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Lyons Ferry Trout Evaluation Study

By Mark L. Schuck, Arthur E. Viola, and Michael G. Keller

Washington Department of
FISH AND WILDLIFE
Hatcheries Program
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ABSTRACT

In 1994, as part of the Lower Snake River Compensation Plan (LSRCP) mitigation program, Lyons Ferry Hatchery (LFH) produced 814,072 summer steelhead (183,686 pounds) with an average smolt size of 4.3 fish/lb. A total of 263,521 rainbow trout (85,013 pounds) were planted into 40 waters at an average size of 3.1 fish/lb. Additionally, 199,612 fry and 51,890 fingerling rainbow trout (9,410 pounds) were reared and provided to Idaho

Nine study groups of juvenile steelhead were branded, coded-wire tagged, fin clipped and released into two rivers. Two tag groups were released into the Walla Walla River for contribution studies. Three groups were released into the Tucannon River to continue our study of smolt behavior and residualism. Three groups were released into the Touchet River from the Dayton acclimation pond for a contribution study, and a single group was released from LFH as a contribution study and for comparison with tributary releases.

Two groups of steelhead from Curl Lake AP and one group from LFH were tagged with Passive Integrated Transponder (PIT) tags. Relative emigration performance to collector dams on the Snake and Columbia rivers was measured and physical characteristics of successful emigrants characterized. The overall group performance of fish released into the Tucannon River, measured as detections at McNary Dam, for acclimated versus direct river releases was similar. All groups traveled downstream at a similar rate.

In an effort to decrease the number of residual steelhead in the Tucannon River which may adversely interact with wild salmonids, we kept 14,212 potential residual juvenile steelhead in Curl Lake AP instead of releasing them into the Tucannon River.

During the summer and fall of 1994, 4,011 adult steelhead were trapped at LFH. Of these, 53.6% were female, 83.9% were one-salt age fish , and 0.6% were wild fish. Tagged/branded made up 15.2% of fish sampled. We spawned three hundred forty-three females and 549 males to produce 1,772,477 eggs . One-salt age females (indicates years of ocean residency) (n = 226) averaged 4,871 eggs per female and two-salt age females (n = 50) averaged 6,397 eggs per female.

We surveyed 9,679 steelhead anglers who caught 2,499 steelhead from area rivers to recover coded-wire tags from study fish. Estimates of angler effort, total harvest and tagged fish harvest are summarized. The average angler required 13.4 hours to catch a fish.

We estimate that releases of Washington's LSRCP smolts in 1991, 1992 and 1993 returned 8,730 adult steelhead to the LSRCP program area in 1994-95. The return is 187% of the goal established for Washington's steelhead mitigation.

Populations of naturally produced steelhead in LSRCP streams were marginally higher than observed in 1993. Adult escapement and redd construction decreased from 1994, but improved flows in most area rivers have benefitted juvenile survival.

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ACKNOWLEDGEMENTS

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A perennial thanks to Jerry Harmon and the other NMFS personnel at Lower Granite Dam for their professional and diligent reading of brands on returning adult steelhead. Their data proves invaluable each year in understanding the behavior of our returning steelhead.

John Johnston and Merl May spent months tracking down anglers and removing snouts from coded-wire tagged steelhead. Their work forms the basis for the tedious, but very important, sport recovery portion of our tag recovery effort. We sincerely appreciate their efforts.

We would like to thank Glen Mendel, Joe Bumgarner, Butch Harty, Doug Maxey and Geraldine Vander Haegen for reviewing the draft manuscript and providing comments.

Finally, we would like to express our special appreciation to the manager and staff of Lyons Ferry Complex for their support and hard work at making Washington's LSRCP program a success; and to the staff of the LSRCP office for their firm support and the funding of these studies.

1.0 INTRODUCTION

This annual report is one of a series describing Washington Department of Fish and Wildlife's (WDFW)[1] progress toward meeting Washington's trout (resident and anadromous) mitigation goals established in the Lower Snake River Compensation Plan (LSRCP). The study period for this report was 1 July 1994 through 30 June 1995.

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

The Lyons Ferry Evaluation study assesses whether the complex produces fish that meet established mitigation goals, 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 an ongoing coastwide review by the National Marine Fisheries Service (NMFS) on the status of steelhead reinforces the need to monitor populations of wild salmonids in rivers receiving LSRCP mitigation. Our data on wild steelhead population density and size is used to assess the potential effects of hatchery fish on natural populations. Also, our work on hatchery smolt residualism, begun in 1991, has helped reduce the potentially negative effects of hatchery fish on0 naturally produced fish.

Our identification of the need to develop locally adapted steelhead broodstocks for use in the LSRCP program will be beneficial to the long term health of wild/natural populations if supplementation must be used to support these populations.

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[1] The Washington Departments of Fisheries and Wildlife were merged in March, 1994. This work is a continuation of Washington Department of Wildlife's evaluation studies, but all references in this report will be to the new agency, WDFW.

2.0 METHODS/ RESULTS / DISCUSSION

2.1 Hatchery Operation Monitoring

2.1.1 Juvenile production

Our methods of sampling growth rates during the production year or when sampling the smolts before release in the spring are the same as past years (Schuck 1985). We measured pre-release fork length and weight, and visually classified the fish as a smolt, transitional smolt, parr or precocious male. Some fish were killed to determine gender.

Table 1: Trout production at Lyons Ferry / Tucannon hatcheries, 1994-95.

Species[A]	Stock[A]	Number of eggs taken	Number of fry	Number released	%[B] survival	Fish lbs. produced
Lyons Ferry Hatchery						
RB	Spokane(93)	388,800	378,582	356,497[C]	91.7	51,250
RB	Spokane(94)	0	56,112	51,890[D]	92.5	3,530
SSH	Wal./Cot.(94)	644,886	302,397	256,233[E]	27.8[E]	51,246[E]
SSH	Wallowa(94)	277,000	233,813			
SSH	LFH(94)	1,352,296[F]	845,316	558,130[G]	41.3	129,518[G]
Tucannon Hatchery						
RB	Spokane(93)	226,800	221,726	183,626[H]	81.0	41,629
RB	Spokane(94)	87,000	82,035	56,112[I]	64.5	
GB	Ford(93)	25,230	24,232			
SSH	LFH(94)	0	160,573	160,282[J]	99.8	11,522

A - RB = rainbow, SSH = summer steelhead, GB = german brown; Wal = Wallowa, Cot.= Cottonwood.
B - egg to smolt survival rate.
C - Includes 166,269 fish (3,393 lbs) transferred to IDFG; and 74,481 fish (2,013 lbs) planted in Sprague Lake, Spokane and Adams County.
D - Received from the Tucannon Hatchery, marked, then transferred to IDFG.
E - Total is for Wallowa and Wal./Cot. combined.
F - 255,299 bad eggs were discarded.
G - Includes 160,573 fish (27,024 lbs) transferred to Curl Lake A.P..
H - Includes 35,852 fry (2,461 lbs) planted in Rock Lake.
I - Transferred to LFH for marking.
J - Includes 14,212 fish (2,369 lbs) retained in Curl Lake A.P. as non-migrants.

Table 1 summarizes production from Lyons Ferry and Tucannon hatcheries. Numbers represent individual fish stock performance over an entire production period.
Egg-to-fry survival for steelhead varied in 1994 (Table 2). Wallowa/ Cottonwood stock egg-to-fry survival improved again in 1994. We refined our spawning procedures at the cottonwood trap to reduce egg loss due to environmental conditions. Egg loss should now be

a problem only when fish are over-mature. This may continue to be a problem at Cottonwood Pond because of the lateness of spawning.

Table 2. Egg to fry survival, Lyons Ferry Hatchery 1989-95.

Stock	Brood Year	Eggs in/ or taken	Eggs retained for rearing	Fry Out	% Survival
Wallowa	1989	236,214	236,214	186,958	79.1
	1990	428,000	428,000	409,477	95.7
	1991	421,025	421,025	416,470	98.9
	1992	225,012	225,012	212,160	94.3
	1993	272,000	272,000	257,599	94.7
	1994	277,000	243,180	233,813	84.4
Wal/Cottonwood	1992	558,437	198,747	186,656	33.4
	1993	533,995	289,198	271,970	50.9
	1994	644,886	366,115	302,397	46.9
	1995	511,283	335,489	321,050	62.8
Lyons Ferry	1989	1,263,237	957,074	941,000	84.2
	1990	2,570,676	1,483,485	1,002,320	67.6
	1991	1,296,249	1,165,315	1,115,368	86.0
	1992	1,239,055	905,438	416,265	33.6
	1993	1,211,053	940,022	860,983	71.1
	1994	1,352,296	899,350	845,316	62.5
	1995	1,772,477	929,597	895,882	50.5

2.1.2 Fish marking

Groups of steelhead were marked in three different ways:

1) all production fish were adipose clipped to designate harvestable hatchery origin adults,

In addition, some study groups of fish were marked with;

2) coded-wire tag (CWT), adipose and left ventral fin clipping and freeze branding for specific contribution and return rate studies,

3) 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 1994, just before the fish were transferred into the large rearing ponds at LFH. We coded-wire tagged and branded fish

during February 1995. Tag loss was determined by sampling 800-1,000 fish from each tag group with a portable CWT detector. Freeze brands were examined for their presence and quality (light, burned, location). Tag codes and brands were reported to the Pacific States Marine Fishery Commission (PSMFC) for publication in their annual report.

Coded-wire tag loss decreased to 0.96% (SD=1.0) in 1995 compared to tag loss of 2.2% (SD= 2.1) in 1994. In 1995, 1.19% (SD=0.4) of freeze brands were unreadable compared to 5.2% (SD= 2.0) in 1994 (Appendix A). This confirms the ability of branders to produce a consistently high quality mark if they follow strict procedural guidelines. We will continue to follow the development of other tagging methods, but we believe that branding remains the best and most cost effective externally visible mark available for our steelhead program. Tag/brand groups are summarized in Appendix A .

2.1.3 Fish releases

Four release methods were used in 1994: 1) brood stock smolt releases from LFH were allowed to volitionally emigrate from rearing ponds and enter the Snake River; 2) fish at LFH were pumped from the release structure into tank trucks and released directly to streams and rivers in Southeast Washington; 3) fish at LFH were pumped from the release structure into tank trucks, then transferred to acclimation ponds (AP) on the Grande Ronde and Touchet rivers. After 5-8 weeks in the acclimation pond, fish were allowed to volitionally emigrate for two weeks. The remaining fish were forced from the ponds, and; 4) fish at LFH were pumped from the release structure into tank trucks, then transferred to Curl Lake AP.

Fish were transferred to acclimation ponds in late February in anticipation of early releases as outlined in our Section 7 Biological Assessment. However, a late arriving Biological Opinion from NMFS, delayed removal of the screens in the outlet structures of Dayton and Cottonwood ponds until 5 April, and until 11 April at Curl Lake.

Fish were actively schooling and circling the ponds from 1 April until release. Fish fed actively during this period; feeding was stopped as the pond levels were lowered. Dayton Pond was empty by 30 April, Cottonwood pond was empty by 28 April. All releases for 1992-1995 are summarized in Appendix A.

At Curl Lake AP, after five weeks in the pond, fish were allowed to volitionally emigrate for five weeks as the pond water level was slowly lowered. We killed and examined for gender and degree of smoltification, 60-120 fish three times near the end of the release. When the fish remaining in the pond were 80% males and were hesitant to leave the pond, screens were replaced in the outlet structure (May 16). This percentage of males is based on studies by Martin (1993) and Viola and Schuck (1995) who found that 75% of residual hatchery reared smolts in the Tucannon River are male. A total of 799,860 steelhead smolts (181,301 pounds) were volitionally released from Curl lake in 1995, and 14,212 potentially residual steelhead juveniles (2,385 pounds) were retained in the pond where they could not adversly affect wild salmonids. A sport fishery was opened on the non-migrating fish.

Pre-release samples were collected from Curl Lake, Dayton, and Cottonwood acclimation ponds in 1995 to characterize the pond population; samples were also taken from production lakes at LFH (Tables 3 and 4). A post-release sample was taken from Curl Lake of non-migrant juvenile steelhead to characterize this group of fish.

Table 3. Mean lengths, weights and condition factors for LFH steelhead releases, 1995.

	Number sampled	Mean length (CV)	Mean weight	K
Dayton Pond				
AD clipped	187	200.3 (15.2)	90.6	1.06
ADLV clipped	137	206.5 (10.8)	98.9	1.09
Cottonwood Pond[A]	307	188.3 (18.3)	82.5	1.12
Curl Lake				
AD clipped	189	197.8 (15.2)	81.7	1.00
ADLV clipped	103	198.3 (11.0)	81.6	1.01
Post-release				
AD + ADLV	428	192.6 (16.6)	76.2	1.06
Walla Walla				
AD clipped	178	225.0 (11.6)	116.2	0.99
ADLV clipped	86	228.0 (9.5)	116.5	0.96
Lake 1[B]	160	224.0 (15.0)	111.1	0.94
Snake River[C]				
AD clipped	103	234.4 (7.6)	120.9	0.93
ADLV clipped	86	235.7 (11.0)	136.1	1.00

A- All steelhead in Cottonwood Acclimation pond were only AD clipped.

B- Steelhead sampled from Lake 1 at Lyons Ferry Hatchery were only AD clipped and destined for releases into Asotin Creek, Mill Creek and the Snake River.

C- The AD clipped steelhead were sampled from Lake 1 and the ADLV clipped steelhead were sampled from raceways at Lyons Ferry Hatchery. This group of fish made up the direct stream release into the Snake River from Lyons Ferry Hatchery.

Table 4. Pre-release characteristics of Lyons Ferry Hatchery juvenile steelhead, 1995.

	n (%)	Mean length (mm)	Mean weight (g)	K	% (n) male/female
Dayton Pond					
Sample 04/03/95					(93) 63.4/36.6
Smolts	85 (26.3)	217.7	111.4	1.05	
Transitional	214 (66.3)	200.4	90.6	1.08	
Parr	12 (3.7)	143.3	33.8	1.02	
Precocious males	12 (3.7)	202.1	95.6	1.13	
Cottonwood Pond					
Sample 04/03/95					(116) 60.3/39.7
Smolts	110 (35.8)	205.7	102.8	1.10	
Transitional	176 (57.3)	180.6	72.2	1.12	
Parr	12 (3.9)	126.3	23.4	1.12	
Precocious males	9 (2.9)	208.8	113.0	1.21	
Curl Lake					
Sample 04/05/95					(106) 62.3/37.7
Smolts	107 (36.6)	212.7	95.3	0.96	
Transitional	146 (50.0)	190.0	72.8	1.00	
Parr	4 (1.4)	117.5	16.7	1.00	
Precocious males	35 (12.0)	195.3	84.4	1.12	
Walla Walla[A]					
Sample 04/18/95					no fish sampled for gender
Smolts	174 (65.9)	233.8	125.0	0.96	
Transitional	81 (30.7)	213.9	102.7	1.01	
Parr	3 (1.1)	150.3	33.2	0.97	
Precocious males	6 (2.3)	200.5	89.4	1.10	

Table 4. (cont.)

	n (%)	Mean length (mm)	Mean weight (g)	K	% (n) male/female
Lake 1[B]					
Sample 04/26/95					no fish sampled for gender
Smolts	103 (64.4)	240.4	129.6	0.92	
Transitional	50 (31.3)	200.8	82.8	0.97	
Parr	5 (3.1)	125.6	19.7	0.98	
Precocious males	2 (1.2)	209.5	95.4	1.04	
Snake River[C]					
Sample 04/20/95					no fish sampled for gender
Smolts	103 (54.5)	241.1	134.7	0.94	
Transitional	86 (45.5)	227.7	119.6	0.98	
Parr	0				
Precocious males	0				

A- Steelhead sampled were from Lake 2 at Lyons Ferry Hatchery, destined for direct stream releases into the Walla Walla River.

B- Steelhead sampled from Lake 1 at Lyons Ferry Hatchery, destined for release into Asotin Creek, Mill Creek and the Snake River.

C- 103 AD clipped steelhead were sampled from Lake 1 and 86 ADLV clipped steelhead were sampled from raceways at Lyons Ferry Hatchery.

