LSRCP No.1077/E

1993-94 ANNUAL REPORT

September 1995

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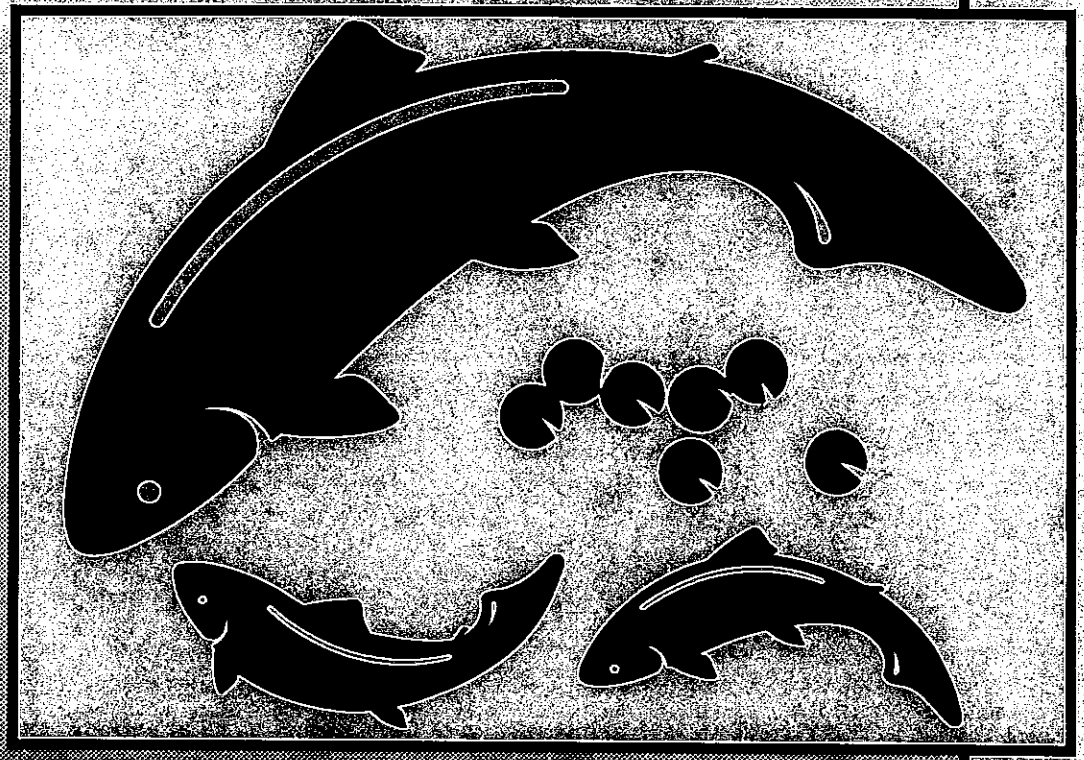
Lyons Ferry Trout Evaluation Study



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Washington Department of
FISH AND WILDLIFE
Hatcheries Program
Assessment and Development Division

Report # H95-06

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LYONS FERRY TROUT EVALUATION STUDY
1993-94 Annual Report

August, 1995

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U.S. Fish and Wildlife Service
Lower Snake River Compensation Plan Office
4696 Overland Road, Room 560
Boise, Idaho 83705

Report # H95-06

Contract # 14-16-0001-93540

ABSTRACT

Summer steelhead production at Lyons Ferry Hatchery (LFH) in 1994 was 942,422 fish (226,091 pounds) with an average smolt size of 4.0 fish/lb. A total of 286,604 rainbow trout (106,325 pounds) were planted into 40 waters at an average size of 2.7 fish/lb. Additionally, 160,062 fry and 57,400 fingerling rainbow trout (9,381 pounds) were reared and given to Idaho as part of the Lower Snake River Compensation Plan (LSRCP) mitigation program.

Seven study groups of branded, coded-wire tagged and fin clipped juvenile steelhead were released into two rivers. Three tag groups were released into the Walla Walla River for contribution studies. Four groups were released into the Tucannon River to complete a four year location and type of release study. A total of 23,898 potential residual juvenile steelhead were retained in Curl Lake AP and not released into the Tucannon River to decrease the number of residual steelhead which may adversely interact with wild salmonids. Overall group performance, measured as recoveries to McNary Dam, for acclimated versus direct river releases were similar. All groups traveled downstream at a similar rate. Two groups of steelhead from Curl Lake AP and one group from Tucannon Hatchery were tagged with PIT tags. Relative emigration performance to collector dams on the Snake and Columbia rivers was measured and physical characteristics of successful emigrants characterized.

During the summer and fall of 1993, 2,905 adult steelhead were trapped at LFH. Females comprised 74.6% of fish trapped. One-salt age fish represented 21.2% of all fish trapped, a significantly lower percentage than in previous years. Wild fish made up 1.2% of fish sampled and tagged/branded fish made up 19.7% of trapped fish. Two hundred sixty-one females and 549 males were spawned to produce 1,211,053 green eggs. One-salt age females ($n = 211$) averaged 4,471 eggs per female ($n = 23$) and two-salt age females averaged 5,754 eggs per female.

Many tagged and branded LFH origin adults were observed in the trap at Lower Granite Dam. Straying of all groups of fish released by LFH was identified.

Creel surveys were conducted on many streams to recover coded-wire tags from study fish. Estimates of angler effort, total harvest and tagged fish harvest are summarized. During the season, 11,595 anglers, who caught 2,536 steelhead, were interviewed. The average angler required 16.3 hours to catch a fish during the season. We estimate that releases of Washington's LSRCP smolts in 1990 and 1991 returned 7,620 adult steelhead to the LSRCP program area in 1993-94. The return represents 164% of the goal established for Washington's steelhead mitigation. The general failure of smolts released in 1992 to return as adults is a concern.

Populations of naturally produced steelhead in LSRCP streams were consistently lower than observed in 1993. Although adult escapement and redd construction increased from 1993, drought flows in most area rivers are believed to have been the principle cause of poor juvenile survival.

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ACKNOWLEDGEMENTS

We would like to thank Kent Ball and the coded-wire tag recovery staff of Idaho Fish and Game for their assistance in the joint Snake River creel survey and in removing our coded-wire tags. Thanks also to Rich Carmichael and his crew for their leadership in the joint Grande Ronde River creel census and for providing the statistical analysis and tag expansions.

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.

Pete Verhey and Charles Morrill offered invaluable assistance in our first year of PIT tagging, and we sincerely appreciate their help.

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

Finally we would like to express our special appreciation to the managers and staffs of Lyons Ferry and Tucannon Hatcheries 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 1993-94 annual report is one of a series describing Washington Department of Fish and Wildlife's (WDFW)[1] progress toward meeting Washington's trout mitigation goals established in the Lower Snake River Compensation Plan (LSRCP). The study period for this report was 1 July 1993 through 30 June 1994.

The LSRCP program began in Washington in 1981 with construction of Lyons Ferry Hatchery (LFH). Refurbishing of the Tucannon Hatchery in 1984-85 followed and completed the production facilities for trout and steelhead. Three remote acclimation ponds were built along the Tucannon, Touchet and Grande Ronde rivers to acclimate smolts prior to release. The Lyons Ferry Evaluation study assesses whether these facilities produce fish that meet these mitigation goals, what parts of the mitigation program may adversely affect salmonids listed under the Endangered Species Act (ESA) and other natural salmonid populations, and recommend actions to improve the hatcheries' productivity.

Long term efforts to monitor populations of wild salmonids in streams and rivers receiving LSRCP mitigation continue. Trend data on population density and size represents an important effort to assess the potential effects of hatchery fish on natural populations. Increasing concern within the Snake River basin for the well being of natural populations of all salmonid species will require this type of monitoring to continue.

2.0 METHODS

2.1 Hatchery Operation Monitoring

2.1.1 Juvenile production

Our methods of sampling growth rates during the production year or in sampling the smolts before release in the spring are the same as past years (Schuck 1985). Pre-release fork length and weight were taken and the fish classified as a smolt, transitional smolt, parr or precocious male.

2.1.2 Fish Marking Program

Groups of steelhead were marked in four different ways this year:

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

In addition, some study groups of fish were marked from production by;

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

3) coded-wire tagging and left ventral only fin clipping of hatchery reared endemic stocks to identify returning adults while restricting sport harvest,

4) implanting of Passive Integrated Transponder (PIT) tags in juvenile fish at emigration to monitor emigration success and identify the characteristics of successful smolts.

Adipose clipping was done during August/September 1993, just before the fish were transferred into the large rearing ponds at LFH. We contracted with WDFW personnel to coded-wire tag and brand fish during February 1994. Tag loss was determined by sampling 1,000 fish from each unique tag group with a portable CWT detector. Freeze brands were visually 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.

PIT tagging was conducted during April and early May at Curl Lake Acclimation Pond (AP) and the Tucannon Hatchery. Three groups of 350 fish were tagged. The first group was steelhead of Tucannon River natural origin stock that had been reared at Tucannon Hatchery. The emigration performance of these fish was compared with the remaining two groups which were LFH stock steelhead released from Curl Lake AP.

Group two was comprised of fish which actively left Curl Lake AP after retaining screens were removed on 9 April. Three subgroups of approximately 115 fish were tagged weekly to sample fish throughout volitional emigration. 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 Tricain Methane Sulfonate (MS-222), tagged, weighed, measured and developmental stage (smolt, transitional, parr, precocious male) was recorded. Fish were then allowed to recover in fresh water and released directly into a quiet pool of the Tucannon River near the pond outlet.

Group three was comprised of fish that failed to emigrate from Curl Lake AP. These fish were collected from the pond on 17 May by cast-net and placed in a holding box. They were then tagged and released in the same way as volitional migrants.

Recoveries of PIT tags at downstream collector dams such as Lower Monumental and McNary, which were reported to the regional PIT tag database in Portland, Oregon, are reported here, and provided the characteristics of successful emigrants and a comparison of group performance.

2.1.3 Fish Releases

Four release methods were used in 1994: 1) brood stock smolt releases from Lyons Ferry

and Tucannon hatcheries were allowed to volitionally emigrate from rearing ponds and enter the Snake and Tucannon rivers respectively; 2) fish at LFH were pumped from the release structure into tank trucks and released directly to various 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 over a two week period. 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. After five weeks in the acclimation pond, fish were allowed to volitionally emigrate over a five week period as the pond water level was slowly lowered. When the fish remaining in the pond were 80% male and showed a strong hesitancy to leave the pond, screens were replaced in the outlet structure and no further fish were allowed to leave. Fish which failed to leave the pond were considered "potentially residual fish". This form of pond management was devised to prevent their released into the river and to prevent any possible adverse effects they might have on wild salmonids.

Beginning in 1993 an additional sampling effort was conducted where 60 fish were killed and examined for gender and degree of sexual development of males. Martin et al. (1993) indicated that males comprised more than 75% of residual hatchery reared smolts in the Tucannon River. We made an attempt in 1993 to retain these fish in the acclimation pond through careful management of the pond outflow and through weekly sampling of fish in the pond. Based on the successful completion of Martin's 1993 work, our 1994 goal of the sampling was to identify when 80% of the fish remaining in the pond were male and showed a strong hesitancy to leave the pond. Degree of sexual development was visually determined and recorded as a percentage of the testes which had become swollen and white (20-100%) or whether the fish was fully precocious (running milt). Fish failing to leave the pond during the extended volitional emigration time were not allowed to enter the river. A sport fishery was then allowed on non-migrating fish.

2.2 Hatchery Smolt Emigration

We assessed smolt survival throughout their migration in the Snake and Columbia Rivers from recovery of freeze brand collected and expanded at the Snake and Columbia River Dams by personnel from the National Marine Fisheries Service (NMFS) and Fish Passage Center (FPC).

2.3 Estimates of Residual Steelhead

We estimated the percentage of all hatchery reared juvenile steelhead released into the Tucannon and Touchet rivers that residualized during the spring of 1994. Also, the number of residual hatchery steelhead present in an index area of the Grande Ronde River was estimated. The method used on the Tucannon and Touchet rivers was similar to the method used in 1991(Viola and Schuck) and 1992 (Martin et al.). This year we collected data by angling in the rivers for two days before the opening of trout season. We thus avoided any bias inherent in a creel survey because of angling methods or angler behavior, and obtained

our sample before any fish were removed by sport angling. Also, in two days of angling we collected a larger sample size than obtained by creel surveys in previous years. A brief summary of new methods used in 1994 is presented below.

2.3.1 Tucannon and Touchet Rivers

By the third week in May, emigration of hatchery reared juvenile steelhead has nearly ceased (Viola and Schuck 1992). During the last week of May, 1994 we placed a known number of hatchery rainbow trout into the Tucannon (6,652 fish) and Touchet (4,864 fish) rivers. This resulted in a population within each river consisting of residual hatchery steelhead and hatchery rainbow trout. Approximately one week was allowed for distribution and mixing of rainbows and residual steelhead. On 31 May and 1 June 1994, WDFW personnel fished both rivers. Information on the number of rainbow trout and residual steelhead caught by WDFW anglers was recorded. We used a Petersen Mark and Recapture calculation (Ricker, 1958) and WDFW angling information to estimate a population size of the combined number of hatchery steelhead and rainbow trout. Rainbow trout represented the marked fish in these calculations. We estimated the number of steelhead that residualized in each river by multiplying the percentage of steelhead in the angling sample, by the population estimate of residualized steelhead and hatchery rainbow trout.

2.3.2 Grande Ronde River

During June, 1994 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. This established an index section that can be sampled annually. The size and flow of the Grande Ronde River precludes a more extensive estimate of residualism.

Hatchery reared juvenile steelhead were captured with hook and line, marked with a caudal punch and released by WDFW personnel and members of a local sportsman group (the Clearwater Fly-casters) during 26, 28 and 29 June 1994. Fish were recaptured with hook and line on 2 July 94. We used a Petersen Mark and Recapture calculation (Ricker, 1958) to calculate a population estimate of residual hatchery reared steelhead within the index section.

2.4 Adult Steelhead Returns to Project Area

2.4.1 Passage at dams and characteristics of adults

The National Marine Fishery Service (NMFS) monitored adult passage at Lower Granite Dam as part of their migration research (Jerry Harmon, NMFS, 1994). Adults coming into the trap were sampled for fin clips and freeze brands.

2.4.2 Returns to Lyons Ferry Hatchery

We examined all steelhead that entered the hatchery trap for fin clips, freeze brands and other external tags. The ladder was open most of the period during which steelhead were migrating past the hatchery and could have entered the trap. All captured fish were retained until November of 1993 when they were sorted for spawning. Fish originating from upstream hatcheries, injured fish, and fish not needed for broodstock were returned to the river. All wild fish were released to spawn naturally.

2.4.3 Adult steelhead returns to spawning grounds

Spawning ground surveys and estimates of redds/mile were conducted as discussed by Schuck et al. (1993). Index areas established in 1992 and 1993 were used in 1994 with additional index sites established on some rivers.

We estimated steelhead spawning escapement into the Touchet and Tucannon rivers and Asotin Creek in 1994. Redds/mile (Schuck et al 1993) 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 a constant (.81 females/redd (Johnson 1987)) to determine the number of female spawners escaping to each river. The proportions of the total run that females and hatchery fish represented were determined from trapping information, creel survey results and historical information. The number of female spawners was then divided by this proportion 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 number of wild and hatchery fish in the spawning runs were calculated by applying the ratio of wild to hatchery fish from trapping information or creel survey results on the Touchet and Tucannon rivers. No estimate of the ratio of wild to hatchery spawners was available for Asotin Creek.

