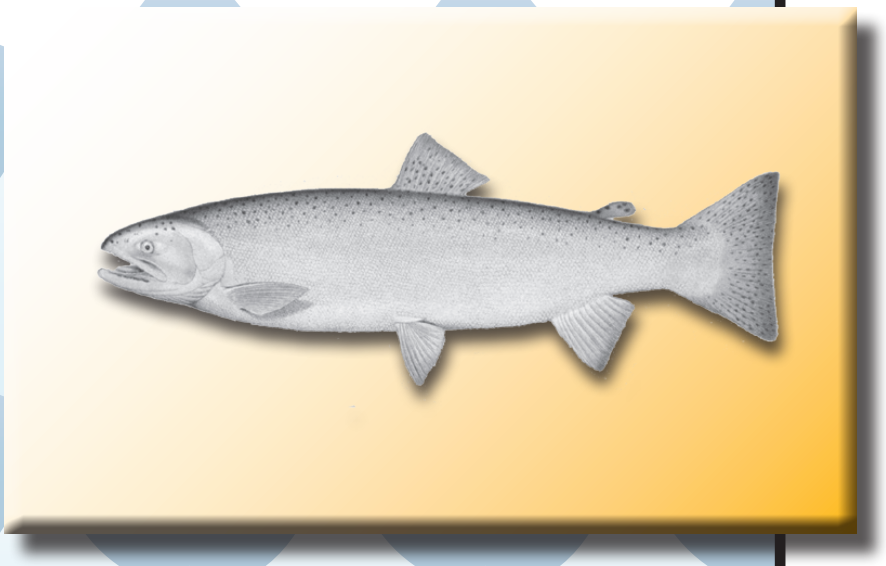
STATE OF WASHINGTON July 2015

Lyons Ferry Hatchery Complex Summer Steelhead Evaluations 2012 Run Year Annual Report



Joseph D. Bumgarner
Jerry T. Dedloff

Washington Department of Fish and Wildlife
Fish Program
Science Division

FPA 15-06

Lyons Ferry Hatchery Complex Summer Steelhead Evaluations

2012 Run Year Annual Report

by

Joseph D. Bumgarner
Jerry T. Dedloff

Washington Department of Fish and Wildlife
Fish Program / Science Division
600 Capital Way North
Olympia, Washington 98501-1091

Prepared for:

U.S. Fish and Wildlife Service
Lower Snake River Compensation Plan Office
1387 Vinnell Way, Suite 343
Boise, Idaho 83709
Cooperative Agreement # F13AC00096

July 2015

Acknowledgments

The ongoing success of the steelhead program is the result of the coordinated/dedicated efforts of many WDFW employees. We thank Doug Maxey, Steve Jones, and the LFH and TFH staff for their hard work, insight, and assistance with summer steelhead monitoring and evaluation activities conducted at Lyons Ferry Complex for the year.

Special thanks to Michael Gallinat and Lance Ross for the operation of the Tucannon River smolt trap. Current evaluations of summer steelhead in the Tucannon River rely on PIT tags, which begins with the capture and PIT tagging at the smolt trap. Mark rates estimated at the smolt trap are applied to the adults detected at main stem dams and instream PIT Tag Arrays. Over the past few years, Michael re-calculated all prior steelhead smolt estimates (with confidence intervals) using a standardized methodology. These new estimates and confidence intervals allow a range of possible returns of steelhead from the Tucannon River back to the project area (above Ice Harbor) and into the Tucannon River itself. Estimates presented in earlier steelhead evaluation reports have been corrected and are presented in this report. We greatly appreciate the time and effort involved to accomplish this task.

We thank the staff of the Snake River Lab, in particular Mark Schuck, Afton Oakerman, Debbie Milks, and seasonal field staff Sean Taylor, Nathan Roueche, Matt Hamby, Doug Falkner, and Cole Webster who helped collect the information presented in this report. We also thank the staff of the Asotin Creek Field Office for assisting with spawning surveys on Asotin Creek.

We thank Don Whitney and staff of Idaho Fish and Game for assistance in conducting joint Snake River creel surveys and providing CWT recoveries from Idaho fisheries. We also thank Rich Carmichael's crew from Oregon Department of Fish and Wildlife, especially Mike Flesher, for their leadership in conducting the Grande Ronde River creel survey and providing angler effort and catch data, and providing CWT recoveries for expansion. Nicole Tancreto with PSMFC provided valuable assistance with our PIT tag files.

We thank additional WDFW personnel (John Sneva, Lance Campbell, Gil Lensgrave, and Lynn Anderson) for their assistance with portions of the project.

We thank Michael Gallinat, Andrew Murdoch, and Rod Engle for their critical reviews of the draft report.

Finally we thank the entire staff of the Lower Snake River Compensation Plan Office for their firm support in funding these monitoring and evaluation studies.

Abstract

This annual report is one in a series describing the Washington Department of Fish and Wildlife's (WDFW) progress toward meeting summer steelhead and rainbow trout mitigation goals established in the Lower Snake River Compensation Plan (LSRCP).

Stocking of LSRCP-produced rainbow trout (208,908 trout) within Washington went as planned and achieved the new LSRCP goal of 198,500. Survival of hatchery steelhead from egg to smolt was greater than 75% for all stocks, and smolt releases and marking/tagging goals for summer steelhead were met, or within acceptable limits.

WDFW operates a series of traps in southeast Washington. We report the number of fish captured and released, spawned, composition of hatchery and natural origin fish, coded-wire tag recoveries (where appropriate) and age composition for each steelhead stock.

WDFW staff surveyed steelhead sport anglers during 2012/2013 within the LSRCP area of southeast Washington to recover CWTs from tagged steelhead. Summary results of those surveys (anglers, effort, number of fish captured), including joint surveys conducted with ODFW, are provided. All fishery sample data and CWTs recovered were transferred to Olympia for inclusion into the RMIS Regional CWT database.

During the spring of 2013, evaluation staff conducted spawning ground surveys to estimate the number of redds in index areas of the Touchet River, Asotin Creek, and Cummings Creek. Stream flows were generally good, but poor conditions limited surveys in some areas. Estimates of redds and spawning fish by origin are provided.

Smolt trapping occurred on the Tucannon River to estimate the number of natural origin migrant steelhead. In the 2012/2013 out-migrations we estimated 23,269 natural origin summer steelhead migrants. We continue to PIT tag natural origin steelhead smolts at the Tucannon River smolt trap to estimate smolt-to-adult survivals (SAR) and document straying above Lower Granite Dam. Average SAR of natural origin steelhead from the Tucannon River was 2.7% back to Bonneville Dam, and 2.0% to Ice Harbor Dam.

Tucannon River steelhead continue to exhibit a disturbing adult migration pattern, with about 60-70% returning to, and about 50% remaining above, Lower Granite Dam. Similar overshoot rates have also been observed for natural and hatchery steelhead from the Walla Walla Basin, and those steelhead released on-station at LFH. Steelhead released from Cottonwood Pond in the Grande Ronde River do not exhibit this behavior that we are aware of, but limited detection sites exist upstream of Lower Granite Dam.

The LFC summer steelhead program continues to meet and/or exceed its original mitigation goals by supplying large returns of steelhead for harvest in southeast Washington, mainly due to the fact that harvest rates in lower Columbia River fisheries have declined substantially in recent years. Survivals to adult for the endemic Tucannon stock have been high enough to warrant adoption of this program in the Tucannon River. Survivals to adult on the Touchet stock program have been less than desired. WDFW will continue to monitor harvest recoveries and adjust programs as necessary to maintain LSRCP goals.

Table of Contents

List of Figures

List of Tables

List of Appendices

Introduction

This annual report (Run Year 2012) is one in a continuing series describing Washington Department of Fish and Wildlife's (WDFW) progress toward meeting summer steelhead (*Oncorhynchus mykiss)* and rainbow trout mitigation goals established in the Lower Snake River Compensation Plan (LSRCP). The reporting period covers between 1 July 2012 and 30 June 2013, unless otherwise noted.

The LSRCP program in Washington State began in 1981 with construction of Lyons Ferry Hatchery (LFH). Refurbishing of the Tucannon Fish Hatchery (TFH) followed in 1984-1985. In addition to the hatchery construction and modifications, three remote acclimation ponds (AP) were built along the Tucannon (Curl Lake AP), Touchet (Dayton AP), and Grande Ronde (Cottonwood AP) rivers to acclimate juvenile summer steelhead before release. All of these facilities make up WDFW's Lyons Ferry Complex (LFC) (Figure 1).

Program Objectives

Legislation under the Water Resources Act of 1976 authorized the establishment of the Lower Snake River Compensation Plan (LSRCP) to help mitigate for the losses of salmon and steelhead runs due to construction and operation of the Snake River dams and authorized hatchery construction and production in Washington, Idaho, and Oregon as a mitigation tool (USACE 1975). The steelhead trout/resident fish (*Oncorhynchus mykiss*) portion of the LSRCP as administered by WDFW for the State of Washington was based on two essential criteria: 1) anadromous summer steelhead losses attributable to hydroelectric dam construction on the Snake River amounting to 4,656 adult fish destined for Washington, and 2) resident fisheries for rainbow trout, smallmouth bass (*Micropterus dolomieu*), sturgeon (*Acipenser transmontanus*), channel catfish (*Ictalurus punctatus*), and crappie (*Pomoxis sp*.) were diminished by 67,500 angler days of recreation annually. These criteria were the basis for designing hatchery facilities capable of producing sufficient steelhead smolt to return 4,656 adults back to the project area (Snake River mouth, including the Walla Walla basin). Additionally, 93,000 pound of catchable size (3 fish/lb) rainbow trout were produced to offset the losses to the resident fisheries.

Originally, the LFH was constructed to produce 931,200 steelhead smolts (8 fish/lb - 116,400 pounds) and 45,000 pounds of legal rainbow trout, and TFH was repaired and updated to produce 41,000 pounds of legal rainbow trout, and to aid in the propagation of spring Chinook in the Tucannon River. The remaining 7,000 pounds of catchable rainbow were foregone in-lieu of improving instream habitat in various streams in southeastern Washington. Various actions (e.g. ESA, smolt performance, etc..) have compelled the program to change its steelhead and rainbow trout production goals over the years.

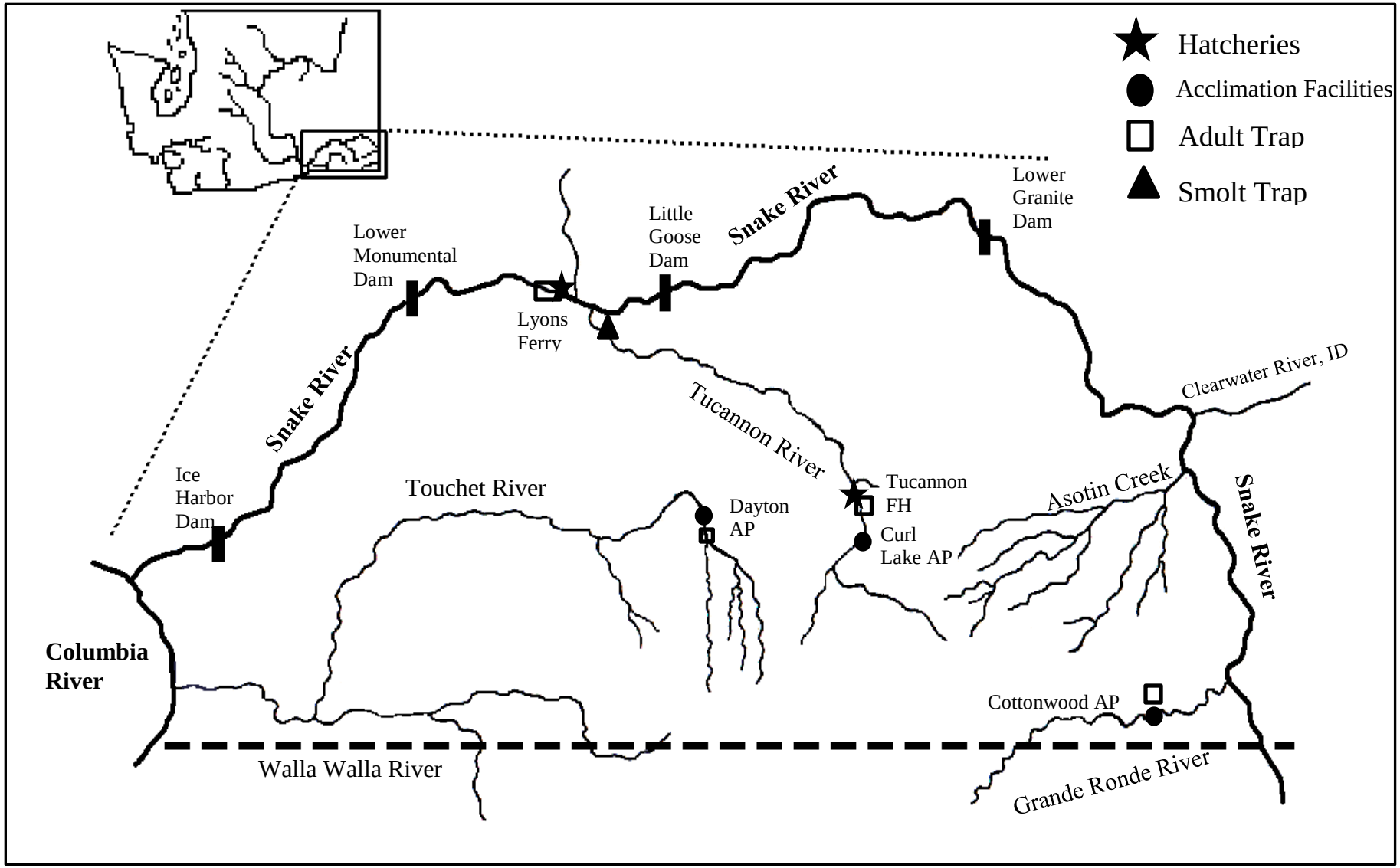


Figure 1. Map of major rivers and streams in southeast Washington, and Lyons Ferry Complex facilities.

Production Goals for Rainbow Trout and Summer Steelhead

Rainbow Trout*:* The LSRCP mitigation trout program has focused on providing recreational fishing opportunities in southeast Washington. The current LFC goal is to produce 198,500 catchable sized (3 fish/lb; generally >8 in) Spokane stock trout (66,167 lbs) for release into southeast Washington area lakes (no stream plants), which is to result in at least 67,500 angler days of recreation. Monitoring of the Tucannon River lakes fishery in 2003 (Mendel and Trump 2010) demonstrate that this goal is easily being met. The LFC also produces a total of 19,250 Spokane stock trout for the Nez Perce Tribe's resident fish program (1,650 fish) and Idaho Department of Fish and Game (IDFG) resident fall fishery program (17,600 fish). During the report period, stocking of LSRCP produced rainbow trout within Washington lakes/streams (Appendix A), and transfers to Nez Perce Tribe and IDFG went as planned.

Summer Steelhead: The LSRCP summer steelhead harvest mitigation program for WDFW is to produce a return of 4,656 adult steelhead to the project area for harvest and to fulfill broodstock needs. The project area is defined as the mouth of the Snake River and upstream. It also includes returns to the Walla Walla basin that were added in the original LSRCP agreement for off-site mitigation because of the drastically reduces fishing areas for steelhead caused by the dams, in addition to the managers being unsure if survival through the hydrosystem in the Snake River would be less than expected . In addition, there is another adult summer steelhead goal for the entire Columbia River (13,968 adults), which assumes a 2:1 economic harvest benefit for lower river fisheries as stated in the original LSRCP planning document (USACE 1975).

In 2012, the LFC used four summer steelhead stocks to produce about 645,000 smolts (target size = 4.5 fish/lb (100.8 g/fish, 143,333 pounds) for release into the Snake, Tucannon, Grande Ronde, Walla Walla, and Touchet rivers primarily for enhanced recreational opportunities for steelhead anglers, in addition to two groups (Tucannon and Touchet stocks) also being used for ESA recovery purposes at this time. Changes to the current production levels of summer steelhead may occur in the near future as we continue to address ESA concerns while meeting harvest mitigation goals.

In December 2012, WDFW made a decision to eliminate the use of LFH stock steelhead for one of the harvest mitigation programs, and switched the releases that were on-station at LFH, Walla Walla River, and Touchet River at Dayton AP to be of Wallowa stock origin beginning with the 2013 brood year. A revised production table for each steelhead stock is provided (Table 1).

The on-station release at LFH is shown as variable, and is adjusted downward from the 160,000 level depending on the production available from the Tucannon endemic stock program, determined on an annual basis per co-manager agreement in US vs Oregon Management Agreement. For example: if there are 110,000 smolts available for the Tucannon endemic stock

(50,000 unmarked, 60,000 marked for harvest), then the on-station release is adjusted downward by 60,000, so only 100,000 fish would be released on-station for that year. Excess production of Wallowa stock will be determined early in the rearing cycle; these fish will be planted as fry/fingerlings in area lakes and may contribute to rainbow trout fisheries.

Table 1. Annual broodstock numbers and origin, release locations, and smolt production, marking and tagging goals for all summer steelhead stock produced at Lyons Ferry Complex.

Stock	Collection point	Broodstock origin	Broodstock needed	Release location	Total smolt production, mark, and tagging goals
Wallowa	Cottonwood Creek Adult Trap	100% Hatchery	140 Females	Cottonwood AP	200K, 100% AD Clip, 20K CWT, 6,000 PIT
				Dayton AP	85K, 100% AD Clip, 20K CWT, 3,000 PIT
				Walla Walla River	100K, 100% AD Clip, 20K CWT, 3,000 PIT
				Lyons Ferry	60-160K, 100% AD Clip, 20K CWT, 3,000 PIT
Tucannon	Tucannon Adult Trap	70% Natural 30% Hatchery	28 Females	Tucannon River @ Curl Lake Intake	50K, No Fin Clip, 100% CWT, 7,500 PIT
				Tucannon River@ Marengo Bridge	50K, 100% AD Clip, 25K CWT, 7,500 PIT
Touchet	Touchet Adult Trap	100% Natural	14 Females	North Fork Touchet River @ Baileysburg Bridge	50K, No Fin Clip, 100% CWT, 5,000 PIT

In-Hatchery Survival

One of our main tasks for the hatchery evaluation program is to track survival from the different stocks of steelhead over time, and recommend any changes to improve efficiency of the program. Survival of summer steelhead at LFC facilities remains highly variable among stocks and among years (Tables 2, 3, and 4). Fish health problems (e.g., cold water disease), presence of pathogens such as Infectious Hematopoietic Necrosis virus (IHNV), spawning conditions, and remote spawning sites have all affected in-hatchery survival rates over the years. Due to the nature of the steelhead program and the frequent culling of eggs that have tested positive for IHNV, the only survival goals we used to monitor in hatchery survival is from green-egg to eyed egg, and eyed-egg to smolt release. The survival standard used for the LSRCP program is 80% for green-egg to eyed-egg, and 75% for eyed-egg to smolt release, which for the three current stocks average we have met (Tables 2, 3, and 4). From eyed-egg to smolt release, generally the largest contributor to mortality has been bacterial cold water disease. The severity of the disease varies from year-to-year, but it is documented nearly every year in all stocks.