The sex ratio, mean length, weight and condition factors of fish within Curl Lake AP changed. Eighty-one percent of fish retained in the pond were males. Compared to pre-release samples, substantially more fish were sexually maturing or fully precocious males. The number of smolts in the pond decreased to 6% of the sample, compared to 50% of the sample before release. Mean condition factor of steelhead retained in Curl Lake (K=1.06) was significantly larger ($P < .05$) than condition factor of fish before release, although the difference was not great (Table 3).

The 1995 data again support the feasibility of separating active migrant steelhead from those which are likely to residualize. Based on our observations, precocious males are selectively removed from the population if ponds are used to prevent potential residual fish from entering rivers (Viola and Schuck, 1995). We now believe this type of pond management will effectively decrease the potential effects of hatchery steelhead on resident wild salmonids in the Tucannon River. However we also believe that pond volume, flow and duration of acclimation and release is crucial to the effectiveness of the method. Furthermore, use of this method with certain types of supplementation or with wild broodstock programs may

have unacceptable genetic effects on the released population. Use of pond management techniques discussed here should be carefully considered in relation to specific management goals.

2.2 Hatchery Smolt Emigration

We calculated relative smolt survival during their migration in the Snake and Columbia Rivers from freeze brands collected and expanded at the Snake and Columbia River Dams (Fish Passage Center 1995). A Passage Index[2] (number of fish collected/ number of fish released) for each brand group is provided.

2.2.1 Migration through dams.

Passage estimates at McNary Dam for freeze brand groups released in 1993-95 are summarized in Table 5.

In 1995, 50% of Walla Walla River branded smolts passed McNary Dam within 12 days of release. Ninety-five percent had passed by May 12. Similar numbers of smolts released into the Walla Walla River were collected at McNary Dam in 1994 and 1995, however there was greater between group variation.

This year, passage indices of smolts released from LFH and Curl Lake AP were measured at Lower Monumental Dam, the first dam below their release site. These indices should not be compared directly with passage indices from previous years which represent passage at McNary Dam, the third dam below these release sites. Half of the smolts released from LFH and Curl Lake AP passed Lower Monumental Dam 15 and 28 days after release, respectively. Ninety-five percent passage had occurred by 29 May and 12 June for LFH and Curl Lake AP releases, respectively.

[2] Passage Index is a relative indicator of group performance within a migration year and does not represent survival. No estimates of collection efficiency of smolts at the dams are made, thereby precluding the calculation of group survival.

Table 5. Estimated passage of freeze branded/tagged Lyons Ferry Hatchery steelhead at McNary Dam, 1993-95. (FPC 1992-1995)

Brand	Release site	Passage index	Number released	% of release	Size (#/lb)	Stock
1993						
RA-H-1	Touchet R.	6,006	20,226	29.7	4.8	LFH
RA-H-2	Touchet R.	5,079	19,943	25.5	4.8	LFH
RA-IC-1	Tucannon from Curl	3,080	21,653	14.2	5.0	LFH
LA-IC-1	Tucannon @ Curl	3,285	28,771	11.4	4.7	LFH
LA-IC-3	Tuc. @ Marengo	3,776	29,040	13.0	4.5	LFH
LA-H-1	Walla Walla R.	5,808	18,254	31.8	4.8	LFH
LA-H-2	Walla Walla R.	3,419	18,889	18.1	4.4	LFH
1994						
RA-7U-1	Tucannon from Curl	2,526	16,682	15.1	4.3	LFH
RA-7U-3	Tucannon from Curl	2,614	16,661	15.7	4.3	LFH
LA-7U-1	Tucannon from Curl	1,934	16,665	11.6	4.3	LFH
RA-IT-1	Walla Walla R.	4,872	20,165	24.2	3.7	LFH
RA-IT-3	Walla Walla R.	5,502	20,093	27.4	3.9	LFH
LA-IT-1	Walla Walla R.	5,910	20,002	29.5	3.7	LFH
1995						
LA-IJ-1	Tucannon from Curl	8,569	18,021	47.6	5.3	LFH
RA-IJ-1	Tucannon from Curl	5,440	17,966	30.3	5.3	LFH
RA-IJ-3	Tucannon from Curl	7,088	16,942	41.8	5.3	LFH
LA-H-1	LFH	11,926	39,728	30.0	3.9	LFH
LA-IC-1	Touchet @ Dayton	4,024	19,831	20.3	3.8	LFH
LA-IC-3	Touchet @ Dayton	2,617	19,841	13.2	3.8	LFH
RA-IC-1	Touchet @ Dayton	2,859	20,146	14.2	3.8	LFH
RA-H-1	Walla Walla R	4,621	24,719	18.7	3.7	LFH
RA-H-2	Walla Walla R	6,918	24,796	27.9	3.7	LFH

2.2.2 Migration success.

Our 1994 PIT tag study had four objectives: 1) characterize migrant and non-migrant juvenile steelhead, 2) determine if fish retained within the acclimation pond were truly non-migrants, 3) determine if our estimates of residualism for different release groups and strategies were reasonable, and, 4) compare the physical characteristics and migration behavior of Tucannon River wild broodstock juveniles released at the Tucannon Hatchery with LFH hatchery broodstock juveniles released from Curl Lake AP. The study was repeated in 1995 with the substitution of a release of LFH stock steelhead from Lyons Ferry Hatchery for objective 4, as no wild brood Tucannon steelhead were available.

Three groups of 350 LFH steelhead were PIT tagged in April and early May at Curl Lake AP and LFH (Tables 6, 7). The emigration performance of two groups released from Curl Lake AP were compared with each other and with a third group released from LFH.

Group #1 fish volitionally left Curl Lake AP between 11 April and 16 May 1995. Group #1 was comprised of three subgroups of about 115 fish which were tagged weekly to represent fish throughout the emigration period. Fish were captured from the pond outlet channel and retained in a holding box until enough fish were available to complete the PIT tag sub-group. Fish were anesthetized with Tricaine Methane Sulfonate (MS-222), tagged, weighed, measured and developmental stage (smolt, transitional, parr, precocious male) recorded. The fish were allowed to recover in fresh water and were released directly into a quiet pool of the Tucannon River near the pond outlet.

Group #2 was comprised of fish that failed to emigrate from Curl Lake AP. These fish were collected from the pond on 16 May by cast-net and placed in a holding box. They were then tagged and released in the same way as volitional migrants. The trigger for closing the pond to emigration was the same as in 1993-94; > 80% of the fish remaining in the pond were male and little or no emigration from the pond was observed.

Group #3 was 200 fish tagged and released directly from LFH. Half of the fish were untagged lake reared production steelhead while the other half of the fish were coded-wire-tagged and branded fish being released to evaluate production. Fish were collected from the outlet structure or from a raceway at LFH, and PIT tagged like the other two groups.

Table 6. Description of PIT tag groups released into the Tucannon and Snake rivers, 1995.

	Curl Lake AP		
	Volitional Migrants	Non-migrants	LFH
Date(s) tagged	24 April 1995 8 & 10 May 1995	16 May 1995	20 April 1995
# of fish tagged (n)	400	428	189
Fish PIT tagged	**% of total (n)**	**% of total (n)**	**% of total (n)**
Smolts	56.7 (227)	11.2 (48)	54.5 (103)
Transitional	35.8 (143)	71.3 (305)	45.5 (86)
Parr	1.2 (5.0)	6.5 (28)	0
Precocious	6.3 (25)	11.0 (47)	0

Table 7. Characteristics of PIT tag groups released into the Tucannon and Snake rivers, 1995.

	Curl Lake AP		
	Volitional Migrants mean (n)	Non-migrants mean (n)	LFH mean (n)
Length (cm)			
Smolts	216.5 (227)	216.5 (48)	241.1 (103)
Transitional	203.4 (143)	193.2 (305)	227.7 (86)
Parr	150.4 (5)	128.9 (28)	0
Precocious	211.6 (25)	202.7 (47)	0
Weight (g)			
Smolts	95.9 (227)	110.6 (18)	134.7 (103)
Transitional	83.1 (143)	103.8 (289)	119.6 (86)
Parr	33.7 (5)	29.8 (4)	0
Precocious	102.4 (25)	107.2 (34)	0
K factor			
Smolt	0.92 (227)	0.92 (48)	0.94 (103)
Transitional	0.95 (143)	0.98 (305)	0.98 (86)
Parr	0.96 (5)	0.966 (28)	0
Precocious	1.06 (28)	1.10 (47)	0

Tag detections at the Snake and Lower Columbia River dams were obtained from the PTAGIS central database maintained by the Pacific States Marine Fisheries Commission in Portland, Oregon, through 27 September. Unique tags were recovered at Lower Monumental, McNary and John Day dams. One 1994 Curl Lake AP volitional emigrant was detected at the dams in 1995: the fish was 239 mm at release and fully smolted. This one recovery represented 0.3% of the tag group released. All remaining detections were from 1995 releases. A summary of the number of PIT tags detected at at least one of the Snake or Columbia River dams during the spring of 1995 is provided in Table 8. Also included in the table are measurements characteristic of detected and undetected tagged fish. The numbers of tags detected include all locations and indicate minimum survival from release to Lower Monumental Dam.

In 1994, significantly more tagged smolts were detected at the dams ($P < .05$) than tagged transitional fish. In 1995, only the non-migrant group from Curl Lake AP showed this result, while smolts and transitionals released from LFH and as volitional migrants from Curl Lake AP were detected in nearly equal numbers. In 1994 and 1995, no tagged parr or precocious males were detected at any location. Also, 4-9 times more volitional emigrants (smolts and transitionals) from Curl Lake AP were detected than non-migrants. Significantly more LFH

fish were detected than either of the Tucannon River groups. Condition factor (K) of detected migrants was not significantly different among any of the groups, but the K of both detected Tucannon groups was lower than the K of undetected fish. Detected fish were longer and heavier than undetected fish in all three groups although the difference was significant for only the volitional emigrants from Curl Lake.

Tagged fish emigrated from the Tucannon River quickly with most PIT tag detections occurring at a dam within 30 days of release. The average migration time to Lower Monumental Dam for tagged Tucannon River fish was 22.5 days (2.7 miles/day) and 13.4 days (1.3 miles/day) for LFH fish. The last Tucannon tag was detected 39.3 days after release on 25 June 1995. The last LFH tag was detected 95.1 days after release on 24 July 1995.

Results from our 1995 release of PIT tags generally confirmed the 1994 results. Not surprisingly, size, condition factor and degree of visual smoltification seem to be strongly related to emigration performance. Longer, leaner, more silvery fish were detected at the dams at a greater rate than their counterparts within the release population. Fish acclimated in Curl Lake AP which failed to volitionally emigrate from the pond during the spring, didn't emigrate effectively when PIT tagged and placed in the river. This behavior of "non-migrant" PIT tagged fish is consistent with results of our residualism studies in 1991-1993. These fish can be characterized as predominantly male, transitionally developed juveniles with a $K \geq 1.05$.

The absence of parr or precocious males in the migrant PIT tagged study groups, suggests that removal of these fish from the released population (through pond management) is unlikely to affect returns of hatchery adult steelhead. Non-migrating fish can better be used in put-take fisheries than by being released into rivers where they could compete with natural origin salmonids for food and space, and potentially prey on smaller fish.

The relative emigration performance of the PIT tagged Tucannon wild broodstock juvenile fish in 1994 was poor. We anticipated that they could migrate during fall 1994 or spring 1995, but none were detected.

Table 8. Characteristics at time of release of detected and undetected PIT tagged fish released into the Tucannon and Snake rivers, 1995.

	Curl Lake AP					
	Volitional Migrants		Non-migrants		LFH	
	detected	undetected	detected	undetected	detected	undetected
% detected(n)						
Smolt	29.5 (67)	70.5 (160)	39.6 (19)	60.4 (29)	41.7 (43)	58.3 (60)
Transitional	30.1(43)	69.9 (100)	3.3 (10)	96.7 (295)	47.7 (41)	52.3 (45)
Parr	0	100.0 (5)	0	100.0 (28)	0	0
Precocious	0	100.0 (25)	0	100.0 (47)	0	0
TOTAL	27.5 (110)	72.5 (290)	6.8 (29)	93.2 (333)	44.4 (86)	55.6 (105)
Mean length (mm)						
Smolt	220.7	214.8	217.8	215.7	243.4	239.4
Transitional	214.2	198.7	191.2	193.4	229.3	226.2
Parr				128.9		
Precocious		211.6		202.7		
Mean weight (g)						
Smolt	101.1	93.8	96.0	96.3	138.3	132.1
Transitional	94.0	78.4	69.7	75.6	121.2	118.2
Parr		33.7		21.1		
Precocious		102.4		94.7		
Mean K-factor						
Smolt	0.92	0.94	0.90	0.93	0.94	0.94
Transitional	0.94	0.95	0.97	0.98	0.98	0.99
Parr		0.96		0.96		
Precocious.		1.06		1.10		

2.3 Estimates of Residual Steelhead

We estimated the number and percentage of all hatchery reared juvenile steelhead released into the Tucannon River that residualized during the spring of 1995. Also, the number of residual hatchery steelhead present in an index area of the Grande Ronde River was estimated. The methods used on the Grande Ronde were similar to those used in 1994 (Schuck and Viola 1995), but we had to use a different method than in the past on the Tucannon River. A brief summary of methods used in 1995 is presented below.

Tucannon River

During the last week of May 1994 , we placed 10,000 hatchery rainbow trout into the Tucannon River to act as marked fish for a mark and recapture estimate. On 31 May and 1 June 1994, we fished the river and recorded the number of rainbow trout and residual steelhead caught. We then calculated an estimate of the population of residual hatchery steelhead and rainbow trout.

Because there are threatened chinook salmon in the Tucannon above Marengo, we could not plant hatchery trout in 1995 to act as marked fish for a mark and recapture population estimate. Therefore we were unable to follow the same methods as in 1994.

Instead we divided the Tucannon River into three sections: *Upper*: from Panjab Bridge downstream to the hatchery bridge, 8 miles; *Middle*: From the hatchery bridge downstream to 1 mile above Marengo, 9 miles, and; *Lower*: from 1 mile above Marengo downstream to the mouth, 8.3 miles. We planted 4,056 hatchery reared rainbow trout to act as marked fish for a mark and recapture estimate in the lower section only. One week later during the last week in May we fished all three sections. A population estimate of residual steelhead was calculated for the lower section using a Petersen mark and recapture estimate (Ricker 1958) as was done in previous years. We also calculated a catch per unit effort (CPE) for residual steelhead for each section. We assumed that CPE was correlated to residual steelhead abundance, and that any difference in CPE between the upper and middle sections of the river from the lower section were directly related to increased or decreased residual steelhead abundance in those sections. The number of residual steelhead in the upper and middle sections of the river was estimated by the following equation:

$$\frac{\text{CPE upper section.}}{\text{CPE lower section}} \times \text{Population Estimate of lower section} = \text{Pop. Est. of upper section}$$

The residual estimates from all sections were summed to provide an estimated population of residual steelhead in the Tucannon River from Panjab bridge downstream to the mouth.

In 1993, 1994 and 1995 we managed Curl Lake AP to reduce excessive residualism of juvenile hatchery steelhead in the Tucannon River. In 1993, our method prevented 14,950

(23% of fish placed in pond) potential residual fish from entering the Tucannon River. In 1994, we prevented 23,745 potential residual fish (14.8% of fish placed in the pond) from entering the river. In 1995, we prevented 14,212 potential residual fish (8.9 % of fish placed in pond) from entering the river. Residualism within the Tucannon River during 1993,1994 and 1995 was significantly lower than in 1991 and 1992 when we did not manage Curl Lake to reduce excessive residualism in the Tucannon (Figure 1). By actively managing Curl lake AP, we have successfully reduced the number of hatchery reared steelhead that residualized in the Tucannon River and thereby reduced the potential for adverse interactions between these fish and wild salmonids.

Grande Ronde River

During June 1995, we conducted a mark and recapture estimate of the number of hatchery reared residual steelhead present in an index area of the Grande Ronde River near Cottonwood Creek. We sampled a one mile section of river that extended from approximately 1/4 mile above to 3/4 mile below WDFW's Cottonwood AP juvenile steelhead release facility. The size and flow of the Grande Ronde River precludes a more extensive estimate of residualism.

We caught hatchery reared juvenile steelhead with hook and line, marked them with a caudal punch and released them on 27, 28 June 1995. Fish were recaptured with hook and line on 5, 6 July 1995. We used the Petersen mark and recapture method (Ricker 1958) to estimate the number of residual hatchery reared steelhead within the index section.

