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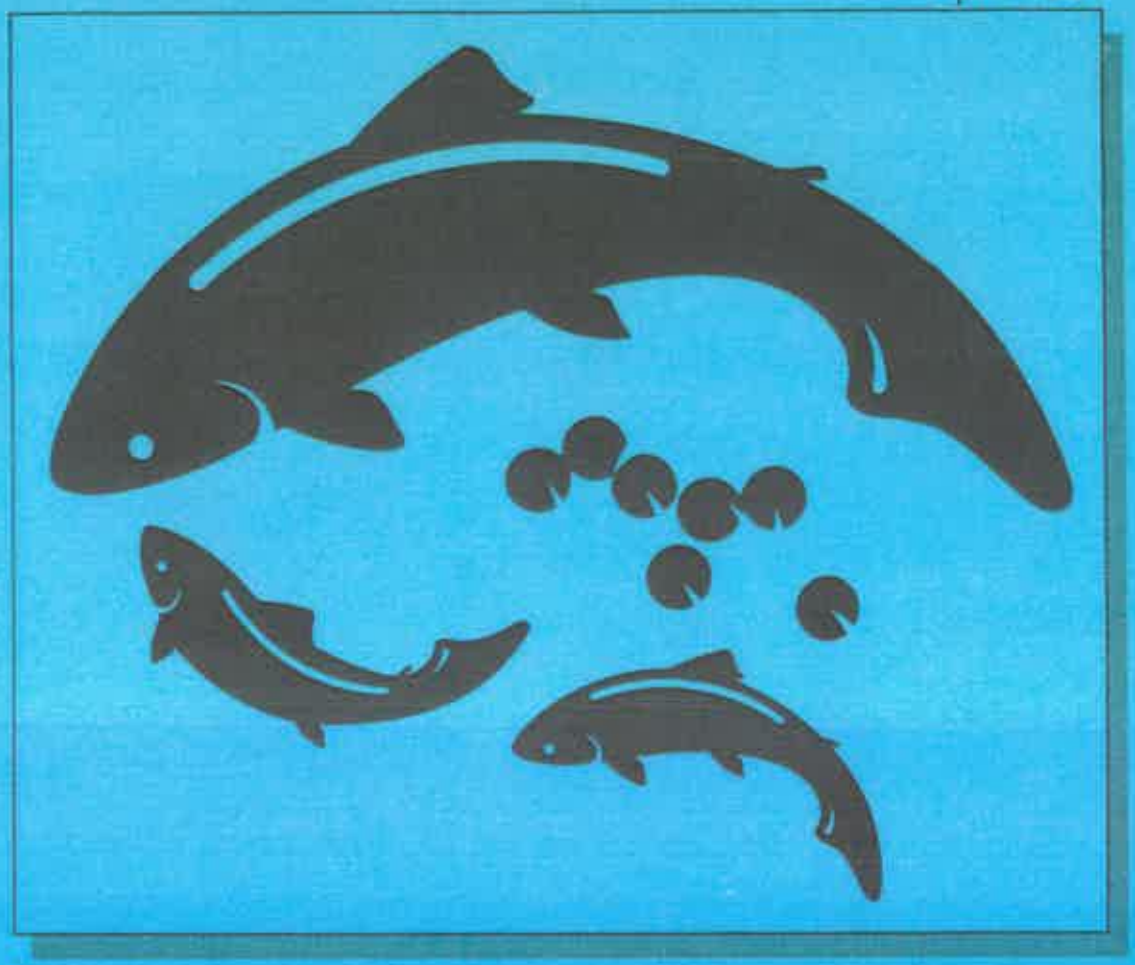

LYONS FERRY EVALUATION STUDY: 1992-93 ANNUAL REPORT

Report # 94-06

FISHERIES MANAGEMENT DIVISION

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LYONS FERRY EVALUATION STUDY
1992-93 Annual Report

February, 1994

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ABSTRACT

Total summer steelhead production at Lyons Ferry Hatchery (LFH) in 1992 was 1,048,817 fish weighing 208,277 pounds for an average smolt size of 5.0 fish/lb. A total of 271,052 rainbow trout weighing 108,956 pounds were planted into 40 waters at an average size of 2.5 fish/lb. Additionally, 212,107 fry and 59,070 fingerling rainbow trout weighing 9,195 pounds were reared and provided to Idaho as part of the Lower Snake River Compensation Plan (LSRCP) mitigation program.

Eight study groups of branded, coded-wire tagged and fin clipped juvenile steelhead were released into three rivers. Four tag groups were released into the Walla Walla and Touchet Rivers for contribution studies. Four of the groups were released within the Tucannon River to complete a four year study of location and type of release study. A total of 15,140 juvenile steelhead were retained in Curl Lake AP and not released into the Tucannon River to decrease the number of residual steelhead which may negatively interact with wild salmonids. Overall group performance, measured as survival to McNary Dam, for acclimated versus direct river releases were similar. All groups traveled downstream at a similar rate.

A total of 3,543 adult steelhead were trapped at LFH in the summer and fall of 1992. Females comprised 57.4% of fish trapped. One-salt age fish represented 91.6% of all fish trapped, a significantly higher percentage than in previous years. Wild fish made up 0.96% of fish sampled and tagged/branded fish made up 21.4% 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.

Large numbers of tagged/branded LFH origin adults returned to Lower Granite Dam and were observed. Straying of all groups of fish released by LFH, regardless of release location, 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, 13,200 anglers who caught 3,105 steelhead were interviewed. The average angler day was 4.97 hours long and anglers required an average of 13.8 hours to catch a fish during the entire season. We estimate that releases of LSRCP program smolts in 1990 and 1991 returned 10,605 adult steelhead to the LSRCP program area in 1992-93. The return represents 228% of the goal established for Washington's steelhead mitigation.

Populations of naturally produced steelhead in LSRCP streams were sampled in 1993. Numbers of 0 aged fish were consistently down from the previous year while numbers of older fish (>0) were stable or slightly higher. Although adult escapement and redd construction increased in 1993 over 1992, very high spring flows are thought to have scoured redds and to have caused poor survival conditions for 0 age fish; older age fish survival was stable.

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

We would like to thank John Hisata, John Kerwin, Daniel Herrig, Butch Harty and William Hubbard 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.

INTRODUCTION

This 1992-93 annual report is one of a series describing Washington Department of Wildlife's (WDW) progress toward meeting mitigation goals established for the Lower Snake River Compensation Plan (LSRCP). The study period for this report was 1 July 1992 through 30 June 1993. The LSRCP program began in Washington in 1981 with construction of Lyons Ferry Hatchery (LFH). Refurbishing of the Tucannon State Hatchery in 1984-85 followed and completed the production facilities for trout and steelhead. Three remote acclimation ponds were constructed along the Tucannon, Touchet and Grande Ronde rivers to allow acclimation of smolts prior to release. These facilities form the basis for WDW's mitigation program around which the evaluation program works. The results of evaluation studies presented are an attempt to answer the questions of whether mitigation goals have been met, what exists in the program that may eventually cause problems for natural salmonid populations and the mitigation program, and what actions can be taken 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.

METHODS

Hatchery operation monitoring

Juvenile steelhead growth

Our methods of sampling growth rates during the production year or in sampling the smolts prior to release in the spring remain unchanged from past years. Juvenile steelhead were sampled prior to release. Pre-release fork lengths in millimeters and weight in grams were taken and a visual determination of whether the fish is a smolt, transitional smolt, parr or precocious male is made. A detailed description of our standard sampling is available in the 1983 annual report (Schuck 1985). In 1993 an additional sampling effort was conducted where 60 fish were killed and examined for sex and degree of sexual development of males. Martin et al. (1993) indicated that males comprised a large percentage (>75%) of residual hatchery reared smolts in the Tucannon River. An attempt was made to retain these fish in the acclimation pond through careful management of the pond outflow and through bi-weekly sampling of fish in the pond. Based on Martin's work, a goal of the sampling was to identify when the fish remaining in the pond were 80% 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 marking program

Five types of marking programs were accomplished this year: 1) adipose clipping to designate hatchery produced harvestable adults for selective fisheries, 2) adipose and right ventral fin clipping to identify a different stock of fish released from LFH in 1993 and to ensure the returning adults are not utilized as broodstock, 3) coded-wire tagging (CWT) and left ventral fin clipping for specific contributions and return rate studies, 4) nitrogen freeze branding of tagged fish to allow easy identification of smolts and returning adults without sacrificing the fish, and, 5) coded wire tag and left ventral only fin clipping of hatchery reared endemic stocks to identify returning adults while restricting sport harvest.

Adipose clipping was completed during August/September 1992 by hatchery and temporary

personnel, just prior to their transfer into the large rearing ponds. We contracted with Washington Department of Fisheries (WDW) to conduct our coded-wire tagging and branding program. Tagging and branding was accomplished during February 1993. Tag loss was determined by sampling 1,000 fish from each group with a portable CWT detector. Brands were visually examined for their presence and quality (light, burned, location). Tag codes and brands are reported to the Pacific States Marine Fishery Commission (PSMFC) for publication in their annual report.

Fish Releases

Multiple release methods were used in 1992: 1) brood stock smolt releases from Lyons Ferry were allowed to volitionally emigrate from the rearing ponds, 2) fish were pumped from the release structure into tank trucks and hauled directly to various streams and rivers in Southeast Washington, 3) fish were pumped from the release structure into tank trucks, then transferred to acclimation ponds on the Grande Ronde and Touchet rivers. After 5-8 weeks in the conditioning pond fish were allowed to volitionally emigrate over a two week period. The remaining fish were forced from the ponds, and 4) fish were pumped from the release structure into tank trucks, then transferred to Curl Lake Acclimation Pond (AP). After five weeks in the acclimation pond fish were allowed to volitionally emigrate over a four week period as the pond was slowly lowered. Fish failing to leave the pond by this time, those which were 80% male or were showing predominately parr or transitional development, were retained in the pond and not allowed to enter the river (see Juvenile Growth, above).

Hatchery smolt emigration

We assessed smolt survival throughout their migration in the Snake and Columbia Rivers from samples collected and expanded at the Snake and Columbia River Dams by personnel from the National Marine Fisheries Service (NMFS) and Fish Passage Center (FPC). Residualized fish were again sampled from the streams and estimates of total residualism by release group was made for the Tucannon and Touchet Rivers.

Estimates of residual steelhead

The percent of all hatchery reared juvenile steelhead released into the Tucannon and Touchet rivers that failed to emigrate, "residualized", during the spring of 1993 was estimated. The method used was the same as used in 1991 and 1992. A brief summary of the method is presented below. A more detailed explanation of methods can be found in Viola and Schuck (1991) and Martin et al. (1993).

We determined from previous work, (Viola and Schuck 1992) that by the third week in May, emigration of hatchery reared juvenile steelhead has ceased. During the last week of May, 1993 we placed a known number of hatchery rainbow trout into the Tucannon (6,130 rainbows) and Touchet (5,000 rainbows) rivers. This resulted in a population within each river consisting of residualized steelhead and hatchery rainbow trout. Approximately one week was allowed for distribution and mixing of rainbows and residual steelhead. During 1-6 June 1993 creel surveys were conducted on both rivers. Information on the number of rainbow trout and residual steelhead observed in anglers creels was recorded. Also pre-determined sections of each river were fished by WDW personnel during the same six days. We used a Chi Square analysis to test for any difference in the retention of rainbow trout and residual steelhead observed during creel surveys and WDW angling. We then used a Petersen Mark and Recapture calculation (Ricker, 1958) creel survey and WDW angling information to estimate a population size of the combined number of residualized steelhead and hatchery rainbow trout. Rainbow trout were considered to be the marked fish in these calculations. We arrived at the number of steelhead that residualized in each river by multiplying the percentage of steelhead in the creel sample times the population estimate of residualized steelhead and hatchery rainbow trout.

Adult steelhead returns to project area

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, personnel., 1993). Adults coming into the trap were sampled for marks and brands.

Returns to Lyons Ferry Hatchery

We examined all steelhead that entered the hatchery ladder and trap for marks. The ladder was open only part of the time when steelhead were migrating past the hatchery and could have entered the trap. All captured fish were retained until December of 1992 when they were sorted for spawning purposes. Fish that were identified as destined for upstream hatcheries, injured fish, and fish not needed for broodstock were returned to the river. All wild fish were released to spawn naturally.

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 were used again in 1993 with additional index sites established on some rivers to provide greater coverage.

Tucannon Hatchery weir/trap

Both hatchery and wild steelhead were trapped in the Tucannon River, December 1992 through May 1993. We were able to document the number of wild and hatchery fish that were returning to spawn above the weir. Also, every fifth wild fish of both females and males was kept for spawning at the hatchery.

Touchet River trap

The Touchet River Adult Steelhead Trap is located at river mile 53.3. The trap was designed to allow collection of wild and hatchery steelhead. We need 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 a redd-to-adult ratio.

The trap was built on the existing intake structure for the Touchet River acclimation pond. The trap consists of a long suspended picket weir and a concrete holding area. The holding area is partially covered by inward sloping pickets which prevent the steelhead from jumping out. The trap was completed and installed on January 28, 1993.

All steelhead captured were anesthetized with CO^2. The fish were measured, sexed and tagged. The steelhead were held in a recovery pen upstream from the trap, allowed to recover, and then released. Steelhead were tagged with blue or yellow, numbered dart tags to identify hatchery or wild origin fish, respectively. An additional mark, a paper punch hole in the caudal fin, was added to help identify fish which may have lost the dart tag. Tagging the steelhead prevented us from counting the same fish twice when fish dropped below the weir and re-entered the trap. Tagging would also enable us to identify them on redds during our spawning ground surveys.

Steelhead creel surveys

Creel surveys of the steelhead sport fishery within the LSRCP area were conducted during the entire recreational fishery on the Snake River and its tributaries. Sport fishing for steelhead was allowed on the Snake River from 1 September 1992 through 15 April 1993 and also on the tributaries to the Snake River and Columbia River from 1 June 1992 through 31 March 1993. 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 WDW 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 Lyons Ferry Hatchery origin. The following methods are required to accomplish this objective:

    a) Sample the sport harvest and collect information on the number of both CWT and non-tagged steelhead harvested. Collect the snouts from all CWT /LV clipped fish for tag removal. 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 both tagged and untagged steelhead sampled during the creel surveys by the estimated total sport harvest. The latter is determined from WDW catch record card estimates of sport harvest.

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

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

3. Estimate angler exploitation rates for groups of adult LFH steelhead. Information is also collected on angler effort and catch rates: hrs/fish caught, hrs/fish kept and total harvest of all steelhead within the LSRCP area.

Trends in naturally produced juvenile steelhead density, population size 1983-1993.

