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Lyons Ferry Complex Hatchery Evaluation: Summer Steelhead Annual Report 2006 and 2007 Run Year

by Joseph D. Bumgarner and Jerry T. Dedloff

Washington Department of
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to

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Executive Summary

This annual report is one in a continuing series describing WDFW's progress toward meeting summer steelhead and rainbow trout mitigation goals established in the LSRCP.

Stocking of LSRCP-produced rainbow trout within Washington, and transfers to the State of Idaho generally went as planned, though in 2007 and 2008 there was a shortfall in rainbow trout production and not all LSRCP goals were met. Hatchery survival and smolt release goals for summer steelhead were met for both years. Adjustments were made to the marks and tags applied to the summer steelhead over the reporting period.

We continued smolt trapping on the Tucannon River to estimate the number of migrant steelhead. In the 2006/2007 and 2007/2008 we estimated 11,546, and 26,099 total migrants, respectively. Mean smolt size and peak of out-migration for both years was similar to previous years. Average smolt-to-adult survival of wild origin summer steelhead from the Tucannon River (based on the PIT tags) was 2.25% back to Bonneville Dam, and 1.75% to McNary Dam. PIT tag detections of naturally produced Tucannon River steelhead exhibited a disturbing migration pattern, with about 50% returning to and remaining above Lower Granite Dam. This same migration pattern has also been observed in the Lyons Ferry stock fish and the Tucannon River hatchery endemic stock steelhead.

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 (where appropriate) age composition, eggtake and fecundity estimates from spawning activities, and historical spawn timing for each steelhead stock,

WDFW staff surveyed steelhead sport anglers during the 2006/2007 and 2007/2008 sport fishing season within the LSRCP area of Washington to recover CWTs from tagged steelhead. In 2007/2008, creel surveys, on the Tucannon, Touchet or Walla Walla rivers were limited or not conducted. This was done to increase our sample rate in the mainstem of the Snake River to achieve at least a 20% sample of what is eventually reported on Washington's catch record cards.

During the springs of 2007 and 2008, evaluation staff conducted spawning ground surveys to estimate the number of redds in index areas of the Tucannon and Touchet rivers and Asotin Creek. Stream flows were favorable in 2007, but were high and turbid during 2008 which greatly affected our ability to estimate redds in the Tucannon River. Evaluation staff standardized all spawning ground survey estimates for summer steelhead in the Touchet River and Asotin 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 program. Due to a variety of factors, smolt-to-adult survivals back to the project area have generally been nearly 3 times the assumed rate. The LFC summer steelhead program (LFH and Wallowa stock only) continues to meet and/or exceed its original mitigation goals by supplying large returns of hatchery steelhead for harvest to the Snake River area. This

is mainly due to the fact that harvest rates in the lower Columbia River fisheries have declined substantially since the program was initiated. Hence more fish are returning to the project area even though hatchery production has been reduced in recent years.

As in previous years, WDFW electrofished using either a multiple or a single pass removal method at index sties to estimate Age 0 and Age 1+ juvenile steelhead densities and derive population estimates for specific river reaches. During the summer of 2005 and 2006, we tested estimator bias (multiple pass estimate vs. mark/recapture estimate) at 44 sites in SE Washington. For both years on average, we found that multiple pass underestimated Age 0 and Age 1+ summer steelhead by 29.9% and 22.7%, respectively, compared to the mark/recapture estimate. Based on these results, and other factors such as high confidence intervals around the electrofishing estimates, we have discontinued electrofishing surveys for juveniles.

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Introduction

This annual report (combination of two run years) is one in a continuing series describing Washington Department of Fish and Wildlife's (WDFW) progress toward meeting *Oncorhynchus mykiss* (summer steelhead and rainbow trout) mitigation goals established in the Lower Snake River Compensation Plan (LSRCP). The reporting period covers between 1 July 2006 and 30 June 2008, 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).

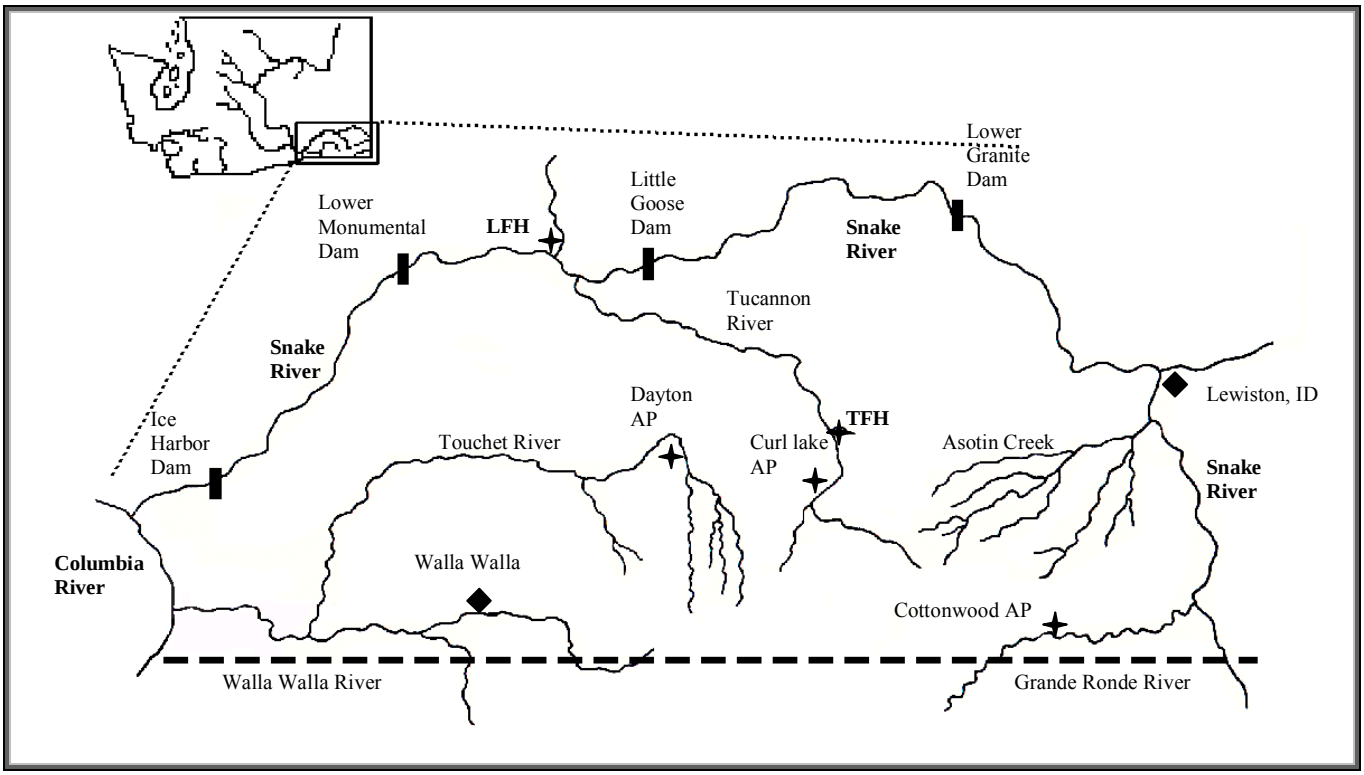

Figure 1. Map of major rivers and streams in southeast Washington, and LFC facilities.

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 237,500 trout (79,900 lbs) for release into southeast Washington area lakes. The LFC also produces another 150,000 (3,000 lbs) fry (Spokane stock), and 50,000 (3,333 lbs) fingerlings (Kamloops stock) for Idaho Fish and Game's (IDFG) LSRCP program. Endangered Species Act (ESA) listings of Chinook salmon (*O. tshawytscha*), steelhead, and bull trout (*Salvelinus confluentus*) caused the stocking of rainbow trout from LFC into Washington State area waters to be shifted exclusively to small lakes and ponds 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, though in 2007 and 2008 there was a shortfall in rainbow trout production and not all LSRCP goals were met for the year. In 2007 and 2008, 138,973 (43,300 lbs) and 134,941 (34,954 lbs), respectively, catchable sized rainbow trout were stocked into area lakes of SE Washington. WDFW also produces larger sized (1.5-2.5 lbs/fish or 181.4-302.4g/fish) rainbow trout at TFH for stocking into areas lakes. These large "jumbo" rainbow trout have been a popular addition to the recreational sport fishery in southeast Washington.

Steelhead: The LFC currently uses four summer steelhead stocks to produce smolts for release into the Snake (60,000 smolts of LFH stock), Tucannon (100,000 smolts of LFH stock, 50,000 smolts of Tucannon Endemic stock), Grande Ronde (160,000 smolts of Wallowa Stock), Walla Walla (100,000 smolts of LFH stock), and Touchet (85,000 smolts of LFH stock, 50,000 smolts of Touchet Endemic stock) rivers to enhance recreational opportunities for steelhead anglers and for ESA recovery purposes. All steelhead smolts for the program are planned for a release size of 4.5 fish/lb (100.8g/fish). Current release numbers of summer steelhead smolts are lower than originally specified by the LSRCP program, although poundage of fish is not. Releases have been reduced through the years in partial response to ESA concerns and because estimated smolt-to-adult returns (SAR) back to the project area (above Ice Harbor Dam) have exceeded the original SAR goal of 0.5%.

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 1, 2, 3, and 4). Despite extra measures taken by both hatchery and evaluation staff to obtain accurate estimates of the number

of eggs or newly hatched steelhead fry, there continue to be errors discovered when 100% of the 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 large number of living organisms. This bias, while not absolutely 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 is doubtful that older data are available to correct the numerical errors 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 survivals greater than 100%.

Table 1. 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 2008 brood years.

	Spawned								Fry to smolt	Egg to smolt
BY	Female	Male	Eggs taken	Eggs retained [a]	Percent retained	Fry	Egg to fry survival	Smolts	survival	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			

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

[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.

Table 2. Numbers of males and females spawned, eggs taken, and survival by life state of LFH stock summer steelhead spawned at LFH, 1987 to 2008 brood years.

	Spawned						Egg to		Fry to	Egg to
BY	Female	Male	Eggs taken	Eggs retained [a]	Percent retained	Fry	fry survival	Smolts	smolt survival	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 [g]	46.0	398,926	95.8 [h]	87.5
1993	234	100	1,211,053	940,022	77.6	860,983	91.6	585,837	70.0 [i]	64.9
1994	253	NA	1,352,296	899,350	66.5	845,316	94.0	543,627	65.4 [j]	62.0
1995	343	NA	1,772,477	929,597	52.4	895,882	96.4	604,756	67.9 [k]	65.6
1996	330	NA	1,614,636	1,151,363	71.3	1,148,114	99.7	596,834	63.6 [l]	70.1
1997	217	246	1,090,638	962,705	88.3	809,845	84.1	554,057	100.0 [m]	84.4
1998	279	280	1,460,967	934,247	63.9	768,522	82.3	567,732	73.9	60.7
1999	227	253	1,140,813	807,374	70.8	783,152	97.0	495,864	63.3 [n]	61.4
2000	183	188	871,856	650,867	74.7	617,380	94.9	381,686	61.8 [o]	65.2
2001	151	242	800,350	636,727	79.6	505,451	79.4	423,065	83.7	66.4
2002	194	231	941,223	768,832	81.6	732,566	95.3	378,917	60.4 [p]	63.0
2003	126	257	483,462	418,195	86.5	408,944	97.8	310,209	75.9	74.2
2004	129	259	494,380	414,258	83.8	408,462	98.7	355,362	87.0	85.8
2005	133	263	571,185	452,011	79.1	439,803	97.2	350,028	79.6	77.4
2006	120	241	529,379	430,667	81.4	423,397	98.3	341,424	84.2 [q]	83.4
2007	123	245	558,683	507,688	90.9	502,766	99.0	351,510	82.8 [r]	84.7
2008	116	193	563,765	507,791	90.1	496,183	97.7			

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

[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.

Table 3. 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 2008 brood years.

	Spawned								Fry to	Egg to
BY	Female	Male	Eggs taken	Eggs retained [a]	Percent retained	Fry	Egg to fry survival	Smolts	smolt survival	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			

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

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

Table 4. 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 2008 brood years.

	Spawned								Fry to	Egg to
BY	Female	Male	Eggs taken	Eggs retained [a]	Percent retained	Fry	Egg to fry survival	Smolts	smolt survival	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	99.7			

[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.

Summer Steelhead Marking, Tagging, and Release

All production steelhead from the LFH and Wallowa stocks were marked for selective fisheries harvest management with an adipose (AD) fin clip prior to release. In January, the 2006 and 2007 brood study groups within the LFH stock 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 5). The 2006 and 2007 brood Wallowa stock were CWT and LV fin clipped in the September prior to their release. 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., they are excluded from selective harvest). In January 2006, the endemic stocks were marked with a red Visual Implant Elastomer (VIE) tag behind the eye for external identification. Beginning in

2007, the endemic stocks were tagged with a CWT only with the use of an automatic marking trailer, as we found adult VIE tag loss to be consistently too high to warrant its continued use.

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 PIT tag loss and differential mortality is negligible as they are tagged at a relatively large size (~90g, 200mm). Over the last couple of years, we have increased PIT tagging on our production groups (LFH and Wallowa stock; Table 5), to help quantify the number of unaccounted for 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 allow us to estimate 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 6). All release groups from all stocks were close to or above program goals (number of fish and size of fish) in 2007 and 2008. Both endemic stocks (later spawn timing) were at program goal size upon release, continuing to show improvement compared to previous years through excellent fish culture practices. However, we still have difficulties in meeting size-at-release goals with the Touchet endemic stock. Nearly half of the yearly production had to be released near the middle of May before size goals were reached. Additional measures to reduce these size differences, that have been a continual problem in the endemic stock programs from the beginning, continue to be investigated. The addition of small, intermediate sized rearing vessels at LFH during the spring of 2006 has helped reduce the difference. The smaller vessels allowed hatchery staff to adjust feeding rates between the size groups to get the fish similar in size before they were all combined into a single raceway. Also, in 2007 we used the automatic marking trailer on the endemic stocks when applying the CWT. The use of the marking trailer allowed each population to be split into two separate raceways based on fork length. This was a more efficient method of grading the fish into two groups. Despite these efforts, two distinct size groups of the Touchet endemic stock were released. Automated tagging trailers was an effective sorting method, but CWT loss in these groups was considerably higher than in our other CWT groups (Table 5). We are unsure of the cause(s) for the higher CWT loss, but hope they can be corrected in future tagging/sorting operations.

Table 5. Summer steelhead smolt releases from Lyons Ferry Complex, 2007 and 2008.

YEAR Location (Stock)	Rkm	Date	Total release	AD-only release	CWT release	CWT code	Other marks	PIT Tags	Lbs	Size #/lb	CWT %Loss	VIE %Loss
2007												
Grande Ronde @ Cottonwood AP (Wallowa)	45.9	4/10 - 4/18	159,242	140,533	18,709	633664	LV	0	33,882	4.7	0.3720	NA
Snake River @ LFH (LFH)	92.8	4/15 - 4/18	59,983	39,536	20,447	633667	LV	0	13,804	4.35	2.9393	NA
Tucannon River ~200m ↓ Pataha Creek (LFH)	18.5	4/16 - 4/18	96,690	96,690	0	None	None	5,000	22,419	4.40	NA	NA
Touchet River @ Dayton AP (LFH)	86.4	4/9 - 4/25	86,985	66,375	20,610	633665	LV	5,000	18,909	4.60	2.0667	NA
Walla Walla River (LFH)	56.0	4/16 - 4/18	97,776	76,919	20,857	633666	LV	5,000	22,715	4.30	2.7505	NA
Tucannon River @ Camp Wooten Br. (Tucannon)	67.0	4/03, 4/11	62,940	0	0	None	Left Green	8,500	14,550	4.40	NA	3.6547
Touchet River @ NF Touchet Bridge (Touchet)	91.5	4/19, 4/30	58,989	0	0	None	Left Pink	8,495	13,272	4.45	NA	5.8779
2008												
Grande Ronde @ Cottonwood AP (Wallowa)	45.9	4/8 - 4/30	175,961	155,795	20,166	634099	LV	4,000	38,252	4.60	0.4208	NA
Snake River @ LFH (LFH)	92.8	4/15 - 4/17	60,360	40,175	20,185	634097	LV	1,500	13,413	4.50	0.4835	NA
Tucannon River ~200m ↓ Pataha Creek (LFH)	18.8	4/15, 4/17	102,313	82,338	19,975	934095	LV	3,500	23,152	4.42	1.0501	NA
Touchet River @ Dayton AP (LFH)	86.4	4/10 - 4/27	87,160	66,999	20,161	634098	LV	3,500	20,270	4.30	0.4887	NA
Walla Walla River (LFH)	56.0	4/16 - 4/16	101,677	81,530	20,147	634096	LV	3,500	22,595	4.50	0.4751	NA
Tucannon River @ Curl Lk Intake (Tucannon)	66.0	4/17 - 4/18	48,910	0	44,370	634165	None	7,463	10,941	4.47	9.2814	NA
Tucannon River @ Marengo Br. (Tucannon)	39.5	4/17	4,160	0	3,773	634165	None	4,038	931	4.47	9.2814	NA
Touchet River @ NF Touchet Bridge (Touchet)	91.5	4/22, 5/14	48,298	0	45,976	634164	None	7,987	10,358	4.66	4.8070	NA

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

Table 6. Mean fork lengths, weights, condition factor (K), co-efficient of variation (CV), fish per pound (FPP), and the percent of each release visually documented as precociously mature males from LFC steelhead prior to release, 2007 and 2008.

Location (Stock)	Date	N	Avg LN (mm)	Avg WT (g)	K	CV	FPP	Percent precocious
2007 Release Year								
Cottonwood (Wallowa)	4/10	327	207.8	97.4	1.03	13.0	4.7	0.0
Tucannon (LFH)	4/13	258	212.8	100.9	1.03	8.9	4.5	0.40
Tucannon (Endemic-Large)	4/02	296	211.3	102.9	1.06	9.0	4.4	3.00
Tucannon (Endemic-Small)	4/09	200	209.3	105.0	1.07	14.9	4.3	0.00
Touchet (LFH)	4/09	200	208.3	103.2	1.05	11.5	4.6	1.00
Touchet (Endemic-Large)	4/13	277	207.3	100.9	1.08	12.2	4.5	4.00
Touchet (Endemic-Small)	4/26	217	204.1	102.4	1.08	18.4	4.4	0.50
Walla Walla (LFH)	4/13	270	213.1	102.6	1.02	10.8	4.4	0.40
Lyons Ferry (LFH)	4/13	230	212.2	102.5	1.04	10.2	4.4	0.00
Lake #1 [a] (LFH)	4/16-18	733	222.6	106.8	0.95	8.4	4.2	0.00
2008 Release Year								
Cottonwood (Wallowa)	4/01	390	207.7	101.1	1.08	11.1	4.5	0.00
	4/08	285	205.6	97.6	1.08	12.1	4.6	0.00
Tucannon (LFH)	4/10	273	212.9	100.8	1.01	10.5	4.5	1.80
Tucannon (Endemic-All)	4/11	253	208.0	101.5	1.13	9.8	4.5	2.40
Touchet (LFH)	4/09	262	210.2	104.5	1.11	8.9	4.3	0.80
Touchet (Endemic-Large)	4/16	200	206.3	106.3	1.13	15.4	4.3	4.80
Touchet (Endemic-Small)	5/14	229	207.0	109.6	1.13	17.7	4.1	4.50
Walla Walla (LFH)	4/10	277	211.2	99.9	1.03	10.8	4.5	1.80
Lyons Ferry (LFH)	4/10	286	214.3	101.7	1.01	9.3	4.5	0.00
Lake #1 [a] (LFH)	4/15-17	600	221.7	104.7	0.94	8.4	4.3	0.83

[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

We operated a 1.5m rotary screw trap at rkm 3.0 on the Tucannon River between fall of 2006 and spring 2007, and the fall of 2007 through the spring of 2008 to estimate the number of migrating natural steelhead smolts. Methods to estimate smolt production are described in Bumgarner et al. (2003) and Bumgarner et al. (2002). In addition, program staff have been

working on re-calculating smolt production estimates with 95% confidence intervals based on a new methodology. These new estimates with confidence intervals were not complete for all years, and will be updated in future reports. For completion of this annual report, old estimates without confidence intervals are reported.

In the 2006/2007 trapping season, 2,203 natural steelhead migrants were captured at the trap for an estimated 11,500 total migrants (95% C.I. = 9,683 – 13,837). About 89.8% of the migrants were captured between 15 March and 15 June, similar to previous years (Figure 2). Age composition based on the scale readings was 12.1% Age 1, 83.65% Age 2, 4.2% Age 3, and 0.05% Age 4. Age composition remains highly variable among years (Figure 3). During the main out-migration period (March-early June) mean length, weight, and K-factor for natural fish (all age groups combined) captured was 179.4 mm, 58.6 g and 0.98, respectively. The mean size of migrants (all age groups combined) captured was similar, but highly variable, as in previous years (Table 7.) Peak of migration for natural steelhead was May 13 (which fell in the normal range of peak migration, see Figure 3) with an estimated 765 summer steelhead migrants past the trap on that day.

In the 2007/2008 trapping season, 2,660 natural steelhead migrants were captured at the trap for an estimated 26,099 total migrants (95% C.I. = 20189 – 34647). About 50% of the migrants were captured between 15 March and 15 June, which was completely different compared to earlier years; the reason for the early outmigration in 2007 in not fully understood (Figure 2). The early outmigration could be related to over-winter rearing capacity, or an environmental effect. Age composition based on the scale readings was 24.2% Age 1, 65.1% Age 2, 10.6% Age 3, and 0.1% Age 4. Age composition remained highly variable among years (Figure 3). During the main out-migration period (March-early June) mean length, weight, and K-factor for natural fish (all age groups combined) captured was 171.8 mm, 53.1 g and 1.01, respectively. The mean size of migrants (all age groups combined) captured was similar, but highly variable, as in previous years (Table 7.) Peak of the spring migration for natural steelhead was April 30 (which fell in the normal range of peak migration, see Figure 3) with an estimated 2,652 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 survivals that could be used in comparison to our hatchery stocks from Lyons Ferry (Table 8). A minimum of five detections was necessary for inclusion into the following table. Due to the lack of PIT tags available, no wild origin migrants were tagged during the 2007 out-migration year. Average smolt-to-adult survival of wild origin summer steelhead from the Tucannon River (based on the PIT tags) is 2.25% back to Bonneville Dam, and 1.75% to McNary Dam.

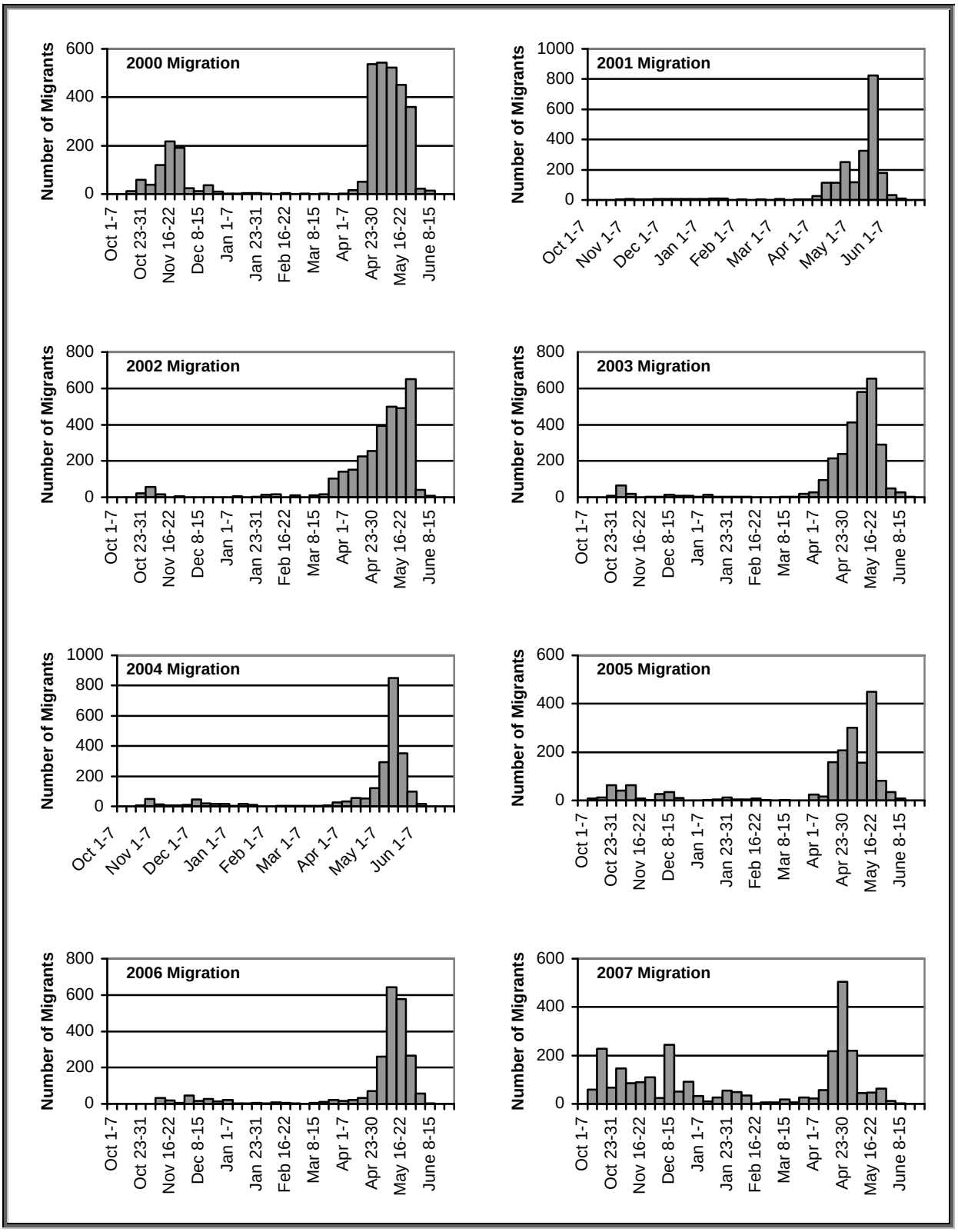

Figure 2. Emigration timing of summer steelhead migrants in the Tucannon River, 2000-2007 migration years.

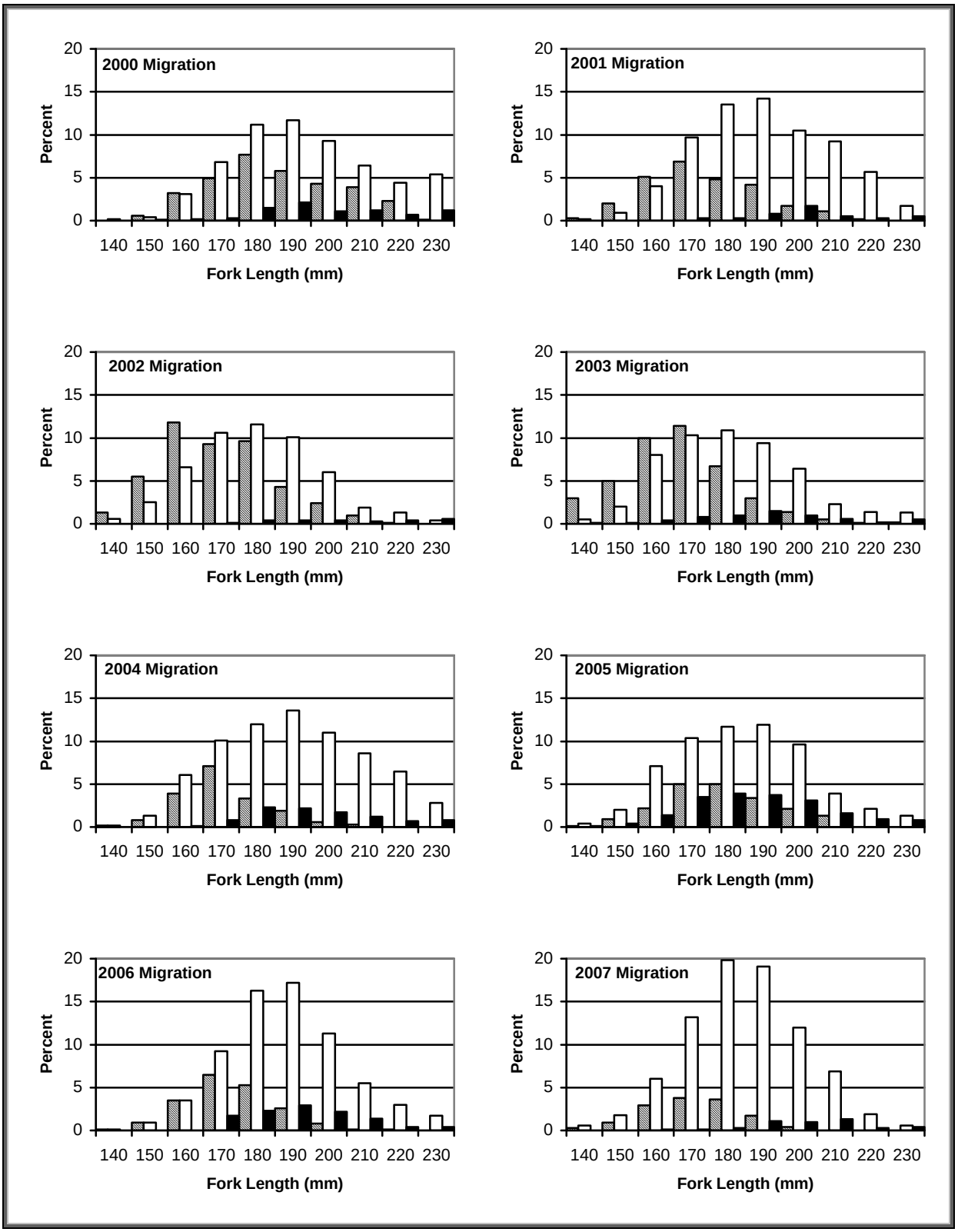

Figure 3. Summer steelhead migrants age distribution by fork length, 2000-2007 migration (data collected from March-June). Age 1 = diagonal slash, Age 2 = open box, Age 3 = solid box.

Table 7. Estimated migrant production, percent composition by age class, and mean length of natural-origin steelhead migrants from the Tucannon River by brood year (1996-2007).

	Age 1			Age 2			Age 3			
Brood	# of migrants	% of brood	Avg ln (mm)	# of migrants	% of brood	Avg ln (mm)	# of migrants	% of brood	Avg ln (mm)	Total
1993	- - -	- - -	- - -	- - -	- - -	- - -	835	- - -	NA	- - -
1994	- - -	- - -	- - -	8,249	- - -	NA	908	- - -	NA	- - -
1995	5,583	36.3	NA	8,967	58.3	NA	834	5.4	190.5	15,384
1996	6,069	32.3	NA	11,584	61.7	187.0	1,133	6.0	189.2	18,786
1997	16,684	49.5	184.1	14,095	41.9	186.5	2,883	8.6	196.5	33,662
1998	9,000	37.2	173.1	14,242	58.8	189.3	960	4.0	197.3	24,202
1999	7,577	26.8	182.3	20,262	71.8	186.4	386	1.3	202.6	28,225
2000	5,532	30.8	177.6	10,998	63.5	176.2	981	5.7	186.0	17,311
2001	8,071	40.5	166.7	9,695	48.7	176.9	2,146	10.8	191.0	19,912
2002	9,243	39.7	163.1	10,723	46.0	185.9	3,324	14.3	183.7	23,290
2003	2,602	19.6	167.7	9,515	71.8	179.9	1,128	8.5	187.5	13,245
2004	3,269	29.6	174.3	7,282	66.0	183.9	486	4.4	197.5	11,037
2005	1,651	11.8	169.7	9,659	69.2	180.1	2,644	18.9	193.6	13,954
2006	1,396	- - -	166.5	15,567	- - -	179.4	- - -	- - -	- - -	- - -
2007	7,870	- - -	164.8							
Average	- - -	32.2	171.8	- - -	59.8	182.9	- - -	8.0	192.3	19,910

Note: Some length data by age not available because scales were not collected. Also, Age 4 smolts (generally <0.5 of 1%) have not been included due to their low frequency each year and to simplify the table.

Table 8. 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. Note: The fish that were PIT tagged were from spring time migrants only, as PIT tags were generally unavailable for the fall migration period. Beginning for the 2009 migration year, groups of fish from both time periods will be PIT tagged so different SAR's can be calculated from the two migration periods, or to represent the entire migrant population.

