Lyons Ferry Hatchery Evaluation
Fall Chinook Salmon
Annual Report: 2015

by

Deborah Milks and Afton Oakerman
Washington Department of Fish and Wildlife
Fish Program
Science Division
600 Capitol Way N.
Olympia, Washington 98501-1091

to

U.S. Fish and Wildlife Service
Lower Snake River Compensation Plan Office
1387 South Vinnell Way, Suite 343
Boise, Idaho 83709
Cooperative Agreements
F14AC00010

November 2018

Citation of this publication: Milks, D., and A. Oakerman. 2018. Lyons Ferry Hatchery Evaluation Fall Chinook Salmon Annual Report: 2015. Washington Department of Fish and Wildlife, Olympia, WA. http://www.fws.gov/lsnakecomplan/reports/WDFWreports.htm

Executive Summary

This report summarizes activities by the Washington Department of Fish and Wildlife's (WDFW) Lyons Ferry Hatchery (LFH) Evaluation Fall Chinook Salmon Program for the period 16 April 2015 through 15 April 2016.

During 2015, WDFW collected a combined 2,456 fish at both LFH and Lower Granite Dam (LGR) for broodstock, monitoring and evaluation of our hatchery releases, and to estimate the run composition at LGR.

In 2015, we spawned 1,233 females for an estimated total green eggtake of 4,569,472; numerically more than full production goals listed in the 2008-2017 *United States v. Oregon* Management Agreement, but well within precision levels expected from large production hatcheries. At the end of the season, 21 females and 37 males were returned to the Snake River to spawn naturally. Green egg to eye-up survival was 97.2%. Based on hatchery records, average fecundity of LFH and LGR trapped females was 3,091 eggs/female and 3,777 eggs/female, respectively. A total of 511 males were spawned, of which 413 fish (81%) were used multiple times to minimize the use of jacks, and to incorporate larger/older fish into the broodstock. The estimated proportion of natural origin (pNOB) fish (as determined from run-reconstruction methodologies) in the LFH broodstock was 15.2%.

Hatchery staff released BY14 subyearlings into the Snake River at LFH and into the Grande Ronde River (GRR) near Cougar Creek in 2015 and BY14 yearlings into the Snake River at LFH in 2016. All WDFW release groups (subyearling and yearling) were represented by a coded wire tag (CWT) group as identified in the *US v. Oregon* production tables, and a portion also received passive integrated transponder (PIT) tags. PIT tags in 29,840 of the released onstation yearlings (BY14) and 19,906 of the released subyearlings (BY14) will be used to monitor adult and jack returns in-season, monitor overshoot rates to LGR, and potentially estimate total contribution to the LSRCP area (above Ice Harbor Dam).

In 2015, and in general, upon adult return, fish from yearling production have been consistently larger than subyearlings that return at the same salt water age. Females from both yearling and subyearling programs consistently return at greater lengths than males of the same salt water age class. Minijacks (0-salt) returned from yearling releases only at 6.6% of the return. Yearling releases returned 1-salt jacks (11.1%) and jills (1.3%), while subyearlings returned no jills, and 6.9% returned as jacks.

In the spring of 2015 a smolt trap was operated on the Tucannon River to estimate juvenile production of fall Chinook salmon, as well as other species within the basin. Trapping estimates of fall Chinook salmon passing the smolt trap (134,213) were expanded for areas below the smolt trap location based on redds observed below the smolt trap location. The total estimate of Snake River fall Chinook salmon emigrating from the Tucannon River was 155,791 from the 2014 spawners, with production estimated at 515 smolts/redd. In the fall of 2015, the Tucannon River was surveyed for spawning fall Chinook salmon. An estimated 506 fall Chinook salmon redds were constructed in the river, resulting in an estimated spawning escapement of 1,518 fall Chinook salmon.

The run size of natural origin fish estimated to reach LGR was 15,773 fish $\geq$ 53 cm fork length (FL) and 1,839 fish 30 cm to <53 cm FL. The remaining portion of the run consisted of 42,557 fish $\geq$ 53 cm FL and 5,557 fish 30 cm to < 53 cm FL, all likely hatchery origin from LFH, Fall Chinook Acclimation Project (FCAP), Idaho Power Company (IPC), and Nez Perce Tribal Hatchery (NPTH). The stray rate of out of basin fish to LGR was estimated at 2.4% for fish $\geq$ 53 cm FL and 0.0% for fish 30 cm to <53 cm FL.

We calculated that a minimum of 33,894 fish (37.0%) of the total LSRCP downriver mitigation goal (91,500 fish) was met in 2015 (WDFW and FCAP releases combined). This estimate includes: returns to the Snake River (WDFW and FCAP), fully expanded (Coded Wire Tag (CWT) tagged and untagged) harvest recoveries outside of the Snake River (WDFW only), and unexpanded harvest recoveries of the FCAP releases with CWTs outside of the Snake River.

The LSRCP escapement goal (18,300 hatchery fish) to the Snake River Basin was exceeded (121.9%) in 2015 (WDFW and FCAP). An estimated 3,488 jacks and jills (1-salt) and 18,813 adults (2-5 salt) contributed to the returns. An additional 1,465 minijacks (0-salt) were also estimated to have returned to the Snake River, but do not count toward the mitigation goal.

Fall Chinook salmon reared at LFH and released into the Snake River at LFH or near Couse Creek (CCD) in the mainstem Snake River, and into the GRR contributed to harvest outside the Snake River Basin in both sport (2,245) and commercial/tribal fisheries (5,098) in 2015. LFH fall Chinook salmon were also recovered outside the basin at hatcheries (Priest Rapids N=12 and Bonneville N=4) and on spawning grounds (Columbia River at Hanford reach N=58 and Little White Salmon River N=10). Of the total number of fish recovered outside of the Snake River, 68.7% came from commercial/tribal fisheries, 30.2 % from sport fisheries, 0.9% from spawning ground surveys, and 0.2% were from hatcheries.

The top four catch areas for fish released as yearling smolts returning in 2015 were located in the Columbia River (43%), in the ocean off the coasts of Washington (27%), Oregon (12%), and British Columbia (10%). The top four catch areas for fish released as subyearling smolts returning in 2015 were located in the Columbia River (45%), in the ocean off the coasts of Washington (26%), Alaska (10%), and British Columbia (9%). Overall, the single largest fishery contributor was the Zone 6 Gillnet fishery which consisted of 22.6% of all the fish recovered outside of the Snake River Basin, and the catch consisted primarily of yearlings.

Two methodologies for estimating returns to the Snake River were compared; PIT tags and CWTs released from LFH. For yearlings, PIT tag estimates were consistently greater than the CWT estimates. For subyearlings, PIT tag estimates were less for both 1-salt and 3-salt returns and greater for 2-salt returns compared to CWT estimates.

Endangered Species Act (ESA) section 10 (a)(1)(A) Permit # 16607 was revised in June 2015 and is now referred to as permit # 16607 (amended). Overall WDFW was below direct take levels of listed Snake River fall Chinook salmon for adult returns in 2015 and juvenile releases in 2016.

Acknowledgments

The Lyons Ferry Fall Chinook Salmon Hatchery Evaluation Program is the result of work by many individuals within the WDFW Fish Program. We want to thank all those who contributed to this program.

We would like to thank the Snake River Lab (SRL) staff: Joe Bumgarner, Jerry Dedloff, Michael Gallinat, Jule Keller, Lance Ross, Ashly Beebe, Sara Schooler, Addie Donohue, Cortney Bunch, Devin Alexander Lewis, and staff from the Dayton Fish Management office for their help. We also thank Bridget Sloat for assisting with the proofing of the report.

We thank the personnel at LFH for their cooperation with sampling and providing information regarding hatchery operations. Thanks also to John Sneva (WDFW) for aging scales collected at LFH and LGR for the run reconstruction and broodstock aging.

We appreciate the efforts of Darren Ogden (NOAA Fisheries) and crew at LGR for trapping, tagging, and documenting fall Chinook salmon for transport to LFH. We also thank Allan Martin (COE) for providing summarized fallback data from the juvenile collection facility at LGR. We also thank Bill Young (NPT), Stuart Rosenberger (Idaho Power) for their assistance in estimating the run composition estimate at LGR in 2015, and Ben Sandford (NOAA) for bootstrapping the data to get bounds around the estimates.

We thank Joe Bumgarner, Jeremy Trump, Alf Haukenes, and Rod Engle for reviewing a draft of this report and providing valuable comments.

Finally, we thank the U.S. Fish and Wildlife Service, Lower Snake River Compensation Plan Office, for providing funding and encouragement for this program.

Table of Contents

Table of Contents i

List of Tables iii

List of Figures vii

List of Appendices ix

Introduction 1
- Program Objectives 1
- Broodstock Collection and Management 2015 7
- Lower Granite Dam Trapping Operations 7
- LFH Trapping Operations 8

Hatchery Operations 2015 9
- Spawning Operations 9
  - Spawning and Egg Take 9
  - Fish Returned to River 12
- Effective Hatchery Population Size 13
- Broodstock Profile 15
  - Males used in broodstock 18
  - Females used in broodstock 20
  - Lengths by Age of CWT fall Chinook salmon that are part of the LSRCP Program Compared to Strays 22
  - Fecundity 23
  - Inclusion of Natural Origin Fish 23
  - Jacks and Jills in Broodstock 25
  - Inclusion of Strays in Broodstock 25
- Rearing and Marking and Tagging 26
- Juvenile Releases 29
  - Brood year 2014 29
- Survival Rates to Release 32
- Migration Timing 33

Tucannon River Natural Production 2015 36
- Adult Salmon Surveys 36
  - Fall Chinook Salmon Redd Surveys 36
  - Escapement and Composition of the Fall Chinook Salmon Run in the Tucannon River 38
- Juvenile Salmon Emigration 42

Fall Chinook Salmon Run Size and Composition 2015 45
- Returns to LGR and Composition of Fish Returning to LGR 45
  - Fallbacks at the LGR Juvenile Collection Facility 47

Characteristics of fall Chinook salmon reaching LGR Dam 48
Sex Ratio 48
Length Frequencies 48
Fallback Rates of Onstation Releases at LGR 49

Status of Mitigation Requirements 50
Overall Mitigation Level 50
Returns to the Project Area 50
Harvest in the Project area 50
Recoveries Outside of the Snake River Basin 52
Harvest Adjustments for Non-Selective Fisheries and Errors in Reporting Detection Method 52
Expansions to Account for Untagged Fish Harvested in Non-Selective Fisheries 53
Total Age of Yearling and Subyearlings Recovered Outside of the Snake River Basin ...57
Estimated Returns to the Snake River using PIT tags and CWTs 59
Estimated Returns above Bonneville Dam using PIT tags and CWTs 62

Direct Take of Listed Snake River fall Chinook Salmon During Fall of 2015 and Spring of 2016 66

Conclusions and Recommendations 69

Literature Cited 70

List of Tables

Table 1. Fall Chinook salmon goals as stated in the LSRCP mitigation document. 2

Table 2. Numbers of fall Chinook salmon initially collected at LFH and LGR for broodstock, evaluation, and run construction needs in 2015. 7

Table 3. Duration and peak of spawning, egg take, and percent egg mortality at LFH, 1984-2015. 10

Table 4. Spawn dates, numbers of fall Chinook salmon spawned, and weekly egg take at LFH in 2015. (Jacks are included with males)... 11

Table 5. Weekly summary and origins of mortality and surplus fall Chinook salmon processed at LFH in 2015. (Jacks are included with males). 11

Table 6. Estimated composition of fall Chinook salmon released into the Snake River near LFH at the end of the season in 2015... 12

Table 7. Origin and age of males that contributed to production at LFH, 2015. 19

Table 8. Origins and age of females that contributed to production at LFH, 2015. 21

Table 9. Sex, origin, and median fork length by age at return of CWT fall Chinook salmon processed in 2015 by WDFW that were part of hatchery yearling juvenile releases. 22

Table 10. Sex, origin, and median fork length by age at return of CWT fall Chinook salmon processed in 2015 by WDFW that were part of hatchery subyearling juvenile releases. ... 23

Table 11. Number of matings of minijacks, jacks, and jills contributing to broodstock at LFH, 2010-2015, during size-selective mating protocols. 25

Table 12. Historical use of out of basin strays in broodstock: 2007-2015. 26

Table 13. Eggs taken and survival numbers by life stage of fall Chinook salmon spawned at LFH, brood years 2010-2015... 27

Table 14. Numbers of fall Chinook salmon sampled by WDFW for marking and tagging quality control checks. 28

Table 15. Length and weight data from subyearling fall Chinook salmon (BY14) sampled by WDFW and released into the Snake and Grande Ronde rivers during 2015. 30

Table 16. Length and weight data from yearling fall Chinook salmon (BY14) released at LFH in 2016. 31

Table 17. Estimated survivals (%) between various life stages at LFH for fall Chinook salmon, 2010-2014 brood years. 32

Table 18. Migration timing of BY14 PIT tagged subyearlings released near Cougar Creek in the GRR in 2015. 33

Table 19. Migration timing of BY14 PIT tagged subyearlings released at LFH in 2015 34

Table 20. Migration timing of BY14 PIT tagged yearlings released at LFH in 2016. 34

Table 21. Date and number of redds and carcasses counted on the Tucannon River in 2015 37

Table 22. Estimated escapement, redd construction, and resulting estimates of smolts/redd and total number of emigrants from fall Chinook salmon spawning in the Tucannon River, 2002-2015.[a] 38

Table 23. Composition of wire tagged carcasses recovered and estimated run composition of fall Chinook salmon on the Tucannon River, 2015 40

Table 24. Composition of untagged carcasses recovered and estimated run composition of fall Chinook salmon on the Tucannon River, 2015. 41

Table 25. Estimated composition of the fall Chinook salmon run to the Tucannon River by salt water age and origin, 2015. 41

Table 26. Trapping efficiency estimates for fall Chinook and coho salmon at the smolt trap on the Tucannon River in 2015. 43

Table 27. Migration timing of naturally produced fall Chinook salmon leaving the Tucannon River in 2015. 43

Table 28. Estimated composition, standard errors, and confidence intervals for fall Chinook salmon reaching LGR during 2015. 46

Table 29. Documented fallbacks of Chinook salmon at the LGR juvenile collection facility during 2015 by clip and wire. 47

Table 30. Composition of fallbacks of Chinook at the LGR separator in 2015 by clip and length. 47

Table 31. Estimated returns of LSRCP (WDFW and FCAP) fall Chinook salmon to the Snake River and levels of mitigation goals met in 2015. 51

Table 32. Estimated Snake River basin recoveries in 2015 of wire tagged LSRCP (WDFW and FCAP) fall Chinook salmon as reported to RMIS on 12/7/2016. 51

Table 33. Fully expanded recovery estimates of tagged and untagged fall Chinook salmon recovered in the Columbia River Basin (freshwater areas) during 2015 for WDFW releases. Jacks and minijacks included in the estimates. 54

Table 34. Fully expanded recovery estimates of tagged and untagged fall Chinook salmon in areas outside of the Snake River Basin (saltwater areas) during 2015 for WDFW releases. Jacks and minijacks are included in the estimates. 55

Table 35. Fully expanded recovery estimates (tagged and untagged) of 2015 returns by region, rear type, and release location for fall Chinook salmon released by WDFW. Jacks and minijacks are included in the estimates. 56

Table 36. Final locations of ADCWT yearling fall Chinook salmon released onstation at LFH to areas outside of the Snake River basin in 2015 by total age, based on estimated recoveries reported to RMIS as of 12/7/16. 57

Table 37. Final locations of ADCWT subyearling fall Chinook salmon released onstation at LFH to areas outside of the Snake River Basin in 2015 by total age, based on estimated recoveries reported to RMIS as of 12/7/16. 57

Table 38. Final locations of ADCWT subyearling fall Chinook salmon released into the Snake River near Couse Creek to areas outside of the Snake River Basin in 2015 by total age, based on estimated recoveries reported to RMIS as of 12/7/16. 58

Table 39. Final locations of ADCWT subyearling fall Chinook salmon released into the Grande Ronde to areas outside of the Snake River Basin in 2015 by total age, based on estimated recoveries reported to RMIS as of 12/7/16. 58

Table 40. Return and survival estimates to the Snake River for yearling fall Chinook salmon released at LFH estimated using PIT tag detections in the Snake River through 2015. 60

Table 41. Return and survival estimates to the Snake River for yearling fall Chinook salmon released at LFH estimated using CWT recoveries and return estimates of live fish through 2015. Cells highlighted in red indicate possible biased data due to trapping restrictions during 2013. 60

Table 42. Return and survival estimates to the Snake River for subyearling fall Chinook salmon released at LFH estimated using PIT tag detections in the Snake River through 2015. 61

Table 43. Return and survival estimates to the Snake River for subyearling fall Chinook salmon released at LFH estimated using CWT detections in the Snake River through 2015. Cells highlighted in red indicate possible biased data due to trapping restrictions during 2013.. 62

Table 44. Total return and survival estimates of yearling fall Chinook salmon released at LFH estimated using PIT tag detections in the Snake and Columbia rivers through 2015. 63

Table 45. Total return and survival estimates of yearling fall Chinook salmon released at LFH estimated using freshwater CWT recoveries above Bonneville Dam and return estimates of live fish through 2015. Cells highlighted in red indicate possible biased data due to trapping restrictions during 2013. 64

Table 46. Total return and survival estimates of subyearling fall Chinook salmon released at LFH estimated using PIT tag detections in the Snake and Columbia rivers through 2015. 65

Table 47. Total return and survival estimates of subyearling fall Chinook salmon released at LFH estimated using freshwater CWT recoveries above Bonneville Dam and return estimates of live fish through 2015. Cells highlighted in red indicate possible biased data due to trapping restrictions during 2013. 65

Table 48. Proposed permissible direct take and actual take of listed Snake River fall Chinook salmon adults returning in 2014 and juveniles released in 2015 for fish cultural purposes for the LFH, IPC, and FCAP programs. Red cells indicate take exceeded permitted limit and green cells combine take from LFH and NPTH programs. 67

Table 49. Proposed permissible direct take and actual take of listed Snake River fall Chinook salmon adults returning in 2014 and juveniles released in 2015 for RM&E activities associated with the LFH fall Chinook salmon programs not directly related to fish culture. Green cells combine take from LFH and NPTH programs. 68

List of Figures

Figure 1. The Lower Snake River Basin showing locations of Lyons Ferry Hatchery, acclimation sites, and major tributaries in the area. 6

Figure 2. Arrival timing of fall Chinook salmon at LGR that were hauled to LFH in 2015. 8

Figure 3. Effective population size for Snake River fall Chinook salmon hatchery production 2005-2015 14

Figure 4. Salt age composition of all broodstock 2005 – 2009. 16

Figure 5. Salt age composition of all broodstock 2010 – 2015. 16

Figure 6. Male salt age composition of broodstock 2005 – 2009. 16

Figure 7. Male salt age composition of broodstock 2010 – 2015. 16

Figure 8. Female salt age composition of broodstock 2005 – 2009. 16

Figure 9. Female salt age composition of broodstock 2010 – 2015. 16

Figure 10. Percentages by fish origin contributing to fall Chinook salmon broodstock at LFH during 2015. 17

Figure 11. Fork lengths of fall Chinook salmon used as broodstock at LFH in 2015. 17

Figure 12. Arrival timing of male (adults + jacks) fall Chinook salmon at LGR compared to the arrival dates of fall Chinook salmon hauled to LFH during 2015. 18

Figure 13. Arrival timing of female fall Chinook salmon at LGR compared to arrival dates of fall Chinook salmon hauled to LFH during 2015. 20

Figure 14. Estimated percent natural origin parents in broodstock at LFH, NPTH, and overall for Snake River basin hatchery production, 2003-2015 24

Figure 15. Migration speed of BY14 LFH and GRR subyearling fall Chinook salmon as they passed Snake and Columbia River dams in 2015. 35

Figure 16. Migration speed of BY14 LFH yearling fall Chinook salmon as they passed Snake and Columbia River dams in 2016. 35

Figure 17. Distribution of the timing of juvenile natural origin fall Chinook salmon trapped on the Tucannon River in 2015. 42

Figure 18. Migration speed of BY13 Tucannon River natural origin fall Chinook salmon in 2015. 44

Figure 19. Fall Chinook salmon window counts at LGR, 1976-2015. 45

Figure 20. Estimated length frequencies of the fall Chinook salmon run to LGR by sex in 2015. 48

Figure 21. Historic median fork lengths of females and males+jacks arriving at LGR dam, 2009-2015. 49

Figure 22. Percent survival of yearling releases from LFH to the Snake River using CWTs and PIT tags through return year 2015 for 1-4 salt fish. 61

Figure 23. Percent return of yearling fall Chinook salmon released at LFH to areas above Bonneville Dam, including the Snake River, through return year 2015 for 1-4 salt fish.... 64

List of Appendices

Appendix A: Fall Chinook Salmon Run to LFH, IHR, LMO, and LGR Dams: 2011-2015 73

Appendix B: Trapping and Sampling Protocols at LGR Adult Trap for 2015 75

Appendix C: Systematic Sampling Rates at Lower Granite Dam 2003-2015 80

Appendix D: Trapping, Sorting and Mating Protocols at Lyons Ferry Hatchery 2015 82

Appendix E: Salmon Processed and Killed at LFH in 2015 84

Appendix F: United States v. Oregon Production and Marking Table 91

Appendix G: LFH 2015 Broodstock PBT Tissue Samples 94

Appendix H: Historical Size at Age of Return of CWT LSRCP Origin Fish Processed by WDFW: 1985-2014 107

Appendix I: Historical number of matings of minijacks, jacks and jills contributing to broodstock at LFH 2000-2009 118

Appendix J: Egg Take and Early Life Stage Survival Brood Years: 1990-2010 120

Appendix K: LFH/Snake River Origin Fall Chinook Salmon Releases Brood Years: 2008-2014 123

Appendix L: Historical Estimated Survivals (%) Between Various Life Stages at LFH 130

Appendix M: Tucannon River Survey Sections and Historical Escapement 132

Introduction

Program Objectives

This report summarizes activities by the Washington Department of Fish and Wildlife's (WDFW) Lyons Ferry Hatchery (LFH) Fall Chinook Salmon Evaluation Program from 16 April 2015 to 15 April 2016. WDFW's Snake River Lab (SRL) evaluation staff completed this work with federal fiscal year 2015/2016 funds provided through the U.S. Fish and Wildlife Service (USFWS), under the Lower Snake River Compensation Plan (LSRCP).

This hatchery program began in 1984 after construction of LFH (Figure 1) and is part of the LSRCP program authorized by Congress in 1976. The purpose of the LSRCP is to replace adult salmon, steelhead and rainbow trout lost by construction and operation of four hydroelectric dams on the Lower Snake River in Washington. Specifically, the stated purpose of the plan was:

> *"…[to]….. provide the number of salmon and steelhead trout needed in the Snake River system to help maintain commercial and sport fisheries for anadromous species on a sustaining basis in the Columbia River system and Pacific Ocean" (NMFS & USFWS 1972 pg. 14.)*

Subsequently in 1994, additional authorization was provided to construct juvenile acclimation facilities (Fall Chinook Acclimation Project – FCAP) for fall Chinook salmon that would

> " … protect, maintain or enhance biological diversity of existing wild stocks."

Numeric mitigation goals for the LSRCP were established in a three step process (COE 1974). First, the adult escapement that occurred prior to construction of the four dams was estimated. Second, an estimate was made of the reduction in adult escapement (loss) caused by construction and operation of the dams (e.g. direct mortality of smolts resulting in reduced adult abundance and loss to mainstem spawning habitat). Last, a catch to escapement ratio was used to estimate the future production that was forgone in commercial and recreational fisheries as result of the reduced spawning escapement and natural production. LSRCP adult return goals were expressed in terms of the adult escapement back to, or above the project area.

For fall Chinook salmon, the escapement to the Snake River below Hells Canyon (HCD) Dam prior to construction of four lower Snake River dams was estimated to be 34,400. Construction and operation of the dams was expected to cause a reduction in the spawning escapement in two ways: 1) the slack water reservoirs created behind the dams was expected to eliminate spawning grounds for 5,000 adults, and 2) 15% of the smolts migrating past each dam were expected to die (48% cumulative mortality).

These factors were expected to reduce the adult escapement by 18,300[1]. This number established the LSRCP fall Chinook salmon escapement mitigation goal back to the project area (Snake River). This reduction in natural spawning escapement was estimated to result in a reduction in the coast-wide commercial/tribal harvest of 54,900 adults, and a reduction in the recreational fishery harvest of 18,300 adults below the project area. In summary the expected total number of adults (excludes minijacks, but includes jacks) that would be produced as part of the LSRCP mitigation program was 91,500 (Table 1).

Table 1. Fall Chinook salmon goals as stated in the LSRCP mitigation document.

Component	Number of adults [a]
Escapement to project area	18,300
Commercial harvest	54,900
Recreational harvest	18,300
Total hatchery fish	**91,500**
Maintain natural origin population	**14,363**

[a] As defined in the LSRCP document, "adults" include adults and jacks, but not minijacks.

Since 1976 when the LSRCP was authorized, many of the parameters and assumptions used to size the hatchery program and estimate the magnitude of benefits have changed.

- The survival rate required to deliver a 4:1 catch to escapement ratio has been less than what was originally assumed, and this has resulted in fewer adults being produced.
- The listing of Snake River fall Chinook salmon and Snake River Steelhead under the Endangered Species Act has resulted in significant curtailment of commercial, recreational and tribal fisheries throughout the ocean and mainstem Columbia River. This has resulted in a higher percentage of the annual hatchery run returning to the project area than was expected.
- The summer spill program initiated in 2005 has increased mean juvenile survival from ~54% to ~71% (DeHart et al 2015)
- Three hatchery programs artificially propagate Snake River fall Chinook salmon. Two of the programs, LSRCP (includes LFH and FCAP) and NPTH, are integrated programs aimed at increasing natural-origin fish abundance and harvest using supplementation and harvest mitigation releases, respectively. Fish released at LFH and FCAP facilities consist of both subyearling and yearling life stages, while NPTH releases are subyearlings only. Information

[1] The LSRCP Special Report has language referring to adult recoveries. That language was intended to differentiate adults from juveniles in the document (Dan Herrig, USFW, personal communication). The LSCRP mitigation goal was based upon 97,500 fall Chinook counted at McNary Dam (MCN) in 1958 and expected 14,363 fall Chinook to persist in the Snake River through natural production. At that time adult and jack counts were combined to give a total count. Therefore the mitigation goal consists of jacks and adults, not just adults. Since minijacks (fish < 30 cm total length) are not counted at the dams, they were excluded from the calculations that determined the mitigation goal.

about the NPTH is presented in NPT annual reports and is not presented here. The third program administered by Idaho Power Company (IPC) is primarily mitigation for lost production due to construction of the Hells Canyon Complex (HCC), and consists of subyearling releases. Releases occur at 10 locations throughout the Snake River basin, with most release located above Lower Granite Dam (LGR). The three programs are highly coordinated in their operations, including broodstock collection at LGR and fish transfers among facilities. A single out of basin hatchery facility is used (Irrigon Hatchery) in addition to the inbasin facilities and acclimation sites. Marking of hatchery-origin fish is guided by a Snake River Basin Fall Chinook Salmon Production Program Marking Justification white paper (Rocklage and Hesse 2004). Mark types and quantities have been adopted under the 2008-2017 *United States v. Oregon* Management Agreement (*United States v. Oregon* 2008). Since 2013, at full production levels, 75% of the hatchery produced fish are marked/tagged in some manner, with ~50% marked with an adipose fin clip. If changes occur, there is a notification process that needs to be followed per the permit #16607 issued from NOAA-Fisheries and amended in 2015 (NMFS 2015).

In summary, the LSRCP (LFH and FCAP) and IPC overall program goals are as follows:

- The LSRCP program purpose is to mitigate for the decreased numbers of fall Chinook salmon harvested and returning to the Snake River due to the construction of the lower Snake River Dams with the presumption that the natural population will remain at 14,363. The first action taken for the LSRCP fall Chinook salmon mitigation program was the initiation of the egg bank effort to keep this population from becoming extirpated. The conservation of this stock, including both demographics and genetic integrity, is paramount under the LSRCP. The Snake River fall Chinook salmon program has been a conservation effort from the beginning.

- The goal of the IPC program is to replace adult fall Chinook salmon lost to the construction and ongoing operation of the HCC by releasing 1,000,000 smolts annually.

- The immediate goal of the FCAP is a concerted effort to ensure that the Snake River fall Chinook salmon above LGR are not extirpated. FCAP is part of the LSRCP mentioned in item 1 above, but accounting for adults is done separately by NPT. Long-term goals of the project are

    1. Increase the natural population of Snake River fall Chinook salmon spawning above LGR.
    2. Sustain long-term preservation and genetic integrity of this population.
    3. Keep the ecological and genetic impacts of non-target fish populations within acceptable limits.
    4. Assist with the recovery of Snake River fall Chinook salmon.
    5. Provide harvest opportunities for both tribal and non-tribal anglers

- There has been substantial effort made to maintain the population's genetic structure and diversity as well as rebuild adult returns of both hatchery and natural origin salmon through supplementation efforts by WDFW and the co-managers. The LSRCP program at LFH has been guided by the following objectives:

    1. Maintain and enhance natural populations of native salmonids
    2. Establish broodstock(s) capable of meeting eggtake needs,
    3. Return adults to the LSRCP area which meet designated goals
    4. Improve or re-establish sport and tribal fisheries.

While recognizing the overarching purpose and goals established for the LSRCP and changes since the program was authorized, the following objectives for the beneficial uses of adult returns have been established for the period through 2017 (*United States v. Oregon* 2008):

1. Contribute to coast-wide ocean fisheries in accordance with the Pacific Salmon Treaty.

2. Contribute to the recreational, commercial and/or tribal fisheries in the mainstem Columbia River consistent with agreed to abundance-based harvest rate schedules established in the 2008–2017 *US v. Oregon* Management Agreement.

3. Spawn enough fish to retain 4.45 million eggs (WDFW 2015) to assure that production goals as stated in 2008–2017 *US v. Oregon* Management Agreement are met. Fecundities vary annually depending upon return age classes, but generally 1,300 spawned females make production goals. In order to produce enough fish to meet the original total LSRCP harvest goals; 1) many more fish would need to be trapped, spawned, and reared, 2) or smolt to adult survivals would need to be increased dramatically. Major infrastructure additions would need to occur at LFH for additional production and changes to the 2008–2017 *US v. Oregon* Management Agreement production tables would need to occur in order to meet the original LSRCP harvest mitigation goals.

4. Estimate the numbers of returns of LSRCP, FCAP, NPTH and IPC program hatchery fish to the Snake River basin (below and above LGR), and estimate the numbers of natural origin fish escaping to spawn above LGR. To accomplish this, an additional 1,300-2,000 CWT fish must be recovered for run reconstruction at LGR.

5. To provide tribal and non-tribal fisheries in the Snake River consistent with co-manager goals, ESA constraints and permits, and the Columbia River Management Plan.

6. To contribute to hatchery and natural-origin return goals identified in the draft Snake River Fall Chinook Management Plan.

Hatchery Origin Return Goals

- Interim total return goal based on current production levels and survival is 15,484 hatchery origin fish above Lower Monumental Dam (LMO), which is comprised of 9,988 from LSRCP, 3,206 from NPTH, and 2,290 from IPC. Returns are estimated in-season to LMO and not to Ice Harbor Dam (IHR) (located closer to the mouth of the Snake River) because Columbia River salmon dip into the Snake River, cross the dam, then fall back below the dam causing an overestimate of fall Chinook salmon to the Snake River.

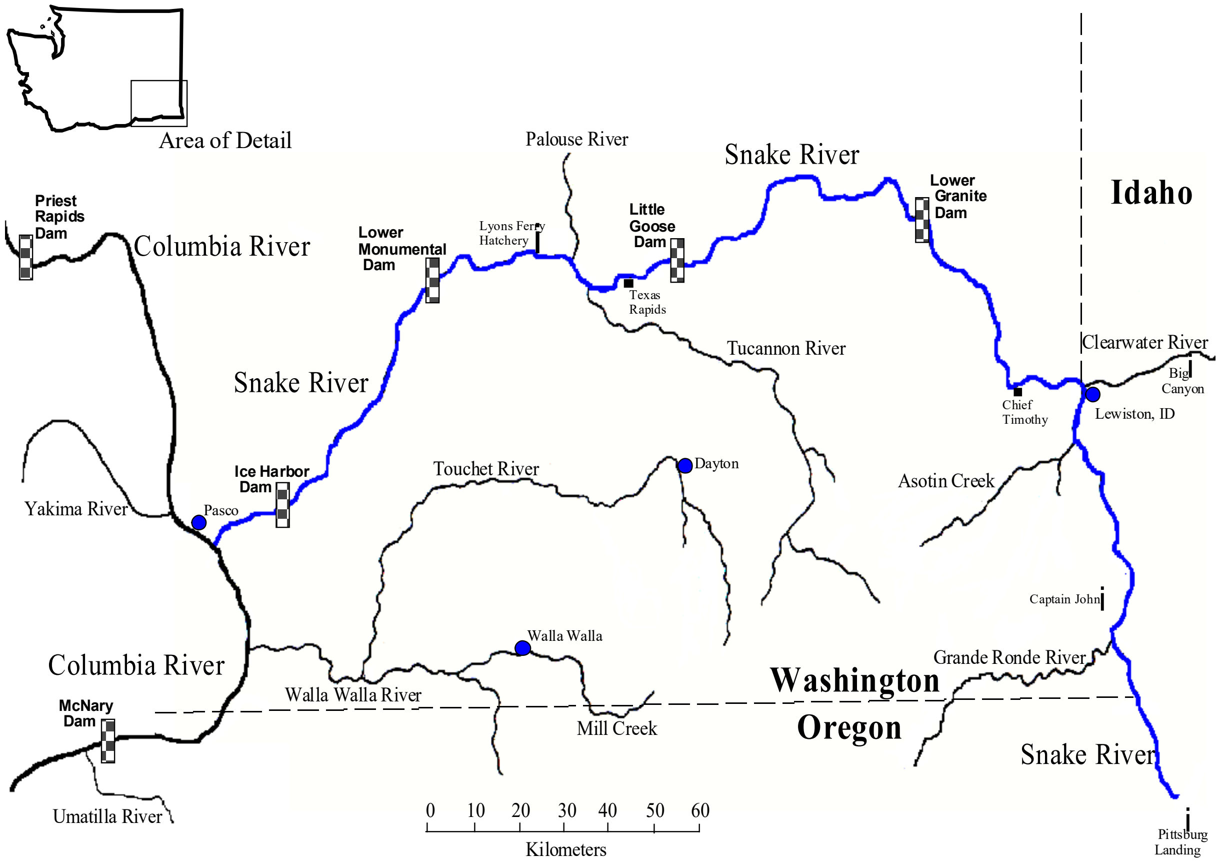
- The long-term total return goal is for a total return 24,750 hatchery-origin fish above LMO, which is comprised of 18,300 from LSRCP, 3,750 from NPTH, and 2,700 for IPC.

Natural-Origin Return Goals

- Achieve Endangered Species Act (ESA) delisting by attaining interim population abundance in the Snake River Evolutionary Significant Unit (ESU) of at least 3,000 natural-origin spawners, with no fewer than 2,500 distributed in the mainstem Snake River (as recommended by the Interior Columbia Technical Recovery Team).

- Interim short-term restoration goal is to achieve a population of 7,500 natural-origin fall Chinook (adults and jacks) salmon above LMO.

- Long-term restoration goal is to achieve a population of 14,363 natural-origin fall Chinook (adults and jacks) salmon above LMO.



Rkm	Location
0.0	Snake River mouth
16.1	Ice Harbor Dam
66.9	Lower Monumental Dam
95.1	Lyons Ferry Hatchery
105.2	Texas Rapids Boat Launch
113.1	Little Goose Dam
115.0	Bryan's Landing Boat Launch
132.3	Central Ferry Park
173.0	Lower Granite Dam
210.3	Chief Timothy Park
253.7	Couse Creek Boat Launch
263.0	Captain John Acclimation Site
346.0	Pittsburg Landing Acclimation Site
397.4	Hells Canyon Dam (not shown)
0.0	Clearwater River mouth
57.0	Big Canyon Acclimation Site
0.0	Grande Ronde River mouth
49.4	Cougar Creek

Figure 1. The Lower Snake River Basin showing locations of Lyons Ferry Hatchery, acclimation sites, and major tributaries in the area.

Broodstock Collection and Management 2015

In 2015, fall Chinook salmon were collected at LFH and LGR for broodstock (Appendix A). Each year there is a discrepancy between estimated numbers of fish collected and the numbers of fish processed/killed (Table 2). The discrepancies are likely data recording errors and reflect an approximate 0.4% difference. The in-season estimate of numbers of fish diverted into the hatchery at LFH is a minimum estimate of the run to LFH. Some of the fish that are trapped at LFH are shunted back to the river and never used for broodstock. The trap is closed much of the fall and opened for limited periods during which times fish recycle through the trap if they are not diverted into the brood ponds (see LFH Trapping Operations below).

Table 2. Numbers of fall Chinook salmon initially collected at LFH and LGR for broodstock, evaluation, and run construction needs in 2015.

Year	Trap location	Number collected/hauled for broodstock	Processed (killed)	Returned to Snake River	Difference from number collected/hauled
2015	LFH	243	243	0	0
	LGR	2,222	2,155	58	9

Lower Granite Dam Trapping Operations

In 2015, trapping at LGR was delayed four days due to high water temperatures (>70 ºF). Fall Chinook salmon trapping began 22 August with the trap open 100% of the time for four hours each day because of warm water conditions. The trap was shut down on 23-26 August and 29 August due to high water temperatures. With the cooling of water temperatures beginning 31 Aug, fall Chinook salmon were trapped by systematically opening the trap 12% of each hour until the trap closed 22 November. The arrival timing of males and females collected for broodstock at LGR and hauled to LFH are provided in Figure 2 (note: gaps in the lines presented in Figure 2 represent periods of no trapping due to the higher water temperatures, or did not met broodstock selection criteria for the particular time period). Trapping protocols for 2015 are presented in Appendix B. Historical trapping rates and operation dates of systematic sampling at LGR are presented in Appendix C. In general, NOAA Fisheries staff at LGR anesthetized the salmon, gathered length and sex data, and indicated if the fish had a fin clip, wire tag or a PIT tag.

Fish collected at LGR for broodstock, run reconstruction, and monitoring and evaluation purposes were hauled to LFH and NPTH with a goal of a 70:30 split. Sorting of broodstock prior to spawning is an essential task for determining the sex composition and lengths of fish on hand. Both of these enumerations are used to modify trapping and spawning protocols in-season. In 2015, approximately 72.0% of the salmon collected for broodstock or for run reconstruction needs, were shipped to LFH, and 28.0% were hauled to NPTH.

