FY2012 Monitoring and Evaluation Work Accomplishments for the WDFW - Lower Snake River Compensation Plan Hatchery Program

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). We will attempt to document initial PIT tag loss that occurs between tagging and release of yearling fall Chinook using a PIT tag array located in the outlet channel at LFH.

Spring Chinook – Two different size groups of BY10 fish (30 g and 50 g) were marked and released from Curl Lake Acclimation Pond. Released fish were healthy and close to program size goals. Excess production fish from BY11 were marked with oxytetracycline and adipose clipped before release at Russell Springs (2011 Annual Spring Chinook Report – page 24).

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. For specific data, see the attached spreadsheet.

Steelhead – Quality control checks and estimated numbers of fish released with each mark type were completed for all summer steelhead released in 2012. We visually examined all groups for precocity at release: precocity rates were about normal for all groups. Size at release was calculated for each release group and all groups were close to program goals of 4.5 fpp. For specific data, see the attached spreadsheet.

We again installed the three original PIT antennas in the outlet structure. Three additional antennas were planned to be built and installed, but this was not completed due to concerns from the previous year's data, and the number of tag collisions which reduced overall efficiency of the PIT array. The thought was that more antennas placed closer together would make collisions worse, and the option to spread out the antennas was not possible. Detection efficiency was lower than the previous year as it appeared the fish moved out in a shorter time

period compared to the previous year, make tag collisions near the antennas higher and reducing the efficiency. As such, we were not able to estimate the numbers of PIT tags shed between tagging and release by fall Chinook salmon due to the low detection rates at the arrays in the outlet structure. Unless other options can be considered for antenna locations, we may have to abandon this task, and rely on other methods (i.e. scanning the rearing lake for shed tags) to estimate PIT tag loss prior to release in fall Chinook salmon from the rearing lakes.

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 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.

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 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 Dayton Adult Trap on the Touchet River for steelhead broodstock collection, and enumeration of summer steelhead returns and other species.

Approach: WDFW evaluation staff will operate the adult fish trap on the Touchet River for endemic broodstock development 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. In the past, evaluation staff has taken the lead on operation and evaluation of adult trapping for the endemic broodstocks in the Tucannon and Touchet rivers. This remains the same in the Touchet River, but with the expansion of the Tucannon River endemic stock program, 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.

Steelhead – Broodstock collection protocols (Tucannon and Touchet Adult Traps) were updated and agreed upon by LFC and Fish Management Staff. 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. Trap and fish ladder maintenance were dealt with accordingly. All biological samples collected (scale and DNA) were processed. Staff obtained similar records from Tucannon Fish Hatchery adult steelhead trapping and entered all appropriate data to spreadsheets, and processed biological samples as needed.

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. 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 Lyons Ferry and Wallowa 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), or adult holding capacity (Lyons Ferry steelhead and 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. Also in 2011 we will minimize jacks from yearling releases used in broodstock. We will maximize the contribution of older males in broodstock by selecting for them via sort-by-code options during trapping at LGR Dam. In addition, we will use older aged males on multiple females.

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 Lyons Ferry and Wallowa steelhead is not a current concern. Coded-wire tag recoveries during broodstock spawning of these two stocks over the years shows <0.5% stray inclusion from any given year.

Sub-Objective 1c.1.1: Determine the origin and stock of fall Chinook salmon used as broodstock at LFC.

Approach: In 2011, we will use scale analysis to determine age and rearing type (subyearling, reservoir-reared) for all of the untagged fish used in broodstock. Composition of wire tagged fish will be used to keep strays below 5% of the fish spawned. The use of Parentage based tagging (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 strays were not used in broodstock. Untagged fish had scales removed and examined to determine ages of fish used as broodstock. 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.***

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 history (2011 Annual Spring Chinook Report – pages 10-17).***
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> ***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.***
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> ***Steelhead – All steelhead broodstocks 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 adult traps, and scales were collected from a portion of the natural-origin steelhead captured on the Tucannon and Touchet rivers for total age composition of each run. All adults were scanned for the presence of CWT and PIT tags. Fecundity by age was determined for all groups and age structure from CWT or scale readings, and sex ratio of fish trapped/collected for broodstocks were documented and will be reported in future 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 (PBT), but plan no genetic sampling of steelhead. We anticipate future steelhead sampling 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 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 are expected to return in 2011.