2.4.4 Tucannon Hatchery trap

Hatchery and wild steelhead were trapped in the Tucannon River at the Tucannon Hatchery (RM 36), December 1993 through May 1994. We documented the number of wild and hatchery fish that returned to spawn above the weir. Also, every fifth female and male wild fish was kept for spawning at the hatchery.

2.4.5 Touchet River trap

The Touchet River adult steelhead trap is located at river mile (RM) 53.3. The trap collects wild and hatchery steelhead to determine if the wild summer steelhead run is large enough to allow creation of a hatchery broodstock. Also, we intended to count the entire run migrating into the upper watershed and determine an adult/redd ratio.

All steelhead captured were anesthetized with CO^2. The fish were measured, sexed and tagged. The steelhead were then held in a recovery pen upstream from the trap, allowed to

recover, and released. Steelhead were tagged with a blue or yellow numbered dart tag to identify hatchery or wild origin fish, respectively. An additional mark, a hole punched in the caudal fin, was added to help identify fish which may have lost the dart tag. Tagging prevented us from recounting fish when they dropped below the weir and re-entered the trap. The presence of visible tags also enabled the identification of hatchery and wild origin fish on redds during spawning ground surveys.

2.5 Steelhead Creel Surveys

We used adjusted state-wide catch record card estimates of 1994 steelhead harvest. We sampled creels to obtain catch composition data and to recover coded-wire tags. Anglers kept only adipose clipped fish though some were also left ventral (LV) clipped indicating the presence of a coded-wire tag. We used data for fish recovered in fall 1993 and spring 1994 to calculate sex ratios, mean length and mark rate.

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. Sport fishing for steelhead was open on the Snake and Columbia rivers from 1 September 1993 through 31 March 1994, and on tributaries to the Snake River from 1 Sept 1993 through 15 April 1994. Data collection methods were as described in Schuck et al. (1990). Regulations required wild steelhead release, with daily catch, possession, and annual limits of 2, 4, and 30 steelhead, respectively.

A joint creel survey of the upper Grande Ronde was conducted by ODFW and WDFW personnel. Angler effort, catch rates, harvest and coded-wire tag recoveries and expansions were calculated by ODFW as described in Carmichael et al. (1988).

Objectives of creel surveys on the Snake and Grande Ronde Rivers during these seasons were:

1. Estimate the portion of the sport catch contributed by returning steelhead of LFH origin. 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 CWT /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 sum of tagged and untagged steelhead sampled during the creel surveys by the estimated total sport harvest. The latter is determined from WDFW catch record card estimates of sport harvest.

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

2. Obtain information regarding 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. Information was also collected on angler effort and catch rates: hrs/fish caught, hrs/fish kept and total harvest of all steelhead within the LSRCP area of Washington.

2.6 Trends in Naturally Produced Juvenile Steelhead Density and Population Size 1983-1994.

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 upstream to the confluence with Panjab Creek (RM 45.6).

Juvenile steelhead densities from sites within index areas were obtained from field sampling specifically for the purpose of monitoring trends in juvenile steelhead abundance in 1991-1994. Juvenile steelhead densities from these same sites within index areas from years earlier than 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).

2.6.1 Asotin Creek and the Tucannon River

Annual 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 both improved and unimproved areas. Population estimates were calculated by multiplying mean densities by river surface area available 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.

2.6.2 North, South and Wolf Forks of the 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 estimates were calculated by multiplying mean densities by river surface area available within each survey section for individual rivers. No instream habitat has been improved in the Touchet River, therefore this was not considered in calculations.

2.6.3 Main Asotin, Charlie and Cummings Creeks

No river survey sections have been established for these waters. During 1994 we electrofished individual sites from previous years. Mean densities (fish/100 m^2) for both 0 aged and > 0 aged naturally produced steelhead were calculated. Juvenile steelhead densities in 1994 and from previous years were compared.

3.0 RESULTS AND DISCUSSION

3.1 Hatchery Operation Monitoring

3.1.1 Juvenile production

A summary of production for Lyons Ferry and Tucannon hatcheries is presented in Table 1. Numbers represent individual fish stock performance over an entire production period.

Table 1: Trout production at Lyons Ferry / Tucannon hatcheries, 1993-94.

Species[A]	Stock[A]	Number of eggs taken	Number of fry	Number released	%[B] survival	Fish lbs. produced
Lyons Ferry Hatchery						
RB	Spok.(92)	376,400	329,867	334,735[C]	88.9	60,254
RB	Spok.(93)		57,325	57,400[D]	100.0	3,174
SSH	Wal./Cot.	533,955[E]	271,970	407,078[F,G]	50.3[F]	55,106[F]
SSH	Wallowa	272,000	257,599			
SSH	LFH	1,211,053[H]	860,983	611,417[I]	50.5	137,824
Tucannon Hatchery						
RB	Spok.(92)	226,800	218,864	189,826[J]	83.7	51,212
RB	Spok.(94)	87,000	81,585	60,690[K]	69.8	1,190
SSH	Tuc.	32,000	13,000	10,179	31.8	1,885
SSH	LFH		160,443	159,259[L]	99.3	11,522

A - RB = rainbow, SSH = summer steelhead, GB = german brown; Wal = Wallowa, Cot.= Cottonwood, Tuc.= Tucannon, Spok.= Spokane
B - egg to smolt survival rate.
C - Includes 160,062 fish weighing 3,914 lbs. transferred to IDFG and 59,820 fish weighing 2,775 lbs. planted in Sprague Lake.
D - Received from the Tucannon Hatchery, marked, then transferred to IDFG.
E - 77,760 eggs infected with IHNV and 60,796 bad eggs were discarded.
F - Total is for Wallowa and Wal./Cot. combined.
G - Includes 80,982 sub-smolts weighing 2,454 lbs. planted in Sprague Lake.
H - 149,182 bad eggs were discarded.
I - Includes 160,443 fish weighing 28,888 lbs. transferred to the Tucannon Hatchery Curl Lake A.P..
J - Includes 22,484 fry weighing 292 lbs. planted in Rock Lake.
K - 60,690 fish weighing 1,190 lbs. were transferred to LFH for marking.
L - Includes 23,898 fish weighing 5,431 lbs. retained in Curl Lake A.P. as non-migrants.

Egg-to-fry survival for steelhead varied in 1993 (Table 2). Wallowa/ Cottonwood stock fish were used again this year with improved results over 1992 and 1991. However, poor egg quality continues to plague this effort with high green-egg loss. Over-ripe eggs, sperm quality, and warm water and air temperatures during spawning are likely causes of this high loss.

Table 2. Egg to fry survival, Lyons Ferry Hatchery 1989-94.

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	506,825	451,770	70.0
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

3.1.2 Fish marking

Coded-wire tag loss increased to 2.2% (SD= 2.1) in 1994 compared to tag loss of only 0.7% (SD= 0.4) in 1993. Also, freeze brand loss increased in 1994 to 5.2% (SD=2.0) unreadable brands from 2.9% (SD= 2.0) unreadable brands in 1993 (Appendix A). Light brands were the most significant cause of brand loss. Alternatives to branding are still being investigated. Elastomer tags implanted behind the eye appear to be improving in quality (visibility, retention) and there are an increasing number of colors available. Elastomer tags are still much more expensive than freeze branding. We will continue to follow the development of other tagging methods, but at present we believe that branding remains the best available technique. Tag/brand groups are summarized in Appendix A .

3.1.3 Fish releases

Fish were transferred to acclimation ponds in late February because of mild weather and in anticipation of early releases as outlined in our Section 7 Biological Assessment. Because of a delay in receiving the Biological Opinion from National Marine Fisheries Service, the screens were not removed from the outlet structures of all the ponds until 11 April, more than two weeks later than requested. Fish were actively schooling and circling the ponds from 1 April until release. Large numbers of fish began exiting the ponds immediately. Fish fed actively during this period; feeding was stopped as the pond levels were lowered. Dayton and Cottonwood ponds were empty by 30 April with Curl Lake AP being operated through 16

May. All smolt plants for 1991-1994 are summarized in Appendix A.

Three stocks of fish were released in 1994. Full production with our two long term hatchery stocks, Lyons Ferry and Wallowa was achieved this year because we had no incidence of IHNV in spawning LFH adults. Wallowa stock fish from Oregon and from our trap at Cottonwood AP provided fish for use in the Grande Ronde River. A small group of Tucannon River wild stock fish were volitionally released from Tucannon Hatchery in late April and early May. These fish received only an LV clip and CWT without an adipose clip (only AD clipped fish may be retained in the sport fishery) to allow maximum return to the river as adults. Pre- and post release samples were collected from Curl Lake, Dayton, and Cottonwood Acclimation ponds in 1994 to identify changes in the pond population that occur during the release period, Table 3.

Table 3. Smolt characteristics of Lyons Ferry Hatchery and Tucannon River wild stock juvenile steelhead.

	n (%)	Mean length	Mean weight	K	% male/female of total sample
Dayton Pond					
pre-release					
Sample 03/28/94					66.8/33.2
Smolts	140(65.0)	222.8	122.4	1.08	
Transitional	65(30.4)	195.3	85.2	1.09	
Parr	1(0.5)	156.0	45.0	1.21	
Precocious males	10(4.2)	188.1	79.9	1.18	
post-release					
Sample 04/26/94					73.4/26.6
Smolts	52(27.6)	228.3	132.2	1.20	
Transitional	105(60.3)	198.0	89.2	1.07	
Parr	0				
Precocious males	17(9.8)	204.6	97.2	1.12	
Cottonwood Pond					
pre-release					
Sample 03/28/94					63.2/36.8
Smolts	53(18.3)	214.1	108.4	1.07	
Transitional	212(73.1)	196.5	85.0	1.08	
Parr	11(3.8)	144.6	32.9	1.03	
Precocious males	14(4.8)	205.4	105.7	1.19	

Table 3. (cont.)

	n (%)	Mean length	Mean weight	K	% male/female of total sample
Cottonwood Pond					
post-release					
Sample 04/26/94					61.0/39.0
Smolts	17(16.0)	219.5	111.1	0.99	
Transitional	83(78.3)	189.3	71.6	1.00	
Parr	2(1.9)	116.0	15.0	0.93	
Precocious males	4(3.8)	219.3	123.5	1.16	
Curl Lake					
pre-release					
Sample 03/29/94					56.2/43.8
Smolts	80(32.0)	221.6	114.8	1.04	
Transitional	153(61.2)	203.9	91.7	1.06	
Parr	5(2.0)	145.4	37.8	1.24	
Precocious males	12(4.8)	189.6	85.2	1.24	
post-release					
Sample 05/16/94					82.2/17.8
Smolts	17(10.1)	239.2	139.4	0.99	
Transitional	116(68.6)	211.1	105.7	1.07	
Parr	0				
Precocious males	36(21.3)	206.7	107.3	1.18	
Tucannon Wild Stock					
pre-release					
Sample 04/13/94					52.0/48.0
Smolts	30(25.4)	208.8	95.4	1.03	
Transitional	68(57.6)	192.6	75.8	1.03	
Parr	20(16.9)	129.8	23.0	1.04	
Precocious males	0				

A large change in the sex ratio, mean length, weight and condition factors of fish within Dayton and Curl Lake AP's was observed. The number of smolts present in the ponds (as a % of the sample) at the end of release decreased substantially with a shift toward transitional and precocious males. Similar changes were not seen in Cottonwood AP. Mean condition factors of steelhead retained in Curl Lake were significantly larger ($P < .05$) than condition factors of fish before release (Table 3). Sexually maturing males were a substantially higher

proportion of the fish that were retained in Curl Lake when compared to samples before release. The data support the possibility of separating active migrant steelhead from those fish which are likely to residualize. Based on our observations, the precocious male portion of the steelhead life history is selectively removed from the population if ponds are used to prevent potential residual fish from entering stream systems (Viola and Schuck, 1995). This may be an effective tool in decreasing the potential effects of hatchery steelhead releases on resident wild salmonids. However, using this method with certain types of supplementation or with wild broodstock programs could have unacceptable genetic effects on the total population.

3.2 Hatchery Smolt Emigration

3.2.1 Migration through dams

A summary of passage estimates at McNary Dam for freeze brand groups released in 1991-94 is presented in Table 4. In 1994, median (50%) passage at McNary Dam occurred 14 days and 30 days after release, for Walla Walla and Tucannon river releases respectively. The 95% passage point for the Walla Walla and Tucannon rivers releases occurred by May 12 and June 25 respectively. Average daily travel rates for Tucannon brand groups was 4.5 miles/day, and was 3.2 miles/day for Walla Walla brand groups.

The 1994 travel rates and passage indices (an estimate of passage through McNary Dam's bypass system) for the groups were very similar to 1993 numbers.

Table 4. Estimated passage of freeze branded/tagged Lyons Ferry Hatchery steelhead at McNary Dam, 1991-94. (FPC 1992-1995)

Brand	Release site	Passage index	Number released	% of release	Size (#/lb)	Stock
1991						
LA,RA-IJ-1,3	Touchet-large	18,752	58,901	31.8	3.8	LFH
LA,RA-IT-1,3	Touchet-small	13,318	55,440	24.0	5.3	LFH
RA-7-1,3	Curl Lake	8,464	38,430	22.0	4.2	LFH
LA,RA-H-2	Tucan. @ Curl	7,384	37,759	19.6	3.7	LFH
LA,RA-H-1	Tuc. @ Marengo	9,198	38,502	23.9	3.6	LFH
1992						
RA-S-1	Curl Lake	8,420	29,324	28.7	4.8	LFH
RA-S-2	Tucan. @ Curl	5,908	28,973	20.4	3.7	LFH
LA-S-1	Tuc. @ Marengo	6,824	28,926	23.6	3.6	LFH
RA-IY-1	Touchet R.	11,560	44,026	26.3	3.5	LFH

Table 4. (cont.)

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	Curl Lake	3,080	21,653	14.2	5.0	LFH
LA-IC-1	Tucan. @ 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

3.2.2 PIT tag study

Studies completed during 1991-1993 estimated the number of juvenile steelhead that had been released into the Tucannon River which failed to emigrate (residualize). In 1993 a method to reduce the number of residual juvenile steelhead in the Tucannon River was also tested. Careful manipulation of the water level during the release of steelhead smolts from Curl Lake AP significantly reduced the incidence of residual steelhead in the river when compared to either direct stream or acclimated/forced releases (Viola and Schuck 1995). Additional information about the physical nature of steelhead emigrants and residuals is desirable for hatchery and wild steelhead management.

In 1994 Passive Integrated Transponder (PIT) tags were used to gather that information. PIT tags allow specific biological data about individual fish to be stored and used. We hoped to accomplish four objectives in 1994 with the use of PIT tags: 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.