Smolt Migration Year	Life Stage	Release Location	Number of PIT Tags	Bonneville or above	Percent Survival	McNary or above	Percent Survival
1999	Smolt	Smolt Trap	363	6	1.65	5	1.38
2000	Smolt	Smolt Trap	555	20	3.60	16	2.88
2002	Smolt	Smolt Trap	1,506	40	2.66	32	2.12
2003	Smolt	Smolt Trap	1,556	36	2.31	30	1.93
2004	Smolt	Smolt Trap	1,984	32	1.61	20	1.01
2005	Smolt	Smolt Trap	1,835	27	1.47	23	1.25
2006	Smolt	Smolt Trap	1,417	35	2.47	24	1.69
Average					**2.25**		**1.75**

The adult PIT tag detections or naturally produced Tucannon River summer steelhead exhibited a disturbing migration pattern (Tables 9). A high proportion of the Tucannon River natural fish that cross Ice Harbor Dam also pass above Lower Granite Dam (65%), with only a few moving back down river (~20%) and entering the Tucannon River. The same 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 on Asotin Creek since 2005 has documented (by CWT recoveries) many Tucannon River endemic stock steelhead during the spawning season (e.g.16 fish in 2007), as well as fish from the LFH stock released into the Tucannon River, Lyons Ferry Hatchery, and the Touchet River. Additionally, Touchet River endemic hatchery steelhead have been detected at the PIT tag array in the lower Tucannon River in March and April (Table 10); presumably spawning there as well. Subsequent detection of these same fish later in the season has not occurred to date (i.e. kelts). These data are very preliminary, and the efficiency of the arrays to detect PIT tags in adult fish in the Tucannon and Walla Walla are unknown at this time. Failure of PIT tagged LFH , Touchet, and Tucannon stock steelhead to return to stocking location or stream of origin is disturbing and needs further investigation.

A logical 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. 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. However, stream flows of both the Walla Walla and Tucannon River are low at this time, and they both empty into relatively large reservoirs of the Columbia and Snake River as created by the dams. It's therefore possible that the fish can't sense the stream where they should return. However, limited historical data from the 1950's (prior to dam construction) suggests that this upstream migration to an overwintering area in the Snake River (at least for the Tucannon River fish) was a normal event, with fish migrating back downstream in the early winter to find their natal stream for spawning. Now that the dams are in place, this downstream migration has been blocked, and fish (Tucannon River fish in this case) look to other streams (i.e. Asotin Creek, Alpowa Creek) above Lower Granite Dam for spawning.

Table 9. Disposition of PIT tagged Tucannon Endemic stock, Tucannon natural stock, and Lyons Ferry hatchery stock summer steelhead that crossed Ice Harbor Dam.

Release Year	Pass Ice	Pass Granite	Enter Tucannon	Unknown Location	Back to Tucannon From Granite	% back to Tucannon from LGR	Total into Tucannon	Percent of those that passed Ice Harbor Dam: % into Tucannon	% above Granite	% 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
Totals	**208**	**134**	**46**	**28**	**29**	**21.6**	**75**	**36.1**	**50.5**	**13.5**
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
Totals	**53**	**31**	**15**	**12**	**5**	**16.1**	**21**	**39.6**	**49.1**	**22.6**
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

Note: The Tucannon River PIT tag array was taken out by high stream flow in January, 2009. Two salt returns from the 2006 release 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 release year are not completely accurate.

Table 10. Disposition of PIT tagged Touchet River Endemic stock summer steelhead that crossed McNary Dam. Note: not all fish that crossed McNary Dam are shown in the table, a few were also detected at Priest Rapids Dam and Rock Island Dam in the upper Columbia River.

Release Year	Pass McNary	Enter Walla2	Stay Pass Ice	Stay Pass Granite	Enter Tucannon	Enter Tucannon Mar-Apr	Percent of those that passed McNary Dam: % into Walla2	% above Ice	% above Granite	% Into Tucannon
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
Totals	**89**	**19**	**40**	**5**	**19**	**14**	**21.3**	**44.9**	**5.6**	**21.3**

Note: The Tucannon River PIT tag array was taken out by high stream flow in January, 2009. Two salt returns from the 2006 release 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 for the 2006 release year are not completely accurate.

Summer Steelhead Broodstock Collections / Adult Returns and Evaluations

As part of our ongoing broodstock collection and research activities, WDFW hatchery and evaluation staff operate a series of adult steelhead traps in southeast Washington rivers. The LFH staff operates the LFH and Cottonwood Creek traps. The TFH staff operates the upper Tucannon River trap, and evaluation staff operates a trap on the lower Tucannon River and on the Touchet River in Dayton. In addition, data are available on steelhead trapping for the Asotin Creek system from a BPA-funded project (Mayer et al, 2005-2008). Some of the information from the Asotin Creek adult trap assists in our evaluations. Information presented below summarizes collection and hatchery spawning activities and any additional evaluation projects for the reporting period.

LFH Trap

2006/2007: Adult steelhead were trapped from 6 September through 17 November 2006. A total of 1,701 adult steelhead (911 female [53.6%] and 790 male [46.4%]) were trapped. Fish retained for broodstock were sorted on 17 November 2006. All fish not needed for broodstock or retained to recover CWTs were returned to the Snake River to contribute to the sport fishery (1,026). Of those steelhead trapped, no wild origin (unmarked) fish were found. We recovered 379 fish with CWTs (Table 11). Age composition based on CWT recoveries was 81.8% one-ocean, and 18.2% two-ocean. Mortality during trapping, holding, and spawning was 80 fish (4.7% of all fish trapped). Pre-spawning mortality rate was low in 2007 compared to the previous eight years average (SD) of 13.8 (8.3%). During January and February of 2007, 123 females were spawned with 245 males (two males were generally combined into one bag and used on a single female), producing 558,683 eyed eggs for the LFH stock program (Table 2). Eggs from two females were destroyed due to a high titer of IHNV in the ovarian fluid. The mean fecundity of one-ocean (4,316) and two-ocean (5,624) females were similar to past values (Figure 4).

2007/2008: Adult steelhead were trapped from 4 September through 14 November 2007. A total of 1,666 adult steelhead (998 female [59.9%] and 653 male [40.1%]) were trapped. Fish to be retained for broodstock were sorted on 30 November 2007. All fish not needed for broodstock or retained to recover CWTs were returned to the Snake River to contribute to the sport fishery (1,036). Of those steelhead trapped, no wild origin (unmarked) fish were found. We recovered 293 fish with CWTs (Table 11). Age composition based on CWT recoveries was 90.4% one-ocean, and 9.6% two-ocean. Mortality during trapping, holding, and spawning was 172 fish (10.4% of all fish trapped). Pre-spawning mortality rate was higher compared to 2007, but similar to previous years (see above). During January and February of 2008, 116 females were spawned with 193 males (two males were generally combined into one bag and used on a single female), producing 563,765 eyed eggs for the LFH stock program (Table 2). No eggs were destroyed due to high IHN titer in 2008. The mean fecundity of one-ocean (4,748) and two-ocean (6,005) females were similar to past years (Figure 4).

Table 11. Summary of tagged adult summer steelhead trapped at LFH for the 2006 run year / 2007 brood year, and 2007 run year / 2008 brood year.

Brood year	CWT code	Stock	Release site	Number of CWTs
2006 Run Year / 2007 Brood Year				
2003	63 / 15 / 16	Lyons Ferry	Snake River – On Station	39
	63 / 15 / 79	Lyons Ferry	Tucannon River	8
	63 / 15 / 80	Lyons Ferry	Touchet River @ Dayton AP	7
	63 / 15 / 81	Lyons Ferry	Walla Walla River	15
2004	63 / 26 / 77	Wallowa	Grande Ronde @Cottonwood AP	1
	63 / 23 / 64	Lyons Ferry	Snake River – On Station	160
	63 / 23 / 65	Lyons Ferry	Tucannon River	38
	63 / 23 / 67	Lyons Ferry	Touchet River @ Dayton AP	42
	63 / 23 / 66	Lyons Ferry	Walla Walla River	69
			No CWT	21
			Lost CWT	4
			Grand Total For Year	**404**
2007 Run Year / 2008 Brood Year				
2004	63 / 23 / 64	Lyons Ferry	Snake River – On Station	12
	63 / 23 / 65	Lyons Ferry	Tucannon River	7
	63 / 23 / 67	Lyons Ferry	Touchet River @ Dayton AP	4
	63 / 23 / 66	Lyons Ferry	Walla Walla River	5
2005	63 / 32 / 90	Wallowa	Grande Ronde @Cottonwood AP	1
	63 / 32 / 91	Lyons Ferry	Snake River – On Station	115
	None	Lyons Ferry	Tucannon River	NA
	63 / 32 / 93	Lyons Ferry	Touchet River @ Dayton AP	81
	63 / 32 / 92	Lyons Ferry	Walla Walla River	68
			No CWT	6
			Lost CWT	2
			Grand Total For Year	**301**

Evaluation staff compiled dates of broodstock spawning at LFH (Figure 5). Between 1987 and 2002, broodstock spawn timing has gradually shifted from the first spawn date typically being near the end of February to near the beginning of January (5 week shift over time). The cause of this shift is not completely known, but may likely due to reaching eggtake goals from the first spawners only, with the later spawning fish not contributing to the next generation. Holding water temperature of the broodstock also is a likely contributor to this shift, since fish were typically held as early as July/August to spawning on 11^{o}C well water. In 2003, a decision was made to not spawn fish earlier than 13 January and to have a minimum of three egg takes per season; as this allows enough time for virology screening to occur while fish are still available in the broodstock for additional egg collection, and to prevent further changing of spawn timing. 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. In addition, having the Lyons Ferry stock fish spawning earlier may be beneficial if this is also occurring in the fish that are left to spawn naturally in the rivers. Fish spawning weeks to months earlier may not be as successful in producing offspring for the next generation, and will be less likely to overlap in spawn timing with natural origin fish. National Marine Fisheries

Service has ruled that Lyons Ferry fish on the spawning grounds are causing jeopardy to listed Snake River summer steelhead populations (NMFS 1999). So, earlier spawn timing should be considered a benefit if that is what is occurring in the rivers. We have some anecdotal information that earlier spawning of Lyons Ferry steelhead might be occurring, but we don't know what percent of the Lyons Ferry fish left to spawn naturally may be doing this. From spawning ground survey observations, we do know that many Lyons Ferry steelhead spawn at the exact same time as natural origin fish.

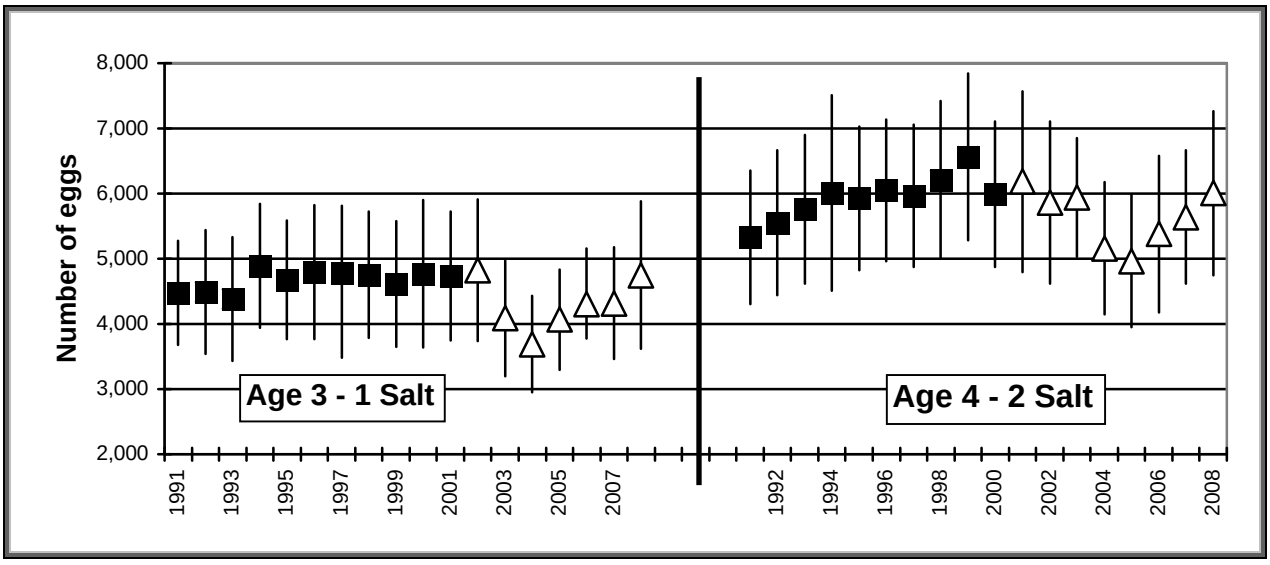

Figure 4. Mean fecundity (±standard deviation) of Lyons Ferry stock summer steelhead from 1991-2008. Note: egg estimation method was changed in 2003 from volumetric (black squares) to weights (open triangles).

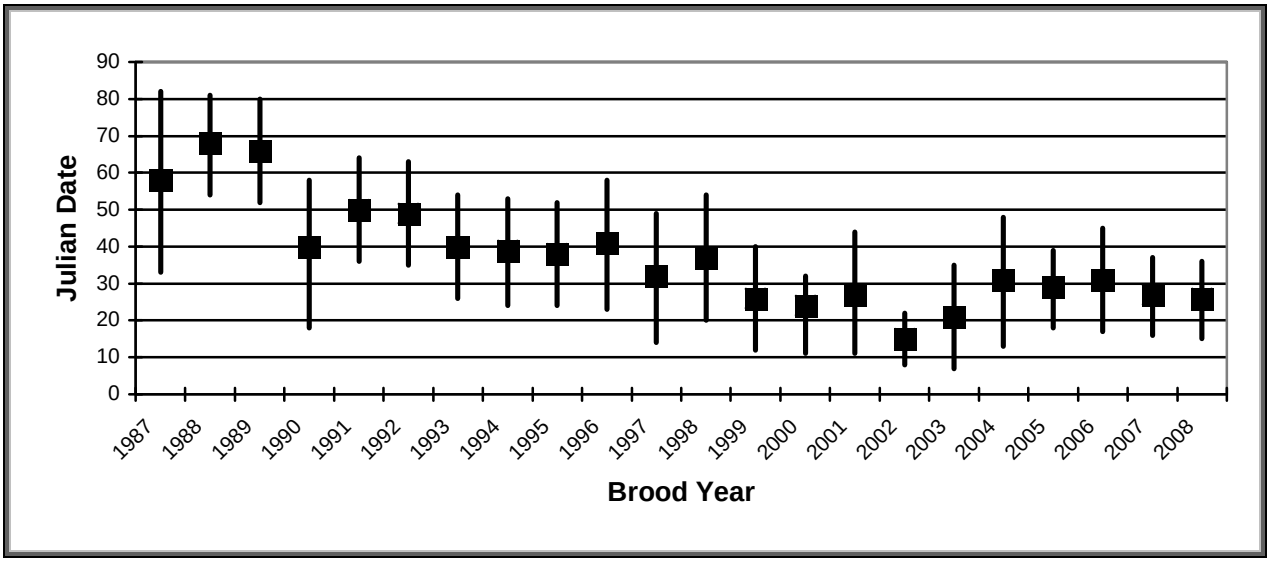

Figure 5. Range and mean spawn dates of Lyons Ferry stock summer steelhead, 1987-2008. Bars indicate first and last date of spawning; square indicates the average spawn date.

Cottonwood Creek Trap

2006/2007: Five-hundred fifty-eight adult steelhead (313 female, 245 male) were trapped from 10 March to 24 April 2007. Eighteen natural origin fish (11 male, 7 female) were captured during the season. Age composition based on CWT recoveries and fork lengths of sampled fish was 44.3% one-ocean and 55.7% two-ocean. For the season, 106 females were spawned with 97 males producing 265,538 fertilized eggs. Twenty-five females tested positive for IHNV in 2007. An estimated 75,050 eggs from those fish were destroyed at LFH and are not included in the total. Fecundities of one-ocean and two-ocean females were not available for this year as most fish were partially spawned (Figure 6; See Partial Spawning Section). The number of fish that were full spawned was too small to produce an accurate estimate of fecundity by age class. Fish that did not contain CWTs or were not spawned were passed upstream of the trap to spawn naturally. Any carcasses from spawning and fish killed to retrieve the CWTs were distributed in upper Cottonwood Creek for nutrient enhancement, or donated to Walla Walla Community College for science lab dissections. We recovered 88 fish that had, or should have had CWTs (Table 12). All recovered CWTs were from fish originally released on-site at Cottonwood AP.

Table 12. Summary of tagged adult summer steelhead trapped at Cottonwood Trap for the 2006 run year / 2007 BY and 2007 run year / 2008 BY.

Brood year	CWT code	Stock	Release site	Number of CWTs
2006 Run Year / 2007 Brood Year				
2003	63 / 15 / 28	Wallowa	Cottonwood AP	44
2004	63 / 26 / 77	Wallowa	Cottonwood AP	35
2005	63 / 32 / 90	Wallowa	Cottonwood AP	1
			No Tags	5
			Lost	3
			Grand Total for Year	**88**
2007 Run Year / 2008 Brood Year				
2004	63 / 26 / 77	Wallowa	Cottonwood AP	11
2005	63 / 32 / 90	Wallowa	Cottonwood AP	68
			No Tag	1
			Lost	1
			Grand Total for Year	**81**

2007/2008: At the Cottonwood Creek Trap, 1,497 adult steelhead (946 female, 551 male) were trapped from 12 March to 29 April 2008. Thirty natural origin fish (19 male, 11 female) were captured during the season. Age composition based on CWT recoveries and fork lengths of sampled fish was 78.0% one-ocean and 22.0% two-ocean. For the season, 85 females were spawned with 85 males producing 275,958 fertilized eggs. Twelve females tested positive for IHNV in 2008. An estimated 26,943 eggs from those fish were destroyed at LFH and are not included in the total. Most, but not all of the females spawned in 2008 were again partially

spawned to continue the study that began in 2006. However, enough fully spawned females were taken to estimate fecundities of one and two-ocean fish. Fecundities of one-ocean and two-ocean females were 4,167 and 6,086, respectively, and were similar to previous year's fecundity estimates (Figure 6). 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 81 fish that had, or should have had CWTs (Table 12). All recovered CWTs were originally released on-site at Cottonwood AP.

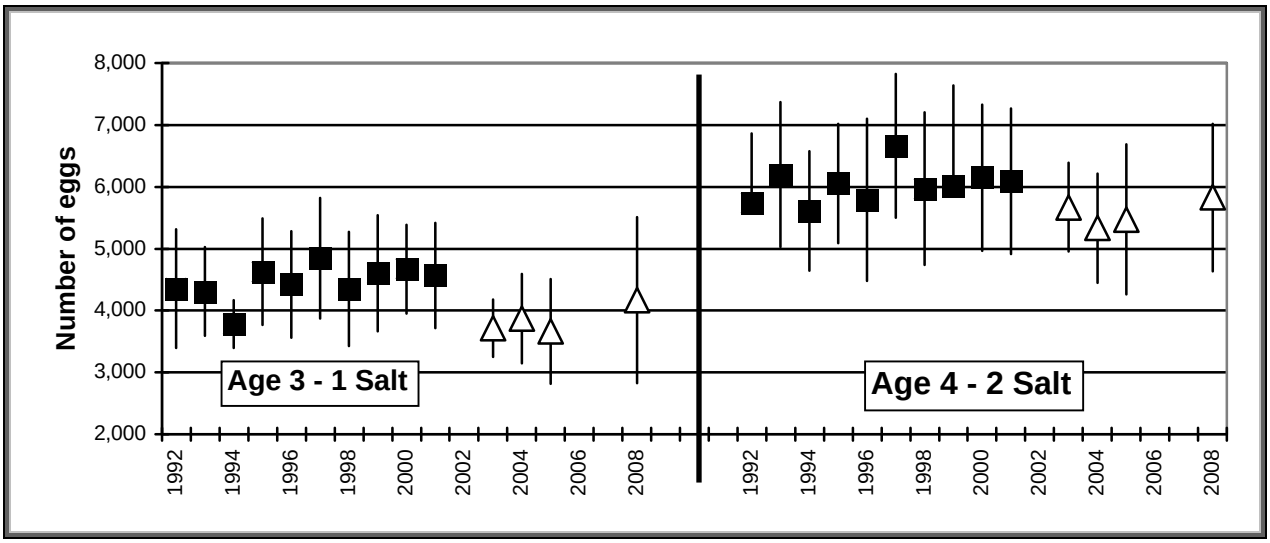

Figure 6. Mean fecundity (+standard deviation) of Wallowa stock summer steelhead from 1992-2008. Note: egg estimation method was changed in 2003 from volumetric (black squares) to weights (open triangles).

Partial Spawning of Females: For the 2006-2008 broods, evaluation staff conducted an experiment on Cottonwood Creek to determine if female steelhead partially spawned in the hatchery 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. Kelts recovered in 2006 indicated that 87% were successful in voiding the rest of their eggs. However, whether or not those eggs were viable and successful in producing juveniles is unknown. 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. In 2007, 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 to early in the development stage to tell for sure whether the eggs had been fertilized or not) caused our results to fall short of our expectations. The 2008 effort was generally that same as 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 other

fish from spawning in the same area. 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 show 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 desire to repeat the experiment for one more year. Based on the results to date, 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, and while allowing those same fish to contribute to natural production. An initial fish health concern was expressed with this partial spawning method. It was feared that an adequate virology sample (ovarian fluid for testing IHNV in the female) would not be obtained. However, we have found that an adequate amount of ovarian fluid was present in the extracted eggs to complete the virology tests.

Since 1992, when eggs were first collected from the Cottonwood Creek Trap, we have compiled dates of broodstock spawning for the Wallowa stock summer steelhead (Figure 7). From 1992 to 2008, 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.

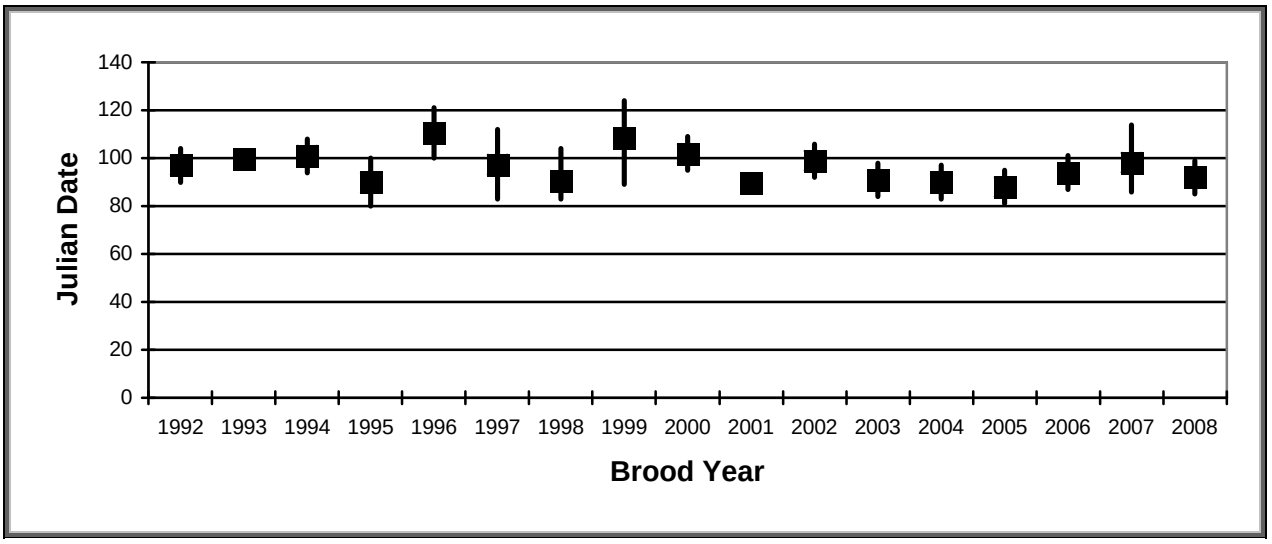

Figure 7. Range and mean spawn dates of Wallowa stock summer steelhead, 1992-2008. Bars indicate first and last date of spawning; square indicates the average spawn date.

TFH Trap

A permanent adult steelhead and salmon trap was installed in 1998 at the TFH water intake diversion dam. Natural and Tucannon River hatchery endemic stock origin steelhead are enumerated, sampled, and passed upstream to spawn, while LFH stock fish are returned to below the trap unless they are a fish with a CWT. For the 2006 run year, hatchery staff trapped 14 natural, 14 Tucannon River endemic stock, and 5 LFH stock hatchery-origin steelhead (Table 13). The number of fish trapped for the 2007 run year was lower with 10 natural origin, 7 Tucannon River Endemic stock, and 5 LFH stock hatchery origin steelhead. During the 2007 run year, one female and one male were collected for broodstock to supplement broodstock trapping from the lower river temporary trap (see below). These fish were spawned and ultimately produced about 2,400 progeny for rearing. Due to the low production, it was decided by WDFW and the co-managers to not rear these fish and release them as fry into the upper Tucannon River. These fish will not be tagged, so no evaluation will occur. However, with such a small number, and their size at release being button-up fry, we don't expect many will return as adults so evaluations of the other groups (hatchery or natural) will not be compromised from this release.

Table 13. Natural origin, hatchery LFH stock origin, hatchery Tucannon endemic stock origin summer steelhead trapped at the Tucannon Fish Hatchery from the 1997-2007 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	69.4	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

Lower Tucannon Adult Trap

Evaluation staff deployed and operated a temporary trap at rkm 17.7 in the lower Tucannon River during the fall to early spring of 2006/2007, with the primary focus to collect natural-origin fish for a new hatchery broodstock (Bumgarner et al. 2002). This program is still considered in the experimental stage (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 that 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 2006/2007, all LFH stock fish (unless they had a CWT) were passed upstream of the trap. All CWT fish were killed for tag extraction and release location information. For 2007/2008, all LFH stock fish captured were to be released downstream of the trap, or removed if they were CWT fish.

2006/2007: The trap was operated between 18 September 2006 and 5 April 2007. Nearly continuous operation was accomplished due to a new floating weir design that has dramatically reduced debris loads and scouring of gravel around the trap. However, high water flows or ice periodically submerged the floating panels, allowing for unrestricted passage for 1-2 weeks at a time during parts of the year. In all, 49 natural fish (18 males and 31 females - Table 14), 16 Tucannon River hatchery endemic stock, and 80 LFH hatchery fish were trapped. We collected and hauled 27 natural fish (14 females and 13 males) to LFH for broodstock. Natural origin fish not collected for broodstock were passed upstream after length and sex were determined, and scales samples were collected. Because the trap was periodically disabled due to high stream flows or ice, other fish species were not commonly captured compared to previous years (Table 15).

Table 14. Total number of male and female summer steelhead at the lower/middle Tucannon River temporary adult trap (1999-2007 run years).

Run Year	Natural			Hatchery LFH Stock			Hatchery Endemic Stock			Totals (Percent)	
	Male	Female	Total	Male	Female	Total	Male	Female	Total	% Natural	% Female
1999	33	23	56	0	0	0	NA	NA	NA	100.0	41.1
2000	17	18	35	7	7	14	NA	NA	NA	71.4	51.0
2001	42	33	75	68	66	134	NA	NA	NA	35.9	47.4
2002	26	56	82	92	121	213	6	2	8	27.1	57.9
2003	33	38	71	116	105	221	6	9	15	23.1	49.5
2004	176	196	372	176	132	308	56	46	100	47.6	47.9
2005	48	43	91	23	25	48	8	15	23	56.2	51.2
2006	18	31	49	53	27	80	10	6	16	31.6	44.1
2007	8	4	12	1	0	1	9	2	11	50.0	25.0

Table 15. Total number of spring/summer/fall Chinook, coho, bull trout, whitefish and sucker at the lower/middle Tucannon River temporary adult trap (1999-2007 run years).

	Spring/summer Chinook		Fall Chinook					
Run Year	natural	hatchery	natural	hatchery	Coho	Bull trout	Whitefish	Sucker
1999	0	0	0	0	0	0	0	NA
2000	0	0	0	0	0	3	1	NA
2001	0	0	3	1	0	2	1	NA
2002	3	0	10	1	6	0	0	NA
2003	2	6	6	13	8	1	1	70
2004	1	0	6	4	3	6	1	38
2005	0	0	1	2	11	3	0	28
2006	2	1	0	0	0	0	0	0
2007	0	0	0	0	0	0	1	0

During 2006/2007, pre-spawning loss was only one male. Pre-spawning loss in recent years has been kept low because of more aggressive fungus control treatments once fish are captured and held. During February and March 2007, 13 adult females were spawned with 12 males at LFH. One female was not spawned and was returned to the river for natural spawning. Total egg take was estimated at 64,129 (Table 3). Natural fish trapped from the lower Tucannon Trap or the Tucannon Hatchery Trap consisted of 42.9% one-ocean and 57.1% two-ocean age fish (Table 16). Fecundities of one-ocean and two-ocean females were 4,358 and 6,194, respectively, for the 2006/2007 run year very similar to previous years (Figure 8).

2007/2008: For the 2007/2008 season, the trap/weir deployment was delayed until mid-December. A new trap box was constructed, and modifications were made to the weir panels so that they could continue floating under higher stream flow conditions. Due to the excessive gravel scouring in the lower river, and the greater likelihood that we were collecting unmarked fish that were direct offspring of LFH stock fish that typically spawn in the lower river, it was decided to move the trap upstream. A new location for the trap was found in the middle section of the Tucannon River near Marengo (rkm 39). Because the trap was moved to an upstream location, a management decision was made to not allow (when possible) any LFH stock fish above this point, thereby creating a "refuge" for unmarked and hatchery endemic stock fish only. Trapping in 2007/2008 was not very successful, as we captured only eight fish (three natural stock, four endemic stock, and one LFH stock), and recovered 16 (nine natural, 7 endemic) kelts off the weir panels (Table 14). The trap was pulled on 30 April due to lack of fish and very high water that had completely submerged the weir panels. One natural male was collected for broodstock, but it died during holding and was not spawned.

During 2007/2008, a total of three fish were collected for broodstock (one fish from the lower adult trap and two fish from the Tucannon Hatchery trap). In April 2008, one adult female was spawned with one male at LFH. Total eggtake was estimated at 3,054 (Table 3). Natural fish trapped from the temporary Tucannon Trap or the Tucannon Hatchery Trap consisted of 62.5% one-ocean and 37.5% two-ocean age fish (Table 16), though the sample size for the 2007 run years was limited by the low numbers of fish trapped. Only one female was spawned for the 2007/2008 run years, so comparisons with previous years are limited.

Since the endemic programs began in 2000, evaluation staff have compiled dates of broodstock spawning (Figure 9). From 2000 to 2008, 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 a greater number of spawning days at the hatchery to obtain the eggs needed for the program, thereby increasing the variability among years.

Table 16. Summary of fresh and salt-water age composition of natural origin adult steelhead from the Tucannon River, 2000-2008 brood years.

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
Combined	**45**	**5.5**	**80**	**9.7**	**316**	**38.3**	**313**	**38.0**	**43**	**5.2**	**19**	**2.3**	**0.7**

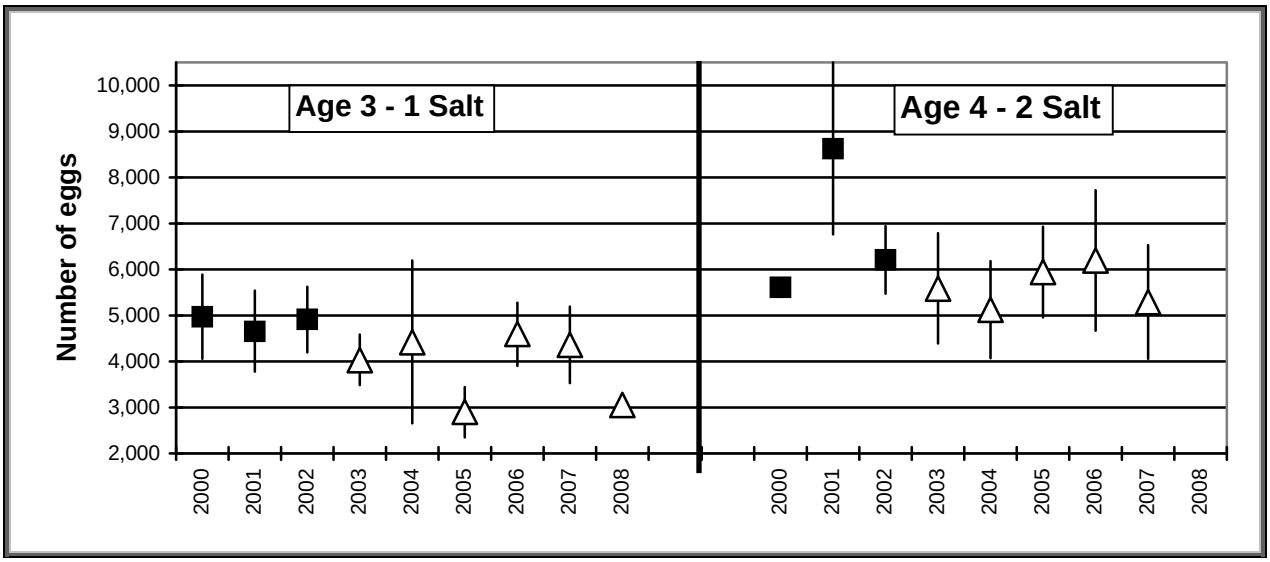

Figure 8. Mean fecundity (±standard deviation) of Tucannon stock summer steelhead from 2000-2008. Note: egg estimation method was changed in 2003 from volumetric (black squares) to weights (open triangles).