We estimated that 831 $\pm$ 28 (α =.05) hatchery reared juvenile steelhead residualized within the one mile index section established on the Grande Ronde. This was the second year that an estimate was made. This 1995 estimate was 42.4% of the 1994 estimate (1,961 fish). The Cottonwood AP was not managed to reduce the abundance of residual steelhead in the Grande Ronde River in either year. The number and size of juvenile steelhead released from the pond in 1994 and 1995 (273,000 fish @ 4.8/lb and 206,182 fish @ 5.0/lb, respectively) was dissimilar enough to account for at least some of the difference in measured residualism. Water flow was considerably greater in the Grande Ronde River during the spring of 1995 than in 1994. This increased flow may have encouraged more fish to emigrate or at least move downstream of the sample area.

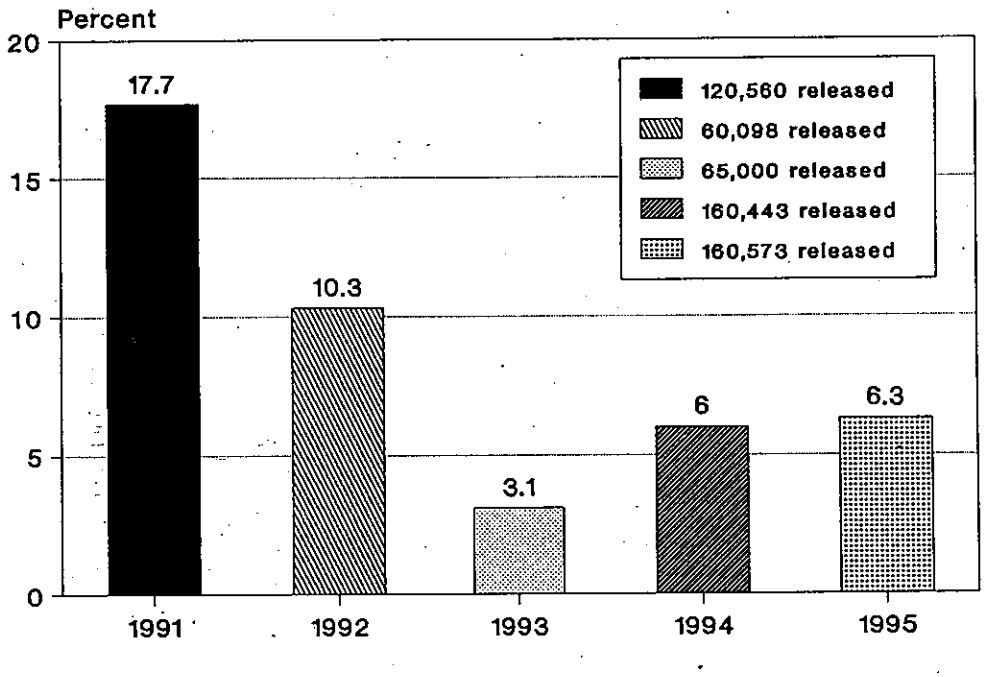

Figure 1. Percent residual steelhead in the Tucannon River from Curl Lake AP releases, 1991-1995; (with the pond management program in years 1993-95).

2.4 Adult Steelhead Returns

2.4.1 Adult fish traps

Tucannon Hatchery trap

The results of the last six years of annual juvenile population and spawning surveys on the Tucannon River indicate some alarming trends. During this time, steelhead spawning (redds/mile) and juvenile steelhead abundance (#/100 m^2) declined sharply in the middle and upper river. Because of a increase of steelhead redds below the trap concurrent with a reduction of redds above the trap in recent years, we suspected that adult steelhead were either blocked or discouraged by the Tucannon hatchery trap/weir. We speculated that adult steelhead were not entering the trap because hatchery effluent, not river water, was flowing through the trap. Migrating steelhead would be attracted to the river water not the hatchery effluent. Because the weir prevents fish from bypassing the trap and continuing upstream, any fish which did not enter the trap had to drop back down-river to spawn.

In 1995, the hatchery weir was removed during most of the steelhead spawning run (until 1 May). This allowed unrestricted passage for steelhead to repopulate the upstream section of the river. After 1 May the trap and weir were modified and an additional trap was installed within the weir that allowed river water to flow through it. Both traps were operated simultaneously at the Tucannon Hatchery (RM 36). Hatchery and wild steelhead were trapped from 15 May through 4 July 1995. We documented the number of wild and hatchery fish that returned to spawn above the trap.

Fourteen adult steelhead were trapped in 1995. Seven wild fish (50%) (three males and four females) and seven hatchery origin fish (five males and two females) were trapped, examined and passed above the weir to spawn naturally. All fish were caught in the instream trap. This supports our speculation that the original trap, with hatchery effluent water flowing through it, inhibited upstream migration of steelhead. Appendix B lists passage date and specific information about trapped fish.

Touchet River trap

The Touchet River adult steelhead trap is at river mile (RM) 53.3 in the City of Dayton at the Dayton AP intake structure. The trap was installed to collect wild and hatchery steelhead to determine if the wild summer steelhead run is large enough to allow creation of a hatchery broodstock. We were concerned that the trap would act as a barrier and prevent up-stream migration of a substantial portion of the run. To prevent this, panels were removed from a portion of the weir during four consecutive days each week. The panels were replaced, and the trap was operational for the remaining three consecutive days.

Adult steelhead were trapped from 7 March through 5 May 1995. Trapped steelhead were anesthetized with MS-222, measured, sexed and marked with a hole punched in the caudal fin. The fish were then held in a recovery pen upstream from the trap, and released. The

hole punched in the caudal fin prevented us from re-counting a fish that dropped below the weir and reentered the trap.

Eight (80%) wild steelhead (two males, five females) and two hatchery steelhead (one male, one female) were examined and measured. Appendix C lists passage date and specific information about each fish.

In 1995, icing conditions, high river flows and heavy debris damaged several sections of the trap. High flows over-topped the weir and adult steelhead passed over it. Alterations and continual need for repairs to the trap during the 1995 season allowed us to sample only a small portion of the run.

Lyons Ferry Hatchery trap

The ladder to the LFH trap was open much of the time when steelhead were migrating past the hatchery. All captured fish were kept until November, 1994 when they were sorted for spawning. Fish originating from upstream hatcheries, injured fish, wild fish and fish not needed for broodstock were released.

From 5 July 1994 through 15 November 1994, 4,011 adult steelhead were trapped at Lyons Ferry Hatchery. Mortality during the trapping and holding period was 98 fish (2.4%) and 2,505 fish were returned to the river. All trapped fish were inspected for fin clips, gender, origin and readable brands. Snouts were collected from a sample of fish that had a ventral fin clip and unreadable or no visible brand. We trapped 2,151 females (53.6%) and 1,858 males (46.4%). Of these 26 were wild fish (0.6%), 608 were tagged or branded fish (15.2%) and the remainder were untagged hatchery fish. One-ocean age fish represented 75% of fish spawned in 1995, and 83.9% of returning coded-wire tagged fish. Two-ocean age fish made up 25% of fish spawned and 15.3% of returning coded wire tags. The remaining 0.8% were three ocean age fish. Average fecundity of one (n=226) and two (n=50) ocean age females was 4,871 and 6,397 eggs, respectively. The mean lengths of one and two ocean age steelhead spawned at LFH in 1995 were 61.2 cm and 73.7 cm, respectively. In 1995, 343 adult female steelhead were spawned at LFH yielding 1,772,477 green eggs (Table 2). Appendix D lists the returns of branded fish by release year to LFH in 1994.

Cottonwood Creek Trap

Between 5 March and 17 April 1994, 281 female (62.4 %) and 169 male (37.6 %) adult steelhead were trapped at the Cottonwood AP. Length and age data were collected from 98 spawned females and 61 spawned males (Table 9). All sampled fish were of hatchery origin. Average fecundity of one and two ocean age females was 4,541 and 6,222 eggs, respectively. One (n=61), two (n=37) and unknown (n=1) ocean age females contributed 54.2, 45 and 0.8%, respectively, of the total egg take. Most of the trapped fish were spawned or shipped to Oregon for spawning, but 47 males and 33 females were released to spawn below the trap.

Table 9. Age composition and mean lengths for steelhead spawned at Cottonwood AP, 1995 .

	1-ocean	2-ocean	Unknown
Females (n= 98)	61.6% (60.5 cm)	37.4% (71.4 cm)	1.0%
Males (n=61)	45.9% (61.7 cm)	44.3% (73.9 cm)	9.8%

Cummings Creek trap

We constructed an adult steelhead trap in Cummings Creek (a major tributary to the Tucannon River) 0.5 miles upstream of the mouth of the creek. The purpose of this trap was to capture naturally produced adult steelhead to use in the development of a new broodstock. We hoped to use the progeny of these fish for LSRCP mitigation efforts in the Tucannon River and to supplement the population of steelhead in the upper section of the river. Detailed methods for trap operations, broodstock development and supplementation are available in project files.

We began trapping three days a week on 28 March and removed the trap during the second week in May. We captured only six adult steelhead (two naturally produced females and four hatchery reared males). Our poor success is attributed to the extremely high flow this spring. We observed many adult steelhead spawning above the trap, indicating that fish passed above the trap when water over-topped the structure. Furthermore, we theorize that the removal of the Tucannon River weir just upstream from the mouth of Cummings Creek may have resulted in fewer adult steelhead entering Cummings Creek this year.

2.4.2 Passage at dams

The National Marine Fishery Service (NMFS) monitored adult passage at Lower Granite Dam as part of their migration research (Jerry Harmon, NMFS, 1995). Adults coming into the trap were sampled for fin clips and freeze brands.

Table 10 lists freeze brands from LFH fish which passed through the adult trap at Lower Granite Dam (LGD). Low returns to LGD for the freeze brand groups generally are consistent with returns to other locations. Fish released in 1992 survived poorly and few two-salt age fish returned anywhere in the basin in the 1994 run year. The 1993 release is showing an improved survival rate over the 1992 release, but not as good as expected. This is likely the result of improved river flow and ocean rearing conditions in 1993. Also, better homing may have decreased the number of stray fish from releases downstream of the dam. (see 2.6 Coded-Wire Tag Studies for further discussion of these results)

Table 10. Adult returns of Lyons Ferry Hatchery steelhead to Lower Granite Dam in run years 1991-1994, from smolts released in 1990-1993.

Brand	Release site	Number of adults Return year 1991	1992	1993	1994	Total adults captured	No. smolts released	% survival
1990								
RA-IC-2[A]	Tuc. R. @ Marengo	108	94	0	1	203	20,020	1.01
1991								
RA-IT-3[B]	Touchet Accl. (small fish)		25	14	1	40	18,236	0.22
1992								
RA-IY-1	Touchet Accl. Pond			22	7	29	45,628	0.06
RA-S-2	Tucannon R. @ Curl			29	22	51	30,096	0.17
RA-S-1	Curl LK. Tucannon R.			28	12	40	30,098	0.13
LA-S-1	Tuc. R. @ Marengo			38	34	72	29,888	0.24
1993								
RA-H-1	Touchet Accl. Pond				46	46	20,328	0.23
RA-H-2	Touchet Accl. Pond				35	35	20,104	0.17
LA-IC-1	Tucannon R. @ Curl				89	89	30,001	0.30
RA-IC-1	Curl LK. Tucannon R.				96	96	21,960	0.44
LA-IC-3	Tuc. R. @ Marengo				63	63	29,876	0.21
LA-H-1	Walla Walla R.				25	25	19,440	0.13
LA-H-2	Walla Walla R.				10	10	19,800	0.05

A- No other 1990 branded steelhead were recovered at Lower Granite Dam in 1994.
B- No other 1991 branded steelhead were recovered at Lower Granite Dam in 1994.

2.5 Steelhead Creel Surveys

Creels were sampled to obtain catch composition data and to recover coded-wire tags. We surveyed anglers in the steelhead sport fishery within the LSRCP area of Washington during the entire recreational fishery on the Snake River and its tributaries (see Schuck et al. (1990) for methods). Sport fishing for steelhead was open on the Snake and Columbia rivers from 1 September 1994 through 31 March 1995, and on tributaries to the Snake River from 1 September 1994 through 15 April 1995. Anglers may keep only adipose clipped fish, some of which are also left ventral (LV) clipped indicating the presence of a coded-wire tag. The daily catch, possession, and annual limits were 2, 4, and 30 steelhead, respectively.

We conducted a joint survey of anglers on the upper Grande Ronde River of Washington and the lower Grande Ronde River of Oregon with ODFW. Angler effort, catch rates, harvest and coded-wire tag recoveries and expansions were calculated by ODFW as described in Carmichael et al. (1988).

The objectives of our creel surveys on the Snake and Grande Ronde rivers were:

1. Estimate the portion of LFH steelhead in the sport catch. The following methods were used:

   a) Sample the sport harvest and collect information on the number of CWT and un-tagged steelhead harvested. Collect the snouts from all LV clipped fish. Examine coded-wire tags and identify the release location, agency and date for all marked steelhead observed in the catch.

   b) Calculate a sample rate by dividing the number of steelhead sampled during the creel surveys by the estimated total sport harvest. The latter is obtained from WDFW estimates of sport harvest.

   c) Expand each LFH origin tag code sampled in the creel survey by dividing the number of each by the fishery sample rate by month.

2. Obtain lengths, weights, gender, age, and duration of ocean residency of LFH origin fish in the harvest.

3. Estimate angler exploitation rates of adult LFH steelhead, angler effort and catch rates: hrs/fish caught, hrs/fish kept and total harvest of all steelhead within the LSRCP area of Washington.

Lower Snake River and tributaries.

We used adjusted state-wide catch estimates of 1994/95 steelhead harvest (Tables 11 and 12) to estimate our coded-wire tag sample rates and to estimate harvest by tag code and by fishery.

During the 1994-95 steelhead season, we surveyed 9,679 anglers that fished a total of 33,468.6 hours within the LSRCP area in Southeast Washington (Table 13). Catch rates ranged from 3.8 - 33.3 hours/fish. Mean catch rate for the entire LSRCP area of S.E. Washington for the 1993-94 season was 13.4 hours/fish, an 18.0% decrease in hours/fish from 1993-94. Characteristics of steelhead observed during the 1994-95 steelhead season are summarized in Table 14.

Table 11. Steelhead harvest estimates for WDFW management sections[A] on the lower Snake River, 1994-95 (WDFW 1996).

	Below Ice H. Dam	Ice Harbor Pool	L. Monumental Pool	L. Goose Pool	L.Granite Pool	Above Clarkston
May	0	0	0	7	0	0
June	0	0	0	31	0	0
July	0	0	3	10	0	3
Aug.	3	0	0	10	0	0
Sept.	17	72	120	55	48	14
Oct.	0	161	695	72	310	737
Nov.	38	431	388	69	619	681
Dec.	144	322	401	82	230	278
Jan.	31	137	322	127	38	103
Feb.	3	45	312	79	72	7
Mar.	0	69	127	59	44	0
Apr.	0	3	3	0	4	0
Total	**236**	**1,240**	**2,371**	**601**	**1,365**	**1,823**

A. WDW management sections: 164= Below Ice Harbor, 165= Ice Harbor Pool, 166= Lower Monumental Pool, 167= Little Goose Pool, 168= Lower Granite Pool, 228= Above Clarkston.

Table 12. Steelhead harvest estimates for rivers in S.E. Washington, 1994-95 (WDFW 1996).

	Tucannon	Touchet	Walla Walla	Grande Ronde	McNary Pool
May	0	0	0	0	15
June	0	0	0	0	0
July	0	0	0	0	0
Aug.	0	0	0	0	13
Sep.	5	0	0	0	321
Oct.	8	0	137	88	1,815
Nov.	25	0	69	43	1,355
Dec.	46	5	115	37	639
Jan.	46	24	70	114	149
Feb.	0	77	51	208	39
Mar.	30	167	30	587	5
Apr.	3	39	3	77	0
Total	**163**	**299**	**475**	**1,154**	**4,351**

Table 13. A summary of creel information from S.E. Washington rivers during the 1994-95 steelhead season.

