Nez Perce Tribal Hatchery Monitoring and Evaluation Project

Fall Chinook Salmon (*Oncorhynchus tshawytscha*) Supplementation in the Snake River Basin

Annual Progress Report

Report covers work performed under BPA contract # 75398

Report was completed under BPA contract # 74017

Report covers work performed from: January 1, 2017 – December 31, 2017

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Report Created: December, 2018

"This report was funded by the Bonneville Power Administration (BPA), U.S. Department of Energy, as part of BPA's program to protect, mitigate, and enhance fish and wildlife affected by the development and operation of hydroelectric facilities on the Columbia River and its tributaries. The views in this report are the author's and do not necessarily represent the views of BPA."

Table of Contents

ABSTRACT

Monitoring and evaluation (M&E) of the Nez Perce Tribal Hatchery (NPTH) and the Fall Chinook Acclimation Project (FCAP) was completed for 2017 fall Chinook juvenile releases and 2017 fall Chinook adult returns. All NPTH and FCAP juvenile release goals were met and occurred on schedule with the exception of Cedar Flats subyearlings which had to be released early because of a power outage and a second group of subyearlings at Captain John did not occur because of a juvenile shortage at Lyons Ferry Hatchery. A total of 459,081 yearlings were released at the three FCAP facilities and a total of 2,976,089 subyearlings were released at all FCAP and NPTH facilities. Marking and tagging goals were met at all release sites except Cedar Flats where we were not able to PIT tag prior to the emergency release. Also, there was no Captain John second subyearling release group in 2017 as scheduled because of the juvenile shortage. Estimated average juvenile survivals to Lower Granite Dam (LGD) was 82.6% across all subyearling release groups and 95.5% for yearling release groups. A total of 3,954 natural fall Chinook juveniles were captured on the Clearwater River and 3,231 were PIT tagged which resulted in a minimum of 38.0% estimated survival to LGD, as PIT tag detectors were shut down early in 2017. The 2017 fall Chinook adult return of 24,779 was about 74% of the recent 10-year average to Lower Granite Dam and 2,411 fewer adults than the preseason forecast. Percent hatchery origin spawners (pHOS) to Lower Granite was estimated at 73.6% by the run reconstruction method as compared to slightly higher (75.9%) using the parentage based tagging (PBT) method. The 2017 fall Chinook spawning goals were met at NPTH with 424 females and 260 males spawned with larger males used on more than one female. The percent natural origin fall Chinook incorporated into the brood (pNOB) at NPTH was 28.5% (run reconstruction method) compared to 39.0% using PBT analysis. The prespawn mortality of females used for broodstock was 15.0% compared to 8.2% for males. Fall Chinook aerial redd surveys resulted in an estimated 1,836 redds in the mainstem Clearwater, 60 redds in Potlatch, 2 redds in the N.F. Clearwater, 22 redds in the M.F. Clearwater, 67 redds in the Selway, 105 redds in the S.F. Clearwater, 280 redds in the Grande Ronde, 15 redds in the Imnaha, and 10 redds in the Salmon rivers. A total of 4,596 redds estimated in the Snake River Basin during 2017 was 2,139 less redds than the previous 5-year average. A total of 20,889 adults were estimated to have escaped to the spawning grounds above LGD during 2017. Smolt-to-adult survivals (SARs) back to LGD for the 2012 broodyear subyearling release groups ranged from 0.42% for Big Canyon to 2.10% for the NPTH on-station group released in 2013. Among the 2011 broodyear yearlings released in 2013, Captain John group had the highest SAR of 2.74% while the Big Canyon and Pittsburg Landing yearling groups were similar at 1.87% and 1.78%, respectively.

INTRODUCTION

The Nez Perce Tribe (NPT) operates the Fall Chinook Acclimation Project (FCAP), which consists of three juvenile acclimation facilities along the Snake and Clearwater rivers with the intent of effectively enhancing population size and distributing natural fall Chinook salmon spawning throughout the existing habitat areas above Lower Granite Dam. The FCAP facilities began operation at Pittsburg Landing (PLAP) on the Snake River in 1996, Big Canyon Creek (BCCAP) on the Clearwater River in 1997 and at Captain John Rapids (CJRAP) on the Snake River in 1998. Initially, target release goals for these sites were 150,000 yearling fall chinook. However, due to sufficient broodstock availability in most years 500,000 subyearling fall Chinook have been available for acclimation at Big Canyon Creek and Captain John Rapids and 400,000 subyearlings at Pittsburg Landing.

Additionally, the Nez Perce Tribal Hatchery Complex (NPTHC) was approved for construction to rear and release 1.4 million subyearling fall Chinook salmon in the Clearwater River Subbasin starting in 2002. The NPTHC produced its first release of subyearling fall Chinook salmon in 2003. However, after working out new facility issues, 2009 was the first year where full production releases of 1.4 million subyearlings was accomplished. In addition to acclimation and releases occurring onsite at NPTHC (NPTH Ponds and NPTH S-Channels), acclimation facilities at North Lapwai Valley (NLVA) on Lapwai Creek, Luke's Gulch (LGA) on the Southfork Clearwater River and Cedar Flats (CFA) on the Selway River are utilized.

The Monitoring and Evaluation (M&E) component of the Fall Chinook Acclimation Project (FCAP M&E; BPA Project 1998-010-04) was incorporated into the NPTH M&E Project in 2012. Since supplementation may pose some risk to natural populations, the NPTH M&E project quantifies regionally standardized performance measures (e.g., Beasley et al. 2008) to evaluate the performance of hatchery released fall Chinook salmon and the potential risks to the natural fall Chinook salmon population. The NPTH M&E Project is also designed to provide information that enables adaptive management of the NPTH and FCAP facilities.

Proper adaptive management will require information from multiple life stages of hatchery and natural fall Chinook salmon. Supplementation benefits to be evaluated under the proposed M&E program include increases in the distribution, abundance, and harvest of hatchery and natural Chinook salmon populations in the both the Clearwater and Snake River basins. To measure these benefits, changes in the abundance of Chinook salmon in these systems and their tributaries will be monitored over the next 15 to 20 years (Hesse and Cramer 2000). In addition to measuring project-related benefits, the NPTH and FCAP M&E programs are designed to provide information on the capacity of the natural environment to support Chinook salmon production, give early warning of adverse effects caused by the project on resident biota, and track trends in environmental quality, management, and policy that may affect project success.

This 2017 annual report details monitoring and evaluation activities associated with the fall Chinook salmon component of the Nez Perce Tribal Hatchery and FCAP programs from January 1 through December 31, 2017. We summarize juvenile releases from both NPTH and FCAP acclimated fall Chinook releases occurring in 2017 (broodyear 2015 yearlings and broodyear 2016 subyearlings). Adult return information from 2017 is summarized and reported along with

complete adult contributions to ocean and freshwater fisheries as well as survival of broodyear 2011 (latest complete adult returns) hatchery and natural fall Chinook.

Earlier NPTH M&E and FCAP M&E fall Chinook salmon results can be found in annual reports by main authors B. Arnsberg and S. Rocklage, respectively, on the website: *https://www.cbfish.org/PiscesPublication.mvc/SearchByTitleDescriptionAuthorOrDate*. A Supplementation Symposium for the first five-years of NPTH Production and Monitoring & Evaluation was held in January 2009. Another symposium was held February 2015, and other symposiums are scheduled about every five years. Results can be obtained on the website: http://www.nptfisheries.org/DFRMHome/Department/Symposiums/2009Symposium.aspx

STUDY AREA

The study area for fall Chinook salmon supplementation is shown in Figure 1. The NPTH and FCAP facilities associated with rearing, acclimation and release of fall Chinook salmon in the Snake River Basin are described below. A more detailed description of rearing and acclimation sites in the Clearwater River can be found in the Nez Perce Tribal Hatchery Program Final Environmental Impact Statement (BPA et al. 1997).

Nez Perce Tribal Hatchery

The Nez Perce Tribal Hatchery (NPTH), located on the lower Clearwater River 38 km above its mouth at Tribal Allotment 1705, is the central incubation and rearing facility for spring and fall Chinook salmon (Figure 1). Incubation for all Chinook salmon occurs at NPTH, with early rearing of one million fish in inside troughs and final rearing and acclimation of 500,000 fall Chinook salmon in two earthen and river rock-lined ponds. Fall Chinook salmon subyearling smolts are forced from the ponds into the Clearwater River.

Sweetwater Springs

Sweetwater Springs is an early rearing facility located approximately 20 km southeast of Lewiston, Idaho and feeds the westernmost fork of Sweetwater Creek which is a tributary to Lapwai Creek (Figure 1). This facility rears up to 400,000 early fall Chinook salmon from fry to parr. Parr are then transferred to Cedar Flats on the Selway River and Luke's Gulch on the South Fork (S.F.) Clearwater River for final acclimation and release (200,000 subyearling smolts at each facility).

North Lapwai Valley Acclimation Pond

Lapwai Creek drains directly into the mainstem Clearwater River 19 km upstream from its confluence with the Snake River (Figure 1). Approximately 1 km above the mouth of Lapwai Creek, two river rock-lined acclimation ponds were constructed to serve as final rearing and acclimation of 500,000 fall Chinook salmon that are transferred from NPTH. Fall Chinook salmon can be volitionally released or forced from the North Lapwai Valley (NLV) acclimation ponds into Lapwai Creek. This site was selected so adult returns would home and spawn in the lower Clearwater River where an abundance of under-utilized spawning habitat occurs (Arnsberg

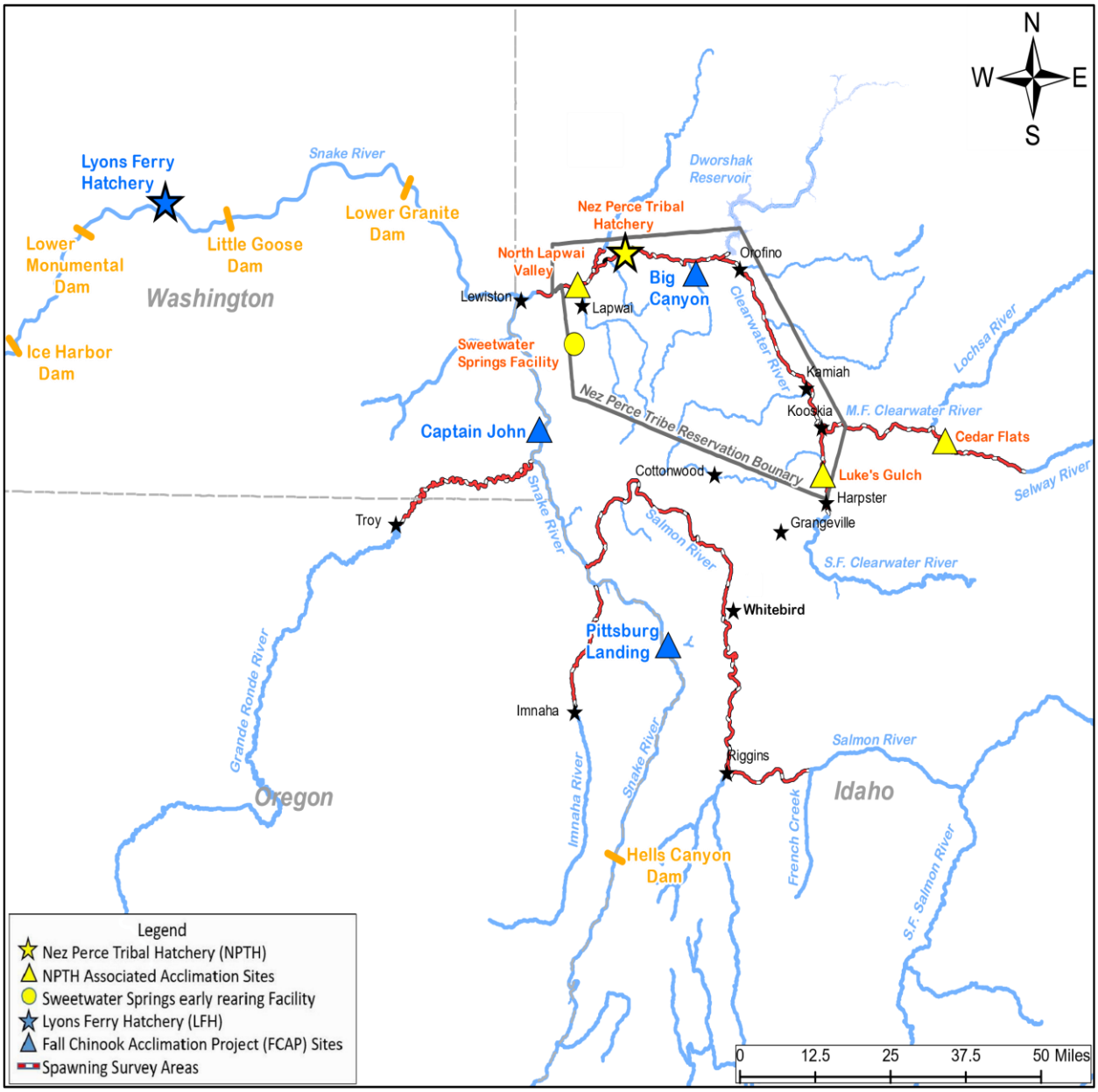

Figure 1. Fall Chinook salmon study area in the Snake River Basin.

et al. 1992). Because of a low water year and warm water temperatures in Lapwai Creek, this facility was not operated in 2017 and NLV fish were final reared and released on-station at NPTH.

Luke's Gulch Acclimation Facility

Luke's Gulch Acclimation Site is located on the S.F. Clearwater River 13 km upstream of its mouth (Figure 1). Final rearing and acclimation of early fall Chinook salmon at this site occurs in ten 5.8 m diameter circular aluminum tanks with fish being released directly into the S.F. Clearwater River. Selection for release at this site are generally from "early" egg takes during

spawning in order to possibly increase the chances of an earlier spawning return to that area. The target number of subyearlings for release is 200,000 which will be transferred as fry from NPTH or Sweetwater Springs early rearing facility (Figure 1).

Cedar Flats Acclimation Facility

Cedar Flats Acclimation Facility is located on the Selway River 8 km above its mouth and confluence with the Lochsa River which forms the M.F. Clearwater River (Figure 1). Final rearing and acclimation at this site also occurs in ten 5.8 m diameter circular aluminum tanks and fish are released directly to the Selway River. As with Lukes Gulch, selection for release will be from "early" egg takes. The target number of subyearlings for release is 200,000 which are transferred as fry from NPTH or Sweetwater Springs early rearing facility.

Fall Chinook Acclimation Project (FCAP) Facilities

The FCAP facilities, all operated by the NPT, are located on the Snake River at Pittsburg Landing (Rkm 346) and Captain John Rapids (Rkm 263) and on the Clearwater River at Big Canyon Creek (Rkm 57; Figure 1). Juveniles at Pittsburg Landing and Big Canyon are acclimated in 16 tanks (6 m diameter), while those at Captain John Rapids are acclimated in a single in-ground 50'X 150' acclimation pond. Fall Chinook salmon released from these facilities are reared at Lyons Ferry Hatchery prior to transport and acclimation. Release goals are 150,000 yearlings at each facility followed by a release of 400,000 subyearlings at Pittsburg and 500,000 each at Captain John and Big Canyon.

METHODS

All fish and wildlife projects funded by BPA are required to document protocols and methods at www.monitoringresources.org sponsored by the Northwest Aquatic Monitoring Partnership. Numbered protocols and associated methods referred to hereafter refer to this web site. The Monitoring and Evaluation (M&E) Project for the Snake River fall Chinook salmon is designed to comprehensively evaluate all hatchery effects on increasing natural production and provide information to enable adaptive management of the hatchery programs. As outlined in the NPTH M&E Action Plan (Hesse and Cramer 2000), proper adaptive management will require information from multiple life stages of hatchery and natural fall Chinook salmon. To measure these effects, the abundance of fall Chinook salmon in the mainstem Clearwater River and its tributaries will follow standardized performance measures as outlined by the Ad Hoc Supplementation Monitoring and Evaluation Workgroup (AHSWG) (Beasley et al. 2008). In this 2017 report, we briefly describe Field Operations and Performance Measures that include: Abundance, Survival-Productivity, Distribution, Genetics, and Life History. Brief descriptions of methods follow each performance measure listed below. Project protocol numbers are given when additional or more detailed methods are needed and can be found at: *http://www.monitoringresources.org/*.

Field Operations

Tagging/Marking (Protocol 2256)

The NPTH M&E staff coded wire tag (Method 6649) and ad-clip fish from NPTH and associated releases with a Northwest Marine Technology Auto-Fish Tagging Trailer. Washington Department of Fish and Wildlife (WDFW) staff coded wire tag and ad-clip fish at Lyons Ferry Hatchery prior to transfer for all FCAP yearling and subyearling releases. Coded wire tag (CWT) retention rates are measured initially during tagging and final retention rates are measured at least 21 days after tagging on a minimum of 500 fish per release group. Passive integrated transponder (PIT) tagging (Method 6649) on all hatchery release groups occurs after CWT and ad-clipping and at least a week before the scheduled release.

Beach Seining (Protocol 2243)

Beach seining (Methods 6633, 6634, 6636, 6639) occurs on the lower Clearwater River, when spring flows are below 30,000 cfs and declining to capture and PIT tag naturally produced subyearling fall Chinook salmon. Catch per unit effort (CPUE) (method 5257) of the entire sampling season was calculated and an average juvenile fall chinook salmon captured per seining haul reported.

Spawning Ground Surveys & Carcass Collections (Protocol 2255)

Multiple pass aerial spawning ground surveys by manned helicopter and subsequent carcass collections (Methods 6639, 6641-6645, 6652, 6653) were scheduled on all study streams including the Clearwater, Potlatch, N.F. Clearwater, S.F. Clearwater, M.F. Clearwater, Selway, Grande Ronde, Imnaha, and Salmon rivers. Fall Chinook salmon carcass collections begin within the spawning window with biological measurements taken and carcasses placed back into the stream for nutrient enhancement.

Habitat (Protocols 2257, 2263)

Flow and temperature data for the lower Snake and Clearwater rivers are obtained from the U.S. Geological Survey (USGS) Anatone, Washington and Spalding, Idaho gauging stations online at *http://waterdata.usgs.gov/id/nwis/current/?type=flow*. Onset temperature loggers (Pro v2) are placed in lower Lapwai Creek at NLV, and upstream in the lower South Fork Clearwater, Selway, and Middle Fork Clearwater rivers. Flow, temperature, and spill data for the Snake River at Lower Granite Dam (LGD) are provided by the U.S. Army Corps of Engineers and obtained online at *http://www.cbr.washington.edu/dart/river.html*. These data at LGD are shown and compares hatchery PIT tag detections to natural fish PIT tagged and released on the Clearwater River.

Performance Measures

Abundance (Protocol 2246)

An adult fall Chinook *run prediction* is given using historic data on fall Chinook escapement to Lower Granite Dam and a sibling regression model for estimating natural and hatchery adult returns the following year (Young et al. 2018). We present the fall Chinook run prediction for 2017 along with the actual return numbers and the prediction for run year 2018.

Total escapement estimate: Fall Chinook salmon adult escapement to and above Lower Granite Dam (LGD; Figure 1) was estimated by expanding the subsample of fish trapped at LGD (Young et al. 2018). The LGD trap rate was set during preseason meetings with comanagers and is based on the forecasted run size and the number of broodstock needed at Lyons Ferry Hatchery (LFH) and the Nez Perce Tribal Hatchery (NPTH). Trapped fall Chinook were hauled either to LFH and NPTH for broodstock, or released upstream to spawn naturally. Population composition was calculated by proportional assignment of the sample count by age, origin, sex and juvenile rearing life history (subyearling or yearling) by the fall Chinook run reconstruction team (Young et al. 2018). Known origins were determined by coded wire tags and/or PIT tags in sampled fish. Natural-origin abundance was estimated by subtracting the estimated number of unmarked hatchery fish from the total estimated number of unmarked fish in the population. Also, an alternative estimate of natural origin fish using parentage based tagging (PBT) (Protocol 78) was compared to the run reconstruction estimate.

Index of Spawner Abundance (Redd Counts): Aerial spawning ground surveys (Protocol 2255) were conducted by manned helicopter as an index of fall Chinook salmon spawner abundance and distribution. We scheduled 3-4 surveys from the first part of October to the end of November along the entire Clearwater River (120 km), lower Potlatch River (5 km), lower N.F. Clearwater River (2 km), entire M.F. Clearwater River (37 km), S.F. Clearwater River from the mouth to Mill Creek past the town of Harpster (32.3 km), and on the Selway River (31 km) from the mouth up to Selway Falls (Figure 1). When conditions make surveys questionable, such as rains and turbid water, redds counts for that survey are estimated by averaging the previous 5-yr counts up to that date to calculate the proportion of the overall redds counted, then that percentage is applied to get an estimate of the potential redds missed. As part of the FCAP M&E, we conducted aerial redd surveys on the Grande Ronde River from the mouth up to the highway bridge above Troy, OR (84.8 km), on the Imnaha River from the mouth up to the town of Imnaha (19.5 km), and on the Salmon River from the mouth up to French Creek (169 km) (Figure 1). On each survey, we mapped, took photos, documented spawn timing, number and distribution of fall Chinook salmon redds. Surveys were conducted from mid-morning to mid-day to take advantage of the best lighting conditions. We noted general weather conditions, water discharges at USGS gauging stations on the Clearwater River (Spalding and Orofino, ID), S.F. Clearwater River (Harpster, ID), lower Selway River (Lowell, ID), Grande Ronde River (Troy, OR), Imnaha River (Imnaha, OR), and Salmon River (Whitebird, ID). General water transparencies (poor to excellent) are recorded on each survey, with excellent being > 4 m, good being 3-4 m, and poor < 3 m. We report Clearwater River Subbasin redd survey results since 1988, the year surveys began (Arnsberg et al. 1992). Also, total fall Chinook salmon redds in the

Snake River Basin above Lower Granite Dam (LGD) are given as reported in Arnsberg et al. 2018.

Total *spawner abundance* above LGD was calculated by subtracting hatchery volunteers into the NPTH adult fish ladder and retained for broodstock and estimated harvest above LGD from the run reconstruction estimated escapement (Young et al. 2018). We also report the estimated adult escapement above LGD, minus estimated harvest, and calculate the *adult/redd* number for 2017 and the average adults/redd since 1988.

The *hatchery fraction* or percent hatchery origin spawners (pHOS) was calculated by taking the estimated adult escapement above LGD from run reconstruction (Young et al. 2018), subtracting out harvest above LGD and volunteers to the NPTH that were retained for broodstock. We applied the natural/hatchery ratio through run reconstruction to tribal harvest as an estimate of natural fish caught since not all hatchery fish are marked and tribal fisheries are non-selective. The hatchery fraction was also calculated from carcasses collected on the spawning grounds and applied PBT analysis to estimate hatchery fraction in specific spawning aggregates.

