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LYONS FERRY EVALUATION STUDY
Part II: 1986-87 Annual Report

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I would personally like to express my appreciation to the Managers and crews at Lyon's Ferry and Tucannon Hatcheries. Their dedication to the program and to the fish that are produced is beyond question.

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ABSTRACT

Lyons Ferry Hatchery operated in its fourth full year with two stocks of steelhead and one stock of rainbow trout from the 1985 and 1986 brood years. A total of 827,548 steelhead smolts weighing 148,723 pounds were released in 1986, and 922,687 steelhead smolts weighing 168,715 pounds in 1987 into the Snake, Grande Ronde, Walla Walla, Touchet and Tucannon Rivers and Asotin and Mill Creeks of Washington and the Wallowa River of Oregon. Smolts averaged 5.5 and 5.5 fish/pound for 1986 and 1987 respectively. A total of 253,951 rainbow trout weighing 86,548 pounds in 1986 and 203,772 rainbow trout weighing 71,614 pounds were planted into 42 different lakes and streams in southeastern Washington. This production level represented 103% and 85% of goal for the two years respectively. Decreased production of trout in 1987 was due to disease losses at the Tucannon Hatchery. Trout averaged 2.9 fish/pound in 1986 and 2.85 fish/pound in 1987.

Twelve study groups of steelhead totalling 243,081 fish in 1986 and 11 groups totalling 243,144 fish in 1987 were coded-wire-tagged, fin clipped and branded as part of catch contribution and return rate studies for evaluating stock success. An additional 95,589 and 92,570 fish in 1986 and 1987 respectively were brand only marked for release by the Fish Passage Center as part of their smolt travel rate and survival study on the lower Snake River. Tag loss for all groups was between 0.11-1.5% for the two years. Brand loss averaged 2.0% (SD=0.74) in 1986 and 3.65% (SD=2.11) in 1987.

Smolt emigration went well both years. Curl Lake conditioning pond continues to show signs excessive residualism and retarded smoltification, possibly due to cold water temperatures. Estimates of the smolt passage Index (P.I.) at Snake and Columbia River dams indicated similar smolt performance in 1986 and 1987 to other years, however, average daily migration rates increased significantly in 1987. Lyons Ferry Hatchery stock fish released into the Tucannon R. passed McNary Dam in greater numbers than any previous release. Wild smolts were trapped during both springs on Asotin and Charlie Creeks and the Tucannon River. Smolt trapping was conducted on Asotin, SF Asotin, Charlie and Cottonwood creeks and on the Tucannon River. Average wild smolt size for these streams was between 156-166 mm. Peak smolt emigration occurred in April but substantial parr emigration appears to be occurring between December and March. Most wild smolts were age 2+ with lesser numbers of 1+ and 3+ fish also. Our traps did not capture hatchery smolts well.

Escapement of adults from tagged groups to above Lower Granite Dam was between 0.23 and 1.58% of release for a single return year. Escapement of individual groups into the project area (above Lower Granite Dam) since 1983 has been between 0.70% and 1.51% of release for an entire three year return cycle. Wallowa stock fish returned in the ratio of 55% 1-ocean to 45% 2-ocean adults. Average fork length for 1-ocean and 2-ocean age Wallowa stock fish was 58.6cm and 72.3cm respectively. The Zone 6 treaty Indian gillnet fishery and the Snake River sport fishery continue to be the major harvestors of Lyon's Ferry released steelhead.

Population densities of juvenile salmonid fish in the compensation plan streams showed some changes over 1981-84 densities. General increases in populations occurred throughout much of the sampling area. These increases may or may not be due to increased spawning escapement of steelhead planted from the hatchery. Residual steelhead smolts are larger than most resident juveniles and have become a predominate populations sector in some stream areas. They are believed to be competing for available food and space. The residual smolts are also contributing to the resident trout fishery.

Redd counts were conducted on 26.5 miles of the Tucannon River and 22.7 miles of Asotin Creek during the spring of 1986; and on 30.4 and 34.1 miles of the Tucannon and Touchet rivers, respectively, and 19.5 miles of Asotin Cr. in 1987. Redd densities were generally greater in 1987 except for the Charlie Cr. and SF Asotin Cr. areas that had operational adult migrant traps. We believe our traps restricted immigration and will not be used in 1988 to allow us to assess increased escapement without restrictions.

Adult trapping occurred on Charlie, SF Asotin and Cottonwood creeks and allowed use to measure escapement, redds per adult and characterize the spawning runs in these streams.

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INTRODUCTION

Evaluation Project Summary

This is the fourth report by the Washington Department of Wildlife concerning Lyons Ferry Hatchery, a new steelhead production facility, located at RM 58 on the Snake River. The reporting period for this report is 1 April 1986 through 31 June 1987. There were, however, activities performed outside of these dates that are essential parts of the data reported here.

Refinements to the evaluation project are continuing. The 1986 proposal as submitted to the U.S. Fish and Wildlife Service (FWS) (Appendix A) served as a guideline for our field activities. The list of objectives and tasks within the proposal served 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 very encouraging now that we have essentially complete recoveries from three release years. We can describe the time of return, size at age for returning fish, smolt to adult survival to the project area and contributions to various Columbia Basin fisheries for one steelhead stock we have used.

Compensation Program Description

The steelhead trout/resident fish portion of the LSRCP as administered by the WDW for the State of Washington was based on two essential criteria; 1) anadromous steelhead losses attributable to hydroelectric dam construction on the Snake River amounting to 4,656 adult fish destined for Washington, and, 2) resident fisheries for rainbow trout, smallmouth bass, sturgeon, channel catfish and crappie were diminished by 67,500 angler days of recreation annually. These criteria were the basis for designing hatchery facilities capable of producing sufficient steelhead smolts at 8 fish/lb to return 4,656 adults back to the project area, and additionally, 93,000 pounds of catchable size (3 fish/lb) rainbow trout to offset the losses to resident fisheries.

Lyons Ferry hatchery was constructed to produce 116,400 pounds of steelhead smolts and 45,000 pounds of legal rainbow trout, and the Tucannon hatchery was repaired and updated to produce 41,000 pounds of legal rainbow and to aid in the propagation of spring chinook salmon for the Washington Department of Fisheries (WDF). The remaining 7,000 pounds of catchable rainbow were foregone in-lieu of improving instream habitat in various streams in southeastern Washington.

Washington Department of Wildlife personnel developed program objectives that will guide our efforts at achieving the compensation plan goals of replacing lost populations and angler opportunity. These are general guidelines that are compatible with WDW long term management goals for both anadromous and resident trout. A more detailed summation of our approach to achieve the goal was provided in the 1984 annual report (Schuck & Mendel, 1986) and has not changed significantly. Brief comments are provided to explain the goals (Appendix A) and facilities (Appendix B).

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 for specific purposes. 1) We adipose clipped all the production fish for the 1986 release. These fish were marked to designate them as hatchery produced and available for harvest in selective fisheries upon return as adults. 2) Coded-wire tagged (cwt) fish were released for specific contribution and return rate studies pertinent to Lyons Ferry production, conditioning pond release operation and to help assess progress toward achieving mitigation goals. Group sizes were set in blocks of 20,000 fish or multiples thereof to fully utilize raceway space while the fish are held after marking. Tagged fish for the 1986 and 1987 release years were left ventral fin clipped (LV) to indicate the presence of a cwt. 3) All cwt fish received a nitrogen freeze brand to allow easy identification of migrating smolts and returning adults without sacrificing the fish. Additional groups of fish released for juvenile emigration timing studies by the Fish Passage Center received only a brand.

The WDW contracted with Washington Dept. of Fisheries (WDF) to conduct our marking and tagging program. Tagging and branding were conducted during February, in 1986 and 1987 for the respective release years. Adipose clipping was accomplished during August of the preceding year for each release, just prior to their transfer into the large rearing ponds. 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

A majority of our fish this year were hauled by truck to one of the conditioning ponds, reared from 4-7 weeks, then allowed to emigrate into stream systems. This was our 2nd and 3rd year for using the remote ponds at Curl Lk. and Cottonwood, respectively, and our first year (spring 1987) using the Dayton CP. These fish were sampled for length, weight, condition factor (K), descaling and precocious males at the time they exited the conditioning ponds. Fish released directly into river systems from the transport trucks were sampled at the hatchery prior to release as in previous years.

All fish were loaded into trucks using a Neilson brand fish pump. Total numbers of fish planted in a stream were determined by one of two methods: 1) When groups of fish had been tagged and enumerated, this number minus any mortality since tagging was multiplied by average weights from samples to determine total pounds of fish planted; 2) Un-tagged fish were volumetrically weighed by water displacement when trucked out of the hatchery. The average number of fish/pound from samples was then used to determine total numbers planted.

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. The fish passage index (P.I.) estimates at the dams are based on the assumption that tagged (cwt) and/or branded juveniles collected and sampled are representative of the entire release. Also, the P.I. for the tagged and /or branded groups is not an estimate of total survival for fish passing that point. The P.I. is a figure developed by FPC personnel to provide a "relative" indicator of passage success within and between years. Total survival would be higher than the P.I. for any particular year, but it is more difficult to obtain and less accurate because it is highly dependent on daily spill and guidance efficiency at the dams. Data are available from samples taken at Lower Granite, Lower Monumental, McNary and John Day dams.

Adult Steelhead Returns To Project Area

Passage at Dams and Characteristics of Adults

The National Marine Fishery Service monitors adult passage at Bonneville, McNary and Lower Granite Dams (Slatick, 1985; Gilbreath, 1985; Jerry Harmon, NMFS, personal comm., 1986). Adults coming into their traps 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 Lyon's Ferry Hatchery

We examined all steelhead for marks that entered the hatchery ladder and trap during the fall of 1986 and spring of 1987. 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 1987 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

A temporary wooden frame weir and box traps (similar to designs by Conlin and Tutty 1979) were constructed on Charlie Creek during the spring seasons of 1986 and 1987 to obtain data about returning adult wild steelhead and juvenile out-migrants in southeast Washington. Charlie Creek was selected because it is a small stream with relatively constant discharge and little or no history of hatchery steelhead influence. We had several objectives for the adult trapping; 1) obtain sex ratios of returning wild steelhead, 2) estimate mean length and weight of wild fish by sex, 3) determine run timing, 4) estimate total run size, 5) analyze scales to determine freshwater and ocean ages, 6) compare run size (and total females) and redd counts to estimate redds per female, and 7) assess the relationship between wild adult escapement and juvenile out-migrant production.

We collected data concerning stream conditions as well as conditions of all fish that we captured (Appendices C & D). Adult steelhead captured in the upstream trap were marked by punching a hole in the right opercle with a paper punch, while adults captured above the weir or in the smolt trap were marked on the left opercle, as an attempt to keep track of how many fish were seen more than once.

Also, the South Fork Asotin Cr. was selected for trapping to supplement the adult steelhead sampling on Charlie Creek. We knew from spawning surveys that the S. Fork had good steelhead runs that could provide a larger sample of adults than was available on Charlie Creek, and that the stream was small enough to be feasible to trap. The objectives were similar to those for Charlie Creek.

The trap consisted of a wooden trap box and weir similar to that used for adults in Charlie Creek. We selected a trap site that was located 0.2 miles above the "Forks Bridge" (0.15 mile above the mouth) and about 100ft. below our lowest habitat improvement site. We collected the same adult steelhead data as on Charlie Creek (Appendix D). The trap was checked daily unless little steelhead activity occurred, then it was checked every second or third day. We installed and calibrated a staff gauge and maximum-minimum thermometer just below the trap.

We attempted to count adult steelhead migrating through upper Asotin Creek during the spring of 1986. The objectives and techniques were much the same as in 1985 (Schuck and Mendel 1987). However, we moved the counting site upstream (just below the confluence of the N. and S. forks of Asotin Creek), to be above most sources of turbid spring runoff, and installed white "Herculite" fabric on the stream bottom to improve visibility for counting migrating steelhead. The fabric was held in place with large rocks and angle-iron just upstream of the bridge. A 4'x 8' wooden fence, attached to steel fence posts, connected the fabric to each bank to narrow the stream to approximately 25 ft wide. Half days (6 hrs) during daylight were selected at random for counting from the bridge. Counts consisted of 20 minutes, followed by a 10 minute break.

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 CP for imprinting hatchery steelhead smolts. During the spring of 1985 it was noticed that downstream migrant steelhead were being trapped on the screen, where they had to be removed and taken to the Grande Ronde River for release. We decided in 1986 to use this structure to trap downstream migrants and adult steelhead to provide us data regarding steelhead in a tributary within the Grande Ronde River Basin.

The objectives for trapping were much the same as for Charlie Creek and Asotin Creek. The intake screen was modified to keep adult and juvenile migrants alive, either on the screen or in a fenced pool just below it. The intake screen was checked for fish daily and captured fish were examined and measured as on Charlie Creek.

Spawning Ground Surveys

Individual 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.

Returns of CWT Groups

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.

We estimated steelhead sport harvest in the Snake River through an intensive creel survey. The results from that survey have been published separately as part of the 1986-87 annual report (Mendel et al. 1988).

Juvenile Steelhead Populations in Project Rivers

Spring Emigration

During the spring of 1986 we began juvenile smolt trapping at three sites in southeast Washington (Charlie Cr., Asotin Cr. and Cottonwood Cr.) to obtain information about wild steelhead smolt size and emigration timing. Our juvenile emigrant trapping objectives were to; 1) obtain run timing and size, 2) estimate the contribution of hatchery fish planted in Asotin Creek to Charlie Creek outmigration, 3) estimate mean lengths and weights of wild smolts, 4) examine composition of the migration by smolt index, and 5) determine freshwater age composition of the emigrants. We continued to trap at Charlie Cr. and Cottonwood Cr. in 1987. Descaling data were collected in 1986 but not in 1987.

The Charlie Cr. smolt trap consisted of a box trap attached to the weir described previously under (Returns of Adult Steelhead). We clipped upper and lower caudal fins to mark smolt groups that were released at least 0.3 miles above the trap. The number of recaptures was a measure of trap efficiency. We also electrofished the area for 100 ft upstream of the weir periodically to capture fish that may have accumulated there and were reluctant to enter the trap.

A 2'x 3' floating inclined plane trap (WDF design), similar to one discussed by Conlin and Tutty 1979, was fabricated for use in Asotin Cr.. We selected a narrow chute that contained water velocities of 5 ft/sec, located about 0.25 miles below the mouth of Charlie Creek. A cable was suspended from trees upstream of the trap site with a yoke and pulley system attached to the trap. A rope connecting the downstream portion of the trap to shore was used to adjust the trap laterally across the stream. Our objectives were similar to those for juvenile trapping on Charlie Creek, plus to obtain as much data as possible for chinook salmon. The trap was checked daily in the mornings and occasionally rechecked late in the afternoon. We collected the same data as for juveniles in Charlie Creek (Appendix E). A maximum/minimum thermometer and a staff gauge were installed below the trap and read daily (Appendices C and J).

In 1985 emigrating juvenile steelhead had to be removed from the intake screen of the Cottonwood Cr. C.P. diversion. Consequently, in 1986 we decided to utilize this diversion to trap emigrating smolts. The objectives and data collection procedures were similar to those used on Charlie Cr. We used smolt index classifications that were slightly different each year, but they were the same in 1987 as we used on Charlie Creek (Appendix D). ANOVA, and a nonparametric equivalent to Tukey's Multiple Range Test (Zar 1984, pg 164 and 189), were used to identify significant differences in mean fork lengths of different age groups of juveniles from scale analysis.

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 November 1986 and June 1987 is presented here.

Summer Densities

Population and density estimates were generally performed as described in Hallock and Mendel (1985) and Schuck and Mendel (1987). Habitat data were collected as in 1985 (Schuck and Mendel 1987). We sampled streams or stream sections where we were lacking data or needed to supplement juvenile trout density information. The upper North Fork of Asotin Creek, within USFS property, was sampled cooperatively with WDF personnel by electrofishing separate habitat types every 300 m above NA2. We stratified the habitat types into pool, riffle, run, and side channel. Habitat data for N. Fork of Asotin sites were collected according to WDF procedures (Seidel and Bugert 1987).

The distance and direction from an access point to a sampling site were selected at random for most streams. Sites on the S. Fork of Asotin are the same sites we used as control sites for our Instream Habitat Improvement Project (Hallock and Mendel 1984). We took a 5 day horse pack trip with Ken Witty (ODFW) to inventory streams within the Wenaha-Tucannon Wilderness of Oregon and Washington to ascertain densities in natural stream systems in southeast Washington to compare with streams that are readily accessible and are heavily stocked and fished. Electrofishing sites on Crooked Creek, Panjab, and Wenatchee creeks were selected to be representative and/or as far upstream as we had reasonable access. The site on the S. Fork of Wenaha River was selected as a representative site and electrofished in Oregon in cooperation with Ken Witty of ODFW. Site designations are the first 2 or 3 letters of river or stream names (eg. WE = Wenatchee Creek).

We conducted snorkel counts to test the applicability of this technique in southeast Washington streams. Counts were made while moving down stream by 2 or more divers across the width of the stream. Fish were recorded by species and length categories, when needed. Rainbow/steelhead trout were classified as parr (age 1+) or "catchables" based on size ranges from our past electrofishing experience.

Biomass estimates were calculated by multiplying mean weight by the estimated density of fish for that age group. We did not weigh all fish at each site. Therefore, we estimated weights for fish we did not weigh, either from a length-weight curve or by using weights of similar sized fish on the same stream.

Scale samples were taken from some fish to obtain age estimates to verify length-frequency histograms for specific size groups or species of fish. We also attempted to determine from scales any previous spawning activity or age and size at first spawning for resident trout.

Data were recorded on the same form as in 1985. Population estimates were based on the removal or depletion method (Zippin 1958) and analyzed using the Burnham Maximum Likelyhood method in "Microfish, version 2.1" software (Van Deventer and Platts 1986). Exceptions to this analysis procedure occurred when second pass capture was equal to zero or capture depletion was $\leq$ 60% of first pass; then captures from both passes were added for a minimum population estimate. Kruskal Wallis nonparametric statistical tests (Zar 1984, p.177) were used to determine whether densities of rainbow trout varied significantly among habitat types for the upper N. Fork of Asotin Creek or the upper Tucannon River (WDF data). A nonparametric multiple range test similar to a Tukey's test (Zar 1984, p.200) was used to identify where significant differences occurred in habitat use when a significant difference was found with Kruskal Wallis tests.

RESULTS AND DISCUSSION

Hatchery Operation Monitoring

Juvenile Growth

Juvenile growth and development for all groups of steelhead and rainbow in 1986 and 1987 were similar. All groups of fish responded well to rearing conditions and converted fish food fed within expected parameters (Table 1).

Table 1: Trout Production at Lyon's Ferry/Tucannon Hatcheries, 1986, 1987.

Specie	Stock	No. Eggs	No. Fry	Number planted	Percent survival	Food fed(lbs)	Fish(lbs) produced	Feed conv.
1986								
SSH	Wallowa	377,770	317,575	312,312	82.7[A]	45,600	33,673	1.35
SSH	Wells	471,200	441,092	592,054	93.6[B]	132,150	93,979	1.41
			144,326					
RB	LFH		147,161	108,882	73.9[C]	40,552	35,693	1.14
	TUC. H.		220,000	159,506	72.5[C]	60,100	43,890	1.37
1987								
SSH	Wallowa	449,952	359,680	352,395 [D]	78.3[A]	54,600	40,826	1.34
SSH	LFH	705,000	446,245[E]	301,155	67.5[C]	58,600	47,905	1.22
SSH	Wells	464,800	407,817	303,835	74.5[A]	65,700	51,638	1.27
RB	LF. H.	218,500	213,020*	100,340		43,900	36,681	1.08
	TUC. H.[F]	199,880	161,900	68,831		23,900	23,273	1.37
RB(SSH)[G]				52,775		12,100	10,575	1.15

A- Egg to smolt survival.
B- Egg to fry survival only.
C- Advanced fry to catchable/smolt size survival.
D- Includes 47,799 pre-smolts planted.
E- 204,728 pre-smolts planted out.
F- 78,000 rainbow @ 10 fish/lb lost to Columnaris and Ichthyophthirius
G- steelhead from LFH converted to rainbow production to offset IHN losses.
* 104,000 fingerling transferred to IDFG

Production of steelhead in 1986 dropped significantly from 1985 production but increased again in 1987. The decreased production represented more realistic production figures for the hatchery without the added production demand of the joint WDW and ODFW steelhead program that had been underway since 1983. The 1986 commitment for 50,000 smolts to Oregon for their brood program was fulfilled with 70,000 fingerling in fall 1985 due to catastrophic losses at the Irrigon hatchery. In 1987, 52,500 smolts were again reared under this cooperative program.

Our last release/production year from fish spawned at other locations was in 1986. Wells fish were spawned in January-March 1985 and Wallowa fish were spawned in April and May 1985. Both were released during April and May of 1986. Wells fish reared approximately 14 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. Fish were moved from concrete raceways to large ponds for final rearing in the late fall after being adipose fin clipped. Wells stock fish ranged between 56-78/lb. while the Wallowa fish ranged between 70-100/lb.. All groups of fish were placed in ponds between mid and late September.

We had no incidence of disease at either hatchery in 1986. In 1987, however, there was a simultaneous outbreak of Columnaris and Ichthyophthirius at the Tucannon Hatchery in the catchable rainbow trout. Total mortality that occurred in the ponds was 78,000 fish during a one month period. Surplus steelhead at Lyons Ferry H. were transferred to the Tucannon H., after the diseases were controlled, to make up for part of the loss.

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

Survival from egg to fry for steelhead was good for the groups in 1986 (Table 2). Increased mortality rates in 1986 for the Wallowa and Wells stocks, and in 1987 for the new Lyons Ferry stock 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 1987 was made to insure adequate eggs in the event of a heavy IHN infestation. No IHN was found in any of the fish spawned, which left a considerable egg surplus.

Fish Marking

In 1986 we contracted our steelhead marking with Washington Dept. of Fisheries (WDF). Tag loss was much better than in previous years, averaging only 0.79%(SD= 0.45%) for 12 groups. All 12 tag groups were branded and brand loss averaged 2.0%(SD= 0.74%). Tag loss for the 1987 release averaged 0.48%(SD= 0.32) and mean brand loss was 3.65%(SD= 2.11%). The increased brand loss was due to four of the 11 groups with brand loss in excess of 5%. A lack of vigilance by the marking supervisor to some apparent mis-branding is the likely cause for the poor brand quality. A complete listing of the tag/brand groups is summarized in Table 4. Six brand-only groups were released each year under the direction of the Fish Passage Center (FPC) for migration rate/survival studies in the Snake River. Three small groups of Passive Induced Transponder (PIT) tagged fish were released from Lyons Ferry in 1987. These were preliminary test groups of PIT tags to help determine how efficiently tags could be inserted and then accurately recovered at time of release by utilizing detection equipment in a production facility.

Table 2: Juvenile mortality, Lyons Ferry Hatchery 1983-87

Stock	Brood year	Eggs In	Fry Out	% mortality
Wallowa	1983	911,504	853,889	6.3
	1984	830,453	794,443	4.4
	1985	377,770	348,360	7.8
	1986	449,952	391,303	13.1
	1987	432,076	414,176	4.2
Wells	1983	474,390	454,913	4.1
	1984	373,648	340,339	8.9
	1985	471,200	431,627	8.4
	1986	464,800	407,817	12.3
	1987	0	0	--
LFH	1986	705,000	650,973	7.7
	1987	1,111,506	983,901	11.5

Fish at Release

Two stock of steelhead were used in 1986 and three stocks in 1987. Samples were taken from various raceways, rearing ponds and conditioning ponds during the release periods for both years (Table 3). Multiple listings for lakes or conditioning ponds indicate distinct samples of mark groups or where gross size differences existed between sample dates in a given year. Some distinct size discrepancies occurred between these numbers and numbers reported on hatchery planting sheets (Table 4). The most evident differences are for conditioning ponds where obtaining random samples from the population is quite difficult. Differences in 1986 could be attributed to small sample size, but the causes in 1987 are unknown as sample size had been increased.

Fish size at release ranged from 4.6 - 6.9 fish/lb in 1986 while the average size for the entire release of smolts was 5.6 fish/lb (Std.Dev.=0.6). Total production was 827,548 fish totaling 148,723 pounds. Table 4 summarizes the smolt releases into southeast Washington rivers for 1984-1987. Fish size at release ranged from 4.8 - 5.9 fish/lb in 1987. The average size for the entire release of smolts for 1987 was 5.5 fish/lb. (Std.Dev.=0.3).

Table 3 Smolt characteristics at Lyons Ferry Hatchery 1986,1987.

Lake/ Raceway	Stock	Number fish sampled	No. of Sample days	Mean length mm (SD)	Mean weight gms (SD)	No. fish /lb.	K factor	% Precocious males
1986								
Lake 3	WE	926	4	203.8(20.6)	78.9(22.7)	5.8	0.9	1.0
Lake 2	WE/WA	167	1	199.9(22.2)	80.4(25.6)	5.6	0.99	1.2
Curl Lk.	WA	77	2	182.7(26.7)	64.9(30.2)	6.9	0.98	0.0
	WE	296	2	204.9(16.9)	90.5(21.9)	5.0	1.03	0.0
RW-14	WE	68	1	196.7(14.7)	75.4(16.1)	6.0	0.98	0.0
RW-19	WA	104	1	185.1(32.2)	70.9(33.3)	6.4	1.08	2.8
Ctwood	WA	315	2	184.5(35.8)	72.1(39.6)	6.3	1.02	1.0
Ctwood[B]	WA	53	1	178.9(26.7)	59.0(26.4)	7.7	0.97	0.0
1987								
Lake 1	WE	374	2	199.0(17.4)	76.1(18.1)	5.9	0.96	3.7
Lake 2	LFH	297	4	211.3(16.9)	88.8(20.8)	5.5	0.93	0.3
	WA	257	4	201.2(16.9)	75.3(19.4)	5.6	0.90	0.0
Lake 3	LFH	430	3	210.9(13.9)	88.7(18.0)	5.1	0.93	0.0
RW 3&5	WA	206	2	196.8(20.2)	82.6(25.8)	5.5	1.04	1.9
Curl Lk.	LFH	186[A]	2	193.8(20.2)	80.9(24.2)	5.6	1.07	1.6
		97[B]	2	197.8(17.0)	84.5(22.5)	5.4	1.07	0.0
Ctwood CP	WA	230[A]	1	183.8(25.0)	59.8(23.5)	7.6	0.90	2.6
		134[B]	1	193.4(16.5)	66.9(19.2)	6.8	0.90	1.5
Dayt. CP	WE	160	2	199.3(15.9)	82.3(57.6)	5.5	1.03	6.8

[A] Unmarked steelhead placed in the Conditioning pond.
[B] Cwt and branded steelhead in the conditioning pond. Samples were kept separate to determine if marking had any measurable effect on fish size at release.

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. Figures 1-11 depict the range and variation of samples of fish lengths and weights taken from lakes, raceways and conditioning ponds in 1986 and 1987.

Discussion

Both production years went well, but for different reasons. Over production of smolts had created space problems in 1984 and 1985. With the elimination of production for ODFW in 1986 it allowed us to evaluate our means of operation and determine more efficient methods of handling and moving our fish within the hatchery to accommodate the clipping and cwt/brand programs. The availability of conditioning ponds also allowed the early removal from the hatchery of several hundred thousand fish in early March. This greatly reduced the amount of time spent hauling fish in the

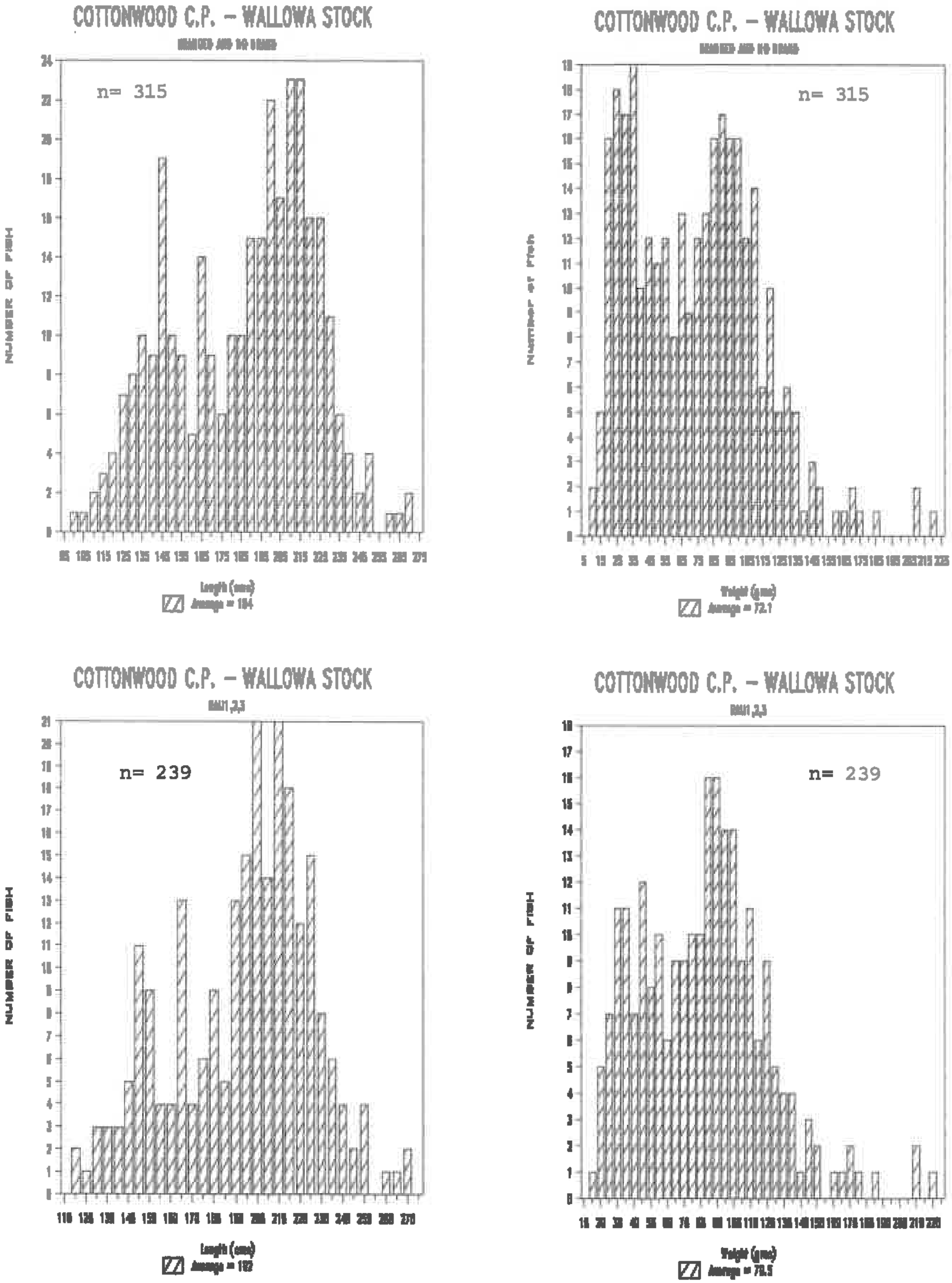


Fig. 1. Length and Weight Histograms, Cottonwood C.P., 1986.