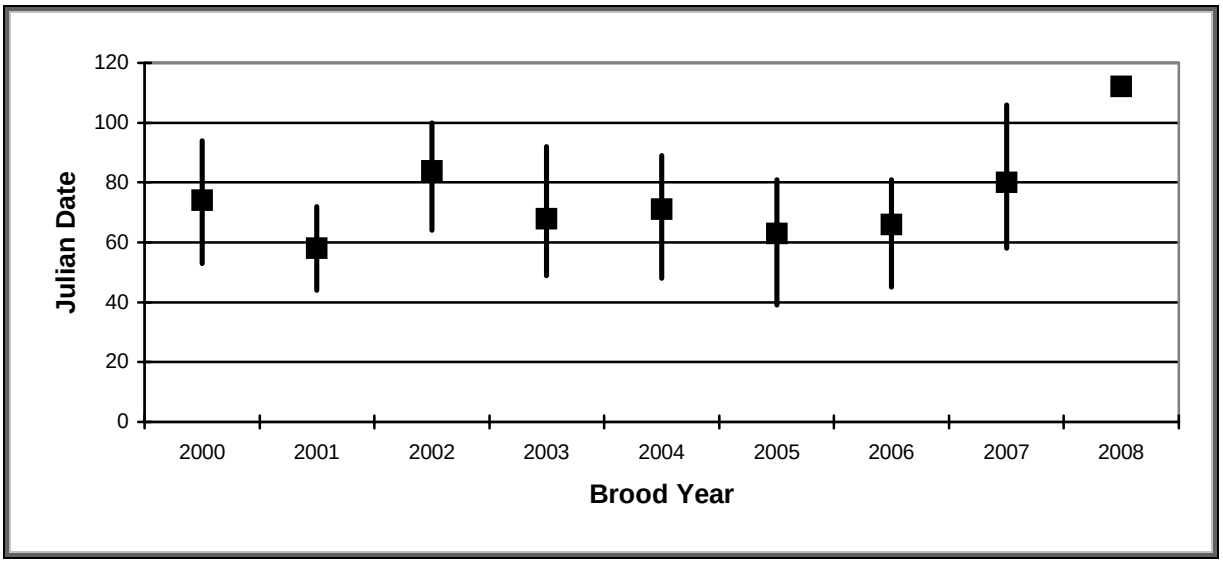

Figure 9. Range and mean spawn dates of Tucannon River endemic stock summer steelhead, 2000-2008. Bars indicate first and last date of spawning; square indicates the average spawn date.

Touchet River Adult Trap

The Touchet River adult trap, located in Dayton near rkm 55, 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 was to capture adult summer steelhead. Of which 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) is still considered experimental as we continue to have problems rearing fish and getting returns that would satisfy the mitigation goals. The adult trap was set up in the existing water intake structure for the Dayton AP (see Bumgarner et al 2002), and while adequate for capturing adult steelhead for broodstock, holding space for many fish in the trap was inadequate (Figure 10). In addition, the concrete weir barrier (designed to maintain stream flow for the water intake) is low enough that adult steelhead or other large species can easily jump the dam. Various barriers have been deployed over the years to prevent fish from jumping the dam, though none have been proven completely effective under high flow conditions. As such, the numbers of fish trapped could not be used to estimate escapement of fish into the upper Touchet River. 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. All LFH stock fish with CWT's have been sacrificed upon capture to obtain the release and brood year information.

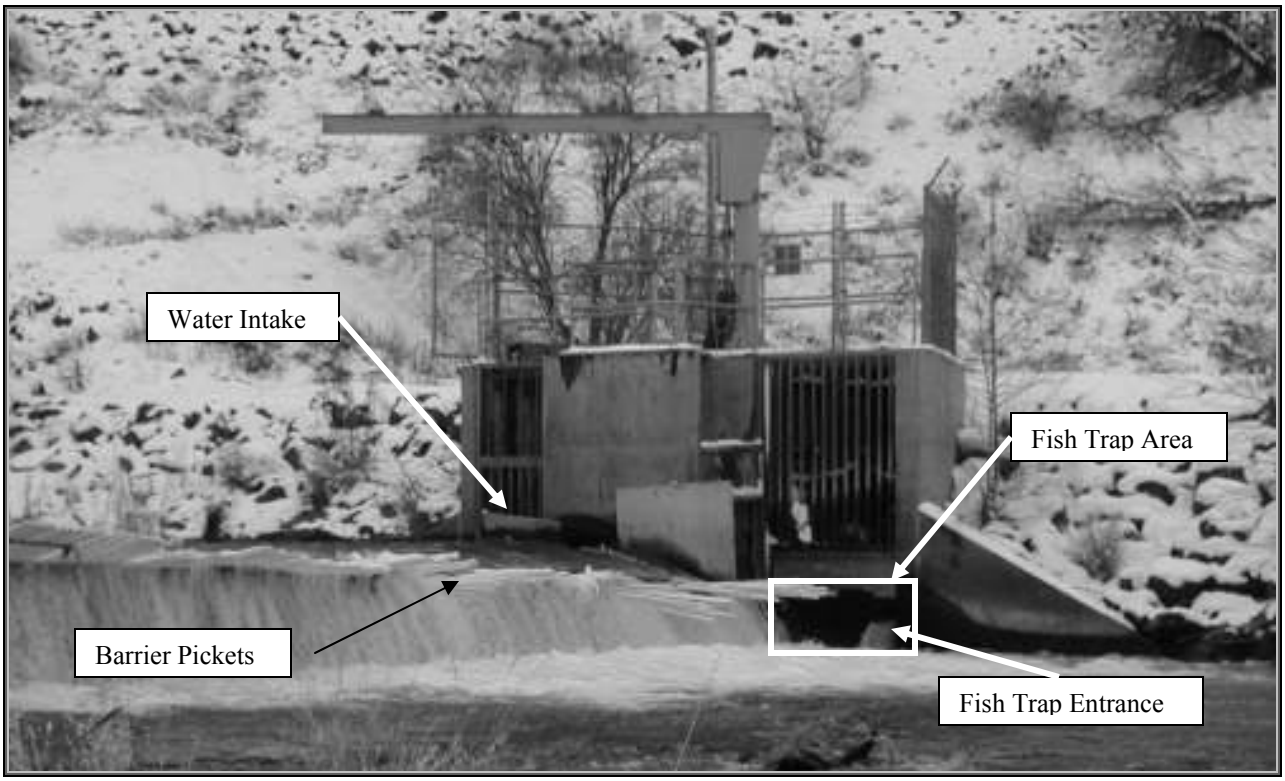

Figure 10. Old Touchet River adult trap and Dayton Acclimation Pond water intake structure.

During 2007 and 2008, a new water intake and fish ladder/trap were constructed at the old site (Figure 11). The new fish ladder was designed for better attraction/passage of all fish species, and the fish trap incorporated in the ladder will accommodate the holding of more fish under less stressful conditions. A barrier across the face of the dam is still needed to prevent fish from jumping over the dam; we hope to have this in place by 2009. If the barrier is successful, more complete counts of summer steelhead, and of all fish species, into the upper Touchet River should be available in the future.

2007 Brood: Evaluation staff operated the adult trap in the Touchet River from 12 February to 27 June 2007. We trapped 143 (71.1%) natural, 13 (6.5%) LFH hatchery origin, and 45 (22.4%) Touchet River endemic hatchery origin steelhead (Table 17). We also trapped five LFH hatchery origin steelhead from the 2007 run year. Natural steelhead trapped in 2007 consisted of 40.0% one-ocean and 60.0% two-ocean age fish (Table 18). Sex ratio of natural origin fish was 74.1% female, while hatchery steelhead was 62% female. We collected 35 natural origin fish (17 females and 18 males) for broodstock. Pre-spawning mortality was low in 2007 with one fish dying (2.9%). For the season, 16 females were spawned with 17 males yielding 73,101 eggs (Table 4).

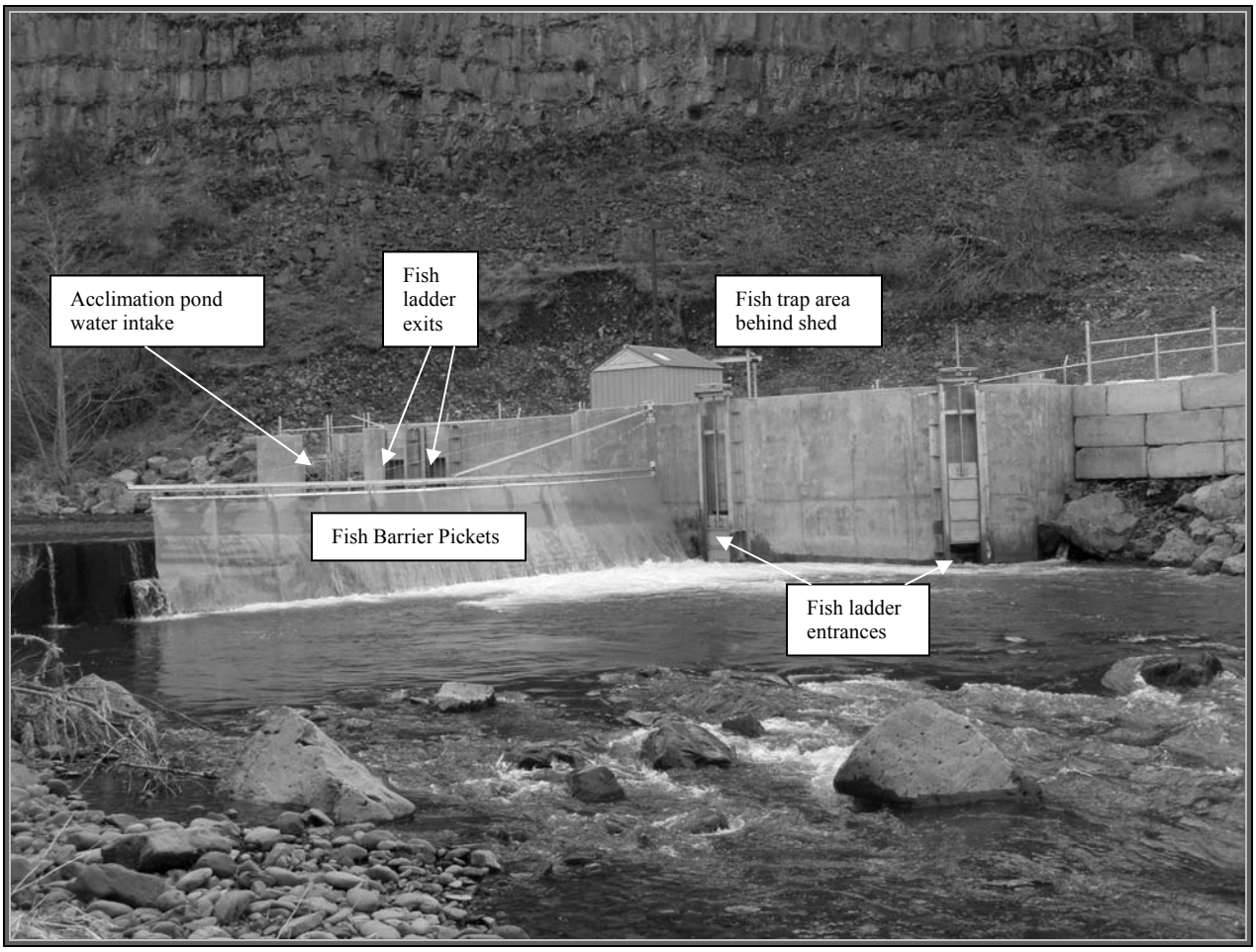

Figure 11. Updated Touchet River fishway/adult trap and Dayton Acclimation Pond water intake structure.

2008 Brood: Evaluation staff operated the adult trap in the Touchet River from 11 March through 30 June 2008 (the adult trap continued to be operated past 30 June but those data will be presented in our next report). For the season staff trapped 119(74.5%) natural, 15 (9.3%) LFH hatchery origin, and 26 (16.1%) Touchet River endemic hatchery origin steelhead (Table 17). Natural steelhead trapped in 2008 consisted of 48.2% one-ocean and 51.8% two-ocean age fish (Table 18). Sex ratio of natural origin fish was 71.1% female, while hatchery steelhead was 61.0% female. We collected 26 natural origin fish (14 females and 12 males) for broodstock. There was no pre-spawning mortality. For the season, 13 females were spawned with 11 males yielding 66,928 eggs (Table 4). This estimate includes one female that was spawned, but the eggs were destroyed as she tested positive for IHNV.

In addition to trapping summer steelhead, we also capture spring Chinook, bull trout, bridgelip suckers (*C. columbianus*), brown trout (*Salmo trutta*), and mountain whitefish (*Prosopium williamsoni*) in the Touchet adult trap (Table19). Biological data collected from bull trout, brown trout and whitefish trapped at the Touchet adult trap in 2007 and 2008 (through July 2008) are presented in Appendix A.

Table 17. Total number of male and female summer steelhead at the Touchet River Adult Trap (1992-1994, 1998-2007 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	86.8	68.9
1993	8	35	43	1	1	2	NA	NA	NA	95.6	80.0
1994	2	6	8	1	1	2	NA	NA	NA	80.0	70.0
1998	13	27	40	5	2	7	NA	NA	NA	85.1	61.7
1999	8	24	32	4	0	4	NA	NA	NA	88.9	66.7
2000	54	130	184	17	19	36	NA	NA	NA	83.6	67.7
2001	67	106	173	9	9	18	NA	NA	NA	90.6	60.2
2002	30	91	121	4	6	10	0	1	1	91.7	74.2
2003	29	73	102	19	8	27	11	5	16	70.3	59.3
2004	38	47	85	20	27	47	4	7	11	59.4	56.6
2005	65	99	164	6	8	14	8	28	36	76.6	63.1
2006	37	106	143	9	4	13	13	32	45	71.1	70.6
2007	35	84	119	9	6	15	6	20	26	74.4	68.8

Table 18. Summary of fresh and salt-water age composition of natural origin adults from the Touchet River, 1994-1995 and 1999-2008 brood years.

BY	Age 1.1		Age 1.2		Age 2.1		Age 2.2		Age 3.1		Age 3.2		Age 4.1		Age 4.2		% Repeat spawners
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	
1994	0	0.0	0	0.0	6	28.6	8	38.1	3	14.3	3	14.3	0	0.0	0	0.0	4.8
1995	0	0.0	0	0.0	0	0.0	6	85.7	0	0.0	0	0.0	0	0.0	1	14.3	0.0
1999	0	0.0	1	3.2	18	58.1	9	29.0	2	6.5	0	0.0	0	0.0	0	0.0	3.2
2000	1	3.2	1	3.2	17	54.8	8	25.8	3	9.7	1	3.2	0	0.0	0	0.0	0.0
2001	1	0.6	14	8.0	84	48.3	40	23.0	15	8.6	9	5.2	1	0.6	0	0.0	5.7
2002	6	4.8	3	2.4	84	67.7	20	16.1	6	4.8	3	2.4	0	0.0	0	0.0	1.6
2003	0	0.0	8	6.7	20	16.7	73	60.8	2	1.7	10	8.3	0	0.0	0	0.0	5.8
2004	0	0.0	1	0.8	47	39.2	18	15.0	18	15.0	2	1.7	1	0.8	0	0.0	8.1
2005	0	0.0	0	0.0	37	44.0	21	25.0	15	17.9	8	9.5	0	0.0	0	0.0	3.6
2006	2	1.3	7	4.5	85	54.8	38	24.5	7	4.5	11	7.1	0	0.0	0	0.0	3.2
2007	2	1.4	11	7.9	46	32.9	54	38.6	7	5.0	14	10.0	1	0.7	0	0.0	2.8
2008	2	1.7	6	5.2	47	40.5	38	32.8	7	6.0	7	6.0	0	0.0	0	0.0	7.7
Totals	**14**	**1.4**	**52**	**5.3**	**491**	**49.9**	**333**	**33.8**	**85**	**8.6**	**68**	**6.9**	**3**	**0.3**	**1**	**0.1**	**5.3**

Table 19. Total number of spring Chinook, bull trout, brown trout, whitefish, northern pike minnow, and bridgelip sucker captured in theTouchet River Adult Trap (1993-1995, 1999-2008).

	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

We operated a Logie 2100C Resistivity Fish Counter generally on weekends at the Touchet River trap in 2007. For the season, the counter detected 116 steelhead on the counter ramp (most were wild origin based on fin clips that could be clearly seen on the video clips). However, of those fish observed, only 42 actually passed the counter ramp and proceeded upstream. For some unknown reason, when the fish made it to the top of the counter ramp, they appeared to hesitate, and were then swept back down the ramp. This falling back behavior was identical to that documented in 2005 and 2006. Attempts were made to correct this problem, without success. The resistivity fish counter was not operated during 2008 as a new fish ladder and trap was constructed at the site in 2007. We are unsure if the fish counter will be utilized in the new facility at this time. Different passage ramps or tubes will have to be constructed to fit the counter into the new fish ladder. The counter may be better utilized in other streams where we currently lack information, or could be passed on to other LSRCP cooperators for their use.

For the 2006/2007 run year, the mean fecundity of natural one-ocean and two-ocean females were 4,124 and 5,460 eggs, respectively, for the 2006/2007 run year; very similar to previous years (Figure 12). Fecundities of one-ocean and two-ocean females were 3,718 and 5,408, respectively, for the 2007/2008 run year.

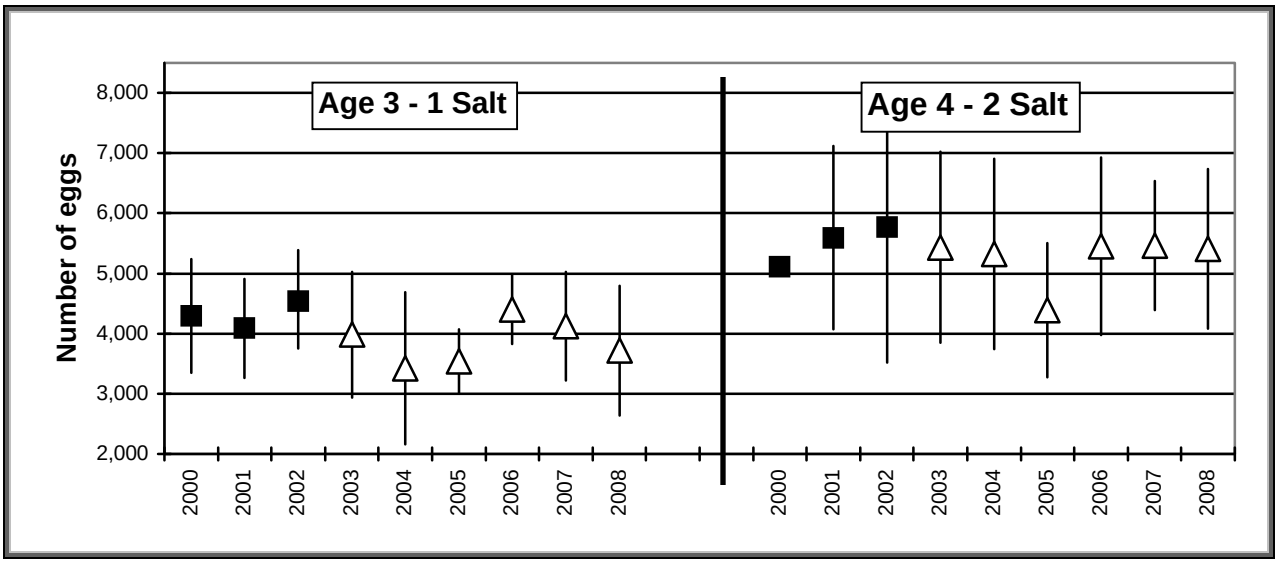

Figure 12. Mean fecundity (±standard deviation) of Touchet stock summer steelhead from 2000-2008. Note: egg estimation method was changed in 2003 from volumetric (black squares) to weights (open triangles).

The Touchet River endemic program began in 2000 and since then evaluation staff have compiled dates of broodstock spawning (Figure 13). Broodstock spawn timing has been slightly earlier than the first two years. However, this spawn-timing shift is artificial and directly caused by intentionally collecting fish from the early part of the run (Figure 14). We assumed that early returning fish would spawn earlier and would allow the hatchery staff more time to produce a one-year old smolt at program size. This is exactly what has happened. The impacts of this strategy long-term is currently unknown, but is potentially harmful to the recovery of the population, and has not been recommended for long-term management of the stock. Data collected to date would not suggest that endemic hatchery fish are returning earlier than the natural population (Figure 15), but this is early in the evaluation. A possible solution that has been proposed 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 considered 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.

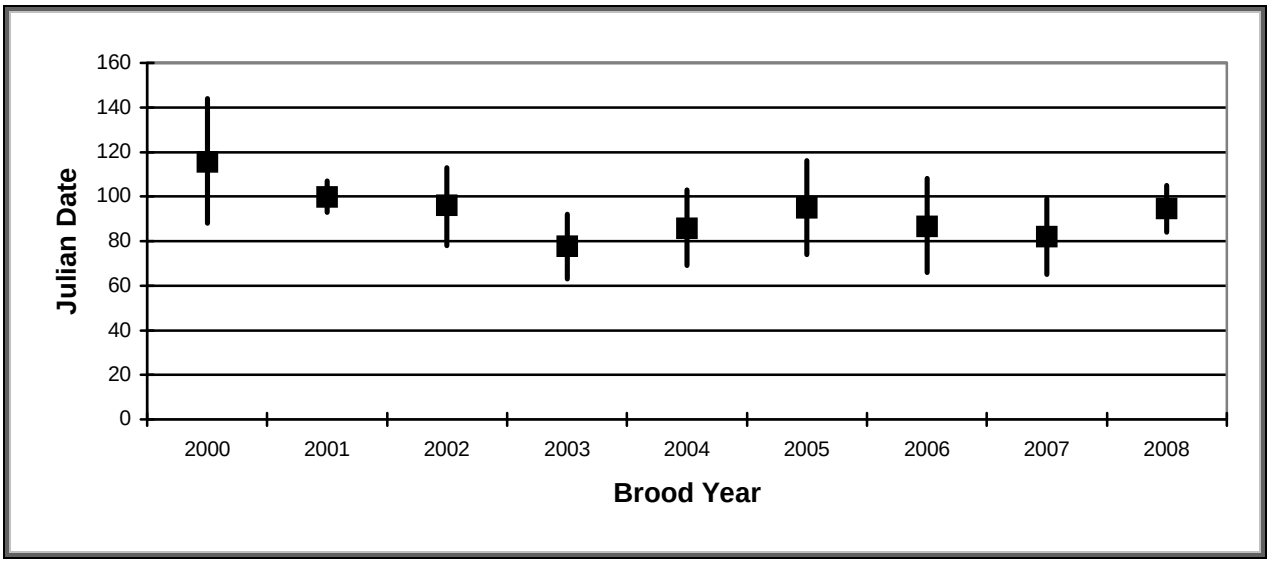

Figure 13. Range and mean spawn dates of Touchet River endemic stock summer steelhead, 2000-2008. Bars indicate first and last date of spawning; square indicates the average spawn date.

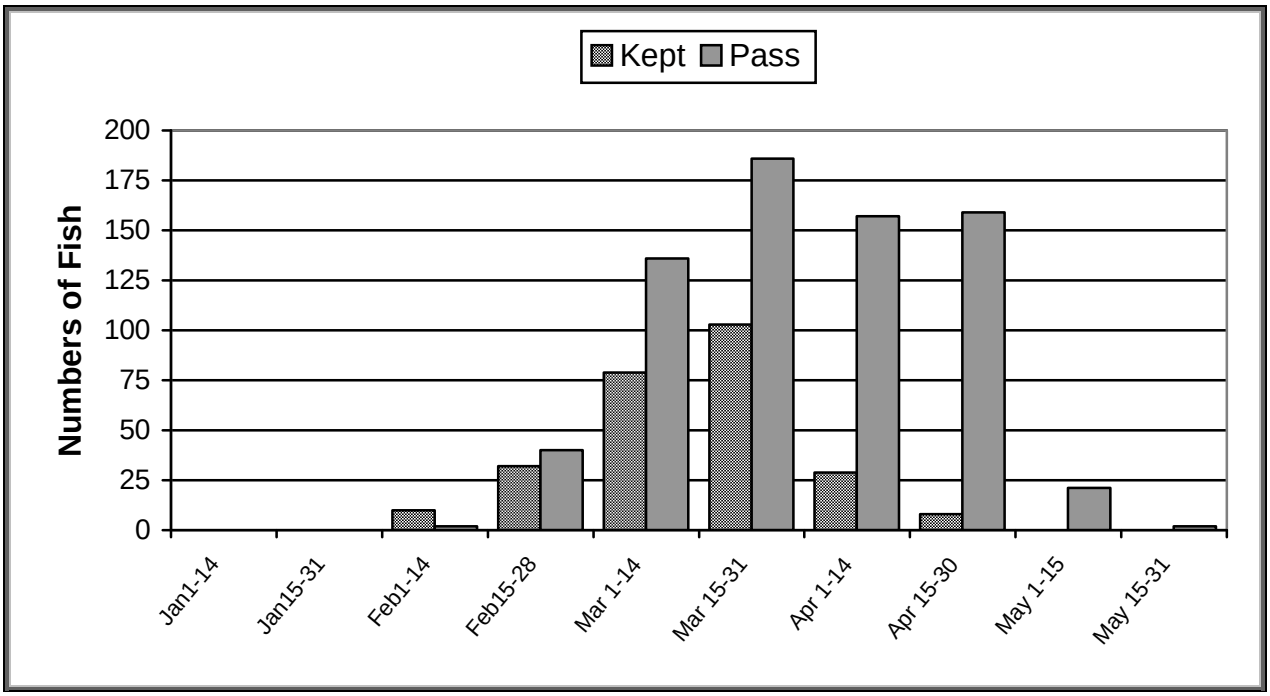

Figure 14. Broodstock collected by weekly catch (2000-2008 BY's).

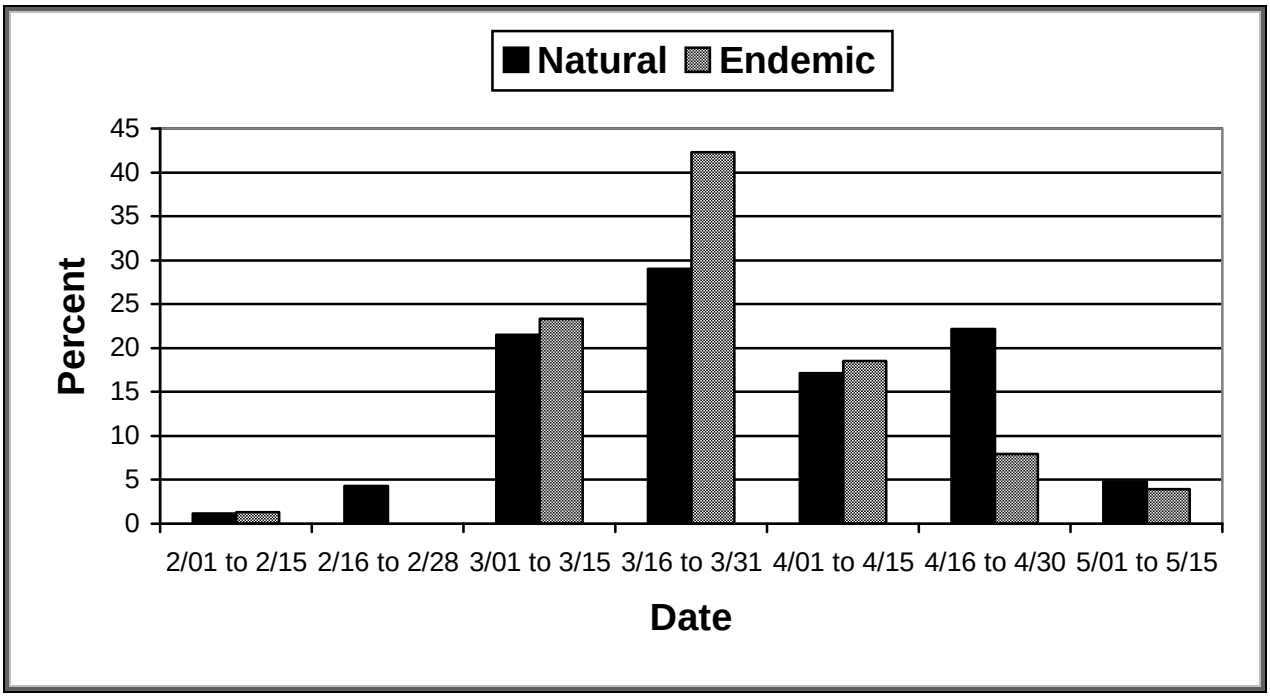

Figure 15. Run Timing of natural and hatchery endemic stock summer steelhead at the Touchet River adult trap, 2004-2009.

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). The number of LFC steelhead in the Washington sport catch in SE Washington was estimated using WDFW sport harvest estimates from Washington catch record cards. Data from weekly surveys was summarized during the season and provided to the local news media to assist anglers. During the 2006/2007 steelhead sport fishery season we surveyed 8,555 anglers who caught 2,844 fish within the LSRCP area of Washington (Table 20), excluding the Grande Ronde River (see next section). A total of 997 natural origin fish (35.1% of the total catch documented from creel surveys) were caught and released during the 2006/2007 steelhead season.

During the 2007/2008 steelhead sport fishery, 12,979 surveyed anglers caught 4,800 fish within the LSRCP area of Washington (Table 21), excluding the Grande Ronde River (see next section). A total of 1,044 natural origin fish (21.75% of the total catch documented from creel surveys) were caught and released during the 2007/2008 season. In 2007/2008, creel surveys, on the Tucannon, Touchet or Walla Walla rivers were limited or not conducted. This was done to increase our sample rate in the mainstem of the Snake River to achieve at least a 20% sample of what is eventually reported on Washington's catch record cards.

Historically, conducting creel on the tributaries has been very time consuming, and has yielded very low sample rates. Based on the summary tables from 2006 and 2007 run years, the increased efforts in the mainstem of the Snake River were beneficial as we nearly doubled our sample of fish kept. From this year forward, we will rely on catch record estimates of harvest within each of those previously sampled rivers, and will use historical CWT recovery data to estimate WDFW LSRCP fish contribution to each. For example, average CWT recovery of Lyons Ferry stock steelhead in the Tucannon River indicates that 57% were from the Tucannon River releases, 22% from the Touchet, 16% from the Walla Walla, and 4% from the on-station release, and an additional 1% originate from the Cottonwood AP release group. Lyons Ferry or Wallowa stock group make up about 94% of the CWT fish harvested from the Tucannon River. Coded-wire tag recoveries from creel and adult traps from these rivers in the past indicate steelhead from other Snake or Columbia river hatcheries are not prevalent (Walla Walla – 2.3%, Touchet River – 1.0%, Tucannon River– 6.0%). All CWTs collected during the steelhead fishery were extracted and sent to Olympia for inclusion in the PSMFC/CWT database maintained in Portland, OR.

Table 20. Steelhead angler interview results for fall/winter/spring of the 2006 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	1,077	2,976	89	102	6	15.1
Walla Walla Subbasin							
Walla Walla River	659	356	747	35	21	8	11.7
Touchet River	657	184	496	67	39	1	4.6
Snake River Basin							
Mouth to IHR	640	2	4	0	0	0	0.0
IHR to LMD	642	2,847	8,606	145	291	17	19.0
LMD to LGD	644	1,478	6,940	114	390	37	12.8
LGD to LGR	646	604	2,398	35	120	6	14.9
LGR to Hwy 12 Br.	648	367	1,875	38	88	7	14.1
Hwy 12 Br. upstream	650	1,330	7,898	423	585	47	7.5
Tucannon River	653	310	933	51	55	27	7.0
Totals		8,555	32,873	997	1691	156	

[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 21. Steelhead angler interview results for fall/winter/spring of the 2007 run year from Washington State licensed anglers. ***Note – Sections 653 (Tucannon), 657 (Touchet), and 659 (Walla Walla) were not extensively censused during 2007/2008 due to a greater emphasis on the mainstem Snake River. Some data were collected in the Tucannon because of proximity to Sections 644 and 646.***

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	2,438	8,075	195	359	30	13.8
Snake River Basin							
Mouth to IHR	640	4,260	12,891	172	404	12	21.9
IHR to LMD	642	2,142	9,661	176	601	15	12.2
LMD to LGD	644	1,004	3,232	29	112	5	22.1
LGD to LGR	646	1,287	6,178	97	299	45	14.0
LGR to Hwy 12 Br.	648	1,285	6,935	296	758	117	5.9
Hwy 12 Br. upstream	650	539	2,837	77	507	475	2.7
Tucannon River	653	24	63	2	15	2	3.3
Totals		12,979	49,870	1,044	3,055	701	10.4

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

The LSRCP steelhead program continues to provide excellent sport harvest opportunities within the Snake River Basin and its tributaries. WDFW catch record card estimates within specific rivers or river sections (Figure 16) clearly demonstrate the benefits of the summer steelhead program within Washington.