Three groups fish were PIT tagged and released in 1994; two groups from Curl Lake AP and one group from Tucannon Hatchery. The first Curl Lake AP group consisted of fish which volitionally exited the pond between 22 April and 5 May 1994. Three equal samples of fish were collected from the discharge channel of the acclimation pond on three different

days. Sample days were systematically selected after a random first day, all samples being taken during active emigration from the pond. This was done to represent our proposed acclimation pond management approach for containment of potential residual juveniles. The second group of fish was taken from the AP one day after the pond was closed to emigration. The trigger for closing the pond to emigration was the same as in 1993; > 80% of the fish remaining in the pond are male and little or no emigration from the pond is observed. Both groups of fish were captured, held in a live box, anesthetized with MS -222, weighed, measured, PIT tagged and visual notations about whether fish were coded-wire tagged or simply adipose clipped, and the degree of smoltification (smolt, transitional, parr, precocious male) recorded. Fish were allowed to recover from anesthesia and were released directly into the Tucannon River near the pond outlet

The third group of fish was from wild origin Tucannon River steelhead. Fish were tagged from a raceway at the Tucannon Hatchery. The group was tagged using the same technique used at Curl Lake AP except all of the fish (~10,000) were crowded in the raceway and random nets of fish were removed for tagging. Tagged fish were returned to the raceway and volitional emigration from the raceway began one week after tagging. The groups tagged and the physical characteristics of tagged fish are summarized in Tables 5 and 6 respectively.

Tag recoveries from 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 29 September. Subsequent 1994 and 1995 recoveries will be reported in the 1994-95 annual report. Unique tags were recovered at Lower Monumental, McNary and John Day dams. Tag recovery summaries presented here are cumulative for all recovered tags, regardless of location, and are considered to indicate minimum survival from release to Lower Monumental Dam.

Table 5. Description of PIT tag groups released into the Tucannon River, 1994.

	Lyons Ferry Brood		
	Volitional Migrants	Non-migrants	Tucannon Brood
Date(s) tagged	22 & 28 April 1994 5 May 1994	17 May 1994	25 April 1994
# of fish tagged (n)	349	345	350
Fish PIT tagged	**% of total (n)**	**% of total (n)**	**% of total (n)**
Smolts	60.5 (211)	5.2 (18)	20.0 (70)
Transitional	31.5 (110)	83.8 (289)	66.0 (231)
Parr	0	1.1 (4)	14.0 (49)
Precocious	8.0 (28)	9.9 (34)	0

Table 6. Characteristics of PIT tagged fish released into the Tucannon River, 1994.

	Lyons Ferry Brood		
	Volitional Migrants mean (n)	Non-migrants mean (n)	Tucannon Brood mean (n)
Length (cm)			
Smolts	234.6 (211)	222.9 (18)	229.8 (70)
Transitional	219.9 (110)	212.4 (289)	205.5 (231)
Parr	0	141.2 (4)	135.6 (49)
Precocious	210.6 (28)	211.4 (34)	0
Weight (g)			
Smolts	125.9 (211)	110.6 (18)	106.3 (70)
Transitional	105.6 (110)	103.8 (289)	79.0 (231)
Parr	0	29.8 (4)	21.1 (49)
Precocious	101.2 (28)	107.2 (34)	0
K factor			
Smolt	0.96 (211)	0.97 (18)	0.86 (70)
Transitional	0.97 (110)	1.03 (289)	1.00 (231)
Parr	0	1.06 (4)	0.87 (49)
Precocious	1.07 (28)	1.11 (34)	0

A summary of the number of PIT tags detected at one of the Snake or Columbia River dams during the spring of 1994 is provided in Table 7. Also included in the table are measurements characteristic of detected and undetected tagged fish.

Detection of tags by degree of smoltification was consistent for each of the three study groups. Significantly more tagged smolts were detected at the dams ($P < .05$) than tagged transitionally developed fish. No parr or precocious male tagged fish were detected at any location. Far more volitionally emigrating tagged fish (smolts and transitionals) were detected than tagged non-migrants. Condition factor (K) of detected migrants was significantly lower ($P < .05$) than the K for all groups at release, except volitional smolts.

Tagged fish emigrated from the Tucannon River fairly quickly with most PIT tag detections occurring at a dam within 30 days of release. The last tag was recovered 76 days after release on 8 July 1994. Steelhead continued to migrate through the Snake River well into August, 1994 but none of the tagged Tucannon River groups were detected.

Table 7. Characteristics of detected and undetected PIT tagged fish released into the Tucannon River, 1994.

	Lyons Ferry Brood					
	Volitional Migrants		Non-migrants		Tucannon Brood	
	detected	undetected	detected	undetected	detected	undetected
% detected(n)						
Smolt	39.8 (84)	60.2 (127)	16.7 (3)	83.3 (15)	22.9 (16)	77.1 (54)
Transitional	29.1 (32)	70.9 (78)	3.1 (9)	96.9 (280)	16.9 (39)	83.1 (192)
Parr	0	0	0	100.0 (4)	0	14.0 (49)
Precocious	0	100.0 (28)	0	100.0 (34)	0	0
TOTAL	33.2 (116)	66.8 (233)	3.5 (12)	96.5 (333)	15.7 (55)	84.3 (295)
Mean length (mm)						
Smolt	236.0	233.6	214.0	224.7	229.8	229.8
Transitional	244.4	217.9	216.0	212.3	213.0	204.0
Parr				141.2		135.6
Precocious		210.6		211.4		
Mean weight (g)						
Smolt	127.5	124.8	91.7	114.3	107.2	106.0
Transitional	108.9	104.1	105.4	103.7	85.5	77.6
Parr				29.8		21.1
Precocious		101.2		107.2		
Mean K-factor						
Smolt	0.96	0.97	0.92	0.97	0.88	0.85
Transitional	0.95	0.98	0.99	1.04	0.85	1.03
Parr				1.06		0.87
Precocious.		1.07		1.11		

Fewer PIT tags from fish released at Tucannon Hatchery and Curl Lake AP were detected than expected. Considering the relatively short distance between the release sites and Lower Monumental Dam, we expected higher detection rates. However, the relative performance of the study groups provides information which could only be surmised in the past.

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. Additionally, fish acclimated in Curl Lake AP which failed to volitionally emigrate from the pond during the spring, failed to 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 which characterized these fish as predominantly male, transitionally developed juveniles with a $K => 1.05$. Furthermore, the absence of parr or precocious males in the migrant PIT tagged study groups, strongly suggests that removal of these fish from the released population (through pond management) is unlikely to affect actual returns of adult steelhead. Measured smolt-to-adult survival rates in the future may significantly increase and may more accurately represent "survival" of true migrants, rather than hatchery released juvenile to adult survival which has been reported in the past. The failure of these fish to emigrate supports our goal of utilizing the acclimation pond to eliminate potentially residual juveniles from the release population. These fish can better be used in put-take fisheries than by being released into natural production waters where they could compete with natural origin salmonids for food and space and potentially prey on smaller fish.

The relative emigration performance of the Tucannon wild broodstock juvenile fish was poor. It was however, not unexpected. Significant proportions of the release were parr and transitional and a much lower percentage of smolts were tagged than for the volitional LFH stock emigrants. Later migration (late fall or spring 1995) of these small fish is possible and will be watched closely. The small average size and great size diversity in the release was the result of later spawning fish and an protracted spawning time.

3.3 Residual Steelhead Estimates

3.3.1 Tucannon River

In 1993 and 1994 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 pond) from entering the river. Residualism within the Tucannon River during 1993 and 1994 was significantly lower than in 1991 and 1992 (Figure 1). However, the percent of fish that residualized in the Tucannon River nearly doubled in 1994 compared to 1993. This could be because the density of fish in Curl Lake was 2.5 times higher in 1994 than in 1993 (Figure 1). This increased density may have reduced the effectiveness of our pond management. If we assume pond load density decreased the effectiveness of our pond management in 1994, potentially 23% of the fish in the AP (the percent retained in 1993) could have been potential residuals, and 13,157 more potential residual fish may have entered the river in 1994. These fish would account for the increased residualism in 1994. Other possible reasons might be reduced flows in 1994 compared to 1993 and an increased number of males in the 1994 pond population (6% higher, 9,627 fish, than in 1993).

Despite the increased percentage of fish that residualized in 1994, we believe this method of acclimation pond management successfully reduced the number of fish that residualized and thereby reduced the potential for adverse interactions between these fish and wild salmonids.

3.3.2 Touchet River

We estimate that 9% (10,771 $\pm$ 58; α=.05) of 119,624 steelhead released into the Touchet River residualized in 1994. All fish in 1994 were released from the acclimation pond. This is lower than the 14.7 % (16,347 $\pm$ 166; α=.05 fish) of 110,999 (75,039 acclimated and 35,960 direct river) steelhead released into the Touchet River that residualized in the spring of 1993. We found that more fish released directly into the river residualized than fish released from the acclimation pond.

3.3.3 Grande Ronde River

We estimate that 1,961 $\pm$ 89 (α =.05) hatchery reared juvenile steelhead residualized within the one mile index section established on the Grande Ronde. This was the first year that an estimate was made. Future estimates of residualism in this index section will be useful in examining acclimation pond management designed to reduce residualism in the Grande Ronde River.

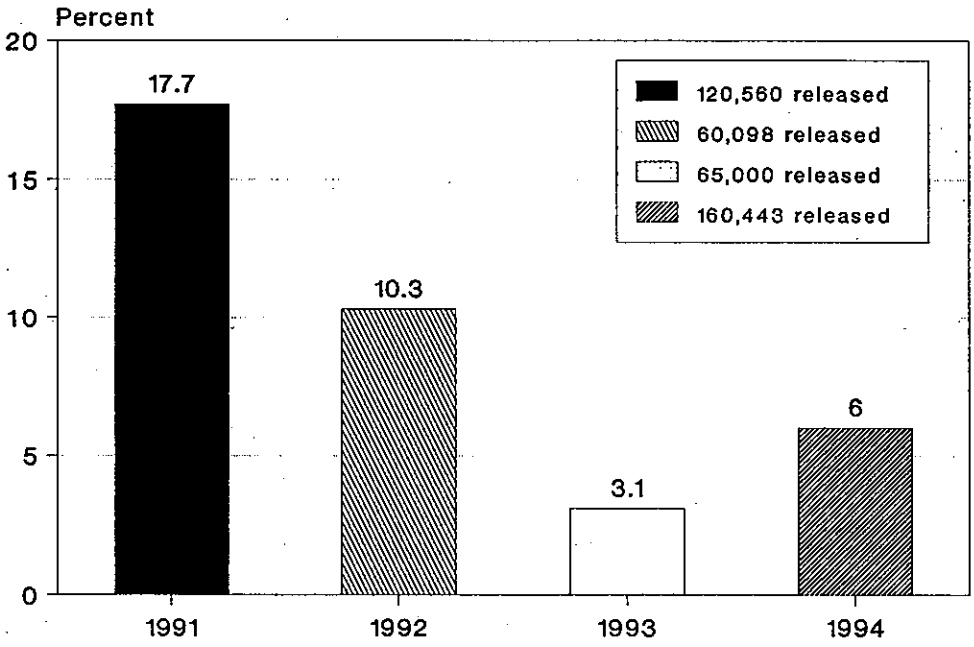

Figure 1. Percent residual steelhead in the Tucannon River from Curl Lake AP releases, 1991-1994.

3.4 Adult Steelhead Returns

3.4.1 Tucannon Hatchery trap

Adult steelhead were trapped on the Tucannon River 14 March through 21 April 1994. Eight adult steelhead were trapped. Three wild fish and one hatchery origin fish were handled. One hatchery female and one wild female were passed above the weir. One wild female and one wild male were kept for spawning. Both wild fish died during the holding period before being spawned. Appendix B lists passage date and specific information about the four handled fish.

3.4.2 Touchet River trap

Adult steelhead were captured, measured, tagged and passed above the weir 1 March through 19 May 1994. Forty-three (95.6%) wild steelhead (10 males, 35 females) and 2 hatchery steelhead (1 male, 1 female) were examined and measured. Appendix C lists passage date and specific information about each fish.

The first year of trapping (1993) on the Touchet River was plagued with problems. Ice damaged several sections of the trap, and high river flow and heavy debris in the river caused additional damage. Also, high flows over-topped the weir and adult steelhead passed above the weir. In 1993 we did not accomplish our goal of trapping the entire run of steelhead. Alterations and repairs to the trap during the season allowed us to obtain only a sample of the run.

We redesigned the weir and trap for 1994. 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 made operational for three consecutive days each week.

3.4.3 Returns to Lyons Ferry Hatchery

A total of 2,905 adult steelhead were trapped at Lyons Ferry Hatchery from 7 July 1993 through 15 November 1993. Mortality during the trapping and holding period was 303 fish (10.4%) and 1,678 fish were returned to the river. All fish trapped were inspected for fin clips, sex, origin and readable brands. Snouts were collected from a sample of fish that had a ventral fin clip and unreadable or no visible brand. Fish sorted from the trap were comprised of 2,092 females (74.6%) and 711 males (25.4%). We identified 35 wild fish (1.2%), and 573 tagged or branded fish (19.7%) of the total with the remainder of fish of untagged hatchery origin. One-ocean age fish returning to LFH represented 27.3% of fish spawned in 1994, while making up only 21.2% of returning coded-wire tagged groups. Two-ocean age fish made up 71.5% of fish spawned and the remaining 1.1% were three ocean age fish. Average fecundity of one (n=69), two (n=181) and three (n=3) ocean age females was 4,315, 5,755 and 7,255 eggs respectively. The mean lengths of one, two and three

ocean age steelhead spawned at LFH in 1994 were 59.7 cm, 71.1 cm and 80.1 cm respectively. A total of 253 adult female steelhead were spawned at LFH in 1994 yielding 1,352,296 green eggs (Table 2). Appendix D lists of the returns of branded fish by release year to LFH in 1993.

3.4.4 Cottonwood Creek Trap

Adult steelhead were trapped at the Cottonwood facility between 5 March and 17 April 1994. A total of 212 females (68.8%) and 96 males (31.2%) were collected. Length and age data were collected from 118 females and 44 males which were spawned (Table 8). All sampled fish were of hatchery origin. Average fecundity of one, two and three ocean age females was 3,782, 5,622 and 6,369 eggs respectively. One (n=9), two (n=108) and three (n=1) ocean age females contributed 5.7, 93.2 and 1.1% respectively, of the total egg take. All trapped fish were spawned and/or destroyed to prevent them from entering the natural spawning population upstream of the trap.

Table 8. Age composition and mean length in ( ), for steelhead spawned at Cottonwood AP, 1993-94 .

	1-ocean	2-ocean	3-ocean
Females (n=118)	7.6% (59.3 cm)	91.5% (70.3 cm)	0.9% (78.5 cm)
Males (n=44)	29.5% (59.8 cm)	59.1% (70.8 cm)	11.4% (77.9 cm)

3.4.5 Passage at dams

Table 9 lists freeze brands from LFH fish which passed through the adult trap at Lower Granite Dam (LGD). Returns to LGD for the freeze brand groups generally are consistent with returns to other locations. The relative survival of the three 1991 Tucannon River groups (direct releases at Marengo and Curl Lake AP, and acclimated from Curl Lake AP) to LGD mirrors their overall return to the Columbia Basin and to the LSRCP area. It is interesting to note however that the same release strategy was repeated in 1992 with little evident difference in the return rates among the groups. Returns for the 1992 release exhibit the general failure of that year class to survive throughout the basin. (see **Coded-Wire Tag Returns** for further discussion of these results)

The widely varying return rates for groups does not necessarily represent varying survival of these fish. Recoveries of LFH adults at LGD may indicate straying due to various factors such as stock suitability and environmental conditions within and between run years.

