1996-1997 ANNUAL REPORT

November 1998

Lyons Ferry Trout Evaluation Study

By Mark L. Schuck, Arthur E. Viola,
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Washington Department of
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Report # H98-10

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ABSTRACT

In 1996, as part of the Lower Snake River Compensation Plan (LSRCP) mitigation program, Lyons Ferry Complex (LFC) released 871,720 summer steelhead (143,479 lbs) at an average size of 6.1 fish/lb. A total of 291,028 rainbow trout (87,570 lbs) were reared and stocked into 36 waters at an average size of 3.3 fish/lb. Additionally, 150,156 fry and 50,107 fingerling rainbow trout (6,129 lbs) were reared and provided to Idaho.

Nine groups of juvenile steelhead were freeze branded, coded-wire tagged (CWT), adipose and ventral fin clipped and released into four area rivers. Two groups were released into the Tucannon River, one directly and one from Curl Lake Acclimation Pond (AP), to continue our study of smolt behavior and residualism and for contribution to the LSRCP area. Two groups were released into the Touchet River from Dayton AP for contribution and size-at-release studies; four groups were released from Lyons Ferry Hatchery (LFH) as a tagging/fin clipping contribution study; and one group was released from Cottonwood AP into the Grande Ronde River for a contribution study.

We implanted Passive Integrated Transponder (PIT) tags to monitor migration timing and success of three groups of steelhead from Curl Lake AP, one group from the direct Tucannon River release, two groups from LFH, and a group of wild outmigrants trapped and released from our smolt trap. Relative emigration performance to collector dams on the Snake and Columbia rivers was measured and physical characteristics of successful emigrants characterized. Detection rates varied among the groups, similar to results seen in previous years. Detections at Lower Monumental Dam of hatchery fish acclimated and released, and of hatchery fish released directly into the Tucannon River were similar. Wild migrants were detected at a greater percentage than any of the hatchery groups.

An effort was made to decrease the number of residual steelhead in the Tucannon River and preclude their potential for adverse interactions with wild salmonids. We identified and kept 5,950 potential residual steelhead in Curl Lake AP. Although we documented the presence of residual steelhead in the Tucannon River during June 1997, high turbid water prevented us from estimating their number.

LFH trapped 5,598 adult steelhead during the summer and fall of 1996. Of those, 54.9% were female, and 0.07% were wild fish. WDFW recovered 1,685 CWT/branded fish (30.1% of fish trapped). LFH spawned 217 females and 246 males which produced 1,090,638 eggs. Fecundity of one- and two-ocean age females averaged 4,796 and 6,006 eggs/female, respectively. No three-ocean age females were spawned in 1997.

To recover CWTs from study groups, we surveyed 10,783 steelhead anglers who caught 3,715 steelhead from area rivers. Estimates of angler effort, total harvest and tagged fish harvested were summarized. The average angler required 10.9 hours to catch a fish.

We estimated that releases of juvenile steelhead from Washington's LSRCP facilities in 1994 and 1995 returned 10,597 adult steelhead to the Snake, Tucannon, Grande Ronde, Asotin and Walla Walla rivers in 1996-97. That return is 227% of the steelhead mitigation goal established for the Washington program as defined by the LSRCP.

The numbers of naturally produced young-of-the-year (0-age) steelhead in LSRCP rivers were considerably higher than in 1996, and in some cases were higher than ever seen before. Older age fish (>0-age) populations were stable in some rivers but much lower in other rivers than observed in previous years. Extremely high, turbid river conditions in the spring of 1997 prevented estimation of adult steelhead spawning escapement.

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1.0 INTRODUCTION

This annual report is one of a continuing series describing Washington Department of Fish and Wildlife's (WDFW) progress toward meeting trout (resident and anadromous) mitigation goals established in the Lower Snake River Compensation Plan (LSRCP). The study period for this report was 1 July 1996 through 30 June 1997.

The LSRCP program began in Washington in 1981 with construction of Lyons Ferry Hatchery (LFH). Refurbishing of the Tucannon Fish Hatchery (TFH) followed in 1984-85. Three remote ponds were built along the Tucannon, Touchet and Grande Ronde rivers to acclimate juvenile steelhead before release. These facilities make up the Lyons Ferry Complex (LFC).

The Lyons Ferry Evaluation study assesses whether the complex produces fish that meet mitigation goals (USCE 1975). It also determines what parts of the mitigation program may adversely affect salmonids listed under the Endangered Species Act (ESA) or other natural salmonid populations, and recommends actions to improve the facilities' effectiveness.

Recent declines in adult wild/natural steelhead escapement and the pending listing of Snake River steelhead as threatened by the National Marine Fisheries Service (NMFS), reinforces the need to monitor populations of wild salmonids in rivers receiving LFC fish. Our wild steelhead density and population estimates are used to assess the potential effects of hatchery fish on natural populations, as well as determine whether hatcheries can be used in recovering ESA listed populations. Our work on hatchery steelhead residualism, which began in 1991, has helped to reduce the potentially negative effects of hatchery steelhead on natural salmonid populations.

2.0 METHODS/ RESULTS / DISCUSSION

2.1 Hatchery Operation Monitoring

2.1.1 Juvenile production

Trout and steelhead production from LFC were monitored closely. Rainbow trout production from LFC by brood year (BY) was summarized (Table 1). Number of fish planted (fry + catchables) represents total production. For specific numbers of fish planted in waters in SE Washington see section 2.10, Appendix H, or the LFC 1996-97 annual production report (Harty 1997).

Table 1. Rainbow trout production and survival rates at LFC, brood years 1986-95.

Stock (BY)	Eggs received	Fry produced	(Egg-to-fry survival)	Fish planted fry (lbs)	Fish planted catchable (lbs)	(fry-to-outplant survival)
Spokane(86)	464,500	377,393	81.2%	100,289 (973)	136,045 (41,570)	62.6%
Spokane(87)	501,500	446,694	89.1%	147,993 (5,903)	266,360 (92,225)	92.8%
Spokane(88)	530,700	426,153	80.3%	207,186 (18,972)	226,690 (91,829)	100.0%
Spokane(89)	758,090	652,535	86.1%	272,164 (7,589)	264,974 (98,088)	82.3%
Spokane(90)	618,000	596,670	96.5%	257,780 (6,162)	218,917 (97,264)	79.9%
Spokane(91)	696,220	637,285	91.5%	269,387 (8,639)	271,052 (108,956)	84.8%
Spokane(92)	603,200	548,731	90.9%	242,366 (6,981)	286,604 (106,325)	96.4%
Spokane(93)	615,600	600,308	97.5%	276,602 (7,867)	263,521 (85,013)	89.9%
Spokane(94)	690,200	660,944	95.7%	319,125 (10,111)	216,837 (72,088)	81.1%
Spokane(95)	685,610	656,301	95.7%	209,905 (7,144)	291,028 (87,570)	76.3%

Note: The precision of hatchery methods at times measure survival between life stages as > 100%; 100% is reported as a maximum in these situations.

Life stage survivals of steelhead at LFC were highly variable between stocks and among years. Fish health, presence of pathogens and spawning conditions at LFC and at remote spawning sites (Cottonwood AP adult trap) all affect survival. A summary by brood year is provided (Table 2) for recent production years of Lyons Ferry and Wallowa stock steelhead.

2.1.2 Fish marking

All hatchery steelhead were marked for harvest management with an adipose (AD) fin clip. In addition some study groups of fish were marked with:

- Coded wire tag (CWT), left ventral (LV) fin clip and freeze brand for specific contribution studies,
- Passive Integrated Transponder (PIT) tags in juvenile fish to monitor emigration success and to identify the characteristics of successful smolts.

Adipose fins were clipped during August/September 1996. CWTs, freeze brands and LV clips were applied during January/February 1997. Tag codes and freeze brands (Appendix A) were reported to the Pacific States Marine Fishery Commission (PSMFC) for publication in their annual report.

Table 2. Survival by life stage of steelhead spawned at Lyons Ferry Complex, BY 1987-97.

Stock	BY	Eggs in/ or taken	Eggs retained (%)	Fry produced (% egg-fry survival)[A]	Smolts produced (% fry-smolt survival)
Wallowa	1992	558,437	198,747 (35.6)	186,656 (93.9)	160,017 (85.7)
	1993	533,995	289,198 (54.2)	271,970 (94.0)	165,630 (60.9)
	1994	644,886	366,115 (56.8)	302,397 (82.6)	144,503 (47.8)
	1995	511,283	335,489 (65.6)	321,050 (95.7)	263,449 (82.0)
	1996	601,979	430,394 (71.5)	447,569 (100)	274,886 (61.4)
	1997	536,723	401,270 (74.8)	317,590 (79.1)	
Lyons Ferry					
	1987	1,111,506	1,095,906 (98.6)	983,901 (89.8)	665,658 (67.6) [B]
	1988	941,756	818,148 (86.9)	793,240 (96.9)	597,607 (75.3)
	1989	1,263,237	957,074 (75.8)	941,000 (98.3)	-0- (0.0) [C]
	1990	2,570,676	1,483,485 (57.7)	1,002,320 (67.6)	635,635 (63.4)
	1991	1,296,249	1,165,315 (89.9)	1,115,368 (95.7)	357,497 (32.1) [D]
	1992	1,239,055	905,438 (73.1)	416,265 (46.0)	387,767 (93.2) [E]
	1993	1,211,053	940,022 (77.6)	860,983 (91.6)	611,417 (71.0)
	1994	1,352,296	899,350 (66.5)	845,316 (94.0)	558,130 (66.0)
	1995	1,772,477	929,597 (52.4)	895,882 (96.4)	610,545 (68.2)
	1996	1,614,636	1,151,363 (71.3)	1,148,114 (99.7)	807,253 (70.3) [F]
	1997	1,090,638	962,705 (88.3)	809,845 (84.1)	

A The precision of hatchery methods at times measure survival between life stages as >100%. 100% is reported as a maximum in these situations.
B An additional 203,857 were outplanted as pre-smolts (fry-outplant survival = 88.4%)
C Losses to IHNV = 100%
D Includes 92,116 fish planted as sub-smolts: 172,000 fish lost to bird predation in lake.
E Destroyed 378,257 fish infected with IHNV.
F Includes 191,000 fry planted into Sprague Lake.

2.1.3 Fish releases

Pre-release samples were collected from LFC's release points to characterize each release population (Table 3). A post-release sample of non-migrant juvenile steelhead was taken from Curl Lake Acclimation Pond (AP) as part of our PIT tagging and residualism studies to

characterize those groups of fish (see below).

Nine groups of juvenile steelhead were freeze branded, CWT tagged, AD and LV fin clipped and released into four area rivers (Appendix A). Two groups were released into the Tucannon River, one directly and one from Curl Lake AP, to continue our study of smolt behavior and residualism and for contribution to the LSRCP area. Two groups were released into the Touchet River from Dayton AP for contribution and size-at-release studies; four groups were released from LFH as a tagging/fin clipping contribution study; and one group was released from Cottonwood AP into the Grande Ronde River for a contribution study.

Table 3. Mean fork lengths, weights, Coefficient of Variation (CV), and condition factors (K) of LFC steelhead prior to release, 1997.

Location (date)	N	Mean length (mm)	CV	Mean wt (g)	(fish/lb)	K	% male/ female
Dayton Pond (20 Mar)	506	182.5	14.5	67.5	(6.7)	1.1	48/52
Cottonwood AP (25 Mar)	498	186.2	13.1	67.0	(6.8)	1.0	57/43
Tucannon River							
Curl Lake AP (21 Mar)	486	179.8	11.2	62.3	(7.3)	1.0	53/46
Marengo (16 Apr)	348	211.9	11.0	99.4	(4.6)	1.0	
Walla Walla R. (16,21,24 Apr)	638	199.6	15.0	78.5	(5.8)	0.9	
Snake River (25 Apr)	358	212.6	11.0	104.4	(4.3)	1.1	

Curl Lake AP sampling, 1997.

Juvenile hatchery steelhead (130,003) were transferred from LFH to Curl Lake AP during the last week of February 1997. Among the fish placed in the pond were 30,156 (hand counted) ADLV-CWT fish. On 3 and 17 March we conducted mark and recapture sampling and estimated that 119,972±57 (P=.05) fish were in Curl Lake. We tested our accuracy by estimating a known number of ADLV-CWT fish. Our estimate (30,815 ±140 fish, P=.05) was very close to the actual number (see footnote on page 11).

Volitional emigration of fish from the lake began 18 March. By 15 April we had lowered the water level of the lake by half. On 22 May, fish that remained in the pond met our criteria for potentially residual juvenile steelhead (fish were 80.6% males and hesitant to leave the pond), therefore volitional emigration was ended. We estimated by mark and recapture method that 5,950 ($\pm$16 , p=.05) potentially residual juvenile steelhead were retained in the pond. The fish were later used for a sport trout fishery in the pond. Approximately 114,022 steelhead smolts volitionally left Curl Lake AP in 1997.

2.2 Hatchery Smolt Emigration

2.2.1 Migration through dams

We calculated relative smolt survival during down river migration in the Snake and Columbia rivers from freeze brands collected at Snake and Columbia river dams (Fish Passage Center 1996-1998). A Passage Index[1], and estimated median and 95% passage time (days) for each freeze brand group released in 1995-97 was determined (Table 4).

[1] Passage Index is a relative indicator of group passage within a migration year and does not represent survival. A passage index is calculated by dividing daily fish collection by the proportion of flow passing through the sampled unit or powerhouse. No estimates of fish guidance efficiency of smolts at the dams were made, thereby precluding the estimation of group survival/ total emigration at a particular dam.

Table 4. Estimated passage of freeze branded LFC steelhead at McNary Dam, 1994-97 (FPC 1998).

