1992-2020.

Juvenile survival from release to Lower Granite Dam

Juvenile release groups for spring and summer Chinook Salmon have been representatively tagged with Passive Integrated Transponders (PIT) tags since 1995 and are used to estimate juvenile survival from release to Lower Granite Dam. Since 2008, PIT tagging efforts increased (number tagged per release group) as part of a cooperative effort with the Comparative Survival Study (McCann et al., 2021) and to provide estimates of adult returns for survival analysis and for in-season fisheries management.

Estimated survival of juvenile spring Chinook Salmon from release to Lower Granite Dam has been stable over the time series and has averaged 67% across all release sites over the entire time series (Figure 8). Some of the highest survival observed has occurred in the most recent three years. During the years when both spring and summer juveniles have been produced (2009-2020) the average survival of spring Chinook Salmon is 70% and the average survival of summer Chinook Salmon is 63%.

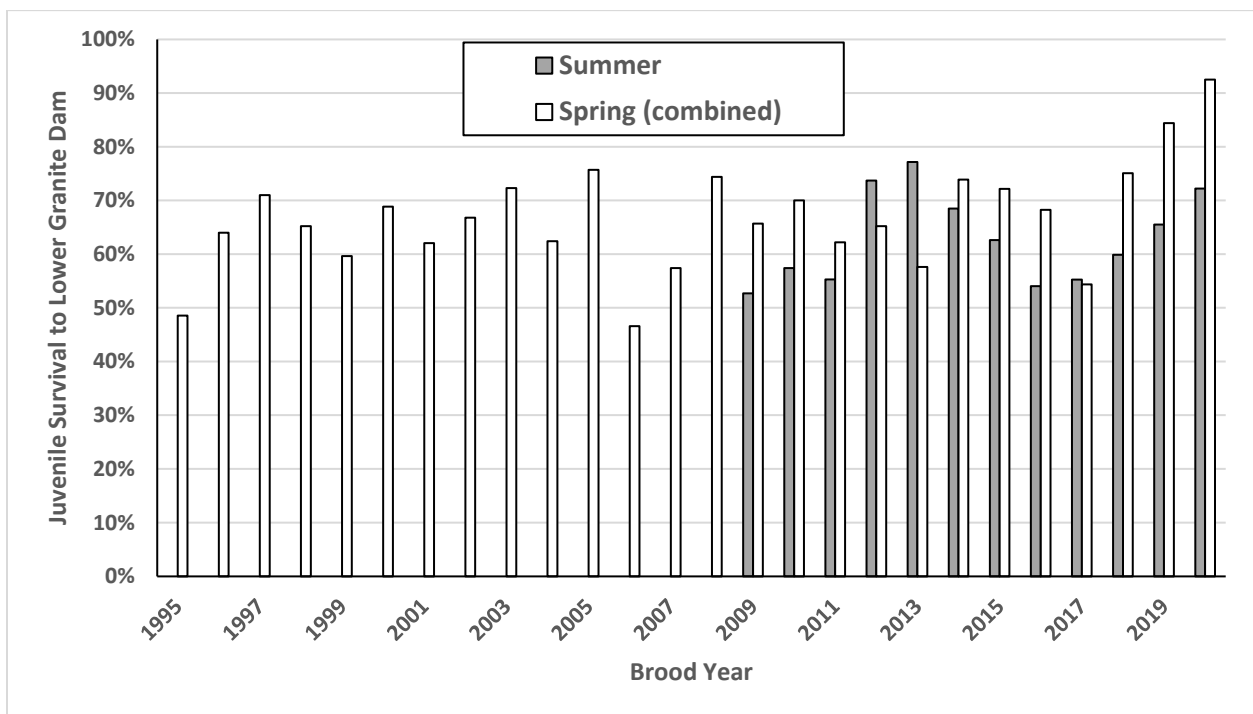


Figure 8. Estimated survival, from release to Lower Granite Dam, of juvenile spring and summer Chinook Salmon from released from Clearwater Fish Hatchery for brood years 1995-2020. The estimates for spring Chinook Salmon represent the weighted average across all release sites. There is a single release site for summer Chinook Salmon.

The data in Figure 9 represents the contemporary release site configuration for Clearwater Fish Hatchery (see Table 2 for release targets). We have observed considerable variation in juvenile survival

between release sites annually and much of this variation is consistent across time. Except for the most recent few years, the Red River release has consistently had the lowest juvenile survival of all release sites.

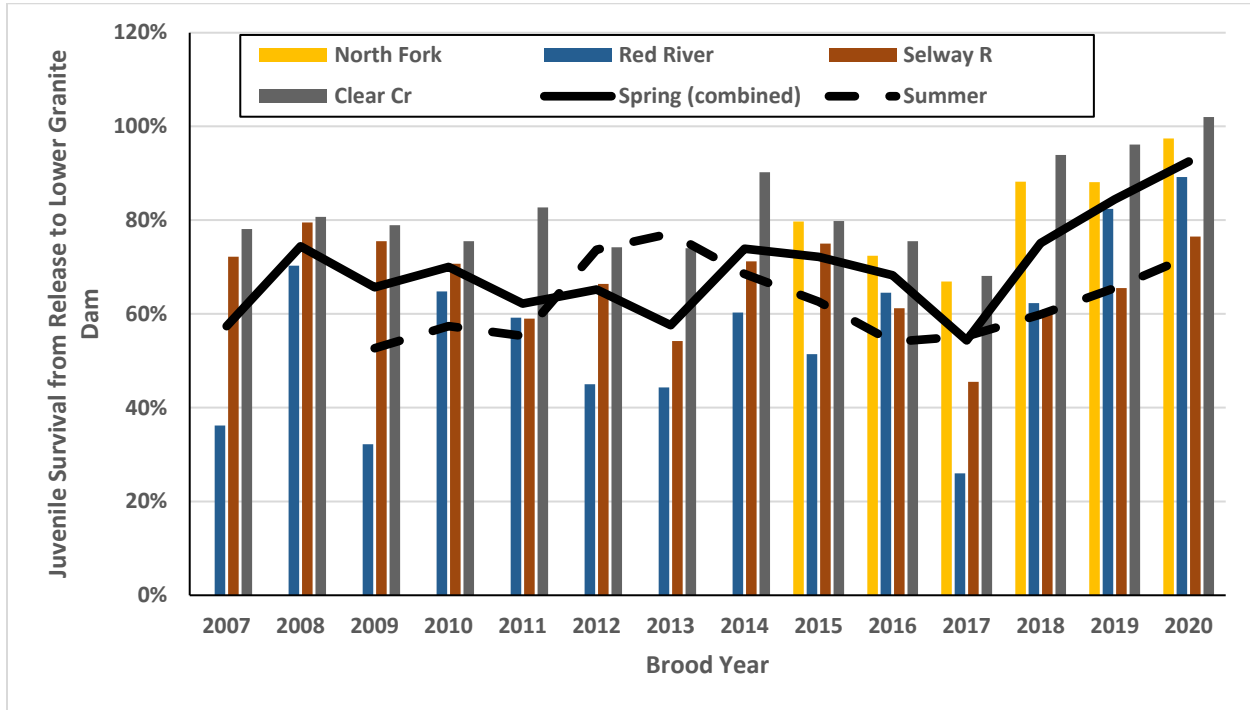


Figure 9. Estimated survival, from release to Lower Granite Dam, of juvenile spring/summer Chinook Salmon released from Clearwater Fish Hatchery for brood years 2007-2020. The solid black line represents the weighted average across all release locations for spring Chinook Salmon. The dashed black line represents the single release site for summer Chinook Salmon. The colored bars represent estimates from individual release sites for spring Chinook Salmon.