The following sections of the North and South Forks of Asotin Creek and the Tucannon River were identified as juvenile steelhead density and population survey sections:

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

South Fork Asotin Creek: Confluence with the North Fork upstream 3.46 miles to the first bridge crossing.

Tucannon River: From Camp 1 upstream 11.6 miles to the confluence with Panjab Creek.

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.

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 1991-1993. 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).

North and South Forks of Asotin Creek and the Tucannon River

Annual electrofishing surveys of six sites within each of the river index section have provided juvenile steelhead trend information for each sample year. Three of the six sites sampled within each river index section were located in areas of artificial habitat improvement, the other three in areas where the habitat had not been altered. Mean densities (#/100 m^2) for both 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 times river surface area (100 m^2) 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 populations estimates from both the improved and unimproved areas. These estimates were then divided by the total area available within the entire index river section for that year. This provided a density per 100 m^2 for each age class.

North, South and Wolf Forks of the Touchet River

Electrofishing surveys of three sites within the index section of each river in 1992 and 1993 provided juvenile steelhead information. Mean densities (#/100 m^2) for both 0 aged and >0 aged naturally produced juvenile steelhead were calculated for the entire index section within each river. Population estimates were calculated by multiplying mean densities by river surface area (100 m^2) available within each index section for individual rivers. No instream habitat alteration has been conducted in the Touchet River, therefore this was not a consideration in calculations.

RESULTS AND DISCUSSION

Hatchery operation monitoring

Juvenile growth

A summary of production for both hatcheries is presented in Table 1. Numbers in the table represent individual fish stock performance over an entire production period.

Table 1 : Trout production at Lyons Ferry / Tucannon hatcheries, 1992-93.

Species[A]	Stock[A]	No. of eggs taken	No. fry	No. produced	%[B] survival	Fish lbs. produced
Lyons Ferry Hatchery						
SSH	LFH	905,438	416,265[C]	387,767	42.8	78,728
SSH	Wal/Cot	783,449[D]	375,414	341,899	43.6	59,734
SSH	Oxbow		400,000[E]	384,650[F]	96.2	67,150
RB	Spok.	393,820	385,285	327,556[G]	85.0	66,544
RB	Spok.		59,070	57,280[H]	97.0	1,594
Tucannon Hatchery						
SSH	Tuc.	9,000	5,565	4,602	51.1	676
SSH	LFH		65,001	64,200	98.8	803
SSH	Oxbow	293,500		296,400[I]	100	520
SSH	Wallowa	225,012	212,160	182,962	81.3	403
RB	Spok.(91)	302,400	252,000	232,481[J]	76.9	53,558
RB	Spok.(92)	69,600		57,325	82.4	2,293
GB	Ford	25,122	21,748	25,394[K]	100	5,320[L]

A - RB = rainbow, SSH = summer steelhead, GB = german brown; LFH = Lyons Ferry Hatchery, Wal = Wallowa, Cot.= Cottonwood, Tuc.= Tucannon, Spok.= Spokane

B - egg to smolt survival rate.

C - 378,257 fry destroyed/died from IHNV.

D - 359,690 eggs from + IHNV parents destroyed and 182,962 fry from Tucannon Hat. transferred to LFH.

E - Received from IDFG.

F - Includes 69,300 fry weighing 700 lbs planted to Rock Lk.

G - Includes 154,283 fish at 32 fish/lb transferred to IDFG and 57,824 fish at 26 fish/lb planted in Sprague Lk.

H - Received from Tucannon Hatchery, marked and transferred to IDFG.

I - Fry planted to Rock Lk., fish were not needed for production.

J - Includes 59,070 fish weighing 2,150 lbs transferred to LFH for marking.

K - Includes 11,384 fry weighing 785 lbs planted to Rock Lk.

L - State funded production.

Egg-to-fry survival for steelhead was highly variable for groups in 1993 (Table 2). Wallowa/ Cottonwood stock fish were utilized again this year with improved results over 1992. Poor egg quality resulted in a 29% green egg loss. Over-ripe eggs and sperm quality are suspected to have been the causes of the loss.

Table 2. Egg to fry survival, Lyons Ferry Hatchery 1989-93

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
Wal/Cottonwood	1992	558,437	198,747	186,656	33.4
	1993	533,995	289,198	271,970	50.9
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

Fish marking

Tag loss decreased significantly in 1993 over that experienced in 1992. Brand loss increased in 1993 with 2.9% (SD=2.0) unreadable brands. Light brands continue to cause problems in accurate brand readings at the dams during the spring emigration (see migration through dams, below). Alternatives to branding are being investigated to improve our ability to non-lethally sample adults at various locations, however branding remains the best available technique at this time. A complete listing of the tag/brand groups is summarized in Table 3 .

Fish releases

Fish were transferred to conditioning ponds in early March. The screens were removed from the outlet structures of all the ponds on 6 April in response to smolts actively schooling and circling the ponds. Large numbers of fish were noted exiting the ponds for the next 3-5 days.

Fish fed actively during this period but 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 11 May. All smolt plants for 1990-1993 are summarized by release day in Table 3.

Table 3. Smolt releases from Lyons Ferry/Tucannon Hatcheries, 1990-1993.

Location	R.M.	Number released	Pounds released	Date (m/dd)	Stock	Tag Code	Brand	Fin Clips	Size (#/lb)	Tag loss %	Brand loss %
1990											
Asotin Creek	0.8	20,142	3,730	4/17	Pahsim	63/07/25	LA-IC-4	AD-LV	5.4	0.4	3.4
Asotin Creek	0.8	19,950	3,500	4/18	Pahsim	63/14/22	RA-IC-4	AD-LV	5.7	1.0	5.8
Asotin Creek	0.8	23,000	5,000	4/24	Pahsim			AD	4.6		
Asotin Creek	0.8	23,275	4,750	4/24	Pahsim			AD	4.9		
Asotin Creek	0.8	28,600	5,500	4/26	Pahsim			AD	5.2		
Asotin Creek	0.8	22,880	4,400	4/30	Pahsim			AD	5.2		
Grande Ronde R.	29	179,250	36,066	4/15	Wallowa			AD	5.0		
Grande Ronde R.	29	59,750	11,274	4/30	Wallowa			AD	5.3		
Mill Creek	3	15,200	4,000	4/18	Wells/Ska			AD	3.8		
Mill Creek	3	17,000	5,000	4/20	Wells/Ska			AD	3.4		
Snake R. @LFH	58	18,150	3,300	4/27	Pahsim.	63/14/21	LA-IC-3	AD-LV	5.5	1.3	5.4
Snake R. @LFH	58	20,805	3,650	4/27	Pahsim.	63/08/42	RA-IC-3	AD-LV	5.7	1.0	2.3
Snake R. @LFH	58	4,524	780	4/30	Pahsim.			AD	5.8		
Touchet @ Dayton	53	20,190	5,769	4/15	Wells/Ska	63/39/08	LA-S-1	AD-LV	3.5	4.4	5.7
Touchet @ Dayton	53	19,780	5,651	to	Wells/Ska	63/39/07	RA-S-1	AD-LV	3.5	0.9	4.6
Touchet @ Dayton	53	69,775	19,936	4/30	Wells/Ska			AD	3.5		
Touchet @ Waitsburg	37	6,600	2,000	4/23	Wells/Ska			AD	3.3		
Tucannon @ Curl	41	20,012	4,002	4/06	Pahsim	63/39/12	LA-IC-1	AD-LV	5.0	1.7	3.3
Tucannon @ Curl	41	20,065	4,013	to	Pahsim	63/39/11	RA-IC-1	AD-LV	5.0	0.7	2.9
Tucannon @ Curl	41	39,175	7,835	5/03	Pahsim			AD	5.0		
Tucannon @ Marengo	26	19,992	3,570	4/25	Pahism	63/08/38	RA-IC-2	AD-LV	5.6	0.4	5.7
Tucannon @ Marengo	26	20,020	3,640	4/25	Pahism	63/08/41	LA-IC-2	AD-LV	5.5	1.0	4.0
Walla Walla River	24	20,015	5,267	4/25	Wells/Ska	63/39/09	RA-S-2	AD-LV	3.8	0.9	4.6
Walla Walla River	25	19,802	5,352	4/24	Wells/Ska	63/39/10	LA-S-2	AD-LV	3.7	1.5	3.2
Walla Walla River	27	14,000	4,000	4/20	Wells/Ska			AD	3.5		
Walla Walla River	24	14,800	4,000	4/19	Wells/Ska			AD	3.7		
Walla Walla River	22	13,200	4,000	4/19	Wells/Ska			AD	3.3		
Walla Walla River	25	14,400	4,000	4/19	Wells/Ska			AD	3.6		
Walla Walla River	25	18,400	4,000	4/18	Wells/Ska			AD	4.6		
Walla Walla River	27	15,600	4,000	4/19	Wells/Ska			AD	3.9		
Totals		**818,352**	**181,985**					**Mean =**	**4.5**	**1.3**	**4.2**
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		

Table 3. (cont) Smolt releases from Lyons Ferry/Tucannon Hatcheries, 1990-1993 .

Location	R.M.	Number released	Pounds released	Date (m/dd)	Stock	Tag Code	Brand	Fin Clips	Size (#/lb)	Tag loss %	Brand loss %
1991 (cont.)											
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		
Totals		**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
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		
Totals		**631,002**	**145,796**					**Mean =**	**4.3**	**1.6**	**2.1**

Table 3. (cont) Smolt releases from Lyons Ferry/Tucannon Hatcheries, 1990-1993

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

Fish size at release was very consistent and ranged from 4.4 - 6.0 fish/lb with the average size of the entire release of smolts being 5.0 fish/lb (Std. Dev. = 0.4). Total steelhead production was 1,048,817 fish totaling 208,277 pounds.

Four stocks of steelhead were released in 1993. The loss of fish at Lyons Ferry Hatchery because of Infectious Hematopoietic Necrosis Virus (IHNV) required their replacement if full

production from the hatchery was to occur. Hells Canyon (Oxbow Hatchery) strain of A-run fish were obtained from Idaho Fish and Game. These fish performed well at LFH. We again received Wallowa stock fish from Oregon for use in the Grande Ronde River. Samples were taken from raceways and conditioning ponds during the release period and are summarized in Tables 4-6.

Table 4. Smolt characteristics of Lyons Ferry Hatchery reared juvenile steelhead, 1993.

	n (%)	Mean length	Mean weight	K	% male/female of total sample
Dayton Pond					
Sample 03/29/93					57.6/42.4
Smolts	27(18.5)	222.9	126.1	1.11	
Transitional	105(71.9)	197.2	90.5	1.11	
Parr	8(5.5)	138.1	29.8	1.09	
Precocious males	6(4.1)	192.5	96.0	1.30	
Sample 04/28/93					74.3/25.7
Smolts	51(27.6)	219.1	109.4	1.01	
Transitional	127(68.6)	197.9	89.0	1.06	
Parr	1(0.6)	118.0	19.3	1.17	
Precocious males	6(3.2)	187.0	79.7	1.19	
Cottonwood Pond					
Sample 03/31/93					57.6/42.4
Smolts	29(14.6)	214.2	111.1	1.12	
Transitional	146(73.3)	186.1	77.8	1.14	
Parr	20(10.1)	136.4	28.2	1.06	
Precocious males	4(2.0)	199.0	93.5	1.16	
Sample 04/26/93					71.0/29.0
Smolts	23(14.6)	210.7	90.3	0.93	
Transitional	126(79.7)	192.5	77.3	0.98	
Parr	0	---	---	---	
Precocious males	9(5.7)	201.6	92.5	1.07	

Table 5. Mean condition factor K and (% sexual composition) of juvenile hatchery steelhead acclimated in Curl Lake, 1993.

	Pre-release	Retained fish	Residual fish
Females	0.79 (50.0)	0.96 (22.6)	1.05 (21.5)
Males	0.80 (41.7)	0.98 (53.4)	1.06 (23.1)
Maturing [a] males	0.81 (8.3)	1.08 (24.0)	1.04 (55.4)

a: Males with 20-100% sexual development of testes.

Table 6. Percent of hatchery juvenile steelhead acclimated in Curl Lake AP exhibiting smolt, parr, transitional or precocious male characteristics.

	Pre-release	Retained fish	Residual fish
Smolts	34.0	7.5	0
Parr	4.0	0	0
Transitional	61.0	84.5	82.2
Precocious males	1.0	8.0	17.8

Mean condition factors of residual steelhead and steelhead retained in Curl lake were significantly larger than condition factors of fish prior to release ($P < .05$) (Table 5). Sexually maturing males made a substantially higher proportion of the fish that were retained in Curl Lake and of the fish that residualized when compared to fish prior to release (Table 5) . Also the fish in Curl Lake prior to release exhibited predominately smolt and transitional physical characteristics. Both residual fish and fish retained in Curl lake exhibited predominately transitional and precocious male physical characteristics (Table 6.)

The tagging program went very smoothly this year. Brand quality is still a problem. Quality of brands, not quantity, was stressed daily in the marking, however the consistent presence of light brands in our samples is frustrating. Constant observation and correction of improper technique is essential for consistent brand quality, even when using experienced branding

personnel. Most branders tend to under time their branding, resulting in "light" brands. We will continue to pursue means to eliminate this problem. The Hells Canyon stock of fish were marked with an additional right ventral (RV) fin clip to allow their easy identification when returning as adults.

Hatchery smolt emigration

Migration through dams

Table 7 summarizes passage estimates at McNary Dam for brand groups released in 1991-93. Median (50%) passage of the fish from 1992 groups passed the first collection dam between 6-18 days after release, although individuals from various groups continued to pass the dams through June. Average daily travel rates for various brand groups ranged between 3.6-4.5 miles per day (FPC 1994).

Table 7. Estimated passage of branded/tagged Lyons Ferry Hatchery steelhead at McNary Dam, 1991-93. (FPC 1992-1994)

Brand	Release site	Passage index	Number released	% of release	Size (#/lb)	Stock
1991						
LA,RA-II-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
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

Average fish size for the entire hatchery production decreased slightly in 1993 from 1992. Size variability also decreased slightly over 1992, which is surprising considering the varied stocks of fish released this year.

The smaller fish acclimated in Curl Lake appear to have performed marginally better in surviving to McNary Dam than did fish released directly into the Tucannon at Curl Lake AP and Marengo. This result is consistent with the 1992 release year, and occurred despite the retention of just over 15,000 fish in Curl Lake AP that refused to emigrate from the pond. The differences in the Passage Indices for acclimated and direct release were not as great as noted in past years. How effectively each group was captured at the dam can be variable depending upon degree of smoltification and other factors. Fish released from the Touchet River consistently travel downstream at a faster rate than do Tucannon River fish. This may be a result of less reservoir travel distance for the Touchet River fish. Tucannon River fish must migrate through 90 miles of reservoirs and pass two dams before reaching McNary Dam.