Table 9. Adult returns of Lyons Ferry Hatchery steelhead to Lower Granite Dam in run years 1991-1993, from smolts released in 1990, 1991, and 1992.

Brand	Release site	Number of adults Return year 1991	1992	1993	Total adults captured	No. smolts released	% survival
1990							
RA-IC-1[A]	Curl Lk. Tucanon R.	127	146	2	275	19,483	1.41
1991							
RA-IT-1	Touchet R.(small fish)		33	28	61	18,805	0.32
LA-IT-1	Touchet R.(small fish)		33	40	73	18,399	0.40
RA-IT-3	Touchet R.(small fish)		25	14	39	18,236	0.21
LA-IJ-1	Touchet R.(large fish)		94	42	136	19,812	0.69
LA-IJ-3	Touchet R.(large fish)		117	62	179	19,723	0.91
RA-IJ-1	Touchet R.(large fish)		82	52	134	19,360	0.69
RA-H-2	Tucanon R. @ Curl		128	84	212	18,409	1.15
LA-H-2	Tucanon R. @ Curl		69	79	148	19,518	0.76
RA-7-1	Curl Lk. Tucanon R.		48	43	91	19,248	0.47
RA-7-3	Curl Lk. Tucanon R.		37	35	72	19,182	0.38
LA-H-1	Tuc. R. @ Marengo		136	110	246	19,198	1.28
RA-H-1	Tuc. R. @ Marengo		153	121	274	19,307	1.42
1992							
RA-IY-1	Touchet R.			22	22	45,628	0.05
RA-S-2	Tucanon R. @ Curl			29	29	30,096	0.10
RA-S-1	Curl LK. Tucanon R.			28	28	30,098	0.09
LA-S-1	Tuc. R. @ Marengo			38	38	29,888	0.13

A- No other 1990 branded steelhead were recovered at Lower Granite Dam in 1993.

3.4.6 Steelhead creel surveys

Lower Snake River and tributaries.

We used adjusted state-wide catch record card estimates of 1994 steelhead harvest (Tables 10 and 11) as the basis for estimating our coded-wire tag sample rates and to estimate harvest by tag code and by fishery.

Table 10. Steelhead harvest estimates for WDFW management sections[A] on the lower Snake River, 1993-94 (WDFW 1994).

	Below Ice H. Dam	Below L.Mon.Dam	Below L.Goose D.	Below L.Granite D.	L.Granite Pool	Above Clarkston
May	0	3	0	0	0	0
June	0	0	3	0	6	6
July	0	5	0	0	0	0
Aug.	0	3	0	0	9	0
Sept.	14	53	126	80	75	42
Oct.	32	281	559	249	565	526
Nov.	29	244	302	107	742	510
Dec.	126	330	394	105	216	195
Jan.	64	158	131	129	237	75
Feb.	48	101	78	78	93	45
Mar.	5	165	176	180	54	3
Apr.	0	0	0	0	3	3
Total	**318**	**1,343**	**1,769**	**928**	**2,000**	**1,405**

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

Table 11. Steelhead harvest estimates for rivers in S.E. Washington, 1993-94 (WDFW 1994).

	Tucannon	Touchet	Walla Walla	Grande Ronde	McNary Pool
June	5	0	0	0	0
July	0	0	0	0	7
Aug.	2	0	2	0	9
Sep.	28	0	2	39	1,005
Oct.	86	0	12	369	2,990
Nov.	76	0	86	211	2,202
Dec.	86	0	123	42	638
Jan.	14	0	63	65	65
Feb.	19	12	475	263	95
Mar.	16	105	114	337	86
Apr.	26	100	7	181	2
Total	**358**	**217**	**884**	**1,507**	**7,099**

The steelhead season ended on 31 March and 15 April on the Snake and tributary rivers, respectively. During the 1993-94 steelhead season, 11,595 anglers that fished a total of 41,279.1 hours were surveyed within the LSRCP area in Southeast Washington (Table 12). Catch rates from all locations surveyed ranged from 5.3 - 31.6 hours/fish. Mean catch rate for the entire LSRCP area of S.E. Washington for the 1993-94 season was 16.3 hours/fish, an 18.1% increase in hours/fish over 1992-93. A summary of the characteristics of steelhead observed during the 1993-94 steelhead season is presented in Table 13.

Table 12. A summary of creel information from S.E. Washington rivers during the 1993-94 steelhead season.

	Number anglers	Hours fished	Fish caught	Hours/fish caught
Area				
McNary Dam	349	1,582.8	87	18.2
Wallula	1,526	5,092.4	305	16.7
Walla Walla R.	847	2,371.6	133	17.8
Mill Creek	99	151.8	13	11.7
Ice Harbor Dam	1,522	4,301.5	136	31.6
Lower Mon. Dam	313	972.2	48	20.3
Touchet R.	623	1,279.0	243	5.3
Tucannon R.	529	1,616.3	158	10.2
Little Goose Dam	2,404	9,857.6	551	17.9
Low. Granite Dam	47	231.3	17	13.6
Mid-Snake R.	2,508	9,916.6	435	22.8
Grande Ronde R.	828	3,906.0	410	9.5
Total	**11,595**	**41,279.1**	**2,536**	**16.3**

Table 13. Characteristic ocean residency, fork length, weight and sexual composition of 182 adult LFH coded-wire tagged steelhead observed in anglers' creels in the LSRCP area of Washington, fall 1993 and spring 1994.

Ocean residence	% Composition	Mean length(cm)	Mean weight(Kg)	% Male	% Female
1 Year[A]	37.3	60.8	2.1	41.7	58.3
2 Years[B]	41.6	70.2	3.2	13.6	86.4
3 Years[C]	21.1	79.2	4.4	38.2	61.8

A : One-ocean age steelhead lengths ranged from 51 - 64 cm.
B : Two-ocean age steelhead lengths ranged from 65 - 74 cm
C : Three-ocean age steelhead lengths were > 75 cm.

In 1993-94 the percent of one-ocean age steelhead (37.3%) in our sample of the sport harvest was only half of what it was in 1992-93 (74.8%). The percent of males that made up two-ocean age fish was very low compared to previous years.

Grande Ronde River

During the 1993-94 steelhead season, 3,136 angler days of fishing effort were expended by anglers on that portion of the Grande Ronde River from Bogan's Oasis (RM 26) upstream to the Oregon State line (RM 38.7). The average angling day was 5.68 hours. This effort is similar to the 1991-92 and the 1992-93 seasons. Tables 14 and 15 summarize ODFW and WDFW data collected during steelhead creel surveys along the Grande Ronde River during fall 1993 and spring 1994. The most fish were harvested in late March and early April near Cottonwood AP.

Table 14. Estimated angler effort, catch rates, and harvest for steelhead anglers on the Grande Ronde River in Washington, 1993-94 (Flescher 1994)

Month	Effort Hours (95% CI)	Catch Rate-F/HR (95% CI)	Total Catch (95% CI)	Fish Kept (95% CI)	Marked Fish Released (95% CI)	Unmarked Fish Released (95% CI)
1993						
Sep.	661.9	0.0552	37	14	4	19
	(234.1)	(0.0303)	(20)	(26)	(3)	(27)
Oct.	2,707.4	0.0654	177	62	11	104
	(456.1)	(0.0235)	(64)	(34)	(15)	(41)
Nov.	1,101.3	0.0336	37	19	0	18
	(413.0)	(0.0316)	(35)	(21)	(0)	(22)
Dec.	571.5	0.0632	36	21	3	13
	(217.8)	(0.0543)	(31)	(24)	(4)	(21)
1994						
Feb.	2,952.4	0.1221	361	170	121	70
	(953.4)	(0.0510)	(156)	(64)	(83)	(49)
Mar.	7,579.0	0.1727	1,309	782	386	141
	(1,447.8)	(0.0327)	(248)	(185)	(121)	(61)
Apr.	2,238.0	0.1688	378	195	122	61
	(472.1)	(0.0611)	(137)	(80)	(65)	(34)
Total	17,811.5	0.1311	2,335	1,263	647	426
	(4,194.3)	(0.0064)	(691)	(434)	(291)	(255)

A - Estimates for fish numbers are rounded to the nearest whole number.

Table 15. Age, sex composition, and fork length of steelhead sampled from creels on the Grande Ronde River in Washington, fall 1993 and spring 1994 (Messmer et al. 1994).

	Sexual composition			Mean fork length (cm)	
Age[A]	% Males	% Females	% Unknown	Male(95% CI)	Female(95% CI)
1:1	6.9	3.5	0.0	60.0 (7.1)	54.0 (--)[C]
1:2	48.2	37.9	3.5	71.7 (4.3)	69.7 (2.4)
n[B]	16	12	1		

A - Age expressed as a ratio of years spent in freshwater : years spent in ocean prior to spawning.
B - n = the number of fish sampled.
C - Only one fish; no confidence interval calculated.

Coded-wire tag recovery

Snouts were collected by WDFW personnel from 214 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[1]. All CWT's 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.

3.4.7 Returns of coded-wire tag groups

We calculated the expanded estimates of harvest for adult Lyons Ferry steelhead within the Columbia River basin and the percent smolt-to-adult survival (Table 16). This information is based on sampling programs conducted by several Federal, State and Tribal agencies.

LFH fish contribute to fisheries throughout the Lower Columbia River basin. Presently, these fisheries are harvesting nearly half of the total adult harvest in the basin for several groups. This level of harvest is a concern, but if adult return behavior, juvenile survival and emigration behavior can be improved through stock development and hatchery management practices, downriver harvest may be less of a concern to our overall LSRCP area goal.

We have complete 1 and 2 ocean age returns for the 1991 coded-wire tag releases (Table 17). For all the tag codes listed, except those released into the Tucannon and Walla Walla rivers, we met or exceeded the production escapement goal of 0.5% release to adult survival to the LSRCP area.

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

Table 16. Adult returns of LFH steelhead, and the percent smolt-to-adult survival those numbers represent in ( ), to locations within the Columbia River Basin, 1993-94.

Release Year				**1990**		
Release Site	Snake R.	Touchet R.	Tucannon R. from Curl Lk.	Tucannon R. @Marengo	Asotin Cr.	Walla Walla R.
CWT code	63/14/21 63/08/42	63/39/08 63/39/07	63/39/11 63/39/12	63/08/38 63/08/41	63/07/25 63/14/22	63/39/09 63/39/10
Brand	LA-IC-3 RA-IC-3	LA-S-1 RA-S-1	RA-IC-1 LA-IC-1	RA-IC-2 LA-IC-2	LA-IC-4 RA-IC-4	RA-S-2 LA-S-2
No. Released	38,511	38,904	39,597	40,012	39,732	39,340
Location						
L. Col. Sport	0	0	0	0	0	0
Mid-Col. Sport	0	0	0	0	0	0
Zone 6 Net	0	2 (0.005)	0	2 (0.005)	0	0
L. Ferry Ladder	1 (0.002)	0	0	0	0	0
Snake. R. Sport	0	0	21 (0.053)	0	0	0
Tucannon Sport	0	4 (0.010)	0	0	0	0
W. Walla Sport	0	0	0	0	0	0
Touchet Sport	0	0	0	0	0	0
Dworshak NFH	0	0	0	0	0	0
Idaho Sport	0	0	0	0	0	0
Ocean Harvest	0	0	0	0	0	0
LSRCP Totals	1 **(0.002)**	4 **(0.010)**	21 **(0.053)**	0	0	0
GRAND TOTALS	1 (0.002)	6 (0.015)	21 (0.053)	2 (0.005)		

Table 16. (cont)

Release Year			**1991**		
Release Site	Touchet R. (small)	Touchet R. (large)	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
Location					
L. Col. Sport	0	6 (0.0001)	0	0	9 (0.023)
Mid-Col. Sport	8 (0.013)	48 (0.080)	0	0	0
Zone 6 Net	0	51 (0.085)	19 (0.048)	9 (0.023)	16 (0.040)
L. Ferry Ladder	112 (0.186)	241 (0.402)	13 (0.032)	32 (0.081)	36 (0.091)
Snake. R. Sport	49 (0.08)	90 (0.150)	65 (0.163)	101 (0.254)	77 (0.194)
Tucannon Sport	2 (0.003)	13 (0.022)	4 (0.010)	5 (0.013)	14 (0.035)
W. Walla Sport	36 (0.060)	62 (0.103)	0	0	0
Touchet Sport	0	52 (0.087)	0	0	0
Idaho Sport	17 (0.028)	30 (0.050)	56 (0.140)	61 (0.154)	111 (0.280)
Ocean Harvest	0	0	0	0	0
LSRCP Total	224 (0.372)	488 (0.814)	138 (0.346)	199 (0.500)	238 (0.600)
Grand Totals	207 (0.343)	593 (0.99)	157 (0.393)	208 (0.523)	263 (0.664)

Table 16. (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
Location					
L. Col. Sport	13 (0.029)	0	0	0	0
Mid-Col. Sport	51 (0.112)	0	0	0	0
Zone 6 Net	0	0	0	0	0
L. Ferry Ladder	85 (0.187)	8 (0.027)	8 (0.028)	1 (0.010)	19 (0.065)
Snake. R. Sport	47 (0.104)	0	56 (0.193)	0	9 (0.030)
Tucannon Sport	3 (0.007)	0	3 (0.010)	0	0
W. Walla Sport	39 (0.086)	0	0	0	0
Touchet Sport	29 (0.064)	0	0	0	0
Idaho Sport	0	0	0	0	0
Ocean Harvest	0	0	0	0	0
LSRCP Total	203 (0.45)	8 (0.027)	67 (0.231)	1 (0.010)	28 (0.095)
Grand Totals	267 (0.589)	8 (0.027)	67 (0.231)	1 (0.10)	28 (0.095)

Table 17. Returns of 1991 released LFH steelhead to locations in the Columbia River basin and the smolt-to-adult survival those numbers represent in ( ), for run years 1992 and 1993.

Release Year			**1991**		
Release Site	Touchet R. (small)	Touchet (large)	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
Location					
L. Col. Sport	19 (0.03)	113 (0.19)	0	26 (0.06)	53 (0.13)
Mid-Col. Sport	8 (0.0131)	102 (0.17)	0	3 (0.01)	9 (0.02)
Zone 6 Net	124 (0.20)	272 (0.45)	29 (0.73)	77 (0.19)	112 (0.28)
L. Ferry Ladder	285 (0.47)	639 (1.06)	25 (0.06)	85 (0.21)	78 (0.20)
Snake. R. Sport	121 (0.20)	317 (0.53)	99 (0.25)	150 (0.38)	149 (0.38)
Tucannon Sport	20 (0.03)	38 (0.06)	28 (0.07)	63 (0.016)	81 (0.20)
W. Walla Sport	36 (0.060)	78 (0.13)	0	0	0
Touchet Sport	54 (0.09)	134 (0.22)	0	0	3 (0.008)
Idaho Sport	84 (0.14)	110 (0.18)	98 (0.25)	92 (0.23)	210 (0.53)
Ocean Harvest	4 (0.07)	1 (0.003)	0	0	1 (0.002)
LSRCP Total	600 (1.09)	1316 (2.20)	250 (0.630)	390 (1.00)	521 (1.31)
Grand Totals	751 (1.250)	1807 (3.01)	280 (0.701)	496 (1.25)	695 (1.753)

The information provided in Tables 16 and 17 of this report and Table 17 of the 1992-93 annual report shows how different stocks and fish release strategies can affect contribution of adults to various locations. In 1993 and 1994 fewer adults returned to the LSRCP area and the Columbia basin from fish released into the Tucannon River in 1991 from Curl Lake AP than for the 1991 direct release into the Tucannon River at Curl Lake AP. The 1991 direct river release at Marengo also returned more adults than for either the direct release near Curl Lake or fish acclimated and then released from Curl Lake. These results are contrary to the 1990 release results where the returns from the Curl Lake AP release were greater than for the direct release at Marengo. These differences may be related to the behavioral differences between the stocks of fish released into the Tucannon River in 1990 and 1991. In 1991 LFH stock fish were released into the Tucannon River. In 1990, all LFH stock fish died from IHNV at LFH, so Pahsimeroi stock fish were released into the Tucannon River. Because of this stock difference, the two release years should not be compared.