Table 2. Numbers of males and females spawned, estimated number of eggs taken, eyed eggs, eyed eggs retained for program needs, smolts released, and estimated survival by life stage of Wallowa stock summer steelhead spawned at Cottonwood Creek and transferred to LFH, 2000 to 2013 brood years.

Brood year	Number spawned		Green eggs taken	Eyed eggs	Green-to-eyed egg survival (%)	Number of eyed eggs retained for program needs	Smolts released	Eyed egg to smolt survival (%)
	Female	Male						
2000	107	116	523,011	322,238	61.6	322,238	215,584 [a]	82.5
2001	97	108	504,182	381,427	75.7	260,000	182,722	70.3
2002	82	87	455,502	360,811	79.2	319,479	236,627	74.1
2003	65	65	327,477	315,616	96.4	242,557	137,915 [b]	85.9
2004	68	105	345,565	326,475	94.5	326,475	150,442 [c]	80.6
2005	60	70	282,675	274,586	97.1	274,586	169,390	61.7
2006	120	115	316,059	290,903	92.0	290,903	159,242 [d]	93.5
2007	106	97	340,589	310,479	91.2	242,710	175,961	72.5
2008	85	85	275,958	241,638	87.6	214,695	170,232	79.3
2009	113	125	494,638	463,442	93.7	172,367 [e]	163,197	94.7
2010	56	48	244,487	212,618	87.0	242,648	197,839	81.5
2011	106	82	522,967	411,077	78.6	193,180	176,902	91.6
2012	120	120	632,738	239,993	77.5	239,993	205,913	85.8
2013	144	135	846,970	642,273	75.8	599,732		
Mean					84.9			81.1

[a] A total of 50,270 fry/parr/fingerlings were planted into area lakes from over production.
[b] A total of 70,455 fry/parr/fingerlings were planted into area lakes from overproduction.
[c] A total of 146,481 fry/parr/fingerlings were planted into area lakes from overproduction.
[d] A total of 112,751 fry/parr/fingerlings were planted into area lakes from over production.
[e] The total number of eggs retained includes 40,000 received from ODFW Wallowa Hatchery to supplement the losses from IHNV positive females spawned at Cottonwood.

Table 3. Numbers of males and females spawned, estimated number of eggs taken, eyed eggs, eyed eggs retained for program needs, smolts released, and estimated survival by life stage of Tucannon River endemic stock summer steelhead spawned at LFH, 2000 to 2013 brood years.

Brood year	Number spawned		Green eggs taken	Eyed eggs	Green-to-eyed egg survival (%)	Number of eyed eggs retained for program needs	Smolts released	Eyed egg to smolt survival (%)
	Female	Male						
2000	16	21	80,850	71,971	89.0	71,971	60,020	83.4
2001	15	15	113,563	101,197	89.1	101,197	58,616	57.9
2002	13	16	74,204	66,969	90.2	66,969	43,688	65.2
2003	14	18	73,573	46,143	62.7	46,143	42,967	93.1
2004	16	15	78,109	62,460	80.0	62,460	61,238	98.0
2005	14	25	77,131	71,933	93.3	71,933	65,245	90.7
2006	13	16	72,520	67,341	92.9	67,341	62,940	93.5
2007	13	12	64,129	59,970	93.5	59,970	57,230	95.4
2008	1	1	3,054	2,537	83.1	2,400	0 [a]	0.0
2009	10	9	77,279	68,959	89.2	68,959	57,562 [b]	92.2
2010	11	11	89,791	81,100	90.3	81,100	77,683	95.8
2011	21	20	121,597	117,919	97.0	117,919	51,124 [c]	81.7
2012	17	19	93,065	72,274	77.7	72,274	58,357	80.7
2013	25	19	150,614	132,460	87.9	132,460		
Mean					86.9			85.6

[a] Production of 2,400 was considered inadequate to be of value, these were planted as fry.
[b] A total of 5,999 fry were planted into the Tucannon River as these were high titer positive progeny for IHNV.
[c] A total of 45,236 fry were planted into the Tucannon River as these were high titer positive progeny for IHNV.

Table 4. Numbers of males and females spawned, estimated number of eggs taken, eyed eggs, eyed eggs retained for program needs, smolts released, and estimated survival by life stage of Touchet River endemic stock summer steelhead spawned at LFH, 2000 to 2013 brood years.

Brood year	Number spawned		Green eggs taken	Eyed eggs	Green-to-eyed egg survival (%)	Number of eyed eggs retained for program needs	Smolts released	Eyed egg to smolt survival (%)
	Female	Male						
2000	12	7	53,139	43,572	82.0	43,572	36,487	83.7
2001	14	11	69,269	53,750	77.6	53,750	45,501	84.7
2002	14	17	70,843	66,460	93.8	66,460	31,440	47.3
2003	16	17	82,602	75,059	90.9	75,059	58,733	78.3
2004	15	10	68,511	58,451	85.3	58,451	55,706	95.3
2005	18	15	78,813	75,991	96.4	75,991	52,476 [a]	97.7
2006	18	18	88,668	85,730	96.7	85,730	58,989 [b]	85.5
2007	16	17	73,101	69,626	95.2	69,626	48,298 [c]	69.4
2008	13	11	66,520	62,279	93.6	62,279	55,255 [d]	97.4
2009	15	13	72,543	69,801	96.2	69,801	62,517 [e]	89.6
2010	15	13	75,596	65,055	86.1	65,055	62,037	95.4
2011	12	13	74,408	64,860	87.2	64,860	54,386	83.9
2012	17	13	81,555	45,418	55.7	45,418	38,726	85.3
2013	10	8	65,469	56,877	86.9	56,877		
Mean					87.4			84.1

[a] A total of 21,765 eggs/fry were planted into the Touchet River as these were high titer positive progeny for IHNV.
[b] A total of 14,276 eggs/fry were planted into the Touchet River as these were high titer positive progeny for IHNV.
[c] High fry-smolt loss was due to stress induced mortality of 20,389 fish caused by overcrowding during the PIT tagging operation.
[d] A total of 5,400 eggs were planted into the Touchet River as these were high titer positive progeny for IHNV.
[e] A total of 5,345 fry were planted into the Touchet River as these were high titer positive progeny for IHNV.

Marking, Tagging, and the 2013 Smolt Release (2012 Brood)

All harvest mitigation production groups (LFH and Wallowa stocks) destined for release in 2013 were marked with an adipose (AD) fin clip, and a portion of each release group also received a coded-wire tag (CWT), a left ventral fin clip, and a PIT tag prior to release (Table 5).

Tagging levels, both CWT and PIT have been set based on expected recoveries/detections as adults. For CWTs, it was determined from previous studies that 20,000/group was adequate to obtain recoveries from a variety of fisheries and traps to assess the harvest program. For PIT tags, the number tagged each year has varied due to budgets, funding source, and the Comparative Survival Study (CSS-Cottonwood releases), though we generally try to tag enough fish to obtain 40-60 adult returns on an annual basis. For all LFH stock steelhead, this equated to a group sizes of 3,000 tags/release, though for 2013, those releases were reduced to 2,500 due to budget constraints. For the Touchet endemic stock (lower survivals) this equated to a minimum of 5,000 tags/release. For the Tucannon endemic stock, all tags are provided by BPA, and due to the nature of that program (conservation and mitigation), and the PIT tag information is guiding those evaluations, 7,500 tags/group are used. At Cottonwood AP, since they are above Lower Granite Dam, releases are included as part of the CSS, where 30% of the fish are run-of-the-river, and 70% are in "passive mode". Minimum group size for run-of-the-river is 2,000 tags, so a total of 6,000 tags are required for their study.

The purpose and use of the marks/tags are as follows: 1) for selective fisheries harvest management (adipose clip), 2) contribution of steelhead to commercial, tribal, and sport fisheries in the ocean, lower Columbia and Snake rivers (CWTs), 3) estimating smolt-to-adult survival and the number of adults back to the project area (PIT), and 4) to document straying (CWT and PIT). Non-harvest mitigation steelhead (Tucannon and Touchet endemic stocks) were given CWTs, but were not externally marked for harvest in the 2013 release. The CWTs for Touchet and Tucannon steelhead stocks are 1) for a hatchery origin identifier when they are captured at the Touchet or Tucannon Adult traps, 2) documenting their harvest in downriver non-selective fisheries, and 3) document straying at other adult traps in SE Washington or other river basins/hatcheries in the Columbia and Snake rivers. Expanded adult returns based on PIT tag detections in all groups will provide the needed information to accurately estimate total contribution of our hatchery summer steelhead to the project area for LSRCP mitigation assessment.

Prior to release each year, the WDFW Snake River Lab evaluation staff collect pre-release samples for all LFC release locations (Table 6). Generally, about 200 fish/group are sampled, with the goal to get a sample of the fish a day or two prior to release, so we can best characterize the fish at release. For acclimation sites (Cottonwood and Dayton) that do volitional releases, the sample is collected a day or two before the screens are pulled so fish can exit the pond on their own. In 2013, all release groups from all stocks were close to or above program goals (number of fish and size of fish).

Table 5. Summer steelhead smolt releases from Lyons Ferry Complex, 2013.

Release river *Release location* (stock)	Rkm	Date of release	Total number of released smolts	Number of AD-only released smolts	Number of CWT released smolts	CWT code	Other external marks	Number of pounds (lbs) released	Size of fish (#/lb)	Estimated loss of CWT (%)	Number of PIT tags
Grande Ronde *Cottonwood AP* (Wallowa)	45.6	4/03-20	205,913	851	20,788	636448	Left Ventral	43,811	4.7	3.9	6,000
Snake *LFH* (Lyons Ferry)	92.8	4/15-19	146,358	168	20,686	636446	Left Ventral	33,926	4.3	0.8	2,500
Touchet *Dayton AP* (Lyons Ferry)	86.4	4/08-26	84,946	337	20,654	636447	Left Ventral	20,719	4.1	1.6	2,500
Walla Walla *McDonald Bridge* (Lyons Ferry)	48.0	4/15-17	100,975	482	20,412	636445	Left Ventral	23,266	4.3	2.3	2,500
Tucannon *Curl Lake Intake* (Tucannon)	66.5	4/22-23	58,357	0	57,011	636078	None	11,404	5.1	2.9	15,000
Touchet *NF Touchet Bridge* (Touchet)	91.5	4/22	38,726	0	37,627	636440	None	8,068	4.8	2.8	5,000

Table 6. Mean fork lengths, weights, condition factor, coefficient of variation (CV), fish per pound (FPP), and the percent of visually apparent precocious mature males from LFC steelhead prior to release, 2013.

Location (Stock)	Sample date	Sample size (N)	Mean length (mm)	Mean weight (g)	Mean condition factor (K)	CV	FPP	Precocious (%)
Cottonwood AP (Wallowa)	4/2	236	201.7	96.6	1.13	12.6	4.7	0.8
Lyons Ferry (LFH)	4/12	213	215.7	102.7	1.00	10.5	4.4	0.9
Lake #1 (LFH) [a]	4/15-16	439	224.0	106.3	0.94	6.6	4.3	0.0
Dayton AP (LFH)	4/11	207	214.7	109.4	1.07	10.9	4.1	0.5
Walla Walla (LFH)	4/12	204	213.7	100.3	1.00	10.0	4.5	0.5
Tucannon (Endemic)	4/19	221	193.9	94.9	1.19	16.7	4.8	0.0
Touchet (Endemic)	4/12	224	198.1	94.3	1.09	17.2	4.8	1.8

[a] Fish removed from Lake#1 during April were released in the Walla Walla River or directly to the Snake River at LFH.

Broodstock Collections/Adult Returns and Evaluations

As part of our annual broodstock collection and research activities, WDFW hatchery and evaluation staffs operate a series of adult steelhead traps in southeast Washington Rivers. These traps are primarily used for collection of broodstock, but in some instances, provide us with the opportunity it monitor and assess natural origin steelhead returns. The LFH staff operates the LFH and Cottonwood Creek adult traps. The TFH staff operates the upper Tucannon River adult trap, and the Snake River Lab evaluation staff operates the Touchet River adult trap in Dayton. Information presented below summarizes trapping, collection of broodstock, and hatchery spawning activities and any additional evaluation projects for the reporting period.

Lyons Ferry Stock Steelhead

The Lyons Ferry adult trap is located the outflow of Lyons Ferry Hatchery, which empties directly to the Snake River. Fish traverse a ladder up to an adult holding pond, where a motorized crowder is used push captured fish to one end of the adult holding pond. A small opening at the end of the pond limits the number of fish that are diverted to a manually operated sorting chute. Summer steelhead and fall Chinook are trapped at the same time, with each diverted to separate adult holding ponds. Fish not needed for broodstock (of either species) can be immediately diverted back to the Snake River.

Adult steelhead were trapped from 4 September through 17 September 2012. A total of 1,608 adult steelhead [818 female (61.7%) and 616 male (38.3%)] were trapped. Fish to be retained for broodstock were sorted using electro-narcosis on 26 September 2012. All fish not needed for broodstock or retained to recover CWTs were returned to the Snake River to contribute to the sport fishery (1,067). A total of 96 fish were killed for CWT extraction. On that same day, a total of 99 fish (96 with CWT) were provided to the Clarkston Food Bank. Of the total steelhead trapped at LFH in 2012, three natural origin (unmarked/untagged) fish were found and returned to the Snake River. In early December 2012, WDFW and the co-managers reached a decision to terminate the Lyon Ferry stock steelhead program in the future (see conclusions and recommendations for further explanation). Therefore, on 19 December, fish that were being held for broodstock were sorted to recover the remaining CWTs that might be present in the fish being held, with all other fish returned to the river to contribute to the fishery; with no eggs collected. A total of 154 fish with CWTs were recovered (Table 7) from both sorting events. One Wallowa stock, and one Imnaha stock were recovered (<2% stray origin). Age composition of the return based on CWT recoveries was 57.8% one-ocean and 42.2% two-ocean. Mortality during trapping and holding was 12 fish (0.7% of all fish trapped).

All steelhead trapped and/or retained were scanned for PIT tags. For the 2013 brood, we detected 38 unique PIT tags in fish trapped for broodstock. Many were tagged and released as juvenile from LFH, Tucannon, Touchet, or Walla Walla rivers, while others were tagged at main stem Columbia or Snake River dams as juveniles during outmigration or as adult returns. All recovered PIT tag data was uploaded to PTAGIS per sampling and reporting protocols.

Table 7. Summary of tagged adult summer steelhead trapped at LFH for the 2012 run year.

Brood year	CWT code	Stock	Release site	Number of CWTs
2009	63 / 51 / 67	LFH	Snake River – On Station	32
	63 / 51 / 68	LFH	Walla Walla River	19
	63 / 51 / 69	LFH	Tucannon River	13
	63 / 51 / 70	LFH	Touchet River @ Dayton AP	20
	63 / 51 / 71	Wallowa	Grande Ronde @ Cottonwood AP	1
2010	63 / 55 / 68	LFH	Snake River – On Station	48
	63 / 55 / 69	LFH	Walla Walla River	10
	63 / 55 / 70	LFH	Touchet River @ Dayton AP	10
	09 / 02 / 96	Imnaha River	Little Sheep Creek, Imnaha River	1
			LV or RV clip - No CWT	6
			Lost CWT	1
			Grand Total For Year	**161**

Wallowa Stock Steelhead

The Cottonwood Creek adult trap is located about 200 meters upstream of the Cottonwood Creek mouth where it meets the Grande Ronde River. Fish enter a small holding area once they enter trap. Fish in the trap area are sorted once or multiple times a day depending on expected returns and stream flows. Fish to be held for broodstock are netted to a holding area immediately upstream of the trap area, with all wild fish (unmarked/untagged) passed immediately upstream so they can spawn in Cottonwood Creek.

A total of 942 adult steelhead [419 (44.5%) male, 523 (55.5%) female] were trapped from mid-February to 23 April. Twenty-six (13 male and 13 female) natural origin fish were captured during the season; all were passed upstream. Age composition based on CWT recoveries of sampled hatchery origin fish was 48.8% one-ocean and 51.2% two-ocean. For the season, 144 females and 136 males were spawned for an egg-take total of 846,970 eggs. Initial egg loss was 24.2%, leaving an estimated 642,273 eyed-eggs for production. No IHNV was detected in any of the females. Eggs in excess of program needs were destroyed per fish health guidelines and with agreement with co-managers (42,541); eyed eggs that were retained equaled 599,732. All carcasses from spawned fish, or those killed to retrieve the CWTs, or were in excess of program needs were buried at LFH, or provided to the Walla Walla Community College for science classroom dissections.

In 2013, hatchery staff used an automatic egg picker on all Wallowa stock steelhead, therefore, no individual fecundities by salt-age class were collected. Mean fecundity for the year (both age classes was 5,882 eggs/female. We recovered 93 fish that had, or should have had CWTs (Table 8). Sex ratio of CWT fish (44% male, 56% female) was similar to those that were trapped at large. All CWTs recovered from the 2012 run year were originally released on-site at Cottonwood AP, similar to previous years. All steelhead trapped and/or retained were scanned for PIT tags. For the 2013 brood, we detected 25 unique PIT tags in the fish trapped at Cottonwood. Ten were tagged and released from Cottonwood AP, while others were tagged at the Grande Ronde smolt trap or at Snake River dams as juveniles, or tagged as adult returns in the Columbia and Snake rivers at various locations. All recovered PIT tag data was uploaded to PTAGIS per sampling and reporting protocols.