Residual steelhead estimates

Tucannon River

A new release strategy was tested on fish released from Curl Lake AP. This method, designed to reduce the number of hatchery reared juvenile steelhead that residualized in the Tucannon River, proved successful. A more complete discussion of results is presented in a separate report (Viola and Schuck 1994). The percent of fish that residualized in the Tucannon River in 1992 and 1993 is presented in Figure 1 .

Approximately the same number of hatchery reared juvenile steelhead were released into the Tucannon River in 1992 and 1993. The estimates of residualism in June of 1992 and 1993 are essentially equal. We did, however, reduce the number of fish that residualized from Curl Lake (Figure 1) with our newly developed release strategy (Viola and Schuck 1994). The percent of direct released fish that residualized increased in 1993 as compared to 1992, thus masking the benefits of our efforts in Curl Lake.

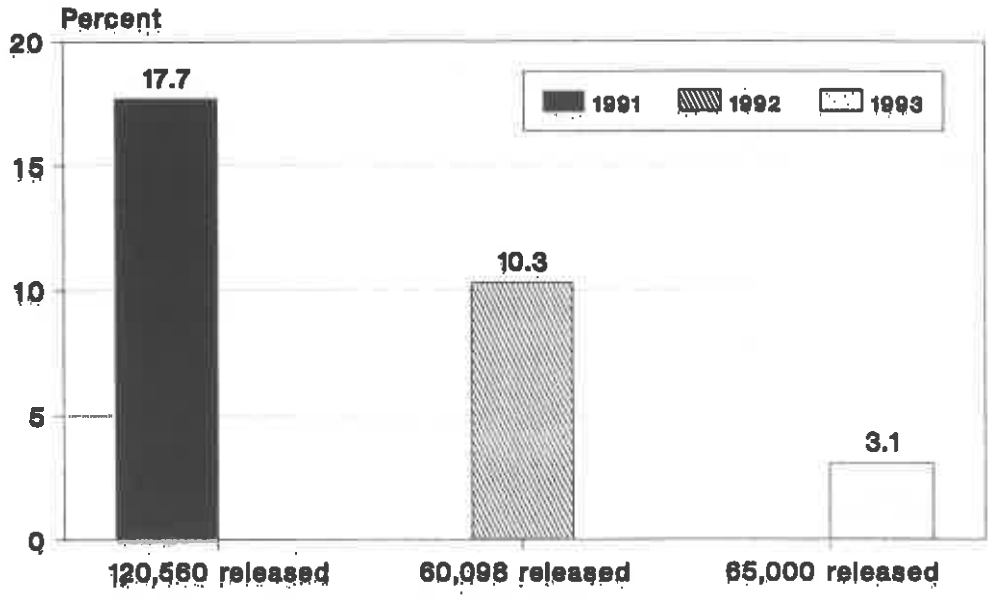

Figure 1. Percent residual steelhead in the Tucannon River from Curl Lake AP releases, 1991-1993.

The main reason for our efforts to reduce the number of steelhead in the Tucannon River is the desire to reduce negative interaction among these residual fish with all other wild salmonids. In 1992 we estimated that 456 wild spring chinook salmon were consumed by hatchery reared steelhead (Martin et al. 1993) In 1993 we estimate that 413 wild spring chinook salmon were consumed by hatchery reared steelhead. In 1994 we plan to release all hatchery reared juvenile steelhead from Curl Lake AP. At this time we are convinced that this will dramatically reduce the number of residual steelhead in the river and, therefore, the number of negative interactions among residual steelhead and other wild salmonids.

Touchet River.

One group of 34,607 (4.8 fish/lb) adipose only clipped juvenile steelhead and another group of 40,432 (4.8 fish/lb) coded-wire tagged (CWT), branded, adipose and left ventral fin clipped juvenile steelhead were released at the same time into the Touchet River from Dayton AP. A third group of 70,567 adipose-only fin clipped steelhead were released directly into the river approximately 5 miles below the acclimation pond.

We found no difference in the retention of rainbow trout and steelhead observed in anglers creels and those captured during angling efforts by WDW personnel ($X^2 = 0.28$, df= 1, P=0.5995). Therefore, an estimate of residualism was calculated using a combination of un-adjusted creel survey information and WDW angling results. We estimate that 16,347 $\pm$ 166 hatchery reared juvenile steelhead residualized in the Touchet River in the spring of 1993. This number represents 14.7% of all steelhead released. An estimated 8,968 adipose-only clipped steelhead residualized, 12.7% of those released. This was significantly greater than the 5.4% (2,171) residualism that occurred with CWT, branded, adipose and left ventral clipped fish (X^2 =1278.24, df=1, P= 0.0000). These results are contrary to what we found on the Tucannon River in both 1992 and 1993. In those cases, CWT steelhead residualized at a slightly higher percent than adipose-only clipped fish. However, we found that direct stream release fish residualized at a higher percentage than fish released from the acclimation pond. The high frequency of residual CWT fish in the Touchet river is most likely the result of releasing an additional 35,960 fish directly into the river.

Adult steelhead returns

Tucannon Hatchery weir/trap

We trapped both hatchery and wild steelhead on the Tucannon River 1 January through 14 May 1993. A total of 158 adult steelhead were trapped and passed above the weir. Thirty nine wild fish and 119 hatchery origin fish were handled. Every fifth wild fish of both males and females was kept for spawning. A complete listing of the fish trapped and passed/retained is provided in Appendix A.

Touchet River trap

A total of 60 adult steelhead were captured, tagged and passed above the weir/trap. Fifty two wild steelhead (18 males, 34 females) and eight hatchery steelhead (2 males, 6 females) were examined and measured. A listing of passage date and specific information about each fish is provided in Appendix B.

The first year of trapping on the Touchet River was plagued with problems. Soon after the trap was installed record cold temperatures encased the trap and weir in ice, damaging several sections. As temperatures warmed and river flow increased, heavy debris in the river caused additional damage. Also, high flows over topped the weir and adult steelhead were observed passing above the weir location. We were unable to accomplish our goal of trapping the entire run of steelhead. Alterations and repairs to the trap during the season allowed us to obtain a sample of the run. A redesign of the weir/trap for the 1994 season is planned.

Returns to Lyons Ferry Hatchery

A total of 3,543 adult steelhead were trapped at Lyons Ferry Hatchery from 1 July 1992 through 15 November 1992. Mortality during the trapping and holding period was 2.8% (10 fish) and 2,464 fish were returned to the river. All fish trapped were inspected for fin clips, sex, whether of wild or hatchery origin and for readable brands. Snouts were collected from a sample of fish that had a ventral fin clip and unreadable brand. Fish sorted from the trap were comprised of 57.4% (2,034) females and 42.6% (1,509) males. Wild fish represented 0.96% (34 fish) of the sample, tagged/branded fish represented 24.1% (854) of the total with the remainder of fish of

untagged hatchery origin. One-ocean age fish returning to LFH represented 90.2% of fish spawned in 1993, while making up only 87.1% of returning coded-wire tagged groups. Two-ocean age fish made up the remainder of female fish spawned; no three ocean age fish were identified. One-ocean age females (n = 211) produced an average of 4,471 eggs and two ocean age females (n = 23) produced 5,754 eggs. Table 8 summarizes age composition and average fish lengths by age for a sample of fish trapped at LFH.

Table 8. Age composition and mean lengths for steelhead spawned at LFH, 1992-93.

	1-ocean	2-ocean	3-ocean
Males (n=100)	95.0% (57.2 cm)	4.0% (67.5 cm)	1.0%(79.5 cm)
Females (n=234)	90.2% (61.1 cm)	9.8% (70.1 cm)	
Combined	91.6% (59.9 cm)	8.1% (69.7 cm)	0.3% (79.5 cm)

A complete listing of the returns of branded fish by release year to LFH in 1992 is provided in Appendix C.

Passage at dams

Table 9 lists estimated escapement of LFH fish to above Lower Granite Dam (LGD) by release year, for each mark group, and the percentage of release that those fish represent. A list of release locations for brand groups is given in Table 3. The widely varying return rates for groups does not necessarily represent comparative performance of the releases. Many of the groups passing LGD were released into tributary streams far below the dam (ie: Walla Walla River). The return of adults to above LGD may be an indicator of straying due to various factors such as stock suitability and environmental conditions within the run year.

Table 9. Adult returns of Lyons Ferry Hatchery steelhead to above Lower Granite Dam, run years 1991-92.

Release year / Brand	Release site	Number of adults (Return year 1991)	Number of adults (Return year 1992)	Total adults captured	No. smolts released	% survival
1990						
LA-S-1	Touchet R.	23	12	35	19,039	0.18
RA-S-1	Touchet R.	25	21	46	18,870	0.24
LA-S-2	Walla Walla R.	7	7	14	19,168	0.07
RA-S-2	Walla Walla R.	7	4	11	19,094	0.06
LA-IC-1	Curl Lk. Tucanon R.	111	156	267	19,352	1.38
RA-IC-1	Curl Lk. Tucanon R.	127	146	253	19,483	1.30
LA-IC-2	Tuc. R. @ Marengo	97	91	188	19,219	0.98
RA-IC-2	Tuc. R. @ Marengo	108	94	202	18,852	1.07
LA-IC-3	Snake R. @ LFH	55	94	149	17,170	0.87
RA-IC-3	Snake R. @ LFH	100	104	204	20,326	1.00
LA-IC-4	Asotin Creek	144	161	305	19,457	1.57
RA-IC-4	Asotin Creek	129	178	307	18,793	1.63
1991						
RA-IT-1	Touchet R.		33	33	18,805	0.18
LA-IT-1	Touchet R		33	33	18,399	0.18
RA-IT-3	Touchet R		25	25	18,236	0.14
LA-IJ-1	Touchet R		94	94	19,812	0.47
LA-IJ-3	Touchet R		117	117	19,723	0.59
RA-IJ-1	Touchet R		82	82	19,360	0.42
RA-H-2	Tucanon R. @ Curl		128	128	18,409	0.70
LA-H-2	Tucanon R. @ Curl		69	69	19,518	0.35
RA-7-1	Curl Lk. Tucanon R		48	48	19,248	0.25
RA-7-3	Curl Lk. Tucanon R.		37	37	19,182	0.19
LA-H-1	Tuc. R. @ Marengo		136	136	19,198	0.71
RA-H-1	Tuc. R. @ Marengo		153	153	19,307	0.79

A detailed discussion of spawning activity is included in the section concerning trends in naturally produced juvenile steelhead density, population size and spawning activity 1983-1993.

Steelhead creel surveys

Lower Snake River and tributaries.

We relied on harvest estimates derived from adjusted state-wide catch record card returns in 1993 (Tables 10 and 11). Our creel sampling was primarily to obtain catch composition data and recover coded-wire tags. All fall 1992, and spring 1993 run year recoveries of steelhead having length or sex information are located in project or district files. These data were used

to calculate sex ratios, mean length and mark rate. All fish kept this year were adipose clipped, some were also left ventral (LV) clipped indicating the presence of a coded-wire tag.

Table 10. Adjusted catch-record card-derived steelhead harvest estimates for WDW management sections[A] on the lower Snake River, fall 1992 and spring 1993 (WDW 1993).

Month	Below Ice H. Dam	Below L.Mon.Dam	Below L.Goose D.	Below L.Granite D.	L.Granite Pool	Above Clarkston
June	0	0	0	2	3	0
Aug.	0	0	2	0	0	0
Sept.	86	167	357	130	294	101
Oct.	165	735	898	285	1,066	1,079
Nov.	63	489	691	67	1,586	1,261
Dec.	142	281	348	79	702	499
Jan.	51	112	86	153	255	273
Feb.	14	56	142	105	286	182
Mar.	0	102	135	181	94	78
Apr.	0	2	0	2	5	0
Totals	521	1,944	2,659	1,004	4,291	3,473

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. Harvest estimates from catch-record card returns for rivers in S.E. Washington, fall 1992 and spring 1993 (WDW 1993).

Month	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 1992-93 steelhead season, 13,200 anglers that fished a total of 49,921.1 hours were surveyed within the LSRCP area in Southeast Washington. An annual summary of creel information collected during the fall 1992 and spring 1993 steelhead season is presented in Table 12. Catch rates from all locations surveyed ranged from 4.3 - 54.3 hours/fish. Mean catch rate for the entire LSRCP area for the 1992-93 season was 13.8 hours/fish. A summary of characteristics observed during the 1992-93 steelhead season is presented in Table 13.

Table 12. A summary of creel information from S.E. Washington rivers during the 1992-93 steelhead season.

Area	Number anglers	Hours fished	Fish caught	Hours/fish caught
McNary Dam	2,215	7,825.9	589	13.3
Wallula	74	185.0	7	26.4
Walla Walla R.	465	1,043.8	111	9.4
Mill Creek	115	184.7	21	8.8
Ice Harbor Dam	1,980	5,184.4	224	23.1
Lower Mon. Dam	92	331.5	10	33.2
Touchet R.	459	920.3	215	4.3
Tucannon R.	282	735.4	155	4.7
Little Goose Dam	3,574	11,649.9	761	15.3
Low. Granite Dam	105	380.0	7	54.3
Mid-Snake R.	2,617	9,414.0	567	16.6
Grande Ronde R.	1,222	5,066.2	438	11.6
Total	**13,200**	**42,921.1**	**3,105**	**13.8**

Table 13. Characteristic ocean residency, mean fork length (cm), weight (kg) and sexual composition of 214 adult Lyons Ferry Hatchery coded-wire tagged steelhead observed in anglers creels in the LSRCP area of Washington, fall 1992 and spring 1993.

Ocean Residence	% Composition	Mean Length	Mean Weight	% Male	% Female
1 Year[a]	74.8	58.9	2.0	46.9	53.1
2 Years[b]	16.8	69.3	3.0	38.9	61.1
3 Years[c]	8.4	81.4	4.9	44.4	55.6

a : One ocean steelhead lengths ranged from 51 - 64 cm.
b : Two ocean steelhead lengths ranged from 65 - 74 cm
c : Three ocean steelhead lengths were > 75 cm.

Grande Ronde River

During the 1992-93 steelhead season 3,019 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 4.97 hours. This effort

represents essentially the same angling effort as estimated for the 1991-92 season. However, the average completed fishing trip in the 1991-92 season was slightly greater than in 1993 at 5.43 hours. Tables 14 and 15 are summaries of ODFW data collected from steelhead examined in angler creel along the Grande Ronde River during Fall 1992 and Spring 1993. The greatest harvest occurred in late March and early April near the Cottonwood Creek AP.