A clear understanding of the 1991 release data is complicated by different sizes of fish being released into the Tucannon River. Fish released from Curl Lake AP, directly into the Tucannon River 0.1 mile above Curl Lake, and at Marengo were 4.2 fish/lb, 3.7 fish/lb and 3.6 fish/lb, respectively. We are unsure if the 0.5-0.6 fish/lb difference in release size caused the difference in adult returns. There does appear to be a consistent smolt-to-adult survival advantage for releases at the lower Marengo site.

Another interesting result was the difference in returning adults from the Touchet River releases for two different sizes of smolt. During run years 1993 and 1994, more of the larger (3.8 fish/lb) smolts returned as adults than smaller (5.3 fish/lb) smolts (Table 18). Furthermore, most of the additional adults returned to the LSRCP area. This suggests that we should release fewer, larger smolts to provide a successful program with minimal effects on natural populations from residual hatchery steelhead.

Our findings on both the Tucannon and Touchet rivers, coupled with the lower incidence of residualism for the larger fish (Schuck et al. 1993), suggest that release of larger smolts (averaging 3.5 - 4.0 fish/lb) will substantially increase smolt-to-adult returns. Results from the Tucannon River releases also suggest that a lower river release at Marengo will increase smolt-to-adult returns. However there is no acclimation pond at Marengo. The larger number of residual fish which could be expected from a direct stream release at Marengo could adversely affect juvenile salmon in the area.

3.4.8 Returns to spawning grounds

Appendix G summarizes our results from the 1994 spawning ground surveys. Average number of redds per mile decreased on the North and South Forks of Asotin Creek in 1994 compared to 1993. Persistent high flows precluded an estimate of redds per mile on the Tucannon River in 1993; however we completed a survey in 1994. Redds per mile on the Tucannon in 1994 were less than 50% of the numbers estimated in 1992. Tables 18 and 19 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. Further discussion of spawning activity is included in the section, "Trends in naturally produced juvenile steelhead density, population size and spawning activity 1983-1994"(page 36).

Table 18. Estimated steelhead spawner escapement into survey sections of the Touchet and Tucannon Rivers, spring 1994.

	Wild			Hatchery		
River	Total	Male	Female	Total	Male	Female
Touchet River[A]						
North Fk.	130	30	100	6	3	3
South Fk.	92	21	71	4	2	2
Wolf Fk.	57	13	44	4	2	2
Robinson Fk.	19	4	15	2	1	1
Total	**298**	**68**	**230**	**16**	**8**	**8**
Tucannon River[A]						
Upper	8	1	7	5	1	4
Middle	6	1	5	5	1	4
Lower	89	12	77	56	8	48
Total	**103**	**14**	**89**	**66**	**10**	**56**

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

Table 19. Estimated steelhead spawner escapement (wild and hatchery fish combined) into survey sections of Asotin Creek, spring 1994.

River	Total	Males	Females
Asotin Creek[A]			
North Fork	42	15	27
South Fork	22	8	14
Main Asotin	5	2	3
Charlie Cr.	10	4	6
Total	**79**	**29**	**50**

A: Information based on a combination of spawning surveys and historical ratio of sexes in the LSRCP area.

3.4.9 Contribution Toward LSRCP Goal

We estimate that LSRCP steelhead smolts released into S.E. Washington streams during 1991-1992 returned 7,620 adult steelhead to the LSRCP area of the Snake River Basin during the 1993 run year. This return represents 164% of the goal established for Washington's steelhead. We believe this is a conservative estimate, but within reasonable limits of actual return. The estimate is derived by applying smolt-to-adult return rates of coded-wire tag groups to untagged releases where applicable and combining these estimates with sport harvest for rivers unrepresented by tag groups.

The adult returns in 1993 represent one of the lowest LSRCP returns in recent years. The general failure of the 1992 release of smolts is the primary reason. The 1992 outmigration is not fully understood, but poor ocean conditions may have been a significant factor in the failure of the year-class.

3.5 Trends in Naturally Produced Juvenile Steelhead Density, Population Size and Spawning Activity, 1983-1994.

We sample established survey sections of three LSRCP rivers in S.E. Washington yearly to monitor the status of naturally produced salmonid populations. Sites in other rivers were sampled this year that were sampled in the past , but not yearly. The continued health of these populations is an important part of the long term goals of the LSRCP program. Population size and density are two parameters by which we monitor their health.

Mean densities of juvenile steelhead for main Asotin, Charlie and Cummings creeks are presented in Tables 20 and 21. Mean densities and population sizes 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 2-7. Appendix H describes the sites sampled for juvenile population densities in 1994. Spawning activity, measured in redds per mile for some S.E. Washington rivers is presented in Figures 8-10 (years presented are when hydraulic conditions allowed a reliable survey to be conducted). In most cases results from 1994 are compared to 1993. A detailed discussion of results from years before 1993 can be found in Schuck et. al. (1991, 1993, 1994) and Viola et. al. (1991).

Table 20. Mean juvenile steelhead densities (fish/100 m^2) in Main Asotin and Cummings Creek.

	1993		1994	
	0 aged	>0 aged	0 aged	>0 aged
Main Asotin Creek	49.1 $\pm$ 0.8	22.1 $\pm$ 14.2	36.8 $\pm$ 1.9	39.6 $\pm$ 0.7
Cummings Creek	43.2 $\pm$13.7	26.3 $\pm$ 10.2	42.9 $\pm$ 12.0	20.4 $\pm$ 14.4

Table 21. Mean juvenile steelhead densities (fish/100 m^2) in Charlie Creek from sites sampled in 1985 and 1994.

1985		1994	
0 aged	>0 aged	0 aged	>0 aged
73.0 ± 39.4	37.6 ±19.1	19.0 ± 8.3	20.0± 3.8

* Comparison is from four sites sampled in 1985.

Annual variations in juvenile steelhead densities and population sizes are the direct result of the extent of adult spawning and young steelhead rearing success. Each of these factors is 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.

3.5.1 North Fork Asotin Creek

In 1994 the density and population size of naturally produced 0-aged steelhead declined substantially from 1993. The density of steelhead greater than zero (>0) aged increased from 1993 levels, although population size in 1994 remained similar to 1993 (Figure 2). In 1994, spawning activity remained similar to 1993 (Figure 8).

3.5.2 South Fork Asotin Creek

Density and population size decreased for all ages of naturally produced juvenile steelhead in the South Fork Asotin Creek in 1994 compared to 1993 (Figure 3). Spawning activity also decreased in 1994 (Figure 8). Southeast Washington experienced a drought in 1994. Water flows were very low in the South Fork of Asotin Creek and water temperatures very high during the summer. Decreased densities and population size of >0 aged juvenile steelhead resulted from these adverse conditions, plus low spawning escapement in 1993 (Figure 8).

3.5.3 Tucannon River

In 1994, we were unable to complete our annual electrofishing surveys of naturally produced juvenile steelhead. An unacceptable number of juvenile chinook salmon were killed during the sampling of our first two sites. This caused us to reach the limit for chinook mortality described in our Biological Assessment so we discontinued our survey. We did complete our annual spawning surveys. Redds per mile decreased from 1992 (Figure 10).

3.5.4 North Fork Touchet River

Density and population size of all naturally produced steelhead decreased in 1994 as compared to 1993 (Figure 4). Redds per mile increased in 1994 over 1993 (Figure 9). An

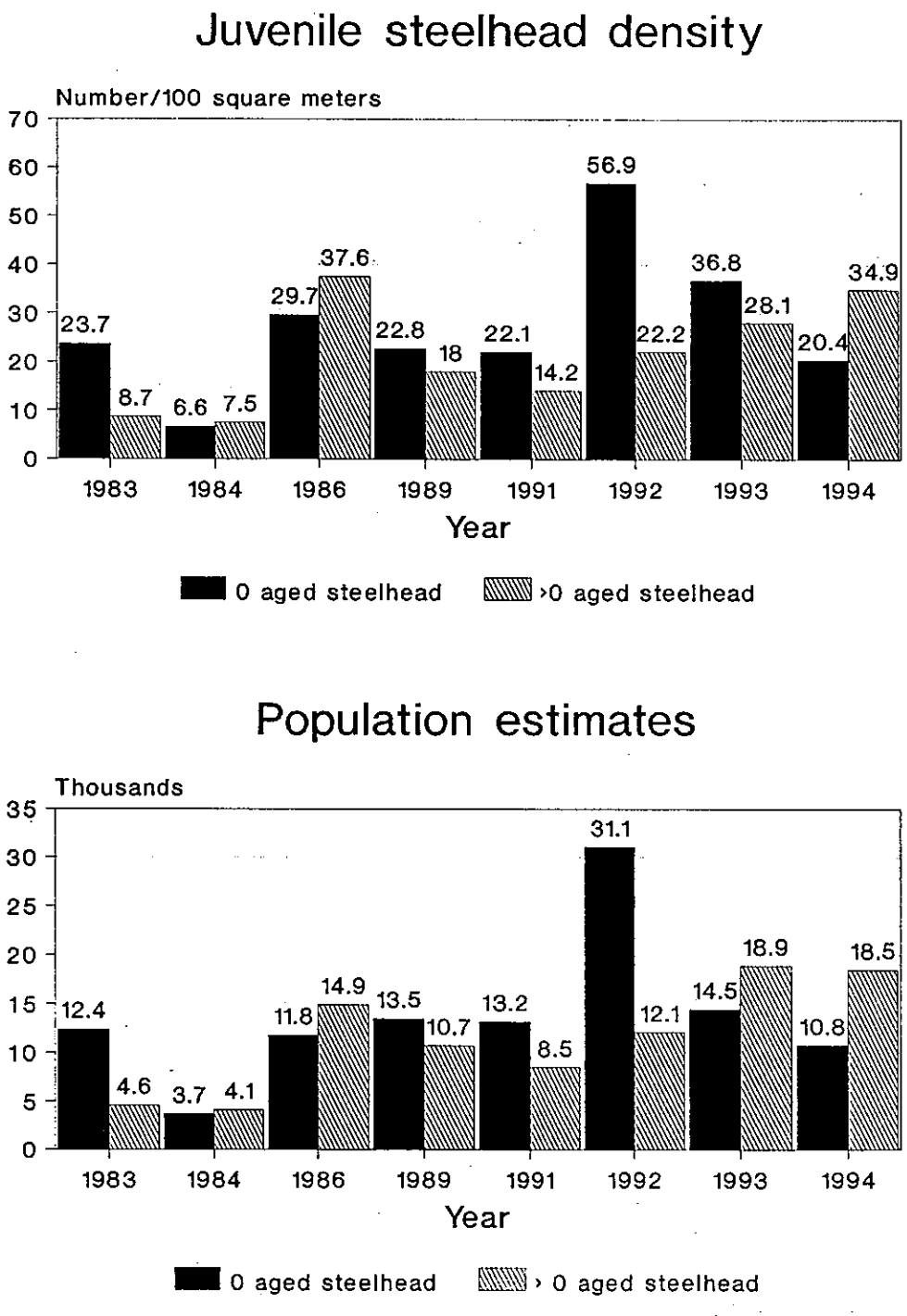

Figure 2. Juvenile steelhead densities and population estimates, N.F. Asotin Creek. 1983-1994.

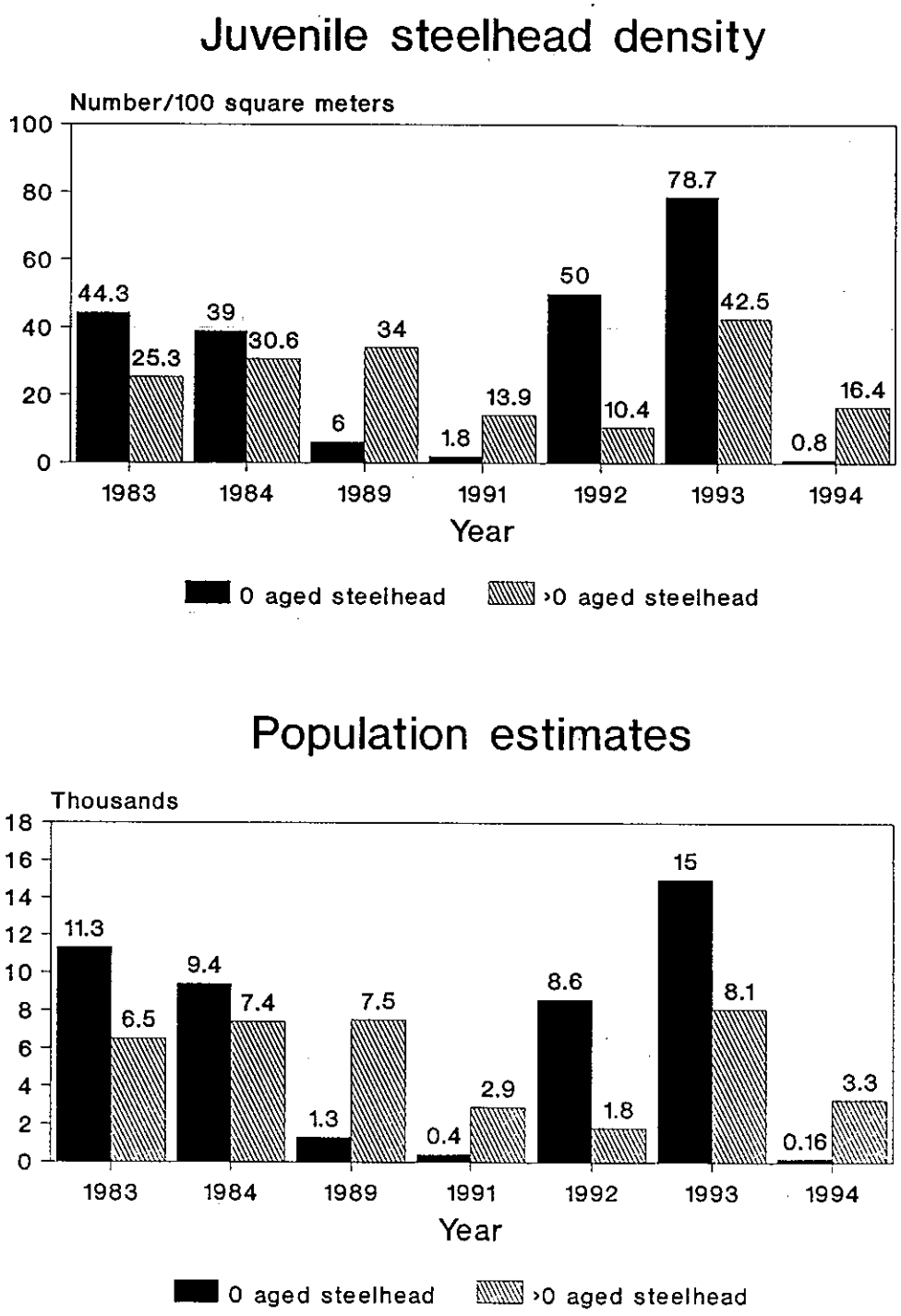

Figure 3. Juvenile steelhead densities and population estimates, S. F. Asotin Creek 1983-1994.