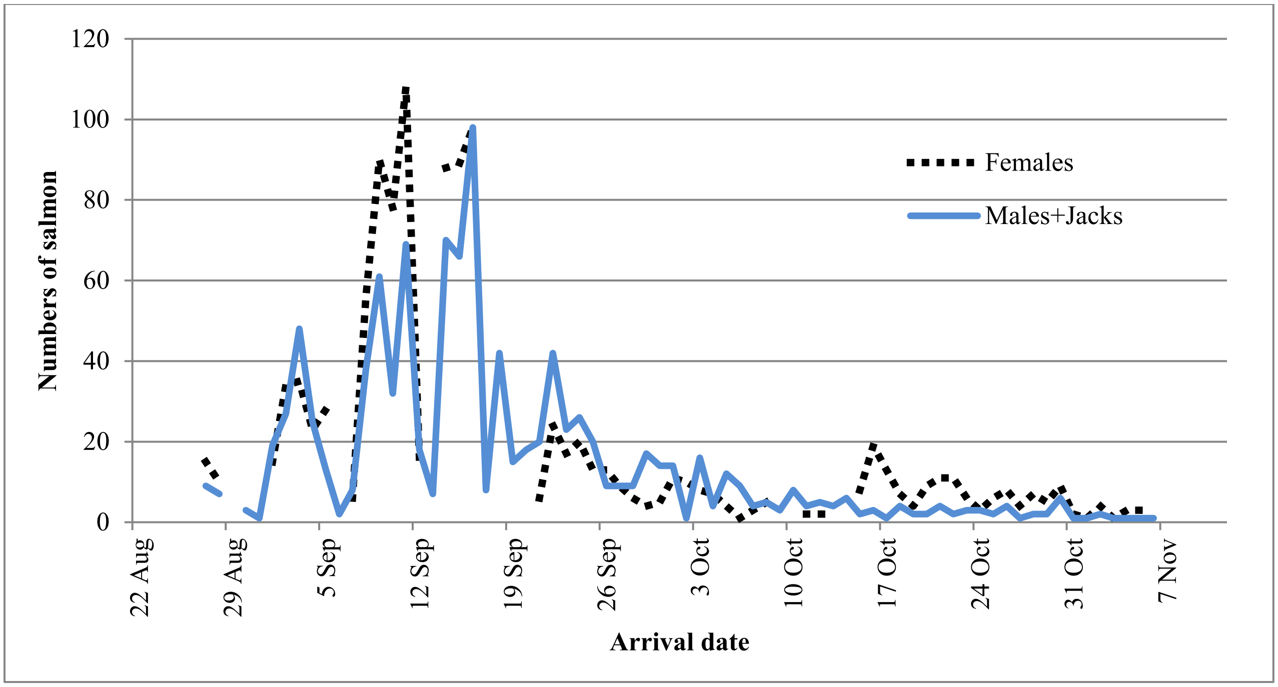


Figure 2. Arrival timing of fall Chinook salmon at LGR that were hauled to LFH in 2015.

LFH Trapping Operations

Broodstock were collected at LFH on 16 November to fulfill primarily female needs not met by trapping at LGR Dam. Trapping and sorting protocols are provided in Appendix D. A total of 243 fish were collected/processed at LFH in 2015.

Hatchery Operations 2015

Spawning Operations

Spawning and Egg Take

The ponds at LFH that held fish transported from LGR had approximately 0.5:1 sex ratio (males:females) in the adults (75 cm or greater) to be used for broodstock, and 2.1:1 sex ratio (males:females) for fish less than 75 cm for run reconstruction purposes. Using the 75 cm criteria has significantly reduced the number of jacks included in broodstock in recent years. Mate selection and spawning protocols changed weekly according to the numbers of males ripe during the spawn day and to allow for maximum use of unmarked/untagged fish from LGR, older aged males (≥ 2-salt), and subyearlings. The 2015 mating protocol at LFH is presented in Appendix D.

The duration, peak of spawning, eggtake, and percent egg mortality (Table 3), numbers of fish spawned (Table 4), and the number killed outright or died in the pond (Table 5) are provided. Natural origin fish were identified based on PIT tags recovered from fish seined and tagged as juveniles and likely underestimate the numbers of natural origin fish processed. On one spawn day, milt from unmarked/untagged males were held overnight and used in matings the following day. The goal was to maximize the use of unmarked/untagged fish during spawning as a way to maximize the proportion of natural origin fish in matings. Composition of fish processed at LFH is presented in Appendix E. In 2015, the eggtake goal for LFH was attained.

Table 3. Duration and peak of spawning, egg take, and percent egg mortality at LFH, 1984-2015.

Year	Spawn duration Begin	End	Peak of spawning	Total egg take	Egg take fully covered through *US v. Oregon* priority number [a]	Egg take partially covered *US v. Oregon* priority number	Egg mortality to eye-up (%) [b]
1984	8 Nov	5 Dec	21 Nov	1,567,823	-	-	21.6
1985	2 Nov	14 Dec	7 Nov	1,414,342	-	-	4.0
1986	22 Oct	17 Dec	19 Nov	592,061	-	-	4.0
1987	20 Oct	14 Dec	17 Nov	5,957,976	-	-	3.8
1988	18 Oct	6 Dec	12 Nov	2,926,748	-	-	3.4
1989	21 Oct	16 Dec	11 Nov	3,518,107	-	-	5.8
1990	20 Oct	8 Dec	6 Nov	3,512,571	-	-	8.3
1991	15 Oct	10 Dec	12 Nov	2,994,676[c]	-	-	8.3
1992	20 Oct	8 Dec	21 Nov	2,265,557[c]	-	-	6.0
1993	19 Oct	7 Dec	2 Nov	2,181,879	-	-	6.7
1994	18 Oct	6 Dec	8 Nov	1,532,404	-	-	5.1
1995	25 Oct	5 Dec	14 Nov	1,461,500	-	-	5.6[d]
1996	22 Oct	3 Dec	5 Nov	1,698,309	-	-	4.6
1997	21 Oct	2 Dec	4 Nov	1,451,823[e]	-	-	5.2
1998	20 Oct	8 Dec	3 Nov	2,521,135	-	-	5.1
1999	19 Oct	14 Dec	9 & 10 Nov	4,668,267	-	-	9.4
2000	24 Oct	5 Dec	7 & 8 Nov	4,190,338	-	-	5.9
2001	23 Oct	27 Nov	13 & 14 Nov	4,734,234	-	-	6.4
2002	22 Oct	25 Nov	12 & 13 Nov	4,910,467	-	-	3.6
2003	21 Oct	2 Dec	10 & 12 Nov	2,812,751	8	9	3.1
2004	19 Oct	22 Nov	9 & 10 Nov	4,625,638	16	17	3.3
2005	18 Oct	29 Nov	15 & 16 Nov	4,929,630	16	17	3.5
2006	24 Oct	5 Dec	7 & 8 Nov	2,819,004	8	9	3.2
2007	23 Oct	3 Dec	13 & 14 Nov	5,143,459	17	-	3.3
2008	21 Oct	25 Nov	4 & 5 Nov	5,010,224	17	-	3.7
2009	20 Oct	18 Nov	9 & 10 Nov	4,574,182	17	12,14[f]	4.7
2010	19 Oct	30 Nov	16 Nov	4,619,533	16	17	2.7
2011	18 Oct	21 Nov	7 & 8 Nov	4,723,501	10&15&17[g]	11-14,16	3.5
2012[h]	16 Oct	13 Nov	6 Nov	4,526,108	5,7-9,11,13,15,16	6,10,17	3.1
2013	22 Oct	3 Dec	5 & 6 Nov	4,565,660	10,13,15,16	11,17	2.6
2014	22 Oct	18 Nov	12 & 13 Nov	4,787,615	17	-	3.6
2015	27 Oct	23 Nov	3 & 4 Nov	4,569,472	17	-	2.8

[a] Priority levels as listed in the 2008-2017 *US v. Oregon* Management Agreement production tables (Appendix F).
[b] Egg mortality includes eggs destroyed due to high ELISA values.
[c] An additional 9,000 eggs from stray females were given to Washington State University.
[d] Does not include loss from 10,000 stray eggs given to University of Idaho. The egg loss from strays was 8.63% excluding eggs used in fertilization experiments.
[e] Total egg take includes eggs from one coho female crossed with a fall Chinook salmon.
[f] Priority levels 12 and 14 did not meet production goal. However, overall production in the subyearling group was more than required.
[g] Fully covered through priority 10 and priorities 15 and 17 were also fully covered.
[h] Priorities 12 and 14 are not included this year forward as the Transportation Study has ended.

Table 4. Spawn dates, numbers of fall Chinook salmon spawned, and weekly egg take at LFH in 2015. (Jacks are included with males).

Spawn dates	Hatchery and unknown origin males [a]	Natural origin males	Hatchery and unknown origin females [a]	Natural origin females	Non-viable [b]	Egg take
27 Oct	61	0	177	0	2	667,345
3 & 4 Nov	109	0	330	0	2	1,261,072
9 Nov	141	0	309	1	1	1,155,806
17 Nov	118	0	333	0	0	1,194,123
23 Nov	82	1	83	0	0	291,126
Totals	**511**	**1**	**1232**	**1**	**5**	**4,569,472**

[a] Numbers of fish presented include spawned fish whose progeny were later destroyed.
[b] Non-viable females—not ripe when killed.

Table 5. Weekly summary and origins of mortality and surplus fall Chinook salmon processed at LFH in 2015. (Jacks are included with males).

Week ending	Mortality						Killed Outright					
	LF/Snake R. [a]		Natural		Other/Unknown [b]		LF/Snake R.[a]		Natural		Other/Unknown[b]	
	M	F	M	F	M	F	M	F	M	F	M	F
30 Aug	1	0	0	0	1	0	0	0	0	0	0	0
6 Sep	0	0	0	0	0	1	0	0	0	0	0	0
13 Sep	0	1	0	0	0	0	0	0	0	0	0	0
20 Sep	0	0	0	0	0	0	75	4	0	0	5	1
27 Sep	0	0	0	0	0	2	0	0	0	0	0	0
4 Oct	0	0	0	0	0	1	124	15	0	0	8	0
11 Oct	0	1	0	0	0	1	51	2	0	0	2	0
18 Oct	0	1	0	0	1	6	30	1	0	0	1	0
25 Oct	0	1	0	0	4	0	16	0	0	0	7	1
1 Nov	1	2	0	0	4	2	19	0	0	0	4	0
8 Nov	4	12	0	0	4	4	6	0	0	0	4	0
15 Nov	11	17	0	0	18	15	8	0	0	0	10	0
22 Nov	41	14	0	0	20	6	29	12	0	0	16	0
Totals	**58**	**49**	**0**	**0**	**52**	**38**	**358**	**34**	**0**	**0**	**57**	**2**

[a] Includes known LFH or NPTH origin (from CWT and/or VIE), and PIT tagged fish of Snake River hatchery origin.
[b] Includes undetermined hatchery yearlings by scales, hatchery strays by scales or wire, regenerated scales, and Lost and No tags.

Fish Returned to River

Fish from LGR that were not needed for broodstock were returned to the Snake River near LFH on 23 November (Table 6). Fish were scanned for PIT tags, scales were taken to determine age composition, and the top of the caudal fin was clipped. Co-managers agreed in-season that these fish could be returned to the Snake River near LFH instead of above LGR due to the number released and that it would not affect run reconstruction estimates as the LGR trap had already closed for the season. We believe that all of these fish remained in the reservoirs between LMO and LGR, or went into the Palouse River, since none were observed from carcass recoveries in the Tucannon River.

Table 6. Estimated composition of fall Chinook salmon released into the Snake River near LFH at the end of the season in 2015.

Origin	Origin estimation method	Release age	Clip	Salt water age	Total age	Females	Males+ Jacks	Total
Snake R hatchery	PIT tag	Subyearling	AD	3	4	1	-	1
			No	3	4	1	1	2
Hatchery	Clip/Wire/scales	Unknown	AD	-	-	1	2	3
Unknown	Scales	Unknown		-	-	18	34	52
Totals						21	37	58

Effective Hatchery Population Size

To determine the effective population size of hatchery fall Chinook production in the Snake River, the number of males and females used at both LFH and NPTH were combined. At both hatcheries, older aged males were mated with multiple females, in part, to prevent an unintentional decline in age at maturity, but also to more closely mimick what occurs in nature (Hankin 2009). In 2015, a total of 1,590 females and 809 males were spawned at both LFH and NPTH. Of the 809 males spawned, 471 were used multiple times to:

- maximize the number of larger, older aged adults used in crosses
- select fish with a greater chance of a subyearling life history,
- increase the number of natural origin fish used, and
- reduce the number of jacks used in the broodstock,

Due to the multiple use of males, procedures described in Busack (2007) were used to estimate the effective number of male breeders at both hatcheries. Based on that, the effective number of male breeders at both hatcheries combined was 621.

Total effective hatchery population size was calculated by the following formula:

Total effective hatchery population size = (4 x (effective number of male breeders x total number of females in matings))/(effective numbers of male breeders + total number of females in matings)

$$1786 = (4 \times (621 \times 1590)) / (621 + 1590)$$

For the Snake River hatchery fall Chinook salmon population, the targeted minimum effective population size is 1,000. The critical threshold is thought to be around 500 (personal communication with Craig Busack PhD, NOAA fisheries). Based on the number of spawned fish at both LFH and NPTH since 2005, the program has been above the targeted minimum in all years (Figure 3). The general decline in the estimated hatchery effective population size observed since 2011 can be attributed to the multiple use of larger/older males in broodstock at both facilities, with less emphasis on spawning younger and smaller males which was a common practice prior to 2011.

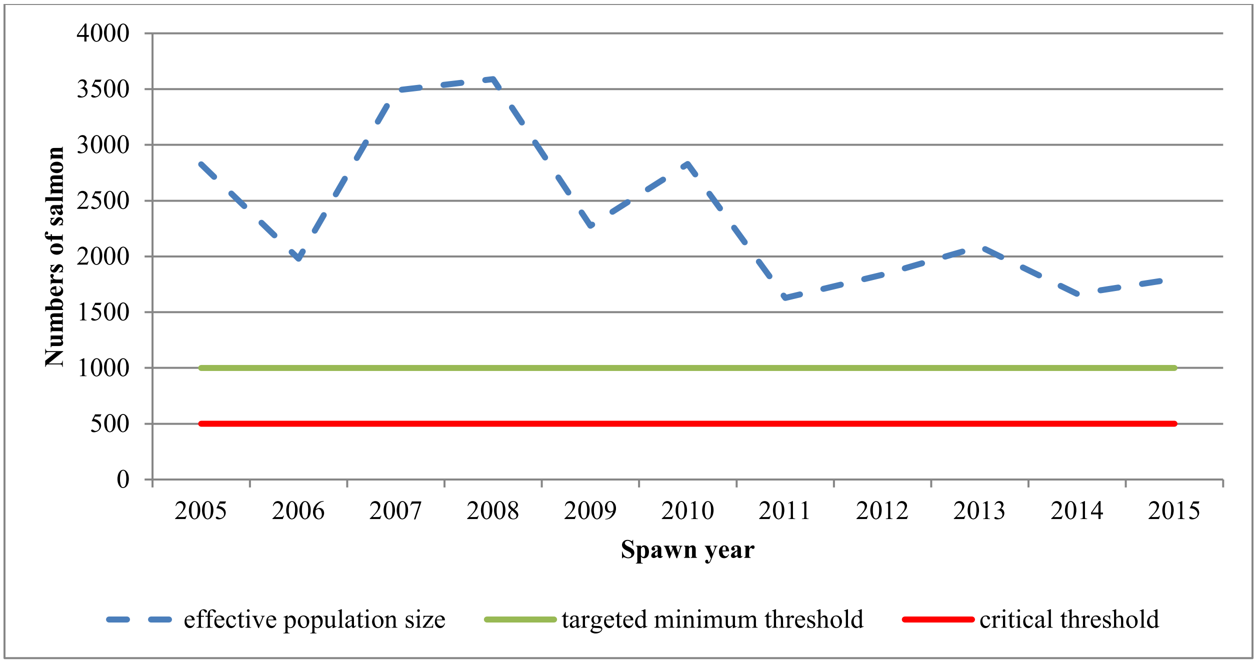


Figure 3. Effective population size for Snake River fall Chinook salmon hatchery production 2005-2015

Broodstock Profile

This was the fifth year fin tissue was taken from all fish contributing to broodstock, including those that were spawned but not used (Appendix G). This was the fourth year scales were taken from all fish contributing to broodstock in order to determine salt age and rearing type (subyearling, yearling, or reservoir reared subyearlings). Otoliths were also taken from the majority of unmarked/untagged fish (spawned and unspawned) hauled from LGR by staff from the University of Idaho to determine where fall Chinook salmon are rearing in the Snake River Basin using isotopic analysis of strontium levels ($^{87}Sr/^{86}Sr$) in the otoliths (Hegg 2013).

Beginning in 2010, concentrated effort is occurring to spawn older/larger sized males and females because of the large number of jacks and jills that had been used in the past and possible heritability of that trait. While not a completely accurate representation of the overall genetic contribution of larger fish to the broodstock, due to some larger males being used repeatedly, it provides a relative representation that can be used in future years when examining changes in age composition. Salt water age composition of fish used as broodstock are summarized pre and post protocol change in Figures 4-Figure 9). The origin composition and length frequencies of fall Chinook salmon used for broodstock at LFH in 2015 are presented in Figure 10 and Figure 11, respectively. Males used multiple times are counted multiple times in both figures and unknown origin includes inbasin hatchery, out-of-basin hatchery (stray) and natural origin fish.

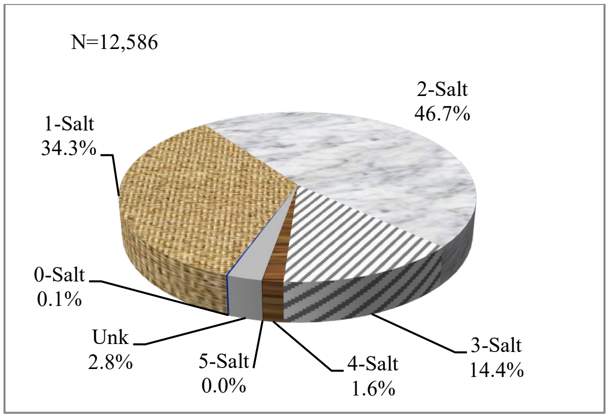


Figure 4. Salt age composition of all broodstock 2005 – 2009.

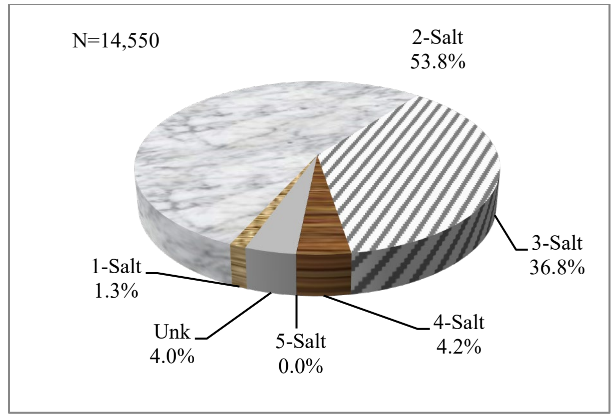


Figure 5. Salt age composition of all broodstock 2010 – 2015.

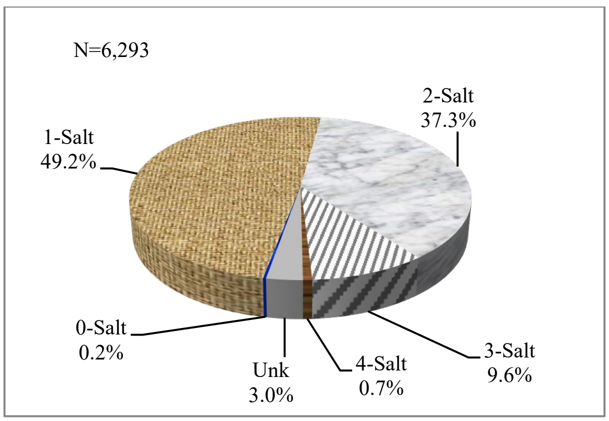


Figure 6. Male salt age composition of broodstock 2005 – 2009.

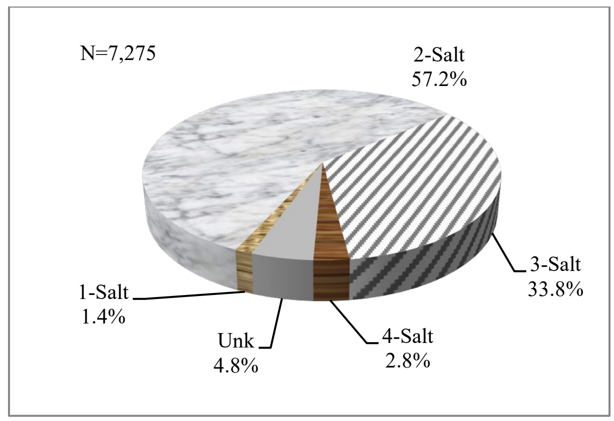


Figure 7. Male salt age composition of broodstock 2010 – 2015.

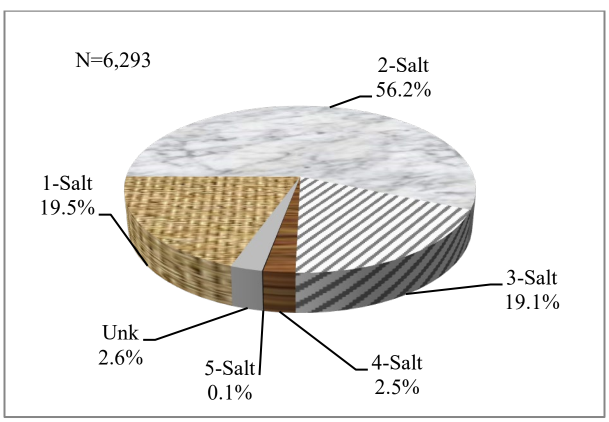


Figure 8. Female salt age composition of broodstock 2005 – 2009.

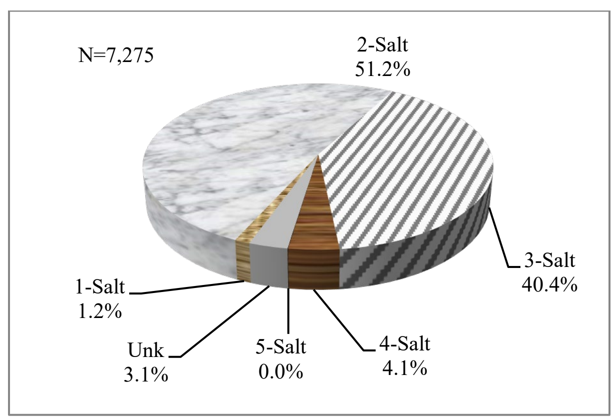


Figure 9. Female salt age composition of broodstock 2010 – 2015.

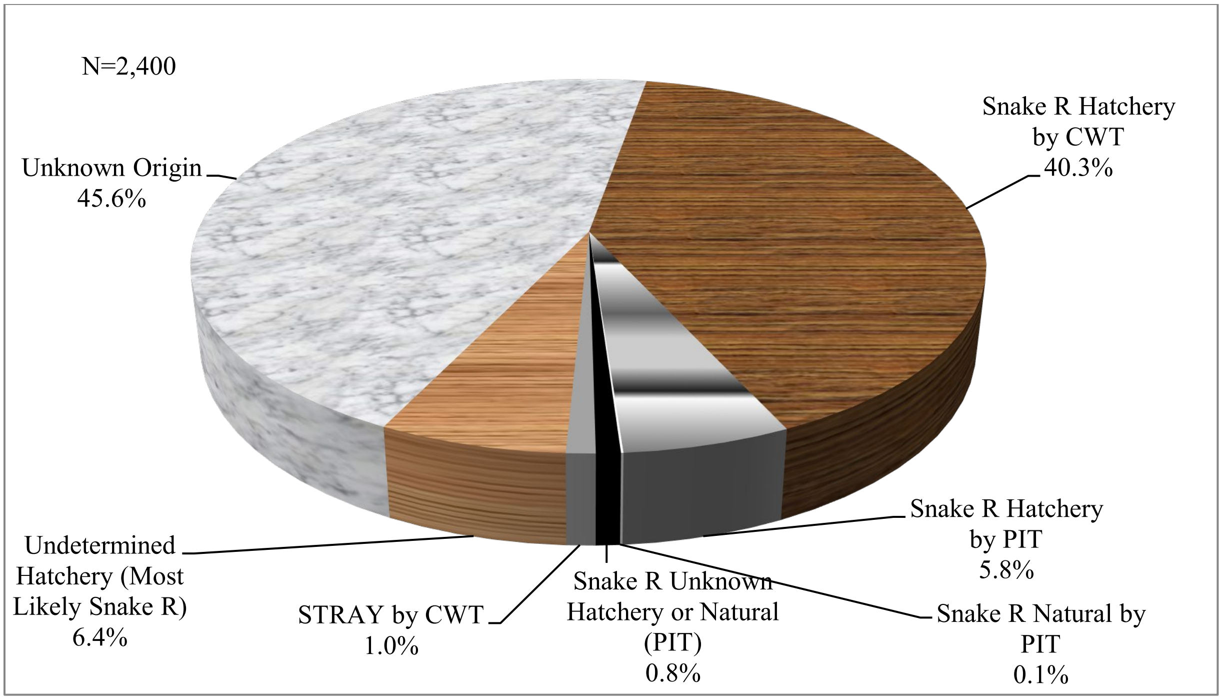


Figure 10. Percentages by fish origin contributing to fall Chinook salmon broodstock at LFH during 2015.

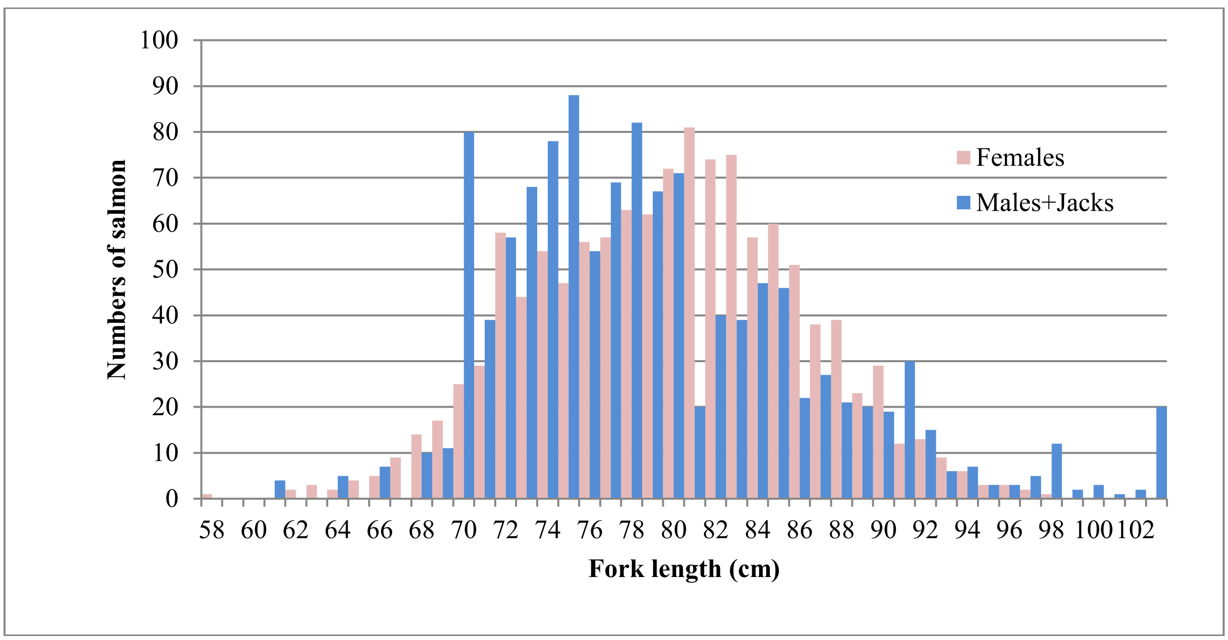


Figure 11. Fork lengths of fall Chinook salmon used as broodstock at LFH in 2015.

Males used in broodstock

Males hauled to LFH were trapped at LGR throughout the run (Figure 12), at nearly identical rates represented by the overall return. Additional males were also trapped at LFH on 16 Nov, but run timing is not available for those fish.

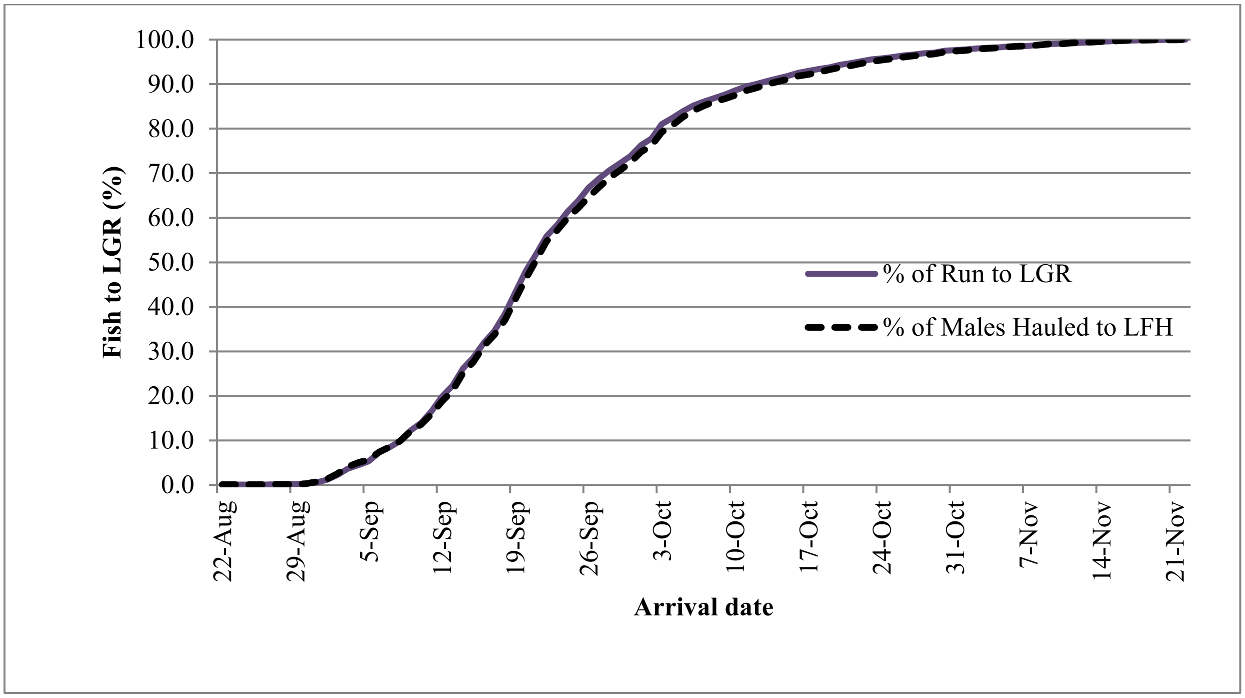


Figure 12. Arrival timing of male (adults + jacks) fall Chinook salmon at LGR compared to the arrival dates of fall Chinook salmon hauled to LFH during 2015.

Origin, including release site information was determined for 36.4% of the males spawned based on CWT or PIT tag data. An additional 6.1% of the males were identified as hatchery origin based AD clip, lost/unreadable tags, or yearling scales with a hatchery check. Males that were unmarked/untagged (hatchery and natural origin) represent 57.5% of the males spawned. Of the total number of males spawned, 83.2% had subyearling juvenile life history, 9.2% yearling, with the remaining 7.6% from unknown age or reservoir reared fish (Table 7).

Table 7. Origin and age of males that contributed to production at LFH, 2015.

	Times each male was used for mating						
Origin determination method / age	**1**	**2**	**3**	**4**	**5**	**6**	**Total spawned males**
Snake R hatchery by CWT							
subyearling 2 salt (age3)	3	16	12	2	0	0	**33**
subyearling 3 salt (age4)	11	26	25	7	1	1	**71**
subyearling 4 salt (age5)	2	1	4	1	0	0	**8**
yearling 2 salt (age4)	2	17	15	1	0	0	**35**
yearling 3 salt (age5)	1	3	2	1	0	0	**7**
Snake R hatchery by PIT							
subyearling reservoir reared 2 salt (age4)	0	1	4	0	0	0	**5**
subyearling 3 salt (age4)	2	4	12	0	0	0	**18**
subyearling 4 salt (age5)	1	2	0	0	0	1	**4**
yearling 3 salt (age5)	0	0	0	0	0	1	**1**
Snake R natural by PIT							
subyearling 3 salt (age4)	1	0	0	0	0	0	**1**
Snake R unknown by PIT							
reservoir reared 2 salt (age4)	0	0	1	0	0	0	**1**
subyearling 3 salt (age4)	0	1	0	0	0	0	**1**
unknown age	0	0	1	0	0	0	**1**
Unknown hatchery by clip, wire or yearling scales							
subyearling 2 salt (age3)	2	3	5	0	0	1	**11**
subyearling 3 salt (age4)	0	2	10	1	0	0	**13**
subyearling 4 salt (age5)	0	0	1	0	0	0	**1**
yearling 1 salt (age3)	0	1	0	0	0	0	**1**
yearling 2 salt (age4)	1	1	1	0	0	0	**3**
unknown age	0	2	0	0	0	0	**2**
Unknown origin							
reservoir reared 2 salt (age4)	3	1	2	1	0	0	**7**
subyearling reservoir reared 2 salt (age4)	0	1	0	0	0	0	**1**
subyearling 2 salt (age3)	12	24	22	0	0	1	**59**
subyearling 3 salt (age4)	38	73	55	3	0	7	**176**
subyearling 4 salt (age5)	14	10	5	0	0	0	**29**
unknown age	5	9	6	0	0	2	**22**
Total unique males	**98**	**198**	**183**	**17**	**1**	**14**	**511**

Females used in broodstock

Females hauled to LFH were trapped at LGR throughout the season (Figure 13), at nearly identical rates represented by the overall return. Additional females were also trapped at LFH on 16 Nov, but run timing is not available for those fish. Origin and release site information was determined for 57.3% of the females spawned based on CWT or PIT tag data. An additional 6.0% of the females were identified as hatchery origin based either on an AD clip, Agency wire tag (AWT), lost/unreadable tags or yearling scales with a hatchery check. Females that were not tagged or clipped represent 36.7 % of the females spawned. The estimated age composition and origins of females contributing to broodstock at LFH are listed in Table 8. Similar to the males used in broodstock, of the total number of females spawned, 72.4% had subyearling juvenile life history, 20.8% yearling, and the remaining 6.8% were from unknown age or reservoir reared fish.

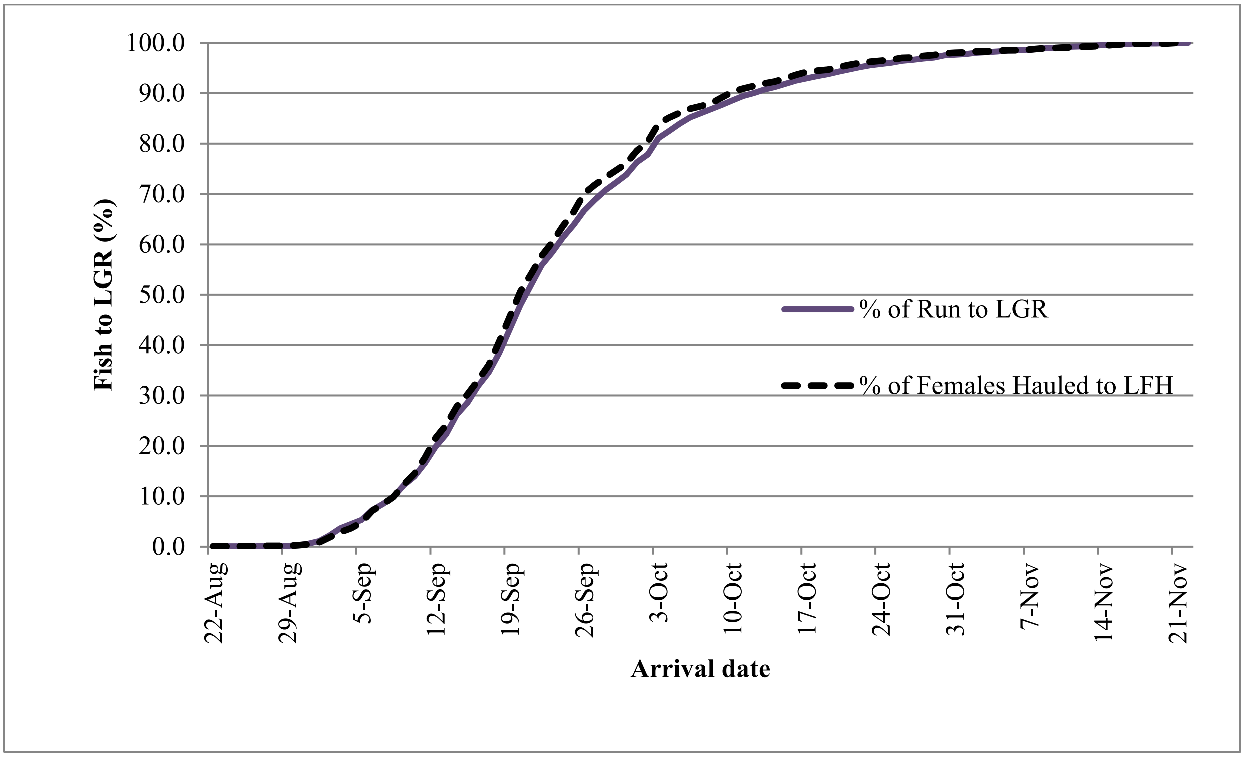


Figure 13. Arrival timing of female fall Chinook salmon at LGR compared to arrival dates of fall Chinook salmon hauled to LFH during 2015.

Table 8. Origins and age of females that contributed to production at LFH, 2015.

