

WDFW RM&E Work Accomplishments

LSRCP Hatchery Program Evaluations

FFY2014 – Contract #F14AC00010

10/01/2013 to 9/30/2014

Category 1. Fish Culture and Production Activities

Project 1a – Production Monitoring

Objective 1a.1. Monitor and evaluate the quality and release of hatchery spring and fall Chinook salmon and summer steelhead produced at LFC.

Approach: Evaluation staff will analyze marking data and releases of juvenile salmon and steelhead to determine survival rates between life stages and examine potential variables that may influence observed survivals (fish quality as defined by hatchery production and IHOT criteria: for example size at release is close to program goal, CV, % precocious males, K-factor, incidence of disease, etc.). To document the percent precocious male fish in all of our release groups, visual sampling of spring and fall Chinook salmon and steelhead juveniles will occur (Visual examination has been corroborated with lethal sampling in the past and serves as a consistent representation of percent precocious males).

Spring Chinook – Two different groups of BY12 fish (TFH reared and LFH reared) were marked and released from Curl Lake Acclimation Pond. The TFH fish were part of a small experimental group (~30,000) to see if long term rearing at TFH was feasible in the future. Groups were examined for precocity prior to release and release size was smaller than target goals (Target 38 g vs. 32 g Released). For specific data, please see Gallinat and Ross 2014.

Fall Chinook – Quality control checks and estimated numbers of fish released with each mark type were completed for all fish released by WDFW. We visually examined all groups for precocity at release. None of the fish examined exhibited signs of precocity in either the subyearling or yearlings released. Size at release was calculated and releases were close to program goals of 10 fpp for yearlings and 50 fpp for subyearlings.. The Snake River release of subyearlings near Couse Creek was changed to Captain John Rapids AP to increase survivals. The change was agreed to by co-managers in the basin. Essentially the first release at Captain John Rapids was done earlier than usual and the second release was delayed until early June to make it more similar to historical releases. We summarized hatchery records and documented survivals at multiple stages for yearlings and subyearling. The rearing lake at Lyons Ferry was scanned for PIT tags after the release. There were 158 tags detected, which equates to a 0.5% tag loss or mortality of PIT tagged fish. For specific data, see the attached spreadsheet.

Steelhead – Quality control checks and estimated numbers of fish released with each mark type were completed for most summer steelhead released in 2014. The Walla Walla release group was loaded and in route prior to sampling. Groups were visually examined for precocity at release: precocity rates were about normal for all groups (<1%). Size at release was calculated for the sampled groups and was close to the program goals of 4.5 fpp. The Touchet group was on the “small” side at 6.1 fpp. For specific data, see the attached spreadsheet.

Objective 1a.2. Assist in the planning, spawning, record keeping, and summarizing of data for spawned spring and fall Chinook salmon and summer steelhead at LFC.

Approach: WDFW evaluation staff annually assists in the spawning operations of spring and fall Chinook salmon and summer steelhead at LFC. The role of the evaluation staff has been and will be to collect the biological data (date of spawning, sex, length, scales, marks/tags, extraction and decoding of CWTs, DNA and scale sampling, etc.) from all fish retained/ spawned for broodstock for all species. Individual fecundity estimates for steelhead (Tucannon and Touchet stocks only – Wallowa stock steelhead are picked with an automatic egg picker and individual fecundities are not possible – only average fecundities are derived) and spring Chinook, and fecundity estimates for the collective whole of fall Chinook trapped at LGR and LFH will be estimated. This collaborative role has been critical for optimizing production strategies (See Category 1c below) since program inception. In addition, evaluation staff has worked closely with the hatchery staff to provide weekly/monthly/yearly summaries of the data for hatchery reports and ESA compliance. The additional fall Chinook scale samples will be used to assess the occurrence of jacks and jills in broodstock based on saltwater age and to address run reconstruction needs and profiling the return by true age taking into consideration fresh water rearing. This will help address concerns regarding the effects of yearling hatchery releases on population and broodstock age structure.

Spring Chinook – Broodstock spawning protocols were reviewed and approved by Fish Management and the tribal co-managers before spring Chinook spawning. Biological information from hatchery spawning was collected, summarized and reported. Monthly reports were also provided to the tribal co-managers and Fish Management to maintain communication and inform management decisions.

Fall Chinook – Broodstock spawning protocols were reviewed and approved by Fish Management and the tribal co-managers before fall Chinook spawning. Staff assisted with spawning activities, entered appropriate data, proofed the data and summarized the data for hatchery reporting purposes as well as co-manager needs.

Steelhead – Broodstock collection protocols (Tucannon and Touchet broodstocks) were updated and agreed upon by LFC and Fish Management Staff. Evaluation staff assisted with all steelhead spawning activities at LFH and Cottonwood, entered appropriate data, proofed the data and summarized the data for hatchery reporting purposes as well as co-manager needs.

Objective 1a.3. Operate the Touchet River Adult Trap and coordinate with LFC hatchery staff for steelhead broodstock collection, and enumeration of summer steelhead returns to the Touchet and Tucannon River.

Approach: WDFW evaluation staff will operate the adult fish trap on the Touchet River for endemic broodstock for the LFC summer steelhead program, and for enumeration of the steelhead run into the upper Touchet River basin (Category 2). The trap/weir is also utilized to remove LFH stock summer steelhead from the upper Touchet River basin. Tucannon steelhead broodstock collection will take place at Tucannon FH and be overseen by Tucannon hatchery staff. Evaluation staff will coordinate with LFH and TFH staffs and the fish manager on broodstock collection protocols for both stocks. Evaluation staff will be responsible for daily record keeping of all species captured, passed, or hauled for broodstock, along with any biological samples collected at the Dayton Adult trap. Tucannon FH staff will do the same for the Tucannon FH, with co-ordination of biological samples needed with evaluation staff.

An important aspect of each endemic stock program is the age composition profiling required so staff can determine the status of these two natural populations of steelhead. Age composition is determined through the collection of scales from each stock. SRL staff have been notified that scale samples sent to Olympia will now be charged a per sample fee for processing (only part of the total cost in most cases). These additional costs for scale sample processing (steelhead, fall Chinook, spring Chinook) have been added into the annual budget.

Trapping Protocols for Endemic Steelhead:

Touchet River: WDFW evaluation staff will operate Touchet River Adult Trap year-round. Low numbers of fish and leaf fall from mid-October to December 1, which clogs the fish screens, may force the trap to be shut; though the fish ladder will remain open. The primary purposes of trapping in the Touchet River will be for monitoring the adult summer steelhead return to the Touchet River, broodstock collection for the Touchet Endemic stock program, and monitoring abundance of other local species (bull trout, whitefish, brown trout, spring Chinook). Data collected from summer steelhead include origin, marks, length, sex, and scales from a systematic sub-sample of natural origin fish. These data, in conjunction with those collected from the endemic broodstock collected will be used for ***Sub-objective 1c.1*** (see below). All hatchery fish (LFH stock origin) are killed or transported to the Dayton Juvenile Pond for local fishing opportunities. All natural and endemic origin hatchery fish are passed upstream for natural spawning.

Tucannon River: TFH staff will begin trapping for Tucannon River steelhead in late winter/early spring of 2013, and will trap/count all summer steelhead, spring Chinook and bull trout) through the summer of 2014. Data collected from summer steelhead from the TFH adult trap will include origin, marks, length, sex, scales and a fin clip for genetic profiling from a systematic sub-sample of natural origin fish only). These data, in conjunction with those collected from the endemic broodstock collected will be used for ***Sub-objective 1c.1*** (see below). All hatchery fish (LFH stock origin) are passed downstream or killed if a CWT is present. Most endemic origin hatchery fish are passed upstream for natural spawning; however some may also be collected for the broodstock if needed. Currently, managers have agreed that up to 25% of the broodstock collected can be endemic origin hatchery fish. This percentage will likely increase as the Tucannon endemic stock program expands.

Broodstock collection protocols (Tucannon and Touchet Adult Traps) were updated and agreed upon by LFC and Fish Management Staff. Evaluation staff operated the Touchet Adult Trap nearly every day, collected and transported Touchet River steelhead broodstock for the hatchery, entered and checked data on all species captured and supplied bi-weekly

updates to fish management staff and other interested parties. The Touchet Trap and fish ladder maintenance were dealt with accordingly by evaluation staff. All biological samples collected (scale and DNA) were processed and sent to appropriate labs for processing. Staff obtained similar records from Tucannon Fish Hatchery adult steelhead trapping and entered all appropriate data to spreadsheets, and processed biological samples as needed. Broodstock composition for the Touchet program remains 100% natural origin fish. For 2014, the expected number of Tucannon natural origin fish was low, so managers agreed that up to 35% of the broodstock could consist of hatchery origin fish (Tucannon stock). Based on the actual number of fish spawned during the season, 32.2% were Tucannon endemic hatchery origin fish.

Project 1c – Optimum Production Strategies

Objective 1c.1. Maintain, and evaluate changes in, the phenotypic and genotypic characteristics of salmon and steelhead stocks used at LFC.

Approach: WDFW uses an assortment of endemic and non-endemic stocks of salmon and steelhead for production at LFC. Both the spring and fall Chinook salmon stocks were developed from endemic sources, while the two original steelhead programs (Lyons Ferry and Wallowa) were not. In the fall of 2012, WDFW stopped using the Lyons Ferry stock steelhead, and converted all harvest mitigation programs to either Wallowa or Tucannon stocks. WDFW, Tribal co-managers and NMFS desire to maintain the integrity of the salmon stocks for use in the program and to minimize the potential negative effects of hatchery operations on ESA listed populations. Likewise, recent efforts to develop endemic steelhead broodstocks on the Touchet and Tucannon rivers have similar goals of protecting the health of natural populations while using Wallowa and Tucannon stocks for harvest mitigation production. To achieve these goals of production, broodstock genetic integrity and population genetic integrity and health, requires WDFW to manage their broodstocks carefully and monitor and evaluate the genetic health of hatchery and wild populations.

Broodstock Management:

To maintain the phenotypic and genotypic integrity of populations cultured for the LSRCP program, WDFW staff strives to collect and mate adults for broodstock to maintain stock demographics (e.g., run/spawn timing, age structure, sex ratios and size of fish) and genetic integrity of gametes retained for production. Ideally this would be accomplished by selecting broodstock from throughout the run/spawning season. However, because of juvenile rearing time constraints (endemic steelhead - 1 year rearing cycle), adult holding capacity (Lyons Ferry steelhead and fall Chinook), and prior spawning protocols which included a large proportion of jacks (fall Chinook), exceptions to this rule have been made.

For fall Chinook we will strive to reduce the numbers of true jacks (1 salt) in broodstock to within the broodstock management goal and not use minijacks. With the inclusion of untagged fish in broodstock, fish are mated prior to scale analysis, which has resulted in high proportion of spawners being jacks or jills in years prior to 2010. To minimize the numbers of jacks and jills in broodstock we will use a fork length criteria and spawn untagged fish >70 cm. Wire tagged broodstock will still be used at all sizes and jacks, based on brood year, will be minimized. In addition, we will use older aged males on multiple females if we have insufficient adult males for 1x1 crosses.