Area	Number anglers	Hours fished	Fish caught	Hours/fish caught
McNary Dam	132	646.8	35	18.5
Wallula	1,641	4,762.4	365	13.0
Walla Walla R.	244	626.2	66	9.5
Mill Creek	37	41.5	10	4.2
Ice Harbor Dam	1,170	3,215.9	101	31.8
Lower Mon. Dam	111	327.4	19	17.2
Touchet R.	465	994.4	260	3.8
Tucannon R.	440	1,102.4	166	6.6
Mouth of Tucannon R.	264	816.2	85	9.6
Little Goose Dam	2,363	10,590.7	631	16.8
Lower Granite Dam	13	19.8	0	---
Mid-Snake R.	1,332	4,437.4	339	13.1
Confluence of Snake and Clearwater R.	961	4,324.5	130	33.3
Grande Ronde R.	506	1,563	292	5.4
Total	**9,679**	**33,468.6**	**2,499**	**13.4**

Table 14. Characteristics of 179 LFH coded-wire tagged steelhead observed in anglers' creels in the LSRCP area in Washington and 41 LFH origin steelhead trapped at LFH, fall 1994 and spring 1995.

Ocean residence	% Composition	Mean length(cm) (range)	Mean weight(Kg)	% Male	% Female
1 Year[A]	83.0	62.8 (54 - 76)	2.5	57.8	42.2
2 Years[B]	27.0	71.6 (60 - 88)	3.5	27.8	72.2

Table 15. Origin of adult steelhead sampled during the 1994-95 creel surveys on the Touchet and Tucannon Rivers.

River	Hatchery kept	Hatchery released	Hatchery Total	Wild released
Touchet	164 (88.6%)	21 (11.4%)	185 (75.2%)	61 (24.8%)
Tucannon	106 (89.8%)	12 (10.2%)	118 (70.2%)	50 (29.8%)

In 1993-94 one-ocean age steelhead comprised 37.3% of our sample of the sport harvest (Schuck et al. 1995). In contrast, during 1994-95, 83% of the fish sampled were one-ocean age (Table 14). Also, the lengths of one and two-ocean age fish overlapped in 1994-95 (Table 14 and Figures 2 and 3). The overlap in length may be the result of poor in-river rearing conditions brought on by drought, and poor ocean conditions due to El Nino current patterns for two-ocean age steelhead, and good in-river and ocean conditions for one-ocean age fish.

The relative composition of hatchery fish kept to hatchery and wild fish released were similar on the Tucannon and Touchet Rivers in 1994-95 (Table 15).

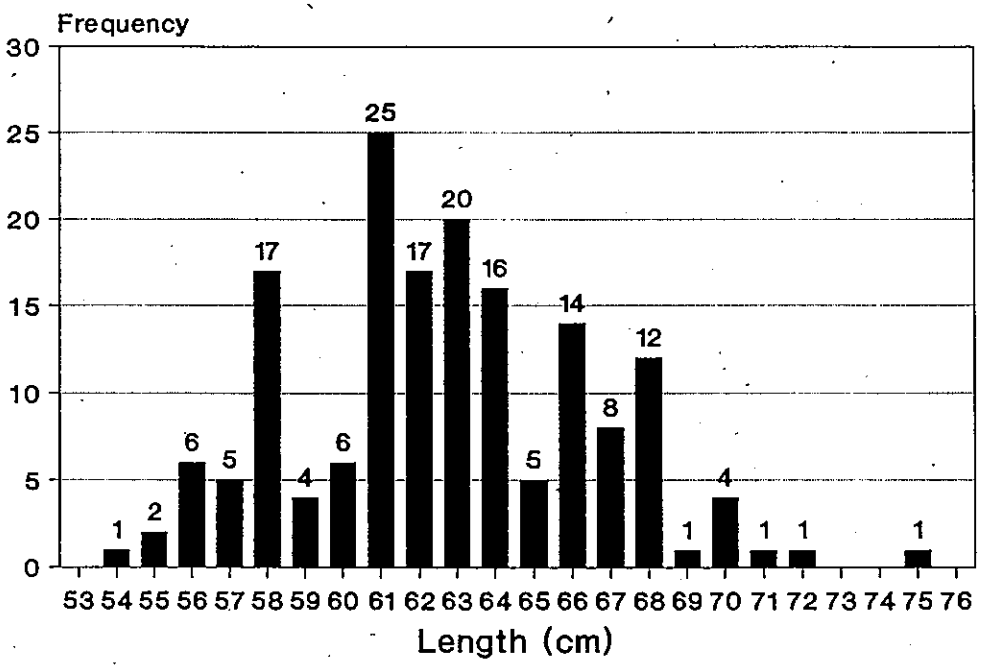

Figure 2 Length frequency of one-ocean age LFH origin steelhead, 1994-95.

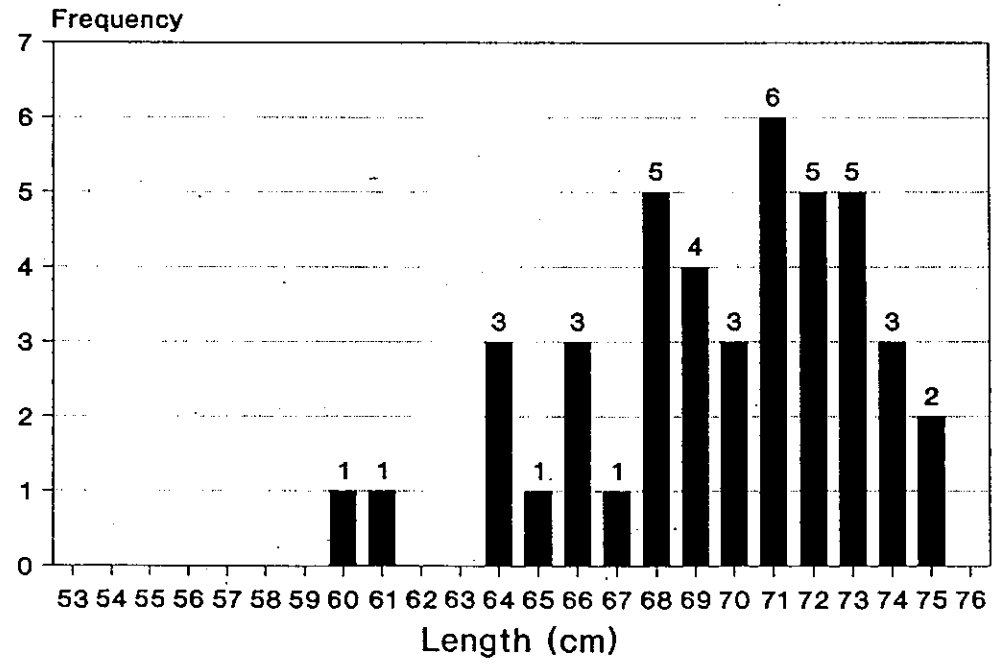

Figure 3. Length frequency of two-ocean age LFH origin steelhead, 1994-95.

Grande Ronde River

During the 1994-95 steelhead season anglers fished 2,499 days on that portion of the Grande Ronde River from Bogan's Oasis (RM 26) upstream to the Oregon State line (RM 38.7) (Tables 16 and 17). The average angling day was 4.8 hours. This is less effort than has occurred in the previous three seasons, probably because high murky runoff made fishing difficult. Most fish were caught in late March and early April near Cottonwood AP.

Table 16. Estimated angler effort, catch rates, and harvest for steelhead anglers on the Grande Ronde River in Washington, 1994-95 (Flesher 1995).

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)
1994						
Sep.[B]	110.2	0.0361	4	0	0	4
Oct.	1,497.7 (397.2)	0.0329 (0.0386)	49 (58)	0 (0)	5 (9)	44 (50)
Nov.	517.2 (111.1)	0.0582 (0.0409)	30 (21)	4 (7)	0 (0)	26 (19)
Dec.	611.5 (227.0)	0.0884 (0.0384)	54 (25)	33 (24)	11 (18)	10 (3)
1995						
Jan.	833.8 (399.1)	0.1434 (0.0567)	120 (47)	59[B]	39[B]	22[B]
Feb.	2,563.5 (705.8)	0.1718 (0.0498)	440 (128)	186 (70)	187 (82)	67 (50)
Mar.	4,526.6 (1,189.5)	0.1555 (0.0344)	704 (156)	338 (93)	319 (88)	47 (34)
Apr.	1,360.3 (648.0)	0.1131 (0.0331)	153 (45)	101 (37)	53 (28)	0 (0)
Total	12,020.8		1,555	721	614	220

A - Estimates for fish numbers are rounded to the nearest whole number.
B - No confidence interval calculated.

Table 17. Characteristic ocean residency, mean fork length, and sexual composition of 132 adult steelhead sampled from anglers creels on the Grande Ronde River ,WA, Spring 1995.

Ocean Residence	Males			Females		
	Length (SD)	N	(%)	Length (SD)	N	(%)
1 Year[A]	61.4 (31.2)	27	(20.5)	60.5 ± 33.7	38	(28.8)
2 Years[B]	68.2 (25.0)	16	(12.1)	69.8. ± 21.5	36	(27.3)
3 Years[C]	78.3 (32.5)	2	(1.5)	76.0 ± 19.6	13	(9.8)
	Total	**45**	**(34.1)**		**87**	**(65.9)**

A: One ocean steelhead were less than 66.0 cm in length.
B: Two ocean steelhead ranged between 66.0 and 73.0 cm in length.
C: Three ocean steelhead were greater than 73.0 cm in length.

2.6 Contribution of LFH Steelhead to Fisheries

We collected snouts from 179 sport caught steelhead with left ventral fin clips. All snouts, except Grande Ronde River recoveries, were examined by Idaho Fish and Game personnel for coded-wire tags[3]. All CWTs recovered by WDFW personnel and estimates of the expanded harvest by individual tag code are presented in Appendix E for the Snake River, and in Appendix F for other rivers in S.E Washington.

We estimated harvest and the percent smolt-to-adult survival for adult Lyons Ferry Hatchery steelhead within the Columbia and Snake River drainages. (Table 18). This information is based on sampling programs conducted by several Federal, State and Tribal agencies. Presently, fisheries throughout the Lower Columbia River basin are harvesting nearly half of the total LFH adult steelhead returns for several release groups. This level of harvest is a concern, and may be complicating achievement of the LSRCP area goal. For the tag codes recovered from releases in 1992, only the group released into the Touchet River met the production escapement goal of 0.5% release to adult survival to the LSRCP area (Table 19).

[3] Grande Ronde River recoveries were examined by ODFW.

Table 18. Adult returns of LFH steelhead (percent smolt-to-adult survival those numbers represent) to fisheries within the Columbia and Snake rivers, fall 1994 and spring 1995.

Release Year	1991				
Release Site	Touchet R. (small)[c]	Touchet R. (large)[c]	Tucannon R. from Curl Lk.	Tucannon R. @ Curl Lk.	Tucannon R. @Marengo
CWT code	63/40/60 63/40/61,62	63/14/56 63/40/58,59	63/14/52 63/14/55	63/14/49 63/14/50	63/14/44 63/14/47
Brand	LA-IT-1 RA-IT-1,3	RA-IJ-1 LA-IJ-1,3	RA-7-3 RA-7-1	RA-H-2 LA-H-2	RA-H-1 LA-H-1
No. Released	60,240	59,958	39,932	39,734	39,625
Fishery					
L. Col. Sport	0	0	0	0	0
Mid-Col. Sport	0	0	0	0	0
Zone 6 Net	0	0	0	0	0
L. Ferry Ladder	1 (0.002)	1 (0.002)	2 (0.005)	0	0
Snake. R. Sport	0	0	0	0	0
Tucannon Sport	0	0	0	0	0
W. Walla Sport	0	0	0	0	0
Touchet Sport	0	0	0	0	0
Grande R. WA +OR	11 (0.018)				
Idaho Sport[a]	19 (0.032)	0	0	0	0
LSRCP Total	**31** **(0.051)**	**1** **(0.002)**	**2** **(0.005)**	**0**	**0**
Grand Totals	31 (0.051)	1 (0.002)	2 (0.005)	0	0

Table 18. (cont)

Release Year			**1992**		
Release Site	Touchet R. Dayton AP	Tucannon R. from Curl Lk.	Tucannon R. @ Curl Lk.	Tucannon R. @Hatchery	Tucannon R. @Marengo
CWT code	63/59/47	63/42/60	63/42/63	63/44/12	63/43/01
Brand	RA-IY-1	RA-S-1	RA-S-2	LV only	LA-S-1
No. Released	45,354	29,255	28,952	9,888	29,410
Fishery					
L. Col. Sport	0	0	0	0	0
Mid-Col. Sport	15 (0.033)	0	0	0	0
Zone 6 Net	0	0	0	0	0
L. Ferry Ladder	56 (0.123)	14 (0.048)	18 (0.062)	0	4 (0.014)
Snake. R. Sport	16 (0.035)	3 (0.010)	2 (0.007)	0	11 (0.037)
Tucannon Sport	2 (0.004)	3 (0.010)	2 (0.007)	0	7 (0.024)
W. Walla Sport	36 (0.079)	0	0	0	0
Touchet Sport	47 (0.104)	0	0	0	0
Idaho Sport	0	0	24 (0.083)	0	0
Ocean Harvest	0	0	0	0	0
LSRCP Total	**157 (0.346)**	**20 (0.068)**	**46 (0.159)**	**0**	**22 (0.074)**
Grand Totals	172 (0.379)	20 (0.068)	46 (0.159)	0	22 (0.074)

Table 18. (cont)

Release Year	1993					
Release Site	Touchet R. Dayton AP	Tucannon R. @ Curl Lk.	Tucannon R. from Curl Lk.	Tucannon R. from Hatchery	Tucannon R @Marengo	Walla Walla R.
CWT code	63/59/41 63/46/49	63/48/16	63/48/15	63/48/47	63/48/17	63/59/42 63/59/44
Brand	RA-H-1,2	LA-IC-1	RA-IC-1	No Brand	LA-IC-3	LA-H-1,2
No. Released	40,432	30,001	21,960	4,602	29,876	39,240
Fishery						
L. Col. Sport	13 (0.032)	14 (0.047)	21 (0.096)	0	2 (0.007)	10 (0.025)
Mid-Col. Sport	18 (0.045)	4 (0.013)	2 (0.009)	0	5 (0.017)	40 (0.102)
Zone 6 Net	75 (0.185)	45 (0.150)	42 (0.191)	0	19 (0.064)	60 (0.153)
Umatilla R.	0	0	0	0	6 (0.020)	0
Deschutes R.	13 (0.032)	7 (0.023)	5 (0.023)	0	6 (0.020)	6 (0.015)
L. Ferry Ladder	189 (0.467)	64 (0.213)	58 (0.264)	3 (0.065)	48 (0.161)	143 (0.364)
Snake. R. Sport	56 (0.139)	15 (0.050)	30 (0.137)	3 (0.065)	18 (0.060)	37 (0.094)
Tucannon Sport	13 (0.032)	6 (0.020)	10 (0.046)	0	11 (0.037)	0
W. Walla Sport	9 (0.022)	0	0	0	0	23 (0.059)
Touchet Sport	94 (0.232)	0	0	0	2 (0.007)	0
Grande Ronde In OR.	0	0	3 (0.014)	0	18 (0.060)	0
Idaho Sport[a]	0	19 (0.063)	38 (0.173)	0	19 (0.064)	19 (0.048)
LSRCP Total	361 (0.893)	104 (0.347)	139 (0.633)	6 (0.130)	116 (0.388)	222 (0.566)
Grand Totals	480 (1.187)	174 (0.579)	209 (0.951)	6 (0.130)	154 (0.515)	338 (0.861)

a: Does not include tagged fish caught in Snake River boundary waters between Washington and Idaho.
b: Not Expanded.
c: Refers to a size at release comparison study.

Table 19. Returns of 1992 released LFH steelhead to fisheries in the Columbia River basin (smolt-to-adult survival those numbers represent) for run years 1993 and 1994.

Release Year			**1992**		
Release Site	Touchet R. Dayton AP	Tucannon R. from Curl Lk.	Tucannon R. @ Curl Lk.	Tucannon R. @Hatchery	Tucannon R. @Marengo
CWT code	63/59/47	63/42/60	63/42/63	63/44/12	63/43/01
Brand	RA-IY-1	RA-S-1	RA-S-2	LV only	LA-S-1
No. Released	45,354	29,255	28,952	9,888	29,410
Fishery					
L. Col. Sport	13 (0.029)	0	0	0	0
Mid-Col. Sport	66 (0.146)	0	0	0	0
Zone 6 Net	0	0	0	0	0
L. Ferry Ladder	141 (0.311)	22 (0.075)	26 (0.090)	1 (0.010)	23 (0.078)
Snake. R. Sport	63 (0.139)	3 (0.010)	73 (0.252)	0	20 (0.068)
Tucannon Sport	5 (0.011)	3 (0.003)	5 (0.017)	0	7 (0.024)
W. Walla Sport	75 (0.165)	0	0	0	0
Touchet Sport	76 (0.168)	0	0	0	0
Idaho Sport	0	0	24 (0.083)	0	0
Ocean Harvest	0	0	0	0	0
LSRCP Total	360 (0.794)	28 (0.096)	80 (0.276)	1 (0.010)	50 (0.170)
Grand Totals	439 (0.968)	28 (0.096)	104 (0.359)	1 (0.010)	50 (0.170)

Tables 18 and 19 of this report and Table 17 of the 1993-94 annual report show how survival varies between release years.