The *stray rate* of Snake River fall Chinook outside the basin was calculated by the proportion of that release group estimated from coded wire tags recovered at other out-of-basin hatcheries or rivers through carcasses collected on the spawning grounds. Conversely, the *stray rate* of out-of-Snake Basin fall Chinook into the Snake Basin was calculated by the escapement estimate above LGD through the run reconstruction process.

The *adult spawner spatial distribution* (Protocol 71) is given by showing the density of redds per each 5-mile section within all study streams. As a comparison to all Snake River Basin fall Chinook redd survey areas above LGD, Snake River redd counts were obtained from Idaho Power Company (IPC) and redd density plotted as well. Redd survey methods differ because on the Snake River unmanned aerial drones (UAVs) and underwater video cameras are used for redd counts and expanded by statistical methods in sections not surveyed. However, this should provide a general description of where the lowest to highest fall Chinook densities occur.

Ocean/Mainstem Harvest: Fall Chinook salmon harvest contributions in the ocean and freshwater fisheries as reported to the Regional Mark Processing Center (RMPC) are presented for the FCAP and NPTH releases above LGD in 2013 (latest year a full contribution of returns could be calculated). Harvest estimates for freshwater fisheries above LGD were obtained from the Nez Perce Tribe Fisheries Harvest Division and from harvest estimates from the Idaho Department of Fish and Game. Washington Department of Fish and Wildlife did not have their harvest estimates for Washington waters above Lower Granite Dam at the time of this report. Ocean and freshwater harvest estimates are combined with smolt-to-adult return (SAR) rates back to the Snake River for overall smolt-to-adult survival (SAS) estimates on release groups.

In-Hatchery Measures (Protocols 2256, 2253)

The *hatchery production abundance* for all release groups are provided which includes age of release, release date, number of coded wire tags, coded wire tag codes, number ad-clips, number unmarked, and number of PIT tags. The average *size-at-release* and *juvenile condition factor* (K) of hatchery fall Chinook are calculated for each release group. Length and weight data used to calculate condition factor from pre-release samples were usually done a day or two prior to release using the following equation (Tesch 1971):

$$\hat{K} = \frac{W}{L^3} \times 100{,}000$$

Where:
W = weight in grams,
L = length in millimeters,
and 100,000 is a constant used as a scalar.

Other performance measures included juvenile *hatchery release timing, pre-release mark retention* from adipose fin clips, and *pre-release tag retention* (CWT) on all groups. The *hatchery broodstock fraction* and *percent natural origin broodstock* (pNOB) was calculated by taking a fin clip on all fish used in the brood and conducting parentage based tagging (PBT) through DNA analysis and comparing results to coded wire tag and PIT tag readings. *Length and age* (scale readings) of all broodstock are reported along with the number of *broodstock prespawn mortalities* or the number of adults that died in holding prior to spawning.

Life History Characteristics (Protocols 2246, 2248)

We estimated the *adult run timing* into freshwater and to LGD by calculating the proportion of PIT tag detections of all release groups that were detected at Bonneville and Lower Granite dams. We give the first, median, 80th percentile, and the last adult detection of all PIT tag groups. We also report the *spawn timing* in all study streams by scheduling surveys early in the spawning season based on past years' surveys, scheduling a mid-season or peak spawning survey, and then one or two surveys closer to the end of spawning in each stream. The *percent females* (adults) of the total escapement and adult *age class structure* are calculated through the run reconstruction process (Young et al. 2018) in the hatchery broodstock during spawning.

Fall Chinook juvenile performance measures include *juvenile emergence timing, emigration timing, age at emigration, size at emigration, and condition* reported by the NPTH M&E project to evaluate similarities and differences of natural and hatchery/supplementation Chinook salmon traits which affect growth, reproduction, and survival in the Clearwater River. Emergence timing of fry was estimated separately for the Clearwater River lower reach and the upriver North Fork/Ahsahka Islands reach by flight date, with spawning commencing on October 1, as we have documented in past years' surveys. Starting on a given flight date, the daily mean water temperatures (^{0}C) were summed forward in time until the date that 1,000 temperature units (TUs) were accumulated (i.e., the estimated fry emergence date). Fall Chinook redds located along the North Fork Clearwater River, and the north channel of the Ahsahka Islands are highly affected by Dworshak Reservoir warm water releases compared to the colder water in the lower Clearwater. We also looked at total dissolved gas (TDG) levels during incubation when spill levels elevated gas levels that may have affected emerging fry. The timing and age at emigration was determined by PIT tag detections at LGD for hatchery fish and natural fish captured and released in the Clearwater River. The size at emigration can only be determined from the average size at release because emigrating PIT tagged fish were not measured at any downstream dams. Likewise, juvenile condition (K) could only be determine just prior to each release group and not actively emigrating fish.

Survival/Productivity (Protocol 2249)

Juvenile survival using the Survival Under Proportional Hazards (SURPH) program (Lady et al. 2002) to Lower Granite Dam (LGD) and below if enough PIT tagged fish were detected. Seining and PIT tagging methods can be found in Appendix A. Survival for all 2017 juvenile release groups was estimated as an overall 'smolt' value or *smolt equivalents* at LGD by taking the release number and multiplying by the survival estimate.

The *smolt-to-adult return rate* (SAR) estimates (Method 395) were calculated by taking yearly fall Chinook run reconstructions to Lower Granite Dam (Young et al. 2018) for all 2013 release groups, the latest year full age returns can be calculated. This would include total age-5 fish that returned in 2017. We rarely get age-6 fish returns and an occasional one would not influence the SAR estimate appreciably. Earlier SARs and smolt-to-adult survivals (SASs) that includes harvest estimates can be found in earlier reports (Arnsberg et al. 2017). Adult returns are summarized, expanded for trapping rates at Lower Granite Dam, and a total SAR given for each release group. We also include fall Chinook salmon contributions in the ocean and freshwater fisheries as reported to the Regional Mark Information System (RMIS) and calculate an SAS for each release group.

We also estimated *prespawn mortalities* (Method 403) of natural and hatchery fish through carcass collection on the spawning grounds. All female carcasses are cut open and examined for egg retention and were determined a pre-spawned mortality if 75% or more eggs were retained. Percent pre-spawned mortality was calculated by dividing the number of pre-spawned mortalities by the total number of female carcasses collected.

Genetics (Protocols 72, 78)

Genetic tissue was collected (Method 6645) from fall Chinook adults in all carcasses collected. The genetic tissue was stored dry on uniquely labeled sheets of Whatman paper and/or envelopes. Genetic samples, along with all spawned fish used for broodstock, were sent to the Hagerman Laboratory of the Columbia River Inter-Tribal Fisheries Commission (CRITFC) for analysis. A parentage based tagging (PBT) analyses were conducted to estimate the proportion of natural origin broodstock (pNOB). The PBT analysis of carcasses estimated the hatchery fraction in specific spawning aggregates.

RESULTS

Field Operations

Tagging/Marking

Tagging goals were to CWT each fall Chinook salmon release group with a unique CWT code for adult return evaluations and have a CWT/ad-clip group for fishery evaluations (Rocklage and Hesse, 2004). Specific tagging and marking goals are given in Appendix Table 1. For 2017 field operations, all CWT and marking goals were met for both FCAP and NPTH fall Chinook release groups (Table 1). PIT tagging goals were met except for Cedar Flats where fish had to be emergency released early because of a power outage and PIT tagging had not occurred.

Table 1. Number and date of fall Chinook yearlings and sub-yearlings released by the Nez Perce Tribe in 2017 with estimated number of marks and tags in each release group.

Broodyear	Release Location	Date Released	Number Released	Number CWT only	Number CWT/Ad	Number Ad only	Unmarked/ Untagged	Number PIT
2015	Captain John Rapids	3/31/17	159,031	86,618	68,105	652	3,656	1,453
2015	Pittsburg Landing	4/7/17	150,879	80,278	68,151	469	1,981	1,536
2015	Big Canyon Cr.	4/11/17	149,171	80,983	65,641	1,771	776	1,496
		Yearling Total	*459,081*	*247,879*	*201,897*	*2,892*	*6,413*	*4,485*
2016	Pittsburg Landing	5/22/17	404,745	110,351	106,698	734	186,962	26,019
2016	Big Canyon Cr.	5/24/17	534,118	112,527	103,301	2,786	315,504	17,045
2016	Captain John Rapids	5/23/17	534,221	108,430	106,180	1,017	318,594	25,924
2016	Captain John Rapids[a]	---	---	---	---	---	---	---
2016	NPTH-S-Channels	5/30/17	474,030	202,104	100,994	441	170,491	1,999
2016	NPTH-FCS Ponds	6/13/17	556,001	203,312	100,202	516	251,971	1,997
2016	Cedar Flats	5/20/17	234,202	105,564	103,567	668	24,403	0[b]
2016	Lukes Gulch	6/7/17	238,772	106,492	103,854	538	27,888	1,997
		Sub-Yearling Total	*2,976,089*	*948,780*	*724,796*	*6,700*	*1,295,813*	*74,981*
		Grand Total	*3,435,170*	*1,196,659*	*926,693*	*9,592*	*1,302,226*	*79,466*

[a] There was no second release as planned in 2017.

[b] Due to unplanned power loss at Cedar Flats fish were released early and no PIT tagging occurred.

Total fall Chinook yearling releases exceeded the total release goal by 9,081 fish (2.0%). Subyearling release goals were short by 23,911 fish (0.80%) because a second Captain John release group did not occur as planned (Table 1). During 2017, a number of fry escaped from LFH and the subyearlings scheduled for the second release at Captain John were back filled for a full release group at Big Canyon.

Beach Seining

Lower Clearwater River beach seining began on June 12 and ended on July 12, 2017. A total of 3,954 chinook juveniles were captured, 3,231 were PIT tagged as natural fall Chinook, and 430 natural fall juveniles were smaller than 50 mm and did not receive a PIT tag. A total of 284 chinook were identified as hatchery origin by presence of a CWT tag and/or an adipose clip and did not receive a PIT tag. Nine natural fall Chinook juveniles were recaptured, showing an average growth rate of 0.89 mm/day. Catch per unit effort (CPUE) of the entire sampling season averaged 192.4 juvenile fall chinook captured per seining haul.

Spawning Ground Surveys & Carcass Collections

Aerial spawning ground surveys on study streams were conducted from October 10 on the lower Clearwater River and ended November 8 in the upper Clearwater and tributaries. Rain and turbid water prevented a last schedule survey on November 20 to be conducted, therefore total redds were estimated based on the average proportion of redds expected after the last survey on lower Clearwater and N.F. Clearwater rivers. Redd surveys on the Grande Ronde, Imnaha, and Salmon rivers were conducted on schedule except one flight on November 1 that was cancelled on the Imnaha because of high winds. Fall Chinook salmon carcasses were collected from October 30 to November 21 in the lower Clearwater and Potlatch rivers.

Performance Measures

Abundance

The 2017 fall Chinook *run prediction* came in close to the actual run to Lower Granite Dam with 2,418 less adults or 8.9% less returns than forecasted (Young et al. 2018; Table 2). The prediction for the 2018 fall Chinook run is down 6,654 adults or 26.9% less than the 2017 actual return number (Table 2).

Table 2. Forecasted and actual Snake River adult fall Chinook salmon returns to Lower Granite Dam in 2017 and predicted run forecast for 2018.

	2017 Forecast	2017 Actual	2018 Forecast
Natural Adults	8,125	6,966	6,113
Hatchery Adults	19,073	17,814	12,013
Total Adults	27,198	24,780	18,126

Total escapement estimate: The 2017 estimated escapement to Lower Granite Dam totaled 28,624 Snake River fall Chinook salmon including 24,780 adults and 3,844 jacks < 57 cm total length (Table 3; Young et al. 2018). The estimated wild or natural portion of the run was 6,966 adults and 644 jacks for a total of 7,610 fish. Out-of-Snake River Basin strays comprised 0.6% of the return (Table 3).

Table 3. Estimates of fall Chinook salmon returns to Lower Granite Dam in 2017 by origin, sex, size and age. Adults (sum of females and males), jacks (< 57 cm total length), Hat (Snake River origin hatchery fish determined by coded wire tag expansions), stray (out-of-Snake Basin) hatchery fish determined by coded wire tag expansions.

	Female	Male	Jacks	adults
total wild	3,227	3,738	644	6,966
total hatchery	9,878	7,936	3,200	17,814
Totals	13,105	11,674	3,844	24,780
wild age 2	45	9	553	54
wild age 3	1,256	2,873	73	4,129
wild age 4	1,048	626	12	1,674
wild age 5	854	230	6	1,084
wild age 6	25	0	0	25
Hat age 2	21	66	2,368	87
Hat age 3	2,396	3,890	832	6,286
Hat age 4	5,978	3,336	0	9,314
Hat age 5	1,383	506	0	1,889
Hat age 6	60	0	0	60
stray age 2	0	0	0	0
stray age 3	0	48	0	48
stray age 4	10	44	0	54
stray age 5	30	36	0	66
stray age 6	0	0	0	0
agency wire	0	10	0	10

Comparison of the run reconstruction method of returning fall Chinook salmon hatchery spawners (pHOS) vs the parentage based tagging (PBT) estimate resulted in close estimates (Figure 2; Young et al. 2018). The PBT method resulted in slightly higher pHOS for males, jacks, and females than the run reconstruction method, however, overall only a 2.3% difference for all fish combined (Figure 2). The natural origin abundance of the fall Chinook return from PBT versus the run reconstruction method resulted in 8.6% less natural fish estimated to LGD with the PBT method (Table 4; Young et al. 2018).

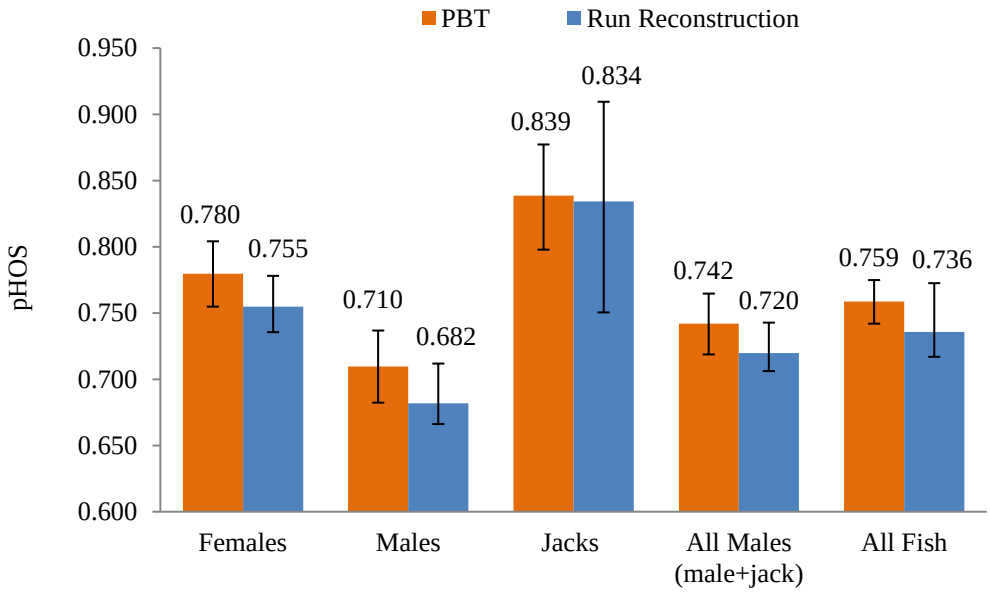

Figure 2. Comparison of parental based tagging (PBT) and run reconstruction estimates of the proportion of fall Chinook salmon hatchery returns (pHOS) to Lower Granite Dam with 95% confidence intervals, 2017.

Table 4. Estimated natural abundance (adjusted count) from the run reconstruction (RR) method versus the parentage based tagging (PBT) method to Lower Granite Dam, 2017.

	Adults	Jacks	Total
RR adjusted count	24,782	3,870	28,652
wild RR	6,930	641	7,571
wild PBT	6,292	625	6,917
difference	638	16	654

The i*ndex of Spawner Abundance (Redd Counts)* resulted in a total of 1,309 redds counted in the Clearwater River Subbasin with 786 redds estimated to have been missed by not conducting the final survey (Figure 3). We averaged the previous 5-yr actual counts up to November 6 (the third and last survey), calculated a proportion of overall redds counted to that date (57.3%), then applied that percentage to get an estimate of potential redds missed (Appendix Table 2). No other redd counts other than the mainstem Clearwater River and N.F. Clearwater River were expanded. The total estimated redd count of 2,095 was the lowest number counted or estimated during the last five years in the Clearwater Subbasin and reflects the general trend in Snake River fall Chinook abundance. A total of 1,022 redds were counted in the lower Clearwater and 32 redds counted in the upper Clearwater above the N.F. Clearwater with estimated total redds of 1,784 and 56, respectively (Appendix Table 2). One redd was observed in the N.F. Clearwater and we estimated a total of two redds. A total of 60 redds were observed in the lower Potlatch

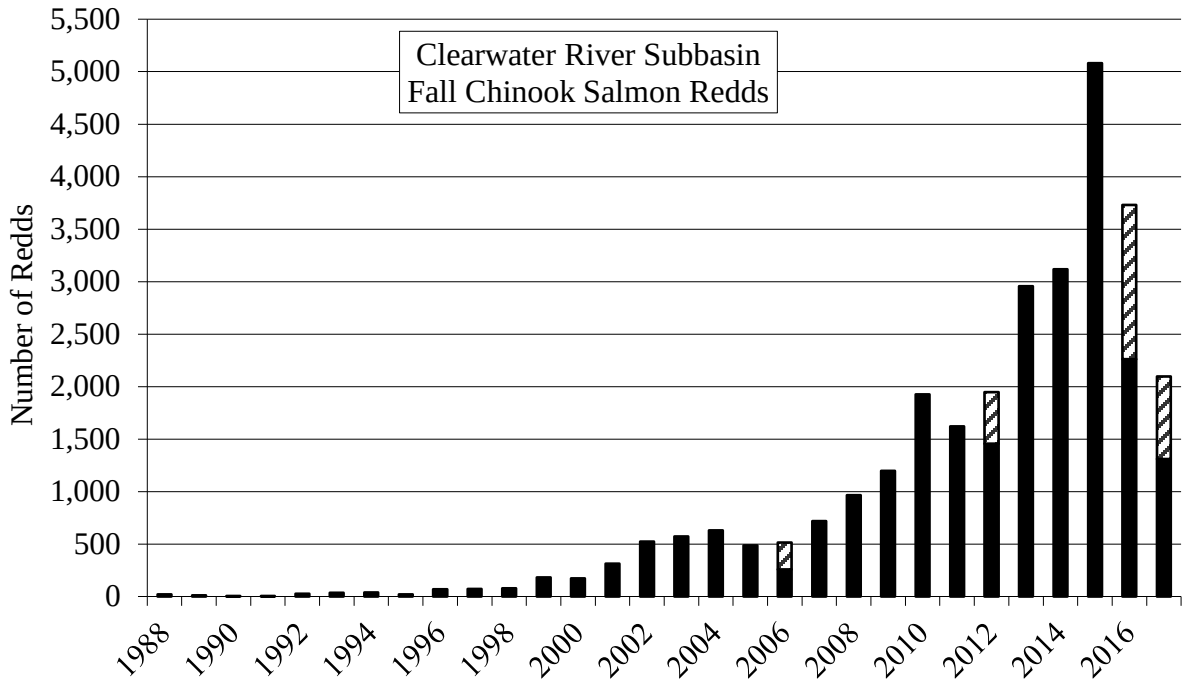

Figure 3. Fall Chinook salmon redds counted in the Clearwater River Subbasin, 1988-2017 (cross hatches indicates an estimated redd number missed due to adverse conditions and incomplete surveys).

River on the last lower Clearwater River survey, however, not many were thought to have been missed because not many live spawning adults were seen.

Lower Clearwater water transparencies were excellent on the first survey with low flows, poor on the second survey with moderate flows, and only good on the last November 6 survey with flows dropping back down (Appendix Table 2). Water temperatures averaged 10.7 ºC on the first October 9 survey and decreased to 7.2 ºC on the last survey. Rains and turbid water the second week of November prevented conducting the last scheduled survey on November 20, therefore redds missed were estimated as mentioned above.

There were a total of 22 redds in the M.F. Clearwater River (Appendix Table 3), 105 redds on the S.F. Clearwater (Appendix Table 4), and 67 redds on the Selway (Appendix Table 5) observed on the same three survey dates of October 10, October 30, and November 8. On the S.F. Clearwater, the second October 30 survey was cut short because of low helicopter fuel which prevented us from surveying the last 15 miles down to the mouth. On the last November 8 survey, we extended the S.F. Clearwater survey up past the town of Harpster, the normal end point, up to the confluence of Mill Creek (Rm 32.3) where a total of 13 redds were observed (Appendix Table 4). Survey conditions were excellent on all three upriver streams. No estimated number was calculated for the upriver redd counts as not many redds were thought to have been missed because of the later survey date and spawning tends to be completed earlier because of higher elevations and colder water temperatures.

Three aerial spawning ground surveys on the Grande Ronde River resulted in a total of 280 redds observed (Appendix Table 6). Surveys on October 18, November 1, and November 16 resulted in 23, 105 and 152 new redds counted, respectively. Due to early rains, survey conditions were only fair on all three surveys, therefore, a few redds may have been missed. Flows were a moderate 1,530 cfs on the first survey and decreased to 1,170 cfs on the last survey. Since 2013, the mean number of redds counted in the Grande Ronde River Subbasin has been 334, ranging from 255 to 415. The lowest redd count for the Grande Ronde Subbasin since intensive surveys began, was zero in 1989 and 1991, while the highest count was 415 in 2016.

Two aerial spawning ground surveys on the Imnaha River resulted in 15 redds observed (Appendix Table 7). Surveys on October 18 and November 8 resulted in 1 and 14 new redds counted, respectively. A scheduled survey on 1 November was cancelled because of high winds. Survey conditions were good on both surveys. Since a later survey was not conducted after November 8, a few redds may have been missed. Flows were a low 159 cfs on the first survey and 168 cfs on the last survey. Since 2013, the mean number of redds observed in the Imnaha River has been 54, ranging from 15 to 103. The lowest redd count for the Imnaha River, since intensive surveys began, was zero redds in 1994 while the highest count was 132 in 2010.

Two aerial spawning ground surveys conducted October 16 and November 15 on the Salmon River resulted in 10 redds observed (Appendix Table 8). The first survey was conducted from the mouth up to French Creek (105 miles), however, the second survey was conducted only up to the mouth of Slate Creek because of high winds. Salmon River flows were slightly higher than normal and measured 5,680 cfs on the first survey and 6,030 cfs on the last survey. Survey conditions were good on both surveys but not excellent, therefore, a few deep water redds were probably missed. Since 2013, the mean number of redds occurring in the Salmon River has been 52, ranging between 10 and 142. The lowest redd count for the Salmon River, since intensive surveys began in 1992, was zero redds in both 1999 and 2000, while the highest count was 142 in 2015.