Table 8. **Summary of tagged adult summer steelhead trapped at Cottonwood Trap for the 2012 run year.**

Brood year	CWT code	Stock	Release site	Number of CWTs
2009	63 / 51 / 71	Wallowa	Cottonwood AP	41
2010	63 / 55 / 67	Wallowa	Cottonwood AP	48
			LV clip - No CWT	4
			Grand Total for Year	**93**

Tucannon River Stock Steelhead

A permanent adult steelhead and salmon trap was installed in 1998 at the TFH water intake diversion dam. Natural and Tucannon River hatchery endemic stock origin steelhead are enumerated, sampled, and passed upstream to spawn, while LFH stock fish are returned to below the trap unless they are a fish with a CWT. Any AD-clipped steelhead with a CWT present are killed so the tag can be extracted. For the 2012 run year (February-May), hatchery staff trapped 82 natural origin, 218 Tucannon River endemic hatchery stock and 15 LFH stock hatchery-origin steelhead (Tables 9 and 10). Twenty-eight females (18 natural, 10 hatchery endemic origin) and 15 males (11 natural and four hatchery endemic origin) were collected for broodstock. Additionally, seven natural males were live spawned at the adult trap and released, with all of those being used for spawning at the hatchery. At the end of the spawning season, endemic hatchery origin fish contributed to 28.9% of the broodstock.

During March and April 2013, 25 females were spawned with 19 males at LFH. Total egg take was estimated at 150,614 (Table 3), and none of the spawned females tested positive for IHNV. Natural fish trapped from the TFH trap consisted of 35.2% one-ocean and 64.8% two-ocean age fish (Table 11). Of the 25 females spawned, 21 were two-ocean females with an average fecundity of 6,338 eggs, with the remaining one-ocean females having an average fecundity of 4,380 eggs.

Table 9. **Natural origin, hatchery LFH stock origin, hatchery Tucannon endemic stock origin summer steelhead trapped at TFH from the 1997-2012 run years.**

Run year	Natural stock			LFH hatchery stock			Tucannon endemic hatchery stock			Totals (%)	
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Natural	Female
1997	8	10	18	31	47	78	NA	NA	NA	18.8	59.4
1998	9	13	22	14	19	33	NA	NA	NA	40.0	58.2
1999	12	6	18	5	5	10	NA	NA	NA	64.3	39.3
2000	9	1	10	3	0	3	NA	NA	NA	76.9	7.7
2001	75	103	178	24	4	28	NA	NA	NA	86.4	51.9
2002	30	34	64	9	3	12	NA	NA	NA	84.2	48.7
2003	23	10	33	5	0	5	4	1	5	78.6	25.6
2004	36	7	43	2	0	2	11	2	13	74.1	15.5
2005	12	8	20	1	0	1	7	11	18	51.3	48.7
2006	12	2	14	3	2	5	11	3	14	42.4	21.2
2007	6	4	10	5	0	5	6	2	8	43.5	26.1
2008	38	50	88	6	2	8	121	121	242	26.0	51.2
2009	181	142	323	3	5	8	183	147	330	48.9	44.5
2010	78	124	202	1	2	3	33	97	130	60.3	66.6
2011	78	108	186	0	2	2	104	107	211	46.6	54.4
2012	37	45	82	10	5	15	76	142	218	26.0	61.0

Table 10. Total number of fish trapped and passed upstream to spawn naturally at the Tucannon River Adult Trap, 1997-2012 run years.

Run year	Natural stock			LFH hatchery stock			Tucannon endemic hatchery stock		
	Trapped	Passed	Passed (%)	Trapped	Passed	Passed (%)	Trapped	Passed	Passed (%)
1997	18	18	100	78	78	100	NA	NA	NA
1998	22	22	100	33	33	100	NA	NA	NA
1999	18	18	100	10	0	0	NA	NA	NA
2000	10	10	100	3	0	0	NA	NA	NA
2001	178	178	100	28	2	7	NA	NA	NA
2002	64	64	100	12	1	8	NA	NA	NA
2003	33	33	100	5	0	0	5	5	100
2004	43	43	100	2	1	50	13	13	100
2005	20	20	100	1	0	0	18	18	100
2006	14	14	100	5	0	0	14	14	100
2007	10	8	80	5	0	0	8	8	100
2008	88	68	77	8	0	0	242	235	97
2009	323	298	92	8	0	0	330	318	96
2010	202	157	78	3	0	0	130	125	96
2011	186	139	75	2	0	0	211	211	100
2012	87	58	67	15	0	0	218	204	94

Table 11. Summary of fresh and salt-water age composition of natural origin adult steelhead from the Tucannon River, 2000-2013 brood years. Note: this table does not include 3-ocean age fish, or those with freshwater age 4. Only a few of those individuals have been documented overall years (0.04%)

Brood year	Age 1.1		Age 1.2		Age 2.1		Age 2.2		Age 3.1		Age 3.2		Repeat Spawners (%)
	N	%	N	%	N	%	N	%	N	%	N	%	
2000	18	25.0	6	8.3	36	50.0	7	9.7	5	6.9	0	0.0	0.0
2001	0	0	13	27.1	13	27.1	19	39.6	0	0.0	3	6.3	0.0
2002	5	8.8	10	17.5	29	50.9	10	17.5	3	5.3	0	0.0	0.0
2003	0	0	4	3.9	29	28.2	56	54.4	5	4.9	6	5.8	3.6
2004	0	0	0	0.0	42	68.9	13	21.3	5	4.9	0	0.0	1.0
2005	15	4.8	32	10.3	99	31.9	141	45.5	14	4.5	7	2.3	0.6
2006	5	4.6	7	6.5	44	40.7	44	40.7	6	5.6	1	0.9	0.9
2007	1	2.0	7	14.3	16	32.7	18	36.7	4	8.2	2	4.1	0.0
2008	1	6.3	1	6.2	8	50.0	5	31.2	1	6.3	0	0.0	0.0
2009	0	0.0	2	2.7	38	50.7	12	16.0	11	14.7	7	9.3	2.7
2010	8	5.6	10	7.0	91	63.6	22	15.4	10	7.0	2	1.4	0.0
2011	1	0.8	2	1.6	30	23.8	78	61.9	5	4.0	10	7.9	0.0
2012	0	0.0	0	0.0	12	17.4	49	71.0	5	7.2	3	4.3	0.0
2013	4	5.5	3	4.1	14	19.2	44	60.3	3	4.1	4	5.5	1.4
Combined	**58**	**4.4**	**97**	**7.4**	**501**	**38.3**	**518**	**39.6**	**77**	**5.9**	**45**	**3.4**	**0.6**

Touchet River Stock Steelhead

The Touchet River adult trap, located in Dayton near river kilometer (rkm) 86.4 has been operated continuously each spring since 1999. Dates of annual operation have varied each year due to environmental or other conditions. The main purpose of the adult trap is to capture adult summer steelhead for stock assessment purposes, or for a potentially new hatchery broodstock for use in the Touchet River. This program (similar in nature to the Tucannon River program; see prior sections) continues, but is still considered experimental. Between 2000 and 2009, nearly all LFH stock fish captured in the Touchet River adult trap were returned downstream to either recycle through the sport fishery, or to separate them from the upriver spawning locations. Beginning in 2009, all LFH stock fish captured were transported to the Dayton Juvenile Pond, or were killed outright to obtain the CWT (if present) and provided to the Dayton food bank if possible.

For the season, staff trapped 194 (64.7%) natural, 21 (7.0%) LFH hatchery origin, and 85 (28.3%) Touchet River endemic hatchery origin steelhead (Tables 12 and 13). Natural steelhead trapped for the 2012 run year consisted of 47.1% one-ocean and 52.9% two-ocean age fish (Table 14). Sex ratio of natural origin fish was 67.0% female, while hatchery steelhead was 68.9% female. We collected 31 natural origin fish (15 females and 16 males) for broodstock. There was one male pre-spawning mortality (3.2%), and no spawned females tested positive for the IHN virus. Of the fish collected for broodstock, 10 females (all 2-ocean) were spawned with eight males yielding 65,469 eggs (Table 4). Since the run consisted mostly of larger fish (age 2-ocean) with greater fecundity, not all females collected were needed to reach eggtake goals. The remaining five females and 15 live males (8 used for spawning, seven were not) were returned to the river on 15 April. For the 2012 run year, mean fecundities of the two-ocean females were 6,547 eggs.

Table 12. Total number of male and female summer steelhead at the Touchet River Adult Trap (1992-1994 and 1998-2012 run years).

Run	Natural stock			LFH hatchery stock			Touchet Endemic hatchery stock			Totals (%)	
year	Male	Female	Total	Male	Female	Total	Male	Female	Total	Natural	Female
1992	17	36	53	2	6	8	NA	NA	NA	86.9%	68.9%
1993	9	34	43	1	1	2	NA	NA	NA	95.6%	77.8%
1994	2	6	8	1	1	2	NA	NA	NA	80.0%	70.0%
1998	13	29	42	5	2	7	NA	NA	NA	85.7%	63.3%
1999	9	22	31	3	0	3	NA	NA	NA	91.2%	64.7%
2000	51	129	180	18	19	37	NA	NA	NA	82.9%	68.2%
2001	68	106	174	9	10	19	NA	NA	NA	90.2%	60.1%
2002	27	91	118	4	7	11	0	1	1	90.8%	76.2%
2003	28	73	101	19	8	27	11	5	16	70.1%	59.7%
2004	38	48	86	19	25	44	4	7	11	61.0%	56.7%
2005	63	98	161	6	9	15	7	28	35	76.3%	64.0%
2006	38	107	145	13	13	26	12	32	44	67.4%	70.7%
2007	34	85	119	9	10	19	7	20	27	72.1%	69.7%
2008	53	95	148	13	13	26	27	48	75	59.4%	62.7%
2009	267	334	601	35	47	82	42	108	150	72.1%	58.7%
2010	92	242	334	21	45	66	14	42	56	73.2%	72.1%
2011	61	114	175	2	8	10	16	33	49	74.8%	66.2%
2012	64	130	194	11	10	21	22	63	85	64.7%	67.7%

Table 13. Total number of fish trapped and passed upstream to spawn naturally at the Touchet River Adult Trap, 1992-1994 and 1998-2012 run years.

Run	Natural stock			LFH hatchery stock			Touchet endemic hatchery stock		
year	Trapped	Passed	Passed (%)	Trapped	Passed	Passed (%)	Trapped	Passed	Passed (%)
1992	53	49	92.5%	8	7	87.5%	NA	NA	NA
1993	43	43	100.0%	2	2	100.0%	NA	NA	NA
1994	8	8	100.0%	2	2	100.0%	NA	NA	NA
1998	42	42	100.0%	7	7	100.0%	NA	NA	NA
1999	31	9	29.0%	3	0	0.0%	NA	NA	NA
2000	180	142	78.9%	37	8	21.6%	NA	NA	NA
2001	174	136	78.2%	19	4	21.1%	NA	NA	NA
2002	118	84	71.2%	11	1	9.1%	1	1	100.0%
2003	101	69	68.3%	27	1	3.7%	16	16	100.0%
2004	86	42	48.8%	44	16	36.4%	11	11	100.0%
2005	161	120	74.5%	15	0	0.0%	35	34	97.1%
2006	145	109	75.2%	26	0	0.0%	44	44	100.0%
2007	119	93	78.2%	19	0	0.0%	27	27	100.0%
2008	148	116	78.4%	26	0	0.0%	75	75	100.0%
2009	601	566	94.2%	82	0	0.0%	150	150	100.0%
2010	334	300	89.8%	66	0	0.0%	56	56	100.0%
2011	175	143	81.7%	10	0	0.0%	49	49	100.0%
2012	194	163	84.0%	21	0	0.0%	85	84	98.8%

Table 14. Summary of fresh and salt-water age composition of natural origin adults from the Touchet River, 1994-1995 and 1999-2013 brood years.

Brood year	Age 1.1		Age 1.2		Age 2.1		Age 2.2		Age 3.1		Age 3.2		Age 4.1		Age 4.2		Repeat Spawners (%)
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	
1994	0	0.0	0	0.0	6	28.6	8	38.1	3	14.3	3	14.3	0	0.0	0	0.0	4.8
1995	0	0.0	0	0.0	0	0.0	6	85.7	0	0.0	0	0.0	0	0.0	1	14.3	0.0
1999	0	0.0	1	3.2	18	58.1	9	29.0	2	6.5	0	0.0	0	0.0	0	0.0	3.2
2000	1	3.2	1	3.2	17	54.8	8	25.8	3	9.7	1	3.2	0	0.0	0	0.0	0.0
2001	1	0.6	14	8.0	84	48.3	40	23.0	15	8.6	9	5.2	1	0.6	0	0.0	5.7
2002	6	4.8	3	2.4	84	67.7	20	16.1	6	4.8	3	2.4	0	0.0	0	0.0	1.6
2003	0	0.0	8	6.7	20	16.7	73	60.8	2	1.7	10	8.3	0	0.0	0	0.0	5.8
2004	0	0.0	1	0.8	47	39.2	18	15.0	18	15.0	2	1.7	1	0.8	0	0.0	10.3
2005	0	0.0	0	0.0	37	44.0	21	25.0	15	17.9	8	9.5	0	0.0	0	0.0	3.6
2006	2	1.3	7	4.5	85	54.8	38	24.5	7	4.5	11	7.1	0	0.0	0	0.0	3.2
2007	2	1.4	11	7.9	46	32.9	54	38.6	7	5.0	14	10.0	1	0.7	0	0.0	2.9
2008	2	1.7	6	5.2	47	40.5	38	32.8	7	6.0	7	6.0	0	0.0	0	0.0	7.8
2009	3	2.1	0	0.0	81	56.3	21	14.6	19	13.2	8	5.6	0	0.0	0	0.0	8.3
2010	15	4.1	14	3.8	230	62.8	74	20.2	23	6.3	4	1.1	0	0.0	0	0.0	1.9
2011	3	1.4	9	4.3	54	25.6	114	54.0	16	7.6	10	4.7	0	0.0	0	0.0	2.6
2012	13	8.5	3	2.0	45	29.4	69	45.1	13	8.5	4	2.6	1	0.7	1	0.7	2.6
2013	3	2.1	37	25.9	32	22.4	53	37.1	0	0.0	14	9.8	0	0.0	0	0.0	3.3
Totals	**51**	**1.8**	**115**	**4.6**	**933**	**40.7**	**664**	**34.6**	**156**	**7.8**	**108**	**5.4**	**4**	**0.2**	**2**	**0.9**	**4.0**

In addition to trapping summer steelhead, we also capture spring Chinook salmon (*O. tshawytscha*), bull trout (*Salvelinus confluentus*), bridgelip sucker (*Catastomus columbianus*), brown trout (*Salmo trutta*), whitefish (*Prosopium williamsoni*) and Northern Pike Minnow (*Ptychocheilus oregonensis*) in the Touchet adult trap. The number of fish trapped since 1993,a and biological data collected from bull trout, brown trout, and whitefish trapped in 2013 at the Touchet adult trap are provided in Appendix B. Appendix B also provides some summary information on all bull trout that have been PIT tagged since 2001, with the number of recaptures each year and estimated growth between ages based on PIT tagged recaptures. All PIT tags used to tag the bull trout were provided by WDFW Fish Management staff.

Creel Surveys – Snake River and Tributaries

Southeast Washington Steelhead Fisheries

Staff stationed out of the Snake River Lab, or in the Clarkston area surveyed sport anglers within the LSRCP area of Washington to recover CWTs from tagged steelhead using methods described in Schuck et al. (1990). Funding for creel surveys are provided by LSRCP (~60%), with the remaining 40% funded by WDFW under the Columbia River Endorsement Stamp collected as part of the purchase of a standard fishing license and salmon/steelhead catch record card. While not presented here, the number of LFC steelhead in the sport catch in southeast Washington was estimated using WDFW sport harvest estimates from Washington catch record cards. Total contribution of LFC steelhead within these fisheries is available upon request from the Snake River Lab office, and can also be acquired from the Regional Mark Information System (RMIS). When possible, data from weekly surveys were summarized during the season and provided to the local news media to inform anglers. For the 2012/13 run year, we sampled over 16,000 anglers which fished, at time of interview, more than 70,000 hours (Table 15). Nearly 2,500 hatchery fish were sampled, with a little over 1,800 natural origin fish captured and released. Vere few (<300) hatchery fish were released, with the majority of those (84%) released in the Grande Ronde River fishery.

Table 15. Steelhead angler interview results for fall/winter/spring of the 2012 run year from Washington State licensed anglers.

River Basin River section description [a]	River section number	Anglers surveyed	Total hours fished	Natural fish released	Hatchery fish kept	Hatchery fish released	Catch rate (hours/fish)
Columbia River Basin							
McNary Dam to Pasco	533	1,941	6,820	221	250	5	14.3
Snake River Basin							
Mouth to IHR	640	92	438	4	8	0	36.5
IHR to LMD	642	4,786	14,575	287	408	6	20.8
LMD to LGD	644	2,138	10,322	323	514	9	12.2
LGD to LGR	646	741	2,620	74	82	1	16.7
LGR to Hwy 12 Br.	648	700	3,135	35	88	0	25.5
Hwy 12 Br. Upstream	650	4,063	25,279	647	707	24	18.3
Lower Grande Ronde (Washington Only)	592	1418	7058	201	407	222	8.5
Tucannon River	653	173	357	28	21	1	7.1
Touchet River	657	19	25	1	2	1	6.3
Walla Walla River	659	32	61	5	1	0	10.2
Totals		**16,103**	**70,690**	**1,826**	**2,488**	**269**	**15.4**

[a] Abbreviations as follows: IHR=Ice Harbor Dam, LMD=Lower Monumental Dam, LGD=Little Goose Dam, LGR=Lower Granite Dam, Hwy=Interstate Highway. Creel information from sections 648 and 650 include data collected by IDFG.