Table 14. Estimated angler effort, catch rates, and harvest for steelhead anglers on the Grande Ronde River in Washington, 1992 and 1993 (Flesher 1993).

Month	Effort Hours (95% CI)	Catch Rate-F/HR (95% CI)	Total[A] Catch (95% CI)	Fish Kept (95% CI)	Marked Fish Rel. (95% CI)	Unmarked Fish Rel. (95% CI)
1992						
Sep.	679.7	.0165	11	11	0	0
	(100.6)	--	--	--	--	--
Oct.	3,139.5	.0990	311	83	129	98
	(504.0)	(.0303)	(95)	(36)	(72)	(57)
Nov.	1,060.9	.1751	186	79	37	70
	(427.3)	(.0932)	(99)	(59)	(52)	(53)
Dec.	215.7	.0430	9	7	0	2
	(128.2)	(.0625)	(14)	--	--	--
1993						
Feb.	612.0	.1391	85	56	14	15
	(579.4)	(.1497)	(92)	(60)	(16)	(21)
Mar.	7,410.6	.0626	464	278	121	65
	(2,096.7)	(.0136)	(101)	(88)	(61)	(49)
Apr.	1,978.7	.1139	225	160	54	12
	(731.3)	(.0376)	(74)	(62)	(37)	(14)
Total	15,097.1	.0855	1,291	673	355	264
	(2,393.7)	(.0137)	(208)	(141)	(115)	(96)

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

Table 15. Age composition (%) and fork length (mm) of steelhead sampled from creels on the Grande Ronde River in Washington, fall 1992 and spring 1993 (Flesher et al. 1993).

Age[A]	n[B]	% Male	% Female	n	Males Length (CI)[C]	n	Females Length (CI)
1:1	14	78.6	21.4	11	596 (17)	3	581 (53)
1:2	15	13.3	86.7	2	708 (31)	13	689 (19)

A Age is expressed as a ratio of years spent in freshwater : years spent in ocean prior to spawning.
B n = the number of fish sampled.
C (CI)= 95% confidence interval.

Coded-wire tag recovery

Snouts were collected by WDW personnel from 214 sport caught steelhead that had left ventral fin clips. All snouts, except Grande Ronde River recoveries which were examined by Oregon, were examined by Idaho Fish and Game personnel for coded-wire tags. All CWT's recovered by WDW personnel and estimates of the expanded harvest by individual tag code are presented in Appendix D for the Snake River, and in Appendix E for other rivers within Southeast Washington.

Returns of coded-wire tag groups

Expanded estimates of harvest of adult Lyons Ferry steelhead within the Columbia River basin and the percent smolt to adult survival that these numbers represent are presented in Table 16. This information is based on sampling programs conducted by several Federal, State and Tribal agencies.

LFH fish are contributing to fisheries throughout the Lower Columbia River basin upon their return. 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. It is likely that if adult return behavior, juvenile survival and emigration behavior can be improved through stock development and proper release size, 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 1990 coded-wire tag releases. A summary of these returns to various fisheries is presented in Table 17. For all the tag codes listed except those released in the Tucannon and Walla Walla rivers, we met or exceeded the production escapement goal of 0.5% survival back to the LSRCP area.

Table 16. Adult returns of Lyons Ferry steelhead, and the percent smolt to adult survival those numbers represent, to locations within the Columbia River Basin, 1992-93.

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	9 (0.02)	25 (0.06)	39 (0.10)	13 (0.03)	39 (0.10)	7 (0.02)
Mid-Col. Sport	3 (0.008)	38 (0.10)	0	3 (0.008)	20 (0.05)	14 (0.04)
Zone 6 Net	77 (0.20)	66 (0.17)	105 (0.26)	88 (0.22)	175 (0.44)	66 (0.17)
L. Ferry Ladder	27 (0.07)	21 (0.05)	17 (0.04)	3 (0.008)	20 (0.05)	12 (0.03)
Snake. R. Sport	149 (0.39)	73 (0.19)	0	16 (0.04)	19 (0.05)	0
Tucannon Sport	0	0	0	0	0	0
W. Walla Sport	0	0	16 (0.04)	0	0	7 (0.02)
Touchet Sport	0	18 (0.05)	2 (0.005)	2 (0.005)	0	2 (.005)
Dworshak NFH	1 (0.003)	0	1 (0.003)	1 (0.003)	0	0
Idaho Sport	52 (0.14)	13 (0.03)	25 (0.06)	29 (0.07)	24 (0.06)	0
Quinault R. Net	0	1 (0.003)	0	0	0	0
Ocean Harvest	6 (0.02)	0	6 (.02)	9 (.02)	0	0
LSRCP Total	**229** **(0.59)**	**125** **(0.32)**	**61** **(0.15)**	**51** **(0.13)**	**63** **(0.16)**	**21** **(0.05)**
Grand Totals	**324** **(0.84)**	**255** **(0.66)**	**211** **(0.53)**	**164** **(0.41)**	**297** **(0.75)**	**108** **(0.27)**

Table 16. (con't)

Release year			1991		
Release Site	Touchet R.	Touchet R.	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)	108 (0.18)	0	26 (0.06)	44 (0.11)
Mid-Col. Sport	0	54 (0.09)	0	3 (0.01)	9 (0.02)
Zone 6 Net	91 (0.15)	221 (0.37)	10 (0.02)	68 (0.17)	96 (0.24)
L. Ferry Ladder	173 (0.29)	398 (0.66)	12 (0.03)	53 (0.13)	42 (0.11)
Snake. R. Sport	72 (0.12)	227 (0.38)	34 (0.08)	49 (0.12)	72 (0.18)
Tucannon Sport	18 (0.03)	25 (0.04)	24 (0.06)	58 (0.14)	67 (0.17)
W. Walla Sport	0	16 (0.03)	0	0	0
Touchet Sport	54 (0.09)	82 (0.14)	0	0	3 (0.008)
Idaho Sport	67 (0.11)	80 (0.13)	42 (0.10)	31 (0.08)	99 (0.25)
Ocean Harvest	0	3 (0.005)	0	0	1 (0.002)
LSRCP Total	**384** **(0.64)**	**828** **(1.38)**	**112** **(0.28)**	**191** **(0.48)**	**283** **(0.71)**
Grand Totals	**494** **(0.82)**	**1,214** **(2.02)**	**122** **(0.31)**	**288** **(0.72)**	**433** **(1.09)**

Table 17. Returns of 1990 release Lyons Ferry Hatchery steelhead to locations in the Columbia River basin, for run years 1991 and 92 (% smolt to adult survival).

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	10 (.026)	47 (.12)	39 (.10)	13 (.03)	75 (.19)	7 (.02)
Mid-Col. Sport	10 (.026)	42 (.11)	0	6 (.015)	28 (.07)	14 (.04)
Zone 6 Net	125 (.32)	113 (.29)	143 (.36)	135 (.34)	246 (.62)	109 (.28)
L. Ferry Ladder	80 (.21)	60 (.15)	27 (.07)	3 (.008)	53 (.13)	27 (.07)
Snake. R. Sport	199 (.52)	107 (.28)	42 (.11)	34 (.085)	98 (.25)	0
Tucannon Sport	0	2 (.005)	0	0	0	0
W. Walla Sport	0	0	16 (.04)	0	0	21 (.05)
Touchet Sport	0	18 (.05)	2 (.005)	2 (.005)	0	2 (.005)
Dworshak NFH	1 (.003)	0	1 (.003)	1 (.003)	0	0
Idaho Sport	84 (.22)	13 (.03)	46 (.12)	29 (.07)	72 (.18)	0
Quinault R. Net	0	1 (.003)	0	0	0	0
Ocean Harvest	9 (.02)	0	13 (.03)	16 (.04)	8 (.18)	0
LSRCP Total	**364** **(.945)**	**200** **(.514)**	**134** **(.338)**	**69** **(.172)**	**223** **(.561)**	**50** **(.127)**
Grand Totals	**518** **(1.345)**	**403** **(1.04)**	**329** **(.831)**	**239** **(.597)**	**580** **(1.46)**	**180** **(.458)**

A broader look at the information provided in Tables 16 and 17 points to some interesting differences in contribution of different stocks and release strategies of fish to various locations. Fish released into the Tucannon River in 1991 after being acclimated in the Curl Lake AP survived to the LSRCP area, and to the entire Columbia River basin, at a substantially lower percentage than for the 1991 direct Tucannon River release (Table 9). The 1991 direct river release at Marengo also survived and contributed to fisheries at a higher percentage than for the direct release near Curl Lake. While this is the first adult returns from this three way release strategy comparison, the results are interesting. 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. A final assessment of the different release strategies will have to wait until all adult returns when completed for the study in 1995. Another interesting result was the difference in returning adults from the Touchet River releases for two different sizes of smolt. The larger (3.8 fish/lb) smolts survived to adults at a much higher percentage than smaller (5.3 fish/lb) smolts. Returns of two-ocean age adults in 1993 will determine whether the survival difference is real or simply a difference in age at return.

All of the marked fish contributed to fisheries outside of the LSRCP area and large numbers of each group migrated above Lower Granite Dam on the Snake River (Table 9). Touchet River fish had a relatively high smolt to adult return despite a concern that we have had over the high percentage of residualism of juvenile fish in that river (Viola and Schuck, 1992, Martin et al. 1993).

We estimate that releases of LSRCP steelhead smolts into S.E. Washington streams during the years 1990-1991 returned 10,605 adult steelhead to the LSRCP area of the Snake River Basin during the 1992 run year. This return represents 228% of the goal established for Washington's steelhead. We believe this to be a conservative estimate that doesn't fully account for spawning escapement into all tributaries, but is within reasonable limits of actual escapement. The estimate is derived from 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 group and estimates of escapement to spawning areas for the rivers.

Adult steelhead returns to spawning grounds

Appendix F presents a summary of our results from the 1993 spawning ground surveys. Average redds per mile increased on the South Fork Asotin Creek in 1992 as compared to the previous year. While average redds per mile increased only slightly on the North Fork Asotin Creek in 1993 as compared to 1992. Persistent flood conditions precluded an estimate of redds/mile on the Tucannon River in 1993. A detailed discussion of spawning activity is included in the section concerning trends in naturally produced juvenile steelhead density, population size and spawning activity 1983-1993.

Trends in naturally produced juvenile steelhead density, population size and spawning activity, 1983-1993.

Densities and population sizes of naturally produced juvenile steelhead in Asotin Creek, and the Touchet and Tucannon rivers are presented in Figures 2-7. A complete description of sites sampled for juvenile population densities is provided in Appendix G. Spawning activity measured in redds/mile, on the rivers mentioned above, is presented in Figures 8-10 (years presented are when hydraulic conditions allowed a reliable survey to be conducted). Only results from 1993 as compared to 1992 will be discussed. A detailed discussion of results from years prior to 1992 can be found in Schuck et. al. (1991,1993) and Viola et. al. (1991).

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 in turn 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 generally result in substantial obstructions to spawning and rearing success and thus cause substantial changes in densities and population sizes.

North Fork Asotin Creek

In 1993 both the density and population size of naturally produced 0 aged steelhead declined substantially from 1992 levels. Both the density and population size of steelhead greater than zero (>0) aged increased from 1992 levels (Figure 2). In 1993 spawning activity increased slightly as compared to 1992 (Figure 8).

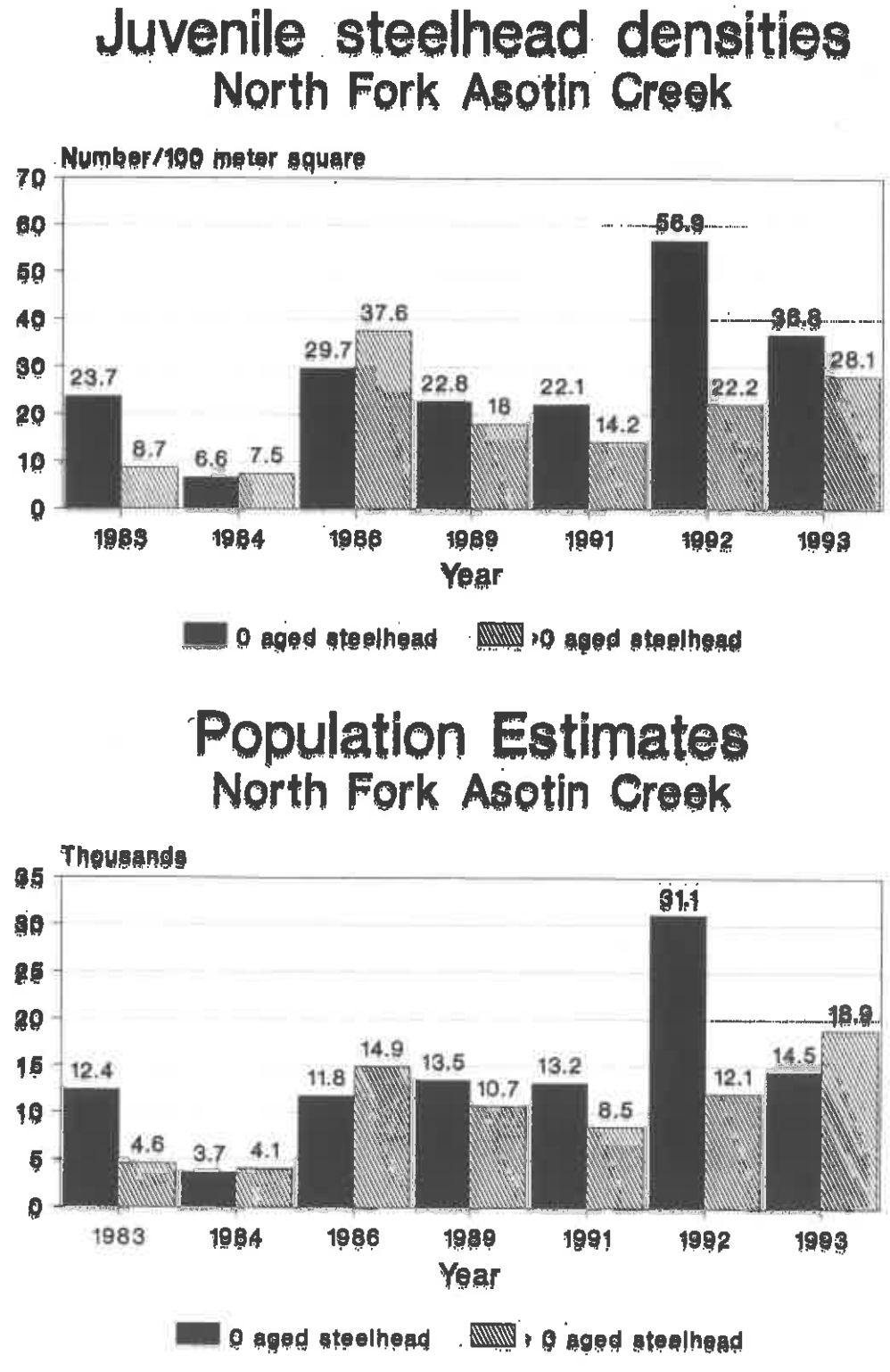

Figure 2. Juvenile steelhead densities and population estimates, North Fork of Asotin Creek 1983-93.

