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Lyons Ferry Complex Hatchery Evaluation: Summer Steelhead Annual Report 2008 and 2009 Run Year

by Joseph D. Bumgarner and Jerry T. Dedloff

Washington Department of
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Fish Program
Science Division

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to

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Executive Summary

This multi-year report is one in a continuing series describing WDFW's progress toward meeting summer steelhead and rainbow trout mitigation goals established in the LSRCP. This report covers monitoring and evaluation activities during the 2008 and 2009 run years.

Stocking of LSRCP-produced rainbow trout (2008 - 227,199, 2009 – 234,484) within Washington and transfers of rainbow trout to the State of Idaho went as planned. Survival of hatchery steelhead from egg to smolt was greater than 70% for all stocks, and smolt releases and marking/tagging goals for summer steelhead were met for the reporting period.

We continued smolt trapping on the Tucannon River to estimate the number of migrant steelhead. In the 2008/2009 migration season we estimated 6,200 total migrants. In the 2009/2010 migration season we estimated 13,118 total migrants. Mean smolt size and peak of out-migration for both migration years were similar to previous years. Average smolt-to-adult survival of wild origin summer steelhead from the Tucannon River (based on the PIT tags) was 2.74% back to Bonneville Dam, 2.15% to McNary Dam, and 1.98% into the Snake River. Natural origin adults returning to the Tucannon River were estimated based on PIT tag detections. Average natural origin adult return based on the PIT tags is about 175 fish annually, well below critical population thresholds. Tucannon River (natural and hatchery endemic stock origin) steelhead continue to exhibit a disturbing adult migration pattern, with about 70% returning to, and about 50% remaining above Lower Granite Dam. This same migration pattern has also been observed in the Lyons Ferry stock steelhead released into the Snake River at Lyons Ferry or into the Tucannon River. We also have observed a large percentage of Touchet and Walla Walla rivers release groups entering the Snake River, with only a small percentage eventually returning to their release location.

As part of our ongoing annual broodstock collection and research activities, WDFW hatchery and evaluation staff operate a series of traps in southeast Washington. We reported the number of fish captured and released at all trap locations, composition of hatchery and wild origin fish, coded-wire tag recoveries, age composition, eggtake and fecundity estimates from spawning activities, and historical spawn timing for each steelhead stock. In addition to those metrics, we've reported returning age composition (ratio of 1-salt : 2-salt) for both the LFH and Wallowa stocks of steelhead. An increase in the proportion of 1-salt steelhead returns has been observed for both stocks since program inception. The cause of this shift is unknown and will be investigated further.

WDFW staff surveyed steelhead sport anglers during the 2008/2009 and 2009/2010 sport fishing season within the LSRCP area of southeast Washington to recover CWTs from tagged steelhead. Results of those surveys (anglers, effort, number of fish captured) were reported. WDFW staff

also conducted joint creel surveys with ODFW on the lower Grande Ronde River. Results from those surveys completed in 2006/2007, 2007/2008, and 2008/2009 were provided by ODFW and presented in this report. All CWTs recovered for all of the above years were submitted to Olympia staff for eventual inclusion in the RMIS CWT database.

During the spring of 2009 and 2010, evaluation staff conducted spawning ground surveys to estimate the number of redds in index areas of the Tucannon and Touchet rivers, as well as in Asotin Creek. Stream flows in most of the rivers were high in 2009, greatly affecting our ability to estimate redds. Only a few of the smaller branches in the Touchet River and Asotin Creek could be surveyed. Based on those stream surveys, information from adult traps on both streams, and regression analysis, we estimate that 271 and 249 redds were present in the index area of the Touchet River and Asotin Creek, respectively, in 2009. Stream condition in 2010 were more favorable. We completed surveys in all areas and throughout all of the spawning season in the Touchet River and Asotin Creek, and estimate that 558 redds were in the Touchet River index area, and that 665 redds were in the Asotin Creek index area. Surveys were also conducted in the Tucannon River and Cummings Creek (major tributary to the Tucannon River), but final surveys in the mainstem Tucannon River could not be conducted in May due to high stream flows. Based on the surveys conducted, and using area under the curve adjustments based on historical spawn timing, we estimate 437 redds in the mainstem Tucannon index area and Cummings Creek.

Coded-wire tag recoveries from fisheries, hatcheries, or from traps in river have provided the basic data to estimate minimum smolt-to-adult return rates on LFH and Wallowa stock summer steelhead from the hatchery program. Due to a variety of factors, smolt-to-adult survivals back to the project area based on CWT recoveries have generally been 3-4 times greater than the assumed rate of 0.5% (LFH stock = 1.52%; Wallowa stock = 1.86%). Despite significant reduction in smolt releases, the LFC summer steelhead program (LFH and Wallowa stock only) continues to meet and/or exceed its original mitigation goals to the Snake River by supplying large returns of hatchery steelhead for harvest primarily in southeast Washington. This is mainly due to the fact that harvest rates in the lower Columbia River fisheries have declined substantially since the program was initiated. WDFW will continue to monitor both downriver and project area harvest and adjust programs as necessary in the future.

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Introduction

This multi-year report (run years 2008/2009 and 2009/2010) 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 2008 and 30 June 2010, 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).

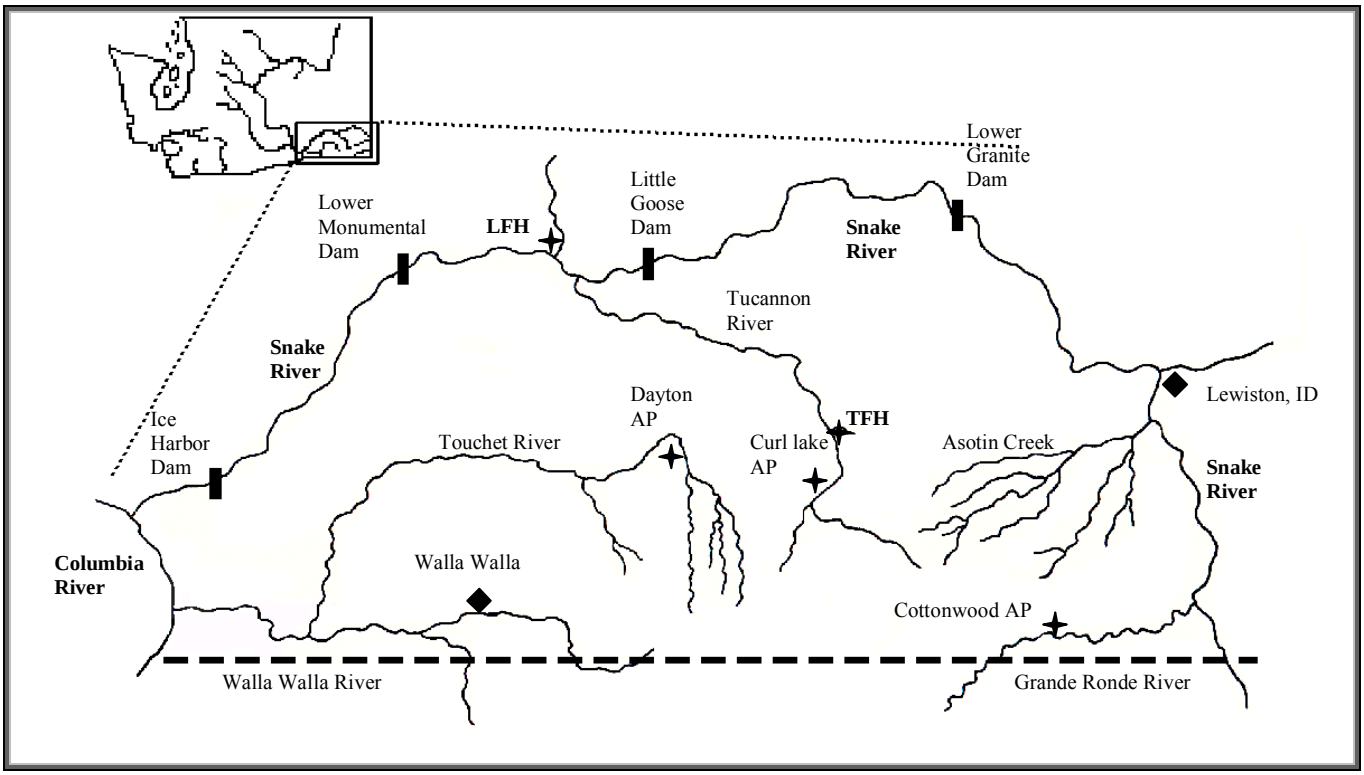

Figure 1. Map of southeast Washington State, showing major rivers and streams, the location of the four Lower Snake River dams, and Lyons Ferry Complex facilities.

Production Goals of Rainbow Trout and Summer Steelhead Stocks

Rainbow Trout*:* The LSRCP mitigation trout program has focused on providing recreational fishing opportunities in southeast Washington. Currently, the LFC goal is to produce 235,000 catchable sized (>8in) trout (78,300 lbs) for release into southeast Washington area lakes, resulting in at least 67,500 angler recreation days. The LFC also produces another 150,000 (3,000 lbs) fry (Spokane stock), and 50,000 (3,333 lbs) fingerling (Kamloops stock) for Idaho Fish and Game's (IDFG) LSRCP program. The Kamloops stock trout program will be terminated effective 2010. Its impact to wild stocks, coupled with low productivity identified in Idaho creel census, justified a modification of the Kamloop stock program at LFH. For replacement, Spokane stock trout will be reared to provide equal pounds for the Nez Perce Tribe's resident fish program (1,650 fish; 1 fish/lb) and IDFG resident fall fisheries (~7,500 fish; 3 fish/lb).

Endangered Species Act (ESA) listings of Chinook salmon (*O. tshawytscha*), steelhead, and bull trout (*Salvelinus confluentus*) in the 1990s caused the stocking of rainbow trout from LFC into Washington State area waters to be shifted exclusively to small lakes to reduce the potential negative effects on listed species. During the report period, stocking of LSRCP produced rainbow trout within Washington, and transfers to the State of Idaho (both Spokane and Kamloops stocks) generally went as planned. In 2009 and 2010, 227,199 (76,060 lbs), and 234,484 (84,610 lbs), respectively, catchable sized rainbow trout were stocked into area lakes. WDFW also produce larger sized (1.5-2.5 lbs/fish or 181.4-302.4g/fish) rainbow trout at TFH for stocking into area lakes (Tables 1 and 2). These large "jumbo" rainbow trout have been a popular addition to the recreational sport fishery in southeast Washington. Release of rainbow trout into SE Washington lakes have been close to the LSRCP goals in most years since 2000 (Table 3). A recent assessment by Mendel and Trump (2008) showed that current stocking levels were producing angler hours that are well above the mitigation goal based on sampling just four of 29 ponds/small lakes that we stock with rainbow trout.

Steelhead: The LFC has used four summer steelhead stocks to produce smolts for release into the Snake (*60,000 - LFH stock*), Tucannon (*100,000 - LFH stock, 50,000 - Tucannon Endemic stock*), Grande Ronde (*160,000 - Wallowa Stock*), Walla Walla (*100,000 - LFH stock*), and Touchet (*85,000 - LFH stock, 50,000 - Touchet Endemic stock*) rivers to enhance recreational opportunities for steelhead anglers and for ESA recovery purposes. All steelhead smolts are planned for release at 4.5 fish/lb (100.8g/fish). Beginning in 2011, the Tucannon River will no longer receive smolts of LFH stock, rather the on-station release at LFH will increase to 160,000 smolts of LFH stock, and the Tucannon Endemic stock will increase to 75,000 smolts. Further adjustments to the program are expected in the near future. Current releases of summer

steelhead smolts are fewer than originally specified for the LSRCP program. Releases have been reduced through the years in partial response to ESA concerns and because estimated adult returns to the project area (above Ice Harbor Dam) have exceeded the original goal. Changes to the current program may occur in the near future as we continue to address ESA concerns while attempting to continue meeting harvest mitigation goals to the Snake River project area and to downriver fishery areas.

Table 1. Summary of rainbow trout plants (catchable size) from Lyons Ferry Complex, 2009.

County	Location	Number of Plants	LSRCP lbs of fish planted	LSRCP # of fish planted	State lbs of fish planted	State # of fish planted
Asotin	Golf Course Pond	11	7,613	21,098	599	404
	Headgate Pond	1	610	2,013		
	Silcott Pond	1	419	1,006		
	West Evans Pond	10	7,310	22,212	711	450
	Total	***23***	***15,952***	***46,329***	***1,310***	***854***
Columbia	Beaver Lake	1	190	513		
	Big Four Lake	2	750	2,025	450	300
	Blue Lake	11	7,196	21,326	736	453
	Curl Lake	6	2,827	8,812	600	320
	Dam Pond	2	350	1,015	31	25
	Dayton Jv. Pond	8	782	2,520	166	100
	Deer Lake	4	949	3,322	36	25
	Donnie Lake	1	118	401		
	Orchard Pond	4	805	2,016	77	55
	Rainbow Lake	10	5,302	15,254	930	575
	Spring Lake	9	3,297	9,199	469	300
	Watson Lake	11	5,446	16,209	532	332
	Total	***69***	***28,012***	***82,612***	***4,026***	***2,485***
Franklin	Dalton Lake	6	8,086	25,492	498	350
	Marmes Pond	4	805	2,016	77	55
	Total	***10***	***8,891***	***27,508***	***575***	***405***
Garfield	Casey Pond	1	152	501		
	Total	***1***	***152***	***501***		
Lincoln	Sprague Lk	1	1252	3005		
	Total	***1***	***1,252***	***3,005***		
Walla Walla	Bennington Lake	8	6,522	20,574	317	210
	Fishhook Pk. Pond	3	1,619	5,023	224	150
	Jefferson Pk Pond	5	756	2,011	199	122
	Lions Park Pond	4	301	1,010	179	100
	Quarry Pond	6	8,626	26,607	513	350
	Total	***27***	***17,824***	***55,225***	***1,432***	***932***
Whitman	Garfield Pond	2	606	2,000	37	25
	Gilcrest Pond	2	303	1,000	37	25
	Pampa Pond	6	1,990	6,005	316	215
	Riparia Pond	2	518	1,502	33	25
	Union Flat Creek	1	560	1,512		
	Total	***13***	***3,977***	***12,019***	***423***	***290***
Totals		**143**	**76,060**	**227,199**	**7,766**	**4,966**

Table 2. Summary of rainbow trout plants (catchable size) from Lyons Ferry Complex, 2010. Note: State funded program was cancelled in 2010.

County	Location	Number of Plants	LSRCP lbs of fish planted	LSRCP # of fish planted	State lbs of fish planted	State # of fish planted
Asotin	Golf Course Pond	10	6,897	20,545	0	0
	Headgate Pond	1	520	2,028	0	0
	Silcott Pond	1	420	1,008	0	0
	West Evans Pond	10	7,828	22,420	0	0
	Total	***22***	***15,665***	***46,001***	***0***	***0***
Columbia	Beaver Lake	1	195	507	0	0
	Big Four Lake	2	1,155	2,302	0	0
	Blue Lake	11	8,629	22,977	0	0
	Curl Lake	6	3,586	11,077	0	0
	Dam Pond	2	388	1,033	0	0
	Dayton Jv. Pond	6	1,024	3,076	0	0
	Deer Lake	4	1,009	3,341	0	0
	Donnie Lake	1	130	507	0	0
	Orchard Pond	4	804	2,065	0	0
	Rainbow Lake	9	6,329	16,080	0	0
	Spring Lake	8	4,307	11,087	0	0
	Watson Lake	9	5,889	16,345	0	0
	Total	***63***	***33,447***	***90,397***	***0***	***0***
Franklin	Dalton Lake	6	8,938	24,987	0	0
	Marmes Pond	4	861	2,073	0	0
	Total	***10***	***9,799***	***27,060***	***0***	***0***
Garfield	Casey Pond	1	130	507	0	0
	Total	***1***	***130***	***507***	***0***	***0***
Lincoln	Sprague Lk	1	1,168	3,037	0	0
	Total	***1***	***1,168***	***3,037***	***0***	***0***
Walla Walla	Bennington Lake	9	7,411	20,851	0	0
	Fishhook Pk. Pond	3	1,805	5,228	0	0
	Hood Pk. Pond	2	926	1,250	0	0
	Jefferson Pk Pond	4	750	1,651	0	0
	Lions Park Pond	4	339	701	0	0
	Quarry Pond	6	8,758	25,404	0	0
	Total	***28***	***19,988***	***55,085***	***0***	***0***
Whitman	Garfield Pond	2	565	2,025	0	0
	Gilcrest Pond	2	302	1,025	0	0
	Pampa Pond	7	2,539	6,270	0	0
	Riparia Pond	2	568	1,537	0	0
	Union Flat Creek	1	440	1,540	0	0
	Total	***14***	***4,413***	***12,397***	***0***	***0***
Totals		**139**	**84,610**	**234,484**		

Table 3. Summary of rainbow trout plants (catchable size) from Lyons Ferry Complex, 2000-2010.

Year	LSRCP lbs of fish	LSRCP #'s of fish	State lbs of fish	State #'s of fish	Total lbs	Total #'s [a]	% of LSRCP lb goal	% of LSRCP lb goal
2000	81,908	239,740	7,482	3,945	89,390	243,685	102.5	100.9
2001	82,413	201,972	7,227	4,086	89,640	206,058	103.1	85.0
2002	69,437	208,213	8,741	4,296	78,178	212,509	86.9	87.7
2003	65,717	213,785	6,802	3,608	72,519	217,393	82.2	90.0
2004	69,351	221,615	7,012	4,097	76,363	225,712	86.8	93.3
2005	79,981	235,907	7,637	5,736	87,618	241,643	100.1	99.3
2006	63,923	218,345	7,508	4,013	71,431	222,358	80.0	91.9
2007	76,384	221,905	6,325	4,200	82,609	226,105	95.6	93.4
2008	72,964	237,080	6,334	4,030	79,298	241,110	91.3	99.8
2009	76,060	227,199	7,766	4,966	83,826	232,165	97.1	96.7
2010 [b]	84,610	234,484	0	0	84,610	234,484	99.8	108.1

[a] The numbers of fish shown are for fish size greater then 7.0 fish/lb

[b] The State funded trout program was dropped in 2010 due to lack of funding, all trout production was from LSRCP funds.

Summer Steelhead In-Hatchery Survival

Survival of steelhead at LFC remains highly variable among stocks and among years. Fish health problems (e.g., cold water disease), presence of pathogens such as Infectious Hematopoietic Necrosis virus (IHNV), and spawning conditions at LFC and remote spawning sites have all affected in-hatchery survival over the years (Tables 4, 5, 6, and 7). Despite extra measures taken by both hatchery and evaluation staffs to obtain accurate estimates of the number of eggs or newly hatched steelhead fry, there continues to be errors discovered when all fish are counted during the marking phase of the program. Within hatchery survival estimates as presented in the following tables may be inaccurate because of bias in dealing with living organisms. This bias, while not critical to program evaluations or determining program success, is likely due to one or a combination of the following: water weight, egg/fish size variability, scale error, or inconsistent methodologies between staff members. Back-calculation from the tagging event when all fish are counted may be possible in more recent years, and will likely be done in coming years, but it's doubtful that older data are correctable in the tables. Further, when fry have been planted they are estimated by weight count into the planting trucks. An error in this estimation process has sometimes led to survival estimates greater than 100%.

Table 4. Numbers of males and females spawned, eggs taken, and estimated survival by life stage of Wallowa stock summer steelhead spawned at Cottonwood Creek and transferred to LFH, 1992 to 2010 brood years. Numbers provided in the final line are overall mean with standard deviation.

BY	Spawned Female	Spawned Male	Eggs taken	Eggs retained [a]	Percent retained	Fry	Percent egg to fry survival	Smolts	Percent fry to smolt survival	Percent egg to smolt survival
1992	113	225	558,437	447,117	80.1	419,842	93.9	341,899	81.4	80.5
1993	96	206	533,995	392,595	73.5	369,039	94.0	322,508	87.4	82.1
1994	118	204	644,886	366,115	56.8	302,397	82.6	256,233	84.7	70.0
1995	99	61	511,283	335,489	65.6	321,050	95.7	263,449	82.0	78.5
1996	124	109	301,979	430,394	71.5	447,569	100.0	274,886	64.1	63.8
1997	92	92	536,723	401,270	74.8	317,590	79.1	252,211	79.4	62.9
1998	173	164	868,973	479,606	55.2	475,181	99.1	268,803 [b]	83.2	82.4
1999	126	116	601,699	389,664	64.8	377,974	97.0	274,146 [c]	84.6	82.1
2000	105	116	523,011	322,238	61.6	312,570	97.0	215,584 [d]	85.1	82.5
2001	94	108	504,182	381,427	75.7	253,743	66.5	182,722	72.0	47.9
2002	82	87	422,441	319,479	75.6	261,335	81.8	236,627	90.5	74.1
2003	65	65	301,090	215,097	71.4	206,062	95.8	137,915 [e]	100.0	96.9
2004	68	105	318,430	290,391	91.2	286,536	98.7	150,442 [f]	100.0	100.0
2005	60	70	282,675	274,586	97.1	273,608	96.8	169,390	61.9 [g]	61.7
2006	120	115	316,059	290,903	92.0	287,761	98.9	159,242 [h]	91.0	93.5
2007	106	97	340,589	242,710	71.3	233,704	96.3	175,961	75.3	72.5
2008	85	85	275,958	214,695	77.8	213,319	99.4	170,232	79.8	79.3
2009	11	113	482,500	172,367 [I]	37.2	171,194	99.3	163,197	95.3	94.7
2010	48	56	244,487	212,618	86.9	208,592	98.1			
Avg(SD)					72.6 (14.3)		93.2 (9.0)		83.8 (9.2)	77.1 (13.4)

[a] The number of eggs retained includes all losses from green egg to eye up (mortality and eggs destroyed due to IHNV are included).

[b] A total of 126,361 fry/parr/fingerlings were planted into area lakes from over production.

[c] A total of 45,824 fry/parr/fingerlings were planted into area lakes from over production.

[d] Program production was changed during the rearing cycle, a total of 50,270 fish were planted in to area lakes to support the rainbow trout catchable program.