Brand	Release site	Passage index	Number [A] released	% of release	Size (#/lb)	Passage(d) [B] 50%	95%
1994							
RA-7U-1	Tucannon from Curl	2,526	16,682	15.1	4.3	33	54
RA-7U-3	Tucannon from Curl	2,614	16,661	15.7	4.3	32	54
LA-7U-1	Tucannon from Curl	1,934	16,665	11.6	4.3	33	67
RA-IT-1	Walla Walla R.	4,872	20,165	24.2	3.7	15	24
RA-IT-3	Walla Walla R.	5,502	20,093	27.4	3.9	12	22
LA-IT-1	Walla Walla R.	5,910	20,002	29.5	3.7	14	23
1995							
LA-IJ-1	Tucannon from Curl	1,864	18,021	10.3	5.3	22	47
RA-IJ-1	Tucannon from Curl	1,485	17,966	8.3	5.3	31	47
RA-IJ-3	Tucannon from Curl	2,165	16,942	12.8	5.3	24	39
LA-H-1	LFH	4,817	39,728	12.1	3.9	27	45
LA-IC-1	Touchet @ Dayton	4,024	19,831	20.3	3.8	20	35
LA-IC-3	Touchet @ Dayton	2,617	19,841	13.2	3.8	27	50
RA-IC-1	Touchet @ Dayton	2,859	20,146	14.2	3.8	25	35
RA-H-1	Walla Walla R.	4,621	24,719	18.7	3.7	11	23
RA-H-2	Walla Walla R	6,918	24,796	27.9	3.7	13	24
1996							
RA-IT-1	Snake R. from LFH	3,529	19,945	17.7	5.3	11	22
LA-IT-1	Snake R. from LFH	4,292	19,850	21.6	5.3	14	32
LA-IT-3	Snake R. from LFH	5,318	19,076	27.9	5.1	12	32
LA-IV-1	Touchet @ Dayton	8,137	38,616	21.1	4.5	24	41
LA-IV-3	Touchet @ Dayton	5,355	38,262	14.0	4.3	27	39
RA-IV-1	Tucannon @ Marengo	3,259	29,611	11.0	5.0	13	37
RA-IV-3	Tucannon from Curl	2,338	27,202	8.6	4.9	21	45
1997							
RA-IL-3	G.Ronde @ Cottonwood [C]	13,931	38,032	36.6	6.8	14	31
LA-S-1	Snake R. from LFH	3,779	19,508	19.4	4.5	20	63
LA-S-2	Snake R. from LFH	3,888	19,495	19.9	4.5	20	32
RA-S-1	Snake R. from LFH	3,962	19,536	20.3	4.5	22	27
RA-S-2	Snake R. from LFH	3,083	20,333	15.2	4.5	19	55
LA-IC-1	Touchet @ Dayton	7,894	29,795	26.5	5.9	22	48
LA-IC-3	Touchet @ Dayton	6,856	29,621	23.1	6.9	21	44
RA-IC-1	Tucannon @ Marengo	4,288	29,756	14.4	4.6	24	40
RA-IC-3	Tucannon from Curl AP	4,632	27,530	16.8	6.8	20	39

A Adjusted for brand loss

B Migration time in days to McNary Dam from the release sites and distances as follows: Curl Lake AP- 135.5 miles; Dayton AP- 95.7 miles; LFH- 90.3 miles; Marengo- 119.2 miles; Walla Walla River- 45.1 miles.

C PI listed is for passage at Lower Granite Dam.

2.2.2 Migration Success

Eight separate groups of LFC steelhead were PIT tagged during March-May (Table 5). The emigration performance of volitional migrants, non-migrants and precocious males from Curl Lake AP (Groups 1-3) and an un-acclimated direct stream release (Group 4) into the Tucannon River were compared with each other and with fish released from LFH (Group 6). Two different smolt sizes (Groups 7 & 8) were compared from the Touchet River's Dayton AP. Wild Tucannon River migrants (Group 5) were tagged to document their migration success and timing. Every PIT tag detected at least once at one of the Snake or Columbia river dams provided total unique detections for each tag group (Table 6). The number of tags detected included all locations and indicate minimum survival from release to Lower Monumental Dam. A full analysis of the four year PIT tag study of juvenile hatchery steelhead migration behavior will be undertaken and reported separately. However, results from the 1997 releases were consistent with previous years data. Larger, leaner fish appear to be more successful migrants. Furthermore, no parr or precocious males were detected during the 1997 spring/summer migration.

Table 5. Characteristics of PIT tag groups released by Lyons Ferry Evaluation, 1997.

	Curl Lake AP			Tucannon R.	Tucannon R.		Dayton AP	
	Migrants (group #1)	Non-migrants (group #2)	Precocious (group #3)	@ Marengo (group #4)	wild migrants (group #5)	LFH (group #6)	LA-IC-1 (group #6)	LA-IC-3 (group #7)
Date(s) tagged	22 Apr - 9 May	22 May	28 May	21 April	30 Apr -14 May	28 April	27 March	
Smolt (%)	**(54.9)**	**(20.7)**	**(0)**	**(3.4%)**	**(56.4)**	**(12.5)**	**(0.8)**	**(0.6)**
n	194	71		12	118	45	3	2
length (mm)	200.1	191.9		226.8	172	219.5	201.7	193.5
CV	8.5	10.6		7.7	11.3	9.9	-----[A]	-----[A]
weight (g)	76.2	67.6		115.0	53.3	109.4	79.7	68.9
K-factor	0.95	0.96		0.98	1.05	1.03	0.97	0.95
Transitional (%)	**(41.4)**	**(65.6)**	**(0)**	**(94.3)**	**(43.6)**	**(83.9)**	**(93.8)**	**(91.4)**
n	146	225		329	91	303	330	319
length (mm)	191.4	171		211.8	161.3	211.8	185.4	174.9
CV	8.5	17.4		20.0	11.8	10.9	10.9	9.4
weight (g)	67.4	54.4		99.3	43.6	103.5	67.8	53
K-factor	0.96	1.09		1.05	1.04	1.09	1.06	0.99
Parr (%)	**(0.8)**	**(5.8)**	**(0)**	**(1.7)**	**(0)**	**(0.8)**	**(4.3)**	**(8.0)**
n	3	20		6		3	15	28
length (mm)	133.3	121.8		195.5		186.7	155.1	141.6
CV	----[A]	9.6		11.0		----[A]	18.2	12.5
weight (g)	27.1	19.5		82.0		73.2	43.7	30.3
K-factor	1.14	1.08		1.09		1.12	1.17	1.07
Precocious (%)	**(2.8)**	**(7.9)**	**(100)**	**(0.6)**	**(0)**	**(2.8)**	**(0)**	**(0)**
n	10	27	114	2		10		
length (mm)	184.5	177.7	184.0	194.0		210.7		
CV	7.7	8.7	9.2	----[A]		14.4		
weight (g)	65.9	61.6	67.6	93.0		115.3		
K-factor	1.05	1.08	1.09	1.27		1.23		

A Sample size too small to compute a CV.

Table 6. Unique detections of PIT tagged steelhead released into the Tucannon, Touchet and Snake rivers, 1997*.

Release location	Release date(s)	Number tagged	Detected L. Monumental #	L. Monumental %	McNary #	McNary %	John Day #	John Day %	Bonneville #	Bonneville %	Total #	Total %
Curl Lake AP												
Group #1	4/22-5/09	353	91	25.8	17	4.8	2	0.6	9	2.5	119	33.7
Group #2	5/22	343	25	7.3	1	0.3	0	0.0	1	0.3	27	7.9
Group #3	5/28	114	0		0		0		0		0	0.0
Tucannon R.												
Group #4	4/21	349	92	26.4	23	6.6	1	0.3	6	1.7	122	35.0
Group #5	4/30-5/14	254	120	47.2	16	6.3	1	0.4	11	4.3	148	58.3
Lyons Ferry Hat.												
Group #6	4/28	361	100	27.7	17	4.7	1	0.3	9	2.5	127	35.2
Dayton AP												
Group #7	3/27-5/01	352			30	8.5	0		19	5.4	49	13.9
Group #8	3/27-5/01	349			34	9.7	4	1.1	17	4.9	55	15.8

* Detections reported to PITAGIS through 10/31/97.

2.3 Estimates of Residual Steelhead

The potential for residual hatchery steelhead to negatively natural salmonid populations through competition, displacement or predation was identified as a concern by NMFS after chinook salmon were listed as threatened under ESA. WDFW began a series of experiments to examine methods to reduce residualism starting in 1992. In spring 1997, we attempted to estimate the number of hatchery released juvenile steelhead that residualized in the Tucannon River and in an index area of the Grande Ronde River. The methods used on the Grande Ronde were similar to those used in 1994 (Viola and Schuck 1995), but we changed methods on the Tucannon River as compared to the past. A brief summary of methods for 1997 is provided below.

2.3.1 Residual steelhead in the Tucannon River

We divided the Tucannon River into two sections: *1) Upper*: from Panjab Bridge (RM 45.6) downstream to one mile above Marengo (19.8 miles), and; *2) Lower*: from 1 mile above Marengo downstream to 1 mile below King Grade (5.8 miles). Because of ESA constraints on the number and location of stocked hatchery trout, we planted 4,000 rainbow trout to act as marked fish for a mark and recapture estimate (Ricker, 1958) in the *Lower* section only. We then conducted our estimates of residual hatchery steelhead as follows:

1. During the last week of May, one week after planting the rainbow trout, we fished both the *upper* and *lower* sections.

2. In the upper section, we calculated catch per unit of effort (CPE). We assumed that the CPE was directly related to residual steelhead abundance.

3. In the lower section, we calculated CPE and estimated the population of residual steelhead and rainbows. The 4,000 marked rainbows were then subtracted from the estimate to provide the population estimate of residual steelhead.

4. We calculated the number of residual steelhead per mile in the lower section and related that to CPE. We then applied the relation to estimate the population of residual steelhead in the upper section as follows:

$$\frac{CPE_{upper}}{CPE_{lower}} x \frac{Population_{lower}}{5.8 miles_{lower}} x 19.9 miles_{upper} = Population_{upper}$$

5. The estimated populations from both sections were summed to provide the total estimated population of residual steelhead in the sampled portion of the Tucannon River.

Approximately 144,000 steelhead were released into the Tucannon River at two different locations; 29,966 fish were released directly into the river at Marengo (RM 24.7), and 113,047 fish were released of 119,972 placed into Curl Lake AP (RM 40.7). Of those fish placed in Curl Lake, 679 fish died or were killed while sampling, and 5,950 (±16, p=.05) suspected to be potential residual steelhead, were not released.[2]

We completed steps 1-3 as listed in the methods above and attempted to calculated an estimate of residualism as described in step 4. However, because of very high and turbid river flows, we were unsuccessful in obtaining the needed information to reliably estimate the number of fish remaining in the river, from either the Curl Lake or Marengo releases.

Observations of smolts during stream sampling suggest that the unusually cold, wet and overcast weather during spring delayed emigration from the Tucannon River, and therefore sampling for residual fish occurred before all migrants had left the river. Characteristics of fish retained in Curl Lake and those sampled in the river are presented (Table 7).

Table 7. Mean fork length (with standard deviation (SD) and coefficient of Variation (CV), mean weight, condition factor and sex ratios of potential residual fish retained in Curl Lake; and residual fish sampled from the Tucannon River, 1997.

		Tucannon River	
Location (Sample date)	Curl Lake AP (5/22/97)	*upper* section (5/30/97)	*lower* section (5/29/97)
Mean length (mm)	173.5	194.4	220.8
(SD)	(31.8)	(81.3)	(26.7)
CV	18.3%	41.8%	12.1%
Mean weight (g)	56.0	78.4	116.8
(SD)	(27.5)	(36.5)	(46.0)
CV	49.0%	46.6%	39.4%
K	1.0	1.0	1.0
Sample size (n)	350	152	100
% male/female	80.6/19.4	78.4/21.6	87.1/12.9
% smolted	7.9	22.8	n/a

n/a = not available

[2] A significant disagreement exists between hatchery planting records and our estimates of fish released from, and retained in Curl Lake AP (see *Curl Lake AP sampling, 1997*). Numbers presented in this section represent our best estimate based on Mark and Recapture procedures, and are used to assess the level of residualism in the Tucannon River. Numbers recorded in hatchery records and which appear elsewhere in this report were obtained from an electronic fish counter to document fish released from, and retained in Curl Lake AP. The degree of difference between the two methods (14,000 fish) could not be resolved, therefore both sets of numbers appear here.

2.3.2 Smolt trapping on the Tucannon River

WDFW operated a 5 ft rotary screw trap intermittently at rm 2 on the Tucannon River between 31 March and 3 July 1997 to estimate numbers of migrating wild and hatchery juvenile steelhead. Each week we attempted to determine trap efficiency by clipping a portion of the caudal fin on captured migrants and releasing them upstream about 0.6 miles. The percent of marked fish recaptured estimated weekly trapping efficiency. When insufficient fish were captured for trap efficiency estimates, data from other time periods with similar flows and turbidity were used. To estimate potential juvenile migrants when the trap was not operated, we calculated the number of fish trapped per hour three days before and after, and then divided that by the average trap efficiency of those two weeks. The calculated capture rate was then applied to periods when the trap was not operated to estimate emigration passage.

Based on catches and trapping efficiencies, we estimated that 15,711 naturally produced steelhead smolts migrated out of the Tucannon River in 1997 (Table 8). In addition, we estimated that 29,968 and 10,273 hatchery steelhead from the Curl Lake AP and Marengo releases, respectively, migrated past the trap. Peak migration of the natural and Curl Lake AP releases occurred about the second week of May. Peak migration of hatchery fish released at Marengo was about the last week of April.

Only 26.3% and 34.3% of the hatchery steelhead released from Curl Lake AP and Marengo, respectively, were estimated to have passed the trap. This may be due to errors in the estimate because of non-continuous trapping (trap was generally operated 5 nights/week), and low trapping efficiency for hatchery steelhead. Mean trapping efficiency of hatchery steelhead for the season was 15.4% (range: 7.4-18.2%). All captured steelhead (natural and hatchery) were classified as either smolts or transitionals. The majority of hatchery fish captured were classified as transitionals, the opposite of pre-release samples collected (Table 9). Smaller sized natural and hatchery fish migrated later in the season (Table 10).

Table 8. Weekly and total population estimates for natural and hatchery juvenile steelhead emigrants from the Tucannon River, 31 March through 3 July, 1997.

		Hatchery migrants	
Month	Natural migrants	Curl Lake AP	Marengo
3/31-4/06	83	0	0
4/07-4/13	292	0	0
4/14-4/20	1,257	70	0
4/21-4/27	1,881	834	2,151
4/28-5/04	2,363	3,402	2,541
5/05-5/11	3,988	6,338	2,432
5/12-5/18	4,470	10,001	2,349
5/19-5/25	863	3,231	237
5/26-6/01	319	2,962	472
6/02-6/08	115	1,184	35
6/09-6/15	75	975	7
6/16-6/22	5	755	29
6/23-6/29	0	208	20
6/30-7/03	0	8	0
Total	15,711	29,968	10,273
Percent Survival		26.3	34.3

Table 9. Characteristics of natural and hatchery steelhead captured at the Tucannon River smolt trap, 1997.

Characteristic	Natural	Curl Lake	Marengo
Smolt (%)	41.3	32.4	11.2
n			
Length (mm)	174.3	202.0	234.5
CV	13.5	9.5	9.0
Weight (g)	55.4	76.6	129.8
K	0.99	0.94	0.94
Transitional (%)	58.7	67.6	88.8
n			
Length (mm)	166.9	195.7	219.7
CV	10.2	10.1	8.3
Weight (g)	48.1	69.2	101.7
K	0.98	0.88	0.95

Table 10. Mean fork length (SD, sample size) and condition factor (K) by week of natural and hatchery steelhead captured in the smolt trap on the Tucannon River, 1997.