The hatchery programs are 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.

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 was collected and archived from all broodstock at Lyons Ferry Hatchery as well as from carcasses sampled in the Tucannon River during fall Chinook spawning ground surveys.

Steelhead – Tissue samples were collected from all four steelhead broodstocks (LFH, 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 2011, 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.

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

Sub-objective 1c.2.1: Complete the size at release experiment with Tucannon River Spring Chinook begun with BY2006.

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 will receive a 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 will also be tagged with equal size groups of PIT tags (utilizing 12,500 from LSRCP and 12,500 from BPA) before release to compare smolt-to-smolt survival within the system (Tucannon River PIT tag array), and 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).

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 (2011 Annual Spring Chinook Report – pages 46-47). Adult returns are incomplete. 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.

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, into the Snake River near Captain John Rapids, and 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.

Yearling fall Chinook have proven to have high fidelity to release locations in the past (Garcia et al. 2000). A new evaluation is anticipated (BIOP funded) regarding the fidelity of subyearlings to release sites upon return. To address this question, subyearlings will be randomly selected via sort-by-code at the LGR trap. 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). This study may also be funded via BIOP recommendations. If the study is funded, 20,000 additional on-station subyearlings would be tagged to provide opportunity to select returning adults at LGR for radio tagging and tracking. Another item that may be funded would be the cross basin tagging of all fall Chinook released (110,000 PIT tags). These tags would be used to estimate magnitude of returns to the Snake River in-season. These 110,000 PIT tags are in addition to the 50,000 PIT tags already identified in Table 1.

Table 1. Proposed marking/tagging of fall Chinook salmon released by WDFW in 2012.

Location	Life Stage	Total Number Released	Marked Release	Marks	PIT tags
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	0
Grande Ronde River	Sub-yearling	400,000	200,000	AD/CWT	0
				Total	**50,000**

Result – Tagging was completed. Completion of this task has been put on hold due to having to rework run reconstruction estimates which will change estimated numbers of returning wire tagged fish to the basin. Preliminary findings indicate that subyearlings released into the Grande Ronde River did not perform as well as subyearlings released at Couse Creek near Captain John Rapids or subyearlings released onstation at LFH. Releases of fish at LFH had the best performance and yearling releases out-performed the subyearling releases.

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 LFH and Wallowa stock fish will be 100% AD-clip production marked for harvest purposes. In addition, a portion of the LFH and Wallowa stocks will be CWT and LV clipped for continued mitigation program contribution. Both endemic stocks will be 100% CWT for identification upon adult return should they be recovered post-spawning at area traps (dead kelts) or from spawning ground surveys. Currently, endemic stocks are not marked for sport harvest. 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. In addition, PIT tag groups have been added to all tributary release groups of Lyons Ferry or Wallowa stocks in the Snake, Walla Walla, Touchet, and Grande Ronde rivers. Many of these have been added since we no longer conduct creel surveys on the Tucannon, Walla Walla or Touchet rivers and will rely on historical CWT data and catch record card estimates to determine contribution from LSRCP fish to these locations (See objective 2.3a). 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 proposed marks/tags for the 2012 release year for summer steelhead.

Table 2. Proposed marking/tagging of summer steelhead from LFH Complex in 2012. (All fish released of LFH or Wallowa stocks of origin receive adipose (AD) fin clips.)

Stock	Release Location	Total Number Released	Marks released (Number)	Tagged (PIT)
LFH	On Station	160,000	LV/CWT (20,000)	4,000
LFH	Touchet R. @ Dayton AP	85,000	LV/CWT (20,000)	4,000
LFH	Walla Walla R.	100,000	LV/CWT (20,000)	4,000
Wallowa [1]	Grande Ronde R. @ Cottonwood AP	200,000	LV/CWT (20,000)	4,000 + 2000
Tucannon [2]	Upper Tucannon R.	55,000 [3]	CWT (55,000)	10,000
Touchet	NF Touchet R.	50,000	CWT (50,000)	7,500
			Total	**23,500 - 33,500**

[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.

[2] WDFW has a proposal with BPA for funding M&E activities for the Tucannon Endemic stock supplementation program, including PIT tagging of summer steelhead from the Tucannon program. Before funding is allowed by BPA, WDFW must have a completed ESA consultation with NOAA Fisheries on the submitted HGMP for the Tucannon Steelhead Program. A completed consultation is expected in fall 2011. However, in case the consultation is not completed, WDFW will request 10,000 PIT tags from LSRCP funding so the supplementation steelhead can be evaluated.

