WASHINGTON DEPARTMENT OF WILDLIFE

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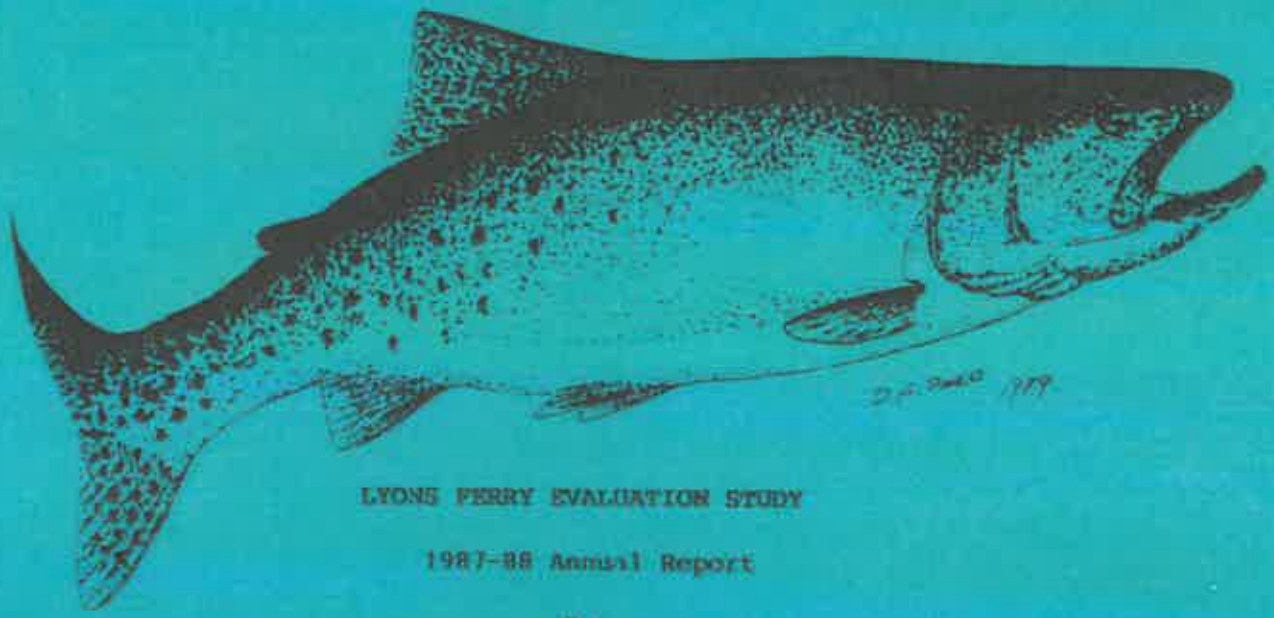

LYONS FERRY EVALUATION STUDY

1987-88 Annual Report

By

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Report No. AFF 1/LSR-89-09

Report Date October 1989

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Funded by:

LSRCP OFFICE
4696 Overland Road, Room 560
Boise, Idaho 83702

Contract No. 14-16-0001-87514(RWG)

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ABSTRACT

Total production at Lyons Ferry Hatchery in 1987 was 970,341 summer steelhead weighing 186,862 pounds, for an average smolt size of 5.5 fish/pound (SD = 0.3). Rainbow trout were planted into 39 waters, 213,937 fish weighing 68,180 pounds. An additional 100,289 trout weighing 973 pounds were reared for Idaho. Tucannon Fish Hatchery lost 169,110 Rainbow to IHN which caused a severe shortfall in production. Total trout production was 82% of goal this year. Average trout size planted was 3.1 fish/pound.

Eleven study groups of coded wire tagged and branded steelhead were released from 3 different locations. Tag loss averaged 0.54% (SD=.24) and brand loss averaged 1.43% (SD=.75), the best tag and brand retention in recent years.

Wild smolts and parr trapped on Cottonwood Creek averaged 163.9 mm and 117.1 mm in length respectively. Mean weights were 43.7 g and 16.1 g for smolts and parr respectively. Average wild parr lenght on the Tucannon River was 97.7 mm while smolts averaged 182.4 mm. Peak emigration of wild smolts occurred in April on Cottonwood Creek and in May on the Tucannon River. The Passage Index (P.I.) for hatchery smolts declined from an average of 33.4% of release at McNary Dam in 1987 to 26.0% of release in 1988. Travel times were similar for both years. We suspect that severe drought conditions in 1988 decreased survival through the Snake and Columbia rivers pools.

Adults from 1986 and 1987 smolt releases returned to Lower Granite Dam at between 0.07% and 0.67% for one year returns and between 0.45% and 2.04% for combined first and second year returns. Return rates for 1-ocean age fish were down substantially over 1985 release fish. One-ocean age fish averaged 58.4 cm in length and 2-ocean age fish averaged 70.3 cm. The adult trap at LFH was operated from Sept. 18, to Nov. 29, 1987 and 1081 fish total were captured. Males and females comprised 43.2% and 56.8% respectively. Wild fish were only 1.5% of the fish trapped at the hatchery this year. Tagged fish made up 19.7% of the total.

We conducted spawning ground surveys on 37.2 miles of the Tucannon River, 43.5 miles of the Touchet River and 19.7 miles of Asotin Creek. Redd densities ranged from 4.6/mile to 27.3/mile. We concluded that redd/mile figures were useful only for trend data and future densities would also be recorded by surface area. Densities in 1988 were similar to higher than in 1987.

Juvenile salmonid densities in project area streams averaged lower in 1988 then in 1987 but were higher than 1986 densities. There was wide variation in population densities from site to site. A comparison of sampling methods (electrofishing vs snorkeling) failed to provide conclusive data about the effectiveness of either method at estimating juvenile trout densties under all circumstances.

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INTRODUCTION

This is the fifth report in a series by the Washington Department of Wildlife concerning Lyons Ferry Hatchery. The reporting period for this report is 1 July 1987 through 30 June 1988.

Previous reports for project years 1984-86 were submitted in two parts to facilitate report completion, to provide results in a timely fashion, and to present complete data analysis and documentation of our early work. That foundation of methodology, and data analysis is now in place and beginning with this report we will be combining all project activities within one report. Alteration of some sections of the project and submission of separate reports dealing with special projects like the Migration/Telemetry report (Mendel and Schuck 1989) have also allowed us to take this step.

The 1987 project proposal as submitted to the U.S. Fish and Wildlife Service (FWS) served as a blueprint for our field activities and as a reference point for us to determine our progress in the evaluation project for the year.

We continue to collect tags from our tag release groups to determine adult steelhead contribution to Compensation Plan and other harvest areas. The data are encouraging for the four release years from which we have results. However, drought conditions in 1987 and 1988 have had as yet unknown effects on adult returns. We expect decreased smolt to adult survival rates for both years.

See Schuck et al. (1989) for a complete program description. Facilities and production goals did not change in 1987-88.

METHODS

Hatchery Operation Monitoring

Juvenile Growth

There were no changes in our methods of sampling growth rates during the production year or in sampling the smolts prior to release in the spring. A detailed description of the sampling is available in our 1983 Annual Report (Schuck 1985).

Fish Marking Program

Three types of marking programs were accomplished this year: 1) adipose clipping to designate hatchery produced harvestable adults for selective fisheries, 2) Coded-wire tagging (cwt) for specific contribution and return rate studies, and 3) All cwt fish received

a nitrogen freeze brand to allow easy identification of migrating smolts and returning adults without sacrificing the fish.

We contracted with Washington Dept. of Fisheries (WDF) to conduct our marking and tagging program. Adipose clipping was completed during August 1987, just prior to their transfer into the large rearing ponds. Tagging and branding was accomplished during February 1988. Tag loss was determined as in 1985 (Schuck and Mendel 1987). Tag codes and brands are reported to the Pacific Marine Fishery Commission for publication in their annual report.

Fish at Release

Fish release strategies and release procedures were the same in 1988 as for 1987 (see Schuck et al. 1989).

Hatchery Smolt Emigration

We assessed smolt survival throughout their migration from samples collected and expanded at the Snake and Columbia River dams by National Marine Fisheries Service (NMFS) and Fish Passage Center (FPC) personnel (Schuck et al. 1989; Fish Passage Center 1987, 1988).

Adult Steelhead Returns To Project Area

Passage at Dams and Characteristics of Adults

The National Marine Fishery Service monitors adult passage at Lower Granite Dam annually as part of their migration research (Jerry Harmon, NMFS, personal comm., 1988). Adults coming into their trap were sampled for marks and the information, along with sample rates when available, was provided to us. Metal jaw tags were placed on some returning adult steelhead at both Bonneville and Lower Granite Dams. These jaw tags helped to track movement of the fish following their handling at the dams and determine the percentage taken in sport fisheries, or returning to the hatchery or other release sites.

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 period when steelhead were migrating past the hatchery and could have entered the trap. All captured fish were retained until the spring of 1988 when they were sorted for spawning purposes. Fish that were identified as destined for upstream hatcheries and injured males were returned to the river. All other fish were retained.

Returns to Other Locations

Trapping

Trapping was conducted only at the Cottonwood Conditioning Pond (C.P.) this year. An intake dam and screen diverts water from Cottonwood Creek a short distance upstream from its confluence with the Grande Ronde River to provide water for operation of the Cottonwood C.P. for imprinting hatchery steelhead smolts. Again in 1988 we used this structure to trap downstream migrants and adult steelhead to provide us data regarding steelhead in a tributary within the Grande Ronde River Basin. We erected a vertical wire fence at the downstream edge of the water diversion to ensure capture of all down stream migrating adults. Fish were collected from above and below the screen and checked for marks and brands and marked with an opercle punch for identification.

We also discovered this year that adults moved into the outlet channel of the pond overnight and could be captured by dropping a screen into the channel and blocking their escape. Fish were then netted into anesthetic and examined for marks and brands. An opercle punch was applied to ensure any previously captured fish were not re-counted.

We had several objectives for the adult trapping; 1) obtain sex ratios of returning steelhead, 2) estimate mean length and weight of wild fish by sex, 3) help estimate total run size, 4) analyze scales to determine freshwater and ocean ages, and 5) recapture tagged or radio instrumented fish (Mendel and Schuck 1989)

Spawning Ground Surveys

Sections of the Touchet and Tucannon Rivers and Asotin Creek were walked to count redds, adults and carcasses. The sections were delineated by road miles, and later some areas were converted into actual river miles taken from U.S.G.S. aerial photographs. Peak spawning period was determined by walking each stream at 2-4 week intervals during the spawning season. While walking down stream we marked current year redds by using surveyor's ribbon marked with the date of the survey. Redds were marked with ribbons each time through to eliminate double counting and to serve as a reference for the following year. An additional notation was made for redds occurring on, or within, 50ft of man made log weirs and boulder placements. Quantification of the use of such structures by spawning fish will be used for evaluating the instream structures.

We recorded observations of both live adults and carcasses. Physical features such as wild or hatchery origin, sex, fin clips and lengths of carcasses were collected.

Steelhead Creel Surveys

The fall 1987 and spring 1987 steelhead seasons were open on the Snake River from 1 September to 31 December, and 1 January to 31 March, respectively. A consumptive fishery existed with a wild steelhead release regulation. Daily catch, possession and annual limits in Washington were 2, 4 and 20 steelhead, respectively, for the Snake River. A run of 117,000 summer steelhead were available for this fishery.

Regulations on the Grande Ronde R. were the same for the fall 1987 fishery. There was, however, a consumptive spring fishery on the Grande Ronde R. 1 January to 15 April 1988. Wild release regulations were in effect and daily, possession and annual limits for steelhead were 2, 4 and 20 respectively.

Fishing regulations for the Touchet, Tucannon, and Walla Walla rivers were unchanged from 1987 (see Mendel et al. 1988).

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

1. Estimate that portion of the sport catch contributed by returning steelhead of Lyons Ferry Hatchery origin. The following tasks are required to accomplish this objective:

   a) Estimate the percentage of the catch that is marked.

   b) Examine coded wire tags, brands and jaw tags and identify the release location, agency, and date for all marked steelhead observed in the catch.

   c) Estimate the total contribution of adult steelhead that was produced by Lyons Ferry Hatchery.

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

3. Estimate angler exploitation rates and determine wintering areas for marked groups of adult Lyons Ferry H. steelhead.

The study area (Fig. 1) was smaller than in 1986-87. We did not survey the Snake river below Lyons Ferry Hatchery this year and we combined the upper river areas described by Mendel et al. (1988) into three main areas:

1. Little Goose -- from Little Goose Dam to Lower Granite Dam (37.2-WDW mgmt, zone 167).

2. Lower Granite -- from Lower Granite Dam to Red Wolf Bridge in Clarkston, WA. (approx. 30.5 miles -- part of WDG mgmt zone 168).

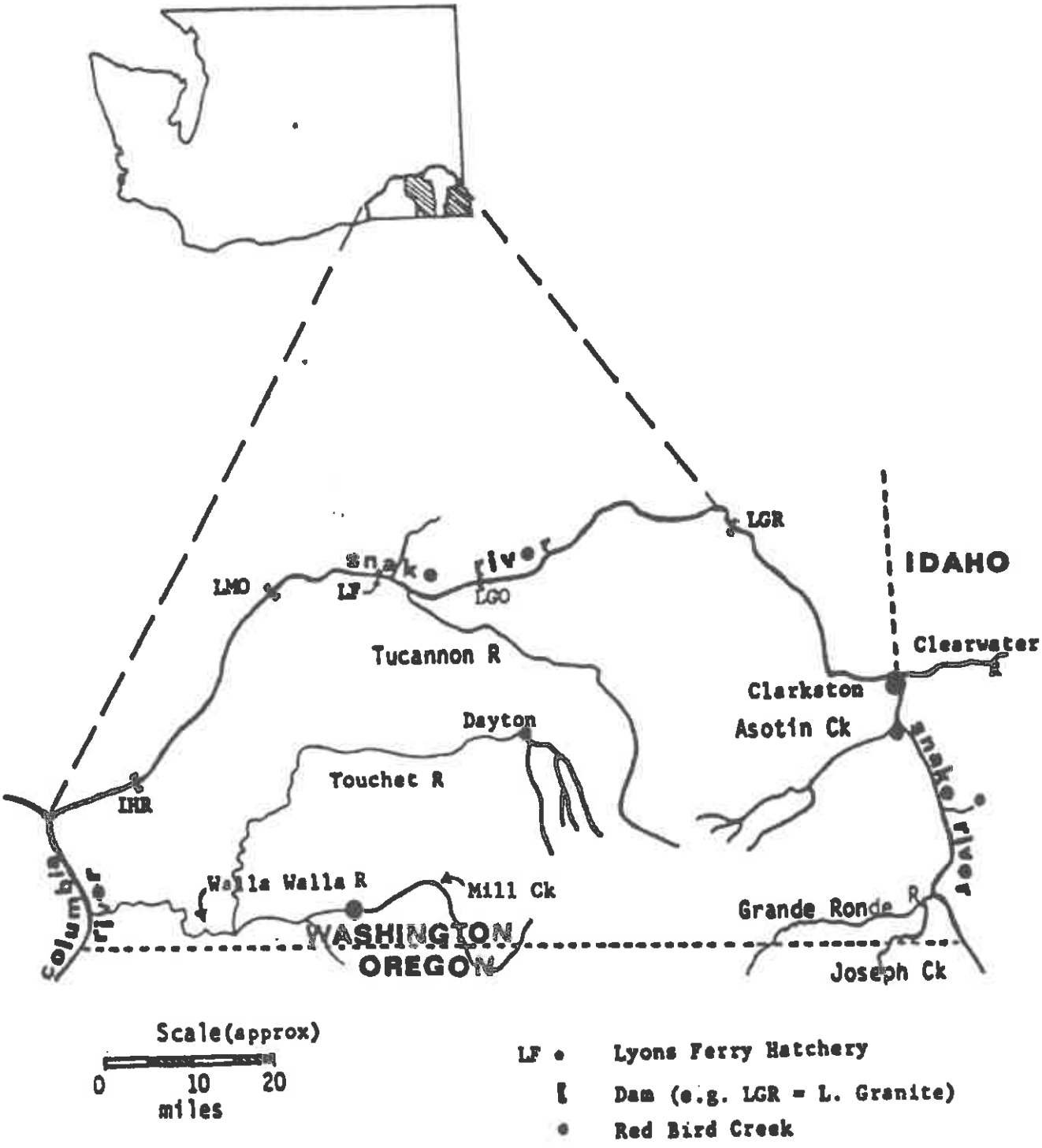


Figure 1. The relative locations of the major streams in southeast Washington and the landmarks used in this study.

3. Mid Snake -- from Red Wolf Bridge in Clarkston (just downstream of the Idaho - Washington border) upstream to the Grande Ronde River (at Lime point) (this portion of the Snake River is managed by the Idaho Fish and Game (IFG) and WDW).

The Grand Ronde River within Washington was divided into 3 major segments as follows:

1. Lower -- mouth to "The Narrows" just upstream of Joseph Creek (approx. 4.5 miles).

   Zone D -- mouth to Asotin County Road Bridge (approx. 2.5 miles) . Catch and release area, bait prohibited.

   Zone E -- Asotin Co. Road Bridge to the "Narrows" (approx. 2 miles). Consumptive fishery area, Wild Steelhead Release.

2. Shumaker -- Access limited to Shumaker Grade. Cosumptive fishery area, Wild Steelhead Release.

3. Upper -- Access area below State Highway 129 Bridge (at Bogans Oasis) to Oregon state line. Cosumptive fishery area, Wild Steelhead Release.

Areas of other streams surveyed include:

Tucannon River -- mouth to the little Tucannon R.

Walla Walla R. -- mouth to the Oregon State line.

Touchet River -- mouth to Wolf Fork, near Dayton.

Mill Creek -- mouth to Mullen ST. Bridge, in Walla Walla.

No effort counts were conducted on these rivers. Punchcard estimates for both Washington and Idaho were used to estimate total harvest for the mid-Snake River. Creel survey methods were generally similar to those described by Mendel et al. (1988). The primary difference in methodology this year was an effort to maximize the number of fish sampled for marks and cwt recovery. Data collected by WDW and IFG were shared to increase the sample size for each states' tag expansion estimates. Because harvest is based on punchcard estimates, sampled fish were identified as marked on either a WDW or IFG punchcard. All Washington punchcard fish were used in our expansions. Only IFG sampled fish marked on an IFG punchcard were used for their expansions. Unknown punchcard fish were claimed by the sampling agency. No scale samples were collected this year.

We adjusted punchcard harvest in Washington by multiplying estimated harvest by our correction factor (.1205) for

underestimation (Mendel et al. 1988). Total estimated tags harvested was based on the adjusted figures. Sport fishing exploitation rates were computed using jaw tags and disk tags as part of a separate radio telemetry study with exploitation rates for the two groups of fish for 1987 presented (Mendel and Schuck 1989).

Harvest of adults destined for Compensation Plan areas occurs in sport, commercial and treaty Indian fisheries throughout the Columbia River Basin. Estimates of harvest and tags recovered (interception rates) are available from WDW, Oregon Department of Fish and Wildlife (ODFW), Idaho Department of Fish and Game (IDFG), WDF and the Indian tribes. Where these data are available, they are used to determine the total contribution of LSRCP fish within the basin.

Returns of Coded Wire Tag Groups

Coded wire tags are collected throughout the Columbia River basin by several agencies in several different sport, tribal and commercial fisheries. Tag recoveries are either reported directly to the tagging agency along with sample rate information and pertinent fishery information or reported to the Pacific Marine Fisheries Commission (PMFC) for inclusion in the tag recovery data base. Both of these types of tag recovery are utilized in assembling data for this report. In addition, recovery of our tags through LSRCP evaluation activities is a primary source of tag recovery for the Snake River drainage.

Juvenile Steelhead Populations in Project Rivers

Spring Emigration

Our juvenile emigrant trapping objectives were to: 1) obtain run timing and size, 2) estimate mean lengths and weights of wild smolts, 3) examine composition of the migration by smolt index, and 4) determine freshwater age composition of the emigrants.

The objectives and data collection procedures were similar to those used on Charlie Cr., in 1987 (see Schuck et al., 1989).

A floating inclined plane trap is operated on the Tucannon River by WDF, one mile below state Hwy 12 bridge crossing. A complete description of trapping methods and results for chinook salmon is presented by Seidel et al.(1988). A summary of the steelhead trapped between December 1987 and June 1988 is presented here.