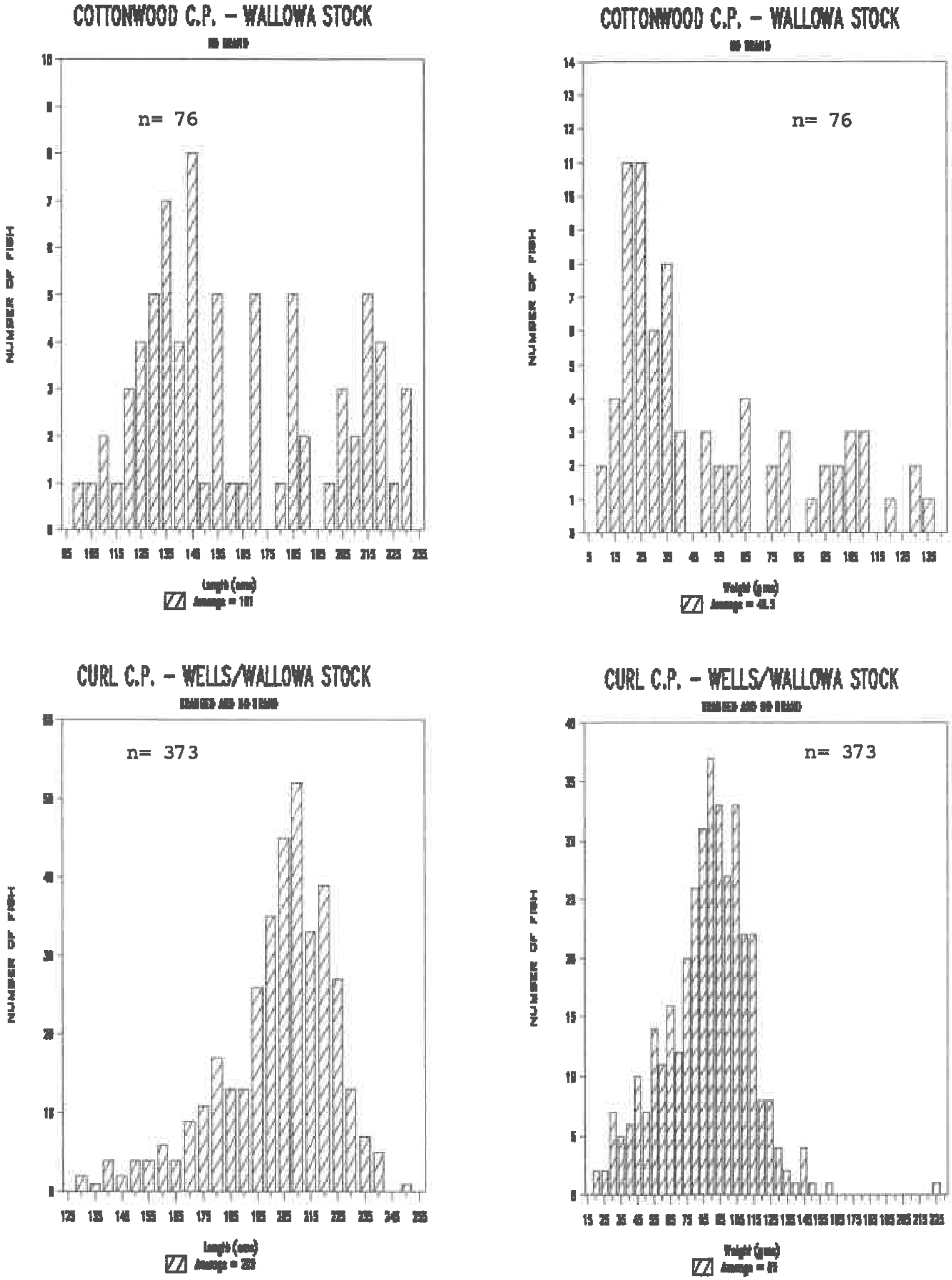


Fig. 2. Length and Weight Histograms for Cottonwood and Curl Lk. C.P.'s 1986.

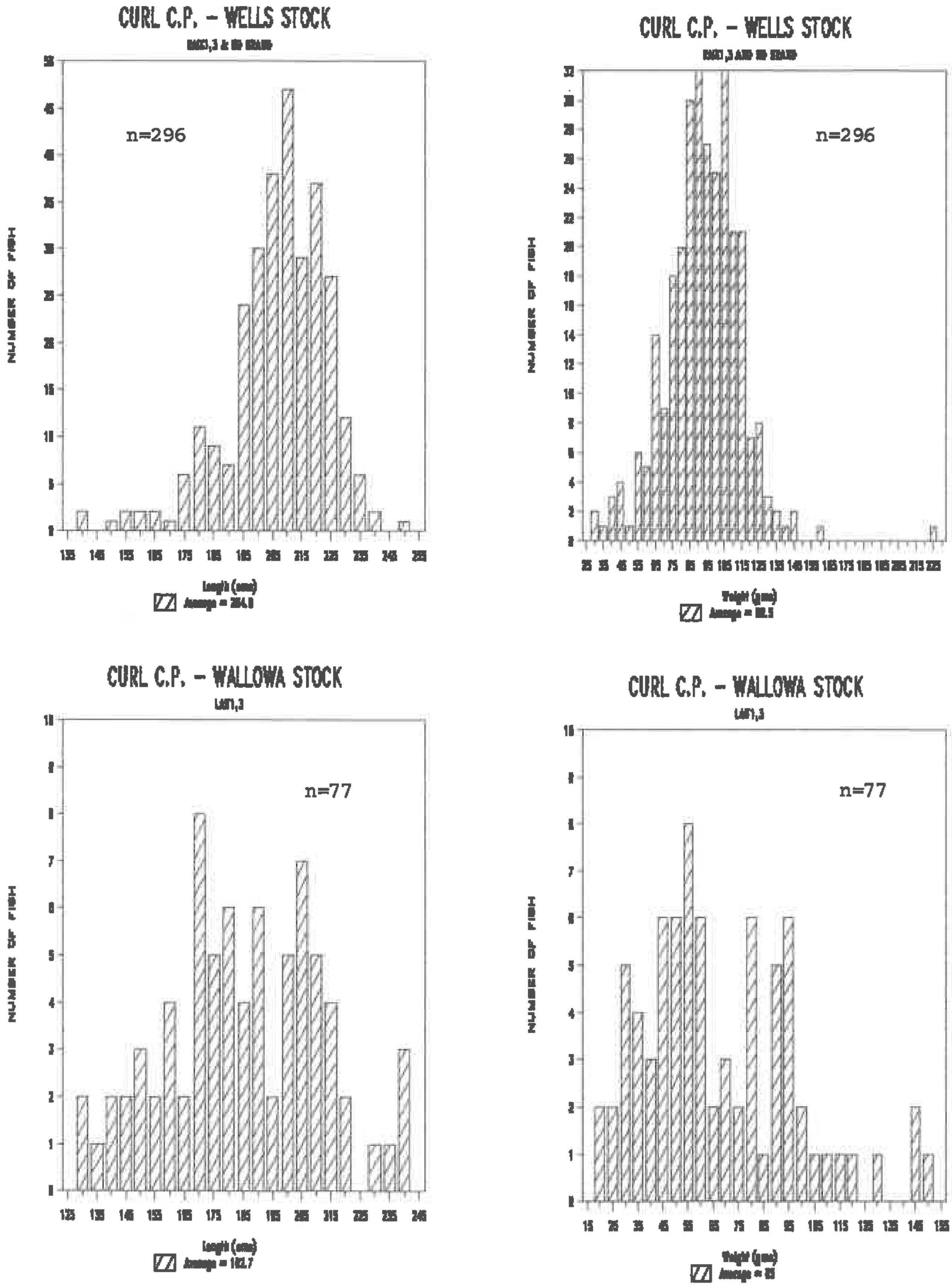


Fig 3. Length and Weight Histograms, Curl Lk. C.P., 1986.

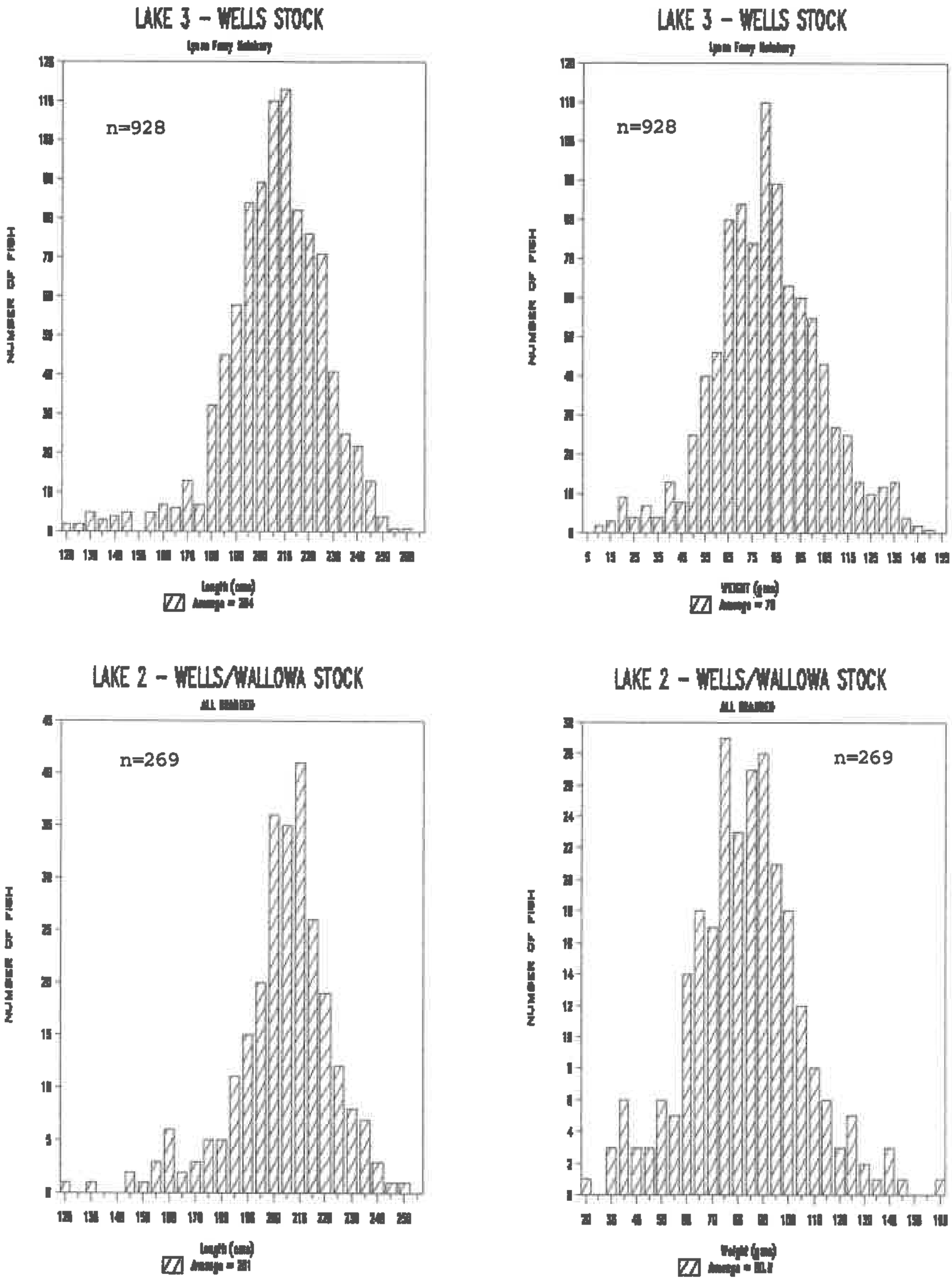


Fig 4. Length and Weight Histograms for Lyon's Ferry Hatchery Released Smolts, 1986.

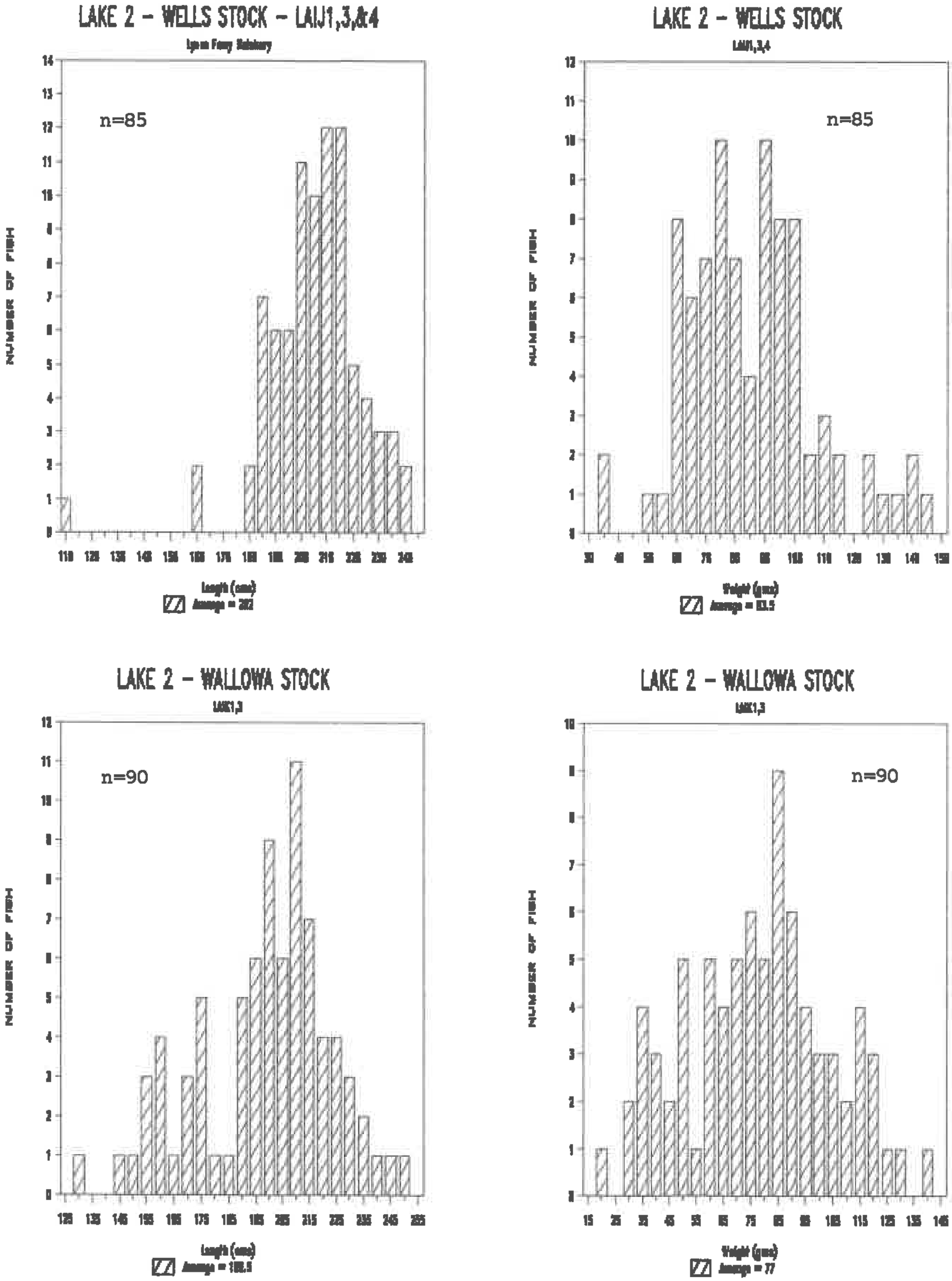


Fig 5. Length and Weight Histograms for coded wire tagged smolts Released at Lyon's Ferry Hatchery, 1986.

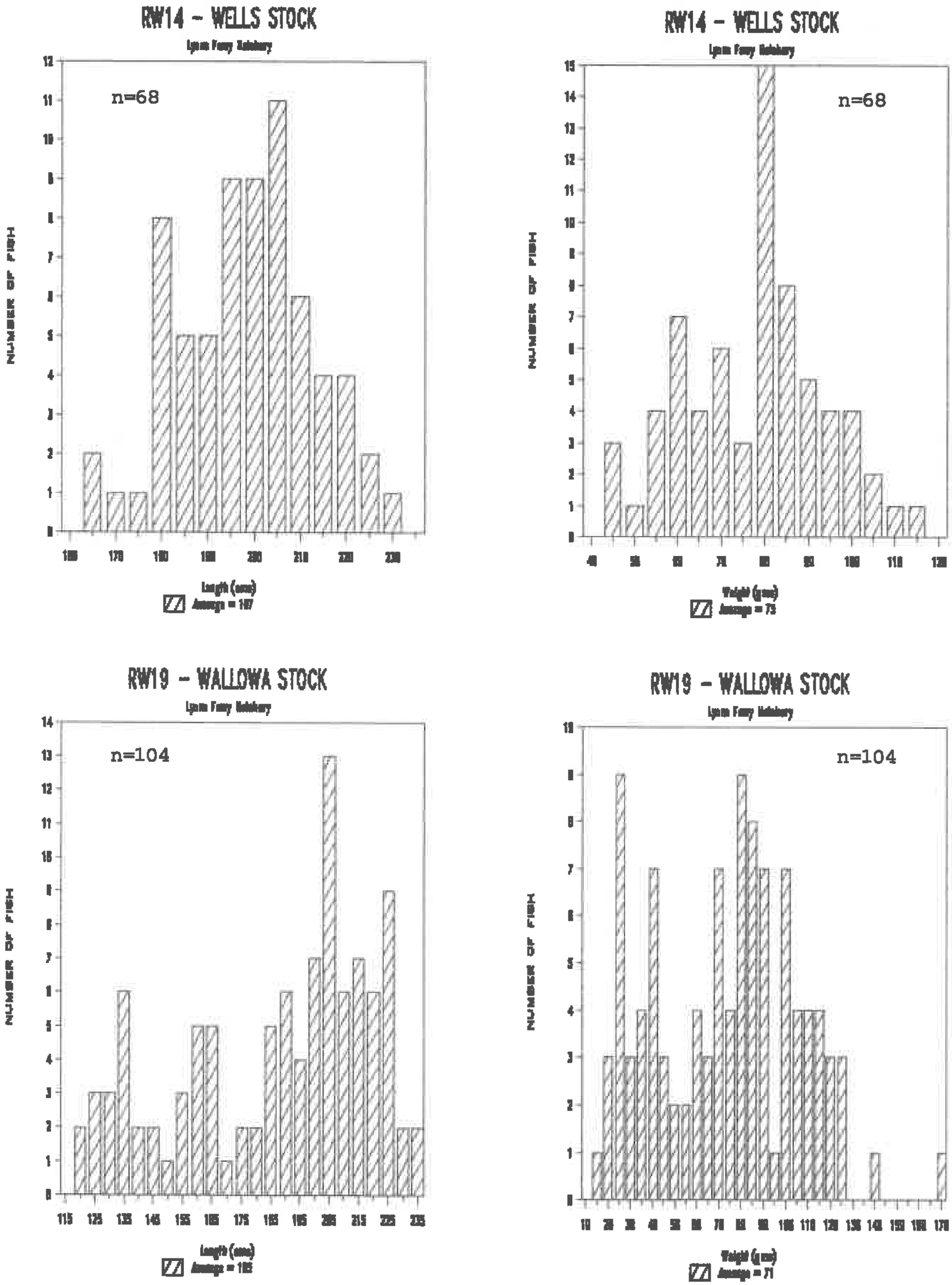


Fig 6. Length and Weight Histograms for Raceway Reared smolts at Lyon's Ferry Hatchery, 1986.

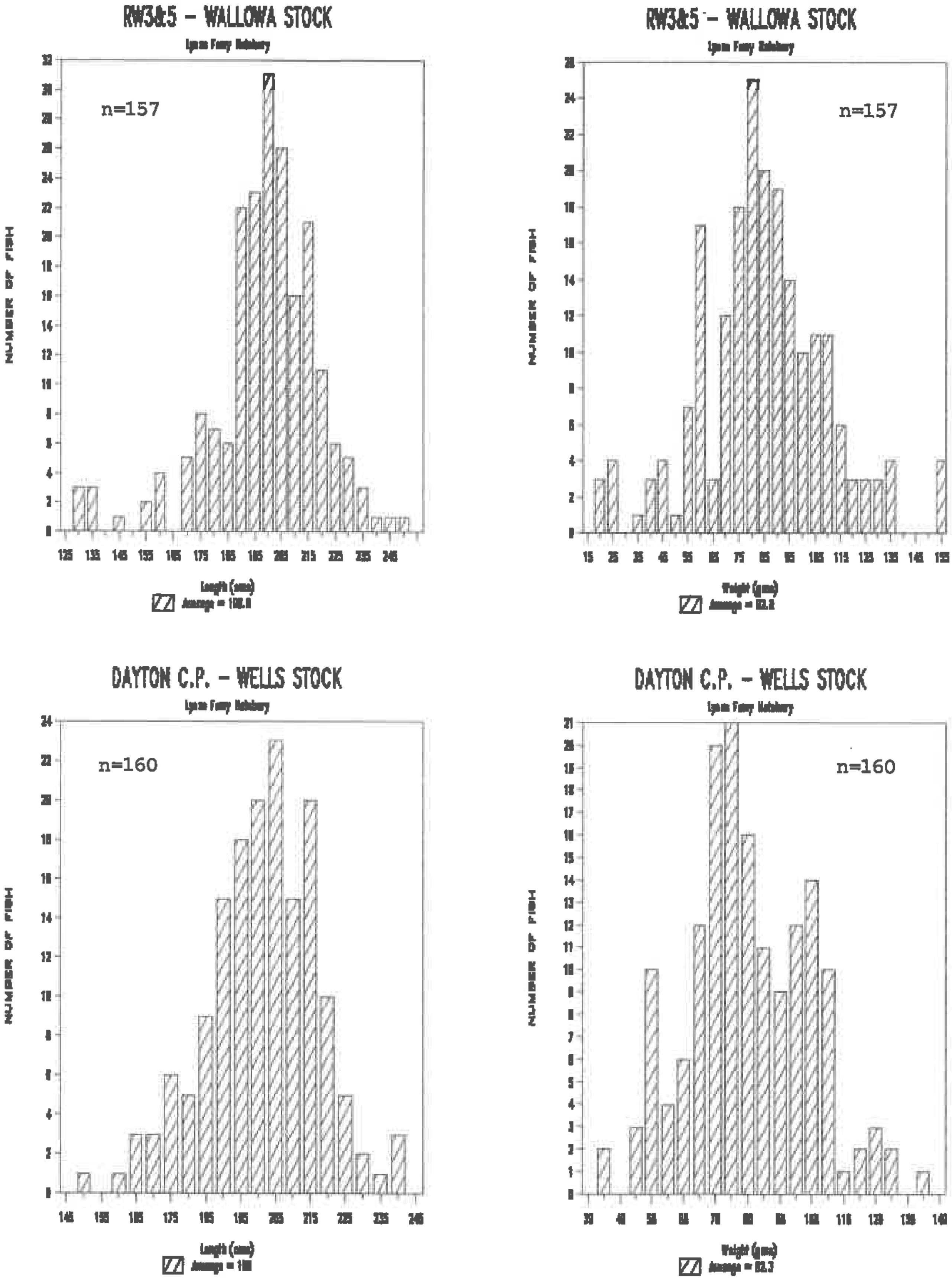


Fig 7. Length and Weight Histograms for Raceway reared and Dayton C.P. released smolts, 1987.

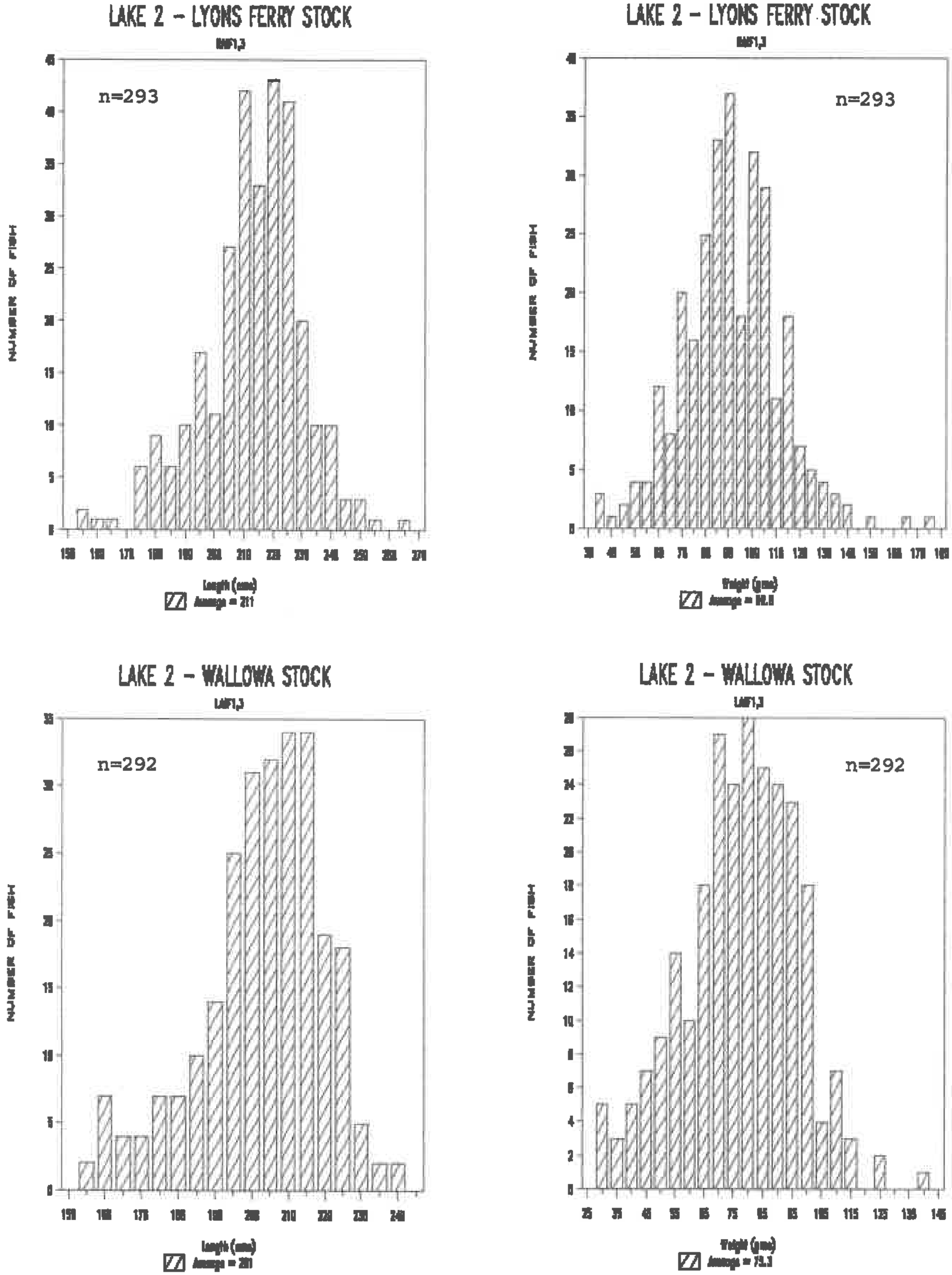


Fig 8. Length and Weight Histograms for Lyon's Ferry reared smolts, 1987.

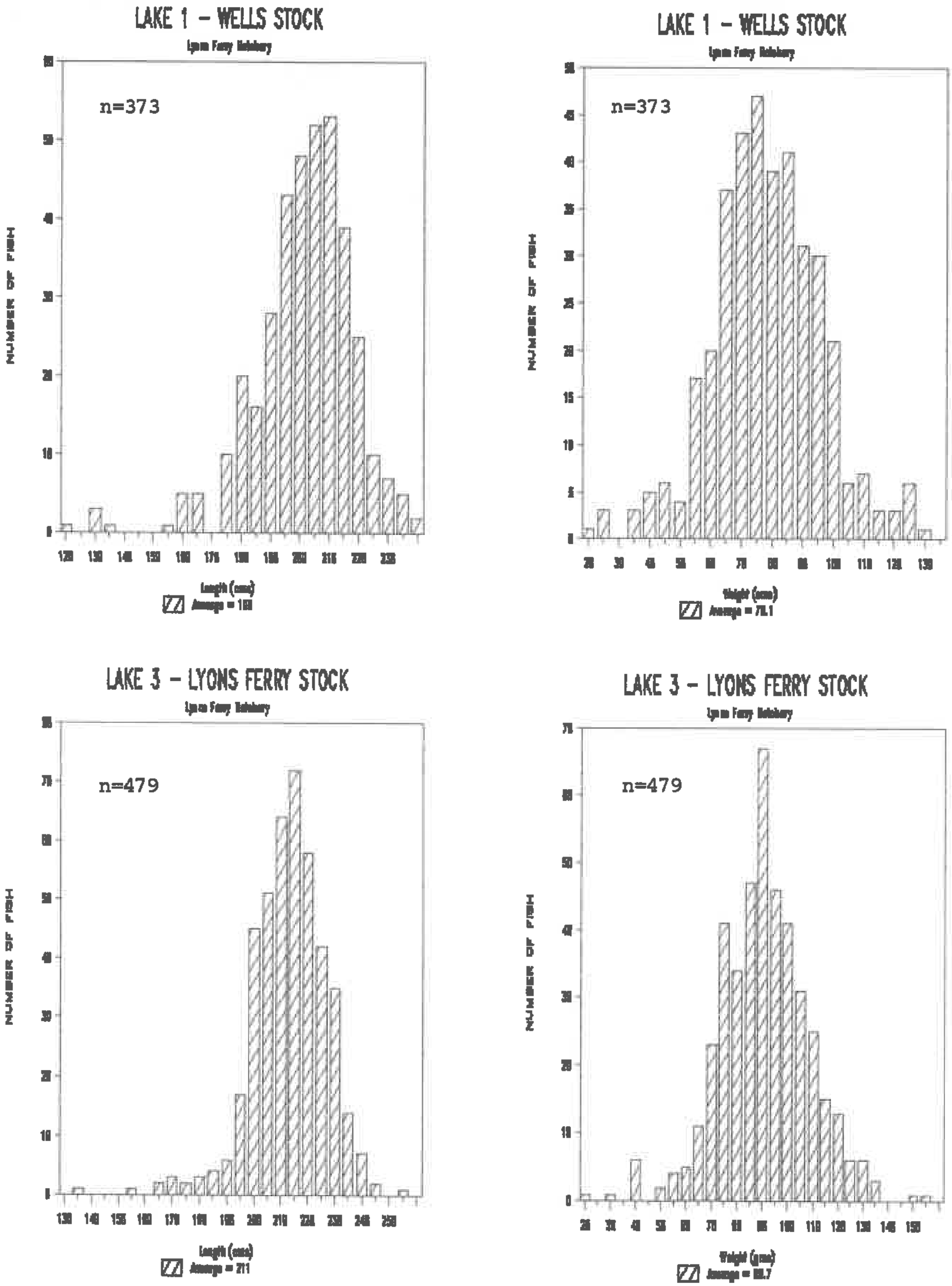


Fig 9. Length and Weight Histograms for Lake Reared smolts, 1987.