Redds per mile increased in 1993 as compared to 1992. The decline in numbers of 0 aged steelhead present in 1993 as compared to 1992 therefore, was most likely due to redd destruction and unfavorable rearing conditions that resulted from the very high flows in the spring of 1993. Older aged steelhead increased in number as compared to the previous year suggesting that older fish were not adversely affected by high flows.

South Fork Asotin Creek

Density and population size increased for all ages of naturally produced juvenile steelhead in the South Fork Asotin Creek in 1993 as compared to the previous year (Figure 3). Spawning activity more than doubled in 1993 as compared to levels found in 1992 (Figure 8).

Increased densities and population sizes of 0 aged steelhead are a result of an increase in spawning activity in 1993 as compared to 1992. The South Fork Asotin Creek is very small relative to other waters mentioned in this report. Water flows, even in a year of high run off, were not substantial enough in this creek to destroy redds or steelhead fry and decrease abundance of naturally produced young-of-the-year steelhead. Also, older aged juvenile steelhead were not adversely affected by water flows in the spring of 1993; their numbers increased indicating good rearing conditions and survival of last years 0 aged steelhead.

Tucannon River

In 1993 both density and population size of 0 aged naturally produced steelhead decreased as compared to the previous year (Figure 4). The density and population size of >0 aged juvenile steelhead increased slightly in 1993 as compared to 1992 (Figure 4).

An estimate of spawning activity was precluded in the spring of 1993 by extremely high and persistent water flows (Figure 10). Due to the lack of spawning ground information we were unable to determine if the decline in numbers of young-of-the-year steelhead was due to reduced spawning activity, high spring flows or both. However, during our spawning ground survey efforts we observed redds that were destroyed by the high flows. This appears to indicate that at least some of the decline in numbers of 0 aged fish was a result of the high spring river flows. Older aged juvenile steelhead were not as adversely affected by water flows in the spring of

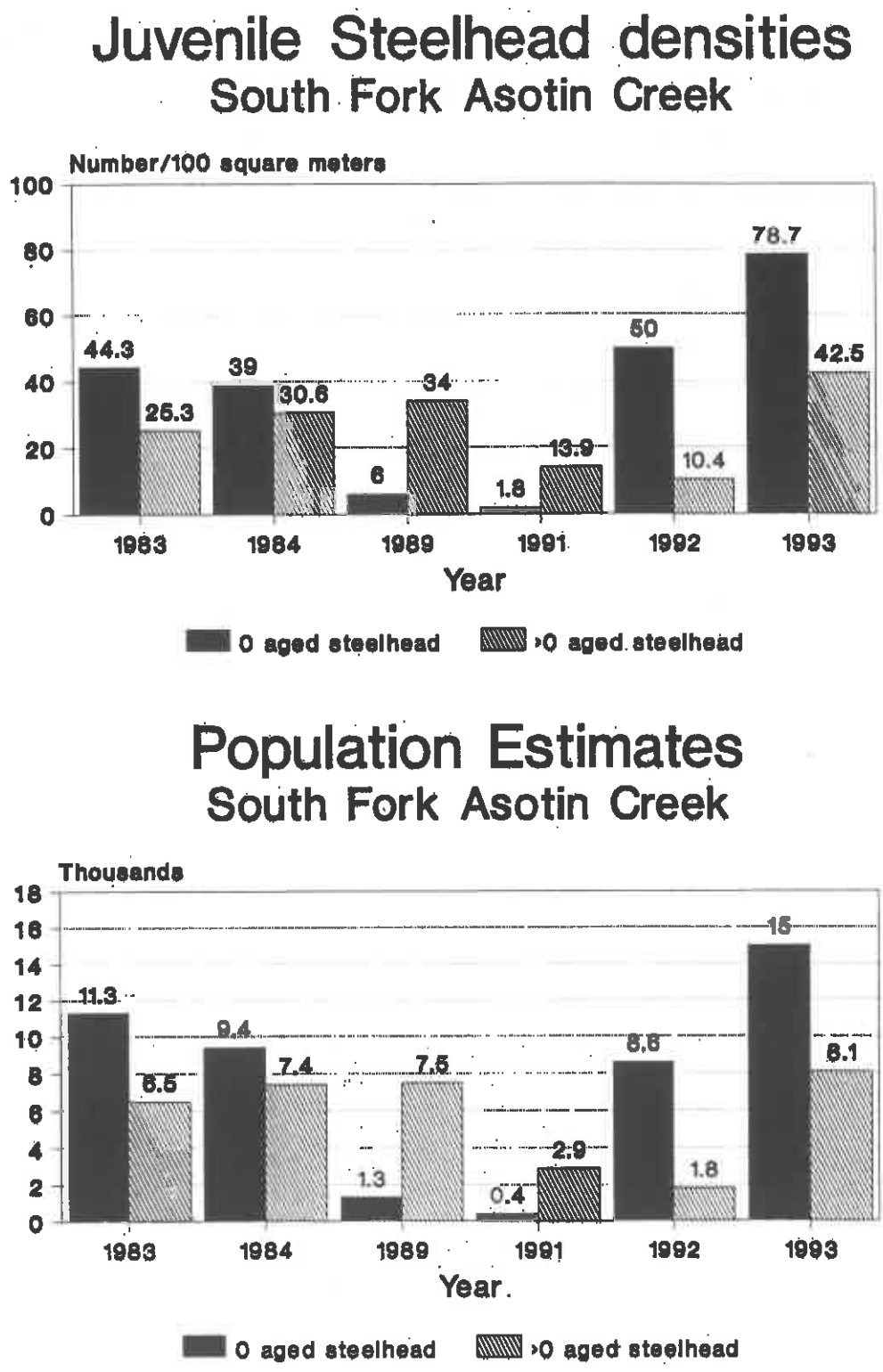

Figure 3. Juvenile steelhead densities and population estimates, South Fork Asotin Creek 1983-1993

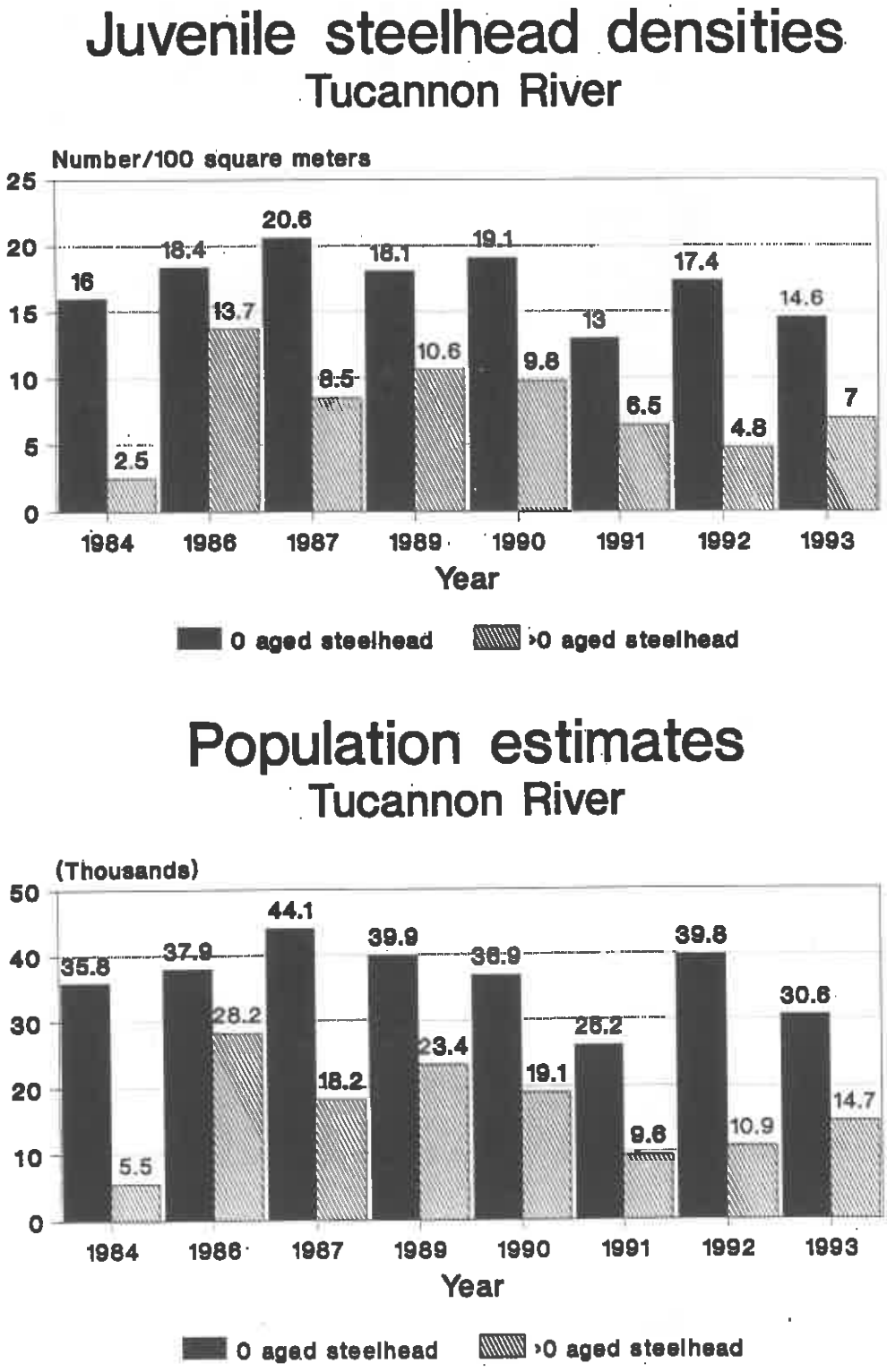

Figure 4. Juvenile steelhead densities and population estimates, Tucannon River 1984-1993.

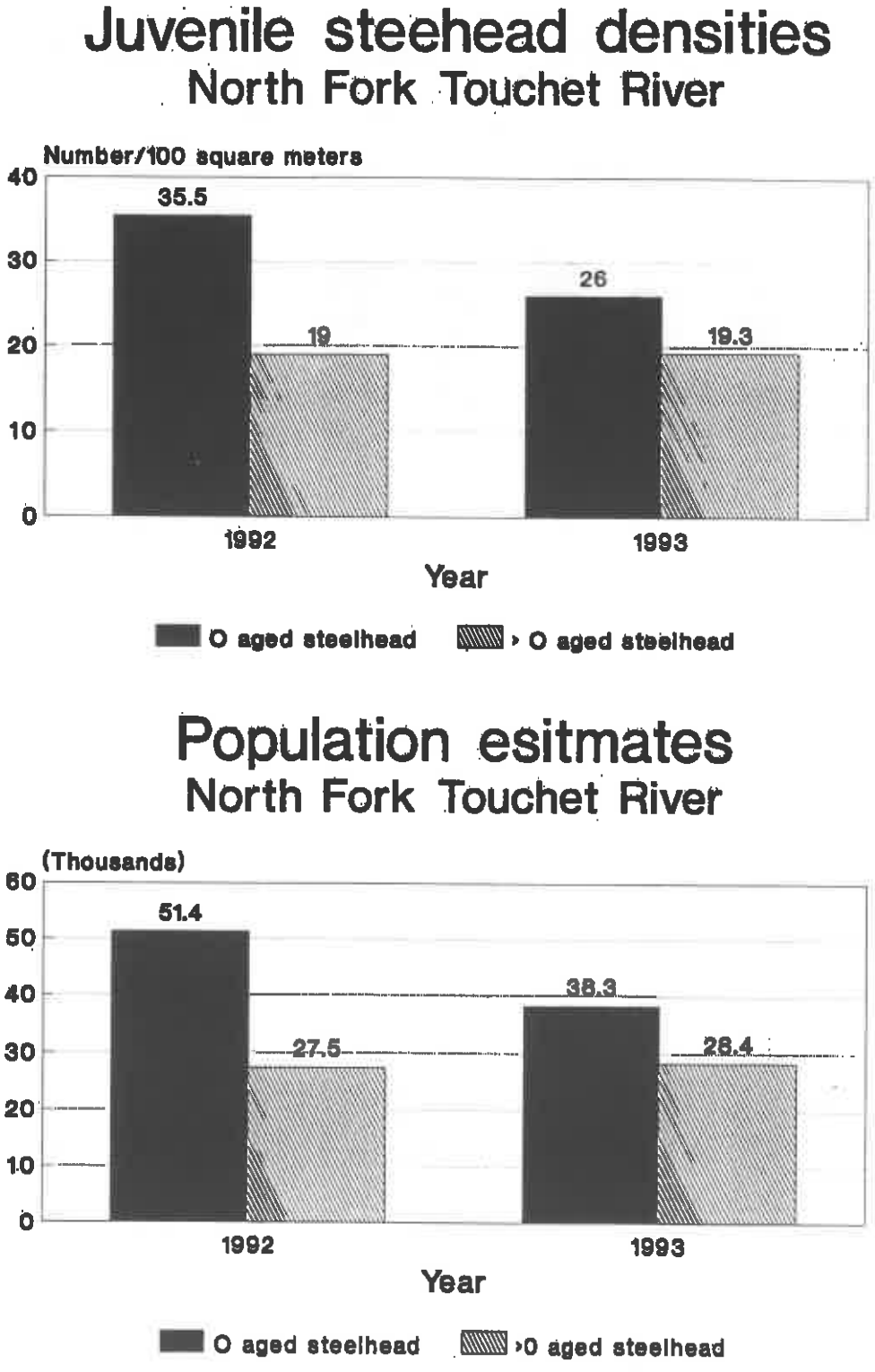

Figure 5. Juvenile steelhead densities and population estimates, North Fork Touchet River 1992-1993.