Summer Densities

The emphasis of our summer density sampling this year was to compare snorkeling and electrofishing density estimating procedures. If snorkeling could be used to provide accurate results, less time could be devoted to this sampling while still

obtaining reliable data. Electrofishing procedure and population and density estimates were generally performed as described in Hallock and Mendel (1985) and Schuck and Mendel (1987). Habitat data was restricted to flow and an assessment of percentage of each of four habitat types; riffle, pool, run and side channel. Both sampling techniques were used for each site. We generally sampled in two different manners; 1) Enclose a site within block nets, snorkel the section from top to bottom with two divers and count numbers of fish for each species observed. Rainbow/steelhead trout were classified as zeros (age 0+), parr (age 1+) or "catchables" based on size ranges from our past electrofishing experience. The section was then electrofished to obtain a population estimate; 2) Enclose a section within block nets, snorkel the site and then electrofish for a population estimate. Then re-snorkel through the area and count any remaining fish by species and age class. We attempted both these sampling schemes on what we considered shallow (average depth <1 ft.) and deep (average depth >1 ft.) sites in Asotin Cr. and the Tucannon River. Once population estimates with confidence limits were computed, a comparison of the two methods was made to determine if the snorkeling estimate fell within the confidence limits obtained with electrofishing.

WDF personnel electrofished extensively throughout the Tucannon River for separate habitat types (pool, riffle, run, and side channel). The steelhead/rainbow trout and other non-chinook species data from that sampling are presented here. A summary of chinook salmon densities by habitat type in the Tucannon River for 1987 can be found in Seidel et al.(1988). Habitat data for sites were collected according to WDF procedures (Seidel and Bugert 1987).

RESULTS AND DISCUSSION

Hatchery Operation Monitoring

Juvenile Growth

A summary of production for both hatcheries is presented in Table 1. The very low survival of rainbow trout reared at Tucannon is the result of an IHN outbreak. Additional groups of fish were obtained from Spokane and Lyons Ferry hatcheries to offset these losses. Production of steelhead and rainbow trout in 1988 increased from 1987.

Table 1: Trout Production at Lyon's Ferry/Tucannon Hatcheries, 1987-88.

Specie	Stock	No. Eggs	No. Fry	Number planted	Percent* survival	Food fed(lbs)	Fish(lbs) produced	Feed conv.
TUCANNON HATCHERY								
RB	SPOK.	246,000	170,500	28,684[A]	11.7	7,050	1,675	4.2
RB	SPOK.		51.005	50,193		12,430	9,645	1.29
RB[E]	LFH		83,542	83,538		20,690	14,012	1.48
LYONS FERRY HATCHERY								
RB	SPOK.	218,500	106,604[B]	107,361	95	53,300	39,895	1.34
SSH	LFH	1,111,605	983,901	665,658[C]	59.9 }			
SSH	WA	432,076	414,176	304,683[D]	70.5 }	220,776	180,692	1.22
SSH	WELLS	386,563	298,254	298,254[E]	77.1			

*- Egg to smolt survival.
A- IHN losses of 169,110 fish.
B- 100,289 fish weighing 973 lbs. shipped to IDFG.
C- 83,542 fish @ 11.3/lb transferred to Tucannon H. and converted to RB production. An additional 120,315 pre-smolts planted.
D- Includes 47,799 pre-smolts planted.
E- Steelhead from LFH converted to rainbow production to offset IHN losses.

Lyons Ferry Hatchery stock fish reared 14-15 months from egg to smolt while Wallowa fish reared one year. Both were fed OMP diet and converted well (Table 1). Grading was done once in the hatchery prior to moving fish outside and once again in the raceways about 2 weeks prior to adipose fin clipping. Fish were moved from concrete raceways to large ponds for final rearing in late September. Lyons Ferry stock fish ranged between 69-82.5/lb. while the Wallowa fish ranged between 69-101/lb. at marking. Both groups averaged smaller at clipping than in 1987.

There was a serious outbreak of IHN at the Tucannon hatchery this year in the catchable rainbow trout. Total losses due to

direct mortality and from destruction of sick fish was 169,110 fish during a one month period. Surplus steelhead at Lyons Ferry H. and surplus rainbow trout from Spokane H. were transferred to the Tucannon H. after the disease was controlled and hatchery facilities disinfected.

All eggs and fry received from Oregon and Washington hatcheries were examined by a pathologist and certified as disease free at the time of transfer. No further disease incidence or complications were noted.

Egg to fry survival for steelhead was acceptable for groups in 1988 (Table 2). Increased mortality rates in 1988 for both Wallowa and LFH stocks are a result of more intensive egg and fry picking. Abundant supplies of eggs allowed marginal eggs and fry to be gleaned from these groups. This was an attempt to remove fish prior to any growth to help reach our production goal with the highest quality fish. The large egg take of LFH stock steelhead in 1988 was again made to insure adequate eggs in the event of a heavy IHN infestation. IHN was found in only 3 of the fish spawned, which left a considerable egg surplus.

Table 2: Juvenile mortality, Lyons Ferry Hatchery 1986-88

Stock	Brood year	Eggs In	Fry Out	% mortality
Wallowa	1986	449,952	391,303	13.1
	1987	432,076	414,176	4.2
	1988	509,956	430,648	15.5
LFH	1986	705,000	650,973	7.7
	1987	1,111,506	983,901	11.5
	1988	941,765	793,240	15.8

Fish Marking

We contracted our steelhead marking with Washington Dept. of Fisheries (WDF). Tag loss was very similar in 1988 to that experienced in 1987. Brand loss and overall brand quality was much improved this year with only 1.43% unreadable brands. A complete listing of the tag/brand groups is summarized in Table 3.

Fish at Release

Two stock of steelhead were used in 1988. Samples were taken from various raceways, rearing ponds and conditioning ponds during the release period (Table 4). Some size discrepancies occurred between these numbers and numbers reported on hatchery planting sheets (Table 3). The most evident differences were again from conditioning ponds as in 1987.

Table 3: Lyons Ferry/Tucannon Hatchery SH smolt releases and Mark groups.

LOCATION	R.M.	NUMBER	POUNDS RELEASED	DATE (MM/DD)	STOCK	TAG CODE	BRAND	FIN CLIPS	SIZE #/LB.	TAG LOSS(%)	BRAND LOSS(%)
1985											
TOUCHET R.		23,400	4,500	4/15	WELLS			AD	5.2		
TOUCHET R.		17,680	3,400	4/16	WELLS			AD	5.2		
TOUCHET R.		28,350	4,500	4/16	WELLS			AD	6.3		
TOUCHET R.		23,400	4,500	4/16	WELLS			AD	5.2		
TOUCHET R.		40,119	6,403	4/19	WELLS			AD	6.3		
TOUCHET R.		16,716	1,990	5/08	WALLOWA			AD	8.4		
WALLA WALLA R.		67,600	12,000	4/17	WELLS			AD	5.6		
WALLA WALLA R.		22,800	4,000	4/18	WELLS			AD	5.7		
WALLA WALLA R.		24,800	4,000	4/19	WELLS			AD	6.2		
MILL CREEK	3	24,000	4,000	4/18	WELLS			AD	6.0		
ASOTIN CR.		31,500	3,750	4/24	WALLOWA			AD	8.4		
SNAKE R. @ L.GOO	71	21,035	3,626	5/06	WELLS		RA-7W-1	AD	5.8		
SNAKE R. @ L.GOO	71	20,309	3,626	5/10	WELLS		RA-7W-3	AD	5.6		
SNAKE R. @ IHR D		4,159	815	5/08	WELLS		LA-7S-1	AD	5.1		
SNAKE R. @ IHR D		4,038	776	5/09	WELLS		LA-7S-3	AD	5.2		
SNAKE R. @ IHR D		4,378	858	5/10	WELLS		RA-7S-1	AD	5.1		
SNAKE R. @ IHR D		4,050	810	5/13	WELLS		RA-7S-3	AD	5.0		
SNAKE R. @ IHR D		4,020	804	5/13	WELLS		LD-7S-3	AD	5.0		
SNAKE R. @ IHR D		4,219	796	5/14	WELLS		RD-7S-1	AD	5.3		
SNAKE R.@ LFH	58	22,394	8,613	5/06	WELLS		RD-H-1		2.6		
SNAKE R.@ LFH	58	28,191	10,842	to	WELLS	62/16/44	RA-H-1	LV	2.6	11.00	
SNAKE R.@ LFH	58	25,540	4,643		WALLOWA		RD-H-2		5.5		
SNAKE R.@ LFH	58	28,373	5,158	5/13	WALLOWA	62/16/45	RA-H-2	LV	5.5	5.70	
G.RONDE @ C.WOOD	25	41,028	7,460	5/04	WALLOWA	62/16/27	RA-17-1	AD-LV	5.5	2.90	
G.RONDE @ C.WOOD	25	40,201	7,309	to	WALLOWA	62/16/28	RA-17-3	AD-LV	5.5	4.00	
G.RONDE @ C.WOOD	25	46,717	8,494	5/10	WALLOWA			AD	5.5		
TUCANNON R.@CURL	48	39,094	6,859	5/17	WALLOWA	62/16/29	LA-S-1	AD-LV	5.7	3.20	
TUCANNON R.@CURL	48	39,094	6,859	to	WALLOWA	62/16/30	LA-S-2	AD-LV	5.7	4.10	
TUCANNON R.@CURL	48	73,421	12,880	5/22	WALLOWA			AD	5.7		
ENTERPRISE, OR.		379,353	48,975	4/2-26	WALLOWA			AD	7.7		
G.RONDE BLW C.WO	22	21,462	2,125	5/17	WALLOWA			AD	10.1		
"totals"		1,149,979	193,246				Mean fish/pound =		6.0		
								SB =	1.2		
1986											
TOUCHET RIVER	46	16,800	3,200	04/22	WELLS			AD	5.3		
TOUCHET RIVER	46	21,800	4,000	04/23	WELLS			AD	5.5		
TOUCHET RIVER	49	21,400	4,000	04/24	WELLS			AD	5.4		
TOUCHET RIVER	49	22,120	3,950	04/24	WELLS			AD	5.6		
TOUCHET RIVER	49	18,585	3,150	04/29	WELLS			AD	5.9		
TOUCHET RIVER	54	27,600	4,000	04/29	WELLS			AD	6.9		
TOUCHET RIVER	49	27,300	4,200	04/30	WELLS			AD	6.5		
WALLA WALLA R.	35	18,900	3,500	04/22	WELLS			AD	5.4		
WALLA WALLA R.	30	22,200	4,000	04/23	WELLS			AD	5.6		
WALLA WALLA R.	32	22,200	4,000	04/23	WELLS			AD	5.6		
WALLA WALLA R.	30	21,600	4,000	04/24	WELLS			AD	5.4		
WALLA WALLA R.	30	26,000	4,000	04/30	WELLS			AD	6.5		
WALLA WALLA R.	35	27,945	4,050	04/30	WELLS			AD	6.9		
MILL CR.	3	25,830	4,100	04/30	WELLS			AD	6.3		

Table 3. Con't.

LOCATION	R.M.	NUMBER	POUNDS RELEASED	DATE (MM/DD)	STOCK	TAG CODE	BRAND	FIN CLIPS	SIZE #/LB.	TAG LOSS(%)	BRAND LOSS(%)
SNAKE R.@ L.GOO	71	19,604	3,380	04/21	WELLS		RA-7F-1	AD	5.8		
SNAKE R.@ L.GOO	71	19,865	3,425	04/25	WELLS		RA-7F-3	AD	5.8		
SNAKE R.@ L.GOO	71	20,087	3,587	04/29	WELLS		RD-7F-1	AD	5.6		
SNAKE R.@ IHR		12,006	2,070	04/21	WELLS		LA-7U-1	AD	5.8		
SNAKE R.@ IHR		11,999	1,967	04/25	WELLS		LA-7U-3	AD	6.1		
SNAKE R.@ IHR		12,028	2,291	04/29	WELLS		LD-7U-1	AD	5.3		
SNAKE R.@ LFH	58	20,136	3,661	04/22	WELLS	63-38-36	LA-IJ-1	AD-LV	5.5	0.30	
SNAKE R.@ LFH	58	20,639	3,822	04/26	WELLS	63-38-37	LA-IJ-4	AD-LV	5.4	0.30	
SNAKE R.@ LFH	58	20,506	3,869	04/30	WELLS	63-38-38	LA-IJ-3	AD-LV	5.3	0.30	
SNAKE R.@ LFH	58	20,246	3,491	04/22	WALLOWA	63-33-03	LA-IK-1	AD-LV	5.8	0.40	
SNAKE R.@ LFH	58	20,234	3,429	04/30	WALLOWA	63-33-04	LA-IK-3	AD-LV	5.9	0.40	
ASOTIN CR.		14,080	2,200	04/30	WALLOWA			AD	6.4		
ASOTIN CR.		23,200	4,000	04/28	WALLOWA			AD	5.8		
ASOTIN CR.		7,370	1,100	04/30	WALLOWA			AD	6.7		
TUCANNON R.@CURL	47	20,244	3,628	5/01	WALLOWA	63/33/50	RA-IK-1	AD-LV	5.6	1.14	
TUCANNON R.@CURL	47	20,250	3,629		WALLOWA	63/33/51	RA-IK-3	AD-LV	5.6	0.74	
TUCANNON R.@CURL	47	60,225	10,793	to	WELLS			AD	5.6		
TUCANNON R.@CURL	47	20,172	3,615		WELLS	63/32/02	LA-IT-1	AD-LV	5.6	1.50	
TUCANNON R.@CURL	47	20,177	3,616	5/13	WELLS	63/33/02	LA-IT-3	AD-LV	5.6	0.72	
G.RONDE @ C.WOOD	25	63,723	13,853	4/24	WALLOWA			AD	4.6		
G.RONDE @ C.WOOD	25	20,205	4,392	to	WALLOWA	63/33/05	RA-IJ-1	AD-LV	4.6	1.18	
G.RONDE @ C.WOOD	25	20,038	4,356		WALLOWA	63/33/06	RA-IJ-2,	AD-LV	4.6	1.35	
G.RONDE @ C.WOOD	25	20,234	4,399	5/06	WALLOWA	63/33/49	RA-IJ-3	AD-LV	4.6	1.19	
"totals"		827,548	148,723				Mean fish/pound =		5.6		
								SD =	0.6		
1987											
TOUCHET R.@DAYT	53	102,050	19,625	4/20-30	WELLS			AD	5.2		
TOUCHET R.@DAYT	53	34,677	6,669	4/20-30	L.FERRY			AD	5.2		
WALLA WALLA R.	32	50,527	8,500	04/21	WELLS			AD	5.9		
WALLA WALLA R.	32	18,880	3,200	04/22	WELLS			AD	5.9		
WALLA WALLA R.	35	25,016	4,905	04/30	WELLS			AD	5.1		
WALLA WALLA R.	35	7,150	1,300	04/22	L.FERRY			AD	5.5		
WALLA WALLA R.	30	23,400	4,500	04/24	L.FERRY			AD	5.2		
MILL CR.	3	26,100	4,500	04/21	WELLS			AD	5.8		
SNAKE R.@ IHD		11,314	2,057	04/23	WELLS		RD-7P-1	AD	5.5		
SNAKE R.@ IHD		11,468	2,085	04/27	WELLS		LA-7P-3	AD	5.5		
SNAKE R.@ IHD		11,406	2,001	04/30	WELLS		LA-7P-1	AD	5.7		
SNAKE R.@ LFH	58	649	118	04/23	WELLS	P.I.T.		AD	5.5		
SNAKE R.@ LFH	58	650	116	04/23	WELLS	P.I.T.		AD	5.6		
SNAKE R.@ LFH	58	650	114	04/23	WELLS	P.I.T.		AD	5.7		
SNAKE R.@ LFH	58	19,972	3,385	04/23	WELLS		LD-7K-1	AD	5.9		
SNAKE R.@ LFH	58	18,676	3,335	04/27	WELLS		RA-7K-3	AD	5.6		
SNAKE R.@ LFH	58	19,716	3,459	04/30	WELLS		RA-7K-1	AD	5.7		
SNAKE R.@ LFH	58	25,384	5,288	4/24-30	L.FERRY	63/39/15	RA-IF-1	AD-LV	4.8	0.30	2.7
SNAKE R.@ LFH	58	25,459	5,304	4/24-30	L.FERRY	63/39/14	RA-IF-3	AD-LV	4.8	0.70	0.8
SNAKE R.@ LFH	58	25,431	4,462	4/24-30	WALLOWA	63/37/03	LA-IF-1	AD-LV	5.7	0.30	3.9
SNAKE R.@ LFH	58	25,586	4,489	4/24-30	WALLOWA	63/39/13	LA-IF-3	AD-LV	5.7	0.93	2.4
ASOTIN CR.	0.7	22,950	4,500	04/22	L.FERRY			AD	5.1		
TUCANNON R.@CURL	47	101,408	17,791	4/21-30	L.FERRY			AD	5.7		

Table 3. Con't.

LOCATION	R.M.	NUMBER	POUNDS RELEASED	DATE (MM/DD)	STOCK	TAG CODE	BRAND	FIN CLIPS	SIZE #/LB.	TAG LOSS(%)	BRAND LOSS(%)
TUCANNON R.@CURL	47	20,272	3,556	4/22-30	L.FERRY	63/38/45	RA-IY-2	AD-LV	5.7	0.35	4.3
TUCANNON R.@CURL	47	20,357	3,571	4/22-30	L.FERRY	63/39/03	RA-IY-3	AD-LV	5.7	0.12	4.9
TUCANNON R.@CURL	47	20,194	3,543	4/22-30	L.FERRY	63/38/44	RA-IY-1	AD-LV	5.7	0.11	1.9
G.RONDE @ C.WOOD	25	20,099	3,722	4/20-30	WALLOWA	63/38/40	RA-IC-1	AD-LV	5.4	0.56	5.4
G.RONDE @ C.WOOD	25	20,083	3,719	4/20-30	WALLOWA	63/38/41	RA-IC-2	AD-LV	5.4	1.00	5.2
G.RONDE @ C.WOOD	25	20,115	3,725	4/20-30	WALLOWA	63/38/42	RA-IC-3	AD-LV	5.4	0.58	1.0
G.RONDE @ C.WOOD	25	20,164	3,734	4/20-30	WALLOWA	63/38/43	RA-IC-4	AD-LV	5.4	0.23	7.7
G.RONDE @ C.WOOD	25	120,384	22,286	4/20-30	WALLOWA			AD	5.4		
G.RONDE IN ORE.	41	25,340	4,500	04/28	WALLOWA			AD	5.6		
G.RONDE IN ORE.	41	27,160	4,656	04/29	WALLOWA			AD	5.8		
"totals"		922,687	168,715				Mean fish/pound =		5.5		
								SD =	0.3		
1988											
SNAKE R.@ LFH	58	25,025	5,324	4/28	L.FERRY	63/50/19	LA-S-1	AD-LV	4.7	0.91	1.40
SNAKE R.@ LFH	58	25,317	5,387	4/28	L.FERRY	63/50/16	LA-S-2	AD-LV	4.7	0.50	1.30
SNAKE R.@ LFH	58	25,260	5,374	4/30	L.FERRY	63/50/14	RA-S-2	AD-LV	4.7	0.39	0.97
SNAKE R.@ LFH	58	25,123	5,345	4/30	L.FERRY	63/50/13	RA-S-1	AD-LV	4.7	0.70	1.40
SNAKE R.@ LFH	58	4,392	915	4/29	WALLOWA			AD	4.8		
ASOTIN CREEK	0.7	28,975	4,750	4/20	WALLOWA			AD	6.1		
WALLA WALLA R.	22	25,200	4,500	4/21	L.FERRY			AD	5.6		
WALLA WALLA R.	24	25,650	4,500	4/21	L.FERRY			AD	5.7		
WALLA WALLA R.	27	19,000	3,600	4/22	L.FERRY			AD	5.3		
WALLA WALLA R.	25	5,040	900	4/22	L.FERRY			AD	5.6		
WALLA WALLA R.	25	25,200	4,500	4/22	L.FERRY			AD	5.6		
WALLA WALLA R.	22	30,596	5,666	4/22	L.FERRY			AD	5.4		
WALLA WALLA R.	24	25,200	4,500	4/25	L.FERRY			AD	5.6		
WALLA WALLA R.	27	25,200	4,500	4/26	L.FERRY			AD	5.6		
MILL CREEK	3	25,650	4,500	4/21	L.FERRY			AD	5.7		
MILL CREEK	3	26,100	4,500	4/26	L.FERRY			AD	5.8		
GRANDE RONDE	25	208,262	43,387	4/15	WALLOWA			AD	4.8		
GRANDE RONDE	22	12,414	2,035	4/29	WALLOWA			AD	6.1		
TOUCHET R.@DAYT	53	19,992	4,209	4/15-	L.FERRY	63/50/28	LA-IV-3	AD-LV	4.7	0.20	2.00
TOUCHET R.@DAYT	53	18,871	3,973		L.FERRY	63/50/31	LA-IV-1	AD-LV	4.7	0.61	0.51
TOUCHET R.@DAYT	53	19,681	4,143	TO	L.FERRY	63/49/49	RA-IV-3	AD-LV	4.7	0.57	1.14
TOUCHET R.@DAYT	53	20,001	4,211		L.FERRY	63/49/47	RA-IV-1	AD-LV	4.7	0.09	0.78
TOUCHET R.@DAYT	53	92,179	19,406	-4/30	L.FERRY			AD	4.7		
TUCANNON R.@CURL	48	20,121	3,530	4/25 -	L.FERRY	63/49/44	LA-H-1	AD-LV	5.7	0.60	0.80
TUCANNON R.@CURL	48	20,110	3,528	TO	L.FERRY	63/49/42	RA-H-2	AD-LV	5.7	0.53	2.66
TUCANNON R.@CURL	48	20,115	3,529		L.FERRY	63/49/41	RA-H-1	AD-LV	5.7	0.77	2.79
TUCANNON R.@CURL	48	100,947	17,710	-4/30	L.FERRY			AD	5.7		
G.RONDE IN ORE.	41	50,640	8,440	4/28	WALLOWA			AD	6.0		
"totals"		970,341	186,862				Mean fish/pound =		5.2		
								SD =	0.5		

Table 4. Smolt characteristics at Lyons Ferry Hatchery, 1988.