3 Program goal size is 75,000. However, due to high IHNV levels in tested spawned females this past spring, full production could not be met.

Result – Marking and tagging (CWT and PIT) of all steelhead groups was completed as planned. 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 20-30% 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.

Spring Chinook – A total of 201,585 BY10 (VIE + CWT) and 39,460 BY11 (AD + Oxytetracycline otolith mark) were released during 2012.

Fall Chinook – Releases in 2012 included 490,000 yearlings released on-station at LFH (49% were ADCWT and 51% were CWT only), 200,900 subyearlings release on-station at LFH (100% ADCWT), 199,300 subyearlings released into the Snake River near Couse Creek (100% ADCWT), and 384,000 subyearlings released into the Grande Ronde River near Cougar Creek (50% were ADCWT, 3% were AD-only, and 47% were unmarked/untagged).

Steelhead – A total of 329,340 Lyons Ferry stock steelhead were released (Walla Walla River = 102,177, Touchet River @ Dayton AP = 89,322, and 137,841 into the Snake River @ Lyons Ferry) during April of 2012. A total of 176,902 Wallowa stock steelhead were volitionally released into the Grande Ronde River from Cottonwood Acclimation Pond during April 2012. A total of 51,124 Tucannon endemic hatchery stock steelhead were released into the Tucannon River in April 2012, and 54,386 Touchet River endemic hatchery stock steelhead were released into the Touchet River above the city of Dayton during April 2012. All Lyons Ferry and Wallowa stock groups were 100% adipose fin clipped, with a portion (~20,000) from each release group receiving a CWT and LV fin clip. Neither endemic stock (Touchet and Tucannon) was externally marked, but releases of both were 100% CWT.

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 140 spring Chinook CWTs and sent tags to Olympia for a confirmation reading. Recovered CWTs are summarized in the 2011 Annual spring Chinook Report (pg 14).

Fall Chinook – During the 2011 return year we extracted 2,403 CWTs, and read and entered the tag codes into data files. After the CWTs were re-read by staff in Olympia, corrections were made to our databases. Recovery data were provided to co-managers for run reconstruction estimates and forecasting needs.

Steelhead – From broodstock spawning and trapping activities: we recovered and read 356 CWTs during Lyons Ferry stock spawning, 89 CWTs from the Wallowa stock spawning, and recovered just a few Tucannon endemic stock CWTs. 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)].

Staff recovered and read 474 CWTs from the steelhead fisheries within the Snake River Basin during the 2011/2012 season. Staff recovered and read 117 CWTs from the fall Chinook fishery that occurred within the Snake River Basin during the 2011/2012 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 and are available through 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 will operate a PIT tag array in the adult fish sorting flume at LFH to document numbers of fall Chinook and steelhead trapped and also allow estimates of recapture events.

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 2011 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.

The PIT tag array in the flume of the adult trap at LFH was in place but did not provide arrival timing of the return because the trap was only open for a very short time period to collect the required number of LFH stock steelhead (1,650 adults). During LFH 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 preliminary run reconstruction estimates. Finalized escapement estimates for 2011 will not be available until early 2013. The PIT tag array in the flume of the adult trap at LFH was in place but did not provide arrival timing of the return because the trap was only open when supplemental broodstock was needed. This decision was made to reduce the numbers of fish trapped and thus reducing stress due to recapture events.

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 would have 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) and 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 for tag groups that are not externally marked for CWT identification. Spawning surveys provide numbers 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 or CWT recoveries gathered from regional databases.

At the end of the season, fall Chinook in excess of broodstock needs are returned to the river. Fish are marked with a partial caudal fin clip to allow Evaluation staff to document the effect of their release (site and date of release) on redd counts and run size to the Tucannon River. The mark is also used to track these fish to upstream locations, which may affect Snake River run size estimation at LGR Dam (run reconstruction).