WDFW currently uses CWTs and/or fin clips to identify and remove stray hatchery spring Chinook, and CWTs to identify and remove stray hatchery fall Chinook from broodstock. Fall Chinook strays with CWT, blank wire, or agency wire tags will be culled prior to spawning if there are enough spawners on hand to fulfill production needs described in US v Oregon. If fall Chinook broodstock is limited, strays may be incorporated into broodstock as not to exceed 5% of the spawners.

Similar actions are followed to maintain the genetic integrity of local endemic steelhead broodstocks being developed and evaluated. Since most endemic steelhead broodstock are from unmarked/ untagged natural origin fish, any external or internal marks that identify them as hatchery origin fish can quickly be identified and enable their removal from the broodstock if desired. Stock integrity of the Willowa steelhead is not a current concern. Coded-wire tag recoveries during broodstock spawning of this stock over the years shows <0.5% stray inclusion from any given year.

Sub-Objective 1c.1.1: Detect and remove strays from fish used as broodstock and document phenotypic characteristics of fall Chinook salmon used as broodstock at LFC.

Approach: In 2013, we will continue collecting scales to determine the true saltwater age and rearing type (subyearling, reservoir-reared) for all fish used in broodstock, and further to document jacks, jills and assess fork length at return by age. Composition of wire tagged fish will be used to assure strays are kept below 5% of the fish spawned. Broodstock will have tissues collected for genotyping at a later date (Parentage based tagging). By genotyping the parents you effectively tag the resulting progeny. The use of PBT has been proposed in the HGMP for the facility and if adopted, would eventually allow a nearly 100% identification of in-basin hatchery fish.

Result – CWTs were decoded and 2.5% of the fish spawned were strays, which contributed to 5.7% of the gametes collected. Untagged fish and all broodstock had scales removed and examined to determine ages. Broodstock was scanned for PIT tags and their origins documented. Biological data were collected on all fall Chinook processed and included documentation of fin clips, wire tags, PIT tags, and sex. The estimated stock and age composition of fish used as broodstock is shown in the attached spreadsheet. Matings were documented and 4.2% of the matings included jacks and/or jills. Average fecundities were estimated by trap location.

Sub-Objective 1c.1.2: Document changes in the phenotypic characteristics of salmon and steelhead stocks used at LFC.

Spring Chinook – We have documented some differences in phenotypic characteristics (e.g., fecundity, egg size, age at maturity) of hatchery and natural origin fish, however genetic traits and run and spawn timing have changed little over the program’s history³ Annual Spring Chinook Report – pages 11-17).

Fall Chinook – Salmon were measured and fork lengths were documented, age structure from CWT and scale reading and sex ratio of fish trapped at Lower Granite Dam were documented. Data were analyzed in-season to determine fork length criteria for exclusion of jacks during spawning. Jacks were minimized in broodstock.

Steelhead – All steelhead broodstock were measured (fork length) and scales were collected from natural-origin broodstock from the Touchet and Tucannon stocks. Staff collected lengths on every steelhead captured at the Tucannon and Touchet adult traps, and scales were collected from a portion of the natural-origin steelhead at both of these for total age composition. All adults were scanned for the presence of CWT and PIT tags. Fecundity by age was determined for Tucannon and Touchet summer steelhead, but not for Wallowa stock steelhead (egg picker was used). Individual fecundities from Wallowa stock females will be taken periodically in coming years to compare with previous data. Age structure from CWT or scale readings, and sex ratio of fish trapped/collected for broodstocks were documented and will be reported in annual reports.

Genetics Monitoring and Evaluation:

Prior to 1983, there had been minimal artificial production of fall Chinook, spring Chinook and steelhead in southeast Washington and steelhead and spring Chinook hatchery production had been nearly nonexistent. The WDFW therefore believes that Chinook and steelhead populations were substantially wild in genetic character. Since the mid 1990's WDFW has actively pursued genetic sampling and characterization utilizing microsatellite DNA technology. Substantial effort has been expended on these characterizations for all the cultured species at the LFC. We will continue in this fiscal year to archive tissue samples from spring and fall Chinook, and summer steelhead (PBT samples are collected from all broodstocks), and plan genetic sampling of steelhead in the Tucannon River on all natural and endemic origin steelhead at the Tucannon FH (archive samples only). We anticipate future steelhead sampling (Tucannon and Touchet Rivers) on a systematic basis to satisfy ongoing concern regarding the effects of hatchery programs on ESA listed populations, or if programs significantly change as a result of hatchery reform.

Sub-Objective 1c.1.3: Monitor the genetic diversity and relationships of natural and hatchery spring and fall Chinook in the Tucannon River.

Background: In 1985, WDFW began the hatchery spring Chinook production program by trapping wild (unmarked) adults for the hatchery broodstock. Hatchery-origin fish have been returning to the Tucannon since 1988. The hatchery broodstock has consisted of both natural and hatchery-origin fish since 1989. The Tucannon River spring Chinook population was listed as “Endangered” in 1992, and then subsequently upgraded to “Threatened” in 1995 under the ESA. The supplementation program is part of the LSRCP mitigation program, and will continue as long as mitigation is required under the LSRCP. In 1994, the adult escapement declined severely to less than 150 fish, and the run in 1995 was estimated at 54 fish. WDFW and the co-managers believed the risk of extinction was high enough that aggressive intervention beyond the current supplementation program, in the form of a captive broodstock program, was warranted. The captive broodstock program collected fish from the 1997-2002 brood years supplementation program to be raised to adults and spawned. The last captive brood adults returned in 2011.

The hatchery program is conducted with the recognition that artificial propagation may have potentially deleterious direct and indirect effects on the listed fish. These effects may include genetic and ecological hazards that cause maladaptive genetic, physiological, or behavioral changes in the donor or target populations, with attendant losses in natural productivity.

Approach: We will collect and archive tissue samples from broodstock and in-river spawners for future genetic analysis if warranted. Carcasses sampled during spring or fall Chinook salmon spawning ground surveys provide the genetic (DNA) data to define stock characteristics, monitor possible introgression of hatchery stock genes into these populations, and evaluate our success at maintaining stock integrity.

Some tasks for 2013/14 include collection of appropriate samples for future analysis.

Spring Chinook - We have previously found that the genetic diversity of spring Chinook in the Tucannon River has not significantly changed as a result of the supplementation or captive brood programs (Kassler and Dean 2010). We continue to collect and archive tissue samples for future analyses.

Fall Chinook – Tissue for DNA archiving was collected from carcasses sampled in the Tucannon River during fall Chinook spawning ground surveys.

Steelhead – Tissue samples were collected from all three steelhead broodstocks (Wallowa, Tucannon and Touchet) as part of the larger Parental Based Tagging (PBT) studies that are on-going within the Snake River Basin. WDFW will continue with PBT sampling of all steelhead broodstocks at Lyons Ferry Complex in the future.

Sub-Objective 1c.1.4: Collect tissue samples for future genotypic characterization of natural and hatchery fall Chinook salmon in the Snake River.

Approach: In 2013/14, we will collect and archive tissue samples from all fish used as broodstock (approximately 3,500 fish) for future parental based tagging analysis. Proceeding with this approach will depend on agreement among the managers and funding from the Action Agencies.

Fall Chinook – Tissue for DNA was collected and archived from all broodstock contributing to production at Lyons Ferry Hatchery.

Sub-Objective 1c.1.5: Collect tissue samples for future genotypic characterization of natural and hatchery summer steelhead in the Tucannon and Touchet rivers.

Approach: In 2013/14, we will collect and archive tissue samples from a representative sample of natural and hatchery (endemic stock origin) summer steelhead from the Tucannon and Touchet rivers for future analysis if needed. WDFW currently collects tissue samples from both of these stocks used as broodstock for the parental based tagging analysis with IDFG.

Summer Steelhead – Tissue for DNA was collected from all broodstock contributing to production at Lyons Ferry Complex. DNA was also collected from natural origin summer steelhead passes upstream of the Tucannon and Touchet river adult traps in 2014 for archival purposes.

Objective 1c.2. Evaluate hatchery release strategies (downstream survival rates).

Sub-objective 1c.2.1: Analyze returns from the Tucannon River spring Chinook size at release experiment.

Background: Zabel and Achord (2004) suggested that increased size and earlier emigration from Idaho rivers improved survival in one life stage (juveniles) and seemed to improve survival in subsequent life stages (adults). Studies have shown that hatchery-reared fish have lower juvenile survival rates during emigration and provide lower adult returns than wild fish. Releasing hatchery fish at a larger size has been shown to increase survival and adult returns in some hatcheries, but this may also increase the number of precocious males. Tucannon River hatchery spring Chinook have had chronic low returns throughout the program's history. The current size at release goal is 15 fish per pound (fpp), but in order to release fish at that size, hatchery staff must hold back growth of the fish, which may compromise their emigration success. Recent studies on growth modulation in hatcheries have shown the potential to decrease the rate of precocialism (Larsen et al. 2006) while attaining a larger smolt size. Current rearing strategies for spring Chinook at LFH/TFH are similar to the growth modulation protocol described by Larsen et al. (2006), and are substantially different from rearing protocols used during the 1980's and 1990's production studies where high numbers of jacks resulted from releasing larger smolts. Modifying size at release could allow production emphasis to shift from quantity to quality in an attempt to improve hatchery efficiency where it counts most, the improvement of post-release survival and adult returns without inducing high precocialism.

Approach: We will compare differences in survival and size and age at return between smolts reared to 9 fpp and the current release goal of 15 fpp for the 2006-2010 brood years. All fish in the two groups received CWT and a VIE tag, which will be used to analyze survival to adult returns (SARs), and size and age of returns between treatments. Each of the groups were tagged with equal size groups of PIT tags (utilizing 12,500 from LSRCP and 12,500 from BPA) before release. Detections of PIT tags for the groups will be analyzed using the SURPH model to calculate relative survival through the Federal Columbia River Power System (FCRPS). Starting in BY2012 and continuing through BY2015, a group of spring Chinook will be reared full term at the Tucannon Fish Hatchery and their performance (juvenile survival, growth and migration performance through the hydro-system, and adult returns) will be monitored and compared with the traditional rearing strategy that utilizes LFH for early rearing, with transfer to TFH for final rearing. Prior to release both groups will be acclimated at Curl Lake AP and allowed to volitionally migrate from the lake. Depending upon PIT tag availability, each study group will be tagged with either 6,250 or 12,500 PIT tags for juvenile survival estimates and adult monitoring. Final SARs will be derived based on CWT recoveries.

Evaluation of the release strategies is ongoing as the final brood year (BY10) was released in 2012. All fish in the two study groups were tagged and released as planned.

Preliminary data shows that survival through the hydrosystem corridor was significantly higher for the larger (50 g) release size based on PIT tag information (2013 Annual Spring Chinook Report – pages 51-52). Adult returns will be complete after 2015. Program size at release was increased from 15 fpp to 12 fpp beginning with BY11 releases based on the hydrosystem corridor survival information.

Sub-objective 1c.2.2: Evaluate fall Chinook release strategies, release sites, and smolt out-migration timing from LFH releases to downstream collection sites.