Grande Ronde River Fishery

In addition to the creel surveys on the Snake River, Tucannon River, and in the Walla Walla Basin, we cooperate with ODFW in conducting a joint survey of anglers on the lower Grande Ronde River of Washington and Oregon. The area of the Grande Ronde within Washington included here is from Highway 129 to the Oregon state border, and it does not include downstream portions of the Grande Ronde River to its mouth. Angler effort, catch rates, and harvest were estimated by ODFW staff as described in Carmichael et al. (1988). The total number of fish sampled during the fishery and estimated harvest by the joint surveys from the Grande Ronde fishery in the Washington portion were supplied by ODFW for the 2011 and 2012 run years (Table 16). Compared to other harvest areas (Table 15), note the number of released hatchery fish in the Grande Ronde fishery. This is primarily due to anglers not wanting to keep fish late in the season, and fisherman that catch/release so they can continue fishing for the day.

Table 16. Estimated angler effort, catch rates, and harvest for steelhead anglers on a portion of the Grande Ronde River in Washington, but near the Oregon border, run years 2011, and 2012 (Mike Flesher, ODFW).

	2011				2012				
	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Total
Effort Hours	1404.2	7256.1	4493.6	1309.6	1448.0	6273.4	6703.3	634.4	29,522.6
Catch Rate [a]	0.0648	0.1220	0.1257	0.0694	0.1039	0.2520	0.3076	0.1620	1.2074
Total Catch [b]	91	885	565	91	151	1,581	2,062	103	5,529
Fish Kept	7	158	209	39	67	945	1,086	85	2,596
Hatchery Released	28	273	94	20	9	369	745	7	1,545
Natural Released	57	455	262	32	75	267	231	11	1,390

	2012				2013				
	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr. [c]	Total
Effort Hours	988.8	3853.2	3554.3	1721.2	390.2	5886.4	8161.7	NA	24555.8
Catch Rate [a]	0.0190	0.0398	0.0809	0.1051	0.1762	0.1491	0.1830	NA	0.7531
Total Catch [b]	19	153	288	181	69	878	1,494	NA	3,082
Fish Kept	0	23	94	64	5	447	781	NA	1,414
Hatchery Released	0	45	45	34	15	176	473	NA	788
Natural Released	19	86	149	83	49	255	240	NA	881

[a] Catch rate here is defined as the estimated fish captured divided by the hours fished.

[b] Estimated fish captured have been rounded to whole numbers, so total of fish kept and released may not always add up to total catch.

[c] Due to low effort and few fish kept during the month of April, WDFW and ODFW decided to discontinue sampling during that month beginning in 2013.

Spawning Ground Surveys

During the spring of 2013, evaluation staff conducted spawning ground surveys to estimate the number of summer steelhead redds in index areas of the Touchet River, Asotin Creek, and Cummings Creek on the Tucannon River drainage. Additional surveys were conducted in the Tucannon River upstream of the TFH adult trap. These surveys were supported by additional funding from BPA and results from those and other surveys will be presented in BPA annual reports. In Asotin Creek, stream flows were low in March, allowing for initial surveys to begin, but then remained moderate in most of the areas during the month of April, which greatly limited our ability to conduct surveys during the prime spawning period. Surveys were able to resume again in late April through the month of May (Table 17), but without surveys being conducted in early to mid-April, our confidence in the estimates provided are less than desired. In the Touchet River, most surveys were limited to the month of May, except in the South Fork, where a few surveys were conducted in March and April by WDFW or the Confederated Tribes of the Umatilla Indian Reservation (CTUIR). However, due the apparent lack of gravel scouring from stream flows, redd life was long and we had greater confidence that our redd counts were accurate. Cummings Creek (Tucannon River Basin) was surveyed once in May.

Table 17. Summer steelhead spawning ground survey results, 2013.

Stream Section surveyed	Estimated river kilometers surveyed	Dates surveyed	Redds counted	Total expanded redds in the index area
Touchet River				
North Fork	14.1	5/2, 5/5, 5/17	115	174
Wolf Fork	13.0	5/1, 5/16	94	139
South Fork	17.2	3/12, 3/20, 3/25, 3/28, 4/03, 4/29, 5/01, 5/15, 5/28	93	144
Robinson Fork	8.2	5/6	40	44
Asotin Creek				
Main Stem	10.5	3/21, 4/27, 5/21	64	189
North Fork	13.3	3/21, 4/27, 5/20, 5/21, 5/26	43	63
Charley Creek	10.6	4/24, 5/9	18	18
South Fork	12.1	3/21, 4/17, 5/13	31	33
Tucannon River				
Cummings Creek	10.6	5/3	36	36

We continue to provide standardized spawning ground survey estimates for summer steelhead in the Touchet River and Asotin Creek (Table 18 and 19). The estimated number of spawners (both hatchery and natural) within the indexed area of Asotin Creek (Figure 2) and the Touchet River (Figure 3) is also provided. However, we caution the reader about these estimates due to the

assumptions that have to be used regarding sex, females/redd ratios, and percent hatchery fish present that are the key elements to estimate the number of fish on the spawning grounds. In addition, we provide preliminary productivity estimates for Touchet steelhead based on the spawning ground estimates and age composition of returns collected at the Touchet adult trap (Figure 4). Stock recruitment curves (e.g.,Ricker, Beverton-Holt, Hockey Stick) for steelhead populations in the SE Washington are under development and will be presented in future reports.

Table 18. Standardized redd estimates and redds/kilometer within index reaches of Asotin Creek in southeast Washington, 1986-2013.

	Main stem		North Fork		South Fork		Charley Creek		Total
Year	redds	redds/km	redds	redds/km	redds	redds/km	redds	redds/km	redds
1986	223	10.8	295	22.2	173	14.3	77	7.3	768
1987	129	6.3	194	14.6	89	7.4	91	8.6	503
1988	56	2.7	141	10.6	87	7.2	48	4.5	332
1989	130	6.3	50	3.8	28	2.3	16	1.5	224
1990	134	6.5	43	3.2	33	2.7	21	2.0	231
1991	147	7.1	58	4.4	28	2.3	20	1.9	253
1992	49	2.4	56	4.2	30	2.5	40	3.8	175
1993	354	17.2	145	10.9	63	5.2	48	4.6	610
1994	70	3.4	50	3.8	18	1.5	15	1.4	153
1995	199	9.7	79	5.9	38	3.1	27	2.6	343
1996	231	11.2	73	5.5	63	5.2	32	3.0	399
1997	140	6.8	69	5.2	13	1.1	19	1.8	241
1998	153	7.4	55	4.1	38	3.1	18	1.7	264
1999	174	8.4	105	7.9	33	2.7	22	2.1	334
2000	120	5.8	71	5.3	46	3.8	24	2.3	261
2001	300	14.6	116	8.7	42	3.5	53	5.0	511
2002	241	11.7	131	9.8	40	3.3	36	3.4	448
2003	285	13.8	103	7.7	36	3.0	40	3.8	464
2004	281	13.6	89	6.7	5	0.4	53	5.0	428
2005	372	18.1	74	5.6	19	1.6	41	3.9	506
2006	254	12.3	62	4.7	32	2.6	32	3.0	380
2007	160	7.8	38	2.9	44	3.6	44	4.2	286
2008	160	7.8	35	2.6	32	2.6	9	0.8	236
2009	146	7.1	56	4.2	28	2.3	22	2.1	252
2010	384	18.6	148	11.1	79	6.5	54	5.1	665
2011	253	12.3	174	13.1	81	6.7	59	5.6	567
2012	274	13.3	134	10.1	65	5.4	51	4.8	524
2013	189	9.2	63	4.8	30	2.7	18	1.7	300

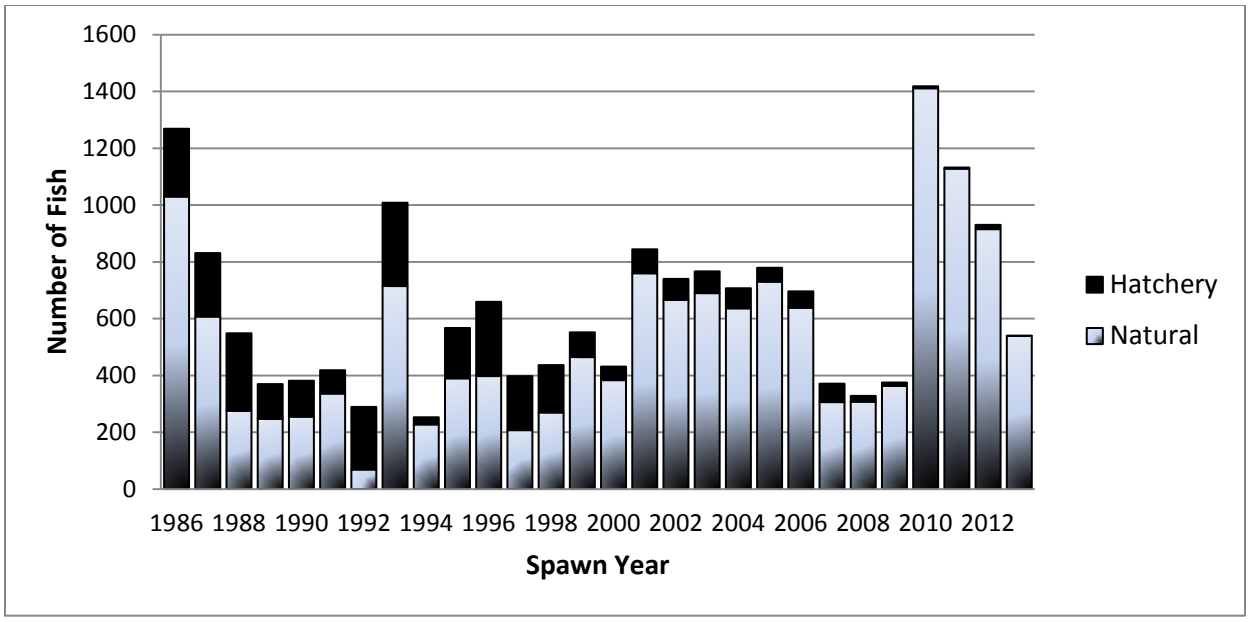


Figure 2. Estimated natural and hatchery origin summer steelhead on the spawning grounds within the Asotin Creek Spawning Ground Survey Index Area (Main stem, North Fork, South Fork, and Charley Creek; 1986-2013).

Table 19. Standardized redd estimates and redds/kilometer within index reaches of the Touchet River in southeast Washington, 1987-2013.

	North Fork		South Fork		Wolf Fork		Robinson Fork		Total
Year	redds	redds/km	redds	redds/km	redds	redds/km	redds	redds/km	redds
1987	99	5.2	147	5.5	100	5.7	34	3.8	380
1988	184	9.7	260	9.7	172	9.8	73	8.1	689
1989	65	3.4	71	2.7	42	2.4	20	2.3	198
1990	88	4.6	90	3.4	88	5.0	23	2.5	289
1991	66	3.5	61	2.3	72	4.1	14	1.6	213
1992	152	8.0	180	6.8	95	5.4	41	4.6	468
1993	65	3.4	107	4.0	36	2.1	20	2.2	228
1994	135	7.1	121	4.5	81	4.6	26	2.9	363
1995	98	4.6	116	4.3	83	4.8	17	1.9	314
1996	64	3.4	104	3.9	72	4.1	23	2.6	263
1997	56	2.9	39	1.4	65	3.7	16	1.8	176
1998	118	6.2	112	4.2	84	4.8	30	3.3	344
1999	82	4.3	131	4.9	49	2.8	19	2.1	281
2000	65	3.4	70	2.6	45	2.6	22	2.5	202
2001	55	2.9	84	3.1	57	3.3	17	1.9	213
2002	115	6.0	123	4.6	60	3.4	29	3.2	327
2003	160	8.4	125	4.7	100	5.7	37	4.1	422
2004	68	3.6	48	1.8	44	2.5	16	1.8	176
2005	116	6.1	94	3.5	91	5.2	28	3.1	329
2006	91	4.7	78	2.9	58	3.3	38	4.2	265
2007	160	8.4	133	5.0	97	5.5	32	3.5	422
2008	80	4.2	99	3.7	46	2.6	22	2.4	247
2009	88	4.6	102	3.8	56	3.2	25	2.8	271
2010	195	10.2	235	8.8	84	4.8	25	2.8	539
2011	140	7.4	146	5.5	88	5.0	34	3.8	408
2012	61	3.2	116	4.3	50	2.9	33	3.7	260
2013	174	9.1	144	5.4	139	8.0	44	4.9	501

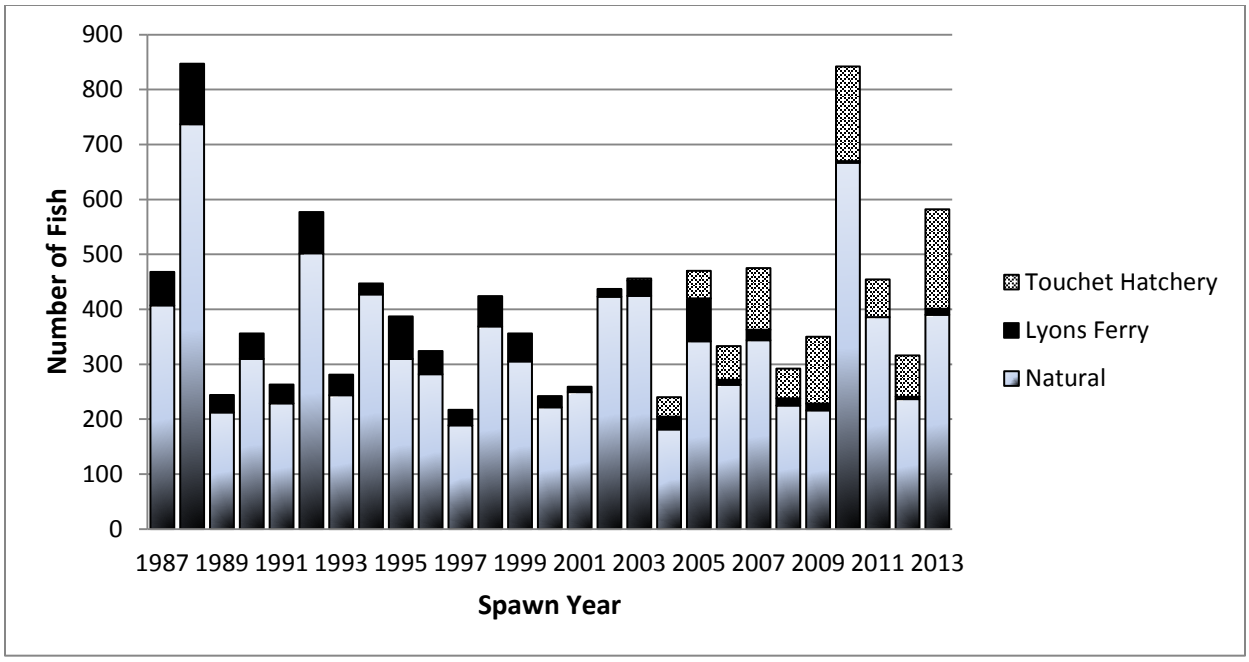


Figure 3. Estimated natural and hatchery origin summer steelhead on the spawning grounds within the Touchet River Index Area (1987-2013) (Areas include the North Fork, South Fork, Wolf Fork, and Robinson Fork).

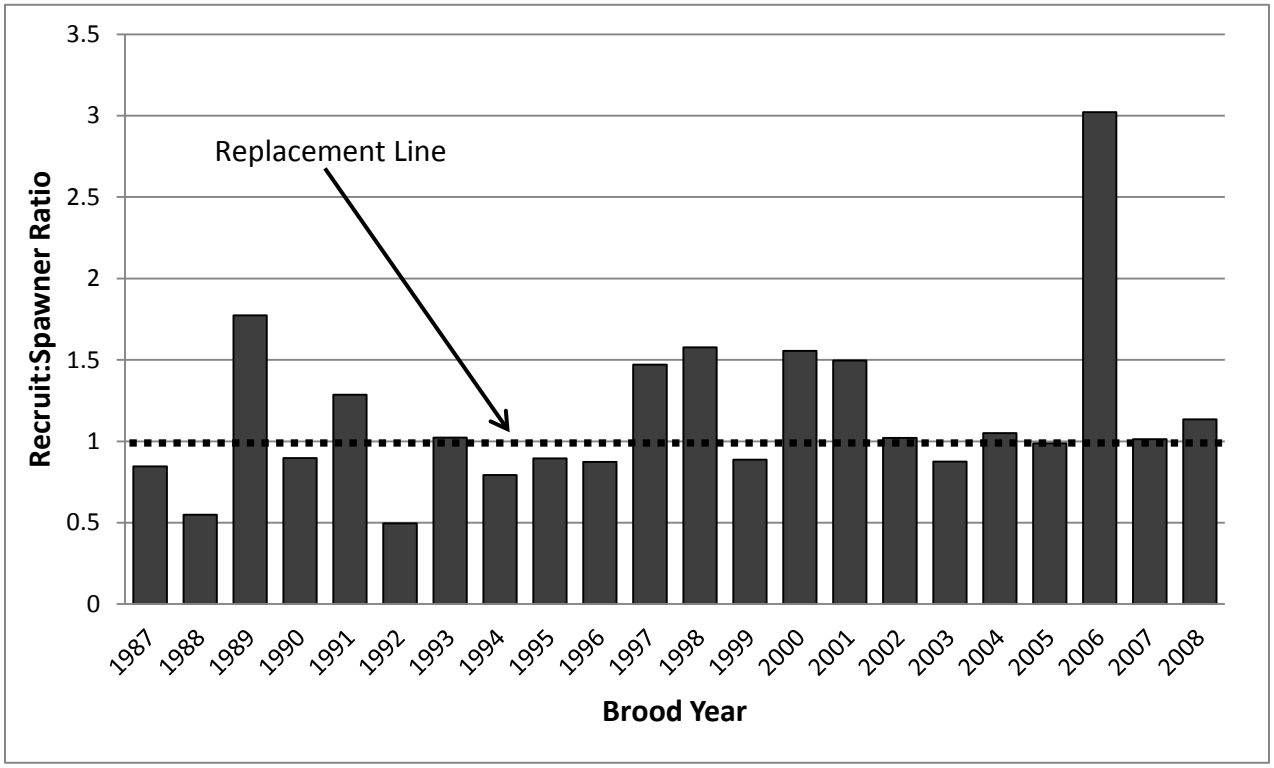


Figure 4. Estimates of recruits:spawner for Touchet River summer steelhead.