The 1992 direct river release at Marengo again returned more adults than acclimated releases from Curl Lake, although fish released directly near Curl Lake returned at a higher rate than either of the other two groups. These results are partially consistent with the 1991 results. In both years, the direct river release at Curl Lake returned more adults than the acclimated release. The Marengo release was inconsistent between years, but also returned more adults than the acclimated release from Curl Lake. In 1992, as in the past, both groups released directly were larger (3.8 fish/lb versus 5.0 fish/lb) than the acclimated fish released from Curl Lake, which may account for differences in survival. We have not determined whether direct or acclimated fish of the same size will perform differently, but we can conclude that direct stream releases of steelhead into the Tucannon River return adults to the river at or above the project goal of 0.5%.

We believe that 1992 releases represent an unusually low survival rate for LFH stock because steelhead released into the Snake River basin during 1992 survived very poorly compared to previous years. Only fish released into the Touchet River met the LSRCP smolt to adult survival goal. The near complete lack of natural/wild origin Tucannon stock returning adults is disappointing (CWT code 63/44/12, Table 18) . Despite the small release group, we had anticipated a return of 100-200 adults over three years. The lack of any information with which to assess the reason for this failure to survive is problematic.

2.7 Returns to Spawning Grounds

Spawning grounds were surveyed to estimate the number of redds/mile as discussed by Schuck et al. (1993). Index areas established in 1992 and 1993 were used in 1995 with additional index sites established on some rivers.

We estimated steelhead spawning escapement into the Touchet and Tucannon rivers and Asotin Creek in 1995. Redds/mile from survey sections was multiplied by miles of available spawning area in each river to obtain an estimated number of redds constructed. Total redds were then multiplied by 0.81 females/redd (Johnson 1987) to determine the number of females spawning in each river. The proportions of the total run that females and hatchery fish represented were determined from trapping data, creel surveys and historical information. The number of female spawners was divided by the proportion of females to determine run size for each river. The number of males in the spawning runs were calculated by subtracting the number of females from the total run size for each river. The numbers of wild and hatchery fish in the Touchet and Tucannon rivers spawning runs were calculated by applying the ratio of wild to hatchery fish. No estimate of the ratio of wild to hatchery spawners was available for Asotin Creek.

Appendix G summarizes our results from the 1995 spawning ground surveys. Mean number of redds per mile increased on the North and South Forks of Asotin Creek in 1995 compared to 1994 (Figure 4).

Mean redds per mile decreased, remained the same, and slightly increased on the North, South and Wolf Forks of the Touchet River, respectively, in 1995 as compared to 1994 (Figure 5).

Mean redds per mile on the Tucannon in 1995 was similar to that estimated in 1994 (Figure 6). However, the distribution of redds within the river changed; more redds were found upstream that in 1994. Redds per mile was 33% higher in the upper section and six times higher in the middle section in 1995 as in 1994. The lower section experienced a 22.7 % decrease in redds per mile when compared to 1994. This shift in spawning activity is most likely the result of removal of the Tucannon weir/ trap which allowed unrestricted passage to the river above the hatchery during the spring of 1995.

Tables 20 and 21 provide an estimate of hatchery and wild steelhead escapement into portions of the Touchet and Tucannon rivers and Asotin Creek, and a breakdown of estimated males and females in the population. Spawning activity is discussed further in the section, "Trends in naturally produced juvenile steelhead, 1983-1995 ".

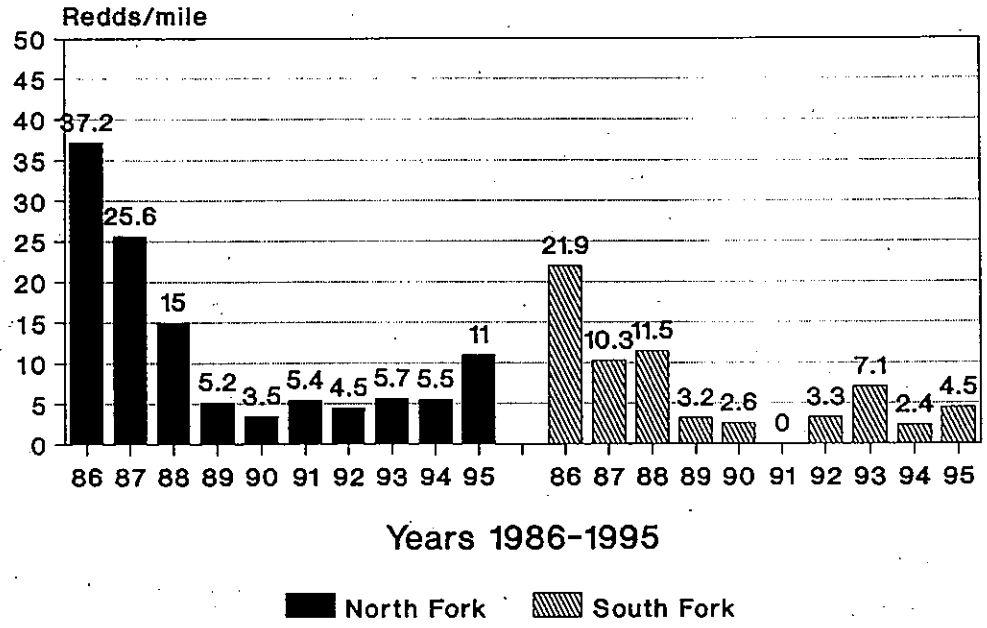

Figure 4. Steelhead spawning density in index areas of Asotin Creek, 1986-95.

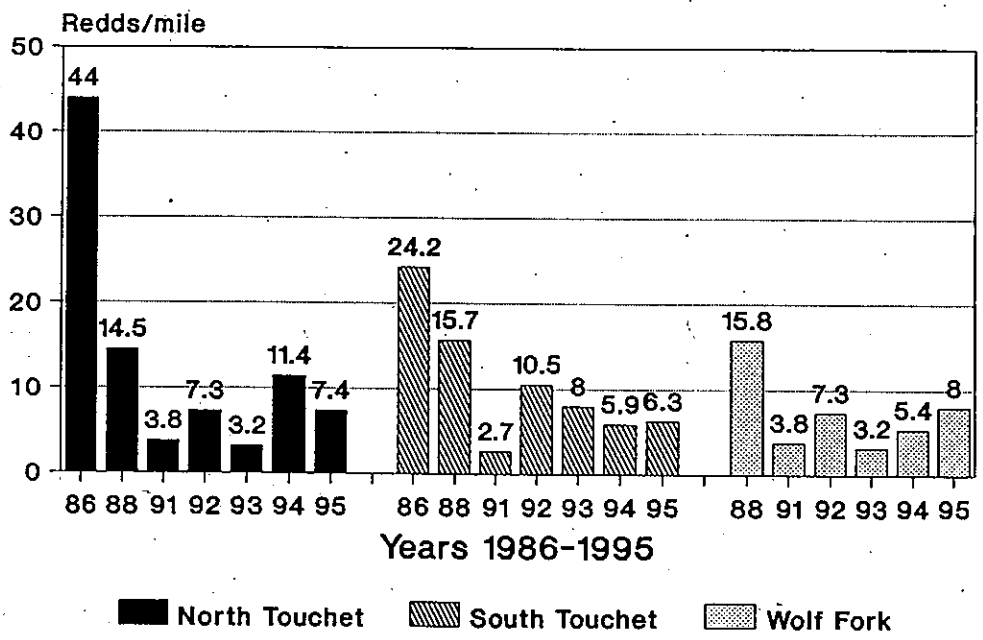

Figure 5. Steelhead spawning density in index areas of the forks of the Touchet River, for selected years 1986-95.

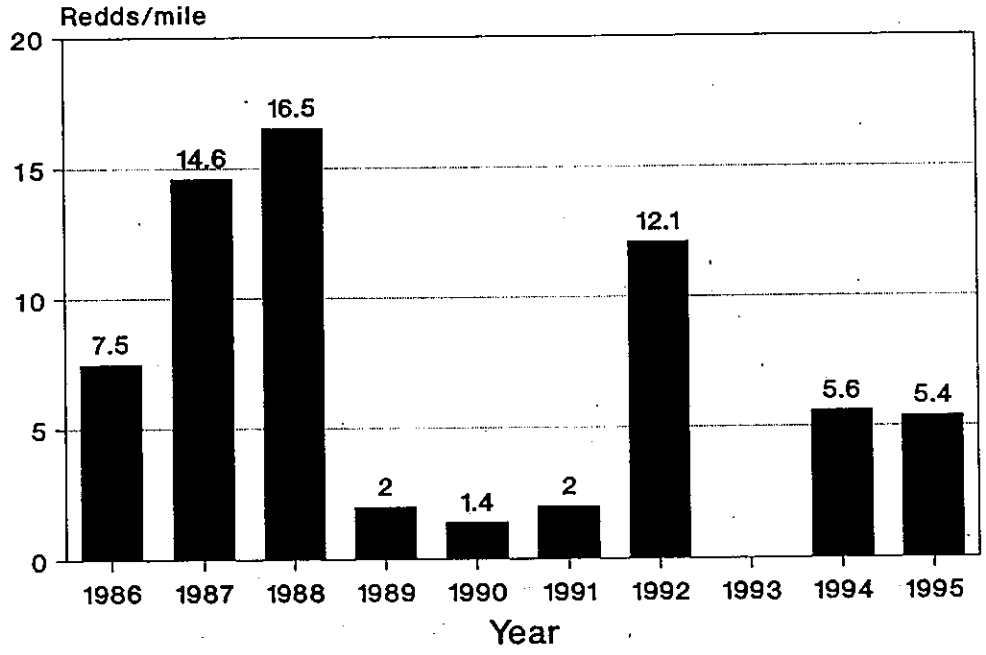

Figure 6. Steelhead spawning density in index areas of the Tucannon River, 1986-95.

Table 20. Estimated steelhead spawner escapement into survey sections of the Touchet and Tucannon Rivers, spring 1995.

River	Wild Total	Wild Male	Wild Female	Hatchery Total	Hatchery Male	Hatchery Female
Touchet River[A]						
North Fk.	98	44	54	24	11	13
South Fk.	117	53	64	29	13	16
Wolf Fk.	98	44	54	24	11	13
Robinson Fk.	10	4	6	3	1	2
Total	**323**	**145**	**178**	**80**	**36**	**44**
Tucannon River[A]						
upper	3	1	2	5	2	3
middle	38	18	20	63	29	34
lower	59	27	32	95	44	51
Panjab Cr.	--	-	-	--	-	-
Cummings Cr.	16	6	10	19	7	12
Total	**116**	**52**	**64**	**182**	**82**	**100**

A: Information based on a combination of spawning surveys and trapping and creel survey information.

Table 21. Estimated steelhead spawner escapement (wild and hatchery fish combined) into survey sections of Asotin Creek, spring 1995.

River	Total	Males	Females
Asotin Creek[A]			
North Fork	123	69	54
South Fork	59	33	26
Main Asotin	---	---	---
Charlie Cr.	23	13	10
Total	**205**	**115**	**90**

A: Information based on a combination of spawning surveys and a total creel survey derived ratio of sexes in the LSRCP area.

2.8 Contribution Toward LSRCP Goal

We estimate that LSRCP steelhead smolts released into S.E. Washington streams during 1991-1993 returned at least 8,730 adult steelhead to the LSRCP area of the Snake River Basin during the 1994 run year (Table 22). This return is 187% of the goal established for Washington's steelhead. The estimate is based on adult escapement and harvest of coded wire tag groups. Adult returns for untagged groups were estimated by using fishery and escapement rates for comparable coded wire tag groups (Table 18).

Table 22. Estimated adult steelhead returns to the LSRCP area in 1994, for specific rivers for the release years shown.

	Asotin Creek	G. Ronde River	Snake River	Touchet River	Tucannon River	Walla Walla R.	Total
Release year							
1991				32			32
1992	0	912	231	330	124	260	1,857
1993	948	2,033	1,862	991	536	471	6,841
Total	**948**	**2,945**	**2,093**	**1,353**	**660**	**731**	**8,730**

2.9 Trends in Naturally Produced Juvenile Steelhead, 1983-1995.

The following sections of Asotin Creek and the Touchet and Tucannon rivers were identified as juvenile steelhead density and population survey sections:

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 the 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 Touchet River: From the mouth upstream 10.3 miles.

Tucannon River: From RM 34.7 (Marengo Bridge) upstream to the confluence with Panjab Creek (RM 45.6).

Juvenile steelhead densities from sites within index areas were used to monitor trends in juvenile steelhead abundance for years 1991-1995. Juvenile steelhead densities for these same

sites within index areas from years before 1991 were available from previous reports (Mendel 1984, Hallock and Mendel 1985, Schuck and Mendel 1987, un-published Washington Department of Fisheries 1990 data, Schuck et al. 1990, and Viola et al. 1991).

We sample survey sections of three LSRCP rivers in S.E. Washington yearly to monitor the status of naturally produced salmonid populations (Appendix H). The continued health of these populations is an important part of the long term goals of the LSRCP program. We use population size and density to monitor their health.

Mean densities of juvenile steelhead are presented in Appendix I. Population estimates of naturally produced juvenile steelhead in the survey sections of the forks of Asotin Creek, and the Touchet and Tucannon rivers are presented in Figures 7-12. Spawning activity, measured in redds per mile, for some S.E. Washington rivers is presented in Figures 4-6 (years presented are when hydraulic conditions allowed a reliable survey to be conducted). In most cases results from 1995 are compared to 1994. A detailed discussion of results from years before 1994 can be found in Schuck et. al. (1991, 1993, 1994, 1995) and Viola et. al. (1991).

Annual variations in juvenile steelhead densities and population sizes depend on the extent of adult spawning and young steelhead rearing success. These factors are affected by annual changes in river flows, water temperatures and habitat quality. Extremes of water flows, water temperatures or changes in habitat quality, even if short lived, can obstruct spawning and decrease rearing success, causing changes in densities and population sizes.

2.9.1 Asotin Creek

Electrofishing surveys of six index sites within each river survey section provide juvenile steelhead population/density trends. Three of the six sites sampled within each river survey section were located in areas of artificial habitat improvement, the other three in areas where the habitat had not been altered. Mean densities (fish/100 m^2) for both zero (0) aged and greater than zero (>0) aged naturally produced juvenile steelhead were calculated for improved and unimproved areas. Population size was estimated by multiplying mean densities by river surface area within improved and unimproved sections. A total population estimate for both 0 aged and >0 aged juvenile steelhead was calculated as the sum of the population estimates from both the improved and unimproved areas. These estimates were then divided by the total area available within the entire river survey section for that year. This provided a density for combined age classes.

North Fork Asotin Creek

In 1995, 2,100 more naturally produced 0 aged steelhead (19.4%) were present in the survey sections than in 1994 (Figure 7). The increase of 0 aged fish in 1995 is relatively small considering that twice as many redds were constructed in 1995 as in 1994 (Figure 4). Thedifference in egg to juvenile survival suggests that rearing conditions were less than optimal or survival was density dependent on the North Fork in 1995.