Background: Production at LFH began with yearling releases as a way to boost returns of fall Chinook into the Snake River. As returns of fall Chinook increased, subyearling production was reinitiated in the program as a way to retain the natural ocean-type life history of fall Chinook.

Despite the proven survival advantage provided by a yearling release strategy, at some point the fish managers may request the shift to all subyearling production. We will continue to monitor the relative survival success of each program to assist the managers with data necessary to inform that decision. To be consistent with PIT tagging allocations that are currently justified for spring/summer Chinook salmon and steelhead, minimum tag groups should be allocated to hatchery programs and not to individual releases. In addition, because fall Chinook salmon are released as both yearlings and subyearlings and freshwater rearing strategies differ by basin, it has been suggested that allocations be divided into the following groups: subyearlings released below LGR, subyearlings above LGR in the Clearwater, subyearlings above LGR in the Snake River, yearlings below LGR and yearlings above LGR. To assure 30 recoveries from each group, average SAR to the Snake River by group was used to estimate the number of fish to PIT tag. Additional yearlings released on-station would need to be PIT tagged to allow for age at return estimates. The total suggested number of PIT tags for release should be as high as 222,288 (95,619 LSRCP, 75,057 FCAP, 37,926 NPTH, 18,687 IPC). However, funding is not currently available through BPA or LSRCP for such large tag numbers. Fewer tags are proposed for release in 2014 to be in line with current funding, but accuracy and precision of estimates of returns are reduced.

Approach: Acclimation facilities are located throughout the Snake River basin to promote homing of fall Chinook to their historical spawning grounds. Our evaluations will be performed on sub-yearling fish released directly from LFH, releases into the Snake River near Couse Creek, and releases into the Grande Ronde River (Table 1), and yearling fish released from LFH. Complementary evaluations of releases made above LGR are done by the NPT, the USFWS or IDFG/IPC. Specific details of the monitoring and evaluation of LFH origin fall Chinook that are released upstream of LGR are included in interagency/tribal cooperative project descriptions. Calculated SARs for the releases will be used to compare and contrast performance, and will be the primary metric for determining relative success of subyearling and yearling releases.

Adult returns from yearling fall Chinook releases have proven to have high fidelity to release locations in the past (Garcia et al. 2000). A new evaluation began in the fall of 2013 (BiOp related and BPA funded) regarding the fidelity of adult returns from subyearlings to release sites. To address this question, adult returns from subyearling releases will be randomly selected via sort-by-code at the LGR trap. From 2013-2017, radio tags will be inserted and the fish will be tracked until spawning. In addition, concern was raised regarding the straying of fish released by WDFW below LGR dam and the straying they may do (see Objective 2b.2).

Table 1. Proposed marking/tagging of fall Chinook salmon released by WDFW in 2014.

Location	Life Stage	Total Number		Marks	PIT tags ^{a,b}
		Released	Marked Release		
Lyons Ferry Hatchery	Yearling	225,000	225,000	AD/CWT	15,000
Lyons Ferry Hatchery	Yearling	225,000	225,000	CWT	15,000
Lyons Ferry Hatchery	Sub-yearling	200,000	200,000	AD/CWT	20,000
Snake River near Couse Creek (direct release)	Sub-yearling	200,000	200,000	AD/CWT	3,000
Grande Ronde River	Sub-yearling	400,000	200,000	AD/CWT	3,000
Total					56,000

a. Proposed tagging for 2013 subject to US v OR review and approval.

b. May PIT tag an additional 39,619 of fish listed in Table 1 if BPA approves funding to allocate tags across all production groups..

Result – Tagging was completed. The Couse Creek release was changed to Captain John Rapids AP second release in 2014 and the NPT is now in charge of the data associated with that release. Findings continue to indicate that subyearlings released into the Grande Ronde River do not perform as well as subyearlings released at Couse Creek near Captain John Rapids or subyearlings released on station at LFH. Data that has come from returns of fish that were released at Couse Creek indicate they return more jacks and adults than fish released in the Grande Ronde. Releases of fish at LFH had the best performance and yearling releases out-performed the subyearling releases. All releases were coordinated with the co-managers.

Evaluation staff radio tagged 104 fish at Lower Granite Dam during the fall of 2013 which was less than desired. This occurred because nearly 70% of the run passed LGR before the trap was opened. The trapping date was delayed due to high river water temperatures in 2013. Data is being summarized for 2013 and will be presented in the 2013 Annual Fall Chinook Report and a BPA Annual Progress Report.

Sub-objective 1c.2.3: Evaluate and monitor summer steelhead (LFH, Wallowa, and Endemic stock) release strategies, release sites, smolt out-migration timing and relative survivals from LFC releases.

Approach: All Wallowa stock are 100% AD-clipped for harvest mitigation purposes. In addition, a portion of the Wallowa stock at each release site are CWT and PIT tagged to determine program contribution. Both endemic stocks (conservation groups) are 100% CWT for identification upon adult return at traps or if they should be recovered post-spawning at area trap or during spawning ground surveys. In addition, a portion of the Tucannon stock is also AD-clipped for harvest mitigation (all production over 50,000). For both endemic stocks, PIT tags will be used to monitor relative out-migration timing and performance, but the primary purpose will be for determining smolt-to-adult returns rates. The listed PIT tagging rates are designed to return 25-60 adults for each brood year (over 1-2 years) depending on release group survival, and should provide reliable estimates of total survival that can be used with CWT harvest records and adult trap recoveries to estimate total contribution from each release location. Table 2 lists the proposed marks/tags for the 2014 release year for summer steelhead.

For the 2013 and 2014 release year, WDFW had proposed to increase the number of PIT tags for evaluation of the Touchet Endemic stock. It has been recommended by co-managers that survival of the Touchet Endemics might be increased if 1) they were acclimated prior to release, or if 2) the broodstock included some hatchery origin adults. In each case, we had proposing to split the release in about half for rearing purposes, and PIT tags would be used to evaluate the different release strategy, or broodstock composition. Based on previous survival estimates, 5,000 PIT tags per release group were required. However, for both the 2013 and 2014 releases, we could not acquire additional PIT Tags to do the evaluation, so only 5,000 tags have been released. Beginning with the 2015 Brood, WDFW, through help from CTUIR was able to secure more PIT Tags for the Touchet Endemic stock evaluation. Beginning with the 2015 Brood, about ½ of the Touchet broodstock mating will be WxW, with the other half consisting of WxH crosses.

Table 2. Proposed marking/tagging of summer steelhead from LFH Complex in 2014.

Stock	Release Location	Total Number Released	Marks released (Number)	Tagged (PIT)
Wallowa	On Station	110,000	AD/CWT (20,000)	3,000
Wallowa	Touchet R. @ Dayton AP	85,000	AD/CWT (20,000)	3,000
Wallowa	Walla Walla R.	100,000	AD/CWT (20,000)	3,000
Wallowa ¹	Grande Ronde R. @ Cottonwood AP	200,000	AD/CWT (20,000)	4,000 + 2000
Tucannon	Upper Tucannon R.	50,000	CWT ONLY (50,000)	7,500
Tucannon	Marengo Tucannon R.	50,000	AD/CWT (50,000)	7,500
Touchet ³	NF Touchet R.	50,000	CWT ONLY (50,000)	5,000
			Total	35,000

¹ An additional 2,000 tags will be added the Cottonwood AP release. These PIT Tags will be provided by the Fish Passage Center as part of the Comparative Survival Study (CSS) for steelhead above Lower Granite Dam.

Result – Marking and tagging (CWT and PIT) of all steelhead groups was completed as generally planned. Final PIT Tag numbers for the Touchet Endemic stock was 5,000 as explained above.

CWT recovery efforts continue in fisheries and at hatchery traps which allows for estimation of adult returns. The use of PIT tags to estimate adult returns to the project area has also been successful for all steelhead groups, and provides a way to account for fish that are not taken in fisheries or recovered at hatchery racks. Additional analysis needs to occur, but preliminary findings suggest 15-30% of the returning adult steelhead are not accounted for by using the standard CWT expansion methods – these fish are likely ending up on the spawning grounds. WDFW will continue to use information from both recovery methods (CWT and PIT) to describe the overall return and straying of Lyons Ferry Complex summer steelhead.

Category 2. Estimating Adult Returns

Project 2a – Catch Accounting

Sub-Project 2a.1: Marking and Tagging

Objective 2a.1.1: Coordinate marking/tagging needs with hatchery and fish management staff.

Approach: The LFC has three species programs (spring and fall Chinook salmon and summer steelhead) with specific mitigation goals for the Snake River Basin. Appropriate types and numbers of marks (fin clips) and/or tags (CWT, VIE, PIT) are required to document successes/failures from various releases of each of the species. The need for marks is further justified because of ESA listings of all anadromous species in the Snake River Basin, and concerns about the potential effects of hatchery fish on listed populations. However, space and funding are limited at hatcheries. As such, evaluation, fish management, and hatchery staffs (along with US v. OR technical input) work closely in developing yearly marking programs that will satisfy most needs and be adequate in size to document 1) smolt-to-adult survivals, 2)

harvest in ocean fisheries, and mainstem Columbia commercial, recreational and tribal fisheries, and 3) recreational fisheries in the project area.

Note: Table of tagging costs will be provided by LFC.

Spring Chinook – A PIT tag array was installed at the outlet of Curl Lake acclimation pond on 10 April, 2014 in order to obtain a more accurate release number. Based on tag detections at the array, mortality due to predation in the lake was high, however, PIT tag “collisions” were a problem with the array so estimated release numbers should be considered minimal estimates. These estimates will be adjusted in the 2014 annual report. Based on detections at the array, a total of 129,952 BY12 LFH reared (CWT only) and 16,609 BY12 TFH reared (CWT only) yearling smolts were released during 2014.

Fall Chinook – Releases in 2014 included 503,273 yearlings released on-station at LFH, 209,972 subyearlings release on-station at LFH, and 403,926 subyearlings released into the Grande Ronde River near Cougar Creek.

Steelhead – A total of 299,436 Wallowa stock steelhead were released (Walla Walla River = 100,436, Touchet River @ Dayton AP = 90,000, and 117,500 into the Snake River @ Lyons Ferry) during April of 2014. A total of 209,000 Wallowa stock steelhead were volitionally released into the Grande Ronde River from Cottonwood Acclimation Pond during April 2014. A total of 49,759 (non-adipose clipped) Tucannon endemic stock were released at the Curl Lake Intake, and an additional 40,724 adipose clipped Tucannon endemic hatchery stock steelhead were released into the Tucannon River at Marengo in April 2014. A total of 49,523 Touchet River endemic hatchery stock steelhead were released into the Touchet River above the city of Dayton during April 2014.

Note: Table of tagging costs will be provided by LFC.

Sub-project 2a.2: CWT Laboratory:

Objective 2a.2.1: Recover and process CWTs recovered from hatchery sampling, creel surveys, adult trap sampling, and spawning ground surveys.

Approach: The Snake River Lab (SRL) LSRCP evaluation office is remote from the main CWT extraction and processing lab in Olympia, where the vast majority of tag reading occurs for the State of Washington. Many of our spawning protocols require real-time extraction and processing of CWTs to remove any stray fish that might be in the broodstock (spring and fall Chinook programs). As such, over the years the SRL has become self-reliant and efficient in CWT extraction and processing (5,000-6,000 CWTs annually). All CWTs processed are eventually shipped to Olympia, re-read, and the data are submitted by Olympia staff to the regional CWT database.