Tucannon River Natural Summer Steelhead Smolt Production, Adult Survival and Return Estimates

2012/2013 Smolt Outmigration: Snake River Lab evaluation staff operated a 1.5m rotary screw trap at rkm 3.0 on the Tucannon River between fall 2012 and spring 2013 to estimate the number of migrating natural steelhead smolts, other salmonids, and the presence of other resident species. Methods to estimate smolt production are described in Gallinat and Ross (2012). Outmigration estimates were based on the approach of Steinhorst et al. (2004), which involves using a Bailey-modified Lincoln-Peterson estimation with 95% bootstrap confidence intervals by running the Gauss Run-Time computer program (version 7.0). Bootstrap iterations numbered 1,000. The program allows for the division of the out-migration trapping season into strata with similar capture efficiencies as long as at least seven marked recaptures occurred. Strata with less than seven recaptures were grouped with either the preceding or following strata, depending upon similarity in trapping/flow conditions (Gallinat and Ross, 2012).

During the 2012/2013 trapping season we captured 3,022 natural steelhead, for an estimated 23,269 migrants (95% CI: 19,421 – 28,612) – Table 20. Age composition based on scale readings was 32.1% age-1, 59.5% age-2, 8.2% age-3, and 0.2% age-4, with age classes by length showing considerable overlap (Figure 5). Mean length, weight, and condition factor (K) for natural fish captured was 174.8 mm, 60.9 g, and 1.03, respectively. Production of age-3 smolts has remained relatively consistent over the years, while age-1 and age-2 have been highly variable (Table 21, Figure 6).

Table 20. Updated Tucannon River summer steelhead smolt emigration estimates, with upper and lower confidence intervals, and proportions of each age class.

Migration	Population estimate			Smolt age				Smolt age (%)			
year	N	Lower	Upper	age-1	age-2	age-3	age-4	age-1	age-2	age-3	age-4
1997/98	30,060	20,396	46,888	17,224	11,964	872	0	57.3	39.8	2.9	0.0
1998/99	17,990	14,628	22,381	6,674	10,470	846	0	37.1	58.2	4.7	0.0
1999/00	17,758	12,770	25,967	6,109	10,285	1,350	14	34.4	57.9	7.6	0.1
2000/01	22,636	17,384	31,097	10,141	11,696	792	7	44.8	51.7	3.5	0.0
2001/02	7,818	5,573	11,610	3,308	4,338	165	7	42.3	55.5	2.1	0.1
2002/03	16,688	13,615	21,219	8,311	7,610	768	0	49.8	45.6	4.6	0.0
2003/04	13,124	10,708	17,242	2,992	8,990	1,116	26	22.8	68.5	8.5	0.2
2004/05	15,812	11,347	24,786	3,210	9,329	3,257	16	20.3	59.0	20.6	0.1
2005/06	9,092	7,722	10,911	1,491	6,574	1,018	9	16.4	72.3	11.2	0.1
2006/07	11,500	9,683	13,837	1,392	9,620	483	6	12.1	83.7	4.2	0.1
2007/08	26,099	20,189	34,647	6,316	16,990	2,766	26	24.2	65.1	10.6	0.1
2008/09	9,033	7,120	11,638	3,830	4,833	361	9	42.4	53.5	4.0	0.1
2009/10	15,348	13,428	17,891	11,847	3,116	384	2	77.2	20.3	2.5	0.0
2010/11	27,288	23,352	31,880	9,332	17,219	737	0	34.2	63.1	2.7	0.0
2011/12	25,636	19,969	33,760	14,151	10,049	1,384	51	55.2	39.2	5.4	0.2
2012/13	23,269	19,421	28,612	7,469	13,845	1,908	47	32.1	59.5	8.2	0.2
Totals 97/98 to 12/13	*289,151*			*113,797*	*156,928*	*18,207*	*220*	*39.3%*	*54.3%*	*6.3%*	*0.1%*

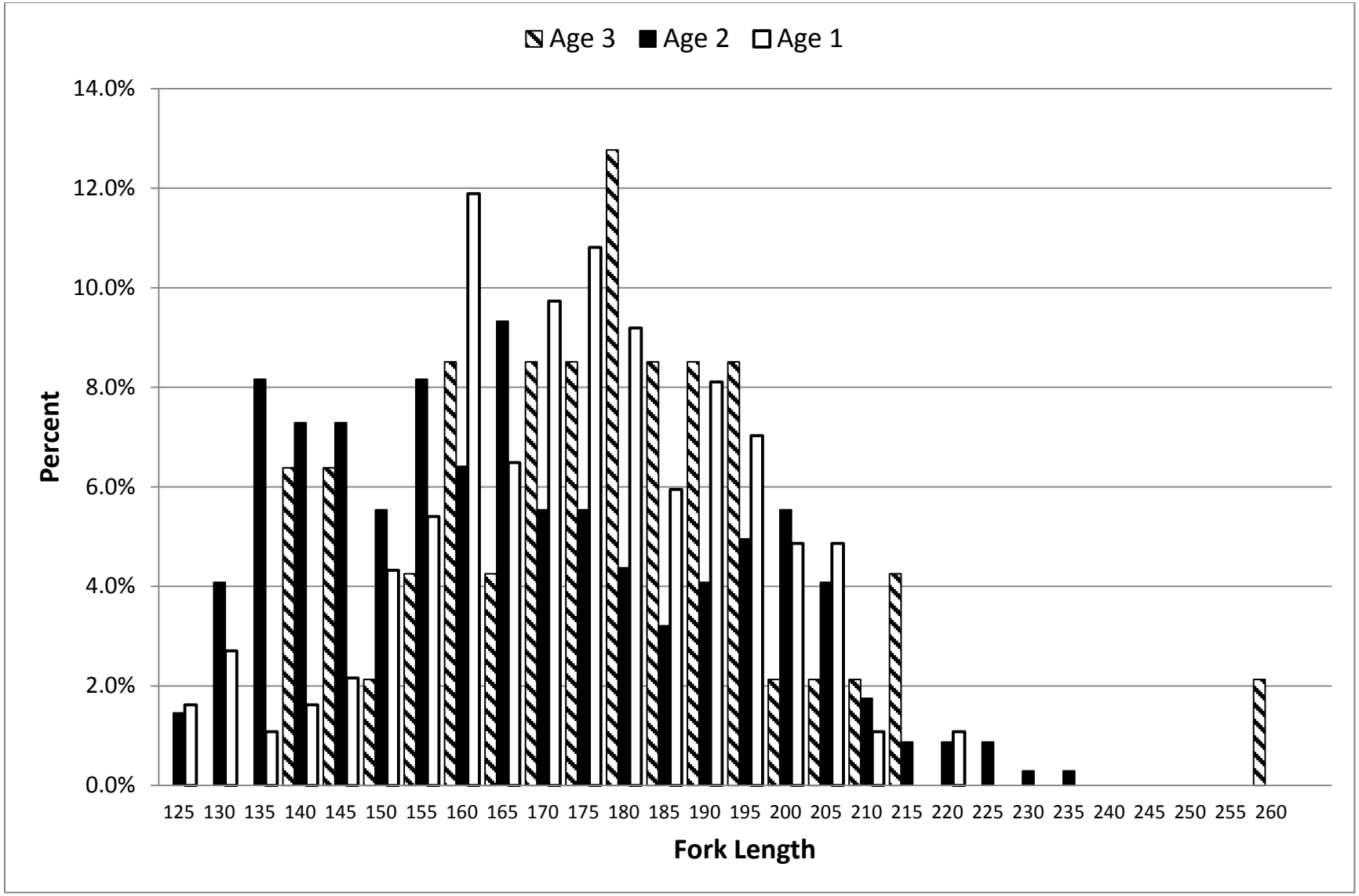


Figure 5. Summer steelhead migrants age distribution by fork length, October 2012 to June 2013 out-migration.

Table 21. Estimated migrant production, percent composition by age class, and mean length of natural-origin steelhead migrants from the Tucannon River by brood year (1995-2012).

Brood year	Age-1		Age-2		Age-3		Age-4		Total by brood year
	Number of migrants	%	Number of migrants	%	Number of migrants	%	Number of migrants	%	
1995	5,583	36.20	8,967	58.14	872	5.65	0	0.000	15,422
1996	6,069	32.12	11,964	63.33	846	4.48	14	0.001	18,893
1997	17,224	59.29	10,470	36.04	1,350	4.65	7	0.000	29,051
1998	6,674	37.58	10,285	57.92	792	4.46	7	0.000	17,758
1999	6,109	34.00	11,696	65.09	165	0.92	0	0.000	17,970
2000	10,141	66.40	4,338	28.40	768	5.03	26	0.002	15,273
2001	3,308	27.45	7,610	63.15	1,116	9.26	16	0.001	12,050
2002	8,311	40.41	8,990	43.71	3,257	15.84	9	0.000	20,567
2003	2,992	22.42	9,329	69.91	1,018	7.63	6	0.000	13,345
2004	3,210	31.19	6,574	63.87	483	4.69	26	0.003	10,293
2005	1,491	10.74	9,620	69.28	2,766	19.92	9	0.001	13,886
2006	1,392	7.43	16,990	90.64	361	1.93	2	0.000	18,745
2007	6,316	54.76	4,833	41.91	384	3.33	0	0.000	11,533
2008	3,830	49.52	3,116	40.29	737	9.53	51	0.007	7,734
2009	11,847	38.85	17,219	56.46	1,384	4.54	47	0.002	30,497
2010	9,332	43.83	10,049	47.20	1,908	8.96	---	---	21,289
2011	14,151	---	13,845	---	---	---	---	---	---
2012	7,469	---	---	---	---	---	---	---	---
Totals ('95-'10)	103,829	37.85	152,050	55.43	18,207	6.64	220	0.001	274,306

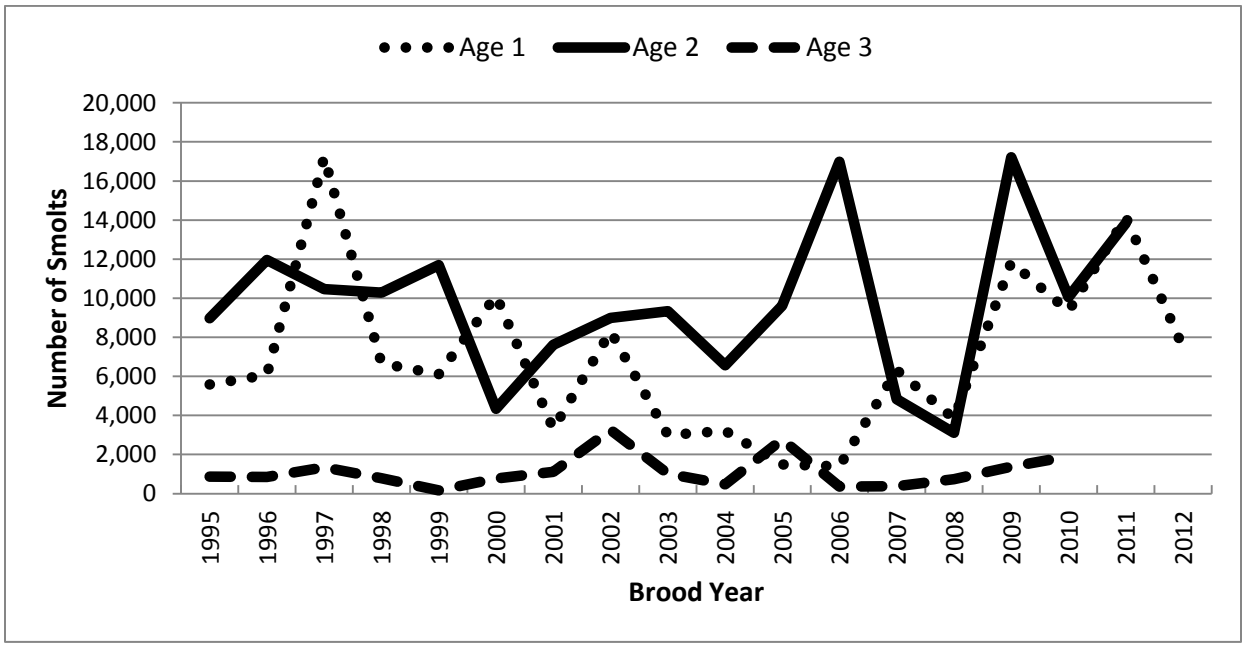


Figure 6. Migrant production by age class, 1995-2012 brood years.

We continue to PIT tag natural origin steelhead migrants from the Tucannon River smolt trap in an attempt to estimate 1) smolt-to-adult survival, 2) estimate adult returns through the use of a series of four PIT tag arrays in the Tucannon River Basin (operations and maintenance funded by Bonneville Power Administration projects 2010-042-00 and 2010-050-00), and 3) to document overshoot or "bypass" of steelhead to areas upstream of the Tucannon River. Average smolt-to-adult survival of natural origin summer steelhead from the Tucannon River (based on PIT tags) is 2.3% back to Bonneville Dam and 1.7% to the LSRCP project area measured at Ice Harbor Dam, and 0.6% to the Tucannon River (Table 22). The discrepancy in survival from Ice Harbor to the Tucannon River will be discussed in the next section (Adult Migratory Behavior).

Table 22. Estimated smolt-to-adult survival rate of naturally produced summer steelhead smolts from the Tucannon River based on adult PIT tag detections at Bonneville Dam, Ice Harbor Dam, and in the Tucannon River 1999-2010 migration years. Data shown is for smolts tagged at 125 mm or greater in length. The Tucannon PIT tag array was not operational until 2005.

Migration year	Number PIT tagged	Number detected at Bonneville Dam	Survival (%)	Number detected at Ice Harbor Dam	Survival (%)	Number detected in Tucannon River	Survival (%)
1999	363	6	1.7	5	1.4	NA	NA
2000	555	20	3.6	15	2.7	NA	NA
2002	1,508	39	2.6	31	2.1	NA	NA
2003	2150	35	1.6	28	1.3	NA	NA
2004	1,983	31	1.6	17	0.9	7	0.4
2005	1,834	27	1.5	20	1.1	10	0.5
2006	1,416	33	2.3	17	1.2	4	0.3
2007	301	8	2.7	5	1.7	1	0.3
2008	1,087	68	6.3	54	5.0	20	1.8
2009	1,193	35	2.9	26	2.2	15	1.3
2010	2,614	81	3.1	64	2.4	34	1.3
2011	2,942	28	1.0	17	0.6	8	0.3
Average			**2.3**		**1.7**		**0.6**

As mentioned above, WDFW has partnered with BPA, in addition to LSRCP, to better determine the escapement of summer steelhead into the Tucannon River. Through the combination of smolt trapping, PIT tagging, and installation of four PIT tag arrays in the Tucannon River, estimates of adult escapement are more readily derived, compared to previous attempts using index spawning ground surveys. Estimates of natural, hatchery endemic and LFH stock origin (Tucannon River releases only), and other hatchery and natural origin returns to the Tucannon River are presented for the last six run years (Table 23). Estimates of the number of spawners (those remaining after harvest has occurred) have also been calculated. Estimates provided in Table 23 represent actual fish detected by the arrays, which have not been adjusted for array efficiency at this time, so the actual number in all groups will be higher. Preliminary efficiency estimates at the Lower Tucannon Array for summer steelhead from 2005 to 2012 are 82%, 79%,

88%, 90%, 97%, 86%, 90%, and 92%, respectively. Estimates of escapement for all steelhead will be adjusted for array efficiency in the next annual report. For Tucannon natural origin steelhead, we used the point estimate from the smolt trap estimates (Table 7) to expand detected PIT tags for the total return to the river.

Table 23. Estimated summer steelhead returns for the 2007-2012 run years (RY) into the Tucannon River based on PIT tag detections. Spawning escapement assumes no pre-spawn mortality due to incidental hooking in the fishery, or other factors. PIT array efficiencies have not been taken into account.

Stock	RY 2007	RY 2008	RY 2009	RY 2010	RY 2011	RY 2012	Average return
Tucannon River Natural Stock	79	73	375	224	127	159	173
Other Natural Stocks [A]	36	48	162	145	147	30	95
Tucannon River Hatchery Endemic Stock	230	416	748	216	306	295	369
Touchet River Hatchery Endemic Stock	23	35	73	12	42	39	37
LFH Stock (Tucannon River release)	1,119	1,061	1,015	602	929	210	823
Other LFH Hatchery Stocks (Dayton AP, Walla Walla River, LFH On-station Releases)	525	390	910	124	703	307	493
Other Hatchery Stock (Upper Snake Releases)	200	200	150	352	100	0	167
Total Return to Tucannon River	2,212	2,223	3,433	1,675	2,354	1,040	2,156
Total Natural Origin (all stocks)	115	121	537	369	274	189	268
Total Unclipped Hatchery Origin	253	451	821	228	348	334	406
Total Clipped Hatchery Origin	1,844	1,651	2,075	1,078	1,732	517	1,483
Total Harvest (Catch Record Cards) Should Represent only Clipped Fish	751	1,228	1,260	1,265	1,650	1,050	1,200
Spawning Escapement							
Total Natural Origin (all stocks)	115	121	537	369	274	189	268
Total Unclipped Hatchery Origin	253	451	821	228	348	334	406
Total Clipped Hatchery Origin	1,093	423	815	-187	82	-533	282
% Hatchery Origin on Spawning Grounds [B]	92.1%	87.8%	75.3%	38.2%	61.1%	63.9%	64.0%

[A] Other natural stocks detected are from the Walla Walla River, Umatilla, Deschutes River, John Day River, etc…

[B] Calculations are based on the number of hatchery fish to the total. In the cases where the number of clipped hatchery fish are less than zero, only the number of unclipped hatchery fish are used.

The average natural origin return (Tucannon River stock) for the last six run years was 173 fish. This estimate is 112 fish below the critical minimum abundance threshold (MAT) of natural-origin adults (285 spawners) described in WDFW's Fishery Management Evaluation Plan (FMEP). However, other small tributaries along the Snake River, but proximal to the Tucannon River, are also considered part of the Tucannon population at this time (Trump et al. 2013). If their abundance were added to the Tucannon River estimates, the population would be near or above the MAT.