During aerial and underwater video counts, IPC and USFWS staff observed an estimated total of 1,869 redds in the main stem Snake River (Arnsberg et al. 2018). This was the third year that surveys along the main Snake River were accomplished only with a small unmanned aircraft system (sUAS) and by underwater video in deeper spawning sections. A total of 4,596 redds was estimated in the Snake River Basin during 2017 (Figure 4), representing the seventh highest estimate since intensive surveys began in 1988, however, 2,139 less redds than the previous 5-year average. This years' redd estimate was 1,830 fewer redds than in 2016 and 4,750 fewer redds than in 2015 when a record high of 9,346 redds was estimated in the Snake River Basin. Figure 4 does not show the Tucannon River redds which is below LGD and other smaller tributaries of the Snake such as Asotin and Alpowa creeks where other but limited fall Chinook salmon spawning occasionally occurs.

The total *spawner abundance* above LGD was estimated as the total spawner abundance after adjusting for fallback through the dam, subtracting fish hauled to NPTH and LFH for broodstock

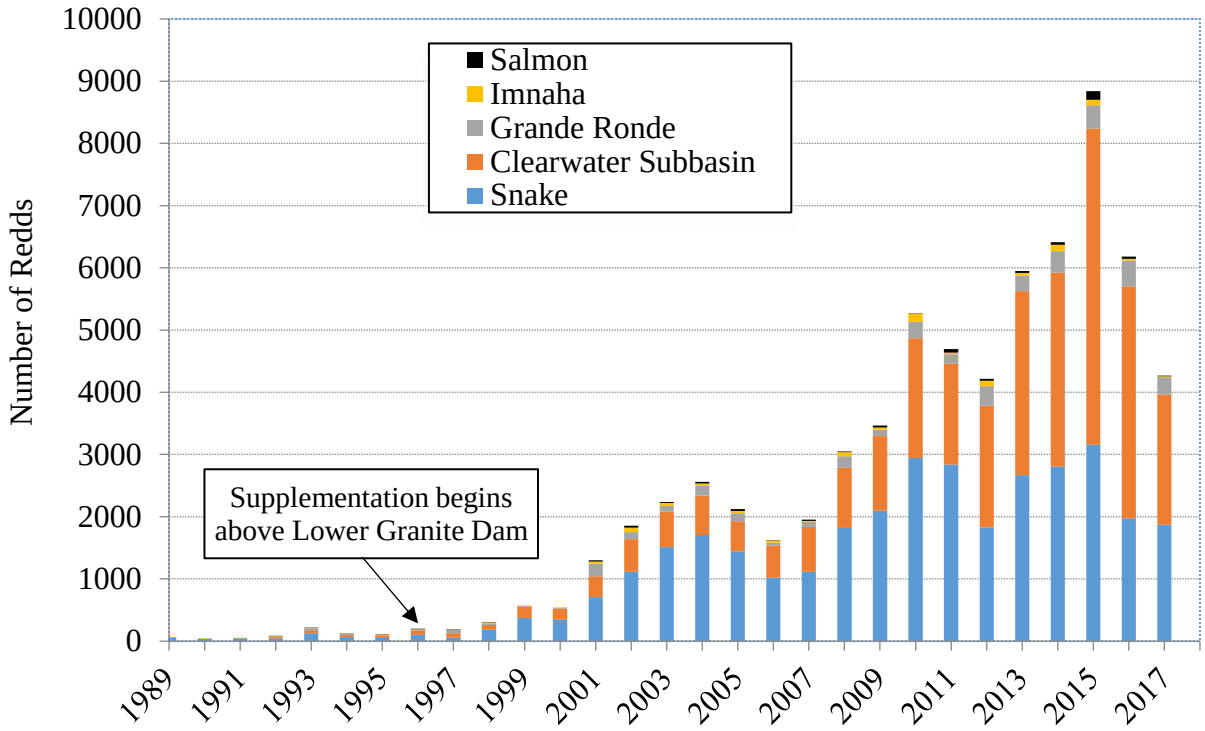

Figure 4. Fall Chinook salmon redds counted in the Snake River Basin above Lower Granite Dam, 1989-2017, along with the year supplementation releases started in the Snake River.

(Young et al. 2018), subtracting harvest estimates, and volunteers to the NPTH fish ladder kept for broodstock in 2017 (Table 5). There were slightly more females (51.6%) in the estimated adult escapement to the spawning grounds than adult males (48.4%). A total of 536 fall Chinook were estimated in the sport harvest above LGD and 26 fish estimated in the Tribal fishery. Sport harvest estimates within Washington state boundaries above LGD are not included as data were not available at the time of this report. A total of 9 fish were kept for broodstock that volunteered into the NPTH fish ladder (Table 5). A total of 20,889 adults were estimated to have escaped to the spawning grounds above LGD with an estimated 4.5 *adults/redd* during 2017. Since 1988, the average number of adults/redd in the Snake River Basin above LGD has been 6.0 with an R^2 value of 0.91 (Figure 5).

Table 5. Fall Chinook salmon abundance above Lower Granite Dam (LGR), sport harvest, Tribal harvest, volunteers to Nez Perce Tribal Hatchery (NPTH) and total spawner abundance above Lower Granite Dam, 2017.

	Abundance above LGD	2017 Sport Harvest	2017 Tribal Harvest	Volunteers To NPTH	Total Spawner Abundance
Females	10,964	167	13	1	10,783
Males	10,284	157	13	8	10,106
Jacks	3,719	212	0	0	3,507
Totals	24,967	536	26	9	24,396

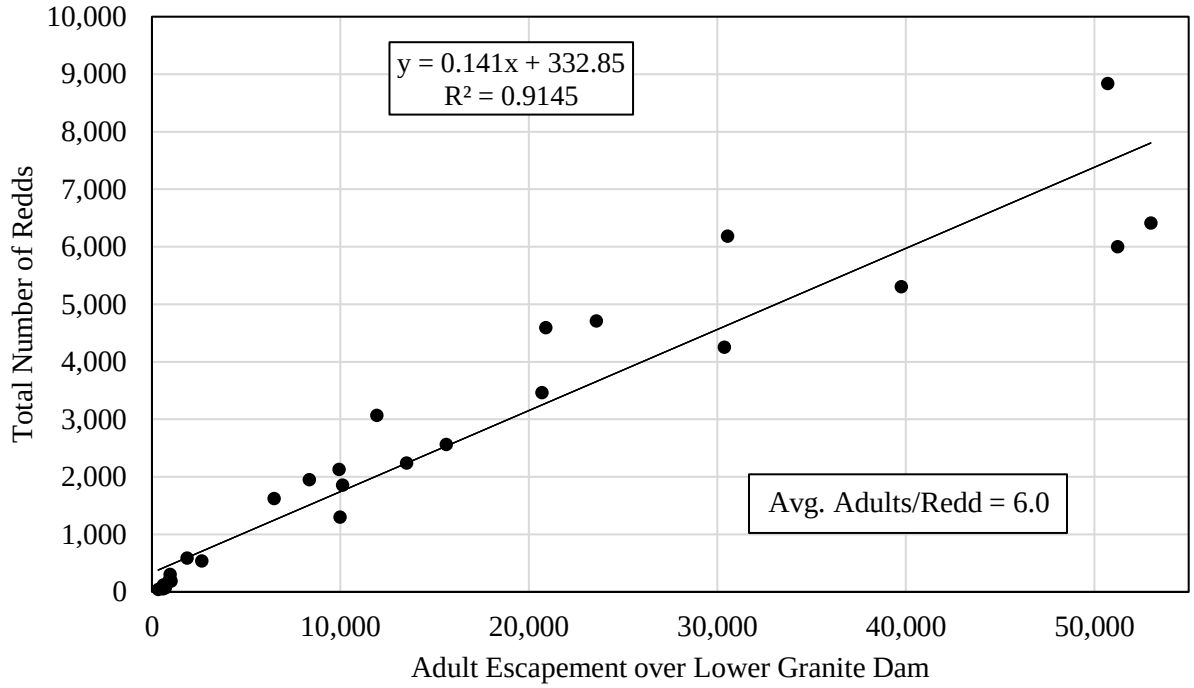

Figure 5. Fall Chinook salmon redds estimated in the Snake River Basin above Lower Granite Dam and adult (not including jacks) escapement regression over Lower Granite Dam from run reconstructions, 1988-2017.

The *hatchery fraction* of the total escapement above LGD was estimated to be 73.6% calculated by the run reconstruction method (Young et al. 2018). The hatchery fraction from carcasses collected on the spawning grounds based on marks and tags was estimated to be slightly higher at 79.5%, however, PBT analysis has not been run on carcasses to confirm hatchery or natural origin of the unmarked fish.

There were a total of 21 recovered (expanded number) Snake River Basin *strays* from 2013 releases that were recovered at other hatcheries outside the basin for a calculated stray rate of 0.002%. A total of 4 Snake River Basin strays were recovered outside the basin at other spawning grounds for a calculated stray rate of 0.0004%. No confirmed (by coded wire tags) out-of-Snake Basin *strays* were collected on the spawning grounds in the Snake Basin during 2017. However, the run reconstruction method estimated there were 147 total out-of-basin *strays* or 0.6% of the total spawner abundance that escaped above LGD during 2017 (Young et al. 2018).

The *adult spawner spatial distribution* within each 5-mile section of river is shown in Figure 6. The greatest density of redds (> 300) were observed within a 5-mile section of the lower Clearwater River adjacent and downstream of the NPTH. Not surprisingly, the lowest distribution of fall Chinook redds were in the Imnaha and Salmon rivers where supplementation has not yet occurred (Figure 6).

Ocean/Mainstem Harvest:

Harvest estimates are presented with smolt-to-adult return rates back to the Snake River in the *smolt-to-adult return rate* (SAR) section.

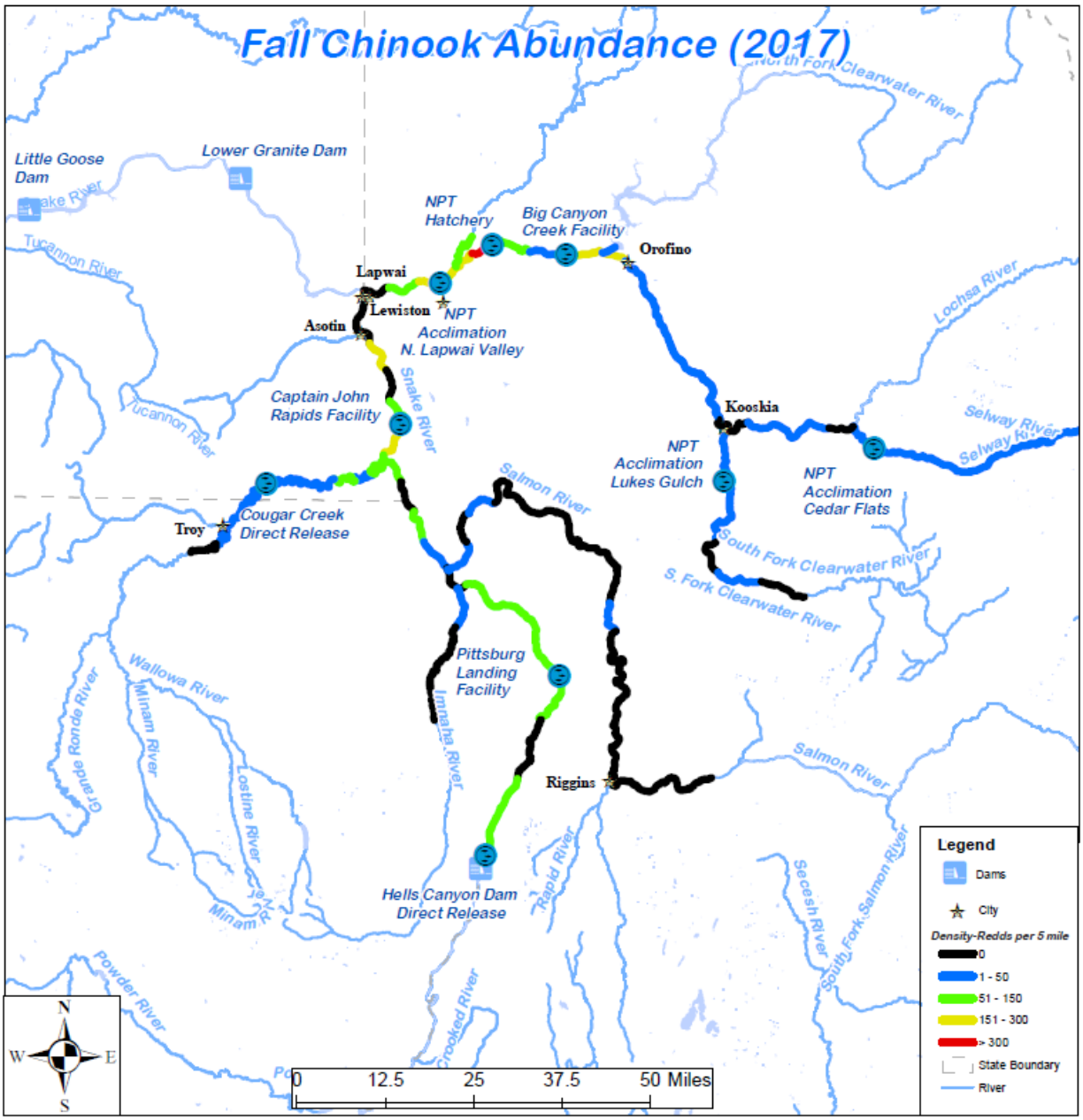

Figure 6. Fall Chinook salmon abundance (estimated density of redds per 5-mile section) within the Snake River Basin, 2017.

In Hatchery Measures

The *hatchery production abundance* goals for the FCAP boodyear 2015 fall Chinook yearlings and broodyear 2016 subyearlings were met for 2017 (see Table 1). *Hatchery Release timing* occurred on schedule (except Cedar Flats subyearlings) with yearlings being released from late March to early April and subyearlings released in late May and early June (Table 6). Cedar Flats subyearlings had to be emergency released on May 20 (about 2½ weeks early) due to a power failure at the acclimation site. S*ize at release* and *fish condition* (K) were good with condition factors ranging from 1.05 to 1.18 (Table 7). As mentioned earlier, because of low water and warm water temperatures in Lapwai Creek, North Lapwai Valley acclimation site was not operated and fish were reared and released at NPTH in 2017. Also, the second release at Captain John did not occur because of the loss of fry at LFH and back filling of fish for Big Canyon.

Pre-release mark and tag retention rates were sampled prior to release on all FCAP release groups (Table 6). However, due to limited rearing space and the ponding of unmarked fish with marked fish at NPTH, as well as an unplanned emergency release of the Cedar Flats group, estimation of tag loss was not possible at these sites. Therefore estimates of mark and tag loss from the Lukes Gulch release group was used as a surrogate because fish were marked/tagged during the same timeframe at Sweetwater Springs early rearing facility. Additionally PIT tagging was not possible on the Cedar Flats release group. PIT tagging goals were met for all other hatchery release groups (see Table 1).

Table 6. Coded wire tag (CWT) codes and pre-release coded wire tag and adipose (AD) fin clip retention rates of hatchery fall Chinook juveniles released in 2017.

Brood Year	Release Location	Release Date	CWT Code	CWT Ret. Rate	AD Clip Ret. Rate
2015	Captain John Rapids	3/31/17	22-03-77	0.990	0.972
2015	Captain John Rapids	3/31/17	22-03-76	0.959	N/A
2015	Pittsburg Landing	4/7/17	22-03-78	0.991	0.973
2015	Pittsburg Landing	4/7/17	22-03-75	0.975	N/A
2015	Big Canyon Cr.	4/11/17	22-03-79	0.992	0.965
2015	Big Canyon Cr.	4/11/17	22-03-74	0.990	N/A
2016	Pittsburg Landing	5/22/17	22-03-85	0.980	0.973
2016	Pittsburg Landing	5/22/17	22-03-84	0.987	N/A
2016	Big Canyon Cr.	5/24/17	22-03-83	0.975	0.965
2016	Big Canyon Cr.	5/24/17	22-03-86	0.990	N/A
2016	Captain John Rapids	5/23/17	22-03-81	0.991	0.972
2016	Captain John Rapids	5/23/17	22-03-80	0.959	N/A
2016	NPTH S-Channel[a]	5/30/17	22-02-59	0.996	0.998
2016	NPTH S-Channel[a]	5/30/17	22-02-57	0.998	N/A
2016	NPTH FCS Pond[a]	6/13/17	22-02-60	0.996	0.998
2016	NPTH FCS Pond[a]	6/13/17	22-02-56	0.998	N/A
2016	Cedar Flats[b]	5/20/17	22-02-52	0.996	0.998
2016	Cedar Flats[b]	5/20/17	22-02-53	0.998	N/A
2016	Lukes Gulch	6/7/17	22-02-61	0.996	0.998
2016	Lukes Gulch	6/7/17	22-02-62	0.998	N/A

[a]Pre-release mark and tag retentions could not occur for these groups due to limited rearing space and ponding of unmarked fish with marked fish. Retention estimates were used from Lukes Gulch fish as a surrogate.

[b]Fish were emergency released early due to unplanned power loss, no pre-release mark and tag retentions could occur. Retention estimates were used from Lukes Gulch fish as a surrogate.

Table 7. Size and condition of hatchery fall Chinook juveniles released in 2017.

Brood Year	Release Location	Fish Per Pound	Ave Length (mm)	Ave Weight (g)	Conditon Factor (K)
2015	Captain John Rapids	10.7	145	33.1	1.05
2015	Pittsburg Landing	9.9	151	39.6	1.11
2015	Big Canyon Cr.	11.1	154	41.2	1.11
2016	Pittsburg Landing	48.9	87	7.7	1.10
2016	Big Canyon Cr.	51.8	88	7.9	1.11
2016	Captain John Rapids	50.9	90	8.5	1.11
2016	NPTH S-Channel	84.9	77	5.3	1.17
2016	NPTH FCS Pond	61.5	85	7.4	1.18
2016	Cedar Flats[b]	64.0	N/A	N/A	N/A
2016	Lukes Gulch	50.9	94	8.9	1.08

[b]Fish were emergency released early due to unplanned power loss, no pre-release mark and tag retentions could occur. Retention estimates were used from Lukes Gulch fish as a surrogate.

Spawning and egg takes for broodyear 2017 fish commenced on October 17 and finished with egg take 5 on November 14, 2017 resulting in a total of 684 fish spawned (Table 8). The *hatchery broodstock fraction* of fish spawned was 71.5% hatchery origin (Table 9; Young et al. 2018). For 2017 spawn year, the incorporation of natural origin fish into the brood (pNOB) was 28.5% (Figure 7; Young et al. 2018). For 2016 and 2017 spawn years, the incorporation of natural origin fish looking at the DNA analysis (PBT), resulted in 35% and 39%, respectively, which was somewhat higher than the run reconstruction method (Figure 7). The dispositions of fish held at NPTH for broodstock spawning including *broodstock prespawn mortality* is shown in Table 8. The brood prespawn mortality of females used for broodstock was 15% (Table 8) compared to 2.8% of the females collected on the spawning grounds. The *average length* of male and female fish selected for broodstock were 78.2 cm and 77.6 cm, respectively. The *length* frequency of male and female fish selected for spawning in 2017 is shown in Figure 8. Since we were short on males for 2017, larger males (76 to 103 cm) were mated with multiple females from two up to seven times, however, only one male was used seven times.

Table 8. Disposition of adult fall Chinook hauled to the Nez Perce Tribal Hatchery for broodstock by sex, 2017.

Sex	# Trapped	Prespawn Mortality	Out-Planted	Spawned
Female	585	88 (15%)	73 (12.5%)	424 (72.5%)
Male	331	27 (8.2%)	44 (13.3%)	260 (78.5%)
Grand Total	916	115 (12.6%)	117 (12.8%)	684 (74.7)

Table 9. Percentage break down of hatchery and natural origin spawners used for broodstock at the Nez Perce Tribal Hatchery for spawn years 2003-2017 (from run reconstructions).

				Origin			
Spawn Year	No. Female	No. Male	Total Broodstock	No. Hatchery	No. Naturals	Proportion Hatchery Origin	Proportion Natural Origin
2003	98	90	188	85	103	0.453	0.547
2004	355	355	710	443	267	0.624	0.376
2005	280	240	520	332	188	0.638	0.362
2006	209	209	418	193	225	0.462	0.538
2007	287	288	575	348	227	0.605	0.395
2008	532	534	1066	874	192	0.820	0.180
2009	494	319	813	606	207	0.745	0.255
2010	485	461	946	803	143	0.849	0.151
2011	436	215	651	450	201	0.692	0.308
2012	468	325	793	461	332	0.582	0.418
2013	425	402	827	537	290	0.650	0.350
2014	413	319	732	522	210	0.713	0.287
2015	390	297	687	562	125	0.817	0.183
2016	440	285	725	536	189	0.740	0.260
2017	424	260	684	489	195	0.715	0.285

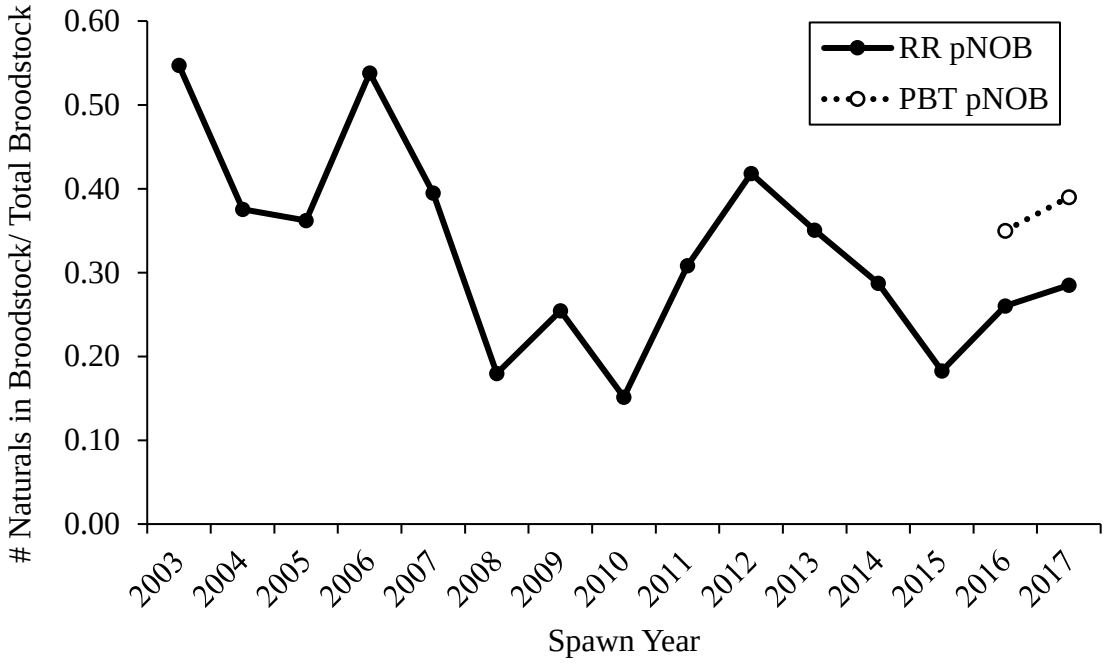

Figure 7. Proportion of natural origin spawners (pNOB) using the run reconstruction (RR) methodology compared to the parentage based tagging (PBT) methodology (2016-2017) that were used for broodstock at the Nez Perce Tribal Hatchery for spawn years 2003-2017.