Spring Chinook – We recovered and read 72 spring Chinook CWTs and sent tags to Olympia for a confirmation reading. Recovered CWTs are summarized in the 2013 Annual spring Chinook Report (pg. 14).

Fall Chinook – During the 2013 return year we extracted 1,998 CWTs, decoded, and entered the tag codes into data files. Recovery data were provided to co-managers for run reconstruction estimates and forecasting needs.

Steelhead – From broodstock spawning and trapping activities: We recovered 63 CWT from spawning of Wallowa stock steelhead at the Cottonwood adult trap. We recovered 20 CWT's from the Tucannon endemic stock steelhead trapped and used in the spawning of the Tucannon endemic stock program. All CWTs from broodstocks/traps were sent to Olympia for a confirmation reading, and eventual submittal to the RMIS Database. Recovered CWTs from broodstock/trapping activities will be summarized by stock origin and release location in the Annual Summer Steelhead Report.

Sub-project 2a.3: Fishery Catch Estimation and Sampling:

Objective 2a.3.1: Conduct summer steelhead (and incidental fall Chinook) fishery sampling to recover CWTs, determine impacts of fisheries to wild stocks, and estimate contribution of LSRCP fish to the sport fishery for mitigation evaluation.

Approach: WDFW personnel have annually surveyed steelhead and fall Chinook sport anglers within the LSRCP area of Washington [Snake River (in cooperation with IDFG), Columbia River, Walla Walla River, Touchet River, Tucannon River and the Lower Grande Ronde River (in cooperation with ODFW)]. Sport fishing for summer steelhead is open yearly on the Snake and Columbia rivers and most of their tributaries from 1 September through 31 March, and on Grande Ronde River from 1 September through 15 April. Anglers can keep only AD clipped fish, some of which are also LV clipped indicating the presence of a CWT. When possible, catch rates from each week's surveys are summarized during the season and provided to the local news media to assist anglers. However, the primary purpose of the creel surveys is to recover CWT tagged fish and to document incidence of wild fish captured in the fishery (Category 3). Estimates of the total number of CWT fish harvested (WDFW, IDFG, ODFW or USFWS origin tags) are calculated by expanding our CWT recoveries with a sample rate (CWTs are expanded only if we achieve a minimum of 5% sample, although a sample rate of 20% is the goal) based on total estimated harvest obtained from statewide steelhead and salmon catch record card estimates. Using the mark rate and total releases, total contribution to the fishery for mitigation evaluation can then be calculated and hatchery production levels can be adjusted as needed. All estimates of CWTs harvested are provided to the Region Mark Information System (RMIS) coded-wire tag database maintained by Pacific States Marine Fisheries Commission (PSMFC).

In addition to our standard CWT recovery/creel census surveys, we also cooperate with ODFW by conducting a joint survey of anglers on the lower Grande Ronde River (sections of which are in both Washington and Oregon). The ODFW samples the lower Grande Ronde River (Bogan's Oasis Resort in Washington to Wildcat Creek in Oregon) from September through January. The WDFW samples this area from February to mid-April. Angler effort, catch rates, and harvest are calculated by ODFW as described in Carmichael et al. (1988).

Historically, it has been difficult to sample the entire steelhead fishery at a high rate in all areas because of the large, relatively remote area. Beginning in the 2007 run year, we changed our creel efforts (locations surveyed) to increase our sampling rate on the mainstem Snake River. To achieve the increased sample rate in high harvest areas, creel surveys are seldom conducted in the Walla Walla, or Touchet Rivers, but have continued in the Tucannon with addition funding

provided by the Washington State. All creel efforts are currently concentrated on the mainstem Snake River, the Columbia River near Wallula (Sept-Oct only), the Tucannon River (state funded), and the Grande Ronde River. In addition to more focused creel surveys, since 2008 we enlisted the help of local guides to collect additional steelhead snouts to increase our sample rate in Sections 648 and 650 of the Snake River (boundary waters with Idaho). This effort was patterned after the IDFG incentive program (3\$/fish snout) using local guides to increase their sample rates. For WDFW, participation by local fishing guides over the last 4 years was very good, and has greatly increased our sample rate. In 2009 and 2010, snouts provided by fishing guides and from one volunteer creel sampler provided greater than 50% of our sample in the two river sections we survey above Lower Granite Dam. We expect to continue with the snout program in the future. These efforts allowed us to achieve the goal of a 20% sampling rate in that fishery. Other areas in the lower Snake River have approached 20% with the increased effort.

Staff recovered and read 413 CWTs from the steelhead fisheries within the Snake River Basin during the 2013/2014 season. Staff recovered and read 329 CWTs from the fall Chinook fishery that occurred within the Snake River Basin during the 2013/2014 season. Pertinent fishery data (sample rates) and biological information from sampled fish, along with CWT's were sent to Olympia for confirmation of CWT readings. Staff will work with Olympia staff on confirming expansion factors prior to RMIS submittal of all creel data. In addition, evaluation and fish management staff determined impacts to wild steelhead stocks and provided the results to NOAA Fisheries through an FMEP Report. Estimates of contribution of LSRCP steelhead to the commercial and sport fisheries in the Columbia and Snake rivers have also been completed at this time (preliminary through the 2009 brood year) and are available within the LSRCP steelhead production tables completed and provided to the LSRCP office.

Project 2b - Estimating Project Area Escapement

Objective 2b.1. Monitor, evaluate and/or conduct adult trapping/collection of spring and fall Chinook and summer steelhead for broodstock and run reconstruction (fall Chinook).

Approach: SRL staff will continue to monitor, conduct, and/or evaluate broodstock collection and returns of spring and fall Chinook salmon and summer steelhead at adult traps that are currently funded under the LSRCP. Duties shared between LFH hatchery staff and the evaluation staff differ at each trapping facility. As an example, evaluation staff will generally provide a broodstock collection schedule/goal, while the hatchery has responsibility to trap fish at LFC and transport fish to the hatchery from LGR. However, both staffs work together (in conjunction with WDFW Fish Management goals and objectives) to optimize performance and reach established goals for the program. Sampling protocols are designed for each location according to site, personnel and ESA limitations to provide the greatest accuracy and precision possible for estimating escapement. Sampling capabilities range from a systematic sub-sample (10-20%) of the fish at Lower Granite Dam for fall Chinook to near 100% capture and enumeration of spring Chinook at the Tucannon Fish Hatchery trap.

When broodstock needs for fall Chinook are met through trapping at LGR, only some of the fish trapped at LFH will be retained. It is necessary to trap more fall Chinook than are needed for spawning to assure enough fish are captured for broodstock, evaluation, and run reconstruction

needs. We may operate a PIT tag array in the adult fish sorting flume at LFH to document numbers/recaptures of fall Chinook during the trapping process.

Sub-objective 2b.1.1: Monitor and evaluate adult trapping/collection of spring Chinook on the Tucannon River.

Spring Chinook – Adult trapping protocols were provided to hatchery staff for collection of spring Chinook broodstock. Data collected by hatchery staff were compiled and used with spawning ground survey data to estimate the returning population of hatchery and wild fish (see 2b.2.1 below). Results are summarized in the 2013 Annual Spring Chinook Report (pages 17-19).

Sub-objective 2b.1.2: Monitor, evaluate, and/or conduct adult trapping/collection of summer steelhead at LFC adult traps or at temporary traps on the Tucannon and Touchet rivers.

Steelhead – Adult trapping and broodstock collection protocols were provided to both evaluations (Touchet) and hatchery (Tucannon) staffs for biological sampling needs and collection of summer steelhead broodstocks. Staff assisted with trapping and spawning activities as needed. Data were collected, entered, proofed, and distributed for use as needed.

Results – Staff operated the Touchet Adult Trap nearly every day during the contract period, collected and transported Touchet River steelhead broodstock for the hatchery, entered and checked data on all species captured, and supplied bi-weekly updates to fish management staff and other interested parties. Due to program changes, the Tucannon FH staff is responsible for adult trapping on steelhead on the Tucannon River.

During steelhead broodstock sorting and spawning, all fish returned to the river were scanned for a PIT Tag (recaptures), fish sacrificed and/or spawned during the season were scanned for PIT tags. All documented PIT tags detected were uploaded to the PTAGIS database.

Sub-objective 2b.1.3: Monitor and evaluate adult trapping/collection of fall Chinook at LFH and Lower Granite Dam Adult traps.

Results – Trapping protocols were developed for staff at LGR Dam and LFH to assure broodstock and run reconstruction needs were met. Staff assisted with trapping and spawning activities. Data were collected, entered, proofed, and distributed for use in run reconstruction estimates. PIT tags detected at spawning were reported to PTAGIS and PIT tags detected at arrays on the Tucannon River are automatically uploaded by Qualitative Consultants Inc.

Objective 2b.2. Estimate adult returns, collect life history characteristics, and document distribution of adult spring and fall Chinook salmon, and summer steelhead to southeast Washington streams and facilities.

Approach: Adult return goals were used to define the LSRCP program; therefore measuring adult returns to the point of release and to other intermediate areas is necessary to determine program success. WDFW monitors the returns of spring and fall Chinook salmon and summer

steelhead throughout southeast Washington through adult trapping (TFH adult trap, LFH adult trap, Lower Granite Dam adult trap, Touchet River adult trap, and Cottonwood Creek adult trap), PIT tag detection arrays and spawning ground and creel surveys. Sport harvest and CWT expansions from surveys can be used to estimate the number of adults that returned to the project area. Trapped and/or spawned broodstock fish and carcasses provide data concerning origin, stray rates, sex ratios, and composition of each year's run. Detections of PIT tagged returning adults of all species occur throughout the Columbia basin at the mainstem dams, hatchery (LFH and Tucannon), in-river trapping locations, and increasingly at detection arrays deployed in tributary rivers and creeks by WDFW and other management agencies. These detections will allow us to reconstruct migration histories and estimate adult returns to the project area; including tag groups that are not externally marked for CWT identification. Spawning surveys provide estimates of redds, spawn timing, and distribution of fish in each of the surveyed rivers. These are primary actions to track program performance and progress toward meeting goals. Another factor that can affect the success of the LSRCP program is downriver and within-area harvest of adults. This primarily affects fall Chinook and steelhead in downriver fisheries. Few Tucannon River spring Chinook have been documented in downriver fisheries. Fisheries are directly sampled and CWT recoveries are gathered from regional databases.

The substantial numbers of stray hatchery origin salmonids has become a broad regional concern in the Columbia and Snake River basins in recent years. Numerous studies have shown or suggested the negative effects of stray salmonids on native populations. For the LSRCP program, strays have become an issue in two ways, 1) numerous strays from outside the Snake River basin have been documented in area rivers (i.e. Umatilla fall Chinook in the Snake River Basin, Umatilla spring Chinook in the Tucannon River), and 2) some LSRCP fish have been found in relatively high numbers in the Columbia River Basin (i.e. Wallowa stock summer steelhead in the Deschutes River, Oregon) and in the Snake River above Lower Granite (Lyons Ferry stock, Tucannon endemic stock). As such, we believe it prudent to compile and evaluate all relevant data on stray LSRCP fish in other basins, and non-LSRCP fish into the Snake River Basin and its tributaries. PIT tags will greatly improve our understanding of straying/wandering behavior, and will likely increase our estimate of overall survival to the basins by accounting for fish that have been overlooked in the past.