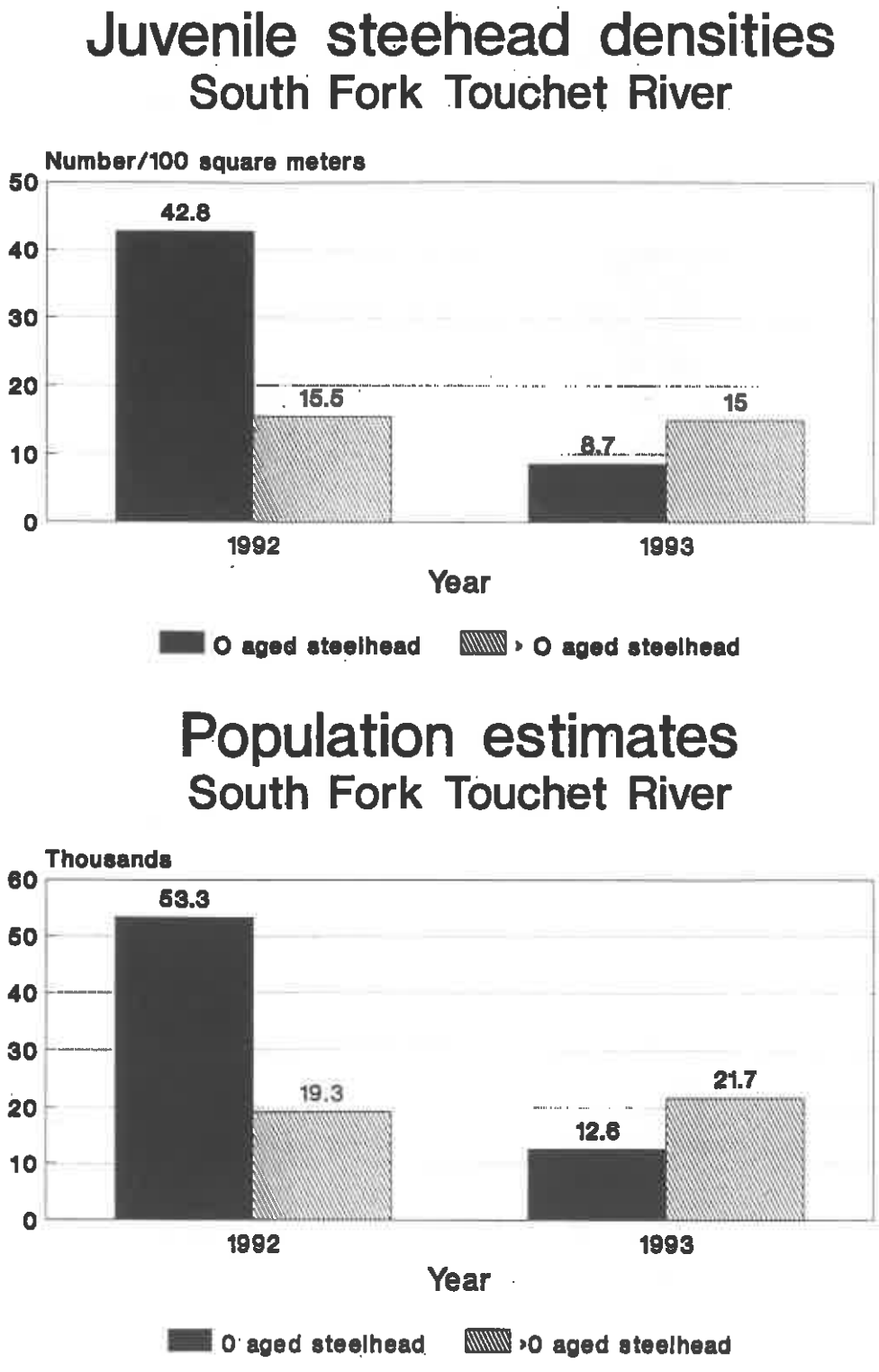

Figure 6. Juvenile steelhead densities and population estimates, South Fork Touchet River 1992-1993.

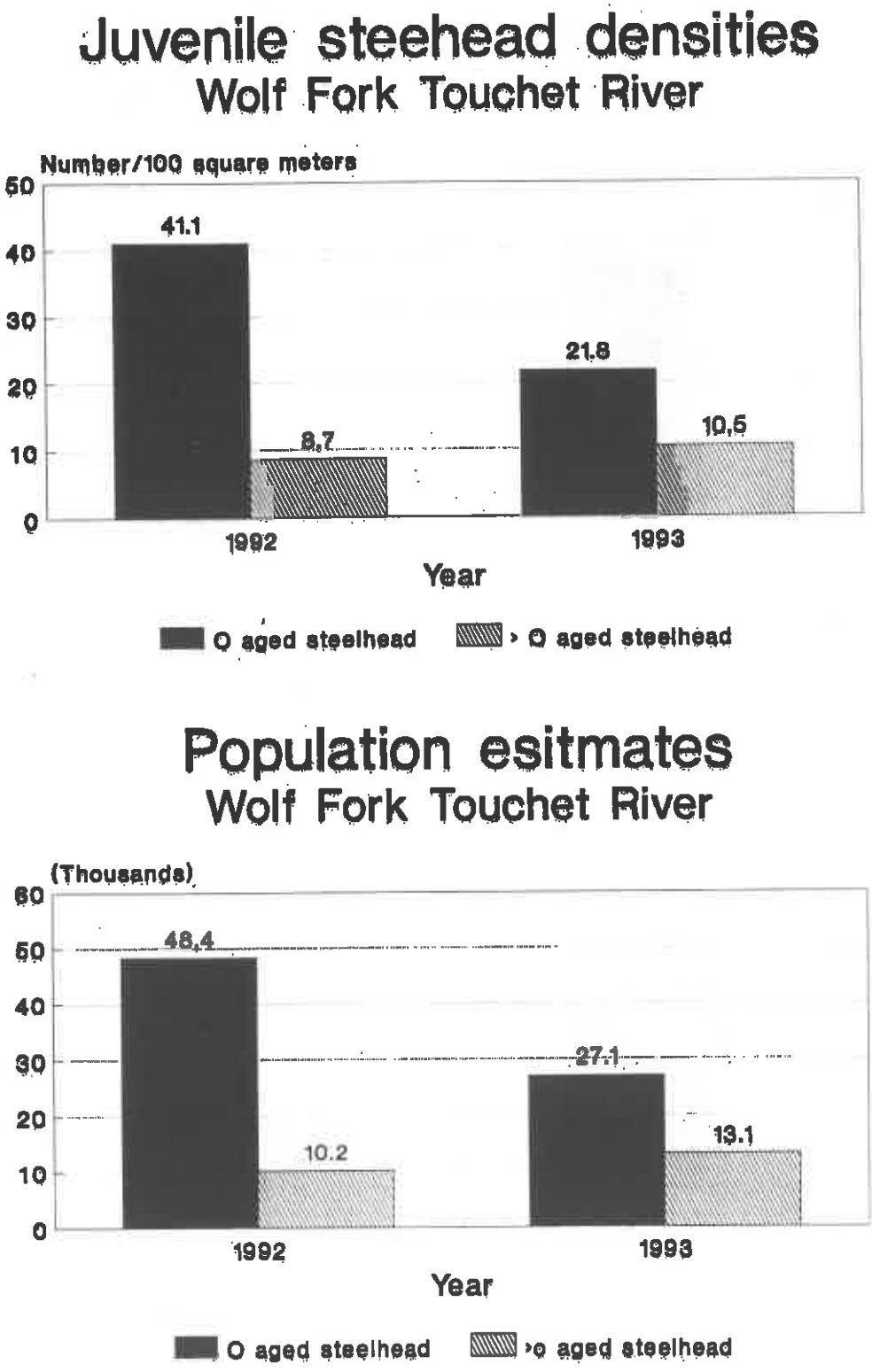

Figure 7. Juvenile steelhead densities and population estimates, Wolf Fork Touchet River 1992-1993.

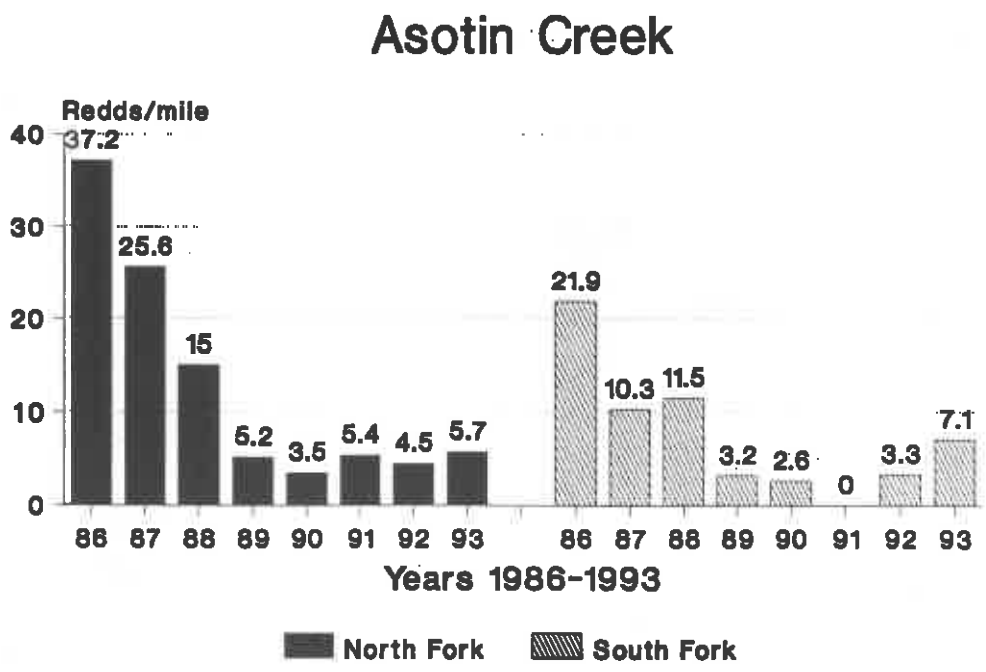

Figure 8. Spawning escapement for Asotin Creek, 1986-1993.

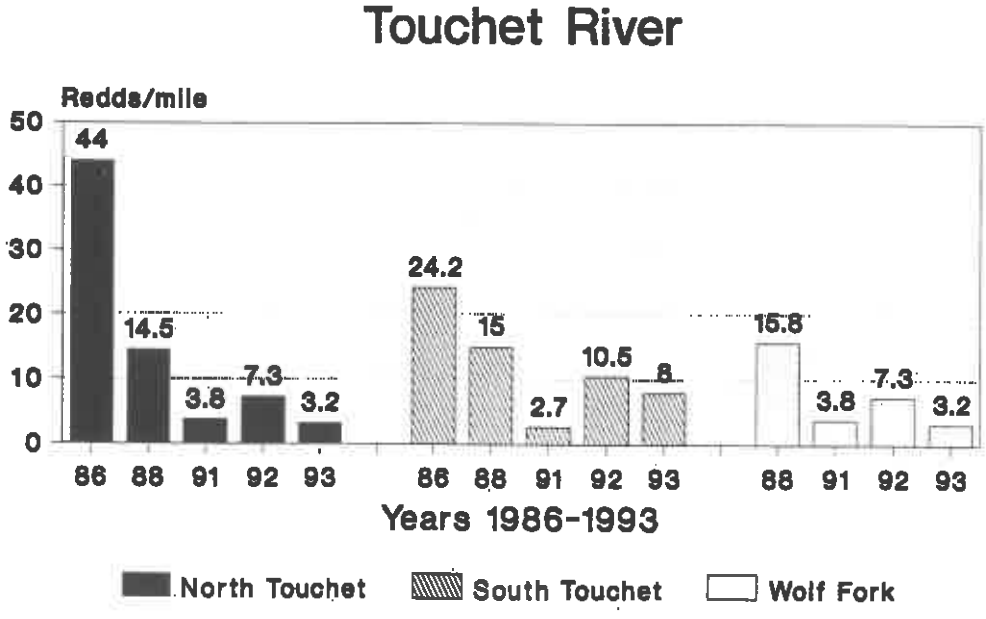

Figure 9. Spawning escapement for the Touchet River, 1986-1993.

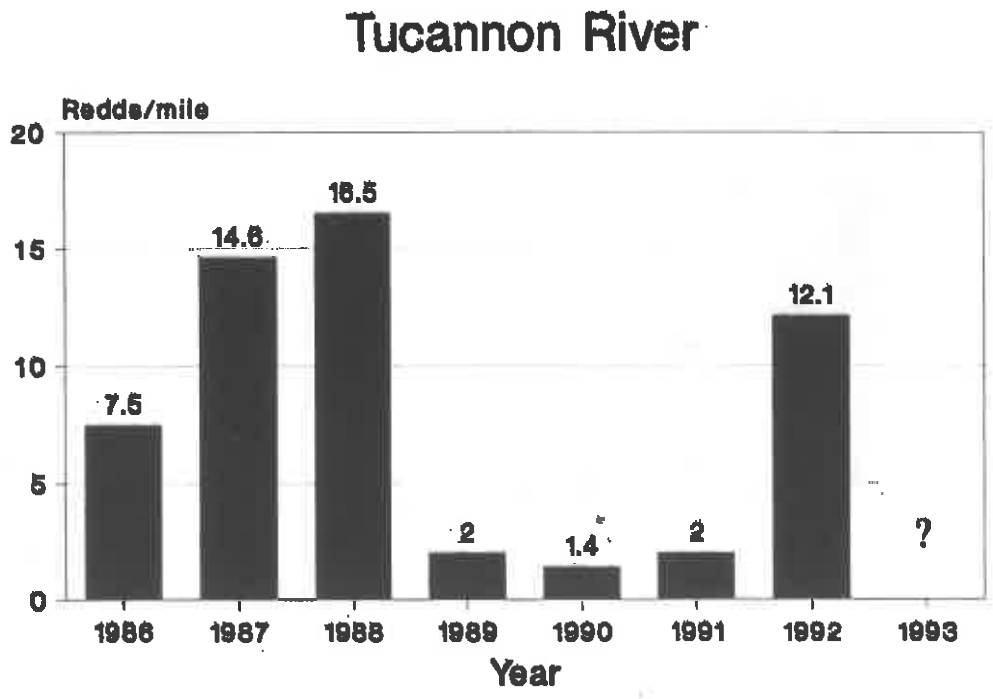

Figure 10. Spawning escapement for the Tucannon River, 1986-1993.

1993; their numbers increased indicating stable rearing and survival conditions for last years 0 aged steelhead.

Touchet River

Both density and population size of 0 aged naturally produced steelhead decreased in 1993 as compared to the previous year (Figures 5-7). The density and population size of >0 aged juvenile steelhead increased slightly in 1993 as compared to 1992 (Figures 5-7). Redds per mile declined substantially in 1993 as compared to 1992 (Figure 9).

Decreases in numbers of young-of-the-year steelhead were likely due to both decreased spawning activity and destruction of redds by the very high water flows that occurred in the spring of 1993. We observed redds constructed during high river flows that were left dry three weeks later when the water flows receded. As on other rivers the older aged juvenile steelhead were able to withstand the affects of the high spring flows, their numbers increased indicating stable rearing and survival conditions for last years 0 aged steelhead.