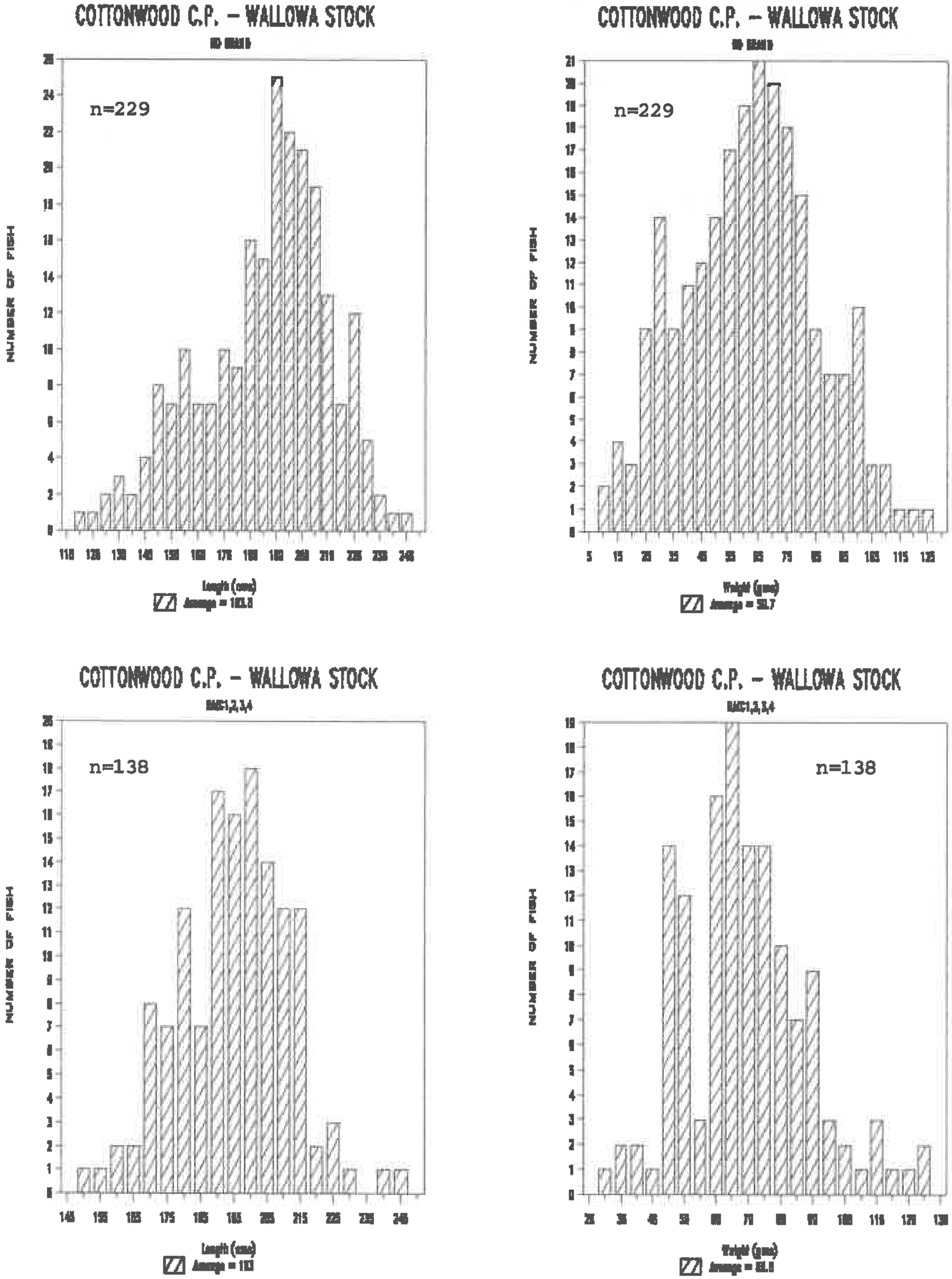


Fig 10. Length and Weight Histograms for smolts released at Cottonwood C.P. 1987.

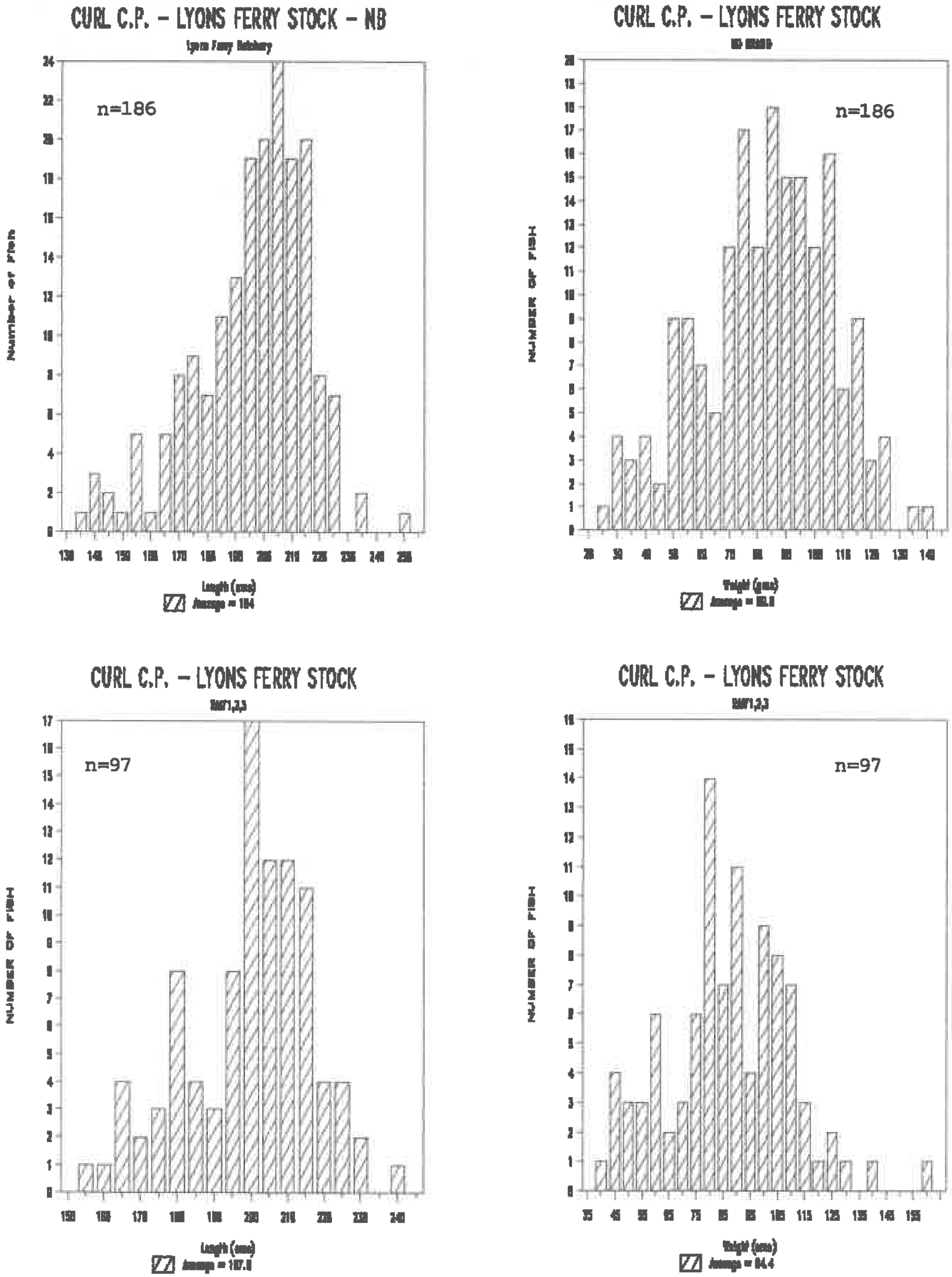


Fig 11. Length and Weight Histograms for smolts released from Curl Lk. C.P. coded wire tagged and untagged groups, 1987.

critical spring smolt release period. The spring crowding in our release structure was further ameliorated in 1987 when the last of our conditioning ponds (in Dayton on the Touchet River) was completed and used. Conditioning ponds (CP's) allowed 237,000 fish to be moved early in 1986 and 524,000 in 1987.

Fish growth and performance during both years was excellent. Feed conversions were within expected parameters. Smoltification at time of release appeared to be very good for most fish. There appeared to be significant differences in the size of fish at release in 1986, as reported on hatchery planting sheets and our juvenile samples taken 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 to address this problem. The two sets of numbers compared much more closely in 1987 than in 1986. Definite differences are apparent in the response of fish to the conditioning ponds and in size at release of marked versus unmarked fish. Tagged and branded fish consistently averaged longer and heavier than their unmarked counterparts. We must conclude that the added stress of marking does not negatively effect the growth of the fish. However, the measurable size differences could bias return results from our tagging studies. Growth rates of fish in the CP's are greatest in the Cottonwood pond and least in Curl Lk., probably due to differences in water temperature. Water temperatures in Curl Lk. have not exceeded 48°F prior to release in any of the three years it has been used, whereas Cottonwood pond water will fluctuate between 45-59°F during the last month of rearing. The consistently cold water of Curl Lk. may be partially responsible for wandering observed in returning adults destined for the Tucannon R.(see <u>Adult Returns</u> section).

The tagging program went smoothly each year. Purchase of a new tagging trailer through LSRCP and contracting the marking/ branding with WDF made scheduling of tagging, clipping, and branding easier. New state-of-the-art tagging machines caused tag loss percentages to decrease to the best level we have ever achieved. Brand quality was stressed daily during the marking in 1986. We suspected that poor quality was due primarily to improper branding procedure and failure to consistently correct the problem. The results were excellent in 1986, but brand quality dropped again in 1987. Constant observation and correction of improper branding appears to be essential to consistent brand quality, even when using experienced branding personnel.

Hatchery Smolt Emigration

Releases

All smolt plants for 1984-87 are summarized by release day in Table 4. 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

Table 4. Lyons Ferry/Tucannon Hatchery Steelhead Smolt Releases and Mark Groups

RELEASE YEAR	LOCATION	RIVER MILE	NUMBER	POUNDS RELEASED	DATE (MM/DD)	STOCK	TAG CODE	BRAND	FIN CLIP(S)	SIZE #/LB.	TAG LOSS(%)	BRAND LOSS(%)
1984	TUCANNON R.	43	30,473	6,219	5/09	WALLOWA	63/32/12	RA-IJ-1	LV	4.9	5.1	
	TUCANNON R.	43	15,680	2,850	4/26	WALLOWA	63/32/13	RA-IJ-2	LV	5.5	6.3	
	TUCANNON R.	43	11,442	2,159	5/09	WALLOWA	63/32/13	RA-IJ-2	LV	5.3	6.3	
	TUCANNON R.	43	31,790	6,113	4/26	WALLOWA	63/32/14	RA-IV-1	LV	5.2	5.8	
	TUCANNON R.	43	30,930	6,312	4/26	WALLOWA	63/32/15	RA-IV-3	LV	4.9	5.2	
	TUCANNON R.	43	36,000	4,000	5/08	WALLOWA				9.0		
	TUCANNON R.	43	39,000	4,699	5/10	LF/WELL			AD	8.3		
	SNAKE R.@ LFH	58	50,450	15,288	4/30	WELLS		RD-IT-3		3.3		
	SNAKE R.@ LFH	58	5,193	1,573	4/30	WELLS				3.3		
	SNAKE R.@ LFH	58	24,920	4,450	4/21	WELLS				5.6		
	SNAKE R.@ LFH	58	30,400	9,212	4/30	WALLOWA		RD-IT-1		3.3		
	SNAKE R.@ LFH	58	20,605	3,887	4/30	WALLOWA		RD-IT-1		5.3		
	SNAKE R.@ LFH	58	6,810	1,718	4/30	WALLOWA				4.0		
	TOUCHET R.		21,360	4,450	4/10	WELLS				4.8		
	TOUCHET R.		32,900	7,000	4/11	WELLS				4.7		
	TOUCHET R.		27,685	5,650	4/16	WELLS				4.9		
	TOUCHET R.		32,775	5,750	4/16	WELLS				5.7		
	TOUCHET R.		29,945	5,650	4/18	WELLS				5.3		
	WALLA WALLA R.		55,370	11,300	4/17	WELLS				4.9		
	WALLA WALLA R.		52,945	11,300	4/12	WELLS				4.7		
	WALLA WALLA R.		24,920	4,450	4/20	WELLS				5.6		
	MILL CREEK	3	30,510	5,650	4/18	WELLS				5.4		
	ASOTIN CREEK		33,005	4,025	5/07	WALLOWA				8.2		
	ENTERPRISE, OR.		330,667	50,775	4/23-30	WALLOWA				6.5		
	ENTERPRISE, OR.		170,785	20,050	5/1-3	WALLOWA				8.5		
	"totals"		1,176,560	204,530				Mean fish/pound =		5.8		
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-7H-1	AD	5.8		
	SNAKE R. @ L.GOO	71	20,309	3,626	5/10	WELLS		RA-7H-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		

Table 4. Lyons Ferry/Tucannon Hatchery Steelhead Smolt Releases and Mark Groups

RELEASE YEAR	LOCATION	RIVER MILE	NUMBER	POUNDS RELEASED	DATE (MM/DD)	STOCK	TAG CODE	BRAND	FIN CLIP(S)	SIZE #/LB.	TAG LOSS(%)	BRAND LOSS(%)
	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		
									SD =	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		
1986	SNAKE R.@ L.GOO	71	19,604	3,380	04/21	WELLS		RA-7F-1	AD	5.8		
(cont.)	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.		14,000	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		

Table 4. Lyons Ferry/Tucannon Hatchery Steelhead Smolt Releases and Mark Groups

RELEASE YEAR	LOCATION	RIVER MILE	NUMBER	POUNDS RELEASED	DATE (MM/DD)	STOCK	TAG CODE	BRAND	FIN CLIP(S)	SIZE #/LB.	TAG LOSS(%)	BRAND LOSS(%)
.	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.	0.75	22,950	4,500	04/22	L.FERRY			AD	5.1		
1987	TUCANNON R.@CURL	47	101,400	17,791	4/21-30	L.FERRY			AD	5.7		
(cont.)	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	1.8
	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	0.75	28,975	4,750	4/20	WALLOWA			AD	6.1		

Table 4. Lyons Ferry/Tucannon Hatchery Steelhead Smolt Releases and Mark Groups

RELEASE YEAR	LOCATION	RIVER MILE	NUMBER	POUNDS RELEASED	DATE (MM/DD)	STOCK	TAG CODE	BRAND	FIN CLIP(S)	SIZE #/LB.	TAG LOSS(%)	BRAND LOSS(%)
	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	19,080	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		

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 fish responded well to the facilities. Retired WDW hatchery managers were hired to operate the Cottonwood and Dayton ponds. In 1986 the screens were removed from the outlet structure of Cottonwood Pond on 24 April and from Curl Lk. on 1 May. To encourage emigration, pond levels were lowered 8". Only small numbers of fish were noted exiting the pond for the next 3-5 days. By the end of the 7th day, climatic changes caused a surge of emigration from Cottonwood pond, but very cold weather in the Tucannon Valley was inhibiting emigration from Curl Lk.. Pond levels were drawn down steadily for the last 6 days for each of the ponds. A rapidly rising water level in the Grande Ronde River backed water through the outlet into Cottonwood pond for three days, drastically slowing emigration from the pond. The water level dropped from the entrance on 2 May and the pond was empty by 6 May. Water temperatures at Curl Lk. remained near 40°F throughout the early release period. We were concerned that a delayed release in 1985 caused excessive residualism in the pond. Therefore we lowered the pond level steadily beginning 9 May, with the pond empty by 13 May, 1986.

Three conditioning ponds were used in 1987, after completion of the Dayton pond on the Touchet R. Initially only 100,000 fish were put in the Dayton pond. Because of a leakage problem in one section of the pond embankment, one third of the fish were held at the hatchery for direct stream planting in case of a structural failure. The leakage was repaired and the remaining 35,000 fish were placed in the pond around 1 April. Screens were removed from all three ponds on 20 April. Standard pond lowering procedure now allows fish to emigrate for the first 5 days without any lowering of the pond. Over the last 6 days, the ponds are steadily lowered until all fish are removed by 1 May. No unusual occurrences or problems were noted for 1987.

Migration Through Dams

Table 5 summarizes passage estimates for each brand group for 1985-87. The 1985 passage figures are included for comparison. In 1986, first arrivals of fish at McNary or L. Granite dams occurred within the first week following release from LFH or the conditioning ponds. Median (50%) passage of the fish from all groups passed the first collector 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 4.0-7.7 miles per day to the first dam (FPC, 1985,1986). These travel rates were generally one third those of in-river fish, a behavior described in 1985 by the FPC as consistent throughout the Columbia R. drainage. Migration rates for LFH groups had increased and were comparable to in-river groups by the time they reached John Day pool. The Cottonwood C.P. groups increased their travel rates once they passed L. Granite Dam.

Travel rates in 1987 were nearly double those for 1986 despite river flows which were fully 20% lower in 1987 (FPC, 1988). First arrivals of branded fish from releases into the G. Ronde and Snake Rivers occurred at their first collector dam within 3-4 days. Median passage occurred at McNary dam at 18 days for Tucannon River fish, 11.8 days for LFH fish and 8 days for G.Ronde R. fish. Travel rates ranged from 7.5-11.3 miles/day to the first dam. These fish also increased their travel speed once past the first dam, when their rate equaled that of in-river groups.

Table 5. Estimated Passage of Branded Lyons Ferry Steelhead at McNary and Lower Granite Dams, 1985-87. (Harmon, 1985; FPC, 1986, 1987).

Brand	Release Site	Passage Index	Number Released	% of Release	Size (#/lb)	Stock
McNary						
1985						
RA-H-1	LFH	10,526	28,191	37.3	2.6	WE
RA-H-2	LFH	6,302	28,373	22.2	5.5	WA
RD-H-1	LFH	6,467	22,394	28.9	2.6	WE
RD-H-2	LFH	6,963	25,540	27.3	5.5	WA
LA-S-1	Curl Lk.	6,503	39,094	16.6	5.7	WA
LA-S-2	Curl Lk.	6,586	39,094	16.8	5.7	WA
1986						
LA-IJ-1,3,4	LFH	20,914	61,281	34.1	5.4	WE
LA-IK-1,3	LFH	10,750	40,480	26.5	5.8	WA
RA-IK-1,3	Tucannon	8,377	40,494	20.6	5.6	WA
LA-IT-1,3	Tucannon	5,239	40,349	12.9	5.6	WE
1987						
RA-IF-1,3	LFH	18,906	50,843	37.2	4.8	LFS
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	LFS
Lower Granite						
1985						
RA-17-1	G.Ronde R.	12,142	41,028	29.6	5.5	WA
RA-17-3	G.Ronde R.	12,066	40,201	30.0	5.5	WA
1986						
RA-IJ-1,2,3	G.Ronde R.	14,619	60,477	24.2	4.6	WA
1987						
RA-IC-1,2,3,4	G.Ronde R.	21,322	80,461	26.4	5.4	WA

Discussion

Average fish size for 1986 and 1987 releases increased slightly each year from 1985 with very consistent average fish weights (SD= 0.6 in 1986 and SD= 0.3 in 1987 based on hatchery planting sheets). Precocious males were not more than 3% of the fish sampled for either year. The decrease in size variability was likely the result of available conditioning pond space to hold marked groups. In past years, cwt fish had to be held in hatchery raceways resulting in increased size and weight of the fish. Thus these fish may not be representative of the hatchery production.

Hatchery steelhead emigration appeared to closely follow that of wild fish, which peaked in late April (see Juvenile Populations). The Tucannon River fish again were the slowest to leave their river system. Migration appeared to occur only after several days residence within the river itself. 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. Migration rates generally appeared to increase as the fish moved downstream and passed through the first reservoir area they encountered in both years, very similar to the 1985 migration (FPC, 1986).

The passage index (P.I.) does show that there is a consistent difference between passage at McNary Dam for groups released at LFH and the Tucannon River. Passage from the Tucannon can be as low as 60% of passage for the LFH groups. This difference is difficult to understand since there are no additional dams to pass, and only 47 miles of free flowing river. Migration speed is also similar for both groups. The difference in the P.I. may indicate that reduced smoltification of the Tucannon releases, due to cold water or some other factor(s), could be affecting emigration, survival and residualism.

Migration rates seem to vary considerably between years but the P.I. has remained fairly consistent for the three major release areas from 1985-1987. The increased migration rates in 1987, despite decreased flow in the Snake R., is not explainable from our sampling. There was no indication in the smolt samples (1985-87) for either length, weight, condition factor, or their apparent smoltification process (except as previously noted for the Tucannon R.) that the fish would not perform similarly during migration. Use of available Water Budget to increase flow through the pools during peak chinook and steelhead migrations could have increased migration rates in 1987.

The Lyons Ferry Stock of steelhead was first released in 1987 to measure their performance with the Wallowa and Wells stocks we have used. The groups passed McNary dam very well, with the greatest increase in passage over 1986 from the Tucannon R. release. These fish passed McNary at a 66% greater survival rate than in 1986, with a small increase seen in survival of the LFH groups also. These numbers were very encouraging for the Tucannon release as they are the best passage ever measured for that release area.

Adult Steelhead Returns

Passage at Dams

Passage of marked (cwt) groups of fish at Lower Granite Dam (LGR) have great significance since it is the uppermost dam in the lower Snake River and the point which is considered the LSRCP project location. Fish escaping to this location can be considered fulfilling their commitment to meeting compensation goals. 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.

Table 6: Adult Returns of Lyon's Ferry Steelhead to Above Lower Granite Dam, 1984-87. (Harmon, 1987)[1]

Release year Brand	Number of Adults Return Year				Total Adults Captured	No. Smolts Rel.	% survival[2]
	1983	1984	1985	1986			
1982							
LA-IJ-1*	74	54	1		129	35,155	0.37
LA-IJ-3	213	196	3		412	27,940	1.47
1983							
RA-S-1		142	132	1	275	34,431	0.82
RA-S-2		111	107	0	218	32,078	0.70
LA-S-1		288	211	0	499	50,597	1.02
1984							
RA-IJ-1			121	141	262	30,473	0.92
RA-IJ-2			99	129	228	27,122	0.90
RA-IV-1			176	168	344	31,790	1.15
RA-IV-3			202	237	439	30,930	1.51
1985							
RA-H-1				429	429	28,191	1.58
RA-H-2				83	83	28,373	0.31
RA-17-1				553	553	41,028	1.39
RA-17-3				468	468	40,201	1.21
LA-S-1				101	101	39,094	0.26
LA-S-2				85	85	39,094	0.23

* 1982: IJ-1 G.Ronde R.; IJ-3= LFH. 1983: RA-S Wallowa R.; LA-S = LFH.
1984: All brands released in Tucannon River.
1985: RA-H LFH; RA-17 G.Ronde R.: LA-S Tucannon R.

[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)

Run timing for the Wallowa stock fish generally follows passage norms at Lower Granite Dam. Eighty percent of the run passes the dam September through November, with the peak month being October (Figs. 12-15). The majority of the remaining run passes the dam during March, April or August. The Wallowa fish pass the dam more strongly during July and August than the main run, with 11-15 % of their total moving upstream in those months. It appears that these fish account for most of the June-August passage at the dam, along with early running wild fish. The fish released directly from LFH exhibit the strongest tendency for early migration with fully 27-28.2% of the one salt age fish passing the dam in July and August. Also, the graphs are somewhat misleading because the ladder is either inoperative or not sampled for passage 16 December through 28 February, and there are shortened sampling hours in November, December, March and April.

Characteristics of Returning Adult Steelhead

We now have complete adult Wallowa stock steelhead return data on the 1982-1984 tag groups from Lyon's Ferry Hatchery. The data were collected at Lower Granite Dam from coded wire tagged/branded adults as they passed through the fish ladder.

The size of fish for each year class for several brand groups is consistent over the 4 years represented (Table 7). Fish rearing in the ocean for one year averaged 55.4 % of total adult returns

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]	L	two ocean n	L
1982	G. Ronde R.	LA-IJ-1	34	57.3	16	69.6
	L.Ferry H.	LA-IJ-3	50	60.2	75	76.2
1983	L.Ferry H.	LA-S-1	100	59.9	150	71.7
	Wallowa R.[2]	RA-S-1,2	115	58.4	100	70.7
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[3]	429	58.5		
	L.Ferry H.	RA-H-2	83	57.4		
	G.Ronde R.	RA-17-1,3	1021	57.6		
	Tucannon R.	LA-S-1,2	186	57.8		
	Weighted Mean			58.6		72.3

[1] Sample size, does not necessarily indicate total return.
[2] Reared at Lyon's Ferry Hatchery but released in Oregon.
[3] Wells stock released at LFH.

while two ocean and three ocean fish averaged 44.2 % and 0.4 % respectively. There is, however, considerable variability between years with one ocean fish ranging from 46.6% to 67.4% of returns for the 4 year classes.

Returns to Lyon's Ferry Hatchery

The ladder at the hatchery was open and operational for the entire fall run of steelhead in 1986. Trapping was discontinued on 3 December because of extreme cold. The ladder was reopened on 3-March and remained open until 30 March. A total of 1,213 adult steelhead were trapped and inspected for brands, fin clips, sex and origin during the fall and spring periods.

Fish sorted from fall and spring trapping were comprised of 63.2% females and 36.7% males. Wild origin fish were 8.7% of the sample and tagged/branded fish represented 22.7% of the total fall and spring trapping. Branded Wallowa stock fish (RA-H-2) returning to Lyons Ferry Hatchery as brood stock were trapped at a 0.175% return rate (47 fish) while branded Wells stock fish returned to the hatchery at a 0.284 % return rate (77 fish). These numbers represent a significant increase over the 1985 run year returns to LFH.

The female fish sorted for spawning were comprised of 76% hatchery origin, based on fin clip and dorsal fin examination, 13.2% wild and 10.8% LV clipped (Appendix F). A complete listing of brand and tag recoveries to the hatchery is summarized in Appendix G. Two hundred fifty (250) females were spawned yielding 1,111,506 eggs (mean =4,446 eggs/female), after first picking. Females were selected weekly for spawning based on physical examination for ripeness. All fish from the fall and spring trapping that were retained for spawning were held in a common pond and no differentiation between fall/spring fish was possible. Scale samples were collected only from spawned females in 1986 and from some of the spawned males and females in 1987 (Appendix H). No IHN positive results were documented from ovarian fluid samples for any of the females.

Returns to Other Locations

<u>Trapping</u>

In 1986 a weir and traps were constructed 0.4 miles above a locked gate, and approximately 0.5 miles above the mouth of Charlie Creek. The adult trap was operated from 26 March to 25 June 1986. The juvenile trap was not installed until 29 March. We modified the weir in 1987 to a diagonal design with an adult trap at the upstream end and a smolt trap at the downstream end. We also moved our trap site downstream about 0.1 mile from the 1986 location and began trapping for adults on 3 February 1987.

We trapped similar numbers of adult steelhead in 1986 and 1987 (Table 8). Scale analysis for 25 adults sampled in 1986 indicates that most fish returned after 1 year in salt water at a mean fork length of 59.9 cm (Table 9). In 1986 most fish were trapped while moving downstream after spawning, while in 1987 most fish were caught migrating upstream. We were unable to accurately determine run timing information in 1986 because the trap was constructed after most fish had entered the creek. In 1987 the first adult steelhead we saw in the creek was on 9 March. We trapped our first adult on 22 March and our earliest unmarked kelt was captured while migrating downstream on 30 March. Spawning activity and several redds had been documented below the weir by that date. Fish continued to migrate above the weir in Charlie Creek until 30 April, and our last capture of a downstream migrating kelt was 21 May in 1987. In 1986 those dates were 25 April and 13 May, respectively.

The S.F. Asotin trap was installed 12 February 1987 and dismantled on 18 May. The first adult steelhead was seen in the trap on 12 March and the last immigrating adult was captured on 14 April. A total of 18 adult steelhead were captured at the trap (Table 10). Eight of these were carcasses of emigrating kelts.

Asotin Cr. adult counting began the morning of 4 April. However, 2 or 3 steelhead spawning just upstream of the fabric moved back and forth over the fabric and made counting of migrating adults difficult. Counting stopped on 12 April after only 5 days of sampling because several fish that moved back and forth over the fabric made accurate counts impossible.

Trapping operations on Cottonwood Cr were conducted from 22 March until 1 May and 30 March to 29 April 1986 and 1987, respectively. Slight modifications were made to trapping procedures each year to improve survival at the trap. A vertical wire fence was placed at the downstream edge of the intake screen on 8 and 9 April 1986 and 1987, respectively, to insure capture of all downstream migrants. We were only able to capture 2 adult steelhead during the spring of 1986. However, in 1987 204 adult steelhead were captured after approximately 30 steelhead kelts had been passed without enumeration or examination between 23 and 30 March. Most steelhead were captured as they migrated downstream after spawning. Approximately 48.8 % of the adult steelhead of known origin were adipose clipped and an additional 47.8 % were missing left ventral fins (Table 11). A total of 28 of the 197 hatchery fish (14.2 %) contained jaw tags. We recovered 26 coded-wire tags or jaw tags representing the 62-16-27 cwt code and 27 with the 62-16-28 code (Appendix I). Analysis of scale samples collected from captured adults was not available in time to be included in this report.