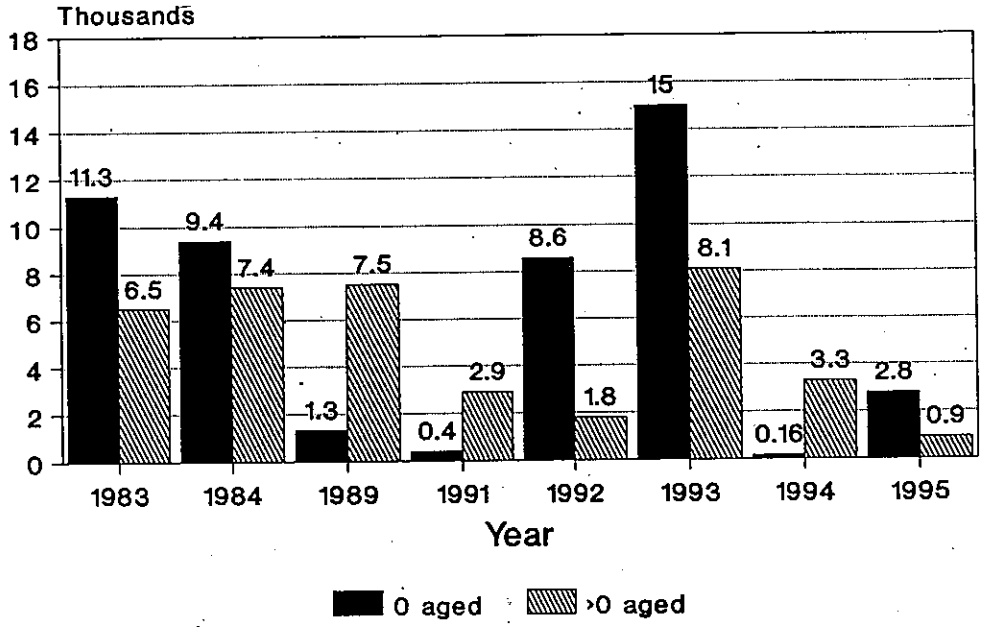

Figure 7. Juvenile steelhead population estimates, S.F. Asotin Creek, 1983-95

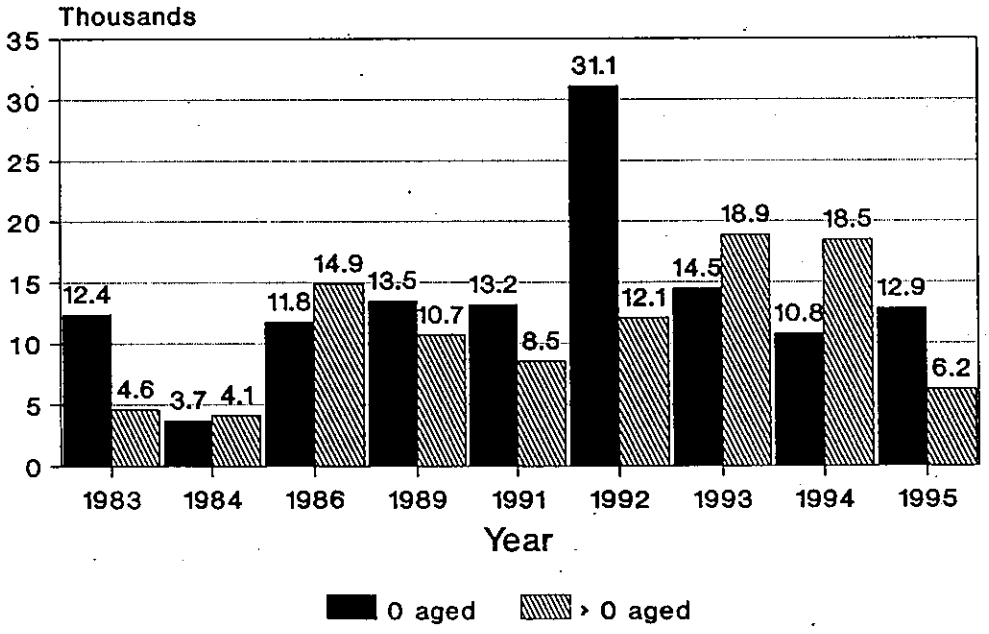

Figure 8. Juvenile steelhead population estimates, N.F. Asotin Creek, 1983-95.

South Fork Asotin Creek

The number of >0 aged fish decreased by 12,300 fish (335%) from 1994 (Figure 7). The relatively low number of >0 aged fish in 1995 corresponds with the low number of 0 aged fish present in 1994, and poor rearing conditions in 1995.

In 1995 the number of naturally produced 0 aged steelhead increased by 2,600 fish (1,300%) over 1994 levels (Figure 8). The increase of 0 aged fish in 1995 is relatively large in comparison to the extent of increase in the number of redds constructed in 1995 (Figure 4). This suggests that rearing conditions were very good on the South Fork in 1995, resulting in very good survival for young-of-the-year steelhead.

In 1995 the abundance of >0 aged fish decreased by 2,400 fish (73%) from levels that were present in 1994 (Figure 8). The relatively low numbers of >0 aged fish in 1995 is most likely the result of a weak year class of 0 aged fish in 1994.

2.9.2 Touchet River

Electrofishing surveys of three index sites within the survey section of each river in 1992 and 1993 provided estimates of juvenile steelhead populations. Mean densities (fish/100 m^2) for both 0 aged and >0 aged naturally produced juvenile steelhead were calculated for the entire survey section within each river. Population size was estimated by multiplying mean densities by river surface area available within each survey section for each river.

North Fork Touchet River

In 1995 the number of naturally produced 0 aged steelhead increased by 45,400 fish (194%) over 1994 (Figure 9). The increase of 0 aged fish abundance in 1995 is very large considering the low number of redds constructed in 1995 compared to 1994 (Figure 6). This suggests that rearing conditions were good on the North Fork in 1995, resulting in high survival for young-of-the-year steelhead.

In 1995 the number of >0 aged fish decreased by 7,300 fish (34%) from that present in 1994 (Figure 9). The relatively low numbers of >0 aged fish in 1995 is most likely the result of low number of 0 aged fish in 1994.

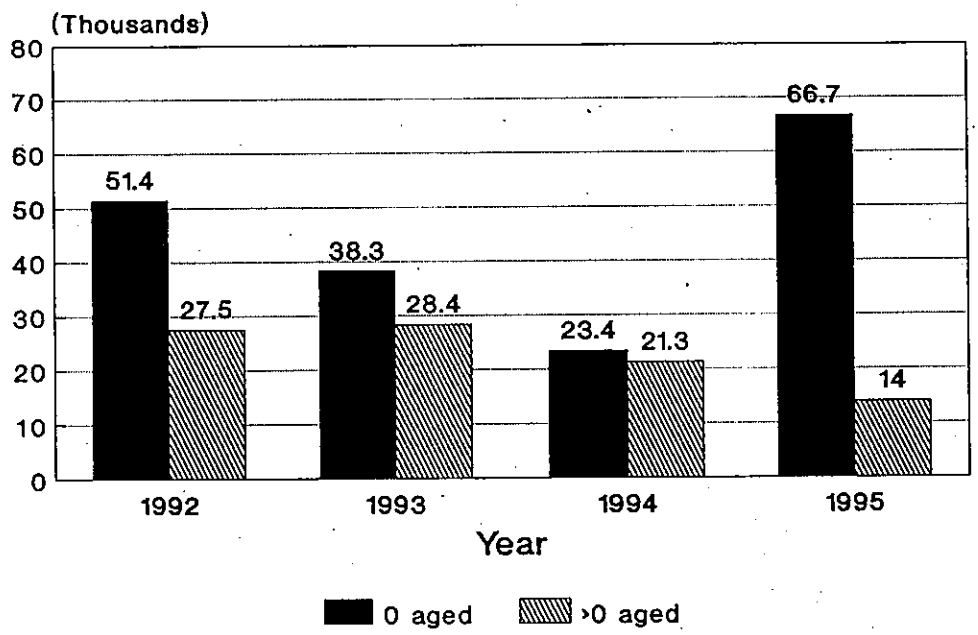

Figure 9. Juvenile steelhead population estimates, N.F. Touchet River, 1992-95.

South Fork Touchet River

In 1995 the number of naturally produced 0 aged steelhead increased by 19,200 fish (68%) over the 1994 level (Figure 10). The increase of 0 aged fish in 1995 when compared to the previous year is large and unexpected as nearly the same number of redds were constructed in 1995 as in 1994 (Figure 6). This suggests that rearing conditions were excellent on the South Fork in 1995, and better than in 1994, resulting in excellent survival of young-of-the-year steelhead.

In 1995 the number of >0 aged fish increased by 4,300 fish (43%) from the level that was present in 1994 (Figure 10).

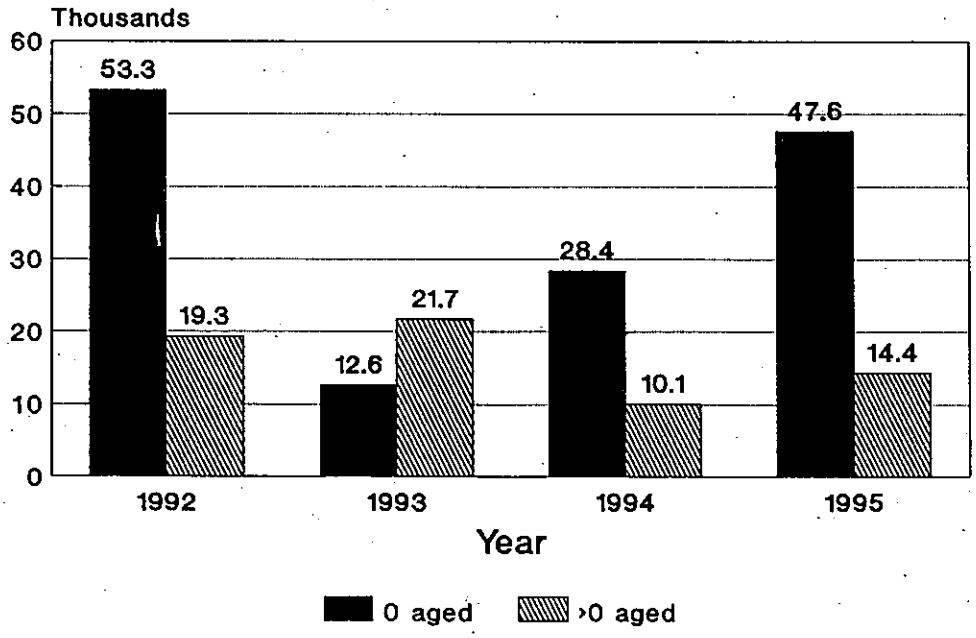

Figure 10. Juvenile steelhead population estimates, S.F. Touchet River, 1992-95

Wolf Fork of North Fork Touchet River

In 1995, naturally produced 0 aged steelhead increased by 7,800 fish (37%) when compared to 1994 (Figure 11). The increase of 0 aged fish in 1995 is in equal proportion to the increase in redd construction in 1995 (Figure 6). This suggests that rearing conditions were similar in the Wolf Fork for 1994 and 1995.

In 1995, >0 aged fish decreased by 4,600 fish (38%) from that present in 1994 Figure 11.

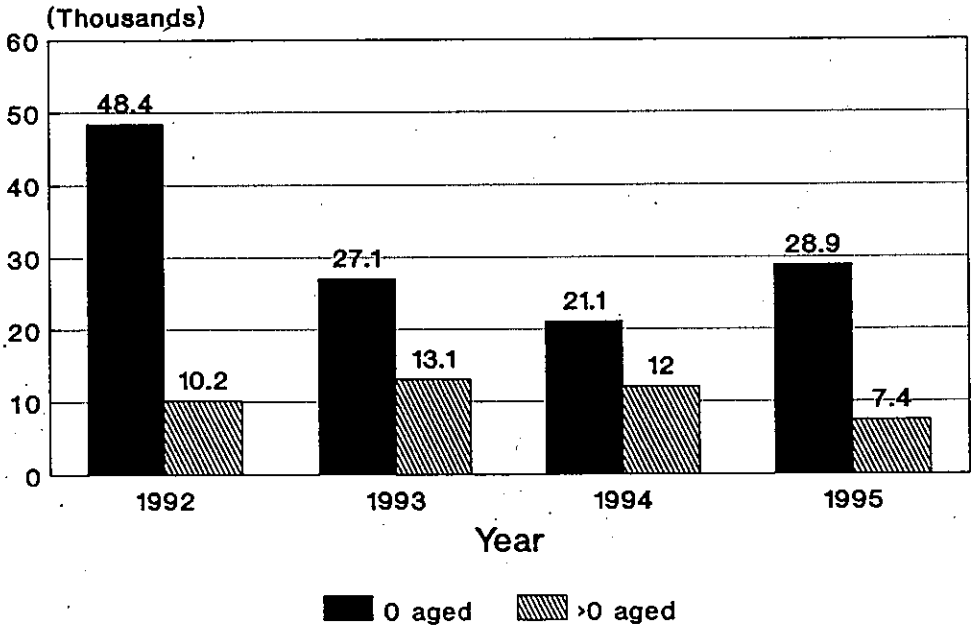

Figure 11. Juvenile steelhead population estimates, Wolf Fork of the N.F. Touchet River, 1992-95.

2.9.3 Tucannon River

In 1995 the abundance of all ages of naturally produced juvenile steelhead decreased when compared to 1993 levels (Figure 12). We could not complete our electrofishing surveys in 1994; so 1994 and 1995 cannot be compared.

2.9.4 Main Asotin and Cummings Creeks

No river survey sections have been established for these waters. During, 1995 we electrofished sites 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 I).

Densities of 0 aged steelhead increased on mainstem Asotin Creek in 1995 compared to 1994, but densities of >0 aged steelhead decreased. Densities of 0 aged steelhead decreased and densities of >0 aged steelhead increased in Cummings Creek in 1995 compared to 1994.

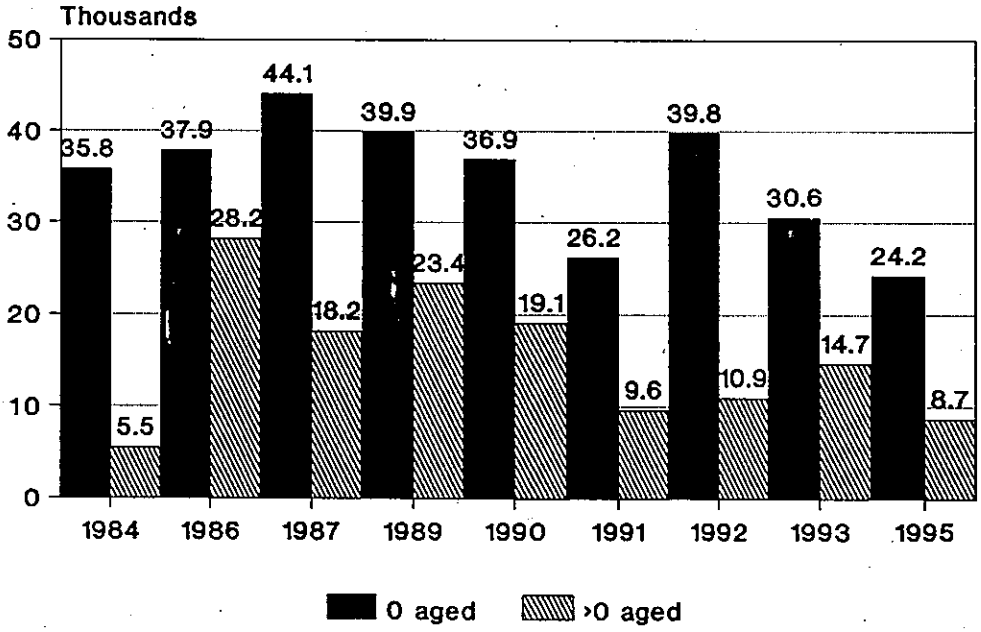

Figure 12. Juvenile steelhead population estimates, Tucannon River, 1984-95

2.9.5 Comparison of electrofishing and snorkeling.

This year we compared juvenile steelhead density/population data collected using our standard electrofishing methods and collected by snorkeling. We snorkeled twelve and six of our juvenile steelhead population sites on the Tucannon and Touchet rivers, respectively, just before electrofishing (Appendix J). Two samplers snorkeled side-by-side from the lower end of each site, upstream to the top. Each snorkeler counted the number of 0 aged and >0 aged steelhead that were observed. Constant communications and an awareness of each diver's location minimized fish being counted multiple times. Counts of fish from both snorkelers were summed and then divided by the total number of 100 m^2 areas in the site to estimate the number of 0 aged (Table 23) and >0 aged fish per 100 m^2 (Table 24). The results from estimates calculated with electrofishing and snorkeling information were compared using a two sample T-test.

Table 23. Mean density (#/100 m^2) of 0 aged steelhead in sites snorkeled and then electrofished on the Tucannon River and Asotin Creek, 1995.