	Natural Steelhead		Hatchery Steelhead	
Sample Period	Fork Length Mean (SD, n)	K	Fork Length Mean (SD, N)	K
4/02-4/04	165.0 (7.4, 7)	1.01		
4/07-4/11	177.7 (17.4, 32)	0.97		
4/14-4/18	182.2 (24.3, 45)	0.99	200.0 (-----, 1)	1.01
4/21-4/25	173.9 (22.0, 40)	0.98	216.8 (19.5, 39)	1.00
4/28-5/02	169.9 (21.9, 134)	1.02	218.1 (17.9, 149)	0.92
5/05-5/09	167.9 (19.5, 92)	0.97	211.9 (16.9, 53)	0.90
5/12-5/16	164.6 (21.0, 125)	0.98	204.9 (21.4, 119)	0.96
5/19-5/23	161.7 (13.1, 46)	0.97	200.9 (19.1, 115)	0.87
5/26-5/30	171.1 (21.0, 17)	0.93	193.4 (21.3, 73)	0.88
6/02-6/06	163.0 (16.9, 11)	0.98	188.7 (21.1, 65)	0.87
6/09-6/13	165.4 (7.3, 10)	0.98	186.9 (16.0, 75)	0.86
6/16-6/20	160.0 (7.1, 2)	- - -	192.4 (19.8, 43)	- - -
6/23-6/27			190.7 (26.9, 11)	0.90
6/30-7/03				

2.3.3 Residual steelhead in the Grande Ronde River

We estimated the number of residual hatchery released steelhead present in a one mile index area of the Grande Ronde River near Cottonwood Creek during June and July 1997. WDFW personnel sampled the river from approximately 1/4 mile above to 3/4 mile below Cottonwood AP.

Hatchery reared juvenile steelhead were caught with hook and line, marked with a caudal punch and released on 26 June. Fish were recaptured with hook and line on 7 July. A Petersen mark and recapture method (Ricker 1958) was used to estimate that 86 ± 8 ($p=.05$) hatchery reared juvenile steelhead were present within the index section of river. The estimated number was the lowest in the last four years (Table 11).

Table 11. The numbers of hatchery reared residual steelhead present in an index area of the Grande Ronde River near Cottonwood Creek, WA, 1994-97.

Year	Number Released	Fish/lb	Number ± 95% CI Residuals	% of release
1994	273,000	4.8	1,961	0.72
1995	206,182	5.0	831 ± 28	0.40
1996	250,000	5.6	816 ± 52	0.33
1997	250,262	6.8	86 ± 8	0.03

Water flows in the Grande Ronde River during the spring of 1997 were very high and may have encouraged emigration. However, flows were also extremely high in 1996. At this time we are unsure why so few residual steelhead were found in our sample section of the Grande Ronde. Intensive sampling resulted in few recovered marked fish, so we are confident of the estimate. The Cottonwood AP was not managed to reduce the abundance of residual steelhead in the Grande Ronde River in 1997.

2.4 Adult Steelhead Returns

2.4.1 Adult traps

Tucannon Hatchery trap

A temporary weir and trap was installed in early May for spring chinook salmon. Twenty-six adult steelhead were handled in the trap (Appendix B), but the majority of adult steelhead had already passed the trap location before the temporary weir was installed. Full time trapping will resume in 1998 with the completion of a new permanent trapping facility.

Lyons Ferry Hatchery trap

Adult steelhead were trapped at LFH from 8 July through 16 November 1996. WDFW trapped 3,073 female (54.9%) and 2,525 male (45.1%) adult steelhead. Four were wild fish (0.07%), 1,685 (30.1%) were CWT/branded fish (Appendix C), and the rest were untagged hatchery fish. Mortality during trapping and holding was 623 fish (2.3%). At completion of trapping, all fish were inspected for fin clips, readable brands, and sex and origin (wild/hatchery) were determined. Snouts were collected from a sample of fish with a ventral fin clip but an unreadable brand.

In 1997, 217 adult female steelhead were spawned [3] with 246 males at LFH (Table 2). Known one-ocean age fish contributed 75.4% (822,290) of the eggs and comprised 93.9% of returning coded-wire tagged fish (Appendix C). Two-ocean age fish contributed 24.6% (268,348) of the eggs but represented only 6.1% of returning coded wire tags. No three-ocean age fish were spawned in 1997. Average fecundity of one and two-ocean age females was 4,796 and 6,006 eggs/female, respectively. Mean lengths of one and two-ocean age female steelhead spawned at LFH in 1997 were 59.4 cm (n=172: SD=3.3) and 70.1 cm (n=45: SD=3.5), respectively. Known one and two-ocean age male steelhead [4] spawned at LFH in 1997 averaged 60.8 cm (n=199, SD=3.1) and 71.1 cm (n=32, SD=3.6), respectively.

Fish originating from upstream hatcheries, injured fish, wild fish, and fish not needed for broodstock were released (4,737 fish). We clipped the top lobe of the caudal fin (TC) of 4,733 of the fish released (wild fish were not clipped). Two-hundred and two (11.0%) TC clipped fish were harvested in the sport fishery. The majority (90.4%) were caught in close proximity to Little Goose Dam, LFH and in the Tucannon River. The remainder were harvested in the Walla Walla River.

Cottonwood Creek Trap

During March and April 1997, 189 female (81.1%) and 44 male (18.9%) adult steelhead were trapped at the Cottonwood AP. Known one-ocean age females contributed 37.9% (203,603) of the eggs taken, while two-ocean age females contributed 62.1% (333,120) of the eggs. Average fecundity of one and two-ocean age females was 4,861 and 6,642 eggs/female, respectively. Mean length for one-ocean age females was 61.6 cm (n=42, SD=2.7), and 73.8 cm (n=50, SD=3.2) for two-ocean age females. Mean length for spawned males was 61.8 cm and 73.6 cm for one and two-ocean age fish, respectively. Because of a shortage of males, individual fish were used two or more times during spawning. All trapped hatchery fish were spawned or killed on site to prevent swamping of wild spawning steelhead in Cottonwood Creek, or other adjacent streams.

2.4.2 Passage at dams

The National Marine Fishery Service (NMFS) monitored adult passage at Lower Granite Dam (LGD) as part of their migration research (Jerry Harmon, NMFS 1997). CWT adult steelhead entering into the LGD trap were sampled for fin clips and freeze brands, then released (Table 12).

[3] Two hundred thirty-eight females were killed during the spawning process, viable eggs were retained from only 217 of those fish.

[4] The age of 15 spawned males was not determined.

Table 12. Adult returns of LFH steelhead to Lower Granite Dam in run years 1994-1996, from smolts released in 1993-1995 (numbers are freeze brand recoveries).

Brand	Release site	Number of adults observed Run year 1994	1995	1996	Total [A] adjusted adults	Smolts released	% survival
1993							
RA-H-1	Dayton Pond - Touchet R.	46	71	0	118	20,328	0.580
RA-H-2	Dayton Pond - Touchet R.	35	72	0	108	20,104	0.537
LA-IC-1	Tucannon R. @ Curl	89	99	0	196	30,001	0.653
RA-IC-1	Curl LK. Tucannon R.	96	111	2	212	21,960	0.965
LA-IC-3	Tuc. R. @ Marengo	63	72	0	139	29,876	0.465
LA-H-1	Walla Walla R.	25	48	0	77	19,440	0.396
LA-H-2	Walla Walla R.	10	27	0	39	19,800	0.197
1994							
RA-7U-1	Curl LK. Tucannon R.		42	11	57	16,682	0.342
RA-7U-3	Curl LK. Tucannon R		45	14	64	16,661	0.384
LA-7U-1	Curl LK. Tucannon R.		59	4	66	16,665	0.396
RA-IT-1	Walla Walla R.		94	13	110	20,165	0.546
RA-IT-3	Walla Walla R.		100	4	110	20,093	0.547
LA-IT-1	Walla Walla R.		75	14	92	20,002	0.460
1995							
LA-H-1	Snake River @ LFH			420	420	40,170	1.046
RA-H-1	Walla Walla R.			165	167	25,067	0.666
RA-H-2	Walla Walla R.			153	156	25,233	0.618
LA-IC-1	Dayton Pond - Touchet R.			191	194	20,133	0.964
LA-IC-3	Dayton Pond - Touchet R.			132	133	20,041	0.664
RA-IC-1	Dayton Pond - Touchet R.			203	204	20,221	1.009
LA-IJ-1	Curl LK. Tucannon R.			130	132	18,288	0.722
RA-IJ-1	Curl LK. Tucannon R.			121	122	18,124	0.673
RA-IJ-3	Curl LK. Tucannon R.			107	108	17,150	0.630

A- Observed brands adjusted for brand loss as measured at release (see Appendix A).

2.5 Steelhead Creel Surveys

WDFW personnel surveyed steelhead sport anglers within the LSRCP area of Washington (see Schuck et al. 1990 for methods). Sport fishing for steelhead was open on the Snake and Columbia rivers from 1 September 1996 through 31 March 1997, and on tributaries to the Snake River from 1 September 1996 through 15 April 1997. Anglers could keep only AD clipped fish, some of which were also LV clipped indicating the presence of a CWT. The objectives of our creel surveys on the Snake and Grande Ronde rivers were: 1) estimate the number of LFC steelhead in the Washington sport catch; 2) obtain lengths, weights, sex, age, and duration of ocean residency of LFC origin fish in the harvest, and; 3) estimate angler effort, catch rates, and exploitation of tagged adult LFC steelhead.

WDFW and Oregon Department of Fish and Wildlife (ODFW) conducted a joint survey of anglers on the upper Grande Ronde River of Washington. Angler effort, catch rates, harvest,

and CWT recoveries and expansions were calculated by ODFW as described in Carmichael et al. (1988).

2.5.1 Lower Snake River and tributaries

We used adjusted WDFW state-wide steelhead harvest estimates (Appendix D) for 1996-97 to estimate our CWT sample rates and to estimate harvest by tag code for each fishery. During the 1996-97 steelhead season, we surveyed 10,783 anglers that fished 40,404.2 hours and caught 3,715 fish within the LSRCP area in SE Washington (Table 13). Catch rates ranged from 3.2 - 40.4 hours/fish. Mean catch rate for the entire LSRCP area of SE Washington was 10.9 hours/fish.

Table 13. Steelhead creel survey results for fall 1996 and spring 1997.

Area	Anglers Interviewed	Hours Fished	Fish Caught	Hours/Fish Caught
McNary Pool	2	7.5	1	7.5
Wallula area	382	1,348.8	57	23.7
Walla Walla	499	1,097.1	73	15.0
Mill Creek	43	75.5	11	6.9
Ice Harbor Dam	1,737	5,834.5	282	20.7
Lower Mon. Dam	167	485.3	12	40.4
Touchet River	272	574.1	105	5.5
Tucannon River	597	1,696.3	537	3.2
Mouth of Tucannon R.	446	1,428.0	75	19.0
Little Goose Dam	2,706	13,245.1	938	14.1
Lower Granite Dam	47	200.1	9	22.2
Snake R. section 228				
boats anglers	1,898	5,764.1	514	11.2
shore anglers	205	688.9	65	10.6
Grande Ronde (WA)[A]	1,148	5,018.7	823	6.1
Grande Ronde (OR)[B]	634	2,940.2	213	13.8
Total:	**10,783**	**40,404.2**	**3,715**	**10.9**

A: Bogan's (RM 26.2) to the Oregon border (RM 38.7).
B: Oregon border (RM 38.7) to Wildcat Creek (RM 53.3).

One-ocean age steelhead comprised 91.4% of our sample from the sport harvest in the 1996-97 surveys (Table 14); considerably higher than for the last three sample years (37%, 83% and 48%, respectively). The lengths of one and two-ocean age fish overlapped in 1996-97 (Figure 1). We observed similar overlap in run years 1994 and 1995. This overlap in length between age classes of fish may be the result of changing ocean-rearing conditions.

Table 14. Characteristic age, length, weight and sex composition of LFC adult steelhead sampled during the 1996/97 creel survey.

Ocean Residence	Percent Composition (N)	Mean length(cm) (N)	Mean weight(Kg) (N)	Percent Male	Percent Female
1 Year	91.4 (189)	62.9 (189)	2.3 (148)	49.7	50.3
2 Years	5.8 (12)	73.5 (12)	3.7 (8)	41.7	58.3

N = number

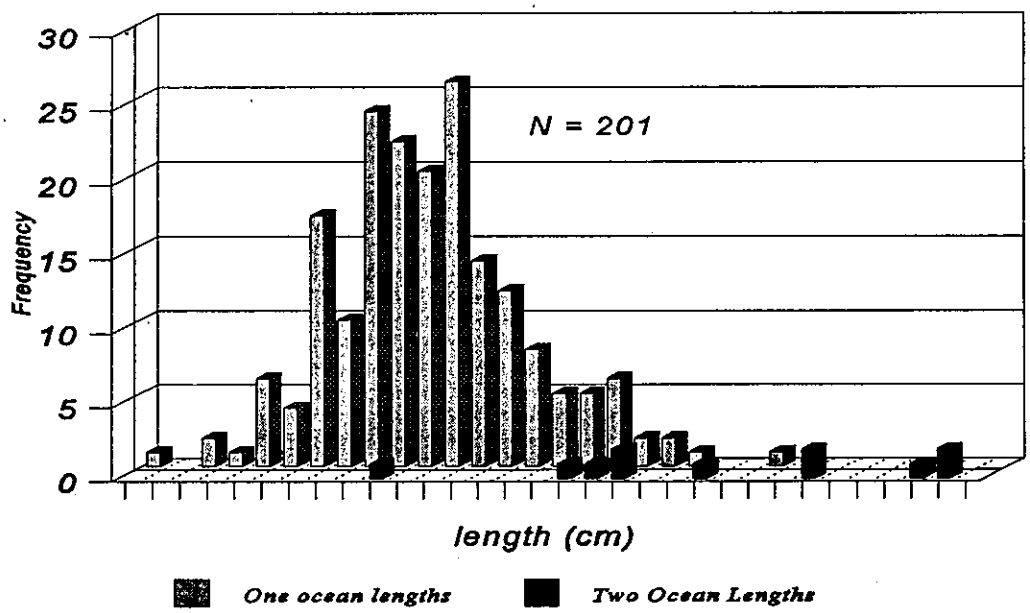

Figure 1. Length frequency of LFC origin steelhead collected in creel surveys, 1996-97.