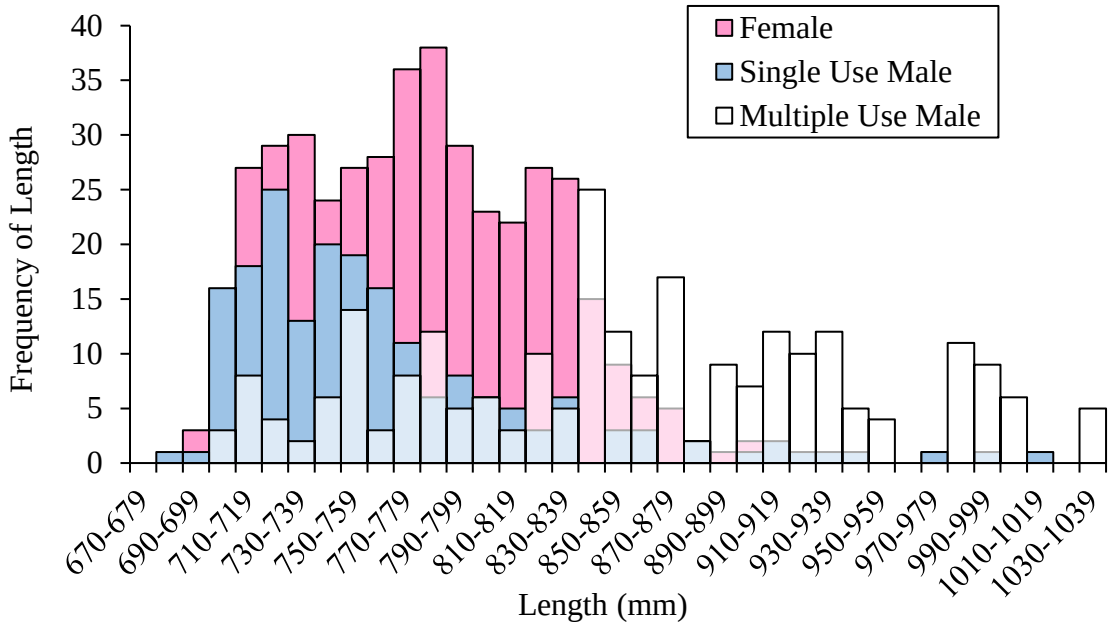

Figure 8. Length frequency for females, single use males, and multiple use males selected for broodstock at the Nez Perce Tribal Hatchery in spawn year 2017.

Life History Characteristics

The *adult run timing* of the FCAP and NPTH release groups and natural fall Chinook salmon detected at Bonneville Dam throughout the 2017 fall season is shown in Figure 9. The run timing of the natural or wild fall Chinook from the lower Clearwater came in earlier than all other hatchery release groups with the first PIT tagged fish being detected on July 20, about 12 days before the official fall Chinook count begins at Bonneville Dam. The next earliest run timing group was Big Canyon subyearling releases on the Clearwater River. There was not enough fish PIT tagged and therefore PIT tag detections to separate out all the NPTH and associated acclimation site release groups, so they were combined and run timing of those were about in the middle of all groups. As with the NPTH groups the FCAP yearlings detections were combined and those groups had a later run timing than the subyearling groups (Figure 9).

The *adult run timing* of the FCAP and NPTH release groups and natural fall Chinook salmon detected at Lower Granite Dam throughout the 2017 fall season is shown in Figure 10. Similar to Bonneville detections, the Clearwater River natural run timing was earlier than hatchery release groups, however there were only 3 fish detected. All other hatchery subyearling release groups run timing was similar with the FCAP yearling releases coming in slightly later on average than the subyearling releases (Figure 10).

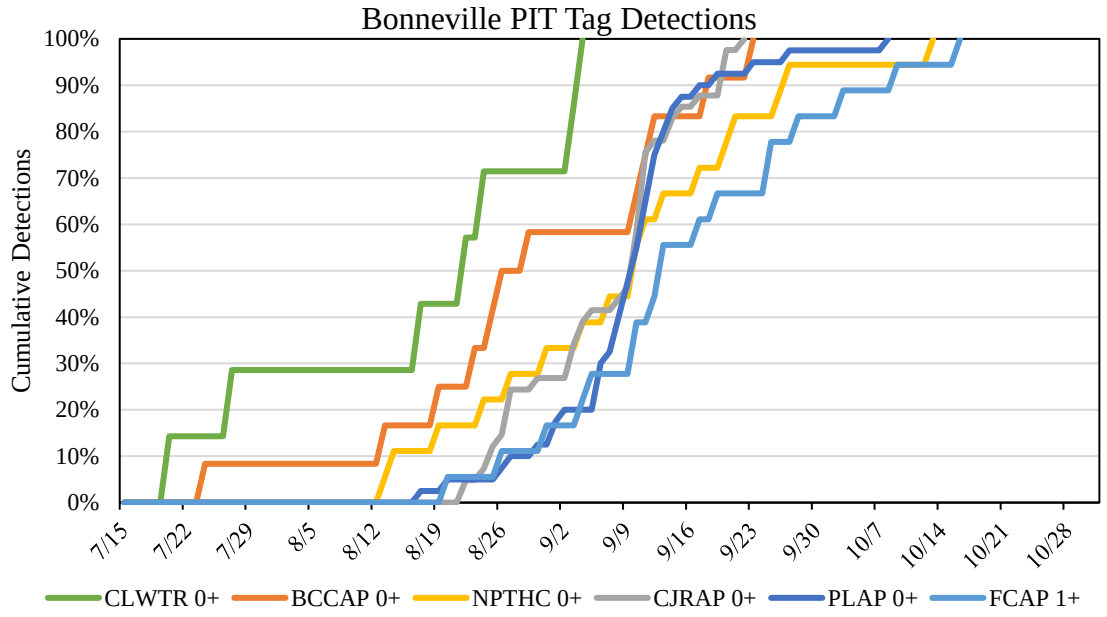

Figure 9. Cumulative adult run timing of PIT tagged natural fall Chinook subyearlings (0+) in the Clearwater River (CLWTR), at Fall Chinook Acclimation Project (FCAP) release sites at Big Canyon (BCCAP), Captain John (CJRAP), and Pittsburg Landing (PLAP), combined Nez Perce Tribal Hatchery Complex (NPTHC) subyearling releases and combined FCAP yearling (1+) releases detected at Bonneville Dam during 2017.

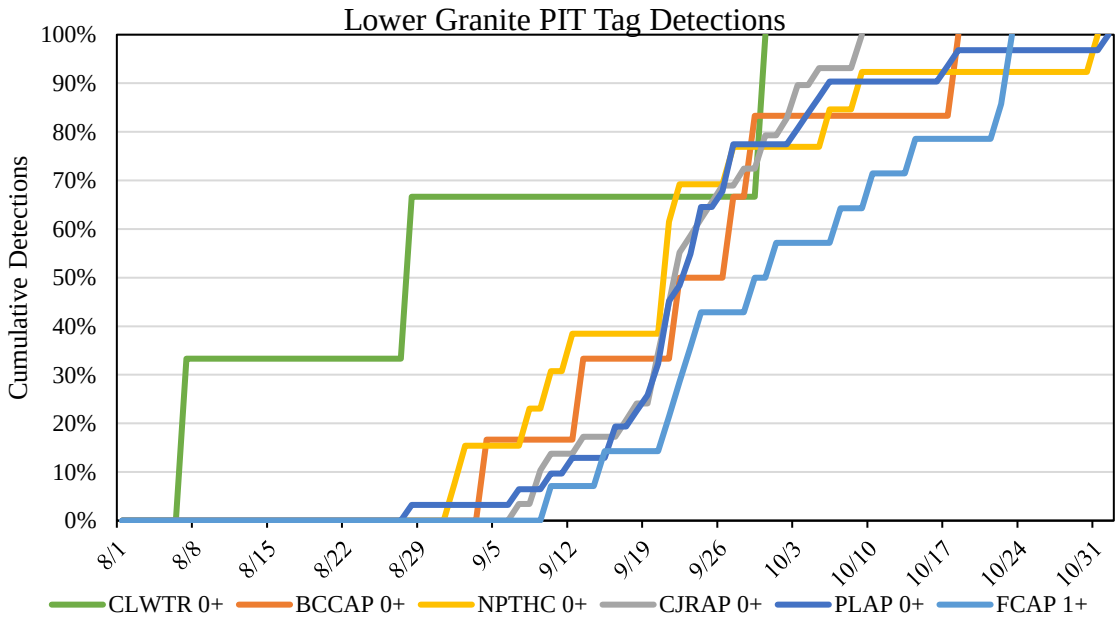

Figure 10. Cumulative adult run timing of PIT tagged natural fall Chinook subyearlings (0+) in the Clearwater River (CLWTR), at Fall Chinook Acclimation Project (FCAP) release sites at Big Canyon (BCCAP), Captain John (CJRAP), and Pittsburg Landing (PLAP), combined Nez Perce Tribal Hatchery Complex (NPTHC) subyearling releases and combined FCAP yearling (1+) releases detected at Lower Granite Dam during 2017.

The adult run timing passage window of all fall Chinook release groups are given in Table 10 which represents the first, median, 80%, and the last passage date based on PIT tag detections at Bonneville Dam. The earliest timing was the Clearwater River natural fish on all passage timing dates, followed by the Big Canyon subyearling release groups on the lower Clearwater River. The NPTHC, Captain John, and the Pittsburg release groups had the same median passage date of September 10. The FCAP combined yearling release groups had the latest median, 80%, and last passage dates of all release groups (Table 10).

As with Bonneville passage dates, the adult run timing passage window of all fall Chinook release groups are given in Table 11 for PIT tag detections at Lower Granite Dam. The Clearwater River natural fish had the earliest run timing dates for all run timing dates except for the 80% timing, however, this was the last run timing date as well. All hatchery subyearling passage timing dates were similar for the median and 80% passage timing. The FCAP yearling releases had the latest passage timing at Lower Granite Dam of all release groups except for the last passage date (Table 11).

Table 10. Adult run timing passage window of PIT tagged natural Clearwater River fall Chinook salmon, FCAP subyearlings and yearlings, and subyearlings released at the Nez Perce Tribal Hatchery Complex (NPTHC) sites that were detected at Bonneville Dam in 2017.

Release Group	First Passage Date	Median Passage Date	80% Passage Date	Last Passage Date
Clearwater River Naturals	7/20	8/22	9/3	9/4
Big Canyon Subyearlings	7/24	8/26	9/12	9/23
NPTHC Subyearlings	8/13	9/10	9/21	10/13
Captain John Subyearlings	8/22	9/10	9/14	9/22
Pittsburg Landing Subyearlings	8/17	9/10	9/13	10/8
FCAP Yearlings	8/20	9/13	9/28	10/16

Table 11. Adult run timing passage window of PIT tagged natural Clearwater River fall Chinook salmon, FCAP subyearlings and yearlings, and subyearlings released at the Nez Perce Tribal Hatchery Complex (NPTHC) sites that were detected at Lower Granite Dam in 2017.

Release Group	First Passage Date	Median Passage Date	80% Passage Date	Last Passage Date
Clearwater River Naturals	8/7	8/28	9/30	9/30
Big Canyon Subyearlings	9/4	9/22	9/29	10/18
NPTHC Subyearlings	9/1	9/21	10/6	10/31
Captain John Subyearlings	9/7	9/22	10/2	10/9
Pittsburg Landing Subyearlings	8/28	9/23	10/3	11/1
FCAP Yearlings	9/10	9/29	10/22	10/23

The *spawn timing* of fall Chinook salmon in all study streams was difficult to determine because we were limited to only two to three surveys on each stream because of budgeting and safety concerns. The first survey conducted on the lower Clearwater River resulted in 150 redds seen on October 9 (Appendix Table 2), therefore the initiation of redds was well on the way by that date. The peak number of new redds on the Clearwater was on the November 6 survey with 727 redds observed. On the upper Clearwater River, M.F. Clearwater, and Selway River, the peak redd count was on the October 30 survey with 16, 12, and 58 new redds observed, respectively (Appendix Tables 2, 3, and 5). The peak redd count on the S.F. Clearwater occurred on the November 8 survey with 99 new redds observed (Appendix Table 4). Peak spawning occurred on the Grande Ronde River on November 16 when 152 new redds were observed (Appendix Table 6). On the Imnaha River, the peak number of 14 new redds were observed on November 8 (Appendix Table 7). On the Salmon River the peak number of 10 redds were observed on November 15 and no redds were seen on the first survey on October 16 (Appendix Table 8).

The *percent females* of the total adult run for subyearling and yearling fall Chinook salmon to Lower Granite Dam in 2017 is given in Figure 11. There were no hatchery age-2 (jills) returning females and only a few (0.5%) returning wild age-2 females. The greatest percentage of hatchery female returns from subyearling releases were age-4 from NPTH at 71.8% and CFA at 71.4%. The greatest percentage of age-5 female returns were from NLV subyearlings and wild fish with 33.5% and 28.3%, respectively, however, age-5 returns are skewed because there were no releases from NLV in 2016 and 2015 to get any age-2 and age-3 returns. There were only a few age-6 subyearling female returns, 1.1% from NLV and 0.3% from wild fish. Out-of-Snake Basin stray females were also skewed toward age-4 and age-5 fish because they were only a few documented returning in 2017 (Figure 11). For female yearling returns, there were 3.0% unassigned yearlings (no associated coded wire tag) and 1.0% wild fish that were age-2 returns. The unassigned and wild female yearling returns made up the greatest percentage of age-3 fish as well with 30.2% and 6.4% returning, respectively. The PLA yearling females had the greatest return of age-4 fish at 84.5% with BCA second at 75.8%. The CJA female yearlings had the greatest number of age-5 and age-6 returns at 72.8% and 20.3%, respectively (Figure 11).

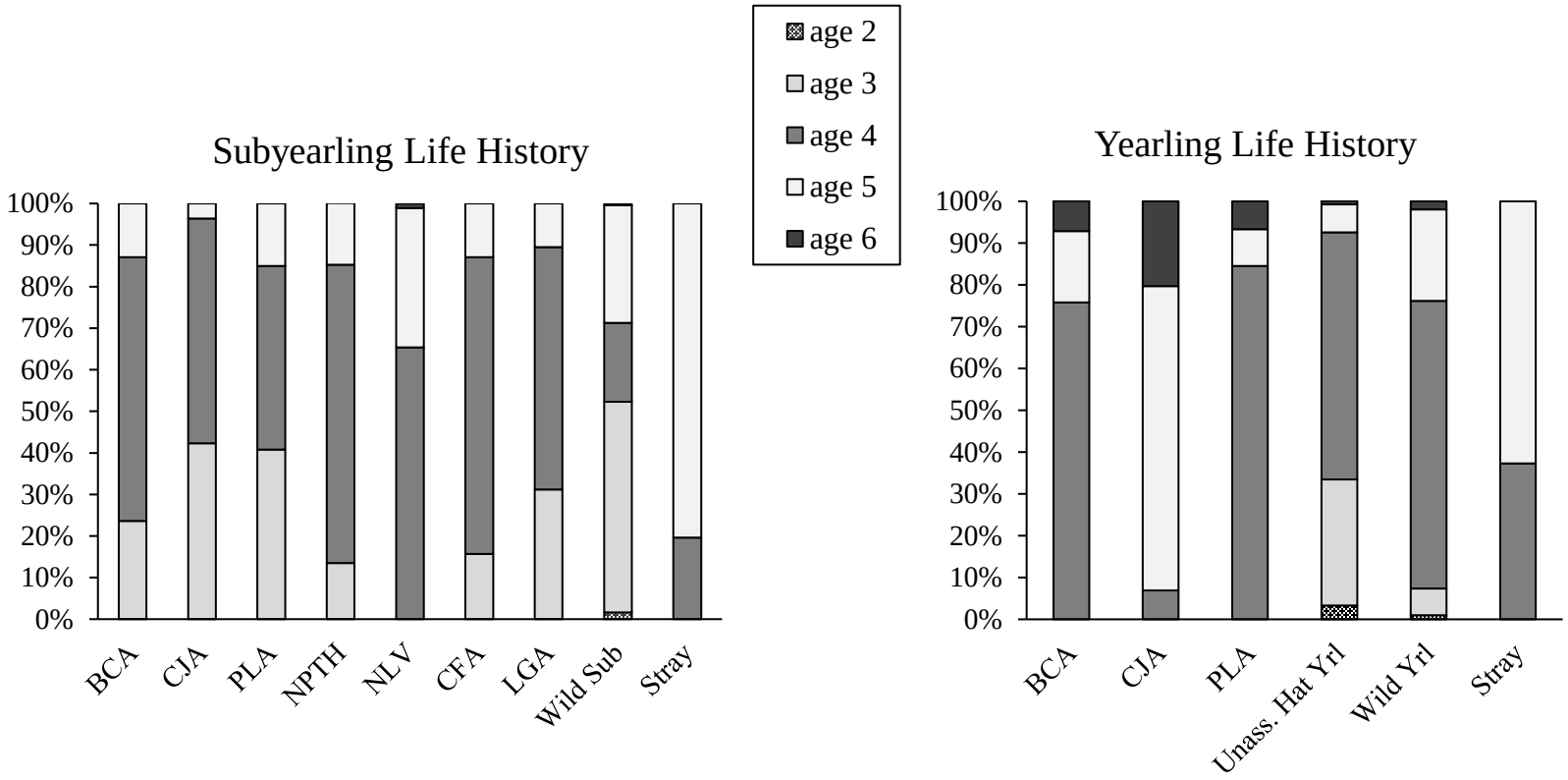

Figure 11. Percent Females (total age) of adult hatchery, wild, and stray origin fall Chinook that returned to Lower Granite dam in 2017 (BCA = Big Canyon Creek, CJA = Captain John Rapids, PLA = Pittsburg Landing, NPTH = Nez Perce Tribal Hatchery, NLV = North Lapwai Valley, CFA = Cedar Flats, LGA = Lukes Gulch, Wild Sub = wild subyearlings, Stray = out-of-Snake Basin strays, Unass. Hat Yrl = unassociated hatchery yearlings).

The *age class structure* for individual subyearling and yearling release groups (males and females) returning in 2017 are given in Figure 12. The NLV return shows the highest proportion of age-4 and age-5 fall Chinook subyearlings because there were no releases during 2015 and 2016 for age-3 and age-2 returns. Of the subyearlings, the wild fish had the greatest percentage of age-3 returns at 65.7%. For age-4 returns, the greatest percentage of returns came from CFA (60.8%), followed by NPTH (50.2%) and then BCA (44.9%). The wild subyearling returns resulted in 12.9% age-5 returns, followed by similar hatchery returns that range from 6.9% at LGA to 8.4% for PLA. The only age-6 return was from NLV at 0.5% of the entire age class structure. The out-of-Snake Basin strays represented a low return number to LGD which resulted in a skewed percentage of age-4 and age-5 fish (Figure 12).

The Big Canyon yearling returns in 2017 represented the highest proportion of age-4, age-5, and age-6 fish of all the yearling returns with no age-2 (mini-jacks) documented (Figure 12). All other age class returns were similar for the yearlings with only a few age-6 fish returning. Similar to the subyearlings, only a few out-of-Snake Basin strays were observed which skewed the return percentages to older age classes (Figure 12).

Age of return for the most recent complete broodyear (2011) for subyearlings and yearlings at all release sites that returned in 2013-2017 are represented in Figure 13. There were no age-2 (jacks) returns from CJA, NLV, CFA, surrogates, and strays with a low of 2.3% age-2 returns from NPTH to 4.9% for PLA. Surrogates were subyearlings released in the Snake and Clearwater rivers as part of on-going survival studies with alternative passage strategies through mainstem dams. For the wild subyearlings, age-2 returns were much higher at 54.8%. Of all hatchery subyearling releases, only PLA had more age-3 returns (54.6%) than age-4 (40.0%). The greatest percentage of age-4 (64.0%) and age-5 (14.4%) returns came from NLV, followed by NPTH with 60.6% age-4 and 13.4% age-5 returns (Figure 13).

Age at return of adult (including jacks) hatchery, and wild origin fall Chinook to the Snake River Basin upstream of Lower Granite dam for broodyears (BYs) 2002-2011 is shown in Figure 14. BY 2011 had the lowest percentage of age-2 hatchery subyearlings returning (4.9%) compared to a high of 54.8% for the wild subyearlings for BY 2011. There was a steady increase in age-4 and age-5 fish from BYs 2009-2011 compared to the previous years from 2002-2008 BYs. Overall, wild subyearlings had a higher percentage of age-4 and age-5 returns as compared to the hatchery subyearlings. The hatchery yearling releases had the highest percentage of age-2 returns with a high of 50.0% from BY 2002 followed closely by BY 2011 at 48.1% (Figure 14). The wild yearlings had lower age-2 returns during all BYs compared to hatchery yearlings except for the BY 2007 which was about 4-times the hatchery age-2 returns. Age-2 yearlings return as minijacks the same year of release and may not ever enter the ocean. There were only a few age-6 returning adults from subyearlings and slightly more from yearlings with a high of 1.5% returning from BY 2005 wild yearlings (Figure 14).