Adult returns to the Project Area (mitigation goal)

The LSRCP adult mitigation goals for programs in Idaho are measured as adult returns above the project area and are defined as returns to Lower Granite Dam. For Clearwater Fish Hatchery, the goal is to return 11,915 adults annually to Lower Granite Dam.

Prior to return year 2012, adult returns to Lower Granite Dam were estimated indirectly from a traditional run reconstruction. Adults were accounted for on the spawning grounds, returns to the trapping facilities, and estimates of harvest in the tribal and non-tribal fisheries upstream of Lower Granite Dam. All of these components were summed to estimate the return to Lower Granite Dam. Beginning in 2012, adult returns to Lower Granite Dam have been estimated directly from a systematic sampling program at the adult fish trap and use of Parental Based Tagging (PBT) to assign sampled fish to their hatchery, stock, and cohort of origin (Belnap et al., 2012).

Over the history of the Clearwater Fish Hatchery program, the Project Area adult goal has been met or exceeded in only three years (Figure 10). However, through improvements in fish culture, better coordination and efficient use of Clearwater basin facilities, post release survival, and increased smolt production, the Clearwater Fish Hatchery has averaged 74% of the Project Area mitigation goal for the last ten years (2012-2021) compared to 29% from the previous 22 years (1990-2011). Arguably, some of the apparent improvement is a result of the more thorough accounting that has resulted from the adult sampling program at Lower Granite Dam and the incorporation of the PBT tagging program.

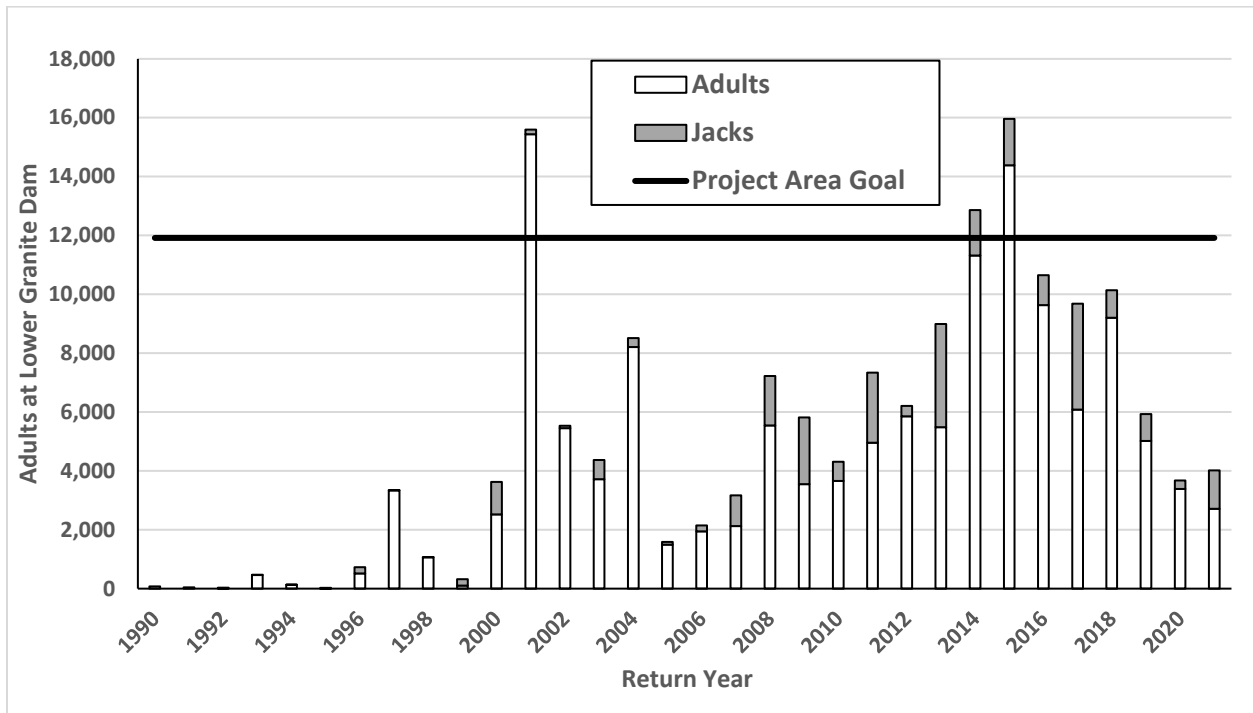


Figure 10. Estimated number of Clearwater Fish Hatchery adult Chinook Salmon at Lower Granite Dam 1990-2021. The black horizontal line represents the Project Area return goal for Clearwater Fish Hatchery.

Since the high adult return in 2015, returns from Clearwater Fish Hatchery have decreased precipitously and are reflective of the decline in overall returns of both hatchery and wild fish to Lower Granite Dam during the same time period (Figure 11).