2.5.2 Grande Ronde River

During the 1996-97 steelhead season, anglers fished nearly 15,000 hours on the Grande Ronde River from Bogan's Oasis (rm 26.2) upstream to the Oregon State line (rm 38.7) (Tables 15 and 16).

Table 15. Estimated angler effort, catch rates, and harvest for steelhead anglers on a portion of the Grande Ronde River in Washington, 1996-97 (Flesher 1998).*

Month	Effort Hours (95% CI)	Catch Rate-F/HR (95% CI)	Total Catch[A] (95% CI)	Fish Kept (95% CI)	Marked Fish Released (95% CI)	Unmarked Fish Released (95% CI)
1996						
Sept.[B]	911.2	0.0084	7.6	1.8	0.0	5.8
	(306.0)	(0.0093)	(8.5)	(0.0)	(0.0)	(0.0)
Oct.	2,089.2	0.0590	123.2	52.9	46.4	23.8
	(345.0)	(0.0156)	(32.6)	(28.7)	(31.3)	(16.5)
Nov.	1,224.2	0.0815	99.8	52.5	22.5	24.8
	(263.3)	(0.0295)	(36.2)	(28.5)	(24.7)	(17.5)
Dec.	925.6	0.2329	215.6	108.1	61.8	45.8
	(310.3)	(0.0987)	(91.4)	(53.2)	(39.2)	(30.6)
1997						
Jan.	1,483.8	0.1290	191.4	109.8	55.0	26.6
	(654.8)	(0.0633)	(93.9)	(56.5)	(32.8)	(19.6)
Feb.	1,492.2	0.2367	353.1	152.4	174.3	26.4
	(353.5)	(0.1029)	(153.5)	(78.0)	(85.3)	(19.9)
Mar.	5,306.5	0.2418	1,282.9	555.8	621.9	105.2
	(744.7)	(0.0442)	(234.6)	(199.9)	(190.2)	(53.0)
Apr.	1,337.8	0.2190	293.0	116.4	167.6	9.0
	(430.4)	(0.0378)	(50.6)	(27.2)	(39.4)	(6.7)
Total	**14,770.5**		**2,567**	**1,150**	**1,150**	**267**

* - Only that portion of the Grande Ronde between RM 26.2 - 38.7 (State HWY 3 crossing to Oregon state line).
A - Estimates for fish numbers are rounded to the nearest whole number.
B - No confidence interval calculated.

Table 16. Age and sexual composition of steelhead sampled from anglers' creels on the Grande Ronde River during the 1996/97 steelhead season (Flesher 1998).

		Age [A]		
Sex	Number	1:1	1:2	2:1
Male	138	37%	56%	7%
Female	202	37%	55%	8%

A Age designation is for years of growth (freshwater : saltwater)

2.6 Contribution of LFC Steelhead to Fisheries

WDFW personnel collected snouts from 210 sport caught steelhead with CWTs. All snouts, except Grande Ronde River recoveries, were examined by Idaho Fish and Game personnel for CWTs. We estimated harvest of CWTs sampled by WDFW personnel, for fisheries in the Columbia and Snake Rivers (Appendix D, Table 1), and in the Grande Ronde River (Appendix D, Table 2).

We estimated harvest and the percent smolt-to-adult survival for LFC steelhead within the Columbia River and Snake River basins (Table 17) from sampling programs conducted by Federal, State and Tribal agencies. Two of the three 1994 release groups met the production escapement goal of 0.5% smolt to adult survival to the LSRCP area (Table 18).

WDFW tag-groups made up the majority of recoveries, and cooperative efforts with adjacent states showed that Washington fish also contribute to multiple out-of-state fisheries. In fact more fish actually returned to the Columbia River Basin, but were harvested in lower river fisheries. This level of success with the steelhead program provides extensive and valuable fisheries throughout SE Washington.

Table 17. Adult returns of LFC steelhead (percent smolt-to-adult survival) to fisheries in the Columbia and Snake rivers, fall 1996 and spring 1997.

Release year		**1994**	
Release site	Tucannon R. From Curl AP	Tucannon R. @ Hatchery	Walla Walla R.
CWT code(s)	63/54/07 63/54/08 63/54/09	63/48/57	63/53/12 63/53/13 63/53/14
Brand(s)	RA-7U-1 RA-7U-3 LA-7U-1	No brand	RA-IT-1 LA-IT-1 RA-IT-3
Number Released [A]	49,258	1,885	59,095
Fishery			
L. Col. sport	0	0	10 (0.017)
Zone 6 Net	6 (0.012)	2 (0.106)	10 (0.017)
L. Ferry Hat.	10 (0.020)	0	92 (0.156)
Snake R. sport	0	0	17 (0.029)
Tucannon sport	17 (0.034)	0	0
Walla Walla sport	0	0	11 (0.019)
LSRCP Total	**27** **(0.055)**	**0**	**120** **(0.203)**
Grand Total	33 (0.067)	2 (0.106)	140 (0.237)

A Number released has been adjusted for tag loss.

Table 17 (continued)

Release year		**1995**		
Release site	Touchet R. @ Dayton	Tucannon R. from Curl AP	Walla Walla R.	Snake River @ LFH
CWT code(s)	63/57/14 63/57/15 63/57/16	63/57/48 63/57/18 63/57/17	63/54/42 63/54/43	63/57/28
Brand(s)	LA-IC-1 RA-IC-1 LA-IC-3	RA-IJ-1 RA-IJ-3 LA-IJ-1	RA-H-1 RA-H-2	LA-H-1
Number Released [A]	60,246	52,646	49,955	39,736
Fishery				
L. Col. sport	43 (0.071)	53 (0.101)	73 (0.146)	26 (0.065)
Zone 6 Net	25 (0.042)	17 (0.032)	16 (0.032)	14 (0.035)
Deschutes R. trap	0	2 (0.004)	0	0
Umatilla R. trap	0	49 (0.093)	0	0
L. Ferry Hat.	598 (0.993)	86 (0.163)	417 (0.835)	482 (1.213)
Snake R. sport	103 (0.171)	102 (0.194)	98 (0.196)	55 (0.138)
Tucannon R. sport	139 (0.231)	52 (0.099)	48 (0.096)	0
Mill Cr. sport	0	0	53 (0.106)	0
Walla Walla sport	20 (0.033)	0	89 (0.178)	0
Touchet R. sport	66 (0.109)	0	0	0
Idaho sport	22 (0.036)	11 (0.021)	101 (0.202)	61 (0.154)
LSRCP Total	**948** **(1.574)**	**251** **(0.477)**	**806** **(1.614)**	**598** **(1.505)**
Grand Total	1,016 (1.686)	372 (0.707)	895 (1.792)	638 (1.606)

A Number released has been adjusted for tag loss.

Table 18. Adult returns of LFC steelhead released in 1994 (percent smolt-to-adult survival) to the Columbia and Snake rivers for run years 1995 and 1996.

Release year		**1994**	
Release site	Tucannon R. From Curl AP	Tucannon R. @ Hatchery	Walla Walla R.
CWT code(s)	63/54/07 63/54/08 63/54/09	63/48/57	63/53/12 63/53/13 63/53/14
Brand(s)	RA-7U-1 RA-7U-3 LA-7U-1	No brand	RA-IT-1 LA-IT-1 RA-IT-3
Number Released [A]	49,258	1,885	59,095
Fishery			
L. Col. sport	22 (0.045)	0	125 (0.211)
Mid. Col. sport	34 (0.069)	0	68 (0.115)
Zone 6 Net	35 (0.071)	2 (0.106)	101 (0.171)
L. Ferry Hat.	10 (0.020)	0	92 (0.156)
Snake R. sport	57 (0.116)	0	294 (0.498)
Tucannon sport	77 (0.156)	0	45 (0.076)
Mill Cr. sport	0	0	30 (0.051)
Walla Walla sport	0	0	393 (0.665)
Miscellaneous other	21 (0.043)	0	6 (0.010)
LSRCP Total	**144** **(0.292)**	**0**	**854** **(1.445)**
Grand Total	256 (0.520)	2 (0.106)	1,154 (1.953)

A Number released has been adjusted for tag loss.

2.7 Returns to Spawning Grounds

In 1997, WDFW attempted to estimate steelhead spawning escapement in the Touchet and Tucannon rivers and Asotin Creek. Steelhead spawning grounds were surveyed to estimate the number of redds/mile as discussed by Schuck et al.(1993). Index areas established in 1992, 1993 and 1995 were used in 1997. Many attempts were made to survey area rivers, however consistently high and turbid river conditions prevented accurate surveys, hence no reliable estimate could be made.

2.8 Contribution Toward LSRCP Goal

To compare returning LFC adult steelhead to the LSRCP goal, we estimated yearly contributions to fisheries and escapement rates for CWT groups, and computed cumulative smolt-to-adult return (SAR) for each tag code (Table 17). Appropriate SAR estimates were applied to total steelhead releases by river for each return year to estimate returns. Where no CWTs had been released, average or closely related SARs were used to estimate returns. We estimate that LSRCP steelhead smolts released into SE Washington streams in 1994 and 1995 returned at least 10,597 adult steelhead to the LSRCP area of the Snake River Basin during the 1996 run year (Table 19). This return is 227% of the steelhead goal established for Washington.

Table 19. Estimated LSRCP adult steelhead returns in run year 1996, for specific rivers for the release years shown.

Release year	Asotin Creek	G. Ronde River	Snake River	Touchet River	Tucannon River	Walla Walla River	Total
1994	39	352	154	276	74	368	1,263
1995	462	2,660	1,005	1,948	696	2,563	9,334
Total	501	3,012	1,159	2,224	770	2,931	10,597

2.9 Trends in Naturally Produced Juvenile Steelhead, 1983-1997

As in previous years, WDFW sampled (electrofished with a multiple removal method (Zippin 1958)) established index sites (Appendix E) and estimated total juvenile steelhead densities (Appendix F) and populations (Mendel 1984, Hallock and Mendel 1985, Schuck and Mendel 1987, Schuck et al. 1990-1996) in the following survey sections of Asotin Creek and the Touchet and Tucannon rivers:

- North Fork Asotin Creek: From the confluence with the South Fork upstream 4.65 miles to the U.S. Forest Service boundary.

- South Fork Asotin Creek: From the confluence with the North Fork upstream 3.46 miles to first bridge crossing.
- North Fork Touchet River: From the confluence with the South Touchet upstream 11.1 miles.
- South Fork Touchet River: From the mouth upstream 15.7 miles.
- Wolf Fork of North Fork Touchet River: From the mouth upstream 10.3 miles.
- Tucannon River: From RM 24.7 (Marengo Bridge) upstream to the confluence with Panjab Creek (RM 45.6).

2.9.1 Asotin Creek

We electrofished six index sites within each survey section of the main forks of Asotin Cr. to estimate juvenile steelhead densities (Appendix F) and populations. In 1997, 0-aged steelhead abundance was the highest recorded since 1983 (Figures 2 and 3). Spawning escapement may have been significantly greater in 1997 or egg to juvenile survival may have been enhanced by the 1996 flood or both. The reason for the increase in survival is unknown. The abundance of >0-aged fish was similar to somewhat higher in 1997 than in 1996, in the North Fork and South Fork respectively (Figures 2 and 3).

Main Asotin Creek

Although no river survey sections have been established for the Asotin Creek mainstem. , we electrofished two sites in 1997 which had been sampled in previous years. Mean densities (fish/100 m^2) for both 0-aged and >0-aged naturally produced steelhead were calculated (Appendix F).

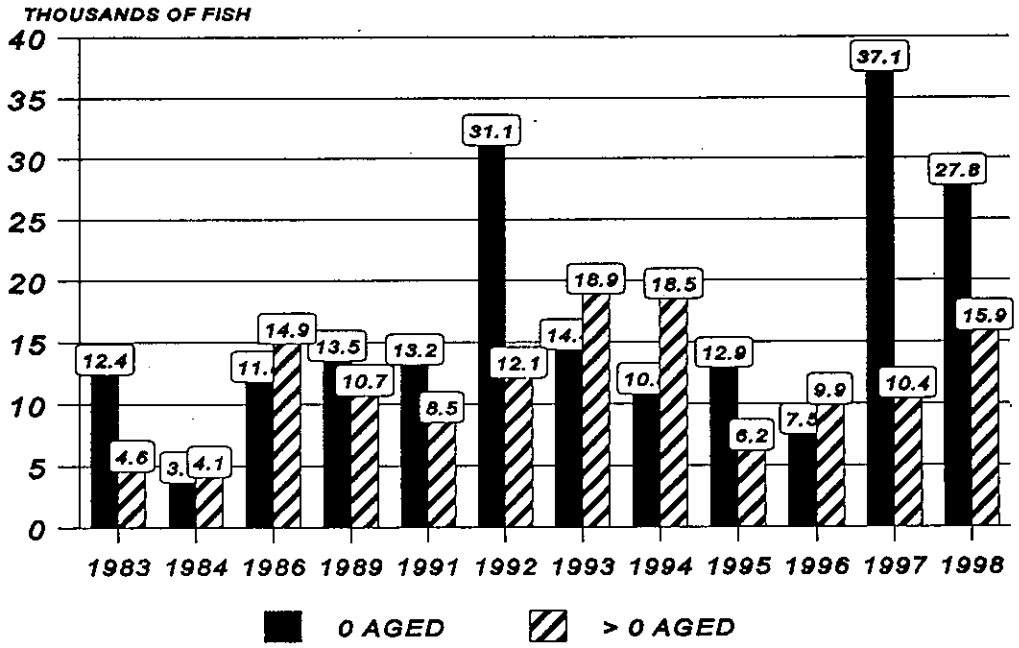

Figure 2. Estimates of juvenile steelhead abundance on the North Fork Asotin Creek from the confluence with the South Fork upstream 4.65 miles to the U.S. Forest Service boundary, 1983 - 1997.