[e] An estimated 70,455 fry/parr/fingerlings were planted into area lakes from overproduction, that created a fry-smolt survival of >100%.

[f] An estimated 146,481 fry/parr/fingerlings were planted into area lakes from overproduction, that created a fry-smolt and egg-smolt survival of >100%.

[g] High fry to smolt loss attributed to excessive bird predation at Lyons Ferry Hatchery

[h] A total of 112,751 fry/parr/fingerlings were planted into area lakes from over production.

[I] The total number of eggs retained includes 40,000 received from the Wallowa Hatchery to supplement the losses from IHNV positive females spawned at Cottonwood.

Table 5. Numbers of males and females spawned, eggs taken, and survival by life state of LFH stock summer steelhead spawned at LFH, 1987 to 2010 brood years. Numbers provided in the final line are overall mean with standard deviation.

BY	Spawned Female	Spawned Male	Eggs taken	Eggs retained [a]	Percent retained	Fry	Percent egg to fry survival	Smolts	Percent fry to smolt survival	Percent egg to smolt survival
1987	250	NA	1,111,506	1,095,906	98.6	983,901	89.8	665,658	85.3 [b]	78.4
1988	267	NA	941,756	818,148	86.9	793,240	96.9	526,541	80.2 [c]	81.1
1989	243	576	1,263,237	957,074	75.8	941,000	98.3	0	0.0 [d]	0.0
1990	439	955	2,570,676	1,483,485	57.7	1,002,320	67.6	635,635	82.1 [e]	58.2
1991	261	532	1,296,249	1,165,315	89.9	1,115,368	95.7	407,422	47.9 [f]	57.6
1992	240	100	1,239,055	905,438	73.1	431,405	46.0	398,926	95.8 [h]	87.5
1993	234	100	1,211,053	940,022	77.6	[g]	91.6	585,837	70.0 [i]	64.9
1994	253	NA	1,352,296	899,350	66.5	860,983	94.0	543,627	65.4 [j]	62.0
1995	343	NA	1,772,477	929,597	52.4	845,316	96.4	604,756	67.9 [k]	65.6
1996	330	NA	1,614,636	1,151,363	71.3	895,882	99.7	596,834	63.6 [l]	70.1
1997	217	246	1,090,638	962,705	88.3	1,148,114	84.1	554,057	100.0 [m]	84.4
1998	279	280	1,460,967	934,247	63.9	809,845	82.3	567,732	73.9	60.7
1999	227	253	1,140,813	807,374	70.8	768,522	97.0	495,864	63.3 [n]	61.4
2000	183	188	871,856	650,867	74.7	783,152	94.9	381,686	61.8 [o]	65.2
2001	151	242	800,350	636,727	79.6	617,380	79.4	423,065	83.7	66.4
2002	194	231	941,223	768,832	81.6	505,451	95.3	378,917	60.4 [p]	63.0
2003	126	257	483,462	418,195	86.5	732,566	97.8	310,209	75.9	74.2
2004	129	259	494,380	414,258	83.8	408,944	98.7	355,362	87.0	85.8
2005	133	263	571,185	452,011	79.1	408,462	97.2	350,028	79.6	77.4
2006	120	241	529,379	430,667	81.4	439,803	98.3	341,424	84.2 [q]	83.4
2007	123	245	558,683	507,688	90.9	423,397	99.0	351,510	82.8 [r]	84.7
2008	116	193	563,765	507,791	90.1	502,766	97.7	366,111	73.8	72.1
2009	106	105	490,434	425,124	86.7	496,183	97.8	364,896	92.5 [s]	90.4
2010	99	99	520,127	451,318	86.8	415,771	98.1			
Avg(SD)					78.9 (11.2)	442,652	91.4(12.4)		78.9 (5.5)	69.3 (18.3)

[a] The number of eggs retained includes all losses from green egg to eye up (mortality and eggs destroyed due to IHNV are included).

[b] A total of 203,857 fry/parr/fingerlings were planted into area lakes/rivers from over production.

[c] A total of 137,021 fry/parr/fingerlings were planted into area lakes/rivers from over production.

[d] Losses due to IHNV outbreak of entire production.

[e] A total of 227,733 fry/parr/fingerlings were planted into area lakes from over production.

[f] A total of 92,116 fry/parr/fingerlings were planted into area lakes, plus an estimated 172,000 fish lost to bird predation

[g] A total of 378,257 destroyed to infection with IHNV

[h] A total of 15,140 fish retained in Curl Lake from residualism.

[i] A total of 23,898 fish retained in Curl Lake from residualism.

[j] A total of 14,212 fish retained in Curl Lake from residualism.

[k] A total of 5,244 fish retained in Curl Lake from residualism.

[l] A total of 191,100 fry/parr/fingerlings were planted into area lakes from over production, and 19,319 fish retained in Curl Lake from residualism.

[m] A total of 259,148 fry/parr/fingerlings were planted into area lakes from over production.

[n] Survival was low due to excessive bird predation.

[o] A total of 42,548 fry/parr/fingerlings were planted into area lakes from over production.

[p] A total of 105,502 fry/parr/fingerlings were planted into area lakes from over production.

[q] A total of 17,815 fry/parr/fingerlings were planted into area lakes from over production.

[r] A total of 78,334 fry/parr/fingerlings were planted into area lakes from over production.

[s] A total of 21,316 fry/parr/fingerlings were planted into area lakes from over production.

Table 6. Numbers of males and females spawned, eggs taken, and survival by life state of Tucannon River endemic stock summer steelhead spawned at LFH, 2000 to 2010 brood years. Numbers provided in the final line are overall mean with standard deviation.

BY	Spawned Female	Spawned Male	Egg taken	Eggs retained [a]	Percent retained	Fry	Percent egg to fry survival	Smolts	Percent fry to smolt survival	Percent egg to smolt survival
2000	16	21	80,850	71,971	89.0	71,971	100.0	60,020	83.4	83.4
2001	15	15	113,563	101,497	89.4	98,836	97.4	58,616	79.3 [b]	82.3
2002	13	16	74,204	66,969	90.3	51,713	77.2	43,688	84.5	65.2
2003	11	19	73,573	46,143	62.7	45,220	98.0	42,967	95.0	93.1
2004	16	15	75,560	59,911	79.3	58,882	98.3	61,238	100.0	100.0
2005	14	25	77,131	71,933	93.3	70,254	91.1	65,245	92.9	90.7
2006	13	17	72,520	67,341	92.9	66,169	91.2	62,940	95.1	93.5
2007	13	12	64,129	59,970	93.5	56,549	94.3	53,070	93.8	88.5
2008	1	1	3,054	2,537	83.1	2,530	99.7	NA	NA	NA
2009	16	11	77,279	62,960	81.5	61,026	96.9	57,562	94.3	91.4
2010	18	16	89,791	81,100	90.3	80,857	99.7			
Avg(SD)					85.9 (9.1)		94.9 (6.7)		92.4 (5.6)	87.6 (9.9)

[a] The number of eggs retained includes all losses from green egg to eye up (mortality and eggs destroyed due to IHNV are included).

[b] A total of 24,948 fingerlings were released into the upper Tucannon River.

Table 7. Numbers of males and females spawned, eggs taken, and survival by life state of Touchet River endemic stock summer steelhead spawned at LFH, 2000 to 2010 brood years. Numbers provided in the final line are overall mean with standard deviation.

BY	Spawned Female	Spawned Male	Eggs taken	Eggs retained [a]	Percent retained	Fry	Percent egg to fry survival	Smolts	Percent fry to smolt survival	Percent egg to smolt survival
2000	12	7	53,139	43,572	82.0	43,296	99.4	36,487	84.3	83.7
2001	14	11	67,861	52,116	76.8	52,116	100.0	45,501	87.3	87.3
2002	14	19	70,843	66,460	93.8	31,715	47.7	31,440	99.1	47.3
2003	16	17	82,602	75,059	90.9	70,198	93.5	58,733	83.7	78.2
2004	15	10	66,125	59,644	90.2	55,358	92.8	55,706	100.0	93.4
2005	18	17	79,540	52,195	63.6	49,870	95.5	52,476	100.0	100.0
2006	18	18	88,668	73,633	83.0	61,141	83.0	58,989	96.5	80.1
2007	16	17	73,101	69,626	95.2	68,626	98.6	48,298	70.4 [b]	69.3
2008	14	12	66,928	57,279	85.6	57,111 [c]	99.7	49,656	97.2	96.8
2009	15	13	74,421	64,581	86.8	64,471 [c]	99.8	56,078	95.5	95.7
2010	15	13	75,596	65,055	86.1	64,462	99.1			
Avg(SD)					84.9 (8.9)		91.7 (15.5)		93.7 (6.7)	83.2 (15.6)

[a] The number of eggs retained includes all losses from green egg to eye up (mortality and eggs destroyed due to IHNV).

[b] High fry-smolt loss was due to stress induced mortality of 20,389 fish caused by overcrowding during the PIT tagging operation.

C About 6,000 fish were removed during the tagging process to begin a study on two-year old smolts.

Summer Steelhead Marking, Tagging, and Release

All production steelhead (LFH and Wallowa stocks) were marked with an adipose (AD) fin clip prior to release for selective fisheries harvest management. Each of the release study groups within the LFH and Wallowa stocks were also marked with a left ventral (LV) fin clip and given

a coded-wire tag (CWT) for specific contribution studies and/or to document straying (Table 8). The Tucannon and Touchet rivers endemic steelhead stocks are not currently managed for harvest and adipose fins were not clipped prior to release (i.e., excluded from selective harvest). Both Tucannon and Touchet endemic stock groups were tagged with a CWT only. There were no Tucannon River endemic stock fish for release from the 2008 brood, as too few fish were spawned from that brood year to properly evaluate the program, hence all progeny that were produced were released back into the upper Tucannon River as fry. These fry were unmarked so no evaluation will occur.

Since the endemic stock releases are not marked for sport harvest, we rely on adult PIT tag detections at the mainstem dams and PIT tag arrays in the Tucannon and Walla Walla rivers to derive SARs. We assume mortality is negligible as the summer steelhead are tagged at a relatively large size (~90g, 200mm). However, tag loss is unknown, thus our estimates are a minimum. Over the last couple of years, we have increased PIT tagging on our production groups (LFH and Wallowa stock; Table 8), to help quantify the number of unaccounted steelhead in each year's run. The CWT estimates obtained from sport harvest or adult trap returns provide a minimum number of fish back to the project area, with an unknown number of fish escaping to the spawning grounds. Adult PIT tag returns, used in combination with the CWT recoveries should allow us to account for fish that return to the spawning grounds, and thus providing a more accurate estimate of total contribution of our hatchery summer steelhead to the project area for mitigation assessment.

Evaluation staff collected pre-release samples for all LFC release locations (Table 9). All release groups from all stocks were close to or above program goals (number of fish and size of fish) in 2009 and 2010. In addition, in 2010, WDFW released a group of two-year smolts from the Touchet River endemic stock.

Table 8. Summer steelhead smolt releases from Lyons Ferry Complex, 2009 and 2010.

Release Year Location (Stock)	Rkm	Date	Total release	AD-only release	CWT release	CWT code	Other marks	PIT Tags	Lbs	Size #/lb	CWT % Loss
2009 Release Year											
Grande Ronde @ Cottonwood AP (Wallowa)	45.6	4/10-18	170,232	148,608	21,624	634682	LV	6,000	36,220	4.7	15.2358
Snake River @ LFH (LFH)	92.8	4/16-22	65,050	43,784	21,266	634684	LV	1,500	15,246	4.3	3.4682
Tucannon River ~200m ↓ Pataha Creek (LFH)	18.5	4/15-22	105,995	85,855	20,140	634685	LV	3,498	24,879	4.3	2.6337
Touchet River @ Dayton AP (LFH)	86.4	4/16-27	86,115	65,314	20,801	634683	LV	3,500	17,575	4.9	2.4194
Walla Walla River (LFH)	48.0	4/16-18	108,951	87,420	21,531	634686	LV	3,499	25,115	4.3	3.0655
Touchet River @ NF Touchet Bridge (Touchet)	91.5	4/27-28	49,656	0	49,656	634689	None	8,000	10,578	4.7	6.5985
2010 Release Year											
Grande Ronde @ Cottonwood AP (Wallowa)	45.6	4/5-12	163,197	142,106	21,091	635171	LV	6,000	38,857	4.2	1.2541
Snake River @ LFH (LFH)	92.8	4/16-22	66,393	45,877	20,516	635167	LV	1,500	15,089	4.4	0.5696
Tucannon River ~200m ↓ Pataha Creek (LFH)	18.5	4/15-22	104,646	84,033	20,613	635169	LV	3,498	23,679	4.4	1.2126
Tucannon River @ Curl Lake Intake (Tucannon)	66.0	4/5, 4/12, 5/12	57,562	0	57,562	635173	None	4,996	12,247	4.7	0.4911
Touchet River @ Dayton AP (LFH)	86.4	4/5-12	86,737	66,054	20,683	635170	LV	3,500	21,155	4.1	0.8026
Walla Walla River (LFH)	48.0	4/20-22	107,120	86,656	20,464	635168	LV	3,500	24,345	4.4	1.0708
Touchet River @ NF Touchet Bridge (Touchet – 1 Year)	91.5	4/12, 5/13	56,078	0	56,078	635172	None	7,971	11,916	4.7	0.4811
Touchet River @ NF Touchet Bridge (Touchet – 2 Year)	91.5	4/12	5,599	0	5,599	634689	None	4,993	1,167	4.8	6.5985

[a] The number shown as marked released has not been adjusted for tag/mark loss. Endemic stock releases are not externally marked, therefore the marked release is equal to the total release number.

Table 9. Mean fork lengths, weights, condition factor (K), co-efficient of variation (CV), fish per pound (FPP), and percent of visually apparent precocious mature males from LFC steelhead prior to release, 2009 and 2010 release years.

Release Year Location (Stock)	Date	Sample size (n)	Avg LN (mm)	Avg WT (g)	K	CV	FPP	Percent precocious
2009								
Cottonwood (Wallowa)	4/14	379	205.9	96.7	1.08	10.6	4.7	1.85
Tucannon (LFH)	4/13	200	219.7	110.3	1.02	7.5	4.1	3.5
Touchet (LFH)	4/16	231	205.3	95.6	1.07	7.9	4.9	0.87
Touchet (Endemic – Large)	4/13	290	207.0	98.0	1.06	9.7	4.6	1.00
Touchet (Endemic – Small)	4/27	200	204.0	95.2	1.10	8.2	4.8	2.00
Walla Walla (LFH)	4/13	200	212.8	101.4	1.03	8.2	4.5	1.0
Lyons Ferry (LFH	4/13	200	218.6	107.9	1.02	7.1	4.2	1.0
Lake #1 [a](LFH)	4/20-22	626	222.2	110.9	1.00	7.6	4.1	1.43
2010								
Cottonwood (Wallowa)	4/05	333	213.3	108.0	1.09	8.5	4.2	0.30
Tucannon (LFH)	4/12	200	213.8	100.7	1.01	8.6	4.5	0.00
Tucannon (Endemic – Large)	4/12	200	213.2	107.0	1.06	10.2	4.2	5.00
Tucannon (Endemic – Small)	5/11	200	194.6	85.5	1.11	10.3	5.3	1.50
Touchet (LFH)	4/08	200	211.4	110.0	1.14	9.0	4.1	0.00
Touchet (Endemic – Large)	4/07	199	208.1	103.6	1.11	9.3	4.4	1.01
Touchet (Endemic – Small)	5/11	200	191.5	82.6	1.14	9.1	5.5	3.00
Touchet (Endemic – 2Year)	4/07	200	206.1	94.2	1.04	9.6	4.8	14.00
Walla Walla (LFH)	4/12	200	214.7	103.0	1.02	9.0	4.4	0.50
Lyons Ferry (LFH	4/12	200	214.0	104.2	1.03	10.9	4.4	2.00
Lake #1 [a](LFH)	4/19-21	597	218.4	103.6	0.98	9.3	4.4	0.50

[a] Fish removed from Lake#1 during April were released in the Tucannon and Walla Walla rivers, and on-station at Lyons Ferry.

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

We operated a 1.5m rotary screw trap at rkm 3.0 on the Tucannon River between fall 2008 and spring 2009, and the fall of 2009 and spring 2010 to estimate the number of migrating natural steelhead smolts. Methods to estimate smolt production were described in Bumgarner et al. 2003. Program staff has been working on re-calculating smolt production estimates with 95% confidence intervals based on a new methodology. Staff continues to work on confidence interval estimations for all prior years, which will be presented in future reports.

During the 2008/2009 trapping season, 1,314 natural steelhead migrants were captured, for an estimated 6,200 total migrants, the lowest on record. About 64% of the fish were captured between 15 March and 15 June. Age composition based on the scale readings was 42.4% Age 1, 53.4% Age 2, 4.0% Age 3, and 0.1% Age 4. During the primary out-migration period (March-early June) mean length, weight, and K-factor for natural fish (all age groups combined) captured was 177.6 mm, 56.7 g and 0.99, respectively. Peak out-migration occurred on 29 April with an estimated 212 summer steelhead migrants past the trap on that day.

During the 2009/2010 trapping season, 2,657 natural steelhead migrants were captured, for an estimated 13,118 total migrants. About 95% of the fish were captured between 15 March and 15 June. Smolt age composition based on the scales were not complete when this report was final. Age composition data will be presented in future reports as needed. During the main out-migration period (March-early June) mean length, weight, and K-factor for natural fish (all age groups combined) captured was 177.2 mm, 59.5 g and 1.01, respectively. Peak out-migration was on 19 May with an estimated 1,081 summer steelhead migrants past the trap on that day.

Over the years, evaluation staff have PIT tagged wild origin steelhead migrants from the Tucannon River smolt trap in an attempt to estimate smolt-to-adult surviva, and be used to compare to our hatchery stocks from LFH (Table 10). A minimum of five detections was necessary for inclusion into the following table. Average smolt-to-adult survival of wild origin summer steelhead from the Tucannon River (based on the PIT tags) is 2.74% back to Bonneville Dam, 2.15% to McNary Dam, and 1.98% to the project area. The survival of steelhead from the 2008 migration year was nearly double the survival from any previous year.

Table 10. Estimated smolt-to-adult survival rate of naturally produced summer steelhead smolts from the Tucannon River based on adult PIT tag detections at Columbia and Snake River dams, 1999-2008 migration years.

Smolt Migration Year	Number of PIT Tags	Bonneville or above	Percent Survival	McNary or above	Percent Survival	Ice Harbor or Lower Granite	Percent Survival
1999	363	6	1.65	5	1.38	5	1.38
2000	555	20	3.60	15	2.88	14	2.52
2002	1,506	40	2.66	32	2.12	32	2.12
2003	1,556	36	2.31	30	1.93	29	1.86
2004	1,984	32	1.61	20	1.01	18	0.91
2005	1,835	27	1.47	23	1.25	20	1.09
2006	1,417	35	2.47	24	1.69	19	1.34
2007	301	8	2.66	6	1.99	5	1.66
2008	1,087	68	6.26	56	5.15	54	4.97
Average (StDev)			**2.74 (1.48)**		**2.15 (1.25)**		**1.98 (1.23)**

Smolt trap estimates of natural origin steelhead production, in conjunction with the adult PIT tag returns, allow the estimation of natural origin returns into the Tucannon River Basin. This is useful, as spawning ground surveys in the Tucannon River can be severely limited by even moderate stream flows. Moreover, it is extremely difficult to determine the origin of the spawners (LFH hatchery, natural, or endemic stock) from visual observation. Based on the PIT tag information, and from adult migratory observations presented in the next section, average spawning escapement in the Tucannon River Basin is at a maximum (assuming 50% of the fish crossing Ice Harbor Dam enter the Tucannon River), about 175 natural origin fish/year (Table 11). This estimate is about 110 fish below the critical minimum abundance threshold (MAT) of natural-origin adults (285 spawners) described in WDFW's Fishery Management Evaluation Plan (FMEP) and the Interior Columbia Technical Review Team (ICTRT).

Table 11. Estimated number of Tucannon River natural origin summer steelhead that return to spawn based on adult PIT tag returns above Ice Harbor Dam, 2000-2009 run years.

Migration year	Estimated smolts [a]	Number PIT tagged	Adult return to Ice Harbor	Adjusted return to Ice Harbor [b]	Salt age [c]			Run year	Total return to Ice Harbor	50% of return to Tucannon River [d]
					1	2	3			
1998	29,067	465	3	3.05	63	125	0	1999	NA	NA
1999	23,451	363	7	7.10	258	193	0	2000	383	191
2000	22,681	555	19	20.74	322	483	0	2001	516	258
2001	19,754	333	0	0.00	0	0	0	2002	483	242
2002	18,558	1506	32	33.57	173	222	25	2003	173	86
2003	18,728	1556	29	30.84	169	229	12	2004	390	195
2004	13,586	1984	18	20.55	62	75	7	2005	315	157
2005	14,477	1835	20	22.39	63	126	0	2006	150	75
2006	8,289	1417	19	23.11	82	53	0	2007	215	107
2007	10,404	300	5	5.55	104	69	---	2008	157	78
2008	14,304	1087	37	51.73	684	---	---	2009	754	377
				Average 2000-2009 Run Years					**354**	**177**

[a] The estimated smolts presented are for spring (March-June) migrants only. PIT tags were only applied during the spring months, as that is when we typically get the largest number of smolt migrating past the smolt trap.

[b] Returns to Ice Harbor were adjusted based on total smolt production for each migration year. Smolts leaving during the fall and winter months (October-February) represent 5-25% of the total outmigration. We assumed that the fall/winter migrants survival as well as spring migrants.

[c] The number of fish presented in the salt age columns are calculated from the number of adult returns by age group divided by the PIT Tag mark rate (PIT Tagged Fish/Total Estimated Smolts).

[d] Based on adult detections at the Snake River dams, it appears that generally 50% of the fish passing Ice Harbor remain above Lower Granite Dam. The remaining 50% have been assigned to the Tucannon River for simplicity. The actual percentage based on the PIT tag array in the lower Tucannon River would suggest 35-40%, though the efficiency of the Tucannon River PIT tag array is unknown.