To fully estimate adult returns of fall Chinook for mitigation, we must account for fish returned to the river that are not accounted for in returns to other locations (the run to LGR Dam, the run to the Tucannon River, fish killed at LFC for broodstock). We will expand fish with caudal clips detected at LGR by dividing by the trapping rate; resulting in the numbers of caudal clipped fish reaching LGR Dam. The percent of caudal clipped fish detected during carcass surveys will be applied to the estimated run to the Tucannon River, resulting in the number of fish with caudal clips presumed in the Tucannon River. After subtracting these estimates and the number of caudal clipped fish killed at LFC from the total number of caudal clipped fish released, we end up with the estimated number of fish remaining in the reservoir between LMO and LGR. We will apply the composition of fish processed at LFC to the reservoir estimate to come up with the numbers of LSRCP fish remaining in the reservoir.

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 LSCRP 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 trap fall Chinook at LFH as well as LGR Dam to determine the return fidelity of fish to the hatchery (yearlings and possibly subyearlings if funding occurs through the BIOP), and to above LGR Dam where the majority of in-basin spawning occurs (radio telemetry study see Sub-Objective 1c.2.2). Since LFH on-station releases occur below LGR Dam, we will document the stray rate of these fish to LGR Dam as well. We will also document straying of LFH origin fall Chinook to out-of-basin areas and interception in fisheries. The fidelity and abundance of fish from LFH production groups will be assessed by documenting returns to 1) point of release, 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 LMO 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. If funded (BIOP), 2011 will be the first year of a parental based tagging study. In the future this should allow us to accurately determine the origin of unmarked/untagged 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.

In addition to attempting to understand relative reproductive success of hatchery and natural fish, we propose to participate in a collaborative radio telemetry study of adult hatchery fish returning to above LGR Dam. PIT tagged returning adult fish would be sorted from the ladder based on their release location and radio tagged. Tagged fish would then be monitored through the spawning season to determine their fidelity to the vicinity of their release. Additional subyearling smolts

released at LFH will be PIT tagged starting in 2012 to provide enough PIT tagged adults to monitor their behavior after returning to the Snake River at LGR Dam (stray), which has been identified as a serious concern by NOAA Fisheries.

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 River 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.

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 1,300 spring Chinook (756 natural origin, 544 hatchery origin) returned to the Tucannon River during 2011. In Asotin Creek we counted 16 redds and collected six carcasses during spawning ground surveys (pages 21-22 in 2011 Annual Report).***

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 –Preliminary 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. Final estimates will be made after the run reconstructions are revised and results will be presented August 2013 at the fall Chinook symposium. Spawning ground surveys were completed on the Tucannon and carcasses sampled. We estimated 302 fall Chinook and 30 coho redds were built during 2011. The return was estimated at 906 fall Chinook which consisted of 6.5 % out-of-basin stray hatchery fish. No excess fish were returned to the river at the end of the season from Lyons Ferry Hatchery.***

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 2011/2012 and 2012/2013 run years were completed and provided to managers as needed. Estimation of adult returns by CWTs for the 2010/2011 and 2011/2012 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 will be updated on an annual basis.

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 2011/2012 run have been processed and sent to the appropriate labs (scale or CWT) in Olympia.

Describing the return distribution of summer steelhead to the LSRCP project area through PIT tag detections or CWT recoveries has been completed for the 2010/2011 and 2011/2012 run years. Distributions from our different release groups of steelhead will be partially described in the LSRCP production tables that will be provided to LSRCP on a an annual basis. However, a more in-depth analysis of distributions should occur in the future.

Staff attempted spawning ground surveys during the spring of 2012. However, consistently high and turbid water conditions prevented surveys from being done until near the end of the spawning season. Estimates were made for some reaches where redds were still visible, but other locations were not possible.

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 9% from 2005-2010 (2011 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, naturally reared fall Chinook salmon and coho, and natural and hatchery-origin (endemic broodstock only) summer steelhead from the Tucannon River.

Approach: WDFW operates a juvenile migrant trap in the lower Tucannon River. Information about naturally produced spring and fall Chinook salmon, coho, and summer steelhead migrants obtained from this trap includes: 1) smolt out-migration timing, 2) duration, 3) magnitude, and 4) smolt age. 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) 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 45,538 (95% C.I. 41,083-51,349) natural origin spring Chinook emigrated from the Tucannon River during the 2010/2011 smolt trapping period (2011 Annual Spring Chinook Report pp. 25-27).

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 24,627 natural origin fall Chinook emigrated from the Tucannon River during 2012 from the 2011 spawn. Biological samples were collected on fall Chinook and coho at the smolt trap. The peak migration occurred during the week of 10 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 BY10 and BY11 in 2012. 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 2013.