Lake/ Raceway	Stock[a]	Number fish sampled	No. of Sample days	Mean length mm (SD)	Mean weight gms (SD)	No. fish /lb.	K factor	% Precocious males
Cotton-wood C.P.	WA	303	2	199.8 (17.8)	85.8 (20.4)	5.29	1.07	4.6
Dayton C.P.	LF	257	3	202.3 (15.3)	86.1 (20.8)	5.27	1.02	11.6
Lake 1	LF	479	3	205.1 (14.3)	78.0 (17.2)	5.82	0.89	2.9
Lake 2	LF	375	2	218.3 (13.7)	95.9 (19.1)	4.74	0.94	1.1
Curl Lk.	LF	394	3	197.1 (16.8)	79.6 (19.1)	5.70	1.02	13.5
RW-11,12 &13	WA	193	2	195.7 (15.2)	78.6 (18.7)	5.77	1.03	5.2

a WA = Wallowa stock, LF = Lyons Ferry Stock.

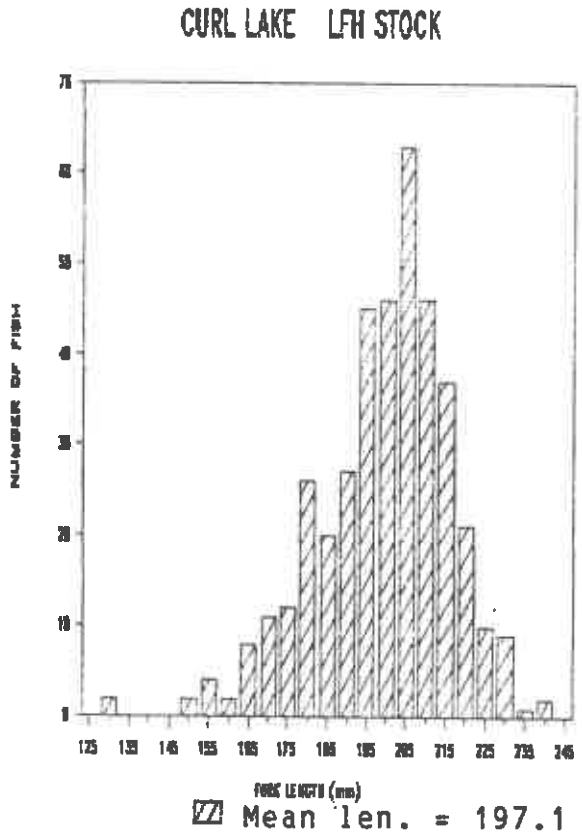
Fish size at release ranged from 4.7 - 6.0 fish/lb and the average size for the entire release of smolts was 5.2 fish/lb (Std.Dev.=0.5). Total production was 970,341 fish totaling 186,862 pounds. Table 3 summarizes the smolt releases into southeast Washington rivers for 1985-1988.

Precocious males usually migrated out toward the end of the release period, with almost no precocious fish captured on the first sample day when fish began migrating volitionally. Transitionally developed fish, those not fully developed as a smolt based on physical appearance, comprised an average 9.6 % (range 1.4-29%) of the fish sampled at release. Cottonwood C.P. had the highest levels of transitional fish with 26 %. Fish coming directly out of the rearing ponds at LFH had the lowest percentage of transitionals (2.0%). Results of samples collected by the USFWS to measure gill ATPase and blood thyroxin (T_4) will be summarized with 1989 data and presented in a future report. Figures 2-7 depict the range and variation of samples of fish lengths and weights taken from lakes, raceways and conditioning ponds in 1988.

Discussion

The availability of conditioning ponds allowed removal from the hatchery of fish in early March. This greatly reduced the amount of time spent hauling fish in the critical spring smolt release period.

Fish growth and performance was excellent. Feed conversions were within expected parameters. Smoltification at time of release appeared to be very good for most fish. There continues to be



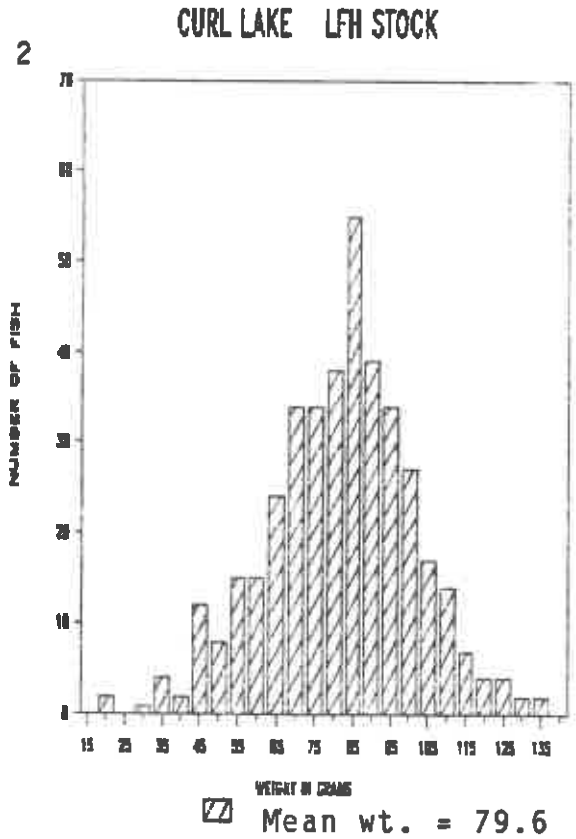
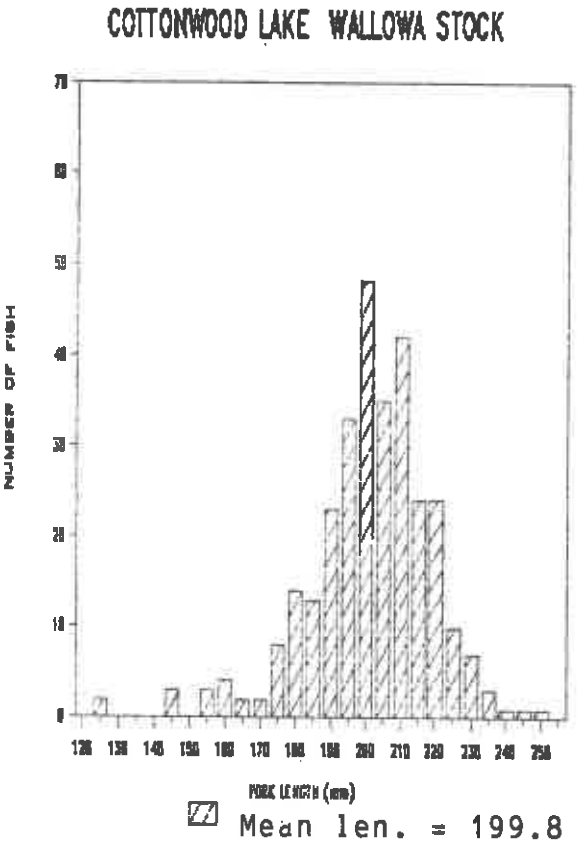


Figure 2



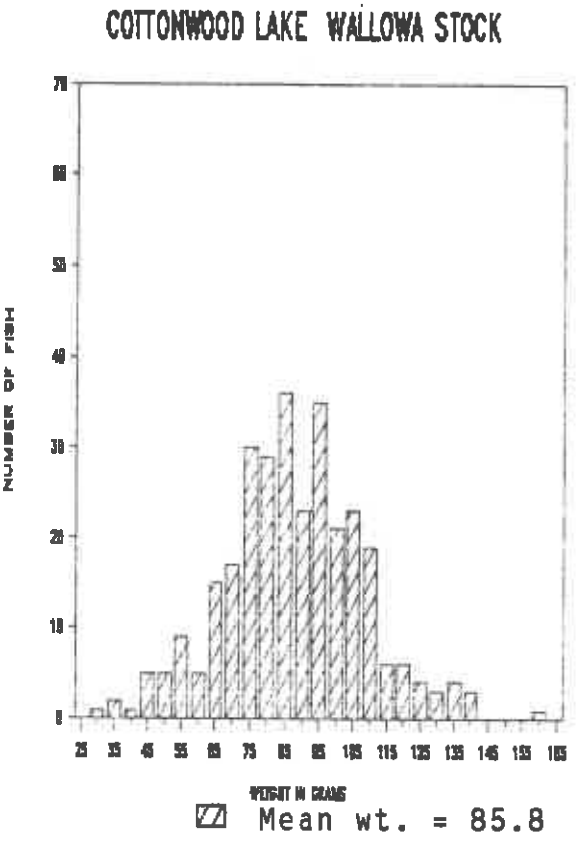


Figure 3

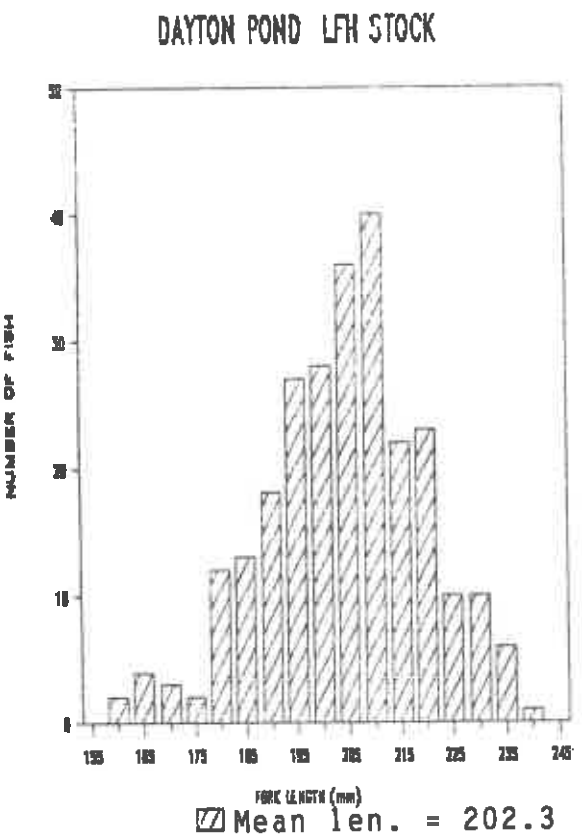
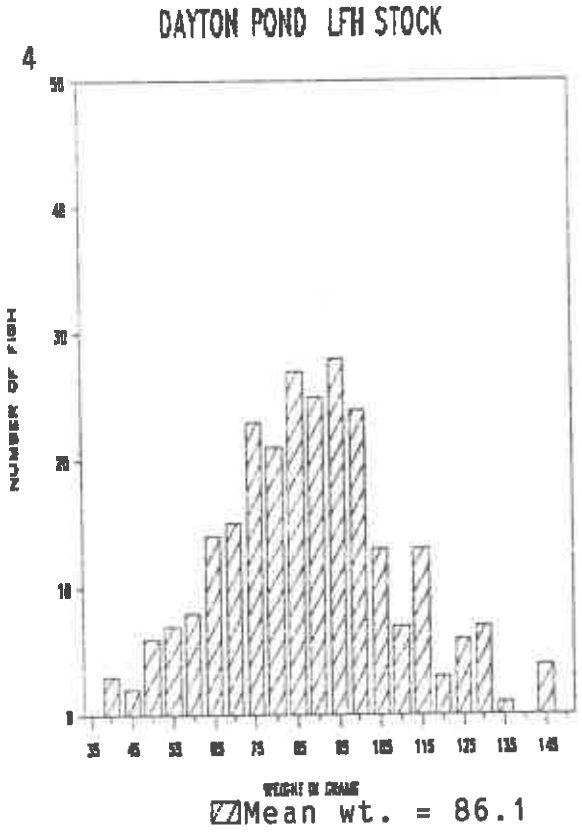
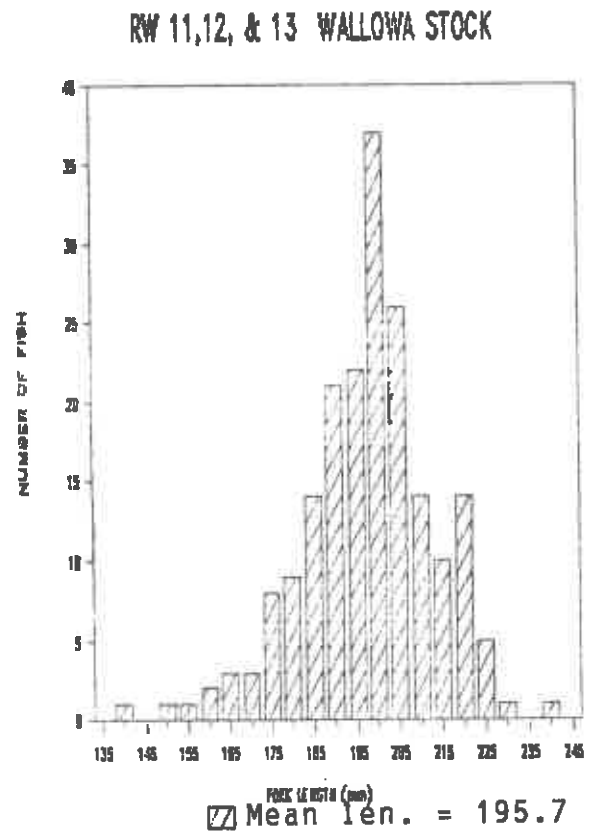


Figure 4





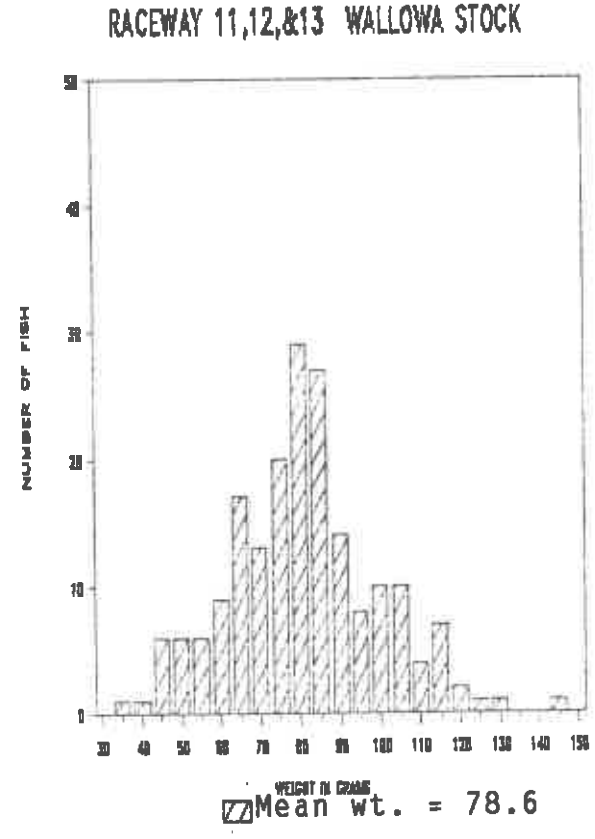


Figure 5

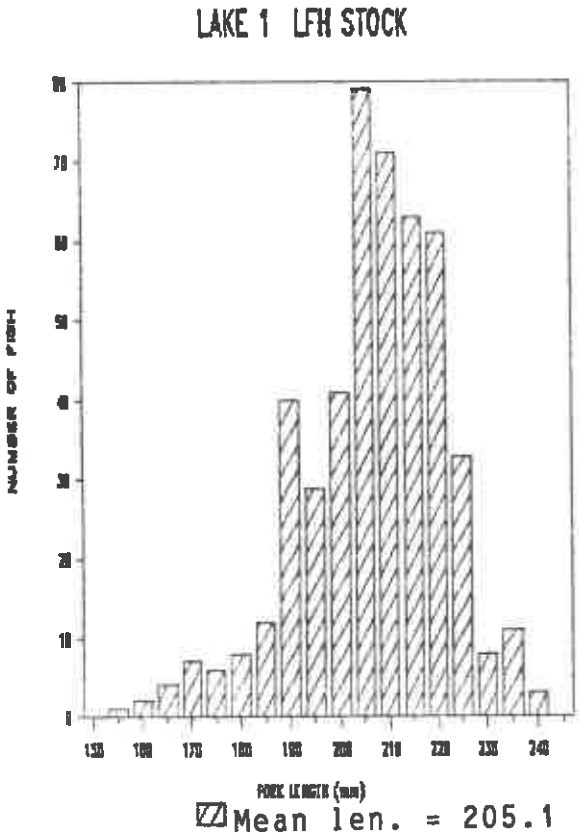
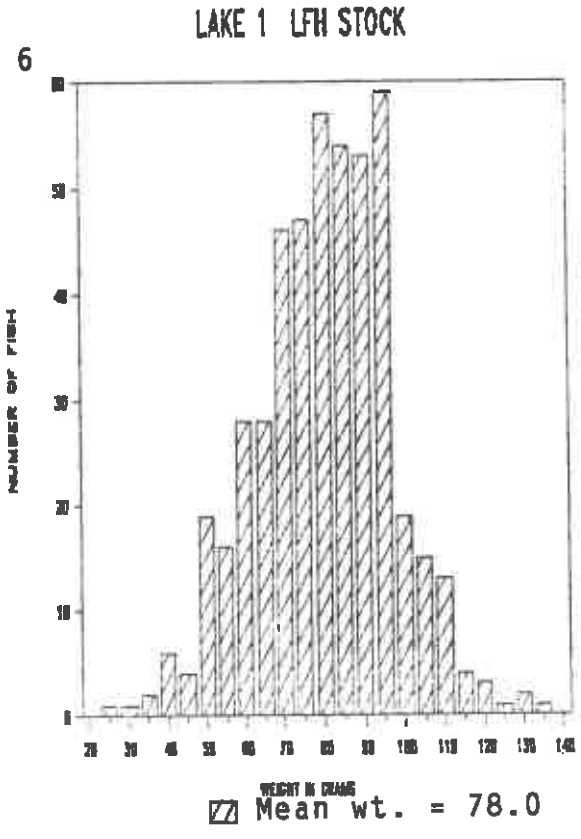
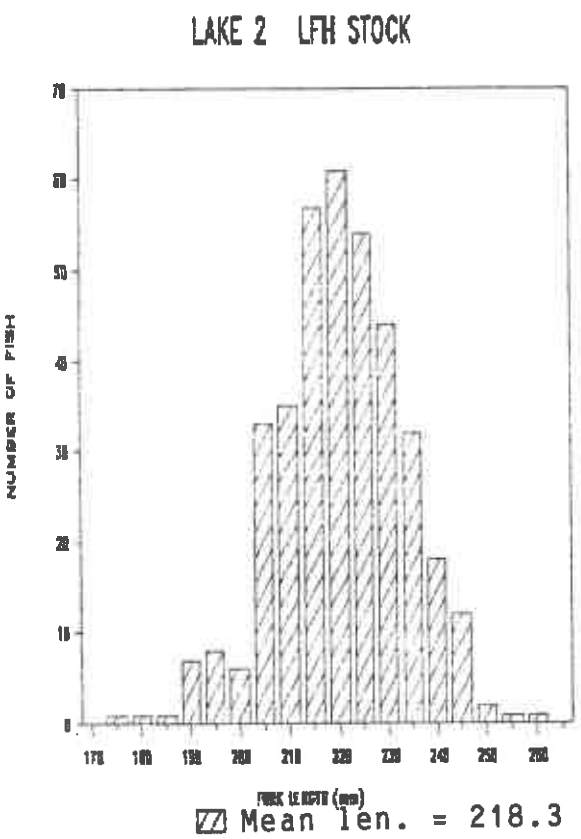


Figure 6





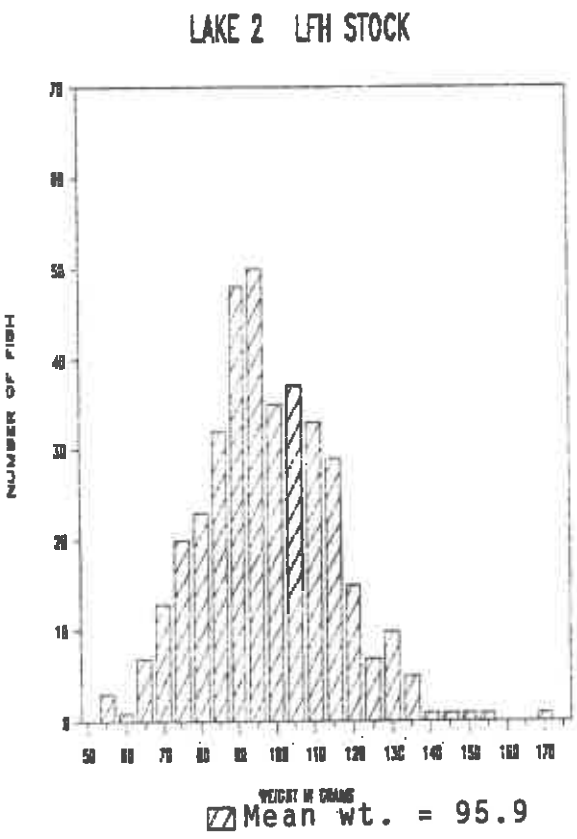


Figure 7

a difference in the size of fish we sample at release and that reported on hatchery planting sheets over the release period. In some cases we attributed differences to small sample size or a biased sample from conditioning ponds. We increased sample size in 1987 and 1988 to address this problem. The two sets of numbers compared much more closely in 1987 whereas marked differences appeared in 1988. The sampling procedure for hatchery records must be scrutinized to determine a method that is more consistant and accurate from year to year.