According to NOAA Fisheries and the ICTRT, the Tucannon River summer steelhead population is comprised of the Tucannon River, its tributaries within the watershed (Panjab Creek, Cummings Creek, and Pataha Creek), and other smaller tributaries that flow directly into the

Snake River below Lower Granite Dam (Almota Creek, Deadman Creek, Alkali Flat Creek, and Penewawa Creek). The estimates provided in Table 11 are only for the mainstem Tucannon River and its tributaries. Limited information is available on the natural steelhead population sizes in these smaller tributaries of the Snake River. However, according to the FMEP, natural origin spawning escapement below the MAT does not meet the minimum for allowing fisheries for hatchery steelhead to occur where that population exists. Obtaining population estimates of natural origin steelhead from these smaller tributaries of the Snake River may be vital in order to maintain a mitigation fishery on the Tucannon River.

Adult Migratory Patterns Based on PIT tags

PIT tag detectors in the adult ladders of mainstem Columbia and Snake River dams have been in place for many years. In-stream tributary detectors (PIT tag arrays) are becoming more common, and have recently been installed in the Tucannon River (at two locations within 3km of the stream mouth) and the Walla Walla River (at the Oasis Road Bridge). Even though the detection efficiencies of these arrays are currently unknown, and it is difficult to accurately calculate escapement based on PIT tags detected, they have provided valuable data on the migratory pattern of steelhead that was relatively unknown.

Tucannon River summer steelhead exhibited an undesirable migration pattern (Table 12). A high proportion of PIT tagged Tucannon River natural fish that cross Ice Harbor Dam also pass above Lower Granite Dam (65%), with few moving back down river (~20%) and entering the Tucannon River. A similar migration pattern (i.e. bypassing the Tucannon River) has also been observed in the Lyons Ferry stock fish released into the Tucannon, and the Tucannon River hatchery endemic stock steelhead. Adult trapping in Asotin and Alpowa Creeks (Kent Mayer – WDFW – pers comm.) in recent years has documented (by CWT recoveries) many Tucannon River endemic stock steelhead during the spawning season, as well as fish from the LFH stock released into the Tucannon River, at Lyons Ferry Hatchery, and in the Touchet River (Table 13). Additionally, Touchet River endemic hatchery steelhead have been detected at the PIT tag array in the lower Tucannon River in March and April (Table 14); presumably spawning in the Tucannon River. Subsequent detection of these same fish later in the season has not occurred (i.e. kelts). Failure of PIT tagged LFH , Touchet, and Tucannon stock steelhead to return to their release location or stream of origin is disturbing and needs further investigation.

One hypothesis as to why this is occurring would be high water temperatures (thermal barrier), or low stream flows exiting the source river when fish are migrating past. However, based on the PIT tag data (migration timing) as determined from the mainstem dams, water temperature (at least in the Tucannon River) is not likely a major problem. But stream flows of both the Walla Walla and Tucannon River are low at this time of year, and they both empty into relatively

large reservoirs of the Columbia and Snake River. It is therefore possible that the fish can't locate their home stream during their initial retutn. However, limited historical data from the 1950's (prior to dam construction) suggests that this migration pattern to an upstream over wintering area in the Snake River (at least for the Tucannon River fish) was known to exist, with fish migrating back downstream in the early spring to their natal stream for spawning. Those early data are insufficient to determine if all that bypassed successfully re-entered the river to spawn. Now that the dams are in place, this downstream migration has been complicated, and fish (Tucannon River fish in this case) may utilize other streams (e.g. Asotin Creek, Alpowa Creek – Table 12) above Lower Granite Dam for spawning.

Table 12. Detections of PIT tagged Tucannon Endemic stock, Tucannon natural stock, and Lyons Ferry hatchery stock summer steelhead released into the Tucannon River that passed Ice Harbor Dam (IHR) and Lower Granite Dam (LGR).

Migration Year	# Pass IHR	# Pass LGR	# Entered Tucannon [a]	Unknown Location	# Back to Tucannon from LGR [a]	% back to Tucannon from LGR	Total into Tucannon [a]	Percent of those that passed Ice Harbor Dam		
								% into Tucannon [a]	% above LGR	% Unknown
Tucannon Endemic Hatchery Stock Summer Steelhead										
2004	48	30	11	7	5	16.7	16	33.3	52.1	14.6
2005	55	35	17	3	8	22.9	25	45.5	49.1	5.5
2006	105	69	18	18	16	23.2	34	32.4	50.5	17.1
2007	120	77	10	33	4	5.2	14	11.7	60.8	27.5
2008	276	263	68	66	35	13.3	103	26.1	57.7	16.7
Totals	**723**	**474**	**124**	**127**	**68**	**16.2**	**192**	**26.6**	**56.2**	**17.6**
Tucannon Natural Stock Summer Steelhead										
2004	17	11	6	2	2	18.2	8	47.1	52.9	11.8
2005	20	12	6	5	3	25.0	10	50.0	45.0	25.0
2006	16	8	3	5	0	0.0	3	18.8	50.0	31.3
2007	5	3	1	1	0	0.0	1	20.0	60.0	20.0
2008	54	37	8	6	3	8.1	11	20.4	63.0	11.1
Totals	**112**	**71**	**24**	**19**	**8**	**11.3**	**33**	**29.5**	**56.3**	**16.9**
Lyons Ferry Hatchery Stock Summer Steelhead (Released into the lower Tucannon River)										
2006	318	229	54	35	44	19.2	98	30.8	58.2	11.0
2007	176	90	37	49	7	7.8	44	25.0	47.2	27.8
2008	121	89	4	16	10	11.2	16	13.2	65.3	13.2
Totals	**615**	**408**	**95**	**100**	**61**	**12.7**	**158**	**23.0**	**56.9**	**17.4**

[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. Therefore, the percent of fish into the Tucannon, above Granite, or Unknown destination for the 2006 and 2007 migrations years are under or over-estimates depending on location. Numbers provided are current through December 22, 2010.

Table 13. Estimated number of Lyons Ferry (LFH), Tucannon Endemic, and Touchet Endemic stock fish recovered from Asotin Creek (2005-2010) and Alpowa Creek (2008-2010) adult steelhead traps. LFH stock estimates based on expanded CWT recoveries, while endemic stocks were based on visual marks (not killed). Numbers shown in parenthesis for each year are based on PIT tag recoveries, expanded by tag rate. Data provided by Kent Mayer and Ethan Crawford from the BPA funded WDFW Asotin Creek Assessment project.

Year	Stream Name	Touchet LFH	Walla Walla LFH	Tucannon LFH [a]	Lyons Ferry LFH	Tucannon Endemic	Tucannon Wild	Touchet Endemic
2005	Asotin	0	0	46	6	10		0
2006	Asotin	0	0	8	0	22		0
2007	Asotin	0	0	32 (0)	0	14 (6)	(7)	2 (6)
2008	Asotin	4	0	0 (11)	0	20 (0)	(0)	0 (0)
2009	Asotin	4 (0)	0 (0)	0 (0)	0	14 (15)	(0)	1 (0)
2010	Asotin	4 (0)	0 (0)	25 (0)	3 (0)	33 (14)	(113)	1 (6)
2008	Alpowa	13 (0)	5 (0)	0 (0)	6	20 (0)	(0)	0 (0)
2009	Alpowa	17 (0)	10 (38)	0 (19)	6 (0)	63 (37)	(0)	0 (0)
2010	Alpowa	9 (0)	0 (0)	75 (29)	33 (40)	56 (32)	(13)	0 (0)

[a] Tucannon LFH stock fish were not Coded-Wire Tagged from the 2006 and 2007 release years, which would have returned as adults in 2008 and 2009, hence they appear to be missing from the Asotin and Alpowa creek recoveries for those two years, when they are probably present.

Table 14. Detections of PIT tagged Touchet River Endemic stock summer steelhead, and Lyons Ferry stock summer steelhead (Walla Walla and Dayton AP release groups) that crossed McNary Dam, Ice Harbor Dam (IHR), and Lower Granite Dam (LGR).

Migration Year	# Passed McNary	# Entered Walla2	# Stayed above IHR	# Stayed above LGR	# Entered Tucannon [a]	# Entered Tucannon Mar-Apr [c]	Percent of those that passed McNary Dam [b]: % into Walla2	% above IHR	% above LGR	% Into Tucannon [a]
Touchet Endemic Hatchery Stock Summer Steelhead										
2004	35	3	15	0	11	9	8.6	42.9	0.0	31.4
2005	22	10	7	1	4	3	45.5	31.8	4.5	18.2
2006	32	7	18	4	4	2	21.9	56.3	12.5	12.5
2007	63	24	18	3	2	1	38.1	28.6	4.8	3.2
2008	83	26	47	14	11	8	31.3	56.6	16.9	13.3
Totals	**235**	**70**	**105**	**22**	**32**	**14**	**29.8**	**44.7**	**9.4**	**13.6**
Dayton AP Release (LFH Stock)										
2007	116	13	93	33	13	0	11.2	80.2	28.4	11.2
2008	155	19	124	47	17	7	12.3	84.3	30.3	11.0
Totals	**271**	**32**	**217**	**80**	**20**	**7**	**11.8**	**80.1**	**29.5**	**11.1**
Walla Walla River Release (LFH stock)										
2007	89	2	75	35	3	1	2.2	80.0	39.3	3.4
2008	77	8	62	10	11	3	10.4	80.5	13.0	14.3
Totals	**166**	**10**	**137**	**45**	**14**	**4**	**6.0**	**82.5**	**27.1**	**8.4**

[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. Numbers provided are current through January 4, 2011.

[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.

[c] Numbers included in this column are also included in the previous column.

Summer Steelhead 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. The LFH staff operates the LFH and Cottonwood Creek adult traps. The TFH staff operates the upper Tucannon River adult trap, and evaluation staff operates the Touchet River trap in Dayton and may operate an adult trap on the lower Tucannon River. In addition, data are available on steelhead trapping for the Asotin Creek system from a Bonneville Power Administration funded project (Mayer et al, 2005-2008). Some of the information from the Asotin Creek adult trap assists our evaluations. Information presented below summarizes collection and hatchery spawning activities and any additional evaluation project's data for the reporting period.

LFH Trap

Run Year 2008: Adult steelhead were trapped from 3 September through 6 November 2008. A total of 1,683 adult steelhead (824 female [48.9%] and 859 male [51.1%]) were trapped. Fish to be retained for broodstock were sorted on 18 November 2008. All fish not needed for broodstock or retained to recover CWTs were returned to the Snake River to contribute to the sport fishery (1,153). Of those steelhead trapped, no wild origin (unmarked) fish were found. We recovered 362 fish with CWTs (Table 15). Sex ratio of CWT fish was not similar (42.1% male, 57.9% female) to those that were trapped, although fish may have been misidentified during sorting. Age composition based on CWT recoveries was 88.7% one-ocean, and 11.3% two-ocean. Mortality during trapping, holding, and spawning was 129 fish (7.7% of all fish trapped). During January and February of 2009, 105 females were spawned with 106 males, producing 490,434 eyed eggs for the LFH stock program (Table 5). No eggs were destroyed due to high IHN virus titer levels in 2009. The mean fecundities of one-ocean (4,528) and two-ocean (5,368) females were similar to past years (Figure 2).

Table 15. Summary of tagged adult summer steelhead trapped at LFH for the 2008 run year / 2009 brood year.

Brood year	CWT code	Stock	Release site	Number of CWTs
2005	63 / 32 / 91	Lyons Ferry	Snake River – On Station	22
2005	63 / 32 / 93	Lyons Ferry	Touchet River @ Dayton AP	9
2005	63 / 32 / 92	Lyons Ferry	Walla Walla River	10
2006	63 / 36 / 67	Lyons Ferry	Snake River – On Station	173
2006	63 / 36 / 65	Lyons Ferry	Touchet River @ Dayton AP	72
2006	63 / 36 / 66	Lyons Ferry	Walla Walla River	76
			LV clip - No CWT	9
			Lost CWT	2
			Grand Total For Year	**373**

Run Year 2009: Adult steelhead were trapped from 2 September through 11 November 2009. A total of 1,657 adult steelhead (865 female [52.2%] and 792 male [47.8%]) were trapped. Fish retained for broodstock were sorted on 19 November 2009. All fish not needed for broodstock or retained to recover CWTs were returned to the Snake River to contribute to the sport fishery (1,166). Of those steelhead trapped, one wild origin (unmarked) fish was found. We recovered 371 fish with CWTs (Table 16). Sex ratio of CWT fish was somewhat different (52.6% male, 47.4% female) from those that were trapped. Fish sex may have been misidentified during sorting. Age composition based on CWT recoveries was 83.8% one-ocean, and 16.2% two-ocean. Mortality during trapping, holding, and spawning was 112 fish (6.8% of all fish trapped). During January and February of 2010, 99 females were spawned with 99 males, producing 520,127 eyed eggs for the LFH stock program (Table 5). No eggs were destroyed due to high IHN virus titer levels in 2010. The mean fecundity of one-ocean (5,080) and two-ocean (6,179) females were slightly higher than some of the more recent years (Figure 2).

Table 16. Summary of tagged adult summer steelhead trapped at LFH for the 2009 run year / 2010 brood year.

Brood year	CWT code	Stock	Release site	Number of CWTs
2006	63 / 36 / 67	Lyons Ferry	Snake River – On Station	35
2006	63 / 36 / 65	Lyons Ferry	Touchet River @ Dayton AP	11
2006	63 / 36 / 66	Lyons Ferry	Walla Walla River	9
2007	63 / 40 / 97	Lyons Ferry	Snake River – On Station	148
2007	63 / 40 / 98	Lyons Ferry	Touchet River @ Dayton AP	94
2007	63 / 40 / 96	Lyons Ferry	Walla Walla River	42
2007	63 / 40 / 95	Lyons Ferry	Tucannon River	23
			LV clip - No CWT	3
			Lost CWT	6
			Grand Total For Year	**371**

All steelhead trapped and retained were scanned for PIT tags. We detected 40 unique PIT tags in the broodstock. Some were tagged and released at LFH, or from the Tucannon, Touchet, or Walla Walla rivers, while others were tagged at mainstem Columbia or Snake river dams as juveniles during outmigration or as adult returns. All PIT tag data was uploaded to PTAGIS per protocols.

Evaluation staff compiled dates of broodstock spawning at LFH (Figure 3). Between 1990 and 2002, broodstock spawn timing gradually shifted from the first spawn date typically being near the middle of February to near the beginning of January (3-4 week shift over time). The cause of this shift is not fully known, but may have resulted from reaching eggtake goals using first spawners only (selection), with later spawning fish not contributing to the next generation. In 2003, a decision was made to not spawn fish earlier than 11 January and to have a minimum of three egg takes per season. This allows enough time for virology screening to occur while

broodfish are still available for additional egg collection, and to prevent further change of spawn timing. Having the Lyons Ferry stock fish spawning earlier may be beneficial if this is also occurring in fish that are spawning naturally in the rivers. Fish spawning weeks to months earlier may not be as successful in producing offspring for the next generation. Also, having the Lyons Ferry stock fish spawn earlier benefits the hatchery program by allowing more time to rear the one-year smolt, providing greater flexibility in feeding rates through the rearing cycle.

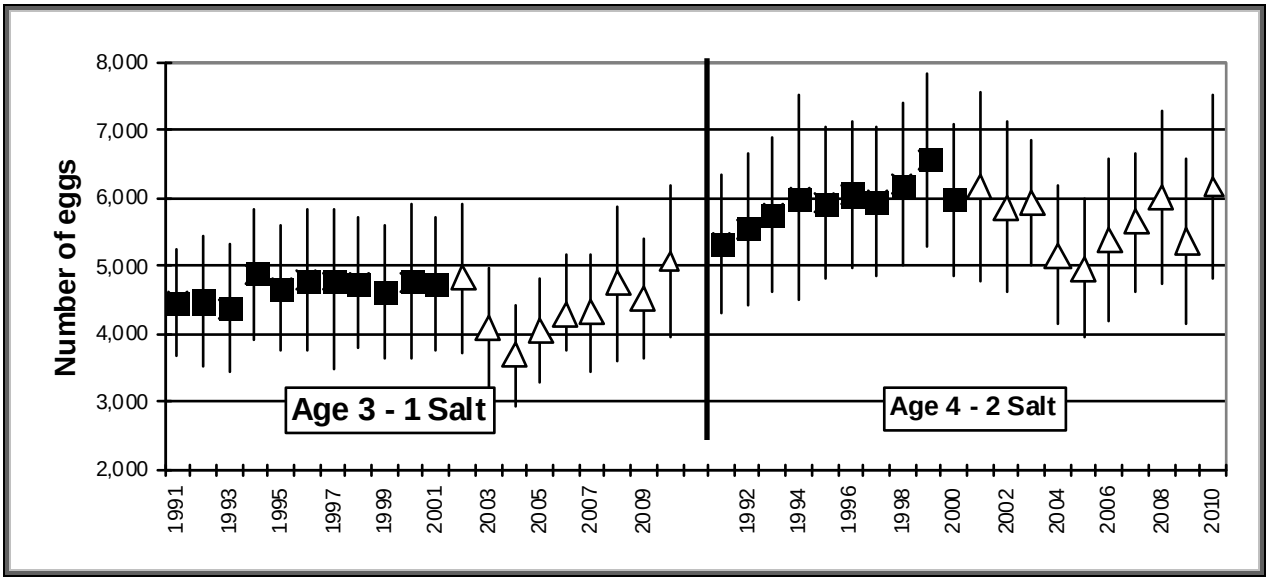

Figure 2. Mean fecundity (standard deviation bars) of Lyons Ferry stock summer steelhead from 1991-2010. Note: egg estimation method was changed in 2003 from volumetric (black squares) to weights (open triangles).

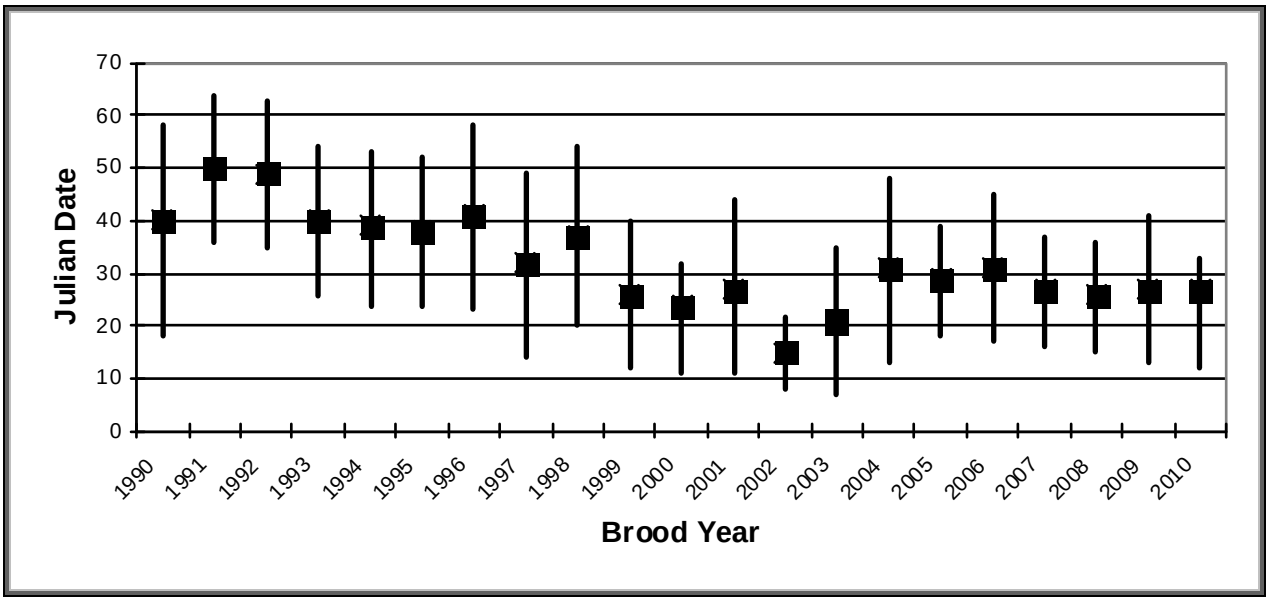

Figure 3. Range and mean spawn dates of Lyons Ferry stock summer steelhead, 1987-2010. Bars indicate first and last date of spawning; square indicates the median spawn date.

In recent years, both hatchery and evaluation staffs have noted a higher ratio of 1-salt fish to 2-salt fish in the broodstock compared to previous years. We used CWT returns from the 1984-2006 brood years (all recovery locations) from LFH stock steelhead released into the Tucannon, Walla Walla, Touchet and Snake rivers to describe changes in age composition since program inception (Figure 4). Based on the analysis to date, it does appear that more younger age fish are returning than historically. The exact cause of this age composition shift is unknown, but could be related to changes in size at release over the years, or changes in downriver fisheries (net) harvest. Further analysis is required to determine if these, or other factors, have caused this shift in age composition.