Catchable trout program

Production of legal or catchable size rainbow trout at the Lyons Ferry/Tucannon complex totaled 271,052 fish weighing 108,956 pounds in 1992-93. The average weight for catchable trout was 2.5 fish per pound for fish released in spring 1993. Appendix H provides a listing of 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. In addition, 154,283 rainbow trout fry weighing 4,680 pounds and 57,280 fingerlings weighing 3,744 pounds were reared for Idaho's LSRCP program in 1992. This production level represented 137% of the program goal.

CONCLUSIONS

The 1992 production year was plagued with problems similar to 1991. Outbreaks of IHNV at the hatchery severely reduced the number of LFH brood steelhead to rear. These occurrences have not been an annual event and managing the production around such unexpected losses is difficult. Unlike the 1991 production year it was decided that fish from Idaho would be used to refill all available production space at LFH. Hells Canyon strain of A-run steelhead were reared and released. To ensure that these fish would not add to the brood stock pool for LFH in future years, an additional right ventral fin clip was added.

Our work to assess and characterize steelhead smolt residualism continues to be very informative. Results from the 1993 spring release were similar to those observed in 1992. An attempt to "manage" Curl Lake AP in 1993 to retain potential residual juveniles in the pond was successful. We retained over 15,000 juvenile steelhead in the pond which were nearly 80% male and 90% parr, transitional or precocious male in visable external development. The performance of tag groups within the pond, measured as survival to McNary Dam, equalled or exceeded the performance of groups released directly into the river. Based on these results, we believe that managing the acclimation ponds to retain potentially residual juveniles may significantly reduce the presence of these fish within the river and their potential impact on wild salmonid populations without affecting the number of returning adults. We shall continue to investigate pond management as part of our release strategy.

Adult returns continue to contribute strongly to fisheries throughout the Columbia and Snake rivers basins. Sport and treaty Indian harvest and escapement to LFH and to above Lower Granite Dam continue to represent the largest components of returning adult CWT marked LFH study fish. Behaviors persist in these returning fish, however, that are undesirable. The Tucannon River releases of fish generally perform poorly (smolt to adult survival percentages) when compared to releases from other rivers. Overall returns are consistently lower than for any other group and they pass Lower Granite Dam at a higher relative rate than for other groups. We believe this long term behavior is an indication of poor stock suitability, although severe environmental conditions (such as drought) may also be a strong determinant factor in

adult behavior. Efforts to develop a broodstock from wild Tucannon steelhead continue. If these efforts are successful, we propose converting entirely to that stock for the mitigation production. This stock may also have beneficial long term effects on the wild steelhead population in the river.

Wandering problems occur with both the Walla Walla and Touchet Rivers releases that are similar to the behavior of Tucannon River released fish, however the problem is not so clearly understood. A near absence of flowing water at the mouth of the Walla Walla during the late summer and fall may prevent adult steelhead from finding their natal river. Under these circumstances, assessing stock behavior is complicated and inconsistent from year to year. The increasing concern over wild stock management in all streams calls for a review of our stock selection for the Walla Walla/ Touchet system. Our trap on the Touchet River at Dayton in 1992-93 was successful despite the highest river flows in recent years that severely damaged the structure. We will alter the trap for the 1993-94 season and continue trapping efforts.

We exceeded our goal for returning adult steelhead. We estimate that 10,605 adult steelhead returned to the LSRCP area during the 1992 run year that were the result of production at LFH. Considerably more fish actually returned to the Columbia River Basin that were harvested in fisheries.

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Appendix A. Steelhead trapped at Tucannon Hatchery weir, Spring 1993.

Date	Wild/Hatchery	Sex	Length	Comments
02/08/93	H	M	58.0	PASSED
02/22/93	H	F	58.0	PASSED
03/01/93	H	M	56.0	PASSED
03/09/93	H	F	66.0	PASSED
03/09/93	W	F	74.0	COLLECTED
03/09/93	W	F	71.0	PASSED
03/09/93	H	M	61.0	PASSED
03/16/93	W	F	76.0	PASSED
03/16/93	W	F	68.5	COLLECTED
03/16/93	W	M	61.0	PASSED
03/16/93	W	M	76.0	PASSED
03/16/93	H	M	76.0	PASSED
03/16/93	H	F	56.0	PASSED
03/16/93	H	M	61.0	PASSED
03/16/93	H	M	66.0	PASSED
03/18/93	H	M	79.0	PASSED
03/18/93	H	M	68.5	PASSED
03/18/93	H	M	58.5	PASSED
03/18/93	H	M	79.0	PASSED
03/18/93	H	M	56.0	PASSED
03/18/93	H	F	56.0	PASSED
03/18/93	W	F	71.0	COLLECTED
03/18/93	W	F	63.5	PASSED
03/18/93	W	F	66.0	PASSED
03/22/93	H	M	56.0	PASSED
03/22/93	H	M	51.0	PASSED
03/22/93	H	F	56.0	PASSED
03/22/93	H	?	51.0	PASSED
03/22/93	W	M	63.5	COLLECTED
03/29/93	H	M	56.0	PASSED
03/29/93	W	F	58.5	PASSED
03/29/93	W	F	61.0	COLLECTED
03/29/93	W	M	53.5	PASSED
03/29/93	H	M	51.0	PASSED
03/29/93	H	M	63.5	PASSED
03/29/93	H	F	61.0	PASSED
03/29/93	H	M	56.0	PASSED
03/29/93	H	M	56.0	PASSED
03/29/93	H	F	53.5	PASSED
03/29/93	H	F	53.5	PASSED

Appendix D. (con't.)

Date	Wild/Hatchery	Sex	Length	Comments
03/29/93	H	M	53.5	PASSED
03/29/93	H	M	51.0	PASSED
03/29/93	H	M	51.0	PASSED
03/30/93	H	M	53.5	PASSED
03/30/93	H	F	51.0	PASSED
03/30/93	W	F	66.0	COLLECTED
03/30/93	W	F	63.5	PASSED
03/30/93	H	?	56.0	PASSED
03/31/93	H	M	63.5	PASSED
03/31/93	H	M	53.5	PASSED
03/31/93	W	M	51.0	COLLECTED
03/31/93	W	M	53.5	PASSED
03/31/93	H	M	68.5	PASSED
04/02/93	H	F	61.0	PASSED
04/02/93	H	M	51.0	PASSED
04/02/93	H	M	53.5	PASSED
04/02/93	H	M	63.5	PASSED
04/02/93	H	M	53.5	PASSED
04/02/93	H	M	56.0	PASSED
04/02/93	H	F	58.5	PASSED
04/02/93	W	M	71.0	COLLECTED
04/02/93	W	F	66.0	COLLECTED
04/02/93	H	M	53.5	PASSED
04/02/93	H	F	48.0	PASSED
04/02/93	H	M	53.5	PASSED
04/02/93	H	F	61.0	PASSED
04/02/93	H	F	63.5	PASSED
04/02/93	H	F	53.5	PASSED
04/02/93	H	M	51.0	PASSED
04/02/93	H	M	51.0	PASSED
04/02/93	H	M	58.5	PASSED
04/02/93	H	F	61.0	PASSED
04/05/93	H	F	53.5	PASSED
04/05/93	H	F	63.5	PASSED
04/05/93	H	F	56.0	PASSED
04/05/93	H	F	66.0	PASSED
04/05/93	H	M	51.0	PASSED
04/05/93	W	M	51.0	COLLECTED
04/06/93	H	F	56.0	PASSED
04/06/93	H	F	66.0	PASSED

Appendix D. (con't.)

Date	Wild/Hatchery	Sex	Length	Comments
04/06/93	H	M	53.5	PASSED
04/08/93	H	F	66.0	PASSED
04/08/93	H	F	51.0	PASSED
04/08/93	H	F	56.0	PASSED
04/08/93	H	F	58.5	PASSED
04/08/93	H	F	66.0	PASSED
04/08/93	H	F	56.0	PASSED
04/08/93	H	M	66.0	PASSED
04/08/93	H	F	61.0	PASSED
04/08/93	H	F	66.0	PASSED
04/08/93	H	M	68.5	PASSED
04/08/93	H	F	51.0	PASSED
04/08/93	H	F	61.0	PASSED
04/08/93	H	M	56.0	PASSED
04/08/93	H	F	53.5	PASSED
04/08/93	H	F	63.5	PASSED
04/08/93	H	M	61.0	PASSED
04/09/93	H	F	56.0	PASSED
04/09/93	H	F	53.5	PASSED
04/09/93	H	F	68.5	PASSED
04/09/93	W	M	63.5	COLLECTED
04/09/93	H	F	56.0	PASSED
04/09/93	H	F	61.0	PASSED
04/09/93	H	F	63.5	PASSED
04/09/93	H	M	56.0	PASSED
04/09/93	W	M	53.5	PASSED
04/09/93	H	F	53.5	PASSED
04/09/93	H	M	53.5	PASSED
04/09/93	H	M	76.0	PASSED
04/09/93	H	M	56.0	PASSED
04/09/93	H	M	58.5	PASSED
04/09/93	H	F	53.5	PASSED
04/09/93	W	M	66.0	COLLECTED
04/09/93	W	F	66.0	COLLECTED
04/13/93	W	F	61.0	PASSED
04/13/93	H	F	56.0	PASSED
04/13/93	H	F	66.0	PASSED
04/13/93	H	F	61.0	PASSED
04/13/93	H	F	56.0	PASSED
04/14/93	W	F	53.5	PASSED

Appendix D. (con't.)

Date	Wild/Hatchery	Sex	Length	Comments
04/14/93	W	F	51.0	COLLECTED
04/14/93	H	F	53.5	PASSED
04/14/93	H	F	66.0	PASSED
04/14/93	H	M	63.5	PASSED
04/14/93	H	F	61.0	PASSED
04/14/93	H	M	76.0	PASSED
04/14/93	H	F	63.5	PASSED
04/17/93	W	M	63.5	COLLECTED
04/17/93	H	F	53.5	PASSED
04/17/93	H	F	53.5	PASSED
04/17/93	H	M	53.5	PASSED
04/17/93	H	F	56.0	PASSED
04/17/93	H	M	56.0	PASSED
04/20/93	H	F	51.0	PASSED
04/20/93	H	M	56.0	PASSED
04/20/93	H	F	63.5	PASSED
04/21/93	W	F	58.5	PASSED
04/21/93	W	M	58.5	PASSED
04/21/93	W	F	61.0	COLLECTED
04/21/93	W	F	58.5	COLLECTED
04/21/93	W	F	61.0	PASSED
04/21/93	W	F	51.0	PASSED
04/21/93	H	F	58.5	PASSED
04/21/93	H	M	51.0	PASSED
04/21/93	H	F	61.0	PASSED
04/22/93	W	M	53.5	COLLECTED
04/22/93	H	F	61.0	PASSED
04/22/93	H	F	51.0	PASSED
04/22/93	H	F	56.0	PASSED
04/22/93	H	M	56.0	PASSED
04/22/93	H	F	56.0	PASSED
04/26/93	W	F	58.5	PASSED
04/26/93	W	F	56.0	PASSED
04/26/93	W	F	61.0	COLLECTED
04/26/93	W	M	53.5	COLLECTED
04/26/93	H	F	56.0	PASSED
04/26/93	H	F	53.5	PASSED
05/14/93	H	M	56.0	PASSED

Appendix B . Touchet River adult steelhead fish trap data, 1993.

Date	Hatchery/Wild	Sex	Length	Comments
03/18	W	F	67.0	
03/18	W	M	62.0	
03/22	W	F	69.7	
03/23	W	F	66.0	
03/23	W	F	71.0	Died in trap
03/24	H	F	65.5	
03/24	W	F	64.0	
03/25	H	F	70.0	Died in trap
03/26	W	M	66.0	
03/27	W	F	66.0	
03/27	H	F	69.0	
03/31	W	F	62.5	
03/31	W	F	72.0	Died in trap
04/02	H	F	67.0	
04/02	H	F	71.5	
04/02	W	F	55.0	
04/03	W	M	58.0	
04/03	W	M	57.5	
04/03	W	M	67.5	
04/03	W	F	59.0	
04/03	W	M	59.0	
04/03	W	M	63.0	
04/03	W	M	58.5	
04/03	W	F	65.0	
04/04	W	F	68.0	Died in trap
04/04	W	F		Recapture
04/04	W	M	79.5	
04/04	W	M	69.5	
04/04	W	F	70.5	
04/06	W	F	70.0	
04/06	W	F	58.0	
04/07	W	M	58.0	
04/07	W	F	67.0	
04/07	W	F	65.5	
04/07	W	M	56.5	
04/07	H	M	74.5	
04/08	W	F	56.0	
04/08	W	F	58.0	

Appendix B (con't.)

Date	Hatchery/Wild	Sex	Length	Comments
04/08	W	F	57.5	
04/08	W	F	59.5	
04/08	H	M	61.5	
04/08	W	M	58.0	Died in trap
04/09	H	F	70.5	
04/12	W	M		Recapture
04/12	W	F	53.5	
04/12	W	M	60.5	
04/12	W	F	51.5	
04/12	W	F		Recapture
04/12	W	M	60.0	
04/12	W	F	72.0	
04/12	W	M	64.0	
04/12	W	F		Recapture
04/12	W	F	70.0	
04/12	W	F	66.5	
04/12	W	F	57.0	
04/12	W	M	50.5	
04/12	W	F	57.0	
04/12	W	F	66.5	
04/14	W	F	57.0	
04/19	W	F	64.5	
04/19	W	F	58.5	
04/19	W	F	54.5	
04/19	W	F	68.5	
04/20	W	F	70.0	

Appendix C : Brand and tag recoveries from the trap at LFH during the 1992 run year .

Brand	Stock	Release Year	Actual Tag Return
LA-IC-3	PAHSIM	1990	15
RA-IC-3	PAHSIM		12
RA-S-2	WEL/SKA		8
LA-S-2	WEL/SKA		4
LA-IC-4	PAHSIM		11
RA-IC-4	PAHSIM		9
LA-S-1	WEL/SKA		10
RA-S-1	WEL/SKA		11
LA-IC-1	PAHSIM		10
RA-IC-1	PAHSIM		7
LA-IC-2	PAHSIM		1
RA-IC-2	PAHSIM		2
Total			**100**
RA-IT-1	LFH	1991	68
LA-IT-1	LFH		57
RA-IT-3	LFH		48
LA-IJ-1	LFH		119
LA-IJ-3	LFH		136
RA-IJ-1	LFH		143
RA-H-1	LFH		23
LA-H-1	LFH		19
RA-H-2	LFH		38
LA-H-2	LFH		15
RA-7-1	LFH		12
RA-7-3	LFH		0
Total			**678**
RA-IY-1	LFH	1992	1
Total			**1**
AD clipped only			2654
Unreadable brands			76
Wild			34

Appendix D. Coded wire tag expansions, Snake River, fall 1992 and spring 1993.