Steelhead – We estimate that 25,505 (95% C.I. 20,498-31,888) natural origin summer steelhead emigrated from the Tucannon River during the 2011/2012 smolt trapping period. Peak out-migration timing for natural and hatchery steelhead was 10 May. Age composition of natural origin smolts was 55% age 1, 39% age 2, 5% age 3, and 0% age 4 for the 2011/2012

migration. Staff PIT Tagged 2,200 natural origin summer steelhead for the 2012 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. 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.

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 1.81 (geometric mean = 0.90) for natural origin fish and 0.26 (geometric mean = 0.16) for hatchery origin fish. Progeny-to-parent survival averaged 1.73 for natural origin and 3.14 for hatchery origin fish (2011 Annual Spring Chinook Report – pages 29-37).

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 therefore estimated the number of probable naturally produced fall Chinook salmon returning to the Tucannon River from all naturally spawning fish (H+N) and estimated productivity from that spawning to be 1.1 adult progeny/redd. More in-depth discussion of progeny/parent productivity across multiple broodyears is provided in the 2010 Annual Fall Chinook Report (pages 34 and 109). 1997-2006 broodyear smolt-to-adult survival rates averaged 1.0% for estimated natural origin fish. Female to female survival rates are currently being estimated and will be addressed in the upcoming 2011 report which will be submitted in March 2013

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 (2006-2010 migration years). Smolt-to-adult survivals (average and geometric mean) to Bonneville Dam from the three groups were: 1) LFH stock = 4.2%, 4.1%, 2) Endemic stock = 2.4%, 2.0%, and 3) Natural stock = 3.1%, 2.8%. Smolt-to-adult survivals (average and geometric) to Ice Harbor Dam from the three groups were 1) LFH stock = 3.1%, 3.0%, 2) Endemic stock = 1.6%, 1.4%, and 3) Natural stock = 2.2%, 1.8%. LFH stock from the Tucannon River have consistently survived higher and returned more adults to the Snake River than any other steelhead groups from the Tucannon River.

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 2005-2011, we estimate that on average 165 natural origin steelhead have returned to the Tucannon River (range:71-371). Over that same time period, we estimate on average that 317 endemic origin steelhead have returned (range: 82-844). Both of these estimates assumed a 50% conversion rate from Ice Harbor Dam into the Tucannon River, but this needs further analysis.

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.

Actions or Results – Numbers of spring Chinook take (indirect and direct) are within the limits listed in our HGMP (2011 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: Numbers of fish takes (indirect and direct) are within the limits listed in our HGMP. We have provided the annual take report to NOAA Fisheries for all species actions taken under HGMP Section 7 and 10 authorizations.

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 our 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 in 2013.

The 2011 Snake River Fall Chinook Addendum to the HGMP was drafted and submitted to NOAA. Data was provided to NOAA for addition into the BIOP and assistance was given regarding development of the take tables in the section 10 permit. The BIOP and section 10 permit were finalized in October of 2012.

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. The Walla Walla Basin, and Cottonwood, and On-station release HGMPs will be updated/ modified to reflect the consolidation of these programs using only one stock (Wallowa Stock).

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 HGMP's. We assessed potential effects of the hatchery program on ESA listed summer steelhead and other listed species (both plant and animal) in the Touchet, Walla Walla, Grande Ronde, Snake and Tucannon rivers and provide a full description within each HGMP document. Staff coordinated with NOAA fisheries regarding stock and production changes.

Actions – Staff coordinated with NOAA regarding data requests and reviewed the special conditions of the Snake River fall Chinook Section 10 permit and provided comments and suggestions.

Project 3b – Hatchery/Wild interactions

Objective 3b.1. Evaluate reproductive success for hatchery and natural origin spring Chinook salmon using pedigree analysis.

Approach: Natural and hatchery origin adult spring Chinook salmon from Washington's LSRCP program are known to utilize overlapping spawning areas. It is currently unknown to what extent natural and hatchery origin fish interbreed, and what effects interbreeding of hatchery and wild fish, and natural production from hatchery x hatchery spawning (whether intended or de facto supplementation) may have on natural production. The spring Chinook program was developed with endemic fish. However, research has documented that hatchery origin fish may not be as successful in reproducing in the wild, and may lower overall fitness of the natural population.