Adult Migratory Patterns Based on PIT tags

PIT tag detectors in the adult ladders of the Columbia and Snake River dams have been in place for a number of years. In-stream tributary detectors (PIT tag arrays) are becoming more common and have provided more information on escapement and distribution of returning adult summer steelhead into the tributaries. WDFW continues to monitor the general distribution of adult hatchery and natural origin summer steelhead from the Tucannon River, which as shown in previous reports, migrate past the Tucannon River and may remain upstream of Lower Granite Dam (Table 24). As of 2014, PIT detectors have now been installed in the ladders of Lower Monumental and Little Goose dams which should provide additional data on steelhead movements within the Snake River, and may provide more answers as to why the Tucannon River steelhead are overshooting the Tucannon River.

Similar to the groups of steelhead from the Tucannon River, we see natural and hatchery origin summer steelhead within the Walla Walla River Basin overshoot, and may remain above Ice Harbor Dam in the Snake River (Table 25). Other Columbia Basin researchers have documented the same overshoot issue with steelhead from the John Day and Umatilla rivers. Many of the overshoot steelhead from the middle Columbia River populations end up in the Snake River as well, with some straying (and we presume spawning based on their entry timing in early spring) in the Tucannon River. The WDFW will continue to monitor this overshoot behavior and assess potential impacts to other steelhead populations.

Two other LFC hatchery steelhead releases (LFH stock in the Snake River at LFH, and Cottonwood AP in the Grande Ronde) have also been PIT tagged in more recent years. Releases of steelhead from LFH show a similar, but slightly lower, rate of overshoot as fish from the Tucannon River. Summer steelhead released from Cottonwood AP show a high rate of conversion from Ice Harbor to Lower Granite Dam as expected, since they are destined for the Grande Ronde River (Table 26). Steehead from Cottonwood may exhibit this overshoot behavior once they get above Lower Granite Dam, but the lack of PIT tag arrays in many of the larger river basins upstream of Lower Granite Dam (Clearwater, Salmon, Grande Ronde) do not allow a similar analysis at this time.

Table 24. Detections of PIT tagged Tucannon endemic stock, Tucannon natural stock, and LFH stock summer steelhead released into the Tucannon River that passed Bonneville Dam (Bonn), Ice Harbor Dam (IHR) and Lower Granite Dam (LGR), and the percent of those that did or didn't make it back to the Tucannon River.

									Fish that passed Bonn	Fish that passed IHR		
Run year	Number detected at Bonn	Number detected at IHR	Number detected at LGR	Number that initially entered Tucannon River	Unknown location	Number that returned to Tucannon from LGR	Fallback rate (%) to Tucannon River from LGR	Total detected in Tucannon River [a]	Into Tucannon River (%)	Into Tucannon River (%)	Remain above LGR (%)	Between IHR and LGR (%)
Tucannon Hatchery Endemic Stock												
2005	46	32	24	5	3	4	16.7	9	19.6	28.1%	62.5%	9.4%
2006	79	58	35	19	5	6	17.1	25	31.6	43.1%	48.3%	8.6%
2007	123	74	51	17	6	15	29.4	32	26.0	43.2%	48.6%	8.1%
2008[a]	172	118	79	16	16	16	20.3	32	18.6	27.1%	59.3%	13.6%
2009	453	333	215	94	25	49	22.8	143	31.6	42.9%	49.5%	7.5%
2010	144	115	72	29	16	14	19.4	43	29.9	37.4%	48.7%	13.9%
2011	48	39	30	20	1	7	23.3	27	56.3	69.2%	28.2%	2.6%
2012	70	52	38	26	3	9	23.7	35	50.0	67.3%	26.9%	5.8%
Totals	**1,135**	**821**	**544**	**236**	**86**	**110**	**20.2**	**346**	**30.5**	**42.1%**	**48.7%**	**9.1%**
Tucannon Natural Stock												
2005	38	24	13	5	6	3	23.1	8	21.1	33.3%	41.7%	25.0%
2006	24	16	13	3	0	1	7.7	4	16.7	25.0%	75.0%	0.0%
2007	39	24	12	8	3	2	16.7	10	25.6	41.7%	45.8%	12.5%
2008[a]	17	11	5	5	1	0	0.0	5	29.4	45.5%	45.5%	9.1%
2009	49	39	26	10	4	5	19.2	15	30.6	38.5%	51.3%	10.3%
2010	45	35	18	11	6	3	16.7	14	31.1	40.0%	42.9%	17.1%
2011	52	39	24	12	7	7	29.2	19	36.5	48.7%	33.3%	17.9%
2012	54	43	26	17	1	8	30.8	25	46.3	58.1%	39.5%	2.3%
Totals	**318**	**231**	**137**	**71**	**28**	**29**	**21.2**	**100**	**31.4**	**43.3%**	**44.6%**	**12.1%**
Lyons Ferry Stock Released into the Tucannon River												
2007	427	295	203	50	45	41	20.2	91	21.3	30.8%	53.9%	15.3%
2008[a]	250	192	98	68	32	19	19.4	77	30.8	40.1%	43.2%	16.7%
2009	179	132	90	17	26	20	22.2	37	20.7	28.0%	52.3%	19.7%
2010	124	96	69	7	26	13	18.8	20	16.1	20.8%	52.1%	27.1%
2011	121	101	48	19	40	12	25.0	31	25.6	30.7%	29.7%	39.6%
2012	19	16	9	4	4	3	33.3	7	36.8	43.8%	31.3%	25.0%
Totals	**1,120**	**832**	**517**	**165**	**173**	**108**	**20.9**	**264**	**23.6**	**31.7%**	**47.5%**	**20.8%**

[a] The Tucannon River PIT tag array was taken out by high stream flow in January, 2009 (2008 Run Year). Estimates of fish back to Tucannon were adjusted upwards based on average spring time entries (65% for natural and endemic stock, and 30% for LFH stock).

Table 25. Detections of PIT tagged Touchet River endemic stock, Touchet River natural stock, and LFH stock summer steelhead (Walla Walla and Dayton AP release groups) that crossed Bonnville Dam (Bonn) McNary Dam (MCN), Ice Harbor Dam (IHR), and Lower Granite Dam (LGR), and the percent of those that did or didn't make it back to the Walla Walla River basin.

Run Year	Number detected at Bonn	Number detected at MCN	Number detected in Walla Walla Basin	Number that stayed above IHR	Number that stayed above LGR	Number that stayed in Tucannon River [a]	Fish that passed Bonn	Fish that passed MCN [b]			
							Into Walla Walla River (%)	Into Walla Walla (%)	Above IHR (%)	Above LGR (%)	Into Tucannon River (%)
Touchet Hatchery Endemic Stock											
2005	33	29	1	11	0	8	3.0%	3.4	37.9	0.0	27.6
2006	32	26	10	12	1	7	31.3%	38.5	46.2	3.8	26.9
2007	25	17	5	9	1	4	20.0%	29.4	52.9	5.9	23.5
2008	76	59	20	24	6	1	26.3%	32.8	41.4	10.3	1.7
2009	96	73	27	34	8	12	28.1%	37.0	41.1	9.6	16.4
2010	52	47	12	24	8	2	23.1%	25.5	53.2	14.9	4.3
2011	60	49	27	13	0	8	45.0%	55.1	26.5	0.0	16.3
2012	52	40	32	6	1	3	61.5%	72.7	13.6	2.3	6.8
Totals	**426**	**340**	**134**	**133**	**25**	**45**	**31.5%**	**39.4**	**39.1**	**7.4**	**13.2**
Touchet Natural Stock											
2009	13	10	6	2	2	0	46.2%	60.0	20.0	20.0	0.0
2010	27	19	3	7	2	0	11.1%	15.8	36.8	10.5	0.0
2011	21	13	6	5	0	1	28.6%	46.2	38.5	0.0	7.7
2012	27	20	18	1	0	1	66.7%	90.0	5.0	0.0	5.0
Totals	**88**	**62**	**33**	**15**	**4**	**2**	**37.5%**	**53.2**	**24.2**	**6.5**	**3.2**
Lyons Ferry Stock Released at Dayton Acclimation Pond											
2008	121	95	11	73	24	10	9.1%	11.6	78.6	25.3	10.5
2009	200	149	19	123	44	22	9.5%	12.8	82.6	29.5	14.8
2010	97	80	16	48	12	2	16.5%	20.0	60.0	15.0	2.5
2011	103	79	10	64	16	12	9.7%	12.7	81.0	20.3	15.2
2012	39	31	4	20	6	4	10.3%	12.9	64.5	19.4	12.9
Totals	**560**	**434**	**60**	**328**	**102**	**50**	**10.7%**	**13.8**	**75.6**	**23.5**	**11.5**
Lyons Ferry Stock Released into the Walla Walla River											
2008	90	76	1	65	25	2	1.1%	1.3	85.5	32.9	2.6
2009	107	81	11	61	11	11	10.3%	13.6	75.3	13.6	13.6
2010	78	64	14	47	16	3	17.9%	21.9	73.4	25.0	4.7
2011	105	87	7	70	12	6	6.7%	8.0	80.5	13.8	6.9
2012	31	29	6	21	5	6	19.4%	20.7	72.4	17.2	20.7
Totals	**411**	**337**	**39**	**264**	**69**	**28**	**9.5%**	**11.6**	**78.3**	**20.5**	**8.3**

[a] The Tucannon River PIT tag array was taken out by high stream flow in January, 2009. Two salt returns from the 2006 migration year, and 1-salt returns from the 2007 migration year, that entered the Tucannon River after the array was destroyed could not be added to the table.

[b] Not all fish that crossed McNary Dam are shown in the table, a few were also detected at Priest Rapids Dam, Rock Island Dam, Rocky Reach Dam, and Wells Dam in the upper Columbia River.

Table 26. Detections of PIT tagged Lyons Ferry stock (released at Lyons Ferry) or Wallowa stock (released in the Grande Ronde at Cottonwood Acclimation Pond) that passed Bonneville Dam (Bonn), Ice Harbor Dam (IHR) and Lower Granite Dam (LGR), and the percent of those that were observed in the Tucannon River, remained between IHR and LGR, or remained above LGR.

					Fish that passed IHR		
Run year	Number detected at Bonn	Number detected at IHR	Number detected at LGR	Total detected in Tucannon River [a]	Into Tucannon River (%)	Remain above LGR (%)	Between IHR and LGR (%)
Lyons Ferry Stock Released at Lyons Ferry Hatchery							
2009	76	57	25	5	8.8	31.6	59.6
2010	52	41	20	1	2.4	34.1	63.5
2011	60	48	18	5	10.4	22.9	66.7
2012	42	34	16	4	11.8	35.3	52.9
Totals	**230**	**180**	**79**	**15**	**8.3**	**30.6**	**61.1**
Wallowa Stock Released at Cottonwood AP							
2009	242	174	168	2	1.1	96.6	2.3
2010	117	85	82	0	0.0	96.5	3.5
2011	175	137	129	0	0.0	94.2	5.8
2012	98	63	58	1	1.6	92.1	6.3
Totals	**632**	**459**	**437**	**3**	**0.7**	**95.2**	**4.1**

Smolt-to-Adult Survival Rates

Over nearly all years, coded-wire tag recoveries from fisheries, hatcheries, or from in river traps have provided the basic data to estimate smolt-to-adult return rates on LFH and Wallowa stock summer steelhead from the program. These estimates are considered a minimum because there is no available adjustment to account for fish that escape to the spawning grounds. Under the original program design, the size of the steelhead programs were based on an assumed smolt-to-adult survival rate of 0.5% to the LSRCP project area, and an assumed 2:1 lower river to upper river (project area) harvest ratio.

In 2012, WDFW and the other LSRCP cooperators conducted a hatchery summer steelhead program review. To prepare for the review, WDFW re-compiled all past CWT recoveries and updated all smolt-to-adult survival estimates previously reported. The following CWT recovery data (Table 27) demonstrate the success of both the LFH and Wallowa stock summer steelhead programs, as compared to the original survival rate and adult return goals.

With initiation of the endemic stock programs on the Touchet and Tucannon Rivers, reductions were made in the LFH stock releases beginning with the 2001 release (in agreement with the co-managers). Further analysis of the CWT data prompted additional reductions that began for the 2003 brood year. Depending on the group, smolt-to-adult return rates since the 2000 brood have been slightly higher, the same, or lower than the long-term average, but are still well above the original assumed LSRCP rate of 0.5%.

In addition to the CWT data, WDFW began PIT tagging standard mitigation production groups (LFH and Wallowa stocks) for estimating total adult returns back to the project area. This was done because we know that some proportion of the fish that return as adults escape the fisheries and return to the spawning grounds. Generally, estimates based on PIT tags have been higher than those estimated by CWTs (Table 27).

Smolt-to-adult survivals (based on PIT tags) to Bonneville Dam for the LFH stock (Tucannon and Touchet river releases) and Tucannon and Touchet river endemic stocks are provided below (Figures 8 and 9). For the 2006-2011 migration years (excluding 2009 as there was no production for the Tucannon endemic stock in that year, and the last release of the LFH stock into the Tucannon was in 2010), Tucannon endemic stock survivals were on average 54% of the LFH stock. In the Touchet River (2007-2011 migration years), the endemic stock survivals were 24% of the LFH stock. While both endemic stocks have not performed to the same level as the LFH stock, these comparisons have been useful in allowing managers to compare the programs and make decisions about expanding them for mitigation purposes. As such, in 2010, WDFW and the co-managers decided to implement Tucannon stock, and eliminate the use of LFH stock

steelhead in the Tucannon River. Due to the poor survivals to data, the Touchet hatchery endemic stock program has not been implemented at this time.

Table 27. Smolt-to-adult return (SAR) survival of LFH stock (LFH, Tucannon, Touchet, and Walla Walla release groups) or Wallowa stock (Grande Ronde release group) summer steelhead back to the lower Snake River project area.

	LFH [a]		Tucannon		Dayton AP		Walla Walla [a]		Grande Ronde [a]	
Brood Year	CWT	PIT	CWT	PIT	CWT	PIT	CWT	PIT	CWT	PIT
1982	1.20		1.48		1.72		1.57		0.83	
1983	1.11		1.23		1.33		1.16		1.27	
1984	2.13		0.65		2.94		2.73		1.93	
1985	1.56		0.62		1.79		1.66		1.58	
1986	2.53		0.96		3.04		2.82		1.50	
1987	2.04		0.98		1.64		1.39		2.13	
1988	1.06		0.75		1.41		1.19		1.10	
1989	1.26		1.55		0.97		0.54		1.31	
1990	1.59		1.05		2.22		1.88		1.82	
1991	0.43		0.35		0.96		0.81		0.49	
1992	1.06		1.38		2.29		1.53		1.21	
1993	1.71		0.80		3.15		2.66		1.69	
1994	3.62		2.04		4.85		3.37		3.77	
1995	1.19		0.60		1.50		1.26		1.24	
1996	0.53		0.53		0.91		0.77		0.44	
1997	1.47		2.07		2.52		2.13		1.00	
1998	1.39		1.70		1.47		1.36		2.03	
1999	3.72		3.17		4.00		3.37		4.01	
2000	1.38		1.32		1.00		1.35		2.21	
2001	1.53		1.90		1.73		1.56		1.82	
2002	1.91		1.81		1.73		2.18		1.73	
2003	1.31		1.21		1.55		1.30		2.19	
2004	1.67		1.50		1.43		1.10		1.14	
2005	2.33		2.57	3.40	2.17		1.85		3.31	
2006	2.11		2.49	3.46	1.70	1.96	1.58	1.50	2.96	
2007	2.25	4.53	2.52	3.46	3.14	3.74	1.71	1.86	5.22	5.23
2008	1.35	2.20	1.47	2.63	1.56	1.37	1.25	1.51	1.54	1.50
2009	2.27	2.60	2.81	2.86	2.29	1.97	2.22	2.20	2.96	2.25
Mean (All CWT Years)	**1.70%**		**1.48%**		**2.04%**		**1.73%**		**1.94%**	
Mean (CWT, PIT Years)	**1.96%**	**3.11%**	**2.37%**	**3.16%**	**2.17%**	**2.26%**	**1.69%**	**1.77%**	**3.24%**	**2.99%**

[a] The LFH group includes releases of fish in other locations of the Snake River and Asotin Creek, the Walla Walla group includes releases of fish in Mill Creek, and the Grande Ronde include releases of fish from Wildcat Creek in Oregon.

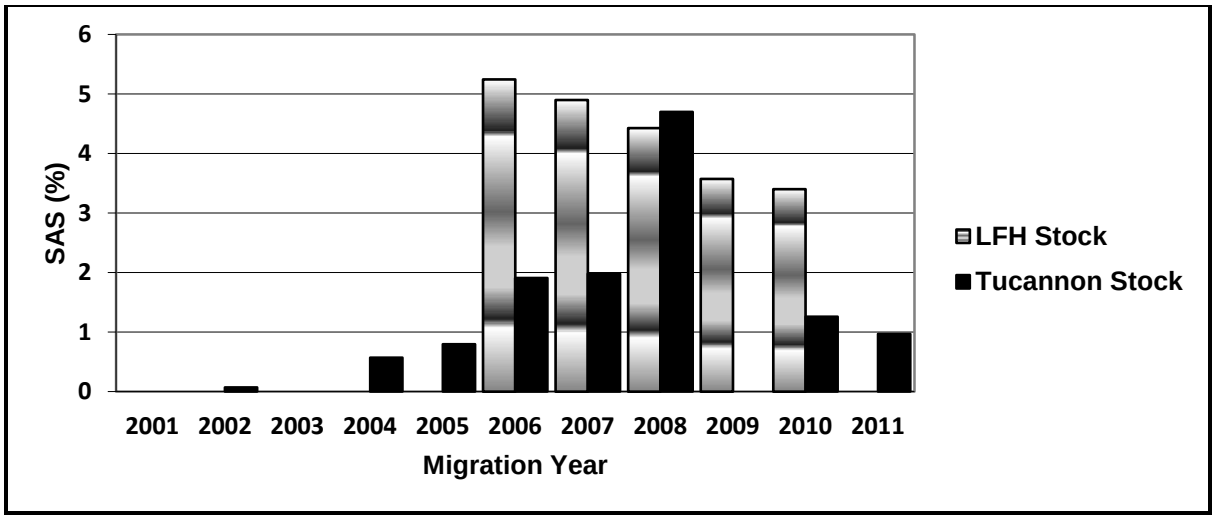


Figure 7. Smolt-to-adult survival (SAS) estimates (to Bonneville Dam) of LFH or Tucannon River endemic stock steelhead, 2001-2011 migration years based on PIT tag detections.