Zone	Sept	Oct	Nov	Dec	Jan	Feb	Mar	CWT	Tags Rec.	Expanded[A] Harv.
			Sample Rate[B]							
228	(0)	(.096)	(.075)	(.052)	---	---	---			
Above			1					63/08/41	1	13
Clarkston		1		1				63/14/21	2	30
		1						63/14/22	1	10
		2						63/14/49	2	21
		1						63/14/50	1	10
			1					63/14/55	1	13
		1						63/14/56	1	10
			1					63/39/08	1	13
				1				63/40/58	1	19
		1						63/40/59	1	10
		1		1				07/51/20	2	30
		1						07/51/21	1	10
		1						07/51/23	1	10
			1					07/53/51	1	13
		1						07/53/52	1	10
			1					07/53/54	1	13
		1	1					07/53/59	2	24
		3						07/53/60	3	31
		1		1				07/54/44	2	30
		10	3					No tag	13	144.

Zone	Sept	Oct	Nov	Dec	Jan	Feb	Mar	CWT	Tags Rec.	Expanded[A] Harv.
			Sample Rate[B]							
168	(.099)	(.111)	(.031)	(.066)	---	(.014)	(0)			
Above Lower Granite Dam										
	1							63/08/42	1	10
		1				1		63/14/21	2	80
		1						63/14/22	1	9
	1		1					63/14/47	2	42
		1						63/14/49	1	10
	1							63/14/50	1	1
	1							63/14/55	1	10
		1						63/39/07	1	9
	1							63/39/08	1	10

Appendix D. (cont.)

Zone	Sept	Oct	Nov	Dec	Jan	Feb	Mar	CWT	Tags Rec.	Expanded[A] Harv.
				Sample Rate[B]						
168 Above Lower Granite Dam	(.099)	(.111)	(.031)	(.066)	---	(.014)	(0)			
	1	1		1				63/40/59	3	34
		1						63/40/61	1	9
		1						05/20/44	1	9
				1				05/20/45	1	15
		1						05/20/48	1	9
		1						07/33/51	1	9
				1				07/51/21	1	15
		1						07/53/52	1	9
		1						07/53/57	1	9
	5	3	1					No tag	9	110.

Zone	Sept	Oct	Nov	Dec	Jan	Feb	Mar	CWT	Tags Rec.	Expanded[A] Harv.
				Sample Rate[B]						
167 Above Little Goose Dam	(.085)	(.221)	(.328)	(.253)	(.209)	(.190)	(.138)			
			1					63/08/38	1	3
	1	1		1				63/14/21	3	20
							1	63/14/44	1	7
							1	63/14/55	1	7
		1						63/14/56	1	5
					1			63/39/08	1	5
				1				63/39/09	1	4
				1				63/39/10	1	4
	1	4			2			63/40/58	7	39
		1	1					63/40/59	2	8
		1			1			63/40/60	2	9
			1		3			63/40/61	4	17
			2					63/40/62	2	6
		1						07/53/51	1	5
					1			07/53/58	1	5
		2			1	1		No tag	4	19

Appendix D. (cont.)

Zone	Sept	Oct	Nov	Dec	Jan	Feb	Mar	CWT	Tags Rec.	Expanded[A] Harv.
				Sample Rate[B]						
166	(.300)	(.259)	(.221)	(.218)	(.128)	(.021)	(.007)			
Below Little Goose Dam		1						63/08/42	1	4
			1					63/14/21	1	5
				1				63/14/44	1	5
	1	1		1				63/14/47	3	12
	2							63/14/50	2	7
		1						63/14/55	1	4
								63/14/56	1	5
		1						63/39/07	1	4
	1				1			63/39/09	2	11
	1	2	2		1			63/40/58	6	28
	1		1	2				63/40/59	4	17
	1			1				63/40/60	2	8
	1	1						63/40/61	2	7
	1	1						63/40/62	2	7
			1					63/50/53	1	5
		1						05/20/42	1	4
		1						05/20/44	1	4
		1						05/20/47	1	4
	1		1					05/20/48	2	8
	1							05/24/25	1	3
		1						05/24/28	1	4
			1					07/51/18	1	5
	1							07/51/21	1	3
		1						07/51/24	1	4
	1	1						07/35/53	1	7
			1					07/54/43	1	5
		1						07/56/60	1	4
		1						10/40/58	1	4
		1						10/40/59	1	4
							1	10/42/37	1	143.
		1						10/42/38	1	4
			1					10/43/16	1	5
		1						10/43/19	1	4
		1						10/43/29	1	4
	1							10/43/34	1	3

Appendix D. (cont.)

Zone	Sept	Oct	Nov	Dec	Jan	Feb	Mar	CWT	Tags Rec.	Expanded[A] Harv.
				Sample Rate[B]						
165 Below Lower Monumental Dam	(.090)	(.109)	(.110)	(.071)	(.161)	(0)	(0)			
					1			63/14/47	1	6
		1	1	1				63/14/56	3	32
		1						63/39/08	3	32
			1					63/39/09	1	9
	1							63/40/58	1	11
			1					63/40/59	1	9
		1						63/40/60	1	9
			1					05/20/45	1	9
			1					05/20/46	1	9
					1			07/54/44	1	6
				1				10/43/29	1	6
		1						10/43/31	1	9
	2	1			1			No tag	4	38

Zone	Sept	Oct	Nov	Dec	Jan	Feb	Mar	CWT	Tags Rec.	Expanded[A] Harv.
				Sample Rate[B]						
164 Below Ice Harbor Dam	(.035)	(.067)	(.016)	(0)	(0)	(0)	(0)			
		1						05/20/44	1	15
		1						10/42/33	1	15

A Est. harvest of tags based on monthly sample rates from the fishery.
B Sample rates used to expand individual CWT recoveries.

Appendix E. Coded-wire tag expansions for other rivers in S.E. Washington, fall 1992 and spring 1993.

Zone	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	CWT	Tags rec	Expanded harvest
185	--	--	--	--	(0)	(.167)	(.648)	(.270)			
Touchet R.							2		63/14/47	2	3
							1		63/08/41	1	2
							8	3	63/14/56	11	23
								2	63/39/07	2	7
							2	1	63/39/08	3	11
							1		63/39/10	1	2
							1		63/39/11	1	2
							7	1	63/40/58	8	15
							9	8	63/40/59	17	44
							6	2	63/40/60	8	17
							6	1	63/40/61	7	13
						1	1	1	63/40/62	3	24
						1			05/20/45	1	6
							1		05/20/49	1	2
189	(.036)	(.186)	(.487)	(.326)	(.143)	(.263)	(.063)	(0)			
Tucannon R.											
		2	4	1					63/14/44	7	46
		1	3	3					63/14/47	6	21
		3	1	2					63/14/49	6	24
			3	4			1		63/14/50	8	34
			1	1					63/14/52	2	5
		2	1	2					63/14/55	5	19
						1			63/14/56	1	4
			2	1	1				63/40/58	5	14
		1	1						63/40/59	2	7
		1	1	1		1			63/40/60	4	14
			1						63/40/61	1	2
			1						63/40/62	1	2
		1							05/20/48	1	5

Appendix E. (con't.)

Zone	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	CWT	Tags rec	Expanded harvest
194	---	---	---	(.138)	(.127)	(.105)	(.061)	(0)			
Walla Walla											
				1					63/39/10	1	7
							1		63/39/11	1	16
							1		63/40/58	1	16
75	(0)	(.024)	(.028)	(0)	---	---	---	---			
Grande Ronde											
River		2							07/53/59	2	83
		2							07/53/60	2	83
		1							07/54/43	1	42
		1	1						No tag	2	77
45											
McNary D.	(.030)	(.083)	(.052)	(.071)	(.077)	(.011)	(0)	--			
Columbia R											
		1							63/07/25	1	12
			2						63/39/07	2	38
				1					63/39/09	1	14
		1							63/40/58	1	12
		3							63/40/59	3	36
			1						05/20/47	1	19
		1	1						05/20/48	2	31
		1							05/20/49	1	12
				1					07/51/22	1	14
		1							07/52/12	1	12
		1							07/52/13	1	12
		3							07/52/14	3	36
			1						07/53/41	1	19
		1							07/53/42	1	12
		1							07/53/58	1	12
		1							10/40/58	1	12
		1							10/42/34	1	12
		1							10/43/17	1	12
		1							10/43/19	1	12
	1								10/43/24	1	33
			1						10/43/31	1	19
	1								10/43/40	1	19
		4	2						No tags	6	76

Appendix F. Spawning Ground Surveys 1993.

River	Date	Location	Miles	Redds/ Mile	Total Redds	Percent Increase
North Fork Asotin Creek	5/25	From the mouth upstream 6 miles	6	5.7^	34	no estimate
South Fork Asotin Creek	5/25	From the mouth upstream 7 miles	7	7.1*	50	50.0
Main Asotin Creek		From the confluence bridge downstream 1.3 miles to Charlie Creek	1.3	-----	-----	-----
Charlie Creek	5/25	From mouth upstream 7.7 miles	7.7	1.0	8	no estimate
South Fork Touchet River	5/19	From mouth upstream 15.7 miles	15.7	8.0*	126	87.5
North Fork Touchet River	5/24	From confluence upstream 11.1 miles	11.1	3.2*	36	76.5
Wolf Fork Touchet River	5/19	From the mouth upstream 10.3 miles	10.3	2.3*	24	57.2
Robinson Fork of Wolf Fork	5/20	From the mouth upstream 5.0 miles	5.0	0.4	2	no estimate
Cummings Creek		From the mouth upstream 7.0 miles	7.0	------	------	------
Upper Tucannon R.	5/26	From Sheep Creek to Panjab bridge	4.0	2.5^	10	no estimate
Middle Tucannon R.	4/27	From Panjab bridge downstream to Blind Grade	11.8	7.0^	82	no estimate
Lower Tucannon R.	4/27	From Blind Grade downstream to Highway 12	15.5	17.0^	264	no estimate
Panjab Creek		From the mouth upstream 3.4 miles	3.4	------	------	------

* : Adjusted to include redds eliminated by run off.
A : based on index surveys only.

Appendix G: Juvenile density sample sites on Southeast Washington streams, 1993.

Site name	Site type	Site length (ft)	Road mile	Description and reference point
Main Asotin Ck.				
MA1-93	Control	108		Behind Thiesens Ranch 1/4 mi. above Headgate Park, along SCS shrub plot, 12 boulders in site.
MA2-93	Control	100		3/4 mi. below mouth of Charlie Ck. river is next to the road,10 boulders in upper end of site.
North Fork Asotin Ck.				
NA-C4	Control	95	1.25	By smalll 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 G. (con't.)

Site name	Site type	Site length (ft)	Road mile	Description and reference point
SA4-84	2 Log Weirs 6 Boulders	100	3.20	Behind a clump of trees along road. 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.
<u>Tucannon River</u>				
TN1-93	Control	98		1/4 mi. above Marengo, open pasture 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.
<u>Cummings Ck.</u>				
CC1-93	Control	99	2.30	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 weirat lower end of site.

Appendix G. (con't.)

Site name	Site type	Site length	Road mile	Description and reference point
North Fork Touchet R.				
NFT1-92	Index	100		1/10 mi. below South Fork Bridge.
NFT2-92	Index	100		1.7 mi. above Wolf fork Bridge.
NFT3-92	Index	45		7.1 mi. above Wolf Fork Bridge, at Touchet R. Road bridge crossing, 1/2 mi. above pond.
South Fork Touchet R.				
SFT1-92	Index	102		6 mi. above Camp Nancy Lee Bridge, just below forks confluence.
SFT2-92	Index	96		2/10 mi. below Camp Nancy Lee Bridge.
SFT3-92	Index	100		Above Petty John Bridge.
Wolf Fork Touchet R.				
WFT1-92	Index	98		Blue Gate.
WFT2-92	Index	96		1/10 mi. below 1st bridge crossing, past Robinsons Fork.
WFT3-92	Index	65		1.3 mi. above Wolf Fork Bridge.

Appendix H.

Rainbow and German Brown trout plants, Lyons Ferry/Tucannon, 1993.

COUNTY	LOCATION	No. of Plants	Pounds of Fish	No. Fish Planted
ASOTIN	Alpowa Cr.	1	450	1,620
	Asotin Cr.	1	1,130	3,955
	Golf Course Pd.	3	6,016	14,277
	Headgate Pond	1	450	1,620
	Silcott Pond	2	1,780	3,952
	West Evans Pd.	3	3,234	7,534
	TOTAL		13,060	32,958
COLUMBIA	Beaver Lake	2	1,027	2,001
	Big Four Lk.	1	1,820	3,458
	Blue Lake	4	6,000	14,180
	Curl Lake	2	1,360	2,856
	Dam Pond	2	566	2,009
	Dayton Jv. Pd.	1	1,050	2,100
	Deer Lake	4	5,930	14,412
	Orchard Pond	1	300	1,050
	Rainbow Lake	8	11,050	27,063
	Spring Lake	4	6,690	15,105
	Touchet R.(Rb)	1	1,660	4,980
	Touchet R.(GB)	2	3,750	14,010
	Tucannon R.	1	2,800	8,400
	Watson Lake	3	7,173	16,057
	TOTAL Rainbow		47,426	113,671
	Browns		3,750	14,010
FRANKLIN	Dalton Lake	1	5,000	10,000
	Marmes Pond	1	250	500
	TOTAL	5,250	10,500	
GARFIELD	Baker's Pond	1	250	875
	Casey Pond	1	450	1,620
	Pataha Creek	2	1,580	5,962
	Deadman Creek	1	450	1,620
	TOTAL	2,730	10,077	
WALLA WALLA	College Pl. Pd.	2	690	2,415
	Coppei Creek	1	450	1,530
	Dry Creek	1	450	1,530
	Fishhook Pk. Pd.	2	1,760	5,910
	Jefferson Pk. Pd.	2	690	2,415
	Quarry	1	10,500	19,900
	Mill Creek	1	2,130	6,816
	Mill Creek Res.	6	17,740	42,150
	TOTAL		34,410	82,666
WHITMAN	Alkalai Creek	1	180	684
	Garfield Pond	1	460	1,564
	Gilcrest	1	400	1,360
	Pampa Pond	1	1,340	4,958
	Riparia Pond	2	770	1,999
	Rock Lake	2	2,460	8,364
	Union Flat Cr.	1	470	1,786
	TOTAL	6,080	20,715	
	TOTAL RAINBOW		108,956	271,052
	TOTAL BROWNS		3,750	14,010
	TOTAL FISH PLANTED		112,706	285,062