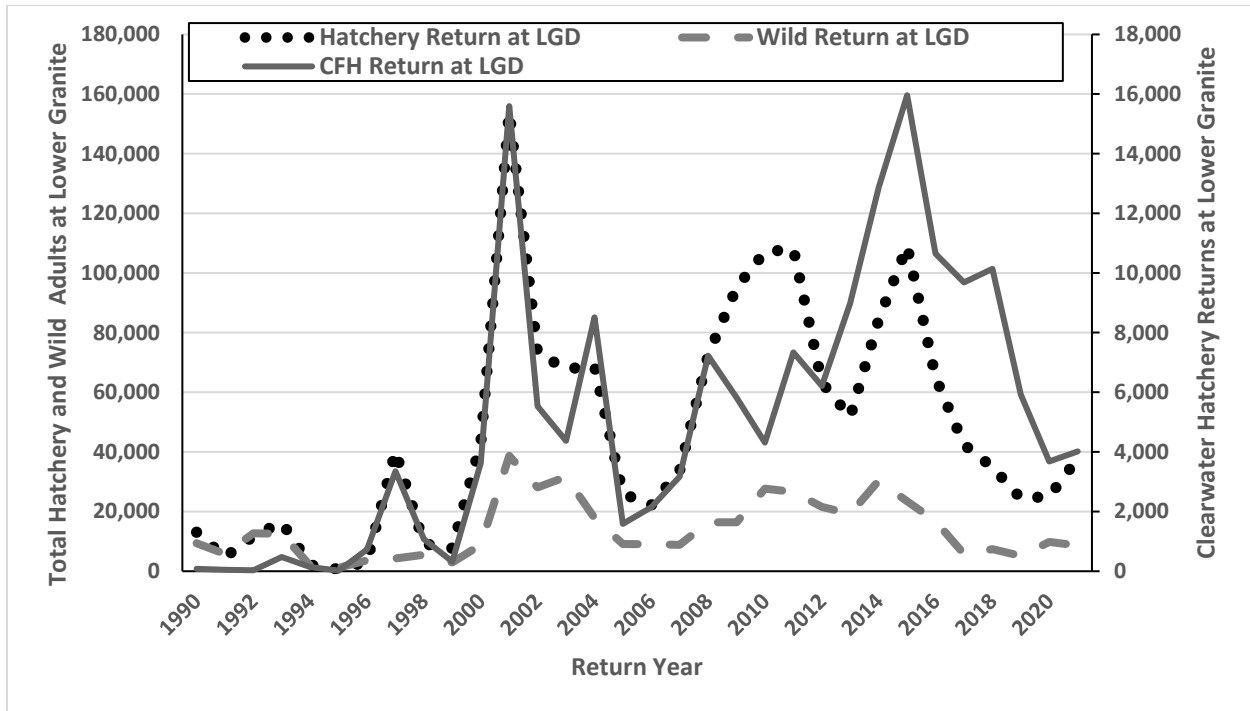


Figure 11. Number of hatchery-origin adults from Clearwater Fish Hatchery (CFH) and the total hatchery and wild return of spring/summer Chinook Salmon at Lower Granite Dam. 1990-2021.

Smolt-to-adult return (SAR)

Smolt-to-adult return rate (SAR) in this report is defined as the fraction of juveniles released that return to Lower Granite Dam as adults. Adults from a single cohort return over three years as one-, two-, and three-ocean adults. Stock and cohort specific estimates at Lower Granite Dam are determined based on PBT analysis described in the “Adult Returns to Project Area” section above. Based on the current smolt production target of 3.75M yearling spring/summer smolts at Clearwater Fish Hatchery, an SAR of 0.32% is necessary to achieve the adult mitigation goal to the Project Area (11,915 adults).

Smolt-to-adult return rates (SARs) for spring Chinook Salmon released from Clearwater Fish Hatchery have varied significantly over the program history (Figure 12). The mean SAR across all release sites is 0.35% indicating that, on average, the Project Area goal would be met under the current smolt release target. Within a year we have observed significant differences in SARs between release sites within the Clearwater basin for spring Chinook Salmon. Generally speaking, the Selway and Clear Cr releases have consistently had the highest SARs across the release sites and Red River has had the lowest. One of the primary management goals in the Clearwater River basin is to provide diverse fishing opportunities across time and space (IDFG 2019), even if it comes at a cost in terms of lower SAR’s at some release sites. The current suite of release sites helps accomplish that goal, and co-managers are continuously balancing the costs and benefits of this approach.

Smolt-to-adult return rates for the summer Chinook Salmon program have also been variable and averaged 0.26% for brood years 2009-2016 (Figure 13). For reference, we compared SARs of the Clearwater summer Chinook Salmon with the South Fork Salmon River (SFSR) program that was used as

the founding broodstock for the Clearwater program. For brood years 2009-2013 SARs for the SFSR program were 2.5 times higher on average. In all of these years, the broodstock for the Clearwater program was almost entirely from SFSR returns (Figure 3). For brood years 2014 and 2016, SARs for the two programs were similar and the majority of the broodstock for the Clearwater program were from locally returning adults to the Clearwater basin indicating that local adaptation to the hatchery environment in the Clearwater may happen rapidly. This is noteworthy because the SFSR program consistently has some of the highest adult return rates across the spring/summer Chinook Salmon hatchery programs in Idaho. Returns from the more recent broods (2017-2021) will be informative to see if this continues to hold true as the dependance on the SFSR for brood diminishes.

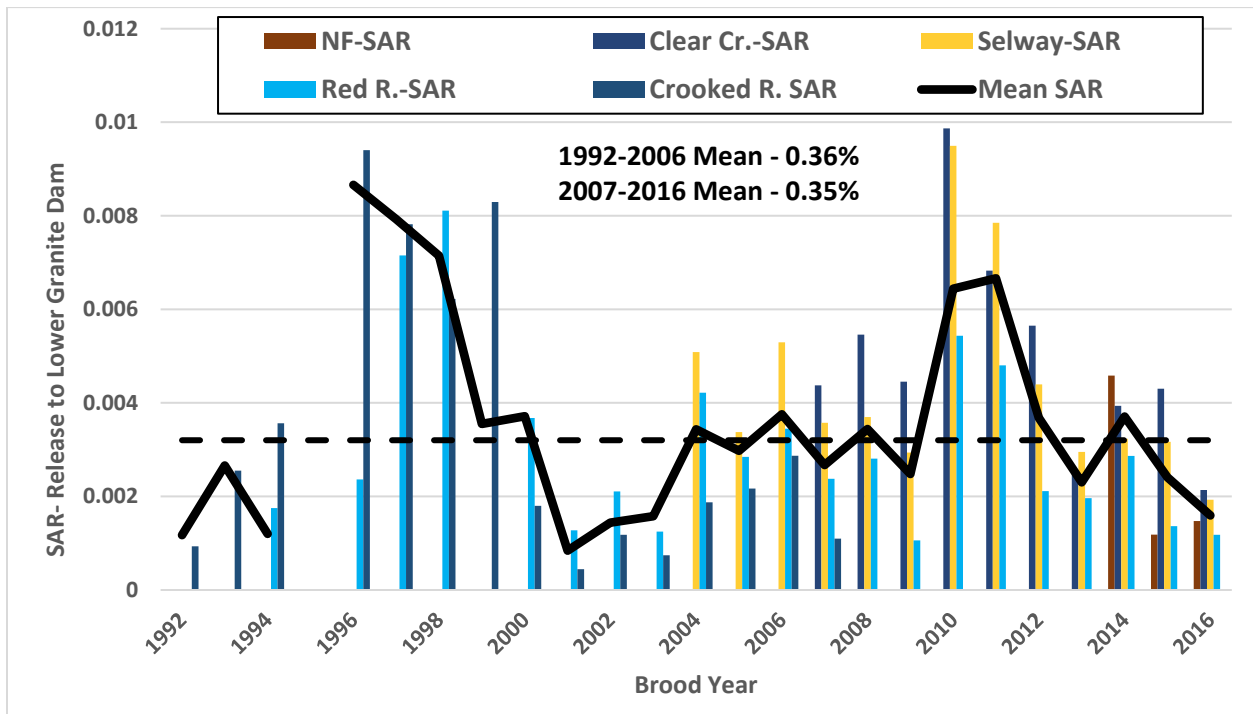


Figure 12. Smolt-to-adult return rate (SAR) of Clearwater River spring Chinook Salmon by individual release location and weighted mean SAR of all release sites by brood year, 1992-2016. For brood year 1995, only 7,000 smolts were released from CFH, so no estimate of SAR is provided for that year.