Origin and determination method	Age	Number of females
Snake R hatchery		
Snake R hatchery by CWT	reservoir reared 2 salt (age4)	**1**
	subyearling reservoir reared 2 salt (age4)	**2**
	subyearling 2 salt (age3)	**51**
	subyearling 3 salt (age4)	**252**
	subyearling 4 salt (age5)	**51**
	yearling 1 salt (age3)	**1**
	yearling 2 salt (age4)	**178**
	yearling 3 salt (age5)	**54**
Snake R hatchery by PIT	subyearling reservoir reared 2 salt (age4)	**11**
	subyearling reservoir reared 3 salt (age5)	**2**
	subyearling 3 salt (age4)	**38**
	subyearling 4 salt (age5)	**10**
Snake R natural		
Snake R natural by PIT	subyearling 5 salt (age6)	**1**
Snake R unknown		
Snake R unknown by PIT	reservoir reared 2 salt (age4)	**7**
	reservoir reared 3 salt (age5)	**2**
	subyearling 3 salt (age4)	**1**
	subyearling 4 salt (age5)	**1**
	unknown age	**1**
Out of basin hatchery		
STRAY Hatchery by CWT	subyearling 2 salt (age3)	**3**
	subyearling 3 salt (age4)	**6**
	subyearling 4 salt (age5)	**4**
	yearling 2 salt (age4)	**3**
	yearling 3 salt (age5)	**8**
Undetermined hatchery		
Undetermined hatchery by clip, wire or yearling scales with a hatchery check	subyearling 2 salt (age3)	**6**
	subyearling 3 salt (age4)	**53**
	subyearling 4 salt (age5)	**4**
	yearling 2 salt (age4)	**4**
	yearling 3 salt (age5)	**1**
	unknown age	**4**
Unknown origin		
Unknown origin	reservoir reared 2 salt (age4)	**16**
	reservoir reared 3 salt (age5)	**9**
	subyearling reservoir reared 2 salt (age4)	**3**
	subyearling 2 salt (age3)	**34**
	subyearling 3 salt (age4)	**228**
	subyearling 4 salt (age5)	**126**
	unknown age	**24**
Total		**1,200**

Lengths by Age of CWT fall Chinook salmon that are part of the LSRCP Program Compared to Strays

Hatchery fish that were not released within the lower Snake River basin (strays) are included in the fish trapped for broodstock and generally do not contribute to broodstock if there is a CWT present. Data presented below consists of LSRCP, FCAP, and out of basin strays with CWTs, and includes fish used as broodstock, fish killed outright, non-viable fish, and dead in pond fish. While the length at age data allow for comparisons by sex, hatchery, and juvenile life history, these data do not represent the age composition of the population because of size selective (non-random) hauling protocols at LGR. It should also be noted that subyearlings classified as 1-salt include some fish that reservoir reared. Size at age of return was calculated for wire tagged yearling (Table 9) and subyearling (Table 10) LSRCP releases (including FCAP) and out-of-basin strays processed by WDFW. Recoveries of fish that are part of IPC and NPTH programs are not included below. The sizes at age of return of LSRCP fish were not different than the sizes of out-of-basin strays processed. Historical sizes at age of return LSRCP program fish are provided in Appendix H.

Table 9. Sex, origin, and median fork length by age at return of CWT fall Chinook salmon processed in 2015 by WDFW that were part of hatchery yearling juvenile releases.

			Total age at return				
Sex	**Origin**	**Fork length**	0-salt	1-salt	2-salt	3-salt	4-salt
Male	LFH	*N*	36	60	125	12	-
		Median (cm)	34	53	70	76	-
		Range (cm)	30-37	42-66	52-88	74-87	-
	Stray	*N*	-	-	4	6	-
		Median (cm)	-	-	71	83	-
		Range (cm)	-	-	65-74	78-91	-
Female	LFH	*N*	-	7	213	62	-
		Median (cm)	-	58	73	80	-
		Range (cm)	-	55-63	63-86	71-90	-
	Stray	*N*	-	-	4	13	-
		Median (cm)	-	-	71	82	-
		Range (cm)	-	-	67-76	71-88	-

Table 10. Sex, origin, and median fork length by age at return of CWT fall Chinook salmon processed in 2015 by WDFW that were part of hatchery subyearling juvenile releases.

			Age at return				
Sex	**Origin**	**Fork length**	0-salt	1-salt	2-salt	3-salt	4-salt
Male	LFH	*N*	-	22	78	30	1
		Median (cm)	-	46	65	77	-
		Range (cm)	-	37-57	52-84	64-95	85
	Stray	*N*	-	-	2	1	1
		Median (cm)	-	-	-	-	-
		Range (cm)	-	-	60-65	68	81
Female	LFH	*N*	-	-	35	123	11
		Median (cm)	-	-	72	80	84
		Range (cm)	-	-	61-78	63-88	77-87
	Stray	*N*	-	-	1	3	10
		Median (cm)	-	-	-	68	83
		Range (cm)	-	-	74	68-82	77-89

Fecundity

Average fecundity of females used in broodstock that were trapped at LGR was 3,777 eggs/female and females trapped at LFH was 3,091 eggs/female. These fecundities are only of fish retained for broodstock and not the average fecundity of females returning to the Snake River Basin due to trapping and broodstock spawning protocols that minimize jills from being included in broodstock.

Inclusion of Natural Origin Fish

This was the thirteenth year that unmarked/untagged fall Chinook salmon were included in broodstock. The estimated percent natural origin fish used in WDFW broodstock (pNOB) was 15% (Figure 14), well under the 30% target. The overall pNOB for LFH and NPTH combined was 16%. To estimate pNOB, a dataset was constructed to reflect all parents contributing to production. Males used with multiple females were included multiple times. Unmarked/untagged fish trapped at LFH were presumed to be unmarked hatchery fish or stray natural origin fish from out of the basin. To estimate natural origin fish, unmarked/untagged fish were split into multiple categories by sex and age based on scales. Unmarked/untagged fish with unknown scale age were estimated based on the composition of the scales that were aged in each category from the broodstock. After aging was estimated for all unmarked/untagged fish (natural origin and hatchery origin) trapped at LGR, each age and sex category was summed and multiplied by the proportion of natural origin fish of the same category using run reconstruction estimates.

pNOB = (total number estimated natural parents/total number of parents) x100

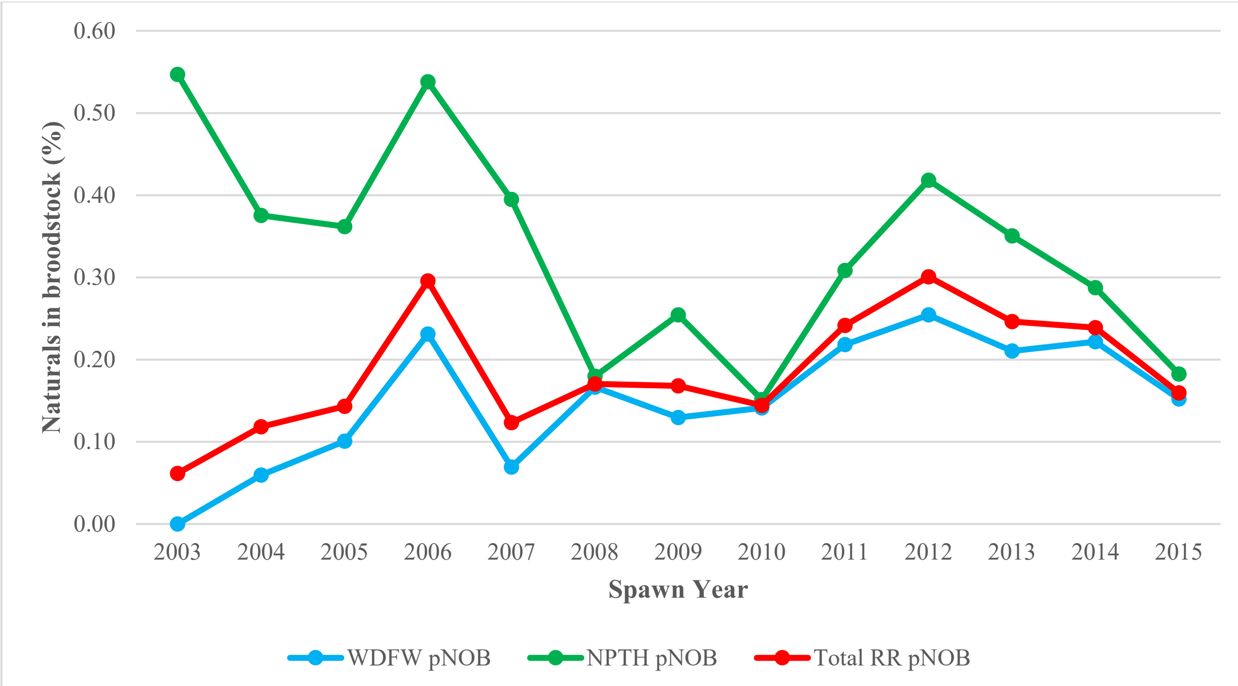


Figure 14. Estimated percent natural origin parents in broodstock at LFH, NPTH, and overall for Snake River basin hatchery production, 2003-2015

Jacks and Jills in Broodstock

As described above, WDFW has implemented a size selective mating protocol, with one of the main goals to reduce and/or eliminate the contribution/influence of mini-jacks, jacks, and jills in the broodstock. We calculated saltwater age for wire tagged fish by subtracting 1 from the total age of subyearlings and 2 from the total age of yearlings. This method overestimates saltwater ages for subyearlings since reservoir rearing is not taken into consideration. Untagged fish are scale sampled and reservoir rearing is used to estimate salt water age. Between 2000 and 2009, percent of contribution of jacks and jills in broodstock averaged a minimum estimate of 62.3% (Appendix I). Intensive monitoring/screening of jacks and jills present in the broodstock began in 2010 in order to minimize their contribution to future production (Table 11). This monitoring and subsequent management action has reduced the total matings of 0-salt and/or 1-salt parentage by 96% within the last six years.

Table 11. Number of matings of minijacks, jacks, and jills contributing to broodstock at LFH, 2010-2015, during size-selective mating protocols.

Year	0-salt	1-salt jack	1-salt jill	Number of matings containing jack x jill mating	% of total matings with 0-salt and/or 1-salt parentage
2010	0	38	2	0	3.2
2011	0	50	37	3	6.7
2012	0	2	3	0	0.4
2013	0	9	45	1	4.3
2014	0	0	0	0	0
2015	0	2	1	0	0.1
Average	**0**	**16.8**	**14.7**	**0.7**	**2.5**

Inclusion of Strays in Broodstock

The WDFW goal is to fully exclude known strays from broodstock to maintain the genetic integrity of the fall Chinook salmon LFH produces. Fish are verified as a stray by CWT or PIT tag and are generally hatchery origin. In years where broodstock may be limited, it was agreed that 5% strays may be included. To assure productions goals were met as mandated in the 2008-2017 *United States v. Oregon* Management Agreement, 52 stray females were spawned in 2015 and gametes were retained until the end of the spawning season. When it was verified that production goals were met, 28 of the progeny of the strays were culled. Strays retained as broodstock over the years are presented in Table 12.

Table 12. Historical use of out of basin strays in broodstock: 2007-2015.

Year	Total number of matings	Matings including Stray males[a]	Matings including Stray females	Number of matings containing stray x stray mating	% of total matings with stray parentage
2007	1,458	3	7	0	0.7%
2008	1,309	1	0	0	0.1%
2009	1,293	0	1	0	0.1%
2010	1,238	3	9	0	1.0%
2011	1,251	0	6	0	0.5%
2012	1,184	0	1	0	0.1%
2013	1,240	6	59	1	5.2%
2014	1,162	0	0	0	0.0%
2015	1,200	0	24	0	1.9%
Average	1,259	**1**	**12**	**0**	**1.1%**

[a] Males used multiple times are included multiple times.

Rearing and Marking and Tagging

Information regarding eggs taken, egg loss, eggs culled, eggs shipped or retained, and numbers of fish ponded is included in Table 13. Historical egg take and ponding information is listed in Appendix J. Rearing followed standard hatchery procedures as described in the Snake River fall Chinook salmon HGMP available at http://www.fws.gov/lsnakecomplan/Reports/HGMPreports.htm. Detailed information regarding type and size of vessels used for rearing can be found in LFH Annual Reports available at http://www.fws.gov/lsnakecomplan/Reports/WDFWreports.html.

Table 13. Eggs taken and survival numbers by life stage of fall Chinook salmon spawned at LFH, brood years 2010-2015.

Brood year	Eggs Taken	Egg loss	Eggs destroyed [a]	Eggs shipped	Eyed eggs retained	Fry ponded	Intended program
2011	4,723,501	165,001	0	1,785,600	2,772,900	960,000	Yearling
						1,812,900	Subyearling
2012	4,526,108	141,608	0	1,480,000	2,904,500	1,010,000	Yearling
						1,894,000	Subyearling
2013	4,565,660	119,550	0	1,558,800	2,887,310	980,000	Yearling
						1,907,310	Subyearling
2014	4,787,615	177,415	96,700	1,540,000	2,973,500	1,000,000	Yearling
						1,978,500	Subyearling
2015	4,569,472	127,974	132,098	1,540,000	2,769,400	930,000	Yearling
						1,839,400	Subyearling

[a] Eggs culled due to ELISA results, strays or jills or jacks matings.

Marking and tagging of fish was consistent with the 2008- 2017 *US v. Oregon* Management Agreement. Yearling fish were ADCWT marked/tagged and CWT tagged from 21 July - 6 August. After marking and tagging, all but 34,000 fish were diverted to the rearing lake. Approximately 17,000 ADCWT fish were diverted into one raceway and 17,000 CWT only fish were diverted into a second raceway. Staff performed tag and fin clip quality control checks from a sample of each group immediately prior to their PIT tagging, and subsequent movement to the rearing lake (Table 14).

Subyearlings released at LFH were ADCWT marked/tagged from 31 March - 2 April. All subyearlings were kept in raceways prior to release. Staff performed tag and fin clip quality control checks from a sample of each raceway prior to PIT tagging and release.

Subyearlings released into the Grande Ronde River (GRR) were ADCWT marked/tagged from 31 March - 2 April at Irrigon Fish Hatchery. All subyearlings were kept in two raceways prior to release (marked/tagged and unmarked/untagged). Staff performed tag and fin clip quality control checks from a sample prior to PIT tagging and release (Table 14).

Table 14. Numbers of fall Chinook salmon sampled by WDFW for marking and tagging quality control checks.

Brood year /age	Release site	Mark type	CWT	Number sampled	AD/ CWT	AD only	CWT only	Unmarked/ untagged
2014 Yearling	LFH	ADCWT	636886	1,867	1,807 (96.8%)	51 (2.7%)	5 (0.3%)	4 (0.2%)
	LFH	CWT only	636885	1,881	0 -	0 -	1,814 (96.4%)	67 (3.6%)
2014 Subyearling	LFH	ADCWT	636882	1,907	1,771 (92.9%)	122 (6.4%)	4 (0.2%)	10 (0.5%)
	GRR	ADCWT	636883	1,873	1,803 (96.3%)	68 (3.6%)	2 (0.1%)	0 (0.0%)

Staff PIT tagged 30,000 onstation yearlings and 20,000 onstation subyearlings for the purpose of monitoring outmigration timing, adult returns in-season, and to compare two methods (CWTs vs PIT tags) of estimating smolt-to-adult survivals (SARs). The tag lists for each release group were submitted to PTAGIS and fish were assigned to monitor mode to allow them to be treated like non-PIT tagged fish when intercepted at dams. Initial tag loss and mortalities of the yearlings could not be collected and scanned for PIT tags, as the fish were diverted directly into the earthen rearing pond at the time of tagging where they remained until release. After release, the pond and outlet structure were scanned for shed tags and tags from mortalities. A total of 159 tags (0.5%) were detected, leaving an estimated 29,841 PIT tags representing the onstation yearling release.

PIT tagged BY14 onstation subyearlings were returned directly to raceways following PIT tagging. Tagging events resulted in 94 mortalities (0.5%), leaving an estimated 19,906 PIT tags representing the onstation subyearling release.

Subyearling fall Chinook salmon at Irrigon Fish Hatchery were also PIT tagged for the sole purpose to monitor outmigration timing. Tagging events resulted in 14 mortalities (0.5%), leaving an estimated 2,986 PIT tags representing the subyearling release into the GRR.

Juvenile Releases

Brood year 2014

Subyearling

Subyearling fall Chinook salmon at LFH were released 18 May 2015. Fish were measured and weighed prior to release (Table 15). Upon visual inspection the fish appeared in good condition, with no external signs of BKD, pop-eye, descaling, or sexual precocity. An estimated 219,359 fish were released as an ADCWT group. Hatchery staff conducted pound counts and calculated the release at 58.0 fish/lb (fpp). Fish used in the pound counts were set aside for SRL staff to subsample for individual lengths and weights (Table 15). Individual length/weight samples and average pound counts were very similar. The release occurred during a decreasing hydrograph in the Snake River. Historical releases (2009 to present) of subyearlings by WDFW, NPT, and IPC are provided in Appendix K.

Subyearling fall Chinook salmon reared at Irrigon FH were released into the GRR on 18 May 2015, a couple weeks earlier than programmed due to forecasted low flows. An estimated 207,701 fish were released as an ADCWT group and 248,400 were released as unmarked/untagged. Fish were measured, weighed, and visually appeared in good condition, with no external signs of BKD, pop-eye, descaling, or sexual precocity. ODFW staff provided pound counts and the release was calculated at 48.9 fpp, similar to what was calculated from individual length/weight sampling from SRL staff. The release occurred during a decreasing hydrograph in the GRR.

Table 15. Length and weight data from subyearling fall Chinook salmon (BY14) sampled by WDFW and released into the Snake and Grande Ronde rivers during 2015.

Length/weight data	Snake R at LFH	Grande Ronde R at Cougar Creek
Sample date	18 May	15 May
Number sampled	226	410
Avg. length (mm)	87	90
Median length	87	91
Range of lengths	66-107	57-106
SD of lengths	7.3	7.6
CV of length (%)	8.5	8.4
Avg. weight (g)	7.6	9.4
SD of weight	2.0	2.4
Avg. K factor	1.15	1.24
FPP	59.4	48.4

Yearling

Yearling fall Chinook salmon at LFH were released from 4 to 6 April 2016, with peak emigration occurring on 4 and 5 April. Fish were measured and weighed prior to release (Table 16) Upon visual inspection the fish sampled appeared in good condition, with no external signs of BKD, pop-eye, descaling, or sexual precocity. Fish were well smolted, slender and very uniform in size with an average CV of 8.0. An estimated 246,874 fish were released from the ADCWT group, and 240,303 were released from the CWT only group. Hatchery staff set aside fish throughout the release for SRL staff to subsample for individual lengths and weights (Table 16). The rearing lake was fully drained 6 April with the last few fish leaving the release structure that day. The release occurred during an increasing hydrograph in the Snake River. Historical releases from 2010 to the present for yearlings by WDFW and NPT are provided in Appendix K.

Table 16. Length and weight data from yearling fall Chinook salmon (BY14) released at LFH in 2016.

	Yearlings	
Length/weight data	**ADCWT**	**CWT only**
Sample date(s)	4-6 April	4-6 April
CWT code	636886	636885
Number sampled	204	211
Avg. length (mm)	159	158
Median length	159	158
Range of lengths	123-207	123-207
SD of lengths	12.9	12.5
CV of length (%)	8.1	7.9
Avg. weight (g)	44.4	42.4
SD of weight	11.6	10.2
Avg. K factor	1.08	1.06
FPP	10.2	10.7

Survival Rates to Release

The estimated number of eggs and fish present at varying life stages in the hatchery were used for 2010-2014 broods to calculate survival rates within the hatchery environment (Table 17). The original in-hatchery survival goal for LFH production was calculated as 80% [(9,160,000 juveniles/11,450,000 eggs) x 100] (USACOE 1975) and has been achieved annually for yearlings since 2003 and since 1990 for subyearlings (Appendix L).

Table 17. Estimated survivals (%) between various life stages at LFH for fall Chinook salmon, 2010-2014 brood years.

Brood year	Release stage	Green egg-ponded fry	Ponded fry-release[a]	Green egg-release
2010	Yearling	96.4	101.9[a]	98.2
	Subyearling	96.4	98.9	95.4
2011	Yearling	95.0	102.1[a]	97.7
	Subyearling	95.0	98.2	96.4
2012	Yearling	95.9	99.9	95.8
	Subyearling	95.9	97.0	93.0
2013	Yearling	97.4	94.6	91.2
	Subyearling	97.4	97.6	94.1
2014	Yearling	95.2	97.1	92.5
	Subyearling	95.2	98.5	93.8
	%	**96.0**	**99.1**	**95.1**
Yearling mean:	**SD**	**1.0**	**3.2**	**3.1**
	%	**96.0**	**98.0**	**94.5**
Subyearling mean:	**SD**	**1.0**	**0.8**	**1.4**

[a] Survival estimates exceed 100% due to inventory tracking methodologies used at LFH.

Migration Timing

The PTAGIS website (www.ptagis.org) was queried for GRR and onstation subyearling and yearling releases. Interrogation summaries were used to populate Table 18- Table 20. Migration speed generally increased for all releases as fish moved downstream through the system (Figure 15 and Figure 16). The yearling release slowed their migration between IHR and MCN, possibly due to lower flows encountered upon entry into the Columbia River, but subsequently increased their speed through the lower Columbia River.

Table 18. Migration timing of BY14 PIT tagged subyearlings released near Cougar Creek in the GRR in 2015.

	Detection Facilities						
	LGR	**LGO[a]**	**LMO**	**IHR**	**MCN**	**JDD[a]**	**BONN[a b]**
Number detected	**356**	**256**	**88**	**121**	**102**	**120**	**38**
Mean travel days from GRR[c]	15	18	19	25	26	32	31
Median passage date	2 Jun	4 Jun	6 Jun	10 Jun	12 Jun	16 Jun	16 Jun
First detection date	25 May	27 May	31 May	2 Jun	8 Jun	28 May	11 Jun
Last detection date	13 Jun	10 Jul	1 Jul	30 Jun	2 Jul	14 Jul	2 Jul
10% of run passage date	29 May	31 May	3 Jun	6 Jun	9 Jun	10 Jun	14 Jun
90% of run passage date	5 Jun	9 Jun	9 Jun	22 Jun	18 Jun	5 Jul	23 Jun
TDG on median date of passage (%)[d]	109.8	110.3	113.3	111.6	113.7	111.0	113.8
Outflow on median date of passage (kcfs)[d]	60.1	59.3	50.5	43.3	163.0	129.9	197.4
Spill on median date of passage (kcfs)[d]	20.2	17.8	23.9	13.0	65.6	52.2	94.7

[a] LGO=Little Goose Dam, JDD=John Day Dam, BONN=Bonneville Dam
[b] TDG, outflow and spill for BONN are detected six miles downstream at Warrendale.
[c] Travel days are from the date of release.
[d] Detections are from the tailrace of each dam.

Table 19. Migration timing of BY14 PIT tagged subyearlings released at LFH in 2015.

	Detection Facilities				
	LMO	**IHR**	**MCN**	**JDD**	**BONN[a]**
Number detected	**1,289**	**766**	**736**	**795**	**216**
Mean travel days from LFH[b]	16	20	23	28	28
Median passage date	4 Jun	7 Jun	10 Jun	14 Jun	15 Jun
First detection date	19 May	22 May	28 May	4 Jun	5 Jun
Last detection date	26 Jun	30 Jun	29 Jun	14 Jul	29 Jun
10% of run passage date	27 May	2 Jun	5 Jun	10 Jun	10 Jun
90% of run passage date	8 Jun	14 Jun	14 Jun	21 Jun	21 Jun
TDG on median date of passage (%)[c]	112.8	112.6	112.7	111.9	114.7
Outflow on median date of passage (kcfs)[c]	62.3	49.6	153.6	118.4	185.3
Spill on median date of passage (kcfs)[c]	23.7	39.9	61.9	36.0	99.2

[a] TDG, outflow and spill for BONN are detected six miles downstream at Warrendale.
[b] Travel days are from the date of release.
[c] Detections are from the tailrace of each dam.

Table 20. Migration timing of BY14 PIT tagged yearlings released at LFH in 2016.

	Detection Facilities				
	LMO	**ICH**	**MCN**	**JDD**	**BONN[a]**
Number detected	**4,151**	**1,394**	**4,120**	**5,719**	**1,832**
Mean travel days from LFH[b]	8	10	15	17	18
Median passage date	11 Apr	12 Apr	18 Apr	20 Apr	20 Apr
First detection date	5 Apr	7 Apr	8 Apr	11 Apr	13 Apr
Last detection date	22 May	25 May	27 May	29 May	24 May
10% of run passage date	7 Apr	9 Apr	12 Apr	15 Apr	16 Apr
90% of run passage date	17 Apr	20 Apr	29 Apr	27 Apr	1 May
TDG on median date of passage (%)[c]	118.7	117.9	117.7	115.3	117.9
Outflow on median date of passage (kcfs)[c]	84.6	95.4	309.8	265.6	304.7
Spill on median date of passage (kcfs)[c]	28.1	85.5	160.3	79.5	115.3

[a] TDG, outflow and spill for BONN are detected six miles downstream at Warrendale.
[b] Travel days are from the date of release.
[c] Detections are from the tailrace of each dam.

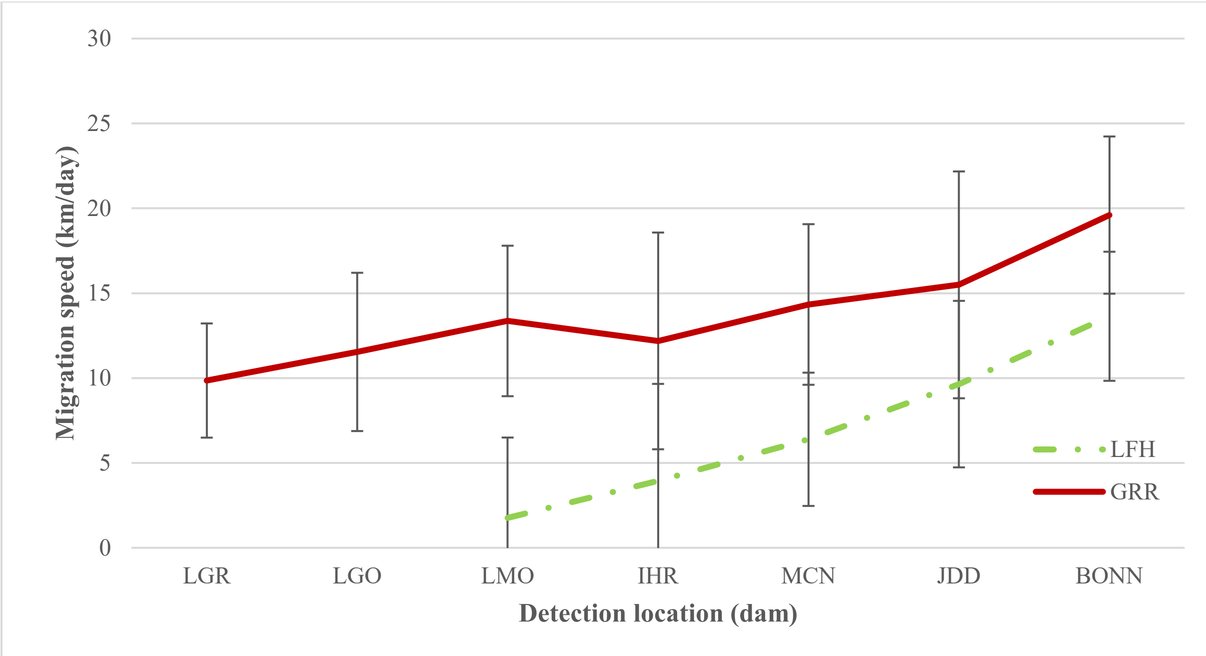


Figure 15. Migration speed of BY14 LFH and GRR subyearling fall Chinook salmon as they passed Snake and Columbia River dams in 2015.

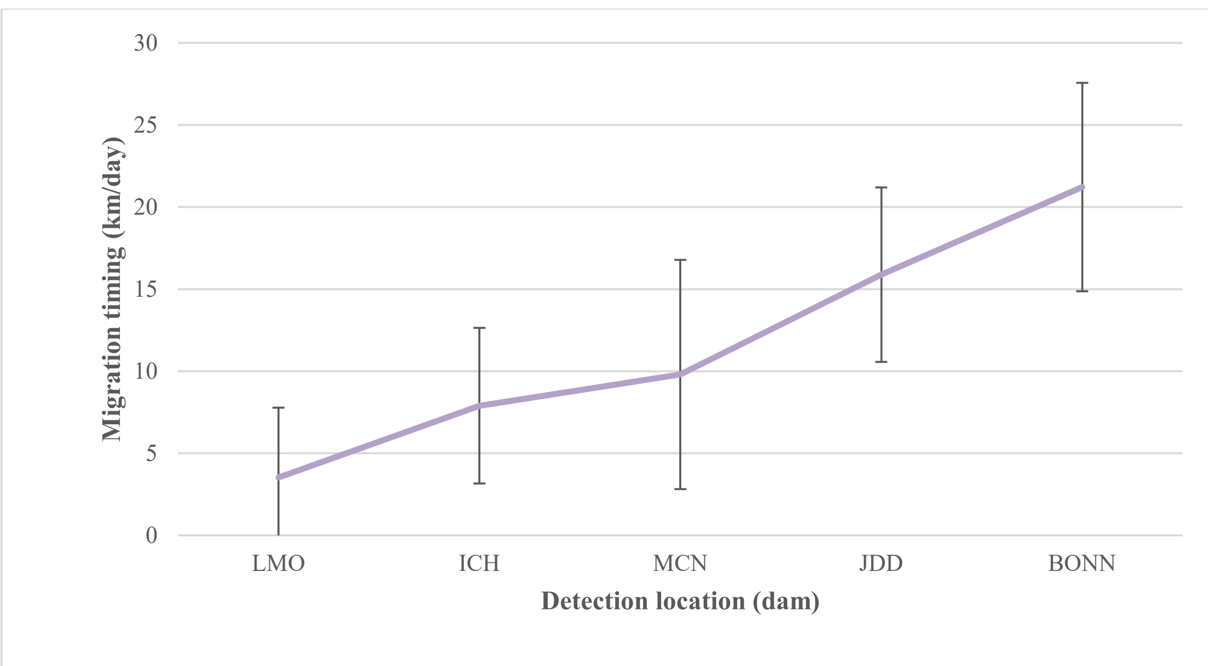


Figure 16. Migration speed of BY14 LFH yearling fall Chinook salmon as they passed Snake and Columbia River dams in 2016.

Tucannon River Natural Production 2015

Adult Salmon Surveys

Fall Chinook Salmon Redd Surveys

WDFW personnel have conducted spawning ground surveys for fall Chinook salmon on the lower Tucannon River since 1985 (Appendix M). Survey sections in 2015 covered the river from river kilometer (rkm) 1.1-33.6. The first 1.1 rkms of the Tucannon River is deep slack water from the Snake River's LMO Dam reservoir and no surveys or estimates are made for that area; the habitat is poor in this area and it is presumed no spawning occurs there. During 2015, landowner access restrictions prevented the surveying of 1.5 rkms above the Starbuck Bridge within survey sections 5 and 6 (Appendix M). Regular weekly surveys began the week of 18 October and continued until the week of 13 December.

A total of 311 redds (from all species) were counted in the Tucannon River (Table 21) and we estimate an additional 204 redds occurred in sections of river not surveyed due to access restrictions from landowners and/or survey conditions. Redds built in inaccessible sections were estimated by calculating redds/km in an adjacent surveyed section and applying it to the non-surveyed area. The fully expanded number of fall Chinook and coho salmon redds combined was 515. Based on staff observations of redd origin and applying it to the total, we would estimate 489 (95%) fall Chinook and 26 (5%) coho salmon redds. However, fish counts at LMO dam indicated that 1.9% of the returns were coho salmon. Given that some staff had little redd survey experience, and in particular identifying redds from a particular species, it was decided to use the composition of fall Chinook and coho salmon at LMO to estimate redds in the Tucannon River. After applying 1.9% to the total number of redds, we estimate 9 redds were from coho salmon and 506 redds were from fall Chinook salmon.

Table 21. Date and number of redds and carcasses counted on the Tucannon River in 2015.

Week beginning	Total redds [a]	Carcasses sampled	
	Chinook & Coho [b]	**Chinook**	**Coho**
18 Oct	0	1	0
25 Oct	12	0	0
1 Nov	70	14	0
8 Nov	62	45	0
15 Nov	99	80	0
22 Nov	29	36	0
29 Nov	39	53	0
6 Dec [c]	no data	no data	no data
13 Dec	0	3	0
Totals	**311**	**232**	**0**

[a] Observed redds not expanded for sections with access restrictions.
[b] Chinook & Coho redd data estimated through visual counts were combined.
[c] High flows and low visibility prevented surveys from being completed this week.

Escapement and Composition of the Fall Chinook Salmon Run in the Tucannon River

The total escapement to the Tucannon River is based on an expansion factor of three fish/redd. We believe this expansion factor provides a conservative estimate of fish spawning in the Tucannon River. Based on that expansion, an estimated 1,518 fall Chinook and 27 coho salmon escaped to the Tucannon River (Table 22). We recovered 232 fall Chinook salmon carcasses (17.2%) of the estimated total spawning escapement to the Tucannon River. Coho salmon were also recovered on the Tucannon River and associated tables can be found in Appendix M.

Table 22. Estimated escapement, redd construction, and resulting estimates of smolts/redd and total number of emigrants from fall Chinook salmon spawning in the Tucannon River, 2002-2015.[a]

			Redd construction [a]			Success of spawning		
Brood year	Estimated escapement [b]	% Strays in carcasses sampled	# Redds observed	# Redds in no access areas (est.)	Total # of redds (est.)	Estimated smolts/redd [c]	Total # estimated emigrants [d]	Adult progeny to escapement ratio
2002	630	35.1	183	27	210	81	17,030	0.05
2003	474	65.8	143	15	158	460	72,656	0.04
2004	345	29.4	111	4	115	631	72,655	0.03
2005	198	60.0	61	5	66	320	21,170	0.17
2006 [e]	460	9.7	127	26	153	289	44,296	0.04
2007	326	7.0	93	16	109	Unknown [f]	Unknown [f]	0.53
2008	763	16.5	209	45	254	20	5,030	0.03
2009 [g]	756	10.7	217	35	252	147	36,991	0.35
2010	972	27.0	281	43	324	76	24,315	0.13
2011	906	4.2	278	24	302	67	20,331	0.21 [h]
2012	1,623	4.9	256	285 [i]	541	231	124,951	0.03 [j]
2013	1,158	8.5	261	125 [i]	386	24	9,262	0.00 [k]
2014	909	10.6	265	38	303	514	155,791	Pending
2015	1,518	8.9	295	211 [i]	506	148	47,487	Pending

[a] Numbers presented in this table may be different from prior reports and represent the most accurate estimates of escapement and production in the Tucannon to date.
[b] These estimates were derived using three fish per redd and no adjustments were made for super imposition of redds.
[c] This estimate was derived using redds counted above the smolt trap and estimates of emigration the following spring.
[d] This estimate was derived using the smolt per redd estimate above the trap and applying it to the total number of redds in the Tucannon River.
[e] Includes approximately 2.3% summer Chinook in escapement that contributed to production estimate.
[f] No estimate was made because the smolt trap sampling box had a hole in it and fish escaped
[g]. First year of using new methodology to estimate proportion of fall Chinook salmon redds based upon proportions of fall Chinook salmon in carcass recoveries. Excludes one summer Chinook redd located below the smolt trap.
[h] Estimate through age 4 returns.
[i] Adjustment includes estimates for weeks not walked due to temperature and water conditions.
[j] Estimate through age 3 returns
[k] Estimate through age 2 returns

The methodology used to estimate run composition of fall Chinook salmon in the Tucannon River was modified in 2012 to account for carcass recovery bias. Generally, more recoveries of females occur than males, primarily because females remain in the vicinity of redds when they die. The numbers of females in the composition were expanded to match the estimated number of redds, presuming 1 redd/female. The numbers of males and jacks are estimated presuming 2 males and/or jacks per redd. The jack ratio is estimated using window counts at LMO. Recovered CWT and scale analysis were used to determine the origin and age of each carcass**.** Compositions of recovered carcasses are presented in Table 23-Table 25.

Females represented 62.9% of the carcass recoveries; primarily adult 2-salt and 3-salt fish. Tissue samples (fin clips or skin samples from the head) were collected and archived from 16 fall Chinook salmon (genetic sample numbers 15PT01-15PT16).

Table 23. Composition of wire tagged carcasses recovered and estimated run composition of fall Chinook salmon on the Tucannon River, 2015

	Clip	CWT origin	CWT	Raw totals F	Raw totals M ≥53 cm	Raw totals M <53 cm	Expanded to the run F	Expanded to the run M ≥53cm	Expanded to the run M <53cm	Total
Inbasin wire fish	AD	LF11SO	636417	3	1	0	10.4	12.0	0.0	22.4
		LF11YO	636443	9	2	0	31.2	24.1	0.0	55.3
		LF11YO	636444	30	14	0	104.0	168.7	0.0	272.6
		LF12SO	636574	6	6	0	20.8	72.3	0.0	93.1
		LF12YO	636583	2	1	2	6.9	12.0	24.1	43.1
		LF12YO	636584	6	6	3	20.8	72.3	36.1	129.2
		LF13YO	636741	0	0	1	0.0	0.0	12.0	12.0
		NPTH12SCFA	220222	0	1	0	0.0	12.0	0.0	12.0
	NO	LF10YO	636079	3	2	0	10.4	24.1	0.0	34.5
		LF11YBCA	220331	1	0	0	3.5	0.0	0.0	3.5
		LF11YO	636443	37	11	0	128.2	132.5	0.0	260.8
		LF11YO	636444	6	1	0	20.8	12.0	0.0	32.8
		LF12YO	636583	2	8	2	6.9	96.4	24.1	127.4
		LF12YO	636584	1	0	0	3.5	0.0	0.0	3.5
		LF13YO	636740	0	0	2	0.0	0.0	24.1	24.1
Out-of-basin wire fish	AD	09BLANK	090909	0	1	0	0.0	12.0	0.0	12.0
		BONN10YUMA	090489	0	1	0	0.0	12.0	0.0	12.0
		BONN10YUMA	090490	3	0	0	10.4	0.0	0.0	10.4
		BONN10YUMA	090491	2	0	0	6.9	0.0	0.0	6.9
		BONN10YUMA	090492	1	1	0	3.5	12.0	0.0	15.5
		UMA11SUMA	090585	1	0	0	3.5	0.0	0.0	3.5
		UMA11SUMA	090655	0	1	0	0.0	12.0	0.0	12.0
		UMA11SUMA	090656	0	0	1	0.0	0.0	12.0	12.0
	NO	BONN11YUMA	090658	2	1	0	6.9	12.0	0.0	19.0
		BONN12YUMA	090685	1	1	0	3.5	12.0	0.0	15.5
		UMA12SUMA	090704	0	1	0	0.0	12.0	0.0	12.0
		LWS10SLWSALMR	055070	1	0	0	3.5	0.0	0.0	3.5
Totals				**117**	**60**	**11**	**405.5**	**722.9**	**132.5**	**1260.9**

Table 24. Composition of untagged carcasses recovered and estimated run composition of fall Chinook salmon on the Tucannon River, 2015.