Species-specific approaches to document straying.

Spring Chinook: WDFW adult trapping and broodstock collection activities are used to gather return data for representative CWT releases. These actions also will result in substantial data annually on stray fish from other watersheds entering the Tucannon River. We will summarize and report LSRCP origin and stray information from our adult trapping (Tucannon Hatchery trap) and carcass recovery during spawning surveys. Because Tucannon River Chinook and steelhead have been documented in Asotin Creek, limited carcass recovery surveys will be conducted there, and data from a BPA/IMW monitoring project will be retrieved and included in our assessment of adult returns as appropriate.

Fall Chinook: We will primarily trap fall Chinook broodstock at LGR Dam, but may trap at LFH if more fish are needed for broodstock than LGR trapping can supply. Estimates of escapement above LGR Dam, where the majority of in-basin spawning occurs, will be derived through a run reconstruction process. Since LFH on-station releases occur below LGR Dam, we will document the stray rate of these fish to LGR Dam and estimate fallback rates of PIT tagged fish (see radio telemetry study Sub-Objective 1c.2.2). We will also document straying of LFH

origin fall Chinook to out-of-basin areas and their interception in fisheries. The fidelity and abundance of fish from LFH production groups will be assessed by documenting returns to 1) Snake River basin below LGR, 2) in-basin hatchery racks 3) in-basin spawning areas, and 4) out of basin (stray) hatchery racks. Since the trap at LFH is only planned for use when trapping efforts at LGR fall short of broodstock goals, we will be unable to document the magnitude and return distribution of fall Chinook destined for LFH. We will document the magnitude of the yearling return using PIT tag detections at downstream detection sites and determine what proportion of those fish remained in the reservoir between IHR and LGR dams. Although not considered straying, recoveries of tagged fish from fisheries affects the overall return of fish to the spawning grounds, and potentially the success of our program. We will document freshwater and saltwater fishery recoveries for sport, commercial, and tribal fisheries, and sum recoveries by the state (or Country) in which they were recovered. Straying of out-of-basin fish to points within our study area must also be addressed. The impact of non-endemic stocks on ESA listed Snake River stock in the LSRCP study area can affect the integrity of the natural population. We will document the extent and the composition of strays into these areas. Run composition will be estimated at LGR Dam, and on spawning grounds of the Tucannon River. Members from the US v OR Technical Advisory Committee (TAC) and our staff will cooperate to develop the run reconstruction at LGR Dam. The run reconstruction of fall Chinook at LGR Dam will be used to estimate LSRCP returns for evaluation and to estimate natural origin returns to meet ESA goals.

It is unknown to what extent hatchery returns, both Snake River and stray origin, affect natural production and the reproductive success of naturally spawning fish. Brood year 2013 will be the third year fin clips will be archived for use in the future for a parental based tagging study. In the future this should allow us to accurately determine the origin of unmarked/untagged hatchery fish and the effectiveness of hatchery fish by documenting the return of their progeny to address FCRPS Biological Opinion RPAs 64 and 65. Broodstock trapping activities at LGR Dam are also important for providing an indication of natural and hatchery adult fall Chinook abundance in the Snake River and potential spawners above LGR Dam. The data collected by WDFW's evaluations were closely linked to the BPA funded study; *Evaluating Relative Reproductive Success of Natural and Hatchery Origin Snake River Fall Chinook Spawners Upstream of Lower Granite Dam*. That study was an outgrowth of concerns about stray fall Chinook in the Snake River, as well as increasing numbers of Snake River stock hatchery adults from the LFH program, but failed to identify an accurate means of distinguishing the offspring of hatchery from natural spawning adults. We will remain engaged in a collaborative approach to find alternative ways to meet RPAS 64 and 65 by attending regional meetings and participating in the development of a consensus proposal if an appropriate method or approach is identified.

Steelhead: The assessment of summer steelhead straying is difficult due to the extended time that they spend in freshwater migrating to their final destination. The majority of WDFW LSRCP summer steelhead in the Snake River may spend 9-12 months in the system before spawning: during that time they may be captured in numerous sport/commercial fisheries. While sport/commercial fisheries are useful in the overall assessment of returns, they may give a skewed view of straying depending on the time of year and location in which the harvest occurred. Steelhead are also periodically recovered in adult traps or from spawning ground surveys. SRL and Lyons Ferry Hatchery staffs operate four adult steelhead traps in SE Washington that are directly associated with the LSRCP program. WDFW Fish Management or Science staffs operate other adult traps in SE Washington. These traps capture many tagged hatchery fish, of which the origin can be determined should the fish be sacrificed and a CWT recovered. In recent years, the number of PIT tagged steelhead of hatchery (LFH and Wallowa

stocks), endemic hatchery (Tucannon and Touchet) and natural (Tucannon River stock, Touchet River stock) origin has increased dramatically. The prevalence of these tags greatly facilitates the tracking of steelhead behavior without sacrificing fish. Numerous detections of tagged fish can more fully explain wandering/straying behavior, and WDFW evaluations studies have adopted sampling protocols for recovering PIT tags wherever traps are operated or sampling is conducted, and have recently deployed detection antennas in the Tucannon and Touchet Rivers and Asotin Creek. All extracted CWTs from traps or spawning ground surveys, and PIT tag detections are eventually submitted to the regional CWT or PIT tags databases in Portland, OR.

Recent results from monitoring of Tucannon River steelhead adults have shown consistent loss of adults to areas above LGR Dam among the three PIT tagged groups: Tucannon River wild steelhead, Tucannon River endemic hatchery stock and Lyons Ferry hatchery stock steelhead released in Tucannon. This behavior suggests that Tucannon River steelhead either 1) may not be finding the river during their initial upstream migration or 2) are incapable of negotiating down through the dams to return to the Tucannon River for spawning. This hydro-system effect has been elevated as a serious concern to the Action Agencies, and the Corps of Engineers (COE) is discussing the possibility of conducting a radio telemetry study of Tucannon River steelhead (using PIT tagged steelhead and Separation-by-Code) to provide more information regarding their behavior during migration than can currently be provided by PIT tags alone. Active participation with the COE's contractor through project development and a possible LSRCP cost share with the COE to complete the study may provide invaluable data that are necessary for recovering the population under the ESA, and for improving the success of the LSRCP steelhead mitigation program for Washington.

We will use recoveries of hatchery steelhead CWTs as reported to RMIS from fisheries (depending on time and location of recovery), adult fish traps, PIT tag antennas and spawning ground surveys to assess straying in summer steelhead (both within-program and out-of-program).

Sub-objective 2b.2.1: Estimate adult returns, collect life history characteristics, and document distribution of adult spring Chinook to the Tucannon River and Asotin Creek.

Results – An estimated 1,117 spring Chinook (752 natural origin, 365 hatchery origin) returned to the Tucannon River during 2013. In Asotin Creek we counted two redds and recovered one natural origin carcass during spawning ground surveys (pages 24-25 in the 2013 Annual Report).

Sub-objective 2b.2.1a: Estimate pre-spawning loss of Tucannon River spring Chinook above the Tucannon FH.

Approach: Over the last few years, the number of redds above the Tucannon Fish Hatchery has not met expectations based on the number of females passed upstream of the trap, and overall carcasses recovered from spawning ground surveys, compared to the number passed upstream has decreased (generally about 25% recovery). These discrepancies are large enough, that we believe high pre-spawning loss (predators, poachers, or natural loss) is occurring. To date, we've not been able to pinpoint the exact cause, even though mid-summer carcass surveys have been conducted, with little results.

For 2014, WDFW has formulated a plan to gather information on the loss that is occurring and to formulate solutions for future returns: 1) install an additional PIT Tag Array at Curl Lake, 2) Radio Tag up to 50 spring Chinook, and 3) work with WDFW Enforcement for conducting more emphasis patrols in the upper Tucannon River.

With assistance from Bonneville Power Administration (BPA) through the Tucannon Steelhead Supplementation project, we've acquired additional PIT Tag Array equipment so that an in-stream array will be placed near Curl Lake Acclimation Pond. WDFW will PIT tag all adults (male and female) passed upstream of the trap. The idea is to get a better understanding of where fish are residing during the summer months when mortality could be occurring. By having the existing PIT array just upstream of the Tucannon Fish Hatchery Adult Trap, and with installation of an array at Curl Lake, we will be able to make population scale estimates by sex that are between the two arrays (about six river miles), or those that pass Curl Lake into the upper Watershed (about another six miles). Spawning ground surveys are typically conducted during late August through September. Results from redd surveys will estimate the number of spawners between the two sections, which can then be directly compared to the PIT Array estimates. Surveyors will also carry portable PIT tag scanners and check all carcasses for a PIT Tag. Recovery of PIT can be checked against array detections and adjusted estimates as necessary.

With assistance from the Corps of Engineers (COE) who has donated 49 radio tags, and using recently upgraded radio telemetry receives from the BPA Fall Chinook Radio Telemetry Study, WDFW plans to radio tag up to 49 adult spring Chinook at the Tucannon Fish Hatchery during May/June, and track them throughout the summer and into the spawning season to document location of holding, migration, mortality, and determine cause of mortality. WDFW will set up two fixed site receivers (one at the Tucannon Fish hatchery Adult Trap outfit with 2-3 antennas, and one at Curl Lake Acclimation Pond associated with the PIT Array for power). A third receiver will be used to mobile track fish on a daily basis to determine location and movements. Individual tags will be pinpointed through snorkeling on a weekly basis to determine if the fish is still alive. Pinpointed radio tagged fish will have a GPS location taken for every reading, and final locations. These can then be mapped out for geographic distribution by cause of mortality which would also help pinpoint where the problem may originate from.

Results – The adult detection PIT tag array was not installed near Curl Lake due to budget concerns and the fact that it would not provide the answer as to what was causing the high pre-spawn mortality. The U.S. Army Corps of Engineers provided 49 radio tags in order to attempt to determine the cause of the high pre-spawn loss that has been observed in the last two years. Our hypothesis was that by radio tagging a representative portion of the run and intensively tracking those fish, we would be able to determine which factors were responsible. However, we experienced high mortality associated with the gastrically implanted radio tags and discontinued tagging after 47 fish were tagged. Of the tagged fish, 21 died of unknown causes, 18 died from perforated stomachs from tagging, four were killed by predators, two spawned, one tag stopped working or the fish/tag left the system, and one tag was regurgitated. We also collected histology samples from pre-spawn mortalities for disease analysis, placed game cameras near redds and fish, and examined stream temperatures and other factors that may have caused the high pre-spawn loss. A report is being written and will be completed by February 2015.

Sub-objective 2b.2.2: Estimate adult returns, collect life history characteristics, and document distribution of adult fall Chinook to southeast Washington streams and facilities.