We propose to use PSC/GAPS standardized microsatellite markers for parentage/sibling-ship analysis. We have chosen not to use SNP loci for this study because the efficacy of SNPs for pedigree reconstruction is currently being evaluated. The laboratory procedures and analytical methods are well established for the microsatellite GAPS loci (Seeb et al. 2007). Microsatellites are highly variable and have been the preferred marker for pedigree reconstruction because there are many alleles per locus, typically 35-40 (Jones and Arden 2003). The maximum-likelihood approach will be used to conduct the analysis. Maximum-likelihood approaches take the form of log-likelihood ratios to determine the most likely parent-offspring relationship from a pool of non-excluded parents, and formulate a likelihood for alternative hypothesized relationships of multiple genotypes. This method explicitly accounts for genotyping error and has shown to be robust in the presence of error (Marshall et al. 1998; Wang 2004; Kalinowski et al. 2007).

Results: This was a new research initiative to address BiOp related issues and concerns, however no funding was provided for this study.

Objective 3b.2. 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 in 2009 (Yakima, Salmon, Wenaha and Upper Columbia River basin tributaries) but the data must be analyzed to determine which of the rivers can serve as reliable references. 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 are still being researched. To date the Deschutes River, Oregon appears to be one indicator stream with fall Chinook that we can compare and contrast metrics with Snake River fall Chinook. Staff continues to search for additional fall Chinook reference streams.

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, very limited work has occurred on this task as more time was spent on preparing for the LSRCP steelhead symposium. Productivity estimates from the Asotin Creek population are becoming available as more brood years complete. Productivity estimates for the Touchet River steelhead population have been made based on index redd surveys. However, 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 by the end of 2013.

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. 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 fall Chinook returns. SaSI databases on summer steelhead stock have not been updated yet.

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 FFY07-10 contract periods.

Spring Chinook – The 2011 spring Chinook annual report was completed and submitted to Lower Snake River Compensation Plan staff on time.

Fall Chinook – The 2009 fall Chinook annual report was submitted to LSRCP in September of 2011, and the 2010 annual report draft was reviewed on time and later finalized and submitted to LSRCP in September of 2012. Work is proceeding on the FFY11 data, which is currently on schedule for completion in March 2012.

Steelhead – Staff began work on the 2010/2011 run year report, but this has not been completed due to data compilation and preparation for the June 2012 LSRCP Summer Steelhead Symposium. Completion of the 2010/2011 and 2011/2012 run years (combined report) is currently being compiled and is expected to be complete by July 2013. Completion of the 2012/2013 run year report (draft) is expected to be complete by December 2014.

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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.

The following Management brief was published in 2012:

Rosenberger, S.J., W.P. Connor, C.A. Peery, D.J. Milks, M.L. Schuck, J.A. Hesse, and S.G. Smith. 2012. Acclimation Enhances Post-release Performance of Hatchery Fall Chinook Salmon Subyearlings while reducing Interaction with Natural Fish. NAJFM (UJFM-2012-0158).

Category 6. Participation in External Forums

At the Future of our Salmon Conference in Portland, Oregon a presentation titled Snake River Fall Chinook Hatchery Program was presented by William Young and co-authored by Glen Mendel and Debbie Milks. The presentation described the history of the Snake River Fall Chinook Program and listed things that we know about abundance, redd counts and harvest, and things we don't know about management effects, environmental effects and hatchery and wild interactions and productivity. In addition, evaluations staff is part of a team of biologists within the Snake River basin tasked with fall Chinook run reconstruction.

Evaluation staff participated in and provided three presentations for the LSRCP steelhead symposium in June, 2012. In addition, 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.

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 second year larger, older aged fish have been prioritized over smaller fish for broodstock. Since all of the sort-by-code fish trapped at LGR Trap were hauled to LFH and NPT there was not a need to selectively sort those fish at the trap for hauling. Ages of fish used as broodstock were compiled. The NPTH is selecting larger sized fish for broodstock as well. Data mining is occurring to determine if arrival timing is different between subyearlings and yearlings although past data will need to be used because we are not actively trapping fish at LFH across the return. Results will be included in the 2011 annual report due in March 2012.

Objective 7b: Conduct and Evaluate the Tucannon River Spring Chinook Captive Broodstock Program.