Grande Ronde River

In addition to the creel surveys conducted on the Snake River, we cooperate with ODFW in conducting a joint survey of anglers on the lower Grande Ronde River near the border of Washington and Oregon. Angler effort, catch rates, and harvest were estimated by ODFW staff as described in Carmichael et al. (1988). At time of this report printing, the 2006 and 2007 run years harvest estimates were not yet completed by ODFW. It was anticipated they would be completed in the next few months. We will present the number of fish sampled and estimated harvest by the joint surveys from the Grande Ronde fishery in the Washington portion in a future report.

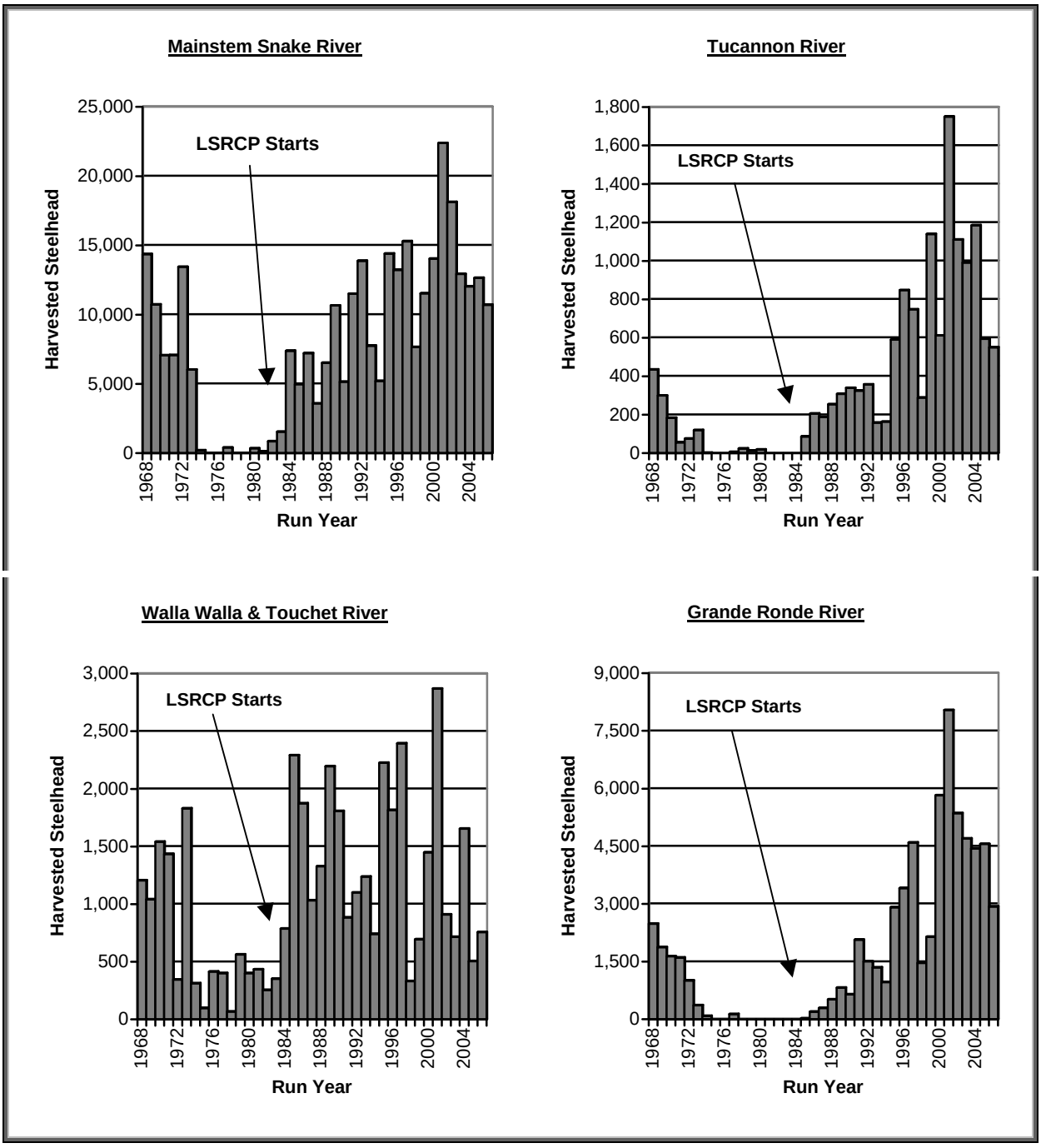

Figure 16. Harvested summer steelhead (from WDFW Catch Record Card Estimates) for the mainstem of the Snake River (Sections 640-650 – mouth of the Snake River to the Oregon Border), Tucannon River (Section 653), Walla Walla and Touchet rivers (Section 657 and 659), and Grande Ronde River (Section 592). Note: Many of the fish captured in the mainstem Snake River and Grande Ronde River are hatchery fish from Idaho and Oregon LSRCP summer steelhead programs.

Smolt-to-Adult Survival Rates

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 program. These estimates are considered a minimum because there is no adjustment to account for fish that escape to the spawning grounds in all areas available. 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. Figures 17-22 demonstrate the great success of both the LFH and Wallowa stock summer steelhead programs. Complete CWT recovery and total estimates of returning adult summer steelhead from the LFH and Wallowa stock for all release locations since the WDFW program began are provided in Appendix B.

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 (per agreement with the co-managers). Further analysis of the CWT data prompted additional reductions that began for the 2003 brood year. With the exception of the Grande Ronde River releases, smolt-to-adult return rates since the 2000 brood have been slightly lower that the long-term average, but still well above the LSRCP goal of 0.5%.

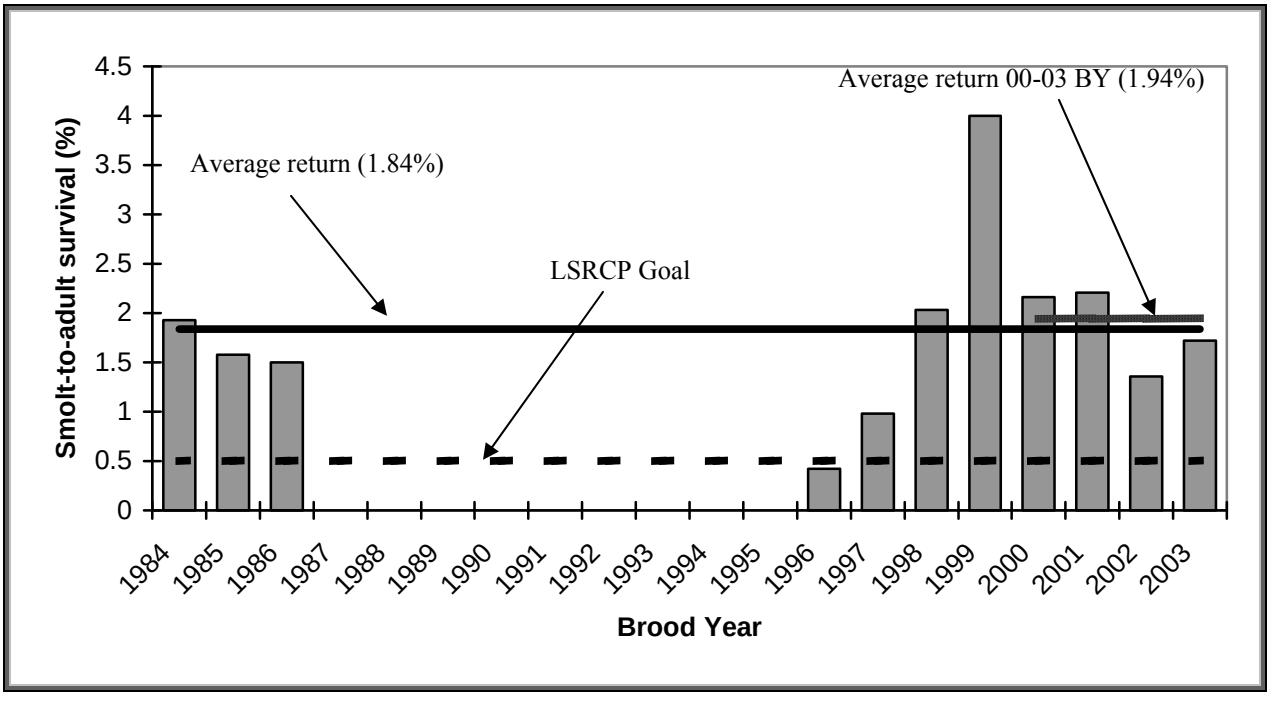

Figure 17. Estimated smolt-to-adult survival (to the LSRCP project area) of summer steelhead released from Cottonwood Acclimation Pond in the lower Grande Ronde River.

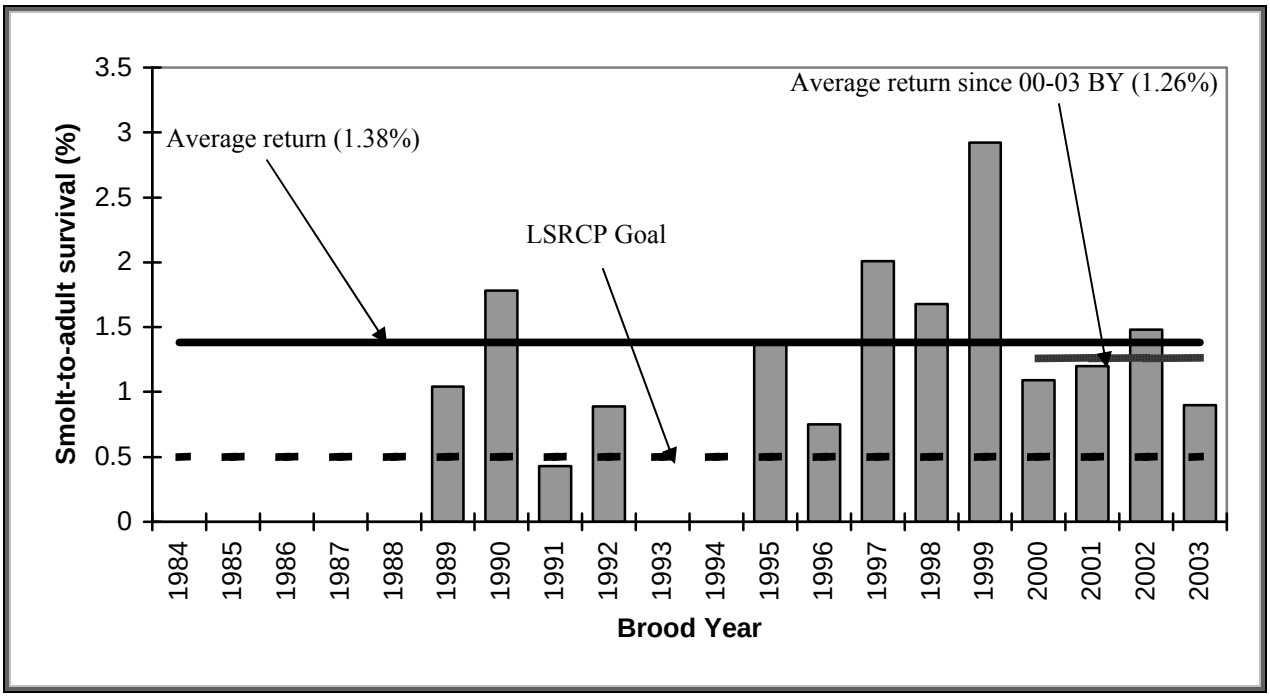

Figure 18. Estimated smolt-to-adult survival (to the LSCRP project area) of summer steelhead released directly into the middle or lower Tucannon River.

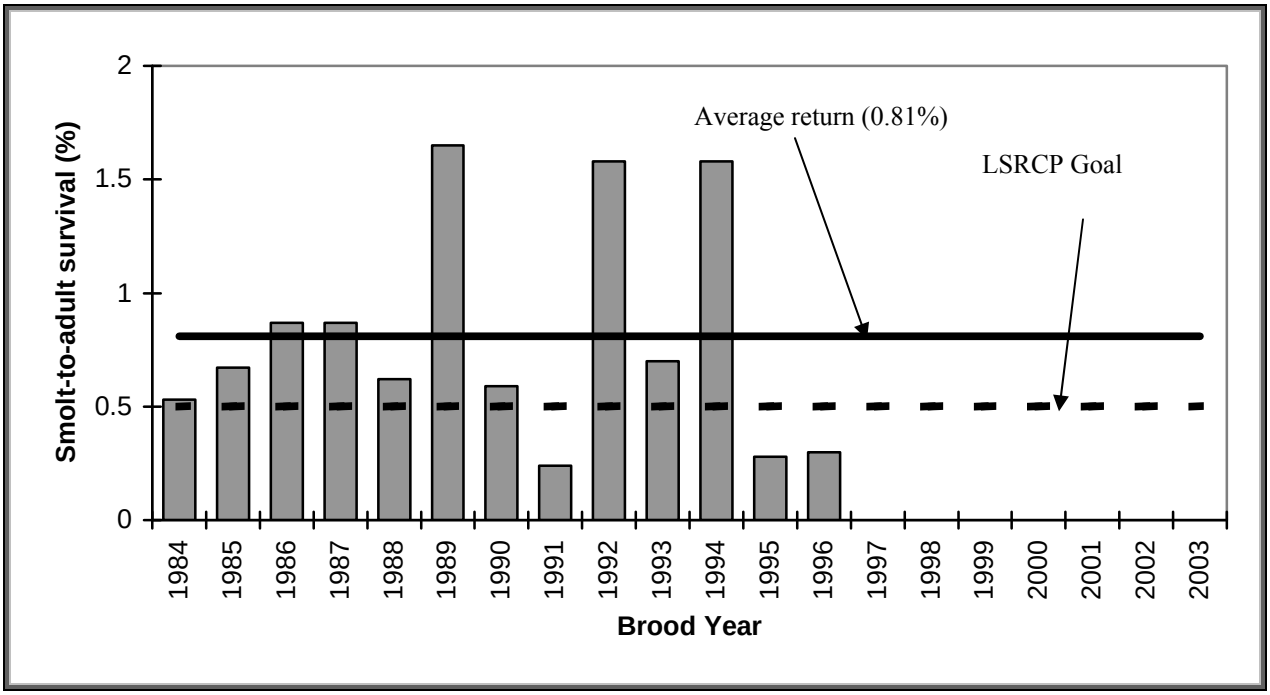

Figure 19. Estimated smolt-to-adult survival (to the LSRCP project area) of summer steelhead released from Curl Lake Acclimation Pond in the upper Tucannon River. Note: The 1996 brood was the last release of steelhead from Curl Lake AP.

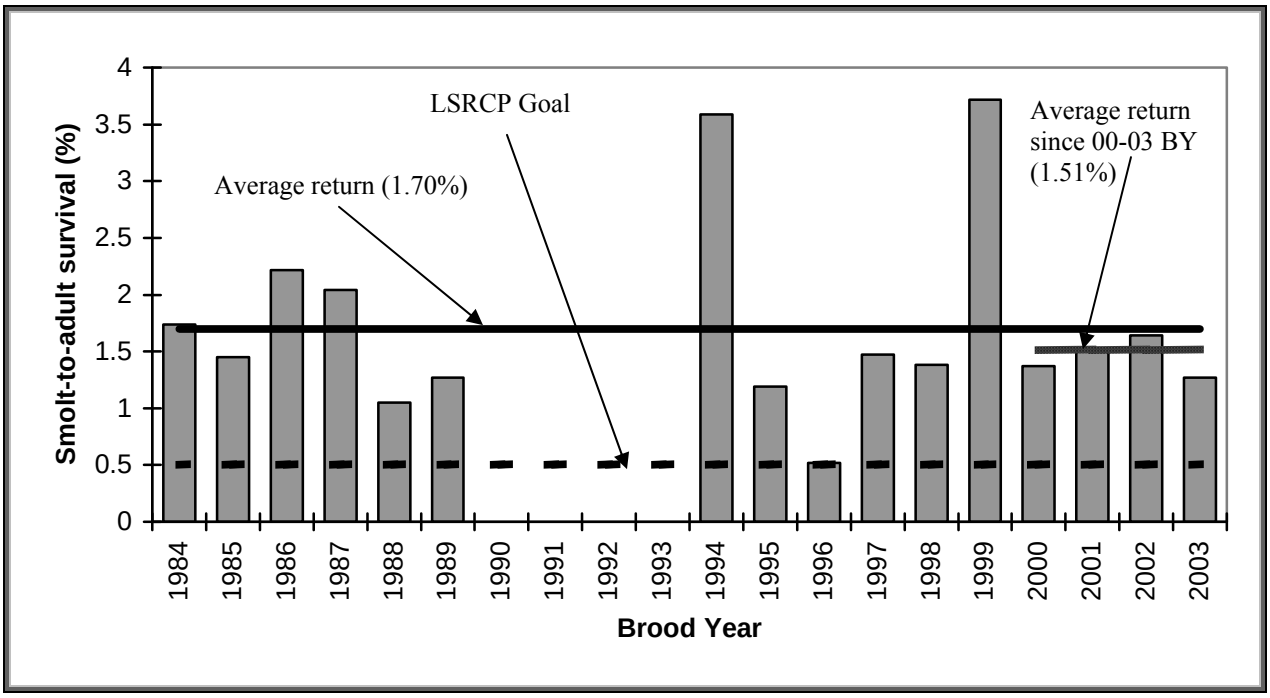

Figure 20. Estimated smolt-to-adult survival of summer steelhead released directly into the Snake River at Lyons Ferry Hatchery.

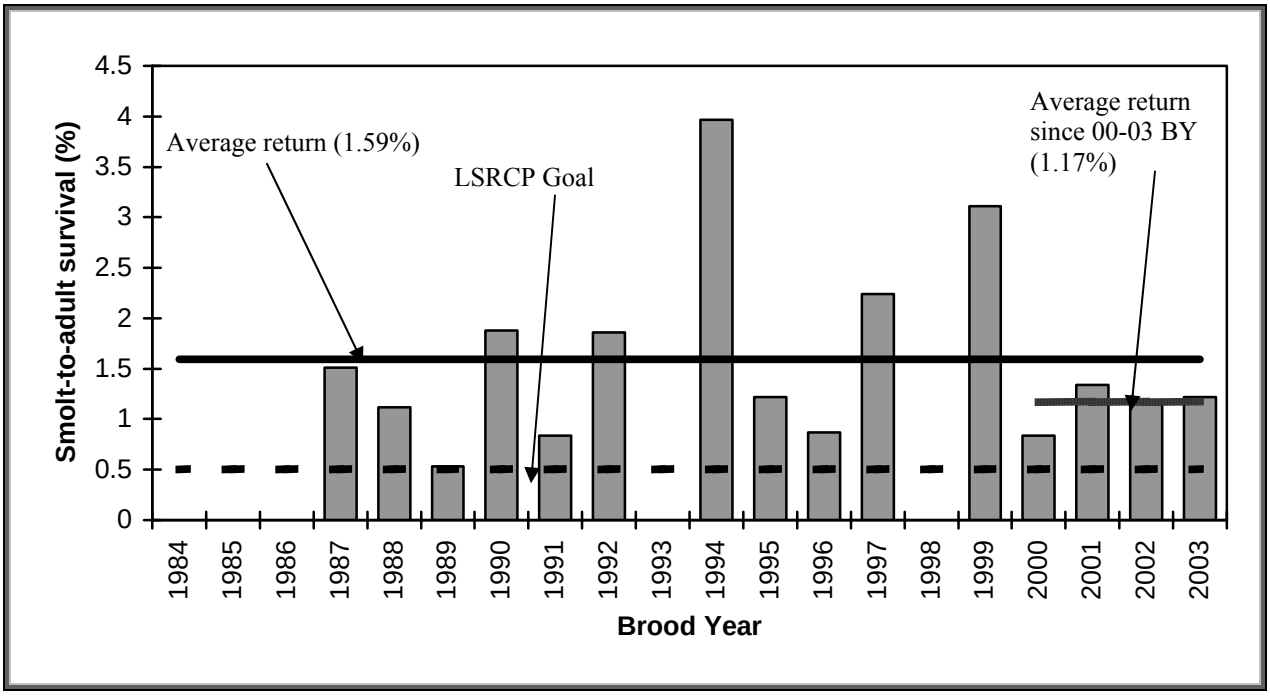

Figure 21. Estimated smolt-to-adult survival of summer steelhead released from Dayton Acclimation Pond in the Touchet River.

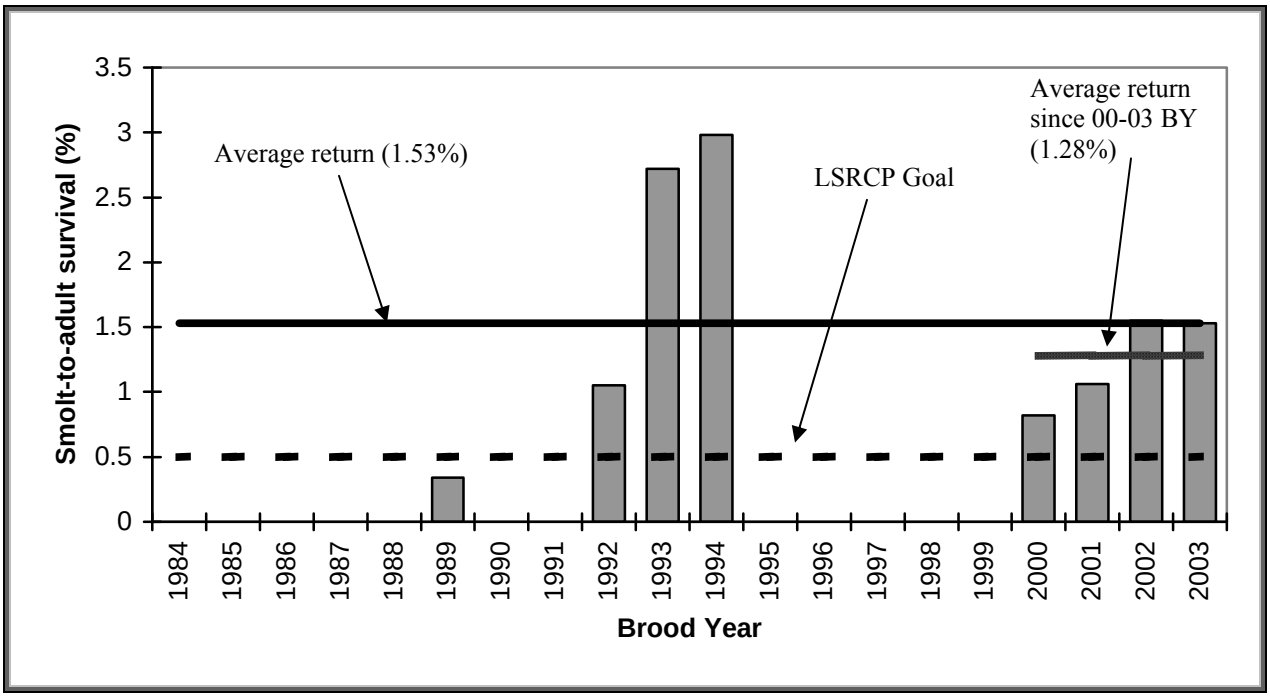

Figure 22. Estimated smolt-to-adult return rates of summer steelhead released directly into the Walla Walla River.

Spawning Ground Surveys

During the springs of 2007 and 2008, evaluation staff conducted spawning ground surveys to estimate the number of redds in index areas of the Tucannon and Touchet rivers and Asotin Creek (Tables 22-27). Stream flows were favorable (i.e., no freshets and good water clarity) in 2007 and we were able to estimate the number of steelhead redds in index sections of each river. In 2008, high, turbid stream flows hampered nearly all spawning surveys in the Tucannon River (no complete estimate could be derived), but nearly all surveys were completed in Asotin Creek and the Touchet River, which allowed us to estimate the number of redds in the index areas.

In 2008, stream conditions in the Tucannon River were favorable at the beginning of the spawning season. Anecdotal reports from anglers suggested considerable steelhead were spawning downstream of the historical index area. We surveyed an area below the typical index area (upstream of HWY 12) to see if there was spawning activity occurring lower in the river. While the surveys were incomplete for the entire spawning season, we counted 89 of 107 total redds counted in the new index area below HWY 12 (Table 25), with the majority in close proximity to the LFH hatchery smolt release location. The majority of the spawning steelhead clearly observed in the area below HWY 12 appeared to be of hatchery origin (adipose fin clipped = 13, non-adipose fin clipped = 2) and we assumed these fish were LFH stock. The non-adipose fin clipped fish could have been either natural origin or hatchery endemic origin

steelhead. Unfortunately, carcasses are rarely found during surveys, so an accurate estimate of the hatchery and wild composition is not possible. Regardless, we have a growing concern that this large group of hatchery fish spawning in this location may delay or detract natural fish from continuing their migration upstream to spawn. Attempts may be made in future years to evaluate this theory. A way to evaluate this would be to deploy multiple PIT tag arrays throughout the watershed and track the groups of natural origin, hatchery endemic origin, and LFH stock hatchery origin as they pass the arrays.

Over the past few years, evaluation staff have begun to standardize all spawning ground survey estimates for summer steelhead. We frequently are requested to provide estimates of spawning steelhead in the 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 28) and the Touchet River (Table 29). Tucannon River estimates are still being derived. The redd estimates provided for each of these streams are for trend information only.

Estimates of the number of spawners and hatchery/wild composition in each of these streams required additional analysis. Due to the needs of other data requests and needs, we have completed ***preliminary*** estimates for the number of spawners (with hatchery and wild composition) in the indexed areas of the Touchet River. From those estimates, and from age structure data collected at the Dayton adult trap, we have been able to develop cohort tables to estimate recruits per spawner for the Touchet River (Figure 23). Eventually, we will have similar relationships developed for Asotin Creek and the Tucannon River, but further data analysis is still needed to make this possible.

Table 22. Results of summer steelhead index redd surveys in the Tucannon River, 2007.

Stream Section surveyed	Est. Rkm	Dates Surveyed	Redds counted	Total redds all surveys	Expanded # of redds [a]	% of total index reach surveyed	Total est. redds for reach
Tucannon River Basin (Index)	**66.6**		**135**	**135**	**21**	**67.4**	**228**
Reach 1 - Highway 12 Bridge to Marengo	***19.2***	***See below dates for this reach***	***37***	***37***	***12***	***50.5***	***97***
Index 1 – 2 miles above Enrich to Enrich	3.5	4/16, 5/07	13, 1	14			
Final Walk 1 - English House to HWY 12 Br	2.5	5/07	17	17			
Final Walk 2 - King Grade to Top of Index 1	3.5	5/07	6	6			
Reach 2 – Marengo to Cumming Creek Bridge (Hartsock Stratum)	***16.9***	***See below dates for this reach***	***53***	***53***	***9***	***79.3***	***78***
Index 1 – Bridge 11 to Marengo	5.6	4/05, 4/19, 5/07	4, 17, 10	31			
Index 2 – Cummings Creek Br to Russels House	2.2	4/05, 4/19, 5/07	1, 2, 2	5			
Final Walk – Russels House to Bridge 14	2.8	5/08	9	9			
Final Walk – Bridge 14 to Bridge 13	2.8	5/08	8	8			
Reach 3 – Wooten Wildlife Area to Wilderness Boundary (HMA Stratum)	***19.5***	***See below dates for this reach***	***13***	***13***	***0***	***61.9***	***21***
Index 1 – Hatchery Bridge to Cummings Creek Bridge	2.2	4/05, 4/19, 5/07	2, 3, 0	5			
Index 2 – Beaver Watson Lake to Old Deer Lake CG	2.5	4/19, 5/17	1, 1	2			
Index 3 – Camp Wooten (HMA 15) to Big 4 Lake	3.7	4/19, 5/17	4, 1	5			
Index 4 – Panjab to Cow Camp Bridge	2.6	4/19, 5/17	0, 1	1			
Reach 4 – Cummings Creek (Old Mine to Mouth)	11.0	4/23, 5/04	18, 14	32	0	100.0	32

[a] Additional redds added to "Final Walk" surveyed areas to account for erasure rate. This number may also include additional redds based on Area Under the Curve (AUC) relationships.

Table 23. Results of summer steelhead index redd surveys in the Touchet River, 2007.

Stream Section surveyed	Est. Rkm	Dates Surveyed	Redds counted	Total Redds all surveys	Expanded # of redds [a]	% of total index reach surveyed	Total est. redds for reach
Touchet River Basin (Index)	**69.0**		**241**	**241**	**72**	**75.2**	**416**
North Fork Touchet Reach – MP 13 to Mouth	*19.1*	***See below dates for this reach***	*99*	*99*	*23*	*75.9*	*160*
Index 1 – Vernon Marll's Bridge to South Fork Mouth	4.2	4/20, 5/08	16, 13	29			
Index 2 - LE of Frames to Wolf Fork Bridge	4.4	3/30, 4/11, 4/27, 5/10	19, 9, 8, 5	41			
Final Walk 1 - Bridge at MP 13 to Dedloff's House	5.9	5/10	29	29			
South Fork Touchet Reach – Griffen Fork to Mouth	*26.7*	***See below dates for this reach***	*77*	*77*	*28*	*83.9*	*133*
Index 1 – 2.2 rd miles above Bridge 2	4.2	3/29, 4/11, 4/19, 5/01, 5/08	5, 4, 4, 0, 1	14			
Index 2 - Camp Nancy Lee down 1.8 miles	2.9	3/29, 4/11, 4/19, 5/01, 5/08	2, 9, 7, 3, 1	22			
Final Walk 1 - Cabins to Camp Nancy Lee	6.4	5/11	14	14			
Final Walk 2 – Kolke's Ford to Cabins	5.8	5/16	21	21			
Final Walk 3 – Bridge 2 to Harting Grade Road	2.8	5/11	6	6			
Wolf Fork Touchet Reach – Newby Cabin to Mouth	*17.5*	***See below dates for this reach***	*56*	*56*	*17*	*75.4*	*97*
Index 1 – Coates Creek to McCaw Bridge	2.5	3/30, 4/06, 4/18, 5/07	1, 2, 6, 8	17			
Index 2 – 1st Br Above Robinson Fork to Holmberg's	3.0	3/30, 4/06, 4/18, 5/07	2, 3, 4, 6	15			
Final Walk 1 – Newby Cabin to Coates Creek	4.6	5/09	8	8			
Final Walk 2 – Holmberg's to Mouth	3.1	5/09	16	16			
Robinson Fork Touchet Reach – 5.0 miles to Mouth	*8.8*	***See below dates for this reach***	*9*	*9*	*4*	*71.1*	*18*
Index 1 – ~4.0 miles above BLC Fence, back to fence.	5.9	4/20	9	9			

[a] Additional redds added to "Final Walk" surveyed areas to account for erasure rate. This number may also include additional redds based on Area Under the Curve (AUC) relationships.

Table 24. Results of summer steelhead index redd surveys in Asotin Creek, 2007.

Stream Section surveyed	Est. Rkm	Dates surveyed	Redds counted	Total Redds all surveys	Expanded # of redds [a]	% of total index reach surveyed	Total est. redds for reach
Asotin Creek Basin (Index)	**56.1**	***See below dates for season***	**260**	**260**	**23**	**100.0**	**286**
Mainstem Asotin Creek Reach – NF/SF Confluence to George Creek Mouth	***20.6***	***See below dates for this reach***	***150***	***150***	***10***	***100.0***	***160***
Index 1 - NF/SF confluence ↓ 2.4 road miles	4.1	3/22, 4/4, 4/18, 4/24	7, 27, 7, 2	43			
Index 2 - 2 miles above Headgate Park to Headgate Park	8.8	3/22, 4/4, 4/18, 4/24	17, 25, 17, 4	63			
Index 3 – 05/06 Adult Trap to New 07 Trap Site	0.9	3/24, 4/6, 4/12, 4/20	1, 4, 0, 0	5			
Index 4 – New 07 Trap Site to George Cr Bridge	1.7	3/24, 4/6, 4/12, 4/20	6, 13, 1, 1	21			
Final Walk 1 - Between index 1 and index 2	2.8	4/24	16	16			
Final Walk 2 – Between index 2 and index 3	2.3	4/25	2	2			
North Fork Asotin Creek Reach – Middle Fork to Mouth	***13.3***	***See below dates for this reach***	***32***	***32***	***4***	***96.2***	***38***
Index 2 - End of old rd down 2.0 miles	3.3	4/6, 4/16, 4/30	6, 1, 1	8			
Index 1 - Lick Creek to NF/SF Confluence Bridge	1.7	3/22, 4/4, 4/18, 4/24	2, 6, 8, 4	20			
Final Walk 1 - Second FS Fence to top of Index 2	4.3	5/1	2	2			
Final Walk 2 – Bottom of Index 2 to Top of Index 1	3.5	5/1	2	2			
South Fork Asotin Creek Reach – Old Chimney to Mouth	***12.1***	***See below dates for this reach***	***37***	***37***	***7***	***100.0***	***44***
Index 1 - 2 rd miles above mouth, down to mouth	3.4	4/2, 4/15, 4/30	2, 4, 6	12			
Final Walk 1 - Old chimney down 1.7 miles	3.0	4/30	10	10			
Final Walk 2 – Bottom of Final Walk 1, down to Schlee Br	3.0	4/30	9	9			
Final Walk 3 – Schlee Bridge to Top of Index 1	2.7	4/30	6	6			
Charley Creek Reach – Old Corral to Mouth	***10.6***	***See below dates for this reach***	***42***	***42***	***2***	***100.0***	***44***
Index 1 – 4.0 miles above Koch Gate down 2.5 miles	4.2	4/11, 4/29	9, 5	14			
Final Walk 1 - Old Corral to State Land Fence	1.8	5/01	7	7			
Final Walk 2 – State Land Fence to Top of Index 1	1.6	5/01	7	7			
Final Walk 3 – Bottom of Index 1 to Asotin Creek Road	2.6	5/01	13	13			
Final Walk 4 – Asotin Creek Road to Charley Cr Mouth	0.4	5/01	1	1			

[a] Additional redds added to "Final Walk" surveyed areas to account for erasure rate. This number may also include additional redds based on Area Under the Curve (AUC) relationships.