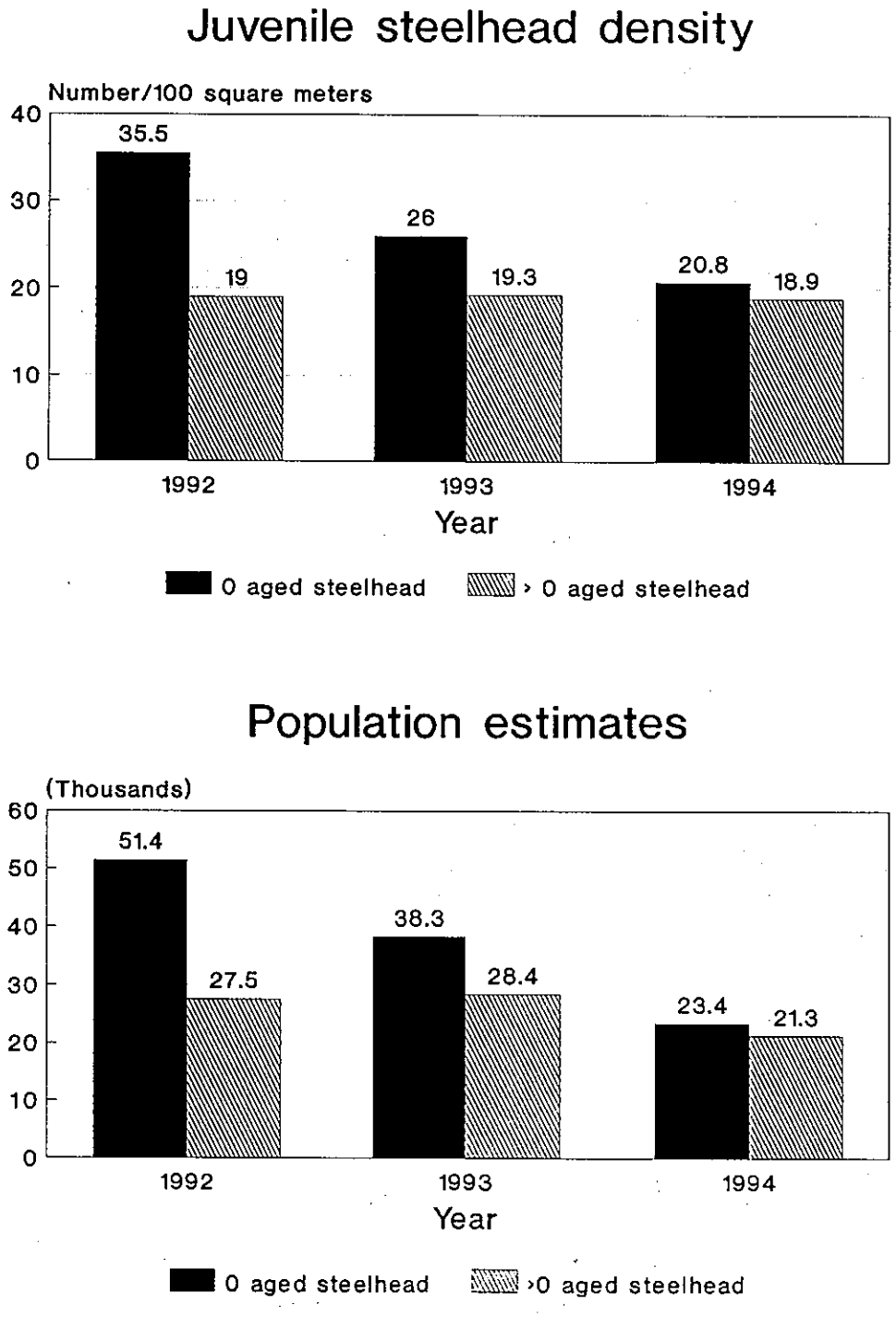

Figure 4. Juvenile steelhead densities and population estimates, N. F. Touchet River 1992-1994.

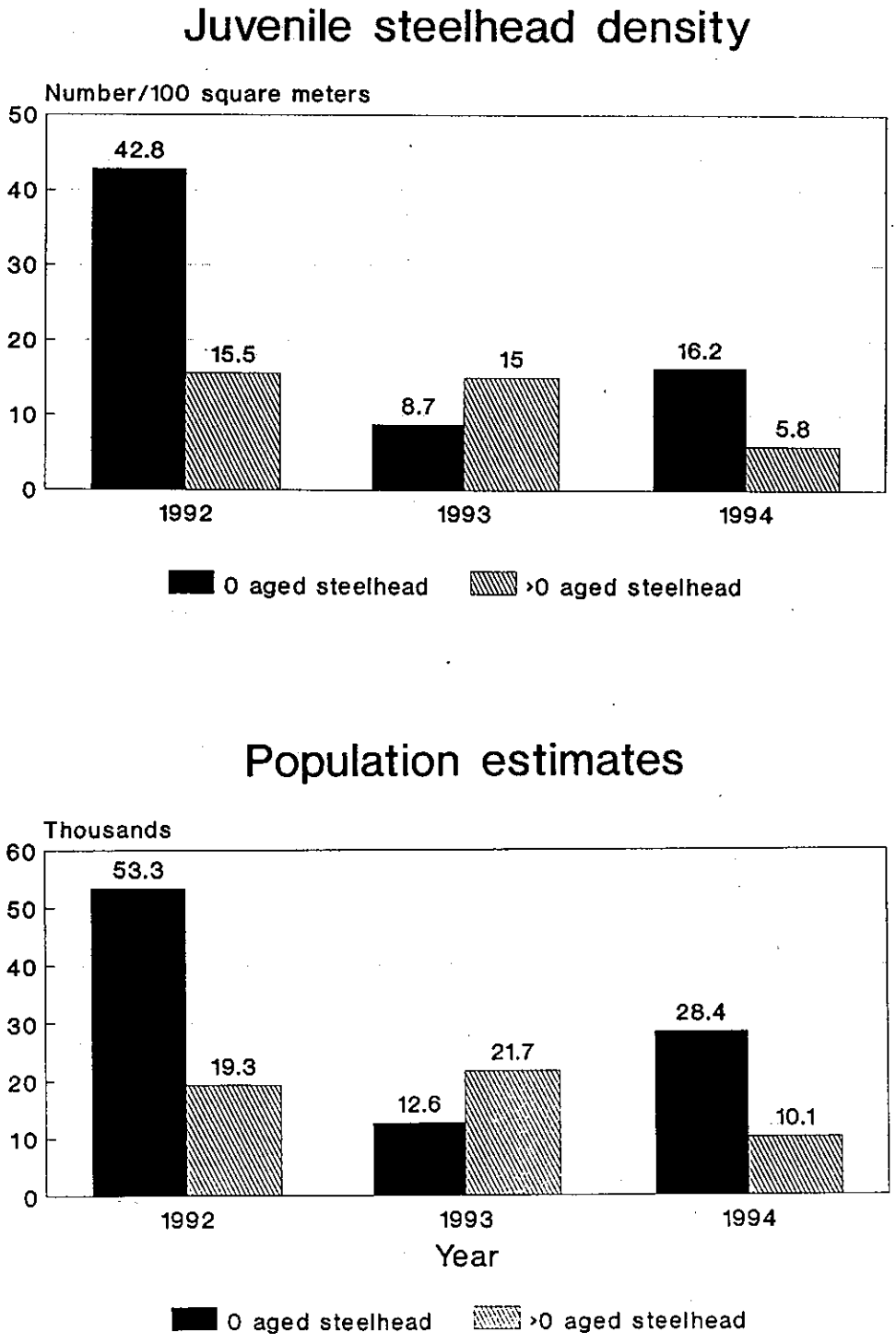

Figure 5. Juvenile steelhead densities and population estimates, S. F. Touchet River 1992-1994.

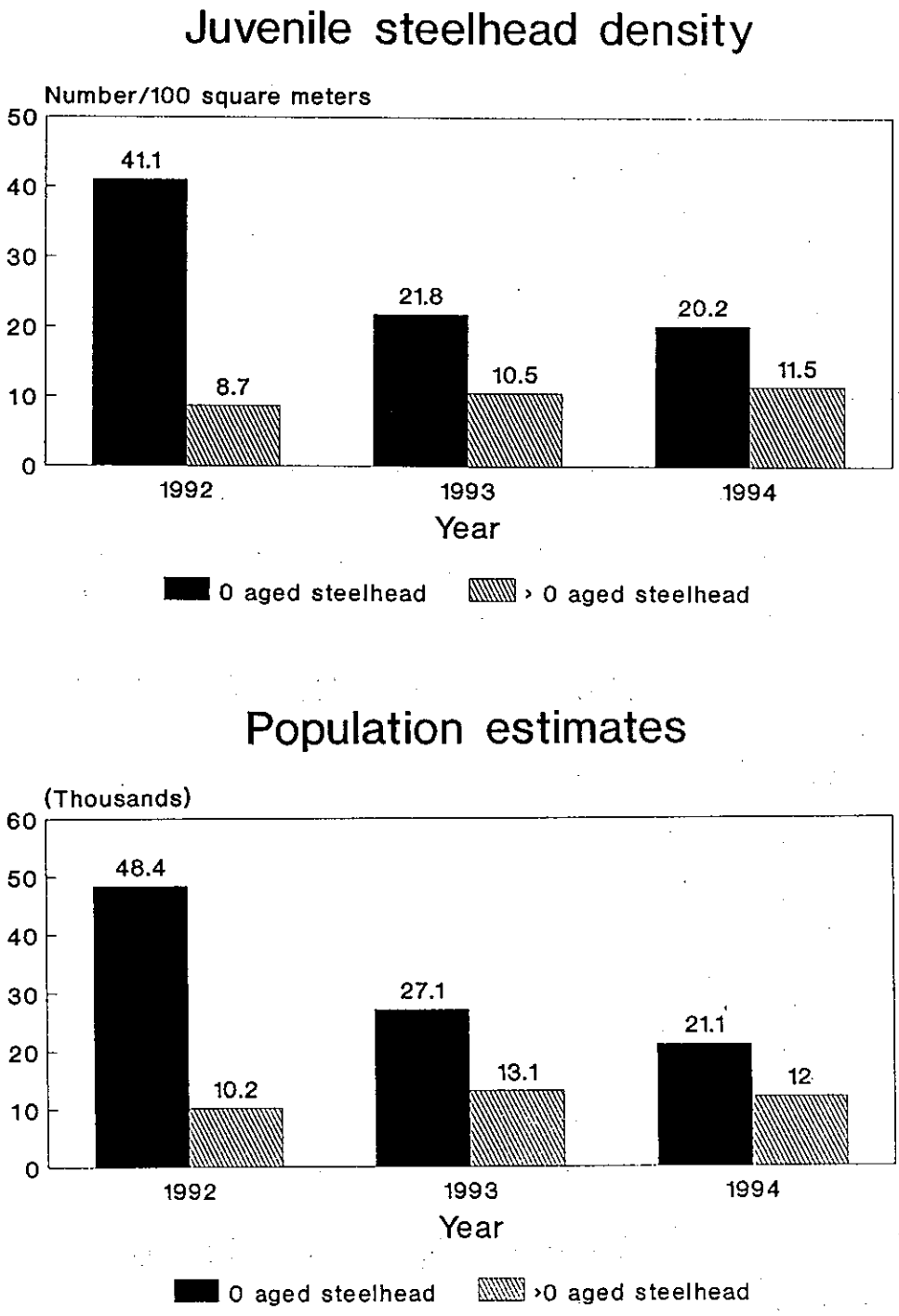

Figure 6. Juvenile steelhead densities and population estimates, Wolf Fork Touchet River 1992-1994.

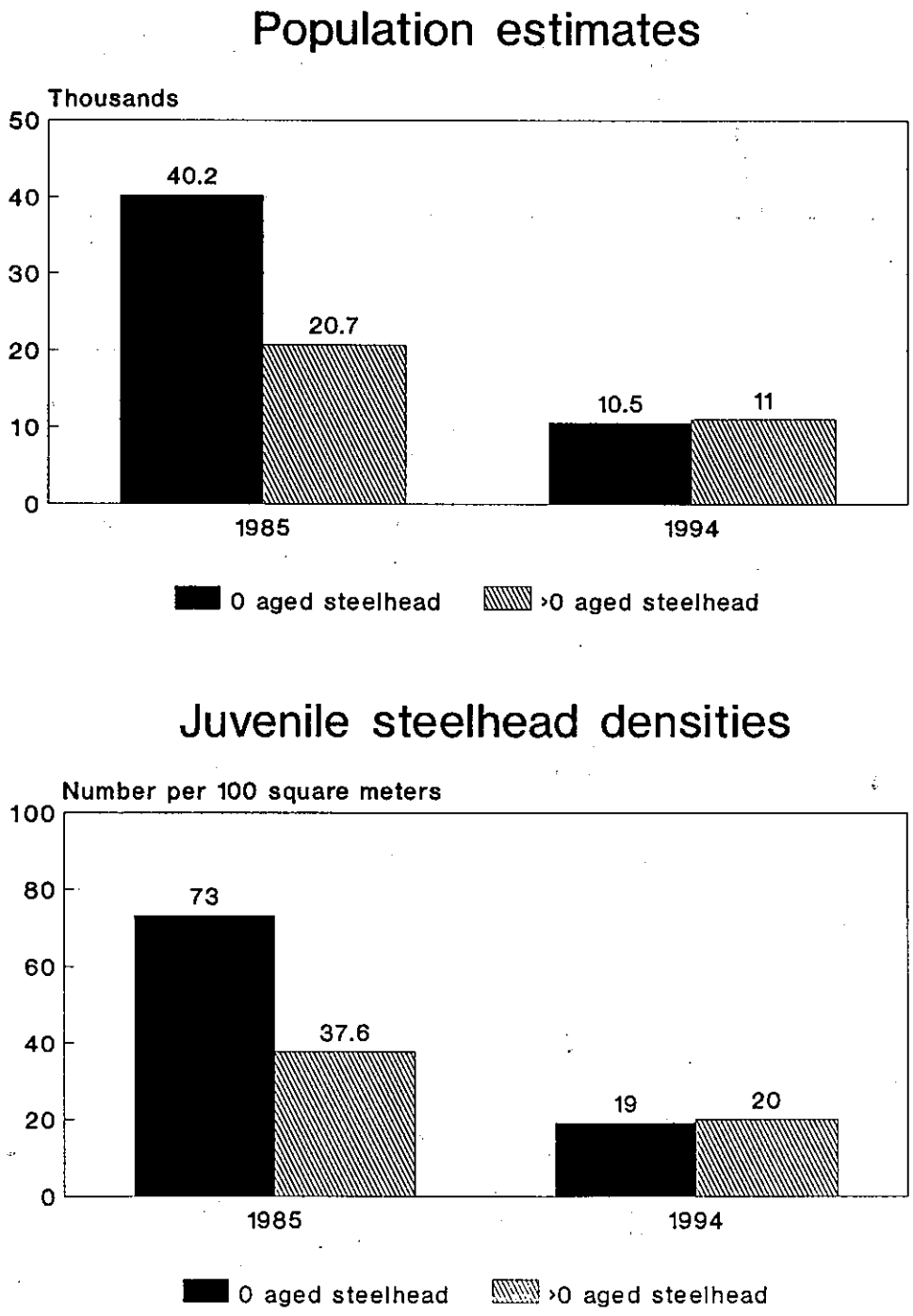

Figure 7. Juvenile steelhead densities and population estimates, Charlie Creek, 1985 and 1994.