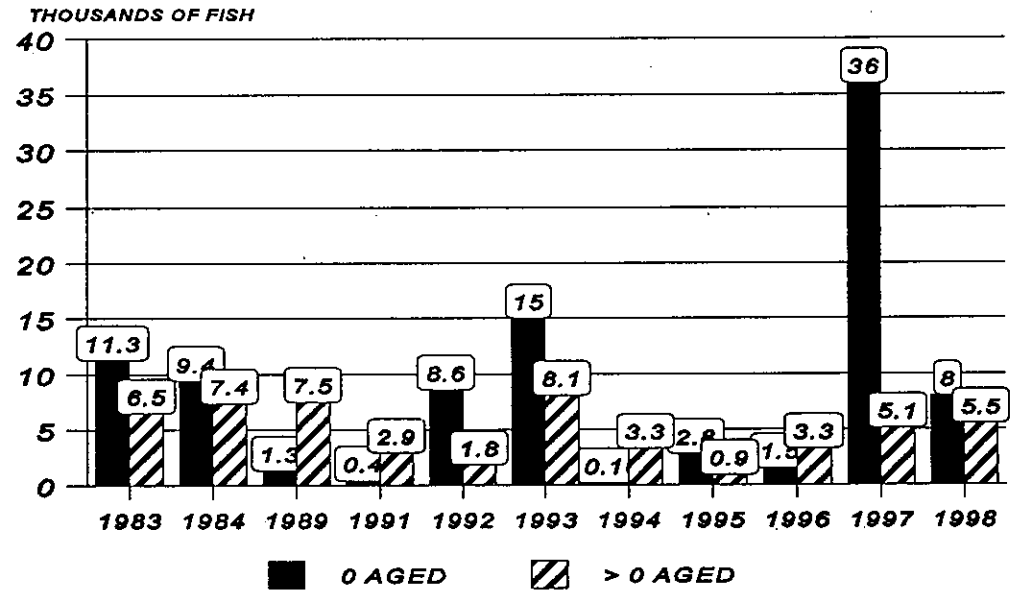

Figure 3. Estimates of juvenile steelhead abundance on South Fork Asotin Creek from the mouth upstream 3.46 miles to the first bridge crossing, 1983 -1997.

2.9.2 Touchet River

In 1997, 0-aged steelhead populations were high in all forks of the river relative to levels recorded since 1983. The populations of >0-aged fish were the lowest recorded since 1983 (Figures 4,5,6).

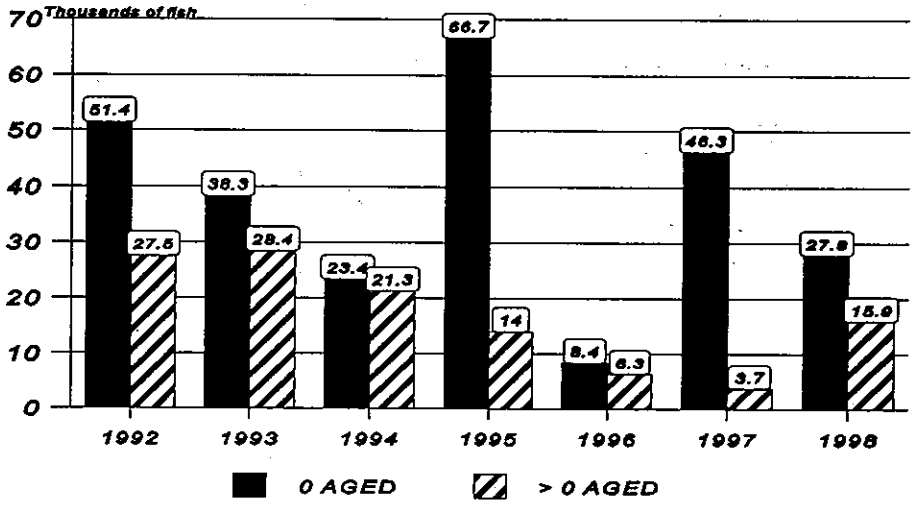

Figure 4. Estimates of juvenile steelhead abundance (in thousands) on North Fork Touchet River, from the mouth upstream 11.1 miles, 1992 - 1997.

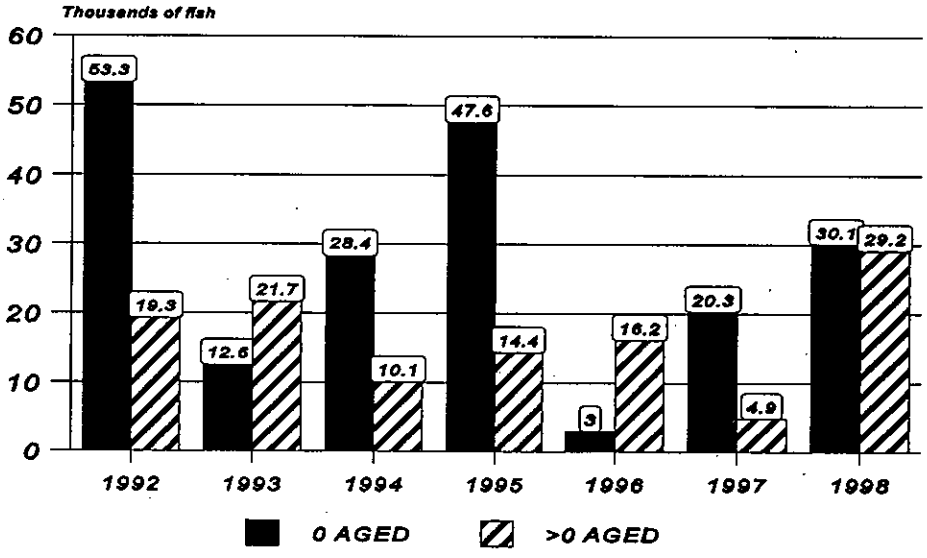

Figure 5. Estimates of juvenile steelhead abundance on South Fork Touchet River, from the mouth upstream 15.7 miles, 1992 - 1997.

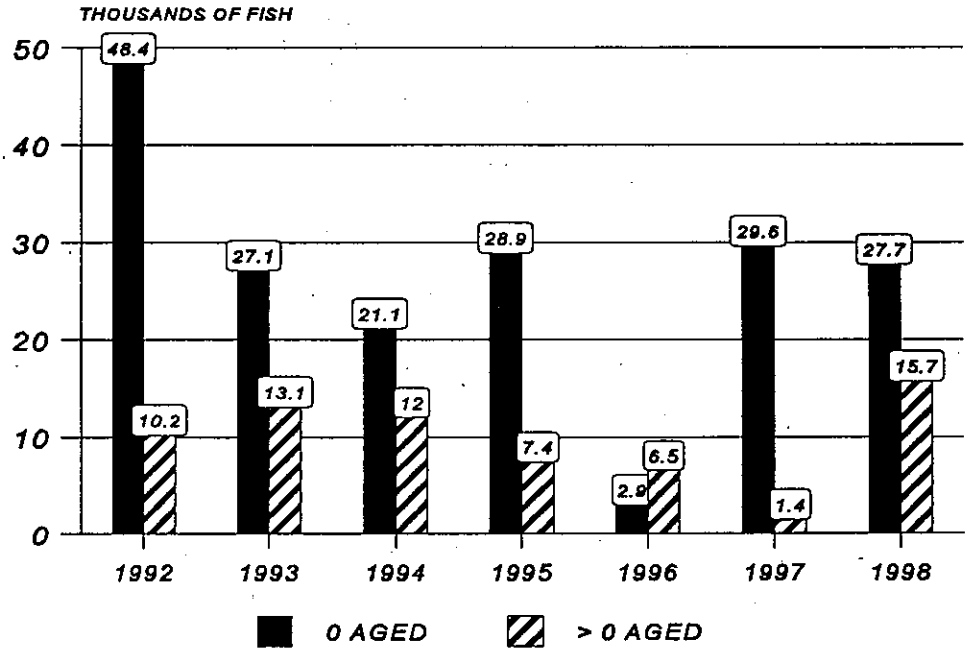

Figure 6. Estimates of juvenile steelhead abundance on Wolf Fork of the North Fork Touchet River, from the mouth upstream 10.3 miles, 1992 - 1996.

2.9.3 Tucannon River

Populations of all ages of juvenile steelhead were similar to population estimates since 1991. The abundance of >0-aged steelhead has gradually declined since 1986 (Figure 7).

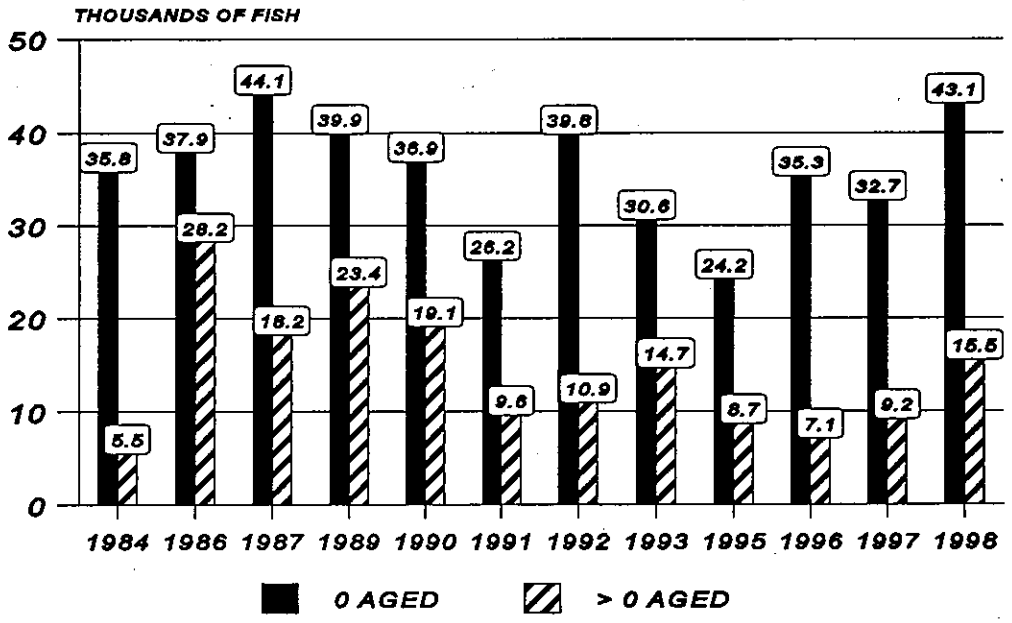

Figure 7. Estimates of juvenile steelhead abundance in the Tucannon River from Camp 1 (RM 34.6), upstream 11.6 miles to Panjab Bridge, for most years between 1984 - 1997.

2.9.4 Comparison of electrofishing and snorkeling for estimating abundance of juvenile steelhead

In 1995, 1996 and 1997 WDFW compared two different methods for estimating abundance of juvenile steelhead on the Tucannon River. One estimate (Appendix F) was derived from information gathered by electrofishing 30-meter long sites using a three-pass removal method (Zippin 1958). The second estimate was derived from data gathered by snorkeling the same sites (Schuck et al. 1996); and in 1997 the same sites plus 24 additional snorkel sites (appendix G). A *t*-test was used to test for significant differences between the estimates. A linear regression analysis was used to determine how well the snorkel estimates correlated to estimates derived from electrofishing (Table 20).

Table 20. Statistical comparisons (α =.05) of juvenile steelhead abundance estimates derived from electrofishing and snorkeling on the Tucannon River in 1995, 1996 and 1997.

	Sample Size [A]		0-aged		> 0-aged	
Year	Snorkel	Electro	*t*-test	Regression	*t*-test	Regression
1995	5	5	T= 2.52	R^2 =.0004	T =.98	R^2 = .4125
			P =.04	P =.98	P =.36	P =.24
		Statistical Results:	*Different*		*Equal*	
1996	7	7	T= 1.48	R^2 =.4176	T =1.46	R^2 = .0486
			P =.16	P =.12	P =.17	P =.63
		Statistical Results:	*Different*		*Equal*	
1997	6	6	Not done	Not done	T =.45	R^2 =.7303
			Not done	Not done	P =.66	P =.03
		Statistical Results:			*Equal*	
	28	7	Not done	Not done	T =.27	R^2 =.047
			Not done	Not done	P =.79	P =.68
		Statistical Results:			*Equal*	

A: Number of sites sampled.

Abundance estimates of 0-aged fish were statistically different between the methods in 1995 and 1996 (Table 20). It was physically impossible to snorkel the shallowest of our sites where many 0-age steelhead were found. Also, we often could not see 0-aged steelhead because they are small enough to hide within the substrate. For these reasons we did not attempt to estimate abundance of 0-aged steelhead by snorkeling in 1997.

Abundance estimates of > 0-aged fish were statistically equal in all three years sampled (Table 20). We concluded that snorkeling can be used to reliably estimate abundance of > 0-aged juvenile steelhead. Results of the regression analysis from all three years were too variable to produce a reliable equation that would convert an abundance estimate derived from snorkeling to an estimate derived from electrofishing for any age steelhead (Table 20).

2.10 Catchable Trout Program

In 1996-97, 291,028 (87,570 lbs) catchable size rainbow trout were produced by the LFC (Appendix I). Catchable trout averaged 3.3 fish/lb at release in spring 1997. Also in 1996-97, 150,156 rainbow trout fry (3,492 lbs) and 50,107 fingerlings (2,637 lbs) were reared for Idaho's LSRCP program. This production represents just over 111% of the program goal of 84,000 pounds.

3.0 CONCLUSIONS & RECOMMENDATIONS

The emphasis of monitoring and evaluation within the LSRCP program has shifted in recent years in response to the NMFS listing of several Snake River salmonid populations under the ESA. Actions to reduce the effects of the trout program (whether real or perceived) on natural salmon populations have been strongly encouraged. While attempting to develop hatchery management procedures to minimize those effects, considerable insights to the biology of steelhead have been gained. A better understanding of the physical attributes of successful smolts, and conversely of residual steelhead, should significantly improve program success while decreasing negative effects on all wild salmonid populations.

We believe it is important to note that the presumed beneficial effects of acclimation ponds in encouraging smolting and homing, do not universally apply. Holding steelhead in an acclimation pond with very cold water conditions may delay the smolting process. In one of three LFC ponds used for steelhead, acclimation appears to decrease survival and does not appear to significantly increase homing fidelity. Given these results, care should be taken when considering whether to recommend acclimation in all cases.

Washington's LSRCP steelhead and trout program has consistently returned adult steelhead and provided recreational opportunity for put-take trout, in excess of the LSRCP goals. The challenge before the program now will be to respond to the changing legal expectations which are being developed by NMFS as the Snake River becomes more directly managed to recover wild steelhead populations listed under the ESA. To that end we recommend the following actions:

1. Temporarily discontinue the use of Curl Lake AP for the acclimation and release of juvenile steelhead. Release all steelhead directly from LFH into the Tucannon River at or below RM 25.8 (Marengo). Evaluate the results and compare with previous CWT experimental results.
2. Begin the development of a locally adapted steelhead brood stock for the Tucannon River from wild/natural steelhead trapped from the Tucannon River. As production from the new brood stock becomes available, decrease production releases of LFH stock steelhead in the Tucannon River by a commensurate amount. Concurrently sample wild and hatchery steelhead populations to monitor their genetic morphology.
3. Continue the use of Wallowa stock steelhead trapped at Cottonwood AP for use in the Grande Ronde River. Continue marking (ADLV-CWT) test groups from Cottonwood AP and determine the degree of straying of these fish to downriver and local tributaries. Begin genetic sampling of natural populations in Washington's portion of the basin.
4. Identify where population estimates of 0-age juvenile salmonids are unnecessary, and discontinue the use of electrofishing for population densities in those areas. Use snorkeling to estimate populations of older age (>0-age) salmonids in rivers.
5. Begin sampling wild Tucannon steelhead population for smolt to adult survival (SAR).