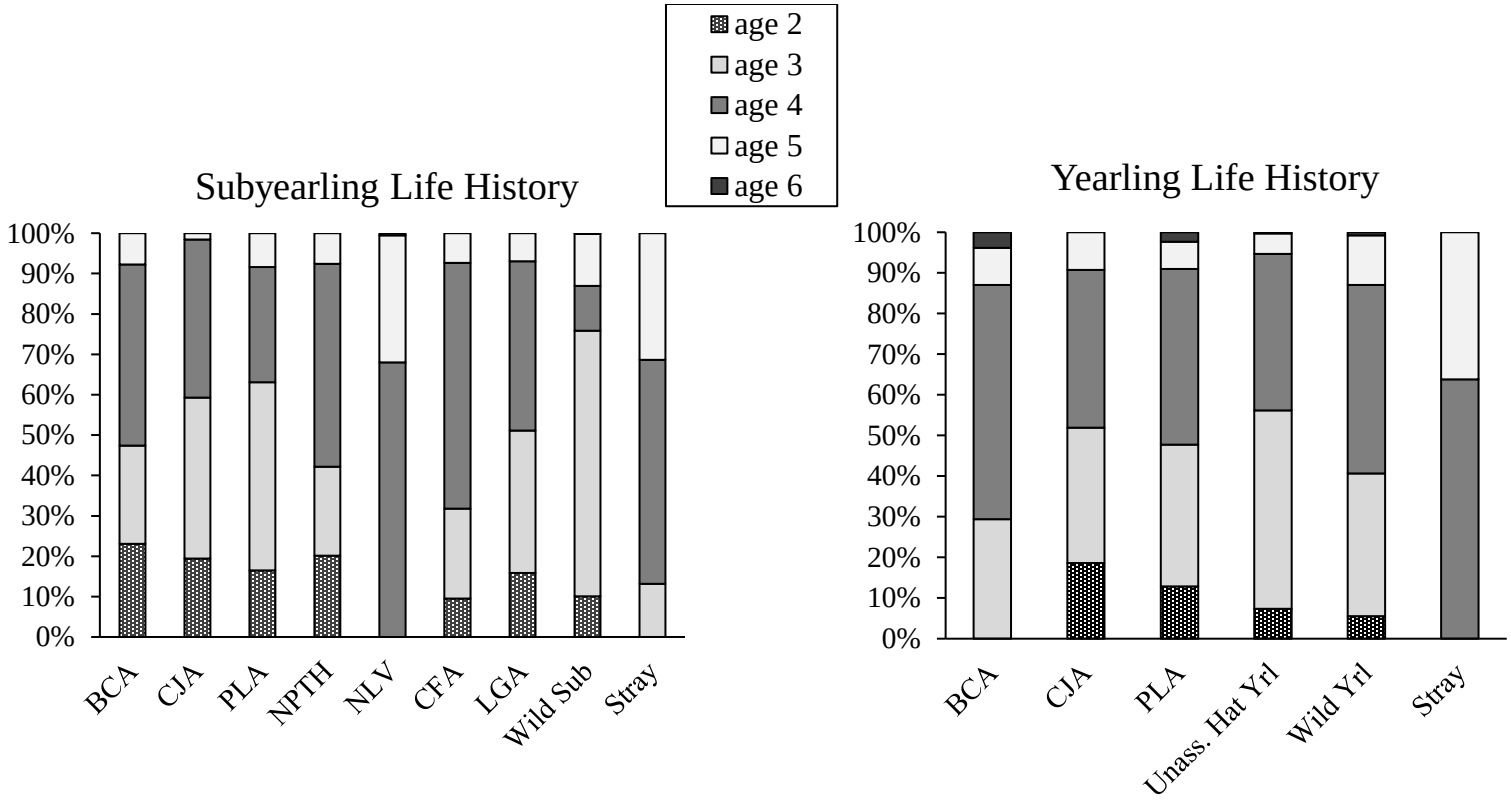

Figure 12. Age Class Structure (total age) of adult (including jacks) hatchery, wild, and stray origin fall Chinook that returned to Lower Granite dam in 2017 (BCA = Big Canyon Creek, CJA = Captain John Rapids, PLA = Pittsburg Landing, NPTH = Nez Perce Tribal Hatchery, NLV = North Lapwai Valley, CFA = Cedar Flats, LGA = Lukes Gulch, Wild Sub = wild subyearlings, Stray = out-of-Snake Basin strays, Unass. Hat Yrl = unassociated hatchery yearlings).

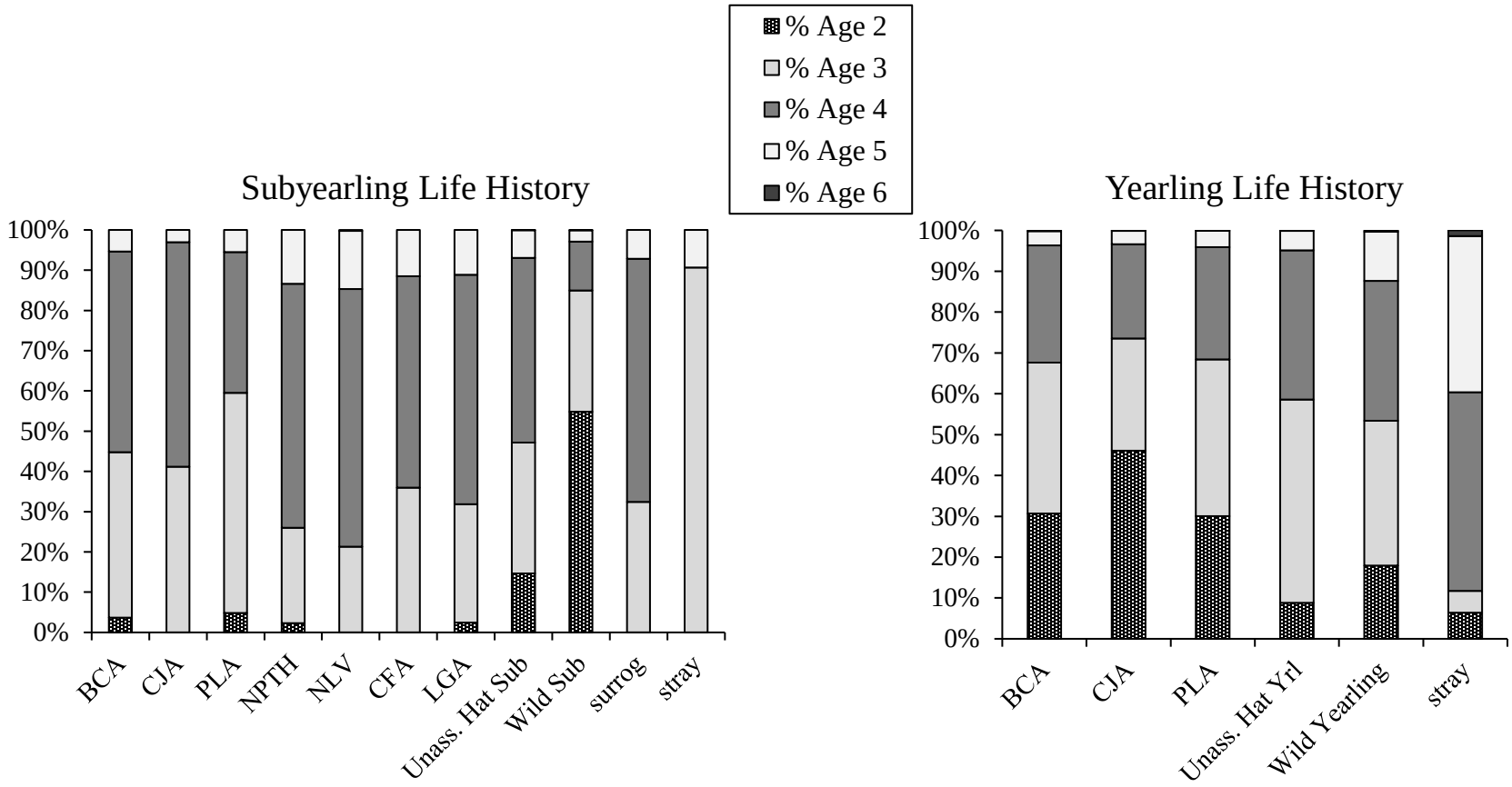

Figure 13. Age at return of complete broodyear 2011 adult (including jacks) hatchery, wild, and stray origin fall Chinook to Lower Granite dam from 2013-2017 (BCA = Big Canyon Creek, CJA = Captain John Rapids, PLA = Pittsburg Landing, NPTH = Nez Perce Tribal Hatchery, NLV = North Lapwai Valley, CFA = Cedar Flats, LGA = Lukes Gulch, Unass. Hat Sub = unassociated hatchery subyearlings, Wild Sub = wild subyearlings, surrog = surrogate subyearlings, stray = out-of-Snake Basin strays, Unass. Hat Yrl = unassociated hatchery yearlings).

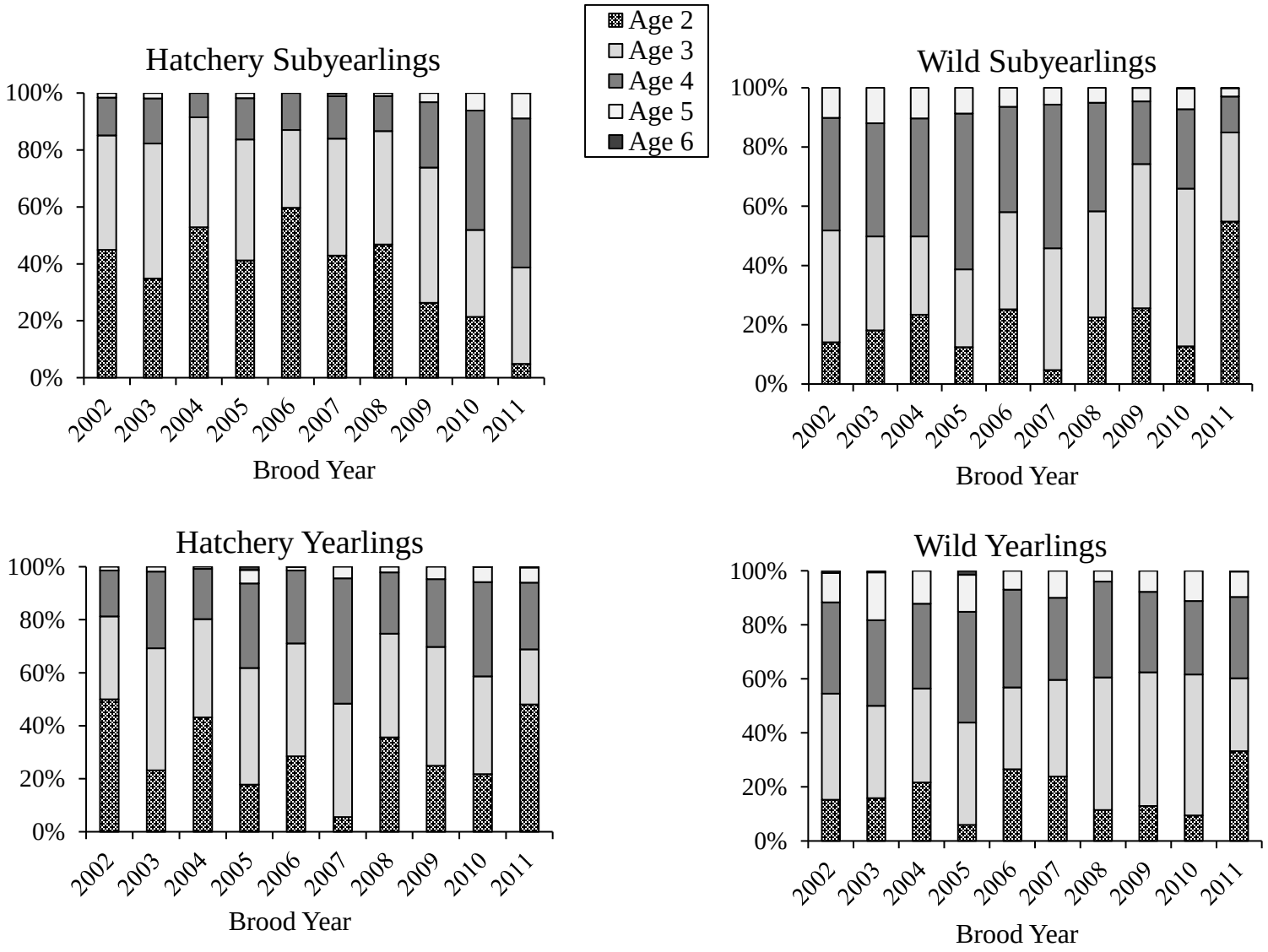

Figure 14. Total age at return of adult (including jacks) hatchery, and wild origin fall Chinook to the Snake River Basin upstream of Lower Granite dam for broodyears 2002-2011.

Fall Chinook juvenile *juvenile emergence timing* for the North Fork Clearwater in the lower Clearwater is shown in Figure 15. Because of warmer water temperatures released from Dworshak Dam, the North Fork and the area just below and around Ahsahka Islands had emergence timing (1,000 ^{0}C TUs) up to two months earlier than the lower Clearwater River. Total juvenile emergence timing was estimated to be 100% by June 1 on the lower Clearwater (Figure 15). Total dissolved gas (TDG) levels peaked in early spring and during the summer spill period at Dworshak (Figure 15). Spill levels and associated TDG levels were much higher in 2017 than in normal years because of work being done on one of the turbines during that time frame. We were monitoring TDG levels in 2017 to see what effect if any it may have on emerging fry and rearing fall Chinook juveniles in the Clearwater River. Results from higher than normal TDG levels did not appear to have adverse effects on rearing fall Chinook during 2017.

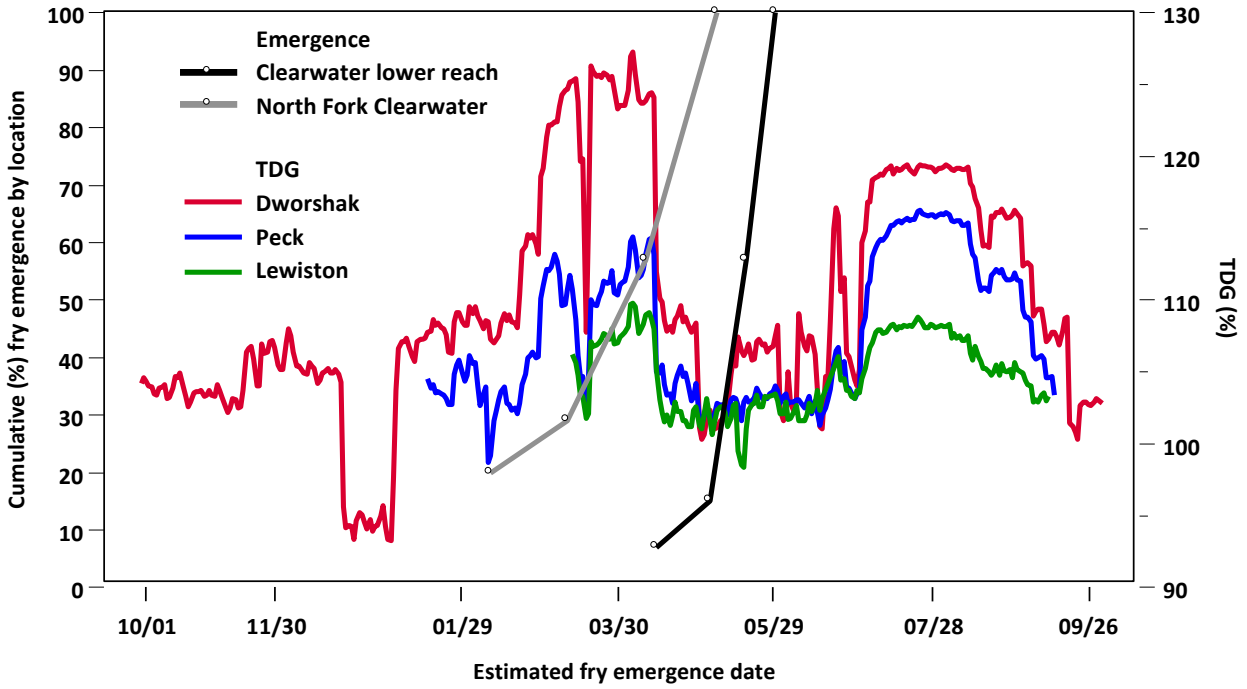

Figure 15. Estimated fall Chinook fry emergence in the N.F. Clearwater and Ahsahka Island reach and in the lower Clearwater River in relation to total dissolved gas (TDG) out of Dworshak Dam, 2016-2017.

Emigration timing depicted as cumulative arrival timing for all hatchery release groups along with the Clearwater River natural subyearlings from PIT tag detections are given in Figure 16. The Clearwater River naturals had the latest arrival timing compared to all hatchery releases. In the Clearwater River Subbasin releases, the 2016 broodyear subyearling migration rates to LGD ranged from 30.0 Rkm/d for Lukes Gulch release to 4.8 Rkm/d for NPTH ponds (Figure 17). The Clearwater River naturals had the lowest migration rates for all broodyears from 2010-2015 except for broodyear 2016 which was 5.6 Rkm/d, just slightly above NPTH ponds (Figure 17).

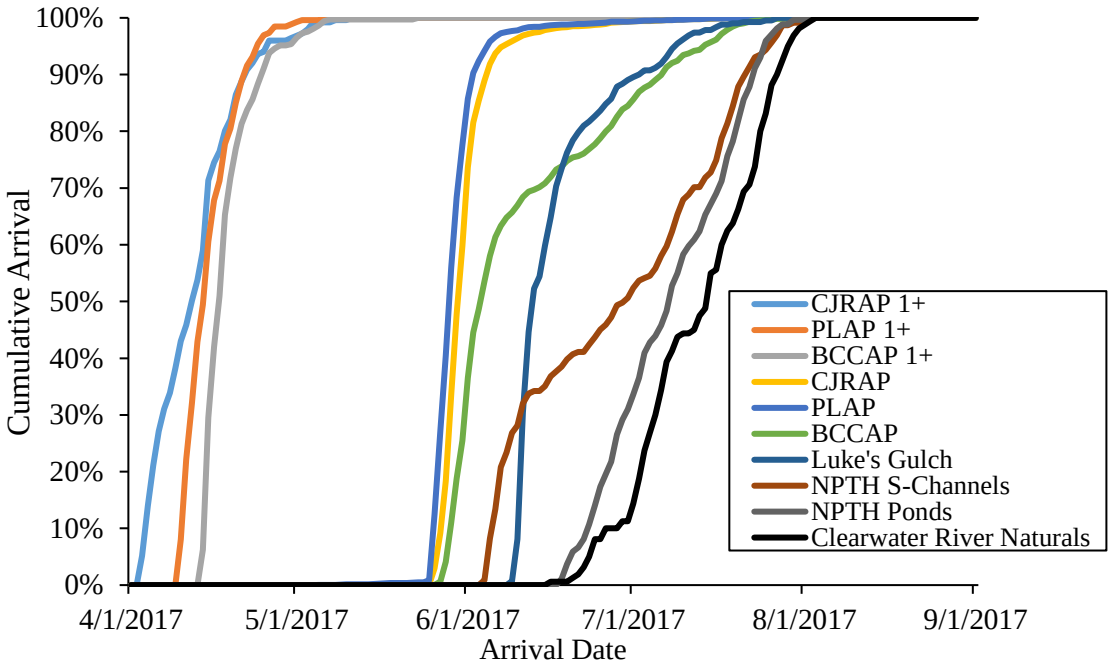

Figure 16. Cumulative arrival timing of hatchery subyearling and yearling (1+) fall Chinook as well as Clearwater River Naturals released in the Snake and Clearwater Rivers at Lower Granite Dam in migratory year 2017 (CJRAP = Captain John Rapids, PLAP = Pittsburg Landing, BCCAP = Big Canyon Creek, NPTH = Nez Perce Tribal Hatchery).

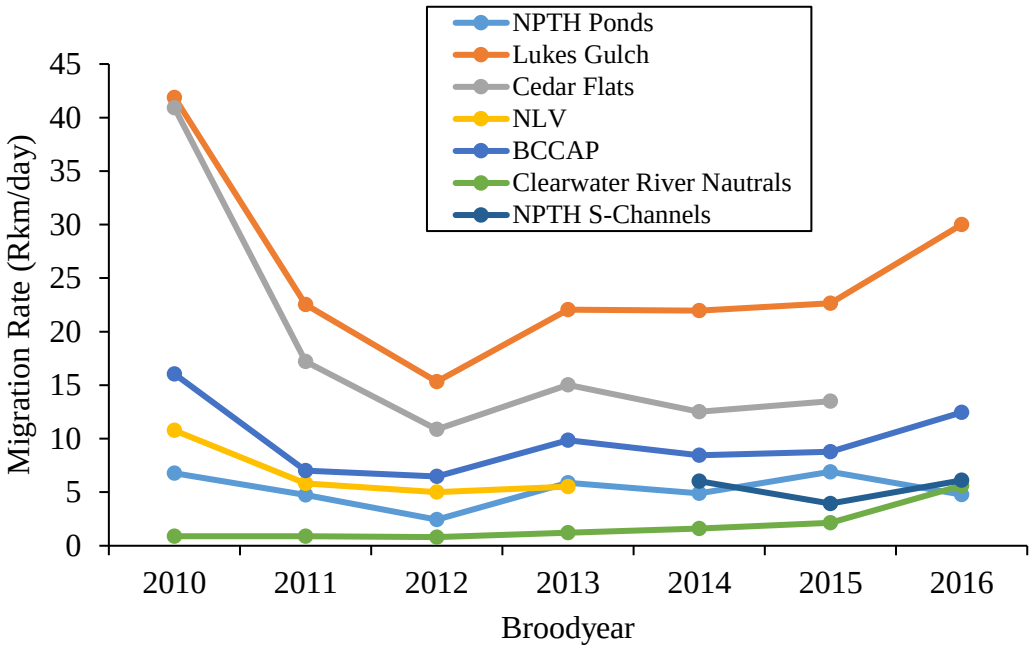

Figure 17. Migration rate (river kilometers per day) from release site in the Clearwater Basin to Lower Granite Dam of hatchery and natural origin fall Chinook subyearlings (broodyears 2010-2016) (NPTH = Nez Perce Tribal Hatchery, NLV = North Lapwai Valley, BCCAP = Big Canyon Creek).

For the Snake River subyearling releases, the Pittsburg Landing broodyear 2016 group migrated an average of 31.2 Rkm/d compared to Captain John group at 15.3 Rkm/d (Figure 18). The Pittsburg Landing yearling 2017 release group also migrated faster in 2017 at 33.9 Rkm/d compared to 23.3 Rkm/d for Big Canyon and 12.9 Rkm/d for Captain John (Figure 19).

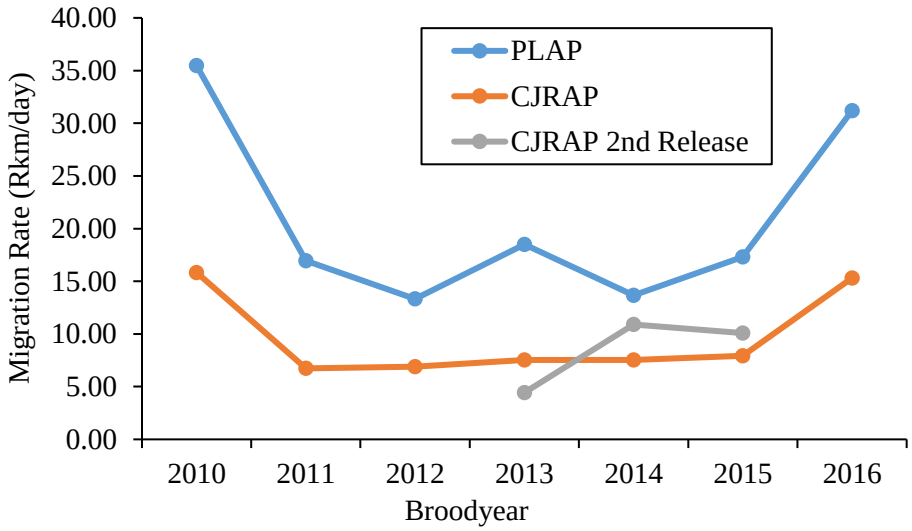

Figure 18. Migration rate (river kilometers per day) from release site in the Snake River to Lower Granite Dam of hatchery origin fall Chinook subyearlings (broodyears 2010-2016) (PLAP = Pittsburg Landing, CJRAP = Captain John Rapids).