Approach: WDFW utilized a captive broodstock program to provide a quick "boost" to the Tucannon River spring Chinook population due to low returns in the mid-90s. The final release of smolts occurred in 2008, but returns will continue to be assessed through the LSRCP M&E program until the last captive brood progeny return in 2011. The program was primarily funded by BPA but the LSRCP program provides additional support through its ongoing M&E and hatchery O&M programs. Captive broodstock programs are experimental and the information gathered from this program will be shared with other interested parties in the Snake River Basin that conduct, or are considering conducting, captive broodstock programs for recovery of ESA-listed populations.

Results – The final captive brood progeny returned in 2011. The final analysis was completed and included in the 2011 Annual Spring Chinook Report. Both the conventional hatchery supplementation program and naturally produced fish performed better than the captive brood program fish.

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 prespawning 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 20-30% 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 affects 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 (2011 Annual spring Chinook Report – pages 40-45).

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 and Beverton-Holt 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 (2011 Annual Spring Chinook Report – pp. 40-45).

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 downriver fisheries are currently 100% electronically sampled, however, some ocean fisheries are not. As a result of this discovery, WDFW continues to externally mark some groups of the fish so CWT tagged fish can be externally identified at recovery locations in the Columbia River system and elsewhere.

Recovery estimates for fall Chinook released by WDFW will continue to be adjusted according to harvest sampling protocols [electronic vs. visual. Data is being summarized for 2011 returns, but the 2010 return data has shown that overall RMIS recovery estimates only accounted for 76% of the fully expanded subyearling and 69% of the yearling recovery estimates of WDFW releases (2010 Annual Report- page 48-49) resulting in 11,800 additional tagged and untagged fish being harvested in 2010 than could be estimated solely using unadjusted RMIS data. 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. Identifying natural origin fall Chinook in the Snake River is becoming more complex. Parentage Based tagging (PBT) using genetic characterization of 100% of hatchery broodstock can also be used to determine origin of their offspring. The benefits of using one of these marks would be nearly 100% identification of inbasin fish resulting in a more accurate estimate of stock composition of the run as well as broodstock. Pursuing a

discussion of implementing one of these marking techniques should be a high priority for fall Chinook. Begin collecting DNA for a parental based tagging study to identify untagged hatchery fish returning from inbasin releases. Stray hatchery fall Chinook are nearly 100% marked/tagged for identification. Eventually we should be able to determine the numbers of natural origin fish returning to the basin by subtraction (Total return minus inbasin hatchery minus stray equals' natural origin returns).

Action or Result – Co-managers have agreed to begin DNA profiling parental broodstock (PBT) of fall Chinook released in the Snake River basin to allow identification of their untagged progeny upon return. The NPT has been profiling their broodstock since 2010 and LFH began profiling their broodstock in 2011. All PBT samples from LFH have been archived for future analysis once funding occurs. Quality control sampling of wire tagged juveniles released by WDFW occurs at LFH as well as Irrigon Hatchery by WDFW staff.

7. Fall Chinook run reconstruction estimates must be reworked for 2003-2009 return years. The systematic random sampling was presumed to be a precise method to estimate the magnitude of the return. Estimated returns using expansions of the trap rates consistently calculated more fish to the dam than were counted at the dam each year. Methodologies were changed in 2010 and the overall composition as estimated in the trap was reduced to match the counts of fish in the ladder at the dam. These adjustments must be done for the 2003-2009 return years.

Action or Result – Currently co-managers are collecting datasets to rework. To date the 2011 return has been completed and is nearly finalized. The co-managers will meet in January 2012 to work through more of the years. Data processing setbacks have occurred due to data requests that have been brought about in association with BIOP and section 10 permit.

8. 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. Limited raceway rearing space for unique groups of fish to test the effect of PIT tags on survival is available at Lyons Ferry Hatchery at this time. Discussions are ongoing with co-managers regarding this issue.

9. Trapping at LFH shunts fall Chinook not needed back to the river. The yearling releases have been PIT tagged at a level that will allow us to estimate the numbers of yearlings trapped multiple times and returned to the river. Detection arrays in the Tucannon and upstream allow for more detections of those fish. We propose that the subyearlings be PIT tagged (BiOp) so we can determine how many recaptures there are of that group of fish.

Although the subyearlings return at a much lower rate than the yearlings, this is a piece of the return that cannot be accurately estimated.

Action or Result – Subyearling fall Chinook were PIT tagged in 2012 to address these concerns.