River Method	Mean Density	Sites n	S.D.	S.E.
Tucannon R.				
Snorkeled	3.5	5	2.89	1.29
Electrofished	15.1	5	9.87	4.41
N.F. Asotin Ck.				
Snorkeled	15.1	6	3.82	1.56
Electrofished	25.4	6	8.49	3.47
Main Asotin Ck.				
Snorkeled	13.6	2	9.69	6.85
Electrofished	47.7	2	32.10	22.70

On the Tucannon River the estimates were statistically equal, P=.057 (Table 23). However, a linear regression analysis indicated that the two estimates were poorly correlated, R^2 = 0.55.

North Fork and Main Asotin Creek estimates of 0 aged steelhead derived from snorkel information were significantly lower than estimates calculated from electrofishing efforts, P=.022 and 0.29, respectively (Table 23). Linear regression results of snorkeling and electrofishing estimates showed little correlation, R^2 = 0.079. The small sample size on the main stem of Asotin Creek precluded a regression analysis.

Table 24. Mean density (#/100 m^2) of >0 aged steelhead in sites snorkeled and then electrofished on the Tucannon River and Asotin Creek, 1995.

River Method	Mean Density	n	S.D.	S.E.
Tucannon R.				
Snorkeled	6.6	5	2.98	1.33
Electrofished	4.5	5	3.76	1.70
N.F. Asotin Ck.				
Snorkeled	14.4	6	4.99	2.04
Electrofished	10.1	6	4.63	1.89
Main Asotin Ck.				
Snorkeled	13.5	2	3.18	2.25
Electrofished	13.1	2	3.11	2.20

Two-sample T-test comparisons were made of the number of >0 aged steelhead per 100 m^2 from snorkel surveys and from electrofishing on the Tucannon River and the North Fork and mainstem Asotin Creek (Table 24). The comparisons found no significant difference between estimates calculated from snorkeling or electrofishing, where P= 0.36, 0.15 and, 0.092, respectively for the three streams.

A linear regression analysis indicated that the two estimates were weakly correlated on the Tucannon River (R^2 = 0.41). However, very little correlation was found between the estimates derived from snorkeling and electrofishing on the North Fork of Asotin Creek (R^2 = 0.002).

In conclusion, we found that snorkel estimates were ineffective for estimating the abundance of 0 aged steelhead. Our field sampling experiences support this conclusion. While snorkeling we could not see young-of-the-year steelhead in the shallow water habitat where they are typically found. In contrast, we found that snorkel estimates were effective for estimating the abundance of >0 aged steelhead.

Regression analysis indicated a poor correlation of snorkel and electrofishing estimates for all ages of juvenile steelhead from the same sites. Unfortunately, this appears to preclude reliable comparisons of any snorkel estimate of juvenile steelhead densities and populations with previous estimates based on electrofishing. Our desire to use more snorkeling for our population trend data collection may be valid for newly established sites, but cannot replace electrofishing for obtaining sample data for our existing index sites. Furthermore, snorkeling under estimates numbers of 0 age fish because of an inherent limitation of the method in shallow water habitat. If information is needed for the full range of ages of the fish

population, electrofishing may still be the most accurate and reliable method with the diversity of habitat conditions we must sample. If only older age (parr and pre-smolt) fish need to be sampled, snorkeling can be effective within the habitats found in SE Washington rivers and streams.

2.10 Catchable Trout Program

In 1994-95, 263,521 (85,013 pounds) catchable size rainbow trout were produced at the Lyons Ferry Complex. The catchable trout averaged 3.1 fish per pound in spring, 1995. Appendix K lists streams and lakes in Southeastern Washington which received LSRCP fish, the number and pounds of fish they received, and the number of different stockings into each water. Also in 1994, 199,612 rainbow trout fry (5,880 pounds) and 51,890 fingerlings (3,530 pounds) were reared for Idaho's LSRCP program. This production represented 112% of the program goal of 84,000 pounds. The number of days of recreational opportunity these fish provided was not estimated in 1994-95.

3.0 CONCLUSIONS

Production from LSRCP trout facilities met or exceeded the program goals. No viral or water supply problems disrupted production. Our continuing study of steelhead smolt residualism is providing information that will be applicable throughout the Columbia Basin. PIT tag detections in 1995 showed that successful smolts were the largest, leanest fish which emigrated from the river, just as observed in 1994. We successfully managed Curl Lake AP in 1995 to retain over 14,000 potential residual juveniles in the pond. Once again these fish were over 80% male with less than 10% being identified as smolts. We believe that managing acclimation ponds to retain potentially residual juveniles reduces the presence of these fish in the river and their potential impact on wild salmonids. Whether this affects the number of returning adults is still unknown. We shall continue investigating acclimation pond management as part of our release strategy.

Efforts to develop a broodstock from wild Tucannon steelhead have been unsuccessful. In 1995 we unsuccessfully attempted to trap fish on Cummings Creek. Alterations to the Tucannon Hatchery trap were completed in 1995 with encouraging results. Unfortunately, the escapement of wild/natural steelhead into the Tucannon River has been alarmingly low in the last two years. The new Tucannon broodstock will not be developed until runs rebound, possible in 1996 or 1997.

We estimate that 8,730 adult LFH steelhead returned to the LSRCP area during the 1994 run year. Considerably more fish actually returned to the Columbia River Basin that were harvested in lower river fisheries. Poor survival of the 1992 release of steelhead continued to affect adult steelhead returns in 1994, however, strong returns from the 1993 release this year should provide good returns in 1995.

Spawning escapement and juvenile densities of naturally produced steelhead within index areas of S.E. Washington streams rebounded somewhat in 1994. We believe that persistent drought within the basin probably had caused the decline in both. Drought amplifies the habitat problems inherent with the Snake River system because of the four hydroelectric dams. More rain and better river flows in 1994-95 should have ongoing benefits to natural populations. Without a long-term weather pattern change, however, the benefits could be short lived and easily reversed with the return of drought conditions.

Our comparison of snorkeling and electroshocking as methods of sampling juvenile populations produced discouraging results. Both methods sample populations with consistency, however we could not strongly correlate estimates of 0 age or >0 age juveniles with the two methods. Our results indicate that we cannot replace electroshocking with our current snorkeling techniques to sample our long term stream population index sites. We believe that the long term nature of our trend data is a valuable management tool, and that the mortality induced by electroshocking our index sites is insignificant at the population level. Therefore electroshocking should continue to be used on a limited basis, despite the presence of ESA listed species. Any new sites could be sampled using snorkel techniques if 0 age population data is not required.

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Appendix A.

Smolt Releases From Lyons Ferry/Tucannon Hatcheries, 1991-1995.

Location	R.M.	Number released	Pounds released	Date m/dd	Stock	Tag Code	Brand/	Fin Clips	Size #/lb	CWT loss %	Brand loss %
1991											
Grande Ronde R.	29	252,799	47,698	4/15-30	Wallowa			AD	5.3		
G.Ronde in Oregon	41	52,500	10,000	4/30	Wallowa			AD	5.2		
Mill Creek	3	17,000	5,000	4/17	L.Ferry			AD	3.4		
Mill Creek	3	12,950	3,500	4/23	L.Ferry			AD	3.7		
Snake R. @ LFH	58	19,550	5,750	4/18	L.Ferry			AD	3.4		
Snake R. @ LFH	58	16,830	5,100	4/18	L.Ferry			AD	3.3		
Snake R. @ LFH	58	21,275	5,750	4/18	L.Ferry			AD	3.7		
Touchet @ Dayton	53	20,044	5,011	4/15	L.Ferry	63/40/61	RA-IT-1	AD-LV	5.3	0.1	6.2
Touchet @ Dayton	53	20,108	5,027	4/16	L.Ferry	63/40/60	LA-IT-1	AD-LV	5.3	0.0	8.5
Touchet @ Dayton	53	20,128	5,032	4/17	L.Ferry	63/40/62	RA-IT-3	AD-LV	5.3	0.1	9.4
Touchet @ Dayton	53	20,044	5,011	4/18	L.Ferry	63/40/59	LA-IJ-3	AD-LV	3.8	0.1	1.6
Touchet @ Dayton	53	20,132	5,033	4/19	L.Ferry	63/40/58	LA-IJ-1	AD-LV	3.8	0.6	1.6
Touchet @ Dayton	53	20,104	5,026	4/22	L.Ferry	63/14/56	RA-IJ-1	AD-LV	3.8	0 9	3.7
Touchet @ Dayton	53	27,960	6,990	4/30	L.Ferry			AD	3.7		
Tucannon @ Curl	48	20,032	5,414	4/24	L.Ferry	63/14/49	RA-H-2	AD-LV	3.7	1.4	8.1
Tucannon @ Curl	48	20,184	5,455	4/24	L.Ferry	63/14/50	LA-H-2	AD-LV	3.7	1.0	3.3
Tucannon from Curl	48	20,390	4,855	4/16	L.Ferry	63/14/55	RA-7-1	AD-LV	4.2	1.2	5.6
Tucannon from Curl	48	20,170	4,803	to	L.Ferry	63/14/52	RA-7-3	AD-LV	4.2	1.9	4.9
Tucannon from Curl	48	80,000	19,048	4/30	L.Ferry			AD	4.2		
Tucannon @ Marengo	25	19,987	5,552	4/23	L.Ferry	63/14/44	RA-H-1	AD-LV	3.6	1.1	3.4
Tucannon @ Marengo	25	19,998	5,555	4/24	L.Ferry	63/14/47	LA-H-1	AD-LV	3.6	0.7	4.0
Walla Walla River	29	34,000	10,000	4/16	L.Ferry			AD	3.4		
Walla Walla River	26	16,500	5,000	4/17	L.Ferry			AD	3.3		
Walla Walla River	27	33,000	10,000	4/18	L.Ferry			AD	3.3		
Walla Walla River	25	74,000	20,000	4/22-25	L.Ferry			AD	3.7		
Walla Walla River	26	17,500	5,000	4/26	L.Ferry			AD	3.5		
Walla Walla River	23	16,269	4,930	4/29	L.Ferry			AD	3.3		
Walla Walla River	25	7,480	2,200	4/17	L.Ferry			AD	3.4		
Total		**940,934**	**227,740**					**Mean =**	**4.1**	**0.7**	**5.0**
1992											
Grande Ronde R.	29	213,622	39,622	4/3-19	Wallowa			AD	5.4		
G. Ronde in Oregon	41	25,425	5,650	4/20	Wallowa			AD	4.5		
G. Ronde in Oregon	41	24,500	4,900	4/21	Wallowa			AD	5.0		
Snake R. @ LFH	58	18,000	5,000	4/14	L.Ferry			AD	3.6		
Snake R. @ LFH	58	21,000	5,000	4/14	L.Ferry			AD	4.2		
Snake R. @ LFH	58	18,000	5,000	4/15	L.Ferry			AD	3.6		
Snake R. @ LFH	58	9,688	3,460	4/17	L.Ferry			AD	2.8		
Touchet @ Dayton	53	45,628	13,036	4/13	L.Ferry	63/59/47	RA-IY-1	AD-LV	3.5	0.6	3.3
Touchet @ Day ton	53	49,889	14,254	4/13	L.Ferry			AD	3.5		
Tucannon @ Curl	48	30,096	8,134	4/16	L.Ferry	63/42/63	RA-S-2	AD-LV	3.7	3.8	3.7
Tucannon from Curl	48	30,098	6,270	4/15	L.Ferry	63/42/60	RA-S-1	AD-LV	4.8	2.8	2.6
Tucannon from Curl	48	30,000	6,200	to	L.Ferry			AD	4.8		
Tucannon from Curl	48	9,958	2,075	4/30	Tucannon	63/44/12		LV	4.8	0.7	
Tucannon @ Marengo	25	29,888	8,308	4/16-17	L.Ferry	63/43/01	LA-S-1	AD-LV	3.6	1.6	3.2

Appendix A (cont.)

Smolt Releases From Lyons Ferry/Tucannon Hatcheries, 1991-1995

Location	R.M.	Number released	Pounds released	Date m/dd	Stock	Tag Code	Brand	Fin Clips	Size #/lb	Tag loss %	Brand loss %
1992 (continued)											
Walla Walla River	25	21,000	5,000	4/14	L.Ferry			AD	4.2		
Walla Walla River	24	20,000	5,000	4/14	L.Ferry			AD	4.0		
Walla Walla River	23	15,210	3,900	4/15	L.Ferry			AD	4.0		
Walla Walla River	25	19,000	5,000	4/15	L.Ferry			AD	3.8		
Total		**631,002**	**145,796**					**Mean =**	**4.3**	**1.6**	**2.1**
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		
Tucann @ 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**

Appendix A (cont.)

Smolt Releases From Lyons Ferry/Tucannon Hatcheries, 1991-1995.

Location	R.M.	Number released	Pounds released	Date m/dd	Stock	Tag Code	Brand	Fin Clips	Size #/lb	Tag loss %	Brand loss %
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
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		
Tucan. 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**

Appendix A (cont.)

Smolt Releases From Lyons Ferry/Tucannon Hatcheries, 1991-1995.

Location	R.M.	Number released	Pounds released	Date m/dd	Stock	Tag Code	Brand	Fin Clips	Size #/lb	Tag loss %	Brand loss %
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		
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**

Appendix B. Steelhead trapped at Tucannon Hatchery trap, spring 1995.

Date	Wild/Hatchery	Sex	Length(cm)	Comments
05/15/95	W	F	51-56[A]	Passed
05/15/95	W	F	51-56[A]	Passed
05/17/95	W	M	56-58[A]	Passed
05/18/95	W	M	51	Passed
05/19/95	H	M	51	Passed
05/22/95	W	F	66	Passed
05/23/95	H	M	56	Passed
05/23/95	W	F	51	Passed
05/24/95	H	M	61	Passed
05/26/95	W	M	61	Passed
05/30/95	H	M	58	Passed
05/30/95	H	F	61	Passed
06/02/95	H	M	61	Passed
07/04/95	H	F	56	Passed

A approximate lengths

Appendix C. Steelhead trapped at the Touchet River trap, spring 1995.

Date	Hatchery/Wild	Sex	Length	Comments
03/09	W	F	65.0	
03/09	W	F	69.0	
03/28	W	M	73.0	
03/28	W	F	67.0	
03/28	W	F	68.0	
03/28	W	M	70.5	
04/04	W	F	61.0	
04/06	H	M	66.0	
04/06	W	F	62.5	
04/11	H	F	67.0	

Appendix D: Brand and tag recoveries from the trap at LFH during the 1994 run year .

Brand	Tag Code	Stock	Release Year	Actual Tag Return
RA-IT-3	63/40/62	LFH	1991	1
RA-7-1	63/14/55	LFH		2
RA-IJ-1	63/14/56	LFH		1
Total				**4**
RA-IY-1	63/59/47	LFH	1992	56
RA-S-1	63/42/60	LFH		14
RA-S-2	63/42/63	LFH		18
LA-S-1	63/43/01	LFH		4
Total				**92**
RA-H-1	63/46/49	LFH	1993	81
RA-H-2	63/59/41	LFH		108
RA-IC-1	63/48/15	LFH		58
LA-IC-1	63/48/16	LFH		64
LA-IC-3	63/48/17	LFH		48
LA-H-1	63/59/42	LFH		76
LA-H-2	63/59/44	LFH		67
Total				**502**
AD clipped only				2,441
ADRV		Oxbow		845
LV only[A]		Tucannon		3
ADLV unkown[B]				13
Hatchery mortalities [C]				59
Study group [D]				21
Wild				26
Other Agencies				
RA-J-3	07/60/61	Imnaha	1993	2
RA-J-3	Unkown [E]	Imnaha	1993	1
	10/44/25	Pahsimeroi	1993	2

A - Wild Tucannon River brood stock. Fish were released back into the Snake River.
B - ADLV clipped steelhead with no CWT or visible brands.
C - Steelhead died before being sorted, unknown orign.
D - Steelhead were shipped out for a fish passage study, unknown origin.
E - Brand was read during sorting , fish was released back into the Snake River, unable to determine tag code because ODFW used two different tag codes for the same brand.

Appendix E. Coded wire tag expansions, Snake River, fall 1994 and spring 1995.