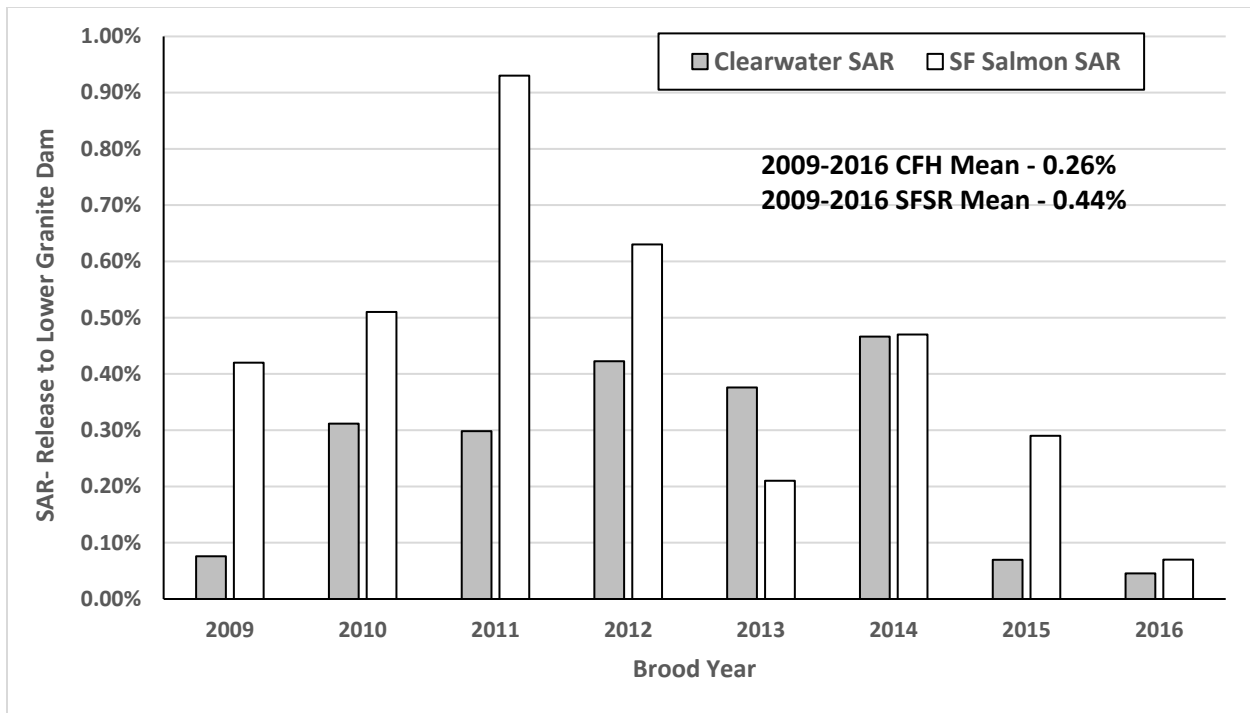


Figure 13. Smolt-to-adult return rate (SAR) of Clearwater River summer Chinook Salmon by brood year, 2009-2016. For comparison, SAR values for the summer Chinook Salmon hatchery program in the South Fork Salmon R. (founding stock for Clearwater summer program) is included.

Smolt-to-adult survival (SAS)

Smolt-to-adult survival rate (SAS) in this report is defined as the fraction of juveniles released that survive to adulthood back to the Columbia River mouth. Due to minimal harvest of spring/summer Chinook Salmon in the Pacific Ocean, returns to the Columbia River mouth represent the survival rates prior to any human exploitation. Estimates to the Columbia River mouth are derived by backing down the Lower Granite estimates (described above) to Bonneville Dam using the stock and cohort specific PIT tag conversion rates between Bonneville and Lower Granite dams. The Bonneville estimates are then backed down to the Columbia River mouth based on coded wire tag recoveries from fisheries sampled in the Columbia River downstream of Bonneville Dam. When the LSRCF program was developed, it was assumed that the catch to escapement ratio of fish harvested downstream of the project area was 4:1. As such, based on the smolt release target of 3.75M, an SAS of 1.6% is required to meet the total adult escapement goal of 59,575 to the Columbia River mouth.

Smolt-to-adult survival rate (SAS) for spring Chinook Salmon released from Clearwater Fish Hatchery has averaged 0.46% over the history of the program indicating that on average, only 29% of the total adult return goal would be achieved under the current smolt release target. (Figure 14). Similar to SAR, we observe significant differences in SAS between release sites within the Clearwater basin for spring Chinook Salmon.

Smolt-to-adult survival rate for summer Chinook Salmon from Clearwater Fish Hatchery have averaged 0.43% for brood years 2009-2016 (Figure 15).

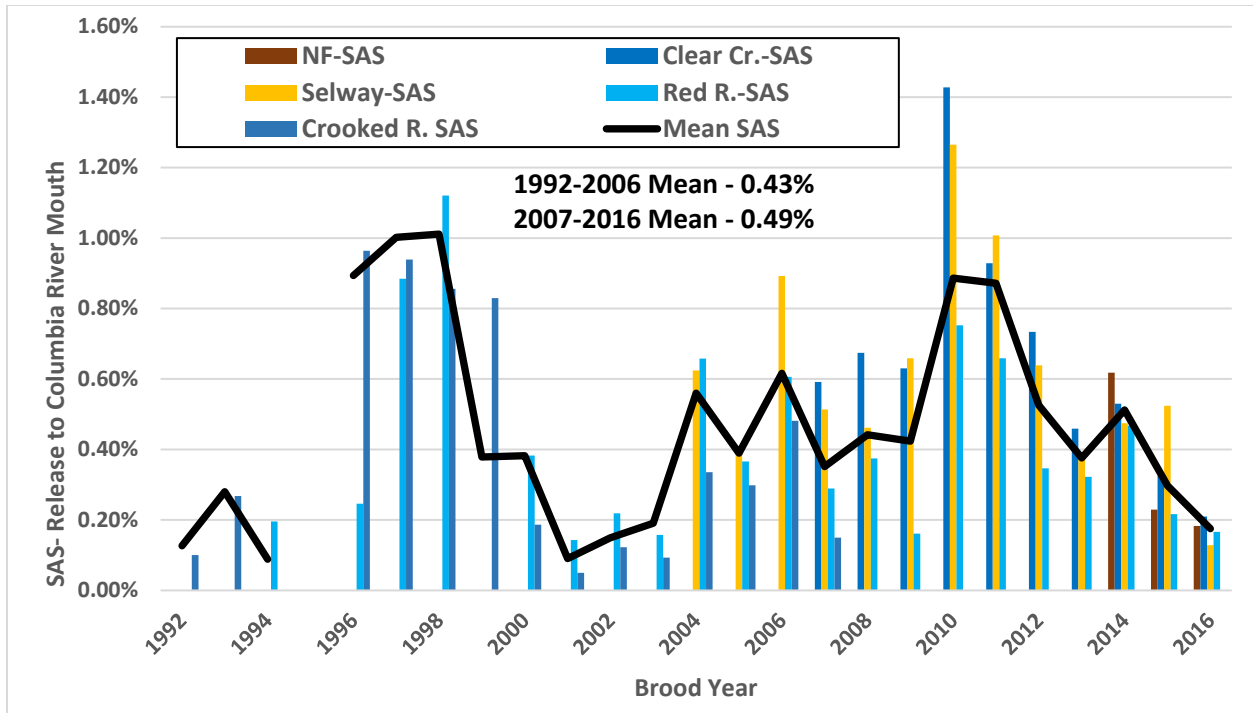


Figure 14. Smolt-to-adult survival rate (SAS) of Clearwater River spring Chinook Salmon by brood year, 1992-2016. For Brood year 1995, only 7,000 smolts were released from CFH, so no estimate of survival rate is provided for that year.