Table 25. Results of summer steelhead index redd surveys in the Tucannon River, 2008.

Stream Section surveyed	Est. Rkm	Dates Surveyed	Redds counted	Total Redds all surveys	Expanded # of redds [a]	% of total index reach surveyed	Total est. redds for reach
Tucannon River Basin (Index)	**66.6**			**107**	***N/A***	***N/A***	***N/A***
Reach 1 - Mouth to Highway 12 Bridge	***22.0***	***See below dates for this reach***	***89***	***89***	***N/A***	***N/A***	***N/A***
Index A - Highway 12 Bridge to Territorial Bridge		4/3,4/25	34,19	53			
Index B - Territorial Bridge to Westergreen Bridge		4/3,/4/25	14,13	27	N/A	***N/A***	***N/A***
Final Walk - Westergreen Bridge to Ducharme's Bridge		4/3	9	9			
Reach 2 - Highway 12 Bridge to Marengo	***19.2***	***See below dates for this reach***	***16***	***16***	***N/A***	***N/A***	***N/A***
Index 1 - King Grade Bridge to Enrich Bridge		3/31	2	2	N/A	***N/A***	***N/A***
Index 2 - Broughton's Hay Barn to Highway 12 Bridge		4/3,4/25	5,9	14			
Reach 3 – Marengo to Cummings Creek Bridge (Hartsock Stratum)	***16.9***	***See below dates for this reach***	***2***	***2***	***N/A***	***N/A***	***N/A***
Index 3 – Bridge 10 to Marengo Bridge	3.6	3/31	2	2	N/A	***N/A***	***N/A***
Reach 4 – Cummings Creek (Old Mine to Mouth)	**11.0**						
Final Walk – End of Car Road to Mouth	5.6	4/30	2	2	N/A	50.9	***N/A***

[a] Additional redds added to "Final Walk" surveyed areas to account for erasure rate. This number may also include additional redds based on Area Under the Curve (AUC) relationships.

Table 26. Results of summer steelhead index redd surveys in the Touchet River, 2008.

Stream Section surveyed	Est. Rkm	Dates Surveyed	Redds counted	Total Redds all surveys	Expanded # of redds [a]	% of total index reach surveyed	Total est. redds for reach
Touchet River Basin (Index)	**69.0**		**43**	**43**	**33**	**32.6**	**249**
North Fork Touchet Reach – MP 13 to Mouth	*19.1*	***See below dates for this reach***	*19*	*19*	*17*	*45.0*	*80*
Index 1 - LE of Frames to Wolf Fork Bridge	4.4	4/4,4/23	5,4	9			
Index 2 – Vernon Marll's Bridge to South Fork Mouth	4.2	4/4,4/23	2,8	10			
South Fork Touchet Reach – Griffen Fork to Mouth	*26.7*	***See below dates for this reach***	*16*	*16*	*10*	*26.6*	*99*
Index 1 – Camp Nancy Lee Bridge down 1.8 road miles	2.9	4/2,4/11	9,0	9			
Index 2 – 2.2 road miles above SF County Rd Br, to South Fork Road, Bridge #2	4.2	4/2,4/10	6,1	7			
Wolf Fork Touchet Reach – Newby Cabin to Mouth	*17.5*	***See below dates for this reach***	*8*	*8*	*6*	*31.4*	*46*
Index 1 – Coates Creek to McCaw Bridge	2.5	4/3,4/11,4/25	1,1,2	4			
Index 2 – 1st Br. above Robinson Fk. to Holmberg's Br.	3.0	4/3,4/11,4/25	3,0,1	4			

[a] Additional redds added to "Final Walk" surveyed areas to account for erasure rate. This number may also include additional redds based on Area Under the Curve (AUC) relationships.

Table 27. Results of summer steelhead index redd surveys in Asotin Creek, 2008.

Stream Section surveyed	Est. Rkm	Dates surveyed	Redds counted	Total Redds all surveys	Expanded # of redds [a]	% of total index reach surveyed	Total est. redds for reach
Asotin Creek Basin (Index)	**56.1**	***See below dates for season***	**95**	**95**	**30**	**50.1**	**209**
Mainstem Asotin Creek Reach – NF/SF Confluence to George Creek Mouth	***20.6***	***See below dates for this reach***	***78***	***78***	***20***	***75.2***	***130***
Index 1 - NF/SF Confluence Bridge, down 2.4 Road Miles to WDFW Access	4.1	4/2,4/24	10,13	23			
Index 2 - Theissen Feed Lot to Green House Bridge	8.8	3/18,4/2,4/21	20,18,9	47			
Index 3 - Old Trap Site to George Creek Bridge	2.6	3/23,4/6,4/26	1,6,1	8			
North Fork Asotin Creek Reach – Middle Fork to Mouth	***13.3***	***See below dates for this reach***	***8***	***8***	***5***	***37.6***	***35***
Index 1 – Lick Creek down to NF/SF Bridge	1.7	4/2, 4/24	2, 5	7			
Index 2 – End of Old FS Road down 2 miles	3.3	4/12	1	1			
South Fork Asotin Creek Reach – Old Chimney to Mouth	***12.1***	***See below dates for this reach***	***5***	***5***	***4***	***28.1***	***32***
Index 1 – 2 Road miles above mouth to Mouth	3.4	3/29,4/21	2,3	5			
Charley Creek Reach – Old Corral to Mouth	***10.6***	***See below dates for this reach***	***3***	***3***	***1***	***39.6***	***9***
Index 1 - 4.0 miles above Asotin Creek Road to 1.5 miles above Asotin Creek Road	4.2	4/11,4/29	3,0	3			

[a] Additional redds added to "Final Walk" surveyed areas to account for erasure rate. This number may also include additional redds based on Area Under the Curve (AUC) relationships.

Table 28. Standardized redd estimates and redds/kilometer within index reaches of Asotin Creek in southeast Washington, 1986-2008.

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

Table 29. Standardized redd estimates and redds/kilometer within index reaches of the Touchet River in southeast Washington, 1987-2008.

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

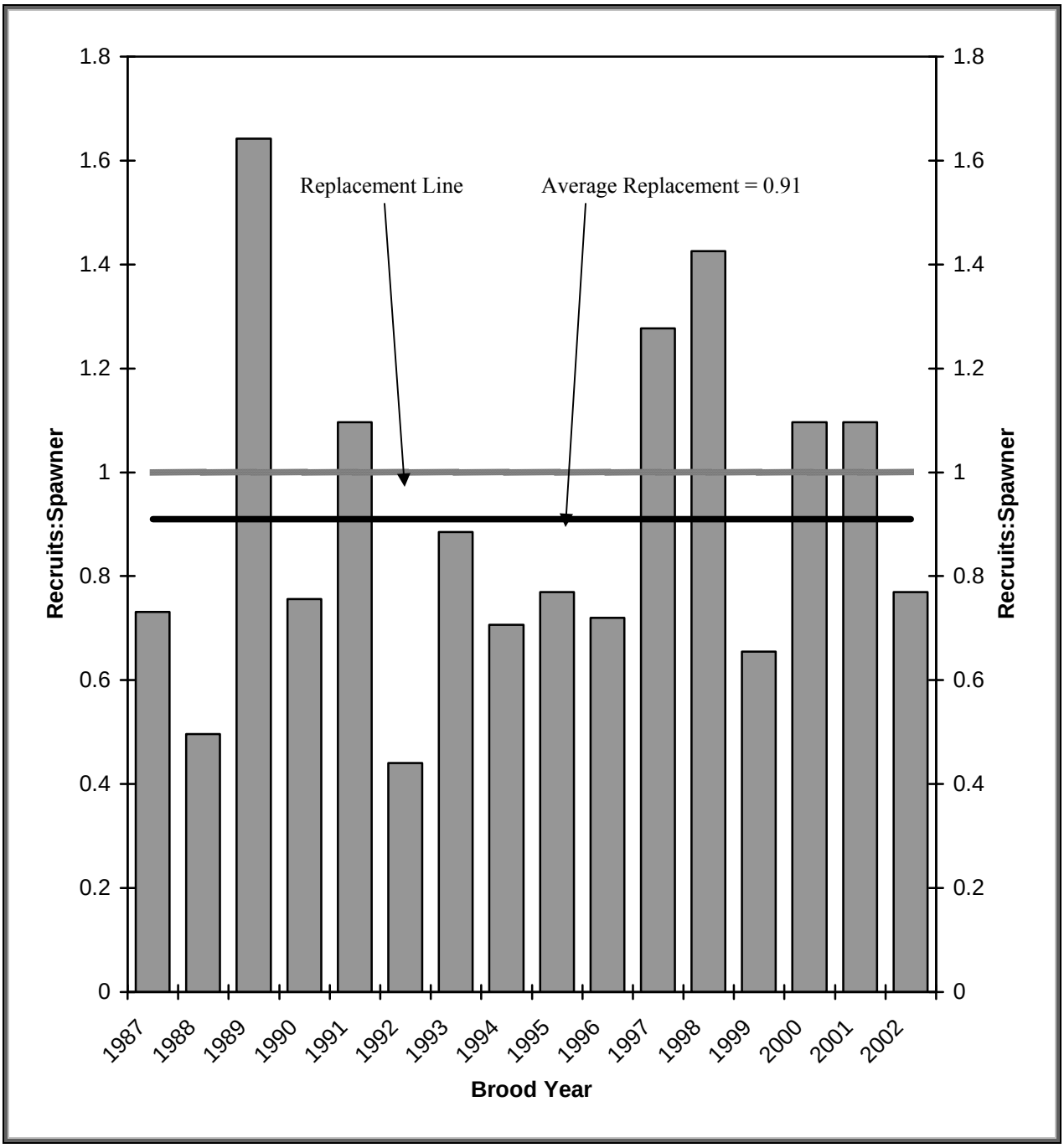

Figure 23. Estimated recruits/spawner for natural origin Touchet River summer steelhead, 1987-2002 brood years.

Contributions to LSRCP Mitigation Goals

The LFC summer steelhead program (LFH and Wallowa stock only) continues to meet or exceed its original mitigation goals by supplying large returns of hatchery steelhead for harvest to the Snake River area. This is mainly due to the fact that 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 harvest ratio. Hence, more fish are returning to the project area even though hatchery production has been reduced in recent years. Based on the analysis presented below (Table 30), currently about 24% of the harvest of the LFH stock, and about 13% of the harvest of the Wallowa stock appears to occur in the lower Columbia River below the project area. This compares to data from the late 1980's that harvest from fisheries in the lower Columbia River accounted for 50-60% in each of these stocks (Table 30), with the greatest majority taking place in the lower Columbia River net fisheries.

Table 30. Percent contribution of Wallowa and Lyons Ferry stock summer steelhead to fisheries 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
1997-2003	0.0	4.1	9.4	13.5	86.5
Lyons Ferry Stock					
1987-1989	0.8	37.4	12.8	50.9	49.1
2000-2003	0.1	2.4	21.8	24.3	75.7

Based on CWT recoveries from adult traps and creel surveys alone, we estimated that a minimum of 4,977 (3,155 goal) LFH stock and 3,441 (1,500 goal) Wallowa stock fish returned in the 2004 run year, and a minimum of 4,746 LFH stock and 2,905 Wallowa stock fish returned in the 2005 run year (Table 31). That represents 158% and 229% of the Washington mitigation goal for each of these stocks in 2004 and 150% and 194% for 2005, respectively. Fish escaping to the spawning grounds are not counted in these calculations. Over the last ten years, LFH stock releases have averaged 267% of the mitigation goal, while the Wallowa stock releases have averaged 314%. Program reductions of about 40% for both the LFH and Wallowa stocks since the 2002 release year should bring these two programs more in line with mitigation goals back to the project area. Estimated returns for the 2002 release year for the Lyons Ferry and Wallowa stock have averaged 153% and 228% of their migration goal, respectively.

Table 31. 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.

Run Year	LFH	Tucannon	Touchet	Walla Walla	Grande Ronde	Total	*Percent of*
Adult Goal	630	875	750	900	1,500	4,655	*goal*
1984	1,137	762	680	1,078	0	3,657	***79%***
1985	2,456	1,686	1,699	2,201	0	8,042	***173%***
1986	4,834	1,712	2,961	3,045	1,945	14,496	***311%***
1987	3,657	685	1,851	2,046	1,817	10,056	***216%***
1988	5,563	1,257	2,577	2,933	3,057	15,388	***331%***
1989	4,955	1,837	3,326	4,620	5,157	19,896	***427%***
1990	1,007	786	1,140	1,365	2,044	6,342	***136%***
1991	1,104	1,658	1,373	1,277	3,451	8,862	***190%***
1992	877	2,037	1,924	3,155	4,559	12,552	***270%***
1993	651	1,085	1,679	2,578	3,167	9,160	***197%***
1994	2,386	914	1,177	655	2,895	8,026	***172%***
1995	5,832	1,861	3,326	4,817	9,173	25,009	***537%***
1996	3,050	1,779	3,754	4,359	7,819	20,762	***446%***
1997	2,112	1,311	2,696	3,676	5,301	15,095	***324%***
1998	718	568	1,246	1,978	1,456	5,966	***128%***
1999	1,169	2,235	2,128	3,444	1,799	10,775	***231%***
2000	1,422	3,283	2,802	4,584	4,730	16,820	***361%***
2001	2,254	4,488	3,839	5,996	10,919	27,497	***591%***
2002	928	1,712	1,237	1,517	5,435	10,833	***233%***
2003	842	1,469	1,440	988	3,925	8,865	***186%***
2004	944	1,601	1,148	1,284	3,441	8,418	***181%***
2005	901	1,256	1,165	1,424	2,905	7,651	***164%***
Average	***2,218***	***1,636***	***2,053***	***2,683***	***4,250***	***12,453***	***268%***
Percent of goal	**352%**	**187%**	**274%**	**298%**	**283%**	**268%**	

Natural Production : Juveniles

As in previous years, we electrofished using either a multiple pass removal method (Zippin 1958) or a single pass method at index sties to estimate Age 0 and Age 1+ juvenile steelhead densities and derived population estimates for specific river reaches (Tables 32 and 33). Another objective of these surveys was to document the number of hatchery residual steelhead from the endemic steelhead broodstock program. The potential for residual hatchery steelhead to negatively affect natural salmonid populations through competition, displacement, or predation was identified as a concern by NOAA Fisheries after Chinook salmon were listed as "threatened" (April 22, 1992; FR 57 No. 78: 14653) under the ESA. In the early 1990's, WDFW began a series of experiments to examine methods to reduce residualism. Residualism results from the Tucannon, Touchet, and Grande Ronde rivers have been provided in the previous reports (Viola and Schuck 1995; Schuck et al. 1998; Martin et al. 2000).

Table 32. Summary of mean fish density (Fish/100 m2) and population estimates of Age 0 summer steelhead in index areas of Asotin Creek, and Touchet and Tucannon rivers for specific tributaries/reaches in 2006 as derived from multiple pass electrofishing surveys.

Basin	Reach/Strata	Sites	Mean Density	Population Estimate	95% C.I.
Asotin Creek	Mainstem	0	NA	NA	NA
	North Fork	0	NA	NA	NA
	South Fork	9	64.3	34,621	+/- 12,467
	Charley Cr.	7	44.8	15,107	+/- 4,469
	Total			*49,728*	
Touchet River	Mainstem	0	NA	NA	NA
	North Fork	6	70.4	106,943	+/- 22,717
	Wolf Fork	8	50.2	66,320	+/- 38,504
	South Fork	6	29.5	43,890	+/- 13,426
	Robinson Fork	5	67.6	20,842	+/- 7,628
	Total			*237,995*	
Tucannon River	Lower	0	NA	NA	NA
	Marengo	0	NA	NA	NA
	Hartsock	0	NA	NA	NA
	HMA	10	14.5	34,954	+/- 9,478
	Wilderness	0	NA	NA	NA
	Cummings Cr.	0	NA	NA	NA
	Total			*34,954*	*+/- 9,478*

Table 33. Summary of mean fish density (Fish/100 m2) and population estimates of Age 1+ summer steelhead in index areas of Asotin Creek, and Touchet and Tucannon rivers for specific tributaries/reaches in 2006 as derived from multiple pass electrofishing surveys.

Basin	Reach/Strata	Sites	Mean Density	Population Estimate	95% C.I.
Asotin Creek	Mainstem	0	NA	NA	NA
	North Fork	0	NA	NA	NA
	South Fork	9	11.9	5,424	+/- 1,948
	Charley Cr.	7	15.3	5,172	+/- 1,430
	Total			*10,596*	
Touchet River	Mainstem	0	NA	NA	NA
	North Fork	6	15.8	24,029	+/- 9,307
	Wolf Fork	8	12.3	16,254	+/- 5,095
	South Fork	6	11.3	16,806	+/- 20,628
	Robinson Fork	5	11.6	3,574	+/- 588
	Total			*60,663*	
Tucannon River	Lower	0	NA	NA	NA
	Marengo	0	NA	NA	NA
	Hartsock	0	NA	NA	NA
	HMA	10	2.7	6,484	+/- 1,773
	Wilderness	0	NA	NA	NA
	Cummings Cr.	0	NA	NA	NA
	Total			*6,484*	*+/- 1773*

During 2006, we estimated residual hatchery steelhead (LFH stock and Endemic stocks) present in the Touchet River in July and August through the use of electrofishing surveys. Estimates were not completed for the Tucannon River in 2006, as we focused more of our sampling time to determine bias in our electrofishing estimates, and less on making complete surveys of the entire watershed where residual hatchery steelhead could reside. The estimated residualism rate is a minimum, as natural mortality and harvest from trout fisherman would have occurred between the time of release (April) and before electrofishing surveys were complete. In addition, we believe our residualism estimates may have been biased. We believe bias in our electrofishing occurs because we consistently underestimate larger sized fish within a site, as they are not as effectively captured. Bias can also occur if fish are able to enter or escape the site while the surveys are taking place. A minimum estimate of residualism for the Touchet River in 2006 was 4,486 (+/- 3,731) or 6.9% of the endemic stock release (65,245) and 37 (+/- 82) or 0.04% of the LFH stock release (100,345).

Natural-origin summer steelhead Age 0 and Age 1+ mean densities by river reach, densities per site, site descriptions, and other sensitive species captured during electrofishing surveys are provided in Appendix C.

Comparisons between Multiple Pass Estimates and Mark/Recapture Estimates

Accurate, precise juvenile population abundance estimates are crucial for describing survival trends of populations over time, and to measure response to management actions such as hatchery supplementation and habitat manipulation/restoration. A recent study (Peterson et al. 2004) identified bias and resulting error in estimates associated with traditional multiple pass removal methodologies for backpack electrofishing. The study called for researchers to carefully evaluate bias and error associated with their study data by conducting separate population estimates with methods having demonstrated accuracy and precision. In this case, it was suggested that mark/recapture methods were less biased. Further, it has been strongly suggested (Peterson et al. 2004) that researchers test the assumptions of population estimators being used. Important assumptions of both estimators are: 1) the population size does not fluctuate from immigration or emigration during the time of sampling; 2) marked and/or unmarked fish are equally catchable during recapture or standard sampling; and 3) marked fish do not lose their marks and are identified and reported correctly.

While the evidence for estimator bias and error seem consistent in the literature, our methods differ from those, and thus had to be tested to estimate the level of error, and confirm compliance of the methods with underlying assumptions. Moreover, we possess significant long-term data

sets for juvenile populations in southeast Washington streams. If bias in our methods is consistent over the term of the data, estimates could be adjusted as appropriate once bias is measured. These corrections could be important in understanding ecological and population response relationships that might be masked by error resulting from methodology bias.

Most authors have recommended a minimum 24-h recovery period between mark and recapture electrofishing passes. The recovery period has been cited as necessary for fish to resume normal behavior (Schreck 1976, Mesa and Schreck 1989) after being exposed to electrofishing. However, it is unclear whether shorter recovery periods could be as effective, without introducing estimator bias. This is a critical point in our evaluations, as it will not be possible in most of the places we conduct electrofishing surveys to maintain the block nets in place for 24 hours. Debris loads associated with stream flows require frequent net cleaning. However, going to a shorter recovery time period may violate the basic assumptions of the estimators. Temple and Pearsons (2006) state:

> "The use of long recovery periods may help satisfy the catchability assumption but also provides an opportunity for failure of the movement assumption, particularly in streams that contain heterogeneous habitats (e.g., large, deep, complex), fast flows, or substantial debris. Short recovery periods may help satisfy the movement assumption, but they may create an opportunity for failure of the catchability assumption if marked fish do not mix randomly with the unmarked population or the marked and unmarked fish do not exhibit equal catchability."

During the summer of 2005, we tested estimator bias (multiple pass estimate vs. mark/recapture estimate) at 44 sites in SE Washington. When the surveys were started in 2005, we were unsure of the recovery period time needed (equal catchability assumption), and we believed we had no movement in/out of the site, so the bias in both estimators should be minimized. Due to crew size and locations need to be sampled, it was determined that we could wait 3-4 hours between the initial marking period, and the recapture event. We soon realized that both of our pre-season assumptions were in error. It was obvious that the number of fish captured during the recapture event was generally much less than was captured during pass one (catchability appeared to be different), and we had some evidence from other work being done at the same time that fish were moving out of the netted site. Even so, we continued on with our original plan and gathered all the data we could to test the differences between the two estimators. After the season was complete, the data were analyzed, population estimates were derived from the methodologies (no correction was made to the mark/recapture estimate for fish movement), and comparisons were made to examine potential bias.

For 2005 on average, we found that multiple pass underestimated 29% and 24% of Age 0 and Age 1+ summer steelhead, respectively, compared to the mark/recapture estimate. Because we had confirmed fish movement and it appeared we violated the catchability assumption, we considered the mark/recapture estimates to be biased high, and that the true population estimate likely fell between the two estimators. This was likely due to the number of unmarked fish captured in the site during the recapture event. While we acknowledged fish movement, it seemed unlikely that there was such a high rate of fish movement into the site past the block nets.

For example, at South Fork Asotin (Site 1d-05), the number of fish captured in passes 1-3 during the multiple pass removal phase for Age 0 steelhead was 79, 37, and 12, and for Age 1+ steelhead was 45, 19, and 6. The number of fish in each age group declined each pass, and it appears we were effectively removing fish from the site. The multiple pass estimator produced estimates of 136 Age 0, and 73 Age 1+ summer steelhead in the site. All of the live fish were then marked (118 Age 0, and 64 Age 1+), placed back within the site for a minimum of 3-h, and then the site was electrofished again for the recapture event. During the recapture event we captured 64 Age 0 (48 marked, 16 unmarked), and 55 Age 1+ (41 marked, 14 unmarked). The estimated number of summer steelhead in the site from the mark/recapture method was 168 Age 0, and 94 Age 1+.

The number of unmarked fish captured during the recapture event is greater than what could be accounted for in the multiple pass estimator, and we do not believe that that many were entering the sites through the net, so we firmly believe that the multiple pass estimator is inherently biased low. For 2005, when the unmarked fish were added to multiple pass estimates, the estimates were biased low by 10% and 7% for Age 0 and Age 1+ fish, respectively. We considered these estimates the minimum number of fish present in the site, with the true population then being between these estimates and the 3-h mark/recapture estimate; somewhere between 10-29% greater than the multiple pass estimates for Age 0, and between 7-24% greater for Age 1+.

For 2006, after taking into consideration our observations in 2005, we decided that we needed to test the assumption that our capture efficiency was not affected because fish were handled and released. We also needed to further explore the observed fish movement, and the different rates of fish movement depending on the amount of time between electrofishing passes.

During the summer of 2006, we compared capture efficiencies between 3 and 24 hour time periods, and we compared those mark/recapture estimates to each other and to the multiple pass estimate at sites in SE Washington. We compared the 3 and 24 hour time periods on 19 different sites, and the 3 hour mark/recapture to multipass estimates at 44 sites. The following applied to

the data in 2006, with movement calculated in 2006 (3 hour wait) applied to the estimates in 2005.

1. All data were entered into standardized spreadsheets that automatically calculated the mark/recapture data (including mortalities, fish not used, and corrected for known and estimated movement between the sites).

2. Known fish moving up or down through the nets were estimated using a corrected estimate of capture efficiency from whichever site the marked fish were captured from (TC fish in the lower site, or BC fish in the upper site).

3. The estimated number of fish moving between sites was calculated from an unweighted mean (all known TC or BC fish in the wrong site expanded by the uncorrected capture efficiency from the upper or lower site as appropriate).

Three-hour vs. 24-hour capture efficiency comparisons

For analysis, the data were divided into age classes. The estimated corrected (for movement) capture efficiency was arcsine-transformed and tested for normality using a Shapiro-Wilks Test (Statgraphics). Differences in the transformed capture efficiencies between 3 and 24 hours were compared using a Student's paired t-test. Finally the proportions of marked and unmarked fish captured in the recapture events were paired, and a paired Student's t-test was used to determine if there were significant differences in the proportions of marked and unmarked fish captured after either recovery period. Population estimates were derived for each recovery period and a Student's paired t-test was used to test that there was no difference in the Petersen estimates between the two time periods. Each of these estimates was also paired against the multiple pass removal estimates in the same manner.

Age 0 and Age 1+ transformed data were found to be normally distributed (Age 0: P=0.28, Age 1+ P=0.33). The paired Student's t-test (hypothesized with a mean difference of 0) between the time periods were also not significant (Age 0: t=1.13, df=18, P=0.13), (Age 1+: t=0.51, df=18, P=0.31) – Figure 24. The proportions of marked and unmarked fish captured in each recapture event were compared, but no statistical differences were found (Age 0: t=0.23, df=18, P=0.41), (Age 1+: t=0.63, df=18, P=0.27; Figure 25). We tested the difference between population estimates derived from the 3 and 24 hour time period and also found no statistical difference (Age 0: t=0.09, df=18, P=0.46), (Age 1+: t=1.29, df=18, P=0.11l; Figure 26). Based on these results, we conclude that no difference results from waiting 3 hours or 24 hours to estimate the population. As such, we will utilize the 3 hour wait, compare those to our multipass removal method, and attempt to obtain a correction factor for previous years' data.

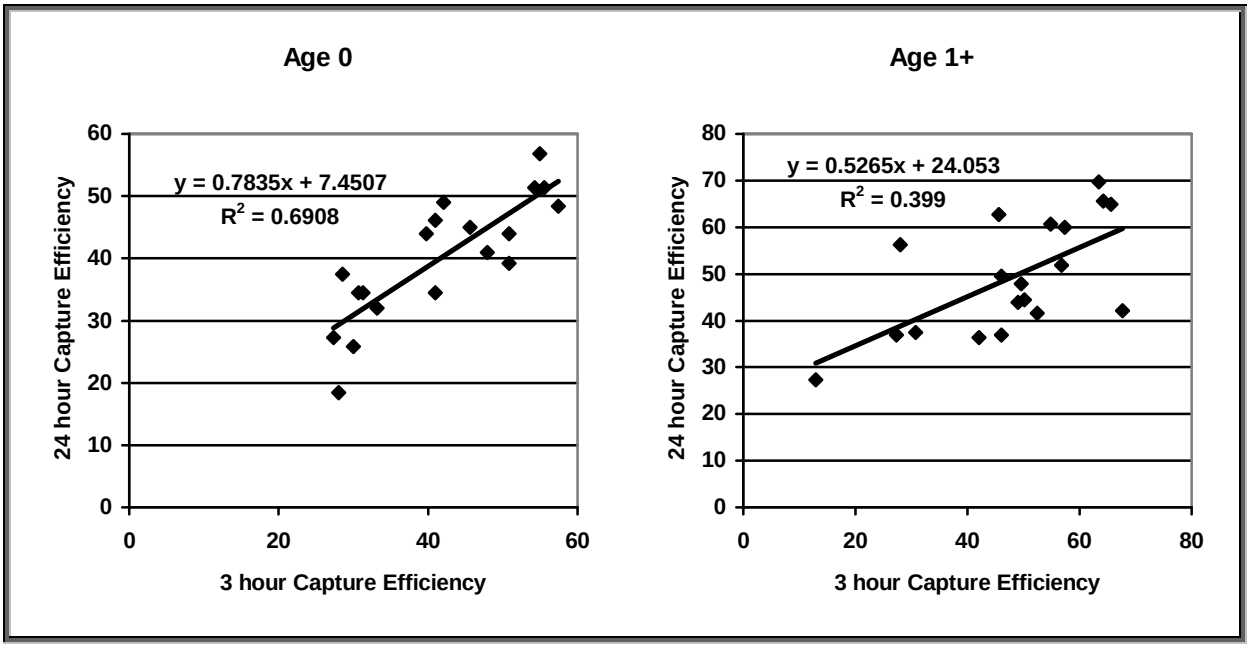

Figure 24. Relationship of 3 hour to 24 hour captured efficiencies (arcsine transformed) for Age 0 and Age 1+ summer steelhead during 2006.

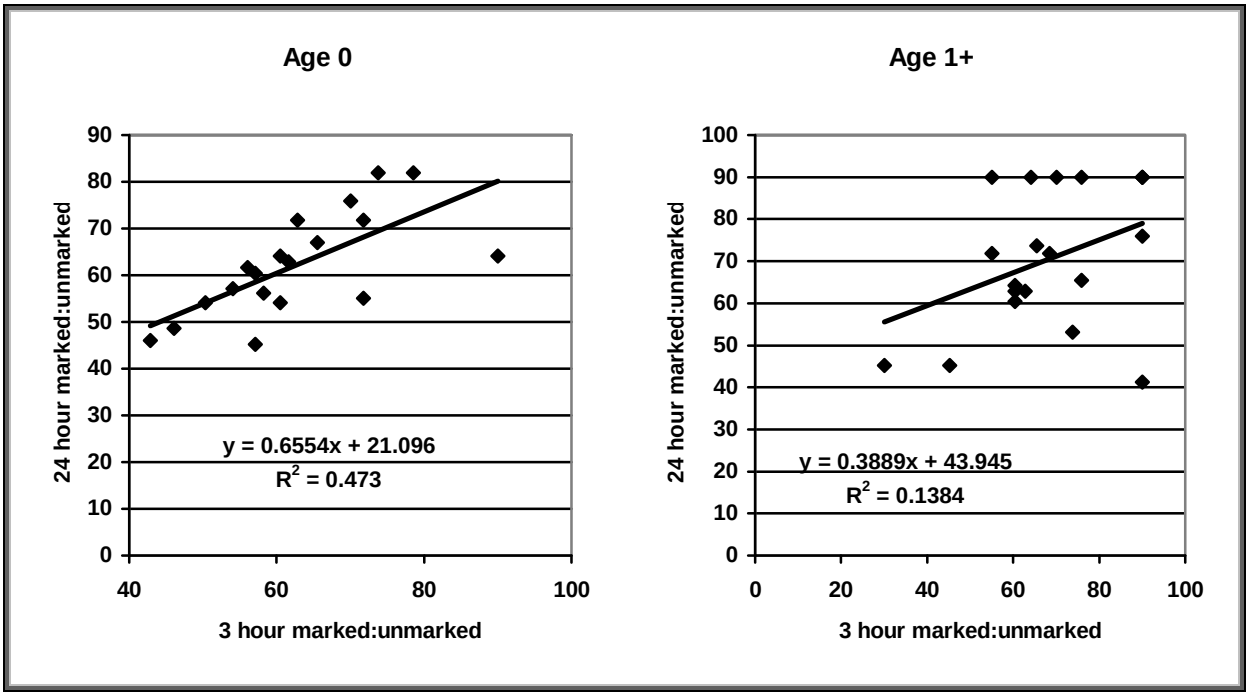

Figure 25. Relationship of 3 hour to 24 hour marked to unmarked proportions (arcsine transformed) for Age 0 and Age 1+ summer steelhead during 2006.