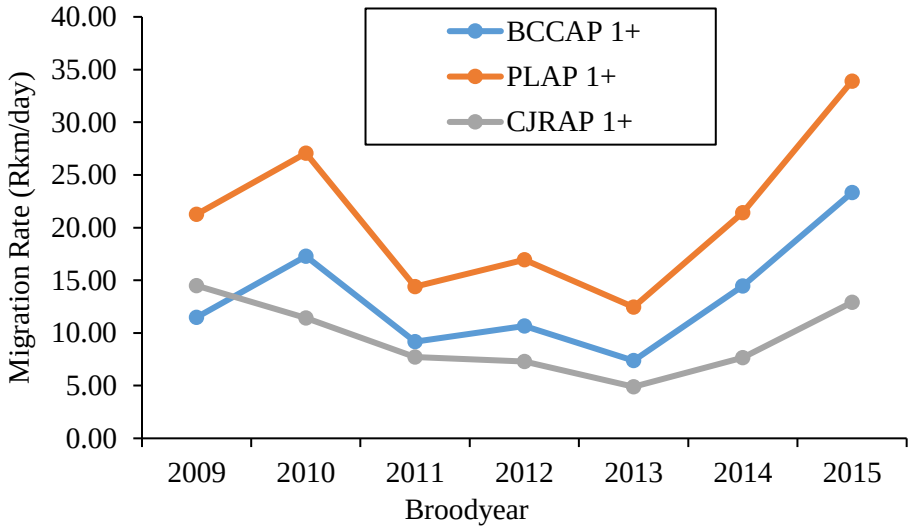

Figure 19. Migration rate (river kilometers per day) from release site in the Snake River Basin to Lower Granite Dam of hatchery origin fall Chinook yearlings (broodyears 2009-2015) (BCCAP = Big Canyon Creek, PLAP = Pittsburg Landing, CJRAP = Captain John Rapids).

The *age at emigration* for all subyearling releases during 2017 were mostly all subyearlings as only two fish (0.13%) were detected as yearling migrants from NPTH and associated releases (Table 12) and only three (0.02%) from the FCAP subyearling releases (Table 13). The Clearwater River natural subyearlings had the highest rate of yearling emigrants or "holdovers" at 13.2% (Table 12). For the subyearlings, especially the wild fish that migrate later, survivals are considered "minimum" estimates because the inability to determine winter passage when juvenile bypass facilities are shut down at the dams, and in 2017 the Lower Granite facility shut down earlier than normal for maintenance. All of the yearling releases migrated as yearlings the same year as released (Table 13).

Table 12. Unique PIT tag detections at all hydrosystem juvenile detection facilities from passive integrated transponder (PIT) tagged releases of fall Chinook salmon subyearlings (0+) in the lower Clearwater River, Nez Perce Tribal Hatchery (NPTH) and associated acclimation facilities, 2017.

Release Site	Brood Year	Release Strategy	Unique PIT Tag Detections	Detected in Migratory Year 2017	Detected as Holdovers In 2018
Clearwater Naturals	2016	0+	502	436 (86.8%)	66 (13.2%)
NPTH S-Channels	2016	0+	611	611 (100.0%)	0 (0.0%)
NPTH Ponds	2016	0+	617	616 (99.8%)	1 (0.2%)
Cedar Flats	2016	0+	NA	NA	NA
Luke's Gulch	2016	0+	942	941 (99.9%)	1 (0.1%)

Table 13. Unique PIT tag detections at all hydrosytem juvenile detection facilities from passive integrated transponder (PIT) tagged releases of hatchery fall Chinook salmon yearlings (1+) and subyearlings (0+) from the Fall Chinook Acclimation Project (FCAP) in the lower Clearwater River at the Big Canyon Acclimation facility (BCCAP) and on the Snake River at the Pittsburg Landing (PLAP) and Captain John Rapids (CJRAP) acclimation facilities, 2017.

Release Site	Brood year	Release Strategy	Unique PIT Tags	Detected in Migratory Year 2017	Detected as Holdovers 2018
BCCAP	2015	1+	947	947 (100.0%)	0 (0.0%)
	2016	0+	6,057	6,055 (99.97%)	2 (0.03%)
PLAP	2015	1+	997	997 (100.0%)	0 (0.0%)
	2016	0+	11,701	11,701 (100.0%)	0 (0.0%)
CJRAP	2015	1+	938	938 (100.0%)	0 (0.0%)
	2016	0+	12,301	12,300 (99.992%)	1 (0.008%)

The *size at emigration* could only be deferred to what size they were at the time of release and is shown in previous Table 7 for all hatchery releases. The NPTH S-channel release group was the smallest at an average fork length of 77 mm while the Lukes Gulch group was the largest at release at 94 mm. Of the three yearling release groups, the Captain John group was the smallest at 145 mm and the Big Canyon group was the largest at 154 mm (Table 7). Release groups *condition* factors ranged from 1.05 for the Captain John yearlings to 1.18 for the NPTH subyearling pond release (Table 7). The average fork length of the Clearwater River natural subyearlings ranged from 59.8 mm during the first seining week of June 12 and increased to 68.5 mm during the week of July 10 (Table 14). Length frequencies of natural fall Chinook salmon subyearlings sampled in the lower Clearwater River is shown in Figure 20. The greatest number of natural fish captured were between 60-69 mm fork length, followed by 50-59 mm fish and then by 70-79 mm fish (Figure 20). The condition factors on natural subyearlings ranged from 1.10 to 1.15 (Table 14).

Table 14. Weekly number, average fork length and number of PIT tagged natural subyearling fall Chinook salmon sampled on the lower Clearwater River, 2017.

Week of	Clearwater R. Avg. Temp (^{0}C)	Clearwater R. Avg. Flow (cfs)	Dworshak Dam Spill (%)	Total # Captured	# PIT Tagged	Avg. Fork Lth. (mm)	Avg. Condition Factor (K)
12-Jun	10.9	25,890	26.4	949	727	59.8	1.13
19-Jun	13.5	25,566	48.1	891	750	68.5	1.10
26-Jun	15.2	16,249	24.2	1,582	1,513	67.4	1.15
3-Jul	14.5	15,086	54.2	194	191	66.8	1.15
10-Jul	13.1	14,171	59.1	50	49	68.5	1.13
Totals				3,666	3,230		1.13

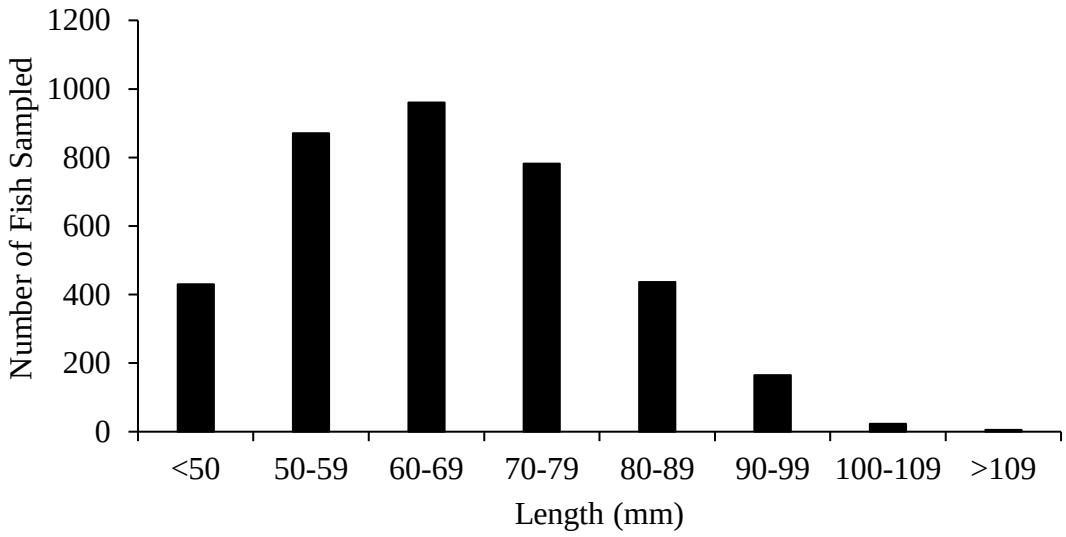

Figure 20. Length frequencies of natural fall Chinook salmon subyearlings sampled in the lower Clearwater River, 2017.

Survival/Productivity

Life stage specific *juvenile survival* to Lower Granite and McNary dams for all NPTH, FCAP, and Clearwater River releases are presented in Tables 15 and 16. Figures 21, 22, and 23 graphically represent survival estimates to Lower Granite Dam for releases of subyearling brood years 2007 through 2016 and yearling brood years 2006 through 2015. All releases exhibit higher survival estimates in migration year 2017 than from the previous year with the subyearling releases from both the Snake and Clearwater rivers showing the sharpest increase in survival estimates. Survival estimates for the hatchery subyearling groups ranged from 0.70 for the NPTH S-Channel release (Figure 21) to 0.90 for the Pittsburg group (Figure 22). Survival estimates for the FCAP yearling releases continue to be high, ranging from 0.94 at PLAP to 0.97 at CJRAP (Figure 23). An estimated average survival of 82.6% was estimated across all subyearling PIT tag release groups and an estimated average survival of 95.5% was estimated across all yearling PIT tag release groups (Table 17). The natural fall Chinook 0.38 survival estimate in 2017 was higher than previous years (Figure 21). Survivals were most likely higher than the SURPH estimates for natural fish, which tend to migrate in the fall, because the PIT tag detectors were shut down in early August for maintenance at Lower Granite Dam. Usually PIT tag detectors are operated until late fall just prior to freeze-up.

Using survivals to Lower Granite for all release groups to calculate *smolt equivalents*, and Lukes Gulch as a surrogate survival for Cedar Flats release since they were not PIT tagged, there were an estimated total of 2,455,906 subyearling hatchery smolts that reached Lower Granite Dam from the NPTH and FCAP programs (Table 17). For the FCAP yearling releases, there was an estimated 438,671 smolt equivalents to Lower Granite Dam (Table 17).

Table 15. Estimated index survivals (using SURPH) with 95% confidence intervals (CI's) from passive integrated transponder **(**PIT) tagged releases of natural fall Chinook salmon subyearlings in the lower Clearwater River and Nez Perce Tribal Hatchery (NPTH) releases to Lower Granite and McNary dams, 2017 (LGD = Lower Granite Dam, MCN = McNary Dam, CI = confidence interval at the 95% level).

Release Site	Release PIT Tag Number	Index Survival to LGD (95% CI's)	Index Survival to MCN (95% CI's)
Clearwater Naturals	3,231	0.38 (0.30 - 0.51)	0.07 (0.03 – 0.11)
NPTH S-Channels	1,999	0.70 (0.59 – 0.84)	0.38 (0.31 – 0.56)
NPTH Ponds	1,997	0.81 (0.68 – 0.99)	0.42 (0.25 – 0.59)
Luke's Gulch	1,997	0.80 (0.73 – 0.89)	0.56 (0.45 – 0.59)

Table 16. Estimated index survivals (using SURPH) with 95% confidence intervals (CI's) from passive integrated transponder (PIT) tagged releases of hatchery fall Chinook salmon yearlings (1+) and subyearlings (0+) from the Fall Chinook Acclimation Project (FCAP) in the lower Clearwater River at the Big Canyon Acclimation facility (BCCAP) and on the Snake River at the Pittsburg Landing (PLAP) and Captain John Rapids (CJRAP) acclimation facilities to Lower Granite and McNary dams, 2017 (LGD = Lower Granite Dam, MCN = McNary Dam, CI = confidence interval at the 95% level).

Release Site	Release Strategy	Release Pit Tag Number	Index Survival to LGD (95% CI's)	Index Survival to MCN (95% CI's)
BCCAP	1+	1,496	0.96 (0.88 – 1.04)	0.67 (0.53 – 0.86)
	0+	17,045	0.89 (0.84 – 0.98)	0.51 (0.44 – 0.59)
PLAP	1+	1,536	0.94 (0.87 – 1.04)	0.75 (0.57 – 0.96)
	0+	26,019	0.90 (0.86 – 0.96)	0.60 (0.53 – 0.66)
CJRAP	1+	1,453	0.97 (0.89 – 1.07)	0.63 (0.50 – 0.71)
	0+	25,924	0.86 (0.82 – 0.90)	0.73 (0.66 – 0.75)

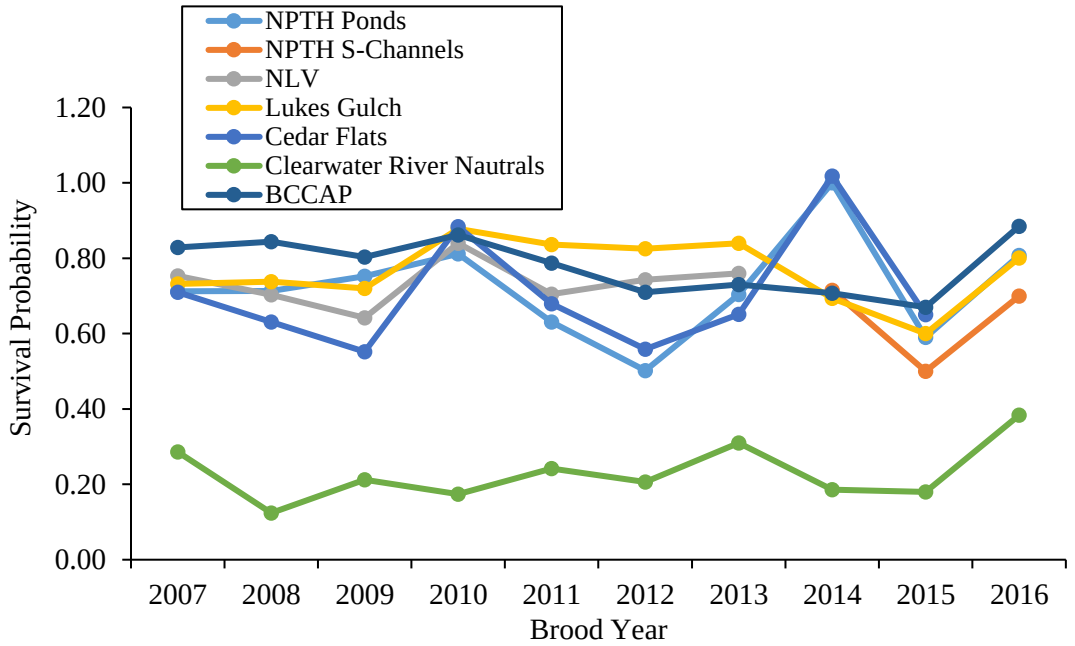

Figure 21. Life stage-specific survival of subyearling Snake River Fall Chinook from release sites in the Clearwater River to Lower Granite Dam (broodyears 2007-2016) (NPTH = Nez Perce Tribal Hatchery, NLV = North Lapwai Valley, BCCAP = Big Canyon Creek).

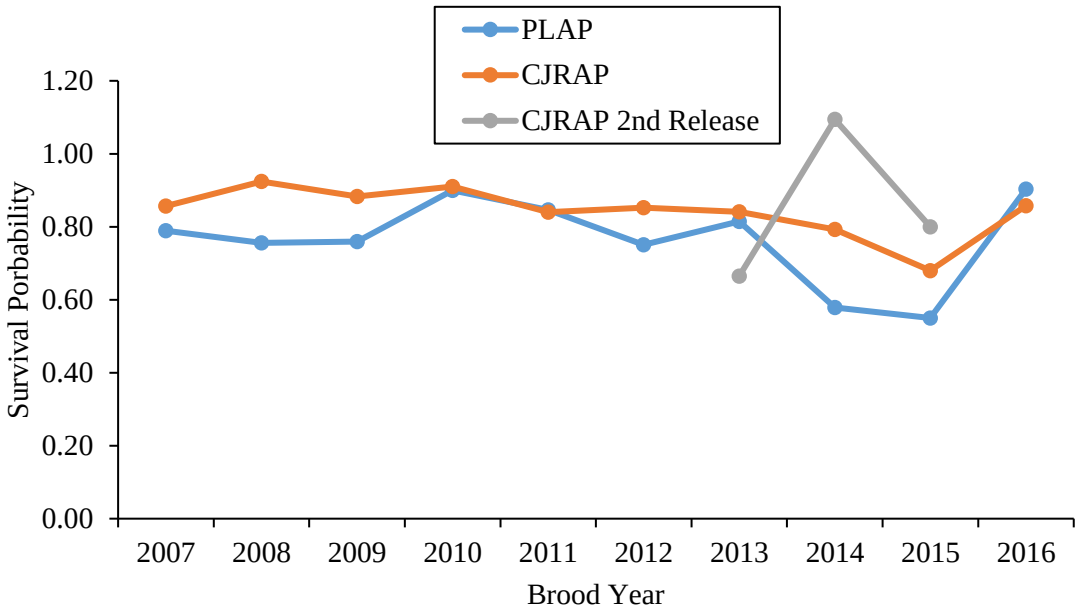

Figure 22. Life stage-specific survival of subyearling Snake River Fall Chinook from release sites in the Snake River to Lower Granite Dam (broodyears 2007-2016) (PLAP = Pittsburg Landing, CJRAP = Captain John Rapids).

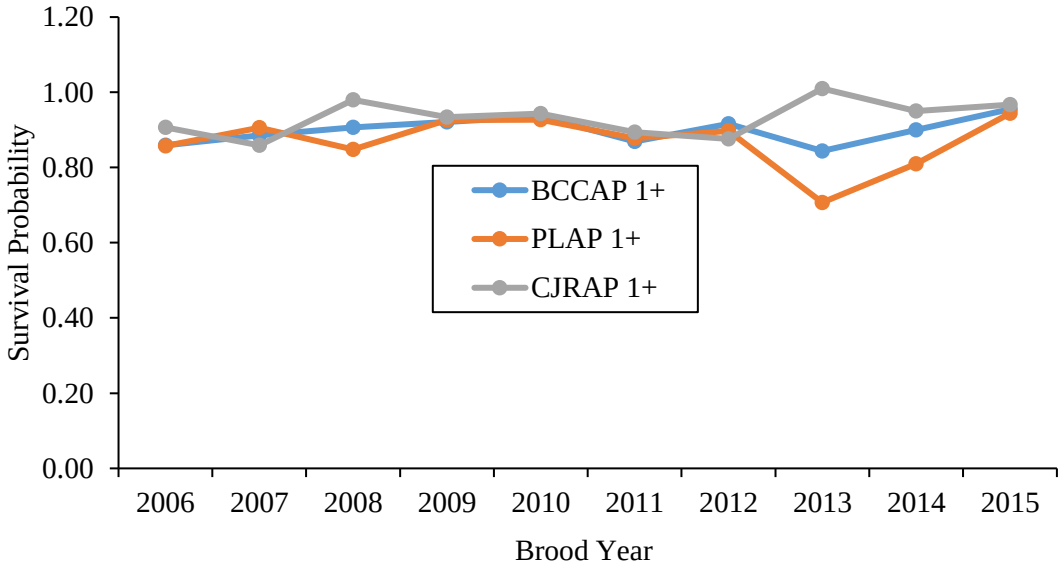

Figure 23. Life stage-specific survival of yearling Snake River Fall Chinook from release sites in the Snake River Basin to Lower Granite Dam (broodyears 2006-2015) (BCCAP = Big Canyon Creek, PLAP = Pittsburg Landing, CJRAP = Captain John Rapids).

Table 17. Estimated index survivals (using SURPH) to Lower Granite Dam, release number, and associated smolt equivalent of fall Chinook subyearlings and yearlings releases by the Nez Perce Tribe in 2017 (NPTH = Nez Perce Tribal Hatchery, NLV = North Lapwai Valley, BCCAP = Big Canyon, PLAP = Pittsburg Landing, CJRAP = Captain John Rapids).

Brood Year	Release Site	# PIT tagged	Survival Estimate	Release #	Smolt Equivalent
2016					
	NPTH Ponds	1,997	0.81	556,001	448,693
	NPTH S-Channels	1,999	0.70	474,030	331,821
	Lukes Gulch	1,997	0.80	238,772	191,256
	Cedar Flats[a]	0	0.80[b]	234,202	187,595[b]
	BCCAP	17,045	0.89	534,118	472,694
	PLAP	26,019	0.90	404,745	365,485
	CJRAP	25,924	0.86	534,221	458,362
	Totals	74,981		2,976,089	2,455,906
2015					
	BCCAP 1+	1,496	0.96	149,171	142,458
	PLAP 1+	1,536	0.94	150,879	142,430
	CJRAP 1+	1,453	0.97	159,031	153,783
	Totals	4,485		459,081	438,671

[a] Due to unplanned power loss at Cedar Flats fish were released early and no PIT tagging occurred.
[b] Lukes Gulch used as a surrogate for survival and smolt equivalent.

Temperature and flow in the Snake and Clearwater rivers and at Lower Granite Dam (LGD) during 2017 as it relates to hatchery and natural PIT tag detections are shown in Figures 24 and 25, respectively. Subyearling hatchery fall Chinook detections in late May and June were more protracted from the Clearwater releases than releases in the Snake River, however, water temperatures were much cooler in the Clearwater River (Figure 24). The Clearwater River natural fall Chinook had the most protracted detection timing when water temperature differences later in July and August were even more pronounced. Normally we would see a greater number of natural fish detected at LGD in late September after temperatures decreased, however, the detectors were shut down for the year in early August for maintenance, therefore, no detections are shown (Figure 24). Higher flows and hence spill at LGD occurred for hatchery fall Chinook juveniles and detections compared to natural detections of fish PIT tagged and released in the Clearwater River (Figure 25).