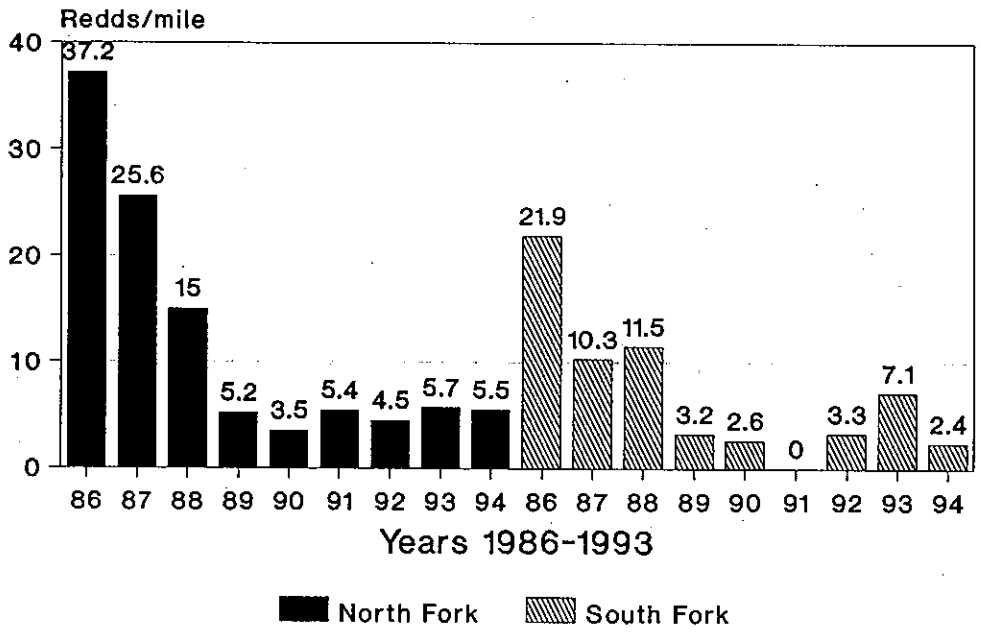

Figure 8. Spawning escapement in Asotin Creek, 1986-1994.

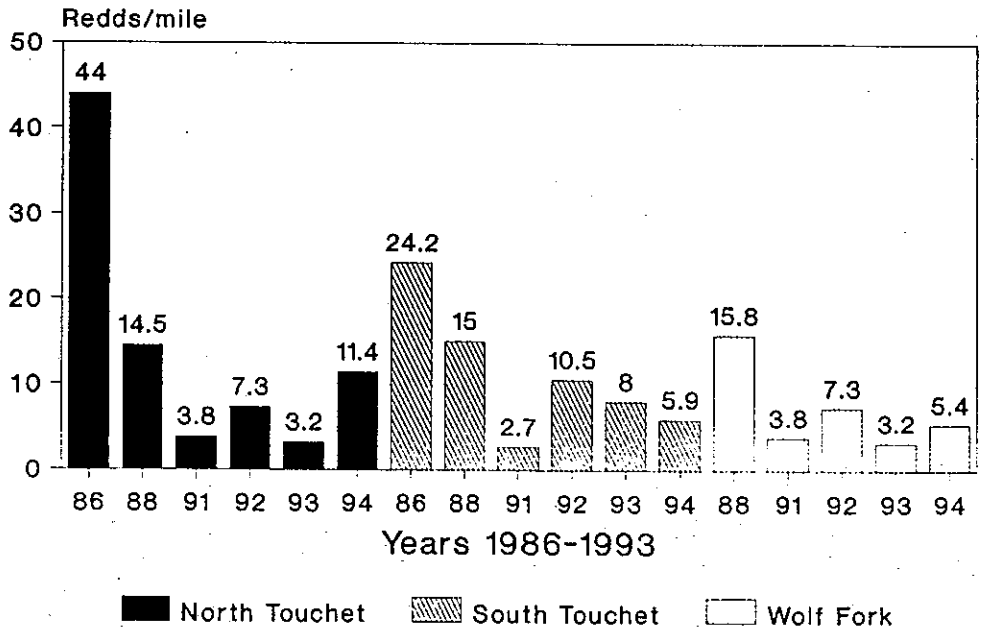

Figure 9. Spawning escapement in the Touchet River, 1986-1994.

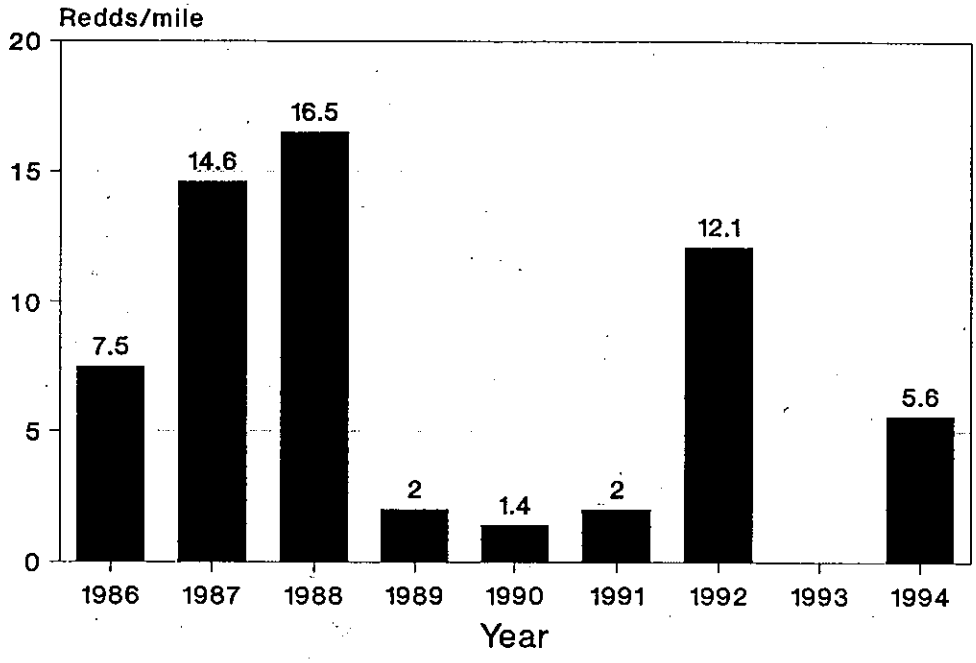

Figure 10. Spawning escapement in the Tucannon River, 1986-1994.

estimate of steelhead spawner escapement into the Touchet River above the Town of Dayton is presented in Table 19. Wild steelhead made up 81.4% of the spawners. Despite substantially increased spawning, the number of young-of-the-year steelhead decreased. We believe this to be the result of very low water flows and high water temperatures in the summer of 1994. Decreases in >0 aged steelhead are consistent with these adverse conditions.

3.5.5 South Fork Touchet River

Density and population size of 0-aged steelhead increased in 1994 when compared to 1993 (Figure 5). Density and population size of >0 aged steelhead decreased in 1994. Redds per mile decreased in 1994 compared to 1993 (Figure 9). The reason why the number of 0 aged steelhead increased is unclear. With a lower estimated spawning escapement in 1994, the increase in numbers of 0-aged steelhead was unlikely. Either the rearing conditions for these fish improved or the number of escaping steelhead was underestimated. Decreases in >0 aged steelhead correspond to changes in other area rivers caused by adverse river conditions in the summer of 1994.

3.5.6 Wolf Fork of Touchet River

Density and population size of all ages of naturally produced juvenile steelhead decreased slightly in 1994 compared to 1993 (Figure 6). Redds per mile increased in 1994 (Figure 9). Very low water flows and high water temperatures in the summer of 1994 probably caused the decline in the number of 0-aged and >0-aged steelhead.

3.5.7 Charlie Creek

Mean densities of naturally produced juvenile steelhead were lower in Charlie Creek in 1994 compared to 1985 (Table 22). The lack of information for the years between 1985 to 1994 limits our ability to provide a sound conclusion for why the population of juvenile steelhead has decreased. However, we found considerable degradation of the riparian vegetation and stream banks of Charlie Creek. Also, in some stream reaches, the creek bottom was covered with silt. The history of land use in the Charlie Creek drainage suggests that overgrazing by cattle in the lower reaches and timber harvesting activities in the upper drainage have degraded the habitat

The decline in the steelhead population is a serious concern. The stable steelhead population that was present in the early 1980's has been eroded by poor land use practices. Although Charlie Creek is small, it is a significant segment of the steelhead habitat and population of Asotin Creek. Better management practices within the drainage should be encouraged to promote recovery of the riparian corridor, and to preserve and rebuild the Charlie Creek steelhead population.

3.5.8 Other streams sampled

Naturally produced juvenile steelhead densities from two sites on Main Asotin Creek and two sites on Cummings Creek are presented in Table 21. Steelhead densities decreased on the main stem of Asotin Creek in 1994 compared to 1993. Cummings Creek densities of 0-aged steelhead in 1994 remained equal to 1993 densities; densities of >0-aged steelhead decreased in 1994 compared to 1993.

3.6 Catchable Trout Program

In 1993-94, 286,604 (106,325 pounds) catchable size rainbow trout were produced at the Lyons Ferry/Tucannon complex. The catchable trout averaged 2.7 fish per pound in spring, 1994. Appendix I 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 1993, 160,062 rainbow trout fry (3,914 pounds) and 57,400 fingerlings (5,467 pounds) were reared for Idaho's LSRCP program. This production represented 138% of the program goal.

4.0 CONCLUSIONS

Production from LSRCP trout facilities met or exceeded goals described for the program. No viral or water supply problems which plagued the previous two production years, disrupted production. We estimate that 7,620 adult steelhead returned to the LSRCP area during the 1993 run year that were the result of production at LFH. 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 will affect adult steelhead returns in 1994. The returns from the 1993 release will determine whether the LSRCP goal for adult steelhead will be met.

Our study of steelhead smolt residualism continues to be very informative. The addition of PIT tags in 1994 showed that successful smolts were the largest, leanest fish which emigrated from the river. We successfully managed Curl Lake AP in 1994 to retain potential residual juveniles in the pond. We retained nearly 24,000 of the 160,000 juvenile steelhead in the pond. These fish were over 80% male and 93% were parr, transitional or precocious males. Although the percentage of fish retained in the pond was lower in 1994, we believe the method prevented potential residual fish from entering the river. Results from the 1994 spring release mirrored those observed in 1992 and 1993. 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 unknown now. We shall continue investigating pond management as part of our release strategy.

Adult returns of LFH steelhead contributed strongly to fisheries throughout the Columbia and Snake River basins. Sport and treaty Indian harvest and escapement to LFH and above Lower Granite Dam represented the largest components of returning adult CWT marked LFH study fish.

The poor success of 1992 steelhead emigrants from the Columbia basin was reflected in LFH releases, however more Tucannon River fish released in 1991 returned than ever measured before. The large differences observed between acclimated and direct release, and between upper and lower river release locations, suggest further study to determine the best release strategy for the Tucannon. This will help define actions to minimize the effects of the hatchery steelhead program on wild salmonid populations.

Efforts to develop a broodstock from wild Tucannon steelhead continue, however the lack of adult returns from releases in 1990 and 1991 was disappointing. Additionally, the poor success trapping steelhead at the Tucannon Hatchery weir and potential negative effects to the wild population, have caused us to reevaluate that effort. In 1995 we will attempt to trap fish on Cummings Creek. If that is successful it could be an alternative to mainstem trapping.

Straying of returning adult steelhead occurs for nearly all Washington's LSRCP rivers. We believe that environmental conditions such as drought and high water temperatures contribute to the straying problem but stock selection for tributary releases is also important.

Efforts to develop new broodstocks will continue in 1994. We will alter our traps design for the 1994-95 season and continue trapping. The program is most crucial on the Tucannon River. Decreasing returns of steelhead above the hatchery weir because of trap design problems and generally decreasing escapements may require different approaches to supplementation. Management options for the Walla Walla/Touchet and Snake River programs are less complicated. It is very possible that environmental conditions in these rivers are the predominant factor affecting their straying. Any decision to develop a new broodstock for use in these areas will wait until WDFW completes the development of a Wild Salmonid Policy, sometime in 1995.

In 1994, spawning escapement and juvenile densities of naturally produced steelhead within index areas of S.E. Washington streams were lower than in 1993. Drought within the basin is the likely cause of the decline in both measurements. Drought amplifies the habitat problems inherent with the Snake River system because of the four hydroelectric dams. It is unlikely that this trend will be reversed without a change in the long-term weather patterns.

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Appendix A.

Smolt Releases From Lyons Ferry/Tucannon Hatcheries, 1991-1994.

Location	R.M.	Number released	Pounds released	Date m/dd	Stock	Tag Code	Brand	Fin Clips	Size #/lb	Tag 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, 1991-1994

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, 1991-1994.

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 B. Steelhead trapped at Tucannon Hatchery trap, spring 1994.

Date	Wild/Hatchery	Sex	Length	Comments
03/14/94	H	F		Passed
03/17/94	W	F		Passed
03/30/94	W	M		Collected[A]
03/31/94	W	F		Collected[A]

A- Fish died during holding period.

Appendix C . Steelhead trapped at the Touchet River trap, spring 1994.

Date	Hatchery/Wild	Sex	Length	Comments
03/15	W	F	78.0	
03/15	W	F	67.0	
03/15	W	F	78.0	
03/15	W	M	57.8	
03/15	W	F	71.2	
03/15	W	M	64.5	
03/16	W	F	67.5	
03/16	W	F	68.9	
03/17	W	F	57.6	
03/29	W	F	62.0	
03/29	W	F	72.5	
03/29	W	F	64.7	
03/29	W	F	69.5	
03/29	W	M	66.3	
03/29	W	F	55.8	
03/29	W	F	57.9	
03/29	W	F	64.4	
03/29	W	F	71.0	
03/29	W	F	69.8	
03/29	W	M	73.2	
03/29	W	M	65.5	
03/29	W	M	61.0	
03/30	W	F	61.0	
03/31	W	M	72.0	
03/31	W	F	70.7	
03/31	W	F	74.0	
03/31	W	F		RECAPTURE
03/31	W	F	54.5	
04/06	W	F	69.5	
04/06	H	M	61.0	
04/07	W	F	70.0	
04/12	W	M	67.5	
04/12	W	M	59.0	
04/13	W	F	65.2	
04/13	W	F	64.3	
04/13	W	F	57.5	
04/14	W	F	58.0	
04/19	W	F	56.0	

Appendix C (con't.)