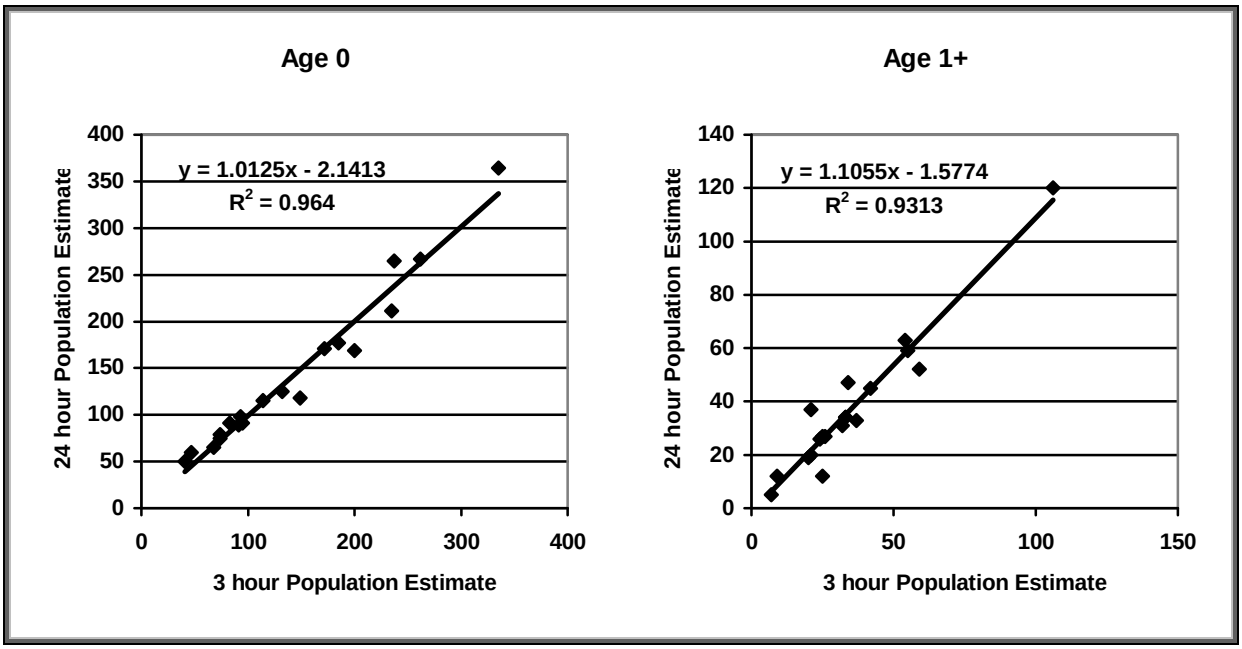

Figure 26. Relationship of 3 hour to 24 hour population estimates for Age 0 and Age 1+ summer steelhead during 2006.

Multiple Pass Estimates Compared to 3 or 24 hour Mark/Recapture Estimates

Our final step was to examine the relationship between the different estimates and determine if a correction factor could be applied to the past 20-year data set for which we have derived densities and populations estimates for various streams in SE Washington. Data comparisons between the estimation methods for both 2005 and 2006 were surprisingly consistent, and we believe the correction factor applied is justified. Figure 27 shows the relationship and correction factor for the multiple pass estimates and the 3 hour mark/recapture estimate for Age 0 summer steelhead, and Figure 28 shows the relationship and correction factor for Age 1+ summer steelhead. From the data presented, we need to increase the old multiple pass population estimates by 29.9% for Age 0 summer steelhead, and by 22.7% for Age 1+ summer steelhead.

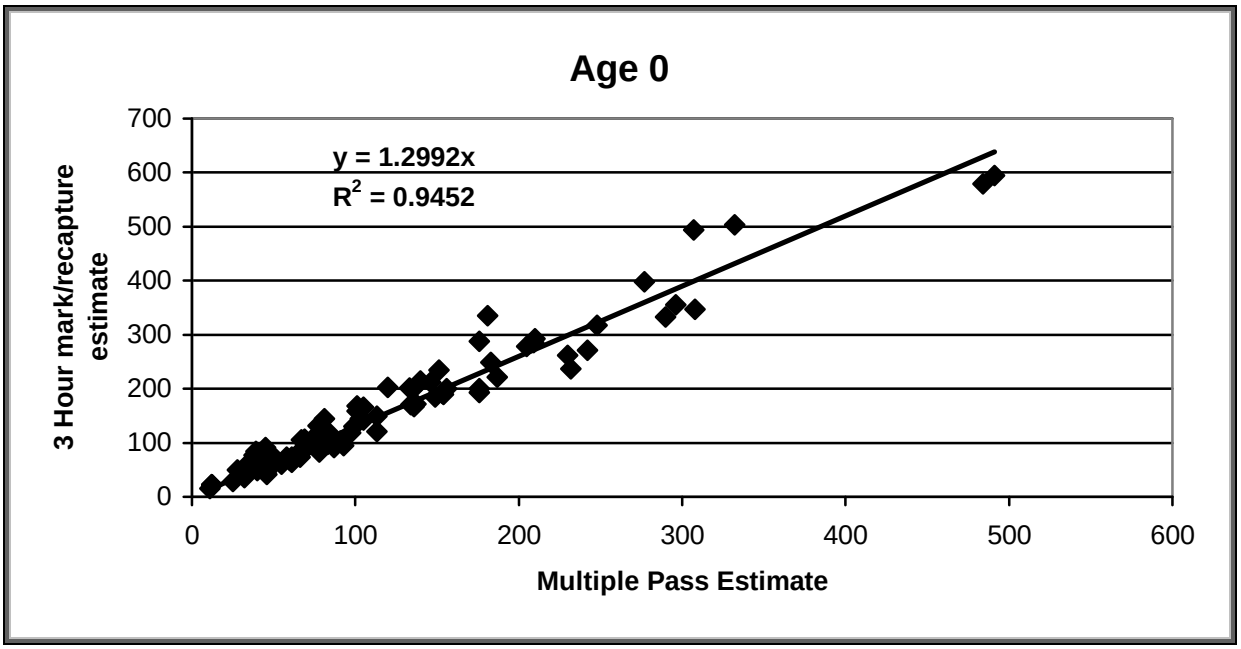

Figure 27. 2005 and 2006 Age 0 summer steelhead multiple pass estimates compared to 3 hour mark/recapture estimates.

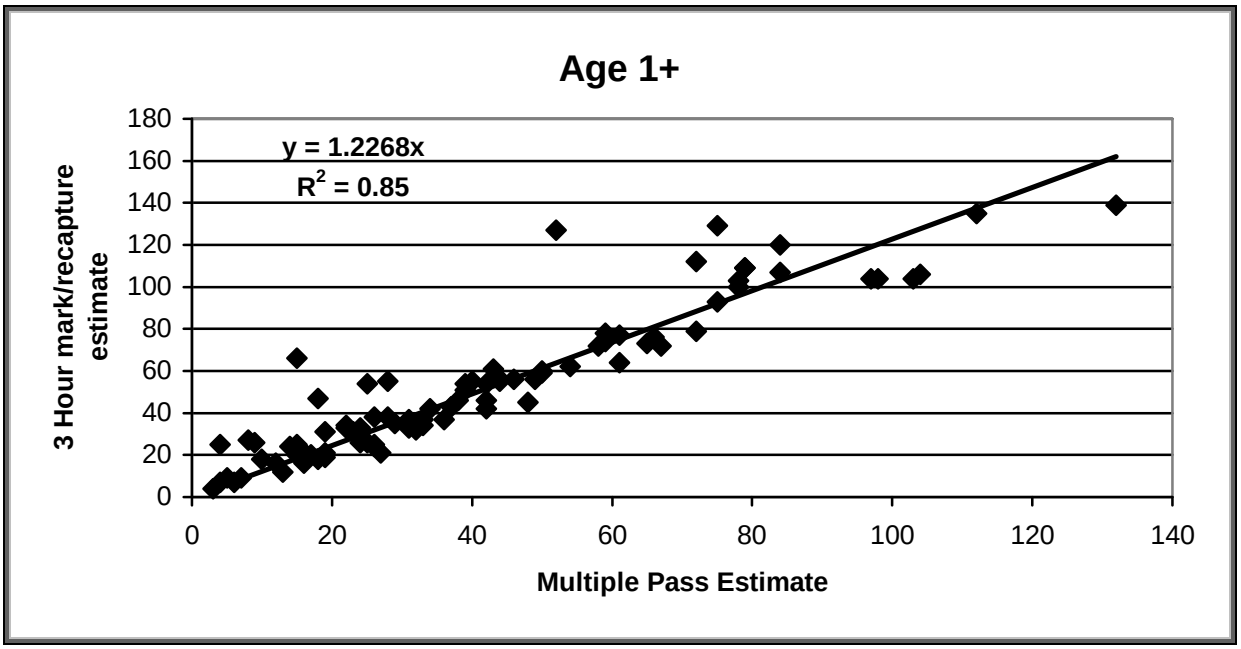

Figure 28. 2005 and 2006 Age 1+ summer steelhead multiple pass estimates compared to 3 hour mark/recapture estimates.

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) Recent data from PIT tags suggests that as many as 50% of the returning steelhead destined for the Tucannon River (natural, endemic hatchery and LFH stock), never return to the Tucannon, but instead remain upstream of Lower Granite Dam. In addition, many of the Touchet River endemic fish are entering the Tucannon River in March and April. The cause for this straying is likely an effect of the Snake River dams by hindering the downstream movement of adults once they pass upstream, or harsh environmental conditions in the Walla Walla or Tucannon River when the adult steelhead first return to the system (July-September).

The numbers of fish used to develop these endemic broodstocks are low, raising genetic concerns (potential lack of genetic diversity within the broodstock, domestication, and escapement of large numbers of these hatchery fish onto the spawning grounds) for the future. Current research conducted at Cottonwood Creek over the last three years is encouraging and may address this problem.

> Recommendation: Continue with development/evaluation of endemic broodstocks in the Tucannon and Touchet rivers on a trial basis. Continue PIT tagging large representative groups of endemic stock smolts for program evaluation (SAR) and straying.

> Recommendation: Evaluate the effect of partially spawning females on completing their spawning in the wild (Wallowa Stock in Cottonwood Creek).

2) Accurate, precise juvenile population abundance estimates are crucial for describing survival trends of populations over time, and to measure response to management actions such as hatchery supplementation and habitat manipulation/restoration. We completed two years of study and determined our electrofishing estimates were biased. While our estimates were likely made more accurate through this process, our precision was not improved, hence the data being gathered from electrofishing surveys has not been valuable in determining effects from the hatchery supplementation programs in area rivers.

> Recommendation: For each survey method that we use to estimate populations, critically look at the assumptions that need to be followed to obtain an unbiased estimate. If assumptions appear to be violated, examine/implement additional surveys that can be used for comparison or correction of past surveys results.

Recommendation: Cease all natural origin summer steelhead population monitoring electrofishing surveys in the Tucannon and Touchet rivers, and Asotin Creek for estimating juvenile production. Correct past data and use as needed to assist with management or other data requests. Put more effort on estimating the number of summer steelhead smolts from each river in SE Washington.

3) The mitigation program for WDFW summer steelhead under the LSRCP is to produce 4,656 adult steelhead to the project area for harvest. 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 way many of the historical downriver fisheries have operated, 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. Calculated 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.

4) The use of PIT tags for program evaluations (i.e. adult returns back to the project area) has increased in recent years. In addition, coded-wire tags continue to be used for the same general purpose. Each of these tagging methods has a cost, not only at initial tagging, but also in recovery and data analysis. Coded-wire tag recoveries are likely an under-estimate of the total return (lack of sampling in some areas), yet recent reports from researchers indicate the survival of PIT tagged fish may be significantly lower than those that are not PIT tagged, which in turn may underestimate total returns as well.

Recommendation: Contact others within the region to fully understand where coded-wire tag sampling is occurring for which fisheries, and to what level it occurs. Determine the degree to which lack of sampling may impact our survival estimates from coded-wire tags, and how that effect the costs of the coded-wire tagging.

Recommendation: Coordinated with others in the LSCRP project area to examine post-release mortality of PIT tagged fish, and how that might impact our program evaluations. Develop a basin wide study plan with LSRCP cooperators to determined post-release survival of PIT tagged summer steelhead at LSRCP facilities.

5) 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 effects the accuracy of our estimates. Further, it is difficult to accurately determine the composition (hatchery:natural) of spawning fish, and carcasses are rarely recovered. Hence, the impacts of our hatchery program on natural populations are relatively unknown.

Recommendation: Where mitigation fish are present, examine the feasibilities to operate weirs and traps and/or PIT tag arrays to determine hatchery:natural origin composition.

Literature Cited

Bumgarner, J., J. Dedloff, M. Herr, and M.P. Small. 2004. Lyons Ferry Complex Hatchery Evaluation: Summer Steelhead and Trout Report 2003 Run Year to USFWS Lower Snake River Compensation Plan Office. Report # FPA04-15.

Bumgarner, J., M. Small, L. Ross, and J. Dedloff. 2003. Lyons Ferry Complex Hatchery Evaluation: Summer Steelhead and Trout Report 2001 and 2002 Run Years to USFWS Lower Snake River Compensation Plan Office. Report # FPA03-15.

Bumgarner, J., M. Schuck, S. Martin, J. Dedloff, and L. Ross. 2002. Lyons Ferry Complex Hatchery Evaluation: Summer Steelhead and Trout Report 1998, 1999 and 2000 Run Years to USFWS Lower Snake River Compensation Plan Office. Report # FPA02-09.

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

Gallinat, M. P. 2004. Tucannon River Spring Chinook Salmon Hatchery Evaluation Program: 2003 Annual Report to USFWS Lower Snake River Compensation Plan Office. Report #FPA 04-12.

Hillman, T. W., J. W. Mullan, and J. S. Griffith. 1992. Accuracy of underwater counts of juvenile Chinook salmon, coho salmon, and steelhead. North American Journal of Fisheries Management. Volume 12 (3) 598-603.

Martin, S. W., A. E. Viola, and M. L. Schuck. 1993. Investigations of the interactions among hatchery reared summer steelhead, rainbow trout, and wild spring Chinook salmon in Southeast Washington. WDW Report #93-4.

Martin, S., M. Schuck, J. Bumgarner, J. Dedloff, and A. Viola. 2000. Lyons Ferry Hatchery Evaluation, Trout Report: 1997-98. Washington Department of Wildlife Report to the USFWS. Report No. FPA00-11.

Mayer, Kent, Mark Schuck, Sean Wilson, and Bobbi Johnson, "Assess Salmonids in the Asotin Creek Watershed", 2004-2005 Progress Report, Project #200205300, 42 electronic pages, (BPA Report DOE/BP-00018229-1).

Mayer, Kent, Mark Schuck, and Darin Hathaway, "Assess Salmonids in the Asotin Creek Watershed", 2005-2006 Progress Report, Project #200205300, 41 electronic pages, (BPA Report DOE/BP-#P102828).

Mayer, Kent, Mark Schuck, and Darin Hathaway, "Assess Salmonids in the Asotin Creek Watershed", 2006-2007 Progress Report, Project #200205300, 39 electronic pages, (BPA Report DOE/BP-#P105436).

National Marine Fisheries Service. 1999. Biological Opinion on Artificial Propagation in the Columbia Basin – Section 7 Consultation. NOAA/NMFS, March 29, 1999. 175 pp.

National Marine Fisheries Service (NMFS). 1992. Final Rule: Threatened status for Snake River spring/summer chinook salmon, threatened status for Snake River fall Chinook salmon. Federal Register [50 CFR Part 227;Docket no. 910847-2043, 22 April 1992] 57 (78) 14653-14662.

Peterson, J. T., R. F. Thurow, and J. W. Guzevich. 2004. An evaluation of multipass electrofishing for estimating the abundance of stream-dwelling salmonids. Transactions of the American Fisheries Society. Volume 133 462-475.

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

Schuck, M., A. Viola, J. Bumgarner and J. Dedloff. 1998. Lyons Ferry Trout Evaluation Study: 1996-97 Annual Report. Washington Department of Fish and Wildlife Report to the USFWS. Report No. H98-10.

Smith, S. G., J.R. Skalski, J.W. Schlechte, A. Hoffmann, and V. Cassen, J.R. 1994. Statistical Survival Analysis of Fish and Wildlife Tagging Studies. Contract # DE-BI79-90BP02341. Project 89-107. Bonneville Power Administration. Portland. Oregon.

Viola, A. E., and M. L. Schuck. 1995. A method to reduce the abundance of residual hatchery steelhead in rivers. North American Journal of Fisheries Management. Volume 15 488-493.

Zippin, C. 1958. The removal method of population estimation. Journal of Wildlife Management. Volume 22 (1) 82-90.

Appendix A

Bull Trout, Whitefish, and Brown Trout Capture Data from the Touchet River Adult Trap, 2007 and 2008

Appendix A: Table 1. Bull trout captured at the Dayton Adult Trap on the Touchet River, 2007. Data shown represents first time captures that were then PIT tagged, or fish that were recaptures from previous years.

Year	Date	Ln (cm)	Wt (g)	Age [a]	PIT Tag Code	Recap	Year	Date	Ln (cm)	Wt (g)	Age [a]	PIT Tag Code	Recap
2007	3/7	51.0	1680.0	7	3D9.1BF1B5F392	4 YEAR	2007	5/10	37.5	650.0	4	3D9.1BF1F687AE	
2007	4/6	36.0		4	3D9.1BF1A294C3		2007	5/11	33.0	425.0	3	3D9.1BF1A6EFD8	
2007	4/10	34.0		3	3D9.1BF1A6DC41		2007	5/11	46.0	1350.0	4	3D9.1BF1F7FB9D	
2007	4/24	35.5	530.0	5	3D9.1BF1A76F5F		2007	5/11	34.0	575.0	R	3D9.1BF1F81ED4	
2007	4/24	36.0	590.0	4	3D9.1BF1A22A45		2007	5/11	50.0	1820.0	6	3D9.1BF1CD71E4	3 YEAR
2007	4/25	30.0	290.0	3	3D9.1BF1A287A1		2007	5/16	42.0	1040.0	5	3D9.1BF1CF0563	2 YEAR
2007	4/25	55.0	2050.0	6	3D9.1BF1B751AA	2 YEAR	2007	5/17	49.0	1380.0	5	3D9.1BF1B60815	2 YEAR
2007	5/3	47.0	1200.0	6	3D9.1BF1A7385F	2 YEAR	2007	5/17	49.0	1500.0	6	3D9.1BF1B60D58	2 YEAR
2007	5/3	38.0	620.0	4	3D9.1BF1A73EEE		2007	5/17	59.0	2300.0	8	3D9.1BF123A317	6 YEAR
2007	5/8	43.0	940.0	5	3D9.1BF204AB64	2 YEAR	2007	5/23	34.0	530.0	2	3D9.1BF1F851C1	
2007	5/8	60.5	2950.0	6	3D9.1BF1C71ED4	4 YEAR	2007	5/23	28.5	340.0	3	3D9.1BF1A2C39D	
2007	5/8	50.0	1820.0	6	3D9.1BF1CD71E4	3 YEAR	2007	5/23	28.0	325.0	3	3D9.1BF1A2F083	
2007	5/8	43.0	1060.0	5	3D9.1BF1B75913	2 YEAR	2007	5/24	33.0	490.0	3	3D9.1BF1A74969	
2007	5/9	29.0	220.0	2	3D9.1BF1A2E069		2007	5/31	36.0	480.0	3	3D9.1BF1CF14A4	
2007	5/9	58.0	2500.0	7	3D9.1BF1B70048	4 YEAR	2007	6/5	33.5		3	3D9.1BF1A28409	
2007	5/10	48.0	1420.0	5	3D9.1BF1F6A29B	2 YEAR	2007	6/27	28.0	180.0	3	3D9.1BF1A22572	

Appendix A: Table 2. Bull trout captured at the Dayton Adult Trap on the Touchet River, 2008. Data shown represents first time captures that were then PIT tagged, or fish that were recaptures from previous years.

Year	Date	Ln (cm)	Wt (g)	Age	PIT Tag Code	Recap	Year	Date	Ln (cm)	Wt (g)	Age	PIT Tag Code	Recap
2008	4/30	27.5		3	3D9.1BF1A77A98		2008	6/19	36.5	650.0	3	3D9.1BF1F9EA08	
2008	5/2	37.0	645.0	5	3D9.1BF1F90AB6		2008	6/20	36.0	650.0	3	3D9.1BF1A29BE2	
2008	5/6	37.0	645.0	5	3D9.1BF1F90AB6		2008	6/20	36.5	650.0	3	3D9.1BF1F6A82C	
2008	5/7	58.0	2585.0	7	3D9.1BF1CD71E4	4 YEAR	2008	6/23	38.0	650.0	Regen	3D9.1BF1A30B1B	
2008	5/7	33.0	475.0	Regen	3D9.1BF1CC38D2		2008	6/23	28.0	325.0	2	3D9.1BF1A7D233	
2008	5/15	46.0	1290.0	5	3D9.1BF1A73EEE	2 YEAR	2008	6/23	31.0	400.0	3	3D9.1BF1A30558	
2008	6/3	42.0	910.0	Regen	3D9.1BF1A7E35A		2008	6/23	30.0	380.0	4	3D9.1BF1F7C8A8	
2008	6/3	32.0	500.0	4	3D9.1BF1A30177		2008	6/23	38.0	690.0	4	3D9.257C5DB73A	
2008	6/15	35.0			3D9.1C2C87676A		2008	6/23	29.0	350.0	3	3D9.257C5C76DA	
2008	6/15	36.5	625.0	5	3D9.1BF27C61A8		2008	6/23	31.0	425.0	4	3D9.257C5D1038	
2008	6/16	34.0	500.0	Regen	3D9.1BF1CF17A7		2008	6/24	43.0	1025.0	4	3D9.257C59E540	
2008	6/17	61.0	2550.0	9	3D9.1BF123A317	7 YEAR	2008	6/26	36.0	625.0	4	3D9.257C592701	
2008	6/18	44.5	1100.0	Regen	3D9.1BF27C3A17		2008	6/30	31.5	450.0	3	3D9.257C5A7D0F	
2008	6/18	29.0	325.0	3	3D9.1BF27C4B84		2008	6/30	25.5	225.0	Regen	3D9.257C5BDAE0	
2008	6/18	38.0	700.0	4	3D9.1BF1A370BE		2008	7/01	26.0	220.0	2	3D9.257C5A108F	
2008	6/18	39.5	800.0	4	3D9.1BF1A305E5		2008	7/01	23.5	120.0	3	3D9.257CFA05CF	
2008	6/19	28.0	240.0	Regen	3D9.1BF1A27F90		2008	7/21	32.5	340.0	4	3D9.257C59F1A6	

Appendix A: Table 3. Whitefish and Brown Trout captured at the Dayton Adult Trap on the Touchet River, 2007.

Date	Species	LN (cm)	Age	Date	Species	LN (cm)	Age	Date	Species	LN (cm)	Age
3/18	WF	29.0	4	5/24	WF	31.0	2	6/8	BRT	47.0	R
3/19	WF	30.0	3	5/30	WF	32.5	3	6/8	BRT	42.5	R
4/24	WF	29.5	R	5/30	BRT	42.0	3	6/11	BRT	37.5	3
4/24	WF	31.0	3	6/01	WF	22.0	1	6/11	BRT	47.5	R
5/2	BRT	28.0	2	6/01	WF	32.5	4	6/13	BRT	43.0	3
5/4	WF	26.0	2	6/5	WF	28.0	2	6/13	WF	30.5	3
5/16	WF	26.5	2	6/5	WF	28.0	2	6/13	WF	30.0	3
5/17	WF	29.0	3	6/5	WF	21.5	1	6/21	BRT	37.0	2
5/22	BRT	46.0	3	6/5	BRT	49.0	3	6/21	BRT	32.0	2
5/23	WF	26.0	2	6/5	BRT	30.0	2	6/22	BRT	37.0	2
5/24	WF	25.0	4								

Appendix A: Table 4. Whitefish and Brown Trout captured at the Dayton Adult Trap on the Touchet River, 2008.

Date	Species	LN (cm)	WT (g)	Age	Date	Species	LN (cm)	WT (g)	Age
3/11	WF	28.5		Regen	7/01	WF	21.5	160.0	1
4/7	WF	33.0		5	7/01	WF	23.0	180.0	1
4/27	WF	26.0		2	7/02	BRT	52.0	2100.0	4
5/5	BRT	30.0		3	7/03	BRT	39.0	740.0	3
5/27	WF	37.0		4	7/03	WF	20.5	120.0	1
6/2	BRT	54.0	1800.0	4	7/05	WF	23.0	140.0	1
6/3	BRT	58.0	2200.0	4	7/05	WF	24.0	170.0	1
6/13	WF	29.0	375.0	2	7/05	WF	22.5	130.0	1
6/13	WF	28.0	375.0	2	7/05	WF	21.5	100.0	1
6/15	WF	34.0		3	7/05	WF	23.0		Regen
6/15	WF	31.0		3	7/05	BRT	33.5	500.0	2
6/16	WF	27.0	260.0	2	7/05	BRT	35.0	620.0	2
6/17	WF	27.0		2	7/05	BRT	44.0	1200.0	3
6/18	WF	27.0		Regen	7/07	WF	22.5	140.0	1
6/23	WF	31.0	450.0	2	7/08	BRT	35.0	540.0	2
6/26	WF	22.0	200.0	1	7/08	WF	20.3	100.0	1
6/27	BRT	47.0	1350.0	Regen	7/10	WF	22.3	140.0	1
6/30	WF	40.0	1500.0	Regen	7/21	WF	23.5	160.0	1
7/01	BRT	64.5		5	7/24	WF	21.9	130.0	1
7/01	WF	22.0	160.0	1					

Appendix B

Historical Freeze Brand and Coded-Wire Tag Returns Of Adult Summer Steelhead Released From Lyons Ferry Complex (1982-2003 Brood Years)

Appendix B: Table 1. Visual records of freeze brands recovered at Lower Granite Dam by NOAA Fisheries on LFH and Wallowa stock summer steelhead released from the LFC program.

Release Site	Brood year	Brands released	Total released	% of total release	1-salt	2-salt	3-salt	Total return	SAR	Total return
Grande Ronde	1984	81,229	149,408	54.4	1021	462	6	1,489	1.83	2,737
River @	1985	59,695	124,200	48.1	342	488	2	832	1.39	1,730
Cottonwood	1986	76,579	253,345	30.2	537	641	0	1,178	1.54	3,901
AP	1996	38,051	274,886	13.8	128	29	0	157	0.41	1,138
	1997	47,348	252,211	18.8	230	211	0	441	0.93	2,346
	1998	85,365	268,803	31.8	1161	636	0	1,797	2.11	5,651
	1999	74,026	274,146	27.0	2514	442	0	2,956	3.99	10,948
	2000	40,301	215,584	18.7	696	127	0	823	2.04	4,403
	2001	38,934	182,722	21.3	264	79	0	343	0.88	1,610
Asotin Creek Mouth	1989	38,250	137,847	27.7	273	339	0	612	1.60	2,209
Wallowa River (OR)	1982	64,133	114,085	56.2	253	249	1	503	0.78	895
Snake River @	1982	50,597	138,552	36.5	288	211	0	499	0.99	1,367
Lyons Ferry	1984	56,564	170,706	33.1	512	211	0	723	1.28	2,184
Hatchery	1985	121,761	197,350	61.7	556	592	0	1,148	0.94	1,361
	1986	99,364	196,361	50.6	940	661	1	1,602	1.61	3,166
	1987	99,448	105,117	94.6	1,170	244	0	1,414	1.42	1,495
	1988	90,673	98,504	92.1	126	224	0	350	0.39	380
	1989	37,496	43,479	86.2	155	198	0	353	0.94	410
	1994	40,190	66,972	60.0	420	161	0	581	1.45	968
	1995	58,870	71,942	81.8	240	57	1	298	0.51	364
	1996	78,878	81,162	97.2	203	45	0	248	0.31	255
	1997	79,339	93,842	84.5	363	179	0	542	0.68	641
	1998	78,537	87,992	89.3	366	134	2	502	0.64	562
	1999	19,361	59,942	32.3	290	24	0	314	1.62	972
	2000	19,837	53,551	37.0	39	9	0	48	0.24	130
	2001	18,590	62,612	29.7	36	11	0	47	0.25	158

Appendix B: Table 1 continued,

Release Site	Brood year	Brands released	Total released	% of total release	1-salt	2-salt	3-salt	Brand return	SAR	Total return
Tucannon	1984	78,188	151,609	51.6	186	159	0	345	0.44	669
River @ Curl	1985	80,843	141,068	57.3	193	268	7	468	0.58	817
Lake AP	1986	57,878	162,231	35.7	208	255	2	465	0.80	1,303
	1987	59,089	161,293	36.6	303	125	1	429	0.73	1,172
	1988	57,589	160,131	36.0	114	135	0	249	0.43	692
	1989	38,835	79,252	49.0	238	302	2	542	1.40	1,106
	1990	38,431	120,560	31.9	85	78	0	163	0.42	511
	1991	29,315	75,235	39.0	28	12	0	40	0.14	103
	1992	47,294	76,160	62.1	96	111	2	209	0.44	337
	1993	46,757	135,359	34.5	146	29	0	175	0.37	507
	1994	52,930	146,070	36.2	358	163	0	521	0.98	1,439
	1995	27,197	139,242	19.5	29	7	0	36	0.13	185
	1996	27,542	110,005	25.0	48	20	0	68	0.25	272
Tucannon	1989	38,071	40,012	95.1	205	185	1	391	1.03	411
River Direct	1990	38,506	39,985	96.3	289	231	0	520	1.35	540
@ Marengo	1991	29,932	29,888	96.8	38	34	0	72	0.25	74
Br. or Enrich	1992	29,039	29,876	97.2	63	72	0	135	0.46	139
Br.	1995	29,626	30,464	97.2	205	45	0	250	0.84	257
	1996	29,768	29,966	99.3	126	26	1	153	0.51	154
	1997	48,310	160,068	30.2	443	196	1	640	1.32	2,119
	1998	40,184	179,089	22.4	253	113	1	367	0.91	1,638
	1999	38,960	145,768	26.7	552	38	0	590	1.51	2,210
	2000	19,837	121,390	16.3	60	0	0	60	0.30	368
	2001	19,647	135,203	14.5	82	25	0	107	0.54	738
Tucannon										
River Direct	1983	120,315	195,315	61.6	598	675	0	1273	1.06	2,067
Upper River	1990	38,327	40,1216	95.3	197	163	0	360	0.94	378
Near Curl	1991	28,982	30,096	96.3	29	22	0	51	0.18	53
Lake	1992	28,771	30,001	95.9	89	99	0	188	0.65	196
Touchet	1987	77675	170,724	45.5	434	42	1	477	0.61	1,048
River @	1988	78,917	158,446	49.8	64	125	0	189	0.24	380
Dayton AP	1989	37,911	116,345	32.6	48	33	0	81	0.21	248
	1990	114,335	148,520	77.0	382	238	1	621	0.54	806
	1991	45,628	95,517	47.8	22	7	0	29	0.06	61
	1992	40,432	110,099	36.7	81	143	0	224	0.55	610
	1994	60,395	120,710	50.0	526	268	0	794	1.31	1,588
	1995	76,862	134,610	57.1	250	52	0	302	0.39	529
	1996	59,419	142,824	41.6	188	29	0	217	0.37	522
	1997	36,781	125,127	29.4	195	49	0	244	0.66	830
	1999	37,077	124,654	29.7	209	47	0	256	0.69	862
	2001	17,742	125,391	14.1	45	14	0	59	0.33	418
Walla Walla	1989	38,262	130,217	29.4	14	11	0	25	0.07	85
River Direct	1992	39,240	83,240	47.1	35	75	0	110	0.28	234
Stream	1993	60,260	159,905	37.7	269	31	0	300	0.50	796
Release	1994	50,300	158,875	31.7	318	77	0	395	0.79	1,246

Appendix B: Table 2. Coded-wire tag recoveries of summer steelhead released from WDFW LFC. Recoveries shown are for those in the Snake River Basin, but including the Walla Walla and Touchet River.