Table 8. Adult Steelhead Captured at the Box Trap and Weir on Charlie Creek, spring 1986 and 1987.

	# of fish	mean fork length (cm)	std. dev.	size range (cm)	mean weight (kg)	std. dev.	% of total fish
				1986			
HATCHERY							
males	1 [A]	59.0	--	--	--	--	3.23
females	1 [B]	74.0	--	--	--	--	3.23
WILD							
males	15	63.8	7.34	48-77	--	--	48.39
females	14	59.4	4.79	56-70	--	--	45.16
	---						
	31 [C]						
				1987			
HATCHERY							
males	8 [D]	58.4	3.25	55-61	1.65	0.23	26.6
females	2 [E]	64.0	4.24	61-67	--	--	6.6
WILD							
males	5	60.2	2.12	55-62.5	--	--	16.6
females	15	61.1	6.50	54-72	2.27 [G]	0.88	50.0
	---						
	30 [F]						

A This fish had only an LV clip (no adipose clip), Jaw Tag (misread), and a tall, straight dorsal fin, therefore, it was probably released at LFH in 1985 with a RA-H brand.

B No adipose or LV clipped fins, based on deformed dorsal fin.

C 1 other fish caught but it escaped before any data was obtained. 38 total fish captured, but believed to be only 32 separate fish: 5 captured going upstream and downstream, and 1 fish recaptured coming downstream after it was captured and returned upstream.

D 6 fish were adipose clipped (2 also had LV clips; 2 with LA-S-2 brand-1985 Tucannon R. release (one with jaw tag G27792).

E 1 adipose clipped fish and another with a deformed dorsal fin and no marks.

F 9 fish only captured going upstream, 9 other fish captured only coming downstream, and 12 captured going both ways. 9 marked fish still upstream when trapping ceased.

G 6 ripe fish were weighed going upstream, mean is 2.40 kg if weight of 1 spawned out fish is included in the weight, SD= 0.86, - n = 7 fish weighed.

Table 9. Results of Scale Analysis from Adult Steelhead Captured at the Charlie Creek Weir, spring 1986.

	freshwater age *			ocean age		total fish
	1+	2+	3+	1	2	
# of fish	3	14	2	22 [A]	3 [B]	25 [C]
# of females	1	7	1	10	1 [D]	11
# of males	2	7	1	12 [E]	2	14
mean fork length (cm) [F]				59.9	75.7	
std.dev.				4.97	1.53	

* only 19 of the 25 total readable scales could be read for duration of freshwater residency. plus 1 hatchery male and 1 female aged as 1 year in freshwater, but they must have resided in the stream for an additional year.

A Includes 1 hatchery fish (stubbed dorsal) and a 3.1S1 wild (respawner).

B Includes 1 hatchery fish (stubbed dorsal).

C 25 readable scale samples (includes 1 male and 1 female hatchery fish) and 7 un-usable samples.

D Hatchery fish.

E 1 hatchery fish included.

F mean fork length for wild (1 salt) females = 58.8 cm, SD = 4.71 - biggest female was 70 cm (aged 3.1S1). mean fork length for wild (1 salt) males = 60.7 cm, SD = 5.45.

Table 10. Adult steelhead captured at the weir on S. Fork of Asotin Creek, spring 1987.

	Total # of fish	# of hatchery fish [B]	mean fork length (cm) [C]	Std. Dev.	size range
males	6 [A]	1	64.4	7.25	56-75
females	12 [D]	2	64.5	6.04	55.5-74

A 3 males captured going upstream and 3 other fish captured coming downstream.

B All adipose clipped.

C Includes all males and females of hatchery or wild origin.

D 2 females caught going upstream and 10 other fish caught coming downstream.

Table 11. Adult Steelhead Captured at the Cottonwood Conditioning Pond Water Intake Screen, spring 1987.

	# of fish	mean fork length (cm)	sample size (n)	std. dev.	size range	% of total (known origin)
HATCHERY	197 [A]					97.04
males	86 [B]	57.8	83	3.17	50-70	42.36
females	109 [C]	56.9	95	4.19	49.5-81	53.69
unknown	2 [D]	--	--	--	--	0.99
WILD	6 [E]					2.96
males	2	--	--	--	54.4-64	0.99
females	4	65.5	4	8.58	59-78	1.97
	203 [A]					

A Plus 1 male of unknown origin, designated as H?,AD?. 99 fish adipose clipped, 94 fish were AD-LV clipped, and 3 fish were LV clipped only, (29 fish were jaw tagged).
B All caught going downstream or below the weir in a pool.
C 105 caught going downstream or below the weir in a pool, and 4 caught going upstream.
D 2 fish caught and jaw tags recovered, but no other data were recorded.
E 2 females caught going upstream, other 4 fish were caught going downstream or below weir in a pool.

Spawning Surveys

Tables 12 and 13 present a summary of redd and adult observations for each stream for the years 1986 and 1987 respectively. Observations are given either by river mile (when possible) or by road mile.

Peak spawning occurred prior to 7 April and mid April on Charlie Cr. and S.F. Asotin Cr. respectively in 1986. Peak of spawning did not occur on the Tucannon and Panjab Cr. until after 4/17 but prior to 5/13. Our trap on Charlie Cr. allowed us to count adults into the system, and then complete spawning ground counts with a known escapement. In 1986, 33 adults (15 fem.) constructed 51 redds or 1.5 redds/adult (3.4 redds/female). In 1987, 30 adults (17 fem.) constructed 28 redds or 0.93 redds/adult (1.65 redds/female). The average for the two years was 1.21 redds/adult and 2.53 redds/female.

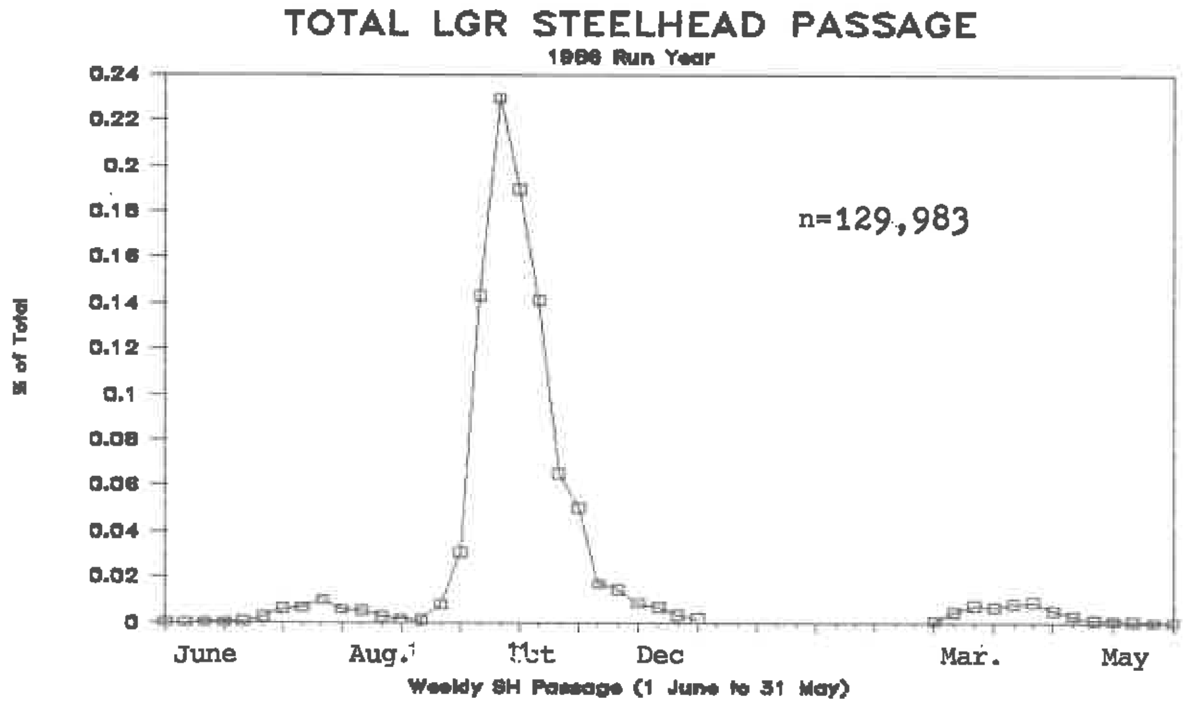

TOTAL LGR STEELHEAD PASSAGE
1986 Run Year
n=129,983
% of Total
0.24
0.22
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
June
Aug.
Oct
Dec
Mar.
May
Weekly SH Passage (1 June to 31 May)

Fig 12.

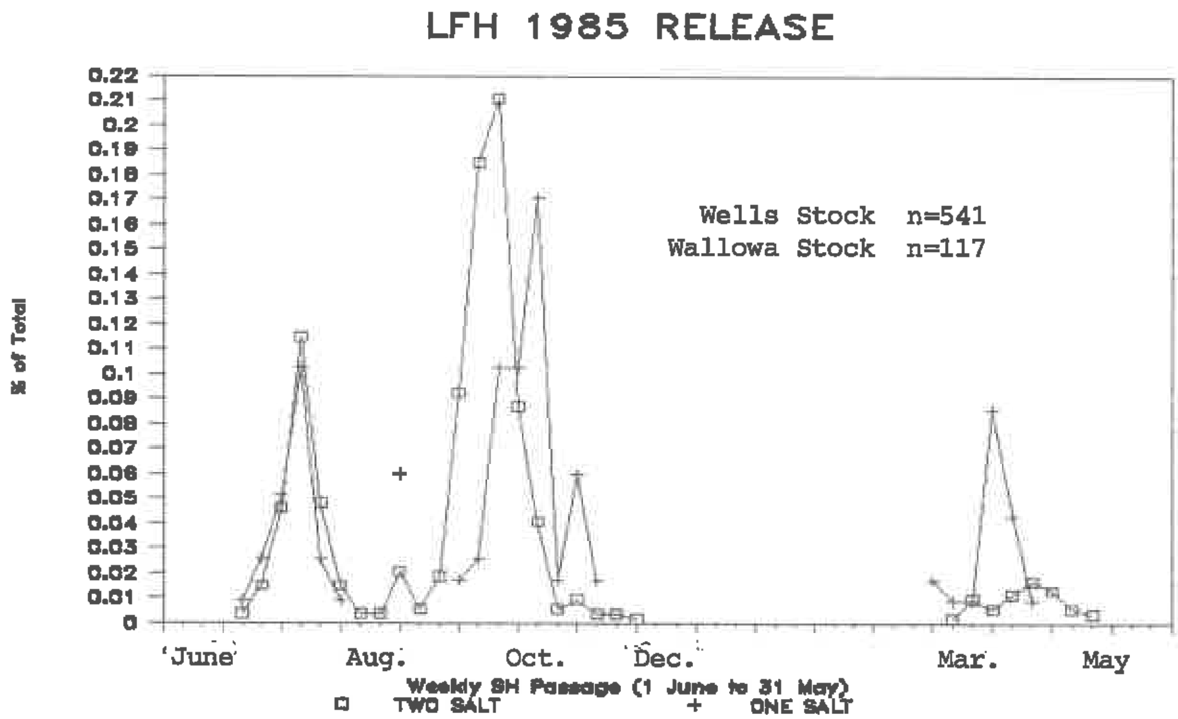

LFH 1985 RELEASE
Wells Stock n=541
Wallowa Stock n=117
% of Total
0.22
0.21
0.2
0.19
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
June
Aug.
Oct.
Dec.
Mar.
May
Weekly SH Passage (1 June to 31 May)
TWO SALT
ONE SALT

Fig 13.

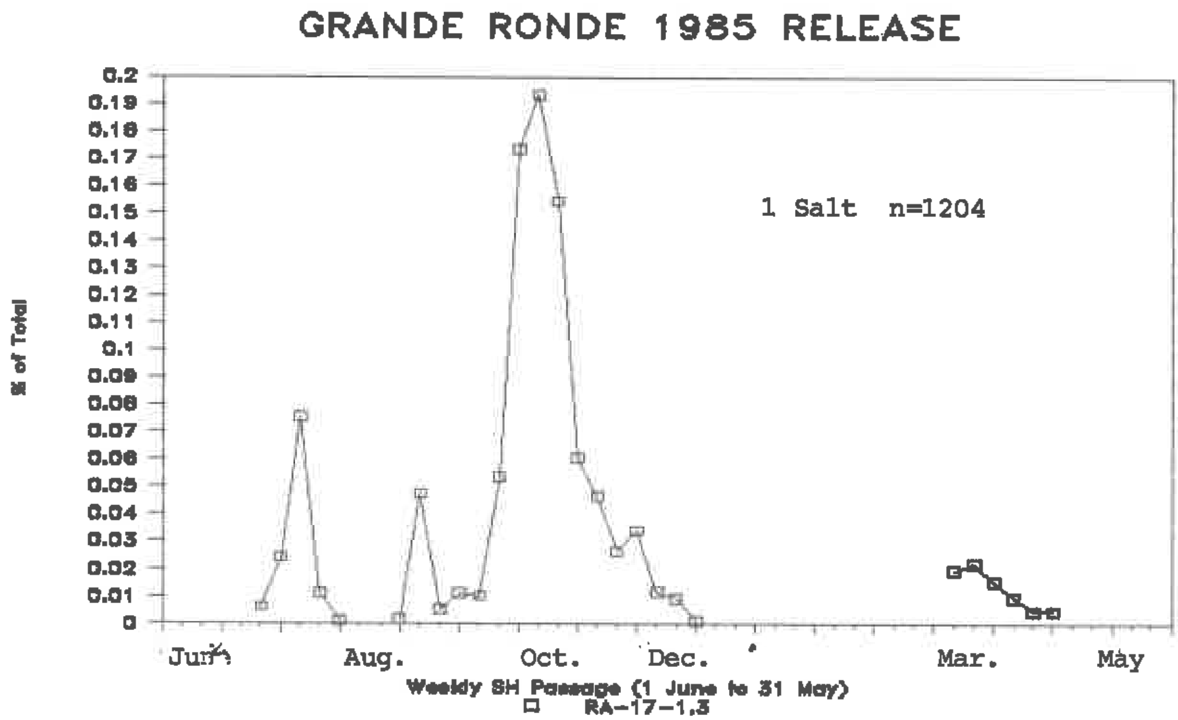

GRANDE RONDE 1985 RELEASE
1 Salt n=1204
% of Total
0.2
0.19
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
June
Aug.
Oct.
Dec.
Mar.
May
Weekly SH Passage (1 June to 31 May)
RA-17-1.3

Fig 14.

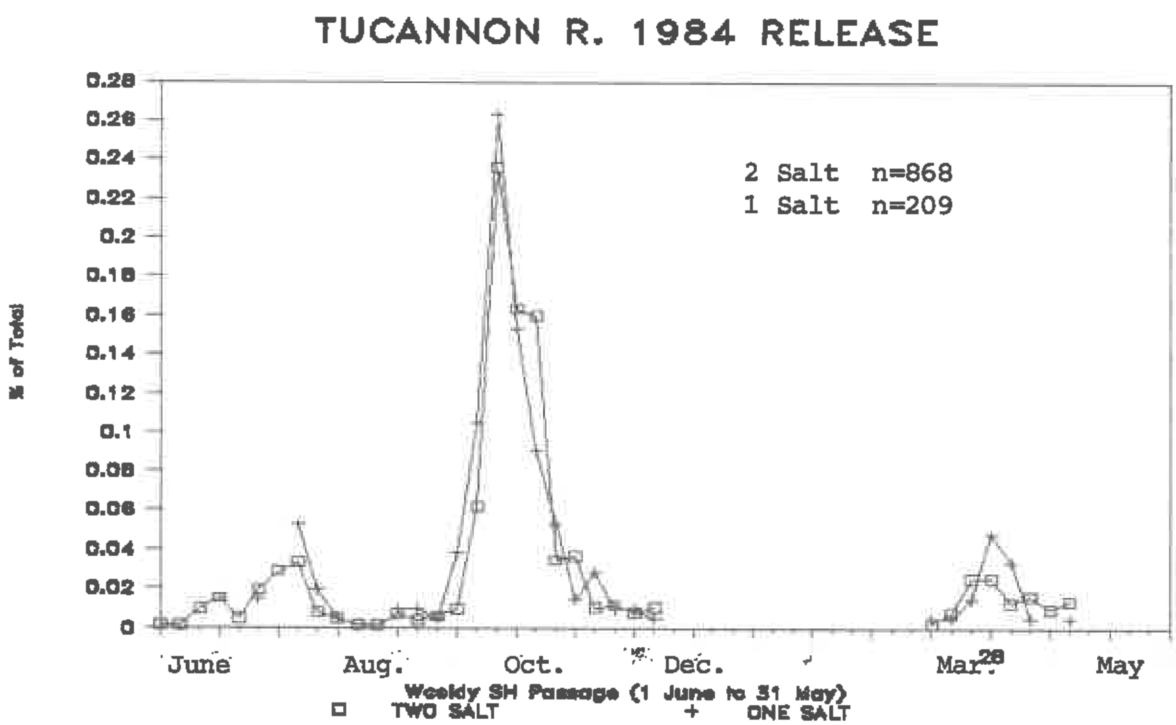

TUCANNON R. 1984 RELEASE
2 Salt n=868
1 Salt n=209
% of Total
0.28
0.26
0.24
0.22
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
June
Aug.
Oct.
Dec.
Mar.
May
Weekly SH Passage (1 June to 31 May)
TWO SALT
ONE SALT

Fig 15.

Table 12. Steelhead Spawning Survey Results for Streams in Southeastern Washington, 1986

Stream	Section	Reach length (miles)	Dates Surveyed (resurveyed)	Surveys 1st Redds	Surveys 1st Adults	Surveys 2nd Redds[A]	Surveys 2nd Adults	Total redds	Total redds/ mile
Tucannon R.	Upper Tucannon	6.25	4/16,17,18 (5/13)	52	8	--	--	52	8.3
	Main Tucannon	11.4	4/9,10,16,18,25 (5/13)	86	48	--	--	86	7.5
	Panjab Creek	2.3	4-17 (5-6)	19	0	25	8	44	19.1
	Cummings Creek	6.5	4/9,10 (5/5,6)	52	9	--	--	52	8.0
Asotin Creek	Main A [B]	2.2 [C]	5/8,9	21	0	--	--	21	9.5
	Main B [D]	1.7 [C]	5/8	46	2	--	--	46	27.1
	North Fork A [E]	4.8 [C]	4/27 5/2	146	6	--	--	146	30.4
	North Fork B [F]	0.5	5/2	22	0	--	--	22	44.0
	South Fork A [G]	3.45 [C]	4/14,15	67	8	--	--	67	19.4
	South Fork B [H]	3.8 [C]	4/15-21 (5/14)	90	9	2	0	92	24.2
	Charlie Cr. A [I]	0.6 [C]	4/7 (5-14)	15	0	9	0	24	40.0
	Charlie Cr. B [J]	5.7 [C]	4/7,8 (5/14)	51	5	0	0	51	8.9

[A] New redds only. Missing flagged redds were subtracted from new redds.
[B] 1.4 miles above Headgates to 0.8 miles below Headgates dam.
[C] Road miles.
[D] Forks Bridge to fenceline at lower end of D.E. Blankenship's property.
[E] Mouth to USFS fence (RM 4.8).
[F] USFS fenceline to 1985 electrofishing site (approx. 0.5 mile)
[G] Mouth to bridge at RM 3.5.
[H] RM 3.5 upstream to pond above chimney ruins (RM 7.3).
[I] Mouth to trap site.
[J] Trapsite to debris jam at RM 5.85.

Many habitat improvement structures that have been placed in the Asotin and Tucannon River systems have created deposits of gravel suitable for spawning. Steelhead have used these areas heavily for hiding cover and redd construction but we have been unable to document total use or the length of stream available on, or adjacent to, the improvement sites.

We collected stream discharge information on some of the streams during our spawning surveys, that information is summarized in Appendix J.

Table 13. Steelhead Spawning Survey Results for Streams in Southeastern Washingtion, 1987.

Stream	Section	Reach length (miles)	Dates Surveyed (resurveyed)	Surveys 1st Redds	Surveys 1st Adults	Surveys 2nd Redds[A]	Surveys 2nd Adults	Total redds	Total redds/mile
Tucannon	Upper Tucannon	5.5	4/13 (5/11)	9	3	24	4	33	6.0
	Main Tucannon	12.8	4/16,17	181	31	25	4	206	16.1
		4.7	(5/13,14)	50	9	--	--	50	10.6
	Panjab Creek	2.3	4/13 (5/5)	4	0	4	5	8	3.5
	Cummings Creek	6.1	4/14 (5/5)	36	15	17	7	53	8.7
Touchet	North Fork	15.3	5/18,20,21	73	0	--	--	73	4.8
	Wolf Fork	7.8	5/21	53	1	--	--	53	6.8
	South Fork	11.0	5/18,21	68	0	--	--	68	6.2
Asotin	Main A [B]	2.6 [C]	4/16	9	4	--	--	9	3.5
	Main B [D]	1.7 [C]	4/16 (5/8)	29	9	14	0	43	25.3
	North Fork A [E]	4.8 [C]	4-8 (5-4,5)	72	28	51	13	123	25.6
	South Fork A [F]	3.45 [C]	4-7 (4-30)	7	4	22	3	29	8.4
	South Fork B [G]	1.8 [C]	4/9 (5/1)	7	0	18	1	25	13.9
	Charlie Cr. A [H]	0.5	4/2 (4/28)	9	0	16	2	25	50.0
	Charlie Cr. B [I]	4.55 [C]	4/2,7 (4/28)	13	0	15	3	28	6.2

[A] New redds only. Missing flagged redds were subtracted from new redds.
[B] from 1.4 miles above Headgates dam to 1.2 miles below it.
[C] Road miles.
[D] Forks Bridge to fenceline at lower end of D.E. Blankenship's property.
-first survey extended another 0.35 mi. downstream but only 2 redds found.
[E] Mouth to USFS fence.
[F] Mouth to bridge at RM 3.5.
[G] RM 3.5 upstream 1.8 mi.. On 5/1, surveyed upstream additional 1.8 miles to 0.1 mi. below pond; 13 redds + 2 adults.
[H] Mouth to new trap site.
[I] Trapsite to beaver dam complex (RM 4.55). Also during initial survey we checked 1.2 mi. upstream to impassable debris jam (0 adults and redds).

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 14).

Table 14: Adult Returns of Lyons Ferry Steelhead to Locations and Fisheries within the Columbia River Basin 1986-87 (% smolt to adult survival those numbers represent).

	Tag Code (Brand)							
Location	63/32/12 (RA-IJ-1)	63/32/13 (RA-IJ-2)	63/32/14 (RA-IV-1)	63/32/15 (RA-IV-3)	62/16/44 (RA-H-1)	62/16/45 (RA-H-2)	62/16/27-28 (RA-17-1,3)	62/16/29-30 (LA-S-1,2)
L.Col. Sport			16(.053)		49(.181)	16(.059)	98(.125)	8(.011)
Mid.Col. Sport	14(.048			7(.024)	21(.077)		56(.071)	
Zone 6 Net	40(.138)	33(.129)	65(.217)	66(.225)	92(.339)	23(.085)	147(.187)	36(.047)
L.Ferry Ladder	1(.004)*			3(.010)*	77(.284)	47(.175)	11(.014)	1(.001)
U.Snake Sport	46(.159)[1]		86(.287)[1]	34(.116)	142(.517)		175(.223)	34(.045)
L.Snake Sport					11(.040)	16(.059)	41(.052)	31(.041)
Priest. R. Dam			6(.020)	3(.010)	4(.015)			
Cottonwood CP							53(.067)	
Dworshak NFH	1(.004)		2(.006)	2(.006)	3(.011)			1(.001)
Idaho Sport[2]					5(.018)		21(.026)	23(.030)
Snake R. Total	48(.167)	--	88(.294)	39(.132)	238(.870)	63(.234)	301(.384)	90(.118)
Grand Totals	102(.353)	33(.129)	175(.584)	115(.392)	404(1.471)	102(.381)	602(.767)	124(.168)

@ 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..

We have complete 1 and 2 ocean age returns now for the 1983 and 1984 coded wire tag releases. A summary by release year is presented in Tables 15 and 16. All fisheries that harvested significant numbers of fish are listed. 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.

Table 15. Returns of 1983 Release LFH steelhead to Locations in the Columbia River Basin, 1984-87 (% smolt to adult survival those figures represent).

Tag Code	63/28/38	63/28/39	63/28/40
Fishery		Estimated Harvest or Return	
L. Columbia Sport	36(.073)	--	14(.045)
Zone 6 Treaty Net	250(.510)	116(.348)	119(.381)
Deschutes River:[A]			
Caught	3(.006)	25(.075)	5(.016)
Escaped	--	28(.084)	20(.064)
LFH ladder	89(.182)	9(.027)	2(.006)
Up. Snake R. Sport	74(.151)	16(.048)	27(.086)
Wallowa Hatchery	--	107(.321)	81(.259)
Idaho Sport [B]	33(.067)	8(.087)	--
	485(.990)	303(.928)	268(.859)

[A] Harvest and escapement data for 1984 only, ODFW cwt data base.
[B] For rivers other than the Snake River.

Table 16. Returns of 1984 Release LFH steelhead to Locations in the Columbia River Basin, 1985-87 (% smolt to adult survival those figures represent).

Tag Code	63/32/12	63/32/13	63/32/14	63/32/15
Fishery		Estimated Harvest or Return		
L. Columbia Sport	—	—	27(.090)	—
Mid-Columbia Sport	14(.048)	—	—	7(.024)
Zone 6 Treaty Net	64(.221)	69(.272)	94(.314)	135(.460)
LFH ladder	3(.010)	3(.012)	2(.007)	5(.017)
Up. Snake R. Sport	46(.159)	57(.224)	104(.347)	61(.208)
Priest Rapids Dam	—	—	6(.020)	3(.010)
Dworshak NFH	1(.003)	—	2(.007)	2(.007)
Deschutes R.*				
Idaho Sport	14(.048)	13(.051)	19(.063)	13(.044)
	142(.491)	142(.559)	254(.848)	226(.771)

* Sampling data unavailable .

Passage of adults at Lower Granite Dam has been an important sampling point for our evaluation study. One additional sampling tool used in recent years has been the metallic jaw tag used by NMFS on coded wire tagged adults coming through the trap at the ladder. These tags have a $5.00 reward to the angler for returning the tag with appropriate catch information. Beginning in 1984, we also utilized the jaw tag to estimate sport exploitation in the fisheries above the dam, and also to try and determine how many wandering steelhead destined for locations below the dam would return to that locale. Table 17 lists passage, number of tags affixed, voluntary sport returns of tags and the exploitation rate those returns represent for returning 1 and 2-salt age tagged and branded LFH origin fish.

Table 17. Sport Exploitation and other Recoveries of LFH Origin Steelhead based on Voluntary Jaw tag Recovery.

Brand	Passage	No. Jaw Tagged	No. of Sport Recover.	% Exploit	Other Recover.	No. and Location[A]
1-SALT AGE						
RA-H-1	429	317	53	6.72	5	4-A,1-B
RA-H-2	83	52	2	3.85	--	
RA-17-1	553	329	36	10.94	27	26-C,1-D
RA-17-3	468	257	24	9.34	27	27-C
LA-S-1	101	71	9	12.68	4	1-A,3-E
LA-S-2	85	58	6	10.35	3	1-E,2-G
2-SALT AGE [B]						
RA-IJ-1	262	197	20	0.15	1	1-A
RA-IJ-2	228	179	25	13.97	1	1-B
RA-IV-1	344	274	30	10.95	2	2-A
RA-IV-3	439	350	31	8.86	3	2-A,1-F

[B] Locations of Recoveries: A-Dworshak NFH; B-Wawawai Cr. near LGD; C-Cottonwood Cr.; D-Pahsimeroi H.; E-Lyons Ferry H.; F-Tucannon H.; G-Charlie Cr.

[B] Includes returns from 1985-86 and 1986-87 run years.

Discussion

Trapping

The difference in sex ratios that we documented for wild adults at Charlie Cr.in 1986 (50/50) and 1987 (75/25) is rather surprising for the same population of fish. Our weir may have selectively affected migration of males in 1987, but it was not in place early enough in 1986 to have any effect. Thus, this difference in sex ratios may be influenced by trapping operations or may simply reflect variability with a small sample size or small population.

It was apparent that some adult steelhead jumped the trap or weir in March 1987 until we increased the weir height on 7 April. Some of those fish were later captured while returning downstream. We are unable to positively determine run size because; 1) in 1986 we apparently built the trap after most fish had migrated past the weir site, 2) some fish were able to jump the weir or trap box during both years, and 3) many steelhead were reluctant to enter the trap and remained below the weir to spawn. We do however, have reasonable estimates of the run size above the weir in 1986, and in

1987 in particular. We are using the total number of fish captured at the trap as our estimates of run size above the weir each year (excluding recaptures).

We were unable to positively match most recaptured fish to their initial capture measurements. Therefore, we were not able to estimate the mean length of residency for spawning activities before adults migrated downstream as kelts. Three adults for which we were able to positively determine spawning duration had remained above the weir for 8, 12, and 19 days.

The S.F. Asotin Cr. trap was relatively ineffective in capturing adults. Many fish jumped the trap until we increased its height, and other fish found it to be a barrier and returned downstream. We became concerned in April when our first spawning survey indicated that few fish resided in the stream above the weir. We opened a portion of the weir to allow passage of steelhead on 9 April. After that modification most fish were caught above the weir as emigrating kelts, or carcasses.

The traps need to be redesigned to attract and trap fish easier. A larger trap box made with wooden pickets would allow more water through it as attraction flow and it would be harder for fish to escape. Also, a diagonal fence below the trap and weir could act as a corral and prevent fish from returning downstream until they could be netted, or they entered the trap.

We found visibility for counting migrating steelhead in Asotin Cr. to be quite good over the white fabric. However, we were too far upstream in the stream system to prevent fish from spawning near the fabric and confusing our counts. Emigrating kelts also contributed to confusing counts of migrating steelhead.

Only 2 out-migrating kelts were trapped at the Cottonwood Pond water intake screen in 1986. We suspect that some adults and juveniles were able to pass the intake structure without being captured until we installed the vertical fence at the intake screen on 8 or 9 April each year. Trapping should have been 100 % effective after the installation of the vertical fence. However, no tests were made to confirm this assumption.