			Raw totals			Expanded to the run			
				M	M		M	M	
Origin	**Clip**	**European age**	**F**	**≥53cm**	**<53cm**	**F**	**≥53cm**	**<53cm**	**Total**
Hatchery	AD	0.2	1	3	0	3.5	36.1	0.0	39.6
		0.3	11	2	0	38.1	24.1	0.0	62.2
		1.2	2	0	0	6.9	0.0	0.0	6.9
	NO	1.2	1	0	0	3.5	0.0	0.0	3.5
		1.3	1	0	0	3.5	0.0	0.0	3.5
Unknown	NO	0.1	0	0	1	0.0	0.0	12.0	12.0
		0.2	9	2	0	31.2	24.1	0.0	55.3
		0.3	4	4	0	13.9	48.2	0.0	62.1
		0.4	0	1	0	0.0	12.0	0.0	12.0
Totals			**29**	**12**	**1**	**100.5**	**144.6**	**12.0**	**257.1**

Table 25. Estimated composition of the fall Chinook salmon run to the Tucannon River by salt water age and origin, 2015.

	0 salt	1 salt		2+ salt			
Origin	**Minijack**	**True jack**	**True jill**	**Adult F**	**Adult M**	**Total**	**% of return**
Snake River hatchery (wire)	36.1	265.0	38.1	329.2	457.8	1126.4	74.2%
Presumed Snake River hatchery (AD clip or yearling scales)	0.0	0	0	55.5	60.2	115.7	7.6%
Out-of-basin hatchery	0.0	12.0	3.5	34.7	84.3	134.5	8.9%
Unknown origin	0.0	12.0	0.0	45.1	84.3	141.4	9.3%
Totals	**36.1**	**289.1**	**41.6**	**464.4**	**686.7**	**1518.0**	**100.0%**
% of return	**2.4%**	**19.0%**	**2.7%**	**30.6%**	**45.2%**		

Juvenile Salmon Emigration

Juvenile fall Chinook salmon (BY14) were observed at the Tucannon River smolt trap (rkm 3.0) from 20 January through 18 June 2015 (Figure 17). The last day of trapping was 26 June (Gallinat and Ross 2016). Trapping efficiency for fall Chinook salmon ranged from 5.1% to 18.2% (Table 26). Median passage date for fall Chinook salmon was 17 May, approximately two weeks earlier than was observed in 2014 and four weeks earlier than 2013. Staff captured 15,295 fall Chinook salmon and estimate that 134,213 (95% C.I. = 116,166-157,400) naturally produced fall Chinook salmon parr and smolts passed the smolt trap during 2015. Based on 261 redds estimated above the smolt trap during 2014, an estimated 514 smolts/redd were produced. After including potential production from redds below the smolt trap in 2014, an estimated 155,791 naturally produced fall Chinook parr and smolts left the Tucannon during 2015.

Staff PIT tagged 770 naturally produced fall Chinook salmon, ≥ 70 mm FL, at the smolt trap from 3 May through 15 June 2015 to monitor outmigration. Lengths of PIT tagged fish ranged from 70-103 mm FL. Unfortunately, lengths were not taken systematically to represent the run so the data only profiled the PIT tagged portion of the population. Migration timing and average speed of migration of naturally produced fall Chinook salmon leaving the Tucannon River to the Snake and Columbia River dams are presented in Table 27 and Figure 18, respectively.

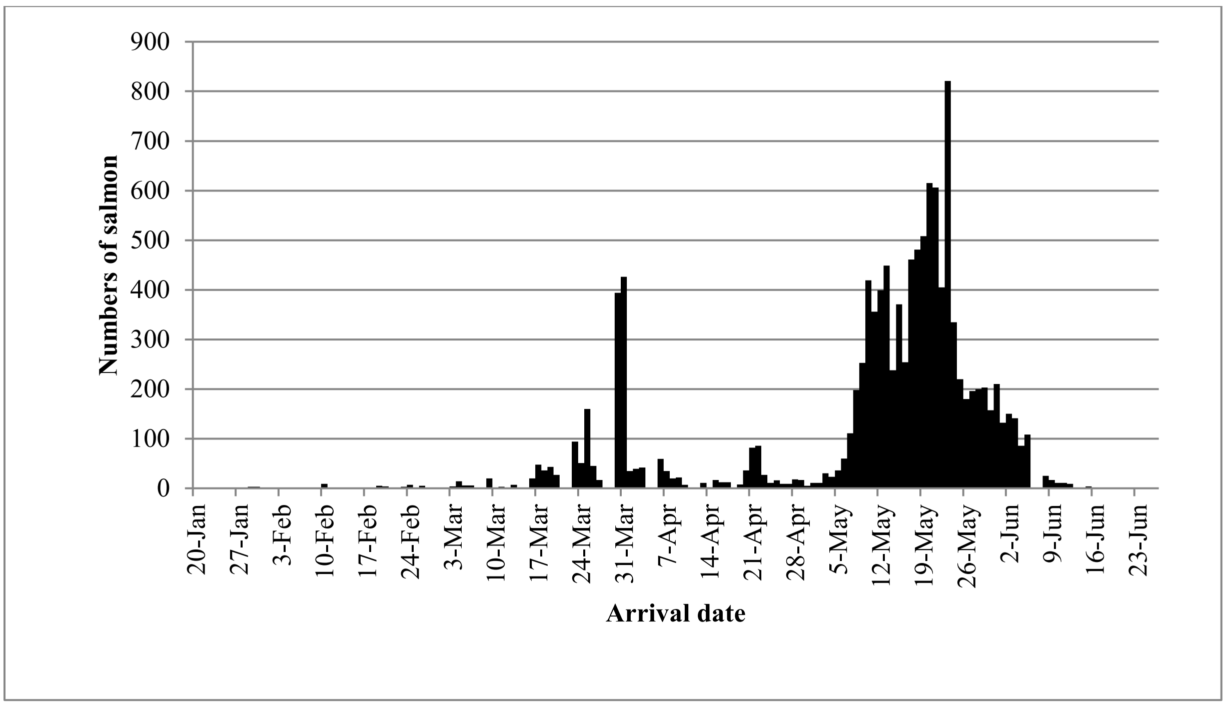


Figure 17. Distribution of the timing of juvenile natural origin fall Chinook salmon trapped on the Tucannon River in 2015.

Table 26. Trapping efficiency estimates for fall Chinook and coho salmon at the smolt trap on the Tucannon River in 2015.

Week beginning	Fall Chinook salmon recapture efficiency	Coho recapture efficiency
12 Apr	unknown	0.0%
19 Apr	unknown	0.0%
26 Apr	14.6%	31.3%
3 May	18.2%	28.6%
10 May	14.9%	14.0%
17 May	10.7%	11.8%
24 May	5.1%	5.0%
31 May	14.2%	33.3%
7 Jun	9.5%	0.0%

Table 27. Migration timing of naturally produced fall Chinook salmon leaving the Tucannon River in 2015.

	Detection Facilities				
	LMO	**ICH**	**MCN**	**JDD**	**BONN**[a]
Number detected	**51**	**24**	**24**	**21**	**8**
Mean travel days from LFH[b]	6	15	21	26	24
Median passage date	31 May	8 Jun	17 Jun	17 Jun	18 Jun
First detection date	9 May	15 May	21 May	24 May	23 May
Last detection date	9 Jun	8 Jul	1 Jul	14 Jul	29 Jun
10% of run passage date	15 May	19 May	31 May	30 May	23 May
90% of run passage date	5 Jun	28 Jun	26 Jun	4 Jul	28 Jun
TDG on median date of passage (%)[c]	116.9	115.2	114.3	111.0	113.2
Outflow on median date of passage (kcfs)[c]	50.6	59.9	130.7	125.4	129.6
Spill on median date of passage (kcfs)[c]	22.9	50.1	65.2	50.5	85.9

[a] TDG, outflow and spill for BONN are detected six miles downstream at Warrendale.
[b] Travel days are from the date of release.
[c] Detections are from the tailrace of each dam.

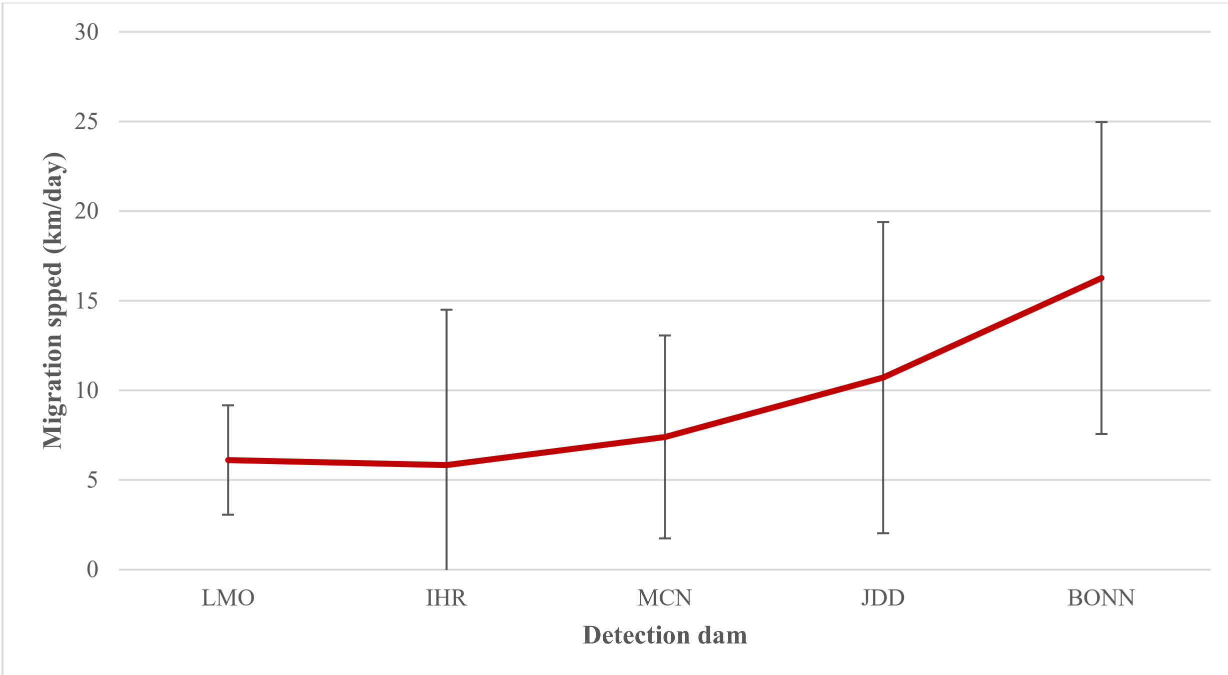


Figure 18. Migration speed of BY13 Tucannon River natural origin fall Chinook salmon in 2015.

Fall Chinook Salmon Run Size and Composition 2015

Returns to LGR and Composition of Fish Returning to LGR

Chinook salmon (all runs) were counted 24 hours per day 15 June through 30 September and 16 hours per day from 1 October through 31 December at the counting window at LGR (U.S. Army Corps of Engineers, 2015). Fish are measured by total length (TL) at fish passage windows. Window counts (day and night) estimated 70,827 fall Chinook salmon (≥ 30 cm TL) reached LGR in 2015 (Figure 19), which includes 11,527 "jacks" by size (30 cm-55 cm TL). Chinook passing LGR after 17 August are designated as fall Chinook salmon based on arrival date. Fish counts do not include fish less than 30 cm FL or adjust for fish that crossed the dam and fell back through the juvenile bypass system, spillway, turbines, or locks, some of which may have reascended the ladder and were double counted.

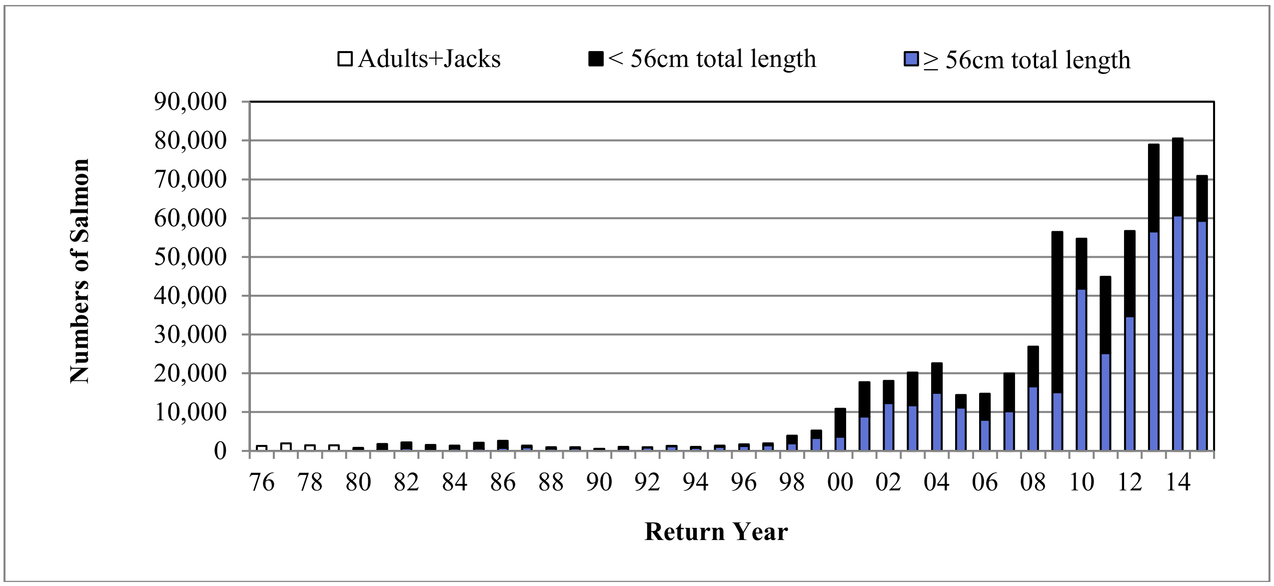


Figure 19. Fall Chinook salmon window counts at LGR, 1976-2015.

The fall Chinook salmon run reconstruction technical team estimated 65,726 fall Chinook salmon (26.8% wild, 71.1% in-basin hatchery, and 2.1% out of basin hatchery) reached LGR in 2015 (Table 28), after accounting for reascension and fallback. The final run estimate to LGR was 7.9% less than window count estimates (USACOE 2016). The fall Chinook salmon run reconstruction technical team consists of staff from NPT, WDFW, IPC, and NOAA. The estimates were bootstrapped by Ben Sandford of NOAA and confidence intervals (CI) were derived for the dataset. Females, regardless of size, were summarized together and males were summarized according to FL (30 cm - <53 cm and ≥ 53 cm). Data was grouped by total age as requested by TAC. The data does not specifically show true jacks because age 2 fish consist of minijacks (0-salt yearlings) and jacks (1-salt subyearlings) and age 3 fish consist of jacks (1-salt yearlings) and adults (2-salt subyearlings).

Table 28. Estimated composition, standard errors, and confidence intervals for fall Chinook salmon reaching LGR during 2015.

Estimates					Bootstrap standard error					Bootstrap 95% CI upper CI, lower CI				
Total run by origin														
Origin	**F**	**M ≥53cm**	**M <53 cm**	**Total ≥53cm**	**Origin**	**F**	**M ≥53 cm**	**M <53 cm**	**Total ≥53cm**	**Origin**	**F**	**M ≥ 53cm**	**M <53 cm**	**Total ≥53 cm**
Total wild	5947	9826	1839	15773	Total wild	503	624	324	812	Total wild	5057, 6985	8742, 11109	1213, 2506	14295, 17496
Total hatchery	20353	22204	5557	42557	Total hatchery	542	610	341	764	Total hatchery	19224, 21343	20992, 23371	4892, 6209	40968, 43887
Totals	26300	32029	7396	58330	Totals	330	358	208	222	Totals	25620, 26904	31343, 32777	6997, 7834	57867, 58756
Run by origin and total age														
Origin	**F**	**M ≥53cm**	**M <53 cm**	**Total ≥53cm**	**Origin**	**F**	**M ≥53cm**	**M <53cm**	**Total ≥53cm**	**Origin**	**F**	**M ≥53cm**	**M <53 cm**	**Total ≥53 cm**
Wild age 2	133	171	1643	304	Wild age 2	42	75	303	86	Wild age 2	47, 204	47, 337	1111, 2271	139, 465
Wild age 3	1947	8593	167	10540	Wild age 3	242	485	145	553	Wild age 3	1486, 2416	7529, 9492	-162, 413	9375, 11568
Wild age 4	2082	680	28	2762	Wild age 4	435	494	26	659	Wild age 4	1250, 3024	-215, 1734	0, 84	1593, 4245
Wild age 5	1775	381	0	2156	Wild age 5	202	130	0	236	Wild age 5	1378, 2159	111, 648	0, 0	1698, 2621
Wild age 6	10	0	0	10	Wild age 6	11	0	0	11	Wild age 6	0, 40	0, 0	0, 0	0, 40
Hat age 2	7	136	4410	142	Hat age 2	6	67	364	67	Hat age 2	-1, 21	25, 276	3614, 5086	26, 277
Hat age 3	2586	9320	1101	11906	Hat age 3	272	568	235	626	Hat age 3	2038, 3119	8304, 10568	695, 1619	10817, 13287
Hat age 4	13616	11365	47	24981	Hat age 4	533	642	48	835	Hat age 4	12492, 14561	9964, 12544	0, 158	23058, 26391
Hat age 5	3113	1043	0	4156	Hat age 5	357	197	0	407	Hat age 5	2405, 3815	680, 1447	0, 0	3345, 4917
Stray age 2	46	26	0	72	Stray age 2	25	23	0	34	Stray age 2	0, 93	0, 78	0, 0	0, 141
Stray age 3	0	53	0	53	Stray age 3	0	36	0	36	Stray age 3	0, 0	0, 132	0, 0	0, 132
Stray age 4	45	103	0	148	Stray age 4	27	51	0	58	Stray age 4	0, 105	24, 215	0, 0	51, 271
Stray age 5	807	131	0	938	Stray age 5	260	61	0	269	Stray age 5	415, 1400	25, 255	0, 0	502, 1562
Stray age 6	15	0	0	15	Stray age 6	16	0	0	16	Stray age 6	0, 48	0, 0	0, 0	0, 48
Agency wire	120	26	0	145	Agency wire	41	27	0	50	Agency wire	45, 202	0, 85	0, 0	59, 251

[a] Agency wire refers to 09 agency code.

Fallbacks at the LGR Juvenile Collection Facility

A total of 1,866 fallback events were counted at the juvenile collection facility (Table 29) and the separator (Table 30) located below LGR. These fallback events occur when fish encounter the traveling screens that bypass fish away from the turbines and shunt them to the juvenile collection facility. Fish can also fallback over the spillway, go through the turbine slot or navigation lock, but we did not estimate fallback for those routes.

Table 29. Documented fallbacks of Chinook salmon at the LGR juvenile collection facility during 2015 by clip and wire.

Run	Clip	Wire	<30cm	30-53cm[a]	Grand total
Chinook [b]	AD	No wire	3	1	4
		Wire	1	1	2
		Unknown	21	30	51
	No clip	No wire	1	4	5
		Wire	0	2	2
		Unknown	22	43	65
Fall Chinook salmon total			**48**	**81**	**129**

[a] Category does not differentiate males from females, although they are likely males.
[b] The run of Chinook is not identified during sampling and may include summer run Chinook.

Fish encountered at the juvenile collection facility and separator were examined for size, fin clips, and operculum punches. Of the fish < 53 cm, at least 59.9% were hatchery origin, although we expect the actual number of hatchery fish was greater because unclipped fish were not scanned for wire at the separator. Likewise, at least 53.2% of the fish ≥ 53 cm were of hatchery origin based solely on adipose clips.

Table 30. Composition of fallbacks of Chinook at the LGR separator in 2015 by clip and length.

Clip	<53cm [a]	≥53 cm [a]	Grand total
AD clip	328	632	960
No clip	220	557	777
Grand total	**548**	**1,189**	**1,737**

[a] Category includes males and females.

Characteristics of fall Chinook salmon reaching LGR Dam

The following data summaries derived from the fall Chinook salmon handled at the LGR adult trap. These data include hatchery and natural origin fall Chinook salmon.

Sex Ratio

The estimated 2015 return, based on run reconstruction estimates, consisted of 60.0% males, including jacks. The sex ratio of the return based on the trap sample was calculated at 1.5 males+jacks/female. After removal of fish for broodstock, fish passing LGR were 67.4% males resulting in 2.1 males+jacks/female.

Length Frequencies

Salmon trapped at LGR were measured and numbers of fish at each length were expanded by the trapping rate on the day they were captured to represent the overall run, at that size, during that day (Figure 20). Median FL for males and females was 65 cm and 77 cm, respectively. Males were 2 cm longer on average in 2015 than in 2014. Median FL for females did not change between 2015 and 2014. Overall, median length of males appears to be increasing (Figure 21), and could be attributed to broodstock collection protocol changes that began in 2010 or ocean conditions.

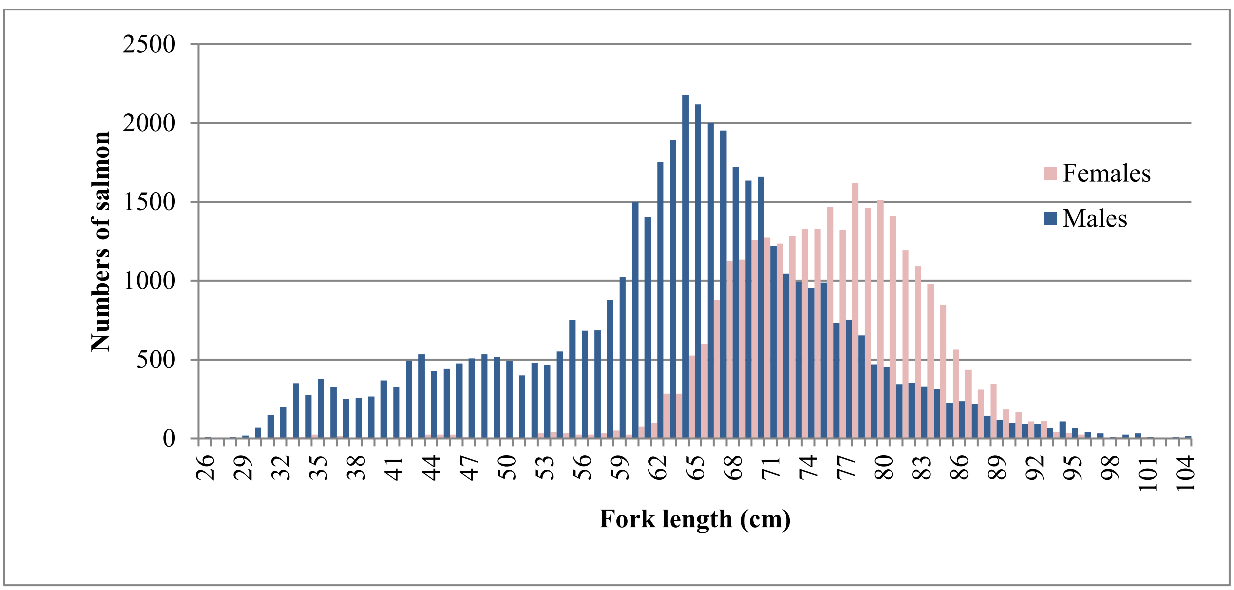


Figure 20. Estimated length frequencies of the fall Chinook salmon run <u>to</u> LGR by sex in 2015.

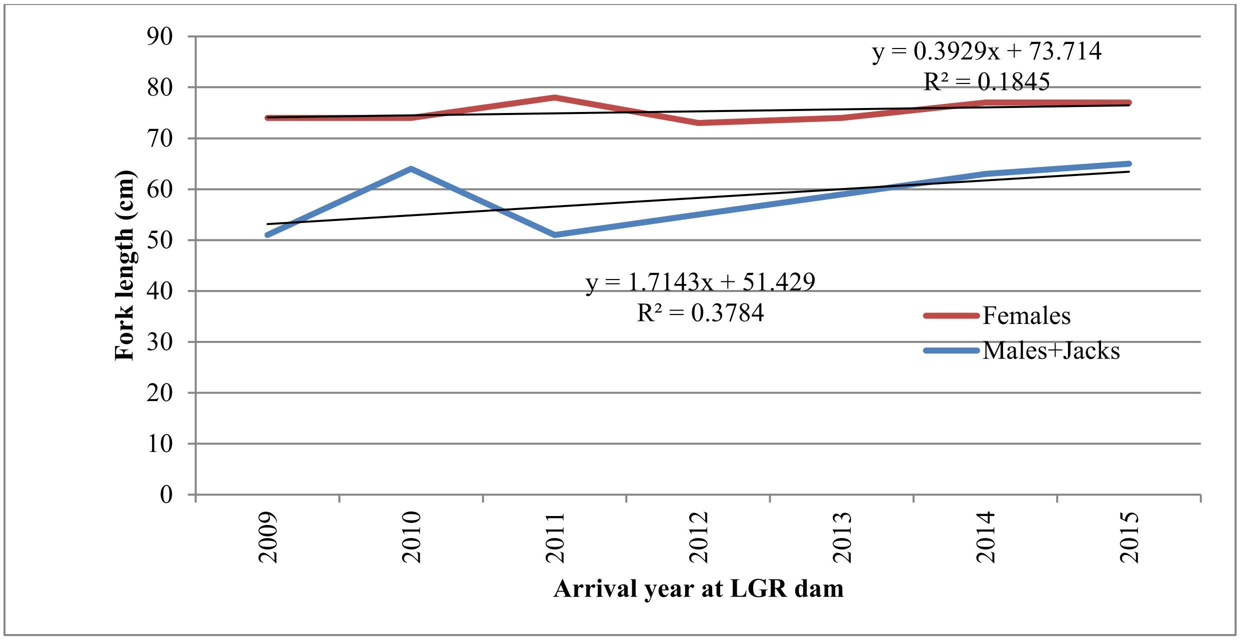


Figure 21. Historic median fork lengths of females and males+jacks arriving at LGR dam, 2009-2015.

Fallback Rates of Onstation Releases at LGR

Fallback rates for fall Chinook salmon released onstation at LFH (both yearling and subyearling) are being assessed through a fidelity and fallback radio telemetry study that is scheduled to run through 2017. Results of fallback rates for LFH onstation releases, as well as other inbasin fall Chinook salmon, will be presented once the study is completed.

Status of Mitigation Requirements

Overall Mitigation Level

To estimate the overall mitigation return, certain caveats of the data are required. Salt water age was estimated by subtracting 1 from the total age of subyearlings and subtracting 2 from the total age of yearlings. These estimates underestimate jacks and overestimate adults because they do not take into account reservoir rearing of the subyearling component. Estimated recoveries of WDFW releases outside of the Snake River are fully expanded, but the FCAP recoveries only include CWT recoveries and are not expanded to account for untagged fish associated with those groups or adjusted for detection method. Mitigation numbers presented in this report are therefore considered minimum estimates. The Regional Mark Processing Center (RMPC) website, www.rmpc.org, was queried on 7 December 2016 for the 2015 returns of CWT tagged fish associated with the LSRCP (FCAP and WDFW releases). A minimum estimated 33,894 (37.0 %) of the total LSRCP mitigation goal of 91,500 fish was achieved in 2015. An additional 11,594 fall Chinook salmon were recovered outside of the Snake River basin.

Returns to the Project Area

The LSRCP mitigation goal of 18,300 fish returning to the Snake River was exceeded in 2015 (Table 31). An estimated 22,300 (122% of the LSRCP project area goal) fall Chinook salmon (adults+jacks) returned from WDFW and FCAP releases into the Snake River. Combining recoveries of fish harvested below LGR, killed at LFH, the carcasses recovered on Tucannon River and the estimated run to LGR provides the best estimate of mitigation returns (tagged and untagged fish). These estimates do not include inbasin hatchery returns from the IPC and the NPTH programs.

Harvest in the Project area

In 2015, anglers in Washington were allowed a daily harvest of six adipose-clipped adult fall Chinook salmon and six jacks. In Idaho, anglers were also allowed a daily limit of six adipose-clipped adults, but there were no limits (number or fin clips) for jack retention in Idaho.

On the Snake River (Washington and Idaho combined), there were 511 CWT recoveries (expanded and not expanded) reported in the Regional Mark Information System (RMIS) database from LSRCP and FCAP releases, but only two were captured below LGR (Table 32). IDFG did not report expanded harvest estimates and Tribal harvest was not reported at all.

Table 31. Estimated returns of LSRCP (WDFW and FCAP) fall Chinook salmon to the Snake River and levels of mitigation goals met in 2015.

	Saltwater age					Total ESTD (Adult+ Jack)	% of LSRCP goal to the Snake River
	0-salt	1-salt		2-4 salt			
Location	**Minijack [a]**	**Jack [b]**	**Jill [c]**	**Adult F**	**Adult M**		
Harvested FCH below LGR [d]	0	1	0	0	1	2	0.0%
Estimated run to the Tucannon R.	32	236	34	334	439	1042	5.7%
Run to LGR [e] (wire+nowire)	1,433	3,111	106	9,173	8,866	21,256	116.2%
Total	**1,465**	**3,348**	**140**	**9,507**	**9,306**	**22,300**	**121.9%**

[a] Minijacks are males that did not spend a year in salt water.
[b] Jacks are males that spent 1 year in salt water.
[c] Jills are females that spent 1 year in salt water.
[d] Harvest includes recoveries of fish released by WDFW and FCAP.
[e] Estimated run to LGR for LSRCP (includes surrogates part of the transportation study) and FCAP releases and includes fish hauled to LFH and NPTH for processing as well as fish released from the dam.

Table 32. Estimated Snake River basin recoveries in 2015 of wire tagged LSRCP (WDFW and FCAP) fall Chinook salmon as reported to RMIS on 12/7/2016.

		0-salt	1-salt	2-4 salt	Total ESTD	% Catch
Freshwater sport location		**Minijack**	**Jack**	**Adult**	**Adult+Jack**	**by location**
Below LGR	Snake R mouth-IHR	0	1	1	2	0.4%
Above LGR	Snake LGR-ID	0	34	316	350	68.5%
	Snake R above HWY12	1	15	80	96	18.8%
	Snake R below Salmon R	0	18	38	56	11.0%
	Snake R above Salmon R	0	0	1	1	0.2%
	Clearwater R	0	2	4	6	1.2%
Totals		**1**	**70**	**440**	**511**	

Recoveries Outside of the Snake River Basin

Approximately 11,594 (15.8%) of the 73,200 downriver fish harvest goal was met through returns in 2015 from LSRCP and FCAP releases. Of the 11,594 fish harvested, 7,344 salmon (10% of the harvest goal) were harvested outside of the Snake River Basin from WDFW releases (onstation at LFH, CCD, and GRR) after expanding for sampling methodologies reported and including associated untagged fish estimated in catches (fully expanded estimates). FCAP releases contributed 4,250 CWT tagged fish (adults and jacks) reported to RMIS (not fully expanded for untagged fish harvested or adjusted for detection method), although we do not include them further in this report.

Estimates of harvest for fish released by WDFW are listed in Table 33 – Table 35 and do not include recoveries of fish released by the NPT (LSRCP-FCAP or NPTH programs) or ODFW (IPC program).

Outside of the Snake River Basin, the majority (56.4 %) of recoveries reported to RMIS occurred in saltwater locations and 43.6% occurred in freshwater locations, with 69.1 % coming from commercial/tribal fisheries, 29.8 % from sport fisheries, 0.9% from spawning ground surveys, and 0.2% from hatcheries. Harvest in the ocean was primarily off the coasts of Washington, Oregon, and British Columbia, but the single largest fishery contributor was the Zone 6 Tribal Gillnet fishery which accounted for 22.8 % of all the fish harvested in 2015.

Harvest Adjustments for Non-Selective Fisheries and Errors in Reporting Detection Method

Non-selective fisheries retain any fall Chinook salmon captured, and include all the current commercial and tribal net fisheries. The Columbia River estuary sport fishery and Canadian and Alaskan sport fisheries are also non-selective. Mark selective fisheries included Washington and Oregon Columbia River sport and Snake River sport. The RMIS database was used to generate estimated (ESTD) harvest data of CWT tagged fish. Fish without CWTs are not reported to RMIS and therefore the CWT harvest estimates must be expanded by their associated release groups to reflect total harvest for mitigation purposes. Adjustments to RMIS harvest data were calculated differently based upon CWT detection methods listed below.

Proofing Data Reported to RMIS for Errors Regarding Detection Method

Since onstation yearling releases at LFH consist of two different tag codes and mark types each year, it is possible to determine if reporting agencies are accurately reporting detection methods. For instance, if a fishery is non-selective and detection method is reported as visual, it would be expected that only tag codes associated with AD clipped fish would be reported. In 2015, it was noted that the non-selective Columbia River Zone 1-5 and Zone 6 net fisheries were reported incorrectly as electronic. This type of misreporting underestimates harvest in those fisheries, because if the sampling was electronic, there would not be any expansions done for unclipped fish with a tag code. Extensive comparisons and adjustments were performed to assure fish contributing to LSRCP mitigation were accounted for. Misreporting errors were validated by looking at ocean fisheries where ADCWT groups were caught at similar rates as CWT only groups for each brood year. The error was also confirmed by comparing run reconstruction estimates by brood year, and clip. Corrections for misreporting were done using the following formula:

For each run year: Corrected CWT only harvest of tag code #1 by fishery and brood year=(ESTD harvest of ADCWT tag code #2/Total number of tag code # 2 wires released)*(Total number of tag code #1 wires released)

Next, the total number of CWTs were expanded to include untagged fish using the methods described in the following sections for non-selective fisheries.

Expansions to Account for Untagged Fish Harvested in Non-Selective Fisheries

Visual Detection Method
Visual detection means only adipose fin clipped fish were scanned for CWTs. Since Oregon, Canada, and Alaska primarily sample adipose clipped fish, but allow harvest of all fish, we expanded the RMIS estimated recoveries by determining an expansion factor based on release data for each tag code recovered. For example, if the tag code recovered was from a release of fish that had ADCWT, CWT only, AD only, and unmarked/untagged fish associated with a single tag code in the release, we used the following formula to expand harvest data of CWT fish to represent the total harvest:

ESTD CWTs harvested by fisheries from RMIS x (total # released that were associated with a tag code/# ADCWT in the release) = Revised ESTD total harvest

Electronic Detection Method
Electronic detection method means all fish were scanned for wire regardless of fin clip. For this detection type we used the following formula to expand the harvest data of CWT fish to estimate the total harvest:

ESTD CWTs harvested by fisheries from RMIS x (total # released that were associated with a tag code/(# ADCWT in the release + # CWT in the release) = Revised ESTD total harvest

Adjustment summary

For WDFW releases, Columbia River recoveries of tagged fish was increased by a factor of 1.57, after accounting for detection method. Estimated ocean harvest of tagged fish was increased by a factor of 1.15, primarily due to AK and BC primarily reporting as visually detected. The overall adjustment resulted in 1,863 more wire tagged fish recovered than were reported to RMIS, if only the ESTD were summed, and no expansions were made for untagged fish harvested.

Table 33. Fully expanded recovery estimates of tagged and untagged fall Chinook salmon recovered in the Columbia River Basin (freshwater areas) during 2015 for WDFW releases. Jacks and minijacks included in the estimates.

		Yearlings			Subyearlings							Total recoveries	
		LFH			LFH		CCD		GRR				
Recovery area	Fishery/ Hatchery/ River	EST CWT	EST CWT adj [a]	Total EST wire +no wire [b]	EST CWT	EST wire + no wire	EST CWT	EST wire + no wire	EST CWT	EST wire + no wire	Total EST wire + no wire [b]	Grand total EST CWT	Grand total EST wire + no wire
COL R Gillnet	Zone 1-5 Non-tribal Net	157	304	306	23	23	37	37	75	147	207	292	514
	Zone 6 Tribal Net	523	1044	1051	184	185	120	121	170	319	626	997	1,677
	BON Pool Net	3	3	3	0	0	0	0	0	0	0	3	3
Commercial Seine	Zone 1-5 seine	30	30	30	5	5	7	7	7	7	19	49	49
COL R Sport	Zone 1-5 sport	177	182	182	17	17	16	16	51	51	84	261	266
Estuary Sport	COL R Estuary	290	335	338	33	33	54	54	55	105	193	432	531
Freshwater Sport	Deschutes R Sport	2	2	2	0	0	0	0	1	2	2	3	4
	Drano LK	27	45	46	0	0	0	0	0	0	0	27	46
	Hanford Reach	19	19	19	0	0	0	0	8	15	15	27	35
	Mid-COL R Sport	1	1	1	0	0	0	0	0	0	0	1	1
Hatchery	Priest Rapids	2	2	2	1	1	1	1	4	8	10	8	12
	Bonneville	2	2	2	1	1	1	1	0	0	2	4	4
Carcass Survey	Hanford Reach	30	30	30	0	0	0	0	15	28	28	45	58
	Little White Sal R	0	0	0	0	0	0	0	5	10	10	5	10
Test fishery	New Test Zone 5	16	16	16	4	4	1	1	2	2	7	23	23
	OR	6	6	6	1	1	0	0	0	0	1	7	7
	WA	1	1	1	0	0	0	0	0	0	0	1	1
	Totals	**1,286**	**2,023**	**2,036**	**269**	**271**	**237**	**239**	**393**	**694**	**1,204**	**2,185**	**3,240**

[a] Estimate adjusted for unclipped CWT fish caught in nonselective fisheries using visual detection method and electronic detections where unclipped CWT fish were not harvested at the same rate as the ADCWT fish

[b] Estimate adjusted for untagged fish caught in nonselective fisheries.

Table 34. Fully expanded recovery estimates of tagged and untagged fall Chinook salmon in areas outside of the Snake River Basin (saltwater areas) during 2015 for WDFW releases. Jacks and minijacks are included in the estimates.

		Yearlings			Subyearlings							Total recoveries	
		LFH			LFH		CCD		GRR				
Region	**Fishery**	**EST CWT**	**EST CWT adj**	**Total EST wire + no wire**	**EST CWT**	**EST wire + no wire**	**EST CWT**	**EST wire + no wire**	**EST CWT**	**EST wire + no wire**	**Total EST wire + no wire**	**Grand Total EST CWT**	**Grand Total EST wire + no wire**
AK	Experimental Area Troll	3	5	5	4	4	2	2	13	26	32	22	37
	Marine Sport (DE,DT,MB,MR,MS)	8	16	16	18	18	0	0	0	0	18	26	34
	Traditional Drift Gillnet	6	12	12	0	0	4	4	0	0	4	10	16
	Traditional Purse Seine	8	16	16	0	0	0	0	0	0	0	8	16
	Traditional Troll	92	183	185	46	47	44	45	59	117	208	241	394
BC	Sport	118	237	240	21	21	14	14	30	57	92	183	332
	Troll Ice Boat	4	4	4	0	0	0	0	4	8	8	8	12
	Troll-Freezer Boat	78	78	79	9	9	9	9	21	42	60	117	139
	Troll-Ice Boat	134	137	138	31	31	25	25	14	27	84	204	222
CA	Ocean Troll (non-treaty)	17	34	35	0	0	0	0	3	6	6	20	41
COL	Marine Sport (private)	116	140	141	21	21	5	5	34	67	93	176	234
OR	Ocean Sport	63	79	80	0	0	0	0	5	9	9	68	89
	Ocean Troll	461	461	466	56	56	24	24	39	77	158	580	624
WA	Marine Sport	356	418	422	71	71	38	38	76	141	251	541	673
	Mixed net and seine	2	3	3	0	0	0	0	0	0	0	2	3
	Treaty Troll	512	512	518	69	69	40	41	77	151	261	698	778
	Troll (Non-treaty)	340	340	344	35	35	38	39	63	125	198	476	542
	Totals	**2,318**	**2,676**	**2,705**	**381**	**384**	**243**	**246**	**438**	**853**	**1,483**	**3,380**	**4,188**

Table 35. Fully expanded recovery estimates (tagged and untagged) of 2015 returns by region, rear type, and release location for fall Chinook salmon released by WDFW. Jacks and minijacks are included in the estimates.