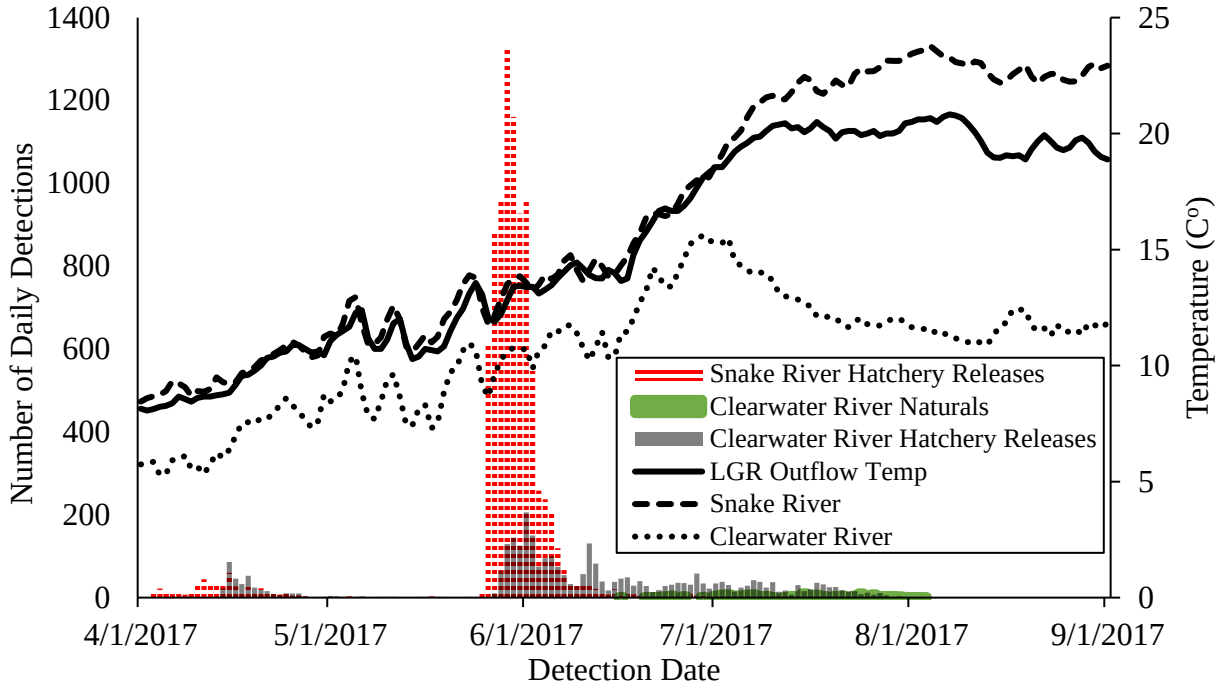

Figure 24. Passive integrated transponder (PIT) fall Chinook detections of Clearwater River naturals and combined detections at Lower Granite Dam from Snake and Clearwater rivers in relation to mean daily temperatures in the Clearwater River, Snake River, and at Lower Granite Dam (LGD), 2017.

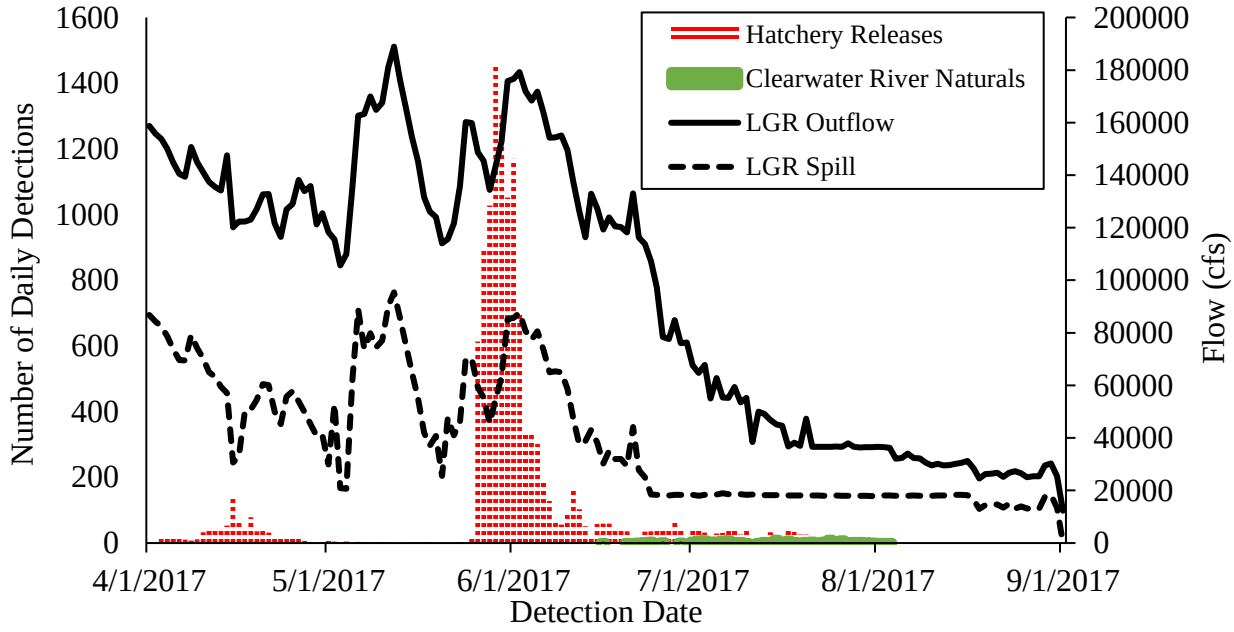

Figure 25. Passive integrated transponder (PIT) fall Chinook detections of Clearwater River naturals and combined detections from the Nez Perce Tribal Hatchery, Cedar Flats, Luke's Gulch, North Lapwai Valley, and FCAP facilities at Lower Granite Dam in relation to mean daily flows and spill at Lower Granite Dam (LGD), 2017.

The *smolt to adult return rate* (SAR) estimates along with ocean and freshwater harvest estimates for all 2013 release groups are given in Table 18 and in Figure 26. Among the subyearling release groups, the NPTH on-station release had the highest SAR of 2.10% back to Lower Granite Dam, whereas the Big Canyon group had the lowest SAR at 0.42%. Among the yearlings, Captain John release group had the highest SAR of 2.74%, while the Big Canyon and Pittsburg Landing yearling releases were similar at 1.87% and 1.78%, respectively. Harvest rates were similar on all release groups with Captain John yearlings having the highest harvest, however, it also had the highest SAR back to the Snake River (Figure 24). Harvest rates on all groups combined were highest in the ocean (57%) as compared to the freshwater harvest rates (Table 21).

Table 18. Estimated fall Chinook Salmon smolt-to-adult returns (SARs) and smolt-to-adult survivals (SASs) for Nez Perce Tribal Hatchery (NPTH) on-station and associated subyearling (subs) releases, and the Fall Chinook Acclimation Facility (FCAP) releases in 2013 (coded wire tag/ad-clip recoveries as reported to the Regional Mark Information System using estimated numbers i.e. expanded, and expanded numbers at Lower Granite Dam (Snake River recoveries) through run reconstructions (includes 1-ocean returns).

Release Location/age	Release Year	Total # coded wire tags/Ad-clip	Total Ocean Fisheries recoveries	Total Freshwater Fisheries recoveries	Total Snake River recoveries	Grand Total recoveries	SARs (%) to Snake	Total SASs %
NPTH (subs)	2013	97,477	143	4	2,050	2,197	2.10	2.25
North Lapwai Valley (subs)	2013	100,435	111	99	1,019	1,229	1.01	1.22
Cedar Flats (subs)	2013	97,468	116	110	1,126	1,352	1.16	1.39
Luke's Gulch (subs)	2013	96,387	137	59	684	880	0.71	0.91
FCAP (subs) Big Canyon	2013	100,804	88	56	426	570	0.42	0.56
FCAP (subs) Captain Johns	2013	101,234	86	83	829	998	0.82	0.99
FCAP (subs) Pittsburg Landing	2013	100,673	111	74	969	1,154	0.96	1.15
FCAP yearlings Big Canyon	2013	71,973	92	81	1,349	1,522	1.87	2.11
FCAP yearlings Captain Johns	2013	71,930	95	162	1,969	2,226	2.74	3.09
FCAP yearlings Pittsburg Landing	2013	71,679	108	82	1,277	1,467	1.78	2.05

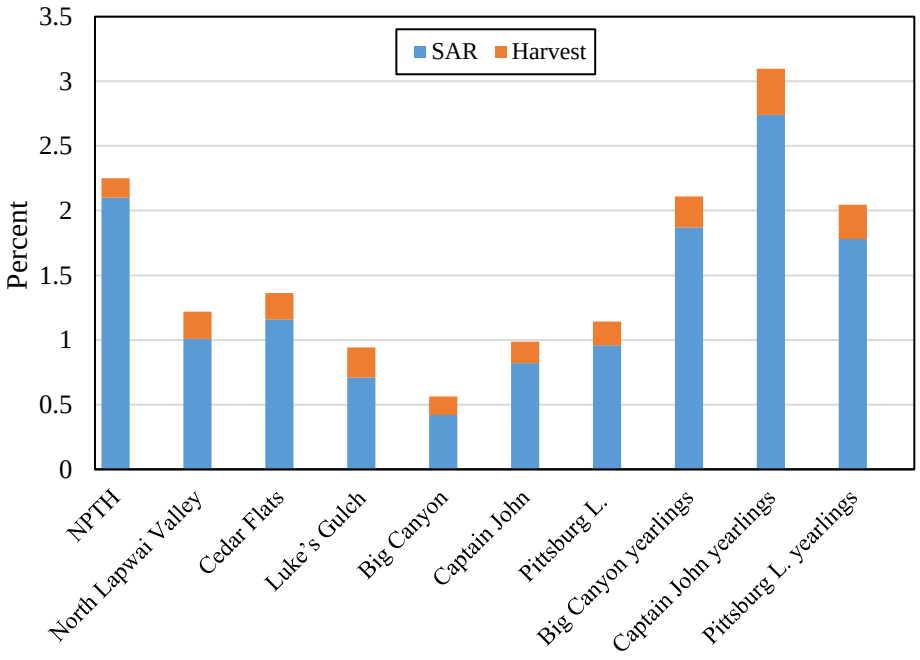

Figure 26. Estimated fall Chinook Salmon smolt-to-adult returns (SARs) and harvest estimates for total percent smolt-to-adult survivals (SASs) for 2013 releases at Nez Perce Tribal Hatchery (NPTH) and acclimation sites within the Snake River Basin (all subyearling releases except yearling designation).

Genetics

The results of PBT samples to Lower Granite Dam and the proportion of fall Chinook salmon hatchery returns (pHOS) to Lower Granite Dam was shown in previous Figure 2. Samples collected on the spawning ground have not been analyzed at the time of this report. This parentage based tagging (PBT) analyses will estimate pHOS in the Clearwater River spawning aggregate in the area of NPTH and other selected aggregates if adequate numbers of carcasses can be collected. The results of natural origin spawners (pNOB) with the parentage based tagging (PBT) methodology resulted in 35% and 39%, respectively, for the 2016 and 2017 broodyears at NPTH (see Figure 7).

DISCUSSION/CONCLUSION

Field Operations

Marking/Tagging

Tagging and marking of both FCAP and NPTH fall Chinook release groups went well in 2017. Fish were in excellent health and mortality was at normal levels during tagging operations.

Beach Seining

Beach seining on the lower Clearwater River in 2017 was successful and without incident. Sampling is highly dependent upon flows as measured from the USGS Spalding, Idaho gauging station. Safe accessibility to shoreline sampling sites occurs on the lower Clearwater River when spring flows are below 30,000 cfs and declining. As the hydrograph is declining so is the amount of woody debris suspended in the water column that negatively affects sampling and safe jet boat operation. Catch rates and overall season PIT tagging totals then is dependent upon how early into late May and early June beach seine sampling can begin. Future efforts will focus on collecting natural juveniles in the upper Clearwater, S.F. Clearwater and Selway rivers.

Spawning Ground Surveys & Carcass Collections

The total fall Chinook salmon redds (n = 4,269) estimated in the Snake River Basin above Lower Granite Dam in 2017 was about equal to the 2012 estimate (n = 4,254), however these two years were the lowest estimates during the last seven years (Figure 4). The highest redd count estimate in the basin was 8,840 redds during 2015 while the lowest was only 45 redds actually counted during 1990 (Figure 4). One can only look at the remarkable increase in adult escapement to conclude that the fall Chinook supplementation programs has worked for the Snake River fall Chinook salmon. In streams where supplementation has not yet occurred such as the Imnaha and Salmon rivers, the number of redds have not increased proportionally to supplemental streams. This next year (2018) will be the first supplementation effort for the mainstem Salmon with one million subyearlings scheduled to be released. It will be important to monitor redd numbers in the Salmon to see if natural production will increase proportionally in the future as well.

Habitat

The *flows and water temperatures* on the lower Clearwater River during 2017 were conducive for beach seining beginning the week of June 12 which was slightly later than normal. The high water temperatrure of 15.2 ^{0}C was observed during the week of June 26 and then dropped to 13.1 ^{0}C during the week of July 10 when cool water discharges from Dworshak Reservoir began. The cooler water during the summer may have contributed to a more protracted emigration of hatchery subyearling fall Chinook down to Lower Granite Dam. We continue to observe this pattern of later emigration in the natural fall Chinook out of the Clearwater River as well.

Performance Measures

Abundance

The fall Chinook salmon *run prediction* of 18,126 adults to Lower Granite Dam for the 2018 return is down substantially (27%) from the actual adult return in 2017. The lower run prediction was a product mainly of lower jack (1-salt) returns during 2017 and recent declines in ocean conditions. Hopefully, ocean conditions will rebound and show improvements in future years that will help all anadromous fish.

The *total escapement estimate* for the 2017 run to Lower Granite Dam followed the same pattern as the redd count estimate and was lower than the previous eight years (Figure 27). Although we reached the mitigation escapement goal of 39,110 adults to Lower Granite Dam within five of the last eight years, we were well below that goal in 2017 (Figure 27).

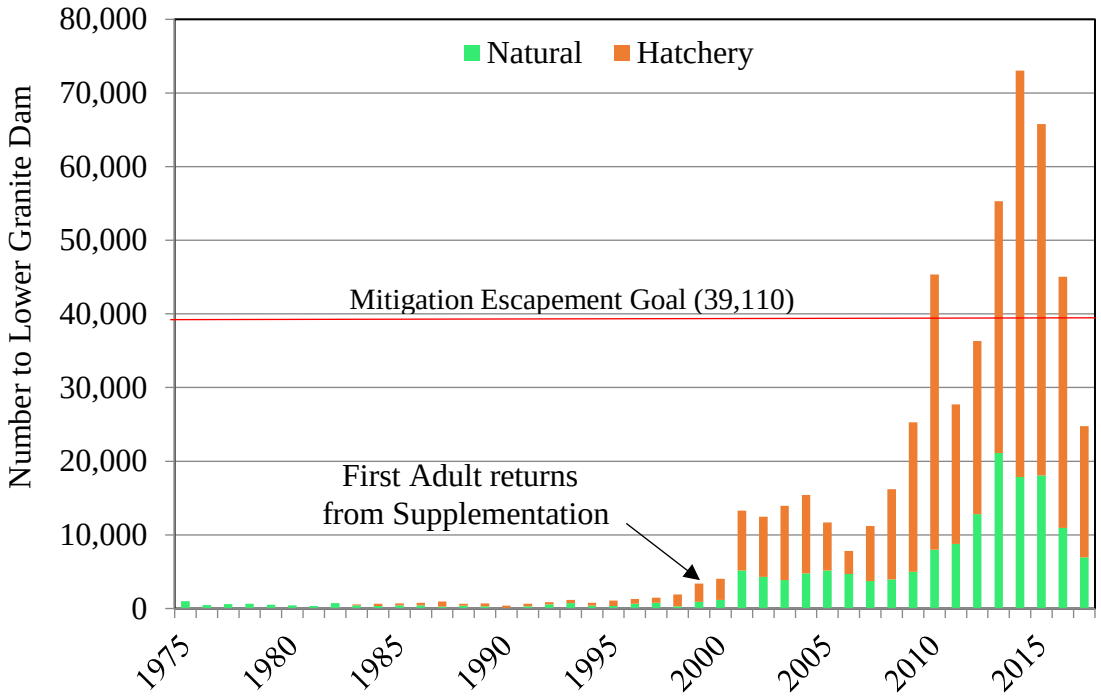

Figure 27. Fall Chinook salmon estimated escapement of hatchery and natural adults to Lower Granite Dam (1975-2017), first adult returns from supplementation efforts, and current mitigation escapement goal.

The index of *Spawner Abundance* through *redd counts* indicated a decline directly proportional to the total escapement estimate to Lower Granite Dam (Figure 27) and was also the lowest in the past five years. Although we were not able to conduct the last mid-November redd survey on the lower Clearwater, we feel the estimate of redds missed were conservative. We may have missed a few redds in the upper Clearwater tributaries since November 8 was the last survey date and spawning seemed to be delayed somewhat this year compared to past years.

The total *spawner abundance* of 20,889 above Lower Granite Dam and an *adult/redd* ratio of 4.5 indicates we may have over counted redds in 2017, since the average adult/redd since 1988 was 6.0 (Figure 5). However, if one looks at the estimated escapement of females (10,964) over Lower Granite (Table 5), and assume that each female constructs one redd, we may have only counted half of the redds in the Snake Basin since the total estimated number was 4,596 redds.

The *hatchery fraction* of the total escapement above LGD was estimated at 73.6%. The Snake River Basin fall Chinook *strays* from 2013 releases (latest complete age class) that were recovered at other hatcheries outside the basin was very low at 0.002%. Stray rates to other spawning areas outside the basin for 2013 releases were even lower at 0.0004%. The stray rate

(0.6%) of out-of-Snake Basin estimated through the run reconstruction methodology was much higher than Snake River fish outside the basin.

The *adult spawner spatial distribution* within the Snake River Basin (Figure 6) showed the greatest concentration of redds within the lower Clearwater River and adjacent to the Nez Perce Tribal Hatchery during 2017. Within the Clearwater Subbasin, there are not many 5-mile sections where no redds were seen as fish are distributed throughout the entire drainage. This is in contrast to the Imnaha and Salmon rivers where there are many 5-mile sections with no redds observed (Figure 6), however, these rivers have not been supplemented with fall Chinook salmon. The Salmon River is scheduled to be supplemented for the first time in 2018 and hopefully the fall Chinook distribution will expand there as well.

The *Ocean/Mainstem Harvest* rates on the most recent complete age class (2013 releases) of fall Chinook was relatively low compared to SARs back to the Snake River (Figure 26). Past years' harvest rates were much higher, for example, all the 2011 subyearling release groups harvest rates exceeded the adult returns back to the Snake (Arnsberg et al. 2017). Harvest rates usually are correlated, but not always, to the escapement number back to the Snake River and we have seen a decline in adult returns and hence associated harvest in recent years.

In-Hatchery Measures

The *hatchery production abundance, fish size and condition at release* was similar to previous years. Except for the power failure and emergency release at Cedar Flats, *hatchery release timing* was consistent with previous years. *Pre-release mark and tag retention* levels were favorable on all groups checked. As stated previously, estimates of tag loss was not possible due to logistics and rearing space onsite at NPTH. However, given consistency in fish size and condition at the time of tagging, retention rates are expected to be similar for these groups. Therefore, the use of the tag loss rates estimated for the Lukes Gulch group was used as a surrogate for fish released onsite at NPTH and at Cedar Flats.

The *hatchery broodstock fraction* of 61% (by BPT) was estimated for the 2017 broodstock at NPTH (Figure 7), which exceeded the goal of at least 30% natural origin fish into the brood. The *percent natural origin broodstock* or pNOB for 2017 (39%) was slightly higher than in 2016 (35%). The PBT results from the 2016 and 2017 broods showed slightly higher pNOB estimates than the run reconstruction estimates. We did not do PBT analysis prior to spawn year 2016.

Over the previous 5-years the average *length of broodstock spawner* has increased by 5.4 cm and 3.0 cm for males and females respectively. This indicates that size selectivity and mating protocols at NPTH may have increased the average size of broodstock recently (Figure 28).

Spawning and egg takes for the broodyear 2017 fish was completed with the outplanting of 117 (12.7% of fish trapped for broodstock) extra adults into the Clearwater River at Kooskia. *Broodstock prespawn mortality* has become elevated in recent years especially on adult females ranging from 1.4% in 2013 to 26.2% in 2016 with a 5 year average of mortality rate of 16.7%. The prespawn mortality rate on females in 2017 was 15.0%. More analysis and small scale trial studies need to be performed in the future to curb this mortality.

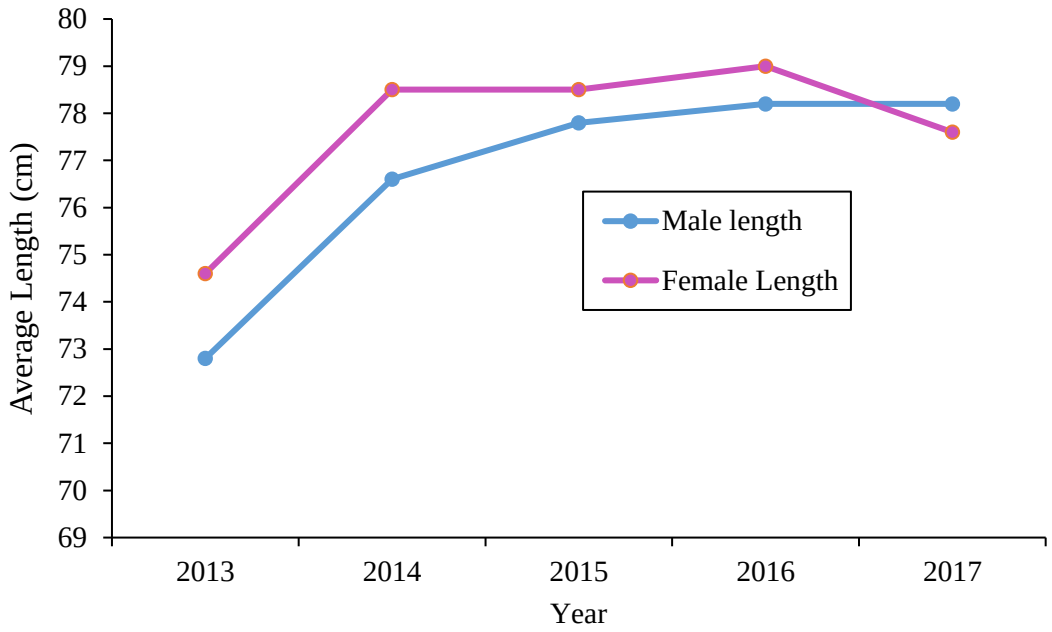

Figure 28. Average fork length of male and female adults used for broodstock at NPTH from 2013 through 2017.

Life History Characteristics

The *adult run timing* of Snake River fall Chinook hatchery and natural fish during 2017 was about 4-days later than the median run timing for the last 10-years. There were a total of 13 days from the peak run timing of Snake River fall Chinook at Bonneville (September 11) to the peak run timing at Lower Granite Dam (September 24).

As stated in the result section, the fall Chinook salmon *spawn timing* on all study streams was more difficult to determine because redd surveys did not commence until natural spawning was well on its way. If and when we go to using unmanned aerial vehicles (UAVs) instead of manned helicopter surveys, we would be able to schedule earlier additional surveys because of lower costs savings and be able to determine more precisely when spawning begins.

The *percent females* (adults) of the total escapement in 2017 was slightly over half the adult return at 52.9%. Compared to the previous two years, the male adult returns were higher than female returns at 53.3% in 2016 and 54.9% in 2015.

The *age class structure* of the 2017 fall Chinook returns showed the wild subyearlings had the greatest percentage of age-3 returns while the greatest percentage of age-4 returns came from CFA, NPTH and BCA. However, the wild subyearling returns resulted in a higher percentage of age-5 returns and lower age-2 returns than all hatchery releases except CFA in which they were equal at about 10%. There were very few age-6 return from either subyearlings or yearlings. The only age-2 (mini-jacks) came from the yearling releases. All other age class returns were similar for the yearlings during 2017.