We released our first hatchery smolts at Cottonwood Creek from the conditioning pond during the spring of 1985. Thus, all data we collected for wild fish in 1985 - 1987 should have been fairly representative of wild fish that were not genetically influenced by our hatchery stocking. Our first returns of adult hatchery steelhead to Cottonwood Creek occurred during the spring of 1987. We were unable to obtain run timing during any of the 3 years that the conditioning pond was used. However, in 1987 adults were observed migrating upstream as early as 10 March while some kelts were emigrating. Each year it becomes difficult or impossible for adult steelhead to migrate upstream while water is diverted into Cottonwood Pond. Some adults are trapped in small pools in Cottonwood Creek as the stream flow declines during the spring, or after large freshets. Upstream migrating adults were known to have entered Cottonwood Creek in early May 1987 after the water was no longer diverted into the conditioning pond.

A comparison of the relative run size, based on the numbers of out-migrating kelts captured at the intake structure, would indicate that the 1987 run was substantially larger than in 1986 because of the presence of returning hatchery steelhead. The sex ratio was 1.3 females/male for these hatchery 1 salt returns. The presence of large hatchery adults (> 70 cm) that we captured would tend to confirm the results of our scale analysis from creel surveys that suggests that 1 salt fish may be as large as 81 cm (Mendel and Schuck 1988). However, none of the tagged fish that were positively known to be 1 salts were larger than 62 cm, and the results from our scale samples collected for adults trapped on Cottonwood Creek are still unavailable.

Cottonwood Creek has become overrun with hatchery fish and the genetic pool for wild steelhead will soon be swamped. The data we were able to collect for wild fish in 1986 and 1987 will be valuable from an historic perspective as well as for comparing with future influences by hatchery steelhead.

Spawning Surveys

These were the first and second years of gathering reliable spawning data on these project streams. Spring runoff conditions determine the success of walking streams. In 1986 conditions were good. The main Tucannon was slightly high but cold water temperatures kept visibility good. An early and minimal runoff in 1987 provided excellent visibility and walking conditions.

Our subjective analyses of Tables 12 and 13 indicates the peak spawning period occurred sometime in the second or third week of April. Tributaries tend to be slightly later than large streams. A slight fluctuation in the peak spawning period is to be expected from year to year, dependent upon spring weather.

A heavy rain and snowmelt in 1987 occurred prior to our first walk on the Touchet River. It is possible some redds washed out during that event or were sufficiently altered by high flow to go unnoticed.

Mainstream counts on the Tucannon River were up significantly in 1987 from 1986, however tributary counts were down from 1986. Early warm temperatures in 1987 possibly caused early escapement up into the main streams, and low water levels (due to early runoff) kept escapement into tributaries down. Such an increase in counts on the main Tucannon could also be due to returns from Curl lake conditioning pond releases (located on the upper Tucannon), or possibly adult returns to Lyons Ferry Hatchery wandering up the Tucannon R..

Asotin Creek counts were similar for both years with the exception of the South Fork. The significant decrease on the

South Fork is most likely due to the combination of an adult trap installed in the early spring of 1987 on the creek and an influx of beavers on the stretch of river below the trap. Very low redd numbers during our first spring survey verified our concern that adults were reluctant to enter the adult trap and be passed. We therefore opened the trap to allow unrestricted passage for spawning. Consequently, redd densities increased from 2.0 redds/mi. to 8.4 redds/mi. by 30 April. We observed a similar problem on Charlie Cr.. Redds densities below our trap were 40-50/mi. while above the trap they were 6.2-8.9/mi. in 1986 and 1987.

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. Next year we will make our first walks on all streams by the end of April.

We are now in the process of redesigning adult traps on Asotin Creek and Charlie Creek. We require trapping facilities for adult steelhead on the Tucannon River to estimate escapement and to assess the impacts of our stocking programs on the native steelhead runs. These traps would enable us to estimate spawning escapement and redds/adult, etc. A more substantial trapping weir than the present temporary structure at the Tucannon hatchery will be required to satisfy our needs during high spring flows. We are currently unable to determine if wandering Tucannon R. released steelhead are returning to the River to spawn and the percentage of these fish that are wandering.

Coded Wire Tag Groups and Passage

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. 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 LSRCP goals if they expand to their maximum potential. In some instances, these fisheries are already harvesting in excess of 50% of the total basin return of a particular tag group. At present, fisheries directly above and below McNary Dam are not sampled.

Fish passage data collected at Lower Granite dam is very useful for many reasons. The dam provides an excellent way to sample adult steelhead under controlled conditions to determine their origin by the presence of freeze brands. We have complete return cycles for LFH released steelhead (1982-83) passing the facility that indicate we are meeting our steelhead goals for the hatchery (Table 6). Unfortunately, many of the fish passing the dam were released down river from the hatchery as smolts and are exhibiting apparent tendancies as adults to wander considerable distances from their point of release. This behavior is also exhibited by fish released in 1984-85 from the Tucannon Hatchery.

We must conclude that smolt survival from our hatchery has been at least acceptable as evidenced by very good smolt to adult survival rates through three release years. Our fish are contributing to fisheries throughout the lower 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 run years 1984, 1985 and 1986, adult returns from Lyon's Ferry Hatchery smolt releases into Washington LSRCP waters were 3,515, 6,838 and 6,920 fish, respectively, 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.

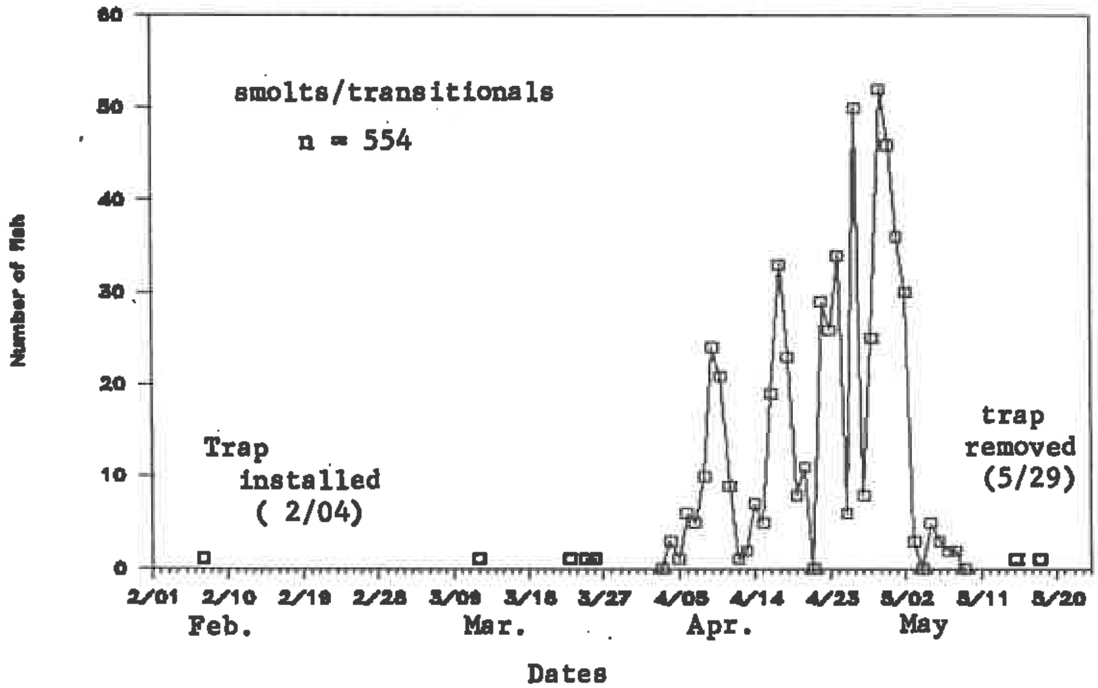
Juvenile Salmonid Populations in Project Rivers

Spring Emigration

A smolt trap box was added to the adult trap in Charlie Cr. on 4 February and trapping continued until the trap was removed on 29 May 1987. Downstream migrating juvenile steelhead were reluctant to enter our smolt trap in 1986 and concentrated upstream of the weir. We electrofished this area several times to capture migrants, but we were unable to evaluate natural timing of the migration for that year. The first steelhead smolt (or transitional) was captured 16 April, and the last on 28 May, 1986. Our recapture efficiency of 1 group of marked steelhead emigrants was 56 % (33/59) in 1986. We also had juvenile fish migrating upstream that were captured in the adult trap box. Most of these were hatchery fish and many were recaptured several times. The hatchery upstream migrants averaged 16.3 cm in length (n= 19, SD= 2.7) and ranged from 12.6 to 20.1 cm.

We improved the trap design in 1987 and electrofishing was not necessary to capture migrants. Trap efficiency for 2 groups of marked downstream migrants was 40.9 % (9 of 22) in early April and 79.3 % (23 of 29) in late April. Most transitionals and smolts migrated downstream during April 1987 (Fig. 16).

Mean length of wild steelhead smolts on Charlie Creek was approximately 15.5 cm during both 1986 and 1987 (Table 18). Transitionals and smolts ranged in size from 12.1 to 21.8 cm during the two years. Length frequencies of smolts and parr are presented in Figs. 17 & 18. The relation of length to weight for transitionals and smolts is presented for 1986 in Appendix K. Scale analysis for 1986 indicates that most downstream migrants are age 2+, but a few fish migrate after their first or even third year (Table 19). Our 1987 scale samples were not read in time for inclusion in this report.



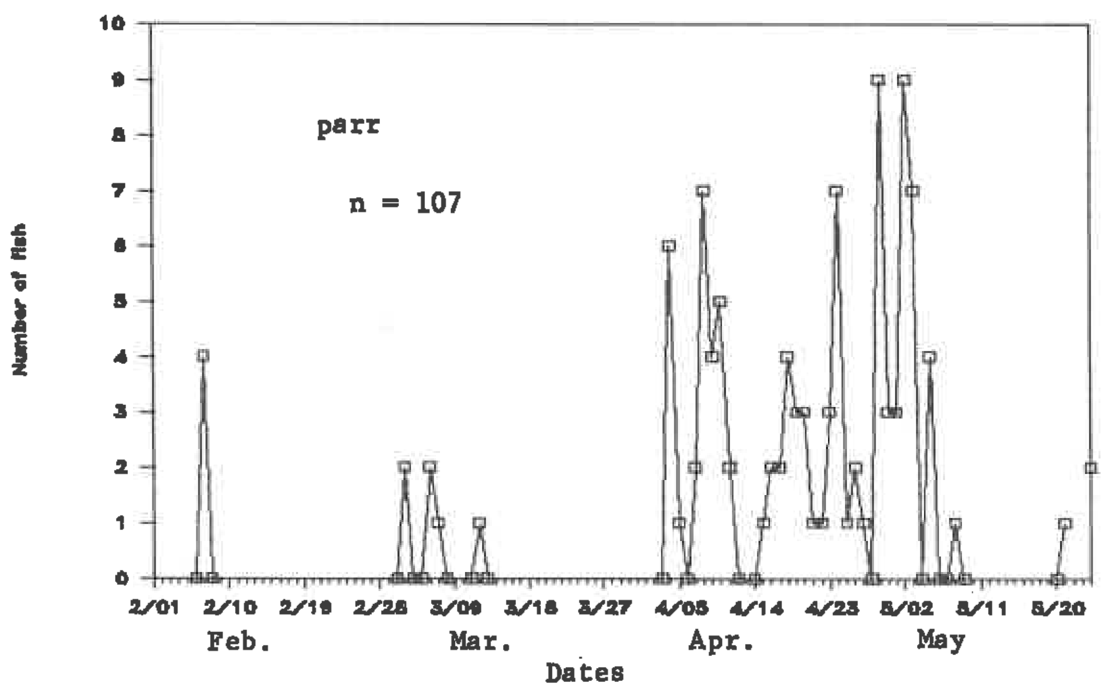


Figure 16. Timing of downstream migrants captured at the weir and trap on Charlie Creek, 1987.

Table 18. Daily Juvenile Steelhead Emigrants Captured during Spring Seasons at the Weir Trap on Charlie Creek, 1986 and 1987.

	Total # of fish (n)	mean length (mm.)	std. dev.	mean weight (gms.) (n)	std. dev.	# of hatchery fish	% of total
				1986 [A]			
Parr	125	84.4	22.3	12.9 (10)	7.5	0	40.2
Transition	122	152.7	14.5	34.3 (95)	10.6	2	39.2
Smolt	52	160.9	13.3	39.9 (42)	10.5	0	16.7
Precocial	1	---	---	---	---	1	---
Resident	3	166.3	20.3	47.0 (3)	19.5	0	1.0
Unknown	4	139.3	43.4	18.7 (3)	11.2	1	1.3
Total	311 *						
				1987			
Parr	107	104.3[B]	14.1	---	---	---	15.8
Transition	385	144.9	15.2	29.3 (14)	8.2	1	57.0
Smolt	169	156.3	16.6	41.1 (11)	19.5	---	25.0
Precocial	3	207.6	26.1	---	---	2[C]	0.4
Resident	6	146.5	18.8	---	---	---	0.8
Unknown	5	141.8	8.4	---	---	---	0.7
Total	675 [D]						

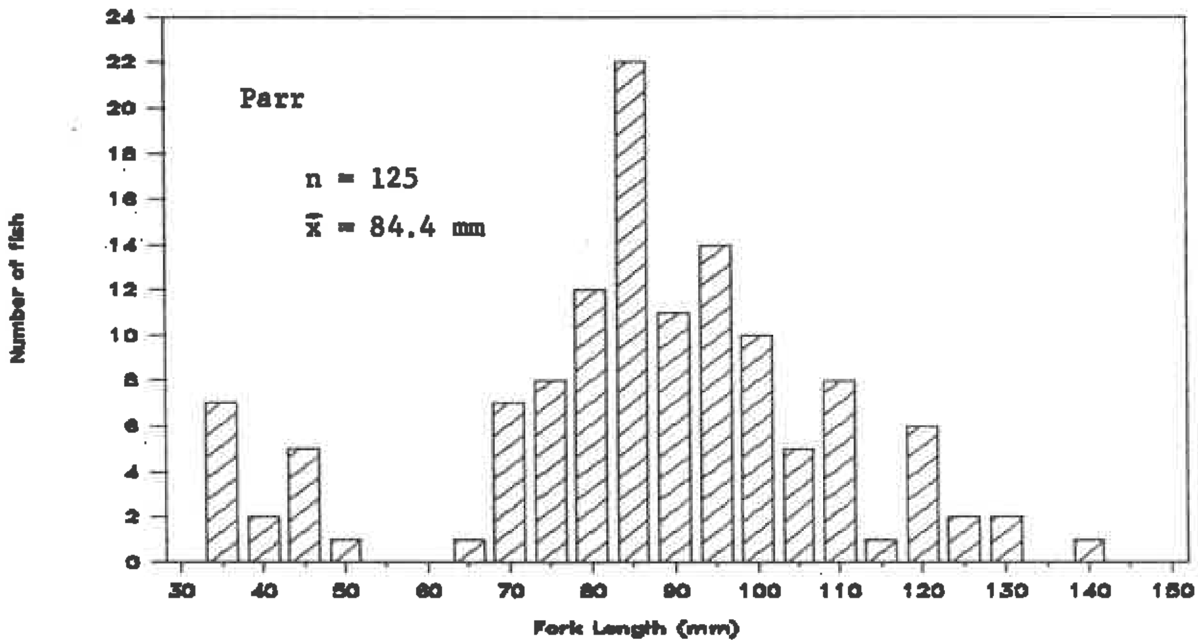
[A] For 1986 a total of 51 upstream migrants were captured (12 parr, 22 transitional, 3 precocious, 1 resident, and 5 unknown). One Bull trout was captured while electrofishing above the traps.

* 49 recaptured fish were included in this total.

[B] Mean length was calculated using 101 lengths. Actual total is 107. One fish inadvertently excluded and 6 fish >135mm as defined for parr.

[C] One of these two hatchery fish was an upstream migrant and the only juvenile upstream migrant captured in 1987.

[D] This total contains 33 recaptures (8 smolts, 1 resident, and 24 transitionals). One Bull trout was captured as a downstream migrant and is not included in the total.



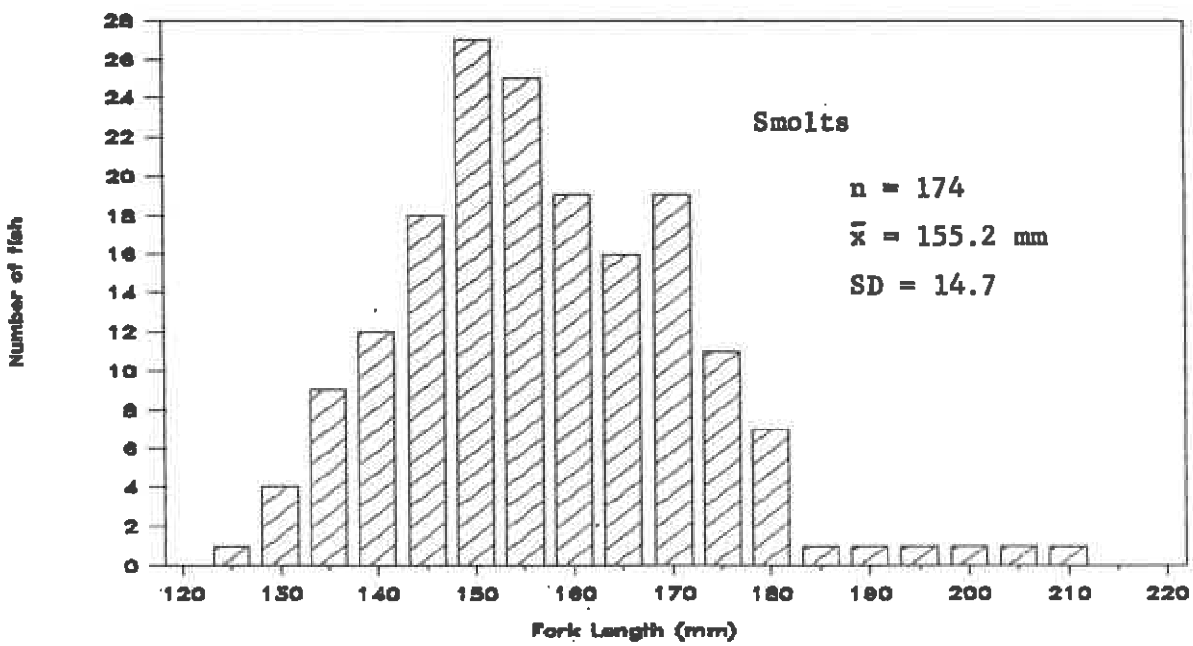
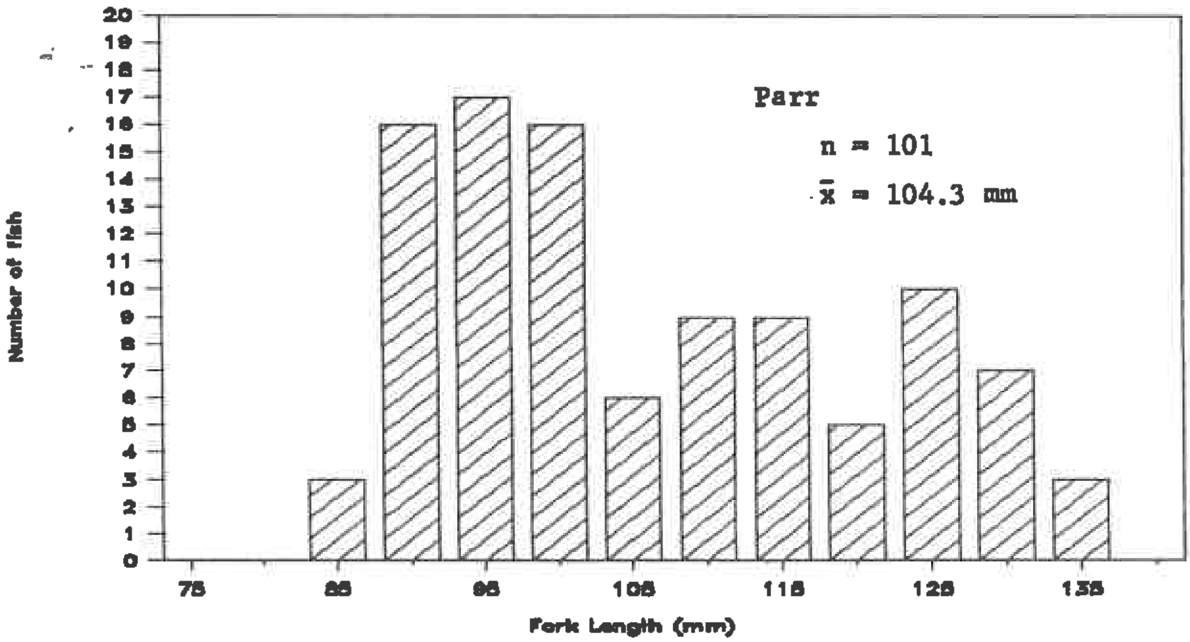


Figure 17. Length frequencies of wild steelhead smolts (or transitionals) and wild parr captured on Charlie Ck, 1986.



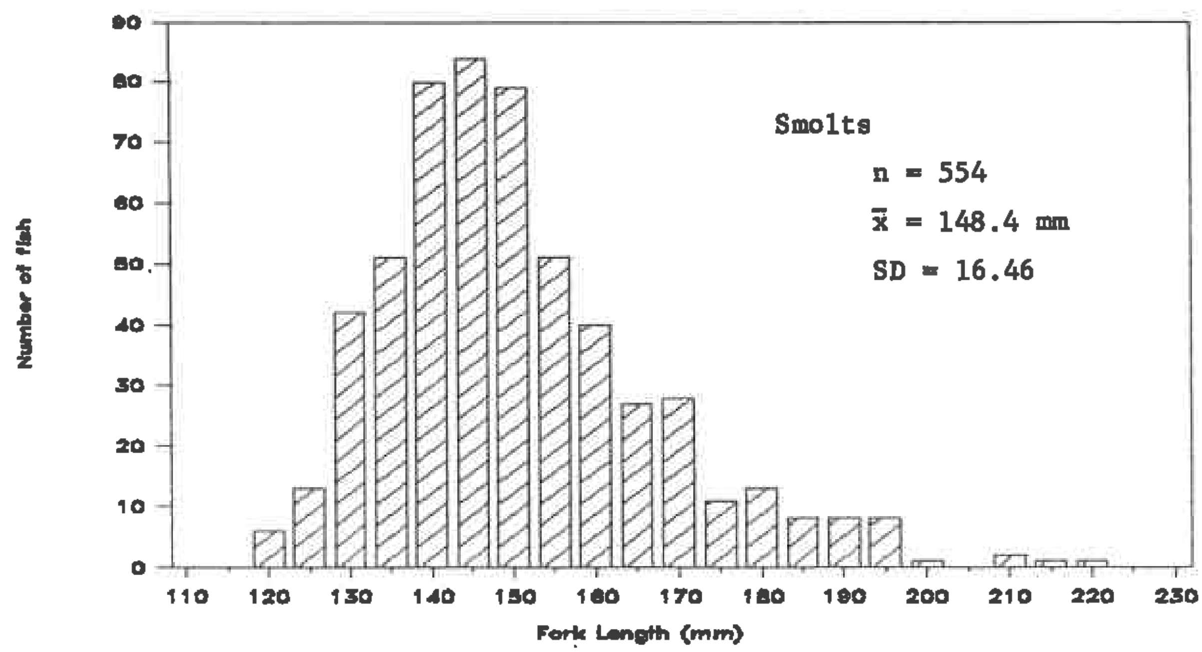


Figure 18. Length frequencies of wild steelhead smolts (or transitionals) and wild parr captured on Charlie Ck, spring 1987.

Table 19. Fresh Water Age of Juvenile Steelhead Emigrants Captured at the Trap on Charlie Creek, spring 1986.

	wild fish					
	fresh water age			#	# of	total # of
	1+	2+	3+	regenerated	unk.	samples
# of fish	1	39	6 [A]	17	2	65 [B]
mean fork length (cm)	--	15.6	17.9	--	--	--
std.dev.	--	1.6	2.2	--	--	--
mean wt.(g)	--	37.8 [C]	55.0	--	--	--
std.dev.	--	12.1	19.4	--	--	--

A Includes 1 fish classified as a resident rainbow.
B Plus 1 hatchery fish and 1 bull trout (29.7 cm).
C n = 35 fish that were weighed.

The Asotin floating trap was installed by mid afternoon on 3 April 1986. Water velocities in the mouth of the trap averaged 4.5 ft./sec. on 3 April, although surface velocities at the yoke were 5.2 ft/sec. By the next morning 14 small salmonids of undetermined species were captured. On 5 April both chinook salmon migrants and steelhead parr were captured. Few steelhead smolts or transitionals were captured during the trapping season, but parr and chinook were common (Table 20). We removed the trap on 9 June.

Chinook salmon migrants were captured at the rate of about 16 fish per day for the first 4 days the trap was operated in April, but that declined to about 1 fish per day during mid May and early June. Length/frequency distribution of the 181 captured chinook is bimodal, and the relation of length to weight is highly variable (Appendix L). On 7 April we clipped left ventral fins on 13 chinook salmon and released them 1.2 miles upstream at the Forks Bridge. None of these fish were ever recaptured.

Steelhead parr were captured nearly every day during the entire trapping season, with the peak of 127 parr occurring on 22 May. The average number of parr was 8 per day (SD = 3.6, n=18 days) in April and 53 per day in late May (SD = 33.2, n = 13). Also, the size range of fish classified as parr increased in May to include fish > 95mm and fish < 62 mm. Only 2 smolts were captured prior to 29 April when 23 adipose clipped smolts were found in the trap. Hatchery smolts had been released upstream on 28 April. The trap was not operational from the afternoon of 29 April until 12 May to allow hatchery smolts to migrate from the stream.

Other species were captured in the trap also (Appendix M). Dace were the most common non-salmonid captured. The numbers of dace in April were low (about 5 per day) and peaked on 28 May (at 138 fish), when dace 11 cm long were found to be full of eggs (mean fork length for 2 groups of fish from 29 and 30 May were 10.16 cm,SD = 1.15, n=16, and 11.14 cm, SD = 1.30, n=15, respectively).

Table 20. Salmonids captured at the floating incline plane trap on Asotin Creek, spring 1986.

	Steelhead			Chinook		
	Parr	Smolt [A]	total	Parr	Smolt [A]	total
# of fish	858 [B]	35	903 [D]	16	129	181 [E]
mean fork length (mm)	76.98 [C]	---	---	61.12	86.97	84.24
Std. Dev.	----	---	---	15.05	7.08	11.20
size range (mm)	47-106	75-175 [F]	---	46-87	65-107	---
mean weight (g)	4.37 [G]	---	---	---	6.8	---
Std. Dev. (n)	----	---	---	---	2.0 (100)	---

A Includes smolts and transitionals; 7 wild and 28 adipose clipped fish included as steelhead smolts.
B Includes 4 adipose clipped parr.
C April weighted mean fork length = 77.04mm, SD = 8.39, range 62-95 mm (n = 98 fish from randomly selected days), May weighted mean fork length = 76.96mm, SD = 8.96, range = 47-106mm.
D Includes 10 rainbow trout of unknown classification.
E Includes 36 chinook of unknown classification.
F Size range for wild fish; size range range for hatchery fish is 11.6-22.1 cm, mean = 18.73 cm, SD = 2.77, n = 27 fish.
G April weighted mean wt. = 4.31 g, SD = 1.72, n = 88.
May weighted mean wt. = 4.42 g., SD = 1.65, n = 102.

Trapping operations were conducted at the Cottonwood C.P. intake screen from 22 March until 1 May and 30 March to 29 April 1986 and 1987, respectively. Slight modifications were made to trapping procedures each year to improve survival at the trap. A vertical wire fence was placed at the downstream edge of the intake screen on 8 and 9 April 1986 and 1987, respectively, to insure capture of all downstream migrants.

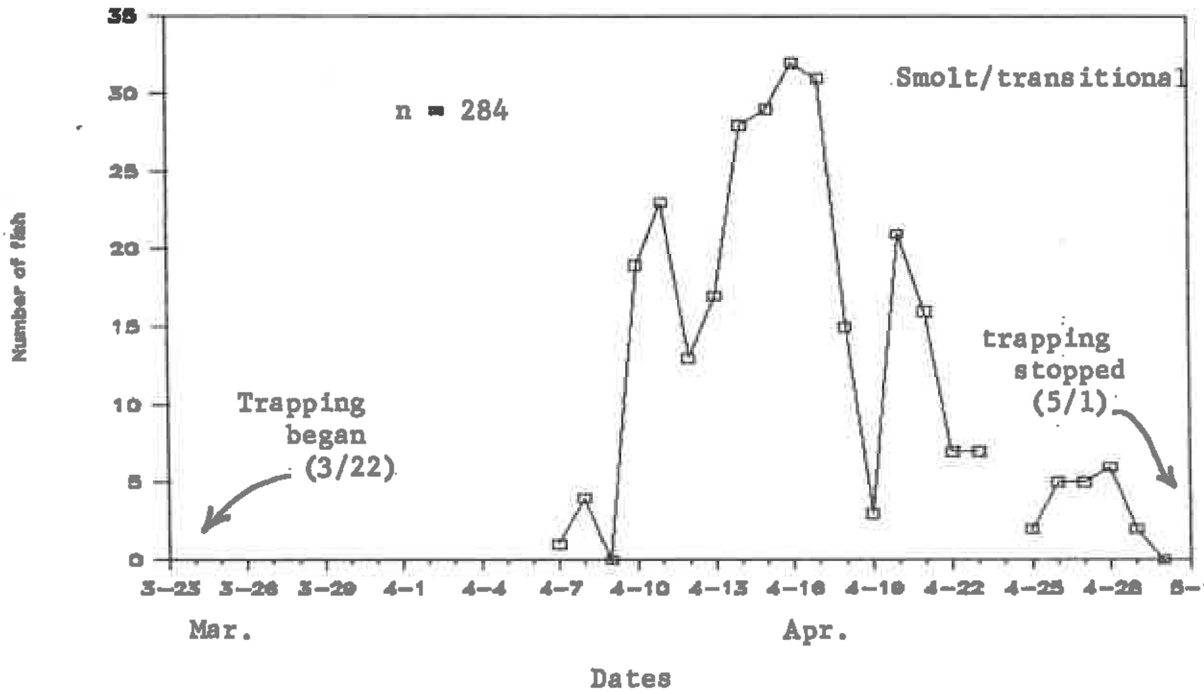
The migration of smolts and transitionals had a more pronounced peak in 1986 than in 1987 (Figs. 19,20). Also, Parr comprised a larger component of the out-migration in 1986 than in 1987. Wild out-migrants comprised 88.5 % of the 374 juveniles captured in 1986 (Table 21). Most wild out-migrants in 1986 were over 2 years old, but many fish had spent 3 years in fresh water before migrating (Table 22). All hatchery fish were aged as 1 year old by scale analysis. Mean fork lengths varied significantly for different age groups of migrants (ANOVA, $F = 1,847$, $p<0.0005$, $df = 3,63$) although only mean fork length of wild 2 year olds' was significantly different than for other age groups of wild fish, or hatchery fish ($p<0.01$ - Appendix N).