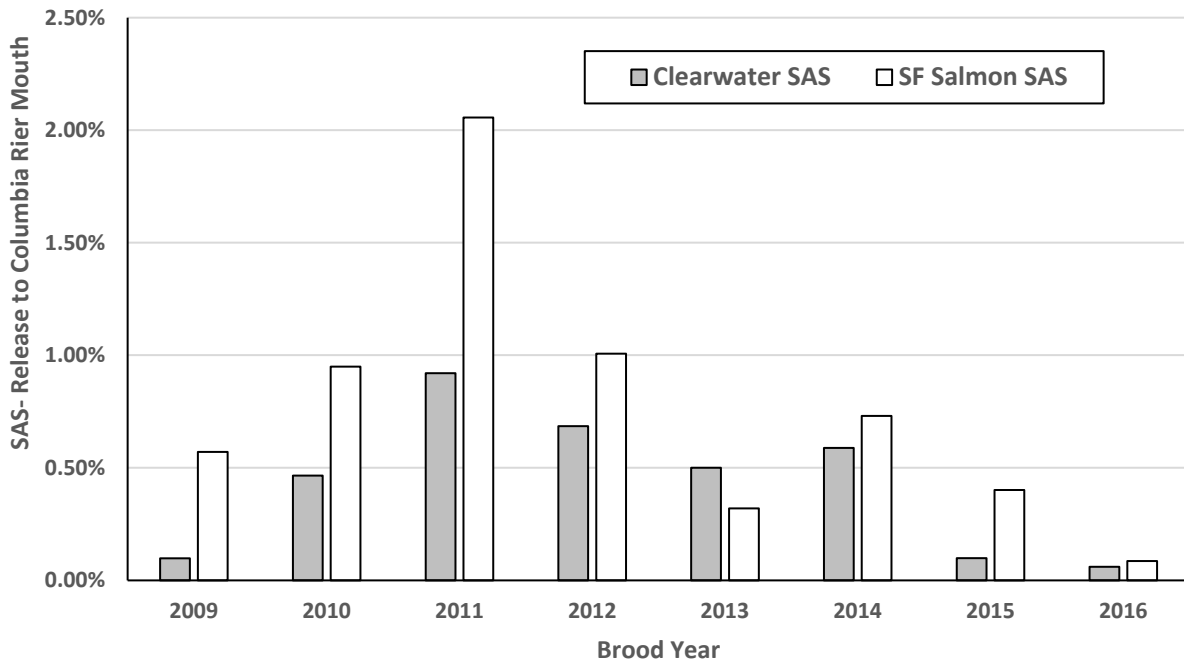


Figure 15. Smolt-to-adult survival rate (SAS) of Clearwater River summer Chinook Salmon by brood year, 2009-2016. For comparison, SAS values for the summer Chinook Salmon hatchery program in the South Fork Salmon R. (founding stock for Clearwater summer program) is included.

Recruits per spawner

The number of returning hatchery origin adults produced per adult spawned is a useful metric that captures survival over the entire lifecycle and highlights the survival advantage that occurs during the hatchery rearing phase of the lifecycle. In this report we provide the number adult recruits produced per spawner that is calculated as the number returning adults estimated at the Columbia R. mouth divided by the number of parents that were spawned for that particular cohort. The number of parents spawned includes those spawned, the number of adults that died prior to spawning, and parents whose eggs were culled at the hatchery for disease management purposes.

The average number of recruits per spawner for the spring Chinook Salmon reared at Clearwater Fish hatchery over the history of the program is 6.8 (Figure 16). The average for the most recent 10 years (BY2007-2016) is 6.9.

For the summer Chinook Salmon reared at Clearwater Fish Hatchery, the average number of recruits per spawner for brood years 2009-2016 is 6.3 (Figure 17)

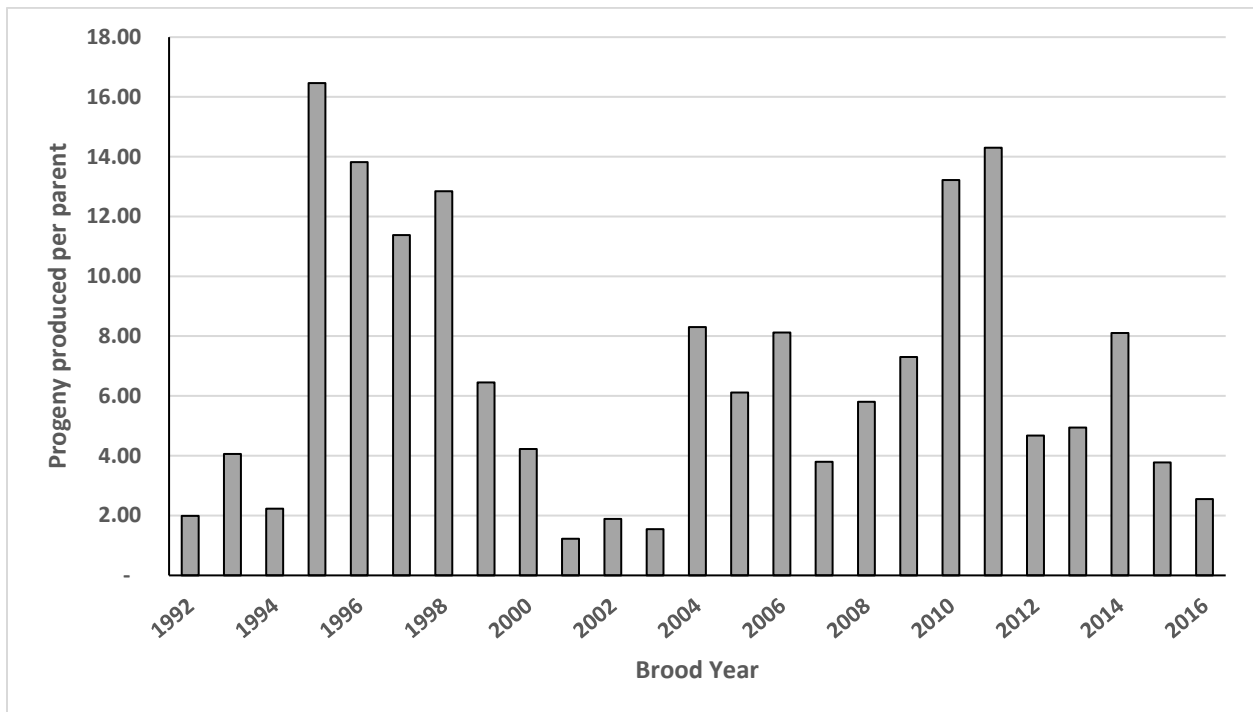


Figure 16. Adult progeny produced per parent for spring Chinook Salmon released from Clearwater Fish Hatchery, brood years 1992-2016.