	Yearlings		Subyearlings								Yearlings and Subyearlings combined	
	LFH		LFH		CCD		GRR		Total subyearlings			
Region	**ESTD wire +no wire**	**Recovery comp %**	**ESTD wire +no wire**	**Recovery comp by region %**	**ESTD wire +no wire**	**Recovery comp by region %**	**ESTD wire +no wire**	**Recovery comp by region %**	**ESTD wire +no wire**	**Recovery comp by region %**	**ESTD wire +no wire**	**Recovery comp by region %**
COL R.(freshwater)	2,036	43%	271	41%	239	49%	694	45%	1,204	45%	3,240	44%
AK	235	5%	69	11%	50	10%	143	9%	262	10%	497	7%
BC	461	10%	62	9%	49	10%	134	9%	244	9%	705	9%
CA	35	1%	0	0%	0	0%	6	0%	6	0%	41	1%
COL R (marine)	141	3%	21	3%	5	1%	67	4%	93	3%	234	3%
OR	546	12%	56	9%	24	5%	86	6%	167	6%	713	10%
WA	1,287	27%	176	27%	117	24%	417	27%	710	26%	1,997	27%
Total recoveries	**4,741**		**655**		**484**		**1,547**		**2,686**		**7,427**	
Recoveries by rear type	**64%**								**36%**			

Total Age of Yearling and Subyearlings Recovered Outside of the Snake River Basin

The Columbia River was the primary recovery area outside of the Snake River for both yearling and subyearling production groups (Table 36-Table 39). Fish from ADCWT yearling production released into the Snake River at LFH and subyearling production released into the GRR were primarily recovered as age 4 fish and subyearlings released at CCD and LFH were recovered as age 3 fish. Adjustments were not made to the original data presented by RMIS as ESTD in the tables below and do not include untagged fish.

Table 36. Final locations of ADCWT yearling fall Chinook salmon released onstation at LFH to areas outside of the Snake River basin in 2015 by total age, based on estimated recoveries reported to RMIS as of 12/7/16.

Brood year:	**2013**	**2012**	**2011**	**2010**	**2009**		
Total age:	**2 (MJ)**	**3 (Jack)**	**4**	**5**	**6**		**Non-Snake R. recovery location comp %**
Tag code:	**636741**	**636584**	**636444**	**636080**	**635564**		
ADCWT at release:	**0**	**247,714**	**240,413**	**246,918**	**226,621**		
Total release (wires+nowire):	**227,447**	**250,892**	**243,649**	**249,062**	**227,391**	**A+J Totals**	
AK			74	39	3	116	5%
BC		30	177	34		241	10%
CA			17			17	1%
COL	32	213	755	218		1,186	49%
OR	3	17	199	57		273	11%
WA		79	457	84		620	25%
Grand Total	35	339	1,679	432	3	2,453	
Percent of recoveries out-of-basin	**1%**	**14%**	**67%**	**17%**	**0%**		

Table 37. Final locations of ADCWT subyearling fall Chinook salmon released onstation at LFH to areas outside of the Snake River Basin in 2015 by total age, based on estimated recoveries reported to RMIS as of 12/7/16.

Brood year:	**2013**	**2012**	**2011**	**2010**		
Total age:	**2 (Jack)**	**3**	**4**	**5**		**Non-Snake R. recovery location comp %**
Tag code:	**636737**	**636574**	**636417**	**635998**		
ADCWT at release:	**203,004**	**210,494**	**198,228**	**200,502**		
Total release (wires+nowire):	**209,972**	**211,599**	**200,900**	**202,200**	**A+J Totals**	
AK	0	9	53	6	68	10%
BC		30	31		61	9%
CA					0	0%
COL	7	176	93	13	289	44%
OR		25	29	3	57	9%
WA		126	45	4	175	27%
Grand Total	7	366	251	26	650	
Percent of recoveries out-of-basin	1%	56%	39%	4%		

Table 38. Final locations of ADCWT subyearling fall Chinook salmon released into the Snake River near Couse Creek to areas outside of the Snake River Basin in 2015 by total age, based on estimated recoveries reported to RMIS as of 12/7/16.

Brood year: Total age: Tag code: ADCWT at release: Total release (wires+nowire):	2012 3 636575 202,159 205,300	2011 4 636418 194,955 199,300	2010 5 635997 200,945 202,300	2009 6 635181 199,326 203162	A+J Totals	Non-Snake R. recovery location comp %
AK	13	24	13		50	10%
BC	20	25	3		48	10%
CA					0	0%
COL	123	70	49		242	50%
OR	4	6	14		24	5%
WA	63	50		3	116	24%
Grand Total	223	175	79	3	480	
Percent of recoveries out-of-basin	**46%**	**36%**	**16%**	**1%**		

Table 39. Final locations of ADCWT subyearling fall Chinook salmon released into the Grande Ronde to areas outside of the Snake River Basin in 2015 by total age, based on estimated recoveries reported to RMIS as of 12/7/16.

Brood year: Total age: Tag code: ADCWT at release: Total release (wires+nowire):	2013 2 (Jack) 636739 191,711 403,926	2012 3 636576 216,159 400,543	2011 4 636419 192,996 384,000	2010 5 635999 199,460 397,428	A+J Totals	Non-Snake R. recovery location comp %
AK		3	69		72	9%
BC		24	45		69	8%
CA			3		3	0%
COL	10	151	255	11	427	51%
OR		8	28	8	44	5%
WA		93	122	1	216	26%
Grand Total	10	279	522	20	831	
Percent of recoveries out-of-basin	**1%**	**34%**	**63%**	**2%**		

Estimated Returns to the Snake River using PIT tags and CWTs

PIT tags have been used in season to assist with estimating returns to the Snake River and to estimate returns to areas below LGR. Over the years, broodstock trapping protocols have focused more on LGR in an effort to increase natural origin fish in broodstock, and less on trapping at LFH. With these changes, fish homing to LFH may not be fully estimated using only returns to the Tucannon River and trapping at LGR because the fish might be remaining in the reservoir waiting for entry into LFH. In addition, fish less than 30 cm FL (mini-jacks – generally all from the yearling programs) are not counted at LGR nor are the traps equipped to contain these fish. To fully monitor returns, PIT tags will be used to assess all age classes, regardless of size.

To address these concerns, we compared two methods of estimating returns to the Snake River: 1) PIT tag detections at return and 2) estimated returns of CWT fish. PIT tag detections of our onstation releases were downloaded 25 May 2016 from www.ptagis.org – all known detections above Ice Harbor Dam. Comparisons of estimates of returns from juveniles released as yearlings are presented in Table 40-Table 41 and Figure 22, and subyearlings are presented in Table 42 and Table 43. Data highlighted in red (CWT tables) are based on fish sampled in 2013, during the last 40% of the return due to delays at LGR caused by warm water temperatures which prevented trapping, and may therefore be biased.

By using PIT tagged returns of yearling fall Chinook salmon released at LFH, it was estimated on average 2.8 times and 1.2 times greater return estimates of 0-salt and 1-salt fish, respectively. Combining return estimates of 2+salt fish resulted in only a 1% difference between the two estimation methods. This is the fourth year of returns from the PIT tagged subyearlings released at LFH. Total survival for subyearlings using PIT tags resulted in 0.7 times less 1-salts and nearly equal estimates of 2+salt fish, when all the years were combined, than estimated by using CWTs.

Table 40. Return and survival estimates to the Snake River for yearling fall Chinook salmon released at LFH estimated using PIT tag detections in the Snake River through 2015.

Brood year	0-salt	1-salt	2-salt	3-salt	4-salt	Total return to date (1-4 salts)
2006	4.0% 18,284	1.7% 7,728	0.8% 3,601	0.0% 201	0.0% -	2.5% 11,530
2007	0.4% 1,804	0.7% 3,319	0.3% 1,413	0.1% 289	0.0% 17	1.1% 5,039
2008	0.6% 2,788	0.9% 4,439	0.5% 2,344	0.0% 160	0.0% -	1.4% 6,942
2009	0.4% 2,018	0.5% 2,313	0.4% 1,925	0.1% 543	0.0% 0	1.0% 4,781
2010	0.4% 2,102	1.3% 6,321	0.9% 4,532	0.1% 410	-	2.3% 11,263
2011	0.6% 2,900	0.9% 4,458	1.0% 5,078	-	-	1.9% 9,537
2012	0.5% 2,684	0.4% 1,857	-	-	-	0.4% 1,857
2013	0.6% 3,116	-	-	-	-	-
Average	0.94% 4,462	0.91% 4,348	0.65% 3,149	0.06% 321	0.00% 9	1.51% 7,278

Table 41. Return and survival estimates to the Snake River for yearling fall Chinook salmon released at LFH estimated using CWT recoveries and return estimates of live fish through 2015. Cells highlighted in red indicate possible biased data due to trapping restrictions during 2013.

Brood year	0-salt	1-salt	2-salt	3-salt	4-salt	Total return to date (1-4 salts)	Total release (wire+nowire)	Tag codes
2006	0.7% 3,435	2.2% 10,188	0.9% 4,103	0.0% 160	0.0% 0	3.1% 14,451	459,634	634092 633987
2007	0.1% 420	0.5% 2,241	0.6% 2,688	0.1% 321	0.0% 1	1.2% 5,251	455,152	634680 634681
2008	0.1% 531	0.6% 3,014	0.4% 2,114	0.1% 279	0.0% 0	1.1% 5,407	478,852	635165 635166
2009	0.2% 1,097	0.5% 2,165	0.6% 2,948	0.1%- 298	0.0% 0	1.2% 5,411	463,729	635510 635564
2010	0.2% 1,128	1.0% 4,842	0.7% 3,387-	0.2% 742	-	1.8% 8,972	490,000	636079 636080
2011	0.7% 3,658	0.4% 1,818	0.7% 3,248	-	-	1.0% 5,066	489,500	636443 636444
2012	0.4% 1,922	0.3% 1,427	-	-	-	0.3% 1,427	503,273	636583 636584
2013	0.1% 436					-	452,373	636740 636741
Average	0.31% 1,578	0.79% 3,671	0.65% 3,020	0.10% 360	0.00% 0	1.39% 6,569		

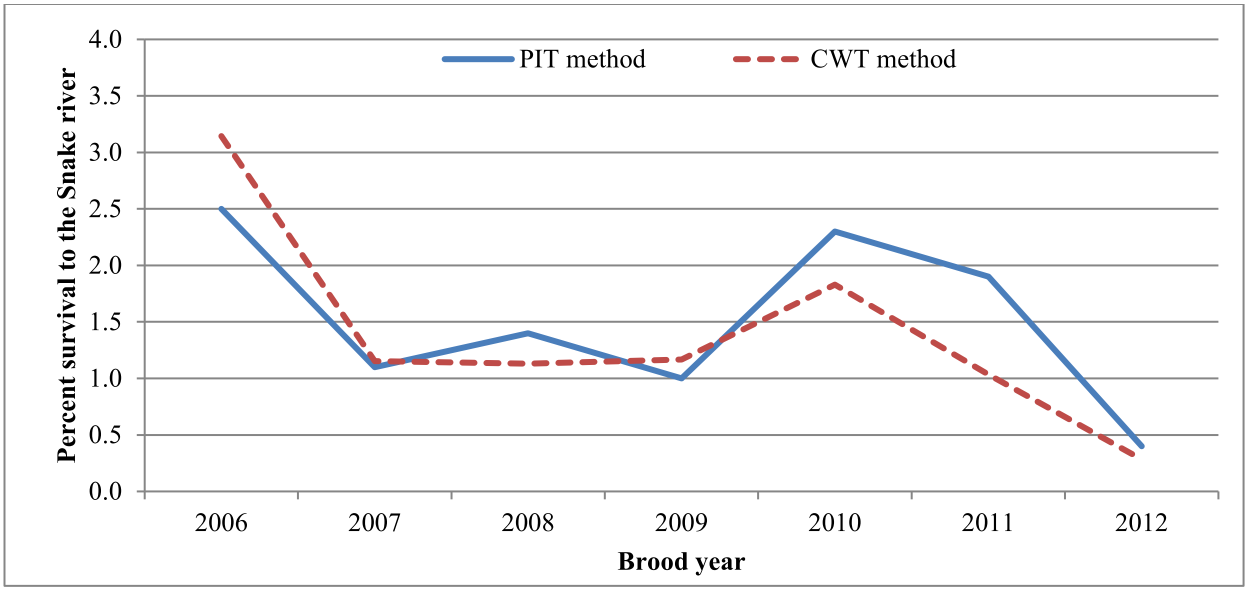


Figure 22. Percent survival of yearling releases from LFH to the Snake River using CWTs and PIT tags through return year 2015 for 1-4 salt fish.

Table 42. Return and survival estimates to the Snake River for subyearling fall Chinook salmon released at LFH estimated using PIT tag detections in the Snake River through 2015.

Brood year	0-salt	1-salt	2-salt	3-salt	4-salt	Total return to date (1-4 salts)
2011	0.0%	0.1%	0.3%	0.1%	-	0.5%
	0	252	504	242		997
2012	0.0%	0.1%	0.3%	-	-	0.5%
	0	278	685			963
2013	0.0%	0.1%	-	-	-	0.1%
	0	105				105
2014	0.0%	-	-	-	-	0.0%
	0					0
Average	0.00%	0.10%	0.30%	0.10%	0.00%	0.28%
	0	212	595	242	0	516

Table 43. Return and survival estimates to the Snake River for subyearling fall Chinook salmon released at LFH estimated using CWT detections in the Snake River through 2015. Cells highlighted in red indicate possible biased data due to trapping restrictions during 2013.

Brood year	0-salt	1-salt	2-salt	3-salt	4-salt	Total return to date (1-4 salts)	Total release (wire+nowire)	Tag codes
2011	0.0%	0.1%	0.1%	0.2%	-	0.4%		
	0	242	206	424		873	200,900	636417
2012	0.0%	0.2%	0.4%	-	-	0.6%		
	0	467	843			1,310	211,599	636574
2013	0.0%	0.1%	-	-	-	0.1%		
	0	230				230	209,972	636737
2014	0.0%	-	-	-	-	-		
							219,359	636882
Average	0.00%	0.13%	0.25%	0.20%	0.00%	0.37%		
	0	313	526	424	0	804		

Estimated Returns above Bonneville Dam using PIT tags and CWTs

Similar to the preceding section, the return of fall Chinook salmon above Bonneville Dam in the Columbia and Snake rivers were estimated using PIT tags (all detections at or above Bonneville Dam) or CWTs (all recoveries above Bonneville Dam). PIT tag detections for yearlings resulted in an average 3.6 times and 1.3 times greater 0-salt and 1-salt survival estimates, and relatively equal 2+ salt survival estimates than occurred by using CWT estimation methods when all years were combined (Table 44 and Table 45, Figure 23). Total survival for subyearlings using PIT tags resulted in 0.8 times less 1-salts and 1.1 times more 2+salt fish than estimated by using CWTs, although there are only four years of data to this point (Table 46 and Table 47).

Table 44. Total return and survival estimates of yearling fall Chinook salmon released at LFH estimated using PIT tag detections in the Snake and Columbia rivers through 2015.

Brood year	0-salt	1-salt	2-salt	3-salt	4-salt	Total survival estimate (1-4 salts)
2006	4.8%	2.1%	1.4%	0.1%	0.0%	3.6%
	21,916	9,814	6,260	402	0	16,476
2007	0.5%	0.8%	0.6%	0.1%	0.0%	1.5%
	2,417	3,830	2,741	426	17	7,013
2008	0.7%	1.1%	0.7%	0.0%	0.0%	1.8%
	3,516	5,185	3,143	231	18	8,576
2009	0.6%	0.5%	0.8%	0.2%	0.0%	1.5%
	2,810	2,468	3,586	916	0	6,970
2010	0.6%	1.6%	1.3%	0.1%	-	3.0%
	2,840	7,848	6,502	591	-	14,941
2011	1.0%	1.0%	1.3%	-	-	2.3%
	4,944	4,978	6,201	-	-	11,179
2012	0.8%	0.4%	-	-	-	0.4%
	4,069	2,127	-	-	-	2,127
2013	0.9%	-	-	-	-	0.0%
	4,647	-	-	-	-	0
Average	1.24%	1.07%	1.02%	0.10%	0.00%	1.76
	5,895	5,179	4,739	513	9	8,410

Table 45. Total return and survival estimates of yearling fall Chinook salmon released at LFH estimated using freshwater CWT recoveries above Bonneville Dam and return estimates of live fish through 2015. Cells highlighted in red indicate possible biased data due to trapping restrictions during 2013.

Brood year	0-salt	1-salt	2-salt	3-salt	4-salt	Total survival estimate (1-4 salts)	Total release (wire+nowire)	Tag codes
2006	0.8% 3,639	2.4% 11,153	1.4% 6,283	0.1% 248	0.0% 3	3.8% 17,687	459,634	634092 633987
2007	0.1% 456	0.6% 2,623	0.9% 4,116	0.1% 473	0.0% 10	1.6% 7,222	455,152	634680 634681
2008	0.1% 531	0.7% 3,555	0.6% 2,911	0.1% 412	0.0% 0	1.4% 6,878	478,852	635165 635166
2009	0.3% 1,167	0.5% 2,299	0.9% 4,066	0.1% 455	0 0	1.5% 6,820	463,729	635510 635564
2010	0.2% 1,149	1.1% 5,317	1.0% 4,862	0.2% 949	-	2.3% 11,128	490,000	636079 636080
2011	0.8% 3,712	0.4% 2,177	0.8% 4,047	-	-	1.3% 6,224	489,500	636443 636444
2012	0.4% 1,922	0.3% 1,578	-	-	-	0.3% 1,578	503,273	636583 636584
2013	0.1% 437					- -	452,373	636740 636741
Average	0.35% 1,627	0.86% 4,100	0.93% 4,381	0.12% 507	0.00% 3	1.74% 8,220		

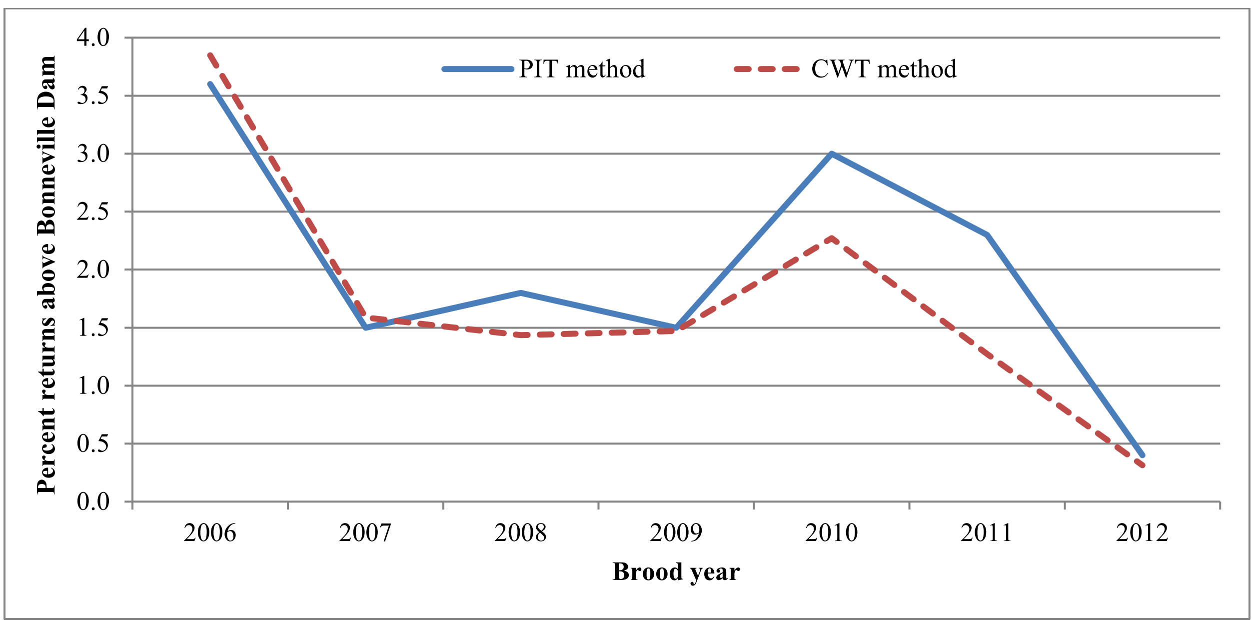


Figure 23. Percent return of yearling fall Chinook salmon released at LFH to areas above Bonneville Dam, including the Snake River, through return year 2015 for 1-4 salt fish.

Table 46. Total return and survival estimates of subyearling fall Chinook salmon released at LFH estimated using PIT tag detections in the Snake and Columbia rivers through 2015.

Brood year	0-salt	1-salt	2-salt	3-salt	4-salt	Total survival estimate (1-4 salts)
2011	0.0%	0.2%	0.3%	0.2%	-	0.7%
	0	322	655	373		1,350
2012	0.0%	0.2%	0.3%	-	-	0.5%
	0	332	738			1,070
2013	0.0%	0.1%	-	-	-	0.1%
	0	126				126
2014	0.0%	-	-	-	-	0.0%
	0					0
Average	0.00%	0.17%	0.30%	0.20%	0.00%	0.33%
	0	260	697	373	0	637

Table 47. Total return and survival estimates of subyearling fall Chinook salmon released at LFH estimated using freshwater CWT recoveries above Bonneville Dam and return estimates of live fish through 2015. Cells highlighted in red indicate possible biased data due to trapping restrictions during 2013.

Brood year	0-salt	1-salt	2-salt	3-salt	4-salt	Total survival estimate (1-4 salts)	Total release (wire+nowire)	Tag codes
2011	0.0%	0.1%	0.2%	0.2%	-	0.5%		
	0	251	302	489		1,043	200,900	636417
2012	0.0%	0.2%	0.5%	-	-	0.7%		
	0	482	957			1,440	211,599	636574
2013	0.0%	0.1%	-	-	-	0.1%		
	0	231				231	209,972	636737
2014	0.0%					-		
	0					-	219,359	636882
Average	0.00%	0.13%	0.35%	0.20%	0.00%	0.43%		
	0	321	630	489	0	905		

Direct Take of Listed Snake River fall Chinook Salmon During Fall of 2015 and Spring of 2016

Adult estimates for permit #16607 for LFH production and permit #16615 for NPTH production have been combined in the tables below. Direct take consists of adults spawned in 2015 at LFH and NPTH (highlighted in green), and eggs/loss/release data associated with BY15 subyearlings released in 2016 and BY14 yearlings released in 2016 that were part of LSRCP, LSRCP-FCAP, and IPC programs. Direct takes of listed Snake River fall Chinook salmon were calculated in Table 48 and Table 49 and were generally within limits. The number of unmarked/untagged juveniles released by these programs totaled 1,040,978 fish, which are not included in the table below.

Table 48. Proposed permissible direct take and actual take of listed Snake River fall Chinook salmon adults returning in 2014 and juveniles released in 2015 for fish cultural purposes for the LFH, IPC, and FCAP programs. Red cells indicate take exceeded permitted limit and green cells combine take from LFH and NPTH programs.

		Annual take of listed fish by life stage							
		Egg/fry		Juvenile or smolt		Adult [b]		Carcass	
Type of Take	Mark [a]	Limit	Take	Limit	Take	Limit	Take	Limit	Take
Observe or harass [c]	No fin clip	0		0		1,000	122	0	
	AD clip	0		0		1,000	122	0	
Collect for transport [d]	No fin clip	0		0		0		0	
	AD clip	0		0		0		0	
Capture, handle, and release [e]	No fin clip	0		0		0		0	
	AD clip	0		0		0		0	
Capture, handle, tag/marked/tissue sample, and release [f]	No fin clip	0		810,455	795,326	1,500 [j]	78	0	
	AD clip	0		2,335,000	2,403,185	1,100 [j]	7	0	
Intentional lethal take [g]	No fin clip	0		0		2,600 [h]	1707	0	
	AD clip	0		0		2,200 [h]	726	0	
Unintentional lethal take [i]	No fin clip	7.5%	5.1%	7.5%	1.7%	500	138	0	
	AD clip	7.5%	5.1%	7.5%	1.7%	450	57	0	

[a] "No fin clip" salmon include hatchery-origin and natural –origin fish. The majority of unclipped fish are hatchery origin.
[b] For purposes of this permit, adults are defined as fall Chinook salmon that are at least 3 years old that have spent at least 2 years in the ocean. Fish that spend only one year in the ocean, called "jacks" or "1-salts," represent a natural life history and are thought to contribute to natural production at a low but relatively constant level. These fish are almost exclusively males (females are called "jills"). Jack returns are highly variable and cannot be accurately forecasted. In-season management and take monitoring will classify fish less than 53 cm (FL) as jacks. Post-season reporting will be based on estimated ocean age. Adult take limits are based on programmatic needs-broodstock number and run-reconstruction numbers – and limits to the overall sampling rate, of the run at age, at the LGR trap and/or supplemental trapping efforts at LFH and NPTH are not to exceed 20%. Any non-lethal take of jacks during trapping efforts is permitted.
[c] Contact with listed fish that could occur from migration delay at dam or traps. Specifically, this refers to fish trapped at LFH and returned to the river without handling, the vast majority being clipped and/or tagged hatchery fish.
[d] Take associate with weir or trapping operations where listed fish are captured and transported, These levels represent full broodstock collection at LGR – see intentional lethal take below.
[e] Take associated with weir or trapping operations where listed fish are captured, handled, and released upstream or downstream.
[f] Take of juveniles due to tagging/marking/PIT tagging prior to release and does not include 1,040,978 unclipped and untagged fish released by LSRCP and LSRCP-FCAP programs. The number shown assumes full production through priority 17 (able B4B. U.S. v. Oregon agreement [2009]) and does not include NPTH production. This number could vary depending on annual egg takes and survival in the hatchery .
[g] Intentional mortality of listed fish as broodstock only. Values represent total need for all program components (LFH, FCAP, NPTH, and IPC). Priority collection occurs at the LGR trap, alternative collection at LFH and NPTH.
[h] Take goal for natural-origin fish for broodstock is 1500 adults. Jacks can compose up to 10% of total broodstock collection
[i] Unintentional mortality from operation of adult traps, including loss of fish during trapping, transport, and holding prior to spawning or release back into the wild after broodstock sorting. Also includes estimates of in-hatchery incubation and rearing mortality, by life-stage. Adult mortality estimates based on 15% prespawning mortality, including adult trapping, holding, and transport.
[j] Adult fish in excess to broodstock needs that are returned to the river from the LFH and the NPTH. These fish are typically fin clipped for re-capture identification.

Table 49. Proposed permissible direct take and actual take of listed Snake River fall Chinook salmon adults returning in 2014 and juveniles released in 2015 for RM&E activities associated with the LFH fall Chinook salmon programs not directly related to fish culture. Green cells combine take from LFH and NPTH programs.

		Annual take of listed fish by life stage							
		Egg/fry		Juvenile or smolt		Adult		Carcass	
Type of Take	Mark	Limit	Take	Limit	Take	Limit	Take	Limit	Take
Observe or harass [a]	No fin clip	0				200	162[j]	0	
	AD clip	0				600	302[j]	0	
Collect for transport [b]	No fin clip	0		0		0		0	
	AD clip	0		0		0		0	
Capture, handle, and release [c]	No fin clip	0		Up to 15% of natural juvenile production not to exceed 25,000 fish [h]	3,194			10	0
	AD clip	0						10	0
Capture, handle, tag/mark/tissue sample, and release [d]	No fin clip	0		2,700 [h]	2,776	4,000 [i]	2,788	100	91[j]
	AD clip	0				2,500 [i]	1,585	300	98[j]
Removal (e.g. broodstock) [e]	No fin clip	0		0		0	0	0	
	AD clip	0		0		0	0	0	
Intentional lethal take [f]	No fin clip	0		0		1,000[i]	181	0	
	AD clip	0		0		1,000[i]	137	0	
Unintentional lethal take [g]	No fin clip	0		300 [h]	88	0	0	0	
	AD clip	0		100 [h]		0	0	0	

[a] Contact with live, ESA-listed fish through juvenile and adult spawning surveys on the Tucannon River and adult spawning surveys on Asotin Creek.
[b] Take of listed fish for transportation only.
[c] Take associated with smolt trapping operations where listed fish are captured, handled, and released. Adult numbers represent adults captured, handled, and released from juvenile trapping operations.
[d] Take associated with adult and juvenile sampling and monitoring projects. These include; adult fall Chinook salmon trapped, handled, sampled, tagged and released from adult trapping facilities and weirs, carcass sampling during spawning ground surveys on the Tucannon River and Asotin Creek, and juvenile fall Chinook salmon captured, handled, sampled, tagged, and released from juvenile trapping, netting, and electro-fishing projects.
[e] RM&E activities do not include broodstock collection.
[f] Intentional mortality of hatchery fish as a result of run reconstruction needs. These are coded-wire tagged hatchery fish.
[g] Unintentional mortality of listed fish, including loss of fish during smolt trapping.
[h] WDFW activities associated with emigrant studies using rotary screw trap and spawning ground surveys on the Tucannon River.
[i] Adults (non-jacks) used for run reconstruction at LGR trap.
[j] Take associated with spawning ground surveys on Asotin Creek located above LGR Dam.

Conclusions and Recommendations

Conclusions and recommendations will be provided in the 2016 Annual Report to expedite completion and distribution of this report.

Literature Cited

Busack, C. 2007. The Impact of Repeat Spawning of Males on Effective Number of Breeders in Hatchery Operations. Aquaculture (2007), doi:10.1016/j.aquaculture.2007.03.027.

DeHart, M., J. McCann, B. Chockley, E. Cooper, H. Schaller, S. Haeseker, R. Lessard, C. Petrosky, E. Tinus, E Van Dyke, and R. Ehlke. 2015. Comparative Survival Study of PIT-tagged Spring/Summer/Fall Chinook, Summer Steelhead, and Sockeye, 2015 Annual Report. Comparative Survival Study Oversight Committee and Fish Passage Center Report to Bonneville Power Administration, BPA Project 1996-020-00.

Gallinat, M. P., and L.A. Ross. 2015. Tucannon River Spring Chinook Salmon Hatchery Evaluation Program, 2014 Annual Report. Washington Department of Fish and Wildlife Fish Program Report to U. S. Fish and Wildlife Service, Boise, ID.

Hankin, D.G., L J. Fitzgibbons, and Y. Chen. 2009. Unnatural random mating policies select for younger age at maturity in hatchery Chinook salmon (*Oncorhynchus tshawytscha*) populations. Can. J. Fish. Aquat. Sci. 66: 1505–1521 (2009).

Heath, D. D., C. W. Fox and J. W. Heath. 1999. Maternal effects on offspring size: variation through early development of Chinook salmon. Evolution 53 (5): 1605-1611.

Hegg, J. 2013. Spatial and Temporal Variation in Juvenile Salmon Life History: Implications of Habitat Alteration. Master of Science Thesis, University of Idaho, Moscow, ID.

Herrig, Dan. 2006. Personal communication, LSRCP project manager.

Knudsen, C. M., S. L. Schroder, C. Busack, M. V. Johnston, T. N. Pearsons, and C. R. Strom. 2008. Comparison of Female Reproductive Traits and Progeny of First-Generation Hatchery and Wild Upper Yakima River Spring Chinook Salmon. Transactions of the American Fisheries Society 137:1433-1445.

Milks, D., M. Varney, J. Jording, and M. Schuck. 2007. Lyons Ferry Hatchery Evaluation Fall Chinook Salmon Annual Report: 2005. Washington Department of Fish and Wildlife, Olympia, WA. Report #FPA 07-04.

Milks, D., M. Varney, and M. Schuck. 2009. Lyons Ferry Hatchery Evaluation Fall Chinook Salmon Annual Report: 2006. Washington Department of Fish and Wildlife, Olympia, WA. Report #FPA 09-04.

Milks, D., A. Grider, M. Varney, and M. Schuck. 2011. Lyons Ferry Hatchery Evaluation Fall Chinook Salmon Annual Report: 2007-2008. Washington Department of Fish and Wildlife, Olympia, WA. Report #FPA 11-02.

Milks, D., A. Grider, and M. Schuck. 2011. Lyons Ferry Hatchery Evaluation Fall Chinook Salmon Annual Report: 2009. Washington Department of Fish and Wildlife, Olympia, WA. http://www.fws.gov/lsnakecomplan/Reports/WDFWreports.html.

Milks, D., A. Grider, and M. Schuck. 2012. Lyons Ferry Hatchery Evaluation Fall Chinook Salmon Annual Report: 2010. Washington Department of Fish and Wildlife, Olympia, WA. http://www.fws.gov/lsnakecomplan/Reports/WDFWreports.html.

Milks, D., A. Grider, and M. Schuck. 2013. Lyons Ferry Hatchery Evaluation Fall Chinook Salmon Annual Report: 2011. Washington Department of Fish and Wildlife, Olympia, WA. http://www.fws.gov/lsnakecomplan/Reports/WDFWreports.html.

Milks, D., A. Oakerman, and M. Schuck. 2014. Lyons Ferry Hatchery Evaluation Fall Chinook Salmon Annual Report: 2012. Washington Department of Fish and Wildlife, Olympia, WA. http://www.fws.gov/lsnakecomplan/Reports/WDFWreports.html.

Milks, D., A. Oakerman, and M. Schuck. 2015. Lyons Ferry Hatchery Evaluation Fall Chinook Salmon Annual Report: 2013. Washington Department of Fish and Wildlife, Olympia, WA. http://www.fws.gov/lsnakecomplan/Reports/WDFWreports.html.

Milks, D., A. Oakerman, and M. Schuck. 2016. Lyons Ferry Hatchery Evaluation Fall Chinook Salmon Annual Report: 2014. Washington Department of Fish and Wildlife, Olympia, WA. http://www.fws.gov/lsnakecomplan/Reports/WDFWreports.html.

NMFS (United States Department of Commerce) and USFWS (Bureau of Sport Fisheries and Wildlife, United States Department of Interior). 1972. A Special Report on the Lower Snake River Dams: Ice Harbor, Lower Monumental, Little Goose, and Lower Granite in Washington and Idaho.

NMFS. 1993. Biological Opinion for 1993 Hatchery Operations in the Columbia River Basin.

NMFS. 2015. ESA Section 10 (a)(1)(A) Permit for Take of Endangered/ Threatened Species, Ammended Permit 16607 Snake River Fall Chinook-LFH/FCAP/IPC.

Rocklage, S., J.A. Hesse. 2004. Snake River Basin Fall Chinook Salmon Production Program Marking Justification. Pre-Decisional White Paper from the Nez Perce Tribe for *US v. Oregon* TAC/PAC Review.

United States v. Oregon Management Agreement. 2008. United States v. Oregon Management Agreement 2008-2017.

U.S. Army Corps of Engineers. 1975. Special report: Lower Snake River Fish and Wildlife Compensation Plan. Walla Walla, WA.

U.S. Army Corps of Engineers. 2016. Annual fish passage report, 2015. Columbia and Snake Rivers for salmon, steelhead, shad and lamprey. Northwestern Division, U.S. Army Corps of Engineers, Portland, OR and Walla Walla, WA.

WDF (Washington Department of Fisheries). 1994. Lower Snake River Compensation Plan, Snake River Hatchery Evaluation Program five-year plan 1994-1998. Washington Department of Fisheries, Olympia, WA

WDFW (Washington Department of Fish and Wildlife). 2015. Lyons Ferry Complex Annual Operations Plan for the period of October 1, 2015 – September 30, 2016.

Appendix A: Fall Chinook Salmon Run to LFH, IHR, LMO, and LGR Dams: 2011-2015

(Numbers of fall Chinook salmon observed at Snake River dams and numbers of fall Chinook salmon trapped and processed at LFH. LGR trapped fish that were processed at LFH are listed under LGR data with COE window counts).

Appendix A Table 1. Numbers of fall Chinook salmon processed at LFH and window counts at IHR, LMO, and LGR dams, 2011-2015.

		Daytime counts				Night video[a]				Totals[b]	
		Through Oct		Nov and Dec		Through Oct		Nov and Dec			
Year	Location	Adults	Jacks	Adults	Jacks	Adults	Jacks	Adults	Jacks	≥ 53 cm FL	< 53 cm FL
2011	IHR	31,405	19,578	nc[c]	nc	nc	nc	nc	nc	31,405	19,578
	LMO	27,594	17,855	nc	nc	nc	nc	nc	nc	27,594	17,855
	LFH									666	154
	LGR	24,819	19,516	430	139	nc	nc	nc	nc	25,249	19,655
2012	IHR	38,546	21,554	nc	nc	nc	nc	nc	nc	38,546	21,554
	LMO	33,518	22,883	nc	nc	nc	nc	nc	nc	33,518	22,883
	LFH									193	6
	LGR	34,060	21,814	628	176	nc	nc	nc	nc	34,688	21,990
2013	IHR	57,850	19,133	nc	nc	nc	nc	nc	nc	57,850	19,133
	LMO	53,399	23,031	nc	nc	nc	nc	nc	nc	53,399	23,031
	LFH									1,025	42
	LGR	55,839	22,019	726	376	nc	nc	nc	nc	56,565	22,395
2014	IHR	61,389	17,944	nc	nc	nc	nc	nc	nc	61,389	17,944
	LMO	51,402	23,836	nc	nc	nc	nc	nc	nc	51,402	23,836
	LFH									0	0
	LGR	59,753	19,250	934	557	nc	nc	nc	nc	60,617	19,869
2015	IHR	62,978	10,008	nc	nc	nc	nc	nc	nc	62,978	10,008
	LMO	54,394	15,844	nc	nc	nc	nc	nc	nc	54,394	15,844
	LFH									0	0
	LGR	58,662	11,177	638	350	nc	nc	nc	nc	59,300	11,527

[a] Night counts occurred during 18-31 August.
[b] Total from LFH consist of killed fish that were identified at processing as LFH trapped.
[c] No counts (nc) were completed at the dam during that time of year.