Juvenile emergence timing of natural juvenile fall Chinook from redds formed in the North Fork Clearwater River occur much earlier than those in the mainstem Clearwater River (Figure 15). This is due to the warmer incubation water and increased daily temperature units that these redds experience in the North Fork below Dworshak Dam than the mainstem Clearwater River during the fall and winter months. Little is known about this group of early emerging fish as beach seining typically does not begin until early June for natural fall Chinook in the lower Clearwater River. Efforts will be made in the future to beach seine beginning in February and continuing until high spring flows, beginning typically in April that halt sampling for safety concerns.

Emigration timing is depicted as cumulative arrival timing of all hatchery fall Chinook releases from NPTH and FCAP facilities as well as natural fish from the Clearwater River. All of the FCAP and NPTH hatchery fall Chinook releases migrated at a significantly faster rate than the natural subyearling fall Chinook from the Clearwater River. Hatchery fall Chinook migration rate from release to each detection point seems to be impacted by the release location and the distance each location is from the beginning of LGD pool near Lewiston, Idaho. *Age at emigration* data show very few (0.01%) 2017 subyearling hatchery releases were detected in 2018 as "holdovers, while 13.2% of the naturals were detected in 2018. However, as mentioned earlier, the detectors were shut down at LGD early for maintenance, therefore, detections were most likely missed in the fall. The emigration timing and life history strategies may be directly correlated with size at release, release date, and smoltification timing. Juvenile c*ondition factor* at release for all groups were excellent. Condition at release could not be calculated for the Cedar Flats group as they were emergency released early due to power outages and water pump failures at the facility.

Survival/Productivity

Due to continuing budget constraints, PIT tag sample sizes were minimal for all subyearling releases from NPTH facilities, as well as all FCAP yearling releases. This resulted in lower precision of *juvenile survival* estimates of these groups to LGD and McNary dams. Subyearling PIT tags will increase for NPTH and associated acclimation facilities beginning in migration year 2019 (brood year 2018) to further enhance juvenile survival estimates and bolster the pre-season and in-season run forecasting. The Fish Passage Center provided extra PIT tags in 2017 for the subyearling groups released at Pittsburg Landing, Big Canyon, and the first subyearling group at Captain John Rapids. As part of the "Comparative Survival Studies", these extra tags are meant to compare in-river survivals to transportation alternatives and to enhance the ability to detect adequate returning adults for statistical comparisons, but also allows us to more precisely estimate juvenile survival using the SURPH model. The LGD juvenile bypass and PIT tag detectors are usually operational from late March thru the end of October, but in 2017 operation stopped in the first week of August, resulting in the last natural juvenile detection at Lower Granite Dam occurring on August 3rd. Extended operation of the LGD juvenile bypass and PIT tag detectors enhances the emigration timing and survival estimates for the Clearwater River natural subyearling fall Chinook, providing more time and detections at LGD. To accurately study the Clearwater River natural fall Chinook population and their life history using PIT tag technology, it is essential that detectors at all juvenile facilities are in operation for as long as possible.

The *smolt equivalents* estimated to Lower Granite Dam based on survival estimates totaled 2.89 million for all subyearling and yearling release groups in the Snake River Basin by the Nez Perce Tribe. Release goals were met for yearling releases in 2017, however, the second subyearling release group at Captain John Rapids did not occur because an escapement of fish at Lyons Ferry Hatchery and the back filling of fish to Big Canyon.

The *smolt to adult return rates* ranged from 0.42% to 2.74% back to the Snake River and was comparable to previous years (Arnsberg et al. 2017). However, there were only two release groups out of ten that had a 2% or higher SAR, which is the minimum goal the Northwest Power and Conservation Council (NPCC 2009) adopted for achieving recovery of federal ESA-listed Snake River salmon.

The 15% *prespawn* mortality of adult fall Chinook females used for NPTH broodstock was quite high and continues to be a perplexing problem we have yet to solve. The WDFW does not see the same high prespawn mortality at Lyons Ferry Hatchery or what we saw on the spawning grounds (2.8% of the females collected). We believe a temperature spike of 2-3 ^{0}C while in holding when flow reductions from Dworshak Reservoir occur in early September may be part of the problem. It was suggested to test this theory, we could haul fish from Lower Granite Dam and hold them at either Lyons Ferry Hatchery or Dworshak Hatchery where a constant water temperature of about 7 ^{0}C occurs throughout the fall.

Genetics

We have now had five years since we started parentage based tagging (PBT) on all Snake River fall Chinook broodstock in the basin. As such in 2017, we conducted the PBT analysis which resulted in about 75.9% of the fall Chinook returns were of hatchery origin which compared closely to the run reconstruction method which showed 73.6% hatchery fish. We will continue to analyze carcasses collected on the spawning grounds for PBT to estimate hatchery fraction in selected spawning aggregates.

ADAPTIVE MANAGEMENT & LESSONS LEARNED

Field Operations

As we talked about earlier, we plan to start beach seining earlier in the year just below the N.F. Clearwater to try and capture and PIT tag earlier emerging natural fall Chinook fry and in the upper Clearwater River Subbasin to document natural production of juveniles in the S.F. Clearwater and Selway rivers. We also plan to PIT tag down to 45 mm fork length with the new 8 mm tags to increase the sample size in the Clearwater River Subbasin.

We also plan to collect more fall Chinook adult carcasses in the up-river reaches of the Clearwater River drainage to see if are homing to the stream of release.

Performance Measures

For the last 5-years, the NPTH and LFH fall Chinook programs have reduced the number of smaller adults (generally 1-salt) in the brood as an on-going effort to increase the future return of older age class fish. Also, as an effort to reduce the number of mini-jack (< 1-salt fish) returns, which are from yearling releases, we will be releasing all subyearlings from the FCAP sites beginning 2020. Instead of yearlings released at FCAP facilities, there will be two back-to-back subyearling release groups at each of the three facilities. There will still be yearling releases on-station at LFH.

As mentioned earlier, we continue to try and address the high adult prespawn holding mortality at NPTH. We will try and hold adults next year at an alternative hatchery where water temperatures are cooler and constant.

ACKNOWLEDGEMENTS

The Nez Perce Executive Committee authorized this monitoring and evaluation with funding provided by the U.S. Department of Energy, Bonneville Power Administration. Nez Perce Tribal Hatchery monitoring and evaluation of fall Chinook salmon supplementation in the Snake River Basin would not be possible without the dedication of the field biologists, technicians and office personnel. The contributions and efforts of Mark Pishl, Carol Reuben, and Charles Axtell to the monitoring and evaluation program have been invaluable. We thank John Sneva and Lance Campbell of the Washington Department of Fish and Wildlife for adult fall Chinook salmon scale reading and analysis. Shawn Narum, Stephanie Harmon and Megan Moore of the Columbia River Inter-Tribal Fish Commission processed and analyzed the genetic samples collected. We also thank Amy Mai and Eric McOmie of the Bonneville Power Administration for their assistance and support.

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APPENDICES

Appendix A.

PIT Tagging: The hatchery fall Chinook released from the FCAP and NPTH acclimation sites were passive integrated transponder (PIT) tagged using a Wells Cargo gooseneck trailer converted for use with five fresh-flow stainless steel tagging stations. Fish were crowded, dip netted out of raceways and transported to the tagging trailer in 18.9L buckets. Salmonids were anesthetized in a 3 ml tricaine methanesulfonate (MS-222) stock solution (100 g/L) per 19 L of water buffered with a sodium bicarbonate solution. Standard sterile 12 mm PIT tags using BIOMARK's HPT-12 pre-loaded trays and MK-25 rapid implant guns were used on all hatchery PIT tag samples. All FCAP yearling and subyearling releases were PIT tagged at Lyons Ferry Hatchery prior to transfer to associated acclimation sites, while all NPTH subyearlings were PIT tagged at each acclimation site after transfer. Following release at respective acclimation sites, hatchery PIT tag files were uploaded to the PIT Tag Information System (PTAGIS) under the Project Leader's coordinator ID (BDA)

Natural Origin Seining/PIT Tagging: Natural origin subyearling fall Chinook salmon were captured in the Clearwater River using experimental 30.5 m x 1.8 m and 15.2 m x 1.2 m beach seines (0.48 cm mesh) with weighted multi-stranded mudlines with center bags of the same mesh size. The larger seine was pulled from the back of a jet boat deck in a large arc until approximately half the net was deployed, then the boat was directed to shore in which all crew members assisted in pulling the seine to shore. The less accessible beach seining sites required the smaller seine pulled from the shoreline utilizing personnel in the water wearing neoprene waders. All salmonids captured were placed in 18.9 L buckets and then placed in larger aerated 114 L plastic holding bins.

We PIT tagged fall Chinook salmon juveniles following methods developed by Prentice et al. (1990a, 1990b) and protocols established by the PIT Tag Steering Committee (1992). Salmonids were anesthetized in a 3 ml tricaine methanesulfonate (MS-222) stock solution (100 g/L) per 19 L of water buffered with a sodium bicarbonate solution. All Chinook salmon subyearlings were measured to the nearest 1 mm fork length and weighed to the nearest 0.1 gm with a digital Ohaus portable advanced balance. We checked all Chinook salmon for the presence of an adipose fin clip and/or a coded wire tag that would signify a hatchery fish using a Northwest Marine Technologies Field Sampling Detector model FSD-I. All natural subyearling Chinook salmon ($\geq$ 60 mm) fork length that were not hatchery marked or had the appearance of being an unmarked hatchery fish were PIT tagged with standard length 12 mm tags. We used 8.5 and 9.0 mm PIT tags for natural fall Chinook that measured 50-59 mm fork length. Our tagging goal was a minimum of 1,000 and up to a maximum of 8,000 natural subyearling fall Chinook salmon. After at least a 10 minute recovery period, we released all Chinook salmon juveniles back to the river where captured.

PIT tag files were created to group fish together that were captured and released from the same seining location. Upon returning to the office project personnel would upload PIT tag files to the PTAGIS website. All PIT tag files were uploaded under the Project Leader's BDA coordinator ID and natural fish identified as 13W (1 = Chinook salmon, 3 = fall run, and W = wild rearing type), hatchery fish as 13H (1 = Chinook salmon, 3 = fall run, and H = hatchery rearing type), and recaptures as 15U (1 = Chinook salmon, 5 = unknown run, and U = unknown rearing type).

Appendix Table 1. Release, marking and tagging goals for FCAP yearlings and subyearlings and NPTH subyearlings in 2017.

Project	Release Life Stage	Release Location	Release Goal	# CWT only	# CWT/Ad clip	# Ad clip only	Unmarked/ Untagged	# PIT
FCAP	Yearling	Captain John Rapids	150,000	80,000	70,000	0	0	1,500
FCAP	Yearling	Pittsburg Landing	150,000	80,000	70,000	0	0	1,500
FCAP	Yearling	Big Canyon Cr.	150,000	80,000	70,000	0	0	1,500
		Yearling Total	*450,000*	*240,000*	*210,000*	*0*	*0*	*4,500*
FCAP	Subyearling	Pittsburg Landing	400,000	100,000	100,000	0	200,000	26,000
FCAP	Subyearling	Big Canyon Cr.	500,000	100,000	100,000	0	300,000	17,000
FCAP	Subyearling	Captain John Rapids	500,000	100,000	100,000	0	300,000	26,000
FCAP	Subyearling	Captain John Rapids	200,000	0	200,000	0	0	2,000
NPTH	Subyearling	NPTH-S-Channels	500,000	200,000	100,000	0	200,000	2,000
NPTH	Subyearling	NPTH-FCS Ponds	500,000	200,000	100,000	0	200,000	2,000
NPTH	Subyearling	Cedar Flats	200,000	100,000	100,000	0	0	2,000
NPTH	Subyearling	Lukes Gulch	200,000	100,000	100,000	0	0	2,000
		Sub-Yearling Total	*3,000,000*	*900,000*	*700,000*	*0*	*1,200,000*	*77,000*
		Grand Total	*3,450,000*	*1,140,000*	*1,110,000*	*0*	*1,200,000*	*83,500*

Appendix Table 2: Fall Chinook salmon aerial redd surveys with new redds observed during given flight date on the lower Clearwater River, 2017 (shaded area not surveyed on given date).

RM	RKM	Landmark	New Redds Counted by Flight Date							Estimated Number
			10/9	10/10	10/23	10/30	11/6	11/8	Totals	
7.1	11.4	Tip of Island at Casine Gas Station					4		4	7
7.7	12.4	Just above NPT Casino			9		17		26	45
10.9	17.5	Island just Upstream of HWY 95 Bridge			4		41		45	79
12.4	20.0	Above RR Bridge at Spalding					22		22	38
13.8	22.2	Catholic Creek					24		24	42
14.6	23.5	Downstream of Arrow Bridge					2		2	3
15.6	25.1	Below Gibbs Eddy Boat Ramp	1						1	2
15.8	25.4	Above Gibbs Eddy Boat Ramp	3		7		2		12	21
16.8	27.0	Under Highline above Gibbs					6		6	10
17.3	27.8	Island above Gibbs Eddy					2		2	3
18.0	29.0	Lower Myrtle	22				78		100	175
18.5	29.8	Below Cottonwood Island	12				18		30	52
19.0	30.6	Cottonwood Islands	1				28		29	51
20.0	32.2	Tip of upstream Island at Cottonwood Cr	2				28		30	52
20.2	32.5	Run above Cottonwood Island					2		2	3
20.4	32.8	Run Below Cherry Lane Boat Ramp					14		14	24
20.8	33.5	Cherrylane Boat Ramp	2		33		25		60	105
21.4	34.4	Fir Island (Hwy 12 Side Channel)					4		4	7
21.8	35.1	Fir Island (North Main Channel)	8		52		115		175	305
22.3	35.9	NPTH (1705) Ladder	4		21		20		45	79
22.6	36.4	Just above NPTH fish ladder			6		44		50	87
23.6	38.0	Just above Pine Creek					6		6	10
24.2	38.9	Below Thunderbird Market			1		5		6	10
25.8	41.5	Just below Bedrock Creek					1		1	2
26.5	42.6	Just above Bedrock Creek					15		15	26
26.8	43.1	Above Bedrock Creek	5				20		25	44
27.0	43.4	Below Big Eddy					12		12	21
27.7	44.6	Big Eddy Tail Out	2				4		6	10
28.5	45.9	Rest Area	2				18		20	35
31.2	50.2	Below Arrowhead Camp-Tree Farm					3		3	5
32.2	51.8	Below Arrowhead Camp-Tree Farm					25		25	44
34.0	54.7	Leaning Pine Hole	30				5		35	61
35.3	56.8	Below Old Peck Bridge	12				43		55	96
35.5	57.1	Above Old Peck Bridge	4				28		32	56
36.5	58.7	Above Old Peck Bridge	10				0		10	17
39.2	63.1	Below Pink House Boatramp					4		4	7
39.6	63.7	Above Pink House Boatramp	2				2		4	7
40.0	64.4	Ahsahka Islands	28		12		40		80	140
0.2	0.3	N.F. Clearwater			1				1	2

Appendix Table 2 (continued). Fall Chinook salmon aerial redd surveys with new redds observed during given flight date on the lower Clearwater River, 2017 (shaded area not surveyed on given date).

RM	RKM	Landmark	New Redds Counted by Flight Date							Estimated Number
			10/9	10/10	10/23	10/30	11/6	11/8	Totals	
45.6	73.4	Richardson's Mill						1	1	2
49.4	79.5	Below Greer Bridge		2					2	3
57.2	92.1	Upstream of 5 mile boat ramp				1			1	2
63.1	101.5	Big Island below Kamiah				6		1	7	12
67.9	109.3	Just above Lawyer's Creek				1			1	2
72.5	116.7	Button Beach		1		8		11	20	35
		Totals	150	3	146	16	727	13	1,055	1,841
		River Mile Start	4	45	4	45	4	45		
		River Mile End	45	74.5	45	74.5	45	74.5		
		Flow at Spalding Gauge (cfs)	3,720	3,980	6,280	4,380	4,240	4,140		
		Avg. Temp at Spalding Gauge	11.7	9.9	9.4	8.4	7.2	6.9		
		Flow from Dworshak	1,800	1,800	1,800	1,700	1,600	1,600		
		Flow at Orofino Gauge (cfs)	1,860	1,910	5,330	2,470	2,340	2,040		
		Avg. Temp at Orofino Gauge	10.7	10.7	8.1	3.3	3.2	3.0		
		General Observation Conditions	Excel	Excel	Poor	Excel	Good	Good		

Appendix Table 3: Fall Chinook salmon aerial redd surveys with new redds observed during given flight date on the M.F. Clearwater River, 2017.

RM	RKM	Landmark	New Redds Counted by Flight Date			
			10/10	10/30	11/8	Total
5.6	9.0	Just above Harris Ridge road			1	1
15.4	24.8	Below Island Before Syringa	3	12		15
16.5	26.5	At Syringa			2	2
19.6	31.6	4.5 km Above Syringa			4	4
		Totals	3	12	7	22
		River Mile Start	0	0	0	
		River Mile End	23	23	23	
		River Flow (cfs)	1,910	1,969	1,492	
		General Observation Conditions	Excel	Excel	Excel	

Appendix Table 4: Fall Chinook salmon aerial redd surveys with new redds observed during given flight date on the S.F. Clearwater River, 2017.

RM	RKM	Landmark	New Redds Counted by Flight Date			
			10/10	10/30	11/8	Total
0.1	0.1	Just above mouth near telemetry site			2	2
1.1	1.8	Downstream end of Kooskia			1	1
2.0	3.2	Upstream end of Kooskia			2	2
2.5	4.0	Island downstream of Stites			3	3
2.8	4.5	Island downstream of Stites			2	2
4.5	7.2	H_2O treatment Ponds in Stites			5	5
4.7	7.6	Islands just upstream of stites			10	10
4.8	7.7	Islands just upstream of stites			2	2
5.4	8.7	Upstream of Stites			7	7
5.8	9.3	Island upstream of Stites Grade			1	1
6.0	9.7	Island above lukes Gulch Turnoff			3	3
6.2	10.0	None			6	6
6.4	10.3	None			5	5
6.7	10.8	None			6	6
6.8	10.9	None			3	3
7.0	11.3	None			4	4
7.6	12.2	Just Above Outfitter Hole			10	10
7.8	12.6	None			1	1
11.3	18.2	At Sally Ann Creek Rd			1	1
11.8	19.0	Campground			6	6
15.2	24.5	Just Upstream of Harpster Grade			10	10
17.0	27.4	None			2	2
18.5	29.8	Above Harpster		6	3	9
26.0	41.8	None			3	3
27.5	44.2	None			1	1
		Totals	0	6	99	105
		River Mile Start	13.4	23.5	32.3	
		River Mile End	0	15	0	
		River Flow (cfs)	267	253	190	
		General Observation Conditions	Excel	Excel	Excel	

Appendix Table 5: Fall Chinook salmon aerial redd surveys with new redds observed during given flight date on the Selway River, 2017.

RM	RKM	Landmark	New Redds Counted by Flight Date			
			10/10	10/30	11/8	Total
0.1	0.1	Just above mouth		24		24
0.6	1.0	Just above mouth		2	3	5
3.4	5.5	Just above Swiftwater Bridge		17	2	19
4.5	7.2	Ranger Station		1		1
9.0	14.5	2.2 miles upstream of O Hara Creek		1		1
14.3	23.0	About 3.5 miles below Gedney Creek		10	2	12
14.6	23.5	About 3.2 miles below Gedney Creek			1	1
17.8	28.6	About 0.6 miles below falls		2	1	3
19.2	30.9	Just Above Selway Falls		1		1
		Totals	0	58	9	67
		River Mile Start	0	0	0	
		River Mile End	19.5	19.5	19.5	
		River Flow (cfs)	762	1,290	952	
		General Observation Conditions	Excel	Excel	Excel	

Appendix Table 6: Fall Chinook salmon aerial redd surveys with new redds observed during given flight date on the Grande Ronde River, 2017.

RM	RKM	New Redds Counted by Flight Date			Total
		10/18	11/1	11/16	
0.2	0.3			3	3
0.3	0.5			3	3
0.5	0.8	1	11	8	20
0.9	1.4	1	5	9	15
2.2	3.5			3	3
2.9	4.7		3		3
3.7	6.0		2		2
3.8	6.1	3	17		20
4.2	6.8	1			1
4.3	6.9	1			1
5.7	9.2	1	1		2
7.0	11.3			20	20
7.5	12.1		1	3	4
8.0	12.9			1	1
9.2	14.8			2	2
9.1	14.6			1	1
10.4	16.7		2	2	4
12.6	20.3	2	1		3
12.7	20.4			12	12
12.8	20.6			14	14
13.2	21.2			2	2
13.8	22.2	6			6
13.9	22.4		22	28	50
15.0	24.1			1	1
16.4	26.4		8	3	11
16.9	27.2			1	1
17.8	28.6	3	5		8
18.0	29.0			3	3
18.5	29.8			4	4
19.7	31.7			1	1
24.2	38.9	1		0	1
25.7	41.4			1	1
26.4	42.5			1	1
27.8	44.7			2	2
27.9	44.9			5	5
28.9	46.5			2	2
30.1	48.4			5	5

Appendix Table 6 (continued). Fall Chinook salmon aerial redd surveys with new redds observed during given flight date on the Grande Ronde River, 2017.

RM	RKM	New Redds Counted by Flight Date			Total
		10/18	11/1	11/16	
32.8	52.8	1	6	0	7
33.4	53.7	1	14	0	15
35.2	56.6		2	2	4
37.4	60.2		3	0	3
40.9	65.8			1	1
41.2	66.3	1	0	0	1
44.7	71.9			4	4
45.8	73.7		2	2	4
46.6	75.0			1	1
46.7	75.1			2	2
	Totals	23	105	152	280
	River Mile Start	52.7	52.7	52.7	
	River Mile End	0	0	0	
	River flow at Troy (cfs)	1,530	1,220	1,160	
	General Observation Conditions	Fair	Fair	Fair	

Appendix Table 7. Fall Chinook salmon aerial redd surveys with new redds observed during given flight date on the Imnaha River, 2017.

RM	RKM	Redds Counted by Flight Date		
		10/18	11/8	Totals
0.8	1.3		1	1
0.9	1.4		1	1
1.3	2.1	1	2	3
3.4	5.5		2	2
3.5	5.6		6	6
5.3	8.5		1	1
7.1	11.4		1	1
	Totals	1	14	15
	River Mile Start	19.0	19.0	
	River Mile End	0	0	
	River Flow (cfs)	159	168	
	Observation Conditions	good	good	

Appendix Table 8. Fall Chinook salmon aerial redd surveys with new redds observed during given flight date on the Salmon River, 2017.

RM	RKM	Landmark	New Redds Counted by Flight Date		
			10/16	11/15	Totals
0.1	0.2	at the mouth		5	5
14.1	22.7			3	3
15.3	24.6			1	1
54.6	87.9			1	1
		Totals	0	10	10
		River Mile Start	0	0	
		River Mile End (mouth of French Creek)	105	66*	
		River Flow at Whitebird (cfs)	5,680	6,030	
		General Observation Conditions	Good	Good	

*November 15 survey ended at Slate Creek (Rm 66) because of high winds.