Results – Estimates of the numbers of fish returning from WDFW releases as well as the ages of the fish at return have been completed and provided to the co-managers. Spawning ground surveys were completed on the Tucannon and carcasses sampled. We estimated 386 fall Chinook and 13 coho redds were built during 2013. The return was estimated at 1,158 fall Chinook which consisted of 4.8 % out-of-basin hatchery strays verified by CWT. Mitigation goal of returns to the Snake River was met in 2013.

Sub-objective 2b.2.3: Estimate adult returns, collect life history characteristics, and document distribution of adult summer steelhead to southeast Washington streams and to LSRCP facilities.

Results – Estimates of adult returns (by PIT Tags) for the 2013/2014 run year was completed, and estimates for the current 2014/2015 run year is on-going and has been provided to managers as needed for conference calls. Estimation of adult returns by CWTs for the 2013/2014 is preliminary at this time and will be completed once all CWT data have been submitted to the RMIS CWT database from all agencies. This may take up to two years to get complete data. Prior run year estimates for summer steelhead have been summarized for the LSRCP Steelhead Symposium, and are updated as needed.

Life history characteristics (from CWTs or scales) were collected where appropriate for hatchery or natural origin steelhead at traps and other recovery locations. All CWTs and scales collected from the 2013/2014 run have been processed and sent to the appropriate labs (scale or CWT) in Olympia.

Staff attempted spawning ground surveys during the spring of 2014. Water conditions in 2014 were generally favorable. Preliminary estimates have been made for the Touchet River and Asotin Creek, but these estimates have not been finalized yet. Final results will be presented in the annual steelhead report expected to be complete in spring of 2015.

Sub-objective 2b.2.4. Assess the nature and extent of straying of LFC spring and fall Chinook salmon and summer steelhead.

Spring Chinook – Tucannon origin spring Chinook bypassing the Tucannon River and going above Lower Granite Dam has been a problem in the past, but has declined in recent years going from 80% of PIT tagged fish from 1995-1999 down to 4% from 2010-2012 (2013 Annual Report).

Fall Chinook – Fall Chinook have been documented at hatcheries and racks outside of the Snake River basin at a low rate (<1%). Straying of LFH released fall Chinook to LGR Dam and the Tucannon likely occurs at a greater rate because of trapping protocols in place. The trap at LFH is only used to divert fish to the hatchery that are need for broodstock and is only open intermittently. Since the trap at LFH is closed during most of the season fall Chinook are returning, they must go to alternative locations to spawn.

Steelhead – The assessment of summer steelhead straying is difficult due to the extended time that they spend in freshwater migrating to their final destination. While recoveries

from sport/commercial fisheries are useful in the overall assessment of returns, they may give a skewed view of straying depending on the time of year and location in which the harvest occurred. Summer steelhead have been documented at hatcheries and racks outside of the Snake River basin at relatively low rates (<2%), but straying within the Snake River basin is more prevalent. For example, we have documented about 50% of the steelhead that should return to the Tucannon River (hatchery or natural origin), stray past Lower Granite Dam and either cannot or do not successfully return downstream. This behavior is likely driven by environmental factors (temperature) but is, we believe, being largely influenced by the Snake River Dams. WDFW will continue to monitor migratory patterns (based on PIT tags) of all steelhead groups and document straying to other locations within the Snake River Basin.

Project 2c- Smolt Production and Adult Survival

Objective 2c.1. Assess and quantify the juvenile out-migration of natural and hatchery-origin spring Chinook salmon, natural and hatchery-origin (endemic broodstock only) summer steelhead and naturally reared fall Chinook salmon and coho from the Tucannon River.

Approach: WDFW operates a juvenile migrant trap in the lower Tucannon River. Information about naturally produced spring Chinook salmon, summer steelhead, fall Chinook salmon and coho salmon migrants obtained from this trap includes: 1) smolt out-migration timing, 2) duration, 3) magnitude, and 4) smolt age. Numbers of fall Chinook are highly variable among years and tend to be incidental compared to spring Chinook and steelhead, and although coho are not a focal species of the LSRCP evaluations, we will document their occurrence in the Tucannon River. WDFW uses data from the trap to calculate life stage survival (smolts/female and recruits/spawner) for both natural spawning and hatchery-spawned fish to assist in the evaluation of the hatchery program. The smolt trap also allows us to capture and PIT tag natural and hatchery origin smolts (all species except coho) to describe migration timing, relative survival through downstream dams, and if applicable, estimate smolt-to-adult survival in natural origin salmonids. These factors are recognized metrics for understanding the viability of populations, and understanding the ecological relationship of the population to its habitat (capacity and density dependent population response). These ecological relationships can have a significant bearing on the ability of hatchery supplementation programs to positively affect depressed salmon populations.

Since coho and fall Chinook have similar spawning duration and locales we will assume that the proportion of coho carcasses recovered is the same as the proportion of coho redds in the Tucannon River. Chinook production the following year will be applied to the number of Chinook redds estimated above the smolt trap and juveniles per redd will be estimated.

Spring Chinook – We estimate that 23,376 (95% C.I.20,848-27,056) natural origin spring Chinook emigrated from the Tucannon River during the 2012/2013 smolt trapping period (2013 Annual Spring Chinook Report pp. 29-31).

Fall Chinook – Smolts per redd were estimated based on smolt trapping estimates and numbers of redds above the trap. We expanded the estimate to include redds occurring below the trap and estimate a total of 9,262 natural origin fall Chinook emigrated from the Tucannon River during 2014 from the 2013 spawn. Biological samples were collected on

fall Chinook and coho at the smolt trap. The peak migration occurred during the week of 1 June. Scales were collected on juvenile fall Chinook and it was determined that all fall Chinook migrating were subyearlings and the coho migrants were a combination of BY12 and BY13 in 2014. Staff tagged 1,000 juvenile fall Chinook. Migration timing of natural smolts compared to hatchery releases from LFH are being worked up and will be presented in the yearly annual report due in March 2015.

Steelhead – We estimate that 16,194 (95% C.I. 12,537-21,948) natural origin summer steelhead emigrated from the Tucannon River during the 2013/2014 smolt trapping period. Peak out-migration timing for natural and hatchery steelhead was 17 May. Age composition of natural origin smolts are not yet available, but will be presented in the annual steelhead report. Staff PIT Tagged 1,506 natural origin summer steelhead for the 2013/2014 out-migration. Natural origin steelhead that are PIT tagged provide information on downstream passage, but more importantly for estimating adult returns to the Tucannon River since spawning ground surveys in the Tucannon are unreliable. In addition, these PIT tags also allow us to continue monitoring straying of these fish to areas above Lower Granite Dam.

Objective 2c.2. Estimate and compare smolt-to-adult (spring Chinook and steelhead) and progeny-to-parent survival rates (spring Chinook) for hatchery origin and natural origin salmon and summer steelhead in the Tucannon River. Estimate female-to-female survival rates for fall Chinook (H+W) returning to the Tucannon River. Estimate progeny-to-parent ratios for summer steelhead in the Touchet River (index only), and Asotin Creek (partnered with the Asotin Creek Assessment Project)

Approach: WDFW will use data from the Tucannon smolt trap to determine natural smolt production, and redd surveys, traps and PIT tag detectors to estimate adult returns, to determine smolt-to-adult (SAR) survival rates for naturally produced salmon and steelhead in the Tucannon River (see Objective 2c.1 above).

Spring Chinook – Smolt-to-adult survival rates averaged 2.22 (geometric mean = 1.07) for natural origin fish and 0.27 (geometric mean = 0.17) for hatchery origin fish. Progeny-to-parent survival averaged 1.70 for natural origin and 3.21 for hatchery origin fish (2013 Annual Spring Chinook Report – pages 33-41).

Fall Chinook – Estimates of natural smolt yield occurred yearly. Since there are unmarked/ untagged hatchery fish in the system that cannot be differentiated from natural origin fish, at this time it is possible that some of the fish in these estimates are of hatchery origin; although CWT recoveries indicate the numbers are small. By 2016, all hatchery in-basin releases will be identified through PBT analysis. At that time we will be able to accurately estimate untagged hatchery returns and therefore be able to calculate the numbers of wild fish by subtraction. Likewise unmarked-untagged hatchery adult returns complicate any derivation of estimates of progeny-to-parent survival estimates for only natural fall Chinook in the Tucannon River. We are currently working on estimating the number of probable naturally produced fall Chinook salmon returning to the Tucannon River from all naturally spawning fish (H+N) and estimating productivity from that spawning as adult progeny/redd. Those results, broodyear smolt-to-adult survival rates, and female to female survival rates will be addressed in the upcoming 2013 report which will be submitted in March 2015.

Steelhead – Through the use of PIT tags in both natural and hatchery smolt releases in the Tucannon River, we've determined the average smolt-to-adult survival from three different groups of summer steelhead (LFH hatchery stock, Endemic hatchery stock, Natural Stock) from comparable release years (2006-2011 migration years). Smolt-to-adult survivals (average and geometric mean) to Bonneville Dam from the three groups were: 1) LFH stock = 4.31%, 4.25%, 2) Endemic stock = 2.15%, 1.84%, and 3) Natural stock = 3.03%, 2.61%. Smolt-to-adult survivals (average and geometric) to Ice Harbor Dam from the three groups were 1) LFH stock = 3.21%, 3.18%, 2) Endemic stock = 1.63%, 1.37%, and 3) Natural stock = 2.23%, 1.83%. LFH stock from the Tucannon River have consistently survived higher and returned more adults to the Snake River than any other steelhead groups released into the Tucannon River, which is likely due to size at migration.

Through the use of the lower Tucannon River PIT Array, we've made estimates of the number of natural and hatchery endemic stock summer steelhead entering the Tucannon River. For run years 2005-2013, we estimate that on average 163 natural origin steelhead have returned to the Tucannon River (range:63-387). Over that same time period, we estimate on average that 249 endemic origin steelhead have returned (range: 60-518). These estimates continued to be refined as additional PIT tag information is gathered.

Category 3. Legal Obligations

Project 3a – ESA compliance

Objective 3a.1. Assess LSRCP hatchery evaluation actions to determine potential effects on species listed under the Endangered Species Act; represent WDFW during formal ESA consultation between NMFS and the USFWS; coordinate and integrate Washington's anadromous fish management and research with the Section 7 LSRCP Biological Assessment, subsequent Biological Opinions and Management Plans, NMFS' Recovery Plan, and develop and submit Hatchery and Genetic Management Plans (HGMPs) for stocks produced at LFC.

Approach: Operation of the LSRCP program in Washington requires close cooperation between WDFW and USFWS personnel to ensure that production and evaluation actions conform to guidelines established by NMFS under the ESA. Moreover, it is the responsibility of evaluation staff to integrate production and evaluation research with existing state management goals and principles. These actions are expressed in the completion of Sections 7 and 10 Biological Assessments, or Section 4(d) Hatchery and Genetic Management Plans (HGMP) that must be submitted to NMFS for approval and ESA operational coverage for production and evaluation actions. WDFW will ensure that pertinent state and federal management policies are considered and that recommendations to minimize deleterious effects of programs on listed species are provided.