The tagging program went smoothly this year. Brand quality was stressed daily during the marking in 1988. We suspected that poor brand quality experienced in 1987 was due primarily to improper branding procedure and failure to consistently correct the problem, especially with new branding personnel. However, constant observation and correction of improper technique is essential to consistent brand quality, even when using experienced branding personnel.

Hatchery Smolt Emigration

Releases

All smolt plants for 1985-88 are summarized by release day in Table 3. Three types of release are now used: 1) brood stock smolt releases from Lyons Ferry are allowed to volitionally migrate from the rearing ponds, 2) fish are pumped from the release structure into tank trucks and hauled directly to various streams and rivers in Southeast Washington; and 3) fish are pumped from the release structure into tank trucks, then transferred to conditioning ponds on the Tucannon, Grande Ronde and Touchet Rivers. After 5-8 weeks in the CP's, the fish are then allowed to emigrate over a 2 week period before the remaining fish are forced from the ponds.

The conditioning ponds were watched closely to ensure that any problems that might occur would not jeopardize the fish. Fish were transferred to conditioning ponds in early March. The screens were removed from the outlet structures of Cottonwood and Dayton ponds on 15 April in response to smolts actively schooling and circling the ponds. Screens were removed from Curl Lk. on 25 April after similar behavior was observed. To encourage emigration, pond levels were lowered 8". Large numbers of fish were noted exiting Dayton and Cottonwood ponds for the next 3-4 days. Emigration then slowed dramatically for the next 7 days. We continued to feed the fish during this period but stopped feeding on 25 April. The fish then began to actively leave the ponds as the level was lowered. Cottonwood and Dayton ponds were empty on the 29th and 30th of April respectively. Very cold weather in the Tucannon Valley again inhibited emigration from Curl Lake. Pond levels were drawn down steadily for 5 days until Curl Lk. pond was empty on 30 April.

The USFWS sampled smolts from all conditioning ponds and from the hatchery rearing ponds throughout the season. The conditioning

ponds do elicit a biochemical response from smolts. The response appears, however, much earlier in the conditioning period than was expected and only in one of the 3 parameters sampled. Additional sampling will be done in 1989 to provide more information about the effects of conditioning ponds on smoltification. A complete presentation of the 1988 data is provided in an unpublished report by Rondorf et al.(1989).

Migration Through Dams

Table 5 summarizes passage estimates for brand groups released in 1987 and 1988. Median (50%) passage of the fish from all groups passed McNary Dam around 20 days after release, although individuals from various groups continued to pass the dams through the end of July. Average daily travel rates for various brand groups ranged between 4.1-5.4 miles per day to the first dam (FPC,1988). These travel rates are consistent with groups released in previous years (Schuck et al, 1989). Travel rates for the groups increased to between 15.3-19.1 miles/day by the time they reached John Day Dam.

Table 5. Estimated Passage of Branded Lyons Ferry Steelhead at McNary and Lower Granite Dams, 1987-88. (FPC, 1987, 1988).

Brand	Release Site	Passage Index	Number Released	% of Release	Size (#/lb)	Stock
McNary						
1987						
RA-IF-1,3	LFH	18,906	50,843	37.2	4.8	LFH
LA-IF-1,3	LFH	18,005	51,017	35.3	5.7	WA
RA-IY-1,2,3	Tucannon	16,930	60,823	27.8	5.7	LFH
1988						
LA,RA-H	Tucannon	12,134	59,290	20.5	5.7	LFH
LA,RA-S	LFH	29,807	99,449	29.9	4.7	LFH
LA,RA-IV-1,3	Touchet	21,547	77,669	27.7	4.7	LFH

Discussion

Average fish size increased again for 1988 releases while size variability decreased (Table 4). The decrease in size variability is likely the result of available conditioning pond space to hold marked groups and our ability to move marked fish into the C.P.'s soon after marking.

Hatchery steelhead emigration appeared to closely follow that of wild fish, which peaked in late April (see Juvenile Populations). The Tucannon River fish were the slowest to leave

their river system. Migration appeared to occur only after several days residence within the river itself. WDF personnel reported seeing large numbers of steelhead hatchery smolts at RM 35 during snorkeling surveys ten days after release from Curl Lake. Whether this behavior is solely related to cold water temperatures or some other factor is unknown. Other groups of fish appeared to migrate quickly from their release site and continue downstream without delay.

The passage index (P.I.) continues to show a consistent difference between passage at McNary Dam for groups released at LFH and the Tucannon River. Passage at McNary for fish released on the Tucannon River increased dramatically in 1987 over 1986 passage (Schuck et al 1989) and we concluded that the change to the new Lyons Ferry stock of fish might be having a strong benefit on the Tucannon. The P.I. was lower this year however and only about 70% of the P.I. for both LFH and Dayton C.P. releases. Migration speed was similar for all groups. The difference in the P.I. may indicate reduced smoltification of the Tucannon releases, however this seems to be inconsistent with the physiological samples collected by the USFWS. We believe that additional intensive sampling of several factors such as stock behavior, fish physiology, C.P. climate and release size is necessary to provide an answer.

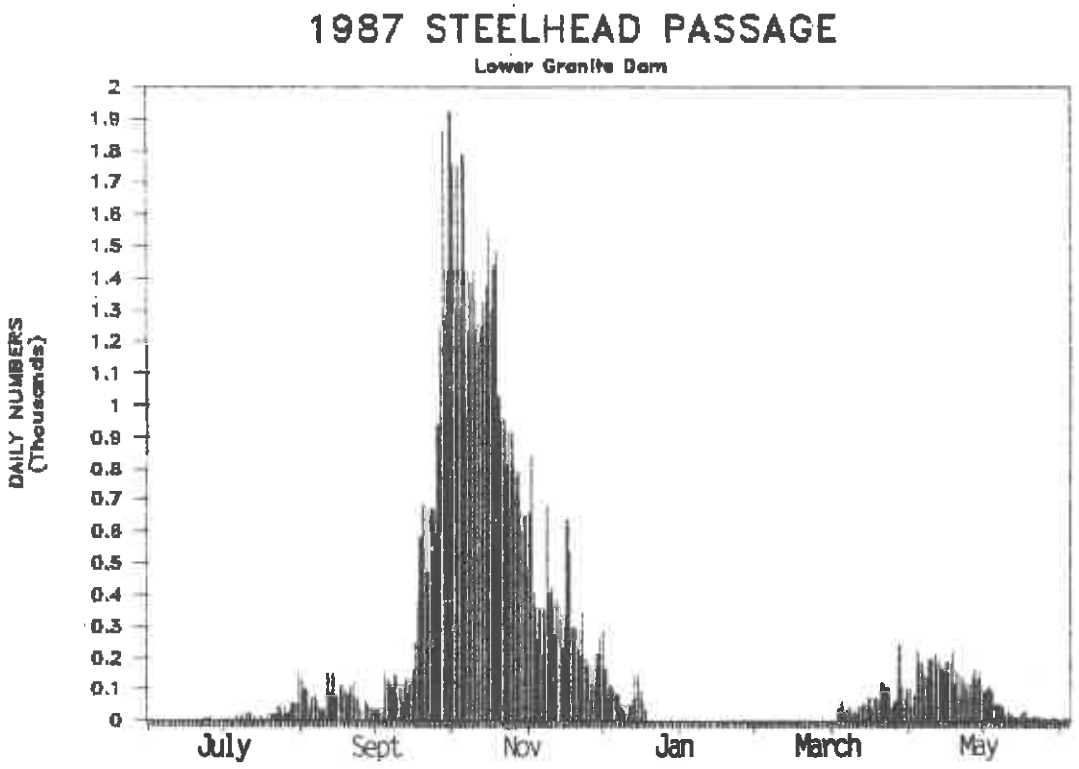
Tagged and branded smolts were released from the Dayton C.P. for the first time in 1988. Performance based on their P.I. and travel rates was very similar to fish released from LFH. This is the beginning of several years of tagging for the Touchet River to determine if these fish contribute to fisheries in a similar manner as other Washington LSRCP fish.

Adult Steelhead Returns

Passage at Dams

Table 6 lists estimated escapement of Lyons Ferry fish to above LGR, by release year, for each mark group and the percentage of release that these fish represent.

Run timing for the Wallowa stock fish generally follows passage norms at Lower Granite Dam (LGD). There is however an early portion of the run passing LGD in late July and early August that is composed primarily of Wallowa stock fish released from LFH and the conditioning ponds (Fig. 8). This early return of fish is unusual and unexpected. The first returns of LFH fish to LGD in 1988 occurred in April, a full year before their spawning time.



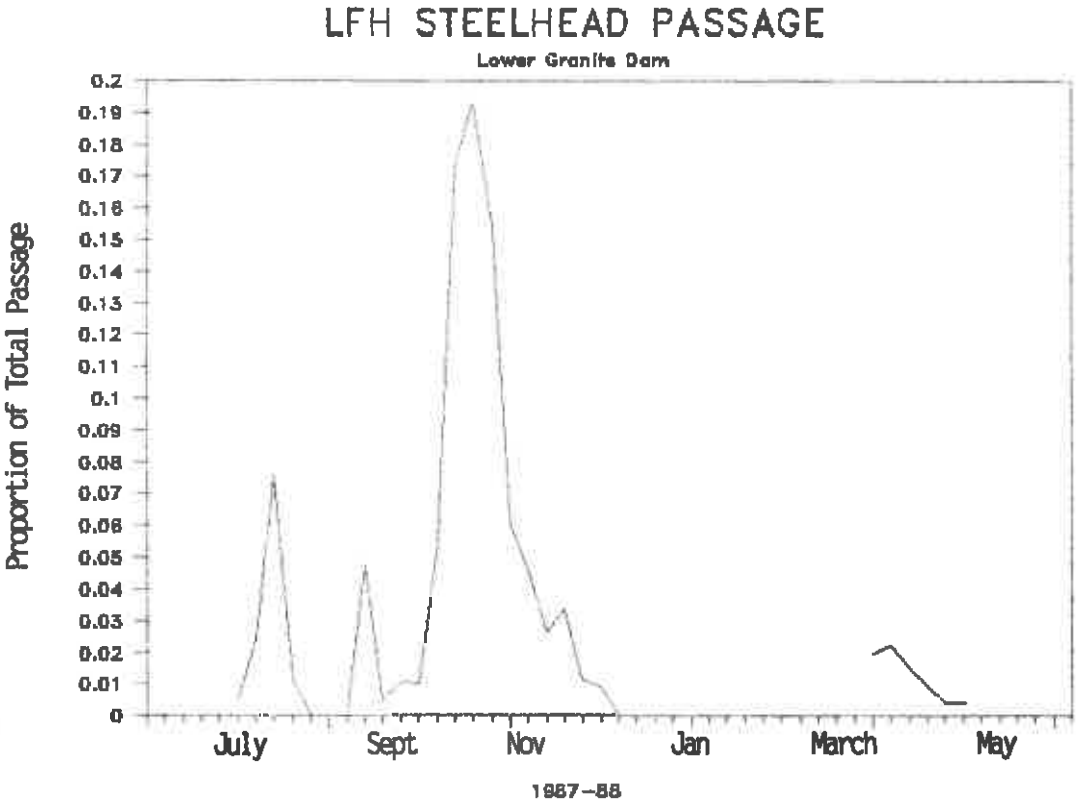


Figure 8. Lower Granite Dam steelhead passage, 1987-88.

Table 6: Adult Returns of Lyon's Ferry Steelhead to Above Lower Granite Dam, 1985-87. (Harmon, 1988)[1]

Release year Brand*	Number of Adults Return Year 1985	1986	1987	Total Adults Captured	No. Smolts Rel.	% survival[2]
1984						
RA-IJ-1	121	141	3	265	30,473	0.92
RA-IJ-2	99	129	2	230	27,122	0.90
RA-IV-1	176	168	3	347	31,790	1.15
RA-IV-3	202	237	3	442	30,930	1.51
1985						
RA-H-1		429	147	568	28,191	2.10
RA-H-2		83	64	146	28,373	0.54
RA-17-1		553	259	812	41,028	2.04
RA-17-3		468	203	671	40,201	1.74
LA-S-1		101	71	172	39,094	0.45
LA-S-2		85	88	173	39,094	0.46
1986						
LA-IJ-1			135	135	20,136	0.67
LA-IJ-3			131	131	20,506	0.64
LA-IJ-4			123	123	20,639	0.60
LA-IK-1			83	83	20,246	0.41
LA-IK-3			84	84	20,234	0.42
RA-IK-1			70	70	20,244	0.35
RA-IK-3			88	88	20,250	0.44
LA-IT-1			14	14	20,172	0.07
LA-IT-3			21	21	20,177	0.10
RA-IJ-1			121	121	20,205	0.61
RA-IJ-4			99	99	20,038	0.50
RA-IJ-3			122	122	20,234	0.61

* 1984: All brands released in Tucannon River. 1985: RA-H LFH; RA-17 G.Ronde LA-S Tucannon R. 1986: LA-IJ & IK LFH; RA-IK & LA-IT = Tucannon; RA-IJ = G.Ronde.

[1] No current estimate of trap efficiency exists for the L. Gran. bypass. Past studies indicate 85-90% (Harmon, Pers. Comm). These numbers are not expanded.

[2] Smolt to adult survival is based on numbers of tagged juveniles released with a corresponding brand. (Adjusted for tag and brand loss)

Characteristics of Returning Adult Steelhead

We now have complete adult Wallowa stock steelhead return data on the 1982-1984 tag groups from Lyons Ferry Hatchery and at least one years return data on releases through 1986. The data were collected at Lower Granite Dam from coded wire tagged/branded adults as they passed through the fish ladder. Releases through 1985 returned as 55.4% 1-ocean age, 44.2% 2-ocean age and 0.4% 3-

ocean age. The size of fish for each year class for several brand groups is consistent over the 4 years represented (Table 7).

Table 7: Average Lengths for Lyons Ferry Hatchery Adult Wallowa and Wells Stock Steelhead Returning to LGD Trap.

Release year	Release site	Brand	Mean length(cm) one ocean n[1]	one ocean L	two ocean n	two ocean L
1984	Tucannon R.	RA-IJ-1,2	100	57.8	270	71.4
	Tucannon R.	RA-IV-1,3	100	58.1	405	71.9
1985	L.Ferry H.	RA-H-1[2]	429	58.5	147	70.0
	L.Ferry H.	RA-H-2	83	57.4	64	67.9
	G.Ronde R.	RA-17-1,3	1021	57.6	462	69.6
	Tucannon R.	LA-S-1,2	186	57.8	159	68.3
1986	L.Ferry H.	LA-IJ-1,3,4	389	59.2		
	L.Ferry H.	LA-IK-1,3	167	59.6		
	Tucannon R.	RA-IK-1,3	158	59.2		
	Tucannon R.	LA-IT-1,3	35	59.4		
	G.Ronde R.	RA-1J-1,2,3	342	59.7		
	Weighted Mean			**58.4**		**70.3**

1 Sample size, does not necessarily indicate total return.
2 Wells stock released at LFH.

Returns to Lyons Ferry Hatchery

The ladder at the hatchery was operational from 18 Sept. to 29 Nov. 1987. The ladder was not reopened during spring 1988. A total of 1,081 adult steelhead were trapped and inspected for brands, fin clips, sex and origin.

Fish sorted from fall trapping were comprised of 56.7% females and 43.2% males. Wild origin fish were 1.5% of the sample and tagged/branded fish represented 19.7% of the total fall trapping. Branded Wallowa stock fish (LA-IK-1,3) returning to Lyons Ferry Hatchery as brood stock were trapped at a 0.017% return rate (7 fish) while branded Wells stock fish returned to the hatchery at a 0.105 % return rate (64 fish). These numbers represent a significant decrease over the 1986 run year returns to LFH.

The female fish sorted for spawning were comprised of 87.6% hatchery origin, based on fin clip and dorsal fin examination, 1.5% wild and 10.9% LV clipped. A complete listing of brand and tag recoveries to the hatchery is summarized in Appendix A. Two hundred and sixty seven (267) females were spawned yielding 941,765 eggs (mean =4,572 eggs/female for 1-ocean age; mean =5596 eggs/female for 2-ocean age). Females were selected weekly for spawning based on physical examination for ripeness. Males and

females from the fall trapping that were retained for spawning were held in seperate ponds. Scale samples were collected from all spawned females and from some of the spawned males (Appendix B). Three egg lots of three fish each tested IHN positive based on ovarian fluid samples. These eggs were destroyed. Samples were also collected from 60 females to test for IPN virus. All samples were negative.

Returns to Other Locations

Trapping

Trapping operations on Cottonwood Cr. were conducted from 4 March until 26 April 1988. Three hundred sixty (360) adults were either captured in the creek below the rearing pond intake screen or in the outlet channel of the pond itself. By mid March there was insufficient water below our pond diversion to allow fish to enter the stream. Adult hatchery origin steelhead made up 99% of the fish we sampled. We sampled 144 males (40%) and 216 females (60%) and recovered 149 brands or snouts from LV clipped/coded wire tagged fish. A complete listing of tag/brand recoveries in included in Appendix C. The average 1-ocean age female and male was 59.4 cm (n=122) and 57.4 cm (n=123) respectively. Two ocean age females and males were 71.7 cm (n=93) and 73.9 cm (n=20) respectively.

Spawning Surveys

Table 8 presents a summary of spawning ground redd and adult observations for each stream surveyed in 1988. Peak spawning occurred after April 19 and before May 19 for the Tucannon river and its tributaries. The peak of Touchet River spawning occurred between April 11 and May 12 except for the South Fork Touchet, where peak spawning occurred within the second week of April. Peak spawning for Asotin Creek and tributaries occurred prior to May 10, with the exception of Charlie Creek where peak spawn occurred prior to April 28.

In the event of searching for coded wire tagged adults, we walked Wawawai and Offield Creek, both located above Lower Granite Dam. We found considerable hatchery and wild steelhead. These streams have no suitable spawning habitat but information from adults observed are presented in Appendix D.

Discussion

This is the third year of reliable spawning data on project streams. Spring runoff conditions determine the success of walking streams. Conditions were good this year with only a few problems. High fast water on the main Tucannon R. kept us from completing our first walk. Poor visibility due to murky water on Charlie and Cummings Creek made us skeptical of our first findings. It was possible we had missed a substantial number of redds. In both instances the redds marked during our first survey and new redds

Table 8. Redd Survey Results for Streams in Southeastern WA. Spring 1988.