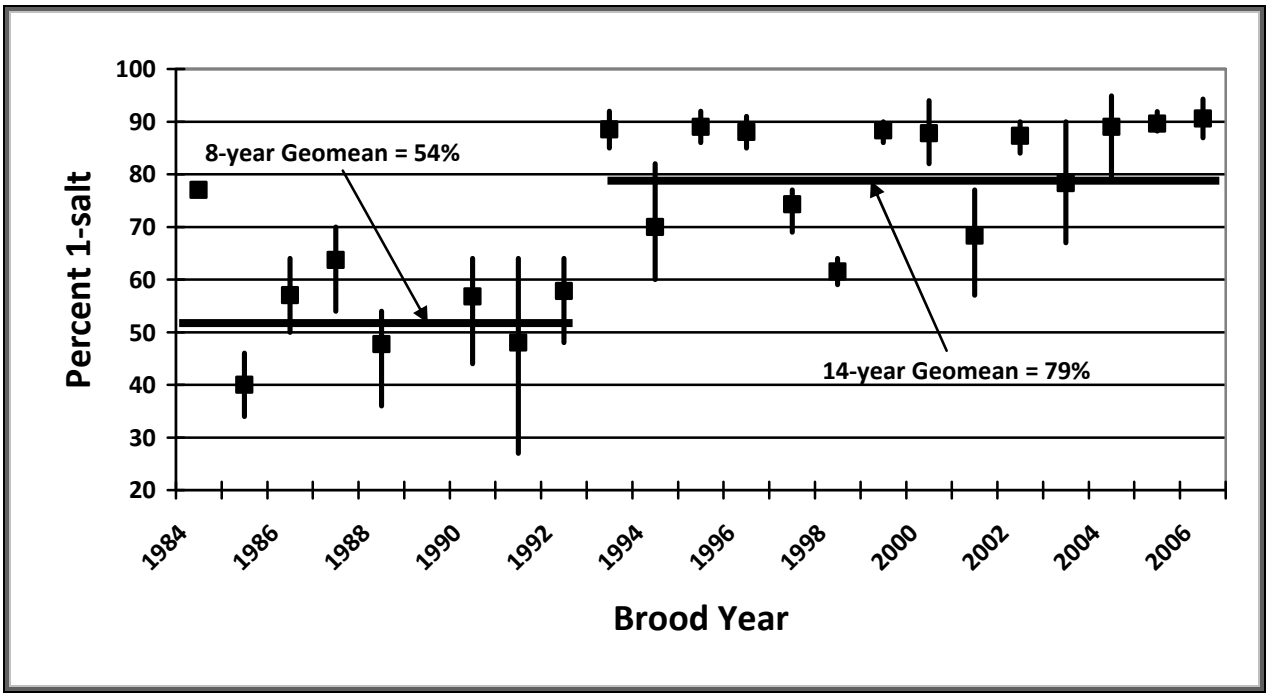

Figure 4. Percent 1-salt returns of LFH stock summer steelhead, 1984-2006 brood years. Squares are the average returns from the four possible release groups, and bars represent minimum and maximum values based on the individual groups.

Cottonwood Creek Trap

Run Year 2008: At the Cottonwood Creek Trap, 2,313 adult steelhead (984 [42.5%] male, 1,329 [57.5%] female) were trapped from 26 February to 29 April. Twenty natural origin fish (13 male, 7 female) were captured during the season; all were passed upstream for natural spawning. Age composition based on CWT recoveries of sampled hatchery origin fish was 69.0% one-ocean and 31.0% two-ocean. For the season, 113 females (33 were ½ spawned) and 125 males were initially spawned producing about 482,500 fertilized eggs. However, 66 females tested positive for IHNV. An estimated 291,075 eggs from those fish were destroyed at LFH, leaving 159,753 green eggs for production. After the IHNV females were removed, it was determined that only 47 females and 48 males actually contributed to the broodstock. Since the final egg total was not adequate for program goal, additional eggs from eight females were collected by ODFW at Wallowa Hatchery (Wallowa stock) and transported to LFH for rearing. Total green eggs taken (including those from ODFW) was 203,563 Final eyed eggs was 172,367 (Table 4).

Fecundities of one-ocean and two-ocean females were 4,365 and 5,595, respectively, similar to previous year's fecundity estimates (Figure 5). Fish that did not contain CWTs or were not spawned were passed upstream of the trap to spawn naturally. All carcasses from spawned fish,

or those killed to retrieve the CWTs, were transported back to LFH and buried. We recovered 177 fish that had, or should have had CWTs (Table 17). Sex ratio of CWT fish (41.7% male, 58.3% female) was similar to those that were trapped at large. All but one of the CWTs recovered were originally released on-site at Cottonwood AP.

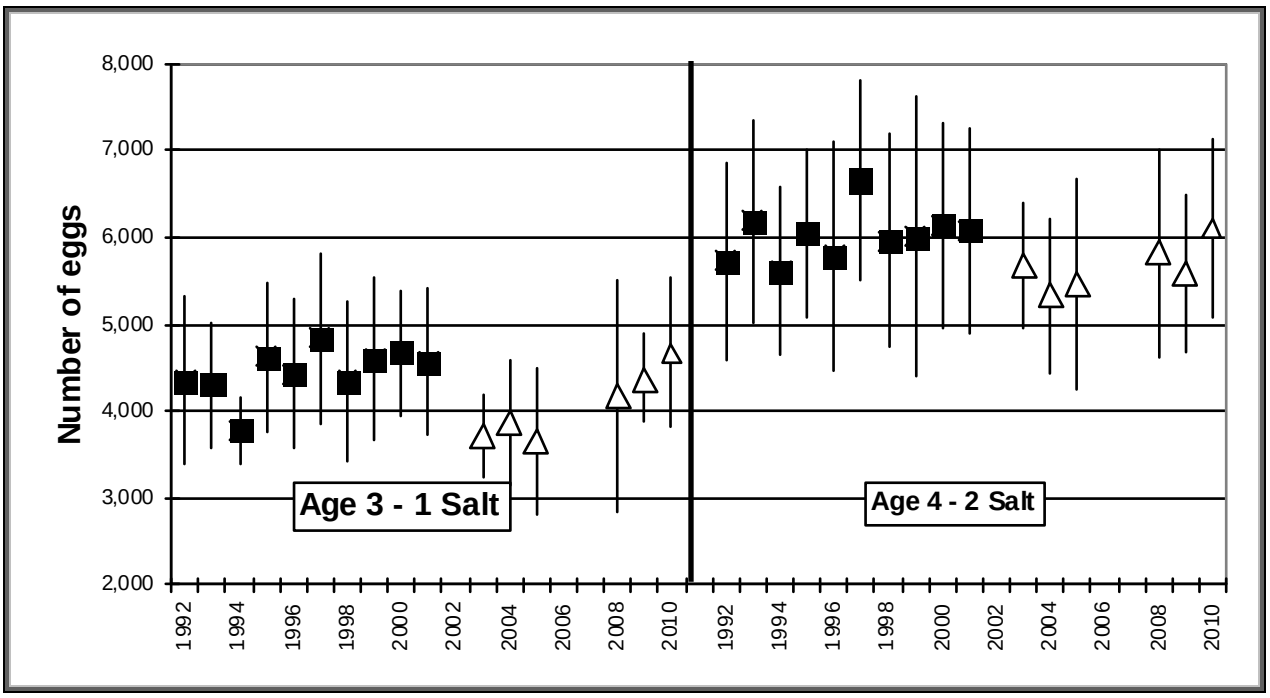

Figure 5. Mean fecundity (standard deviation bars) of Wallowa stock summer steelhead from 1992-2010. Note: egg estimation method was changed in 2003 from volumetric (black squares) to weights (open triangles).

Table 17. Summary of tagged adult summer steelhead trapped at Cottonwood Trap for 2008 run year / 2009 BY.

Brood year	CWT code	Stock	Release site	Number of CWTs
2005	63 / 32 / 90	Wallowa	Cottonwood AP	39
2006	63 / 36 / 64	Wallowa	Cottonwood AP	128
2006	63 / 36 / 65	LFH	Dayton AP	1
			LV clip - No CWT	5
			Lost CWT	4
			Grand Total for Year	**177**

There is growing concern from hatchery and fish health staff that the high incidence of IHNV detected in the broodstock is directly related to the number of hatchery fish passed upstream of the holding area for natural spawning in Cottonwood Creek. There is a further concern that disease from the adults could be transmitted to juveniles in the acclimation pond, since Cottonwood Creek is the water source for the pond. Options to reduce the number of fish passed upstream of the trap were explored for 2010 (see below in 2010 Run Year).

Run Year 2010: At the Cottonwood Creek Trap, low stream flows prevented any fish from swimming into the trap early in the season. As such WDFW decided to obtain all broodstock from Oregon. Wallowa stock eggs were collected from ODFW's Big Canyon Acclimation and Adult Trapping facility. On 6 April 2010, green eggs and semen were taken at Big Canyon and transported to LFH where they were fertilized, incubated and reared. A total of 244,487eggs were collected, with a 13.1% loss to eye-up, leaving 212,618 eggs for rearing (Table 4). All biological data and coded-wire tags recovered from spawned fish given to WDFW were collected by ODFW, and will be reported by ODFW per their agency protocols.

After the juveniles were released from the acclimation pond, and more water was then available in Cottonwood Creek, a total of 1,409 adult steelhead (551 [39.1%] male, 858 [60.9%] female) were trapped from 13 April to 30 April, 2010 at the Cottonwood adult trap. Fifty-nine natural origin fish (32 male, 27 female) were captured during the season; all of which were passed upstream of the trap for natural spawning. All captured hatchery fish were sacrificed and taken to LFH to be buried. Attempts were made to distribute carcasses to local food banks or for tribal use, but no interest was expressed from either source. We recovered 135 fish that had, or should have had CWTs (Table 18). Nearly all were released from Cottonwood AP, but we recovered three hatchery fish that were originally released into the Tucannon River.

In addition, all fish trapped at Cottonwood were scanned for PIT tags. We detected 40 PIT tags, some which were tagged and released from Cottonwood AP, while others were tagged at mainstem Columbia or Snake river dams as juveniles during outmigration, or as adult returns. All PIT tag data was uploaded to PTAGIS per protocols.

Table 18. Summary of tagged adult summer steelhead trapped at Cottonwood Trap for 2009 run year / 2010 BY.

Brood year	CWT code	Stock	Release site	Number of CWTs
2006	63 / 36 / 64	Wallowa	Cottonwood AP	16
2007	63 / 40 / 99	Wallowa	Cottonwood AP	111
2007	63 / 40 / 95	Lyons Ferry	Tucannon River	1
2007	63 / 41 / 65	Tucannon	Tucannon River	2
2008	63 / 46 / 82	Wallowa	Cottonwood AP	1
			LV clip - No CWT	2
			Lost CWT	2
			Grand Total for Year	**135**

Sex ratio of CWT fish (37.6% male, 62.4% female) was similar to those that were trapped at large. Age composition of Wallowa stock fish based on CWT recoveries at Cottonwood AP was 87.4% one-ocean, 12.6% two-ocean. Fecundities of one-ocean and two-ocean females were 4,675 and 6,111, respectively, similar to previous year's fecundity estimates (Figure 5).

Since 1992 (ever since eggs were collected from the Cottonwood Creek Trap), evaluation staff has compiled dates of broodstock spawning for the Wallowa stock summer steelhead (Figure 6). From 1992 to 2009, broodstock spawn timing has remained virtually unchanged. A minimum of three egg takes per season is also desired for this program, as it allows for virology screening of previously spawned broodstock while fish are still available to be collected from Cottonwood Creek.

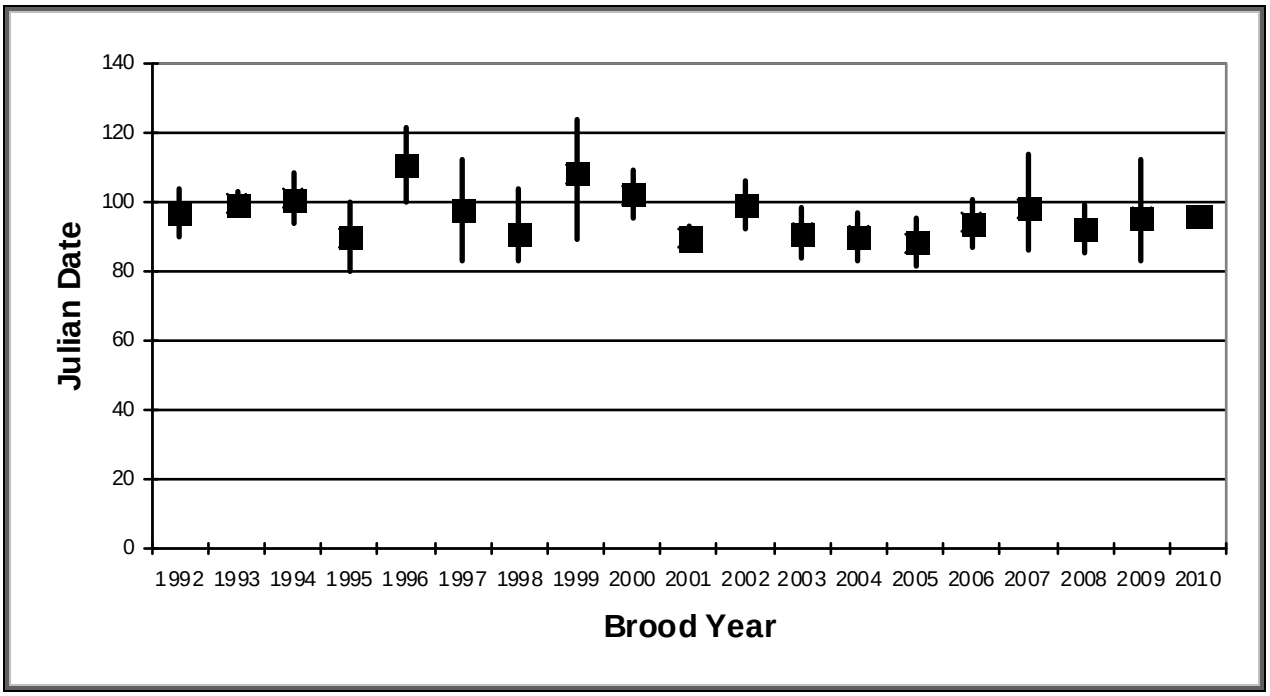

Figure 6. Range and mean spawn dates of Wallowa stock summer steelhead, 1992-2010. Bars indicate first and last date of spawning; square indicates the median spawn date.

Similar to the LFH stock though perhaps not as pronounced, hatchery and evaluation staffs have commented on the higher ratio of 1-salt fish to 2-salt fish in the Wallowa broodstock in recent years. We used CWT returns from the 1984-2006 brood years (all recovery locations combined) from Wallowa stock steelhead released into the Grande Ronde at Cottonwood AP to describe changes in age composition (Figure 7). Based on the analysis to date, it does appear that more younger age fish are returning than what was observed historically, though this shift has not been as dramatic as the LFH stock. The exact cause of this age composition shift is unknown, but similar to the Lyons Ferry stock, could be related to changes in size at release over the years, or changes in downriver fisheries (net) harvest. Further analysis is required to determine if these or other factors have caused this shift in age composition.

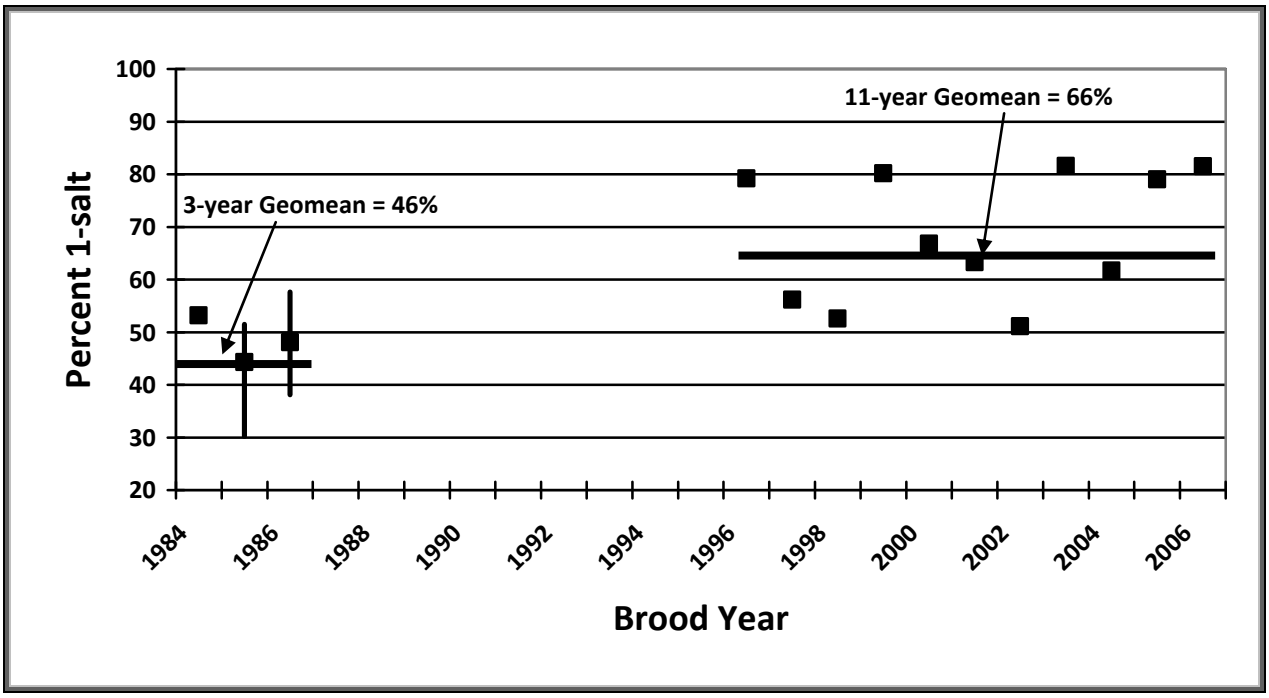

Figure 7. Percent 1-salt returns of Wallowa stock summer steelhead, 1982-2006 brood years. Squares are the average returns from the three possible release groups, and bars represent minimum and maximum values based on the groups.

Partial Spawning of Females: For the 2006-2009 broods, evaluation staff conducted an experiment in Cottonwood Creek to determine if partially spawned female steelhead can be released to spawn naturally and produce viable gametes. In 2006, partially spawned females were tagged (numerical Floy spaghetti type tags) and released, with kelts recovered either from spawning ground/carcass surveys or at the Cottonwood Creek adult trap. Of the kelts recovered in 2006, 87% successfully voided the rest of their eggs. However, we did not determine if those eggs were viable, and successfully deposited in a redd. In 2007, we attempted to answer that question by marking redds from tagged females and excavating their eggs from the gravel to check for embryonic development. That year,75% of the fish were successful in voiding their eggs, and many of the tagged fish were documented making redds. An error in egg development timing and when to extract the eggs from the redds (we extracted the eggs too early in the development stage to tell for sure whether the eggs had been fertilized or not) hampered our results. The 2008 effort generally repeated 2007, but additional fish were tagged as controls so they could be compared to the study fish, and flagged redds were covered with vexar screening to prevent redd disturbance and super-imposition. Again, we documented that many study fish were successful in voiding their eggs (67%) and making redds. A similar rate was also observed for the control fish (60% egg voidance). In all, 13 treatment and 4 control redds were covered, with 11 treatment and two control redds excavated at a later date. High stream flows and lost marker flags prevented us from excavating all marked redds. Preliminary results showed that

91% of the study-fish redds examined had growing embryos, and both of the control redd eggs were developing as expected. High stream flows and turbid waters hampered our sampling and obtaining more conclusive results, hence we desired to repeat the experiment for one more year.

The 2009 effort was generally the same as 2008, however very high and turbid stream flows prevented us from documenting redds. We tagged 47 partial spawned females and 20 control fish (tagged and released only). Kelts were recovered at the adult trap as in previous years and examined for egg retentions. In 2009, we documented that 94.5% (35 of 37 recovered) of the study fish, and 87.5% (14 of 16 recovered) of the control fish recovered had voided their eggs.

Based on the results obtained, we believe that partially spawning females may be a viable option for some of our hatchery programs where founding population size is limited (i.e. endemic programs). Employing such a strategy in those programs may be the best way to ensure a larger genetic contribution from the population into the broodstock, while allowing those same fish to contribute to natural production.

Lower Tucannon Adult Trap

Evaluation staff deployed and operated a temporary trap in the middle Tucannon River (rkm 39) during the fall of 2008, with the primary focus to collect natural-origin fish for a new endemic hatchery broodstock (Bumgarner et al. 2002). This program is still experimental (See Bumgarner et al 2002 for further details and goals). The original goal was to run the program for five years, assess the status/success and then cease or expand the program. The lack of adult return information, along with rearing difficulties at LFH (which have been improved since the program began) have delayed this assessment. A secondary objective of the trap is to enumerate and collect biological samples from natural-origin steelhead in the Tucannon River. For 2008/2009, all LFH stock fish (unless they had a CWT) were to be passed downstream of the trap. All CWT fish were to be killed for tag extraction and release location information.

For the 2008/2009 season, the trap/weir deployment occurred in October. No fish were trapped from October through December. A high stream flow event occurred in early January and damaged the trap box by rolling it about ½ mile downstream. Stream flow stayed high for the remainder of the season and we were unable to re-deploy the trap. The temporary adult trap has not been re-deployed since that time.

TFH Trap

Run Year 2008: 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 contained a CWT. Fish with a CWT are sacrificed for tag extraction. For the 2008 run year, hatchery staff trapped 88 natural origin, 242 Tucannon River endemic stock, and 8 LFH stock hatchery-origin steelhead (Table 19). During the 2008 run year, the lower river trap was taken out by high stream flows in January, so the TFH trap was solely responsible for broodstock collection. Sixteen females (12 natural, 4 endemic origin) and 11 males (8 natural and 3 endemic origin) were collected. Due to the lack of natural fish expected at the adult trap, WDFW managers decided to supplement the broodstock collection with no more than 25% endemic origin fish in the broodstock. At the end of the season, endemic origin fish contributed to 23.1% of the broodstock.

During March and April 2009, 16 females were spawned with 10 males at LFH. One female jumped the barrier between the ponds and was accidentally spawned with a Touchet River endemic stock male. After picking at eye-up, ½ of the eggs were moved into the Touchet River program and ½ were kept in the Tucannon River program. Total egg take was estimated at 77,298 (Table 6). One female tested positive for IHNV. Progeny from this female were reared to the unfed fry stage at LFH and then planted into the Tucannon River near Cummings Creek (Rkm 56). Natural fish trapped from the TFH trap consisted of 67% one-ocean and 33% two-ocean age fish (Table 20). Fecundities of one-ocean and two-ocean females were 4,257 and 5,765, respectively, for the 2008/2009 run year, very similar to previous years (Figure 9).

Run Year 2009: For the 2009 run year, hatchery staff trapped 323 natural origin, 330 Tucannon River endemic stock, and eight LFH stock hatchery-origin steelhead (Table 19). In the spring of 2010, WDFW and the co-managers decided to increase the production of Tucannon River endemic stock steelhead to 75,000 smolts. Broodstock numbers were adjusted accordingly. Eighteen females (11 natural, 7 endemic origin) and 19 males (14 natural and 5 endemic origin) were collected. Three natural males died prior to spawning, all females collected were spawned. During March and April 2009, 18 females were spawned with 16 males at LFH. Total egg take was estimated at 89,791 (Table 6). Endemic origin fish contributed to 35.3% of the broodstock. Natural fish trapped from the TFH trap consisted of 76.2% one-ocean and 23.8% two-ocean age fish (Table 20). Fecundities of one-ocean and two-ocean females were 4,369 and 5,382, respectively, very similar to previous years (Figure 8).