Acknowledgements

The ongoing success of the steelhead and trout program is the result of the coordinated and dedicated efforts of many WDFW employees. We especially thank Butch Harty, Doug Maxey, Larry Barger, Bruce Walters and all the other Lyons Ferry/Tucannon staff for their hard work, insight, and assistance.

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Once again Jerry Harmon and the other NMFS personnel at Lower Granite Dam provide valuable data on adult steelhead passage. The accuracy and timeliness of their data is always appreciated.

We thank Ross Fuller, John Sneva, and Lyn Anderson for their assistance with portions of the project. Charles Morrill provided guidance with our PIT tag studies.

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5.0 APPENDICES

Appendix A

Smolt releases from Lyons Ferry Complex, 1993-1997.

Location	R.M.	Number released	Pounds released	Date m/dd	Stock	Tag Code	Brand	Fin Clips	Size #/lb	CWT loss %	Brand loss %
1993											
Asotin Creek	0.5	18,000	4,000	4/15	Oxbow			AD-RV	4.5		
Asotin Creek	0.5	48,500	10,000	4/20	Oxbow			AD-RV	4.8		
Asotin Creek	0.5	51,000	10,000	4/21	Oxbow			AD-RV	5.1		
Asotin Creek	0.5	18,550	3,500	4/22	Oxbow			AD-RV	5.3		
Grande Ronde River	29	291,711	49,865	4/3-30	Wallowa			AD	5.9		
Snake R. @ LFH	58	29,400	6,000	4/23	L.Ferry			AD	4.9		
Snake R. @ LFH	58	27,000	5,000	4/24	L.Ferry			AD	5.4		
Snake R. @ LFH	58	12,250	2,500	4/24	L.Ferry			AD	4.9		
Snake R. @ LFH	58	49,500	10,000	4/21	Oxbow			AD-RV	4.9		
Snake River	66	36,300	8,950	4/14	Oxbow			AD-RV	4.1		
Snake River	66	21,500	5,000	4/16	Oxbow			AD-RV	4.3		
Snake River	66	23,000	5,000	4/20	Oxbow			AD-RV	4.6		
Snake River	66	24,500	5,000	4/21	Oxbow			AD-RV	4.9		
Snake River	66	24,500	5,000	4/22	Oxbow			AD-RV	4.9		
Touchet @ Dayton	53	20,104	4,189	4/3	L.Ferry	63/59/41	RA-H-2	AD-LV	4.8	0.2	0.8
Touchet @ Dayton	53	20,328	4,235	to	L.Ferry	63/46/49	RA-H-1	AD-LV	4.8	0.3	0.5
Touchet @ Dayton	53	34,607	7,209	4/30	L.Ferry			AD	4.8		
Touchet @ Dayton	46	35,960	7,400	4/24	L.Ferry			AD	4.9		
Tucannon @ Curl	41	30,001	6,400	4/22	L.Ferry	63/48/16	LA-IC-1	AD-LV	4.7	1.0	4.1
Tucannon from Curl	41	21,960	4,392	4/3-30	L.Ferry	63/48/15	RA-IC-1	AD-LV	5.0	0.2	1.4
Tucannon from Curl	41	27,100	5,420	4/3-30	L.Ferry			AD	5.0		
Curl Lake		7,640	1,528	retained	L.Ferry	63/48/15	RA-IC-1	AD-LV	5.0		
Curl Lake		7,500	1,500	retained	L.Ferry			AD	5.0		
Tucann from Hatch.	36	4,602	767	4/10	Tucann	63/48/47		LV	6.0		
Tucannon @ Marengo	26	29,876	6,600	4/22	L.Ferry	63/48/17	LA-IC-3	AD-LV	4.5	1.2	2.8
Walla Walla River	35	19,440	4,050	4/16	L.Ferry	63/59/42	LA-H-1	AD-LV	4.8	0.6	6.1
Walla Walla River	35	19,800	4,500	4/16	L.Ferry	63/59/44	LA-H-2	AD-LV	4.4	1.1	4.6
Walla Walla River	36	22,000	5,000	4/23	L.Ferry			AD	4.4		
Walla Walla River	36	22,000	5,000	4/23	L.Ferry			AD	4.4		
Wildcat Ck. in Oregon	1	25,097	5,150	4/15	Wallowa			AD	4.9		
Wildcat Ck. in Oregon	1	25,091	5,122	4/19	Wallowa			AD	4.9		
Total		**1,048,817**	**208,277**					**Mean =**	**5.0**	**0.7**	**2.9**
1994											
Asotin Creek	0.5	17,500	5,000	4/25	L.Ferry			AD	3.5		
Asotin Creek	0.5	12,960	3,600	4/26	L.Ferry			AD	3.6		
Grande Ronde River	29	273,000	56,875	4/08-27	Wallowa			AD	4.8		
Mill Creek	2.7	21,450	5,500	4/20	L.Ferry			AD	3.9		
Snake R. @ LFH	58	31,650	9,000	4/26	L.Ferry			AD	3.5		
Snake R. @ LFH	58	28,500	7,500	4/27	L.Ferry			AD	3.8		
Snake R. @ LFH	58	6,189	1,587	4/28	L.Ferry			AD	3.9		
Snake River	83	52,700	13,000	4/28	L.Ferry			AD	4.1		
Touchet @ Dayton	53	119,624	31,480	4/15-29	L.Ferry			AD	3.8		
Tucannon from Curl	41	16,661	3,875	4/11-5/16	L.Ferry	63/54/09	RA-7U-3	ADLV	4.3	1.3	8.4

Appendix A (cont.)

Smolt releases from Lyons Ferry Complex, 1993-1997.

Location	R.M.	Number released	Pounds released	Date m/dd	Stock	Tag Code	Brand	Fin Clips	Size #/lb	Tag loss %	Brand loss %
(1994 continued)											
Tucannon from Curl	41	16,665	3,876	4/11-5/16	L.Ferry	63/54/08	LA-7U-1	ADLV	4.3	2.0	4.4
Tucannon from Curl	41	16,682	3,880	4/11-5/16	L.Ferry	63/54/07	RA-7U-1	ADLV	4.3	1.2	6.7
Tucannon from Curl	41	85,351	19,849	4/11-5/16	L.Ferry			AD	4.3		
Curl Lake		9,937	2,686	retained	L.Ferry			ADLV	3.7		
Curl Lake		13,961	3,773	retained	L.Ferry			AD	3.7		
Tucann. from Hatch.	36	10,179	1,885	5/13-20	Tucann	63/48/57		LV	5.4	7.3	
Walla Walla River	25	20,165	5,450	4/18	L.Ferry	63/53/12	RA-IT-1	ADLV	3.7	0.5	2.9
Walla Walla River	24	20,002	5,406	4/19	L.Ferry	63/53/13	LA-IT-1	ADLV	3.7	1.4	2.9
Walla Walla River	30	17,965	4,242	4/18	L.Ferry			AD	4.2		
Walla Walla River	34	16,280	4,400	4/19	L.Ferry			AD	3.7		
Walla Walla River	27	22,000	5,500	4/20	L.Ferry			AD	4.0		
Walla Walla River	24	22,500	5,000	4/21	L.Ferry			AD	4.5		
Walla Walla River	35	20,900	5,500	4/21	L.Ferry			AD	3.8		
Walla Walla River	23	20,093	5,152	4/21	L.Ferry	63/53/14	RA-IT-3	ADLV	3.9	1.7	5.6
Wildcat Ck. in Or.	1.0	24,600	6,000	4/26	Wallowa			AD	4.1		
Wildcat Ck. in Or.	1.0	24,908	6,075	4/27	Wallowa			AD	4.1		
Total		**942,422**	**226,091**					**Mean=**	**4.0**	**2.2**	**5.2**
1995											
Asotin Creek	0.5	22,000	5,000	4/26	L.Ferry			AD	4.4		
Asotin Creek	0.5	13,800	3,000	5/01	L.Ferry			AD	4.6		
Grande Ronde River	29.0	206,182	41,236	4/05-28	Wallowa			AD	5.0		
Mill Creek	2.7	15,200	4,000	4/19	L.Ferry			AD	3.8		
Snake R. @ LFH	58.0	20,094	5,152	4/20	L.Ferry	63/57/28	LA-H-1	ADLV	3.9	1.08	NA
Snake R. @ LFH	58.0	20,076	6,084	4/20	L.Ferry	63/57/28	LA-H-1	ADLV	3.3	1.08	NA
Snake R. @ LFH	58.0	9,702	2,488	4/20	L.Ferry			AD	3.9		
Snake R. @ LFH	58.0	3,329	876	4/24	L.Ferry			AD	3.8		
Snake R. @ LFH	58.0	6,793	1,544	4/26	L.Ferry			AD	4.4		
Snake R. @ LFH	58.0	6,978	1,586	5/02	L.Ferry			AD	4.4		
Touchet @ Dayton	53.0	20,133	5,369	4/05-30	L.Ferry	63/57/14	LA-IC-1	ADLV	3.75	0.13	1.50
Touchet @ Dayton	53.0	20,221	5,392	4/05-30	L.Ferry	63/57/15	RA-IC-1	ADLV	3.75	0.37	0.37
Touchet @ Dayton	53.0	20,041	5,344	4/05-30	L.Ferry	63/57/16	LA-IC-3	ADLV	3.75	0.37	1.00
Touchet @ Dayton	53.0	60,315	16,084	4/05-30	L.Ferry			AD	3.75		
Tucannon from Curl	41.0	17,150	3,236	4/11-5/18	L.Ferry	63/57/48	RA-IJ-3	ADLV	5.3	3.53	1.21
Tucannon from Curl	41.0	18,288	3,451	4/11-5/18	L.Ferry	63/57/18	LA-IJ-1	ADLV	5.3	0.97	1.46
Tucannon from Curl	41.0	18,124	3,420	4/11-5/18	L.Ferry	63/57/17	RA-IJ-1	ADLV	5.3	0.74	0.87
Tucannon from Curl	41.0	92,508	17,454	4/11-5/18	L.Ferry			AD	5.3		
Curl Lake		7,298	1,225	retained	L.Ferry			AD	6.0		
Curl Lake		6,914	1,160	retained	L.Ferry			ADLV	6.0		
Walla Walla River	35.0	25,233	6,820	4/18	L.Ferry	63/54/42	RA-H-2	ADLV	3.7	0.74	1.73
Walla Walla River	30.2	25,067	6,775	4/18	L.Ferry	63/54/43	RA-H-1	ADLV	3.7	0.63	1.39
Walla Walla River	30.2	9,300	2,405	4/18	L.Ferry			AD	3.9		
Walla Walla River	36.1	15,600	4,000	4/19	L.Ferry			AD	3.9		
Walla Walla River	35.0	14,400	4,000	4/19	L.Ferry			AD	3.6		

Appendix A (cont.)

Smolt releases from Lyons Ferry Complex, 1993-1997.

Location	R.M.	Number released	Pounds released	Date m/dd	Stock	Tag Code	Brand	Fin Clips	Size #/lb	Tag loss %	Brand loss %
(1995 continued)											
Walla Walla River	30.2	16,400	4,000	4/20	L.Ferry			AD	4.1		
Walla Walla River	34.0	12,000	3,000	4/20	L.Ferry			AD	4.0		
Walla Walla River	34.0	15,990	4,100	4/21	L.Ferry			AD	3.9		
Walla Walla River	35.0	13,500	3,000	5/02	L.Ferry			AD	4.5		
Walla Walla River	36.1	11,385	2,475	5/02	L.Ferry			AD	4.6		
Wildcat Ck. in Or	1.0	50,051	10,010	4/24	Wallowa			AD	5.0		
Total		**814,072**	**183,686**					**Mean=**	**4.3**	**0.96**	**1.19**
1996											
Asotin Creek	0.5	38,500	7,945	4/19	L.Ferry			AD	4.8		
Grande Ronde River	28.7	249,530	49,906	4/30	Wallowa			AD	5.0		
Mill Creek	2.7	17,550	3,900	4/17	L.Ferry			AD	4.5		
Mill Creek	2.7	2,448	480	4/18	L.Ferry			AD	5.1		
Mud Creek	0.05	13,919	2,717	4/19	Wallowa			AD	5.1		
Snake R. @ LFH	58	5,000	980	4/18	L.Ferry			AD	5.1		
Snake R. @ LFH	58	20,153	3,802	4/19	L.Ferry	63/60/36	LA-IT-1	ADLV	5.3	3.2	1.5
Snake R. @ LFH	58	6,500	1,300	4/19	L.Ferry			AD	5.0		
Snake R. @ LFH	58	20,122	3,946	4/19	L.Ferry	63/60/35	LA-IT-3	ADLV	5.1	3.1	5.2
Snake R. @ LFH	58	20,167	3,805	4/19	L. Ferry	63/60/34	RA-IT-1	ADLV	5.3	1.7	1.1
Touchet @ Dayton	54	40,065	9,307	4/30	L. Ferry	63/60/31	LA-IV-3	ADLV	4.3	1.7	4.5
Touchet @ Dayton	54	40,017	8,893	4/30	L. Ferry	63/60/30	LA-IV-1	ADLV	4.5	1.8	3.5
Touchet @ Dayton	54	54,528	12,393	4/30	L. Ferry			AD	4.4		
Tucannon from Curl	40	111,371	22,729	5/29	L. Ferry			AD	4.9		
Tucan.@ Marengo	25.8	30,464	6,093	4/15	L. Ferry	63/60/33	RA-IV-1	ADLV	5.0	4.3	2.8
Tucannon from Curl	40	27,871	5,688	5/29	L. Ferry	63/60/32	RA-IV-3	ADLV	4.9	4.4	2.4
Walla Walla River	35	55,165	11,950	4/17	L. Ferry			AD	4.6		
Walla Walla River	30.2	30,775	6,950	4/16	L. Ferry			AD	4.4		
Walla Walla River	35	29,190	6,950	4/16	L. Ferry			AD	4.2		
Walla Walla River	30.2	1,805	354	4/18	L. Ferry			AD	5.1		
Walla Walla River	35	32,065	6,950	4/18	L. Ferry			AD	4.6		
Walla Walla River	30.2	21,000	5,000	4/17	L. Ferry			AD	4.2		
Total		**868,205**	**182,038**					**Mean =**	**4.8**		
1997											
Asotin Creek	0.5	39,997	5,753	4/22	L.Ferry			AD	7.0		
Grande Ronde River	28.7	210,728	30,989	4/30	Wallowa			AD	6.8		
Grande Ronde River	28.7	39,534	5,814	4/30	Wallowa	63/63/39	RA-IL-3	ADLV	6.8	1.1	3.8
Grande Ronde in OR	45.4	24,624	5,130	4/24	Wallowa			AD	4.8		
Mill Creek	2.7	21,900	3,000	4/23	L.Ferry			AD	7.3		
Snake R. @ LFH	58	20,195	4,478	4/28	L.Ferry	63/62/58	LA-S-1	ADLV	4.5	1.3	3.4
Snake R. @ LFH	58	19,975	4,429	4/19	L.Ferry	63/61/33	RA-S-1	ADLV	4.5	3.2	2.2
Snake R. @ LFH	58	20,769	4,605	4/19	L.Ferry	63/61/34	RA-S-2	ADLV	4.5	1.7	2.1
Snake R. @ LFH	58	20,223	4,484	4/19	L.Ferry	63/62/59	LA-S-2	ADLV	4.5	1.3	3.6

Appendix A (cont.)