WDFW will help the USFWS-LSRCP Office ensure that the Section 7 Biological Assessments, Section 10 permit applications, and HGMP documents are coordinated. Further, WDFW will continue to provide data for ESA concerns to other agencies, and program tasks and objectives will be modified as necessary to minimize adverse impacts to listed species. WDFW will be involved in the USFWS/NMFS consultations for the LSRCP Program under the ESA.

Sub-objective 3a.1.1: Assess LSRCP hatchery evaluation actions to determine potential effects on species listed under the Endangered Species Act.

Spring Chinook: Actions or Results – Numbers of spring Chinook take (indirect and direct) are within the limits listed in our HGMP (2013 Annual Spring Chinook Report). We assessed potential effects of the hatchery program on ESA listed spring Chinook and other listed species (both plant and animal) in the Tucannon River and provide a full description within the HGMP document.

Fall Chinook: Actions or Results - Discussions with NOAA Fisheries are ongoing to resolve errors in the take table that occurred prior to finalizing the section 10 permit. Although it may appear that our take levels exceed the limits for juveniles trapped on the Tucannon and released, we are in compliance with the US v Oregon agreement on numbers of fish to release and the large numbers of fish trapped on the Tucannon are due to large returns and increased production. Footnotes in the tables will also be modified for clarification purposes. Numbers of fish takes (indirect and direct) were summed and will be submitted to NOAA Fisheries in our 2013 Annual report.

Actions or Results – Numbers of summer steelhead takes (indirect and direct) are within the limits listed in the steelhead HGMP's for Lyons Ferry Complex. We assessed potential effects of the hatchery program on ESA listed summer steelhead and other listed species (both plant and animal) in the Snake River Basin and its tributaries, and within the Walla Walla and Touchet Rivers where hatchery steelhead from this program are released and provide a full description within the HGMP documents.

Sub-objective 3a.1.2: Represent WDFW during formal ESA consultation between NMFS and the USFWS.

The spring Chinook HGMP was submitted to NOAA in a previous contract year. No action was taken by NOAA during this contract year toward initiation of Consultation for the program, but is expected to be completed soon.

The 2011 Snake River Fall Chinook HGMP and Addendum was accepted and approved by NOAA. Evaluation staff provided corrections to the “take” tables for fall Chinook regarding smolts captured in the Tucannon River smolts trap, in addition to adults that may be trapped/collected at Lyons Ferry should the needed arise for broodstock needs.

HGMP's for summer steelhead programs in the Tucannon River (endemic stock program), Cottonwood Acclimation Pond on the Grande Ronde, and the on-station release of steelhead at Lyons Ferry were edited and submitted for consultation under either Section 10 or Section 7 of the Endangered Species Act. The HGMP for the Touchet endemic stock program was updated and submitted to NOAA Fisheries in the summer of 2010 – there was no status change in the program so no formal consultation occurred. At NOAA Fisheries' request, WDFW provided a status update on the Lyons Ferry stock steelhead releases into the Walla Walla Basin (Walla Walla River and Dayton Acclimation Pond). This was in place of a formal HGMP submission, but was used for consultation on Section 7 programs in the mid-Columbia ESU. Due to the elimination of the LFH stock steelhead program in 2012, WDFW modified the Wallowa stock HGMP (Cottonwood) to include all releases of Wallowa stock steelhead in the future (on-station at LFH, Walla Walla River

and Touchet River at Dayton AP. A letter describing the changes to HGMP was provided to NOAA Fisheries prior to consultation of the WDFW steelhead programs in the Snake River Basin. Formal consultation by NOAA Fisheries for the Wallowa stock program is not yet complete.

Sub-objective 3a.1.3: Coordinate and integrate Washington's anadromous fish research with the Section 7 LSRCP Biological Assessment, subsequent Biological Opinions and Management Plans, HGMPs, and NMFS' Recovery Plans.

Actions or Results – Numbers of fish takes (indirect and direct) were within the limits listed in our steelhead, spring or fall Chinook HGMP's, and fall Chinook "take" exceeding the limits within our HGMP were discussed with NOAA and will result in future changes to the "take" tables. Staff coordinated with NOAA Fisheries on a draft Tucannon Steelhead Adult Management Plan (broodstock collection and passage of hatchery fish above the Tucannon FH Adult Trap). Discussions with NOAA Fisheries and the co-managers regarding this plan are continuing and will hopefully be adopted in spring of 2015.

Project 3b – Hatchery/Wild interactions

Objective 3b.1. Utilize reference streams within the Snake and Columbia basins to evaluate the effects of LSRCP hatchery production supplementation on ESA listed target mitigation populations.

Background: Direct and de facto supplementation, of spring Chinook and steelhead respectively, under the LSRCP has been ongoing in the Tucannon and Touchet Rivers of Washington since the program's inception. More recently, direct supplementation of Snake River fall Chinook has been actively pursued by WDFW and NPT programs funded jointly by the LSRCP and BPA. Beginning with the 2010 brood, the endemic steelhead program in the Tucannon River is being implemented/ expanded to a full supplementation program in the short-term. The Independent Scientific Review Panel (ISRP) and the Independent Scientific Advisory Board (ISAB) have stated the need for a comprehensive evaluation of the use of supplementation as a recovery tool for depressed salmon populations in the Columbia River basin (ISRP and ISAB 2005). Development of a comprehensive supplementation evaluation plan was undertaken in 2006-2008 by fisheries researchers and managers. They concluded that there is an "insufficient effort within the basin" to obtain estimates for relative reproductive success (RRS) from non-supplemented (reference) streams, against which RRS values for natural origin fish in supplemented populations can be compared (Galbreath, et al., 2007). This evaluation would partially meet the regional desire to address programmatic concerns regarding hatchery production and the ESA.

In order to assess the effects of supplementation, comparisons of a number of treated versus untreated streams may be the best method of detecting differences in long-term fitness attributable to supplementation programs (Galbreath et al. 2006). Galbreath et al. (2006) noted that one of the difficulties in evaluating monitoring data for supplementation programs is the limited availability of reference streams. These reference streams provide the best opportunity to determine if there is a change in reproductive success or productivity as a result of supplementation.

Within this context, data from ongoing LSRCP funded evaluations are available to populate comparisons between LSRCP supplemented streams and appropriate reference streams, if and when they can be found. Asotin Creek was identified as an important steelhead reference stream that is ecologically and geologically similar to the Tucannon and Touchet rivers, and has recently expanded intensive monitoring under BPA's Fish and Wildlife Program (adult and smolt trapping). As such, we believe that Asotin Creek represents an excellent reference stream for comparison of the RRS and population demographics of steelhead from LSRCP supplemented streams. Possible reference streams were identified for Tucannon spring Chinook (Wenaha, Camas Creek, and Loon Creek) but further analysis is needed. One possible reference population (Deschutes R., OR.) for Snake River fall Chinook has been identified, but others would be highly desirable.

Approach: We will use data sets from the Tucannon River, Touchet River, and Asotin Creek steelhead to compare and contrast metrics identified as part of supplementation evaluation developed through the CSMEP and recommended by the Ad Hoc Supplementation Work Group (Beasley et al. 2008). Some of these metrics are: adult age structure, adult sex ratio, spawn timing, pHOS, fecundity and change in fecundity over time, and smolt age structure. We expect to collaborate with other managers and utilize the data to describe and evaluate the impacts of hatchery supplementation as developed by the AHSWG.

Spring Chinook – Tucannon River spring Chinook abundance and productivity were compared to twelve reference streams around the Columbia River Basin. The Wenaha River (Oregon) and Camas Creek (Idaho) spring Chinook abundance regressions were significantly similar (99%) to the Tucannon River during the pre-supplementation period. Loon Creek (Idaho) was significant at the 95% level. Productivity relationships with the reference streams were not significant. Further analysis is needed for the post supplementation period.

Fall Chinook reference streams were discussed and it was decided to cease looking for one since NOAA was already using the Deschutes River as a reference stream for the Snake River. This action allowed more time to populate the LSRCP summary report back to trapping in 1975.

The Asotin Creek summer steelhead population has been identified as a reference stream for summer steelhead within the lower Snake River Basin, as it currently receives no hatchery supplementation. The Touchet River may also be another partial reference stream as limited supplementation (both from an endemic stock and non-endemic stock) is currently present. During the past contract year, limited analysis was completed on this task. Productivity estimates from the Asotin Creek population are becoming available as more brood years are completed. Productivity estimates for the Touchet River steelhead population have been made based on index redd surveys. Productivity measures for the Tucannon are still in progress, with additional data analysis needed. We hope to have preliminary comparisons of these three basins complete in 2016.

Category 4. Electronic Database Systems

Upload PIT tag data to PTAGIS after PIT tagging, and tag recovery data from fish spawned at LFH or recovered at traps. Estimates of returns of hatchery and wild fish sampled on the project

are provided to Washington's Salmonid Stock Inventory (SaSI) database, which functions to assess stock status. Coded wire tag recoveries and expansion estimates are provided to the Regional Mark Information System (RMIS) by WDFW Olympia staff, after SRL evaluation personnel finalize the data. Using a web-based data portal, track numbers of fall Chinook collected at Lower Granite Dam, monitor composition of hauled fish to ensure hauling protocols are followed, and download data for use in run reconstruction estimates. No databases are directly funded by LSRCP, only the data are provided.

Results – Spring and fall Chinook salmon and summer steelhead PIT tag data were uploaded to the PIT tag regional data base and coded wire tags were submitted to WDFW for uploading to the RMIS data base. SASI databases were updated for spring and fall Chinook returns. A review of the summer steelhead data included in the SaSI database is under review as to its appropriateness and usefulness for managers with the State. The database will be updated with current data once additional decisions are made.

Category 5. Peer Review, Biometric Review, Analysis and Reporting

Project 5a – Annual progress reports

Objective 5a.1. Complete annual reports to summarize results of all LSRCP funded work conducted during the 2012-2013 contract period.

Spring Chinook – The 2013 spring Chinook annual report was completed and submitted to Lower Snake River Compensation Plan staff on time.

Fall Chinook – The 2012 fall Chinook annual report was submitted to LSRCP in March of 2014 and the 2013 report is currently on schedule for completion in March 2015.

Steelhead – Staff completed a draft of the 2012 run year annual report. Staff will begin drafting the report for the 2013 run year this coming spring (2015). Both reports have been delayed in completion due to a shift in personnel, changes in duty, and new staff getting familiar with the summer steelhead program. We anticipate completion of both 2012 and 2013 run year reports to be completed and finalized by the end of 2015.

Project 5b – Peer reviewed publications

Evaluation studies may produce regionally significant results pertaining to the use and efficacy of hatchery programs to provide fisheries and maintain natural populations. Where applicable, publish results of studies in peer-reviewed journals to make results available in the broadest possible manner.

No journal publications were completed in 2014.

Category 6. Participation in External Forums

Not Anticipated for FFY2014.

Spring Chinook evaluation staff presented a talk at the Carrying Capacity Symposium for the Washington-British Columbia Chapter of the American Fisheries Society in Vancouver, Washington

Evaluation staff participated in run reconstruction focus groups and calculated the runs of fall Chinook to Lower Granite Dam for 2013, standardized the calculation methods, and reworked run reconstruction calculations back to 2005. Staff also attended fall Chinook coordination meetings and weekly call in meetings to discuss fall Chinook trapping and spawning activities.