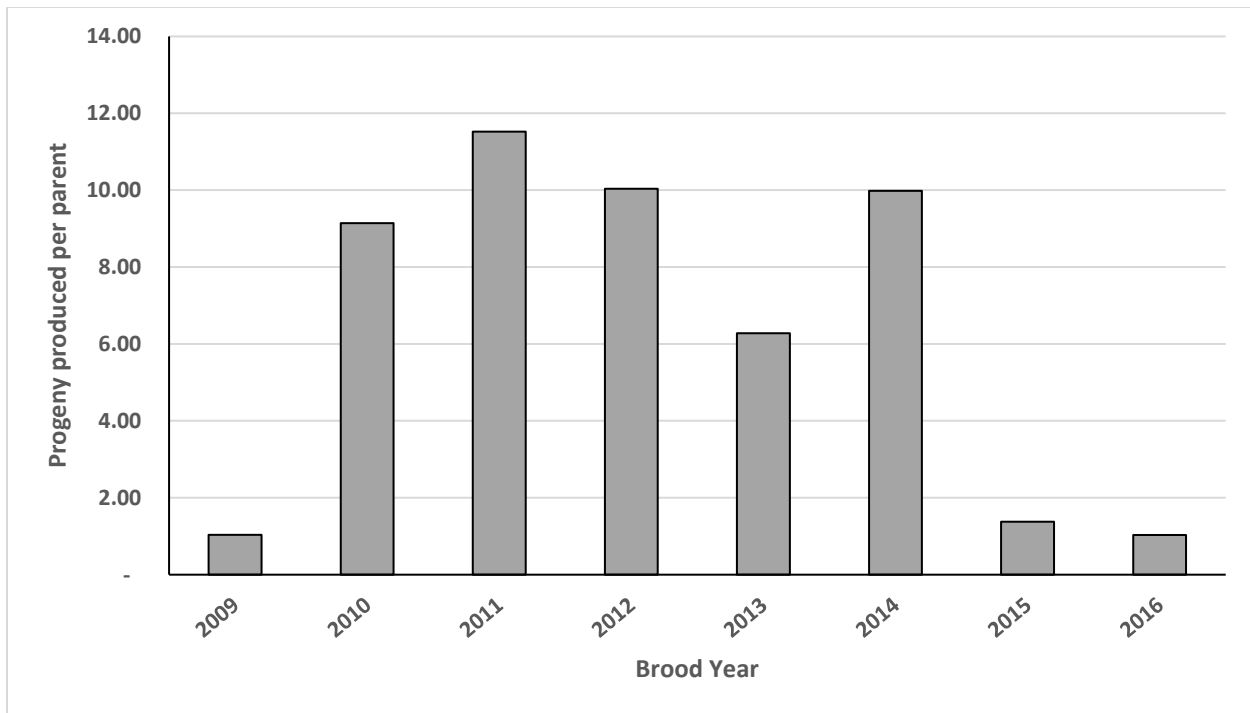


Figure 17. Adult progeny produced per parent for summer Chinook Salmon released from Clearwater Fish Hatchery, brood years 2009-2016.

Harvest contributions

The primary objective for the LSRCF funded fish produced at Clearwater Fish Hatchery is to provide for lost harvest opportunity associated with the construction and operation of the four lower Snake River hydroelectric dams.

Fisheries in Idaho

Both tribal and non-tribal fisheries occur in the Clearwater River basin but for the purposes of this report, only information from the non-tribal fishery is provided. Staff from the Nez Perce Tribe will provide data relevant to the tribal harvest in the Clearwater River basin as part of their written report and presentation.

Annually, non-tribal fisheries in Idaho are initially established based on pre-season forecasts of Chinook Salmon destined for return to the Clearwater basin from production at all of the rearing facilities (DNFH, CFN, KNFH, NPTH). In-season, the forecasted numbers are updated based on PIT tag detections at the Columbia River and Snake River dams. Fish returning that are in excess to brood needs are split evenly between the tribal and non-tribal fisheries. Weekly conference calls conducted during the fisheries are used to update the projected returns and numbers of fish harvested to date.

Between 1997 and 2022, non-tribal fisheries have been operated in the Clearwater River drainage every year except 1999. The number of fish harvested, and the amount of angler effort have varied over that

timeframe with an average annual harvest of 3,963 (range: 11-21,883) spring/summer Chinook Salmon and an average of 70,669 (range: 1,756-307,681) hours of angler effort (Figure 18).