Date	Hatchery/Wild	Sex	Length	Comments
04/19	W	F	68.0	
04/19	H	F	52.5	
04/19	W	M	74.0	
04/20	W	F	70.0	
04/21	W	F	56.5	
04/27	W	F	60.0	
05/03	W	F	66.0	
05/05	W	F	57.5	

Appendix D: Brand and tag recoveries from the trap at LFH during the 1993 run year .

Brand	Tag Code	Stock	Release Year	Actual Tag Return
RA-IC-3	63/08/42	PAHSIM	1990	1
Total				**1**
RA-IT-1	63/40/61	LFH	1991	35
LA-IT-1	63/40/60	LFH		43
RA-IT-3	63/40/62	LFH		34
LA-IJ-1	63/40/58	LFH		83
LA-IJ-3	63/40/59	LFH		77
RA-IJ-1	63/14/56	LFH		81
RA-H-1	63/14/44	LFH		19
LA-H-1	63/14/47	LFH		17
RA-H-2	63/14/49	LFH		15
LA-H-2	63/14/50	LFH		17
RA-7-1	63/14/55	LFH		11
RA-7-3	63/14/52	LFH		2
Total				**434**
RA-IY-1	63/59/47	LFH	1992	85
RA-S-1	63/42/60	LFH		8
RA-S-2	63/42/63	LFH		8
LA-S-1	63/43/01	LFH		19
Total				**120**
AD clipped only				2,281
ADLV-unknown				7
LV only		Tucannon		1
Wild				35
Other Agencies				
	10/43/22	E. Fk. Salmon R. B SH	1991	2
	10/43/21	E. Fk. Salmon R. B SH	1991	2
	07/53/53	Wallowa R.	1991	2
	07/54/44	Wallowa R.	1991	2
	05/24/29	Dworshak B SH	1991	2

Appendix E. Coded wire tag expansions, Snake River, fall 1993 and spring 1994.

Zone	Sample Rate[a] Sept	Oct	Nov	Dec	Jan	Feb	Mar	CWT	Tags Rec.	Expanded[b] Harv.
228 Above Clarkston	(.048)	(.167)	(.231)	(.036)	---	---	---			
			1					05/24/30	1	4
		2						63/14/50-R2	2	12
			1					63/14/52-R1	1	4
			1					63/14/55-R3	1	4
				1				63/42/63	1	28
			1					63/59/47-R3	1	4
		3	2					07/53/52	5	27
		2	2					07/53/53	4	13
		1	1					07/53/54	2	10
			1					07/53/59	1	9
		2						07/53/60	2	12
			2					07/54/43	2	9
		1	2					07/54/44	3	15
			1					10/43/16	1	4
		1						10/43/23	1	6
		2	1					No Tag	3	16
168 Above Lower Granite Dam	(.040)	(.069)	(.042)	(.014)	---	----	---			
	1							63/14/44-R1	1	25
	1							63/14/50	1	25
	1							63/14/52	1	25
	1							63/14/55	1	25
	1							63/42/63	1	25
		1						10/43/22	1	14
	2							No Tag	2	50

Appendix E. (cont.)

Zone	Sept	Oct	Nov	Dec	Jan	Feb	Mar	CWT	Tags Rec.	Expanded[b] Harv.
				Sample Rate[a]						
167	(.150)	(.257)	(.168)	(.200)	(.062)	-----	-----			
Above Little Goose Dam										
			1					05/20/47	1	1
				1				05/24/28	1	5
		1						63/14/56-R3	1	4
								63/14/55	1	7
		3						63/40/58	3	12
	2	1						63/40/59	3	17
					1			63/40/60	1	16
	1	2						63/40/62	3	14
	1							63/59/47-R1	1	7
		1						10/43/17	1	4
		1						10/43/19	1	4
		1						10/43/20	1	4
		1			1			10/43/30	2	20
		1	1	2				No Tag	4	20
166	(.317)	(.431)	(.176)	(.350)	(.114)	-----	(.028)			
Above Lower Monumental Dam					1				05/20/48	13
			1					05/24/25	1	6
							1	05/24/26	1	36
			1		1			05/24/27	2	14
		1						05/24/28	1	2
							1	05/24/30	1	36
	1			1				63/14/44-R3	2	6
	1		1					63/14/47-R1	2	9
	1							63/14/49-R3	1	3
	1							63/14/50-R2	1	3
			1					63/14/50-R3	1	6
				2				63/14/56-R1	2	6
			1	4				63/40/58	5	17
				1				63/40/59	1	3
		1						63/40/61	1	2
		1		1				63/40/62	2	5
				1				63/42/63	1	3
			1	1				63/43/01	2	9

Appendix E. (cont.)

Zone	Sept	Oct	Nov	Dec	Jan	Feb	Mar	CWT	Tags Rec.	Expanded[b] Harv.
				Sample Rate[a]						
166	(.317)	(.431)	(.176)	(.350)	(.144)	------	(.028)			
Above Lower Monumental Dam	1			1				63/59/47-R1	2	6
				1				63/59/47-R2	1	3
				1	1			63/59/47-R3	2	12
		1						07/53/40	1	2
				1				07/53/41	1	3
		1						07/53/59	1	2
			1					07/53/60	1	6
		1						10/15/30	1	2
		1						10/42/38	1	2
		1						10/43/14	1	2
		1						10/43/18	1	2
		1						10/43/19	1	2
		1						10/43/20	1	2
		1		2				10/43/30	3	8
		1						10/43/34	1	2
			1					10/43/35	1	6
		1						10/43/36	1	2
					1			10/43/38	1	9
		3						10/43/40	3	7
	1							10/44/03	1	3
				1				10/44/05	1	3
		1						10/44/06	1	2
		6	1	3				No Tag	10	28

Appendix E. (cont.)

Zone	Sept	Oct	Nov	Dec	Jan	Feb	Mar	CWT	Tags Rec.	Expanded[b] Harv.
				Sample Rate[a]						
165	(.113)	(.160)	(.107)	(.109)	(.082)	(.059)	(.018)			
Above Ice Harbor Dam					1			05/24/25	1	12
					1			05/24/27	1	9
		1						05/24/28	1	6
		2				1		05/24/29	3	21
						1		63/14/56-R3	1	9
						1		63/40/58	1	17
			1					63/40/59	1	9
					1			63/40/61	1	12
		1						63/59/47-R2	1	6
				1				63/59/47-R3	1	9
							1	07/53/60	1	56
		1						10/43/14	1	6
		1						10/43/18	1	6
		1		1				10/43/20	2	9
		3	3					No Tag	6	47
164 ---	(.0125)	(.069)	---	---	---	---				
Below Ice Harbor Dam										0

a: Sample rates used to expand individual CWT recoveries.

b: Expanded harvest of tags was calculated by dividing tags recovered by the monthly sample rates from the fishery.

Appendix F. Coded-wire tag expansions for other rivers in S.E. Washington, fall 1993 and spring 1994.

Zone	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	CWT	Tags Recovered	Expanded[b] Harvest
				Sample Rate[a]							
185 Touchet R.											
	---	---	---	(.029)	(.316)	(.271)	(1.01)	(1.14)			
							3	1	63/14/56-R1	4	4
					1	1	2		63/14/56-R2	4	9
								1	63/14/56-R3	1	1
							5		63/40/58	5	5
						1	3		63/40/59	4	7
							7	2	63/40/60	9	9
					1		2	3	63/40/61	5	8
						2	1	1	63/40/62	4	9
							6	1	63/59/47-R1	7	7
						2	4	2	63/59/47-R2	8	13
					1		4	2	63/59/47-R3	7	9
					1				07/53/60	1	1
					1		1	4	No Tag	6	8
189 Tucannon R.											
	(.154)	(.333)	---	(.816)	(.368)	(.636)	(.250)	---			
				1					63/14/44-R1	1	1
				1	1				63/14/44-R2	2	4
				2					63/14/44-R3	2	2
	1								63/14/47-R1	1	6
				1					63/14/47-R2	1	1
						1			63/14/49-R3	1	2
					1				63/14/50-R2	1	3
				1	1				63/14/55-R1	2	4
				1	2				63/14/56-R2	3	7
							1		63/39/08	1	4
				2			1		63/40/59	3	6
				1					63/40/61	1	2
				1		1			63/42/63	2	3
		1							63/59/47-R2	1	3
				1					07/53/51	1	1
				1					07/53/59	1	1
						1			07/53/60	1	2
				1					10/43/40	1	1
				1	1				No Tag	2	4

Appendix F. (cont.)

Zone	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	CWT	Tags Recovered	Expanded[b] Harvest
				Sample Rate[a]							
194 Walla Walla											
	---	(.086)	(.109)	(.067)	(.146)	(.106)	---	---			
		2							63/14/56-R1	2	23
				1					63/14/56-R3	1	15
				1					63/40/58	1	15
			1						63/40/59	1	9
				1					63/40/60	1	15
		1							63/40/61	2	21
		2		1					63/59/47-R1	3	27
		1							63/59/47-R3	1	12
			1						07/53/54	1	9
75 Grande Ronde R.											
		(.017)	(.067)	(.010)	---	---	---	---	---		
		1							07/53/52	1	15
			1						07/53/59	1	100
		1							07/53/60	1	15
		1							No Tag	1	15
45 McNary Pool , Columbia R.											
		(.077)	(.084)	(.124)	(.035)	(.005)	---	---	---		
				1					05/20/49	1	8
				1					05/24/21	1	8
				1					05/24/24	1	8
				1					05/24/26	1	8
		1							05/24/29	1	12
				1					63/14/56-R1	1	8
		1							63/40/58	1	12
		2							63/40/59	2	24
				1					63/40/60	1	8
		1							63/59/47-R1	1	12
	1								63/59/47-R2	1	13
	1	2							63/59/47-R3	3	24
				1					07/53/52	1	29
				1					07/53/59	1	29
				1					10/42/35	1	8
		1							10/43/18	1	12
				1					10/43/29	1	8
		1							10/43/32	1	12
		2							10/43/39	2	24
		1							10/44/08	1	12
		1	1	1					No Tag	3	49

a: Sample rates used to expand individual CWT recoveries

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

Appendix G. Southeast Washington spawning ground surveys, 1994.

River	Date	Location	Miles	Redds/ Mile	Total Redds	Percent Expansion
North Fork Asotin Creek	5/6	From the mouth upstream 6 miles	6	5.5*	33	33.3
South Fork Asotin Creek	5/6	From the mouth upstream 7 miles	7	2.4*	17	33.3
Main Asotin Creek	5/6	From the confluence bridge downstream 1.3 miles to Charlie Creek	1.3	3.1^A	4	no estimate
Charlie Creek	5/6	From mouth upstream 7.7 miles	7.7	1.1^A	8	no estimate
South Fork Touchet River	5/9	From mouth upstream 15.7 miles	15.7	5.9*	92	22.2
North Fork Touchet River	5/11	From confluence upstream 11.1 miles	11.1	11.4*	127	27.3
Wolf Fork Touchet River	5/10	From the mouth upstream 10.3 miles	10.3	5.4*	56	26.7
Robinson Fork of Wolf Fork	5/11	From the mouth upstream 5.0 miles	5.5	3.5^A	19	no estimate
Cummings Creek	5/13	From the mouth upstream 7.0 miles	7.0	9A	63	no estimate
Upper Tucannon R.	5/18	From Sheep Creek to Panjab bridge	4.7	3.0*	14	50
Middle Tucannon R.	5/19	From Panjab bridge downstream to hatchery trap/ wier	9.8	1.1^A	11	no estimate
Lower Tucannon R.	5/23	From hatchery trap/ weir downstream to Highway 12	17.5	8.8*	154	70.5
Panjab Creek	5/13	From the mouth upstream 3.4 miles	3.4	1.5^A	5	no estimate

*- Adjusted 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 0.25 mi. above Headgate Park, along SCS shrub plot, 12 boulders in site.
MA2-93	Control	100		0.75 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. (cont.)

Site name	Site type	Site length (ft)	Road mile	Description and reference point
SA6B-83	1 Log Weirs 8 Boulders	77	2.35	.15 miles below road closure gate. Ref: 0+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 Koch's gate.
CH-1A	Index	93		Mid way between CH-1 and CH-2.
CH-2	Index	98		5.7 miles above Koch's gate.
CH-3	Index	107		3.9 miles above Koch's gate.
CH-4	Index	98		0.6 miles above Koch's gate
Tucannon River				
TN1-93 pasture	Control	98		0.25 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. (cont.)

Site name	Site type	Site length	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		0.1 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, 0.5 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		0.2 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		0.1 mi. below 1st bridge crossing, past Robinsons Fork.
WFT3-92	Index	65		1.3 mi. above Wolf Fork Bridge.

Appendix I.

Trout plants from Lyons Ferry andTucannon Hatcheries, 1994.

COUNTY	LOCATION	No. of Plants	Pounds of Fish	No. Fish Planted
ADAMS	Sprague Lake	2	2,600	7,800
	TOTAL Rainbows		2,600	7,800
ASOTIN	Alpowa Creek	1	300	1,020
	Asotin Creek	2	1,200	3,900
	Golf Course Pond	3	4,450	11,050
	Headgate Pond	3	600	1,950
	Silcott Pond	2	2,700	5,800
	West Evans Pond	4	3,300	8,140
	TOTAL Rainbows		12,550	31,860
COLUMBIA	Beaver Lake	2	1,356	2,818
	Big Four Lake	1	1,000	2,000
	Blue Lake	5	4,580	14,038
	Dam Pond	2	890	2,996
	Dayton Jv. Pond	2	950	2,540
	Deer Lake	7	6,660	18,642
	Orchard Pond	2	602	1,564
	Rainbow Lake	8	11,746	33,194
	Spring Lake	4	5,177	13,935
	Touchet R.(Rb)	1	1,520	4,864
	Touchet R.(GB)	1	1,820	6,006
	Tucannon R.	2	2,095	6,652
	Watson Lake	8	8,044	21,419
	TOTAL Rainbows		44,620	124,662
	Browns		1,820	6,006
FRANKLIN	Dalton Lake	2	7,200	16,320
	Marmes Pond	1	210	504
	TOTAL Rainbows		7,410	16,824
GARFIELD	Baker's Pond	1	300	990
	Casey Pond	1	420	1,428
	Pataha Creek	2	1,210	4,023
	Deadman Creek	1	300	1,020
	TOTAL Rainbows		2,230	7,461
WALLA WALLA	College Pl. Pond	2	605	2,025
	Coppei Creek	1	445	1,513
	Dry Creek	1	445	1,513
	Fishhook Pk. Pond	2	2,040	7,038
	Jefferson Pk. Pond	2	605	2,025
	Quarry Pond	2	7,200	16,000
	Mill Creek	2	2,260	7,102
	Bennington Lake	8	16,435	42,313
	TOTAL Rainbows		30,035	79,529
WHITMAN	Alkalai Creek	1	140	504
	Garfield Pond	1	670	2,010
	Gilcrest Pond	2	640	2,094
	Pampa Pond	1	2,100	4,200
	Riparia Pond (RB)	1	420	1,008
	Riparia Pond (GB)	1	450	2024
	Rock Lake (RB)	2	2,040	7,140
	Rock Lake (GB)	1	1,590	6,678
	Union Flat Creek	1	420	1,512
	TOTAL Rainbows		6,880	18,468
	Browns		2,040	8,702
	TOTAL RAINBOWS		**106,325**	**286,604**
	TOTAL BROWNS		**3,860**	**14,708**
	TOTAL FISH PLANTED		**110,185**	**301,312**

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