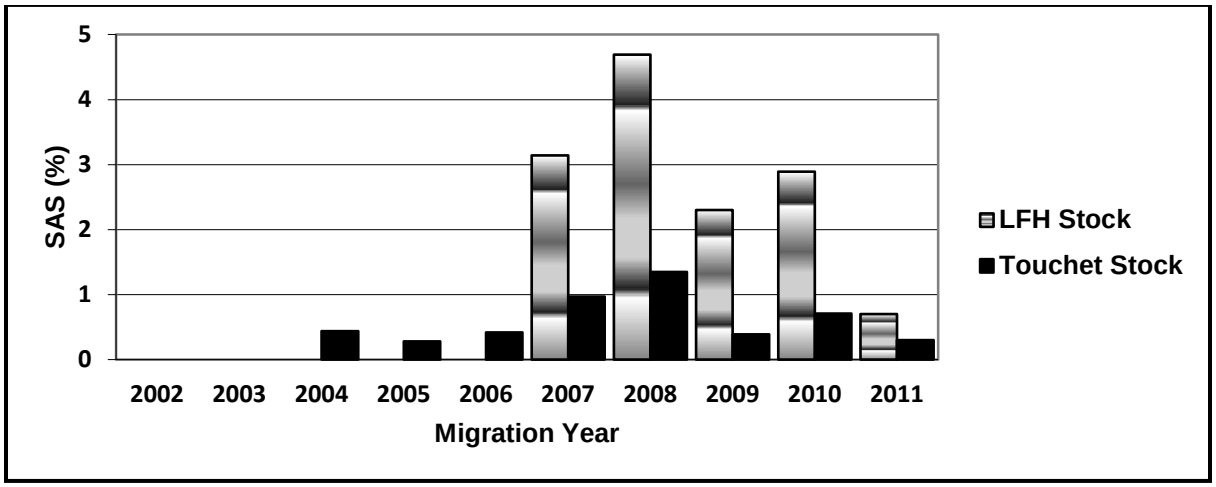


Figure 8. Smolt-to-adult survival (SAS) estimates (to Bonneville Dam) of LFH or Touchet River endemic stock steelhead, 2002-2011 migration years based on PIT tag detections.

Contributions to LSRCP Mitigation Goals

The LFC summer steelhead harvest mitigation programs (LFH and Wallowa stock only) continues to meet and/or exceed its original adult return mitigation goals by supplying large returns of hatchery steelhead for harvest to the Snake River Project area (including the Walla Walla Basin). This is to: 1) the fact that fishery harvest rates in the lower Columbia River fisheries have declined substantially since the program was initiated; which assumed a 2:1 lower river to project area fishery economic benefit harvest ratio, and 2) that smolt-to-adult survivals are about three times higher than originally expected. Hence the same, and sometimes even more adult steelhead are returning to the project area even though hatchery production has been

reduced in recent years (beginning with the 2002 release year). Based on total CWT recoveries (fisheries and adult traps) and other information, we estimate that a minimum of 7,942 (3,155 goal) LFH stock and 3,891 (1,501 goal) Wallowa stock fish returned to the Snake River project area in the 2011 run year (Table 28), representing 251.7% and 259.2% of the project area goal for each stock, respectively. Further the WDFW returns for the 2011 run year represent 21.5% of the entire LSRCP mitigation goal for summer steelhead, even though WDFW accounts for only about 10% of the overall juvenile steelhead production under the LSRCP program. Since program inception (1982), both stocks combined have averaged 280% of the WDFW mitigation goal to the project area (Table 28). Adult returns such as these suggest 1) that the most appropriate immediate action would be further reductions in summer steelhead production so the numbers of hatchery fish returning are closer to project area goals, or 2) promote ways to increase the downriver harvest (commercial, sport, or tribal) to remove these fish prior to returning to the project area. Increasing downriver harvest seems unlikely given the status of ESA listed populations within the Columbia and Snake river basins, and the current limitations imposed on downriver fisheries to protect these ESA listed populations.

As previously mentioned, the original mitigation goal assumed a 2:1 downriver to project area harvest rate; therefore, the total downriver and project area mitigation goal is 9,465 and 4,503 adult steelhead for the LFH and Wallowa stocks, respectively. For the 2011 run year, we estimated that a minimum of 9,967 LFH stock (105.3% of goal) and 4,895 Wallowa stock (108.7% of goal) fish returned as adults (Table 29). Since program inception, the LFH stock has averaged almost 111% of the total mitigation goal, and the Wallowa stock has averaged nearly 114% of the total mitigation goal. The percent of the total mitigation goal in the last ten run years (2002-2011 – following program smolt reductions) has averaged 81% and 108% for the LFH and Wallowa stocks, respectively (Table 29).

While the downriver goals are not generally being met at this time (see past ten years), project area goals are being exceeded by nearly 2-3 times (Figure 10). Given the ESA environment, and knowing that not all hatchery fish can be removed at traps, or within local fisheries, discussions should occur with the managers about reducing current production levels of the current Wallowa stock program to lessen potential impacts to natural populations. In addition, WDFW should begin, or use the data on hand, to quantify impacts to natural populations from these hatchery programs (i.e. pHOS – proportion of hatchery origin spawners on the spawning grounds), as well as other Hatchery Scientific Review Group (HSRG) guidelines.

Table 28. Contribution of LFH stock (LFH, Tucannon, Touchet, and Walla Walla release groups) or Wallowa stock (Grande Ronde release group) summer steelhead back to the lower Snake River project area.

Run year (Goal)	LFH [a] (630)	Tucannon (875)	Touchet (750)	Walla Walla [a] (900)	Grande Ronde [a] (1,501)	Total (4,656)	Percent of goal
1984	1,013	1,233	736	1,054	424	4,460	95.8%
1985	1,553	1,836	1,439	1,671	3,261	9,760	209.6%
1986	3,771	1,495	4,076	3,838	6,161	19,341	415.4%
1987	2,786	770	2,303	2,149	2,645	10,653	228.8%
1988	5,047	1,571	3,754	3,729	2,781	16,882	362.6%
1989	4,378	2,353	4,070	4,345	6,011	21,157	454.4%
1990	1,494	1,234	2,013	1,789	3,363	9,893	212.5%
1991	2,038	1,506	2,346	1,155	2,476	9,521	204.5%
1992	2,107	2,160	2,511	3,038	5,304	15,120	324.7%
1993	548	1,217	2,055	2,123	2,835	8,778	188.5%
1994	2,199	978	1,517	913	3,414	9,021	193.8%
1995	4,468	1,594	4,752	4,923	4,844	20,581	442.0%
1996	3,003	2,112	4,287	5,188	9,222	23,812	511.4%
1997	2,201	1,834	3,737	3,270	4,938	15,980	343.2%
1998	701	744	1,379	1,560	1,844	6,228	133.8%
1999	1,099	2,531	2,524	2,983	1,591	10,728	230.4%
2000	1,210	2,822	1,994	2,529	4,681	13,236	284.3%
2001	2,418	5,240	4,949	5,825	11,450	29,882	641.8%
2002	778	1,894	1,620	1,937	5,659	11,888	255.3%
2003	937	1,740	1,709	1,261	3,443	9,090	195.2%
2004	1,229	2,839	2,011	2,418	3,279	11,776	252.9%
2005	838	1,067	1,073	909	4,509	8,396	180.3%
2006	1,167	1,282	1,734	1,380	1,578	7,141	153.4%
2007	1,330	2,693	1,776	1,764	4,504	12,067	259.2%
2008	1,250	2,374	1,268	1,542	5,185	11,619	249.5%
2009	1,378	2,592	2,553	1,684	9,335	17,550	376.9%
2010	858	1,652	1,630	1,469	1935	8,125	174.5%
2011	1,573	2,624	1,693	2,052	3,891	11,833	254.2%
Average	***1,906***	***1,928***	***2,411***	***2,446***	***4,306***	***13,019***	***279.6%***
% of Goal (all years)	**302.6%**	**220.4%**	**321.5%**	**271.8%**	**286.9%**	**279.6%**	
% of Goal last 10 years	**180.0%**	**237.2%**	**227.6%**	**182.4%**	**288.6%**	**235.1%**	

[a] The LFH group includes releases of fish in other locations of the Snake River and Asotin Creek, the Walla Walla group includes releases of fish in Mill Creek, and the Grande Ronde include releases of fish from Wildcat Creek in Oregon.

Table 29. Contribution of LFH stock (LFH, Tucannon, Touchet, Walla Walla release groups) or Wallowa stock (Grande Ronde release group) summer steelhead back to the Columbia River.

Run rear (Goal)	LFH [a] (1,890)	Tucannon (2,625)	Touchet (2,250)	Walla Walla [a] (2,700)	Grande Ronde [a] (4,503)	Total (13,968)	Percent of goal
1984	1,547	1,447	882	919	741	5,536	39.6%
1985	2,247	2,272	1,853	1,852	4,310	12,534	89.7%
1986	4,955	2,009	5,363	5,042	8,076	25,445	182.2%
1987	4,309	1,076	3,420	3,213	4,286	16,304	116.7%
1988	7,462	2,025	5,296	5,321	4,991	25,095	179.7%
1989	5,648	2,858	5,313	5,873	8,105	27,797	199.0%
1990	1,830	1,466	2,676	2,430	4,152	12,554	89.9%
1991	2,603	1,820	2,900	1,532	3,067	11,922	85.4%
1992	3,223	2,908	3,748	4,159	6,564	20,602	147.5%
1993	692	1,460	2,560	2,834	3,444	10,990	78.7%
1994	2,959	1,324	1,968	1,306	4,435	11,992	85.9%
1995	5,676	2,127	5,876	6,615	5,966	26,260	188.0%
1996	3,206	2,486	4,539	5,662	10,055	25,948	185.8%
1997	2,543	2,177	4,121	4,031	5,550	18,422	131.9%
1998	756	780	1,442	1,682	2,040	6,700	48.0%
1999	1,141	2,735	2,622	3,165	1,704	11,367	81.4%
2000	1,304	3,281	2,134	2,754	5,433	14,906	106.7%
2001	2,663	5,899	5,501	6,597	12,797	33,457	239.5%
2002	935	2,457	1,882	2,079	5,986	13,339	95.5%
2003	1,002	2,101	1,776	1,400	3,631	9,910	70.9%
2004	1,557	2,973	2,221	2,531	3,423	12,705	91.0%
2005	1,020	1,356	1,535	1,350	5,085	10,346	74.1%
2006	1,326	1,391	1,857	1,480	1,731	7,785	55.7%
2007	1,459	2,892	2,212	2,321	5,337	14,221	101.8%
2008	1,531	2,691	1,565	1,797	5,809	13,393	95.9%
2009	1,597	3,011	2,891	1,819	10,208	19,526	139.8%
2010	1,097	1,961	1,899	2,007	2,474	9,438	67.6%
2011	2,121	3,065	2,381	2,400	4,895	14,682	106.4%
Average	***2,443***	***2,287***	***2,944***	***2,794***	***5,153***	***15,622***	***111.8%***
% of Goal (all years)	**129.3%**	**87.1%**	**130.9%**	**103.5%**	**114.4%**	**111.8%**	
% of Goal last 10 years	**72.2%**	**91.0%**	**89.9%**	**71.1%**	**107.9%**	**89.9%**	

[a] The LFH group includes releases of fish in other locations of the Snake River and Asotin Creek, the Walla Walla group includes releases of fish in Mill Creek, and the Grande Ronde include releases of fish from Wildcat Creek in Oregon.

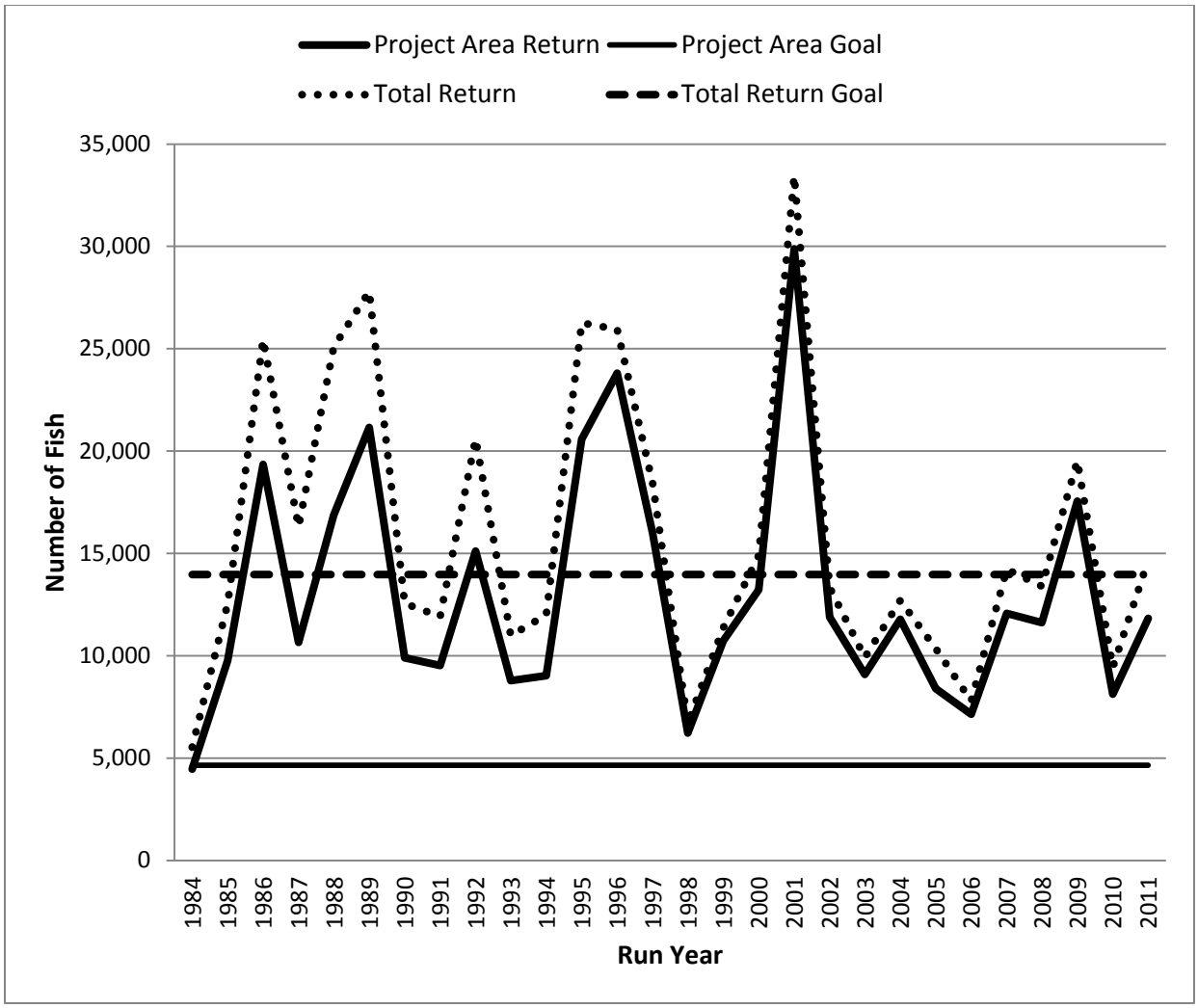


Figure 9. Adult hatchery summer steelhead returns (LFH and Wallowa stock combined) in relation to the project area or total program goals.

Conclusions and Recommendations

In an effort to maintain successful mitigation in an ESA environment, we offer the following conclusions/recommendations from our monitoring and evaluation work, and suggest additional critical questions that should be pursued in the future:

1) In December of 2012, WDFW, with agreement from the co-managers and NOAA Fisheries, terminated the LFH stock steelhead program. Steelhead production of LFH stock was switched over to the Wallowa stock program, with no decrease in production overall. The overall basis for this decision were from conversations about making efficient use of rearing space at LSRCP facilities, and looking for additional rearing space for spring Chinook for harvest mitigation under the LSRCP. The Wallowa stock was chosen for the preferred stock based on 1) origin history (Wallowa = Snake Basin composite stock versus LFH = was primarily an out-of-basin upper Columbia stock), 2) Wallowa stock are older and larger at adult return compared to the LFH stock, making them more desirable from a harvest standpoint (i.e., anglers like bigger fish), and 3) run timing of Wallowa stock fish back to the Snake River is 2-4 weeks later, providing more opportunity for anglers to catch fish when the fishery first opens. Through consolidation of these two program, WDFW has freed up one of the three large rearing lakes at LFH, which could then be used for spring Chinook, or some other LSRCP production for a more efficient use of rearing space.

   Recommendation: Mark/Tag representative (see #3 below) groups of Wallowa stock steelhead for the harvest mitigation program. Continue with individual marking by release location for at least five years (2017) to document difference in returns locations to what was previously seen with the LFH stock steelhead. Following such an evaluation, consider consolidating the coded-wire tagging of this group into a single code for documenting straying and contribution to downriver fisheries, and using PIT tag returns from individual release locations to estimate total return to the project area for program evaluation.

2) The mitigation program for WDFW summer steelhead under the LSRCP is to produce 4,656 adult steelhead to the project area for harvest/broodstock needs. Since program inception, WDFW's Wallowa stock or LFH stock steelhead programs have produced adults back to the project area (above Ice Harbor and including the Walla Walla Basin (off-site mitigation)) well in excess of the mitigation goal – refer to Table 26. In addition, the total mitigation goal of 13,968 (assuming a 2:1 downriver to upriver harvest allotment) has also been met, though with reductions in program size in 2001, returns over the last ten years have generally been below the total adult production goal of 13,968. Downriver harvest, especially in the Zone 6 net fishery, has decreased significantly since the middle 1990s because of ESA protection required for B-run steelhead destined for Idaho. So while smolt production was reduced in an

attempt to decrease the number of adults returning to the project area, there has been little effect due to the reduced harvest in the Zone 6 net fishery.