Smolt releases from Lyons Ferry Complex, 1993-1997.

Location	R.M.	Number released	Pounds released	Date m/dd	Stock	Tag Code	Brand	Fin Clips	Size #/lb	Tag loss %	Brand loss %
(1997 continued)											
Touchet @ Dayton	54	30,341	5,142	4/30	L. Ferry	63/61/21	LA-IC-1	ADLV	5.9	1.0	1.8
Touchet @ Dayton	54	30,164	4,372	4/30	L. Ferry	63/61/22	LA-IC-3	ADLV	6.9	0.8	1.8
Touchet @ Dayton	54	82,319	11,930	4/30	L. Ferry			AD	6.9		
Tucannon from Curl	40	82,027	12,059	5/20	L. Ferry			AD	6.8		
Tucannon from Curl	40	27,978	4,114	5/20	L. Ferry	63/63/37	RA-IV-3	ADLV	6.8	1.7	1.6
Tucan.@ Marengo	25.8	29,966	6,530	4/22	L. Ferry	63/63/38	RA-IV-1	ADLV	4.6	1.2	0.7
Walla Walla River	35	18,865	3,850	4/15	L. Ferry			AD	4.9		
Walla Walla River	35	27,000	5,000	4/17	L. Ferry			AD	5.4		
Walla Walla River	35	35,500	5,000	4/22	L. Ferry			AD	7.1		
Walla Walla River	30.2	37,850	7,500	4/16	L. Ferry			AD	5.0		
Walla Walla River	30.2	47,750	8,750	4/21	L. Ferry			AD	5.5		
Walla Walla River	30.2	4,015	550	4/23	L. Ferry			AD	7.3		
Total		**871,720**	**143,479**					**Mean =**	**6.1**	**1.5**	**2.3**

Appendix B

Steelhead trapped at Tucannon Hatchery trap, spring 1997. [A]

Date	Wild/Hatchery	Sex	Marks	Length(cm)	Condition
05/09	H	M	AD	74	Fair
05/10	H	F	AD	66	Ripe
05/19	H	F	AD	66	Good
05/19	W	F		61	Good
06/07	H	F	AD	66	Net marks
06/09	H	F	AD	71	Good
06/12	H	F	AD	74	Good
06/17	H	F	AD	61	Good
06/17	H	M	AD	66	Good
06/18	H	F	AD	66	Good
06/18	H	F	AD	66	Good
06/18	H	F	AD	61	Good
06/21	H	F	AD	61	Good
06/23	H	F	AD	61	Good
06/27	H	F	AD	61	Good
06/29	W	F		68	Good
07/06	H	F	AD	61	Good
07/07	H	F	AD	66	Good
07/08	H	F	AD	61	Good
07/12	H	M	AD	68	Good
07/14	H	M	AD	68	Good
07/17	W	F		64	Good
07/22	H	F	AD	66	Good
07/22	H	F	AD	66	Good
08/04	H	F	AD	66	Good
09/09	H	F	AD	61	Good

A: Trapping dates: 5/07/97 to 9/12/97 inclusive. All fish were passed upstream from the trap upon arrival.

Appendix C

Brand and tag recoveries from the trap at LFH during the 1996 run year.

Freeze brand	Tag Code	Stock	Release Year	Release site	Actual [A] Tag Return
RA-IT-1	63/53/12	LFH	1994	Walla Walla R.	34
RA-IT-3	63/53/14	LFH		Walla Walla R.	20
LA-IT-1	63/53/13	LFH		Walla Walla R.	38
RA-7U-1	63/54/07	LFH		Tucannon R.(Curl AP)	6
RA-7U-3	63/54/09	LFH		Tucannon R.(Curl AP)	0
LA-7U-1	63/54/08	LFH		Tucannon R.(Curl AP)	4
				Total	**102**
RA-H-1	63/54/43	LFH	1995	Walla Walla R.	227
RA-H-2	63/54/42	LFH		Walla Walla R.	190
LA-H-1	63/57/28	LFH		Snake R.	482
LA-IJ-1	63/57/18	LFH		Tucannon R.(Curl AP)	42
RA-IJ-1	63/57/17	LFH		Tucannon R.(Curl AP)	18
RA-IJ-3	63/57/48	LFH		Tucannon R.(Curl AP)	26
RA-IC-1	63/57/15	LFH		Touchet R.	226
LA-IC-1	63/57/14	LFH		Touchet R.	205
LA-IC-3	63/57/16	LFH		Touchet R.	167
				Total	**1,583**
AD only					3,895
Wild					4
ADRV					3
No tag					1
Unrecognizable tag					1
Not mark sampled					9
				TOTAL	**5,598**

A Includes recoveries of visible freeze brands and CWTs from fish killed and spawned.

Appendix D

Coded-wire tag expansions for LSRCP rivers in SE Washington.

Table 1. Coded wire tag expansions, fall 1996 and spring 1997.

River	Section										
Snake River	**228**										
	Sept [B]	Oct	Nov	Dec	Jan	Feb	March	April			
Sample size	8	145	88	30	0	0	0	0			
Harvest [A]	**217**	**1684**	**1128**	**266**	**4**	**0**	**25**	**4**		Number	Expanded
Sample rate	0.0369	0.0861	0.0780	0.1128					CWT	Tags	Number
			2						070325	2	26
			1						070326	1	13
		2	1						070327	3	36
		1							070328	1	12
		1							070330	1	12
		2	1						070920	3	36
		1							075822	1	12
				1					075823	1	9
		1		1					075825	2	20
		1							102005	1	12
		1							102007	1	12
		1							102009	1	12
		1							103046	1	12
		1							103048	1	12
		1							104516	1	12
			1						104623	1	13
		1							232017	1	12
				1					232443	1	9
			1						635716	1	13
		2							635718	2	23
		2							635728	2	23
			1						635748	1	13
		3	1	1					NO TAG	5	57

Snake River	**252**										
	Sept [B]	Oct	Nov [B]	Dec	Jan	Feb	March	April			
Sample size	1	16	2	9	0	0	0	0			
Harvest [A]	**208**	**274**	**197**	**98**	**12**	**0**	**8**	**0**		Number	Expanded
Sample rate	0.0048	0.0584	0.0102	0.0918					CWT	Tags	Number
				1					635717	1	11
		1							635718	1	17
				1					NO TAG	1	11

Appendix D : Table 1 (cont.)

Snake River	**167**										
	Sept	Oct	Nov	Dec	Jan	Feb	March	April			
Sample size	26	38	40	35	0	0	0	0			
Harvest [A]	**196**	**225**	**168**	**213**	**12**	**0**	**8**	**0**		Number	Expanded
Sample rate	0.1327	0.1689	0.2381	0.1643					CWT	Tags	Number
			1						070920	1	4
			1						102010	1	4
			1						103047	1	4
			2	2					635442	4	21
		4		2					635443	6	36
			1						635714	1	4
		2	2						635715	4	20
			1						635718	1	4
		2		1					635728	3	18
			1						NO TAG	1	4

Snake River	**166**										
	Sept	Oct	Nov	Dec	Jan	Feb	March	April			
Sample size	189	300	114	121	2	0	0	0			
Harvest [A]	**1238**	**1538**	**1079**	**816**	**41**	**61**	**164**	**0**		Number	Expanded
Sample rate	0.1527	0.1951	0.1057	0.1483	0.0488				CWT	Tags	Number
		2	1						052155	3	20
	1								052458	1	7
			1						053407	1	9
			1						070321	1	9
		1		1					070325	2	12
				1					070327	1	7
	1								070920	1	7
				2					075824	2	13
	1								101532	1	7
				1					102002	1	7
	1								102007	1	7
		1							102009	1	5
		1		1					102011	2	12
	1	1							102012	2	12
		2							102018	2	10
	1								102024	1	7
		1							103046	1	5
	1								104517	1	7
		1							104628	1	5
		1							104703	1	5
	1	1							104704	2	12
	1	1							104711	2	12
				1					104712	1	7
		1							104714	1	5
		1							104722	1	5
		1							104723	1	5
	1	4							104925	5	27
	1								231958	1	7
		1							232017	1	5
	1								634661	1	7
	1								635314	1	7
	1	1							635442	2	12
	6	1							635443	7	44

Appendix D: Table 1 (cont.)

Snake River	**166**										
	Sept	Oct	Nov	Dec	Jan	Feb	March	April			
Sample size	189	300	114	121	2	0	0	0			
Harvest [A]	**1238**	**1538**	**1079**	**816**	**41**	**61**	**164**	**0**		Number	Expanded
Sample rate	0.1527	0.1951	0.1057	0.1483	0.0488				CWT	Tags	Number
	1								635714	1	7
	1	1		1					635715	3	18
	5	1							635716	6	38
	2	1							635717	3	18
	1								635718	1	7
	1	3							635728	4	22
		1							635942	1	5
	8	7	4						NO TAG	19	126

Snake River	**165**										
	Sept [B]	Oct	Nov	Dec	Jan	Feb	March	April			
Sample size	6	48	67	79	0	0	0	0			
Harvest [A]	**221**	**548**	**650**	**585**	**29**	**4**	**4**	**4**		Number	Expanded
Sample rate	0.0271	0.0876	0.1031	0.1350					CWT	Tags	Number
			1						053407	1	10
		1							070144	1	11
			1						635312	1	10
		2	2	1					635443	5	50
	1								635714	1	1
			1						635716	1	10
		1							635718	1	11
			1						635748	1	10
	1	1	1						NO TAG	3	22

Snake River	**164**										
	Sept	Oct	Nov	Dec	Jan	Feb	March	April			
Sample size	0	12	0	0	0	0	0	0			
Harvest [A]	**12**	**37**	**32**	**4**	**0**	**0**	**0**	**0**		Number	Expanded
Sample rate		0.3243							CWT	Tags	Number
		1							635748	1	3

Appendix D: Table 1 (cont.)

Tucannon River	**189**										
	Sept [B]	Oct	Nov	Dec	Jan	Feb	March	April			
Sample size	5	26	59	71	72	10	0	0			
Harvest [A]	**108**	**205**	**110**	**184**	**166**	**36**	**28**	**5**		Number	Expanded
Sample rate	0.0463	0.1268	0.5364	0.3859	0.4337	0.2778			CWT	Tags	Number
		1			1				635407	2	10
						1			635408	1	4
			2		1				635409	3	6
	1	2			3				635442	6	24
			1		1				635443	2	4
	1	1	6	1	1				635714	10	25
	1	4	3		2				635715	10	43
		3	2		2				635716	7	32
		2	3	1	3				635717	9	31
		2		1	1				635718	4	21
			2						635748	2	4
			5	2	1				NO TAG	8	17

Touchet River	**185**										
	Sept	Oct	Nov	Dec	Jan	Feb	March	April			
Sample size	0	0	0	1	4	9	30	2			
Harvest [A]	**0**	**0**	**45**	**4**	**12**	**53**	**151**	**20**		Number	Expanded
Sample rate				0.2500	0.3333	0.1698	0.1987	0.1000	CWT	Tags	Number
					1	2	4		635714	7	35
							1		635715	1	5
						1	4		635716	5	26
							1		NO TAG	1	5

Mill Creek	**106**										
	Sept	Oct	Nov	Dec	Jan	Feb [B]	March	April			
Sample size	0	0	0	0	3	1	4	0			
Harvest [A]	**0**	**0**	**0**	**4**	**8**	**28**	**53**	**8**		Number	Expanded
Sample rate					0.3750	0.0357	0.0755		CWT	Tags	Number
							2		635442	2	26

Grande Ronde River	**75**		See WDFW / ODFW results								
	Sept	Oct	Nov. [B]	Dec	Jan	Feb	March	April			
Sample size	0	0	5	0	0	0	0	0			
Harvest [A]	**96**	**470**	**413**	**350**	**398**	**677**	**719**	**245**		Number	Expanded
Sample rate			0.0121						CWT	Tags	Number
			1						070920	1	1

Appendix D: Table 1 (cont.)

Walla Walla	**194**										
River	Sept	Oct	Nov [B]	Dec [B]	Jan	Feb [B]	March [B]	April			
Sample size	0	30	2	3	17	3	3	0			
Harvest [A]	**183**	**293**	**227**	**257**	**268**	**142**	**85**	**28**		Number	Expanded
Sample rate		0.1024	0.0088	0.0117	0.0634	0.0211	0.0353		CWT	Tags	Number
		1							635312	1	10
				1					635313	1	1
		4		1	2				635442	7	72
					1		1		635443	2	17
		1							635714	1	10
		1							635716	1	10

McNary Pool	**45**										
Columbia R.	Sept[B]	Oct	Nov	Dec	Jan	Feb	March	April			
Sample size	3	12	6	0	0	0	0	0			
Harvest [A]	**0**	**14**	**10**	**0**	**0**	**0**	**0**	**3**		Number	Expanded
Sample rate		0.86	0.60						CWT	Tags	Number
	1								635728	1	1
			1						070656	1	2

A: WDFW sport catch estimates; based on catch record card returns (WDFW 1998).

B: Sample rate of <0.05 considered too small for reliable expansions.

Appendix D (cont)

Table 2. Observed and expanded numbers of ADLV + CWT marked steelhead recovered on the Grande Ronde River in Washington during the 1996-97 steelhead season.

Tag Code	Release site	Brood year	Number observed	Number expanded
07/03/26	Big Canyon Cr.	93	1	2.4
07/03/29	Spring Cr.	93	1	2.1
07/03/30	Spring Cr.	93	1	5.4
07/09/20	Deer Cr. [A]	94	4	11.3
07/58/24	Deer Cr. [B]	94	1	1.8

[A]: Direct release into Deer Creek.
[B]: Acclimated and then released into Deer Creek.