Table 19. Natural origin, hatchery LFH stock origin, hatchery Tucannon endemic stock origin summer steelhead trapped at the Tucannon Fish Hatchery from the 1997-2009 run years.

Run	Natural			Hatchery LFH Stock			Hatchery Endemic Stock			Totals (Percent)	
Year	Male	Female	Total	Male	Female	Total	Male	Female	Total	% Natural	% Female
1997	8	7	15	28	29	57	NA	NA	NA	20.8	50.0
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	1	7	45.5	22.7
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

Table 20. Summary of fresh and salt-water age composition of natural origin adult steelhead from the Tucannon River, 2000-2010 brood years.

Brood Year	Age 1.1		Age 1.2		Age 2.1		Age 2.2		Age 3.1		Age 3.2		Percent 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
Combined	**53**	**5.9**	**92**	**10.2**	**445**	**49.6**	**347**	**38.6**	**64**	**7.1**	**28**	**3.1**	**0.9**

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 over all years (0.03%).

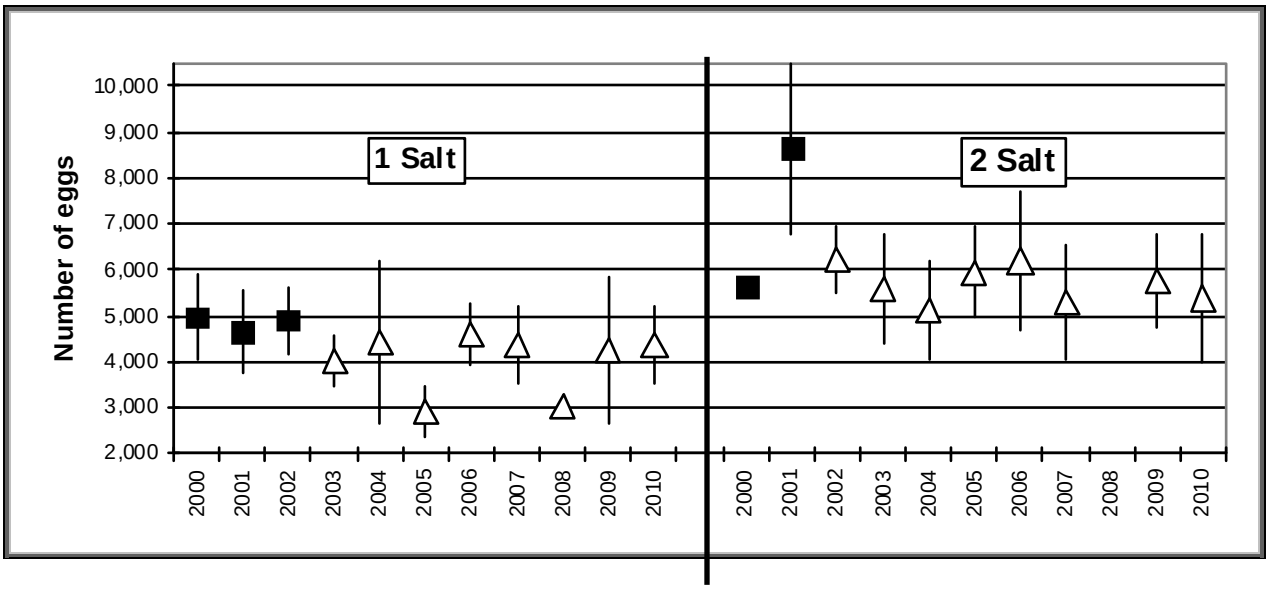

Figure 8. Mean fecundity (standard deviation bars) of Tucannon stock summer steelhead from 2000-2010. Note: egg estimation method was changed in 2003 from volumetric (black squares) to weights (open triangles).

Since the endemic programs began in 2000, evaluation staff has compiled dates of broodstock spawning (Figure 9). Through 2010, broodstock spawn timing has remained unchanged, though highly variable. Spawn timing of the Tucannon River stock is more protracted then other stocks and in some years requires many spawning days at the hatchery to obtain the eggs needed for the program, thereby increasing the variability in juvenile rearing sizes (coefficient of variation in fish length) among years.

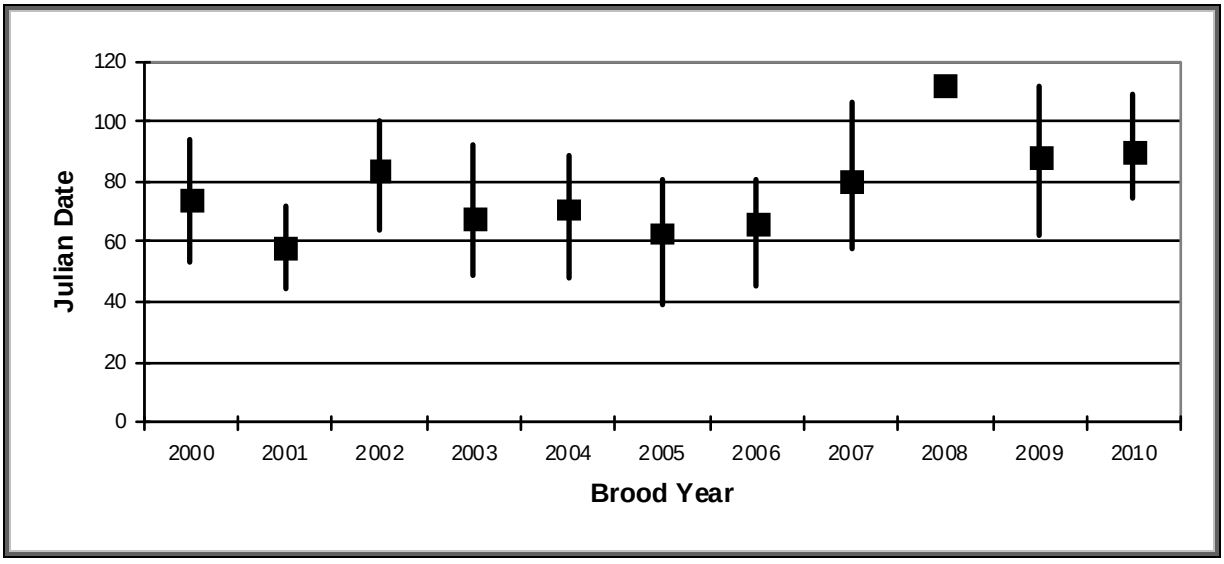

Figure 9. Range and mean spawn dates of Tucannon River endemic stock summer steelhead, 2000-2010. Bars indicate first and last date of spawning; square indicates the median spawn date.

Touchet River Adult Trap

The Touchet River adult trap, located in Dayton near rkm 86.4 (note: this is a deviation from and a correction to what was reported in earlier reports), 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: Some were to be collected for a new hatchery broodstock for use in the Touchet River. This program (similar in nature to the Tucannon River programs; see prior section) continues, but is still considered experimental. Since 2000, nearly all LFH stock fish captured in the Touchet River adult trap have been returned downstream to either recycle through the 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 a CWT.

Run Year 2008: For the 2008 run staff trapped 148 (59.2%) natural, 27 (10.8%) LFH hatchery origin, and 75 (30.0%) Touchet River endemic hatchery origin steelhead (Table 21). Natural steelhead trapped in 2009 consisted of 71.6% one-ocean and 28.4% two-ocean age fish (Table 22). Sex ratio of natural origin fish was 64.2% female, while hatchery steelhead was 59.8% female. We collected 32 natural origin fish (16 females and 16 males) for broodstock. There was one male pre-spawning mortality (3.1%). For the season, 15 females were spawned with 13 males yielding 74,421 eggs (Table 7). This estimate includes eggs from a Tucannon River origin female that was mistakenly crossed with a Touchet River origin male, and one female that was spawned, but the unfed fry were planted in the Touchet River as she tested positive for IHNV.

Run Year 2009: For the 2009 run staff trapped 602 (72.2%) natural, 82 (9.8%) LFH hatchery origin, and 150 (18.0%) Touchet River endemic hatchery origin steelhead (Table 21). Natural steelhead trapped in 2010 consisted of 73.2% one-ocean and 26.8% two-ocean age fish (Table 22). Sex ratio of natural origin fish was 55.7% female, while hatchery steelhead was 66.8% female. We collected 32 natural origin fish (18 females and 17 males) for broodstock. There were two pre-spawning mortality males (5.7%), and one female disappeared. We assume that it jumped out of the pond into the fallback channel. For the season, 15 females were spawned with 13 males yielding 75,596 eggs (Table 7).

In addition to trapping summer steelhead, we also capture spring Chinook (*O. tshawytscha*) , bull trout (*Salvelinus confluentus*), bridgelip suckers (*C. columbianus*), brown trout (*Salmo trutta*), and whitefish (*Prosopium williamsoni*) in the Touchet adult trap (Table 23). Biological data collected from bull trout, brown trout and whitefish trapped at the Touchet adult trap in 2009 and 2010 are presented in Appendix A.

Table 21. Total number of male and female summer steelhead at the Touchet River Adult Trap (1992-1994, 1998-2009 run years).

Run Year	Natural			Hatchery LFH Stock			Hatchery Endemic Stock			Totals (Percent)	
	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	8	NA	NA	NA	84.0	62.0
1999	9	22	31	3	0	3	NA	NA	NA	91.2	64.7
2000	52	130	182	19	18	37	NA	NA	NA	83.1	67.6
2001	68	106	174	9	10	19	NA	NA	NA	90.2	60.1
2002	28	91	119	4	7	11	1	1	2	90.2	75.0
2003	29	73	102	19	8	27	12	5	17	69.8	58.9
2004	38	48	86	19	25	44	4	7	11	61.0	56.7
2005	65	98	163	6	9	15	8	28	36	76.2	63.1
2006	38	107	145	13	13	26	13	32	45	67.1	70.4
2007	34	85	119	9	10	19	7	20	27	72.1	69.7
2008	53	95	148	14	13	27	27	48	75	59.2	62.4
2009	267	335	602	35	47	82	42	108	150	72.2	58.8

Table 22. Summary of fresh and salt-water age composition of natural origin adults from the Touchet River, 1994-1995 and 1999-2010 brood years.

BY	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	%	
1994	0	0.0	0	0.0	6	28.6	8	38.1	3	14.3	3	14.3	4.8
1995	0	0.0	0	0.0	0	0.0	6	85.7	0	0.0	0	0.0	0.0
1999	0	0.0	1	3.2	18	58.1	9	29.0	2	6.5	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
2001	1	0.6	14	8.0	84	48.3	40	23.0	15	8.6	9	5.2	5.7
2002	6	4.8	3	2.4	84	67.7	20	16.1	6	4.8	3	2.4	1.6
2003	0	0.0	8	6.7	20	16.7	73	60.8	2	1.7	10	8.3	5.8
2004	0	0.0	1	0.8	47	39.2	18	15.0	18	15.0	2	1.7	8.1
2005	0	0.0	0	0.0	37	44.0	21	25.0	15	17.9	8	9.5	3.6
2006	2	1.3	7	4.5	85	54.8	38	24.5	7	4.5	11	7.1	3.2
2007	2	1.4	11	7.9	46	32.9	54	38.6	7	5.0	14	10.0	2.8
2008	2	1.7	6	5.2	47	40.5	38	32.8	7	6.0	7	6.0	7.7
2009	3	2.1	0	0.0	81	56.3	21	14.6	19	13.2	8	5.6	8.2
2010	15	4.1	14	3.8	230	62.8	74	20.2	23	6.3	4	1.1	1.9
Totals	**32**	**2.1**	**66**	**4.3**	**802**	**52.0**	**428**	**27.8**	**127**	**8.2**	**80**	**5.2**	**5.1**

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 over all years (0.32%).

Table 23. Total number of spring Chinook, bull trout, brown trout, whitefish, northern pike minnow, and bridgelip sucker captured in the Touchet River Adult Trap (1993-1995, 1999-2010). Data presented in this table is through the month of December, 2010.

	Spring Chinook						Bridgelip
Year	Natural	Hatchery	Bull trout	Brown trout	Whitefish	Pike Minnow	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	663
2004	4	6	65	17	7	0	226
2005	4	1	49	6	8	1	171
2006	0	0	53	31	34	0	54
2007	1	3	32	13	18	0	13
2008	1	2	29	11	28	5	16
2009	15	13	110	10	32	2	64
2010	14	2	123	18	120	0	227

For the 2009 brood year, the mean fecundities of natural one-ocean and two-ocean females were 3,977 and 5,919 eggs, respectively (Figure 10). For the 2010 brood year, the mean fecundities of natural one-ocean and two-ocean females were 4,222 and 5755 eggs, respectively (Figure 10).

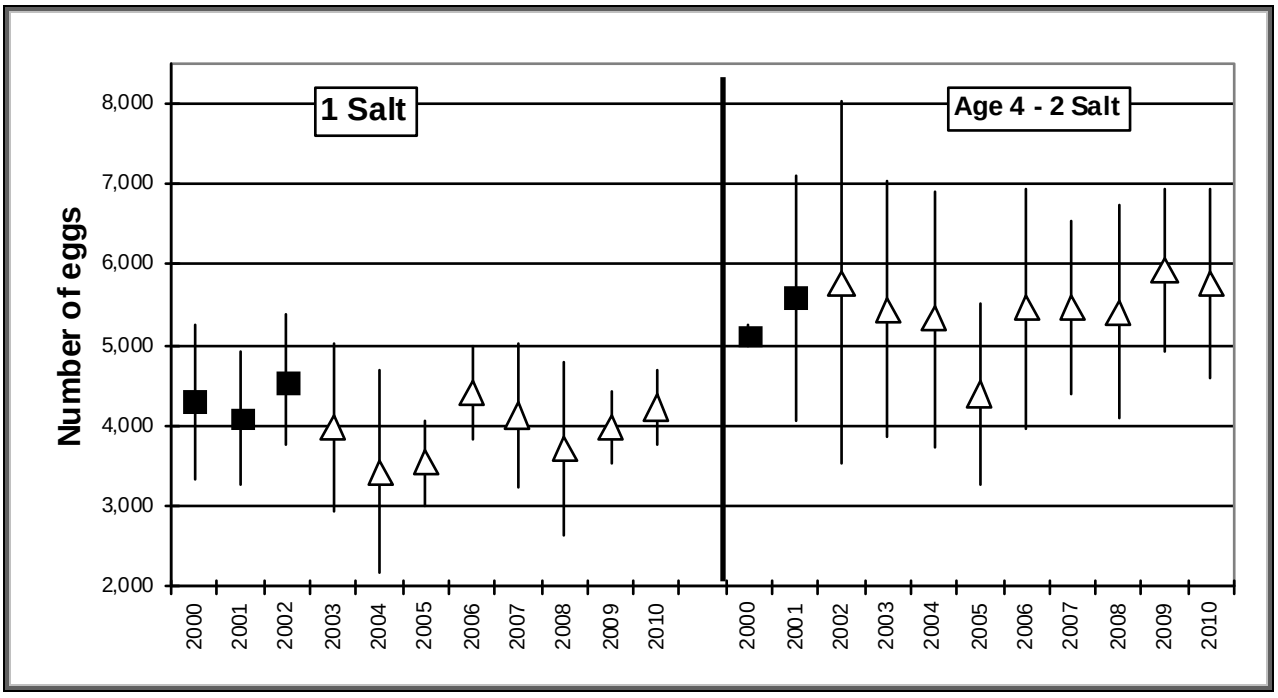

Figure 10. Mean fecundity (standard deviation bars) of Touchet stock summer steelhead from 2000-2010. Note: egg estimation method was changed in 2003 from volumetric (black squares) to weights (open triangles).

The Touchet River endemic program began in 2000 and evaluation staff has compiled dates of broodstock spawning (Figure 11). Broodstock spawn timing has been slightly earlier than the first two years. However, this spawn-timing shift is artificial and results from intentionally collecting fish from the early part of the run. We assumed that early returning fish would spawn earlier and would allow the hatchery staff additional rearing time to produce a one-year old smolt at program size. This is exactly what has happened. The long-term impacts of this strategy are currently unknown, but are potentially harmful to the recovery of the population, and have not been recommended for long-term management of the stock. One possible solution would be to collect fish for broodstock proportional to the entire run timing, and then designate a portion of the juvenile population that would be reared in a two-year smolt program. As stated previously, the Touchet endemic program is experimental, and short-term actions have been taken for program evaluation purposes only, as this program has not been formally adopted by WDFW. Similar with the Tucannon River stock, multiple spawns have been required in some years to obtain the eggs needed for the program (Figure 12).

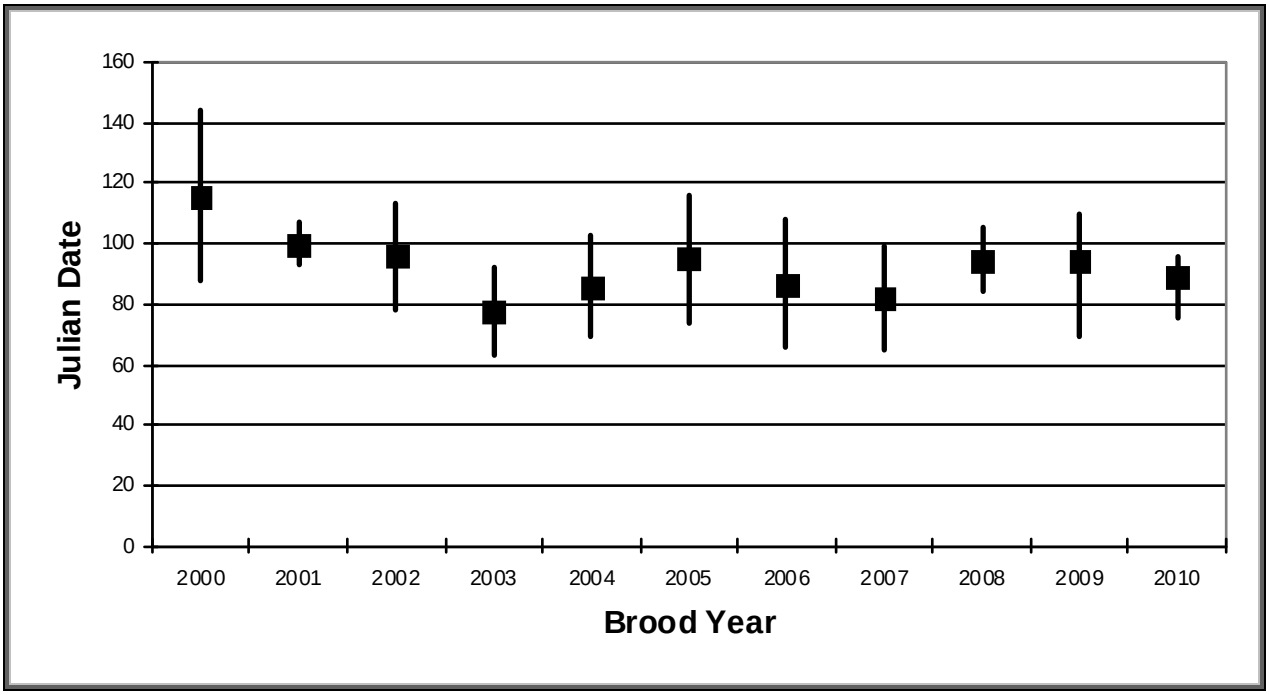

Figure 11. Range and mean spawn dates of Touchet River endemic stock summer steelhead, 2000-2010. Bars indicate first and last date of spawning; square indicates the median spawn date.

Creel Surveys

Snake River and Tributaries

WDFW personnel surveyed steelhead sport anglers within the LSRCP area of Washington to recover CWTs from tagged steelhead using methods described in Schuck et al. (1990). When possible, data from weekly surveys were summarized during the season and provided to the local news media to inform anglers. Overall summaries of anglers interviewed, hours fished and catch rates are provided (Tables 24 and 25). Not all months throughout the steelhead season are sampled in each section as low catch rates and low effort do not warrant staff time. Therefore these summaries are not indicative of the entire steelhead season.

Table 24. Steelhead angler interview results for fall/winter/spring of the 2008 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 (hr/fish)
Columbia River Basin							
McNary Dam to Pasco	533	2,797	9,883	217	272	16	19.6
Snake River Basin							
Mouth to IHR	640	96	300	3	6	0	33.3
IHR to LMD	642	4,269	14,772	242	321	19	25.4
LMD to LGD	644	2,251	12,009	263	511	21	15.1
LGD to LGR	646	650	2,633	46	79	1	20.9
LGR to Hwy 12 Br.	648	1,421	7,860	160	333	17	15.4
Hwy 12 Br. Upstream	650	819	5,572	472	471	25	5.8
Lower Grande Ronde (Washington Only)	592	2,302	10,729	237	852	519	6.7
Totals		14,605	63,757	1,640	2,845	618	12.5

[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

In addition to creel surveys on the Snake River, we cooperate with ODFW in conducting a joint survey of anglers on the lower Grande Ronde River of Washington and Oregon. 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 2006 to 2008 run years (Table 26).

Table 25. Steelhead angler interview results for fall/winter/spring of the 2009 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 (hr/fish)
Columbia River Basin							
McNary Dam to Pasco	533	1,482	4,578	98	178	7	16.2
Snake River Basin							
Mouth to IHR	640	194	652	13	16	1	21.7
IHR to LMD	642	3,457	12,042	255	461	18	16.4
LMD to LGD	644	2,359	12,955	394	755	35	10.9
LGD to LGR	646	120	445	13	9	0	20.7
LGR to Hwy 12 Br.	648	1,821	11,057	257	557	113	11.9
Hwy 12 Br. upstream	650	1,513	8,340	563	1,150	85	4.6
Lower Grande Ronde (Washington Only)	592	2,365	11,850	946	2,606	1,617	2.3
Totals		13,311	61,916	2,539	5,732	1,776	6.2

[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.

Table 26. Estimated angler effort, catch rates, and harvest for steelhead anglers on a portion of the Grande Ronde River in Washington, run year 2006-2008 Run Years (Mike Flesher, ODFW).