					Below Lower Granite Dam										Above Lower Granite Dam														
Release Location	Brood year	CWT fish released	Total number released	%of total release	Walla Walla River	Touchet River	Snake R. below IHD	Snake River IHD to LMD	Snake River LMD to LGO	Snake River – LGO to LGR	Tucannon River	Lyons Ferry Hatchery	Snake River Tributary	Total below Lower Granite	Snake River above LGR	Clearwater River	Grande Ronde River	Salmon River	Cottonwood	Wallowa / Big Canyon	Dworshak Hatchery	Oxbow Hatchery	Pahsimeroi Hatchery	Hells Canyon Dam Trap	Total Above Lower Granite	Total LSRCP Project Area	Estimated SAR to LSRCP Area	Total Return by Brood Year
Grande Ronde	1984	78,431	149,408	52.5	0	0	0	0	11	2	0	13	0	**26**	441	5	49	16	117	0	0	0	1	0	**629**	**655**	**0.84**	**1,248**
	1985	59,722	124,200	48.1	0	0	0	0	0	18	18	73	0	**109**	96	0	216	0	68	0	0	0	0	0	**380**	**489**	**0.82**	**1,017**
	1986	79,984	253,345	31.6	0	3	0	0	6	0	4	9	0	**22**	206	6	200	14	0	0	0	0	0	0	**426**	**448**	**0.56**	**1,419**
	1996	38,405	274,886	14.0	0	0	0	0	6	0	0	0	0	**6**	51	0	70	0	16	1	0	0	0	0	**138**	**144**	**0.37**	**1,031**
	1997	48,598	252,211	19.3	0	0	0	0	36	0	0	1	0	**37**	52	0	145	0	42	0	0	0	0	0	**239**	**276**	**0.57**	**1,432**
	1998	88,980	268,803	33.1	0	0	0	0	0	0	0	7	0	**7**	297	140	628	0	173	1	0	0	0	0	**1,239**	**1,246**	**1.40**	**3,764**
	1999	75,199	274,146	27.4	0	0	0	20	23	0	0	8	0	**51**	424	330	658	10	344	3	0	0	0	0	**1,769**	**1,820**	**2.42**	**6,635**
	2000	39,905	215,584	18.5	0	0	0	19	0	12	6	1	0	**39**	247	0	337	10	58	1	0	0	0	0	**653**	**692**	**1.73**	**3,738**
	2001	40,520	182,722	22.2	0	1	0	5	5	11	0	2	0	**23**	187	0	405	0	290	0	0	0	0	0	**882**	**905**	**2.23**	**4,081**
	2002	40,366	236,627	17.1	0	0	0	5	11	0	1	1	0	**18**	145	123	251	0	117	2	0	0	0	0	**638**	**656**	**1.63**	**3,845**
	2003	40,202	138,179	29.09	0	0	0	23	8	0	9	2	0	**42**	86	18	405	0	203	1	0	0	0	0	**713**	**755**	**1.89**	**2,607**
Asotin	1989	39811	137,847	28.9	0	0	0	0	14	16	0	51	0	**81**	95	0	4	0	0	0	0	2	0	0	**101**	**182**	**0.46**	**630**
Wallowa R.	1982	62,193	114,085	54.5	0	0	0	0	0	0	0	11	0	**11**	28	0	0	0	0	188	0	0	0	0	**216**	**227**	**0.36**	**417**
Lyons Ferry	1982	48,998	138552	35.4	0	0	0	0	0	0	0	89	0	**89**	71	51	0	10	0	0	3	0	0	0	**135**	**224**	**0.46**	**633**
	1984	51,846	170706	30.4	0	0	0	0	6	44	0	131	0	**181**	234	5	0	0	0	0	5	0	0	0	**244**	**425**	**0.82**	**1,398**
	1985	100,821	197350	51.1	0	0	0	0	46	54	18	200	0	**318**	170	50	0	0	0	0	5	0	0	0	**225**	**543**	**0.54**	**1,063**
	1986	101,292	196,361	51.6	0	0	0	0	26	123	17	479	0	**645**	197	49	0	0	0	0	3	0	0	0	**249**	**894**	**0.88**	**1,733**
	1987	100,096	105,117	95.2	0	0	0	4	81	135	0	405	0	**625**	187	77	0	0	0	0	5	0	0	0	**269**	**894**	**0.89**	**939**
	1988	96,237	98,504	97.7	0	0	0	14	77	156	23	395	0	**665**	76	20	0	0	0	0	1	1	0	0	**98**	**763**	**0.79**	**781**
	1989	38,511	43,479	88.6	0	0	0	14	19	20	8	75	0	**136**	68	40	0	0	0	0	1	0	0	0	**109**	**245**	**0.64**	**277**
	1994	39,736	66,972	59.3	0	0	0	0	144	46	0	655	0	**845**	14	30	0	0	0	0	2	2	0	0	**48**	**893**	**2.25**	**1,506**
	1995	58,827	71,942	81.7	0	0	0	8	18	9	0	366	0	**401**	54	20	0	0	0	0	2	0	0	0	**76**	**477**	**0.81**	**584**
	1996	79,768	81,162	98.3	0	0	0	0	4	14	0	151	0	**169**	43	0	0	0	1	0	0	0	0	0	**44**	**213**	**0.27**	**217**
	1997	81,266	93,842	86.6	0	0	0	0	28	54	11	559	0	**652**	33	0	0	0	0	0	0	0	0	0	**33**	**685**	**0.84**	**791**
	1998	78,296	87,992	89.0	0	0	16	108	32	0	0	420	1	**577**	6	10	0	0	0	0	0	0	0	0	**16**	**593**	**0.76**	**666**
	1999	20,055	59,942	33.5	0	0	0	100	13	0	22	297	0	**432**	10	110	0	0	0	0	0	0	0	0	**120**	**552**	**2.75**	**1,648**
	2000	19,726	53,551	36.8	0	0	0	0	44	21	14	143	0	**222**	0	10	0	0	0	0	0	0	0	0	**10**	**232**	**1.18**	**630**
	2001	19,236	62,612	30.7	0	0	0	0	25	19	5	189	0	**238**	19	30	0	0	0	0	0	0	0	0	**49**	**287**	**1.49**	**935**
	2002	21,041	60,001	35.1	0	0	0	0	101	9	0	185	0	**295**	0	96	0	2	0	0	0	0	0	0	**98**	**393**	**1.87**	**1,120**
	2003	20,069	59,993	33.5	0	0	0	5	66	24	5	144	0	**244**	0	18	0	0	0	0	0	0	0	0	**18**	**262**	**1.31**	**783**

Appendix B: Table 2 continued,

					Below Lower Granite Dam										Above Lower Granite Dam														
Release Location	Brood year	CWT fish released	Total number released	%of total release	Walla Walla River	Touchet River	Snake R. below IHD	Snake River IHD to LMD	Snake River LMD to LGO	Snake River – LGO to LGR	Tucannon River	Lyons Ferry Hatchery	Snake River Tributary	Total below Lower Granite	Snake River above LGR	Clearwater River	Grande Ronde River	Salmon River	Cottonwood	Wallowa / Big Canyon	Dworshak Hatchery	Oxbow Hatchery	Pahsimeroi Hatchery	Hells Canyon Dam Trap	Total Above Lower Granite	Total LSRCP Project Area	Estimated SAR to LSRCP Area	Total Return by Brood Year
Tucannon	1984	75,334	151,609	49.7	0	0	0	0	33	0	19	1	0	**53**	58	23	0	0	0	0	1	0	0	0	**82**	**135**	**0.18**	**272**
@ Curl	1985	80,034	141,068	56.7	0	0	0	0	27	2	22	19	0	**70**	70	15	0	0	0	0	2	0	0	0	**87**	**157**	**0.20**	**277**
Lake AP	1986	60,706	162,231	37.4	0	0	0	0	0	7	4	52	0	**63**	29	23	2	0	0	0	4	0	0	0	**58**	**121**	**0.20**	**324**
	1987	59,963	161,293	37.2	6	0	0	0	0	21	34	34	0	**95**	104	13	7	0	0	0	4	0	0	0	**128**	**223**	**0.37**	**599**
	1988	60,373	160,131	37.7	0	0	0	0	3	11	32	79	0	**125**	43	0	0	0	0	0	0	1	0	0	**44**	**169**	**0.28**	**448**
	1989	39,597	79,252	50.0	10	2	0	9	0	9	56	27	0	**113**	28	10	0	0	0	0	1	2	0	1	**42**	**155**	**0.39**	**310**
	1990	39,946	120,560	33.1	0	0	0	0	4	14	26	28	0	**72**	62	50	0	10	0	0	2	0	0	1	**125**	**197**	**0.49**	**595**
	1991	29,264	60,098	48.7	0	0	0	0	3	0	4	22	0	**29**	0	0	9	0	0	0	0	0	0	0	**9**	**38**	**0.13**	**78**
	1992	21,916	76,160	28.8	0	0	0	0	32	6	23	76	0	**137**	45	20	0	0	0	0	1	0	0	0	**66**	**203**	**0.93**	**705**
	1993	49,160	135,359	36.3	0	0	0	0	8	14	85	62	0	**169**	43	0	12	0	0	0	0	1	0	0	**56**	**225**	**0.46**	**620**
	1994	52,644	146,070	36.0	1	0	0	22	53	18	100	118	0	**312**	112	40	1	0	0	0	1	0	0	0	**154**	**466**	**0.89**	**1,294**
	1995	26,652	139,242	19.1	0	0	0	8	0	0	11	20	0	**39**	0	0	0	0	0	0	0	0	0	2	**2**	**41**	**0.15**	**215**
	1996	26,636	110,005	24.2	0	0	0	0	0	0	0	12	0	**12**	13	0	0	0	0	0	0	0	0	1	**14**	**26**	**0.10**	**107**
Tucannon	1989	39,732	40,012	99.3	0	2	0	0	0	3	2	14	0	**21**	35	20	0	0	0	0	2	0	0	1	**58**	**79**	**0.20**	**80**
Direct @	1990	39,631	39,985	99.1	0	3	0	6	37	7	56	78	0	**187**	26	70	2	0	0	0	1	10	0	0	**109**	**296**	**0.75**	**299**
Marengo	1991	29,419	29,888	98.4	0	1	0	0	14	11	6	23	0	**55**	0	0	0	0	0	0	0	0	0	0	**0**	**55**	**0.19**	**56**
Br. or	1992	29,517	29,876	98.8	0	2	0	0	23	12	28	63	0	**128**	0	10	24	0	0	0	0	0	0	0	**34**	**162**	**0.55**	**164**
Enrich Br.	1995	29,135	30,464	95.6	0	0	0	0	9	10	46	83	0	**148**	39	10	7	0	0	0	5	0	0	1	**60**	**208**	**0.71**	**218**
	1996	27,076	29,966	90.4	0	0	0	0	0	9	6	36	0	**51**	14	0	0	0	0	0	0	0	0	2	**16**	**67**	**0.25**	**74**
	1997	49,385	160,068	30.9	0	14	0	0	35	30	136	137	0	**352**	156	30	7	0	0	0	0	0	0	1	**194**	**546**	**1.11**	**1,767**
	1998	39,665	179,089	22.1	0	0	0	0	33	20	152	95	0	**300**	14	0	0	10	0	0	0	0	0	0	**24**	**324**	**0.82**	**1,466**
	1999	39,505	145,768	27.1	1	0	0	0	80	12	256	213	1	**563**	44	60	0	0	0	0	0	0	0	0	**104**	**667**	**1.69**	**2,461**
	2000	19,742	121,390	16.3	5	0	0	0	32	12	65	42	0	**156**	0	0	0	0	0	0	0	0	0	0	**0**	**156**	**0.79**	**957**
	2001	20,468	135,203	15.1	0	7	0	0	12	0	70	49	0	**138**	84	30	0	40	0	1	0	0	0	0	**135**	**273**	**1.33**	**1,808**
	2002	20,735	115,496	17.9	0	0	0	1	6	16	164	48	0	**235**	52	52	0	0	0	0	0	0	0	0	**104**	**339**	**1.63**	**1,894**
	2003	20,201	83,726	24.1	0	0	0	10	5	5	87	31	2	**140**	22	49	10	0	0	0	0	0	0	0	**81**	**221**	**1.09**	**916**
Tucannon	1983	113,600	195,315	58.2	0	0	0	0	0	0	0	13	0	**13**	467	40	0	10	0	0	6	0	0	0	**523**	**536**	**0.47**	**921**
Direct	1990	39,740	40,216	98.8	0	0	0	0	19	0	61	85	0	**165**	63	40	0	0	0	0	0	5	0	0	**108**	**273**	**0.69**	**276**
Upper River	1991	28,946	30,096	96.2	0	0	0	0	3	0	5	26	0	**34**	17	20	0	0	0	0	0	1	0	0	**38**	**72**	**0.25**	**75**
Near Curl	1992	29,701	30,001	99.0	0	0	0	0	23	0	21	82	0	**126**	5	10	8	0	0	0	1	0	0	0	**24**	**150**	**0.51**	**152**
Lake																												

Appendix B: Table 2 continued,

					Below Lower Granite Dam										Above Lower Granite Dam													
Release Location	Brood year	CWT fish released	Total number released	%of total release	Walla Walla River	Touchet River	Snake R. below IHD	Snake River IHD to LMD	Snake River LMD to LGO	Snake River – LGO to LGR	Tucannon River	Lyons Ferry Hatchery	Snake River Tributary	Total below Lower Granite	Snake River above LGR	Clearwater River	Grande Ronde River	Salmon River	Cottonwood	Wallowa / Big Canyon	Dworshak Hatchery	Oxbow Hatchery	Pahsimeroi Hatchery	Hells Canyon Dam Trap	Total Above Lower Granite	Total LSRCP Project Area	Estimated SAR to LSRCP Area	Total Return by Brood Year
Touchet	1987	78,254	170,724	45.8	146	231	0	12	44	29	38	205	0	**705**	78	9	2	0	0	0	4	0	0	0	**93**	**798**	**1.02**	**1,742**
	1988	81,106	158,446	51.2	30	119	10	87	42	31	73	325	0	**717**	12	0	0	0	0	0	1	0	0	0	**13**	**730**	**0.90**	**1,426**
	1989	39,530	116,345	33.9	0	14	0	17	23	9	8	56	0	**127**	32	10	0	0	0	0	1	0	0	0	**43**	**170**	**0.43**	**501**
	1990	120,196	148,520	80.9	102	171	0	109	120	148	57	926	0	**1,633**	83	120	0	0	0	0	1	6	0	0	**210**	**1843**	**1.53**	**2,278**
	1991	45,377	95,517	47.5	80	71	0	20	25	10	5	141	0	**351**	5	0	0	0	0	0	0	0	0	0	**5**	**356**	**0.78**	**749**
	1992	40,331	110,099	36.6	8	150	0	8	51	48	23	239	0	**527**	33	0	0	0	0	0	1	0	0	0	**34**	**561**	**1.39**	**1,533**
	1994	60,220	120,710	49.9	64	196	0	35	200	92	206	803	0	**1,596**	52	20	1	0	0	0	2	0	0	0	**75**	**1671**	**2.77**	**3,349**
	1995	78,689	134,610	58.5	30	80	0	8	48	26	21	448	0	**661**	39	70	0	0	0	0	1	0	0	0	**110**	**771**	**0.98**	**1,318**
	1996	55,595	142,824	38.9	18	10	0	8	22	13	18	180	0	**269**	29	10	0	0	0	0	0	0	0	0	**39**	**308**	**0.55**	**792**
	1997	39,668	125,127	31.7	53	73	0	13	82	46	80	296	0	**643**	31	0	0	0	0	0	0	0	0	0	**31**	**674**	**1.70**	**2,126**
	1999	39,282	124,654	31.5	95	76	0	144	173	10	40	428	0	**966**	0	0	0	0	0	0	0	0	0	0	**0**	**966**	**2.46**	**3,067**
	2000	20,439	102,765	19.9	0	12	0	8	12	8	19	53	0	**112**	0	0	0	0	0	0	1	0	0	0	**1**	**113**	**0.55**	**568**
	2001	20,407	125,391	16.3	27	40	8	9	29	3	21	106	0	**243**	21	10	0	0	0	0	0	0	0	0	**31**	**274**	**1.34**	**1,681**
	2002	20,627	100,445	20.5	38	48	0	4	6	13	35	74	0	**218**	0	22	0	0	0	0	0	0	0	0	**22**	**240**	**1.16**	**1,171**
	2003	19,902	86,347	23.1	36	58	0	14	28	25	0	61	0	**222**	31	15	0	0	0	0	0	0	0	0	**46**	**268**	**1.35**	**1,163**
Walla	1989	39,340	130,217	30.2	22	2	0	23	22	8	7	25	0	**109**	0	0	0	0	0	0	0	0	0	1	**1**	**110**	**0.28**	**364**
Walla	1992	38,905	83,240	49.7	43	0	0	3	34	29	2	187	0	**298**	0	10	0	0	0	0	1	0	0	0	**11**	**309**	**0.79**	**622**
	1993	60,260	159,905	37.7	421	0	0	116	171	40	44	548	0	**1,340**	57	0	0	0	0	0	0	1	0	0	**58**	**1,398**	**2.32**	**3,708**
	1994	49,955	158,875	31.4	148	0	3	113	160	72	82	518	0	**1,096**	25	50	0	0	0	0	2	0	0	0	**77**	**1,173**	**2.35**	**3,736**
	2000	18,856	103,980	18.1	0	0	0	14	25	10	0	96	0	**145**	0	10	0	0	0	0	0	0	0	0	**10**	**155**	**0.82**	**856**
	2001	18,938	99,859	19.0	21	0	0	5	9	3	29	83	0	**150**	41	17	0	0	0	0	0	0	0	0	**58**	**208**	**1.10**	**1,095**
	2002	21,165	102,975	20.6	53	0	0	13	41	29	38	92	0	**266**	43	17	0	0	0	0	0	0	0	0	**60**	**326**	**1.54**	**1,583**
	2003	19,912	80,143	24.9	42	0	0	4	29	1	7	76	0	**159**	116	57	0	0	0	0	0	0	0	0	**173**	**332**	**1.67**	**1,336**

Appendix B: Table 3. Coded-wire tag recoveries of summer steelhead released from WDFW LFC. Recoveries shown are for those areas outside the Snake River Basin, and the Walla Walla Basin. Total Recoveries by brood year and Total SAR are from CWT recoveries only.

Release Location	Brood year	CWT fish released	Total number released	%of total release	Ocean	Quinault River	Columbia R. – below Bonneville Net	Columbia R. – below Bonneville Sport	Below Bonneville – Tributary Sport	Columbia R. – above Bonneville Net	Columbia R. – above Bonneville Sport	Columbia River Hatchery	Above Bonneville – Tributary Sport	Mouth/Macks Canyon/Kloan	Sherars Falls	Subsistance Fishery	Warm Springs NFH	Pelton Dam	Umatilla River	Total Below LSRCP Project Area	Total Within LSRCP project Area	Total Return by Brood Year	Total SAR
Grande Ronde	1984	78,431	149,408	52.5	3	0	0	77	0	550	0	0	0	26	0	0	10	3	0	**669**	**655**	**1,248**	**0.84**
	1985	59,722	124,200	48.1	3	0	0	51	0	558	1	0	0	45	0	0	5	3	2	**668**	**489**	**1,017**	**0.82**
	1986	79,984	253,345	31.6	1	0	0	79	0	667	9	0	0	9	2	0	11	2	6	**786**	**448**	**1,419**	**0.56**
	1996	38,405	274,886	14.0	0	0	0	4	0	2	1	0	0	0	0	0	2	0	0	**10**	**144**	**1,031**	**0.37**
	1997	48,598	252,211	19.3	0	0	2	20	0	16	2	0	11	3	0	0	0	0	0	**54**	**276**	**1,432**	**0.57**
	1998	88,980	268,803	33.1	0	0	20	69	0	53	10	0	182	15	0	0	0	1	0	**350**	**1,246**	**3,764**	**1.40**
	1999	75,199	274,146	27.4	0	0	50	84	0	35	9	0	9	65	0	0	5	9	0	**267**	**1,820**	**6,635**	**2.42**
	2000	39,905	215,584	18.5	0	0	2	7	0	9	21	0	0	13	0	1	0	5	0	**58**	**692**	**3,738**	**1.73**
	2001	40,520	182,722	22.2	2	0	8	15	0	14	6	0	0	1	0	1	0	1	0	**47**	**905**	**4,081**	**2.23**
	2002	40,366	236,627	17.1	0	0	0	30	0	13	12	0	14	0	0	0	0	0	0	**69**	**656**	**3,845**	**1.63**
	2003	40,202	138,179	29.1	0	0	0	0	0	33	27	0	0	1	0	0	0	5	0	**66**	**755**	**2,607**	**1.89**
Asotin	1989	39811	137,847	28.9	7	0	138	72	0	103	19	0	0	5	0	0	1	1	9	**355**	**182**	**630**	**0.46**
Wallowa R.	1982	62,193	114,085	54.5	1	0	0	13	0	225	0	0	0	0	1	21	3	19	0	**283**	**227**	**416**	**0.36**
Lyons Ferry	1982	48,998	138552	35.4	3	0	0	38	0	252	0	0	0	2	0	0	0	0	0	**295**	**224**	**633**	**0.46**
	1984	51,846	170706	30.4	1	0	0	58	0	260	4	0	0	0	0	0	0	0	0	**323**	**425**	**1,399**	**0.82**
	1985	100,821	197350	51.1	25	0	0	109	0	821	0	0	0	11	0	0	1	0	0	**967**	**543**	**1,063**	**0.54**
	1986	101,292	196,361	51.6	1	0	0	102	0	649	0	0	0	6	0	0	0	0	0	**758**	**894**	**1,733**	**0.88**
	1987	100,096	105,117	95.2	14	0	36	120	0	346	10	1	0	7	0	0	0	0	0	**534**	**894**	**939**	**0.89**
	1988	96,237	98,504	97.7	0	0	105	70	0	56	5	0	0	0	0	0	0	0	0	**236**	**763**	**781**	**0.79**
	1989	38,511	43,479	88.6	2	0	93	1	0	34	6	0	0	3	0	0	0	0	0	**139**	**245**	**277**	**0.64**
	1994	39,736	66,972	59.3	1	0	16	33	0	24	17	0	11	8	0	0	0	0	0	**110**	**893**	**1,505**	**2.25**
	1995	58,827	71,942	81.7	0	0	14	16	0	22	9	0	76	3	0	0	1	0	1	**142**	**477**	**582**	**0.81**
	1996	79,768	81,162	98.3	0	0	4	8	0	0	0	0	0	0	0	0	0	0	0	**12**	**213**	**217**	**0.27**
	1997	81,266	93,842	86.6	0	0	2	25	0	11	6	0	1	2	0	0	0	0	1	**48**	**685**	**791**	**0.84**
	1998	78,296	87,992	89.0	0	0	15	6	0	18	44	0	25	5	0	0	0	0	0	**113**	**594**	**668**	**0.76**
	1999	20,055	59,942	33.5	0	0	5	33	0	20	5	0	0	2	0	0	0	0	1	**66**	**552**	**1,650**	**2.75**
	2000	19,726	53,551	36.8	0	0	0	39	0	2	11	0	0	10	0	0	0	0	1	**63**	**232**	**630**	**1.18**
	2001	19,236	62,612	30.7	0	0	1	31	0	24	2	0	0	3	0	0	0	0	0	**61**	**287**	**934**	**1.49**
	2002	21,041	60,001	35.1	0	0	3	57	0	5	0	0	0	2	0	0	0	0	0	**66**	**393**	**1,121**	**1.87**
	2003	20,069	59,993	33.5	0	0	0	20	0	5	37	0	0	1	0	0	0	0	0	**63**	**262**	**783**	**1.31**

Appendix B: Table 3 continued,

Release Location	Brood year	CWT fish released	Total number released	%of total release	Ocean	Quinault River	Columbia R. – below Bonneville Net	Columbia R. – below Bonneville Sport	Below Bonneville – Tributary Sport	Columbia R. – above Bonneville Net	Columbia R. – above Bonneville Sport	Columbia River Hatchery	Above Bonneville – Tributary Sport	Mouth/Macks Canyon/Kloan	Sherars Falls	Subsistance Fishery	Warm Springs NFH	Pelton Dam	Umatilla River	Total Below LSRCP Project Area	Total Within LSRCP project Area	Total Return by Brood Year	Total SAR
Tucannon @ Curl Lake AP	1984	75,334	151,609	49.7	6	0	0	25	0	121	1	0	0	4	0	0	0	0	0	**157**	**135**	**272**	**0.18**
	1985	80,034	141,068	56.7	2	0	0	27	0	179	0	0	0	2	0	0	0	0	0	**210**	**157**	**277**	**0.20**
	1986	60,706	162,231	37.4	0	0	0	10	0	96	0	0	0	6	0	0	0	0	0	**112**	**121**	**327**	**0.20**
	1987	59,963	161,293	37.2	2	0	11	0	0	91	1	0	0	2	0	0	0	0	0	**107**	**223**	**599**	**0.37**
	1988	60,373	160,131	37.7	0	0	32	32	0	30	4	0	0	2	0	0	0	0	0	**100**	**169**	**448**	**0.28**
	1989	39,597	79,252	50.0	6	0	101	36	0	38	0	0	0	0	0	0	0	0	0	**181**	**155**	**310**	**0.39**
	1990	39,946	120,560	33.1	0	0	20	14	0	20	0	0	0	0	0	0	0	0	3	**57**	**197**	**595**	**0.49**
	1991	29,264	60,098	48.7	0	0	4	0	0	4	0	0	0	0	0	0	0	0	0	**8**	**38**	**78**	**0.13**
	1992	21,916	76,160	28.8	0	0	30	22	0	23	4	0	0	5	0	0	0	3	15	**102**	**203**	**705**	**0.93**
	1993	49,160	135,359	36.3	0	0	16	26	4	22	15	0	0	16	0	0	0	3	21	**123**	**225**	**650**	**0.46**
	1994	52,644	146,070	36.0	0	0	11	45	0	16	6	0	0	13	0	0	0	3	90	**184**	**466**	**1,294**	**0.89**
	1995	26,652	139,242	19.1	0	0	1	6	0	0	2	0	0	0	0	0	0	0	4	**13**	**41**	**214**	**0.15**
	1996	26,636	110,005	24.2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	5	**7**	**26**	**107**	**0.10**
Tucannon Direct @ Marengo Br. or Enrich Br.	1989	39,732	40,012	99.3	3	0	78	14	0	49	0	0	0	2	0	0	0	4	0	**150**	**79**	**80**	**0.20**
	1990	39,631	39,985	99.1	0	0	66	52	0	56	0	0	0	7	0	0	0	0	0	**181**	**296**	**299**	**0.75**
	1991	29,419	29,888	98.4	2	0	17	9	0	6	0	0	0	0	0	0	0	0	0	**34**	**55**	**56**	**0.19**
	1992	29,517	29,876	98.8	1	0	18	2	4	0	23	0	1	3	0	0	0	0	14	**66**	**162**	**164**	**0.55**
	1995	29,135	30,464	95.6	0	0	0	17	0	16	2	0	4	3	0	0	0	0	14	**56**	**208**	**217**	**0.71**
	1996	27,076	29,966	90.4	0	0	1	0	0	3	0	0	0	0	0	0	0	0	0	**4**	**67**	**74**	**0.25**
	1997	49,385	160,068	30.9	0	0	4	45	0	19	1	0	18	2	0	0	0	0	7	**96**	**546**	**1,770**	**1.11**
	1998	39,665	179,089	22.1	0	0	19	41	0	8	0	0	26	5	0	0	0	0	8	**107**	**324**	**1,463**	**0.82**
	1999	39,505	145,768	27.1	0	0	20	31	0	19	9	0	13	24	0	1	0	1	8	**126**	**667**	**2,461**	**1.69**
	2000	19,742	121,390	16.3	0	0	0	44	0	4	40	0	0	18	0	14	0	1	0	**121**	**156**	**959**	**0.79**
	2001	20,468	135,203	15.1	0	0	0	8	0	0	0	0	1	3	0	0	0	0	0	**12**	**273**	**1,803**	**1.33**
	2002	20,735	115,496	17.9	1	0	1	31	0	3	1	0	0	1	0	0	0	0	0	**38**	**339**	**1,888**	**1.63**
	2003	20201	83726	24.1	1	0	0	0	0	3	12	0	0	4	0	0	0	0	0	**20**	**221**	**916**	**1.09**
Tucannon Direct Upper River Near Curl Lake	1983	113,600	195,315	58.2	1	0	0	25	0	401	19	0	0	0	0	0	0	0	0	**446**	**536**	**922**	**0.47**
	1990	39,740	40,216	98.8	10	0	48	47	0	34	0	0	0	2	0	0	0	1	0	**142**	**273**	**276**	**0.69**
	1991	28,946	30,096	96.2	0	0	13	1	0	11	0	0	0	0	0	0	0	0	0	**25**	**72**	**75**	**0.25**
	1992	29,701	30,001	99.0	1	0	25	37	0	23	38	0	0	5	0	0	0	3	10	**142**	**150**	**152**	**0.51**

Appendix B: Table 3 continued,

Release Location	Brood year	CWT fish released	Total number released	%of total release	Ocean	Quinault River	Columbia R. – below Bonneville Net	Columbia R. – below Bonneville Sport	Below Bonneville – Tributary Sport	Columbia R. – above Bonneville Net	Columbia R. – above Bonneville Sport	Columbia River Hatchery	Above Bonneville – Tributary Sport	Mouth/Macks Canyon/Kloan	Sherars Falls	Subsistance Fishery	Warm Springs NFH	Pelton Dam	Umatilla River	Total Below LSRCP Project Area	Total Within LSRCP project Area	Total Return by Brood Year	Total SAR
Touchet	1987	78,254	170,724	45.8	5	0	39	107	0	338	12	0	0	14	0	0	0	0	1	**516**	**798**	**1,741**	**1.02**
	1988	81,106	158,446	51.2	3	0	112	33	0	83	38	0	0	4	0	0	0	0	0	**273**	**730**	**1,426**	**0.90**
	1989	39,530	116,345	33.9	1	0	57	36	0	57	39	0	0	4	0	0	0	0	0	**194**	**170**	**500**	**0.43**
	1990	120,196	148,520	80.9	2	0	195	139	0	244	104	1	0	15	0	0	0	0	3	**703**	**1,843**	**2,277**	**1.53**
	1991	45,377	95,517	47.5	0	0	39	30	0	52	79	0	0	7	0	0	0	1	0	**208**	**357**	**749**	**0.78**
	1992	40,331	110,099	36.6	0	0	67	36	0	46	37	0	0	7	0	0	0	0	6	**199**	**561**	**1,531**	**1.39**
	1994	60,220	120,710	49.9	3	0	9	77	0	33	6	0	24	7	0	0	0	0	0	**159**	**1,671**	**3,349**	**2.77**
	1995	78,689	134,610	58.5	1	0	21	44	0	42	5	0	24	2	0	0	0	1	0	**140**	**771**	**1,319**	**0.98**
	1996	55,595	142,824	38.9	0	0	0	11	0	5	1	0	0	1	0	0	0	0	0	**18**	**308**	**791**	**0.55**
	1997	39,668	125,127	31.7	0	0	4	22	0	6	2	0	0	1	0	0	0	0	0	**35**	**674**	**2,126**	**1.70**
	1999	39,282	124,654	31.5	0	0	24	53	0	11	69	0	1	12	0	0	0	0	0	**170**	**966**	**3,065**	**2.46**
	2000	20,439	102,765	19.9	0	0	1	5	0	0	35	0	0	1	0	0	0	0	0	**42**	**112**	**567**	**0.55**
	2001	20,407	125,391	16.3	0	0	3	0	0	7	1	0	0	0	0	0	0	0	0	**11**	**274**	**1,684**	**1.34**
	2002	20,627	100,445	20.5	0	0	1	36	0	5	9	0	0	3	0	0	0	0	0	**54**	**240**	**1,169**	**1.16**
	2003	19,902	86,347	23.1	0	0	0	16	0	2	73	0	0	0	0	0	0	0	1	**92**	**268**	**1,163**	**1.35**
Walla Walla	1989	39,340	130,217	30.2	0	0	59	7	0	48	14	0	0	0	0	0	0	0	0	**128**	**110**	**364**	**0.28**
	1992	38,905	83,240	49.7	1	0	40	18	0	59	64	0	28	0	0	0	0	0	7	**217**	**309**	**661**	**0.79**
	1993	60,260	159,905	37.7	1	0	54	126	0	49	102	0	144	13	0	0	0	0	5	**494**	**1,398**	**3,710**	**2.32**
	1994	49,955	158,875	31.4	0	0	18	99	0	10	2	0	20	3	0	0	0	0	0	**152**	**1,173**	**3,731**	**2.35**
	2000	18,856	103,980	18.1	0	0	0	7	0	1	0	2	0	0	0	2	0	0	0	**12**	**155**	**855**	**0.82**
	2001	18,938	99,859	19.0	0	0	1	5	0	8	18	0	0	0	0	0	0	0	0	**31**	**208**	**1,097**	**1.10**
	2002	21,165	102,975	20.6	0	0	2	18	0	4	11	0	0	0	0	0	0	0	0	**35**	**326**	**1,586**	**1.54**
	2003	19,912	80,143	24.9	0	0	0	0	0	6	78	0	0	2	0	0	0	0	0	**86**	**332**	**1,336**	**1.67**

Appendix B: Table 4. Maximum return (CWT + freeze brand recoveries) and estimated SARs of LFC summer steelhead (Total and to the LSRCP project area).