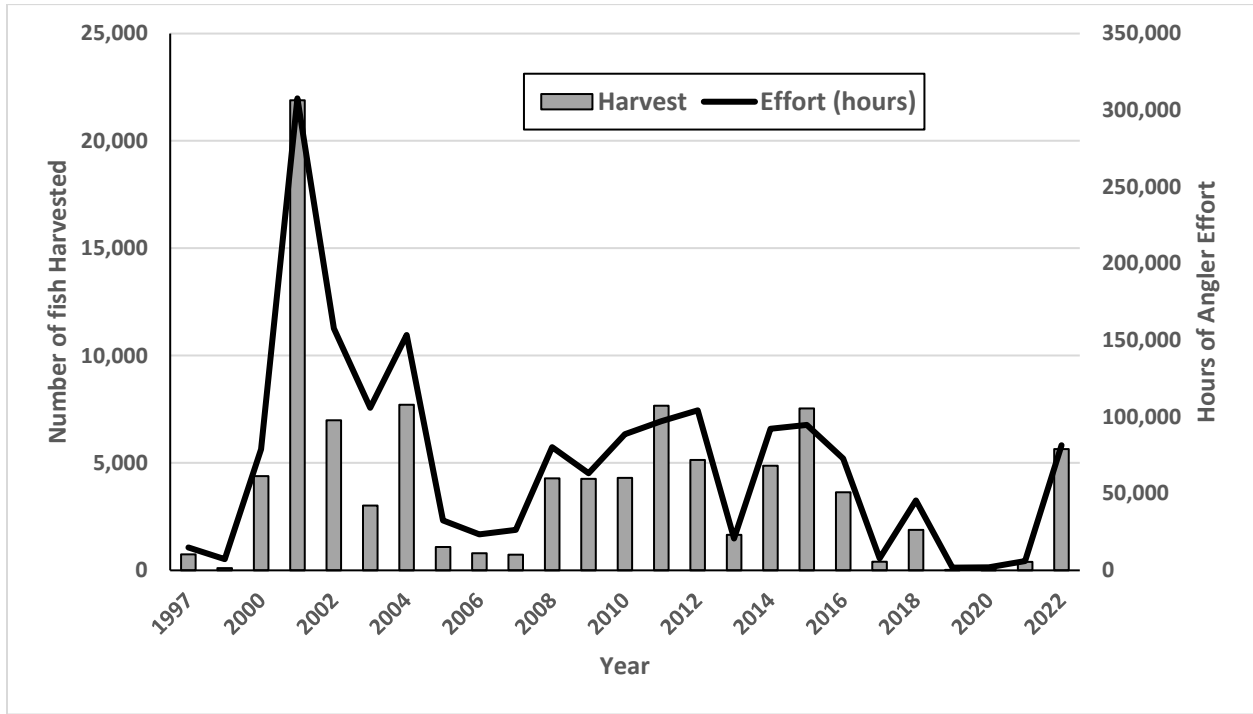


Figure 18. Annual harvest and hours of angler effort estimated from the non-tribal fisheries operated within the Clearwater River basin, 1997-2022.

Fish harvested in these fisheries resulted from production at all of the rearing facilities in the Clearwater basin. Figure 19 shows the composition of the harvest each year with respect to the facility the harvested fish were released from. Over the entire time series, the percent of the catch from Clearwater fish hatchery is 42%. In the most recent 10 years, fish from Clearwater Fish Hatchery represent 59% of the fish harvested. This is consistent with the fraction of the total juvenile releases in the Clearwater basin that come from Clearwater Fish Hatchery.

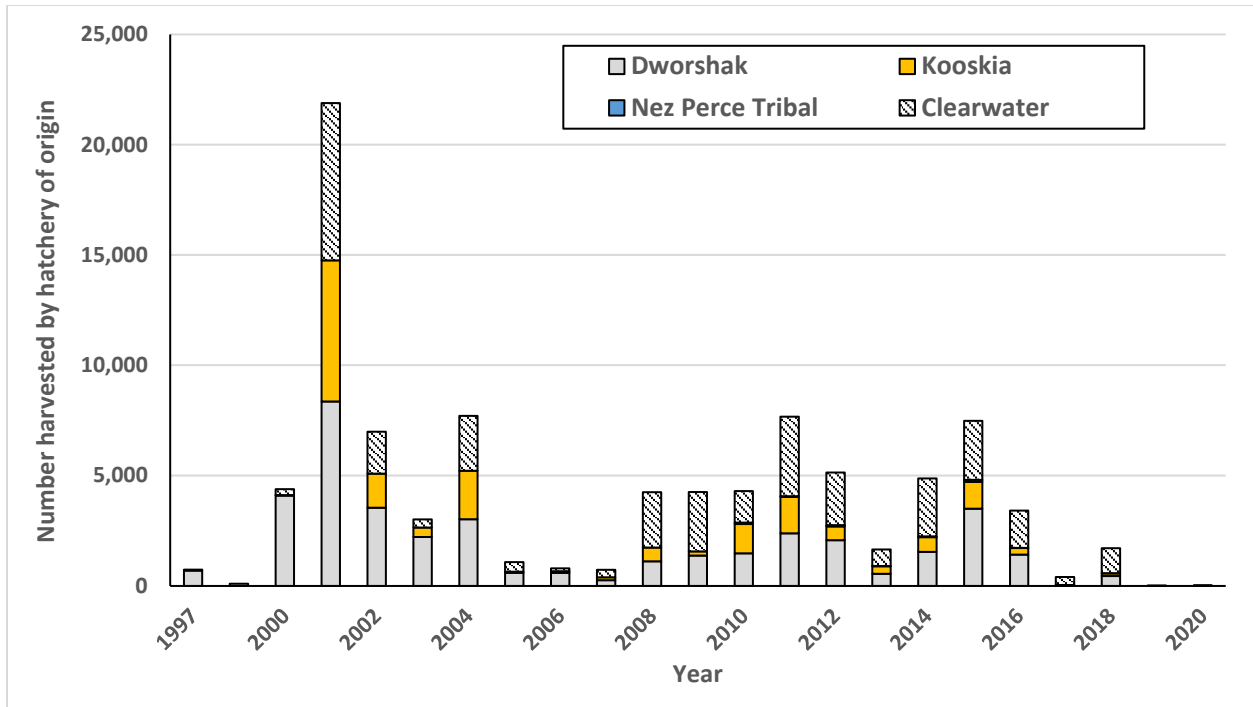


Figure 19. Catch composition (number harvested by hatchery of origin) of spring/summer Chinook Salmon from fisheries operated within the Clearwater River basin, 1997-2020.

Harvest downstream of Idaho

Between 1992 and 2019, harvest of spring/summer Chinook Salmon produced by Clearwater Fish Hatchery occurred in fisheries downstream of Idaho in all but four years (Figure 20). During this time period an average of 1,043 (range: 0-4,214) fish were harvested annually.