Stream	Section	Reach length (miles)	Dates surveyed	Surveys 1st Redds	1st Adults	2nd Redds[A]	2nd Adults	Total redds	Total adults	Total redds/ mile
Tucannon R.	Upper Tucannon[B]	6.2	4-19/5-16	13	9	36	2	49	11	7.9
	Panjab to wier[C]	10.9	4-19, 5-16,18	159	[illegible]	--	--	159	7	14.6
	Main Tucannon	11.3	5-18,19	187	9	--	--	187	9	16.5
	Panjab Creek	2.3	4-19/5-16	[illegible]	2	9	2	13	4	5.6
	Cummings Creek[D]	6.5[E]	4-20/5-17	132	33	--	--	132	33	20.3
Touchet R.	Main Touchet[F]	1.5	5-12	41	--	--	--	41	--	27.3
	South Fork	15.75	4-11,12/ 5-12	108	36	129	5	237	41	15.0
	North Fork	11.2	4-13/5-12	44	[illegible]	119	9	163	42	14.5
	Wolf Fork	10.3	4-12/5-11,12	[illegible]	15	127	5	163	20	15.8
	Robinson Fork	2.3/3.8	4-4/5-11	0	1	50	0	50	1	13.2[E]
	Burnt Fork	0.5	4-11	[illegible]	0	0	0	--	--	--
	Griffin Fork	0.5	4-11	0	0	0	0	--	--	--
Asotin Creek	Main Asotin[G]	1.7[E]	[illegible]	[illegible]	2	13	4	15	6	8.8
	George Creek[H]	4.6[E]	[illegible]	0	0	--	--	--	--	--
	South Fork-A[I]	3.45	4-26	16	[illegible]	--	--	16	3	4.6
	South Fork-B[J]	[illegible]	5-10	62	1	--	--	62	1	18.5
	North Fork-A[K]	4.9[E]	5-10	72	1	--	--	72	1	15.0
	Charlie-A[L]	0.5[E]	4-28	[illegible]	0	--	--	4	--	8.0
	Charlie-B[M]	[illegible]	4-28	33	1	--	--	33	1	[illegible]

[A] New redds only.
[B] End of foot trail down to Panjab bridge.
[C] Panjab bridge to Tucannon Hatchery wier.
First survey of this section interrupted by high, fast water. Combined the 24 redds and 15 adults found to the second survey's finding and listed as one walk.
[D] First survey incomplete, added first survey and second survey counts together.
[E] Road miles. All other are actual river miles taken from USGS maps.
[F] Mouth of South Fork Touchet downstream to HWY 12 bridge.
[G] Forks to old floating trap site at Blankenships (miles below mouth of Charlie).
[H] 0.5 miles above mouth to just above Stringtown Creek.
[I] Mouth to Schlee's.
[J] Schlee's barn to chimney.
[K] Mouth to USFS.
[L] Mouth to 1987 trap site.
[M] Trap site to debris jam at RM [illegible]

located on the second survey were added together and recorded as one walk through. Despite these problems we have consistent data that shows a slight fluctuation in the peak spawning period can be expected from year to year, dependent upon spring weather.

The lower 0.5 miles of Meadow and Bear Creeks on the upper Tucannon River, and Burnt and Griffin Creeks on the South Touchet were each walked, but no redds were found. These creeks will not be walked again since they require substantial time and effort in getting to and from the site.

Mainstream counts on the Tucannon River continued to increase significantly from the last two years (Schuck and Mendel 1988). The number of redds found on Cummings Creek nearly tripled from previous years. Increases in redd counts on the main Tucannon and Cummings could be due to adult returns from Curl Lake acclimation pond releases (located on the upper Tucannon R.) or returns to Lyons Ferry Hatchery fish straying up the Tucannon. Another possible reason may be because of passage problems at the Tucannon Hatchery weir. Cummings Creek is approximately 0.3 miles below the weir site. Fish veering away from the weir could soon find themselves at the mouth of Cummings Creek.

Asotin Creek and its tributary counts were down overall this year. The decrease on Asotin Creek could have been a result of low drought related stream flows which restricted fish escapment. There was however a significant increase in redds on the upper South Fork from last year. This may have been due to improved passage conditions because our adult was not installed this year. Also, passage over the beaver dam located just above the mouth of the South fork was improved over previous years.

Redd counts are useful as an indication of the extent of habitat being accessed by fish and for determining relative densities from year to year. In the future we plan on converting our redds/mile into redds/100 m^2, so a more universal usage of our data will be possible.

We are now in the process of fool proofing adult traps on Asotin and Charlie Creeks and installing an adult trap on the Tucannon River. With the aid of such traps, estimating redds/adult ratios will be much easier.

Steelhead Creel Surveys

Lower Snake River

We relied on harvest estimates derived from punchcard returns to Olympia (Table 9). Our sampling was primarily to obtain catch composition data and recover coded wire tags. A summary of data collected from fish observed on the Snake R. is presented in Table 10.

This was the first full season where fin clips were used as the only legal criteria for retaining steelhead, thus all fish kept this year were adipose clipped. In addition some were left ventral (LV) or right ventral (RV) clipped indicating the presence of a coded wire tag.

The average size of harvested fish was greatest in sections 168L and 168M (Table 10) where Dworshak Hatchery "B run" steelhead winter in the reservoir and lower portions of the free flowing river.

Grande Ronde River

Angler effort was highest throughout the season in the catch-and-release zone near the mouth of the river and near the Cottonwood Cr. Conditioning Pond (Table 11). Approximately 3,780 angler days were expended by anglers on the Grande Ronde River with an average completed fishing trip of 2.5 hours (Appendix E). Boat anglers contributed only 170 hours to the total fishing effort for the season, and we have no estimate of an average completed boat trip. Table 12 summarizes data collected from steelhead examined in angler creels along the Grande Ronde River, spring 1988. The greatest harvest occurred in late March and early April near the Cottonwood CP.

Table 9. Punchcard-derived steelhead harvest estimates for WDW management sections on the lower Snake River, fall 1987 and spring 1988 * (WDW 1988).

Month	Below Ice H.Dam	Below L. Mon. Dam	Below L. Goose D.	Below L. Granite D.
Sep.	9	7	31	15
Oct.	15	35	262	46
Nov.	4	138	180	107
Dec.	7	184	93	64
Jan.	22	67	102	111
Feb.	0	5	18	56
Mar.	0	2	11	49
	57	438	697	448

* WDG mgmt. sections are 164 = below Ice Harbor, 165 = below Lower Monumental Dam, 166 = below Little Goose Dam, 167 = below Lower Granite Dam.

Table 10. Data from steelhead observed in angler creels along the Snake River, fall 1987 and spring 1988.

Section	Mean fork Length (cm) Std.dev. (n) [A]	Mean wt. (kg) Std.dev. (n) [A]	% Female (n) [A]	% Males (n) [A]	% Unknown (n) [A]	% fish released (n) [AB]	% Ventral clipped (n) [A]	Sampling rate[C]
166	73.6 (91)	4.1 (69)	51.3 (39)	37.6 (35)	1.1 (1)	22.0 (38)	2.9 (12)	13.3
167	72.5 (89)	3.7 (80)	31.5 (45)	30.8 (44)	37.8 (54)	22.3 (41)	10.5 (15)	31.9
168L	75.2 (135)	4.8 (81)	45.7 (67)	50.0 (74)	4.7 (7)	17.8 (32)	14.1 (18)	
168M	75.1 (332)	4.4 (115)	51.4 (191)	43.6 (153)	4.0 (17)	29.2 (145)	17.5 (45)	25.6[D]
TOTALS			47.6 (150)	41.6 (306)	10.7 (79)	25.8 (256)	12.2[E] (90)	

A n = # of kept fish sampled in the harvest; some fish were not seen or no data were recorded - not included in n.

B Percent released is equal to (# of fish released/# of fish kept + # of fish released).

C (# of fish checked/punch card estimated harvest).

D Includes 168L.

E Includes fish checked by IDFG in 168M. Total checked by WDW = 71.

Table 11. Estimated angler effort, catch rates, and harvest for steelhead anglers on the Grande Ronde R., fall 1987.

Month	Zone [B]	Angler Effort hrs	(± CI)	Catch Rate fish/hr [C]	Harvest [A] # of fish
Sept.	D	332			0
	E	166			
	S	146			
	A	915			
	Total	1,559		0.00163	2
Oct.	D	1,058			
	E	384			
	S	460			
	A	866			
	Total	2,768		0.00643	11
Nov.	D	435			
	E	134			
	S	520			
	A	444			
	Total	1,533		0.0180	18
Dec.	D	119			
	E	164			
	S	638			
	A	143			
	Total	1,064		0.0053	5
Jan.	D	90			
	E	0			
	S	0			
	A	0			
	Total	90		----	2
Feb.	D	0			
	E	84			
	S	126			
	A	0			
	Total	210		0.0238	5
Mar.	D	0			
	E	0			
	S	0			
	A	1,947			
	Total	1,947		0.0693	135

Table 11 (cont.)

Month	Zone [B]	Angler Effort hrs (± CI)	Catch Rate fish/hr [C]	Harvest [A] # of fish
Apr.	D	- [D]		
	D	-		
	S	-		
	A	-		
	Total	375[E]	0.[illegible]	113
Grand total		9,445		[illegible]

A Harvest estimates from WDW punchcard returns. Estimates not possible from creel survey.
B Zone D is a catch and release area from the mouth to the County bridge (2.5 miles). D1 is from the bridge upstream to "The Narrows" (approx. 2 miles), S1 is Chumaker Grade area (6 miles), A1 is just below Bogan's at Rattlesnake Grade to Oregon State Line (12 miles). All zones labels ending in 1 are wild steelhead release zones.
C Catch rate for kept fish only.
D No estimate of angler effort made.
E Effort obtained from harvest divided by catch rate from creel for April 1-15, 1988 in Zone A.

Table 12. Data for steelhead in angler creels along Grande Ronde River, spring 1988.

	x length in cm (n)[A]	x weight in kg (n)[A]	% females (n)[A]	% males (n)[A]	% LV clipped (n)[A]	sampling rate[B]
1-ocean age	59.6 (110)	2.0				
2-ocean age	72.5 (41)	3.6				
Combined	63.1 (151)	2.4 (145)	57.6 (87)	42.4 (64)	30.5 (46)	60.0

A # of fish sampled.
B (# of fish checked/punch card estimated harvest)

Other Streams

Harvest estimates for Mill Creek and the Touchet, Tucannon and Walla Walla rivers were obtained from WDW punchcard estimates (Table 13). Catch rate and catch composition data were collected by sampling weekend days 2-3 times per month. A summary of data from fish observed during creel survey of these rivers is presented in Table 13. We surveyed 1 day in the fall and 5 days in spring for the Walla Walla River and Mill Creek. Ten days were sampled on the Touchet River, and 19 days on the Tucannon River during the season, although only one day in the fall on each river. Sampling periods ranged from 11 November, 1987 to 20 February, 1988 on the Walla Walla R. and Mill Creek; 31 December, 1987 to 9 April, 1988 on the Touchet River and 20 December, 1987 to 9 April, 1988 on the Tucannon River.

Table 13. Harvest estimates from punchcard returns for the Walla Walla, Touchet, Tucannon rivers and Mill Creek, fall 1987 and spring 1988 (WDW 1988).*

Month	Tucannon R.	Touchet R.	Walla W. R.	Mill Ck.
Sep.	0	4	0	0
Oct.	0	2	40	0
Nov.	16	0	177	0
Dec.	13	7	131	0
Jan.	7	4	84	0
Feb.	44	33	209	11
Mar.	109	147	124	7
Apr.	0	22	49	7
Total	189	219	814	25

All 1987 run year recoveries of marked Lyons Ferry Hatchery (LFH) origin steelhead containing length or sex information are located in project or district files. These data were used for sex ratios, mean length and mark rate.

Table 14. Data for steelhead observed in angler creels along the Walla Walla, Touchet and Tucannon Rivers, fall 1987 and spring 1988.

Season	WDW mgmt. sec.[A]	x length in cm (n)[B]	Std. dev.	% Female (n)[B]	% Wild (n)[B]	% of fish adipose clipped (n)[B]	Total # of fish creeled
Fall	194	--	--	--	--	--	--
	185	--	--	--	--	--	--
	189	67 (2)	0.71	--	--	--	2
Fall Total		67 (2)	0.71	--	--	--	2
Spring	194	69.1 (4)	8.4	100.0 (4)	50.0 [C] (4)	50.0 (4)	8
	185	72.5 (4)	5.2	100.0 (5)	0 (0)	100.0 (5)	5
	189	66.7 (26)	6.08	42.9 (15)	41.4 (15)	63.4 (26)	41
Spring Total		69.4 (34)	--	54.5 (24)	35.0 (19)	65.0 (35)	54

A WDW fishery mgmt sections: 194=Walla Walla River; 185=Touchet River, and 189=Tucannon River.
B # of fish sampled.

Coded-Wire Tag Recovery

Snouts were collected, or brands and jaw tags were read, by WDW personnel from 134 steelhead that had left ventral fin clips. Eleven additional LV clipped fish were examined but removal of snouts from these fish was not allowed by the angler and we were unable to obtain any further information. One snout was lost, but all others were examined by NMFS personnel for coded-wire tags (cwts). All cwts recovered by WDW personnel and estimates of the expanded harvests by individual tag code are presented for Lower Granite and the lower Snake River (Table 15). Idaho Fish and Game cwt recoveries are expanded for the mid Snake R. (Appendix F) but IFG recoveries above the Grande Ronde had to be excluded because we were unsure whether these fish were caught below the Oregon State Line within our management section 168.

Table 15. Coded-wire tag expansions for the Snake R., and tributaries, fall 1987 and spring 1988.

Sec.[A]	Season[B]	Estimated Harvest[C]	# Fish Checked (Sample Rate)[D]	# Fish Marked[E] (Mark Rate)[F]	# Snouts Taken[E]	# Snouts Checked (# cwt, no tags)	Total Estimated # Fish Marked[G] (% w/ cwt)[H]	Total Estimated cwt in Harvest[I]	CWT code	# Tags Recovered	Expanded tags in Harvest (by code)[J]
MID 168	Fall	1640	185 (.1128)	33 (.1784)	29	29 (29,0)	292 (87.8)	292	7-38-02	2	20
									63-33-05	1	10
									63-32-15	1	10
									62-16-27	3	30
									63-32-02	1	10
									LA-W-1	1	10
									63-33-50	1	10
									63-33-49	1	10
									10-26-36	1	10
									63-33-04	1	10
									63-38-44	2	20
									63-33-03	1	10
									7-37-62	3	30
									LA-J-4	2	20
									63-38-38	2	20
									63-33-51	1	10
									62-16-28	3	30
									63-38-36	1	10
									63-33-06	1	10
										29	290
MID 168	Spring	541	66 (.1219)	5 (.0757)	4	4 (4,0)	41 (80.0)	41	10-25-17	1	10
									5-13-35	1	10
									63-33-02	1	10
									62-16-44	1	10
										4	40
L.SN. 167	Fall	260	33 (.1269)	8 (.2424)	8	8 (6,2)	63 (100.0)	63	62-16-44	1	8
									63-38-36	1	8
									63-38-38	1	8
									7-38-01	1	8
									10-26-31	1	8
									63-38-36	1	8
									NO TAG	2	16
										8	64
L.SN. 167	Spring	242	54 (.2231)	10 (.1296)	7	7 (5,1)	31 (70.0)	31	10-26-31	1	4
									63-33-50	1	4
									63-33-04	2	8
									63-38-36	1	4
									62-16-27	1	4
									NO TAG	1	5
										7	29

Table 15. (Continued)

Sec.[A]	Season[B]	Estimated Harvest[C]	# Fish Checked (Sample Rate)[D]	# Fish Marked[E] (Mark Rate)[F]	# Snouts Taken[E]	# Snouts Checked (# cwt, no tags)	Total Estimated # Fish Marked[G] (% w/ cwt)[H]	Total Estimated cwt in Harvest[I]	CWT code	# Tags Recovered	Expanded tags in Harvest (by code)[J]
L.SN. 166	Fall	634	77 (.1214)	12 (.1428)	9	9 (9.0)	90.5	91	63-38-36	1	9
									63-32-02	1	9
									62-16-30	1	9
									62-16-44	1	9
									7-37-62	1	9
									UNREADABLE	1	9
										9	91
L.SN. 166	Spring	147	11 (.0749)	2 (.1818)	2	2 (2,0)	27 (100.0)	27	62-16-30	1	14
									62-16-27	1	14
										2	28
Tuc.R. 109	Spring	220	25 (.1138)	9 (.3600)	9	9 (8,1)	79 (100.0)	79	62-16-30	5	27
									63-38-29	2	18
									63-33-49	1	9
									63-33-02	1	9
									63-33-06	1	9
									No Tag	1	9
										9	81

A L. Granite Dam (LGR) up to Red Wolf BR., L.Sn.= Lower Snake R. below LGR.
B Fall = 1 Sept. to 31 Dec., Spring = 1 Jan. to 31 Mar.
D (# Fish checked / estimated harvest) = sample rate.
F (# of fish fin clipped / # fish checked) = mark rate.
G (Total harvest x mark rate) = estimated # of fin marked fish in harvest.
H (# tags and brands / # snouts checked) x 100 = % of snouts with cwt's or other marks.
I (Estimated total marked fish x proportion of snouts with tags) = # tags in harvest.
J (# recoveries of a tag code / total # tags) x Estimated marks in harvest
= estimated tag codes in the harvest (expanded).

In the course of spawning ground surveys and attempting to find missing radio tags (see Mendel and Schuck, 1989) we walked Wawawai and Offield Creeks just upstream of Lower Granite Dam. We found considerable numbers of hatchery and wild steelhead carcasses. These streams have no suitable spawning habitat but results from adults and coded wire tags recovered are presented in Appendix D. A list of jaw tags and brands that were seen during the creel survey, spawning survey or were volunteered by anglers is retained in district files and is available upon request. Any readable brands or jaw tags for fish from which we didn't take a

snout have been included in the cwt recoveries and expanded harvest estimates for individual tag codes.

Returns of Coded Wire Tag Groups

Many other fish bound for the Snake river were intercepted in consumptive fisheries or wandered into other stream systems where they were sampled (Table 16).

Table 16: Adult Returns of Lyons Ferry Steelhead to Locations and Fisheries within the Columbia River Basin 1987-88 (% smolt to adult survival those numbers represent).

	Tag Code (Brand)							
Location	62/16/44-45 (RA-H-1,2)	62/16/27-28 (RA-17-1,3)	62/16/29-30 (LA-S-1,2)	63/38/36-7-8 (LA-IJ-1,3,4)	63/33/03-04 (LA-IK-1,3)	63/33/50-51 (RA-IK-1,3)	63/32/02-33/02 (LA-IT-1,3)	63-33-05-6-49 (RA-IJ-1,2,3)
L.Col. Sport		21(.027)	7(.009)	28(.046)		7(.017)		7(.012)
Mid.Col. Sport								
Zone 6 Net	112(.216)	329(.419)	70(.093)	227(.372)	101(.251)	57(.142)	8(.020)	177(.296)
L.Ferry Ladder	13(.025)	2(.002)	-	22(.036)	10(.025)	1(.002)	(.)	65(.109)
Snake R. Sport	3(.006)	8(.010)	2(.003)[1]	32(.052)	4(.010)	3(.007)	10(.025)	3(.005)
Cottonwood CP		78(.099)						68(.114)
Dworshak NFH								
Idaho Sport[1]	14(.027)	13(.017)		61(.10)		22(.055)		20(.033)
Ocean Harvest		1(.001)		1(.002)	1(.002)			
WDF Tuc.R. rack			7(.009)			2(.005)		
Trib. Spawning	4(.008)		1(.001)	4(.006)	4(.010)	2(.005)		
Tuc. R. Sport			3(.004)	2(.003)			1(.003)	2(.003)
Deschutes R.		27(.034)	2(.003)	5(.008)				41(.069)
Snake R. Total	34(.066)	101(.129)	13(.017)	121(.198)	18(.045)	30(.075)	11(.027)	158(.264)
Grand Totals	146(.282)	479(.611)	90(.119)	382(.625)	119(.296)	94(.234)	19(.048)	383(.641)

@ tag recoveries are based on sample data collected by several agencies and forwarded to WDW through each states' tag coordinator.
* Indicates that no sample rate could be obtained and the number listed is for fish collected.
[1] Not in-sample sport recoveries. Number listed here is jaw tags returned to NMFS at L. Granite dam for a $5.00 reward.
[2] Expanded estimates for rivers other than the Snake R.(section 01)- data from Kent Ball, IDFG, pers. comm..
- WDW tag recoveries included (but not shown above) 1 Oregon (7/37/63) and 1 Idaho (10/28/03) tag.
- Zone 6 also includes 15 tag recoveries from 1984 releases (63/32/12-13-15 for RA-IJ-1,2,3).