	2006				2007				Total
	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	
Effort Hours	1,076.7	4,924.9	4,201.3	1,268.6	2,392.3	5,438.6	9,263.7	942.7	29,508.8
Catch Rate [a]	0.0000	0.0609	0.1501	0.2216	0.1687	0.0896	0.1802	0.2549	0.1359
Total Catch [b]	0	300	631	281	404	487	1,669	240	4,012
Fish Kept	0	180	342	177	225	257	896	88	2,165
Hatchery Released	0	53	127	30	72	141	546	124	1,093
Natural Released	0	67	162	75	106	89	227	29	755

	2007				2008				Total
	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	
Effort Hours	533.2	4,105.5	2,014.0	1,203.1	891.4	5,047.9	8,490.9	1,969.1	24,255.1
Catch Rate [a]	0.0239	0.0358	0.1211	0.1390	0.1389	0.1862	0.2126	0.2926	0.1656
Total Catch [b]	13	147	244	167	124	940	1,805	576	4,016
Fish Kept	13	33	163	92	56	602	969	289	2,217
Hatchery Released	0	79	16	31	18	271	724	265	1,404
Natural Released	0	34	65	44	49	67	112	23	394

	2008				2009				Total
	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	
Effort Hours	992.4	4186.8	2796.8	905.7	1052.3	7025.7	7207.2	939.1	25106.0
Catch Rate [a]	0.0613	0.0307	0.0709	0.1118	0.0480	0.1009	0.1254	0.0692	0.0883
Total Catch [b]	61	129	198	101	51	709	904	65	2,218
Fish Kept	28	22	79	71	37	350	522	40	1,149
Hatchery Released	5	28	32	12	1	192	345	20	635
Natural Released	28	79	87	18	13	167	37	5	434

[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.

Coded-Wire Tag Recoveries
Smolt-to-Adult Survival Rates

Coded-wire tag recoveries from fisheries, hatcheries, or from in-river traps have provided the basic data to estimate minimum 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 adjustment to account for fish that escape to the spawning grounds in all available areas, and some fishery areas are not sampled 100% of the time. 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. The following CWT recovery data (Figures 13-17) demonstrate the success of both the LFH and Wallowa stock summer steelhead programs.

With the initiations of the endemic stock programs on the Touchet and Tucannon River, subsequent 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. Smolt-to-adult return rates since the 2000 brood have been above, similar or slightly lower that the long-term average for some groups, but still well above the LSRCP goal of 0.5% to the project area.

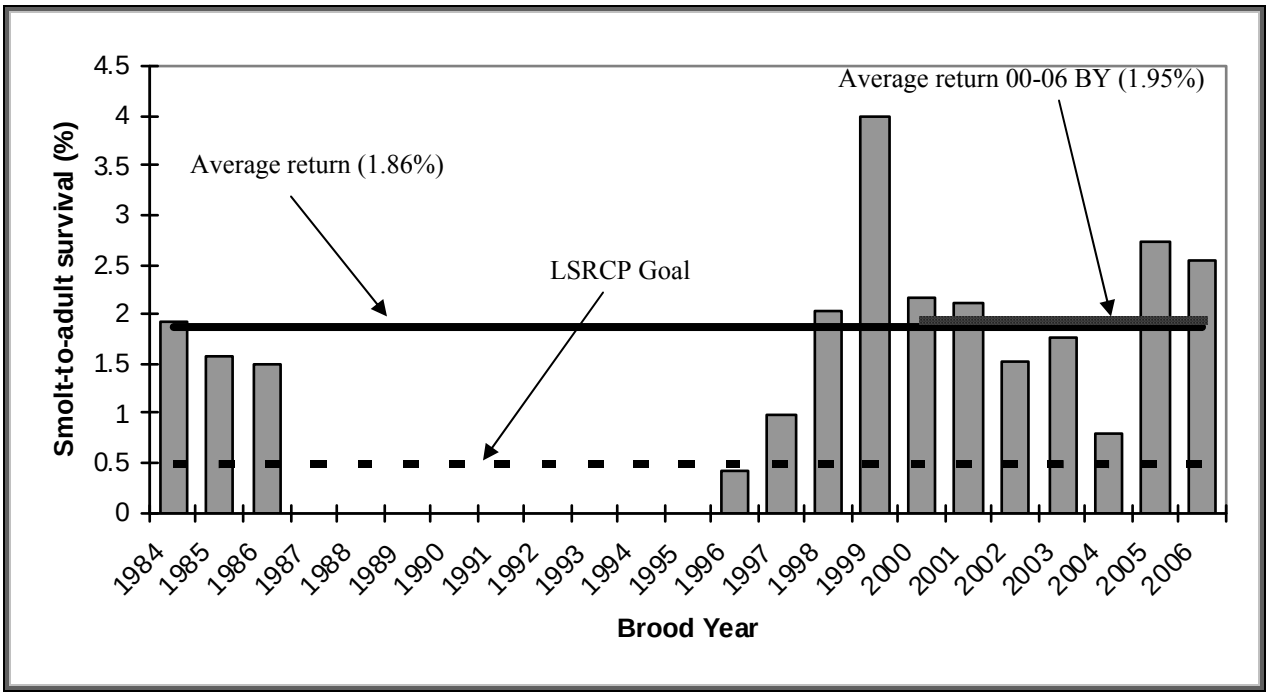

Figure 12. Estimated smolt-to-adult survival (to the LSRCP project area) of summer steelhead released from Cottonwood Acclimation Pond in the lower Grande Ronde River (1984-1986; 1996-2006 broods).

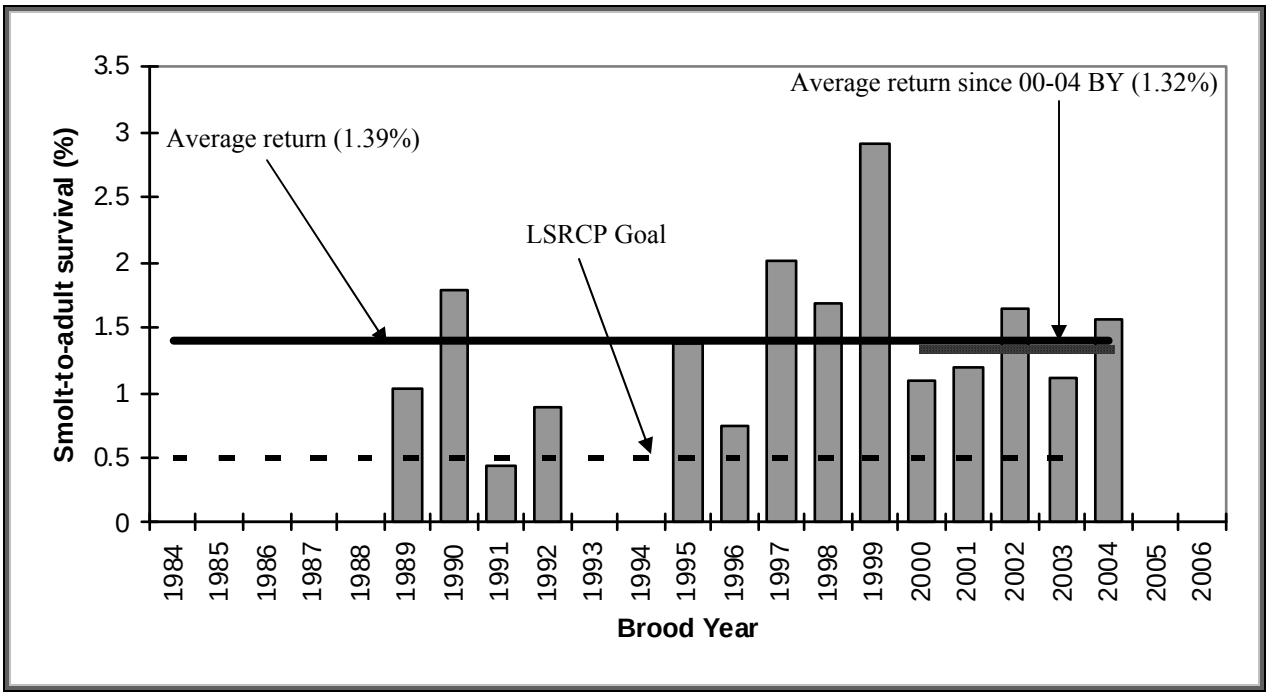

Figure 13. Estimated smolt-to-adult survival (to the LSCRP project area) of summer steelhead released directly into the middle or lower Tucannon River (1989-1992; 1995-2004 broods). Note: 2005 and 2006 brood fish did not receive a CWT.

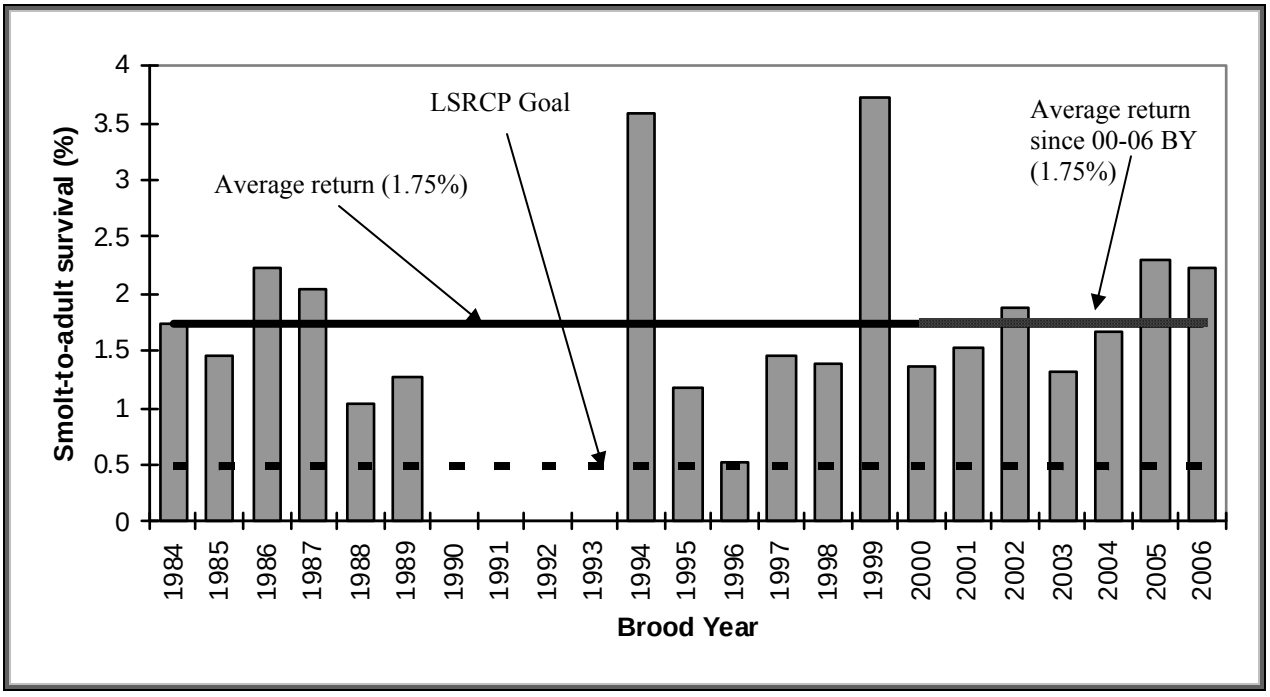

Figure 14. Estimated smolt-to-adult survival (to the LSCRP project area) of summer steelhead released directly into the Snake River at Lyons Ferry Hatchery (1984-1889; 1994-2006 broods).

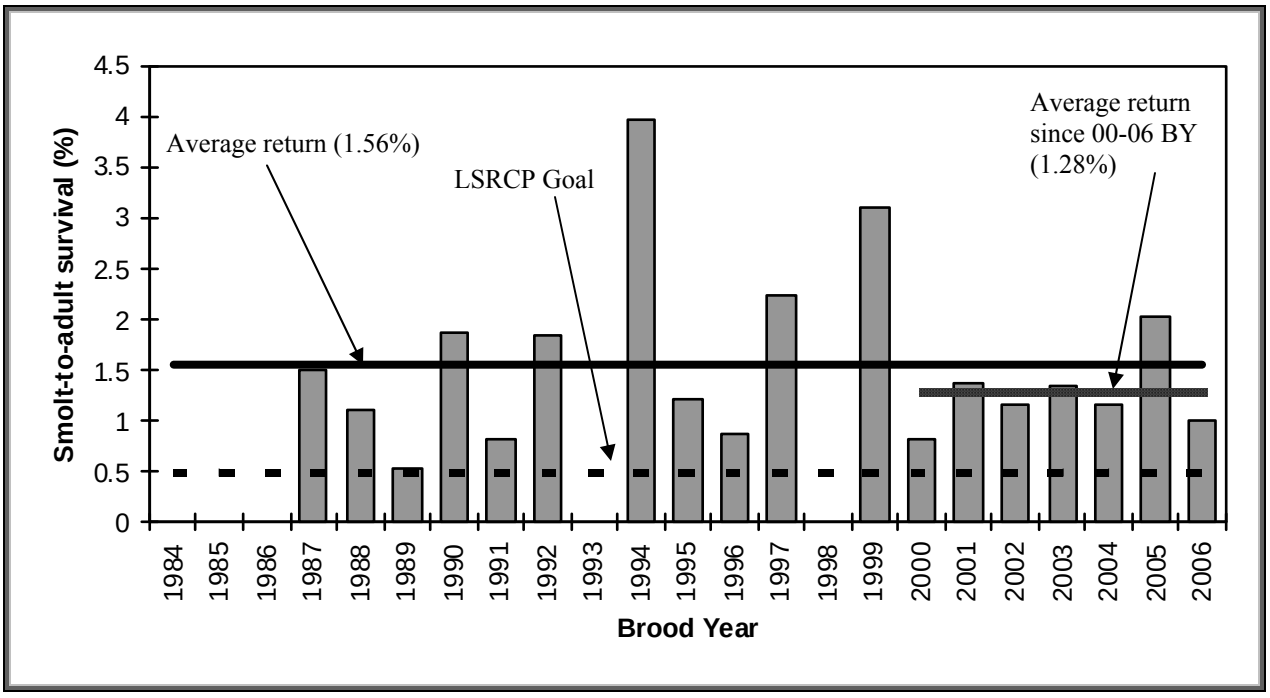

Figure 15. Estimated smolt-to-adult survival (to the LSCRP project area) of summer steelhead released from Dayton Acclimation Pond in the Touchet River (1987-1992; 1994-1997; 199-2006 broods).

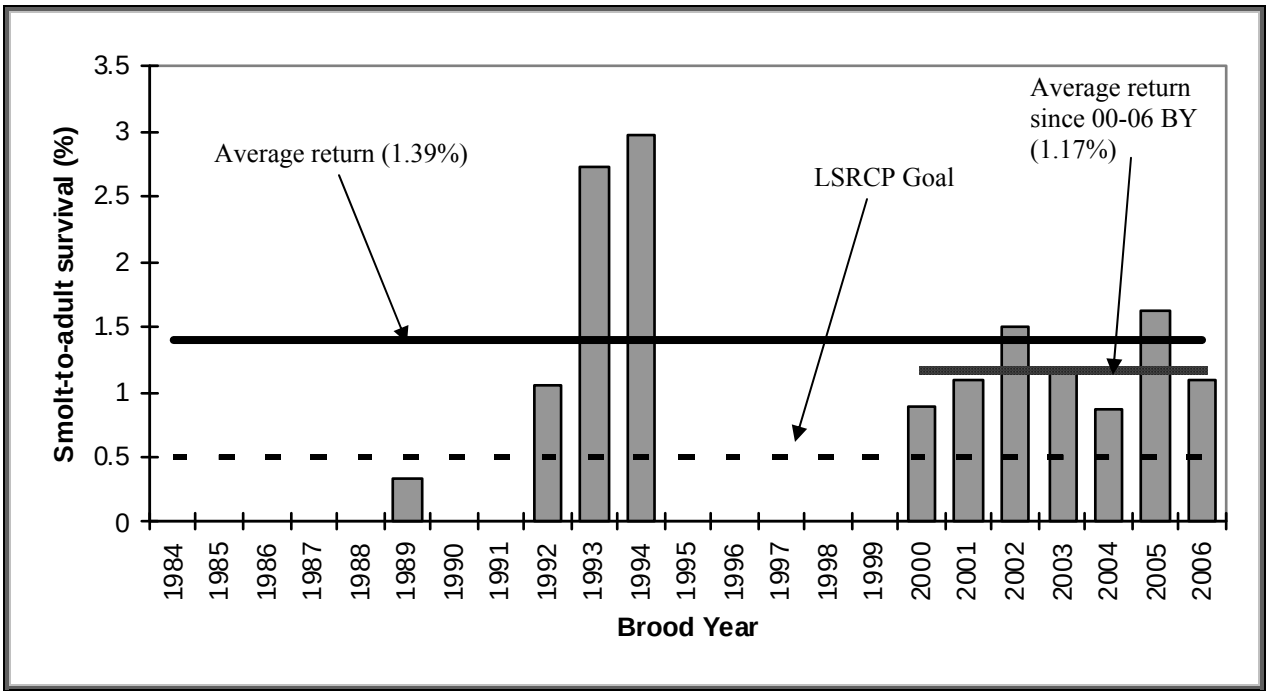

Figure 16. Estimated smolt-to-adult survival (to the LSCRP project area) of summer steelhead released directly into the Walla Walla River (1989; 1992-1994; 2000-2006 broods).

Because the two endemic stock releases are protected under the ESA, neither has been marked for harvest. Smolt-to-adult survival information has been gathered through the use of PIT tags. Unfortunately, PIT tag and CWT return data are not directly comparable (Figure 17), and it has been only in the last few years that we have simultaneously PIT tagged large numbers of LFH and Wallowa stocks for comparison and better adult accounting than what CWT data was providing. Figure 18 is based on PIT tag release numbers ranging from 300-700/year/group, until the 2006 brood, which had 5,000 tags in the Dayton and Walla Walla release groups. These small samples may not reliably represent the true difference in PIT/CWT survival estimates, but are provided here for reference. Smolt-to-adult survivals (based solely on PIT tags) to Bonneville Dam for the LFH stock (Tucannon and Touchet river releases) and Tucannon and Touchet river endemic stocks are provided (Figures 18 and 19). Until the 2008 migration year, Tucannon endemic stock survivals were about 50-60% less than the LFH stock. In the Touchet River groups, the endemic stock survivals were 60-80% less than the LFH stock.

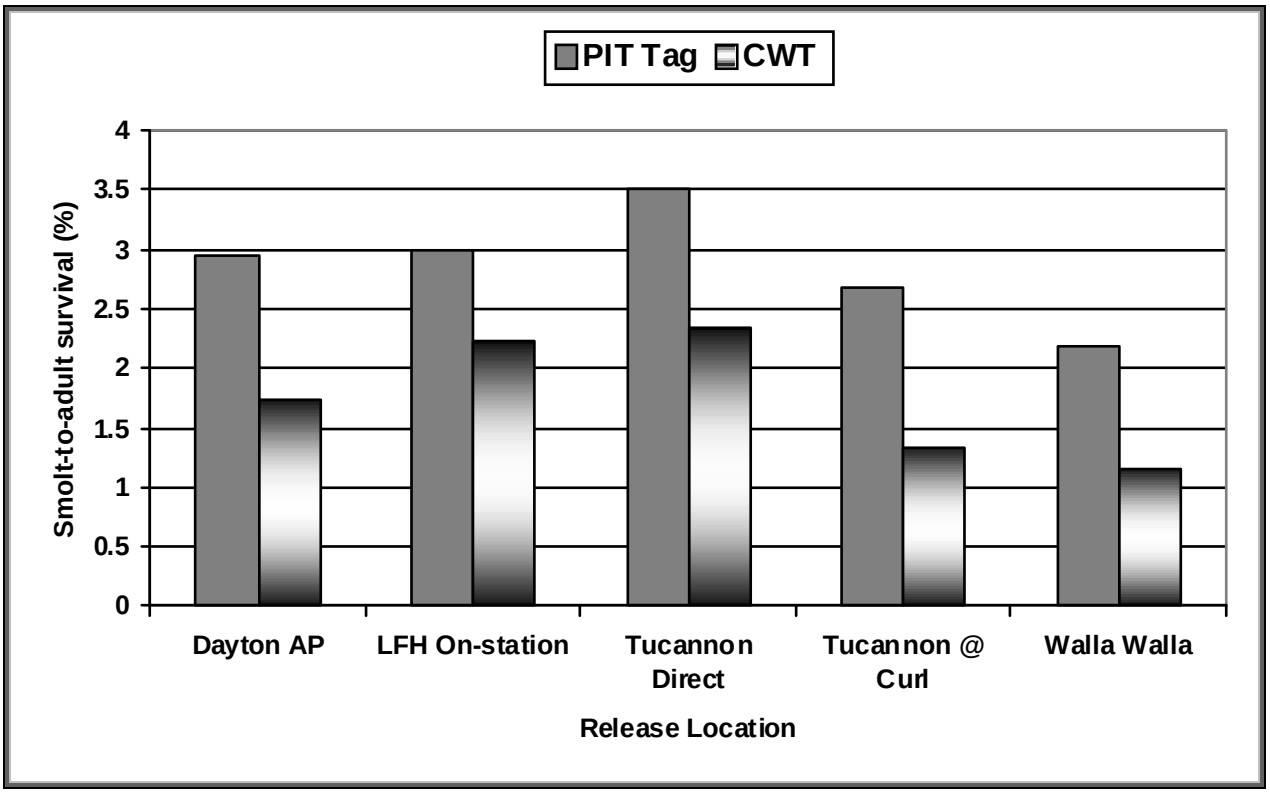

Figure 17. Comparison of smolt-to-adult survival rates from PIT tags or CWT based on detection/recoveries from Bonneville Dam or upstream. Dayton = Average of 1996,1997,1999,2000, and 2006 brood years, LFH On-station = Average of 1995, 1996-1999 brood years, Tucannon = Average of 1998-2000 brood years, Tucannon at Curl Lake = Average 1993-1994 brood years, and Walla Walla (2006 brood only)

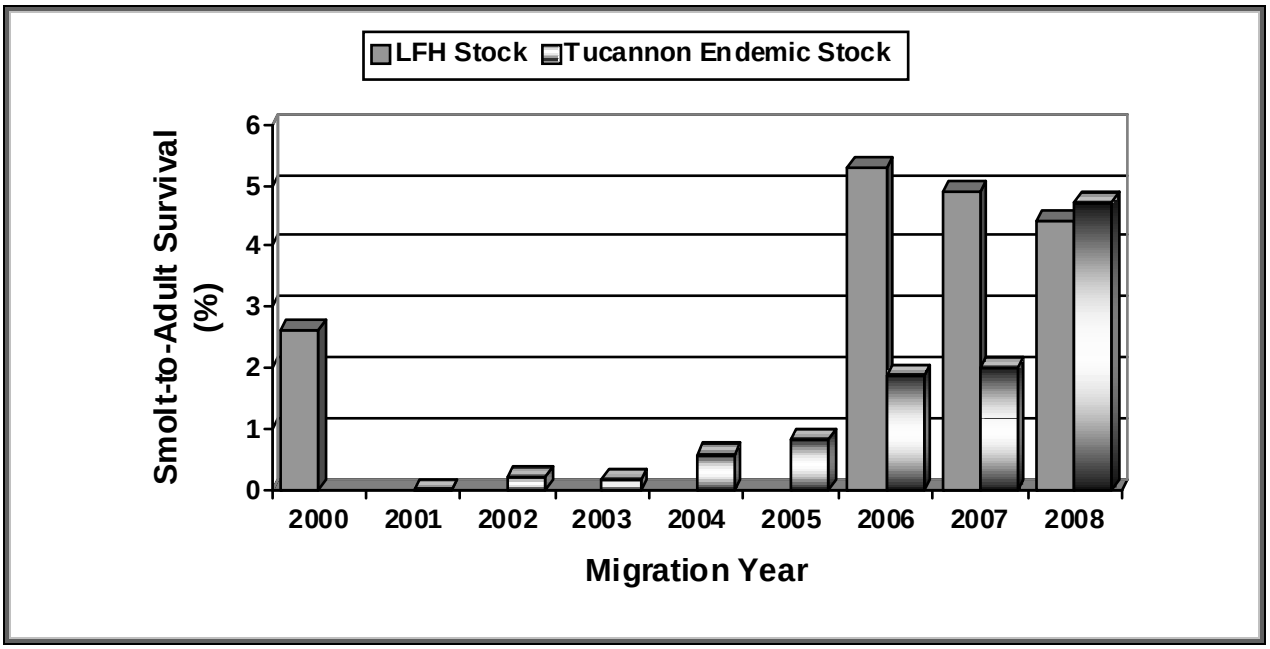

Figure 18. Smolt-to-adult survival estimates (to Bonneville Dam based on PIT tags) of LFH stock released into the Tucannon River, and Tucannon River endemic stock steelhead, 2000-2008 Migration Years.