Appendix B: Trapping and Sampling Protocols at LGR Adult Trap for 2015

2015 Fall Chinook Salmon Trapping/Sampling Protocols at LGR
by

Debbie Milks, WDFW
Bill Arnsberg/Bill Young, NPT
Stuart Rosenberger, IPC
Stuart Ellis, CRITFC
August 2015

The following protocol presumes 24 hour trapping 7 days per week: The trapping rate will be set at 12% and kept at that level throughout the season, if possible. If the trap is swamped with fish: Shut down the trap for an hour or so but clearly identify in the data when the trap was shut down and when it was started up again. Do not shut down and stay shut down for the rest of the day because we need to have a pre and post shut down sample so we can average them to estimate what passed during the shutdown.

If trapping is changed to 4 hours per day operation, any fish collected during that time MUST receive an operculum punch on the right side if they are hauled to the hatcheries.

WDFW is providing two staff for helping with the broodstock collection activities at LGR. Scales sampled at the LGR Trap for run reconstruction needs will be mounted by WDFW staff at LGR and sent to Olympia every two weeks. An additional two staff will be provided by WDFW as part of the Snake River Fall Chinook Salmon Fidelity and Fallback Study (radio telemetry) funded by BPA.

In an effort to reduce the numbers of jacks and jills hauled to the hatcheries and to reduce the numbers of fish sacrificed with wire for run reconstruction purposes the following protocols were approved by co-managers in the basin on 8/7/2015. The sub-sampling of wire tagged fish should allow for ample recoveries for evaluation purposes.

This will be the third year that carcasses of fish used for run reconstruction will be given to Asotin Count Food bank after sampling. Food bank fish will primarily come from wire tagged males <70 cm trapped early in the season. The small males will be held separately from the larger fish for easy access. The food bank may collect fish weekly starting in October.

Wire tagged females <70 cm will be added to the "BIGS" group of fish and may be used for broodstock if needed. If not needed for broodstock, these smaller younger aged females will be used for run reconstruction needs.

2015 Fall Chinook Salmon Trapping/Sampling Protocols

Protocols:

1) These protocols presume a 24 hour/day, 7 days per week trapping. Fish trapped during a 24 hour 7 day a week trapping period will not be operculum punched. If the trapping protocol is changed to only 4 hours per day, all fish hauled to the hatcheries must receive an operculum punch on the right side (ROP).

2) This is the third year females will not be inoculated. Males will not be inoculated either.

3) Sort by code fish follow the same haul/release protocol below unless the tag action code indicates that the fish should be radio tagged and released.

4) LFH will haul 70% of the fish trapped fish >70 cm and the NPT will haul 30%.

5) All wire tagged males <70 cm (aka: SMALLS) will be held separately in a tank and hauled to LFH.

6) Wire tagged females <70 will be added to the tank of "LARGE" fish and either hauled to LFH or NPTH.

7) Jacks suspected of being summers will need to be subsampled for wires.

Wire tagged fish:

Fork Length	Action
≥ 70cm	Haul all wires (no scales collected)
<70 cm	Haul 1 out of 5 wires (put F in with "LARGES" and M go into "SMALLS" tank)
	Release 4 out of 5 wires (no scales collected)

Untagged fish:

Fork Length	Action
≥ 70 cm	Haul all fish (collect scales, 1 in 3 will be processed) data will be used to document arrival timing and profile the run for reconstruction needs.
<70 cm	Release all (collect scales, 1 in 3 will be processed) data will be used to document arrival timing and profile the run for reconstruction needs.

2015 Fall Chinook Salmon Trapping/Sampling
Protocols at LGR
by

Debbie Milks, WDFW
Bill Arnsberg/Bill Young, NPT
Stuart Rosenberger, IPC
Stuart Ellis, CRITFC
September 18, 2015

On 9/16/15 it was determined that protocols would need to change or else broodstock needs would have been met too early in the run. At 1:30pm on 9/16/15 Darren Ogden was directed to pass all fall Chinook salmon until a revised sampling protocol could be agreed to. In an effort to collect fish across the run for broodstock, have the flexibility to select larger older aged fish, increase the proportion of unmarked/untagged potentially wild fish in broodstock, target a 1x1 spawning matrix, and assure run reconstruction needs are met, the following changes were agreed to by the co-managers on a conference call on 9/17/15:

The trapping rate will remain set at 12%.

Wire tagged fish:

Fork Length	**Action**
$\geq$ 80cm	Haul all wires (no scales collected)
79-70	RELEASE ALL (no scales collected)
<70 cm	Haul 1 out of 5 wires (put F in with "LARGES" and M go into "SMALLS" tank)
	RELEASE 4 out of 5 wires (no scales collected)

No Wire

AD only	RELEASE ALL (collect scales, 1 in 3 will be processed)
AD+PIT tag	RELEASE ALL (collect scales, 1 in 3 will be processed)
PIT tag only	RELEASE ALL (collect scales, 1 in 3 will be processed)

Unmarked/Untagged (Potentially wild fish)

Fork Length	**Action**
$\geq$85 cm Females $\geq$ 75 cm Males	Haul all fish (collect scales, 1 in 3 will be processed) data will be used to document arrival timing and profile the run for reconstruction needs.
<85 cm Females <75 cm Males	Release all (collect scales, 1 in 3 will be processed) data will be used to document arrival timing and profile the run for reconstruction needs.

2015 Fall Chinook Salmon Trapping/Sampling Protocols at LGR

by

Debbie Milks, WDFW
Bill Arnsberg/Bill Young, NPT
Stuart Rosenberger, IPC
Stuart Ellis, CRITFC

October 15, 2015

On 10/15/15 it was determined that protocols would need to change to collect more females for broodstock. At 10:00am on 10/15/15 Darren Ogden was directed to collect all females 70 cm or larger. No changes will occur in the male collection protocol. The following changes were agreed to by the co-managers:

The trapping rate will remain set at 12%.

Wire tagged fish:

Fork Length	Action
≥ 80cm	Haul all wires (no scales collected)
79-70	Haul all females (no scales collected) RELEASE ALL males(no scales collected)
<70 cm	Haul 1 out of 5 wires (put F in with "LARGES" and M go into "SMALLS" tank)
	RELEASE 4 out of 5 wires (no scales collected)

No Wire

AD only (≥70 cm)	Haul ALL females (collect scales, 1 in 3 will be processed)
<70 cm	RELEASE ALL females (collect scales, 1 in 3 will be processed)
All sizes	RELEASE ALL males(collect scales, 1 in 3 will be processed)
AD+PIT tag(≥70 cm)	Haul ALL females (collect scales, 1 in 3 will be processed)
<70 cm	RELEASE ALL females (collect scales, 1 in 3 will be processed)
All sizes	RELEASE ALL males (collect scales, 1 in 3 will be processed)
PIT tag only (≥70 cm)	Haul ALL females(collect scales, 1 in 3 will be processed)
< 70 cm	RELEASES ALL females (collect scales, 1 in 3 will be processed)
All sizes	RELEASE ALL males(collect scales, 1 in 3 will be processed)

Unmarked/Untagged	**(Potentially wild fish)**
Fork Length	**Action**
≥70 cm Females ≥ 75 cm Males	Haul all fish (collect scales, 1 in 3 will be processed) data will be used to document arrival timing and profile the run for reconstruction needs.
<70 cm Females <75 cm Males	Release all (collect scales, 1 in 3 will be processed) data will be used to document arrival timing and profile the run for reconstruction needs.

DONE

Appendix C: Systematic Sampling Rates at Lower Granite Dam 2003-2015

Appendix C Table 1. Dates, times, and trapping rates of fall Chinook salmon at Lower Granite Adult trap,

Year	Date opened trap	Trap rate (%)	Date trap closed	Date/time trapping rate changed	Modified trapping rate (%)	Date/time trapping rate changed	Adjusted trapping rate (%)	Date trap closed
2003	9 Sept	11	-	-	nc[a]	-	nc	19 Nov
2004	2 Sept	15	3&5 Sept[b]	10 Sept	13	-	nc	22 Nov
2005	6 Sept	13	-	-	nc	-	nc	20 Nov
2006	1 Sept	13	-	-	nc	-	nc	21 Nov
2007	1 Sept	20	-	-	nc	-	nc	20 Nov
2008	24 Aug 8:00 am[c]	20	-	12 Sept 2:52 pm	12	26 Sept 3:00 pm	10	21 Nov
2009	18 Aug 7:37 am	12	-	9 Sept 7:25 am	9	-	nc	15 Nov
2010	22 Aug 11:05 am	12	10 Sept-10:50 am [d] 18 Sept-10:50 am [b]	18 Sept 3:00 pm	10	-	nc	18 Nov
2011	18 Aug 10:30 am	10	-	-	nc	-	nc	21 Nov
2012	28 Aug 10:36 am	15	-	-	nc	-	nc	19 Nov
2013	23 Sept 10:07 am	12	27 Sept- 3:00 pm[e]	1 Oct 2:22 pm	15	8 Oct 2:22 pm	20	24 Nov
2014	18 Aug 9:54 am	100	19&20 Aug[f] 22-29 Aug[f]	1 Sept 8:38 am	10	2 Oct 7:40am	8	11 Nov
2015	22 Aug 7:55 am	100	23-26 Aug[f] 29 Aug[f]	31 Aug 8:39 am	12	-	nc	22 Nov

[a] No change (nc) was made to the trapping rate.
[b] Trap was closed down for two hours each day.
[c] Trap was operated between 8-8:30 am, then 12:30-12:55 pm, then 2:20-3:02 pm on 24 Aug due to water temperature restrictions. Full operation began 25 August
[d] Trap was closed down at 10:50 am for three hours due to large numbers of fall Chinook salmon.
[e] Trap was closed down at 3:00 pm for two hours due to large numbers of fall Chinook salmon.
[f] Trap closed down due to high water temperatures.

2003-2015.

Appendix D: Trapping, Sorting and Mating Protocols at Lyons Ferry Hatchery 2015

2015 Trapping & Mating Protocol
at LFH

LFH may start up the volunteer trap if a shortfall of females being collected at LGR happens. Staff will target fish >80 cm to increase numbers of older aged fish for broodstock. The size criteria will be further relaxed to 75 cm in mid-October if necessary.

Sorting protocol

Sort LFH trapped fish during first spawn in October.
Count and sex all fish: 1) Males and females ≥ 75, 2) Males and females <75.

Count LGR trapped females returned to the pond during the spawn day.

Mating protocol at LFH

Our goals are to maximize the use of potentially natural origin fish and larger/older aged fish and to exclude jills and strays from broodstock.

All wire tagged fish must wait until their CWTs are decoded before they are used in a mating.

Strays will be culled based on CWTs. If broodstock limited, up to 58 stray females may be spawned and retained, presuming 1,154 matings are needed to make production. All stray males will be culled. Any male used on a stray female must also be used on another female that will be retained for production (inbasin hatchery origin, or untagged unknown origin).

Wire tagged Males verified as adults can be used on multiple females.

Untagged Males ≥75 cm can be used on multiple females.

Untagged Males 70-74 cm will only be used in 1 x 1 crosses unless there is a shortage of males.

Males <70 cm will not be used in matings unless they are verified as adults. This size criteria may be adjusted in season.

Jills

Jills will be cycled back to the holding pond for the first three weeks. If we have enough adult females to make production goals, jills will not be used in production. If jills are used for broodstock they will be kept separate until a decision can be made regarding what to do with the eggs. Jills verified by CWTs will be spawned with males of a larger FL. Any male used on a jill must also be used on a larger or older aged fish that will be retained for production. This will be done to ensure if the jill is culled or a fry plant is made, the gametes from the male will still contribute elsewhere in production.

Appendix E: Salmon Processed and Killed at LFH in 2015

(Age/Rearing states origin, brood year, age at release, and release site (LF09SO is a LFH hatchery origin fish from the 2009 brood year, released as a subyearling, onstation at LFH).

Appendix E Table 1: Estimated composition of non-wire tagged salmon trapped and killed at LFH during 2015.

Age/origin determinations by method	< 53 cm Males	Females	≥53 cm Males	Grand total
Unknown hatchery AD age 4(3salt) by scales	0	3	1	4
Unknown hatchery AD age 5(4salt) by scales	0	1	0	1
Unknown hatchery AD yearling age 4(2salt) by scales	0	1	0	1
Unknown hatchery age/origin by AD clip	0	0	1	1
Unknown origin age 3(2salt) by scales	0	0	1	1
Unknown origin age 4(3salt) by scales	0	2	3	5
Unknown age/origin (Presume hatchery)	0	1	0	1
Total	**0**	**8**	**6**	**14**

Appendix E Table 2: Estimated composition of wire tagged salmon that were trapped and killed at LFH during 2015.

Origin by CWT	CWT	<53 cm Males	Females	≥53 cm Males	Grand total
LF10YO	636079	0	6	2	8
	636080	0	8	2	10
LF11SGRRD	636419	0	1	0	1
LF11SO	636417	0	6	1	7
LF11SPLA	220325	0	0	1	1
LF11YO	636443	0	56	32	88
	636444	0	55	20	75
LF12SCCD	636575	0	1	0	1
LF12SO	636574	0	4	6	10
LF12YBCA	220336	0	0	1	1
LF12YO	636583	2	0	1	3
	636584	2	1	3	6
LF13SO	636737	3	0	0	3
LF13YO	636740	2	0	0	2
NPTH12SLGA	220219	0	0	1	1
BONN10YUMA	090490	0	0	1	1
	090491	0	0	1	1
	090492	0	0	1	1
	090493	0	1	0	1
BONN11YUMA	090658	0	1	0	1
UMA10SUMA	090433	0	0	1	1
	090435	0	1	0	1
	090436	0	1	0	1
UMA11SUMA	090654	0	1	0	1
UMA12SUMA	090705	0	1	0	1
LOST TAG	Age 4(2salt)	0	1	0	1
	Age 5(3salt)	0	1	0	1
Total		**9**	**146**	**74**	**229**

Appendix E Table 3: Estimated composition of non-wire tagged salmon trapped at LGR that were hauled to LFH and killed during 2015.

Age/origin determinations by method	< 53 cm Males	Females	≥53 cm Males	Grand total
Snake R. hatchery sub res rear age 4 by PIT tag	0	11	6	17
Snake R. hatchery sub res rear age 5 by PIT tag	0	2	0	2
Snake R. hatchery sub age 4 by PIT tag	0	41	23	64
Snake R. hatchery sub age 5 by PIT tag	0	10	4	14
Snake R. hatchery yearling age 5 by PIT tag	0	0	1	1
Snake R. natural sub age 4 by PIT tag	0	0	1	1
Snake R. natural sub age 6 by PIT tag	0	1	0	1
Unknown Snake R. res rear age 4 by PIT tag	0	8	2	10
Unknown Snake R. res rear age 5 by PIT tag	0	2	1	3
Unknown Snake R. sub age 4 by PIT tag	0	1	1	2
Unknown Snake R. sub age 6 by PIT tag	0	1	0	1
Unknown hatchery AD age 3(2salt) by scales	0	6	11	17
Unknown hatchery AD age 4(3salt) by scales	0	53	19	72
Unknown hatchery AD age 5(4salt) by scales	0	4	2	6
Unknown hatchery AD yearling age 4(2salt) by scales	0	0	1	1
Unknown hatchery yearling age 3(1salt) by scales	0	0	1	1
Unknown hatchery yearling age 4(2salt) by scales	0	2	2	4
Unknown hatchery yearling age 5(3salt) by scales	0	0	1	1
Unknown hatchery age/origin by AD clip	0	4	3	7
Unknown origin sub res rear age 4(2salt) by scales	0	3	1	4
Unknown origin res rear age 4(2salt) by scales	0	18	9	27
Unknown origin res rear age 5(3salt) by scales	0	9	0	9
Unknown origin age 3(2salt) by scales	0	37	67	104
Unknown origin age 4(3salt) by scales	0	238	205	443
Unknown origin age 5(4salt) by scales	0	133	42	175
Unknown age/origin (Presume hatchery)	0	34	32	66
Total		**618**	**435**	**1,053**

Appendix E Table 4: Estimated composition of wire tagged salmon that were trapped at LGR, hauled to LFH, and killed during 2015.

Origin by CWT	CWT	<53 cm Males	Females	>53 cm Males	Grand total
LF10SBCA	220117	0	2	1	3
	220118	0	1	0	1
LF10SCCDA	635997	0	1	0	1
LF10SCJA	220119	0	3	0	3
	220120	0	1	0	1
LF10SIPCHC	090447	0	1	0	1
LF10SO	635998	0	1	0	1
LF10SPLA	220121	0	2	0	2
LF10YBCA	220318	0	1	2	3
	220323	0	1	0	1
LF10YCJA	220320	0	5	1	6
	220321	0	2	1	3
LF10YO	636079	0	16	1	17
	636080	0	12	1	13
LF10YPLA	220319	0	7	1	8
	220322	0	4	1	5
LF11SBCA	220328	0	8	5	13
	220329	0	11	3	14
LF11SCCD	636418	0	7	1	8
LF11SCJA	220326	0	12	1	13
	220327	0	16	4	20
LF11SGRRD	636419	0	22	6	28
LF11SIPCHC	090587	0	16	2	18
LF11SIPCHC-OXBOW	100201	0	14	2	16
LF11SO	636417	0	12	2	14
LF11SPLA	220324	0	17	3	20
	220325	0	11	3	14
LF11YBCA	220331	0	6	5	11
	220333	0	7	4	11
LF11YCJA	220332	0	7	7	14
	220335	1	6	5	12
LF11YO	636443	0	30	18	48
	636444	0	36	22	58
LF11YPLA	220330	0	9	5	14
	220334	0	1	6	7
LF12SBCA	220142	0	1	3	4
	220144	0	4	2	6
LF12SCCD	636575	0	5	9	14
LF12SCJA	220141	0	4	8	12
	220143	1	0	3	4

Appendix E Table 4: Estimated composition of wire tagged salmon that were trapped at LGR, hauled to LFH, and killed during 2015.

Origin by CWT	CWT	<53 cm Males	Females	>53 cm Males	Grand total
LF12SGRRD	636576	0	2	11	13
LF12SIPCHC	090703	0	4	3	7
LF12SO	636574	0	6	22	28
LF12SPLA	220145	0	3	7	10
	220146	0	5	6	11
LF12YBCA	220336	2	0	1	3
	220341	1	0	0	1
LF12YCJA	220338	1	0	3	4
	220339	2	1	2	5
LF12YO	636583	7	2	7	16
	636584	5	3	15	23
LF12YPLA	220337	2	0	0	2
	220340	1	0	2	3
LF13SBCA	220342	3	0	0	3
	220345	2	0	0	2
LF13SCJA	220343	1	0	0	1
LF13SCJA2	636738	4	0	0	4
LF13SGRRD	636739	1	0	0	1
LF13SIPCHC	090818	2	0	0	2
LF13SO	636737	5	0	1	6
LF13SPLA	220344	2	0	0	2
LF13YBCA	220348	3	0	0	3
	220351	3	0	0	3
LF13YCJA	220350	5	0	0	5
	220353	4	0	0	4
LF13YO	636740	5	0	0	5
	636741	5	0	0	5
LF13YPLA	220349	8	0	0	8
	220352	1	0	0	1
NPTH10SCFA	220205	0	8	0	8
	220206	0	4	0	4
NPTH10SLGA	220207	0	2	0	2
	220208	0	2	0	2
NPTH10SNLVA	220203	0	5	1	6
	220204	0	4	2	6
NPTH10SO	220209	0	3	0	3
	220210	0	10	6	16
	220211	0	3	2	5
	220212	0	2	0	2
NPTH11SCFA	220215	0	20	6	26

Appendix E Table 4: Estimated composition of <u>wire</u> tagged salmon that were trapped at LGR, hauled to LFH, and killed during 2015.

Origin by CWT	CWT	<53 cm Males	Females	≥53 cm Males	Grand total
NPTH11SCFA	220216	0	8	6	14
NPTH11SLGA	220213	0	9	9	18
	220214	0	17	8	25
NPTH11SNLVA	220218	0	12	7	19
	220224	0	19	13	32
NPTH11SO	220217	0	10	5	15
	220223	0	19	16	35
NPTH12SCFA	220221	0	2	7	9
	220222	0	3	9	12
NPTH12SLGA	220219	1	2	4	7
	220220	0	3	3	6
NPTH12SNLV	220225	0	0	5	5
	220231	0	6	20	26
NPTH12SO	220226	0	4	11	15
	220232	0	10	21	31
NPTH13SCFA	220233	2	0	1	3
	220235	1	0	1	2
NPTH13SLGA	220234	3	0	0	3
	220236	9	0	1	10
NPTH13SNLVA	220240	3	0	0	3
NPTH13SO	220237	1	0	0	1
	220239	5	0	0	5
BON09YUMA	090355	0	1	0	1
BON10YUMA	090489	0	6	0	6
	090490	0	4	1	5
	090491	0	2	1	3
	090492	0	2	1	3
	090493	0	11	0	11
BON11YUMA	090657	0	2	0	2
	090658	0	1	4	5
KLICK10SO	635978	0	1	0	1
	635979	0	1	0	1
RINGOLD10SCOLR	090488	0	1	0	1
UMA10SUMA	090434	0	4	0	4
	090435	0	1	0	1
UMA11SUMA	090585	0	1	0	1
	090655	0	0	1	1
	090656	0	1	0	1
UMA12SUMA	090682	0	0	2	2
09BLANK	Stray/unknown age	0	8	1	9

Appendix E Table 4: Estimated composition of <u>wire</u> tagged salmon that were trapped at LGR, hauled to LFH, and killed during 2015.

Origin by CWT	CWT	<53 cm Males	Females	≥53 cm Males	Grand total
IDFG11SSUMRCHPAHSIM	100199	0	1	0	1
CLW13YSUMRCHCLWHATCH	100282	1	0	0	1
SAWTOOTH12YSPRSALM	100261	0	0	1	1
SAWTOOTH13YSPRSALM	100276	1	0	0	1
LOST TAG	Age 3(2salt)	0	0	2	2
	Age 4(3salt)	0	3	0	3
	Age 4(2salt)	0	1	0	1
	unknown age	5	2	8	15
Total		**109**	**589**	**404**	**1,102**

Appendix F: United States v. Oregon Production and Marking Table

Appendix F Table B4B. Revised production table listing Snake River fall Chinook salmon production priorities for LFH per the 2008-2017 *US v. Oregon Management Agreement*, Table *B4B*, and agreed upon by members of the SRFMP for Brood Years 2008-2017.

Priority	Production program				
	Rearing facility	**Number**	**Age**	**Release location(s)**	**Marking[a]**
1	Lyons Ferry	450,000	1+	Onstation	225KADCWT 225K CWT
2	Lyons Ferry	150,000	1+	Pittsburg Landing	70K ADCWT 80K CWT only
3	Lyons Ferry	150,000	1+	Big Canyon	70K ADCWT 80K CWT only
4	Lyons Ferry	150,000	1+	Captain John Rapids	70K ADCWT 80K CWT only
5	Lyons Ferry	200,000	0+	Onstation	200K ADCWT
6	Lyons Ferry	500,000	0+	Captain John Rapids	100K ADCWT 100K CWT only 300K Unmarked
7	Lyons Ferry	500,000	0+	Big Canyon	100K ADCWT 100K CWT only 300K Unmarked
8	Lyons Ferry	200,000	0+	Pittsburg Landing	100K ADCWT 100K CWT only
9	Oxbow	200,000	0+	Hells Canyon Dam	200K ADCWT
10	Lyons Ferry	200,000	0+	Pittsburg Landing	200K Unmarked
11	Lyons Ferry	200,000	0+	Captain John Rapids 2nd Release	200K ADCWT
~~12~~	~~DNFH/Umatilla~~	~~250,000~~	~~0+~~	~~Transportation Study[b,c]~~	~~250K PIT Tag only~~
13	Irrigon[d]	200,000	0+	Grande Ronde River	200K ADCWT
~~14~~	~~DNFH/Umatilla~~	~~78,000~~	~~0+~~	~~Transportation Study[b,c]~~	~~78K PIT tag only~~
15	Umatilla	200,000	0+	Hells Canyon Dam	200K ADCWT
16	Irrigon[d]	200,000	0+	Grande Ronde River	200K Unmarked
17	Umatilla	600,000	0+	Hells Canyon Dam	600K AD only
TOTAL	**Yearlings**	**900,000**			
	Subyearlings	**3,200,000[e]**			

Footnotes for Table B4B:

[a] The Parties expect that fisheries conducted in accordance with the harvest provisions of this Agreement will not compromise broodstock acquisition. If broodstock acquisition is nevertheless compromised by the current mark strategy and as a result of implementation of mark selective fisheries for fall Chinook salmon in the ocean or Columbia/Snake River mainstem, the Parties will revisit the marking strategy during the course of this Agreement.
[b] Production of transportation study surrogates is in effect for five brood years. After this group of fish has been provided for five years the transportation study group will be removed from the table and the groups of fish below will move up one step in priority. If eggs available for subyearling production are 1.2M or less, production of the transportation study surrogate group will be reduced to 250K or be deferred for that year. The PAC will review broodstock collected and projected egg take and make a recommendation to the policy group on whether to provide 250,000 fish or defer by November 1.
[c] USACOE Transportation Study natural-origin surrogate groups direct stream released into the Clearwater and mainstem Snake River.
[d] For logistical purposes, fish may be reared at Irrigon (LSRCP).
[e] Total does not include 328,000 from Transportation Study.

Appendix G: LFH 2015 Broodstock PBT Tissue Samples

Appendix G Table 1: Lyons Ferry Hatchery 2015 broodstock PBT tissue samples by fish ID number.

OtsPBT15-LF-Fall Genetic ID	Fish ID	Genetic ID	Fish ID	Genetic ID	Fish ID	Genetic ID	Fish ID
0001	M4963	0041	1013	0083	1068	0124	1055
0002	M4966	0042	1004	0084	1069	0125	1096
0003	M4967	0043	M4980	0085	1061	0126	1099
0004	M4968	0046	1027	0086	1067	0127	1090
0005	M4965	0047	M4982	0087	1065	0128	1098
0006	M4964	0048	1026	0088	1071	0129	1100
0007	1003	0049	1025	0089	M4997	0130	1101
0008	1001	0050	1029	0090	1072	0131	1107
0009	1002	0051	M4983	0091	1053	0132	1105
0010	M4969	0052	M4984	0092	1073	0133	M5001
0011	M4971	0053	1028	0093	1064	0134	1104
0012	M4973	0054	1030	0094	M4998	0135	M5003
0013	M4972	0055	M4985	0095	1054	0136	1112
0014	1010	0056	M4986	0096	1063	0137	1102
0015	1011	0057	1031	0098	1049	0138	1108
0016	1009	0058	1032	0099	1074	0139	1093
0017	M4970	0059	1033	0100	1078	0140	1109
0018	1007	0060	M4987	0101	1076	0141	1110
0019	1012	0061	1034	0102	1079	0142	1097
0020	M4974	0062	1035	0103	1051	0143	1091
0021	M4975	0063	1037	0104	1075	0144	M5000
0022	M4976	0064	1038	0105	1082	0145	1103
0023	1017	0065	1039	0106	1077	0146	1095
0024	1018	0066	M4989	0107	1057	0147	1106
0025	M4977	0067	1041	0108	1080	0148	1094
0026	1014	0068	1045	0109	M4999	0149	1111
0027	1006	0069	M4990	0110	M4996	0150	1050
0028	1016	0070	M4988	0111	1056	0151	1040
0029	1020	0071	1047	0112	1085	0152	1046
0030	M4978	0072	M4993	0113	1083	0153	1044
0031	1015	0073	1042	0114	1084	0154	M5002
0032	M4979	0074	M4991	0115	1088	0155	M4992
0033	1022	0075	1036	0116	1087	0156	1043
0034	1019	0076	M4995	0117	1086	0157	M5007
0035	1024	0077	1058	0118	1089	0158	M5006
0036	1023	0078	1052	0119	M4994	0159	M5004
0037	1021	0079	1059	0120	1048	0160	M5008
0038	M4981	0080	1060	0121	1081	0161	M5005
0039	1008	0081	1062	0122	1070	0162	1116
0040	1005	0082	1066	0123	1092	0163	1113

Appendix G Table 1: Lyons Ferry Hatchery 2015 broodstock PBT tissue samples by fish ID number.

OtsPBT15-LF-Fall Genetic ID	Fish ID	Genetic ID	Fish ID	Genetic ID	Fish ID	Genetic ID	Fish ID
0164	1118	0205	1140	0245	1174	0334	M5049
0165	1120	0206	1145	0246	1175	0335	2019
0166	1119	0207	1147	0247	1176	0336	2033
0167	1117	0208	M5019	0248	1177	0337	2032
0168	1122	0209	1148	0249	1178	0338	2036
0169	1114	0210	1146	0251	1179	0339	2034
0171	1115	0211	M5018	0252	1180	0340	M5050
0172	M5010	0212	M5022	0301	M5030	0341	2020
0173	1121	0213	M5024	0302	M5033	0342	M5047
0174	M5009	0214	M5025	0303	M5035	0343	2031
0175	M5011	0215	M5023	0304	M5032	0344	2024
0176	M5013	0216	1153	0305	2002	0345	M5042
0177	1129	0217	1149	0306	2004	0346	2030
0178	1123	0218	1150	0307	2005	0347	M5040
0179	1130	0219	1151	0308	2006	0348	2038
0180	M5014	0220	1152	0309	2001	0349	M5048
0181	1124	0221	1159	0310	M5041	0350	2035
0182	1126	0222	1154	0311	M5044	0351	2042
0183	1127	0223	1158	0312	2009	0352	2037
0184	1131	0224	1157	0313	2008	0353	2043
0185	M5012	0225	1155	0314	M5039	0354	2040
0186	M5015	0226	1156	0315	2013	0355	2045
0187	1125	0227	M5026	0316	2012	0356	2041
0188	1133	0228	1161	0317	2014	0357	M5051
0189	1134	0229	M5027	0318	M5031	0358	2049
0190	1132	0230	M5028	0319	2016	0359	M5057
0191	1135	0231	1163	0320	2018	0360	2051
0192	1128	0232	1164	0321	2015	0361	M5058
0193	M5016	0233	1162	0322	2021	0362	M5053
0194	M5017	0234	1160	0323	2022	0363	2055
0195	1136	0235	1166	0324	M5043	0364	2053
0196	1137	0236	1167	0325	M5046	0365	2054
0197	1138	0237	1165	0326	2010	0366	M5052
0198	1139	0238	1168	0327	2026	0367	2063
0199	1142	0239	1169	0328	2017	0368	2067
0200	M5021	0240	1170	0329	2028	0369	M5061
0201	1143	0241	1171	0330	2027	0370	2066
0202	1144	0242	1173	0331	2011	0371	2069
0203	1141	0243	M5029	0332	2029	0372	2039
0204	M5020	0244	1172	0333	2025	0373	M5060

Appendix G Table 1: Lyons Ferry Hatchery 2015 broodstock PBT tissue samples by fish ID number.

OtsPBT15-LF-Fall Genetic ID	Fish ID	Genetic ID	Fish ID	Genetic ID	Fish ID	Genetic ID	Fish ID
0374	M5056	0414	2105	0454	2104	0494	2143
0375	2073	0415	2107	0455	2101	0495	2145
0376	2075	0416	M5072	0456	2103	0496	M5089
0377	2065	0417	M5074	0457	M5076	0497	2146
0378	2076	0418	2112	0458	2100	0498	M5082
0379	2077	0419	2115	0459	M5067	0499	M5088
0380	2078	0420	2113	0460	2085	0500	2150
0381	2079	0421	2117	0461	2096	0501	2152
0382	2080	0422	2108	0462	2097	0502	2148
0383	2074	0423	2120	0463	M5070	0503	M5085
0384	2068	0424	2123	0464	2093	0504	2147
0385	2060	0425	M5079	0465	M5068	0505	2153
0386	2064	0426	M5077	0466	M5059	0506	2156
0387	2046	0427	2125	0467	2086	0507	2155
0388	2047	0428	2110	0468	2084	0508	2154
0389	2050	0429	2119	0469	M5073	0509	2149
0390	2059	0430	2109	0470	M5066	0510	2151
0391	2072	0431	2121	0471	M5069	0511	2144
0392	2044	0432	2124	0472	2056	0513	M5081
0393	2057	0433	2136	0473	M5055	0514	M5083
0394	M5062	0434	M5078	0474	M5054	0515	M5080
0395	2062	0435	2133	0475	M5065	0516	M5086
0396	2070	0436	2137	0476	M5064	0517	M5084
0397	2071	0437	2129	0477	2090	0518	2160
0398	2081	0438	2139	0478	M5045	0519	M5090
0399	M5063	0439	2122	0479	2061	0520	M5095
0400	2083	0440	2127	0480	2058	0521	M5094
0401	2087	0441	2138	0481	2048	0522	2165
0402	2089	0442	2118	0482	M5038	0523	2164
0403	2092	0443	2134	0483	M5034	0524	M5093
0404	2091	0444	2128	0484	2052	0525	M5097
0405	2082	0445	2135	0485	2023	0526	M5096
0406	2094	0446	2114	0486	2007	0527	2171
0407	M5071	0447	2132	0487	M5036	0528	2172
0408	2099	0448	M5075	0488	2003	0529	2163
0409	2098	0449	2131	0489	M5037	0530	M5102
0410	2088	0450	2130	0490	2140	0531	2178
0411	2095	0451	2126	0491	2141	0532	2179
0412	2106	0452	2111	0492	2142	0533	M5103
0413	2102	0453	2116	0493	M5087	0534	M5105

Appendix G Table 1: Lyons Ferry Hatchery 2015 broodstock PBT tissue samples by fish ID number.

OtsPBT15-LF-Fall Genetic ID	Fish ID	Genetic ID	Fish ID	Genetic ID	Fish ID	Genetic ID	Fish ID
0535	M5098	0578	2167	0620	M5121	0661	2242
0536	M5091	0579	2198	0621	M5125	0662	M5131
0537	2183	0580	M5111	0622	2226	0663	2241
0538	M5106	0581	2202	0623	M5123	0664	2259
0539	M5104	0582	2199	0624	2225	0665	2260
0541	2184	0583	M5109	0625	2231	0667	2262
0542	2176	0584	2203	0626	M5122	0668	2261
0543	2157	0585	M5113	0627	2232	0669	2263
0544	2159	0586	M5114	0628	2228	0670	2258
0545	2187	0587	2200	0629	M5119	0671	M5132
0546	2186	0588	M5116	0630	2233	0672	2265
0547	2189	0589	2204	0631	M5128	0673	M5133
0548	2191	0590	M5110	0632	M5130	0674	2264
0549	2185	0591	2205	0633	2234	0675	2266
0550	2192	0592	2207	0634	2229	0676	2270
0553	2196	0593	2208	0635	M5129	0677	2268
0554	2190	0594	M5108	0636	2236	0678	M5134
0555	2195	0595	2212	0637	2230	0679	2269
0556	2197	0596	2214	0638	2240	0680	2275
0557	2194	0597	2211	0639	2237	0681	2267
0558	M5099	0598	2210	0640	M5126	0682	2272
0559	2193	0599	2213	0641	2244	0683	2279
0560	2161	0600	M5107	0642	2248	0684	2282
0561	2158	0601	2206	0643	M5127	0685	2285
0562	2174	0602	2220	0644	2235	0686	2281
0563	2188	0603	M5117	0645	2246	0687	2273
0564	2175	0604	M5118	0646	2245	0688	2287
0565	2173	0605	M5115	0647	2247	0689	2276
0566	2170	0607	2215	0648	2243	0690	2289
0567	2182	0608	M5112	0649	2250	0691	2277
0568	2180	0609	2209	0650	2251	0692	2278
0569	M5101	0611	2223	0651	2238	0693	2288
0570	2181	0612	2217	0652	2252	0694	2271
0571	2162	0613	2221	0653	2249	0695	2284
0572	2169	0614	2222	0654	2253	0696	M5135
0573	2177	0615	2201	0655	2239	0697	2280
0574	M5100	0616	2219	0657	2256	0698	2283
0575	2166	0617	2218	0658	2254	0699	2286
0576	2168	0618	2216	0659	2257	0700	2274
0577	M5092	0619	M5120	0660	2255	0701	M5124

Appendix G Table 1: Lyons Ferry Hatchery 2015 broodstock PBT tissue samples by fish ID number.

OtsPBT15-LF-Fall Genetic ID	Fish ID	Genetic ID	Fish ID	Genetic ID	Fish ID	Genetic ID	Fish ID
0702	M5136	0742	2314	0827	M5148	0869	3034
0703	2294	0743	2332	0828	M5168	0870	3049
0704	2296	0744	2304	0829	3020	0871	M5184
0705	2295	0745	2331	0830	M5145	0872	3031
0706	2293	0746	2330	0831	3019	0874	3032
0707	2292	0747	M5144	0832	3018	0875	3036
0708	2298	0748	2328	0833	M5146	0876	3022
0709	2297	0749	2320	0834	3021	0877	M5180
0710	2299	0750	2311	0835	3023	0878	3054
0711	M5137	0751	2301	0838	3025	0879	M5181
0712	2300	0752	2224	0839	3026	0880	3051
0713	M5138	0753	2227	0840	3030	0881	3024
0714	2291	0754	2290	0841	3028	0882	M5166
0715	2302	0755	2316	0842	M5171	0883	M5187
0716	2306	0801	M5147	0843	M5162	0884	3053
0717	2305	0802	3001	0844	M5176	0885	3027
0718	2303	0803	M5149	0845	M5153	0886	3056
0719	M5141	0804	3002	0846	M5174	0887	M5186
0720	M5139	0805	M5150	0847	M5173	0888	M5183
0721	M5140	0806	3003	0848	3040	0889	M5188
0722	2307	0807	3004	0849	M5178	0890	3057
0723	2310	0808	3005	0850	M5179	0891	3052
0724	2309	0809	M5156	0851	3044	0892	3035
0725	2312	0810	M5154	0852	M5167	0893	3009
0726	2313	0811	M5158	0853	M5175	0894	3055
0727	2315	0812	M5152	0854	3048	0895	3058
0728	M5142	0813	M5155	0855	3046	0896	M5189
0729	2308	0814	3007	0856	3047	0897	3062
0730	2318	0815	3006	0857	M5170	0898	M5185
0731	2321	0816	M5159	0858	3042	0899	M5191
0732	2323	0817	3008	0859	3043	0900	M5193
0733	2324	0818	3010	0860	3045	0901	3064
0734	2322	0819	M5161	0861	M5151	0902	M5194
0735	M5143	0820	M5160	0862	M5169	0903	M5192
0736	2325	0821	M5164	0863	3037	0904	M5200
0737	2326	0822	3013	0864	3041	0905	M5196
0738	2319	0823	M5157	0865	3038	0906	M5197
0739	2317	0824	3015	0866	M5182	0907	3076
0740	2329	0825	M5163	0867	3033	0908	3083
0741	2327	0826	3011	0868	3039	0909	3073

Appendix G Table 1: Lyons Ferry Hatchery 2015 broodstock PBT tissue samples by fish ID number.