Appendix E

Juvenile density sample sites on SE Washington streams.

Site name	Site type	Site length (ft)	Road mile	Description and reference point
Main Asotin Ck.				
MA1-93	Control	108		Behind Thiesens Ranch 1/4 mi. above Headgate Park.
MA2-93	Control	100		3/4 mi. below mouth of Charlie Ck. river is next to the road, 10 boulders in upper end of site.
North Fork Asotin Ck.				
NA-C4	Control	95	1.25	By small clearing past rusted road closure gate.Ref:0+90RB,alder
NA2c-83	3 Log Weirs	100	1.35	Across a large meadow. Ref: 0-13 LB alder.
NA-C2	Control	87	1.80	Above split in creek 300 ft. above NA4a. Ref:0+04 RB, Doug. fir.
NA4-84	18 Boulders	100	1.90	In first campgrd. above NA4a-83. Ref:0+00 RB, alder.
NA-C1	Control	83	2.60	Across the road from a rock face. Ref:1+16 RB, alder.
NA8-84	12 Boulders	75	3.00	Ref:0-18 LB, alder.
South Fork Asotin Ck.				
SA1-83	2 Log Weirs	119	0.40	300ft. above Campbell Grade Road. Ref:0+00 RB, alder.
SA-C3	Control	100	0.80	0.1 mile above Hodson's cattleguard Ref:1+29 RB, alder.
SA-C2	Control	99	1.95	By 20 ft. high eroding bank. Ref:0+25 RB, boulder.

Appendix E. (cont.)

Site name	Site type	Site length (ft)	Road mile	Description and reference point
SA6B-83	1 Log Weirs 8 Boulders	77	2.35	.15 miles below road closure gate. Ref: 0+00 LB, cottonwood.
SA-C5	Control	104	3.55	Above and continuous with SA6-84. Ref: 0+03LB, cottonwood.
SA7-84	8 Boulders	70	3.60	Creek runs next to road here. Ref: 0-50LB, ponderosa pine.
Charlie Creek				
Site-2	Index	100		9.35 miles above Koch's gate and 1.35 miles below the top gate.
CH-1	Index	100		8.9 miles above Koch's gate.
CH-1A	Index	100		Mid way between CH-1 and CH-2.
CH-2	Index	100		5.7 miles above Koch's gate.
CH-3	Index	100		3.9 miles above Koch's gate.
CH-4	Index	100		0.6 miles above Koch's gate
Tucannon River				
TN1-93	Control	98		1/4 mi. above Marengo Bridge.
TN-C1	Control	100	0.10	Near lower outhouse at camp 2. Ref: 0+02LB, ponderosa pine.
TN3-84	12 Boulders	166	0.35	Day use above camp 3. Ref: 2+66LB, cottonwood.
TNC5-84	Control	100	8.40	Day use area just above large B.P. Ref: 0+30LB, douglas fir
TNS1-96	Control	174		150 m upstream of Camp 8 outhouse.

Appendix E. (cont.)

Site name	Site type	Site length (ft)	Road mile	Description and reference point
TNS2-96	Control	98.4		100 m upstream of Camp 8 outhouse.
TN31-84	13 Boulders 1 Log Weir	153	11.10	Just below Panjab bridge. Ref: 0-62LB, bridge piling.
Cummings Ck.				
CC0.5-96	Control	99	0.5	0.5 Mile above gate, at site of old steelhead trap
CC1-93	Control	99	1.0	2.3 miles above the gate. Lower end of site is 10.6 meters above bridge.
CC1.5-96	Control	99	3.6	3.6 miles above the gate. First big canyon below Forest service fence at outfitters camp
CC.-93	1 Log Weir	85	4.1	Steep bank goes down from road to a flat, fairly open area along Ck., log weir at lower end of site.
North Fork Touchet R.				
NFT3-92	Index	100		1/10 mi. below South Fork Bridge.
NFT2-92	Index	100		1.7 mi. above Wolf fork Bridge.
NFT1-92	Index	45		7.1 mi. above Wolf Fork Bridge, at Touchet R. Road bridge crossing, 0.5 mi. above pond.

Appendix E. (cont.)

Site name	Site type	Site length (ft)	Road mile	Description and reference point
South Fork Touchet R.				
SFT1-92	Index	102		6 mi. above Camp Nancy Lee Bridge, just below forks confluence.
SFT1-96	Index	102		3.15 miles above Camp Nancy Lee Bridge, at cabins, before crossing.
SFT2-92	Index	96		2/10 mi. below Camp Nancy Lee Bridge.
SFT3-92	Index	100		20 yards above Petty John Bridge.
Wolf Fork Touchet R.				
WFT1-92	Index	98		6.3 miles above the Robinsons Fork Bridge; at the Blue Gate
WFT2-92	Index	96		1/10 mi. below 1st bridge crossing, past Robinson's Fork.
WFTU-92	Index	65		1.3 mi. above Wolf Fork Bridge.

Appendix F. Juvenile steelhead densities for SE Washington rivers that are part of the LSRCP program.

	Juvenile steelhead per 100 square meters														
Years Sampled	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Tucannon River															
0-aged steelhead		16.0		18.4	20.6		18.1	19.1	13.0	17.4	14.6		11.0	15.8	16.5
>0-aged steelhead		2.5		13.7	8.5		10.6	9.8	6.5	4.8	7.0		4.0	3.2	4.6
Cummings Ck.															
0-aged steelhead											43.2	42.9	32.4	47.8	
>0-aged steelhead											26.3	20.4	29.6	16.6	
North Fork Asotin Ck.															
0-aged steelhead	23.7	6.6		29.7			22.8		22.1	56.9	36.8	20.4	23.4	13.0	24.0
>0-aged steelhead	8.7	7.5		37.6			18.0		14.2	22.2	28.1	34.9	11.2	17.4	6.7
South Fork Asotin Ck.															
0-aged steelhead	44.3	39.0					6.0		1.8	50.0	78.7	0.8	34.6	2.0	32.5
>0-aged steelhead	25.3	30.6					34.0		13.9	10.4	42.5	16.4	11.4	11.2	4.6
Main Asotin Ck.															
0-aged steelhead											49.1	36.8	47.7	62.8	33.4
>0-aged steelhead											22.1	39.6	13.1	12.2	6.9

Appendix F. (cont.)

Years Sampled	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
	Juvenile steelhead per 100 square meters														
Charlie Ck.															
0-aged steelhead			73.0									19.0		64.4	
>0-aged steelhead			37.6									20.0		15.3	
North Fork Touchet R.															
0-aged steelhead										35.5	26.0	20.8	42.5	4.9	28.5
>0-aged steelhead										19.0	19.3	18.9	8.9	3.6	2.3
South Fork Touchet R.															
0-aged steelhead										42..8	8.7	16.2	31.1	1.9	11.6
>0-aged steelhead										15.5	15.0	5.8	9.5	10.2	2.8
Wolf Fork Touchet R.															
0-aged steelhead										41.1	21.8	20.2	25.0	2.3	22.8
>0-aged steelhead										8.7	10.5	11.5	6.4	5.3	5.4

Appendix G

Snorkel sites for juvenile steelhead density on SE Washington rivers. [A]

SITE #	TAG # /BANK	OLD SITE NAME	PARK CAR	SITE DESCRIPTION
TUC-1 TUC-1A	900/RB -100M	New-Mar#2	King Gr Br.	Upstream 200-300m, near upper end of high clay bank
TUC-2 TUC-2A	899/RB -100M	MARENGO #6	2.3 rd miles above King Gr Rd.	Old Marengo #6 site, or close to it, find a riffle
TUC-3 TUC-3A	898/RB -100M	New-Mar#12	Marengo Br.	75m below Marengo Bridge, before sharp bend in river.
TUC-4 TUC-4A	897/RB -100M	TN1-93	0.4 rd miles above Marengo Br.	See tag on left bank across river
TUC-5 TUC-5A	896/LB -100M	New-Hart#3	Bridge 10	100m below Bridge 10, around corner so you can't see bridge.
TUC-6* TUC-6A	895/LB -100M	R5, Hartsock 1	Bridge 11	20-30m above Bridge 11
TUC-7 TUC-7A	894/RB -100M	R4	Bridge 13	17.3 m below bridge to center of site.

Appendix G (cont.)

SITE #	TAG # /BANK	OLD SITE NAME	PARK CAR	SITE DESCRIPTION
TUC-8 TUC-8A	893/RB -100M	HARTSOCK #5	Fowl Farm	Across field, upstream from small log cabin
TUC-9 TUC-9A	892/LB -100M	HARTSOCK #7	Dahms house	Old Hartsock #7, below Dahms house
TUC-10 TUC-10A	891/RB -100M	HARTSOCK #9	L.E. Campground #1	Below HMA fence line about 25 meters
TUC-11* TUC-11A	890/RB -100M	TN0-84	CUMMINGS BRIDGE	Just below Cummings Bridge
TUC-12* TUC-12A	889/RB -100M	TNC1-84, HMA #1	1st pull out on left, above C.C. Br.	Just above mouth of Cummings Creek
TUC-13 TUC-13A	888/LB -100M	HMA #6	Hatchery Intake	300 m below intake (old #6)
TUC-14 TUC-14A	887/RB -100M	New HMA #7	Cabled off dayuse, above old#6 CG	Follow trail to right 100-150 m to river, can't miss pool

Appendix G (cont.)

SITE #	TAG # /BANK	OLD SITE NAME	PARK CAR	SITE DESCRIPTION
TUC-15	886/LB	TN13-84	1.9 mi. abv Tuc Hat Br,	Across from New Camp#5
TUC-15A	-100M			
TUC-16	885/LB	HMA #9	2.4 miles above hatchery Br.	Below Beaver/Watson, pull out on left with dirt pile
TUC-16A	-100M			
TUC-17	884/LB	TNS1-96	30m below Campground #6	100m above HMA 10
TUC-17A	-100M			
TUC-18*	883/LB	TNS2-96	150m aboveCampground #6	150m above campground outhouse
TUC-18A	-100M			
TUC-19	882/LB	HMA-12	Closed C.G, Big 4 intake	Above Big 4 intake (OLD HMA 12)
TUC-19A	-100M			
TUC-20	881/LB	HMA-13	2.8 mi. above B/W, F.S. G.S.	L.E. end of pullout at guard station (old #13)
TUC-20A	-100M			
TUC-21*	880/LB	TNC5-84	First cattleguard fence	Day use area with cattle shute.
TUC-21A	-100M			
TUC-22	879/RB	HMA-19	Cow Camp Br.	upper end of HMA 19 is lower end of bridge
TUC-22A	-100M			
TUC-23*	878/	TN31-84,	Panjab Bridge	25-30m below Panjab br.
TUC-23A	-100M	HMA #23		

Appendix G (cont.)

SITE #	TAG # /BANK	OLD SITE NAME	PARK CAR	SITE DESCRIPTION
TUC-24 TUC-24A	877/RB -100M	Wild #1	Wild C.G. #1	L.E. CG #1, now a riffle
TUC-25 TUC-25A	876/RB -100M	Wild #6	L.E. closed C.G. #1	Old Wild #6, now a riffle
TUC-26 TUC-26A	875/LB -100M	Wild #12	Lady Bug Flat	Old Wild #12, U.E. ladybug flat c.g., now a riffle
TUC-27 TUC-27A	874/? -100M	Wild #16	Winchester Cr. site	Old Wild #16, now a riffle
TUC-28 TUC-28A	873/? -100M	New Wild-15	Sheep Creek	About 30m below Sheep Creek mouth, now a run
TUCSC#1	----	Side Channel	0.9 rd miles, Q-Hut	Directly behind quanset hut, near cliff
TUCSC#2	----	Side Channel	L.E. upper most campground	1.25 miles above C.C. Bridge (old HMA 21)

A - All sites are sampled by snorkeling; sites with an asterisk were also sampled at a later date by electrofishing. Tag numbers are located in middle of site (Bank designation is determined while looking downstream). "A" Sites are determined by measuring 100m downstream from lowest end of regular site (ie: Marks the upper end of "A" site).

Appendix H

Trout plants from Lyons Ferry Complex, 1997.

COUNTY	LOCATION	No. of Plants	Pounds of Fish	No. Fish Planted
ADAMS	Sprague Lake	1	1,500	7,050
	TOTAL Rainbows		1,500	7,050
ASOTIN	Alpowa Creek	1	70	315
	Asotin Creek	1	469	2,000
	Golf Course Pond	5	7,245	25,266
	Headgate Pond	1	450	2,025
	Silcott Pond	2	1,350	4,105
	West Evans Pond	6	4,863	17,821
	TOTAL Rainbows		14,447	51,532
COLUMBIA	Beaver	1	1,040	2,600
	Dam Pond	2	807	2,951
	Dayton Jv. Pond	3	929	3,064
	Orchard Pond	2	619	2,095
	Rainbow Lake	12	12,602	43,388
	Spring Lake	10	8,587	27,319
	Touchet R.(GB)	1	2,830	10,188
	Tucannon R.	1	1,017	4,000
	Watson	1	1,020	2,754
	TOTAL Rainbows		26,621	88,171
	Browns		2,830	10,188
FRANKLIN	Dalton Lake	3	5,240	16,996
	Marmes Pond	1	200	500
	TOTAL Rainbows		5,740	17,496
GARFIELD	Baker's Pond	1	314	1,099
	Casey Pond	1	98	500
	Deadman Creek	1	130	507
	Pataha Creek	1	390	1,521
	TOTAL Rainbows		932	3,627
GRANT	Blue lake	4	10,169	29,746
	Park Lake	3	8,026	20,065
			18,195	49,811

Appendix H. (cont.)

COUNTY	LOCATION	No. of Plants	Pounds of Fish	No. Fish Planted
WALLA WALLA	Bennington Lake	1	4,000	10,400
	College Place Pond	2	765	3,291
	Coppei Creek	1	216	972
	Dry Creek	1	216	972
	Fishhook Pk. Pond	4	2,145	8,959
	Mill Creek	1	1,836	7,000
	Quarry Pond	3	8,240	29,274
	TOTAL Rainbows		17,418	60,868
WHITMAN	Garfield Pond	1	450	2,025
	Gilcrest Pond	2	710	3,039
	Pampa Pond	1	1,075	4,838
	Riparia Pond (RB)	1	417	1,001
	Riparia Pond (GB)	1	351	2,000
	Rock Lake (GB)	1	780	2,808
	Union Flat Creek	1	365	1,570
	TOTAL Rainbows		3,017	12,473
	Browns		1,131	4,808
	TOTAL RAINBOWS		**87,570**	**291,028**
	TOTAL BROWNS		**3,961**	**14,996**
	TOTAL FISH PLANTED		**91,531**	**306,024**