We have complete 1 and 2 ocean age returns now for the 1985 coded wire tag releases. A summary of returns to various fisheries is presented in Table 17. A total contribution of the releases to the Columbia River basin fisheries and escapement is an important estimate of contribution to the LSRCP area. These numbers are an indication of our progress toward meeting our compensation goal of 0.5% smolt to adult survival and our adult return goal of 4,656 fish back to the Snake River basin.

Table 17. Returns of 1985 Release LFH steelhead to Locations in the Columbia River Basin, for run years 1986-87 (% smolt to adult survival those figures represent).

Tag Code	62-16-44	62-16-45	62-16-27/28	62-16-29/30
Recovery Location		Estimated Harvest or Return		
L. Columbia Sport	49(.181)	16(.059)	119(.154)	15(.020)
Mid-Columbia Sport	---	---	---	---
Deschutes R.	---	---	27(.034)	2(.003)
Zone 6 Treaty Net	141(.562)	86(.321)	476(.607)	106(.141)
Priest Rapids Dam	4(.016)	---	---	---
LFH ladder	89(.355)	48(.179)	13(.017)	1(.001)
Up. Snake R. Sport	156(.622)	16(.060)	224(.286)	67(.089)
Dworshak NFH	---	---	---	---
Idaho Sport	19(.076)	---	34(.043)	23(.031)
	458(1.82)	166(.620)	866(1.12)	212(.281)

The actual performance of the various mark groups of LFH steelhead is very encouraging and it appears that we are close to meeting our mitigation/ compensation goals. For all the tag codes listed, we met or exceeded the production escapement goal of 0.5% survival back to the Columbia River system and met the goal for escapement to the Snake River (Table 6). Sampling Lower Columbia River harvest is crucial to tracking the performance and contribution of our releases. These fisheries capture substantial percentages of total returns into the system and are also subject to wide fluctuations in season length and gear restrictions from year to year. They could jeopardize ultimate achievement of Snake River goals if they expand to their maximum potential. Reliable data concerning LSRCP fish contributions to these fisheries will be the only means to protect long term programs if downstream management of mixed stock fisheries threatens the success of mitigation. At present, fisheries directly above and below McNary Dam are not sampled but will be sampled starting in 1988-89.

Fish passage data collected at Lower Granite dam continues to be our single most effective tag recovery sample site. We have complete return cycles for LFH released steelhead (1982-84) passing the facility that indicate we are meeting our steelhead goals for the hatchery (Table 6). Many of the fish passing the dam had been released from the hatchery as smolts and are wandering considerable

distances upstream from their point of release. This behavior is also exhibited by fish released in 1984-85 from the Tucannon Hatchery. We discussed migrational behavior in another publication this year (Mendel and Schuck 1989) in greater detail. This behavior can jeopardize our ability to meet escapement or harvest goals for our individual mitigation streams.

Our fish are contributing to fisheries throughout the lower Columbia River basin upon their return but at present, those fisheries have not harvested sufficient numbers to place LSRCP goals for returning adults in jeopardy. We estimate that for release year 1985, the 1987 return of adults to the Snake River was 0.39 % of smolts released and the average adult return for the two run years of 1986 and 1987 was 1.22 % of smolts released. One year returns from the 1986 release averaged 0.452 % adults from smolts. This represents a decrease over the previous years survival although still well within our goal of 0.5 % over their life cycle. Based on these numbers, we estimate that adult returns from Lyons Ferry Hatchery smolt releases into Washington LSRCP waters in 1987 were 6,758 fish to the project area (above Lower Granite Dam or into an appropriate tributary). These figures are based on return rate information in Table 6 and do not represent adult returns from smolts reared for ODFW.

Exploitation Rates

The total number of jaw tags attached at Lower Granite Dam during the season and the total return of tags from the sport fishery provide the numbers to calculate a simple estimate of sport exploitation, by group and by year (Table 18).

Table 18. Estimates of sport exploitation of tagged/branded steelhead groups passing L. Granite, 1987 run year.

Release Year	Brand	No.Fish Examined	No. of fish jaw tagged (%)	No.Sport Recoveries	Percent Exploit.
1985	LA-S-1,2	211	69 (32.7)	2	2.9
	RA-H-1,2	462	151 (32.7)	26	17.2
	RA-17-1,3	159	57 (35.8)	2	3.5
1986	LA-IJ-1,3,4	389	121 (31.1)	2	1.6
	LA-IK-1,3	167	55 (32.9)	2	3.6
	RA-IK-1,3	158	46 (29.1)	4	8.7
	LA-IT-1,3	35	10 (28.6)	0	---
	RA-IJ-1,3,4	342	102 (29.8)	10	9.8
		1923	611 (31.8)	48	7.8

The calculated exploitation rates by brand group for the two years are widely variable and appear to be low for all marked groups of LFH steelhead. IFG estimates that sport fishing exploitation for LSRCP hatchery "A run" steelhead in Idaho varied between 38 and 69 % (Ball 1986). However, they use a different method to calculate exploitation rates than we do so the numbers are not directly comparable. These estimates are less than exploitation rates derived from radio tagged steelhead with higher rewards (Mendel and Schuck 1989). We now believe that estimates of exploitation based on jaw tags are consistently low for our fish.

Juvenile Salmonid Populations in Project Rivers

Spring Emigration

Smolt trapping operations were conducted at the Cottonwood CP intake screen from March 9 until April 29, 1988. The migration of smolts and transitionals had a very pronounced peak in 1988 (Fig. 9). and parr comprised a larger component of the emigration in 1988 than in 1987.

Naturally produced emigrants comprised 95.6 % of the 552 juveniles captured in 1988 (Table 19). However, mean lengths for smolts were similar for 1987 and 1988 (Fig. 10).

Emigrating steelhead were trapped on the Tucannon River during each month the WDF scoop trap was operational. Table 20 summarizes results of the trapping. Although mark/recapture tests were conducted to estimate trapping efficiency for each month, insufficient recaptures occurred to allow calculation of a trapping efficiency this year. Table 21 lists the estimated emigration of wild steelhead by life stage and month for the Tucannon River, fall 1987 and spring 1988.

Table 19. Juvenile steelhead emigrants trapped at the Cottonwood conditioning pond intake screen, spring 1988.

	hatchery	wild	
	smolt	parr[A]	smolt[B]
# of fish	24	179	340
% of total	4.4	32.9	62.6
Mean fork length (cm)	209.0	117.1	163.9
SD	42.4	16.0	23.5
(n)	(24)	(179)	(340)
Mean weight (g)	85.1	16.1	43.7
SD	59.8	5.2	20.4
(n)	(21)	(179)	(340)

A Parr = brightly colored, <135mm, and parr marks distinct.
B Consists of 12 transitional and 328 smolts.

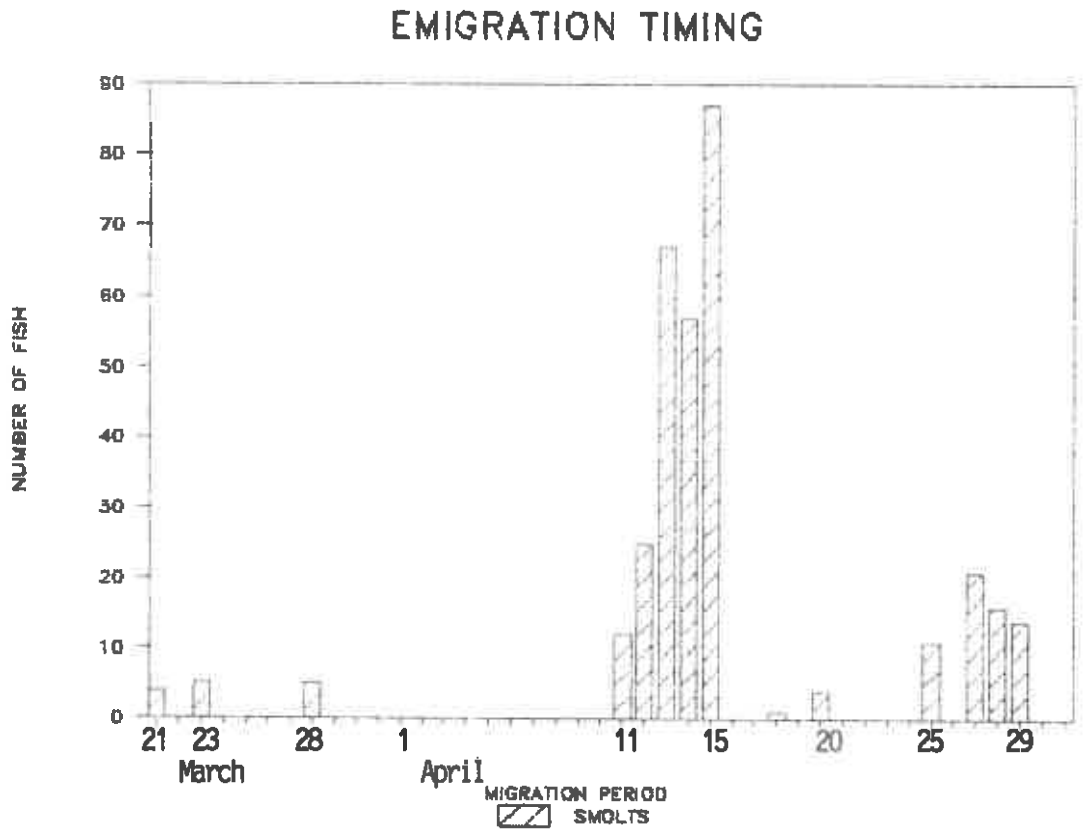


Figure 9. Timing of downstream migrants captured on Cottonwood Cr., spring 1988.

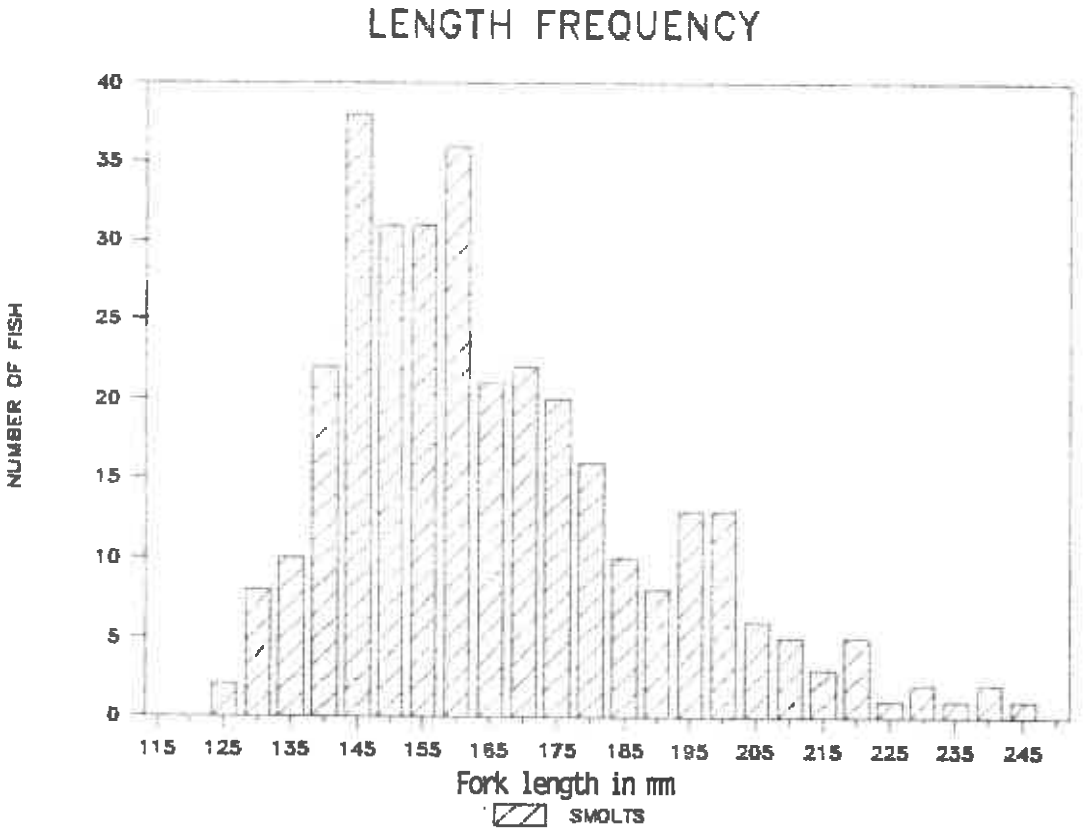


Figure 10. Length frequencies of emigrating wild smolts on Cottonwood Cr., spring 1988.

Table 20 Tucannon River Smolt trapping data for Steelhead, 1987-88.

Month	Fish Captured Hat.	Wild	Average Length (X) A Smolts X (SD)	n	Transitional X (SD)	n	Parr X (SD)	n
Oct. 87	0	7	---		84.0 (11.6)	5	83.5 (3.5)	2
Nov.	0	11	137.0 (0)	1	110.2 (15.2)	9	69.0 (0)	1
Dec.	0	21	---		114.0 (18.5)	15	91.6 (16.2)	5
Jan. 88	0	24	103.0 (0)	1	114.0 (14.6)	23	101.3 (19.0)	4
Feb.	0	27	112.0 (0)	1	111.1 (14.4)	13	108.9 (19.2)	12
Mar.	0	6	168.6 (15.8)	3	112.0 (7.0)	2	36.5 (0)	1
Apr.	3	40	156.8 (17.7)	13	130.8 (15.8)	4	---	
May	193	122	185.5 (26.1)	162	164.7 (18.5)	17	59.5 (45.5)	6
June	17	276	187.7 (30.4)	15	54.5 (3.6)	8	45.3 (6.1)	266

A These values express combined statistics for both hatchery and wild fish.

Table 21. Emigration of Tucannon River Wild Steelhead by Life Stage by Month (Estimated Total Passage)* 1987-88.

Month	Parr #fish	Transitional #fish	Smolts #fish	Totals
Oct. 87	16	40	0	56
Nov.	8	73	8	89
Dec.	40	121	0	161
Jan. 88	32	185	8	225
Feb.	97	105	8	210
Mar.	8	16	24	48
Apr.	0	32	89	121
May	48	56	507	611
June	2,142	64	24	2,250
Totals	**2,391**	**692**	**668**	**3,751**

* Figures expanded from actual numbers trapped using the 1987 trap efficiency of 0.12421.

Discussion

Trapping activities were very limited this year. Trapping efficiency for the Cottonwood C.P. we assumed to be near 100% because of extremely low drought related flows. The fish emigrated in a much different fashion than in 1987. Brief spikes of large numbers of fish moved out of the system during the few rainfall occurances of the spring however total emigration for the two years was similar. Parr emigration in 1988 was more than three fold the 1987 numbers. This increase in emigrating parr may also represent the population response to low flow drought conditions and the limited rearing habitat available in the system.

Tucannon River trapping data was disappointing. Very low

numbers of wild fish were collected during this trapping season. Mark/recapture tests to measure trap efficiency with upstream releases of wild emigrants were totally unsuccessful. Too few individuals were ever collected on one day to compute a recapture rate. The 1987 efficiency rate was therefore used to expand capture numbers into estimated emigration. If these numbers are remotely close to the actual emigration, wild production from the Tucannon has been severly impacted by drought conditions. Additional years of data are needed to determine if these numbers are accurate or merely an abberation of an ineffective trap.

Summer Densities

Summer electrofishing samples for density estimates of juvenile salmonids were collected by both WDW and WDF in 1987. Table 22 is a summary of steelhead juvenile densities by habitat type on the Tucannon River. The WDW sampling data from the Tucannon River and Asotin Creek is presented in Appendix G. Relative abundance of non salmonids is also presented in Appendix G. Sampling data collected by WDF during summer and fall 1987 from the Tucannon River is presented in Appendix H.

Table 22. Mean steelhead densities per 100^2 meters in the Tucannon River by habitat type and tributaries for fall 1987 (WDF electrofishing data).

site	pool	run	riffle	boulder groups	side chan.	tributaries
HMA						
	23.4	42.7	34.3	26.8	42.5	--
n =	6	6	6	6	6	--
WILDERNESS						
	35.0	20.4	22.8	--	--	--
n =	6	1	4	--	--	--
HARTSOCK						
	25.5	29.4	48.5	--	--	--
n =	2	4	3	--	--	--
SHEEP Cr.	--	--	--	--	--	15.9
n =						2
PANJAB Cr.	--	--	--	--	--	34.0
n =						2
CUMMINGS Cr.	--	--	--	--	--	51.9
n =						2

We used length-frequencies to determine ages of gamefish for age-specific population and density estimates. We did not statistically compare densities of trout by habitat type this year.

Total rainbow trout densities are similar for 1985, 1986 and 1987 for sites electrofished within the Wilderness and Hartsock portions of the Tucannon River (Table 23).

Five of 11 sites electrofished in the Wilderness section of the Tucannon River and 18 of 30 sites within the HMA contained adipose clipped (includes branded and LV clipped) steelhead smolts that had residualized after release from Curl Lake. Residual hatchery fish accounted for 3.8% and 5.0% of the density of fish in the Wilderness and HMA sections respectively that had hatchery fish present.

Table 23. Comparisons of densities of total rainbow trout for sites electrofished by WDF personnel 1985-1987 Tucannon River (sites renamed in 1986).

1985		1986		1987
site	fish/100 m²	site	fish/100 m²	fish/100 m²
Wilderness				
2.2	24.1	3	49.6	29.0
2.4	48.9	5	24.2	50.0
3.3	43.1	10	41.3	20.4
3.4	16.1	11	38.9	42.3
4.2	25.2	14	27.1	24.8
7	17.6	19	21.0	35.2
10	20.3	21	28.8	
mean =	27.9		33.0	33.6
Hartsock				
TU7	44.0	Hart 2	80.1	41.6
TU8	36.8	Hart 3	53.8	50.4
mean =	40.4		66.95	46.0

Snorkeling/Electrofishing comparison

Snorkeling sections of streams for juvenile densities has been presented in recent years as an alternative methodology to electrofishing with comparable results. The advantages of snorkeling are speed, increased stream area sampled, no stress on juvenile fish from electrical shock or handling and acceptable accuracy. We needed to decide whether snorkeling was an acceptable alternative method for estimating juvenile densities in our S.E. Washington streams which are generally shallow and swift. In 1987, we

selected 3 sites on the Tucannon River and 4 sites on Asotin Creek in which we would compare the two methodologies. Shallow (<1ft. average depth) and deep (>1ft. average depth) sites were selected for comparison. In all sites the section to be sampled was enclosed within upper and lower blocking nets to ensure a constant population. We then snorkeled the sites from top to bottom, recording numbers of fish by age class and by species. Two or 3 snorkelers were used, depending on the width of stream and visibility. We then conducted a 2 pass electrofishing removal of juvenile fish to estimate a population similar to our sampling in previous years (Schuck and Mendel 1988, Hallock and Mendel 1985). Two sites were completed with this technique. Because of a concern about the efficiency of 2 pass removals, starting with site number 3, we snorkeled each section a second time after completion of the electrofishing. Five sites were sampled in this manner. Snorkel counts were considered to be a direct population count from the site. No confidence limits are placed around these numbers. Data from electrofishing were analyzed using Microfish 2.2 (VanDeventer and Platts, 1986) which estimated (N) and placed a 95% confidence interval (C.I.) around the estimate.

In comparing the two methods, we listed the respective estimates of population ($\hat{N}$) and determined an actual population (N) from the two methods by adding the number of fish removed in electrofishing plus the number seen in the post electrofishing snorkel count. Each estimator was then compared to the actual population and a percentage variation from N was listed. Electrofishing estimates were considered accurate or acceptable if N fell within the 95% C.I. of the estimate. No C.I. could be placed around snorkel estimates. We therefore considered a snorkel estimate to be accurate if it fell within $\pm$ 10% of N.

Results are presented in Table 24. The lack of post electrofishing snorkel counts effectively prevented us from any useful comparison of techniques for 2 sites on the Tucannon River. Results of our comparison showed that snorkeling provided acceptably accurate estimates in only 7 (35%) of 20 categories for 5 sites while results of electrofishing provided accurate estimates in 11 (55%) of 20 categories in the same sites. Electrofishing consistently estimated 0+ age fish populations better than snorkeling while snorkeling was more reliable for 2+ age fish. Neither method was consistently accurate for chinook, however snorkeling over-estimated chinook numbers while all other species categories in other sites were under-estimated.