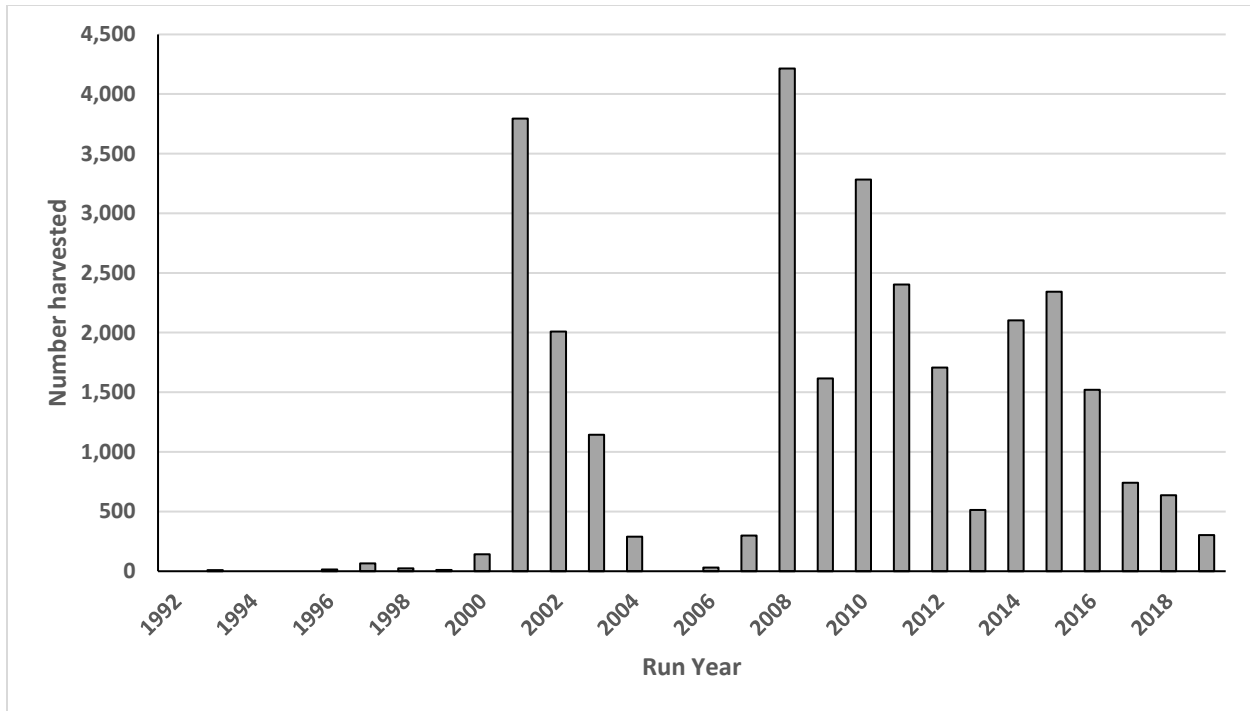


Figure 20. Number of spring/summer Chinook Salmon produced at Clearwater Fish Hatchery harvested in fisheries downstream of Idaho, 1992-2019.

Adaptive management

In order to move the needle closer to meeting the LSRCP mitigation objectives, managers in the Clearwater basin have taken advantage of increases of rearing capacity that resulted from efficiencies realized by managing the Clearwater basin hatchery facilities as more of a hatchery complex than as individual facilities. Managing the spring Chinook Salmon programs as a single stock has also ensured that the hatchery facilities have operated at full capacity during recent years. In addition to increasing the numbers of smolts released, managers are also evaluating alternative rearing practices to increase post release survival of program fish.

Baffle Study at Clearwater Fish Hatchery

A study was conducted at Clearwater Fish hatchery for brood years 2015-2019 looking at the response in adult returns rates for fish reared in baffled raceways compared to a traditional plug-flow configuration. The baffled raceways provided variable water velocities with the highest velocities near the bottom of the raceway in the gap between the baffle and raceway floor with velocities maintained at approximately 2.5 body lengths per second compared to the control raceways with uniform velocities at approximately 0.2 body lengths per second. While this study will not be complete until the final adults return in 2024, results to date show no significant differences in juvenile size or condition factor at release, or travel time or survival to Lower Granite Dam. Similarly, for the two completed brood years

(2015 and 2016) of adult returns, the SAR was not significantly different between treatment and control raceways.

Time of release evaluation

A cooperative effort across facilities in the Clearwater basin began in 2021 to look at the effect of release timing on outmigration timing and survival and ultimately on adult return rates. Treatment groups were released two week later than the traditional release dates (4/14 compared to 3/31) at Clearwater and Dworshak facilities. For the two years of juvenile outmigration (2021 and 2022), results show that even though the release dates were two weeks different, the median passage dates at Lower Granite and Bonneville dams were similar with the late release groups arriving 0-3 days later than the early release groups at Lower Granite and 1-3 days later at Bonneville (Table 4). Survival estimates to Lower Granite for the early and late release groups were within 1% for Clearwater Fish Hatchery releases and 6% for Dworshak Fish Hatchery releases. Point estimates for survival differences to Bonneville Dam were larger than for those to Lower Granite Dam but the 90% confidence intervals for all comparisons at Bonneville overlapped. Based on these two years of data it appears that the conditions each group experienced through the hydro system was likely similar based on passage dates. Survival to Lower Granite was very similar for early and late groups but it appears that survival to Bonneville may be lower for the early groups. The primary difference between the treatment and control groups is the amount of time each group spent at large prior to arriving at Lower Granite dam (10-14 days). Evaluation of the returning adults from these releases should provide insight on whether the difference in time spent in the environment prior to outmigration impacted survival to adulthood.

Table 4. Differences in outmigration timing and survival of early and late release groups of spring Chinook Salmon reared at Clearwater and Dworshak fish hatcheries, 2021-2022.

Facility	Juvenile Migration Year	Difference in Release Date (days)	Difference in Median Passage Date at LGD (days) ^a	Difference in Median Passage Date at Bonn (days) ^a	Difference in Survival to LGD ^a	Difference in Survival to Bonn ^a
Clearwater	2021	14	3	3	-1%	14%
Clearwater	2022	14	0	1	1%	13%
Dworshak	2021	14	3	2	4%	15%
Dworshak	2022	14	2	3	6%	1%

^aDifferences in passage and survival are calculated as (Late Group - Early Group)

90% confidence intervals overlapped for all survival comparisons to Lower Granite and Bonneville dams

Managers in the basin will continue to look for opportunities to refine rearing methods with the goal of increasing post release performance of hatchery reared fish.

Summary and outlook for the future

Since the last ISRP review in 2010, there has been a concerted effort among co-managers in the Clearwater River basin to operate all hatchery facilities in a more coordinated manner as a hatchery complex rather than as individual programs which has resulted in a more efficient use of facilities in the basin. High in-hatchery survival has remained consistent and juvenile production targets were achieved in most years. Production of hatchery-origin spring Chinook Salmon has increased at all rearing facilities and has resulted in a larger and more consistent return of adults despite the recent downturn in abundance of both hatchery and wild populations.

The adult mitigation goal to the project area (11,915) for Clearwater Fish Hatchery has been met or exceeded in only three years (2001, 2014, and 2015) over the history of the program, but in the last ten years has averaged 74% of the goal compared to 29% from the previous 22 years. The total return goal to the Columbia River mouth has never been achieved.

A summer-run program was initiated in the Clearwater to provide more diversity and opportunity for fisheries and potentially higher post-release survival of that stock. For the completed brood year returns to date, SAS of the summer stock has been equal to or greater than the spring Chinook Salmon from Clearwater Fish Hatchery in four of the eight years. Fishery opportunity and harvest provided by the summer stock to date has been modest and managers will continue to evaluate the performance of the summer stock as local adaptation of this stock to the Clearwater basin occurs.

In addition to increasing the number of hatchery smolts released, co-managers are also evaluating alternative rearing practices to increase the post release performance of hatchery fish. The baffle study at Clearwater Fish Hatchery will be completed in two years but the initial data does not indicate increased performance of the treatment groups reared with higher and variable water velocities. The time of release evaluation that is occurring in the Clearwater has just recently started and the first adult returns will be coming back starting in 2023.

Managers have and will continue to look at performance of fish released at the various sites in the Clearwater Basin to ensure production is being allocated in a manner that maximizes adult returns while maintaining the diverse fishing opportunities available in the basin.

Looking ahead, managers will continue to seek ways to increase hatchery production and productivity while balancing the needs of the tribal and non-tribal fisheries across the landscape to provide in-kind, in-place mitigation for lost harvest opportunities. Additionally, major infrastructure investments are needed at Clearwater Hatchery including installation of a new water-supply pipeline to replace the existing one before a catastrophic failure occurs. A new pipeline would also allow vacant raceways at the hatchery to be watered-up and used for production of additional smolts which would contribute to more consistent returns in the future and move the program closer to regularly meeting its goal.

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