OtsPBT15-LF-Fall Genetic ID	Fish ID	Genetic ID	Fish ID	Genetic ID	Fish ID	Genetic ID	Fish ID
0910	3084	0950	M5207	0990	3141	1035	M5172
0911	3085	0951	M5204	0991	3144	1036	M5231
0912	M5190	0952	M5212	0992	3138	1037	3012
0913	3086	0953	3106	0993	3143	1038	3016
0914	M5195	0954	M5213	0994	M5225	1039	3014
0915	3089	0955	3107	0995	3130	1040	M5234
0916	3088	0956	3108	0996	3133	1041	M5232
0917	3092	0957	M5205	0997	3134	1042	3146
0918	3080	0958	3109	0999	3132	1043	M5233
0919	3074	0959	3110	1000	3139	1044	M5230
0920	3094	0960	3096	1001	3142	1045	3147
0921	3081	0961	M5216	1002	3145	1046	3149
0922	3061	0962	M5214	1004	M5218	1047	M5235
0923	3072	0963	3114	1005	3117	1048	3152
0924	3090	0964	3111	1006	M5224	1049	3154
0925	3093	0965	3112	1007	M5229	1050	M5239
0926	M5199	0966	M5217	1008	3119	1052	3151
0927	3068	0967	3115	1009	3124	1054	3153
0928	3067	0968	3116	1010	M5226	1055	M5236
0929	3078	0969	M5211	1011	M5198	1058	M5240
0930	3082	0970	3122	1014	3118	1059	3160
0931	3069	0971	M5215	1015	3077	1060	3157
0932	M5201	0972	3120	1016	3126	1061	M5242
0933	3063	0973	3123	1017	3127	1062	3158
0934	3095	0974	M5220	1018	M5219	1063	M5244
0935	3070	0975	M5227	1019	M5202	1064	3162
0936	M5203	0976	3113	1020	3079	1065	M5246
0937	3065	0977	M5222	1021	3087	1066	3156
0938	3099	0978	3125	1022	3071	1067	3165
0939	3100	0979	3121	1023	3091	1068	M5245
0940	3104	0980	M5223	1024	3050	1069	3167
0941	M5208	0981	M5221	1025	3066	1070	3159
0942	3102	0982	3128	1026	3029	1071	M5248
0943	3105	0983	3129	1027	3060	1072	3168
0944	3101	0984	3135	1028	3075	1073	3150
0945	M5209	0985	M5228	1029	M5177	1074	3161
0946	3103	0986	3131	1030	3059	1075	M5241
0947	M5210	0987	3136	1031	M5206	1076	3148
0948	3098	0988	3140	1032	M5165	1077	3163
0949	3097	0989	3137	1034	3017	1078	M5243

Appendix G Table 1: Lyons Ferry Hatchery 2015 broodstock PBT tissue samples by fish ID number.

OtsPBT15-LF-Fall Genetic ID	Fish ID	Genetic ID	Fish ID	Genetic ID	Fish ID	Genetic ID	Fish ID
1079	M5238	1119	3199	1159	3225	1199	3263
1080	3169	1120	M5257	1160	3227	1200	3241
1081	M5247	1121	3201	1161	3226	1201	3266
1082	3155	1122	3206	1162	3230	1202	3264
1083	M5237	1123	3191	1163	3229	1203	3250
1084	3166	1124	3208	1164	3228	1204	3265
1085	3164	1125	3210	1165	M5267	1205	3258
1086	M5250	1126	3204	1166	3231	1206	3256
1087	M5251	1127	3211	1167	3233	1207	3262
1088	M5249	1128	3200	1168	M5271	1208	3261
1089	M5252	1129	3186	1169	3235	1209	3248
1090	3174	1130	3207	1170	M5269	1210	3255
1091	3176	1131	3197	1171	M5270	1211	3259
1092	3175	1132	3202	1172	3234	1212	M5274
1093	3177	1133	3195	1173	3237	1213	3245
1094	3178	1134	3203	1174	3236	1214	3232
1095	3172	1135	3209	1175	3238	1215	M5281
1096	M5253	1136	M5261	1176	M5276	1216	3267
1097	3171	1137	3190	1177	M5279	1217	3269
1098	3180	1138	3214	1178	3239	1218	M5284
1099	3179	1139	M5262	1179	M5278	1219	3268
1100	3181	1140	3212	1180	M5277	1220	3270
1101	3173	1141	3216	1181	3243	1221	M5286
1102	3182	1142	3218	1182	M5275	1222	3271
1103	3170	1143	3213	1183	3247	1223	M5283
1104	3183	1144	3215	1184	3244	1224	3272
1105	M5254	1145	M5260	1185	M5280	1225	3273
1106	3184	1146	3217	1186	3249	1226	3274
1107	3189	1147	3220	1187	3251	1227	M5288
1108	3185	1148	M5263	1188	3252	1228	M5287
1109	3188	1149	3205	1189	3246	1229	3277
1110	3187	1150	3192	1190	M5273	1230	M5282
1111	M5255	1151	3219	1191	3254	1231	3280
1112	3194	1152	3223	1192	3240	1232	3275
1113	M5256	1153	3221	1193	M5272	1233	M5285
1114	M5259	1154	3222	1194	3242	1234	3276
1115	3196	1155	M5264	1195	3257	1235	3283
1116	3193	1156	M5266	1196	M5268	1236	3288
1117	3198	1157	3224	1197	3260	1237	3290
1118	M5258	1158	M5265	1198	3253	1238	3291

Appendix G Table 1: Lyons Ferry Hatchery 2015 broodstock PBT tissue samples by fish ID number.

OtsPBT15-LF-Fall Genetic ID	Fish ID	Genetic ID	Fish ID	Genetic ID	Fish ID	Genetic ID	Fish ID
1239	3281	1310	M5295	1350	4022	1390	M5324
1240	3292	1311	4001	1351	4031	1391	4077
1241	3282	1312	4005	1352	4029	1392	4070
1242	3296	1313	4002	1353	4032	1393	M5328
1243	M5290	1314	M5297	1354	4030	1394	4078
1244	3297	1315	4004	1355	4040	1395	4074
1245	M5289	1316	4003	1356	4051	1396	M5332
1246	3298	1317	M5294	1357	4026	1397	4081
1247	3299	1318	4012	1358	4037	1398	M5323
1248	3294	1319	M5301	1359	M5318	1399	4059
1249	3285	1320	M5305	1360	M5317	1400	4084
1250	3295	1321	M5304	1361	4045	1401	4093
1251	3301	1322	4011	1362	4041	1402	4096
1252	3286	1323	4016	1363	4024	1403	4092
1253	3284	1324	M5303	1364	4039	1404	4089
1254	3306	1325	4019	1365	4048	1405	4090
1255	3279	1326	4007	1366	M5319	1406	4100
1256	3287	1327	M5310	1367	4044	1407	4097
1257	3304	1328	M5311	1368	4043	1408	4080
1258	3303	1329	4018	1369	M5321	1409	M5330
1259	3302	1330	4017	1370	M5320	1410	4095
1260	3300	1331	M5307	1371	4053	1411	4104
1261	3293	1332	4010	1372	4058	1412	4105
1262	3311	1333	4013	1373	4056	1413	4113
1263	3305	1334	4015	1374	4042	1414	4109
1264	3307	1335	M5314	1375	4033	1415	4116
1265	3289	1336	M5316	1376	4069	1416	4115
1266	3309	1337	4009	1377	4068	1417	4112
1267	3310	1338	M5309	1378	4066	1418	4101
1268	3308	1339	4014	1379	4060	1419	4110
1269	3278	1340	M5313	1380	4063	1420	4102
1301	M5291	1341	M5315	1381	4052	1421	4099
1302	M5296	1342	M5312	1382	4049	1422	4107
1303	M5298	1343	M5306	1383	4046	1423	4075
1304	M5293	1344	M5308	1384	M5322	1424	4086
1305	M5299	1345	4008	1385	4073	1425	4094
1306	M5292	1346	4020	1386	4057	1426	4111
1307	M5300	1347	4034	1387	4061	1427	4067
1308	M5302	1348	4025	1388	4062	1428	4072
1309	4006	1349	4021	1389	4047	1429	M5339

Appendix G Table 1: Lyons Ferry Hatchery 2015 broodstock PBT tissue samples by fish ID number.

OtsPBT15-LF-Fall Genetic ID	Fish ID	Genetic ID	Fish ID	Genetic ID	Fish ID	Genetic ID	Fish ID
1430	4091	1470	M5346	1511	4133	1551	M5374
1431	4027	1471	M5350	1512	M5337	1552	4189
1432	4082	1472	4158	1513	4083	1553	M5356
1433	4117	1473	4153	1514	4098	1554	M5371
1434	M5338	1474	4166	1515	4103	1555	4186
1435	4120	1475	4148	1516	4108	1556	4185
1436	4118	1476	4140	1517	M5331	1557	M5376
1437	4065	1477	4130	1518	M5326	1558	4177
1438	4128	1478	4143	1519	4079	1559	4181
1439	4055	1479	4129	1520	M5325	1560	M5360
1440	4125	1480	4131	1521	M5334	1561	M5380
1441	4121	1481	4151	1522	4085	1562	4180
1442	4132	1482	4136	1523	M5333	1563	M5358
1443	4124	1483	4119	1524	4076	1564	M5381
1444	4122	1484	4137	1525	4088	1565	4175
1445	4127	1486	4150	1526	4054	1566	M5377
1446	4126	1487	4139	1527	4071	1567	4184
1447	M5335	1488	4146	1528	4087	1568	4187
1448	M5341	1489	4123	1529	4064	1569	M5379
1449	4138	1490	4155	1530	M5329	1570	4188
1450	4141	1491	4157	1531	4036	1571	4202
1451	4142	1492	4162	1532	4028	1572	4201
1452	M5345	1493	M5342	1533	4038	1573	M5357
1453	4145	1494	4163	1534	4023	1574	M5361
1454	M5348	1495	4159	1535	4050	1575	M5359
1455	4147	1496	4167	1536	4035	1576	4203
1456	4149	1497	4174	1537	M5327	1577	4200
1457	M5347	1498	4168	1538	M5363	1578	4204
1458	M5343	1499	4164	1539	4179	1579	M5373
1459	4154	1500	4144	1540	M5366	1580	4199
1460	M5349	1501	4160	1541	4183	1581	M5385
1461	4156	1502	M5352	1542	M5369	1582	4205
1462	M5351	1503	4106	1543	4182	1583	M5386
1463	4169	1504	4152	1544	4178	1584	4198
1464	4171	1505	M5340	1545	4176	1585	4206
1465	4172	1506	4161	1546	4114	1586	M5387
1466	M5344	1507	4134	1547	M5367	1587	4207
1467	4173	1508	4135	1548	M5370	1588	M5382
1468	4165	1509	M5353	1549	4190	1589	4193
1469	4170	1510	M5336	1550	4192	1590	4209

Appendix G Table 1: Lyons Ferry Hatchery 2015 broodstock PBT tissue samples by fish ID number.

OtsPBT15-LF-Fall Genetic ID	Fish ID	Genetic ID	Fish ID	Genetic ID	Fish ID	Genetic ID	Fish ID
1591	M5389	1631	M5365	1671	M5415	1711	4283
1592	4211	1632	4194	1672	M5414	1712	4288
1593	4210	1633	4195	1673	4268	1713	4291
1594	M5391	1634	4197	1674	M5419	1714	4292
1595	4213	1635	4191	1675	4269	1715	4290
1596	4212	1636	4235	1676	4271	1716	4293
1597	4217	1637	4237	1677	M5413	1717	4296
1598	M5390	1638	4236	1678	4274	1718	4295
1599	4216	1639	4239	1679	M5416	1719	4294
1600	4218	1640	M5375	1680	4275	1720	4299
1601	4220	1641	4240	1681	M5418	1721	4298
1602	M5368	1642	M5397	1682	4273	1722	4302
1603	4221	1643	4238	1683	4262	1723	4297
1604	M5364	1644	4241	1684	M5411	1724	4304
1605	4225	1645	M5393	1685	4272	1725	4300
1606	4223	1646	4242	1686	4257	1726	4303
1607	M5378	1647	4243	1687	4259	1727	4301
1608	4229	1648	4244	1688	M5405	1728	4307
1609	M5383	1649	4246	1689	M5403	1729	4312
1610	4232	1650	4248	1690	4267	1730	4308
1611	M5372	1651	M5396	1691	4254	1731	4313
1612	4234	1652	4245	1692	M5404	1732	4309
1613	M5384	1653	4250	1693	4263	1733	4311
1614	4233	1654	4249	1694	4266	1734	M5421
1615	4230	1655	M5402	1695	M5408	1735	4306
1616	M5388	1656	4247	1696	M5400	1736	4322
1617	4227	1657	M5406	1697	4261	1737	4321
1618	4231	1658	4252	1698	M5417	1738	4315
1619	4224	1659	4253	1699	4276	1739	4316
1620	M5355	1660	4251	1700	M5394	1740	4320
1621	4215	1661	M5407	1701	M5392	1741	4319
1622	4228	1662	4256	1702	M5401	1742	4310
1623	4226	1663	M5410	1703	4270	1743	4317
1624	4219	1664	4255	1704	M5398	1744	4323
1625	M5354	1665	M5409	1705	M5399	1745	4328
1626	M5362	1666	4258	1706	M5395	1746	4318
1627	4222	1667	4260	1707	4282	1747	4326
1628	4214	1668	M5412	1708	4278	1748	4327
1629	4208	1669	4264	1709	4285	1749	4332
1630	4196	1670	4265	1710	M5420	1750	4325

Appendix G Table 1: Lyons Ferry Hatchery 2015 broodstock PBT tissue samples by fish ID number.

OtsPBT15-LF-Fall Genetic ID	Fish ID	Genetic ID	Fish ID	Genetic ID	Fish ID	Genetic ID	Fish ID
1751	4333	1826	5010	1866	5041	1906	5067
1752	4305	1827	M5436	1867	M5480	1907	M5501
1753	4314	1828	M5426	1868	5043	1908	M5512
1754	4324	1829	M5432	1869	5046	1909	M5502
1755	4329	1830	M5456	1870	M5488	1910	5065
1756	4331	1831	M5428	1871	5039	1911	5063
1757	4279	1832	M5424	1872	M5494	1912	5069
1758	4287	1833	M5453	1873	5047	1913	5057
1759	4277	1834	M5434	1874	5042	1914	M5504
1760	4286	1835	M5438	1875	5052	1915	M5499
1761	4330	1836	M5448	1876	M5482	1916	M5507
1762	4284	1837	M5455	1877	M5489	1917	5060
1763	4289	1838	M5452	1878	M5493	1918	M5503
1764	4281	1839	M5423	1879	5051	1919	M5505
1765	4280	1840	M5451	1880	M5487	1920	5053
1801	M5422	1841	M5446	1881	M5479	1921	M5497
1802	5001	1842	M5440	1882	M5490	1922	M5515
1803	M5431	1843	M5443	1883	M5483	1923	M5498
1804	5002	1844	5028	1884	5040	1924	M5516
1805	M5430	1845	M5457	1885	M5486	1925	M5517
1806	5005	1846	5030	1886	M5495	1926	5054
1807	M5439	1847	5031	1887	M5492	1927	M5522
1808	5007	1848	M5465	1888	M5496	1928	5074
1809	5011	1849	M5459	1889	M5500	1929	M5525
1810	5006	1850	M5461	1890	M5506	1930	M5526
1811	5012	1851	M5463	1891	5058	1931	5073
1812	5015	1852	M5462	1892	M5508	1932	M5524
1813	M5441	1853	M5468	1893	M5509	1933	M5527
1814	M5450	1854	M5471	1894	5061	1934	5078
1815	5019	1855	M5474	1895	M5510	1935	M5530
1816	5021	1856	M5477	1896	5062	1936	M5529
1817	5016	1857	M5476	1897	5066	1937	5083
1818	5022	1858	M5473	1898	5068	1938	5079
1819	M5449	1859	M5467	1899	M5513	1939	M5531
1820	5020	1860	5034	1900	5070	1940	M5534
1821	5025	1861	5036	1901	M5514	1941	M5528
1822	M5445	1862	M5475	1902	5064	1942	M5518
1823	M5447	1863	M5472	1903	M5511	1943	M5523
1824	5013	1864	M5470	1904	5071	1944	5075
1825	M5433	1865	M5481	1905	5059	1945	M5519

Appendix G Table 1: Lyons Ferry Hatchery 2015 broodstock PBT tissue samples by fish ID number.

OtsPBT15-LF-Fall Genetic ID	Fish ID	Genetic ID	Fish ID	Genetic ID	Fish ID	Genetic ID	Fish ID
1946	5081	1959	M5485	1972	M5469	1985	5008
1947	5077	1960	M5484	1973	5038	1986	M5437
1948	5076	1961	M5532	1974	5029	1987	M5454
1949	5080	1962	5049	1975	5032	1988	M5444
1950	M5520	1963	5055	1976	M5464	1989	5027
1951	M5533	1964	5048	1977	M5466	1991	5014
1952	5056	1965	5050	1978	5017	1992	M5427
1953	5082	1966	5037	1979	5026	1993	5003
1954	M5491	1967	5044	1980	5009	1994	M5429
1955	5045	1968	5035	1981	5023	1995	M5425
1956	M5460	1969	M5478	1982	5024	1996	5004
1957	M5521	1970	M5458	1983	M5435	1997	M5442
1958	5072	1971	5033	1984	5018		

Appendix H: Historical Size at Age of Return of CWT LSRCP Origin Fish Processed by WDFW: 1985-2014

(Size at return of fish processed may not represent the full run depending upon trapping and sampling protocols. WDFW and LSRCP releases are included. Historical recoveries (1985-1987) of subyearling fall Chinook salmon released from Hagerman National Fish hatchery are not included. Caution must be taken when comparing historical data because of changes in the program including addition of releases upstream of LGR. Another item for consideration is the BY89 which was progeny from broodstock consisting of a large proportion of strays. Although the BY89 is presented in Appendix I, they were never used as broodstock when they returned.)

Appendix H Table 1: Size at age of return in 1985-1990 by sex for CWT LSRCP fish processed by WDFW that were from yearling production.

Return year	Sex		Total age at return 2(Minijack)	3(Jack)	4	5	6	7
1985	Male	N=	1870	-	-	-	-	-
		Median (cm)	**35**	**-**	**-**	**-**	**-**	**-**
		Range (cm)	29-53	-	-	-	-	-
	Female	N=	15	-	-	-	-	-
		Median (cm)	**35**	**-**	**-**	**-**	**-**	**-**
		Range (cm)	30-40	-	-	-	-	-
1986	Male	N=	48	636	-	-	-	-
		Median (cm)	**36**	**57**	**-**	**-**	**-**	**-**
		Range (cm)	31-40	37-70	-	-	-	-
	Female	N=	-	15	-	-	-	-
		Median (cm)	**-**	**63**	**-**	**-**	**-**	**-**
		Range (cm)	-	50-73	-	-	-	-
1987	Male	N=	241	88	552	-	-	-
		Median (cm)	**36**	**54**	**80**	**-**	**-**	**-**
		Range (cm)	29-49	40-64	41-100	-	-	-
	Female	N=	1	1	867	-	-	-
		Median (cm)	**-**	**-**	**78**	**-**	**-**	**-**
		Range (cm)	35	66	46-98	-	-	-
1988	Male	N=	225	239	55	110	-	-
		Median (cm)	**35**	**55**	**68**	**97**	**-**	**-**
		Range (cm)	26-43	35-66	55-93	55-111	-	-
	Female	N=	-	2	42	165	-	-
		Median (cm)	**-**	**-**	**74**	**88**	**-**	**-**
		Range (cm)	-	64-67	58-90	54-106	-	-
1989	Male	N=	81	226	203	21	3	-
		Median (cm)	**34**	**54**	**70**	**85**	**92**	**-**
		Range (cm)	30-46	33-66	44-93	63-105	84-94	-
	Female	N=	-	4	200	38	4	-
		Median (cm)	**-**	**64**	**75**	**82**	**93**	**-**
		Range (cm)	-	58-66	54-89	60-93	76-104	-
1990	Male	N=	293	75	71	57	2	-
		Median (cm)	**34**	**54**	**73**	**93**	**-**	**-**
		Range (cm)	28-40	43-62	58-93	62-102	103-109	-
	Female	N=	-	2	120	94	1	1
		Median (cm)	**-**	**-**	**75**	**83**	**-**	**-**
		Range (cm)	-	54-61	56-86	68-94	84	89

Appendix H Table 2: Size at age of return in 1991-1996 by sex for CWT LSRCP fish processed by WDFW that were from yearling production.

Return year	Sex		Total age at return: 2(Minijack)	3(Jack)	4	5	6	7
1991	Male	N=	-	197	71	44	8	-
		Median (cm)	**-**	**52**	**73**	**94**	**89**	**-**
		Range (cm)	-	31-65	45-88	61-109	86-101	-
	Female	N=	-	2	123	89	9	-
		Median (cm)	**-**	**-**	**73**	**81**	**92**	**-**
		Range (cm)	-	57-74	60-86	56-95	79-103	-
1992	Male	N=	129	-	161	22	-	-
		Median (cm)	**34**	**-**	**73**	**89**	**-**	**-**
		Range (cm)	29-39	-	46-110	60-102	-	-
	Female	N=	-	-	241	34	1	-
		Median (cm)	**-**	**-**	**71**	**80**	**85**	**-**
		Range (cm)	-	-	55-90	68-94	85	-
1993	Male	N=	102	58	-	60	1	-
		Median (cm)	**33**	**51**	**-**	**85**	**-**	**-**
		Range (cm)	28-41	40-68	-	51-99	77	-
	Female	N=	-	2	-	102	-	-
		Median (cm)	**-**	**-**	**-**	**80**	**-**	**-**
		Range (cm)	-	53-75	-	67-94	-	-
1994	Male	N=	241	283	54	-	4	-
		Median (cm)	**35**	**53**	**75**	**-**	**83**	**-**
		Range (cm)	29-51	36-82	42-91	-	76-98	-
	Female	N=	-	4	86	-	10	-
		Median (cm)	**-**	**58**	**73**	**-**	**79**	**-**
		Range (cm)	-	57-63	58-86	-	67-92	-
1995	Male	N=	1781	230	26	122	-	-
		Median (cm)	**35**	**55**	**78**	**78**	**-**	**-**
		Range (cm)	22-47	41-72	51-90	57-105	-	-
	Female	N=	-	14	53	175	-	1
		Median (cm)	**-**	**61**	**75**	**75**	**-**	**-**
		Range (cm)	-	56-68	60-90	55-95	-	80
1996	Male	N=	380	374	238	18	2	-
		Median (cm)	**33**	**51**	**72**	**90**	**-**	-
		Range (cm)	27-47	37-66	54-98	77-105	77-83	-
	Female	N=	-	20	314	32	1	-
		Median (cm)	**-**	**60**	**74**	**83**	**-**	-
		Range (cm)	-	54-80	56-92	70-92	95	-

Appendix H Table 3: Size at age of return in 1997-2002 by sex for CWT LSRCP fish processed by WDFW that were from yearling production.

Return year	Sex		Total age at return 2(Minijack)	3(Jack)	4	5	6	7
1997	Male	N=	434	401	224	55	-	-
		Median (cm)	**34**	**50**	**70**	**90**	**-**	-
		Range (cm)	28-40	37-68	48-93	57-104	-	-
	Female	N=	-	-	347	116	2	-
		Median (cm)	**-**	**-**	**73**	**82**	**-**	-
		Range (cm)	-	-	55-89	57-97	77-102	-
1998	Male	N=	136	1770	289	136	2	-
		Median (cm)	**35**	**52**	**70**	**88**	**-**	-
		Range (cm)	22-43	33-73	45-97	56-121	96-98	-
	Female	N=	1	142	301	351	3	-
		Median (cm)	**-**	**57**	**73**	**84**	**77**	-
		Range (cm)	34	49-78	49-91	61-106	76-82	-
1999	Male	N=	358	394	570	42	10	-
		Median (cm)	**36**	**53**	**69**	**88**	**96**	-
		Range (cm)	30-49	37-70	45-95	63-104	76-108	-
	Female	N=	-	14	741	96	27	-
		Median (cm)	**-**	**61**	**72**	**85**	**89**	-
		Range (cm)	-	49-70	53-86	64-96	74-99	-
2000	Male	N=	412	1066	188	97	1	-
		Median (cm)	**36**	**59**	**70**	**88**	**-**	**-**
		Range (cm)	28-44	34-72	55-95	59-110	86	-
	Female	N=	-	110	292	249	4	-
		Median (cm)	**-**	**64**	**77**	**82**	**92**	-
		Range (cm)	-	54-74	54-89	58-94	91-92	-
2001	Male	N=	14	858	221	29	3	1
		Median (cm)	**34**	**57**	**75**	**91**	**97**	**-**
		Range (cm)	32-40	39-74	57-98	69-103	84-103	78
	Female	N=	-	60	614	111	13	-
		Median (cm)	**-**	**63**	**77**	**84**	**92**	-
		Range (cm)	-	52-76	55-95	65-98	79-100	-
2002	Male	N=	219	471	241	35	2	-
		Median (cm)	**35**	**55**	**74**	**98**	**85**	-
		Range (cm)	27-51	40-67	51-96	71-112	73-97	-
	Female	N=	-	6	505	94	3	-
		Median (cm)	**-**	**64**	**77**	**86**	**86**	-
		Range (cm)	-	60-80	51-93	73-97	84-87	-

Appendix H Table 4: Size at age of return in 2003-2008 by sex for CWT LSRCP fish processed by WDFW that were from yearling production.

Return year	Sex		Total age at return 2(Minijack)	3(Jack)	4	5	6	7
2003	Male	N=	690	846	232	24	-	-
		Median (cm)	**35**	**54**	**72**	**88**	**-**	-
		Range (cm)	27-53	31-78	47-90	62-105	-	-
	Female	N=	-	63	269	158	3	-
		Median (cm)	**-**	**62**	**76**	**83**	**90**	-
		Range (cm)	-	45-68	52-88	68-101	85-96	-
2004	Male	N=	329	1444	259	21	3	-
		Median (cm)	**36**	**59**	**69**	**95**	**99**	-
		Range (cm)	30-43	40-74	54-97	60-113	86-101	-
	Female	N=	-	249	513	104	4	-
		Median (cm)	**-**	**64**	**74**	**84**	**88**	-
		Range (cm)	-	44-84	57-91	65-98	70-95	-
2005	Male	N=	438	472	346	69	1	-
		Median (cm)	**36**	**58**	**71**	**84**	**-**	**-**
		Range (cm)	29-47	43-71	50-96	60-106	84	-
	Female	N=	-	55	917	192	7	-
		Median (cm)	**-**	**64**	**77**	**81**	**83**	-
		Range (cm)	-	50-82	52-90	61-95	74-90	-
2006	Male	N=	660	964	109	8	-	-
		Median (cm)	**35**	**59**	**71**	**75**	**-**	-
		Range (cm)	28-45	41-80	56-86	67-95	-	-
	Female	N=	-	125	266	88	8	-
		Median (cm)	**-**	**65**	**76**	**84**	**85**	-
		Range (cm)	-	49-74	60-88	70-99	74-96	-
2007	Male	N=	281	1759	285	5	-	-
		Median (cm)	**33**	**60**	**73**	**83**	**-**	-
		Range (cm)	27-56	42-79	52-98	76-92	-	-
	Female	N=	-	513	780	35	2	-
		Median (cm)	**-**	**63**	**76**	**83**	**-**	-
		Range (cm)	-	50-83	58-96	75-93	80-84	-
2008	Male	N=	1244	723	120	6	-	-
		Median (cm)	**35**	**57**	**75**	**82**	**-**	-
		Range (cm)	28-54	32-79	59-99	75-100	-	-
	Female	N=	-	75	494	58	-	-
		Median (cm)	**-**	**65**	**78**	**83**	**-**	-
		Range (cm)	-	57-80	60-97	62-92	-	-

Appendix H Table 5: Size at age of return in 2009-2014 by sex for CWT LSRCP fish processed by WDFW that were from yearling production.

Return			Total age at return					
year	**Sex**		**2(Minijack)**	**3(Jack)**	**4**	**5**	**6**	**7**
2009	Male	N=	43	1293	130	5	-	-
		Median (cm)	**34**	**59**	**74**	**89**	**-**	-
		Range (cm)	29-42	39-75	56-92	76-96	-	-
	Female	N=	-	545	389	11	1	-
		Median (cm)	**-**	**65**	**77**	**85**	**-**	-
		Range (cm)	-	53-88	61-90	80-92	80	-
2010	Male	N=	137	201	161	4	1	-
		Median (cm)	**35**	**59**	**77**	**93**	**-**	-
		Range (cm)	30-56	48-77	50-105	84-100	89	-
	Female	N=	-	20	504	20	-	-
		Median (cm)	**-**	**67**	**79**	**86**	**-**	-
		Range (cm)	-	53-74	55-98	72-92	-	-
2011	Male	N=	165	457	155	7	-	-
		Median (cm)	**35**	**57**	**72**	**85**	**-**	**-**
		Range (cm)	32-45	41-72	60-89	78-102	-	-
	Female	N=	-	142	526	53	2	-
		Median	**-**	**64**	**76**	**80**	**-**	**-**
		Range	-	55-79	63-90	66-91	80-87	-
2012	Male	N=	342	438	120	6	-	-
		Median (cm)	**35**	**56**	**69**	**84**	**-**	-
		Range (cm)	28-67	32-69	51-92	56-94	-	-
	Female	N=	-	24	475	59	2	-
		Median (cm)	**-**	**63**	**76**	**83**	**-**	**-**
		Range (cm)	-	50-68	62-89	72-95	77-86	-
2013	Male	N=	260	263	193	10	-	-
		Median (cm)	**35**	**57**	**71**	**79**	**-**	**-**
		Range (cm)	29-54	38-73	52-88	68-90	-	-
	Female	N=	-	60	393	62	1	-
		Median (cm)	**-**	**61**	**72**	**78**	**-**	**-**
		Range (cm)	-	49-85	62-83	68-91	82	-
2014	Male	N=	59	103	100	4	-	-
		Median (cm)	**33**	**55**	**70**	**74**	**-**	**-**
		Range (cm)	29-45	43-68	53-87	57-77	-	-
	Female	N=	-	7	202	12	-	-
		Median (cm)	**-**	**59**	**74**	**82**	**-**	**-**
		Range (cm)	-	54-64	50-84	72-92	-	-

Appendix H Table 6: Size at age of return in 1985-1990 by sex for CWT LSRCP fish processed by WDFW that were from subyearling production.

Return year	Sex		Total age at return 1(Minijack)	2(Jack)	3	4	5	6	7
1985	Male	N=	-	-	-	-	-	-	-
		Median (cm)	**-**	**-**	**-**	**-**	**-**	**-**	-
		Range (cm)	-	-	-	-	-	-	-
	Female	N=	-	-	-	-	-	-	-
		Median (cm)	**-**	**-**	**-**	**-**	**-**	**-**	-
		Range (cm)	-	-	-	-	-	-	-
1986	Male	N=	-	34	-	-	-	-	-
		Median (cm)	**-**	**45**	**-**	**-**	**-**	**-**	-
		Range (cm)	-	32-55	-	-	-	-	-
	Female	N=	-	-	-	-	-	-	-
		Median (cm)	**-**	**-**	**-**	**-**	**-**	**-**	-
		Range (cm)	-	-	-	-	-	-	-
1987	Male	N=	-	24	80	-	-	-	-
		Median (cm)	**-**	**44**	**65**	**-**	**-**	**-**	-
		Range (cm)	-	37-51	49-76	-	-	-	-
	Female	N=	-	-	37	-	-	-	-
		Median (cm)	**-**	**-**	**72**	**-**	**-**	**-**	-
		Range (cm)	-	-	58-81	-	-	-	-
1988	Male	N=	-	153	29	27	-	-	-
		Median (cm)	**-**	**45**	**61**	**88**	**-**	**-**	-
		Range (cm)	-	32-57	48-74	62-100	-	-	-
	Female	N=	-	-	2	32	-	-	-
		Median (cm)	**-**	**-**	**-**	**81**	**-**	**-**	-
		Range (cm)	-	-	74-76	66-99	-	-	-
1989	Male	N=	-	6	112	19	5	-	-
		Median (cm)	**-**	**44**	**63**	**81**	**100**	**-**	-
		Range (cm)	-	43-50	41-76	57-95	96-105	-	-
	Female	N=	-	-	42	50	5	-	-
		Median (cm)	**-**	**-**	**72**	**81**	**85**	**-**	-
		Range (cm)	-	-	59-79	58-92	74-93	-	-
1990	Male	N=	-	6	8	50	17	-	-
		Median (cm)	**-**	**49**	**63**	**92**	**101**	**-**	**-**
		Range (cm)	-	45-55	50-70	57-101	83-110	-	-
	Female	N=	-	-	3	105	16	-	-
		Median (cm)	**-**	**-**	**63**	**84**	**92**	**-**	**-**
		Range (cm)	-	-	59-69	62-99	65-103	-	-

Appendix H Table 7: Size at age of return in 1991-1996 by sex for CWT LSRCP fish processed by WDFW that were from subyearling production. (Fish highlighted in red were returns of BY89 subyearlings, progeny of broodstock with a high stray component)

Return			Total age at return						
year	**Sex**		**1(Minijack)**	**2(Jack)**	**3**	**4**	**5**	**6**	**7**
1991	Male	N=	-	45	10	4	19	1	-
		Median (cm)	**-**	**46**	**63**	**77**	**101**	**-**	**-**
		Range (cm)	-	40-56	49-95	72-88	84-109	98	-
	Female	N=	-	-	3	11	31	1	-
		Median (cm)	**-**	**-**	**70**	**80**	**90**	**-**	**-**
		Range (cm)	-	-	68-73	68-89	73-98	92	-
1992	Male	N=	-	24	59	3	-	-	-
		Median (cm)	**-**	**47**	**67**	**80**	**-**	**-**	**-**
		Range (cm)	-	40-54	48-79	70-83	-	-	-
	Female	N=	-	-	21	14	-	2	1
		Median (cm)	**-**	**-**	**71**	**76**	**-**	**-**	**-**
		Range (cm)	-	-	61-84	61-88	-	79-99	92
1993	Male	N=	-	-	42	23	-	-	-
		Median (cm)	**-**	**-**	**69**	**84**	**-**	**-**	**-**
		Range (cm)	-	-	58-85	68-99	-	-	-
	Female	N=	-	-	20	44	2	-	-
		Median (cm)	**-**	**-**	**71**	**80**	**-**	**-**	**-**
		Range (cm)	-	-	62-79	72-89	66-87	-	-
1994	Male	N=	-	134	-	27	4	-	-
		Median (cm)	**-**	**45**	**-**	**86**	**89**	**-**	**-**
		Range (cm)	-	36-54	-	69-101	83-103	-	-
	Female	N=	-	-	-	67	7	-	-
		Median (cm)	**-**	**-**	**-**	**81**	**88**	**-**	**-**
		Range (cm)	-	-	-	71-90	82-92	-	-
1995	Male	N=	-	-	180	-	8	1	-
		Median (cm)	**-**	**-**	**64**	**-**	**103**	**-**	**-**
		Range (cm)	-	-	46-87	-	88-107	104	-
	Female	N=	-	-	79	-	19	-	-
		Median (cm)	**-**	**-**	**69**	**-**	**89**	**-**	**-**
		Range (cm)	-	-	54-78	-	82-102	-	-
1996	Male	N=	-	-	-	68	-	1	-
		Median (cm)	**-**	**-**	**-**	**82**	**-**	**-**	**-**
		Range (cm)	-	-	-	54-102	-	103	-
	Female	N=	-	-	-	126	-	-	-
		Median (cm)	**-**	**-**	**-**	**79**	**-**	**-**	**-**
		Range (cm)	-	-	-	62-90	-	-	-

Appendix H Table 8: Size at age of return in 1997-2002 by sex for CWT LSRCP fish processed by WDFW that were from subyearling production.

Return year	Sex		Total age at return 1(Minijack)	2(Jack)	3	4	5	6	7
1997	Male	N=	-	-	-	-	5	-	-
		Median (cm)	**-**	**-**	**-**	**-**	**107**	-	**-**
		Range (cm)	-	-	-	-	76-121	-	-
	Female	N=	-	-	-	-	12	-	-
		Median (cm)	**-**	**-**	**-**	**-**	**87**	-	**-**
		Range (cm)	-	-	-	-	75-93	-	-
1998	Male	N=	-	69	-	-	-	-	-
		Median (cm)	**-**	**46**	**-**	**-**	**-**	-	**-**
		Range (cm)	-	35-58	-	-	-	-	-
	Female	N=	-	-	-	-	-	-	-
		Median (cm)	**-**	**-**	**-**	**-**	**-**	-	**-**
		Range (cm)	-	-	-	-	-	-	-
1999	Male	N=	-	-	146	-	-	-	-
		Median (cm)	**-**	**-**	**62**	**-**	**-**	-	**-**
		Range (cm)	-	-	44-89	-	-	-	-
	Female	N=	-	-	45	-	-	-	-
		Median (cm)	**-**	**-**	**70**	**-**	**-**	-	**-**
		Range (cm)	-	-	60-76	-	-	-	-
2000	Male	N=	-	634	-	37	-	-	-
		Median (cm)	**-**	**46**	**-**	**80**	**-**	**-**	**-**
		Range (cm)	-	34-64	-	57-94	-	-	-
	Female	N=	-	-	-	101	-	-	-
		Median (cm)	**-**	**-**	**-**	**80**	**-**	-	**-**
		Range (cm)	-	-	-	59-91	-	-	-
2001	Male	N=	-	515	567	-	3	-	-
		Median (cm)	**-**	**46**	**66**	-	**99**	-	**-**
		Range (cm)	-	32-61	42-89	-	93-100	-	-
	Female	N=	-	-	375	-	26	-	-
		Median (cm)	**-**	**-**	**70**	**-**	**88**	-	**-**
		Range (cm)	-	-	57-87	-	75-93	-	-
2002	Male	N=	-	181	434	144	-	-	-
		Median (cm)	**-**	**43**	**65**	**83**	**-**	-	**-**
		Range (cm)	-	35-55	40-91	60-101	-	-	-
	Female	N=	-	-	130	499	-	-	-
		Median (cm)	**-**	**-**	**71**	**82**	**-**	-	**-**
		Range (cm)	-	-	55-81	50-99	-	-	-

Appendix H Table 9: Size at age of return in 2003-2008 by sex for CWT LSRCP fish processed by WDFW that were from subyearling production.