Wild out-migrants comprised 69.7 % of the 545 juveniles captured in 1987 (Table 23). Mean fork lengths for wild smolts were much smaller than for hatchery smolts captured at the intake screen. However, mean lengths for wild smolts were similar for 1986 and 1987 (Fig. 21). Analysis of scale samples for 1987 were not available for this report.

Table 21. Results of Juvenile Steelhead Emigrant Trapping at the Cottonwood Conditioning Pond Intake Screen, spring 1986.

	hatchery				wild			
	parr [A]	smolt [B]	precoc.[C]	unk [D]	parr [A]	smolt [E]	precoc.	unk [F]
# of fish	5	22	13	3	76	254	0	1
% of total	1.3	6.6	3.9	0.9	23.0	76.7	0.0	0.3
mean fork length (cm)	22.1	19.5	21.7	—	13.3	16.6	—	—
std. dev.	4.2	2.1	2.9	—	2.9	2.4	—	—

A Parr = brightly colored, parr marks distinct, includes resident trout.
B Includes 14 smolts and 8 transitional (2 branded smolts included). No signif. diff. in mean lengths between smolts and trans. Transitional = silvery but parr marks still obvious, no banding on tail. Smolt = silvery, little or no parr marks, and banding on tail.
C Precocial = ripe, brightly colored trout; includes 1 RA-17-1 and 1 LA-S-2 ? brand.
D 2 hatchery ? smolts - no marks but deformed dorsal fins, plus 1 fish either trans. or smolt.
E 140 transitionals, 112 smolts, and 2 fish either smolts or trans.
F 1 unknown hatchery or wild smolt.



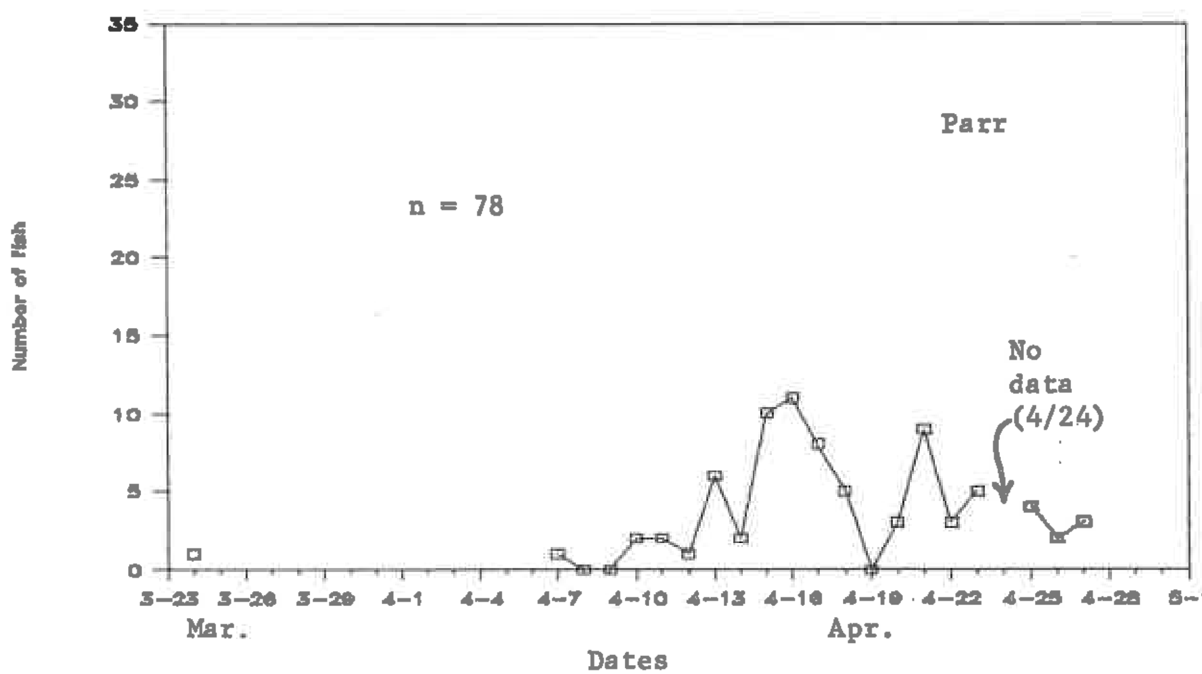
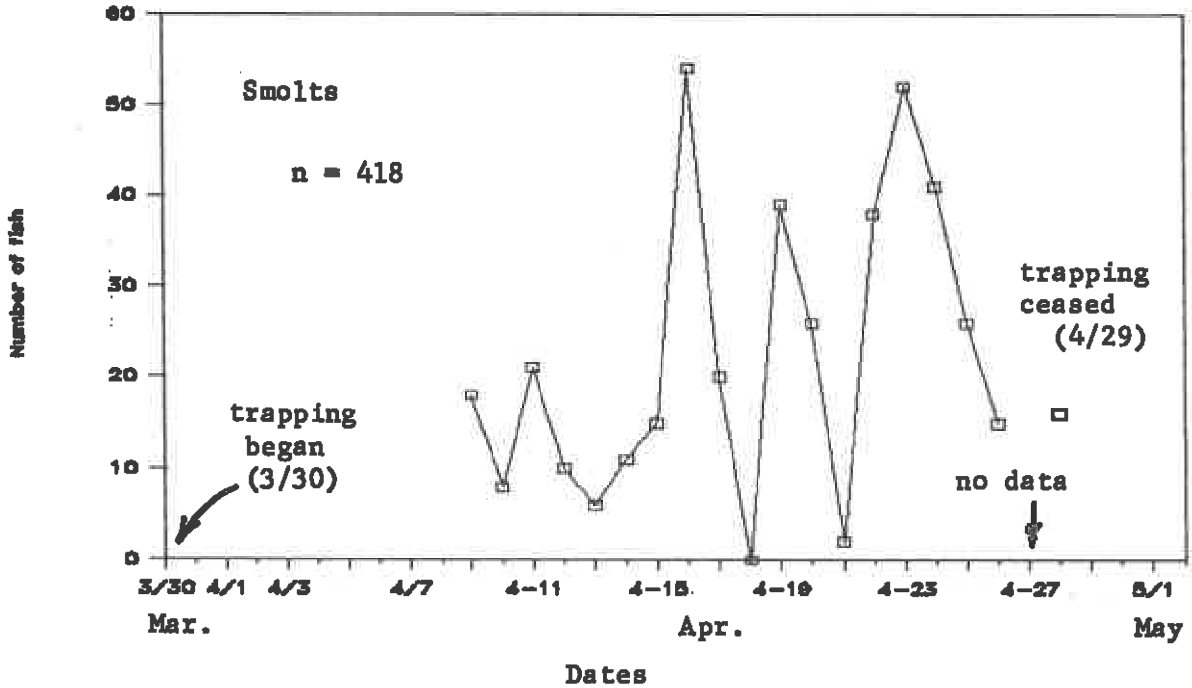


Figure 19. Timing of downstream migrants captured at the Cottonwood Conditioning Pond intake screen, spring 1986.



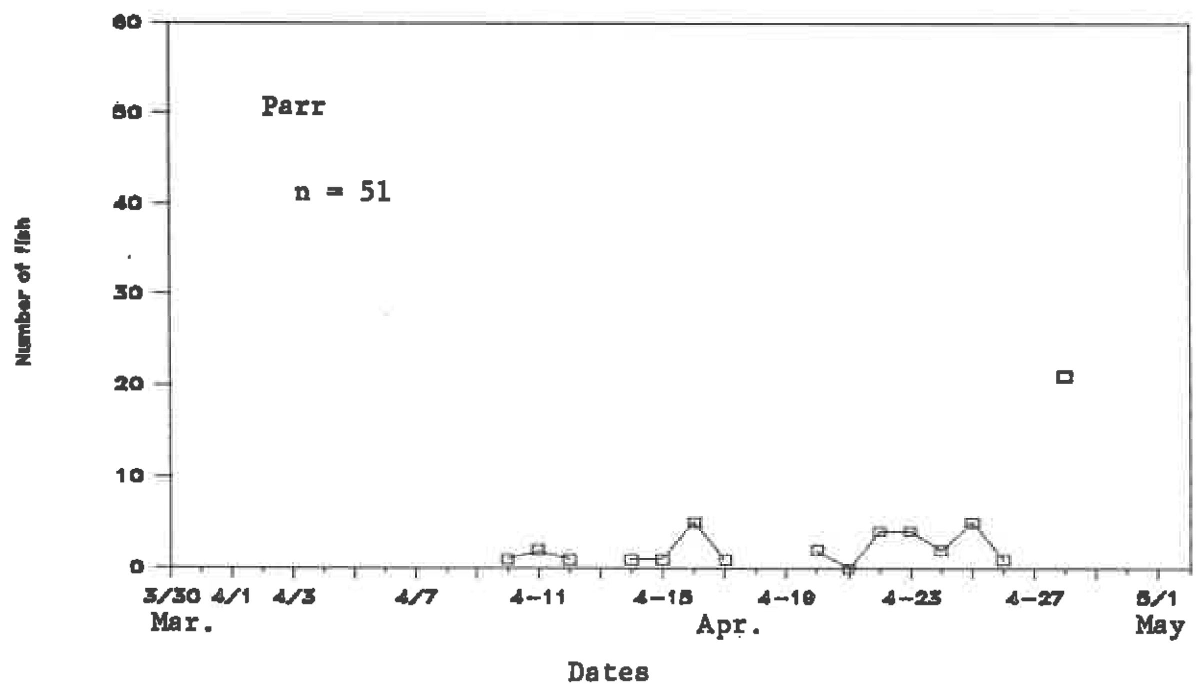


Figure 20. Timing of downstream migrants captured at the Cottonwood Conditioning Pond intake screen, spring 1987.

Table 22. Scale Analysis from Juvenile Steelhead Emigrants Caught at the Cottonwood Conditioning Pond Intake Screen, 1986.

	wild fish fresh water age					
	1+	2+	3+	regenerated	hatchery	total
# of fish	5	29	23	12 [A]	10 [B]	81 [C]
mean fork length (cm)	19.6	15.5	18.9	--	19.1 [D]	--
std.dev.	0.79	1.71	1.94	--	2.69	--

A Includes 2 samples with no scales.
B 8 fish were aged as 1+ in freshwater and 1 sample was regenerated. Also, 1 fish (26.1 cm) was aged as 4 yrs. old.
C This sample includes 2 fish confiscated from anglers fishing the Grande Ronde River (22 & 27cm), one fish was branded with RA-17-3 and other brand unreadable.
D Sample size = 8 fish aged as 1+.

Emigrating steelhead were trapped on the Tucannon River during each month the trap was operational. Table 24 summarizes results of the trapping. Mark/recapture tests were conducted to estimate trapping efficiency for each month. Two different marks were used to assess short distance (300m) recapture efficiency and long distance (10Km) recapture. Most of the efficiency percentages listed in Table 25 are based on short distance recaptures. The large number of marks released in June were disregarded because of erratic trapping after their release. Also, no marking was done in November, so average trapping efficiency for the other months (0.12421) was applied for estimating emigration in November and June. Figure 22 shows estimated parr and smolt/transitional emigration by month for the trapping period. Trapping efficiency on hatchery origin steelhead released from Curl Lk. conditioning pond was computed on total number captured, divided by total release or 389/162,201 = 0.0024. Even with a 10% residualism rate assumed for the release, the trap efficiency would raise to only .0027, a fraction of the estimated efficiency for wild steelhead. Average length for hatchery fish caught was 196.2 mm $\pm$ SD=14.9 (n=99). Table 24 summarizes estimated emigration by month by life stage for the trapping season. Parr accounted for as high as 92.7% of trapped fish in June with smolt/transitional emigration peaking in April, Figure 22.

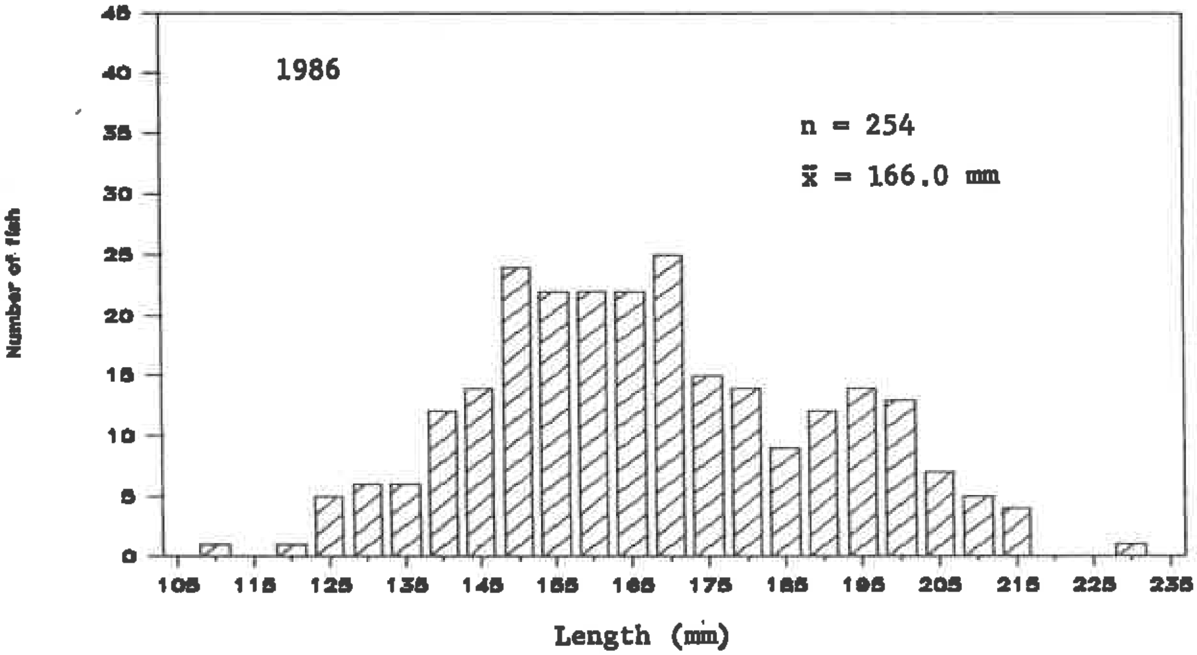
Table 23. Juvenile Steelhead Emigrants Trapped at the Cottonwood Conditioning Pond Intake Screen, spring 1987.

	hatchery				wild			
	parr [A]	smolt [B]	resid. [C]	unk	parr	smolt [D]	resid.	unk
# of fish	2 [E]	112	47	4 [F]	49	306	24	1 [G]
% of total	0.37	20.5	8.62	0.73	8.99	56.15	4.4	---
range in length	---	136-280	155-345	---	92-130	123-245	135-162	---
mean fork length (cm)	---	188.3	231.5	---	114.3	163.1	142.5	---
std. dev.	---	29.7	47.5	---	10.96	21.59	7.16	---
(n)	(2)	(112)	(47)	---	(49)	(306)	(24)	---
range in weight	---	26.5-237	20-280	---	7.5-25	19-179	20-50	---
mean weight (g)	---	62.2	95.8	---	14.2	40.4	27.5	---
std. dev.	---	37.2	58.4	---	3.65	20.2	7.45	---
(n)	(1)	(108)	(41)	---	(49)	(282)	(23)	---

A Parr = brightly colored, <135mm, and parr marks distinct.
B Consists of 37 transitional and 75 smolts.
C Includes 3 milting males at 252,296,& 195 cms.
D Consists of 155 transitional and 151 smolts.
E 11.0 & 12.8 cm adipose clipped fish.
F 5 unclassified hatchery fish (20.7, 29.2, 25.8, 20.0, & 23.0cm).
G 1 unclassified wild fish (15.0cm).

Table 24. Emigration of Tucannon River Wild Steelhead by Life Stage by Month (Estimated Total Passage) 1986-87.

Month	Parr #fish	Transitional #fish	Smolts #fish	Totals
Nov. 86	428	526	301	1255
Dec.	2324	2440	1383	6147
Jan. 87	1332	2725	254	4311
Feb.	281	494	29	804
Mar.	112	274	48	434
Apr.	177	336	1140	1653
May	371	502	946	1819
June	903	0	71	974
Totals	5928	7297	4172	17397



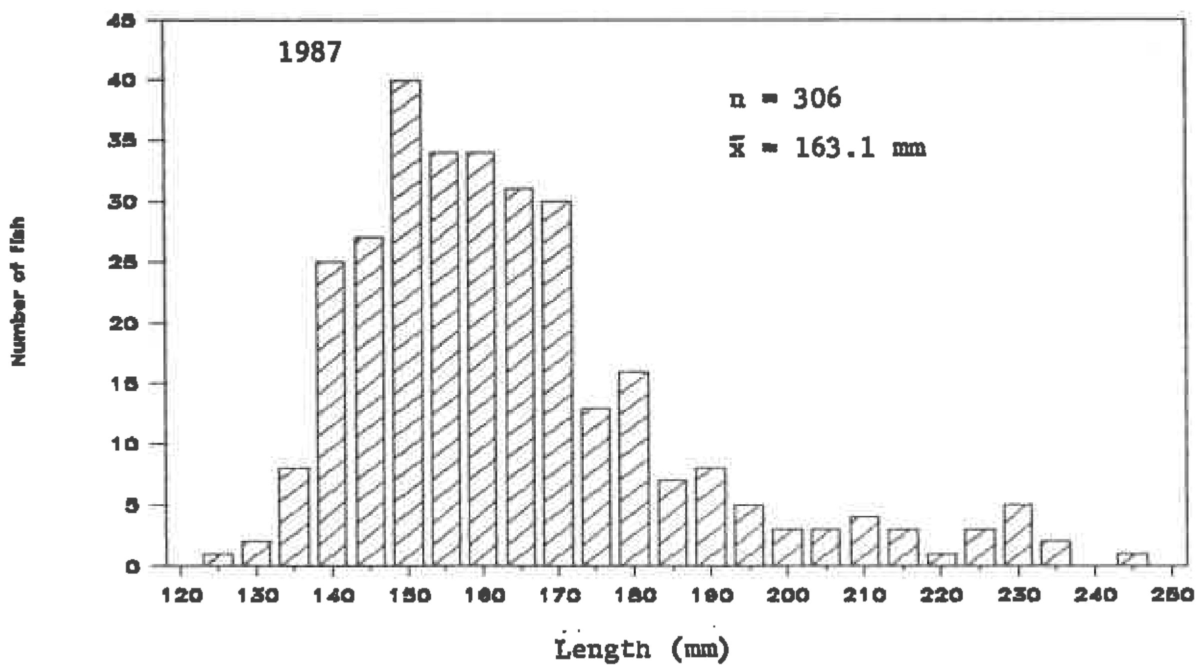


Figure 21. Length-frequencies for wild smolt/transitionals captured at the intake screen for Cottonwood Conditioning Pond, springs of 1986 and 1987.

Table 25. WDF Tucannon River Smolt Trapping Data for Steelhead, 1986-87

Month	Days of Operat.	Fish Captured Hat.	Fish Captured Wild	# of Fish Marked	# of Fish Recapt.	% [A] Trap Effic.	Average Length Smolt/Tran. length	Smolt/Tran. SD	Smolt/Tran. (n)	Parr length	Parr SD	Parr (n)
Nov. 86	5		156	0	0	0.12421*	101.7	10.7	26			
Dec.	20		232	54	2	0.03774	101.8	17.8	69	93.3	11.6	42
Jan. 87	9		479	126	14	0.11111	105.0	11.1	94	91.8	11.7	42
Feb.	18		134	84	14	0.16667	104.8	10.5	54	88.9	9.4	29
March	28		31	14	1	0.07143	99.3	18.9	20	87.9	10.9	7
April	30	68	248	40	6	0.15000	152.3	24.7	155	100.9	17.5	19
May	31	321	379	24	5	0.20833	144.8	25.2	78	67.2	24.6	20
June	25	6	121	*	*	0.12421*	151.3	42.5	7	46.9	5.3	89
Totals		389	1,659	343	42	0.12421[B]						

[A] # recaptured/# marked * 100 = % trap efficiency.
* No estimate of trap efficiency available, average from Dec.- May used.
[B] Average Trap efficiency: n=6, SD=0.06

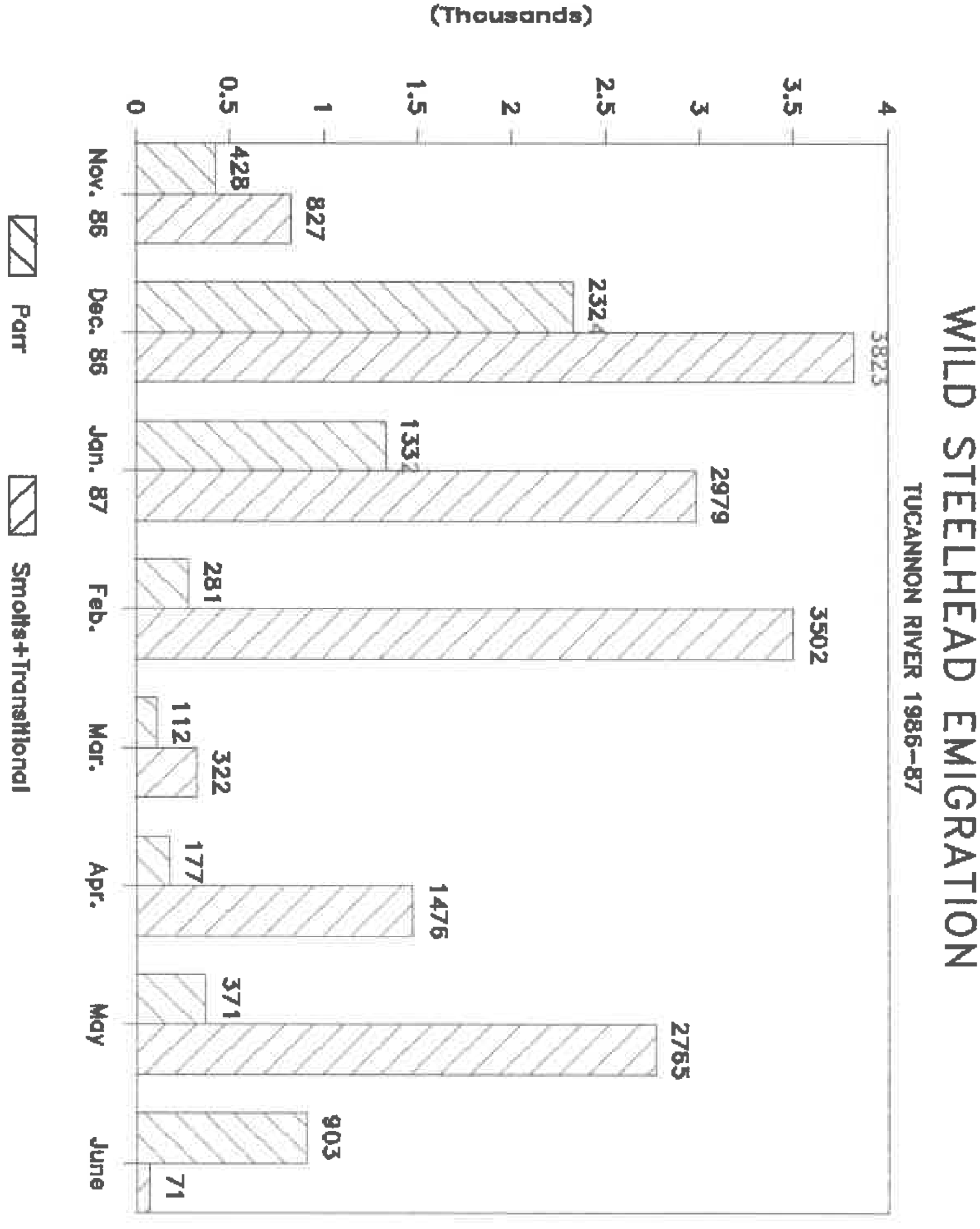


Fig 22. Wild smolt/transitional emigration, Tucannon River, 1986-87.

Summer Densities

Electrofishing site locations are presented in Appendix O. Our electrofishing samples were collected between mid July and early September 1986. Habitat data are reported in Appendix P. Water quality and substrate data, as well as estimates of the percent run and percent pool, cover types, and percent eroding banks at most sites were collected, but are not reported here. The data are available in our files if desired.

We used length-frequencies to determine ages of gamefish for age-specific population and density estimates (Appendix Q). Data used for calculating salmonid density estimates are presented in Appendix R. Estimated densities from electrofishing are presented in Table 26. Biomass estimates are in Appendix S. A length-weight curve had to be used to estimate some weights for the N. Fork of Asotin Creek (Appendix T). Snorkeling estimates of salmonid densities are presented in Table 27. The relative abundance of non salmonid fish are presented in Appendix U. Stream discharge measurements taken during our juvenile sampling are reported in Appendix J.

Trout population densities for 1+ and older trout on the upper N. Fork of Asotin Creek varied significantly ($H=7.0$, $n=3,3,2,2$, $p<0.05$) by habitat type (Table 28). Runs had significantly higher densities of trout than riffles ($p<0.1$, $q=2.59$, $k=4$), although densities of trout were not significantly different between any other habitat types ($p>0.1$).

Length-frequencies for rainbow trout captured at sites electrofished by WDF are presented in Appendix V. Population density data for game fish collected by WDF are also included. Densities for ages 0+ and 1+ rainbow trout were similar (Kruskal Wallis $H=3.36$, $n=5,2,2$, $p>0.1$) for runs, pools, and riffles within the Wilderness (above Panjab Creek) portion of the Tucannon River (Table 29), as well as for age 1+ rainbows ($H=4.18$, $n=6,6,6,6$, $p>0.1$) among 5 habitat types within the HMA (Panjab to WDW Habitat Mgmt. Area headquarters).

WDF personnel captured many bull trout of about age 1+ size within the Wilderness and Panjab Creek, while larger bull trout predominated in the HMA and Hartsock portions of the Tucannon River (Appendix V).

Total rainbow trout densities are similar for 1985 and 1986 for sites electrofished both years within the Wilderness portion of the Tucannon River. However, densities in 1986 in the Hartsock portion of the Tucannon River for the 2 sites electrofished in 1985 far exceed those of 1985 (Table 30).

Table 26. Salmonid Density Estimates (number of fish/100 m² and 95 % confidence limits) for Sites Electrofished in 1986.

	RAINBOW TROUT						OTHER		
	Age 0+		Age >= 1+		Total RBT		species [b]		
Site [A]	#/100m²	CL	#/100m²	CL	#/100m²	CL		#/100m²	CL
GRANDE RONDE WATERSHED									
SFW	10.9	1.4	3.3	1.0	15.0	1.9	CH	1.7 *	--
							DV	1.5 *	--
CR1	15.9	2.9	7.7 *	--	28.8 *	--	DV	0.5 *	--
CR2	34.2 *	--	4.8 *	--	39.0 *	--			
WE1	20.2	2.9	4.8	--	27.1	--			
CO1	41.9	8.8	19.9	11.4	61.2	7.4			
CO2	61.2	13.1	41.8	1.9	101.6	9.1			
RA1	110.3	5.0	23.4	1.7	134.8	5.8	CH	1.1	--
RA2	61.2	11.7	33.5	1.5	93.7	8.9			
RA3	0.0	0.0	23.6	2.1	23.6	2.1			
RA4	23.1	0.0	15.4	3.1	38.5	1.5			
TUCANNON R. TRIBUTARIES									
PA2	20.1	3.4	7.8	1.6	30.2	5.3			
PA1	15.4	0.9	8.9	2.0	24.3	1.8	BK 0+	3.2	0.0
							BK 1+	0.8	0.0
							TOT	4.0	0.0
PA3	8.6	1.4	1.3	0.0	9.9	1.3	BK 0+	12.5	1.5
							BK 1+	6.6	--
							TOT	21.0	5.1
							DV	2.5	0.0
PAN1	18.4	6.0	22.1	0.6	39.3	2.6			
PAN2	10.6	0.0	20.0	3.1	30.1	1.8			
PAN3	4.4 *	--	77.2 *	--	81.6 *	--			
ASOTIN CK. TRIBUTARIES									
SAC3	81.0	5.6	34.7	0.9	115.8	5.0			
SAC5	104.2	4.9	20.0	5.6	124.8	5.7			
NA2	12.1	0.0	15.2	4.6	27.3	2.4	CH	9.1	0.0
NA3	36.7	19.4	52.0	1.7	87.2	5.4	CH	16.8	--
NA4	19.1	2.3	16.1	4.9	35.3	5.7			
NA5	48.9*	27.4	61.1	13.8	111.6*	28.4	CH	4.6	0.0
NA6	23.3	3.4	50.8	0.8	74.1	2.3			
NA7	31.7	1.5	7.6	0.0	39.3	1.4			
NA8	34.0	4.5	70.2	3.6	106.4	7.2	CH	4.5 *	--
NA9	50.4	1.1	52.6	3.1	103.1	2.9	CH	6.6 *	--
NAS2	48.0	0.0	27.4	--	75.4	11.0			
NAS3	27.8	--	27.8	0.0	55.6	7.0			

A SFW= S.Fork Wenaha in NE Oregon (coop. w/ODFW), CR= Crooked Ck., WE= Wenatchee Ck., Co= Cougar Ck, RA= Rattlesnake Ck, PA= Pataha Ck, PAN= Panjab Ck, SAC= S.Fork Asotin Ck. Control, NA= N. Fork Asotin Ck, NAS= N. Fork Asotin Ck. in a side channel.

* <= 60 % reduction between passes, used sum of passes for minimum density estimate, should be used with caution.

B DV = Bull Trout, CH = Chinook Salmon, BK = Brook Trout.

Table 27. Results of snorkeling counts on the Tucannon and Touchet rivers, September 1986.