Discussion

Marginal success in 1986 (Schuck et al, 1988) in comparing these two techniques lead us to believe that snorkeling could be a valuable and accurate sampling methodology for determining juvenile density estimates. Our expanded though still somewhat limited comparison this year casts doubt on that conclusion. A larger number of sites needs to be examined before an accurate or appropriate comparison of these density estimating techniques is possible.

Table 24. Comparisons of electroshocking and post shock snorkel counts for Tucannon River and Asotin Creek, fall 1987.

Site (type)	Trout age or specie	N Actual # removed[A]	Electro shocking (N)	C.I.	Preshock snorkel (N)	Post shock snorkel (N)	ESTIMATOR (Comparison)[B] Snorkel	Shocking
TUCANNON RIVER								
Big 4 access	0	40	40	---	39	---	comparisons not possible	
(shallow)	1+	39	39*	---	58	---		
	CH	39	44	10.3	43	---		
	* includes 2+							
Hurl Lake	0	29	29	1.7	47	---	comparisons not possible	
(deep)	1+	13	16	11.8	29	---		
	2+	3	3	3.2	3	---		
	CH	33	36	5.7	82	---		
Hat site	0	39	42	2.2	16	1	under by 62%	good
(shallow)	1+	30	31	4.3	16	2	under by 48.4%	good
	2+	12	12	---	19	3	under by 21%	under by 20%
	CH	38	39	5.6	29	1	under by 25.7%	good
NORTH ASOTIN CR.	0	61	73	18.6	56	30	under by 38.5%	good
(shallow)	1+	33	34	3.5	35	8	under by 14.6%	under by 17.1%
	2+	7	7	2.7	9	2	good	good
	CH	1	1	---	8	2	over by 100%	under by 75%
NA2C	0	48	60	21.0	50	31	under by 36.7%	good
(deep)	1+	38	52	28.6	56	20	good	good
	2+	12	13	5.5	17	7	good	under by 31.5%
	CH	9	11	10.9	29	12	over by 27.6%	good
NA5 CONTROL	0	84	97	17.2	67	21	under by 63.2%	good
(shallow)	1+	35	35	2.4	19	4	under by 51.2%	under by 10%
	2+	18	18	2.4	15	0	under by 16.7%	good
	CH	5	8	25.8	9	1	good	bad, need 3rd pass
NA5	0	61	64	6.3	47	11	under by 40%	under by 11.1%
(deep)	1+	41	41	2.2	32	3	under by 27.2%	under by 6.8%
	2+	13	13	0.6	16	4	under ny 5.9%	under by 23.5%
	CH	10	10	6.4	14	1	under by 21.4%	good

A Actual population (n) = # removed + # seen in post shock snorkel count.
B Electrofishing estimate is poor if n $\pm$ C.I. is outside Actual (n).
Percent differences were computed by dividing estimate of procedure by (# removed + # seen in post shock count).

Note: ad clipped fish were not used in comparisons.
Used microfish estimate despite capture probability.

Snorkeling does appear to be a viable technique for older (2+) age class fish, but electrofishing was consistently more accurate in estimating 0+ and 1+ age class steelhead in both shallow and deep sites. We consider snorkeling to be a completely unreliable estimator for 0+ age class fish as it underestimated numbers of these fish by 36-63% in all sites.

In general, however, our results indicated that electrofishing worked better in shallow sites than in deep sites and for younger age classes than for older, larger fish. Snorkeling worked better for older age class fish and in deeper sites that restrict the effectiveness of backpack electrofishing gear.

Post electrofishing snorkel counts proved very useful in assessing capture probability. In several instances, large numbers of fish remained in the section after the second pass was complete, even though an excellent reduction occurred between passes 1 and 2. These discrepancies occurred most often with chinook and older age class (=>2+) steelhead. Electrofishing was consistently better at estimates for 1+ age fish than was snorkeling. While only 2 of 5 sites met our criteria for providing good population estimates, the electrofishing estimate was considerably closer (6.8% vs. 27.2% under) and (10% vs. 51.2% under) on 2 other sites than provided by snorkeling.

Based on results from our sample sites, our conclusions are:

1. Snorkeling has serious limitations - especially with younger age class fish in shallow water areas.

2. Older age class fish can be underestimated by electrofishing and can better be estimated with snorkeling, especially in deeper sites with complex cover.

3. 2 pass removals do not appear to work well and care must be taken to calculate percent reduction from pass 1 to pass 2. The 3rd pass is probably worth while in most cases!

4. Post shocking snorkel counts, especially on 2 pass sites, are very important to assesss effectiveness and capture probability.

5. Greater electrical output, especially in deep sites, might improve the electrofishing technique.

6. Additive estimates from 2 pass electrofishing sites should be avoided since it appears that it is a significant underestimate of the population. The results from Microfish 2.2 with C.I.s should always be used. They provide better data than additive estimates.

7. Both techniques have limitations and may inaccurately estimate juvenile salmonid numbers in SE Washington streams.

Catchable Trout Program

Production of legal or catchable size rainbow trout at the Lyons Ferry/Tucannon complex totaled 213,937 fish weighing 68,180 pounds in 1987-88. The cumulative average weight for catchable trout was 3.1 fish per pound for fish released in spring 1988. Appendix I gives a listing of streams and lakes in Southeastern Washington which received compensation plan fish, the number and pounds of fish they received and the number of different stockings into each water. In addition, 100,289 fry weighing 973 pounds, and 3,100 pounds of catchable trout were reared for Idaho. This production level represented 86% of the program goal. Losses of rainbow trout at Tucannon Hatchery to IHN virus, was the reason for this production shortfall.

CONCLUSIONS

A helpful way to summarize is to list the overall evaluation objectives for this year and discuss the data collected to fulfill those objectives.

Objective 1: Document juvenile growth and development and fish cultural procedures.

Rearing of both rainbow and steelhead at LFH went well with average rearing times similar to production years 1984-87. Precocious males tend to be highly variable in their presence in samples but are higher in the Dayton and Curl lake conditioning ponds then for any of our other samples. This appears to be a particular problem at the Dayton pond this year and may be due to the feeding rate. Condition factors (K) two weeks prior to release were at 1.14 for those fish, heavy feeding could have encouraged premature male maturation.

Descaling was not a problem in 1988. We reported no incidence of descaling in our samples except for fish impinged by crowders while exiting the ponds. Descaling is not a problem at LFH.

An attempt to use portions of Goede's organosomatic index was aboandoned because of inconsistant results. Individual samplers subjectively rate fish health and sampling variables differently. We believe that to be effective for comparison with other hatcheries, a single individual or team would need to conduct all the sampling.

Objective 2: Document smolt and resident trout releases and evaluate smolt out-migration behavior.

Much of the need to evaluate smolt emigration behavior stems from the wandering of returning adults far upstream of their release site. Much of our work this year centered on describing and understanding adult migration behavior. Mendel and Schuck

(1989) discussed these aspect fully in their report on the migratory behavior of steelhead.

Juvenile work was delayed because of a dichotomy of opinion in the literature on predominant factors affection migration/homing ability. We plan to continue this investigation to more fully understand what is happening; aspects of genetics, stock capabilities/limitations and environmental deterants will be researched.

Juvenile trapping data was sparse this year from the Tucannon River. Trap efficiency is low and we are unsure whether it is at all reliable. We are currently considering construction of another style of trap to improve trapping data usefulness.

Objective 3: Estimate adult returns to down-river and terminal areas as a measure of compensation success.

This objective consumes a great majority of our time. The widely scattered fisheries require a large time investment to obtain a meaningful sample. We abandoned our efforts to estimate angler effort and harvest this year and concentrated on tag recovery. We believe this is a more appropriate type of sample.

Recovery of brands from Lower Granite Dam is very informative and provides our biggest single source of recoveries in the Snake River.

Spawning surveys were very successful, showing a marked decrease in escapement in some areas, and tremendous increases in others. We were unable to trap at the Tucannon Hatchery weir this year. Construction was delayed until 1989.

Objective 4: Estimate juvenile age class densities on selected streams as an indicator of any increased spawning escapement and success.

We conducted electrofishing surveys for juveniles on Asotin Creek and the Tucannon River. A comparison of electrofishing and snorkeling techniques of juvenile density sampling provided mixed results. We are convinced that both techniques have inherent limitations. A researching or management biologist must scrutinize his/her needs and the morphology of streams before deciding on one or the other.

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APPENDIX A. Brand and tag recoveries at Lyons Ferry Hatchery, 1987-88.

Brand	Stock	Release year	# of fish
RA-7N-1	WELLS	1985	5
RA-7N-3	WELLS		4
RA-7S-3	WELLS		2
LD-7S-3	WELLS		2
LA-7S-1	WELLS		2
LA-7S-3	WELLS		2
RA-H-1	WELLS		6
RD-H-1	WELLS		1
RA-H-2	WALLOWA		1
RA-IJ-1	WALLOWA	1986	1
RA-IJ-3	WALLOWA		5
LA-IJ-1	WELLS		22
LA-IJ-3	WELLS		36
LA-IJ-4	WELLS		6
LA-IK-1	WALLOWA		3
LA-IK-3	WALLOWA		4
RA-7F-1	WELLS		11
RA-7F-3	WELLS		8
RD-7F-1	WELLS		1
LA-7U-1	WELLS		12
LA-7U-3	WELLS		15
LD-7U-1	WELLS		1
TOTAL			150^

A Does not include 2 LA-7S-1 brand fish, most likely a misread brand.

Note: All brands containing a "7" are brand only from Fish Passage Center and are for juvenile migration studies.

Appendix B.

Table 1: Scale age summary for female steelhead spawned at LFH, 1988.

Scale Age	n [A]	% of Sample	Mean Length	SD
1.1	145	55.3	59.7	3.5
1.2	114	43.5	71.4	3.1
2.1	1	0.4	58.1	---
TOTAL	260		64.8	

A 145 includes 1 wild fish at 65.9, 114 includes 2 wild fish at 72.7, 73.3, and 1 wild fish at 58.1.

Table 2: Scale age summary for fish sampled during creel on the Snake River and tributaries, 1987-88.

	AGE 1.1					AGE 1.2				
Location[A]	Mean len.(cm) (n)	Mean wt.(kg) (n)	# males	# females	# unk.	Mean len.(cm) (n)	Mean wt.(kg) (n)	# males	# females	# unk.
166	62.8 (7)	2.3 (7)	3	4	0	75.2 (6)	4.1 (4)	2	4	0
167	63.4 (8)	2.4 (7)	---	---	---	---	---	---	---	---
168L	60.6 (3)	2.2 (3)	0	3	0	81.5 (1)	4.6 (1)	1	0	0
168M	61.3 (2)	---	2	0	0	72.0 (1)	3.8 (1)	1	0	0
Tuc. R.	62.6 (13)	2.4 (4)	7	5	1	73.6 (9)	3.4 (9)	1	8	0
Grande R. E.	62.0 (1)	---	1	0	0	74.5 (6)	4.7 (4)	4	2	0
Cottonwood	61.4 (7)	2.3 (7)	3	4	0	72.0 (6)	3.5 (4)	2	14	0

A Snake River mgmt codes 166 = below Little Goose Dam, 167 = below Lower Granite Dam, 168L = above Lower Granite Dam to Red Wolf Bridge (at Clarkston), and 168M = Snake river above Red Wolf Bridge.

Appendix C.

Table 1. Variables used in calculating angler effort and catch rates, Grand Ronde River, fall 1987 and spring 1988.

Month	Zone[A]	Strata	Mean count Bank(SD)	Mean count Boat(SD)	Total Effort (95% CI)	C/E[B]	Harvest
Sept.	D	WD	1.0 (1.00)	0	273.0(245.6)		
		WE	0.5 (0.76)	0	58.5 (84.3)		
	E	WD	0.25(0.66)	0	68.2(162.4)		
		WE	0.83(1.21)	0	97.5(133.8)		
	S	WD	0.25(0.43)	0	68.3(106.4)		
		WE	0.67(0.94)	0	78.0 (82.2)		
	3	WD	0.57(0.93)	0	155.6(141.3)		
		WE	2.63(2.62)	0	307.9(228.5)		
	4	WD	0.57(0.93)	0	155.6(141.3)		
		WE	2.53(2.54)	0	295.5(221.7)		
					1558.1	0.0016	2
Oct.	D	WD	2.75(2.48)	0	695.8(567.5)		
		WE	3.50(1.31)	0	362.3(101.4)		
	E	WD	0.75(0.94)	0	189.8(215.8)		
		WE	1.88(1.54)	0	194.1(118.5)		
	S	WD	1.00(0.71)	0	253.0(161.8)		
		WE	1.5 (0.87)	0.5 (0.87)	207.0 (66.8)		
	3	WD	0.63(0.99)	0	158.1(141.6)		
		WE	1.81(1.59)	0	187.5(122.6)		
	4	WD	1.06(1.92)	0	268.0(274.0)		
		WE	2.44(2.21)	0.12(0.48)	252.3(170.3)		
					2767.9	0.0064	11
Nov.	D	WD	1.25(1.29)	0	275.0(256.7)		
		WE	2.0 (2.10)	0	160.0(118.6)		
	E	WD	0.5 (0.68)	0	110.0(136.3)		
		WE	3.0 (2.21)	0	24.0(125.0)		
	S	WD	0.0	0	0.0		
		WE	5.25(3.49)	0.5 (0.5)	420.0(197.5)		
	3	WD	2.26(0.53)	0	57.4 (72.6)		
		WE	1.25(1.23)	0	100.0 (69.7)		
	4	WD	0.83(1.34)	0	182.6(184.0)		
		WE	2.5 (1.85)	0	200.0(104.5)		
					1433.0	0.018	18
Dec.	D	WD	0.11(0.30)	0	19.6 (41.8)		
		WE	1.17(1.67)	0	99.2(137.5)		
	E	WD	0.44(0.92)	0	79.2(127.6)		
		WE	1.0 (1.15)	0	85.0 (94.8)		
	S	WD	2.0 ---	0	---		
		WE	7.5 (0.5)	0	637.5 (53.8)		
	3	WD	0.0	0	0.0		
		WE	0.0	0	0.0		
	4	WD	0.05(0.21)	0	8.5 (23.5)		
		WE	1.58(2.10)	0	134.5(138.2)		
					1063.5	0.0053	5
Jan.	D	WD	0.0	0	---		
		WE	1.0 (1.0)	0	90.0(112.2)		
	E	WD	0.0	0	---		
		WE	0.0	0	---		
	S	WD	0.0	0	---		
		WE	0.0	0	---		
	3	WD	0.0	0	---		
		WE	0.0	0	---		
	4	WD	0.0	0	---		
		WE	0.0	0	---		
					90.0	0.022	2

Appendix C, table 1 (Con't)

Month	Zone[A]	Strata	Mean count Bank(SD)	Mean count Boat(SD)	Total Effort (95% CI)	C/E[B]	Harvest
Feb.	D	WD	0.0	0	---		
		WE	0.0	0	---		
	E	WD	0.0	0	---		
		WE	1.0 (1.0)	0	84.0(---)		
	S	WD	0.0	0.33(0.47)	---		
		WE	0.0	1.50(1.50)	126.0(154.3)		
	3	WD	0.0	0	---		
		WE	0.0	0	---		
	4	WD	0.0	0	---		
		WE	0.0	0	---		
					210.0	0.024	5
March	D	WD	0.0	0	---		
		WE	0.0	0	---		
	E	WD	0.0	0	---		
		WE	0.0	0	---		
	S	WD	0.0	0	---		
		WE	0.0	0	---		
	3	WD	0.0	0	---		
		WE	0.0	0	---		
	4	WD	7.0 (1.0)	0	1771.0(341.8)		
		WE	2.0 ---	0	76.0(---)		
					1947.0	0.069	135
April	No effort estimates made				375.0(0.301)[C]		113
					9444.5		293

A Zone D = mouth to county road bridge, catch and release only.
Zone E = county road bridge to above narrows.
Zone S = Shumaker Grade area.
Zone 3&4 = Rattlesnake Grade to Oregon state line.

B For catch and keep areas only. Average for all strata.

C Effort computed from harvest divided by catch rate from creel.

Appendix D. Idaho Fish and Game (IFG) sport recoveries for Lyons Ferry Hatchery steelhead coded-wire tags in fall 1987 and spring 1988 (cwts from fish recorded on Idaho permits, IFG data from K. Ball, pers. comm.).

Cwt code	Recovery type	River Location[A]	Capture Month	No. of Recoveries	Estimated harvest (expanded)[B]
62-16-27	sport	L.Snake	Nov.	1	7
62-16-28	sport	L.Snake	Dec.	1	6
62-16-44	sport	L.Snake	Oct.	1	7
62-16-44	sport	L.Snake	Nov.	1	7
63-33-06	sport	L.Snake	Nov.	1	7
63-33-49	sport	L.Snake	Nov.	1	7
63-33-49	sport	L.Snake	Dec.	1	6
63-33-50	sport	L.CLW	Oct.	1	15
63-33-51	sport	L.Snake	Nov.	1	7
63-38-36	sport	L.Snake	Oct.	1	7
63-38-36	sport	L.CLW	Oct.	1	15
63-38-36	sport	L.CLW	Nov.	1	16
63-38-37	sport	L.Snake	Oct.	1	7
63-38-38	sport	L.CLW	Nov.	1	16

[A] CLW A = Clearwater R. confluence to pump station.
CLW B = Clearwater R. pump station to Cherry Lane.
CLW D = Below Orofino Bridge.
L.Snake = Snake R. below Salmon R. to State Line at Clearwater confluence.
Snake A, B, or C = WDG zones for mid Snake R.

Appendix E.

Table 1. Fish collected during spawning ground surveys of streams immediately above LGD.

Sex	Origin: Hatchery Ad	Hatchery Lv	Wild	Unk.	Total
Wawawai Cr.					
Male	12	2	2	0	16
Female	18	8	3	4 [A]	33
Unknown			1	1	2
	30	10	6	5	51 [B]
Offield Cr.					
Male	7	4			11
Female	10	4	2	1	17
Unknown					
	17	8	2	1	28

[A] includes 1 unclipped fish with stubbed dorsal fin which may have been hatchery origin.

[B] 1 additional radio frequency was detected for which no live fish or carcass could be found.

Table 2. Tag recoveries from lv clipped fish collected during spawning ground surveys of streams immediately above LGD.

Brand	Stock[A]	Release year	# of fish
RA-H-1&2	WE/WA	1985	4
LA-S-1&2	WA		1
LA-IJ-1,3&4	WE	1986	4
LA-IK-1&3	WA		4
RA-IK-1&3	WA		2
NO TAG			3
Total			18

A WE = Wells stock, WA = Wallowa stock.

Appendix F. Tag/brand recoveries from adult steelhead trapped in Cottonwood Creek, spring 1988.

Brand	# of fish	% of total	Estimated [A] Return to River
RA-IJ-1,3,&4	55	37.4	113
LA-1J-3	1	0.7	3
RA_J (ODFW)	2	1.4	-
RA-17-1&3	64	43.5	101
Unreadable	25 [B]	17.0	45 [C]
Total	147		262

A Expanded to include unmarked fish returning that these mark groups represent.
B Captured fish which had unreadable brands and no snout was taken.
C Estimated from average marking rates for the 1985 and 1986 releases at Cottonwood pond.

Appendix G.

Table 1. Gamefish population and density information from sites electrofished and snorkeled by WDW personnel, fall 1987.

SITE TYPE (Date)	AGE^	PASS 1	2	3	POPULATION (N)	95% CI	AREA (m^2)	DENSITY (FISH/100m^2)
TUCANNON RIVER								
Big 4 access	0+	20	20		40	---	563.56	7.1
(09-01)	1+	15	10		25	---		4.4
	2+	8	6		14	---		2.5
	TOT	46	36		82	---		14.6
	AD	3	0		3	---		0.5
	CH	28	11		44	10.3		7.8
	Snorkeling data for Big 4 access^. 43 CH, 39 0+RB, 58 1+RB, 1 1+DV							
Curl Lake	0+	25	4		29	1.7	684.2	4.2
(09-02)	1+	8	5		16	11.8		2.3
	2+	2	1		3	3.2		0.4
	TOT	39	11		53	6.4		7.7
	AD	4	1		5	1.5		0.7
	CH	25	8		35	5.7		5.1
	Snorkeling data for Curl Lake 82 CH, 47 0+RB, 29 1+RB, 3 2+RB (INCL. 1 AD), 1 DV							
Hat. site	0+	29	10		42	7.2	592.0	7.1
(09-17)	1+	23	7		31	4.3		5.2
	2+	12	0		12	---		2.0
	TOT	65	19		90	9.1		15.2
	AD	1	2		3	---		0.5
	CH	31	7		39	3.6		6.6
	Snorkeling data for Hatchery site 29 CH, 16 0+RB, 16 1+RB, 19 2+RB							
	Post shocking snorkel count 1 CH, 1 0+RB, 3 1+RB, 3 2+RB							
NORTH ASOTIN CR. (Below log wier, near USFS line.) (09-10)								
	0+	42	19		73	18.6	464.6	13.1
	1+	27	6		34	3.5		7.3
	2+	5	2		7	2.3		1.5
	TOT	74	27		114	15.9		24.5
	CH	1	0		1	---		0.2
	Snorkeling data 8 CH, 56 0+RB, 35 1+RB, 9 2+RB.							
	Post shocking snorkel count 3 CH, 30 0+RB, 8 1+ and 2+RB							

Table 1. (cont.)