Release Location	Brood year	CWT fish released	Total number released	%of total release	CWT Total Below LSRCP Project Area	CWT Total below Lower Granite	CWT Total above Lower Granite	Freeze Brand Total above Lower Granite	Maximum Return Total	SAR Total	Maximum Return to LSRCP Project	SAR to LSRCP Project Area
Grande	1984	78,431	149,408	52.5	669	26	628	1,489	2,184	2.78	1,515	1.93
Ronde	1985	59,722	124,200	48.1	668	109	380	832	1,609	2.69	941	1.58
	1986	79,984	253,345	31.6	786	22	426	1,178	1,986	2.48	1,200	1.50
	1996	38,405	274,886	14.0	10	6	138	157	173	0.45	163	0.42
	1997	48,598	252,211	19.3	54	37	239	441	532	1.09	478	0.98
	1998	88,980	268,803	33.1	350	7	1,239	1,797	2,154	2.42	1,804	2.03
	1999	75,199	274,146	27.4	267	51	1,769	2,956	3,274	4.35	3,007	4.00
	2000	39,905	215,584	18.5	58	39	653	823	920	2.31	862	2.16
	2001	40,520	182,722	22.2	47	23	882	343	952	2.35	905	2.23
	2002	40,366	236,627	17.1	69	18	638	NA	725	1.80	656	1.63
	2003	40,202	138,179	29.1	66	42	713	NA	821	2.06	755	1.89
Average										**2.25**		**1.85**
Asotin	1989	39,811	137,847	28.9	355	81	101	612	1,048	2.63	693	1.74
Wallowa R.	1982	62,193	114,085	54.5	283	11	216	503	797	1.28	514	0.83
Lyons	1982	48,998	138,552	35.4	295	89	135	499	883	1.80	588	1.20
Ferry	1984	51,846	170,706	30.4	323	181	244	723	1,227	2.37	904	1.74
	1985	100,821	197,350	51.1	967	318	225	1,148	2,433	2.41	1,466	1.45
	1986	101,292	196,361	51.6	758	645	249	1,602	3,005	2.97	2,247	2.22
	1987	100,096	105,117	95.2	534	625	269	1,414	2,573	2.57	2,039	2.04
	1988	96,237	98,504	97.7	236	665	98	350	1,251	1.30	1,015	1.05
	1989	38,511	43,479	88.6	139	136	109	353	628	1.63	489	1.27
	1994	39,736	66,972	59.3	110	845	48	581	1,536	3.87	1,426	3.59
	1995	58,827	71,942	81.7	142	401	76	298	841	1.43	699	1.19
	1996	79,768	81,162	98.3	12	169	44	248	429	0.54	417	0.52
	1997	81,266	93,842	86.6	48	652	33	542	1,242	1.53	1,194	1.47
	1998	78,296	87,992	89.0	113	578	16	502	1,193	1.52	1,080	1.38
	1999	20,055	59,942	33.5	66	432	120	314	812	4.05	746	3.72
	2000	19,726	53,551	36.8	63	222	10	48	333	1.69	270	1.37
	2001	19,236	62,612	30.7	61	238	49	47	348	1.81	287	1.49
	2002	21,041	60,001	35.1	67	295	98	NA	460	2.19	393	1.87
	2003	20,069	59,993	33.5	63	244	18	NA	325	1.62	262	1.31
Average										**2.08**		**1.70**

Appendix B: Table 4, continued

Release Location	Brood year	CWT fish released	Total number released	%of total release	CWT Total Below LSRCP Project Area	CWT Total below Lower Granite	CWT Total above Lower Granite	Freeze Brand Total above Lower Granite	Maximum Return Total	SAR Total	Maximum Return to LSRCP Project	SAR to LSRCP Project Area
Tucannon	1984	75,334	151,609	49.7	157	53	81	345	555	0.74	398	0.53
@ Curl	1985	80,034	141,068	56.7	210	70	88	468	748	0.93	538	0.67
Lake AP	1986	60,706	162,231	37.4	112	63	58	465	640	1.05	528	0.87
	1987	59,963	161,293	37.2	107	95	128	429	474	1.05	524	0.87
	1988	60,373	160,131	37.7	100	125	45	249	474	0.79	524	0.62
	1989	39,597	79,252	50.0	181	113	41	542	836	2.11	655	1.65
	1990	39,946	120,560	33.1	57	72	125	163	292	0.73	235	0.59
	1991	29,264	60,098	48.7	8	29	9	40	77	0.26	69	0.24
	1992	21,916	76,160	28.8	102	137	65	209	448	2.04	346	1.58
	1993	49,160	135,359	36.3	123	169	55	175	467	0.95	344	0.70
	1994	52,644	146,070	36.0	184	311	154	521	1,016	1.93	832	1.58
	1995	26,652	139,242	19.1	13	39	2	36	88	0.33	75	0.28
	1996	26,636	110,005	24.2	7	12	14	68	87	0.33	80	0.30
Average										**1.02**		**0.81**
Tucannon	1989	39,732	40,012	99.3	150	21	58	391	562	1.41	412	1.04
Direct @	1990	39,631	39,985	99.1	181	181	109	520	888	2.24	707	1.78
Marengo	1991	29,419	29,888	98.4	34	55	0	72	161	0.55	127	0.43
Br. or	1992	29,517	29,876	98.8	66	128	34	135	329	1.11	263	0.89
Enrich Br.	1995	29,135	30,464	95.6	56	148	60	250	454	1.59	398	1.37
	1996	27,076	29,966	90.4	4	51	16	153	208	0.77	204	0.75
	1997	49,385	160,068	30.9	96	352	194	640	1,088	2.20	992	2.01
	1998	39,665	179,089	22.1	107	300	24	367	774	1.95	667	1.68
	1999	39,505	145,768	27.1	123	563	104	590	1,279	3.24	1,153	2.92
	2000	19,742	121,390	16.3	121	156	0	60	337	1.71	216	1.09
	2001	20,468	135,203	15.1	12	138	135	107	257	1.26	245	1.20
	2002	20,735	115,496	17.9	38	235	104	NA	377	1.82	339	1.63
	2003	20,201	83,726	24.1	20	140	81	NA	241	1.19	221	1.09
Average										**1.62**		**1.38**
Tucannon	1983	113,600	195,315	58.2	446	13	523	1,273	1,732	1.52	1,286	1.13
Direct	1990	39,740	40,216	98.8	142	165	108	360	667	1.68	525	1.32
Upper	1991	28,946	30,096	96.2	25	34	38	51	110	0.38	85	0.29
	1992	29,701	30,001	99.0	142	126	24	188	456	1.54	314	1.06
Average										**1.28**		**0.95**

Appendix B: Table 4, continued

Release Location	Brood year	CWT fish released	Total number released	%of total release	CWT Total Below LSRCP Project Area	CWT Total below Lower Granite	CWT Total above Lower Granite	Freeze Brand Total above Lower Granite	Maximum Return Total	SAR Total	Maximum Return to LSRCP Project	SAR to LSRCP Project Area
Touchet	1987	78,254	170,724	45.8	516	705	93	477	1,698	2.17	1,182	1.51
	1988	81,106	158,446	51.2	273	717	13	189	1,179	1.45	906	1.12
	1989	39,530	116,345	33.9	194	127	43	81	402	1.02	208	0.53
	1990	120,196	148,520	80.9	703	1,633	210	621	2,957	2.46	2,254	1.88
	1991	45,377	95,517	47.5	208	351	5	29	588	1.30	380	0.84
	1992	40,331	110,099	36.6	199	527	34	224	950	2.36	751	1.86
	1994	60,220	120,710	49.9	159	1,596	75	794	2,549	4.23	2,390	3.97
	1995	78,689	134,610	58.5	140	661	110	302	1,103	1.40	963	1.22
	1996	55,595	142,824	38.9	18	269	39	217	504	0.91	486	0.87
	1997	39,668	125,127	31.7	35	643	31	244	922	2.32	887	2.24
	1999	39,282	124,654	31.5	170	966	0	256	1,392	3.54	1,222	3.11
	2000	20,439	102,765	19.9	42	112	1	59	213	1.04	171	0.84
	2001	20,407	125,391	16.3	11	243	31	NA	285	1.40	274	1.34
	2002	20,627	100,445	20.5	54	218	22	NA	294	1.43	240	1.16
	2003	19,902	86,347	23.1	92	222	46	NA	360	1.81	268	1.35
Average										**1.92**		**1.59**
Walla	1989	39,340	130,217	30.2	128	109	1	25	262	0.67	134	0.34
Walla	1992	38,905	83,240	49.7	217	298	11	110	625	1.61	408	1.05
	1993	60,260	159,905	37.7	494	1,340	58	300	2,134	3.54	1,640	2.72
	1994	49,955	158,875	31.4	152	1,096	77	395	1,643	3.29	1,491	2.98
	2000	18,856	103,980	18.1	12	145	10	NA	167	0.89	155	0.82
	2001	18,938	99,859	19.0	32	150	58	NA	240	1.27	208	1.10
	2002	21,165	102,975	20.6	35	266	60	NA	361	1.71	326	1.54
	2003	19,912	80,143	24.9	86	159	173	NA	418	2.10	332	1.67
Average										**1.88**		**1.53**

Appendix C

Summer Steelhead Index Areas for Spawning Ground Surveys in 2007 and 2008

Appendix C: Table 1. Start and stop coordinates (latitude and longitude) for index sections and final walks for summer steelhead spawning ground surveys in the Tucannon and Touchet rivers, and Asotin Creek, 2007. (Note: Reference coordinates were determined from Maptech® Terrain Navigator Pro Software – Decimal Format – WGS 84). Locations provided are in a downstream to upstream progression.

Stream	Reach #	Stream – Surveyed Section	Upstream coordinates (Start)		Downstream coordinates (Stop)	
Tucannon	Reach 1	Index 1	46.4609024 N	117.8578918 W	46.4656627 N	117.8981895 W
		Final Walk 1	46.4776196 N	117.9404769 W	46.4888853 N	117.9617449 W
		Final Walk 2	46.4548195 N	117.8209948 W	46.4609024 N	117.8578918 W
	Reach 2	Index 1	46.243477 N	117.441748 W	46.4402013 N	117.7499048 W
		Index 2	46.3335051 N	117.6764251 W	46.3469464 N	117.6818743 W
		Final Walk 1	46.3684588 N	117.6914114 W	46.3905060 N	117.6991451 W
		Final Walk 2	46.3469464 N	117.6818743 W	46.3684588 N	117.6914114 W
	Reach 3	Index 1	46.3184570 N	117.6636783 W	46.3335051 N	117.6764251 W
		Index 2	46.2843364 N	117.6566065 W	46.3055286 N	117.6538663 W
		Index 3	46.2431901 N	117.6889240 W	46.2594785 N	117.6684503 W
		Index 4	46.2064325 N	117.7070981 W	46.2237775 N	117.7217789 W
	Reach 4	Final Walk 1	46.154963 N	117.365969 W	46.195705 N	117.403019 W
Touchet	North Fork	Index 1	46.2403915 N	117.8659865 W	46.2709703 N	117.8901357 W
		Index 2	46.2877384 N	117.9213268 W	46.3013313 N	117.9594511 W
		Final Walk 1	46.1891239 N	117.8231971 W	46.2309496 N	117.8513156 W
	South Fork	Index 1	46.1994283 N	117.9558754 W	46.2218739 N	117.9480657 W
		Index 2	46.2426344 N	117.9344154 W	46.2633666 N	117.9397129 W
		Final Walk 1	46.2633666 N	117.9397129 W	46.2822762 N	117.9577990 W
		Final Walk 2	46.1086901 N	117.9823739 W	46.1510594 N	117.9745474 W
		Final Walk 3	46.1510594 N	117.9745474 W	46.1994283 N	117.9558754 W
	Wolf Fork	Index 1	46.1821242 N	117.8630134 W	46.2019177 N	117.8692192 W
		Index 2	46.2332365 N	117.8811240 W	46.2507992 N	117.9022599 W
		Final Walk 1	46.1476939 N	117.8747643 W	46.1821242 N	117.8630134 W
		Final Walk 2	46.2507992 N	117.9022599 W	46.2740840 N	117.8960812 W
	Robinson Fork	Index 1	46.1715255 N	117.9198603 W	46.2147287 N	117.8948932 W
Asotin	Mainstem	Index 1	46.2736428 N	117.2922465 W	46.2994710 N	117.2656072 W
		Index 2	46.3151888 N	117.2428068 W	46.3292206 N	117.1542946 W
		Index 3	46.3226523 N	117.1322349 W	46.3218950 N	117.1214299 W
		Index 4	46.3218950 N	117.1214299 W	46.3256108 N	117.1086907 W
		Final Walk 1	46.2994710 N	117.2656072 W	46.3151888 N	117.2428068 W
		Final Walk 2	46.3292206 N	117.1542946 W	46.3226523 N	117.1322349 W
	North Fork	Index 1	46.2621031 N	117.2967454 W	46.2736428 N	117.2922465 W
		Index 2	46.2362854 N	117.3585477 W	46.2422111 N	117.3238100 W
		Final Walk 1	46.2169880 N	117.3968698 W	46.2362854 N	117.3968698 W
		Final Walk 2	46.2422111 N	117.3238100 W	46.2621031 N	117.2967454 W
	South Fork	Index 1	46.2409751 N	117.2846588 W	46.2725318 N	117.2921665 W
		Final Walk 1	46.1910573 N	117.3239375 W	46.2073209 N	117.2928093 W
		Final Walk 2	46.2073209 N	117.2928093 W	46.2254787 N	117.2809943 W
		Final Walk 3	46.2254787 N	117.2809943 W	46.2409740 N	117.3846939 W
	Charley Creek	Index 1	46.2823990 N	117.3589155 W	46.2859746 N	117.3108819 W
		Final Walk 1	46.2828110 N	117.3982001 W	46.2812295 N	117.3778894 W
		Final Walk 2	46.2812295 N	117.3778894 W	46.2823990 N	117.3589155 W
		Final Walk 3	46.2859746 N	117.3108819 W	46.2884163 N	117.2784403 W
		Final Walk 4	46.2884163 N	117.2784403 W	46.2885877 N	117.2784403 W

Appendix C: Table 2. Start and stop coordinates (latitude and longitude) for index sections and final walks for summer steelhead spawning ground surveys in the Tucannon and Touchet rivers, and Asotin Creek, 2008. (Note: Reference coordinates were determined from Maptech® Terrain Navigator Pro Software – Decimal Format – WGS 84). Locations provided are in a downstream to upstream progression.

Stream – Surveyed Section	Upstream coordinates (Start)		Downstream coordinates (Stop)	
Tucannon River				
Reach 1				
Index A	46.4888853 N	117.9617449 W	46.4993427 N	117.9784137 W
Index B	46.4993427 N	117.9784137 W	46.5081261 N	117.9981987 W
Final Walk 1	46.5081261 N	117.9981987 W	46.5051292 N	118.0170947 W
Reach 2				
Index 1	46.4548195 N	117.8209948 W	46.4656627 N	117.8981895 W
Index 2	46.4802057 N	117.9490281 W	46.4888853 N	117.9617449 W
Reach 3				
Index 3	46.4213042 N	117.7308758 W	46.4402013 N	117.7499048 W
Reach 4				
Final Walk 1	46.175587 N	117.382040 W	46.195705 N	117.403019 W
Touchet River				
North Fork Touchet Reach				
Index 1	46.2403915 N	117.8659865 W	46.2709703 N	117.8901357 W
Index 2	46.2877384 N	117.9213268 W	46.3013313 N	117.9594511 W
South Fork Touchet Reach				
Index 1	46.1994283 N	117.9558754 W	46.2218739 N	117.9480657 W
Index 2	46.2426344 N	117.9344154 W	46.2633666 N	117.9397129 W
Wolf Fork Touchet Reach				
Index 1	46.1821242 N	117.8630134 W	46.2019177 N	117.8692192 W
Index 2	46.2332365 N	117.8811240 W	46.2507992 N	117.9022599 W
Asotin Creek				
Main Asotin Creek Reach				
Index 1	46.2736428 N	117.2922465 W	46.2994710 N	117.2656072 W
Index 2	46.3151888 N	117.2428068 W	46.3292206 N	117.1542946 W
Index 3	46.3218950 N	117.1214299 W	46.3256108 N	117.1086907 W
NF Asotin Creek Reach				
Index 1	46.2621031 N	117.2967454 W	46.2736428 N	117.2922465 W
Index 2	46.2362854 N	117.3585477 W	46.2422111 N	117.3238100 W
SF Asotin Creek Reach				
Index 1	46.2409751 N	117.2846588 W	46.2725318 N	117.2921665 W
Charley Creek Reach				
Index 1	46.2823990 N	117.3589155 W	46.2859746 N	117.3108819 W

Appendix D

Estimates of Juvenile Summer Steelhead Densities in SE Washington Rivers that are part of the LSRCP Program – Summer of 2006.

Appendix D: Table 1. Summary of natural origin juvenile summer steelhead / rainbow trout mean densities (fish/100 m2) by age class for SE Washington rivers that are a part of the LSRCP Program.

Stream Name	Asotin Creek				Touchet River				Tucannon River	Cummings Creek
Year	Main	North Fork	South Fork	Charley Creek	North Fork	South Fork	Wolf Fork	Robinson Fork	Main	Main
Age 0 Steelhead / Rainbow Trout										
1983	- - -	23.7	44.3	- - -	- - -	- - -	- - -	- - -	- - -	- - -
1984	- - -	6.6	39.0	- - -	- - -	- - -	- - -	- - -	16.0	- - -
1985	- - -	- - -	- - -	73.0	- - -	- - -	- - -	- - -	- - -	- - -
1986	- - -	29.7	- - -	- - -	- - -	- - -	- - -	- - -	18.4	- - -
1987	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	20.6	- - -
1988	- - -	45.8	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
1989	- - -	22.8	6.0	- - -	- - -	- - -	- - -	- - -	18.1	- - -
1990	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	19.1	- - -
1991	- - -	22.1	1.8	- - -	- - -	- - -	- - -	- - -	13.0	- - -
1992	- - -	56.9	50.0	- - -	35.5	42.8	41.1	- - -	17.4	- - -
1993	49.1	36.8	78.7	- - -	26.0	8.7	21.8	- - -	14.6	43.2
1994	36.8	20.4	0.8	19.0	20.8	16.2	20.2	- - -	- - -	42.9
1995	47.7	23.4	34.5	- - -	42.5	31.1	25.0	- - -	11.0	32.4
1996	62.8	13.0	2.0	64.4	4.9	1.9	2.3	- - -	15.8	47.8
1997	33.4	24.0	32.5	- - -	28.5	11.6	21.1	- - -	16.5	- - -
1998	52.2	44.6	32.9	18.3	15.4	16.7	23.6	- - -	17.2	12.5
1999	20.9	11.0	27.4	12.7	24.5	9.4	15.6	- - -	5.2	31.3
2000	26.6	41.9	21.8	43.0	15.6	10.9	15.3	20.4	19.3	40.3
2001	35.6	33.9	68.8	38.5	23.6	13.8	13.6	25.0	17.8	14.8
2002	37.1	40.4	84.7	65.8	48.0	52.1	43.4	41.7	27.2	54.9
2003	51.9	36.9	83.6	57.7	54.2	32.8	42.9	39.6	21.7	48.9
2004	41.4	23.6	15.0	48.0	33.5	33.8	35.0	16.4	5.3	17.7
2005	41.2	31.1	15.3	12.0	33.3	15.0	24.9	18.4	7.4	19.7
2006	- - -	- - -	64.3	44.8	70.4	29.5	50.2	67.6	14.5	- - -
Age 1+ Steelhead / Rainbow Trout										
1983	- - -	8.7	25.3	- - -	- - -	- - -	- - -	- - -	- - -	- - -
1984	- - -	7.5	30.6	- - -	- - -	- - -	- - -	- - -	2.5	- - -
1985	- - -	- - -	- - -	37.6	- - -	- - -	- - -	- - -	- - -	- - -
1986	- - -	37.6	- - -	- - -	- - -	- - -	- - -	- - -	13.7	- - -
1987	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	8.5	- - -
1988	- - -	8.1	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
1989	- - -	18.1	34.0	- - -	- - -	- - -	- - -	- - -	10.6	- - -
1990	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	9.8	- - -
1991	- - -	14.2	13.9	- - -	- - -	- - -	- - -	- - -	6.5	- - -
1992	- - -	22.2	10.4	- - -	19.0	15.5	8.7	- - -	4.8	- - -
1993	22.1	28.1	42.5	- - -	19.3	15.0	10.5	- - -	7.0	26.3
1994	39.6	34.9	16.4	20.0	18.9	5.8	11.5	- - -	- - -	20.4
1995	13.1	11.2	21.7	- - -	8.9	9.5	6.4	- - -	4.0	29.6
1996	12.2	17.4	11.2	15.3	3.6	10.2	5.3	- - -	3.2	16.6
1997	6.9	6.7	4.6	- - -	2.3	2.8	7.4	- - -	4.6	- - -
1998	10.2	25.5	22.8	49.0	4.9	16.2	13.4	- - -	6.4	12.7
1999	14.4	13.9	17.3	22.9	3.4	8.4	13.0	- - -	4.2	16.1
2000	9.7	16.6	22.3	17.9	11.2	13.3	8.9	11.1	4.9	17.3
2001	19.7	30.4	29.8	23.6	13.7	13.6	11.6	13.6	6.9	8.6
2002	12.0	19.7	24.7	19.4	12.1	10.7	6.6	14.3	4.3	27.4
2003	15.5	18.7	36.2	38.3	16.7	17.2	16.2	27.4	7.20	28.3
2004	20.1	23.6	21.1	27.2	21.1	13.9	16.1	15.9	8.5	25.1
2005	23.3	17.5	13.9	33.2	16.4	17.3	13.5	11.6	2.7	11.9
2006	- - -	- - -	11.9	15.3	15.8	11.3	12.3	11.6	2.7	- - -

Appendix D: Table 2. Densities of natural origin juvenile steelhead/rainbow trout (fish/100 m2) from multiple pass (MP) electrofishing sites in the Tucannon River and Asotin Creek, 2006.

Stream Site Name	Est. rkm	Site length (m)	Mean width (m)	Area (m^2)	Fish/100m^2 Age 0	Fish/100m^2 Age 1+	Fish/100m^2 Legal (>200mm)
Tucannon River							
Tuc HMA1-06 (Top)		45	13.1	588.6	13.76	1.53	0.00
Tuc HMA1-06 (Bottom)		40	14.8	592.0	12.84	3.04	0.00
Tuc HMA2-06 (Top)		40	13.0	518.4	14.66	3.67	0.00
Tuc HMA2-06 (Bottom)		40	13.3	531.2	7.15	3.58	0.00
Tuc HMA3-06 (Top)		50	9.5	475.8	16.60	1.68	0.00
Tuc HMA3-06 (Bottom)		50	13.9	685.0	5.04	4.75	0.00
Tuc HMA4-06 (Top)		40	14.5	580.8	20.66	2.07	0.17
Tuc HMA4-06 (Bottom)		40	11.5	458.7	22.47	3.27	0.00
Tuc HMA5-06 (Top)		35	9.8	341.6	23.13	0.88	0.00
Tuc HMA5-06 (Bottom)		45	13.3	598.5	9.02	2.51	0.00
Asotin Creek							
South Fork Asotin	0.1	50	5.2	261.7	67.26	13.76	0.00
SF+0.1 miles (Top)	0.1	50	4.4	217.5	51.95	22.99	0.00
SF+0.1 miles (Bottom)	0.8	50	5.7	282.5	53.45	14.87	0.00
SF+0.5 miles (Top)	0.8	50	4.3	220.0	37.73	19.09	0.91
SF+0.5 miles (Middle)	0.8	50	3.4	167.5	46.57	8.96	0.00
SF+0.5 miles (Bottom)	3.0	50	4.0	198.3	87.73	4.03	1.01
SF2-00	5.4	50	3.8	191.7	52.69	6.26	0.52
SF3-00	8.2	50	4.8	238.0	66.39	7.14	1.26
SF4-00	11.5	50	3.1	157.0	115.29	10.19	0.00
SF5-00							
Charley Creek							
CC01-01	0.3	50	3.5	175.0	24.57	7.43	0.00
CC+2.4 miles (Top)	3.7	50	3.6	182.0	25.27	22.53	0.55
CC+2.4 miles (Middle)	3.7	50	3.0	148.3	40.46	19.55	4.94
CC+2.4 miles (Bottom)	3.7	50	3.1	155.0	42.58	20.65	0.00
CC+4.0 miles (Top)	6.4	50	3.7	186.7	46.61	11.79	8.58
CC+4.0 miles (Bottom)	6.4	50	3.1	154.0	60.39	14.94	1.30
CC4-01	9.1	46	2.9	132.5	73.97	10.57	0.75

Appendix D: Table 3.Densities of natural origin juvenile steelhead/rainbow trout (fish/100 m2) from multiple pass (MP) electrofishing sites in the Touchet River basin, 2006.

Stream Site Name	Est. Rkm	Site length (m)	Mean width (m)	Area (m^2)	Fish/100m^2 Age 0	Fish/100m^2 Age 1+	Fish/100m^2 Legal (>200mm)
North Fork							
NFT1-01 (Top)	0.1	50	9.9	495.0	55.96	5.05	0.00
NFT1-01 (Bottom)	0.1	50	9.2	460.0	63.04	8.48	0.00
NFT3-01 (Top)	6.8	65	7.8	507.0	96.84	15.58	0.00
NFT3-01 (Bottom)	6.8	50	6.5	325.0	91.08	20.62	0.31
NFT5-01 (Top)	12.4	50	8.2	710.0	59.02	23.41	0.24
NFT5-01 (Bottom)	12.4	50	6.6	330.0	56.67	21.82	0.00
South Fork							
SFT1-01 (Top)	0.1	75	7.4	555.0	41.80	0.72	0.00
SFT1-01 (Bottom)	0.1	75	5.9	551.5	40.90	0.90	0.00
SFT3-02 (Top)	7.0	50	6.4	320.0	14.38	8.13	0.31
SFT3-02 (Bottom)	7.0	50	6.0	300.0	25.00	1.67	0.00
SFT5-02 (Top)	13.4	52	4.4	228.8	33.65	45.02	0.44
SFT5-02 (Bottom)	13.4	50	5.5	275.0	21.09	11.27	0.00
Wolf Fork							
WF1-01 (Top)	0.2	50	8.6	430.0	71.63	6.74	0.00
WF1-01 (Bottom)	0.2	50	7.6	380.0	127.37	6.32	0.00
WF3-01 (Top)	4.3	50	8.0	400.0	22.75	10.0	0.00
WF3-01 (Bottom)	4.3	50	8.7	435.0	15.40	9.66	0.00
WF6-01 (Top)	10.6	40	8.9	356.0	29.49	17.13	0.00
WF6-01 (Bottom)	10.6	40	10.0	400.0	35.00	16.25	0.00
WF7-01 (Top)	12.6	43	6.0	258.0	43.80	18.60	0.00
WF7-01 (Bottom)	12.6	50	6.3	315.0	55.87	13.65	0.00
Robinson							
RF3-01 (Top)	3.8	50	4.3	215.0	106.98	11.63	0.00
RF3-01 (Middle)	3.8	50	3.7	183.0	81.42	8.74	0.00
RF3-01 (Bottom)	3.8	50	4.1	203.0	67.49	10.84	0.00
RF4-01 (Top)	5.6	50	4.0	200.0	43.00	12.00	0.00
RF4-01 (Bottom)	5.6	48	3.3	156.0	39.10	14.74	0.00

Appendix D: Table 4. Estimated number of other sensitive species present from electrofishing sites in the Tucannon River, Touchet River, and Asotin Creek, 2006. Sites were surveyed using multiple pass (MP) and/or mark/recapture (MR) surveys. Estimates shown below are from MP surveys estimates.

Stream Site Name	Bull Trout Age 0	Bull Trout Age 1+	Bull Trout legal (>200mm)	Whitefish [a]	Brown Trout [b]	Spring Chinook	Hatchery Steelhead	Endemic Hatchery Steelhead
Tucannon River								
Tuc HMA1-06	0	0	2	0	0	70	0	0
Tuc HMA2-06	0	0	0	0	0	68	0	0
Tuc HMA3-06	0	1	0	3-0, 1-legal	0	98	0	34
Tuc HMA4-06	0	0	0	0	0	81	0	6
Tuc HMA5-06	0	0	0	0	0	38	0	18
Touchet River								
North Fork								
NFT1-01	0	0	0	0	6 (age 0)	3	0	9
NFT3-01	0	0	0	0	0	0	0	29
NFT5-01	0	3	2	0	0	0	0	16
South Fork								
SFT1-01	0	0	0	0	0	0	4	1
SFT3-02	0	0	0	0	0	0	0	0
SFT5-02	0	1	0	0	0	0	0	1
Wolf Fork								
WF1-01	0	1	0	0	(5-0, 1-1+, 1-legal)	3	0	6
WF3-01	0	3	0	0	0	4	0	2
WF6-01	0	3	1	0	0	6	0	1
WF7-01	0	0	3	0	0	21	0	3
Robinson								
RF3-01	0	0	0	0	0	0	0	0
RF4-01	0	0	0	0	0	0	0	0
Asotin Creek								
South Fork								
SF+0.1 miles	0	0	0	0	0	0	0	0
SF+0.5 miles	0	0	0	0	0	0	0	0
SF2-00	0	0	0	0	0	0	0	0
SF3-00	0	0	0	0	0	0	0	0
SF4-00	0	0	0	0	0	0	0	0
SF5-00	0	0	0	0	0	0	0	0
Charley Creek								
CC01-01	0	0	0	0	0	0	0	0
CC+2.4 miles	0	0	0	0	0	0	0	0
CC+4.0 miles	0	0	0	0	0	0	0	0
CC4-01	0	0	0	0	0	0	0	0

[a] Whitefish have been observed as Age 0 or legal based on size.

[b] Brown Trout have been observed to have at least three age classes in the Touchet River. We have designated age based on length at time of capture.

Appendix D: Table 5. 2006 Electofishing site locations for the Tucannon River, Touchet River, and Asotin Creek.

Stream / Site name	Approximate GPS Location	Approximate site location/description
Tucannon River		
Tuc HMA1-06 (2 sites)	46.200118 N, 117.403603 W	10m below Old Cummings Creek Bridge
Tuc HMA2-06 (2 sites)	46.183534 N, 117.392974 W	~200m below Tucannon Hatchery Intake
Tuc HMA3-06 (2 sites)	46.172832 N, 117.391263 W	Across from Forest Service Information Board
Tuc HMA4-06 (2 sites)	46.154017 N, 117.395837 W	Across from Big 4 Lake, top is at the overflow from lake
Tuc HMA5-06 (2 sites)	46.142291 N, 117.414412 W	Across from Camp Wooten, old HMA 15 Snorkel Site
Touchet River		
North Fork		
NFT1-01 (2 sites)	46.180469 N, 117.573129 W	~50m above the mouth of the South Touchet (Road Mile 0.1)
NFT3-01 (2 sites)	46.161434 N, 117.531823 W	~50m above Wolf Fork Bridge (Road Mile 4.2)
NFT5-01 (2 sites)	46.135389 N, 117.510852 W	Behind Jerry Dedloff's House (Road Mile 7.6)
South Fork		
SFT1-01 (2 sites)	46.180270 N, 117.573396 W	~20m up from mouth (Road Mile 0.0)
SFT3-02 (2 sites)	46.140023 N, 117.562264 W	2 miles above Pettyjohn Bridge (Road Mile 4.4)
SFT5-02 (2 sites)	46.115700 N, 117.572192 W	~100m above Camp Nancy Lee Bridge (Road Mile 8.4)
Wolf Fork		
WF1-01 (2 sites)	46.161038 N, 117.533960 W	~100m above mouth of the Wolf Fork, behind Fairchild's house
WF3-01 (2 sites)	46.141222 N, 117.533202 W	2.4 miles above Wolf Fork Bridge
WF6-01 (2 sites)	46.114257 N, 117.520342 W	~1/2 mile below new County Road Bridge (Martins Bridge)
WF7-01 (2 sites)	46.105769 N, 117.514703 W	Mouth of Coates Creek (Road Mile 7.8)
Robinson		
RF3-01 (3 sites)	46.122721 N, 117.535833 W	2.4 miles upstream from bridge at mouth
RF4-01 (2 sites)	46.114058 N, 117.541489 W	3.5 miles upstream from bridge at mouth
Asotin Creek		
South Fork Asotin		
SF+0.1 miles (2 sites)	46.161948 N, 117.172968 W	~20m above South Fork mouth
SF+0.5 miles (3 sites)	46.160363 N, 117.172825 W	~0.5 road miles above the SF mouth
SF2-00	46.145349 N, 117.170211 W	2 miles above mouth of South Fork
SF3-00	46.133365 N, 117.165241 W	~50 m downstream from Schlee Bridge
SF4-00	46.123150 N, 117.143066 W	1.7 miles above Schlee Bridge
SF5-00	46.113135 N, 117.191968 W	3.4 miles above Schlee Bridge
Charley Creek		
CC01-01	46.171779 N, 117.171354 W	0.25 miles above main Gate at Koch's house
CC+2.4 miles (3 sites)	46.170614 N, 117.192118 W	2.4 miles above main Gate at Koch's house
CC+4.0 miles (2 sites)	46.170131 N, 117.212081 W	4.0 miles above main Gate at Koch's house
CC4-01	46.165574 N, 117.212081 W	4.4 miles above main Gate at Koch's house

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