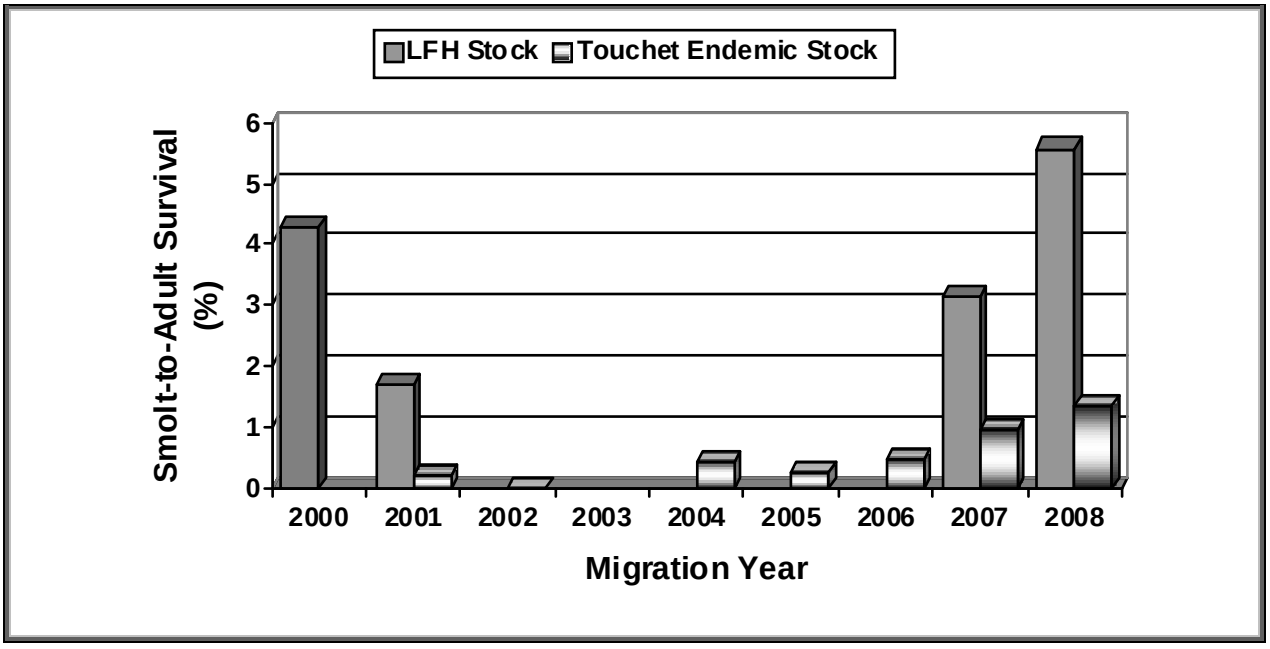

Figure 19. Smolt-to-adult survival estimates (to Bonneville Dam based on PIT tags) of LFH stock released into the Touchet River from Dayton Acclimation Pond, and Touchet River endemic stock steelhead, 2000-2008 Migration Years.

Spawning Ground Surveys

During the springs of 2009 and 2010, evaluation staff conducted spawning ground surveys to estimate the number of summer steelhead redds in index areas of the Tucannon and Touchet rivers and Asotin Creek. Stream flows were very high in 2009 and resulted in many incomplete surveys or no surveys in some areas. A few exceptions were the South Fork Touchet, Wolf Fork (Touchet), Robinson Fork (Touchet), South Fork Asotin, and Charley Creek (Asotin), where estimates were possible (Table 27). Spawning ground surveys in 2010 were more complete as stream flows were generally favorable for most surveys areas throughout the season (Table 28). The exception was the Tucannon River, where high spring flows throughout the month of May prevented the completion of final surveys. Based on redds counted in 2010, steelhead returns to all three basins were higher than normal.

Over the past few years, we standardized all spawning ground survey estimates for summer steelhead in the Touchet River and Asotin Creek. We are frequently requested to provide estimates of spawning steelhead for areas that we survey. Unfortunately, changes in survey methodology over the years and sections surveyed, and years in which high stream flows cut surveys short, have made it very difficult to provide data that were consistent among years. By applying area-under-the-curve methodologies, average redd erasure rates by stream, and regression analyses, we have now standardized the summer steelhead redd estimates for Asotin Creek (Table 29) and the Touchet River (Table 30). Tucannon River estimates remain to be derived. The number of spawners within each of these streams, as derived from these redd estimates, can be provided upon request.

Table 27. Summer steelhead spawning ground survey results, 2009.

Stream Section surveyed	Estimated river kilometers surveyed	Dates surveyed	Redds counted	Total expanded redds in index area
Touchet River				
South Fork	10.9	4/30, 5/11, 5/12	18	102
Wolf Fork	10.1	4/29, 5/13	17	56
Robinson Fork	6.4	5/11	5	25
Asotin Creek				
Charley Creek	4.2	3/27, 4/17	6	22
South Fork	9.4	3/27, 4/17, 5/1, 5/14	20	28

Table 28. Summer steelhead spawning ground survey results, 2010.

Stream Section surveyed	Estimated river kilometers surveyed	Dates surveyed	Redds counted	Total expanded redds in index area
Touchet River				
North Fork	14.5	3/26, 4/8, 4/16, 4/27, 5/12	148	195
South Fork	14.6	3/23, 4/16, 5/13	128	235
Wolf Fork	10.1	3/25, 4/16, 4/19, 5/14, 5/17, 5/19	48	84
Robinson Fork	6.4	5/14	31	44
Asotin Creek				
Mainstem	20.6	3/19, 4/15, 5/3, 5/5	282	384
North Fork	14.5	3/19, 4/11, 4/15, 4/25, 5/3, 5/7	121	148
South Fork	12.1	4/7, 4/19, 4/28, 5/6	67	79
Charley Creek	10.6	4/10, 4/24, 5/3, 5/4, 5/9	47	54
Tucannon River				
Mainstem [a]		3/18, 3/22, 3/29, 4/26, 4/27	148	382
Cummings Creek	10.6	5/26	55	55

[a] The Tucannon River index area in 2010 was from the Tucannon FH Intake to HWY 12. Redd surveys above the hatchery were not conducted.

Table 29. Standardized redd estimates and redds/kilometer within index reaches of Asotin Creek in southeast Washington, 1986-2010.

Year	Mainstem		North Fork		South Fork		Charley Creek		Total
	Redds	Redds/km	Redds	Redds/km	Redds	Redds/km	Redds	Redds/km	Redds
1986	354	17.2	295	22.2	173	14.3	77	7.3	899
1987	182	8.8	229	17.2	89	7.4	91	8.6	591
1988	199	9.7	154	11.6	87	7.2	48	4.5	488
1989	122	5.9	50	3.8	28	2.3	16	1.5	216
1990	125	6.1	43	3.2	33	2.7	21	2.0	222
1991	138	6.7	58	4.4	29	2.4	20	1.9	245
1992	120	5.8	56	4.2	30	2.5	40	3.8	246
1993	335	16.3	149	11.2	63	5.2	47	4.4	593
1994	165	6.6	52	3.9	18	1.5	15	1.4	250
1995	185	9.0	79	5.9	38	3.1	26	2.5	327
1996	215	10.4	73	5.5	63	5.2	30	2.8	380
1997	129	6.3	69	5.5	13	1.1	18	1.7	229
1998	144	7.0	55	4.1	38	3.1	18	1.7	255
1999	174	5.8	105	7.9	33	2.7	22	2.1	344
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	227	11.0	62	4.7	32	2.6	32	3.0	353
2007	160	7.8	38	2.9	44	3.6	44	4.2	286
2008	130	6.3	35	2.6	32	2.6	12	1.1	209
2009	149	7.2	50	3.8	28	2.3	22	2.1	249
2010	384	18.6	148	11.1	79	6.5	54	5.1	665

Table 30. Standardized redd estimates and redds/kilometer within index reaches of the Touchet River in southeast Washington, 1987-2010.

Year	North Fork		South Fork		Wolf Fork		Robinson Fork		Total
	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	180	6.8	95	5.4	41	4.6	468
1993	65	3.4	107	4	36	2.1	20	2.2	228
1994	135	7.1	121	4.5	81	4.6	26	2.9	363
1995	88	4.6	116	4.3	83	4.8	17	1.9	304
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	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	84	4.8	235	8.8	44	4.9	558

Contributions to LSRCP Mitigation Goals

The LFC summer steelhead program (LFH and Wallowa stocks only) continues to meet and/or exceed its original mitigation goals by supplying large returns of hatchery steelhead for harvest to the project area. This is in part due to the fact that fishery harvest rates in the lower Columbia River fisheries have declined substantially since the program was initiated; which called for a 2:1 lower river to project area fishery harvest ratio. Hence, the same, and sometimes even more fish are returning to the project area even though hatchery production has been reduced. Based on the analysis presented below (Table 31), about 21% of the harvest of the LFH stock, and about 11% of the fishery harvest of the Wallowa stock currently occurs in the lower Columbia River below the project area. This compares to data from the late 1980's where harvest from fisheries in the lower Columbia River accounted for 50-60% in each of these stocks, with the largest proportion occurring in the lower Columbia River net fisheries.

Table 31. Percent contribution of Wallowa and Lyons Ferry stock summer steelhead to fisheries (commercial or sport) below the project area, or within the project area based on the brood years provided.

	Below Project Area				Project Area
Hatchery Stock Brood Years	% Ocean fishery	% Net fishery	% Sport fishery	% Total	% Sport fishery
Wallowa Stock					
1984-1986	0.2	55.7	3.2	59.1	40.9
1997-2005	0.1	5.1	5.8	11.0	89.0
Lyons Ferry Stock					
1987-1989	0.8	37.4	12.8	50.9	49.1
2000-2005	0.0	3.3	17.3	20.6	79.4

Using total CWT recoveries (fisheries, adult traps, other surveys), we estimate that a minimum of 7,416 (3,155 goal) LFH stock and 3,256 (1,501 goal) Wallowa stock fish returned to the Snake River project area in the 2007 run year (Table 32). That represents 235% and 217% of the Washington mitigation goal for each of these stocks in the 2007 run year. For the 2008 run year, we estimate that a minimum of 6,474 (3,155 goal) LFH stock and 5,271 (1,501 goal) Wallowa stock fish returned to the Snake River project area. That represents 205% and 351% of the Washington mitigation goal for each of these stocks for the 2008 run year. Fish escaping to the spawning grounds are not counted in these calculations. Since program inception, both stocks have averaged 245% of the mitigation goal to the project area. Program (smolt release) reductions of about 40% for both the LFH and Wallowa stocks since the 2002 release year should bring both programs more in line with mitigation goals to the project area. The percent of the mitigation goal to the project area in the last five run years (2003-2008) has averaged 192% for the LFH and Wallowa stocks combined, which would suggest that further production cuts may be needed, or that harvest rates downriver will need to be increased to more historic levels.

However, as previously mentioned, the original mitigation goal assumed a 2:1 downriver to project area harvest rate. Using that assumption, the total mitigation goal (accounting for downriver and upriver harvest) for the LFH stock would be 9,465 adult steelhead, and 4,503 adult steelhead for the Wallowa stock. Expanding our total CWT recoveries (fisheries, adult traps, other surveys), we estimate that a minimum of 9,386 LFH stock and 3,772 Wallowa stock fish returned as adults in the 2007 run year (Table 33). That represents 99% and 84% of the total Washington mitigation goal for each of these stocks. For the 2008 run year, we estimate that a minimum of 8,516 LFH stock and 5,960 Wallowa stock fish returned as adults. That represents 90% and 132% of the Washington mitigation goal for each of these stocks. Since program inception, the LFH stock has average 103%, and the Wallowa stock has averaged 99% of the total mitigation goal. The percent of the total mitigation goal in the last five run years (2004-

2008) has averaged 75% and 81% for the LFH and Wallowa stocks, respectively. Viewing the mitigation in this way, for the last five run years, each of the programs are 20-25% short of fulfilling the LSRCP total mitigation goal. Hence further cuts to production are not recommended at this time.

Table 32. Contribution of Lyons Ferry stock (LFH, Tucannon, Touchet, Walla Walla release groups) or Wallowa stock (Grande Ronde release group) summer steelhead back to the lower Snake River project area, 1984-2008 run years.

Run Year Adult Goal	LFH [b] 630	Tucannon 875	Touchet 750	Walla Walla [a] 900	Grande Ronde a 1,501	Total 4,656	***Percent of Goal***
1984	1,137	714	445	570	0	2,865	***62***
1985	2,389	1,645	1,486	1,510	0	7,031	***151***
1986	3,981	1,712	2,831	2,361	1,945	12,830	***276***
1987	2,724	685	1,675	1,370	1,817	8,271	***178***
1988	4,473	1,257	2,541	2,254	2,648	13,174	***283***
1989	4,792	1,837	3,431	3,552	4,264	17,876	***384***
1990	1,052	633	1,140	961	1,530	5,315	***114***
1991	1,906	1,415	1,373	975	2,720	8,388	***180***
1992	1,865	2,040	1,924	2,308	3,966	12,103	***260***
1993	664	1,080	1,679	1,814	2,640	7,876	***169***
1994	1,480	941	1,184	570	2,244	6,419	***138***
1995	6,574	1,903	4,672	4,817	9,597	27,563	***592***
1996	3,333	1,779	3,947	4,359	6,260	19,679	***423***
1997	2,112	1,311	2,696	3,019	4,447	13,585	***292***
1998	718	568	1,246	1,392	1,337	5,261	***113***
1999	1,053	2,235	2,128	2,423	1,870	9,709	***209***
2000	1,352	3,283	2,083	2,396	4,781	13,895	***298***
2001	2,251	4,485	3,755	4,108	10,919	25,519	***548***
2002	957	1,759	1,303	1,543	5,615	11,176	***240***
2003	866	1,486	1,524	1,030	3,787	8,693	***187***
2004	1,056	1,786	1,240	1,414	3,552	9,047	***194***
2005	860	1,142	1,166	1,071	2,745	6,983	***150***
2006	1,336	1,669	1,177	1,029	1,392	6,402	***138***
2007	1,308	3,269	1,458	1,381	3,256	10,671	***229***
2008	1,315	3,362	820	977	5,271	11,744	***252***
Average	***2,079***	***1,756***	***1,963***	***1,969***	***3,710***	***11,399***	***245***
Percent of goal (all years)	**318**	**201**	**262**	**219**	**247**	**245**	
Percent of goal (last 5 years)	**173**	**242**	**164**	**128**	**222**	**192**	

[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 33. Total contribution of Lyons Ferry stock (LFH, Tucannon, Touchet, Walla Walla release groups) or Wallowa stock (Grande Ronde release group) summer steelhead (all recovery location combined), 1984-2008 run years.

Run Year Adult Goal	LFH [b] 1,890	Tucannon 2,625	Touchet 2,250	Walla Walla [a] 2700	Grande Ronde [a] 4,503	Total 13,968	***Percent of goal***
1984	1,707	1,458	787	1,122	0	5,075	***36***
1985	2,771	2,639	1,867	2,187	0	9,465	***68***
1986	4,714	2,332	3,798	3,462	2,809	17,114	***123***
1987	4,173	954	2,901	2,655	2,848	13,532	***97***
1988	6,602	1,618	4,230	4,162	4,428	21,040	***151***
1989	6,216	2,215	4,995	5,741	6,779	25,945	***186***
1990	1,312	785	1,546	1,467	2,055	7,164	***51***
1991	2,405	1,816	1,963	1,542	3,576	11,301	***81***
1992	2,374	2,601	2,722	3,513	5,547	16,756	***120***
1993	833	1,367	2,324	2,733	3,355	10,612	***76***
1994	1,836	1,242	1,583	918	1,952	7,532	***54***
1995	5,605	2,548	4,186	6,391	7,999	26,730	***191***
1996	3,321	2,179	4,062	4,917	6,551	21,029	***151***
1997	2,406	1,554	2,982	3,590	5,134	15,665	***112***
1998	780	619	1,324	1,646	1,498	5,868	***42***
1999	1,094	2,444	2,211	2,800	2,075	10,624	***76***
2000	1,460	3,735	2,492	3,189	5,643	16,519	***118***
2001	2,454	5,012	4,358	5,309	12,041	29,174	***209***
2002	1,121	2,353	1,563	1,756	6,001	12,794	***92***
2003	1,049	1,894	1,612	1,176	3,957	9,687	***69***
2004	1,244	2,025	1,466	1,574	3,897	10,206	***73***
2005	1,024	1,272	1,535	1,670	3,010	8,221	***59***
2006	1,333	1,843	1,407	1,322	1,664	7,396	***53***
2007	1,444	4,084	1,907	1,951	3,772	13,717	***98***
2008	1,517	4,724	1,107	1,168	5,960	14,453	***103***
Average	***2,357***	***2,189***	***2,434***	***2,678***	***4,294***	***13,951***	***100***
Percent of goal (all years)	**125**	**83**	**108**	**99**	**95**	**99**	**100**
Percent of goal (last 5 years)	**70**	**111**	**66**	**53**	**81**	**74**	**77**

[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.

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) The NOAA Fisheries ruled that the WDFW LSRCP hatchery steelhead programs (LFH and Wallowa stocks) jeopardized listed steelhead populations within the Snake and Columbia river basins (NMFS 1999), and called for the development of new endemic broodstocks where possible to eventually replace these programs. Since 2000, WDFW has been evaluating two new steelhead broodstocks (Tucannon and Touchet rivers) as a means to address this issue.

Recent PIT tag data shows that as many as 50% of the returning steelhead destined for the Tucannon River (natural, endemic hatchery and LFH stock), fail to return to the river, but rather bypass the Tucannon river, remain upstream of Lower Granite Dam, and stray into other natural spawning areas such as Asotin Creek and Alpowa Creeks. Further, estimated adult returns of natural origin steelhead to the Tucannon River suggests that the number of spawning steelhead is critically low, and below MAT described in the WDFW's Fishery Management Enhancement Plan (FMEP) submitted to NOAA Fisheries. According to the FMEP, fisheries should not occur in areas where the natural origin adults are below such critical thresholds.

Further, approximately half of the Touchet River endemic fish return to the Snake River basin. Some of these have been documented entering the Tucannon River in March and April presumably to spawn, apparently not being able to find their way downstream past Lower Monumental Dam or Ice Harbor Dam to enter the Walla Walla Basin. The cause of the "straying" in both endemic stocks is likely an effect of the Snake River dams hindering the downstream movement of adults once they pass upstream. Also, harsh environmental conditions in the Walla Walla and Tucannon river basins when the adult steelhead first return to the system (July-September), may limit the degree to which steelhead can find or want to enter these rivers. Whatever the cause, this "straying" effect needs further investigation and possible solutions to lessen the effects on natural production areas.

Besides the straying issue of the Touchet endemic stock fish mentioned above, the Touchet endemic stock has not performed to expectations. Rearing of the 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 LFH stock, and to the Tucannon River endemic stock program. Trapping of fish for broodstock has intentionally shifted to the early part of the run in an attempt to address some of the hatchery issues with this stock (spawn

timing, rearing time to meet program release size/date). Broodstock collection (if it should continue in the future) should be carefully regulated to reflect natural origin returns to the Touchet River, which will pose even greater challenges to the hatchery to produce a quality one-year smolt that survives to the desired levels. To address survival issues on the smaller 1-year smolts, a pilot study on a 2-year smolt release was implemented on a portion of the 2008 brood year program, and is planned to run for at least two years. PIT tags will be used to assess the performance of the 2-year smolts compared to the 1-year smolts.