Stream (Date)	Location	Habitat	site Length (m)	mean width (m)	Area (m)	Density * (fish/100 m2) Parr	legals	CH	BT	WF	DV
N.F. Touchet R. (9-19-86)	Aurora Orchards -top of site is	riffle	68.0	8.82	599.76	4.3	--	--	--	0.17	--
	56 m above center or road at bridge	run	108.25	11.21	1,213.48	25.3	0.58	--	1.48	1.65	--
Tucannon R. (9-18-86)	HMA - Camp 9 - top of site is	riffle	28.5	10.25	292.12	5.5	--	2.4	--	--	--
	35 m upstream of Big 4 outlet	run	162.7	9.17	1,492.32	7.1	4.0 #	10.25	--	0.33	0.27
(9-18-86)	Curl Lake - upstream of Curl lake outlet	run/ glide	75.25	11.21	843.87	16.5	2.4 #	43.61	--	0.24	0.59
(9-18-86)	- boulder placement below Curl lake intake	boulder riffle	111.75	10.47	1,170.58	10.6	2.3 #	11.61	--	--	0.85

* parr = rainbow trout of age 0 + and 1 + size, legals "= >150 mm, CH = chinook parr, BT = Brown trout, WF = white fish, DV = Bull trout.

\# hatchery (Adipose Clipped) steelhead smolts included.

Table 28. Comparison of Rainbow Trout Densities (# of fish/100 m^2) by Habitat Type on the Upper N. Fork of Asotin Creek, Summer 1986.

	Age 0+				Age 1+			
	pool	run	riffle	side channel	pool	run	riffle	side channel
	12.1	36.7	19.1	48.0	15.2	52.0	15.1	27.4
	25.4	48.9	31.7	27.8	48.7	61.1	7.6	27.8
	50.4	34.0	--	--	52.6	70.2	--	--
X =	29.3	39.9	25.4	37.9	38.8	61.1	11.3	27.6
SD=	19.4	7.9	8.9	14.3	20.6	9.1	5.3	0.3

Table 29. Comparison of Rainbow Trout Densities (# of fish/100 m^2) by Habitat Type on the Upper Tucannon River, Summer 1986.

	Age 0+					Age 1+				
	pool	run	riffle	boulder groups	side chan.	pool	run	riffle	boulder groups	side chan.
HMA										
	6.5	21.1	49.4	15.0	17.0	3.2	6.7	4.1	6.0	25.4
	6.3	19.1	36.4	16.1	23.8	7.7	18.2	14.4	10.7	9.5
	11.6	13.8	13.8	14.4	7.8	25.8	6.2	3.6	34.7	8.9
	14.6	11.9	17.9	14.4	19.2	18.9	21.7	8.4	14.4	4.8
	9.5	26.6	14.4	11.6	39.1	18.9	4.0	11.6	26.2	13.7
	38.1	14.3	22.5	22.1	16.7	15.4	15.6	11.3	22.1	16.7
X =	14.4	17.8	25.7	15.6	20.6	16.6	12.1	8.9	17.3	13.2
SD=	12.0	5.5	14.3	3.5	10.4	10.0	7.4	4.3	8.2	7.3
WILDERNESS										
	10.5	19.4	13.3	--	--	9.6	22.8	13.9	--	--
	6.4	33.0	17.0	--	--	22.4	16.5	4.6	--	--
	5.7	--	--	--	--	18.5	--	--	--	--
	24.5	--	--	--	--	14.4	--	--	--	--
	15.4	--	--	--	--	17.6	--	--	--	--
X =	12.5	26.2	15.1	--	--	16.5	19.6	9.2	--	--
SD=	7.7	9.6	2.6	--	--	4.8	4.4	6.6	--	--

Table 30. Comparisons of densities of total rainbow trout for sites electrofished by WDF personnel in both 1985 and 1986, Tucannon River (sites renamed in 1986).

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

Eight of 9 sites electrofished in the Wilderness section of the Tucannon River, 5 of 6 sites on Panjab Creek, and 23 of 30 sites within the HMA contained adipose clipped (includes branded and LV clipped) steelhead smolts that had residualized after release from Curl Lake. All brands were 1986 releases (RA-IT-1 or 3) in the Tucannon R. system. Adipose clipped steelhead comprised 36 % (mean FL=187.0mm, SD=24.7, n=17) of all rainbows >140 mm in the Wilderness, 83.9 % > 135mm (mean FL= 178.0mm,SD=21.3, n=26) in Panjab Creek, and 26.9 % > 135mm (mean FL 169.5mm, SD= 24.67, n=103) captured in the HMA by WDF electrofishing. Most fish > 191mm captured by WDF in Panjab and the Wilderness section were of hatchery origin. We found 50 % of the rainbow trout > 135 mm (mean FL=191.6, SD=22.7, n=24) captured by electrofishing in upper Panjab were residualized hatchery origin steelhead smolts. Even in the upper N. Fork of Asotin Creek we found that 51.6 % of all rainbow trout > 160mm (mean FL=202.6mm, SD=22.1, n=16) were of hatchery origin, either as residualized smolts or fish stocked as catchable size trout.

Discussion

Trapping

Transitionals and smolts from Charlie Cr. are not always mutually exclusive classifications; they are of similar sizes, and we considered both as active emigrants. Therefore, they are probably artificial separations and the results for these two categories were considered together. We believe that we had 90 - 100 % trapping efficiency in our emigrant trapping activities because the entire stream was blocked and no gaps were apparent where fish could pass. However, our tests of trapping efficiency were much lower than we expected. We believe that some of the marked migrants that we took upstream may have; 1) died, 2) not been actively migrating, or 3) been missed upon recapture. These factors would produce an underestimate of our trapping efficiency. Our trap did not work well in 1986 and most fish were caught by electrofishing above the weir. Some parr, as well as 1 bull trout, that we captured by electrofishing above the trap may not have been migrating through the area but residing there. By increasing the width of the chute and trap box in 1987 we were able to trap more effectively. Electrofishing was unnecessary to capture fish that year and probably presents a more representative picture of the size and timing of migrants in Charlie Creek.

Our scale samples were taken throughout the trapping period but they were not taken as a truly random sample for statistical analysis, and therefore may or may not be representative of the population of migrant steelhead smolts.

We experienced severe problems with the operation and reliability of the floating trap on Asotin Cr. Many days the trap was either sunk, or we had high mortality in the live box, because of a small amount of debris. When we tried to anticipate the debris load we often found the trap the next day without any flow into the live box. Mortality of captured fish was not consistent or correctable by any of our modifications to the trap. Because of the inconsistency of our trap we are not able to present graphs of run timing nor could we not obtain any estimate of trap efficiency for steelhead parr or chinook salmon.

It appears that the peak of chinook salmon migration was occurring, or had occurred, by the onset of our trapping in early April. Numbers of chinook captured each day declined substantially after 12 April. The bimodal length-frequency distribution for chinook is caused primarily by the outmigration of parr in June. All chinook captured after 28 May were classified as parr (50 % of all parr were captured after 28 May, and >81 % of total parr captured were captured on, or after, 13 May).

The numbers of steelhead parr that we captured on Asotin Cr. was unexpected. It is possible that parr are also migrating during other months of the year as well as during those months that we trapped. We were unsuccessful in capturing wild steelhead smolts/transitionals. These fish are obviously able to avoid the trap because of their large size.

This was the first year for the WDF smolt trap in a new location on the Tucannon River to try and improve trapping efficiency (Seidel and Bugert,1987). Trapping efficiency greatly improved for wild steelhead (it was unmeasurable in 1986) but remained extremely low for hatchery released fish. We presume that most hatchery smolts are capable of either avoiding the trap or swimming out of the trap because of their greater size and swimming ability. Smaller wild fish are more effectively trapped.

The WDF trap captured large numbers of parr emigrants. Parr averaged 92.6 mm from December through April. Transitionals and some smolts dominated the emigration in December through March, and averaged only 102.7mm. It is possible that parr became transitionals during these months, but it is unlikely that they grew enough to become smolts by April and May (when the average smolt or transitional averaged between 145-152mm).

The estimates of emigration have been included here for informative purposes but are not likely very accurate. Trapping efficiency fluctuated considerably over the season and the standard deviation for mean trapping efficiency was 50% of the average. Because of this large deviation we did not provide confidence limits. We believe that with additional mark/recapture tests and subsequent year's trapping data, the information could be very useful in assessing smolt production. It does not appear to be useful in estimating hatchery fish emigration or allow us to determine residualism in the system. Trapping efficiency in future years will be evaluated for estimating residualism.

Some hatchery fish from the 1985 and 1986 Cottonwood C.P. releases moved upstream and remained in Cottonwood Creek until the following year before migrating. The timing of the emigration in 1986 and 1987 appears to be nearly a month earlier than in 1985, when the first of 225 emigrants was noted on 8 May. It could be that many of the migrants passed the intake screen unnoticed prior to 8 May in 1985. The hatchery contribution to the juvenile emigration became much more significant in 1987 than in 1986 and hatchery smolts were consistently larger than wild smolts. Hatchery parr in 1986 were generally large fish that in 1987 were classified as resident. Many residual hatchery fish in 1987 were ripe males.

Summer Densities

We are uncertain about the separation of age 0+ rainbow or brook trout from length-frequency histograms for Pataha Creek. It appears there may have been very poor production in Pataha Cr. in 1986 based on the small number of fish in the 0+ age class. We were unable to verify ages for specific lengths because our scale samples are not yet analyzed. Therefore, we assumed that 0+ aged rainbow trout were ≤ 102mm, and 0+ age brook trout were ≤ 100mm. Brook trout density exceeds that of rainbow trout at site PA3. This is the only known naturally reproducing population of brook trout in southeast Washington.

We attempted to electrofish all tributaries of the Grande Ronde River within Washington State to learn about rainbow/ steelhead distribution and species composition within this drainage. We also wanted to examine populations that are not stocked, and presumably not heavily fished, to contrast with most streams in southeast Washington. We found moderate densities of trout and few large fish in our limited sample of sites in the Wilderness. Rainbow/steelhead trout were in every location we electrofished in 1986, even in areas of Cougar Creek and Grouse

Creek with gradients in excess of 8-10 % (we only qualitatively electrofished Grouse Creek). We were unable to either differentiate between steelhead or resident trout or to delineate their distribution within these drainages. The steep gradients in the upper portions of some of these small tributaries would preclude adult steelhead trout use, but these stream sections may be ascended by age 1+ and older steelhead for rearing. They may also contain resident trout only. Genetic comparisons may be the only means to differentiate between steelhead in the lower drainages and resident trout in the upper drainages.

Our experimentation with the feasibility of snorkeling for species composition and density estimates was successful. We were able to sample larger stream sections than with electrofishing and we got a better idea of habitat use by fish species and age groups. We may obtain better density estimates for fish over 150mm by snorkeling than by electrofishing, but we have not directly compared the two techniques. Zero age rainbow trout would undoubtedly be under-estimated because of their small size and their habit of remaining in very shallow water or near the substrate. We intend to use snorkeling in the future for larger, deeper sites but we need to calibrate the results of the two techniques by making a direct comparison of density estimates from the same sites.

Few gamefish over 200 mm were captured at any sites. Most of the larger trout that were captured on Panjab Creek, the Tucannon River, the N. and S. Forks of Asotin Creek, and Rattlesnake Creek were of hatchery origin. Again, this verifies our previous contention that the steelhead stocking program is affecting more than our target streams and the specific stream areas receiving smolt plants (Schuck and Mendel 1987).

Catchable Trout Program

Production

Production of legal or catchable size rainbow trout at the Lyons Ferry/Tucannon complex totaled 253,951 fish weighing 86,548 pounds in 1986 and 203,772 fish weighing 71,614 pounds in 1987. The cumulative average weight for catchable trout was 2.9 fish/lb and 2.85 fish/pound for 1986 and 1987 respectively. Appendix W gives a listing of streams and lakes in southeast Washington which received compensation plan plantings, the number and pounds of fish they received, and the number of different stockings into each water. Total compensation plan production would be 84,000 pounds of fish total, with 3,100 pounds of catchable fish and 100,000 fingerling provided to Idaho. The program accounted for about 103% of that goal in 1986 and 85% of the goal in 1987 with a full compliment of catchable sized and fingerling fish raised for Idaho.

CONCLUSIONS

Wild smolts from the Tucannon closely match the size of fish from the Asotin Creek system (see Asotin Cr. Trapping) and the large parr emigration appears to occur from both mainstem systems, but not from the small tributaries (see Cottonwood and Charlie Cr.'s Trapping). We are unsure at present whether this parr emigration is in response to habitat limitations in the system or a pre-smolt response that provides fish to the Snake River for rearing prior to smolt emigration in a subsequent year.

Objective 1: Fish cultural practices at the hatchery did not changed significantly over previous years. Operation of the hatchery however changed to accommodate the addition of the final conditioning pond in Dayton on the Touchet River. Moving fish to conditioning ponds in early March places some additional work load on the hatchery in spring but lessens work and transport problems later in April when all the fish have to be outplanted. All steelhead grew to acceptable smolt size and converted food fed at or above target levels.

Beginning in 1987, a new stock of summer steelhead was released at Lyons Ferry Hatchery. Insufficient numbers of either the Wallowa or Wells stock origin adults returned to the hatchery trap to allow selective spawning of known origin fish. We had designated the Wallowa stock fish as primarily an upper river stock (Grande Ronde R., Asotin Cr.) and could no longer depend on Wells hatchery for the remainder of our egg needs. We therefore utilized fish returning to the hatchery trap that spawned between 7 February and 30 March. These fish were a mixture of predominately "A run" hatchery origin females and males. A percentage of wild fish were present in those spawned and numbers of one and two ocean age adults were about equal. Numbers of fish spawned weekly were roughly representative of the spawning curve (fewer fish early and late with the majority of spawned fish occurring in the middle of the period).

We recognized that our selection of adults to spawn may not have been optimum for any one of the tributary rivers which would ultimately be receiving the smolts. However, trapping facilities are not currently available on any of those rivers, and need demanded the use of existing facilities.

Disease at Lyons Ferry has not been a problem. Minor outbreaks of coldwater disease at LFH, and IHN at the Tucannon Hatchery have not caused serious mortality. Rearing pond mortality at Lyons Ferry has been surprisingly low. Avian predation is only a serious problem at the hatchery during the spring when rearing ponds are lowered to remove the fish, thus making the fish more susceptible to predation. Stocking estimate errors are generally of less than 1 %. Condition factors (C.F.) on most smolt groups are acceptable (C.F.<1) except for raceway reared fish which tend to be heavier (C.F.>1), and also have a higher percentage of precocious males in the samples. Every effort will be made to limit the need for rearing steelhead in raceways. Descaling at release is not a problem for either hatchery or truck releases.

Objective 2: Smolt size and weight were more consistent this year than in previous years. We attribute this improved consistency to a greater amount of time the smolts reared in the rearing ponds. Smolts reared in the raceways were again larger and heavier than the fish released from the ponds. Such large fish are not likely an improvement since condition factors and precocious male rates indicate these fish are not of the highest quality. In 1986 we placed the brood fish smolts back into a rearing pond for the last two months prior to release to prevent the over size and over weight condition. We consider the smolt quality to have been greatly improved.

Releases of steelhead from the Curl Lk. CP appeared to fare better in both years than in 1985 when residualism was very high. Very cold water may be causing poor survival or emigration response of smolts and the wandering of returning adults that we have documented the past few years. We began forcing the smolts into the river by the first week in May to ensure the fish every chance of emigrating from the river at the most opportune time. The new Lyon's Ferry stock of fish may also be performing better in the Tucannon R. than stocks used in the past. Improved passage figures from the dams are at least encouraging for this area. Adult returns and contribution to the sport fishery will be watched closely.

Freeze branding juvenile fish to assess migration rates through the river system seems to be an effective tool. Information obtained by the Fish Passage Center does provide insights into migrational behavior from year to year. Relying on this information to determine survival, as we first proposed, is however, not possible. Variables in estimating passage of marked groups at the dams are too numerous and too difficult to estimate accurately throughout the season. We no longer believe that the sampling program in place at the dams is capable of providing us an accurate estimate of survival. The best we can determine from the juvenile sampling is an assessment of year to year variation of groups as represented by the Passage Index. Continued developments in the use of PIT tags may lessen the need for branding of 240,000 fish annually.

Plans to administer a morpholine drip to test groups of smolts released at the hatchery were again delayed. Because of several unknowns concerning the differences in stocks in use at the hatchery and how these same stocks would react after conditioning at the remote ponds, we delayed this experiment until we could be more sure of the nature of the straying/wandering behavior. This morpholine study may be conducted in the future but will be reserved until more stock specific studies have been done.

Our smolt trapping results indicate that some hatchery fish are residualizing in the area streams and that some of these fish emigrate the following spring. Unfortunately, our scale analysis mis-interpreted 100% of these "holdover" hatchery fish by aging them as having resided 1 year in freshwater. We plan to continue to attempt to estimate how many of the "holdover" hatchery smolts contribute to our hatchery production and how many residualize and compete with wild resident trout.

Smolt trapping at Cottonwood Ck., Charlie Ck. and the Tucannon River have provided us with some valuable information and residualism. We have not been successful in trapping migrating hatchery steelhead smolts. Traps in Charlie Ck. and the Tucannon R. have had acceptable trapping efficiencies for wild steelhead smolts and parr. Wild smolts from the Tucannon R. closely match the size of fish from the Asotin Ck. system and the large parr emigration appears to occur from both mainstem areas, but not from small tributaries. We are unsure at present whether this parr emigration is in response to habitat limitation in the system or is a pre-smolt response that provides fish to the Snake River for rearing prior to smolt emigration in a subsequent year. Scale analysis of wild steelhead emigrants during the spring and summer and length-frequencies for rainbow trout in Panjab and Cougar creeks suggest that there may be 3 age classes of trout < 200 mm length in many southeast Washington streams.

Objective 3: Tagging, fin clipping and branding are still important tools to allow our evaluation of the different stocks of fish and different release strategies. Adipose clipping and coded wire tagging went smoothly, although brand quality on some of the groups is still a problem. Branding requires greater concentration on the part of the individual doing the work, than does tagging or fin clipping. The key to acceptable brand quality is increased supervision of branders and emphasizing more concentration by them during their work.

Returns of tagged and or branded adult steelhead to the hatchery are disappointingly low. All releases from the hatchery starting in 1983 received some type of distinct mark to allow positive identification upon return to the hatchery and separation of different stocks of fish for spawning. We, therefore, expected a majority of adults returning to the ladder at the hatchery to be marked. That was not the case. Only 19 % of the 1253 fish that were trapped from the 1986 run were externally marked. A complicating factor was the absence of other tagged or branded fish in the samples that might indicate a possible source or origin for the large number of unmarked fish. The large migration movement of Lyon's Ferry and Tucannon River released fish to above LGD is disturbing. We are still unsure whether this is straying caused by an inability to locate the hatchery and river mouth during low summer flows, or general wandering that is exhibited by this specie in the Snake river in their attempt to find preferred summering and overwintering areas. Their inability to move back down stream through two dams during a period when the ladders are sometimes inoperative would not be unusual, and disorientation may then bring about more active straying into upper river tributaries. This subject is more fully investigated by Mendel and Schuck (1988).

Estimating harvest of adult steelhead is the single most expensive and time consuming aspect of the evaluation program. Creel surveys were conducted on the entire Snake River system and estimates of effort and harvest made by section (Mendel et al, 1988). Estimates of harvest in the Snake R. were also obtained from statewide punchcard returns and found to be reasonably close to our statistical estimates. Sport and commercial harvest estimates were obtained where possible to provide the estimates of contribution of Lyon's Ferry reared and released fish. The importance of Lower Granite Dam adult sampling to estimating returning performance is becoming more evident. Large sample sizes can be obtained at relatively low cost to both estimate smolt to adult survival within the project area and to collect biological information for describing the characteristics of the returning fish. The obvious limitation of this data is its' inability to accurately provide data on LSRCP streams receiving smolt plants down river (Walla Walla, Touchet Rivers) and the unsureness of the full meaning of passage of LFH and Tucannon River fish. Tables 6 and 14 within this report provide the essential information for interpreting program success. It is obvious that our fish are contributing to multiple fisheries throughout the basin and also that those fisheries do not at present appear to be a significant threat to meeting our compensation goal of adults into the project area. Incorrect data was presented in our last annual report and a corrected table estimating contribution of LFH origin fish to various fisheries in the Columbia R. basin is presented in Appendix X.

Scale samples of sport caught fish were taken, mounted, impressed on plastic and read with the aid of a scale projector. The scale age results were reported in the 1986-1987 Creel portion of our annual report.

Our LFH steelhead are demonstrating some differences in run timing over LGD than the general steelhead run. Fish released from the LFH and the Tucannon River have a higher proportion of adults that cross LGD in July and August than is typical of other returns to the dam. We have been concerned in past years that these fish crossing LGD in large numbers from down river release sites may be lost. Until we can sample the entire returns more effectively at Lyon's Ferry and Tucannon hatcheries, we will not be able to document the proportion of fish from these release sites that actually stray above LGD, nor will we be able to document the numbers of fish jaw tagged at LGD that are able to return to LFH or the Tucannon River to spawn or be available to sport fisheries. A permanent trapping weir on the Tucannon R. is necessary for us to obtain this information.

Counting adults into Asotin Ck. was not successful again in 1986. However, our adult trapping at Charlie and Cottonwood creeks did provide us with valuable data concerning wild returning adults as well as recovery of tagged hatchery adults. We will not trap in Asotin Creek in 1988 so we can document natural spawning distribution in Charlie Ck. and the SF of Asotin Ck. and evaluate the effects of our trapping weir on adult steelhead passage. We have been redesigning our traps and weirs to improve adult steelhead passage and trapping efficiency in the future. We hope to obtain accurate estimates of redds/female and sex ratios of adults to enable us to develop reliable estimates of spawning escapement from our spawning surveys. Spawning surveys have proven to be very successful during 1986 and 1987. Redd densities have been quite high in most streams. We will continue to conduct these surveys when possible to develop an index of spawning escapement and evaluate the benefits of supplementation.

Return rates of marked groups of steelhead have generally surpassed the returns required in the LSRCP goal (0.5%). Returning adult steelhead have averaged 55% 1 salt age over the past several years with 2 salt age fish comprising nearly 45%. Three salt age fish comprise only < 1% of returning adults.

Objective 4: Electrofishing to determine increased abundance of steelhead in a stream is proving to be a questionable methodology for evaluating adult return performance. The electrofishing does provide valuable information on existing populations of juvenile salmonids, but we are unsure at present to what extent increased hatchery origin adult fish escapement will increase juvenile populations. Gross increases in juvenile numbers would likely suggest increased spawning. Supporting redd count data would be necessary, however, to provide full usefullness of the data. Also, the indication from our trapping that large numbers of parr emigrate from mainstem streams complicates the usefullness of parr density data. What electrofishing has shown is that large numbers of residual hatchery steelhead smolts have migrated throughout the tributary streams and are competing with existing populations far from the stocking sites. Some of these hatchery fish also contribute to the catchable trout fishery. After several years of electrofishing, we are still unsure of the status of resident rainbow trout populations in southeast Washington. We have been able to document the presence of few spawning resident rainbow trout females and we haven't determined size and age at first spawning. Now that we have trout densities for most of the major streams in southeast Washington, we will limit our sampling in the future to specific index areas to compare densities with previous years.

We were able to accomplish some snorkeling this project year. We will do more snorkeling in 1987 to determine if that technique would be effective in replacing some of the time consuming electrofishing.

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Appendix A. Study Proposal.

OBJECTIVE 1: DOCUMENT JUVENILE GROWTH AND DEVELOPMENT AND FISH CULTURAL PROCEDURES.

Approach: Lyons Ferry hatchery was designed to produce 931,000 smolts annually at 8 fish /pound. These numbers were based upon experience and were the best estimate at the time. No large well water hatchery existed on the Snake R. at that time so actual assessment of performance is an important need to accurately predict long-term production capacity. Multiple stocks of steelhead will also be cultured at the hatchery; one long term hatchery stock and at least one wild/natural-origin stock to be used in upper Snake R. tributaries. Relative performance of juvenile fish in the hatchery may be an indicator of long-term adult performance. All aspects of hatchery operation will be monitored. Recommendations for changes in hatchery procedure will be made, if necessary, to improve returns. Work on this aspect of the program will be ongoing.

SUB-OBJ. 1.1 Determine mean rearing time from egg to release for resident trout and for comparison of Wallowa and Wells steelhead stocks. Document hatchery performance through monitoring growth rates, conversion factors and succeptability to predation or die-off.

Task 1.11 Sample 0.005 to 0.01 percent of separately reared groups for mean fork length and weight, in millimeters and grams respectively.

Task 1.12 Document disease history to determine effects on growth. (Available from hatchery records but will include viral disease certification from parent samples taken at time of spawning).

Task 1.13 Estimate raceway, or pond mortality, based on estimates of numbers of fish stocked versus number of fish removed. Attempt to identify sources of mortality. Some possibilities are:

a. disease
b. avian predators
c. stocking estimate errors

Task 1.14 Calculate condition factors for all groups based on data from task 1.11.

Task 1.15 Compare smolt and resident trout production (pounds and numbers) with hatchery compensation goals.

Task 1.16 Document special fish cultural requirements (if any) of each release group and/or stock.

SUB-OBJ. 1.2 Determine condition of hatchery smolts at time of release.

Task 1.21 See task 1.14

Task 1.22 Sample for descaling and fin condition utilizing standard descaling report forms (if available) used by transporting agencies.

Task 1.23 Sample all CWT/brand groups for tag/brand loss prior to release. (see Objective 2)

Task 1.24 Utilize portions of Goede's organosomatic index procedure to assess the quality of smolts released. This will also allow for comparison to other state hatchery smolts.

OBJECTIVE 2: DOCUMENT SMOLT AND RESIDENT TROUT RELEASES AND EVALUATE SMOLT OUT-MIGRATION BEHAVIOR. PROVIDE MANAGEMENT RECOMMENDATIONS.

Approach: Marking of juveniles with coded-wire tags, brands, fin clips and combinations of the three are an essential part of the juvenile/adult performance program. Improvements in tagging technology have aided the rapid collection and interpretation of migration data. Representative groups from each stock and release group will be marked, tagged and branded for positive identification. Established monitoring systems at hydroelectric dams on the Snake and Columbia Rivers supply the needed juvenile migration data to assess initial migration performance and smolt survival to, or past, multiple sampling points.

SUB-OBJ 2.1 Document numbers, size, time of release, methods, and location of steelhead smolt and resident trout plants. Evaluate out-migration performance.

Task 2.11 Tag and brand representative groups from each major release area within the restrictions of hatchery holding space. Minimum group size of 20,000 fish will be used to ensure adequate tag return.

Task 2.12 Observe and record smolt migration behavior from rearing ponds, Wallowa Hatchery, and conditioning ponds. Observe numbers of fish migrating over period of time and estimate total numbers left in rearing ponds.

Task 2.13 Observe and document smolt behavior from river release sites, according to river conditions and willingness to migrate.

Task 2.14 Determine migration time and performance down river by using information gathered at established smolt transport and sampling locations on the Snake and

Columbia Rivers. Brands allow immediate assessment of group performance.

Task 2.15 Assess smolt residualism by censusing release sites and reasonably adjacent areas of streams through electroshocking and/or angler creel checks.

Task 2.16 Operate smolt traps on the Tucannon River, Asotin, Cottonwood and Charlie Creeks. Estimate total smolt outmigration of wild and hatchery salmonids for assessment of residualism. (Data recovered will aide in tasks 2.12, 2.13, 2.14 also. Tucannon trapping will be assisting WDF personnel.)

<u>SUB-OBJ 2.2</u> Attempt to determine reasons for Lyons Ferry brood stock releases to bypass the hatchery outlet; and discover other methods to properly imprint smolts and improve returns to the hatchery.

Task 2.21 Mark all brood stock releases from the hatchery with CWT/brand to allow ease of trapping and tracking at dams as returning adults. (See table 1).

Task 2.22 Release four test groups and two control groups at two different times (late April;early May). One group at each release time would be subjected to an artificial imprinting chemical. Chemical would then be released from the facility during subsequent years to attract adults to the ladder.

<u>SUB-OBJ 2.3</u> Attempt to determine out-migration timing and condition of wild or naturally produced steelhead smolts.

Task 2.31 Electroshock sections of streams on several occasions during the spring to determine relative abundance, condition and out-migration timing.

Task 2.32 Operate smolt trap to collect same information as in task 2.31, on selected streams. Streams to be trapped in 1986-87 include:

- Tucannon River (jointly with WDF)
- Asotin Cr. (below the forks)
- Charlie Cr. (tributary to Asotin Cr.)
- Cottonwood Cr. (at conditioning pond diversion)

(Same as Task 2.16)

OBJECTIVE 3: ESTIMATE ADULT RETURNS TO DOWN-RIVER AND TERMINAL AREAS (STREAMS, OCEAN HARVEST, SPORT, COMMERCIAL AND TREATY INDIAN HARVEST, HATCHERIES, ESCAPEMENT) AS A MEASURE OF COMPENSATION SUCCESS.

Approach: Adult returns are the purpose of L.S.R.C.P. hatcheries. Measuring adult returns to the point of release and other intermediate or terminal areas is necessary. Adult harvest will be sampled in appropriate main river and terminal area commercial, treaty Indian and sport seasons through existing state and federal programs. Continuance of down-river programs is essential for complete, accurate evaluation of compensation goals. Terminal harvest within the L.S.R.C.P. area will be statistically sampled to estimate total harvest, % Lyons Ferry contribution to harvest and escapement. Two methods to assess spawning escapement will be compared. 1) Redd counts in established stream areas will continue despite problems encountered with high spring flows hampering visibility. 2) Adult trapping and enumeration in some areas, and spawning ground surveys will allow WDG to properly manage existing native stocks in concert with expected hatchery returns.

SUB-OBJ. 3.1 Identify returning hatchery adults using coded-wire tags, freeze brands or fin clips to estimate return rates.

Task 3.11 (Same as Task 2.11; see also Table 1).

Task 3.12 Adipose clip remaining steelhead production to comply with state management criteria and allow positive identification for wild/hatchery ratios. (see Task 3.33).

Task 3.13 Compile sample data from Columbia River and Snake River adult sampling stations to determine regional return rates for marked groups.(See Sub-obj. 3.3).

SUB-OBJ. 3.2 Document hatchery rack returns of marked production and broodstock hatchery releases. Marked returns will be used as part of totals for quantifying percent return from release.

Task 3.21 Use rack returns from hatchery records for Lyons Ferry, Tucannon, and Wallowa Hatcheries to compute adult return rates to hatcheries.

Task 3.22 Compare adult returns, to Lyons Ferry, from Wells and Wallowa broodstock releases made in 1983 through 1985.

Task 3.23 Determine timing of returns from Lyons Ferry releases by examining returns of branded, CWT adults to adult collection facilities at McNary and Lower Granite Dams, and to Lyons Ferry and

Wallowa hatcheries.