With consolidation of the Wallowa and LFH stock steelhead into one program and into one rearing vessel at LFH (see #3 below), we have the options to re-consider current smolt production levels to address ESA concerns in the project area (i.e., stray hatchery fish). With the current rearing scheme (Appendix C), Wallowa stock production levels could be lowered and then increased again in the future without impacting other LSRCP programs at LFH.

Recommendation: Meet with program managers, co-managers, and other interested parties to discuss recommended changes to WDFW's harvest mitigation steelhead programs at LFH, without hindering recovery of native steelhead stocks.

Recommendation: Current production level of Wallowa stock summer steelhead is 495,000 smolts. Assuming the downriver fisheries do not change appreciably, and based on historical smolt-to-adult survival back to the project area, this program could be reduced to approximately 245,000 smolts annually, and still fulfill adult mitigation needs to the project area. Due to the nature of the program, current releases in four different sub-basins, and ESA concerns for each of those, there are multiple options available to restructure the steelhead program. To initiate those discussions, WDFW evaluation staff recommends the following specific production changes at the current release locations to better align WDFW adult steelhead returns to the project area to better address ESA concerns. **This is only one of many options that have been thought of by the evaluation staff.**

- Reduce on-station release from 110,000 to 35,000 (-68%)
- Reduce the Dayton AP release from 85,000 to 45,000 (-48%)
- Reduce the Walla Walla release from 100,000 to 60,000 (-40%)
- Reduce the Cottonwood AP release from 200,000 to 105,000 (-48%)

3) Representative marking/tagging has always been an issue with the Wallowa and LFH stock summer steelhead program at LFH. Rearing of fish in the large rearing lakes do not allow for individual marking programs specific for a single release point. As such, coded-wire tag groups or PIT tag groups, which are supposed to represent the entire release population, are many times separated from the fish in the rearing lake for many months. For numerous reasons not discussed here, WDFW evaluation and hatchery staff derived a rearing scheme which will limit the amount of time that tag groups are separated from the rest of the rearing population (Appendix C).

Holding numerous mark groups for each release location has proven difficult in the past, and can impact other programs at LFH, and may limit future production potential. With the

recent shift to using Wallowa stock steelhead for harvest mitigation, there is an immediate need to monitor specific release sites using CWTs for at least the short term. However, the long-term need for individual release information could be derived by other methods, and may provide benefits to other LSRCP programs.

Parental Based Tagging has been occurring since 2009 with LFH, Wallowa, Tucannon, and Touchet stocks as part of a bigger Snake River Basin project. Data (fin clips) from returning adults trapped at Lower Granite or sampled at Snake River fisheries are showing that this technique to assign capture fish back to a rearing facility (and sometimes to a specific release location) is viable.

Recommendation: As soon as possible and/or practical, implement a marking/tagging schedule at LFH for Wallowa stock steelhead so resultant tag groups will represent untagged fish going to the same release location.

Recommendation: Continue to tag (both CWT and PIT) individual release groups of Wallowa stock steelhead. Monitor adult recoveries and compare harvest timing and distributions within fisheries compared to historical data (LFH stock). If similar, propose using a single CWT for the entire Wallowa stock group to document contribution to fisheries and straying, but use the PIT tag returns/proportions to estimate adult returns of individual release sites.

Recommendation: Continue with the collection of tissue samples from all steelhead broodstock sources and provide to IDFG Genetics Lab per requests. Continue to collect tissue samples from steelhead fisheries in the main stem Snake River and provide samples to IDFG for analysis.

4) PIT tag data continues to show as many as 50% of the returning steelhead destined for the Tucannon River (natural, endemic hatchery, and LFH stock), never return to the river, but overshoot the Tucannon River and remain upstream of Lower Granite Dam, where they may stray into other natural spawning areas such as Asotin Creek, Alpowa Creek, or elsewhere. Similarly, other agencies have noted this overshoot phenomenon with mid-Columbia steelhead populations such as the John Day, Umatilla, and Walla Walla natural origin summer steelhead.

Recommendation: Continue PIT tagging large representative groups of all stocks of steelhead for program evaluation (adult return rates) and straying. Work with BPA to continue, and increase if possible, the number of natural origin smolts PIT tagged at the Tucannon River smolt trap to document SARs, estimating total natural origin returns to the Tucannon River, and continued documentation of the overshoot behavior.

Recommendation: Work with the U.S. Army Corps of Engineers and others to conduct a telemetry study to develop a better understanding of behavior of returning Tucannon steelhead near the mouth of the Tucannon River, and potentially determine why there is such a high rate of fish overshooting that river and crossing Lower Granite Dam. It is imperative that this high overshoot rate, and the failure of many of these fish to return downstream, be better understood and rectified for WDFW to be able to achieve either LSRCP mitigation fisheries or ESA/WDFW natural stock conservation goals in the Tucannon River.

Recommendation: Coordinate with ODFW, CTUIR, NOAA Fisheries, and any other agencies to compile all relevant PIT tag data from mid-Columbia and Tucannon River summer steelhead populations. Begin compiling a report for submission into a peer-reviewed journal.

5) The Touchet endemic stock program was initiated with the intent to replace the LFH stock production in the Touchet River (WDFW intent only). The Touchet endemic stock has not performed to expectations (low SARs), and would therefore not be able to replace the harvest mitigation program without severely reducing the number of fish for harvest. Rearing of the Touchet stock juveniles at LFH continues to be a challenge. Released smolts have varied in size and release date, and downstream survival and adult return survival has been very low compared to the mitigation stock. WDFW has recommended the discontinuation of this program since 2012, but to date, none of the parties agree with that recommendation.

   Recommendation: Coordinate with co-managers, LSRCP, and BPA to discuss the possibility of continuing this as a conservation program only (RPA #40 – 2008 NOAA Fisheries FCRPS Biological Opinion). Continue to work with the Umatilla Tribe on alternative rearing strategies and/or broodstock composition (i.e. include more hatchery fish into broodstock) to improve the in-hatchery performance (and potentially the post-hatchery performance). Secure funding other than LSRCP to study examine benefits of such actions and recommend changes to the program based on results.

6) Natural production of Touchet summer steelhead appears to be stable (refer to Figures 6 and 7), and it is unclear at this time that the hatchery fish (LFH stock or Touchet endemic stock) have provided any benefit or harm to the population. Harvest mitigation benefits are limited in the Touchet Basin, as most of the harvest occurs in the Snake River or the lower Walla Walla, with only a very small percentage (14%: range 4-28%) of the fish actually making it back to the Touchet River for harvest.

   Recommendation: Begin discussions with co-managers and the public about discontinuing all hatchery steelhead production in the Touchet River Basin. Discuss with co-managers and

the public about expanding production of spring Chinook in the Touchet River to replace the steelhead mitigation program for harvest.

7) In the spring of 2010, WDFW, the tribal co-managers, NOAA Fisheries, and LSRCP agreed to discontinue releases of LFH stock steelhead into the Tucannon River and to fully implement the Tucannon River endemic stock program per the FCRPS Bi-Op RPA 40.2. In the short term (1-3 years), the Tucannon River endemic stock program was increased to 75,000 smolts annually. It was agreed at the time that additional hatchery rearing space (circular tanks) would be added to expand the program to the desired level (150,000 smolts annually). To date, additional space has not been added. Further, the managers agreed that an adult management plan and sliding scale would be developed for broodstock management and disposition of hatchery fish at the weir. To date, this has not been completed either.

   Recommendation: Continue to work with LSRCP on the addition of circular tanks at LFH for Tucannon River steelhead rearing.

   Recommendation: Work with co-managers and NOAA Fisheries in the development of an adult management plan and sliding scale for Tucannon summer steelhead.

8) The Tucannon River steelhead population was defined by the Interior Columbia Technical Recovery Team (ICTRT) as including the Tucannon River and other smaller tributaries to the Snake River (between Lower Monumental and Lower Granite dams). The abundance of natural origin adults in these smaller tributaries is relatively unknown, but recent trapping efforts (Trump et al. 2013) have helped expand our knowledge. Further, we have yet to confirm the genetic similarities between these small streams and the Tucannon River. Yet, these smaller tributaries could have enough natural origin adults present (of the appropriate stock) that if added to the Tucannon River natural origin adults, could raise the population level above the critical threshold, and allow for continued fisheries within the Tucannon River under the LSRCP mitigation program.

   Recommendation: Continue to support/assist adult monitoring efforts within these small Snake River tributaries and conduct a genetic analysis that compares the adult steelhead sampled in the Tucannon, Asotin, Almota, Alpowa, Penawawa, Deadman, and Alkali Flat creeks against the Tucannon and Asotin population baselines and the LFH stock that has been used for mitigation in the lower Snake Basin.

Literature Cited

Carmichael, R.W., R. T. Messmer and B.A. Miller. 1988. Summer Steelhead Creel Surveys in the Grande Ronde, Wallowa and Imnaha rivers for the 1987-88 Run Year. Progress Report, 1988. Oregon Department of Fish and Wildlife, Portland, Oregon.

Gallinat, M.P., and L.A. Ross. 2012. Tucannon River Spring Chinook Salmon Hatchery Evaluation Program 2011 Annual Report to U.S. Fish and Wildlife Service, Cooperative Agreement 14110-B-J012. Washington Department of Fish and Wildlife, Olympia, Washington. Report # FPA12-02. 94 p.

Steinhorst, K., Y. Wu, B. Dennis, and P. Kline. 2004. Confidence intervals for fish outmigration estimates using stratified trap efficiency methods. Journal of Agricultural, Biological, and Environmental Statistics 9 (3): 284-299.

Mendel, G., and J. Trump. 2010. Tucannon Lakes Fishery Monitoring Report for 2003. Washington Department of Fish and Wildlife. 48 p.

Trump, J., G. Mendel, and M. Gembala. 2013. Estimate Adult Steelhead Abundance in Small Streams Associated with the Tucannon and Asotin Populations: 2010-2012 Annual Report to U.S. Department of Energy, Bonneville Power Administration, Environment, Fish and Wildlife, Portland, OR 97208. Project #2010-028-00 Contract Numbers 49149 and 55446. 53 pages.

Schuck, M., A. Viola and S. Nostrant. 1990. Lyons Ferry Evaluation Study: Annual Report 1988-89 . Washington Department of Wildlife Report to the USFWS. Report No. AFF1/LSR-90-04.

USACE (U.S. Army Corps of Engineers). 1975. Special Reports: Lower Snake River Fish and Wildlife Compensation Plan. Walla Walla, Washington.

.

Appendix A

Rainbow Trout Plants from LFC 2013

Appendix A: Table 1. Summary of rainbow trout plants (catchable size) from LFH and TFH, 2013.

County	Location	Number of Plants	LSRCP lbs of fish planted	LSRCP # of fish planted
Asotin	Golf Course Pond	11	7,447	15,440
	Headgate Park Pond	2	423	1,025
	West Evans Pond	12	7,607	16,363
Asotin Total		**25**	**15,477**	**32,828**
Columbia	Big Four Lake	2	1,171	2,300
	Blue Lake	12	7,489	16,400
	Curl Lake	8	5,350	11,550
	Dayton JV Pond	8	956	2,165
	Deer Lake	5	1,169	2,714
	Donnie Lake	1	192	500
	Orchard Pond	3	639	1,550
	Rainbow Lake	10	6,896	14,720
	Spring Lake	10	4,337	9,328
	Watson Lake	12	6,919	14,858
Columbia Total		**71**	**35,118**	**76,085**
Franklin	Dalton Lake	9	6,562	14,946
	Marmes Pond	3	448	1,050
Franklin Total		**12**	**7,010**	**15,996**
Walla Walla	Bennington Lake	10	9,587	19,456
	Hood Park Pond	6	1,494	2,851
	Jefferson Park Pond	8	11,385	2,200
	Lions Park Pond	2	192	425
	Quarry Pond	8	9,364	21,530
Walla Walla Total		**34**	**32,022**	**46,462**
Whitman	Garfield Pond	2	807	2,025
	Gilcrest Pond	2	423	1,025
	Pampa Pond	6	2,676	6,200
	Riparia Pond	2	264	545
	Rock Lake	1	9,979	27,242
	Union Flat Creek	1	217	500
Whitman Total		**14**	**14,366**	**37,537**
Totals for Year		***156***	***103,993***	***208,908***

Appendix B

Bull Trout, Whitefish, and Brown Trout Capture Data from the Touchet River Adult Trap, 2013

Appendix B. Table 1. Total number of spring Chinook, bull trout, brown trout, whitefish, northern pikeminnow, and bridgelip sucker (excluding in-season recaptures) captured in the Touchet River Adult Trap (1993-1995 and 1999-2012). Data presented in this table is through the month of September, 2013. Numbers in parenthesis indicate fish removed and not passed upstream.

	Spring Chinook					Northern	Bridgelip
Year	Natural	Hatchery	Bull trout	Brown trout	Whitefish	Pikeminnow	Sucker
1993	0	0	0	0	0	NA	NA
1994	0	0	3	3	0	NA	NA
1995	0	0	0	0	0	NA	NA
1999	0	0	20	4	5	NA	NA
2000	2	2	22	8	16	NA	NA
2001	24	7	43	14	4	NA	NA
2002	0	0	22	0	5	NA	NA
2003	2	1	45	19	40	2 (2)	663
2004	4	6	65	17	7	0	238
2005	4	1	49	6	8	1 (1)	171
2006	0	0	53	31	33	0	54
2007	1	3	31	13	18	0	13
2008	1	2	34	11	28	5 (5)	16
2009	15	13	106	10 (10)	32	2 (2)	64
2010	13	3	122	18 (18)	120	0	227
2011	1	0	129	2 (2)	59	0	36
2012	8	1	59	5 (5)	14	0	24
2013	2	2	57	0	15	2 (2)	11

Appendix B. Table 2. Bull trout captured at the Dayton Adult Trap on the Touchet River, 2013. Data shown represents first time captures that were then PIT tagged, or fish that were recaptures from previous years (2nd, 3rd, 4th, 5th year recaps, or S, 1st year S were initially tagged at the Dayton Smolt Trap and then recaptured in the adult trap.

Date	Length	PIT Tag #	Recap	Date	Length	PIT Tag #	Recap
4/29	31.0	3D9.1C2DCAE625		5/14	40.0	3D9.1C2DCAD0A3	
5/6	38.0	3D9.1C2DD3FB2B	2nd year	5/14	40.0	3D9.1C2DCB4E16	
5/6	36.0	3D9.1C2DCBD063		5/14	33.0	3D9.1C2DCB7AC3	
5/6	50.0	3D9.1C2DCA81E7	3rd year	5/14	46.0	3D9.1C2DD535DC	2nd year
5/6	34.0	3D9.1C2DCAF162		5/14	36.0	3D9.1C2DCB6348	
5/6	34.0	3D9.1C2DDA392E	S	5/14	43.0	3D9.1C2DCB16F6	
5/6	56.0	3D9.1C2DCA9FC2	3rd year	5/14	44.0	3D9.1C2DCBB2E9	
5/6	51.0	3D9.1C2CCC61BE	4th year	5/14	34.0	3D9.1C2DCAAB5C	
5/6	36.0	3D9.1C2DCB1588		5/14	31.0	3D9.1C2DCAE48A	
5/7	29.0	3D9.1C2DCACFD2		5/14	34.0	3D9.1C2DCBCF3C	
5/7	48.0	3D9.1C2DC9B8F4	2nd year	5/14	43.0	3D9.1C2D72C763	2nd year
5/7	35.0	3D9.1C2DCA942F		5/14	35.0	3D9.1C2DCB6ACF	
5/7	55.0	3D9.1C2CC9C93E	3rd year	5/21	55.0	3D9.1C2CC9DA2D	4th year
5/13	43.0	3D9.1C2DD60673	2nd year	6/5	35.0	3D9.1C2DCBBEF6	
5/13	43.0	3D9.1C2D048F8A	2nd Year	6/6	36.0	3D9.1C2DCB8405	
5/13	35.0	3D9.1C2DCAB4C2		6/6	61.0	3D9.1C2C876748	6th year
5/13	34.0	3D9.1C2DCB995A		6/6	32.0	3D9.1C2DCAFA88	
5/13	39.0	3D9.1C2DCA92CB		6/7	38.0	3D9.1C2DCA92C2	
5/13	34.0	3D9.1C2DCAF208		6/7	36.0	3D9.1C2DCBA7B8	
5/13	37.0	3D9.1C2DCAF0EC		6/7	32.0	3D9.1C2DCBC18B	
5/13	34.0	3D9.1C2DCB98E7		6/7	31.0	3D9.1C2DCB8E1D	
5/13	56.0	3D9.1C2C4BAF13	5th year	6/7	29.0	3D9.1C2D9C69DC	1st year S
5/13	36.0	3D9.1C2DCB6E26		6/7	37.0	3D9.1C2DCA9F44	
5/13	58.0	3D9.1C2DCA9BA8	3rd year	6/11	33.0	3D9.1C2DCB1699	
5/13	48.0	3D9.1C2DC9DE9A	3rd year	7/1	24.0	3D9.1C2DCAD0A1	
5/13	36.0	3D9.1C2DCB9E0C		7/1	27.0	3D9.1C2DD46330	
5/13	37.0	3D9.1C2DCB7A5A		7/3	34.0	3D9.1C2D42559D	
5/13	34.0	3D9.1C2CFD85AE	1st Year S	7/3	25.0	3D9.1C2DD3D0BC	
5/13	38.0	3D9.1C2DCA7BA3					

Appendix B: Table 3. Whitefish (WF) and brown trout captured at the Dayton Adult Trap on the Touchet River, 2013. Note: No brown trout were captured in 2013.

Date	Species	Ln (cm)	Date	Species	Ln (cm)	Date	Species	Ln (cm)
5/7	WF	41.0	6/10	WF	27.0	7/3	WF	23.0
5/7	WF	32.0	6/11	WF	21.0	7/3	WF	21.0
5/14	WF	36.0	6/11	WF	37.0	7/3	WF	37.0
5/28	WF	33.0	6/18	WF	37.0	7/3	WF	31.0
6/6	WF	32.0	7/1	WF	23.0	8/19	WF	31.0

Appendix C

Wallowa Stock Marking/Tagging Scheme

Attachment #1. Proposed marking/tagging strategy for Wallowa stock summer steelhead – Lyons Ferry Complex.