In the spring of 2010, WDFW, the tribal co-managers, 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 BiOp RPA 40.2. In the short term (1-3 years), the Tucannon River endemic stock program would be increased to 75,000 smolts annually. Additional hatchery rearing space at Lyons Ferry is needed to expand the program to the desired level (150,000 smolts annually) and is being sought through Bonneville Power Administration for implementation of RPA 40.2 in the FCRPS BiOp. At full production level, 50,000 smolts would remain unmarked for conservation purposes, and the remaining 100,000 would be marked for harvest mitigation under the LSRCP program.

Recommendation: Continue to increase the number of natural origin smolts PIT tagged at the Tucannon River Smolt Trap to document SARs, and to estimate total natural origin returns to the Tucannon River.

Recommendation: Cease the Touchet River endemic stock program as a possible replacement for the LFH stock for mitigation in the Touchet River. 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).

Recommendation: Continue the LFH stock mitigation program in the Touchet River. Operate as a segregated harvest mitigation program, continueing to exclude LFH stock fish from the upper Touchet River basin through management actions at the Touchet River adult weir/ladder.

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. This original mitigation goal was under the premise that 2/3 of the returning adults would be harvested in the lower Columbia River in the net and sport fisheries. Implementation of ESA restrictions have curtailed or changed the conduct of downriver fisheries, hence more fish are returning to the project area even though overall reductions in the steelhead program have occurred since program inception.

Recommendation: Reexamine adult return survival estimates and downriver fisheries for harvest impacts. Calculate the number of smolts required to achieve the mitigation goal with these updated estimates. Meet with program managers, co-managers and other interested parties to discuss recommended changes to the steelhead programs to meet mitigation goals if possible, without hindering recovery of native steelhead stocks.

3) Natural origin summer steelhead escapements (Touchet River, Tucannon River, and Asotin Creek) have been estimated through the use of spawning ground surveys. Due to stream flow conditions, surveys can be severely hampered, which affects the accuracy of our estimates. Further, because of the stream conditions, it is very difficult to accurately determine the composition (hatchery:natural) of spawning fish, and unlike Chinook surveys, steelhead carcasses are rarely found. Hence, the impacts of our hatchery program on natural populations are relatively unknown.

By increasing the number of PIT tagged natural juveniles/smolts in each of these systems, increasing PIT tagging of hatchery smolts prior to release, and by increased operation of adult traps or deployment of PIT tag arrays, the likelihood that estimates of spawner and hatchery:natural composition can be estimated on a more consistent basis will increase. One limiting factor to this method will be determining the effects of PIT tagging on fish survival (SAR). Other researchers have shown that PIT tags can reduce smolt-to-adult survival. This value, or being able to correct for this survival impact, on summer steelhead from these populations is currently unknown and should be explored further.

Recommendation: Where possible, increase the number of PIT tagged natural origin and hatchery origin smolts. Where mitigation fish are likely present, secure funding to operate weirs and traps and/or PIT tag arrays to determine hatchery:natural origin composition, and estimate total escapement to spawning grounds.

4) The Tucannon River steelhead population was defined by the ICTRT as including the Tucannon River, and other smaller tributaries to the Snake River (between Lower Monumental and Lower Granite dams). The population status of natural origin adults in these smaller tributaries is relatively unknown, as well as the hatchery:natural composition. Yet, these smaller tributaries could have enough natural origin adults present, when added to the Tucannon River natural origin adults, to raise the population level above the critical MAT. Fisheries could be justified within the Tucannon River for the LSRCP mitigation program under those circumstances.

Recommendation: Develop plans/proposals to secure funding for adult monitoring in these smaller Snake River tributaries.

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Appendix A

Bull Trout, Whitefish, and Brown Trout Capture Data from the Touchet River Adult Trap, 2009 and 2010

Appendix A: Table 1. Bull trout captured at the Dayton Adult Trap on the Touchet River, 2009. Data shown represents first time captures that were then PIT tagged, or fish that were recaptures from previous years.

Date	Length	PIT Tag #	Recap	Date	Length	PIT Tag #	Recap	Date	Length	PIT Tag #	Recap
2/6	330	3D9.257C5D392B		5/31	390	3D9.1BF27E04C1		6/13	355	3D9.1BF1B2E84F	2 year
3/19	280	3D9.257C5D1A32		5/31	520	3D9.1C2C9C8D28	1 YEAR	6/13	320	3D9.1C2CCA04A9	
4/6	350	3D9.257C0CA11A		5/31	350	3D9.1C2C4BAF13		6/15	320	3D9.1C2CCC61D5	
4/20	295	3D9.257C5A2CF8		6/1	350	3D9.257C5A108F	2 YEAR	6/16	355	3D9.1C2CC9D359	
4/20	300	3D9.257C5CDF13		6/1	540	3D9.1BF27E29A2		6/16	350	3D9.257C5A108F	2 YEAR
5/11	345	3D9.257C5A6B15		6/1	430	3D9.257C5ADEB0		6/16	435	3D9.1C2CE1D65D	
5/11	460	3D9.257C5D2FF9		6/3	360	3D9.257C5AE46C		6/16	320	3D9.1C2CCA43D5	
5/13	345	3D9.1C2C875C6A	2 year	6/3	330	3D9.257C56B58C		6/17	575	3D9.1BF1B60815	4 YEAR
5/13	320	3D9.257C5C997D		6/3	335	3D9.257C5D1F6B		6/17	310	3D9.1C2CCE55F4	
5/14	410	3D9.257C5B65B2		6/4	340	3D9.1BF26D5C36		6/18	325	3D9.1C2CC99841	
5/14	410	3D9.257C5D33D8		6/4	340	3D9.1BF27E00EB		6/18	425	3D9.1C2CC9945B	
5/14	380	3D9.257C5AD3AC		6/4	440	3D9.257C5DB73A	2 YEAR	6/18	330	3D9.1C2CCC6057	
5/14	370	3D9.257C5C926B		6/5	625	3D9.1BF123A317	8 YEAR	6/19	470	3D9.257C59E540	2 year
5/15	300	3D9.1C2C3B477E		6/5	360	3D9.257C5C9FDC		6/19	370	3D9.1C2C876748	2 year
5/18	420	3D9.257C5D2E73		6/5	320	3D9.1BF27C51A9		6/19	285	3D9.1C2CC98362	
5/18	320	3D9.257C5B4DC7		6/8	345	3D9.1C2C4BE06B		6/19	330	3D9.1C2CCC6558	
5/19	350	3D9.257C5C84AD		6/8	430	3D9.257C592701	2 YEAR	6/20	330	3D9.1C2CCA4B18	
5/19	340	3D9.257C5C9E65		6/8	340	3D9.1C2C9C6405	2 YEAR	6/22	325	3D9.1C2CCA4759	
5/20	340	3D9.257C5D2464		6/8	250	3D9.257C5D48AA		6/24	340	3D9.1C2C9C6405	2 YEAR
5/24	310	3D9.257C5BFC6E		6/8	510	3D9.1BF1A6EFD8	3 YEAR	6/25	430	3D9.1BF1F6A82C	2 YEAR
5/26	310	3D9.257C5C9FD2		6/8	315	3D9.1BF57DFB7E		6/26	330	3D9.1C2CCC556A	
5/26	310	3D9.257C5CA438		6/8	330	3D9.1C2C4134C7		6/26	280	3D9.1C2CCC66D8	
5/26	330	3D9.1BF27E1FFB		6/8	310	3D9.1C2C4AF973		6/28	310	3D9.1C2CCC6236	
5/26	445	3D9.257C5D4EF8		6/8	340	3D9.1C2C4B7392		6/30	295	3D9.1C2CCA75C2	
5/26	500	3D9.257C5D22B0		6/9	350	3D9.1C2CA98AC8	2 YEAR	6/30	320	3D9.1C2CC9D6DA	
5/26	440	3D9.1BF26DA375		6/9	410	3D9.1BF1A30B1B	2 YEAR	7/1	325	3D9.1C2CC9FD19	
5/27	340	3D9.257C5D1D74		6/9	330	3D9.257C5CF005		7/1	295	3D9.1C2CC9D98F	
5/27	395	3D9.1BF26D6A38		6/9	280	3D9.257C5D2CDB		7/1	270	3D9.1C2CC9DDDC	
5/28	425	3D9.257C5CA385		6/9	300	3D9.257C5CBDF7		7/2	325	3D9.1C2CC9C9D0	
5/28	310	3D9.257C5CE1BE		6/10	310	3D9.257C5B5FB1		7/2	305	3D9.1C2CCC5572	
5/28	345	3D9.1C2C985C54	2 YEAR	6/10	315	3D9.257C5CAFA3		7/5	335	3D9.1C2CC9D39B	
5/29	340	3D9.257C5C9BB5		6/10	300	3D9.257C5CA69B		7/5	335	3D9.1C2CCC68A7	
5/30	340	3D9.257C5B4E2A		6/10	280	3D9.257C5CA056		7/6	230	3D9.1C2CCA3E63	
5/30	360	3D9.1BF1A7D233	2 YEAR	6/10	300	3D9.1BF27E1866		7/10	430	3D9.1BF1F6A82C	2 YEAR
5/31	400	3D9.257C5A13D3		6/11	320	3D9.257C5D3B51		7/13	290	3D9.1C2CCEF31B	
5/31	425	3D9.1BF27C61A8	2 YEAR	6/12	360	3D9.1C2CC9C67F		7/29	280	3D9.1C2CB284A0	1 YEAR
5/31	430	3D9.1BF1F6A82C	2 YEAR	6/13	480	3D9.1C2CCC66E5					

Appendix A: Table 2. Bull trout captured at the Dayton Adult Trap on the Touchet River, 2010. Data shown represents first time captures that were then PIT tagged, or fish that were recaptures from previous years.

Date	Length	PIT Tag #	Recap	Date	Length	PIT Tag #	Recap	Date	Length	PIT Tag #	Recap
2/3	280.0	3D9.1BF246301E		5/16	380.0	3D9.1C2CCC60D8		6/9	390.0	3D9.1C2CCC0B7D	
4/2	370.0	3D9.1BF242D832		5/16	430.0	3D9.257C5C9BB5	1 YEAR	6/9	400.0	3D9.1C2CCC6A4C	
4/11	375.0	3D9.1BF246577D		5/16	300.0	3D9.1C2CC9D68A		6/11	380.0	3D9.1C2CC9CD52	
4/18	370.0	3D9.257C5CE1BE	1 YEAR	5/16	360.0	3D9.1C2CC9D9E7		6/11	360.0	3D9.1C2C4C536C	
4/18	330.0	3D9.1BF2462D49		5/16	300.0	3D9.1C2C43C974		6/11	370.0	3D9.1C2CC9CD86	
4/20	335.0	3D9.1BF24664C3		5/17	420.0	3D9.1C2C4BAF13		6/14	500.0	3D9.1BF1A30B1B	2 YEAR
4/20	330.0	3D9.1C2CCA4037		5/17	330.0	3D9.1C2CCC3CA8		6/14	370.0	3D9.1C2C437A12	
4/20	340.0	3D9.1C2CCC433A		5/17	510.0	3D9.257C5ADEB0	1 YEAR	6/14	370.0	3D9.1C2CCA47B3	
4/22	315.0	3D9.1C2C4C590A		5/17	420.0	3D9.257C5D1D74	1 YEAR	6/14	360.0	3D9.1C2CC950CE	
4/26	340.0	3D9.1C2C875A51	2 YEAR	5/17	290.0	3D9.1C2C4BB7D4		6/14	340.0	3D9.1C2CC9D674	
4/26	340.0	3D9.1C2CCC65DE		5/17	400.0	3D9.1C2CC960A6		6/14	310.0	3D9.1C2C3F04ED	
4/26	360.0	3D9.1C2CC9A097		5/18	540.0	3D9.257C5D22B0	1 YEAR	6/14	360.0	3D9.1C2C465F86	
4/26	360.0	3D9.1C2C437FC5		5/18	290.0	3D9.1C2C4C7786		6/14	520.0	3D9.257C5DB73A	2 YEAR
4/27	325.0	3D9.1C2C4B77D6		5/19	380.0	3D9.1C2CCE4A21		6/15	545.0	3D9.257C59E540	2 YEAR
4/27	320.0	3D9.1C2C432DD5		5/20	415.0	3D9.1C2CCE55F4	1 YEAR	6/15	355.0	3D9.1C2CC947ED	
4/27	440.0	3D9.1C2CC9C746		5/22	435.0	3D9.1C2CA98AC8	2 YEAR	6/15	380.0	3D9.1C2CCC5EDF	
4/27	415.0	3D9.1C2CCC61F5		5/24	440.0	3D9.1C2CCC59EE		6/16	350.0	3D9.1C2CC9D557	
4/27	345.0	3D9.1C2CC99D6C		5/24	340.0	3D9.1C2D03FBC6		6/16	370.0	3D9.1C2C3E1818	
4/28	340.0	3D9.1C2C422B7D		5/25	440.0	3D9.1C2CBAD9EB	1 YEAR	6/16	340.0	3D9.1C2C412562	
4/28	325.0	3D9.1C2CCC61BE		5/25	325.0	3D9.1C2CC93CEC		6/16	460.0	3D9.1C2C876748	2 YEAR
4/28	440.0	3D9.257C5D2464	1 YEAR	5/28	360.0	3D9.1C2C43A766		6/20	340.0	3D9.1C2CC95E70	
5/3	440.0	3D9.257C5D1D74	1 YEAR	5/28	345.0	3D9.1C2CCE5002		6/21	340.0	3D9.1C2CC9CA44	
5/3	350.0	3D9.1C2C48D0A4		5/28	345.0	3D9.1C2CC9CC40		6/21	400.0	3D9.1C2C3F37C4	
5/3	330.0	3D9.1C2CCA33A6		5/28	330.0	3D9.1C2CC9D68A		6/21	410.0	3D9.1C2C438C56	
5/3	260.0	3D9.1C2CCC597A		5/28	315.0	3D9.1C2C3ACBBA		6/21	380.0	3D9.1C2CC9620F	
5/4	440.0	3D9.1C2CC9D39B	1 YEAR	5/31	375.0	3D9.1C2CCCD458		6/21	350.0	3D9.1C2CBAF10E	1 YEAR
5/4	310.0	3D9.1C2CC959B1		6/1	370.0	3D9.1C2CC9D8B8		6/21	340.0	3D9.1C2C4C5887	
5/6	350.0	3D9.1C2C34133F		6/1	395.0	3D9.1C2CC96955		6/22	360.0	3D9.1C2CC9D2DD	
5/10	310.0	3D9.1C2CCA4901		6/1	410.0	3D9.1C2CCA04A9	1 YEAR	6/22	600.0	3D9.1BF1B60815	5 YEAR
5/10	350.0	3D9.1C2C4BC445		6/1	360.0	3D9.1C2CC9F07A		6/23	340.0	3D9.1C2CC997C2	
5/12	340.0	3D9.1C2CC9DDED		6/1	445.0	3D9.257C5C9FDC	1 YEAR	6/23	330.0	3D9.1C2CC9D1EF	
5/12	320.0	3D9.1C2CCA4A7D		6/2	415.0	3D9.1C2CCC66D8	1 YEAR	6/23	340.0	3D9.1C2CCC623F	
5/13	415.0	3D9.1C2CC9C67F	1 YEAR	6/2	355.0	3D9.1C2CCA0A61		6/25	380.0	3D9.1C2C3E1B10	
5/13	350.0	3D9.1C2C43D3EF		6/4	420.0	3D9.257C5C997D	1 YEAR	6/27	340.0	3D9.1C2CCA457F	
5/13	490.0	3D9.257C5AD3AC	1 YEAR	6/4	365.0	3D9.1C2C4B6764		6/27	310.0	3D9.1C2C432ABB	
5/13	440.0	3D9.1BF26D5C36	1 YEAR	6/7	360.0	3D9.1C2CC9C93E		6/27	350.0	3D9.1C2CC9DC72	
5/13	400.0	3D9.1C2CCA3503		6/7	285.0	3D9.1C2CCA38D5		6/27	330.0		
5/13	315.0	3D9.1C2CCE46BC		6/8	330.0	3D9.1C2CCA3554		6/29	330.0	3D9.1C2CCC9066	
5/13	410.0	3D9.257C56B58C	1 YEAR	6/9	425.0	3D9.1C2CC99841	1 YEAR	6/29	330.0	3D9.1C2CC9DA2D	
5/13	360.0	3D9.1C2CC9C545		6/9	340.0	3D9.1C2CC99D8E		6/29	260.0	3D9.1C2CC9C663	
5/14	450.0	3D9.1C2CCC6558	1 YEAR	6/9	330.0	3D9.1C2CCA393E		6/29	380.0	3D9.1C2CC95E46	
								7/14	280.0	3D9.1C2CCA385C	

Appendix A: Table 3. Whitefish and Brown Trout captured at the Dayton Adult Trap on the Touchet River, 2009.

Date	Species	Ln (cm)	Date	Species	Ln (cm)	Date	Species	Ln (cm)	Date	Species	Ln (cm)	Date	Species	Ln (cm)
4/19	WF	30.0	5/26	WF	35.0	6/8	WF	26.5	6/20	WF	21.5	7/9	BRN	36.0
4/20	WF	29.0	5/26	WF	26.0	6/8	WF	27.0	6/25	WF	22.5	7/10	BRN	32.0
4/30	WF	31.0	5/28	WF	33.0	6/10	WF	22.5	6/26	WF	28.0	7/16	WF	NA
5/5	BRN	25.0	5/29	WF	30.5	6/12	BRN	64.0	7/1	BRN	40.5	7/24	WF	NA
5/10	BRN	22.0	5/30	BRN	32.0	6/15	WF	28.0	7/5	WF	23.0	7/24	WF	NA
5/18	WF	36.0	6/3	WF	28.0	6/16	WF	19.5	7/5	BRN	39.5	8/8	BRN	32.0
5/22	WF	35.5	6/3	WF	27.0	6/17	WF	30.0	7/5	WF	23.0			
5/22	WF	36.5	6/3	WF	26.0	6/17	WF	29.0	7/5	WF	22.0			
5/24	WF	40.5	6/8	WF	27.0	6/19	WF	29.0	7/6	BRN	38.0			

Appendix A: Table 4. Whitefish and Brown Trout captured at the Dayton Adult Trap on the Touchet River, 2010.

Date	Species	Ln (cm)	Date	Species	Ln (cm)	Date	Species	Ln (cm)	Date	Species	Ln (cm)	Date	Species	Ln (cm)
1/19	WF	24.5	5/16	WF	27.0	5/24	WF	27.0	6/21	WF	28.0	6/29	BRN	46.0
3/2	WF	25.0	5/16	WF	28.0	5/24	WF	28.0	6/21	WF	28.0	6/29	BRN	39.5
3/18	WF	24.0	5/16	WF	27.0	5/25	WF	30.0	6/21	WF	29.0	6/29	BRN	44.0
4/9	WF	25.0	5/16	WF	29.0	5/28	WF	28.5	6/21	WF	28.0	6/29	WF	21.5
4/9	WF	25.0	5/16	WF	28.0	5/28	WF	31.0	6/21	WF	28.0	6/29	BRN	39.0
4/9	WF	24.0	5/16	WF	26.0	5/28	WF	29.0	6/21	WF	27.0	6/29	BRN	54.0
4/11	WF	32.0	5/16	WF	24.0	5/31	WF	30.0	6/21	WF	27.0	6/29	BRN	40.0
4/18	WF	30.0	5/17	WF	28.0	5/31	WF	28.5	6/21	WF	28.0	6/29	BRN	39.0
4/20	WF	25.0	5/17	WF	29.0	5/31	WF	31.0	6/21	WF	29.0	6/29	BRN	38.0
4/26	WF	25.0	5/17	WF	29.0	5/31	WF	30.5	6/21	WF	26.0	6/29	BRN	39.0
4/27	WF	28.0	5/18	WF	27.0	5/31	WF	25.0	6/21	WF	27.0	6/29	BRN	38.5
4/28	WF	28.0	5/18	WF	28.0	6/2	WF	28.0	6/22	WF	27.0	6/29	BRN	41.0
5/3	WF	24.0	5/18	WF	29.0	6/2	WF	28.0	6/22	WF	27.0	7/1	WF	33.0
5/3	WF	26.0	5/18	WF	29.0	6/2	WF	29.0	6/23	WF	28.0	7/1	BRN	41.0
5/3	WF	27.0	5/19	WF	29.0	6/7	WF	28.0	6/23	WF	28.0	7/1	WF	29.0
5/3	WF	24.0	5/19	WF	26.0	6/7	WF	29.0	6/23	WF	28.0	7/1	WF	31.5
5/4	WF	26.0	5/19	WF	31.0	6/14	WF	27.0	6/23	WF	29.0	7/1	BRN	41.5
5/7	WF	25.0	5/19	WF	27.0	6/14	WF	28.0	6/23	WF	27.0	7/1	BRN	41.0
5/10	WF	28.0	5/19	WF	27.0	6/14	WF	28.0	6/23	WF	31.0	7/1	WF	28.5
5/10	WF	25.5	5/20	WF	29.0	6/14	WF	28.0	6/25	WF	27.0	7/2	WF	30.5
5/10	WF	26.0	5/20	WF	29.0	6/16	WF	33.0	6/25	WF	29.0	7/4	WF	31.0
5/10	WF	28.0	5/21	WF	26.0	6/18	WF	27.0	6/25	WF	29.0	7/4	WF	24.0
5/10	WF	26.5	5/24	WF	29.0	6/18	WF	28.0	6/25	WF	24.0	7/6	BRN	37.5
5/10	WF	28.0	5/24	WF	30.0	6/20	WF	29.0	6/27	WF	21.0	7/6	BRN	41.0
5/12	WF	28.0	5/24	WF	29.5	6/20	WF	26.0	6/27	WF	22.0	7/15	BRN	43.0
5/12	WF	26.5	5/24	WF	29.0	6/21	WF	30.0	6/27	WF	29.0	7/26	BRN	42.0
5/14	WF	29.5	5/24	WF	29.5	6/21	WF	28.0	6/29	WF	23.5			
5/14	WF	27.5	5/24	WF	27.5	6/21	WF	59.0	6/29	WF	28.0			

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