Return year	Sex		Total age at return: 1(Minijack)	2(Jack)	3	4	5	6	7
2003	Male	N=	-	148	63	33	3	-	-
		Median (cm)	**-**	**43**	**64**	**80**	**100**	-	**-**
		Range (cm)	-	32-54	47-78	67-100	98-108	-	-
	Female	N=	-	-	11	91	21	-	-
		Median (cm)	**-**	**-**	**70**	**82**	**90**	-	**-**
		Range (cm)	-	-	63-73	65-97	78-97	-	-
2004	Male	N=	-	73	162	4	-	-	-
		Median (cm)	**-**	**49**	**62**	**72**	**-**	-	**-**
		Range (cm)	-	34-58	41-78	57-73	-	-	-
	Female	N=	-	-	41	27	10	-	-
		Median (cm)	**-**	**-**	**68**	**81**	**87**	-	**-**
		Range (cm)	-	-	56-77	51-88	59-99	-	-
2005	Male	N=	-	39	39	22	2	-	-
		Median (cm)	**-**	**47**	**65**	**74**	**-**	**-**	**-**
		Range (cm)	-	38-58	51-78	62-93	70-100	-	-
	Female	N=	-	-	16	61	4	2	-
		Median (cm)	**-**	**-**	**70**	**79**	**87**	**-**	**-**
		Range (cm)	-	-	65-81	70-89	86-94	82-88	-
2006	Male	N=	-	38	26	4	1	-	-
		Median (cm)	**-**	**48**	**63**	**85**	**-**	**-**	**-**
		Range (cm)	-	38-56	56-76	69-91	80	-	-
	Female	N=	-	-	14	16	12	2	-
		Median (cm)	**-**	**-**	**73**	**80**	**84**	**-**	**-**
		Range (cm)	-	-	63-81	73-89	65-95	87-89	-
2007	Male	N=	-	520	31	2	-	-	-
		Median (cm)	**-**	**48**	**68**	**-**	**-**	-	**-**
		Range (cm)	-	34-57	53-82	69-83	-	-	-
	Female	N=	-	-	16	16	3	-	-
		Median (cm)	**-**	**-**	**70**	**79**	**81**	-	**-**
		Range (cm)	-	-	67-75	73-87	77-86	-	-
2008	Male	N=	-	75	376	1	1	-	-
		Median (cm)	**-**	**48**	**68**	**-**	**-**	-	**-**
		Range (cm)	-	31-55	46-85	65	89	-	-
	Female	N=	-	-	176	5	-	-	-
		Median (cm)	**-**	**-**	**73**	**78**	**-**	-	**-**
		Range (cm)	-	-	55-82	69-85	-	-	-

Appendix H Table 10: Size at age of return in 2009-2014 by sex for CWT LSRCP fish processed by WDFW that were from subyearling production.

Return year	Sex		1(Minijack)	2(Jack)	3	4	5	6	7
			Total age at return						
2009	Male	N=	-	611	17	28	-	-	-
		Median	**-**	**48**	**67**	**78**	**-**	-	**-**
		Range	-	39-61	52-80	63-107	-	-	-
	Female	N=	-	-	16	102	-	-	-
		Median	**-**	**-**	**73**	**83**	**-**	-	**-**
		Range	-	-	65-80	70-94	-	-	-
2010	Male	N=	-	51	216	-	2	-	-
		Median	**-**	**51**	**68**	**-**	**-**	-	**-**
		Range	-	42-64	52-88	-	88-90	-	-
	Female	N=	-	-	185	4	6	-	-
		Median	**-**	**-**	**74**	**85**	**89**	-	**-**
		Range	-	-	65-84	78-86	79-99	-	-
2011	Male	N=	-	204	40	17	-	-	-
		Median	**-**	**47**	**68**	**80**	**-**	**-**	-
		Range	-	34-60	53-81	61-86	-	-	-
	Female	N=	-	1	48	122	-	-	-
		Median	**-**	**-**	**72**	**82**	**-**	**-**	-
		Range	-	45	61-86	63-99	-	-	-
2012	Male	N=	-	371	627	7	2	-	-
		Median	**-**	**48**	**65**	**75**	**-**	**-**	**-**
		Range	-	35-62	41-85	65-84	81-88	-	-
	Female	N=	-	-	255	56	10	-	-
		Median	**-**	**-**	**71**	**80**	**82**	**-**	**-**
		Range	-	-	54-82	72-88	70-92	-	-
2013	Male	N=	-	10	116	42	-	-	-
		Median	**-**	**46**	**69**	**75**	**-**	**-**	**-**
		Range	-	41-58	51-78	62-99	-	-	-
	Female	N=	-	-	104	95	2	-	-
		Median	**-**	**-**	**70**	**78**	**-**	**-**	**-**
		Range	-	-	57-80	65-89	90	-	-
2014	Male	N=	-	48	80	49	-	-	-
		Median	**-**	**48**	**67**	**76**	**-**	**-**	**-**
		Range	-	42-59	53-78	57-100	-	-	-
	Female	N=	-	-	18	133	4	-	-
		Median	**-**	**-**	**73**	**79**	**83**	**-**	**-**
		Range	-	-	64-76	71-89	81-86	-	-

Appendix I: Historical number of matings of minijacks, jacks and jills contributing to broodstock at LFH 2000-2009

Prior to size mating protocol

Appendix I: Historical number of matings of minijacks, jacks, and jills contributing to broodstock at LFH, 2000-2009, prior to selective size mating protocol.

Year	0-salt	1-salt jack	1-salt jill	Number of matings containing jack x jill mating	% of total matings with 0-salt and/or 1-salt parentage
2000	195	609	157	127	80.4
2001	9	876	67	47	67.6
2002	4	480	11	9	24.7
2003	3	527	78	63	74.5
2004	28	943	254	204	77.3
2005	14	611	57	25	45.4
2006	1	519	121	91	70.0
2007	0	1138	480	408	83.0
2008	0	345	80	30	30.2
2009	1	539	503	143	69.6
Average	**26**	**659**	**181**	**115**	**62.3**

Appendix J: Egg Take and Early Life Stage Survival Brood Years: 1990-2010

Appendix J Table 1: Egg take and survival numbers by life stage of Lyons Ferry origin fall Chinook salmon spawned at LFH, brood years 1990-2009.

Brood year	Eggs taken	Egg loss[a]	Eggs destroyed[b]	Eggs shipped[c]	Eyed eggs retained	Fry ponded	Intended program
1990	1,103,745	0		0	1,011,998	729,311	Yearling
						228,930	Subyearling
1991	906,411	0		0	828,514	807,685	Yearling
						0	Subyearling
1992	901,232	0		0	855,577	624,961	Yearling
						210,210	Subyearling
1993	400,490	0		0	363,129	352,461	Yearling
						0	Subyearling
1994	583,871	0		0	553,189	542,461	Yearling
						0	Subyearling
1995[d]	1,056,700	0		0	1,022,700	847,241	Yearling
						112,532	Subyearling
1996	1,433,862	0		0	1,377,202	941,900	Yearling
						419,677	Subyearling
1997	1,184,141	0		0	1,134,641	1,037,221	Yearling
						63,849	Subyearling
1998	2,085,155	0		0	1,978,704	916,261	Yearling
						1,010,344	Subyearling
1999	3,980,455	156,352		0	3,605,482	991,613	Yearling
						2,541,759	Subyearling
2000	3,576,956	53,176		115,891	3,249,377	998,768	Yearling
						2,159,921	Subyearling
2001	4,734,234	144,530		200,064	4,230,432	1,280,515	Yearling
						2,697,406	Subyearling
						125,600	Research
2002	4,910,467	44,900		1,195,067	3,540,000	1,032,205	Yearling
						2,376,251	Subyearling
						73,229	Research
2003	2,812,751	0		250,400	2,476,825	985,956	Yearling
						1,455,815	Subyearling
2004	4,625,638	0		1,053,278	3,421,751	914,594	Yearling
						2,191,102	Subyearling
						184,682	Research
2005	4,929,630	0		1,180,000	3,562,700[e]	980,940	Yearling
						2,078,206	Subyearling
						216,417	Research
2006	2,819,004	0		127,564	2,601,679	961,105	Yearling
						1,640,574	Subyearling
						2,000	Research
2007	5,143,459	0		1,761,500	3,212,900[f]	960,900	Yearling
						1,894,933	Subyearling
2008	5,010,224	0		1,810,800	2,969,200	1,000,000	Yearling
						1,969,200	Subyearling
2009	4,574,182	0		1,507,300	2,853,020	977,667	Yearling
						1,875,353	Subyearling
2010	4,619,533	124,433	0	1,630,000	2,865,100	980,000	Yearling
						1,885,100	Subyearling

[a] Eggs from ELISA positive females were incorporated into the rest of the broodstock in 1997-1998 and 2003-2004.
[b] Eggs culled due to ELISA results, stray or stray mate, and jill or jack mate.
[c] Includes eyed eggs shipped for research.
[d] An overage of 58,500 fish was found during marking. This number was added (unexpanded) to total green and eyed eggs and fry ponded. Also includes 83,183 fry up to ponding that were accidentally released as strays. Back calculated to estimate 32,088 eggs for subyearlings and 91,808 eggs for escaped fry (resulting in 847,241 ponded for yearling release).
[e] This number includes 154,100 eyed-eggs that were destroyed as ponded fry and 30,000 eyed-eggs that were shipped as fry to NPTH in February 2006.
[f] This number includes 364,983 eyed-eggs that were destroyed as ponded fry in January and February 2007.

Appendix K: LFH/Snake River Origin Fall Chinook Salmon Releases Brood Years: 2008-2014

From brood year 2011 and on, all hatchery production can be profiled through PBT sampling

Appendix K Table 1: LFH/Snake River hatchery origin fall Chinook salmon releases with number marked, tagged, and unmarked by release year and type.

Release year	S/Y[b]	Brood year	Release location-type	Release date	CWT code	Number of fish released[a] AD clip +CWT	CWT only	AD clip only	No clip or CWT	Total Released	FPP	PIT tagged[c]
2010	Y	2008	LFH	12-15 April	635166	250,814	169	2,542	678	254,203	9.8	13,479
2010	Y	2008	LFH	12-15 April	635165	-	221,376	-	3,273	224,649	9.8	13,490
2010	Y	2008	CJ1	5 April	220305	70,925	-	1,284	-	72,209	8.0	8,922
2010	Y	2008	CJ1	5 April	220300	-	81,467	-	961	82,428	8.0	10,184
2010	Y	2008	BC1	14 April	220303	70,043	-	1,993	-	72,036	9.0	8,925
2010	Y	2008	BC1	14 April	220302	-	79,756	-	1,907	81,663	9.0	10,117
2010	Y	2008	PL1	13 April	220304	70,834	-	984	-	71,818	9.3	8,902
2010	Y	2008	PL1	13 April	220301	-	80,417	-	1,244	81,661	9.3	10,123
2010	S	2009	LFH	25 May	635180	198,457	1,068	2,803	-	202,328	52.4	0
2010	S	2009	CJ1	24 May	220309	100,778	-	392	-	101,170	47.0	7,376
2010	S	2009	CJ1	24 May	220308	-	102,167	-	325,440	427,607	47.0	31,174
2010	S	2009	BC1	25 May	220307	100,461	-	441	-	100,902	52.3	7,587
2010	S	2009	BC1	25 May	220306	-	101,207	-	309,127	410,334	52.3	30,855
2010	S	2009	PL1	24 May	220311	100,537	-	765	-	101,302	50.5	7,725
2010	S	2009	PL1	24 May	220310	-	100,619	-	203,120	303,739	50.5	23,162
2010	S	2009	Couse Creek Direct [vs. CJ1 Accl. Study]	24 May	635181	199,326	926	2,381	529	203,162	58.0	15,445
2010	S	2009	GRR Direct	24 May	635182	197,252	-	2,868	186,720	386,720	42.0	30,488
2010	S	2009	Snake R. below HC Dam-Oxbow hatchery-IPC-direct	6 May	104383	50,433	-	4,609	-	55,042	47.0	4,208
2010	S	2009	Snake R. below HC Dam-Oxbow hatchery-IPC-direct	6 May	100142	64,144	-	5,862	-	70,006	47.0	5,352
2010	S	2009	Snake R. below HC Dam-Oxbow hatchery-IPC-direct	6 May	106482	61,977	-	5,664	-	67,641	47.0	5,171
2010	S	2009	Snake R. below HC Dam-Umatilla hatchery-IPC-direct	25-27 May	090331	208,330	1,242	476,055	-	685,627	46.3	50,036
2010	S	2009	NPTH-Cedar Flats Accl.	14 June	612764	-	74,939	-	14,328	89,267	48.3	6,737
2010	S	2009	NPTH-Cedar Flats Accl.	14 June	612765	97,930	-	1,214	-	99,144	48.3	7,482
2010	S	2009	NPTH-Lukes Gulch Accl.	9 June	612747	-	99,116	-	415	99,531	44.4	8,208
2010	S	2009	NPTH-Lukes Gulch Accl.	9 June	612748	98,220	-	1,218	-	99,438	44.4	8,201
2010	S	2009	NPTH-North Lapwai Valley Accl.	14 May	220201	-	164,981	-	200,716	365,697	81.2	2,424
2010	S	2009	NPTH-North Lapwai Valley Accl.	14 May	220202	99,024	-	1,228	-	100,252	81.2	665

Appendix K Table 1: LFH/Snake River hatchery origin fall Chinook salmon releases with number marked, tagged, and unmarked by release year and type.

Release year	S/Y[b]	Brood year	Release location-type	Release date	CWT code	Number of fish released[a] AD clip +CWT	CWT only	AD clip only	No clip or CWT	Total Released	FPP	PIT tagged[c]
2010	S	2009	NPTH-Site 1705	7 June	220200	99,100	-	1,229	-	100,329	54.2	577
2010	S	2009	NPTH-Site 1705	7 June	612772	-	199,710	-	236,960	436,670	54.2	2509
2010	S	2009	Snake R. at Couse Creek-Surrogates	17 May- 4 June	none				197,569	197,569		195,493
2010	S	2009	Clearwater R. at BC-Surrogates	21 June- 9 July	none				116,162	116,162		114,017
2011	Y	2009	LFH	12-15 April	635564	226,621	462	308		227,391	9.9	14,932
2011	Y	2009	LFH	12-15 April	635510	-	236,175	-	163	236,338	9.9	14,940
2011	Y	2009	CJ1	1 April	220315	71,407	-	867	-	72,274	10.3	8,862
2011	Y	2009	CJ1	1 April	220314	-	80,830	-	1,482	82,312	10.3	10,092
2011	Y	2009	BC1	14 April	220317	71,096	-	286	-	71,382	9.9	8,300
2011	Y	2009	BC1	14 April	220312	-	89,325	-	1,637	90,962	9.9	10,577
2011	Y	2009	PL1	12 April	220316	69,415	-	2,766	-	72,181	9.5	8,218
2011	Y	2009	PL1	12 April	220313	-	93,103	-	1,126	94,229	9.5	10,729
2011	S	2010	LFH	1 June	635998	200,502	283	1,415		202,200	50.0	0
2011	S	2010	CJ1	22 May	220119	100,967		200		101,167	45.3	8,037
2011	S	2010	CJ1	22 May	220120		100,986		314,327	100,986	45.3	32,992
2011	S	2010	BC1	25 May	220117	100,622		200		100,822	51.0	8,111
2011	S	2010	BC1	25 May	220115		100,748		307,576	408,324	51.0	32,847
2011	S	2010	PL1	23 May	220121	100,987		201		101,188	49.0	8,044
2011	S	2010	PL1	23 May	220122		100,999		211,097	100,999	49.0	24,811
2011	S	2010	Couse Creek Direct [vs. CJ1 Accl. Study]	2-3 June	635997	200,945	971	384		202,300	49.0	16,459
2011	S	2010	GRR Direct	24 May	635999	199,460	134	1,206	196,628	397,428	79.5	32,441
2011	S	2010	Snake R. below HC Dam-Oxbow hatchery-IPC-direct	5 May	100153	167,137		15,769	11,903	194,809	48.2	14,927
2011	S	2010	Snake R. below HC Dam-Irrigon hatchery-IPC-direct	24-26 May	090447	195,414	397	435,100	7,989	638,900	81.0	36,925
2011	S	2010	NPTH-Cedar Flats Accl.	15 June	220205		103,007		323	103,330	54.5	8,244
2011	S	2010	NPTH-Cedar Flats Accl.	15 June	220206	96,604		5,622		102,226	54.5	8,155
2011	S	2010	NPTH-Lukes Gulch Accl.	14 June	220207		99,115		5,364	104,479	50.2	8,283
2011	S	2010	NPTH-Lukes Gulch Accl.	14 June	220208	101,688		1,315		103,003	50.2	8,166
2011	S	2010	NPTH-North Lapwai Valley Accl.	14 May	220203		202,265		206,799	409,064	75.0	2,392
2011	S	2010	NPTH-North Lapwai Valley Accl.	14 May	220204	99,174		1,282		100,456	75.0	588
2011	S	2010	NPTH-Site 1705	7-15 June	220210		201,980		224,365	426,345	52.5	2,412
2011	S	2010	NPTH-Site 1705	7 June	220209	94,893		5,523		100,416	52.5	568

Appendix K Table 1: LFH/Snake River hatchery origin fall Chinook salmon releases with number marked, tagged, and unmarked by release year and type.

						Number of fish released[a]						
Release year	S/Y[b]	Brood year	Release location-type	Release date	CWT code	AD clip +CWT	CWT only	AD clip only	No clip or CWT	Total Released	FPP	PIT tagged[c]
2011	S	2010	NPTH late release-Site 1705	6-11 July	220211		99,907		313	100,220	93.0	1,038
2011	S	2010	NPTH late release-Site 1705	6-11 July	220212		94,673		91,694	186,367	93.0	1,931
2011	S	2010	Snake R. at Couse Creek-Surrogates	23 May-10 June	none				202,462			201,608
2011	S	2010	Clearwater R. at BC-Surrogates	20 June-8 July	none				114,356			111,580
2012	Y	2010	LFH	10-13 Apr	636080	246,918	660	495	989	249,062	10.4	14,930
2012	Y	2010	LFH	10-13 Apr	636079		236,056		4,882	240,938	10.4	14,914
2012	Y	2010	CJ1	28 Mar	220321	72,233		432		72,665	10.3	8,881
2012	Y	2010	CJ1	28 Mar	220320		81,042		1,427	82,469	10.3	10,080
2012	Y	2010	BC1	12 Apr	220323	74,973		903		75,876	9.7	8,441
2012	Y	2010	BC1	12 Apr	220318		86,184		1,554	87,738	9.7	9,760
2012	Y	2010	PL1	11 Apr	220322	79,519		316		79,835	9.4	8,777
2012	Y	2010	PL1	11 Apr	220319		90,110		1,177	91,287	9.4	10,036
2012	S	2011	LFH	29-30 May	636417	198,228	261	2,270	141	200,900	50.0	19,943
2012	S	2011	CJ1	21 May	220326	101,194		202		101,396	47.0	20,586
2012	S	2011	CJ1	21 May	220327		100,818		303,514	404,332	47.0	20,469
2012	S	2011	BC1	23 May	220329	101,565				101,565	46.0	20,555
2012	S	2011	BC1	23 May	220328		101,327		308,737	410,064	46.0	20,507
2012	S	2011	PL1	22 May	220324	100,850		405		101,255	47.0	16,497
2012	S	2011	PL1	22 May	220325		100,500		200,645	301,145	47.0	16,373
2012	S	2011	Couse Creek Direct [vs. CJ1 Accl. Study]	29-30 May	636418	194,955	658	3,548	139	199,300	54.0	16,313
2012	S	2011	GRR Direct	24 May	636419	192,996		9,723	181,281	384,000	48.0	32,432
2012	S	2011	Snake R. below HC Dam-Oxbow hatchery-IPC-direct	3 May	100201	187,146		15,135		202,281	48.0	14,910
2012	S	2011	Snake R. below HC Dam-Irrigon hatchery-IPC-direct	22-24 May	090587	200,844	273	587,232	12,051	800,400	46.0	36,927
2012	S	2011	NPTH-Lukes Gulch Accl.	13 June	220213	94,079		5,305		99,382	49.6	8,179
2012	S	2011	NPTH-Lukes Gulch Accl.	13 June	220214		99,570		495	100,065	49.6	8,236
2012	S	2011	NPTH-Cedar Flats Accl.	12 June	220215	96,099		1,276		97,375	51.7	8,110
2012	S	2011	NPTH-Cedar Flats Accl.	12 June	220216		95,710		5,771	101,481	51.7	8,451
2012	S	2011	NPTH-North Lapwai Valley Accl.	8&30 May	220224		191,699		268,454	460,153	115/ 54	2,440
2012	S	2011	NPTH-North Lapwai Valley Accl.	8&30 May	220218	98,697		4,363		103,060	115/ 54	546

Appendix K Table 1: LFH/Snake River hatchery origin fall Chinook salmon releases with number marked, tagged, and unmarked by release year and type.

						Number of fish released[a]						
Release year	S/Y[b]	Brood year	Release location-type	Release date	CWT code	AD clip +CWT	CWT only	AD clip only	No clip or CWT	Total Released	FPP	PIT tagged[c]
2012	S	2011	NPTH-Site 1705	11-15 June	220223		202,095		291,091	493,186	51/53	4,877
2012	S	2011	NPTH-Site 1705	11-15 June	220217	103,487		1,813		105,300	51/53	1,041
2012	S	2011	Snake R. at Couse Creek-Surrogates	21 May-8 June	none				226,819	226,819		226,786
2012	S	2011	Clearwater R. at BC-Surrogates	18 June-6 July	none				97,013	97,013		92,964
2013	Y	2011	LFH	10-12 Apr	636444	240,413	809	809	1,618	243,649	10.2	14,675
2013	Y	2011	LFH	10-12 Apr	636443		243,085		2,766	245,851	10.2	14,531
2013	Y	2011	CJ1	1 Apr	220335	71,930		580		72,510	9.5	1,372
2013	Y	2011	CJ1	1 Apr	220332		89,993		720	90,713	9.5	1,716
2013	Y	2011	BC1	17 Apr	220333	71,973		580		72,553	9.8	1,369
2013	Y	2011	BC1	17 Apr	220331		85,359		1,005	86,364	9.8	1,629
2013	Y	2011	PL1	16 Apr	220334	71,679		564		72,243	9.7	1,285
2013	Y	2011	PL1	16 Apr	220330		88,908		1,761	90,669	9.7	1,612
2013	S	2012	LFH	10 May	636574	210,494	138	967		211,599	68.0	19,772
2013	S	2012	CJ1	17 May	220141	101,234				101,234	47.0	1,497
2013	S	2012	CJ1	17 May	220143		100,631		297,721	398,352	47.0	1,489
2013	S	2012	BC1	22 May	220142	100,804		202		101,006	44.0	1,505
2013	S	2012	BC1	22 May	220144		99,807		301,474	401,281	44.0	1,488
2013	S	2012	PL1	20 May	220145	100,673		404		101,077	44.0	1,495
2013	S	2012	PL1	20 May	220146		101,085		195,865	296,950	44.0	1,495
2013	S	2012	Couse Creek Direct [vs. CJ1 Accl. Study]	9-10 May	636575	202,159	2,012	1,006	123	205,300	68.0	2,985
2013	S	2012	GRR Direct	21 May	636576	216,159	430	861	183,093	400,543	49.5	3,000
2013	S	2012	Snake R. below HC Dam-Irrigon hatchery-IPC-direct	20-22 May	90703	228,054	156	651,123	413	879,746	50.4	2,994
2013	S	2012	NPTH-Cedar Flats Accl.	10 June	220221		101,113		10,899	112,012	49.4	1,570
2013	S	2012	NPTH-Cedar Flats Accl.	10 June	220222	97,468		4,384		101,852	49.4	1,427
2013	S	2012	NPTH-Lukes Gulch Accl.	11 June	220219		94,062		11,357	105,419	48.5	1,545
2013	S	2012	NPTH-Lukes Gulch Accl.	11 June	220220	96,387		2,524		98,911	48.5	1,450
2013	S	2012	NPTH-North Lapwai Valley Accl.	10 May	220231		199,689		194,398	394,087	85.0	2,374
2013	S	2012	NPTH-North Lapwai Valley Accl.	10 May	220225	100,435		1,015		101,450	85.0	611
2013	S	2012	NPTH-Site 1705	7 June	220232		194,561		387,401	581,962	74.0	2,532
2013	S	2012	NPTH-Site 1705	13 June	220226	97,477		7,154		104,631	74.0	455

Appendix K Table 1: LFH/Snake River hatchery origin fall Chinook salmon releases with number marked, tagged, and unmarked by release year and type.

						Number of fish released[a]						
Release year	S/Y[b]	Brood year	Release location-type	Release date	CWT code	AD clip +CWT	CWT only	AD clip only	No clip or CWT	Total Released	FPP	PIT tagged[c]
2014	Y	2012	LFH	8-11 April	636583		250,362		2,019	252,381	9.6	14,902
2014	Y	2012	LFH	8-11 April	636584	247,714	1,673	502	1,003	250,892	9.6	14,908
2014	Y	2012	CJ1	1 April	220338		86,972		350	87,322	9.9	530
2014	Y	2012	CJ1	1 April	220339	76,256		306		76,562	9.9	464
2014	Y	2012	BC1	17 April	220336		86,380		580	86,960	8.8	526
2014	Y	2012	BC1	17 April	220341	75,180		1,274		76,454	8.8	463
2014	Y	2012	PL1	14 April	220337		88,140		295	88,435	9.0	533
2014	Y	2012	PL1	14 April	220340	76,657		774		77,431	9.0	466
2014	S	2013	LFH	3 June	636737	203,004	402	5,896	670	209,972	50.0	19,969
2014	S	2013	CJ1	21 May	220346	101,241		2,801		104,042	47.0	1,024
2014	S	2013	CJ1	21 May	220343		99,142		308,643	407,785	47.0	975
2014	S	2013	BC1	22 May	220345	94,950		9,588		104,538	49.7	1,023
2014	S	2013	BC1	22 May	220342		98,628		324,660	423,288	49.7	966
2014	S	2013	PL1	20 May	220347	100,063		1,404		101,467	53.0	1,008
2014	S	2013	PL1	20 May	220344		99,455		199,946	299,401	53.0	989
2014	S	2013	CJ 2nd Release	6 June	636738	185,799		5,352		191,151	53.4	1,999
2014	S	2013	GRR Direct	21 May	636739	191,711	434	9,983	201,798	403,926	48.9	2,999
2014	S	2013	Snake R. below HC Dam-Irrigon hatchery-IPC-direct	19 May	090818	191,092	525	717,974	2,023	911,614	49.4	3,000
2014	S	2013	NPTH-Cedar Flats Accl.	10 June	220235		99,344		50,375	149,719	49.7	1,181
2014	S	2013	NPTH-Cedar Flats Accl.	10 June	220233	102,430		740		103,170	49.7	813
2014	S	2013	NPTH-Lukes Gulch Accl.	10 June	220236		103,285		50,399	153,684	47.6	1,203
2014	S	2013	NPTH-Lukes Gulch Accl.	10 June	220234	100,870		729		101,599	47.6	795
2014	S	2013	NPTH-North Lapwai Valley Accl.	11 June	220240		202,383		110,492	312,875	63.5	1,501
2014	S	2013	NPTH-North Lapwai Valley Accl.	11 June	220238	100,911		1,770		102,681	63.5	492
2014	S	2013	NPTH-Site 1705	11 June	220239		207,537		215,099	422,636	52.5	1,605
2014	S	2013	NPTH-Site 1705	11 June	220237	102,898		744		103,642	52.5	394
2015	Y	2013	LFH	6-8 April	636740		221,511		3,415	224,926	9.7	13,318
2015	Y	2013	LFH	6-8 April	636741	219,396	732	6,294	1,025	227,447	9.7	14,949
2015	Y	2013	CJ1	1 April	220353	72,145				72,145	9.6	470
2015	Y	2013	CJ1	1 April	220350		80,656		324	80,980	9.6	528
2015	Y	2013	BC1	10 April	220351	72,369		145		72,514	9.7	466
2015	Y	2013	BC1	10 April	220348		81,558		808	82,366	9.7	529
2015	Y	2013	PL1	9 April	220352	72,595		144		72,739	9.6	467

Appendix K Table 1: LFH/Snake River hatchery origin fall Chinook salmon releases with number marked, tagged, and unmarked by release year and type.

Release year	S/Y[b]	Brood year	Release location-type	Release date	CWT code	Number of fish released[a] AD clip +CWT	CWT only	AD clip only	No clip or CWT	Total Released	FPP	PIT tagged[c]
2015	Y	2013	PL1	9 April	220349		82,413		324	82,737	9.6	531
2015	S	2014	LFH	18 May	636882	189,788	429	21,922	7,220	219,359	58.0	19,906
2015	S	2014	CJ1	19 May	220355	95,493		6,312	102,311	204,116	49.6	8,363
2015	S	2014	CJ1	19 May	220354		96,612	17,161	220,490	334,263	49.6	13,695
2015	S	2014	BC1	21 May	220357	95,796		6,332	102,866	204,994	58.0	748
2015	S	2014	BC1	21 May	220356		94,575	28,759	219,163	342,497	58.0	1,250
2015	S	2014	PL1	13 May	220359	97,130		4,897	87,285	189,312	60.6	10,513
2015	S	2014	PL1	13 May	220358		96,274	1,084	111,340	208,698	60.6	11,590
2015	S	2014	CJ 2nd Release	5 June	220360	208,078		7,238	3,274	218,590	48.2	
2015	S	2014	GRR Direct	18 May	636883	199,938	222	7,541	248,400	456,101	48.9	2,986
2015	S	2014	Snake R. below HC Dam-Irrigon hatchery-IPC-direct	11-13 May	090888	244,342	268	800,547	1,110	1,046,267	55.2	3,000
2015	S	2014	NPTH-Cedar Flats Accl.	2 June	220227		103,380		58,302	161,682	63.0	1,002
2015	S	2014	NPTH-Cedar Flats Accl.	2 June	220228	101,234		1,499	58,100	160,833	63.0	996
2015	S	2014	NPTH-Lukes Gulch Accl.	29 May	220230		102,539		59,367	161,906	66.4	1,000
2015	S	2014	NPTH-Lukes Gulch Accl.	29 May	220229	101,549		890	59,167	161,606	66.4	999
2015	S	2014	NPTH-Site 1705	4 June	220248		200,997		154,619	355,616	65.7	1,323
2015	S	2014	NPTH-Site 1705	4 June	220245	102,279	1,810	503	77,123	181,715	68.7	676
2015	S	2014	NPTH-Site 1705	29 May	220247		203,450		50,290	253,740	70.9	1,314
2015	S	2014	NPTH-Site 1705	29 May	220246	101,866	2,045	479	24,953	129,343	67.7	670
2016	Y	2014	LFH	4-6 April	636885		231,744		8,559	240,303	10.7	14,924
2016	Y	2014	LFH	4-6 April	636886	238,940	661	6,744	529	246,874	10.2	14,916
2016	Y	2014	CJ1	1 April	220364	70,821		135	1,083	72,039	9.7	427
2016	Y	2014	CJ1	1 April	220363		91,267		1,394	92,661	9.7	549
2016	Y	2014	BC1	8 April	220366	71,112		141	563	71,816	10.0	461
2016	Y	2014	BC1	28 March-8 April	220361		80,995		640	81,635	10.0	525
2016	Y	2014	PL1	7 April	220365	70,212		1,267	421	71,900	9.5	462
2016	Y	2014	PL1	7 April	220362		81,524		160	81,684	9.5	524

[a] Numbers presented do not necessarily match hatchery records for fish per pound because of reporting constraints for the hatchery. Release information for some NPT release sites that had multiple CWT codes was estimated by WDFW based upon proportions of fish at tagging since those data were not available at the time this report was printed.
[b] S/Y indicates subyearling or yearling rearing strategy.
[c] Numbers of fish PIT tagged are included in the Number of Fish Released categories.

Appendix L: Historical Estimated Survivals (%) Between Various Life Stages at LFH Brood Years: 1990-2009

Appendix L Table 1: Estimated survivals (%) between various life stages at LFH for fall Chinook salmon of LFH/Snake River hatchery origin.

Brood year	Release age	Green egg to ponded fry	Ponded fry to release	Green egg to release
1990	Yearling	86.8	94.5	82.1
	Subyearling	86.8	98.0	85.1
1991	Yearling	89.1	94.1	83.8
1992	Yearling	92.7	96.5	89.5
	Subyearling	92.7	98.4	91.2
1993	Yearling	88.0	99.0	87.1
1994	Yearling	92.7	99.3	92.1
1995	Yearling	90.8	94.8	86.1
	Subyearling	90.8	99.0	89.9
1996	Yearling	95.0	76.6	72.8
	Subyearling	95.0	89.5	85.0
1997	Yearling	93.0	92.5	86.0
	Subyearling	93.0	97.6	90.8
1998	Yearling	92.4	94.8	87.6
	Subyearling	92.4	95.1	87.9
1999	Yearling	92.4	66.3	61.3
	Subyearling	92.4	95.2	87.9
2000	Yearling	92.8	91.3	84.8
	Subyearling	92.8	94.9	88.1
2001	Yearling	93.6	79.5	74.5
	Subyearling	93.6	97.7	95.8
2002	Yearling	95.3	86.8	82.8
	Subyearling	95.3	94.8	90.3
2003	Yearling	95.5	75.7	72.3
	Subyearling	95.5	95.1	90.8
2004	Yearling	93.0	96.8	90.1
	Subyearling	93.0	97.6	90.8
2005	Yearling	92.2	99.3	91.5
	Subyearling	92.2	104.9	96.7
2006	Yearling	95.7	95.4	91.3
	Subyearling	95.7	100.2	95.5
2007	Yearling	95.8	95.4	91.4
	Subyearling	95.8	100.3	95.5
2008	Yearling	95.8	95.3	91.3
	Subyearling	95.8	107.1	89.4
2009	Yearling	94.1	98.3	92.5
	Subyearling	94.1	100.2	94.0
Yearling mean:	**%**	**92.8**	**91.1**	**84.5**
	SD	**2.6**	**9.3**	**8.3**
Subyearling mean:	**%**	**93.3**	**98.0**	**90.9**
	SD	**2.3**	**4.1**	**3.6**

Appendix M: Tucannon River Survey Sections and Historical Escapement

Appendix M Table 1: Description and length of sections, survey length, percent of reach surveyed, and estimated total number of fall Chinook salmon redds in the Tucannon River, 2015.

Section	Description	Length of section (km)[a]	Length surveyed (km)	% of productive reach surveyed[b]	Estimated total # of redds[c]
1	Mouth of Tucannon R to highway 261 Bridge	2.8	1.7	100	105
2	Highway 261 Bridge to Smolt trap	0.2	0.2	100	10
3	Smolt trap to Powers Bridge	0.5	0.5	100	60
4	Powers Bridge to upper hog barns	1.2	1.2	100	43
5	Hog barns to Starbuck Br.	2.5	2.4	96	67
6	Starbuck Br. To Fletchers Dam	2.7	1.3	48	114
7	Fletcher's Dam to Smith Hollow	2.9	2.9	100	7
8	Smith Hollow to Ducharme's Sheep Ranch Br.	4.4	4.4	100	11
9	Ducharme's Bridge to Highway 12	5.5	5.5	100	19
10	Highway 12 to Brines Bridge	6.2	6.2	100	6
11	Brines Bridge to 4.7 km above Brines Bridge	4.7	4.7	100	0
	Total	**33.6**	**31.0**	**92**	**506**

[a] Section lengths measured using Maptech, Terrain Navigator Pro version 6.0 software.
[b] Percentage is based upon length of stream that is presumed to successfully produce fry.
[c] Counted redds were expanded for temporal and spatial sampling to estimate total number of redds.

Appendix M Table 2: Estimated escapement, % stray component of the run, and number of redds (observed and estimated), estimates of smolts/redd, and total number of emigrants from fall Chinook salmon spawning in the Tucannon River, and parent to progeny ratios, 1985-2001.

	Escapement		Redd construction			Success of spawning		
Year	Estimated escapement[a]	% Strays in escapement estimate	# Redds observed	# Redds in no access areas (estim)	Total # of redds (estim)	Estimated smolts/redd[b]	Total estimated # emigrants[c]	Adult progeny/ parent ratio
1985[d]	0	unknown	0	No estim	0	unknown	unknown	Unknown
1986[e]	2[f]	unknown	0	No estim	0	unknown	unknown	Unknown
1987	48	0	16	0	16	unknown	unknown	Pending
1988	78	0	26	0	26	unknown	unknown	Pending
1989	150	27.9	48	2	50	unknown	unknown	Pending
1990	186	30.8	62[g]	0	62	unknown	unknown	Pending
1991	150	20.0	50	0	50	unknown	unknown	Pending
1992	69	0	23	0	23	unknown	unknown	0.22[h]
1993	84	6.3	28	0	28	unknown	unknown	1.17[h]
1994	75	28.0	25	0	25	unknown	unknown	0.56
1995	87	33.3	29	0	29	unknown	unknown	0.50
1996	144	95.5	43	5	48	0.6[i]	29	0.06
1997	93	5.3	27	4	31	712	22,076	0.71
1998	132	7.1	40	4	44	15	666	0.40
1999	87	9.1	21	8	29	441	12,799	0.67
2000	60	27.8	19	1	20	468	9,352	0.47
2001	219	14.9	65	8	73	336	24,545	0.63

[a] These preliminary estimates were derived using three fish per redd.
[b] This estimate was derived using redds counted above the smolt trap and estimates of emigration the following spring. Estimates began in 1997 when the smolt trap was moved to its current position at rkm 3.0, at an area low enough in the system to trap fall Chinook salmon.
[c] This estimate was derived using the smolt per redd estimate above the trap and applying it to the total number of redds in the Tucannon River.
[d] Based on one survey completed 12/17/85.
[e] Based on one survey completed 11/18/86.
[f] Two carcasses counted but not sampled.
[g] Correction of number of redds observed that was presented in the 1990 Annual Report.
[h] Data is incomplete for returns of progeny.
[i] Flood event occurred January of 1997, nearly eliminating all the progeny from the 1996 spawn.

Escapement and Composition of Coho Run to the Tucannon River in 2015

Coho produced an estimated 9 redds when expanded for areas not surveyed. No coho carcasses were recovered in 2015.

Juvenile Coho Emigration

Juvenile coho salmon were also captured at the Tucannon River smolt trap. Mark-recapture trap efficiencies were calculated, but were highly variable. Excluding the invalid tests, efficiencies averaged 13.8% during the trapping period (Table 26). Staff captured 279 coho and estimate that 1,704 (95% C.I. = 1,155–2,644) naturally produced coho parr and smolts passed the Tucannon River smolt trap during 2015. Juvenile coho were observed at the smolt trap from 11 March through 11 June. Median passage date was 12 May. Staff took FLs on 267 fish which ranged from 34-140 mm in length. Weights from 253 fish ranged from 1.2-30.1 g, and K-factors ranged from 0.92-1.98. Unfortunately, fish were not sampled randomly so average FLs cannot be calculated for this year.