SITE TYPE (Date)	AGE[A]	PASS 1	2	3	POPULATION (N)	95% CI	AREA (m^2)	DENSITY (FISH/100m^2)
NA2C (09-10)	0+	32	16		60	21.0	385.6	12.4
	1+	24	14		52	28.6		9.8
	2+	8	4		13	5.5		3.4
	TOT	64	34		132	41.5		25.4
	CH	5	4		11	10.9		2.3
	Snorkeling data 29 CH, 50 0+RB, 56 1+RB, 17 2+RB							
	Post shocking snorkel count 12 CH, 31 0+RB, 20 1+RB, 7 2+RB							
NA5 CONTROL (09-11)	0+	60	24		97	17.2	335.7	28.9
	1+	29	6		35	2.4		10.4
	2+	14	4		18	2.4		5.2
	TOT	104	35		155	16.6		46.2
	AB	0	1		1	---		0.3
	CH	2	3		8	25.8		1.5
	Snorkeling data 8 CH, 67 0+RB, 19 1+RB, 15 2+RB							
	Post shocking snorkel count 1 CH, 21 0+RB, 4 1+RB							
NA5 3 log weirs (09-14)	0+	48	13		64	6.3	410.4	15.6
	1+	35	6		41	2.2		10.0
	2+	12	1		13	0.6		3.2
	TOT	95	20		119	6.4		29.0
	CH	10	0		10	---		2.4
	Snorkeling data 14 CH, 43 0+RB, 32 1+RB, 16 2+RB							
	Post shocking snorkel count 1 CH, 11 0+RB, 3 1+RB, 4 2+RB							

A Snorkeling data included for comparison. See text for discussion.

Note: In past reports, when capture probility was <60% for 2 passes, an additive (n) for pass 1 and 2 was used. For the above table microfish estimate was used despite capture probability.

Appendix H. Gamefish population and density information from sites electrofished by WDF personnel, summer and fall 1987.

SITE TYPE (Date)	AGE[A]	PASS 1	2	3	POPULATION (N)	95% CI	AREA (m^2)	DENSITY (FISH/100m^2)
WILDERNESS (Above Panjab Cr.)								
1 RIFFLE	0+	14	3		17	1.8	73.26	23.20
(10-06)	1+	3	0		3	---		4.09
	2+	2	0		2	---		2.73
	TOT	19	3		22	1.5		30.03
2 POOL	0+	14	1		15	0.6	84.0	17.86
(9-15)	1+	7	1		8	0.9		9.52
	2+	2	2		4	4.5		4.76
	TOT	24	4		28	1.8		33.33
	AD	1	0		1			1.2
3 POOL	0+	4	1		5	1.5	51.7	9.7
(8-26)	1+	6	0		6	---		11.6
	2+	2	1		3	3.2		5.8
	TOT	12	2		15	1.2		29.0
5 POOL	0+	4	1		5	1.5	44.2	11.4
(9-01)	1+	11	0		11	---		25.0
	2+	3	2		5	3.3		11.4
	TOT	19	3		22	1.5		50.0
	AD	1	0		1	---		2.3
7 POOL	0+	10	5		17	7.8	121.8	13.9
(9-28)	1+	3	1		4	1.9		3.3
	2+	5	0		5	---		4.1
	TOT	18	6		25	4.4		20.5
10 RUN	0+	18	0		18	---	146.8	12.3
(9-15)	1+	6	1		7	1.1		4.8
	2+	3	1		4	1.9		2.7
	TOT	28	2		30	0.8		20.4
	AD	1	0		1	---		0.7
11 POOL	0+	34	3		37	1.1	132.5	27.9
(8-27)	1+	4	1	1	6	1.7		4.5
	2+	9	2		11	1.6		8.3
	TOT	49	6	1	56	0.7		42.3
	AD	2	0		2	---		1.5
12 RIFFLE	0+	4	2		6	2.7	91.5	6.5
(9-28)	1+	2	0		2	---		2.2
	TOT	6	2		8	2.0		8.7
13 RIFFLE	0+	13	1		14	0.6	65.6	21.3
(10-07)	1+	3	0		3	---		4.6
	2+	1	0		1	---		1.5
	TOT	17	1		18	0.5		27.4

Table 1. Con't.

SITE TYPE (Date)	AGE	PASS 1	2	3	POPULATION (N)	95% CI	AREA (m^2)	DENSITY (FISH/100m^2)
14 RIFFLE	0+	14	4		18	2.4	104.5	17.2
(10-07)	1+	1	1		2	---		1.9
	2+	3	1		4	1.9		3.8
	TOT	19	6		26	4.3		24.8
	AD	1	0		1	---		0.9
19 POOL	0+	4	1		5	1.5	31.2	16.0
(10-05)	1+	5	0		5	---		16.0
	TOT	9	2		11	1.6		35.2
HMA(Habitat Mgmt. Area H.Q. to Panjab Cr.)								
1 RIFFLE	0+	42	13	6	63	4.4	212.4	29.6
(8-31)	1+	9	4		14	5.2		6.6
	2+	1	0		1	---		0.5
	TOT	44	17	7	71	5.8		33.4
	AD	0	0	1	1	---		0.5
2 BOULDER	0+	40	9		50	3.8	574.6	8.7
(9-01)	1+	20	9		33	10.1		5.7
	2+	1	1		2*	---		0.3
	TOT	61	19		87	10.3		15.1
3 RUN	0+	21	5	6	34	5.4	139.7	24.3
(8-31)	1+	7	5	0	12	1.6		8.6
	2+	2	0	0	2*	---		1.4
	TOT	30	10	6	48	5.0		34.4
4 POOL	0+	2	0		2	---	112.7	1.7
(8-25)	1+	1	1		2*	---		1.7
	TOT	3	1		4	1.9		3.5
5 RIFFLE	0+	35	6		41	2.2	193.6	21.2
(8-24)	1+	9	3		12	2.3		6.2
	2+	4	1		5	1.5		2.6
	TOT	48	10		60	4.5		30.9
6 RUN	0+	22	3		25	1.4	117.9	21.2
(8-24)	1+	13	1		14	0.6		11.8
	2+	4	0		4	---		3.4
	TOT	39	4		43	1.3		36.5
7 BOULDER	0+	21	6	1	28	1.3	200.1	13.9
(8-20)	1+	15	1	3	19	1.6		9.5
	2+	7	1	0	8	0.9		3.9
	TOT	44	9	4	57	1.9		28.5
	AD	1	1	0	2	---		1.0

Table 1. Con't.

SITE TYPE (Date)	AGE	PASS 1	PASS 2	PASS 3	POPULATION (N)	95% CI	AREA (m^2)	DENSITY (FISH/100m^2)
8 POOL	0+	19	3		22	1.5	132.5	16.6
(8-20)	1+	13	2		15	1.3		11.3
	2+	2	0		2	---		1.5
	TOT	34	5		39	1.8		29.4
9 RIFFLE	0+	31	12		48	10.1	232.3	20.7
(8-19)	1+	8	1		9	0.9		3.9
	2+	1	0		1	---		0.4
	TOT	40	13		57	8.0		24.5
10 RUN	0+	32	4		36	1.5	175.8	20.5
(8-19)	1+	9	2		11	1.6		6.3
	2+	2	0		2	---		1.1
	TOT	47	6		53	1.8		30.2
	AD	4	0		4	---		2.3
11 BOULDER	0+	15	7		25	9.0	233.4	10.7
(8-18)	1+	6	5		16	22.4		6.9
	2+	1	1		2*	---		0.9
	TOT	23	15		38	---		16.3
	AD	1	2		3	7.6		1.3
12 POOL	0+	14	3		17	1.8	416.9	4.1
(9-31)	1+	7	2		9	1.8		2.2
	2+	5	3		8	3.3		1.9
	TOT	28	8		38	5.4		9.1
	AD	2	0		2	---		0.5
13 RIFFLE	0+	25	6		31	2.1	195.1	15.9
(9-03)	1+	9	1		10	0.8		5.1
	TOT	37	6		43	2.1		22.1
	AD	1	0		1	---		0.5
14 RUN	0+	21	1		22	0.5	93.9	23.4
(8-17)	1+	3	0		3	---		3.2
	2+	1	0		1	---		1.1
	TOT	25	1		26	0.4		27.7
15 BOULDER	0+	43	0		43	---	131.9	32.6
(8-13)	1+	14	2		16	1.2		12.1
	2+	2	5		7	---		5.3
	TOT	62	7		69	1.8		52.3
	AD	3	0		3	---		2.3
16 POOL	0+	38	7		46	3.2	185.9	24.7
(8-13)	1+	7	3		10	2.7		5.4
	2+	1	2		3*	---		1.6
	TOT	47	13		63	6.4		33.9
	AD	1	1		2*	---		1.1

Table 1. Con't.

SITE TYPE (Date)	AGE	PASS 1	2	3	POPULATION (N)	95% CI	AREA (m^2)	DENSITY (FISH/100m^2)
17 BOULDER	0+	29	16		59	25.8	194.8	30.3
(8-12)	1+	11	5		17	5.2		8.7
	2+	1	3		4*	---		2.1
	TOT	42	24		66	---		33.9
	AD	1	0		1	---		0.5
18 RIFFLE	0+	30	3		33	1.2	126.5	26.1
(8-11)	1+	6	3		9	3.0		7.1
	2+	0	2		2*	---		1.6
	TOT	36	8		45	3.7		35.6
19 RUN	0+	27	2		29	0.8	136.3	21.3
(8-10)	1+	3	2		5	3.3		3.7
	2+	0	3		3*	---		2.2
	TOT	30	7		38	3.7		27.9
20 RIFFLE	0+	56	10		67	3.5	153.9	43.5
(8-12)	1+	11	4		15	2.7		9.7
	2+	3	3		7	8.8		4.5
	TOT	70	17		91	6.8		59.1
21 POOL	0+	22	0		22	---	105.1	20.9
(8-11)	1+	7	1		8	0.9		7.6
	2+	3	1		4	1.9		3.8
	TOT	35	2		37	0.7		35.2
	AD	3	0		3	---		2.9
22 POOL	0+	39	1		40	0.3	152.2	26.3
(8-11)	1+	2	0		2	--		1.3
	2+	2	1		3	3.2		2.0
	TOT	44	2		46	0.6		30.2
	AD	1	0		1	---		0.7
23 BOULDER	0+	5	4		11	10.9	291.4	3.8
(8-05)	1+	13	1		14	0.6		4.8
	2+	9	2		11	1.6		3.8
	TOT	30	8		40	5.2		13.7
	AD	2	1		3	3.2		1.0
24 RUN	0+	13	1		14	0.6	94.3	14.9
(8-05)	1+	5	1		6	1.2		6.4
	2+	2	0		2	---		2.1
	TOT	20	3		23	1.5		24.4
	AD	0	1		1	---		1.1

Table 1. Con't.

SITE TYPE (Date)	AGE	PASS 1	2	3	POPULATION (N)	95% CI	AREA (m^2)	DENSITY (FISH/100m^2)
HMAS (Side channels within the HMA)								
1-S	0+	12	3		15	2.0	59.6	25.1
(8-26)	1+	10	2		12	1.5		20.1
	TOT	26	5		31	2.1		51.9
	AD	4	0		4	---		6.7
2-S	0+	21	1		22	0.5	76.1	29.0
(8-06)	1+	14	1		15	0.6		20.0
	2+	4	1		5	1.5		6.6
	TOT	41	3		44	1.0		57.9
	AD	2	0		2	---		2.6
3-S	0+	13	0		13	---	46.6	28.0
(8-10)	1+	9	0		9	---		19.3
	2+	3	0		3	---		6.4
	TOT	26	0		26	---		55.8
	AD	1	0		1	---		2.2
4-S	0+	13	5		19	4.8	89.9	21.1
(8-10)	2+	2	1		3	3.2		3.3
	TOT	17	6		24	4.6		26.7
	AD	2	0		2	---		2.2
5-S	0+	1	3		4*	---	61.7	6.5
(8-10)	1+	4	1		5	1.5		8.1
	TOT	5	4		11	11.0		17.8
6-S	0+	27	4		31	1.6	102.6	30.2
(8-06)	1+	9	0		9	---		8.8
	2+	5	0		5	---		4.9
	TOT	42	4		46	1.3		44.9
	AD	1	0		1	---		1.0
HARTSOCK (HMA H.Q. to Hartsock grade)								
1 RUN	0+	7	7	2	18	7.2	93.3	19.3
(10-08)	1+	5	1	1	7	1.4		7.5
	TOT	12	8	3	25	6.1		26.8
2 RUN	0+	15	4		19	2.3	221.1	8.6
(9-17)	1+	47	7		54	2.4		24.4
	2+	10	5		15	7.7		6.8
	TOT	72	16		91	5.8		41.2
3 RIFFLE	0+	61	11		73	3.6	168.5	43.3
(9-10)	1+	8	2		10	1.7		5.9
	2+	1	0		1	---		0.6
	TOT	70	13		85	4.5		50.4

Table 1. Con't.

SITE TYPE (Date)	AGE	PASS 1	2	3	POPULATION (N)	95% CI	AREA (m^2)	DENSITY (FISH/100m^2)
4 POOL	0+	1	1		2	---	100.8	2.0
(9-10)	1+	4	1		5	1.5		5.0
	2+	3	0		3	---		3.0
	TOT	8	2		10	1.7		9.9
5 RIFFLE	0+	33	12		50	9.8	159.4	31.4
(9-10)	1+	11	1		12	0.7		7.5
	2+	1	0		1	---		0.6
	TOT	45	13		62	7.5		38.9
6 RUN	0+	14	7	2	24	3.6	188.7	12.7
(9-08)	1+	8	7	3	21	9.3		11.1
	2+	0	1	0	1	---		0.5
	TOT	22	15	5	47	9.4		24.9
7 POOL	0+	31	3		34	1.1		32.5
(10-05)	1+	6	2		8	2.0		7.6
	2+	1	0		1	---		1.0
	TOT	38	5		43	1.7		41.1
8 RIFFLE	0+	47	20	16	98	18.1	259.7	37.7
(9-08)	1+	11	13	7	55	60.4		21.2
	TOT	58	33	23	146	32.8		56.2
10 RUN	0+	22	5		27	2.3	170.0	15.9
(9-10)	1+	7	4		12	5.0		7.1
	2+	2	0		2	---		1.2
	TOT	31	9		42	5.5		24.7
SHEEP CREEK								
1 RIFFLE	0+	8	1		9	0.9	95.8	9.4
(7-27)	1+	5	0		5	---		5.2
	2+	2	0		2	---		2.1
	TOT	15	1		16	0.6		16.7
2 RIFFLE	0+	2	1		3	3.2	39.6	7.6
(7-27)	1+	2	0		2	---		5.1
	2+	1	0		1	---		2.5
	TOT	5	1		6	1.2		15.2
CUMMINGS CR.								
1 RUN	0+	10	0		10	---	20.7	48.2
(7-28)	1+	2	0		2	---		9.6
	2+	1	1		2*	---		9.6
	TOT	13	1		14	0.6		67.5
2 RIFFLE	0+	5	1		6	1.2	27.5	21.8
(7-28)	1+	1	1		2*	---		7.3
	2+	1	1		2*	---		7.3
	TOT	7	3		10	2.7		36.3

Table 1. Con't.

SITE TYPE (Date)	AGE	PASS 1	2	3	POPULATION (N)	95% CI	AREA (m^2)	DENSITY (FISH/100m^2)
PANJAB CR.								
1 RIFFLE	0+	10	3		13	2.2	63.6	20.4
(7-27)	1+	4	2		6	2.7		9.4
	2+	4	0		4	---		6.3
	TOT	18	5		24	3.9		37.7
2 POOL	0+	13	0		13	---	52.8	24.6
(7-28)	1+	1	0		1	---		2.0
	2+	3	0		3	---		5.9
	TOT	17	0		17	---		32.2

^ Age based on length-frequency histograms. 1+ and Total includes hatchery fish. AD = adipose or ventral fin clips or brands.

* Pass 1 and 2 added for a minimum estimate. Reduction between passes insufficient.

Table 2. Other Game Fish Species Data.

SITE	Species[A]	Pass 1	Pass 2	Pass 3	Lengths (mm)
WILD 1	DV	1	1	0	132,189
5	DV	3	0	0	194,203,235
7	DV	2	0	0	152,111
	WF	1	1	0	73,70
10	DV	2	0	0	204,158
11	DV	3	1	0	257,225,350,201
14	DV	1	0	0	139
19	DV	4	0	0	48,50,134,48
PANJAB					
2	DV	1	0	0	147
SHEEP					
1	DV	2	0	0	149,123
HMA					
1	DV	1	0	0	228
3	DV	0	1	0	213
	WF	1	0	0	265
6	WF	2	1	0	270,265,230
8	DV	1	0	0	241
	WF	1	0	0	284
9	DV	1	0	0	166
10	DV	1	0	0	245
12	DV	3	2	0	212,235,266,222,226
	WF	2	0	0	380,385
14	WF	1	0	0	310
15	DV	1	0	0	189
16	DV	0	1	0	260
17	DV	0	1	0	230
22	DV	2	0	0	150,230
23	DV	1	0	0	170
HART					
2	WF	2	0	0	120,130
6	WF	0	8	0	280,320,400,280,350, 330,200,200
7	WF	0	1	0	300

[A] DV = bull trout, WF = white fish.

Appendix I. Trout Plants in S.E. Washington, 1988.

Total # Fish = 267452
Total pounds= 88930

COUNTY	LOCATION	# OF PLANTS	LBS.	# PLANTED
ADAMS	Sprague Lk.	1	3640	18200
	TOTALS	TOTALS	3640	18200
ASOTIN	Alpowa Ck.	1	464	1995
	Asotin Ck.	1	1168	5022
	Golf Course Pd.	2	1275	4427
	Headgate Pd.	2	626	2920
	Silcott Pd.	1	326	1630
	W.Evans Pd.	2	608	2865
	TOTALS	TOTALS	4467	18859
COLUMBIA	Beaver Lk.	1	300	870
	Big Four	1	1000	2700
	Blue Lk.	5	4658	14111
	Curl Lk.	3	3738	13160
	Dam Pd.	1	400	900
	Dayton Jv.Pd.	2	389	1753
	Deer Lk.	0	0	0
	Orchard Pd.	1	556	1001
	Rainbow Lk.	5	7756	24427
	Spring Lk.	4	6646	21088
	Touchet R.(RB)	0	0	0
	Touchet R.(GB)	1	5616	10646
	Tucannon R.	2	5440	22269
	Watson Lk.(RB)	6	5612	17974
	Watson Lk.(GB)	0	0	0
	TOTALS	TOTALS	42111	130899
FRANKLIN	Dalton Lk.	1	1215	2916
	Marmes Pd.	1	500	1100
	TOTALS	TOTALS	1715	4016
GARFIELD	Bakers Pd.	1	250	1075
	Casey Pd.	1	234	1053
	Coles Pd.	1	120	540
	Pataha Ck.	2	890	3925
	TOTALS	TOTALS	1494	6593
WALLA WALLA	Blue Ck.	0	0	0
	College Pl. Pd.	2	383	1724
	Coppei Ck.	1	328	1607
	Dry Ck.	1	328	1607
	Fishhook Pk. Pd.	2	1856	6426
	Jefferson Pk. Pd.	2	383	1724
	Mill Ck.	3	1168	5022
	Mill Ck. Resv.	5	15808	40044
	Quary Pd.	1	2239	6717
	TOTALS	TOTALS	22493	64871
WHITMAN	Alkali Ck.	1	170	816
	Garfield Pd.	1	472	1558
	Gilcrest Pd.	1	472	1558
	Klemguard Park Pd.	0	0	0
	Pampa Pd.	1	4750	10925
	Riparia Pd.	2	1600	3280
	Rock Lk.	1	1056	3696
	Union Flat Ck.	1	340	1632
	TOTALS	TOTALS	8860	23465