Zone	Sample Rate[a] Sept	Oct	Nov	Dec	Jan	Feb	Mar	CWT	Tags Rec.	Expanded[b] Harv.
228 Above Clarkston	---	(.085)	(.171)	(.019)	---	(.143)	---			
			1					07/61/02	1	6
		1	1					07/61/03	2	18
		2	1					07/61/05	3	29
			1					07/61/06	1	6
		1						07/61/07	1	12
			1					10/44/27	1	6
		1						10/49/49	1	12
			1					10/50/12	1	6
			1					23/24/46	1	6
		1						63/46/49	1	12
			2					63/48/15	2	12
			1					63/48/16	1	6
		2	3					No Tag	5	41
168 Above Lower Granite Dam	(.022)	(.059)	(.004)	--	---	----	---			
	1							10/40/07	1	1[c]
		1						63/42/63	1	1[c]
167 Above Little Goose Dam	(.250)	(.324)	(.189)	(.302)	(.167)	(.424)	(.040)			
						1		10/44/16	1	2
						1		10/44/26	1	2
						1		10/49/24	1	2
		1						23/24/46	1	3
			1					63/43/01	1	5
		1						63/46/49	1	3
				1				63/48/17	1	3
					1			63/59/41	1	6
		1						63/59/44	1	3
		1				1		63/59/47	2	5
	1	2		2				No Tag	5	17

Appendix E. (cont.)

Zone	Sept	Oct	Nov	Dec	Jan	Feb	Mar	CWT	Tags Rec.	Expanded[b] Harv.
				Sample Rate[a]						
166	(.333)	(.324)	(.302)	(.347)	(.124)	(.138)	(.018)			
Above Lower Monumental Dam			1	1				05/24/19	2	6
				1				05/24/22	1	3
		1		1				05/24/23	2	6
				1				05/24/25	1	3
					1			07/60/63	1	8
				1				07/61/05	1	3
				1				10/43/12	1	3
		1						10/43/16	1	3
		1						10/44/01	1	3
			1					10/44/05	1	3
		1						10/44/07	1	3
		1						10/44/09	1	3
			1					10/44/12	1	3
		1						10/44/14	1	3
		1						10/44/16	1	3
		1						10/44/19	1	3
		1						10/49/24	1	3
				1				10/49/46	1	3
	1							10/49/47	1	3
			1					10/49/48	1	3
		1						10/49/50	1	3
			1					10/50/21	1	3
		1						10/50/22	1	3
		1	1					23/24/16	2	6
						1		23/24/48	1	7
			1					23/24/49	1	3
		2						23/29/63	2	6
			1					63/42/60	1	3
				2				63/43/01	2	6
		2		3				63/46/49	5	15
	3	2		1				63/48/15	6	18
		3						63/48/16	3	9
		2		3				63/48/17	5	15
			1					63/48/47	1	3
		1		3				63/59/41	4	12
		1		1	2			63/59/42	4	22
		1		2				63/59/44	3	9
		2						63/59/47	2	6
		17	6	2				No Tag	25	78

Appendix E. (cont.)

Zone	Sample Rate[a] Sept	Oct	Nov	Dec	Jan	Feb	Mar	CWT	Tags Rec.	Expanded[b] Harv.
165	(.298)	(.196)	(.066)	(.037)	(.036)	----	----			
Above Ice Harbor Dam	1	1						63/59/41	2	8
	1							63/59/42	1	3
		1						63/59/47	1	5
			5	1				No Tag	6	6[c]

a: Sample rates used to expand individual CWT recoveries.
b: Harvest of tags was calculated by dividing tags recovered by the monthly sample rates.
c: No expansion, sample rate was too small.

Appendix F. Coded-wire tag expansions for other rivers in S.E. Washington, fall 1994 and spring 1995.

Zone	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	CWT	Tags Recovered	Expanded[b] Harvest
				Sample Rate[a]							
185 Touchet R.											
	---	---	---	(.333)	(.895)	(.610)	(.460)	(.136)			
						5	11	1	63/46/49	17	39
						1			63/48/17	1	2
					3	8	11	2	63/59/41	24	55
				1	1	7	11	1	63/59/47	21	47
189 Tucannon R.											
	---	(.111)	(.800)	(.872)	(.589)	(1.00)	(.108)	---			
							1		10/50/20	1	9
				1	1				63/42/60	2	3
			1	1					63/42/63	2	2
			1	2	2				63/43/01	5	7
			1	1	2				63/46/49	4	6
			3	4	1				63/48/15	8	10
			3	2					63/48/16	5	6
			2	3	3				63/48/17	8	11
					4				63/59/41	4	7
					1				63/59/47	1	2
194 Walla Walla											
	---	(.112)	(.036)	(.170)	(.034)	(.068)	---	---			
		1							63/46/49	1	9
		1			1[c]				63/59/42	2	10
				2					63/59/44	2	12
		4							63/59/47	4	36
		1							No Tag	1	9
75 Grande Ronde R.											
	---	(.076)	---	---	---	---	---	---			
		1							63/48/17	1	13

Appendix F. (cont.)

Zone	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	CWT	Tags Recovered	Expanded[b] Harvest
				Sample Rate[a]							
45 McNary Pool , Columbia R.											
	(.240)	(.215)	(.041)	(.020)	---	---	---	---			
		1							05/20/52	1	5
		2							05/24/20	2	9
		1							05/24/23	1	5
		2							05/26/46	2	9
		1							07/53/41	1	5
		1							07/60/59	1	5
		1							07/60/62	1	5
		1							10/43/40	1	5
		1							10/44/06	1	5
		1							10/44/08	1	5
		1							10/44/15	1	5
			1						10/44/22	1	24
		1							10/44/27	1	5
		1							10/49/24	1	5
	1								10/49/48	1	4
		1							10/49/50	1	5
		1							10/49/51	1	5
		1							10/50/12	1	5
	1								10/50/13	1	4
		1							10/50/14	1	5
	1								10/50/16	1	4
		1							10/50/19	1	5
		1							23/24/17	1	5
		1							23/24/47	1	5
		1							23/24/49	1	5
		1							23/30/12	1	5
		1							23/30/13	1	5
	2	2							63/46/49	4	18
	1								63/48/16	1	4
		1							63/48/17	1	5
	1	2							63/59/42	3	13
	2	4							63/59/44	6	27
	1	2		1[c]					63/59/47	4	14
	4	17	2[c]						No Tag	23	98

a: Sample rates used to expand individual CWT recoveries

b: Harvest of tags was calculated by dividing tags recovered by the monthly sample rates.

c: No expansion, sample rate was too small.

Appendix G. Spawning Ground Surveys 1995.

River	Date	Location	Miles	Redds/ Mile	Total Redds	Percent* Increase
North Fork Asotin Creek	6/15	From the mouth upstream 6 miles	6	11.0[a]	66	no estimate
South Fork Asotin Creek	6/15	From the mouth upstream 7 miles	7	4.5[a]	32	no estimate
Main Asotin Creek	---	From the confluence bridge downstream 1.3 miles to Charlie Creek	--	--	--	--
Charlie Creek	6/15	From mouth upstream 7.7 miles	7.7	1.6[a]	12	no estimate
South Fork Touchet River	5/22	From mouth upstream 15.7 miles	15.7	6.3*	99	265
North Fork Touchet River	6/2	From confluence upstream 11.1 miles	11.1	7.4*	82	188
Wolf Fork Touchet River	6/2	From the mouth upstream 10.3 miles	10.3	8.0*	82	158
Robinson Fork of Wolf Fork	5/23	From the mouth upstream 5.0 miles	5.5	1.6[a]	9	no estimate
Cummings Creek	5/26	From the mouth upstream 7.0 miles	7.0	3[a]	23	no estimate
Upper Tucannon R.	6/12	From Sheep Creek to Panjab bridge	4.7	1.0[a]	5	no estimate
Middle Tucannon R.	6/12	From Panjab bridge downstream to hatchery trap weir	9.8	6.8[a]	67	550
Lower Tucannon R.	6/13	From hatchery trap/ weir downstream to Highway 12	17.5	5.8*	102	338
Panjab Creek	6/13	From the mouth upstream 3.4 miles	3.4	0	0	no estimate

* : Percent increased to include redds eliminated by run off.
a : based on index surveys only.

Appendix H: Juvenile density sample sites on Southeast Washington streams, 1994.

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, along SCS shrub plot, 12 boulders in site.
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:0-13LB,alder.
NA-C2	Control	87	1.80	Above split in creek 300ft. above NA4a.Ref:0+04RB,D.fir.
NA4-84	18 Boulders	100	1.90	In first campgrd. above NA4a-83. Ref:0+00RB,alder.
NA-C1	Control	83	2.60	Across the road from a rock face. Ref:1+16RB,alder.
NA8-84	12 Boulders	75	3.00	Ref:0-18LB,alder.
South Fork Asotin Ck.				
SA1-83	2 Log Weirs	119	0.40	300ft. above Campbell Grade Road. Ref:0+00RB,alder.
SA-C3	Control	100	0.80	0.1 mile above Hodson's cattleguard Ref:1+29RB,alder.
SA-C2	Control	99	1.95	By 20ft. high eroding bank. Ref:0+25RB,boulder.

Appendix H. (con't.)

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+00LB, 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				
CH-1	Index	126		8.9 miles above Cook's gate.
CH-1A	Index	93		Mid way between CH-1 and CH-2.
CH-2	Index	98		5.7 miles above Cook's gate.
CH-3	Index	107		3.9 miles above Cook's gate.
CH-4	Index	98		0.6 miles above Cook's gate
Tucannon River				
TN1-93 pasture	Control	98		1/4 mi. above Marengo, open joins brush, river bends, pool at top of site.
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
TN31-84	13 Boulders 1 Log Weir	153	11.10	Just below Panjab bridge. Ref: 0-62LB, bridge piling.

Appendix H. (con't.)

Site name	Site type	Site length (ft)	Road mile	Description and reference point
Cummings Ck.				
CC1-93	Control	99	2.3	Lower end of site is 10.6 meters above bridge.
CC2-93	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.				
NFT1-92	Index	100		1/10 mi. below South Fork Bridge.
NFT2-92	Index	100		1.7 mi. above Wolf fork Bridge.
NFT3-92	Index	45		7.1 mi. above Wolf Fork Bridge, at Touchet R. Road bridge crossing, 1/2 mi. above pond.
South Fork Touchet R.				
SFT1-92	Index	102		6 mi. above Camp Nancy Lee Bridge, just below forks confluence.
SFT2-92	Index	96		2/10 mi. below Camp Nancy Lee Bridge.
SFT3-92	Index	100		Above Petty John Bridge.
Wolf Fork Touchet R.				
WFT1-92	Index	98		Blue Gate.
WFT2-92	Index	96		1/10 mi. below 1st bridge crossing, past Robinsons Fork.
WFT3-92	Index	65		1.3 mi. above Wolf Fork Bridge.

Appendix I. Juvenile steelhead densities for LSRCP area rivers.

	Juvenile steelhead per 100 square meters												
Years Sampled	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Tucannon River													
0 aged steelhead		16.0		18.4	20.6		18.1	19.1	13.0	17.4	14.6		11.0
>0 aged steelhead		2.5		13.7	8.5		10.6	9.8	6.5	4.8	7.0		4.0
Cummings Ck.													
0 aged steelhead											43.2	42.9	32.4
>0 aged steelhead											26.3	20.4	29.6
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
>0 aged steelhead	8.7	7.5		37.6			18.0		14.2	22.2	28.1	34.9	11.2
South Fork Asotin Ck.													
0 aged steelhead	44.3	39.0					6.0		1.8	50.0	78.7	0.8	34.6
>0 aged steelhead	25.3	30.6					34.0		13.9	10.4	42.5	16.4	11.4
Main Asotin Ck.													
0 aged steelhead											49.1	36.8	47.7
>0 aged steelhead											22.1	39.6	13.1

Appendix I. cont.

	Juvenile steelhead per 100 square meters												
Years Sampled	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Charlie Ck.													
0 aged steelhead			73.0									19.0	
>0 aged steelhead			37.6									20.0	
North Fork Touchet R.													
0 aged steelhead										35.5	26.0	20.8	42.5
>0 aged steelhead										19.0	19.3	18.9	8.9
South Fork Touchet R.													
0 aged steelhead										42..8	8.7	16.2	31.1
>0 aged steelhead										15.5	15.0	5.8	9.5
Wolf Fork Touchet R.													
0 aged steelhead										41.1	21.8	20.2	25.0
>0 aged steelhead										8.7	10.5	11.5	6.4

Appendix J. Juvenile density snorkel sites on Southeast Washington streams, 1995.

Site name	Site type	Site length	Road[A] miles	Description and reference point.
Tucannon River				
TN1-93	Control	30m	24.8	1/4 mi. above Marengo, open pasture joins brush, river bends, pool at top of site; Ref.: signs.
R4	Residual steelhead	30m	27.8	Downstream from the 2nd bridge below the Wooten Wildlife area boundary. From the bridge downstream 30m; Ref.: signs.
R5	Residual steelhead	30m	30.4	Forty nine meters upstream of bridge 11; Ref. signs.
TN-C1	Control	30m	34.6	Near lower outhouse at camp 2. Ref. signs
TN3-84	12 Boulders	30m	34.9	Day use above camp 3. Ref. signs.
TNC2-84	Control	30m	36.3	5m below TN8-84 Ref. signs
TN8-84	14 Boulders	30m	36.3	Below camp 6 foot bridge Ref. signs
TN9,10-84	31 Boulders 1 rock weir	30m	36.5	Above camp 6 footbridge, Ref. signs.
TN13-84	10 Boulders	30m	37.7	Upper end of camp 7 Ref. signs.
TNC5-84	Control	30m	42.9	Day use area just above large B.P..Ref: 0+30LB, douglas fir Ref. signs.
TN31-84	13 Boulders 1 Log Weir	30m	45.6	Just below Panjab bridge. Ref: 0-62LB, bridge piling; Ref. signs.

A: Road miles upstream from the mouth.

Appendix K. Trout plants from Lyons Ferry and Tucannon Hatcheries, 1995.

COUNTY	LOCATION	No. of Plants	Pounds of Fish	No. Fish Planted
ADAMS	Sprague Lake	2	3,240	10,562
	TOTAL Rainbows		3,240	10,562
ASOTIN	Alpowa Creek	1	150	570
	Asotin Creek	1	550	2,035
	Golf Course Pond	4	4,015	11,982
	Headgate Pond	2	535	2,017
	Silcott Pond	2	1,610	4,003
	West Evans Pond	3	3,835	10,057
	TOTAL Rainbows		10,795	30,664
COLUMBIA	Big Four Lake	1	1,240	2,976
	Blue Lake	8	5,255	16,626
	Dam Pond	2	760	2,016
	Dayton Jv. Pond	2	733	2,290
	Deer Lake	7	5,020	16,433
	Orchard Pond	1	417	1,000
	Rainbow Lake	10	8,829	28,233
	Spring Lake	8	5,917	17,788
	Touchet R.(GB)	1	3,235	10,752
	Tucannon R.	1	1,040	4,056
	TOTAL Rainbows		29,211	91,418
	Browns		3,235	10,752
FRANKLIN	Dalton Lake	3	6,151	15,062
	Marmes Pond	1	185	499
	TOTAL Rainbows		6,336	15,561
GARFIELD	Baker's Pond	1	256	998
	Casey Pond	1	394	1,537
	Deadman Creek	1	256	998
	Pataha Creek	1	409	1,595
	TOTAL Rainbows		1,315	5,128

Appendix K. (cont)

COUNTY	LOCATION	No. of Plants	Pounds of Fish	No. Fish Planted
WALLA WALLA	Bennington Lake	6	11,125	36,290
	College Pl. Pond	2	643	2,501
	Coppei Creek	1	390	1,521
	Dry Creek	1	390	1,521
	Fishhook Pk. Pond	2	1,590	6,183
	Jefferson Pk. Pond	2	912	3,538
	Mill Creek	1	1,837	7,036
	Quarry Pond	2	8,100	19,990
	TOTAL Rainbows		24,987	78,580
WHITMAN	Garfield Pond	1	534	2,189
	Gilcrest Pond	1	650	2,666
	Pampa Pond	1	2,086	5,006
	Riparia Pond (RB)	2	758	2,156
	Riparia Pond (GB)	1	419	2,030
	Rock Lake (RB)	3	4,735	18,090
	Union Flat Creek	1	366	1,501
	TOTAL Rainbows		9,548	33,638
	Browns		419	2,030
	TOTAL RAINBOWS		**85,013**	**263,521**
	TOTAL BROWNS		**3,654**	**12,782**
	TOTAL FISH PLANTED		**88,667**	**276,303**