Evaluation staff participated in and provided a presentation at the Coast Wide Steelhead Managers meeting in March, 2014. The presentation was a summary of PIT Tagged wild-origin summer steelhead from the Deschutes River, John Day River, Umatilla River, Walla Walla River, and Tucannon River overshooting their natal streams, and what ramifications that action is having on returning numbers of fish to spawn. Evaluation staff also presented a similar presentation at a Columbia Basin wide workshop in November 2014 that examined this overshoot issue with more detailed analysis by basin. Presentations were provided by multiple agencies and included steelhead populations from multiple basins in the Snake and Columbia rivers. In addition, the steelhead evaluation staff is part of a team of biologists within the Snake River basin tasked on summer steelhead run reconstruction.

Category 7. Regionally Significant Research

Background: From 1983 until 2008 the average weighted age of returns of hatchery fish to the Snake River basin have been getting younger. This occurrence is being noted across the state of Washington, in different river basins, with different species. These fish have to negotiate different numbers of dams and have differing distances to migrate, but the end result is still the same; decreased age at return. At the Size at Maturation workshop in Portland, Oregon it was brought to light that many things can be causing a decline in age at return; older aged fish intercepted in fisheries, mating protocols randomly selecting broodstock instead of using mate selection as observed in nature, inclusion of jacks in broodstock perpetuating jacks, feeding regimes causing an increase in numbers of younger aged fish returning (jacks). To address this decline in age we will maximize the use of older aged fish in broodstock in an effort to change the trend. Protocols will be reviewed annually with the co-managers and NMFS.

Objective 7a: Conduct and evaluate the effects of selectively incorporating older aged fish in the fall Chinook broodstock at LFC.

Approach: WDFW will select older aged fish to use in broodstock and true jacks will only be used if there are not enough fish to go around. The study will continue for 10 years. Results from this protocol will be compared with data collected at NPTH. Protocols at NPTH will remain status quo. The trend line of average age at return for the study period will be compared to the trend line pre-study period as well as the NPTH trend line. Overtime it is expected that a change in weighted age at return would trend towards older aged fish.

Results – This is the fourth year larger, older aged fish have been prioritized over smaller fish for broodstock. Ages of fish used as broodstock were compiled. The NPTH is selecting larger sized fish for broodstock as well.

Objective 7b: Participate in the reconstruction of the annual summer steelhead runs to the Snake River.

Approach: Idaho Department of Fish and Game received a BPA contract to reconstruct the annual run of steelhead at Lower Granite Dam. This process will involve gathering all data from fisheries, PIT tag detections, weir and hatchery rack counts, spawning ground surveys from a multitude of agencies within the Snake River Basin. These efforts (similar to what has occurred for fall Chinook in the Snake River), will produce a unified estimate of hatchery and natural origin steelhead to the Snake River above Lower Granite Dam, and if possible, down to the Snake River Mouth below Ice Harbor Dam. WDFW has been asked to be part of this working group since many of WDFW's LSRCP hatchery program steelhead are captured and/or return above Lower Granite Dam.

Evaluation staff participated with a team of biologists within the Snake River basin tasked on summer steelhead run reconstruction. IDFG was the leader on this effort, and with input from all managers, have produced an annual report describing the 2010, and 2011 run year of summer steelhead to Lower Granite Dam. Since a portion of the run also resides below Lower Granite, the team attempted to estimate the run down to Ice Harbor Dam. The model has performed relatively well for stocks that reside/originate higher in the Snake Basin, but this relationship is less precise to stocks located in the Lower Snake River. Additional data was gathered for the 2012 run year effort, and that report is in the final stages of completion.

Category 8. Data Gaps

Ongoing monitoring and evaluations conducted within the LSRCP generate questions that may not be answered as part of the work through which they were identified. These questions, or data gaps, can have both a direct and indirect relevancy to LSRCP programs. Some of these are identified and studied as part of regionally significant research (Category 7) where their applicability to LSRCP programs is inferential rather than directly applicable to its success. The remainder represents studies that can and should be addressed as part of the LSRCP monitoring and evaluation program. Following are data gaps identified for future studies within Washington. A brief description of each unknown and its relevancy to the program is provided. Data gaps are not listed in priority order.

1. Unaccounted steelhead – steelhead are particularly difficult to enumerate because of their protracted pre-spawning migration period, the extensive nature of their distribution, their predilection to wander into far reaching streams where they may (stray) or may not eventually spawn, their long spawning season and difficult environmental and river conditions during spawning which makes surveys very difficult and accuracy questionable, and the difficulties associated with trying to effectively trap steelhead. Expanded PIT tagging and adult trapping is occurring within the LSRCP program and the broader BPA Fish

and Wildlife Program, and will assist in accurately accounting for hatchery origin fish returning to the Snake Basin and then subsequently to their intended river.

Action or Result – WDFW has recently added PIT tags to all summer steelhead release groups, along with all groups being tagged with CWTs. Preliminary data suggests that 15-30% of the summer steelhead accounted for by PIT tags, are not accounted for by CWT recoveries. WDFW will continue to mark/tag fish with both tag types and continue this evaluation into the future.

2. Relative reproductive success of LSRCP salmon and steelhead stocks – hatchery stocks used for direct supplementation (developed from endemic populations), and the effects of de facto supplementation of other hatchery stocks on ESA listed populations is not completely understood. LSRCP cooperators should engage where possible with regional actions to assess the productivity of hatchery and wild populations. Continued data analyses from long term data sets, and/or changes to data collection protocols within the LSRCP program may be necessary.

Action or Result – We have completed an examination of hatchery effects on productivity for Tucannon River spring Chinook. We found that hatchery fish on the spawning ground did not appear to lower productivity. Large numbers of spawning fish (regardless of origin) did affect productivity, suggesting density-dependent effects (2013 Annual spring Chinook Report – pages 44-50).

For fall Chinook and summer steelhead, the data are not currently available to perform a similar analysis. As better spawner and recruit data become available we'll examine the relationships.

3. Hooking mortality – significant fisheries are currently in place for LSRCP spring Chinook salmon and steelhead in the Snake Basin. Harsh environmental conditions may negatively affect a fishes' recovery after being hooked and released. The delayed hooking mortality rates associated with fisheries in the Columbia basin east of the Cascades is currently not well understood. A study similar to one conducted by ODFW in the Willamette River (Lindsay et al. 2004) should be conducted within the Snake River for steelhead, and the applicability Oregon's study results for Chinook examined.

Action or Result – No specific action was taken during the contract year. This has been identified as a priority for many years but lack of dedicated funding has not allowed any evaluation.

4. Evaluate the ecological status of LSRCP Rivers in relation to the Mitigation goals – mitigation goals were established within the context of historical productivity and capacity. Those capacities may now be substantially more limiting than in the past because of a lack of marine derived nutrients and other ecological changes. These changes may prevent the LSRCP program from succeeding (e.g., high within tributary mortalities of smolts) if systems are not ecologically capable of supporting mitigation numbers of fish. An evaluation of this unknown and the potential actions to increase productivity (e.g., carcass analogs) and capacity, or to reduce the LSRCP goal, may be appropriate.

Action or Result – We have conducted stock-recruitment analysis (Ricker, Beverton-Holt, and hockey stick models) of Tucannon River spring Chinook to examine carrying capacity of the Tucannon River. Based on the density effects we have observed, the mitigation goal may be higher than the habitat can support under current conditions (2013 Annual Spring Chinook Report – pp. 44-50).

Action or Result – Stock-recruitment analysis (Ricker and Beverton-Holt models) of summer steelhead to examine carrying capacity in the Tucannon or Touchet rivers, or Asotin Creek, have not been conducted at this time due to the lack of reliable return and spawner information. With new techniques to estimate both (PIT detections or weirs (Asotin Creek), this analysis should be available in the future and might provide a re-examination of the current goals and escapement levels for steelhead in SE Washington. WDFW staff worked with WDFW Olympia staff on preliminary results of stock-recruitment curves for the Touchet River. However, more analysis is required before we are comfortable reporting those results in an annual report.

5. Review current fishery sampling coverage and protocols and advocate for uniform electronic sampling protocols in the Columbia basin and NW coastal fisheries– a substantial proportion of the original LSRCP mitigation goal was designated to downriver and ocean fisheries. Certain fisheries downriver or in the ocean are known to not electronically sample fish that are not externally marked (i.e., fin clips). This lack of consistent sampling protocols among the agencies makes using the CWT database suspect, and greatly limits our ability to adequately monitor/assess the LSRCP salmon and steelhead program.

Action or Result – Inquiries made of other organizations regarding this topic seem to indicate that most steelhead fisheries are currently 100% electronically sampled, however, some ocean fisheries are not. However, steelhead are rarely caught in ocean fisheries. As a result of our findings, WDFW has dropped the use of the LV fin clip as a visual cue of presence for a CWT in steelhead production from Lyons Ferry Complex.

Recovery estimates for fall Chinook released by WDFW will continue to be adjusted according to harvest sampling protocols [electronic vs. visual. Double index tagging of yearling fall Chinook has allowed us to identify fisheries that are reporting sampling methods incorrectly as electronic when they are actually sampling visually.

6. The use of PIT tags to expand our knowledge of fish behavior and survival within the Snake and Columbia Rivers has increased dramatically in recent years. There is sufficient information within the basin and in published literature to caution researchers about the potential decrease in survival (SAR) for PIT tagged fish. We believe PIT tagging will continue to play a significant role in hatchery and wild fish research. As such we also believe that a comprehensive study to assess the effect of a PIT tag on fish survival is needed. There exists within the LSRCP program sufficient facilities and use of multiple species for mitigation that would support the development and conduction of a comprehensive PIT tag survival study, and strongly suggest that the LSRCP cooperators work toward such a study.

Action or Result – No specific action was taken during the contract year by WDFW. Limited raceway rearing space at Lyons Ferry for unique groups of fish to test the effect of PIT tags on survival is available at this time. Discussions are ongoing with co-managers

regarding this issue and WDFW would be willing to participate in a study if rearing space would not compromise production levels.

7. Estimated returns to the Snake River are calculated primarily at LGR Dam and supplemented with estimates of run size to Tucannon River. Since trapping occurs only sporadically at LFH we cannot estimate numbers of fall Chinook returning to the hatchery. If the yearling and subyearling fall Chinook are homing to the point of release it is possible that they are remaining in the Snake River near the hatchery but are not being detected. We can estimate returns of yearlings based on PIT tag detections at IHR which were not detected at LGR or on the Tucannon but we cannot do the same for the subyearlings released on-station until 2015 when all age classes of subyearlings will be PIT tagged. This data gap when addressed should result in additional fish being assigned as LSRCF mitigation.

Results –The contribution of yearlings released from Lyons Ferry based on PIT Tag detections was completed and will be presented in the 2013 annual report. We continue to PIT Tag subyearling releases from Lyons Ferry Hatchery, and beginning with 2015 returns, we can examine the PIT Tag data from subyearling release groups to estimate total returns to the Snake River.

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