Task 3.24 Document length and sex of returning adults. Collect scales as in Task 3.35.

Task 3.25 Assist with spawning of adults and collection of samples to ensure control of infectious viral diseases. Samples will be analyzed by WDF disease laboratories in Washington.

SUB-OBJ. 3.3 Estimate sport and commercial harvest of returning adults.

Task 3.31 Design and conduct creel surveys for the Snake, Grande Ronde and Tucannon rivers to estimate angler effort and catch of marked fish.

Task 3.32 Obtain sport harvest of adult steelhead on the Tucannon river using steelhead punch card estimates as a check against creel survey estimates. Regular creel checks would be required to determine wild/hatchery ratios in the catch.

Task 3.33 Obtain estimates of down-river (Columbia and other incidental tributary) sport and commercial harvest through existing sampling conducted under other programs.

Task 3.34 Obtain estimates of adult mortality rates through lower river hydroelectric projects.

Task 3.35 Collect and read scale samples to determine length/ age relationships and duration of fresh water and ocean residence.

SUB-OBJ. 3.4 Estimate spawning escapement.

Task 3.41 Operate Tucannon Hatchery wier and trap to enumerate up-river escapement.

Task 3.42 Use coded-wire tag return rates at Lower Granite Dam to estimate mean adult escapement for sample groups. Subtract harvest estimates for the mid-Snake and Grande Ronde Rivers (Task 3.31) to obtain net adult escapement to point of release. (Note: estimates of escapement to Wallowa Hatchery through ODFW marking programs may be available as a check for this estimate.)

Task 3.43 Install and Operate a temporary adult counting station or trap on main Asotin Creek (and/or tributaries) and Cottonwood Creek to enumerate adult escapement.

Task 3.44 Walk study sections established on tributary streams beginning March 1, to identify: (a) initial date of spawning; (b) density of spawners, expressed as redds/mile; (c) differences in spawning areas; (d) completion of spawning. Number of times walked and dates will be dependent upon climatic and water clarity conditions. Streams include:

Charlie Cr.	L.Tucannon R.
S. Fk. Asotin	Cummings Cr.
Robinson Fk.	Panjab. Cr.
Blue Cr.	Wolf Fk.

OBJECTIVE 4: ESTIMATE JUVENILE AGE CLASS DENSITIES ON SELECTED STREAMS AS AN INDICATOR OF ANY INCREASED SPAWNING ESCAPEMENT AND SUCCESS.

Approach: Electroshocking/snorkling for juvenile age-class densities are an indicator of increased spawning escapement and/or spawning success. Data collected will allow WDG to properly manage existing native stocks in concert with expected hatchery returns. Management recommendations from these data will allow protection for native stocks while encouraging harvest of hatchery stocks.

Task 4.1 Utilize representative sample sections in juvenile rearing areas previously sampled, or new areas in streams not already sampled, that provide year-round habitat for steelhead.

Task 4.2 Establish two or three 30-40 meter sections to be electroshocked in the fall for 0, 1, and 2+ steelhead on each river. Snorkling sections will be 50-100 meters in length.

Task 4.3 Use standard backpack electroshocker and block nets at upper and lower end of section to prevent recruitment or escape. A two or three pass removal method for population calculation will be used. Fish would be kept live in buckets until shocking was complete, then weighed (gms) and measured (mm). Age classes would then be established by length frequencies.

Task 4.4 Compute population estimates and confidence intervals as described by Zippin (1958). These data will serve as an indirect measure of increased spawning escapement from smolt plants when compared to baseline date collected between 1981-85. These will also be useful in monitoring any long-term affect on wild spawner success because of gene dilution.

Task 4.5 Utilize snorkling procedures developed by Idaho and Washington to estimate juvenile population densities on large stream sections.

Task 4.6 The relation between average parr density and smolt production (survival rates) will be estimated for streams containing smolt traps. This may allow us to predict smolt production for streams from our parr density estimates. This relationship would allow greater understanding of management alternatives or changes in regulations.

OBJECTIVE 5: WRITE ANNUAL REPORT OF ALL ACTIVITIES LISTED IN OBJECTIVES 1-4 AND EVALUATE EFFECTIVENESS OF APPROACH AND TASKS FOR SATISFYING ALL OBJECTIVES.

Approach: Timely analysis of data is critical to the continuity and efficacy of the evaluation program. Completion of an annual report should precede the budgeting process for subsequent years. Results should guide changes that may be necessary in programs and their budgets. The current contracting period does not allow enough time for completion since peak work times fall in the first 90 days after a contract year has ended. Analysis and report writing should be done between important field data collection periods.

Task 5.1 Complete all tasks listed in Objectives 1-4 according to the following schedule:

Task	Activity	Time Period
1.11	Growth rates	Monthly
1.12	Disease history	May
1.13	Pond and raceway mortality	Monthly
1.14	Condition factors	Monthly
1.15	Yearly production (pounds)	May, August
1.16	Document special requirements	May-April
1.22	Descaling/fitness sampling	April-May
1.23	Tag/brand loss sampling	March/May
2.11	CWT tagging	February
2.14	Smolt migration (regional compilation)	May-September
2.22	Chemical imprinting	April
2.31	Spring electroshocking	April-May
2.32	Smolt trapping	March-June
3.12	Adipose clipping	August-Sept.
3.13	Tag recovery (regional compilation)	Sept-December
3.21	Hatchery tag recoveries	February-May
3.23	Run timing	July-May
3.24	Adult sampling in hatchery	February-May
3.25	Viral sampling and spawning	February-May
3.31	Creel surveys	Sept-March
3.32	Punchcard catch estimates	June-July
3.33	Down-river catch estimates	June-March
3.34	Adult mortality at dams	June-March
3.35	Scale collection and analysis(see 3.31)	

3.41	Operate Tucannon adult trap, and other stream traps.(task 3.43)	February-May
3.42	Brand recovery at Dams(summaries)	June
3.44	Spawning ground counts	April-May
4.1-4.3	Electroshocking for fall populations	August-Sept.
4.4	Compute populations	January-March
4.5	Snorkling transects	August-Sept.

Task 5.2 Analyze all data collected in Objectives 1-4 and prepare an annual report discussing results and recommendations for subsequent years. State whether compensation goals have been met. The report would be completed under the following schedule:

Task	Description	Time
5.21	Assemble results from yearly tasks	March
5.22	Designate responsibility for report sections	March
5.23	Draft Report for inter-project review	October 1
5.24	Draft Report for agency review	November 1
5.25	Final Report to Printer	December 15

Appendix B. Description of Facilities.

Facilities constructed under the LSRCP program were designed to achieve anticipated results. Constant evaluation of the performance of the facilities and the fish produced will be necessary to insure program goals are being met. Changes in the program or facility will be made to assure long term success. The facilities and study area are scattered over a five county area and involve portions of six drainage systems.

Lyons Ferry Hatchery

Production facilities include egg and starter troughs for 1.15 million steelhead. One hundred thousand (100,000) rainbow eggs from outside sources will also be hatched annually. Nineteen intermediate concrete raceways and three rearing ponds (80'x 1150') with a surface area of 2.1 acres are used for advanced rearing. The hatchery and rearing ponds are designed for single pass water flow. Water is provided by eight deep wells capable of producing 103 cfs constant flow. Water temperature is constant, around 52 degrees Fahrenheit. A fish ladder, enclosed spawning building and concrete release structure below the rearing ponds complete the WDG facility.

Design capacity was for 116,400 pounds of steelhead smolts at 8 fish/lb, and 45,000 pounds of legal rainbow trout at 3 fish/lb.

Tucannon Hatchery

The Tucannon Hatchery recently underwent complete renovation by the Corps of Engineers as part of Washingtons' LSRCP program. The hatchery now has an expanded spring collection network to provide sediment free, constant temperature water for egg hatching and raceway rearing. Six round ponds and four large raceways can be used for rearing , and adult steelhead and salmon holding. One large earthen pond will be used for advanced rainbow rearing. One deep well provides 56 degree Fahrenheit water for tempering very cold river water during winter.

The design capacity was for 41,000 pounds of legal rainbow annually, and for adult chinook holding and spawning. The long-range WDF spring chinook program will be trapped, spawned and partially reared at Tucannon Hachery.

Curl Lake Conditioning Pond

This earthen structure is for late season rearing/conditioning of steelhead smolts for the Tucannon River. Curl Lake C.P. is located five miles up river from Tucannon Hatchery and will be operated by Tucannon personnel. Design capacity is for 160,000 smolts, and water is supplied by a diversion pipeline from the Tucannon River. Curl lake was first used in 1985 and is planted with legal rainbow trout after all smolts have migrated.

Cottonwood Creek Conditioning Pond

This structure is located approximately eight miles north of the Oregon border on the Grande Ronde River. The facility consists of one large earthen-rock rearing pond, water diversion system, feed storage building, and temporary living quarters to be occupied three months each year. Water is supplied by Cottonwood Creek, a tributary to the Grande Ronde River, and flows range between 2-6 cfs. during the spring use period. The pond is dry the remainder of the year. Design capacity is for 250,000 steelhead smolts to be reared during March and April for release into the Grande Ronde in May. Temporary personnel oversee care and feeding. This facility was first used in 1985.

Dayton Conditioning Pond

Dayton C.P. is located on the Touchet River within the City of Dayton, construction was completed in 1986. The facility consists of one small asphalt lined earthen-rock rearing pond with concrete bottom drain channel, feed storage building, and temporary living quarters. Water is provided by a concrete diversion and pipeline from the Touchet River. Release of fish is accomplished through a pipeline exiting into the river immediately below the pond. Design capacity is for 150,000 steelhead smolts to be reared in March and April for release into the Touchet River in May. The pond was used for the first time during the spring of 1987.

Appendix C. Stream temperatures taken at trapping sites during the spring of 1986 and spring of 1987.

Charlie Creek 1987

date	time	temp. (o F)	max (o F)	min (o F)
2-8	1630	42		
2-9	1115	39		
2-10	930	42		
2-12	925	39		
2-14	1415	43		
2-17	915	42	54	39
2-18	815	35	44	35
2-19	1000	41	44	33
2-21	900	38	45	36
2-22	1115	42	44	37
2-23	1130	41	42	38
2-25	900	35	43	34
2-27	1400	40	42	33
3-1	1030	43	44	38
3-3	845	48	48	42
3-4	930	46	51	43
3-5	1700	53	54	44
3-6	930	47	53	46
3-7	1100	46	51	42
3-8	840	42	50	39
3-9	1545	50	50	40
3-10	1100	46	50	43
3-11	930	46	50	42
3-12	1000	47	52	44
3-13	1440	50	50	43
3-14	830	44	52	42
3-15	1200	47	50	40
3-17	1130	48	50	41
3-18	1400	48	50	42
3-19	1230	44	49	39
3-20	900	43	47	40
3-21	1300	49	49	37
3-22	1230	48	50	38
3-23	1000	44	51	38
3-24		53	53	39
3-25	1045	48	54	36
3-26	1000	42	52	40
3-27	845	42	50	39
3-28	745	40	49	39
3-29	1015	40	48	33
3-30	1015	42	50	34
3-31	1045	48	54	39
4-1	1300	56	56	40
4-2	1100	50	50	42
4-3	1200	55	58	44
4-4	1600	54	58	44
4-5	1200	52	54	48
4-6	1030	50	56	48

Charlie Creek 1986

date	time	temp. (o F)	max (o F)	min (o F)
3-31	1500	52		
4-1	1230	48		
4-2	1500	51		
4-3	1500	54		
4-4	1230	52		
4-5	1600	55		
4-6	1830	54	58	42
4-7	1100	52	54	42
4-8	1130	55	59	45
4-9	1100	53	60	47
4-10	1000	50	60	44
4-12	902	46	54	40
4-14	900	45	52	41
4-15	815	47	54	44
4-16	800	48	53	44
4-17	730	45	52	53
4-18	915	45	53	42
4-19	900	49	55	41
4-20	815	50	56	45
4-21	900	53	63	49
4-22	830	54	65	52
4-23	900	47	56	42
4-24	820	43	52	40
4-25	845	46	55	43
4-26	830	47	55	41
4-27	845	48	55	44
4-28	850	46	57	45
4-29	1015	46	54	43
5-1	1030	52	56	40
5-2	1030	54	59	48
5-4	1000	50	63	47
5-5	1035	50	57	43
5-6	1030	46	56	46
5-8	908	50	56	40
5-9	800	49	60	47
5-10	830	49	57	47
5-12	930	49	53	43
5-13	1130	52	56	48
5-14	900	47	55	43
5-15	900	48	57	44
5-16	930	47	53	42
5-17	845	49	62	46
5-18	1215	60	62	48
5-19	915	55	66	51
5-20	1030	56	67	54
5-21	900	51	57	49
5-22	945	49	53	44
5-23	945	49	56	44

Asotin Ck. Smolt trap 1986

date	time	temp. (o F)	max (o F)	min (o F)
4-7	1001	48	56	44
4-8	1000		58	46
4-9	1000	50	57	48
4-10	800	48	58	45
4-11	702	42	52	41
4-12	802	46	51	40
4-15	700	46	52	45
4-16	630	45	52	45
4-17	630	45	51	44
4-18	700	43	53	43
4-19	700	45	53	43
4-20	700	48	55	44
4-21	700	49	60	48
4-22	700	50	63	48
4-23	700	45	52	45
4-24	715	42	44	42
4-25	700	46	54	42
4-26	715	43	54	43
4-27	700	46	53	44
4-28	730	46	55	45
4-29	730	45	55	45
5-6	1030	46	60	41
5-8	1130	52	54	46
5-10	950	49	58	47
5-12	1030	50	54	44
5-13	945	50	55	49
5-14	730	45	53	43
5-15	730	47	55	45
5-16	800	45	54	44
5-17	745	48	59	44
5-18	745	50	62	47
5-19	730	51	62	50
5-20	815	52	62	50
5-21	730	50	54	50
5-22	745	46	50	45
5-23	745	46	53	46
5-24	830	50	57	45
5-27	930	57	67	50
5-28	1030	59	67	55
5-29	900	58	68	56
5-30	900	59	69	57
6-3	830	62	71	57
6-4	800	60	67	59
6-5	845	60	69	58
6-6	845	57	64	56
6-7	900	57	67	57
6-8	900	56	60	55
6-9	1017	58	60	54

S.F. Asotin Ck. 1987.

date	time	temp. (o F)	max (o F)	min (o F)
2-12	930	40		
2-18	745	34	42	34
2-19	930	37	43	35
2-21	830	34	42	34
2-22	1045	38	43	35
2-23	1100	40	45	38
2-25	830	32	41	32
2-27	1330	37	40	32
3-1	1000	39	41	35
3-3	815	42	45	35
3-4	830	40	45	39
3-5	1630	48	48	41
3-6	1030	42	48	42
3-7	1008	43	44	40
3-8	815	41	46	39
3-9	1520	47	47	40
3-10	930	42	47	41
3-11	900	43	47	41
3-12	930	44	48	43
3-13	1345	48	48	43
3-14	745	42	48	42
3-15	1125	44	48	40
3-17	1345	48	48	42
3-18	1545	45	43	41
3-19	1100	43	46	38
3-20	1000	43	44	40
3-21	1200	45	47	37
3-22	1200	47	50	37
3-23	900	40	50	38
3-24		50	51	40
3-25	1230	49	51	39
3-26	930	40	51	39
3-27	800	40	51	38
3-28	700	40	51	38
3-29	900	36	47	33
3-30	900	38	48	35
3-31	930	42	52	38
4-1	1345	55	55	40
4-2	1500	56	56	43
4-3	1030	48	56	42
4-4	1300	50	56	44
4-6	1141	49	52	42
4-7	1500	56	62	45
4-8	1700	53	69	26
4-9	1119	46	64	33
4-10	1440	53	56	42
4-11	1212	48	54	42
4-14	1015	47	55	44

Appendix C. (Cont.)

Charlie Creek 1987

date	time	temp. (o F)	max (o F)	min (o F)
4-7	830	50	60	49
4-8	1730	53	61	45
4-9	930	45	54	40
4-9	1500	54	54	44
4-10	1320	54	56	42
4-11	1050	48	56	41
4-12	1030	46	52	40
4-13	1030	46	52	39
4-14	1115	51	56	45
4-15	1000	50	57	47
4-16	1000	50	57	47
4-17	845	50	57	49
4-18	1030	47	56	42
4-19	1100	48	53	40
4-21	1015	50	56	43
4-22	1100	57	60	49
4-23	1015	56	62	52
4-24	1130	57	60	50
4-25	1430	61	61	49
4-26	915	50	61	47
4-27	715	64	66	52
4-28	1030	58	65	53
4-29	1100	61	64	55
4-30	1035	59	68	55
5-1	930	51	62	50
5-2	1100	50	55	46
5-3	1215	55	55	47
5-4	930	53	58	49
5-5	1000	56	65	53
5-6	1100	60	68	54
5-7	1100	60	69	53
5-8	1245	66	70	55
5-9	1300	68	70	58
5-10	1230	63	68	53
5-11	1430	67	68	53
5-13	700	54	69	54
5-15	1130	62	65	42
5-18	1045	56	66	51
5-21	1300	57	64	46
5-24	1300	58	63	48
5-27	930	54	63	53
5-29	830	51	60	50

Charlie Creek 1986

date	time	temp. (o F)	max (o F)	min (o F)
5-24	1100	57	61	47
5-27	1000	62	73	51
5-28	1115	70	72	58
5-30	1010	66	76	56
6-1	1115	67	83	58
6-3	1025	64	80	60
6-4	915	63	70	60
6-5	945	62	70	61
6-6	945	59	67	53
6-7	1000	57	68	54
6-8	1230	58	60	52
6-9	830	55	60	51
6-12	915	63	72	59
6-15	900	56	72	52
6-19	1100	60	73	49
6-25	1125	66	74	50

Asotin Ck. Smolt trap 1986

date	time	temp. (o F)	max (o F)	min (o F)

S.F. Asotin Ck. 1987.

date	time	temp. (o F)	max (o F)	min (o F)
4-15	915	47	59	46
4-16	1048	50	54	46
4-20	800	40	55	39
4-29	1030	58		
4-30	1000	56	56	44
5-1	1039	53	53	50
5-4	1015	53	53	48
5-5	1330	65	65	52
5-6	1015	57	62	52
5-7	1030	58	62	53
5-8	1341	55	67	
5-10	1145	63	65	55
5-11	1400	67	67	62
5-15	1220	62	68	44
5-18	1230	63	63	53

Appendix D. Trapping data collection form for 1987.

1987 ASOTIN CREEK TRAPPING DATA

TRIBUTARY NAME ______________________________

DATE	TIME CHECKED	WATER TEMP (F) pres	max	min	WATER CLARITY (g,f,p)	DEBRIS LOAD (H M L)	FLOW (staff,cfs)	** FISH SPEC	LENG. (cm)	WT (g)	SEX	ORIG (H,W,?)	FISH DATA SCALE SAMP (Y,N)	PRIOR MARKS (AD,Rop)	NEW MARKS	FIN COND	SMOLT INDEX	** TRAP (U,D)	*** COMMENTS (fish cond,probs.DESCALED?) ***

NEW MARKS: installed TODAY
ADULTS-- R. operc.-Up
L. operc.-D
JUV.--- UP. caudal-Up

SMOLT INDEX: PARR, TRANS, SMOLT, RESIDENT (>135 mm), RIPE

Appendix E. Smolt Trapping field data Form.

MAIN ASOTIN CREEK INCLINE TRAP 1986
(Blankenship's property - 0.25 mile below Charlie Creek)

FISH DATA

DATE	TIME CHECKED	WATER TEMP (F) pres	max	min	WATER CLARITY (g,f,p)	DEBRIS LOAD (H M L)	FLOW (staff,cfs)	** FISH SPEC	LENGTH (cm)	WT (g)	SEX	ORIG. (H,W,?)	SCALE SAMP	DESCALE (1 - 0)	MARKS PRES	SPAWN 1/CLIP	FIN COND	** SMOLT INDEX	COMMENTS (fish cond,problems,etc)

Appendix F.

Spawning and sorting summaries for LFH, 1986-87.

	1986	1987
Steelhead Sorted/trapped	1431/1556[A]	1213
% Female (n)	78.2% (259)[B]	63.2% (744)[C]
% Male (n)	21.7% (72)	36.7% (433)[C]
% Hatchery (n)	82.7% (274)	91.5% (1110)
% Wild (n)	17.2% (57)	8.5% (103)
Steelhead Spawned		
No. Females	187	250
No. Males	68[D]	300[D]
% Hatchery [E]	65.7%	88.4%
% Wild	34.2%	11.6%

[A] 125 fish were sent directly to the river without examination.
[B] Only one group of 331 fish were sampled for sex.
[C] Sample size = 1177. 36 fish had undetermined sex.
[D] In 1986, all males used in spawning except 4 pre-spawning morts. In 1987, badly injured fish and prespawning morts were not used of spawning, this is an estimate of actual numbers of males used.
[E] These figures are for females only and are based on dorsal fin examination.

Appendix G. Brand Recoveries from the Trap at LFH During the 1986 Run year.

Brand	No. of Fish	Fin Clip	% Return *
RA-IJ-1	1	LV [A]	.003
RA-IV-3	2	LV	.007
RA-H-1	77	LV	.285
RA-H-2	47	LV	.176
LA-S-2	1	LV	.003
RA-S-2	1	LV	.003
RA-17-1	2	LV	.005
RA-17-3	9	LV	.023
RA-T-3	3	LV	unknown
RD-H-1 [B]	16	--	.074
RD-H-2	25	--	.102
RD-IT-1	17	--	.035
LA-7S-1	6	AD	.150
LA-7S-3	6	AD	.155
RA-7S-1	21	AD	.500
RA-7S-3	4	AD	.103
RD-7S-1	1	AD	.025
RA-7N-1	19	AD	.094
RA-7N-3	16	AD	.082
MISREAD	2	AD	unknown

* Represents smolt to adult return.
[A] All LV clipped fish contained a cwt.
[B] Fish were branded for identification only, no cwt could be collected to confirm brand reading.

Appendix H

Scale Age Summary for Fish Spawned at LFH, 1986-87

Scale Age		1986 n	1986 % of total	1986 Mean (cm)[A] Length (SD)	1987 n	1987 % of total	1987 Mean (cm) Length (SD)
1.1	H*	57	37.7	62.3 (3.2)	113[C]	81.3	59.3 (3.7)
	W	42	27.8	62.4 (2.6)	3[D]	2.2	60,58,63
1.2	H	26	17.2	72.8 (3.7)	11[E]	7.9	71.7 (4.5)
	W	5	3.3	68.1 (7.0)	7[F]	5.0	74.2 (4.1)
2.1	H	2	1.3	67,71			
	W	11	7.3	61.0 (5.3)			
2.2	H						
	W	1	0.6	73			
R.1	H	2	1.3	62,65	2[G]	1.4	58,62
	W	1	0.6	62			
R.2	H	1	0.6	71	2[E]	1.4	72,75
	W	3	1.9	73,75,75	1[E]	0.7	79

[A] Only females were scale sampled in 1986.
[B] Actual fish lengths are given where n ≤ 3.
[C] 75 females, 38 males.
[D] 2 females, 1 male.
[E] All female.
[F] 6 females, 1 male.
[G] 1 female, 1 male.
* H or W indicate origin based on dorsal fin examination to assess accuracy of fin condition for determining wild/hatchery origin.

Appendix I. Tags recovered from adult steelhead captured at the intake screen for the Cottonwood Conditioning Pond, spring 1987.

Date Captured	Length (cm)	Sex	Origin	Fin clips	Marks	Snout taken	cwt
3/30	58	F	H	ADLV		Y	62-16-28 ^
3/31	59	F	H	ADLV		Y	62-16-28 ^
4/06	59.7	M	H	AD		Y	62-16-27
4/06	57.1	F	H	AD		Y	no cwt
4/08	57	M	H	AD (LV?)		Y	62-16-28
4/08	54.5	F	H	ADLV		Y	62-16-28
4/08	56	F	H	ADLV		Y	62-16-27
4/09	57	M	H	ADLV		Y	62-16-27
4/09	55.5	F	H	ADLV		Y	62-16-28
4/09	53.5	F	H	ADLV		Y	62-16-27
4/09	54	M	H	ADLV		Y	62-16-28
4/10	56.5	M	H	ADLV		Y	62-16-28
4/11	60.5	M	H	ADLV		Y	62-16-27
4/12	58	M	H	ADLV		Y	62-16-27
4/12	56.5	F	H	ADLV		Y	no cwt
4/12	59.5	F	H	ADLV		Y	62-16-27
4/12	53	F	H	ADLV		Y	62-16-27
4/12	61	F	H	ADLV		Y	62-16-28
4/12	57	F	H	ADLV		Y	62-16-28
4/13	58.4	F	H	ADLV		Y	62-16-28 ^
4/15	59.2	M	H	AD		Y	62-16-28 ^
4/15	60	M	H	ADLV		Y	62-16-28 ^
4/16	58.4	M	H	ADLV	G18321	Y	62-16-28 *
4/28	58	F	H	ADLV		Y	62-16-27
3/30	52	M	H	AD	G26241	N	62-16-28
3/30	58	M	H	LV	G27901	N	62-16-27
4/02	59	M	H	ADLV	G18307	N	62-16-27
4/02	54	F	H	AD	G27956	N	62-16-28
4/03	59	M	H	ADLV	G18151	N	62-16-28
4/09		M	H	ADLV	G18298	N	62-16-28
4/09		F	H	AD	G26774	N	62-16-27
4/09		F	H	ADLV	G18297	N	62-16-27
4/09		F	H	ADLV	G26317	N	62-16-27
4/09		F	H	ADLV	G26279	N	62-16-27
4/09		F	H	ADLV	G26368	N	62-16-28
4/09		F	H	ADLV	G26856	N	62-16-28
4/10		F	H	ADLV	G18526	N	62-16-28
4/10		M	H	ADLV	G26200	N	62-16-27
4/10		F	H	ADLV	G27928	N	62-16-28
4/10		F	H	ADLV	G27826	N	62-16-28
4/10	57.5	F	H	ADLV	G26631	N	62-16-28
4/10	56	F	H	ADLV	G27907	N	62-16-28
4/11	62	M	H	ADLV	G18363	N	62-16-28
4/12	55.5	F	H	ADLV	G26186	N	62-26-27
4/13	56.2	M	H	ADLV	G18567	N	62-16-28
4/15	57	M	H	ADLV	G26558	N	62-16-28
4/15	58	M	H	ADLV	G27886	N	62-16-27
4/16	58.4	M	H	ADLV	G18321	Y	62-16-28 *
4/17	54	M	H	ADLV	GR015	N	62-16-27
4/17	53	M	H	ADLV	G26657	N	62-16-28

Appendix I. (Cont.).

Date Captured	Length (cm)	Sex	Origin	Fin clips	Marks	Snout taken	cwt
4/12		F	H	ADLV	G26435	N	62-16-27 [a]
4/12		F	H	ADLV	RA-17-1		62-16-27
4/12		F	H	ADLV	RA-17-3		62-16-28
4/12		F	H	ADLV	RA-17-1		62-16-27
4/12		M	H	ADLV	RA-17-1		62-16-27
4/12		F	H	ADLV	RA-17-1		62-16-27
4/16	55	F	H	ADLV	ID03245B [c]		
4/07	56.5	F	H	ADLV	ID01785R [c]		

A These 5 coded-wire tags can't be positively matched to the correct fish.

* Duplicate because snout was taken and cwt was read in addition to the jaw tag.

B RA-17-1 brand was read on a fish that had lost a jaw tag, plus a jaw tag was found on the stream bottom from a RA-17-1 branded fish. Therefore, we matched these as the same fish.

C IDFG floy anchor tags. B or R at the right means blue or red tag.

Appendix J. Discharge measurements from southeast Washington streams, 1986 and 1987.

Stream	Date	Location *	Discharge (cfs)
Rattlesnake Ck.	8-11-86	RA-2 site	0.2
Cougar Ck.	8-13-86	CO-1 site	0.1
Cottonwood Ck.	8-13-86	Near intake dam	1.0
Cottonwood Ck.	3-21-86	Above intake dam 100 ft	12.3
Cottonwood Ck.	3-21-86	below intake dam	4.7
Cottonwood Ck.	4-13-86	above intake dam 100 ft	5.8
Wenatchee Ck.	8-14-86	WE-1 site	11.5
Tucannon R.	9-16-86	above outlet to Curl Lake	48.7
Panjab Ck.	8-5 -86	PAN-1 site	2.9
Panjab Ck.	8-6 -86	PAN-2 site	6.7
Pataha Ck.	8-4 -86	PA-3 site	1.1
Crooked Ck.	9-5 -86	400ft. bel. First Ck.	11.4
First Ck.	9-5 -86	At USFS cabin	5.7
N.F. Wenaha R.	9-3 -86	300 yds. abv. mouth	53.4
S.F. Wenaha R.	9-3 -86	400 yds. abv. mouth	50.7
Charlie Ck.	4-02-86	0.45 miles abv. gate	13.9
Charlie Ck.	4-21-86	0.45 miles abv. gate	9.2
Charlie Ck.	4-29-86	0.45 miles abv. gate	8.9
Charlie Ck.	2-12-87	0.45 miles abv. gate	6.9
Charlie Ck.	3-07-87	0.45 miles abv. gate	11.5
Charlie Ck.	4-02-87	0.45 miles abv. gate	8.8
Charlie Ck.	4-07-87	0.45 miles abv. gate	9.4
Charlie Ck.	5-08-87	0.45 miles abv. gate	7.7
S.F. Asotin Ck.	4-21-86	Hodson's meadow	11.3
S.F. Asotin Ck.	8-19-86	SA-C3 site	2.4
S.F. Asotin Ck.	2-12-87	0.3 miles above Forks Br.	5.9
S.F. Asotin Ck.	3-07-87	0.3 miles above Forks Br.	24.2
S.F. Asotin Ck.	4-06-87	0.3 miles above Forks Br.	9.2
S.F. Asotin Ck.	5-04-87	0.3 miles above Forks Br.	10.7
S.F. Asotin Ck.	5-18-87	0.3 miles above Forks Br.	4.1
N.F. Asotin Ck.	4-09-87	NA3-84 instream site	52.2
N.F. Asotin Ck.	5-05-87	NA3-84 instream site	78.6
Asotin Creek	4-03-86	Blankenships - at smolt trap	90.6
Asotin Creek	4-22-86	100 yds above smolt trap	105.2
Asotin Creek	4/29/86	100 yds above smolt trap	76.1

* For location of electrofishing sites see Appendix .

Appendix K.

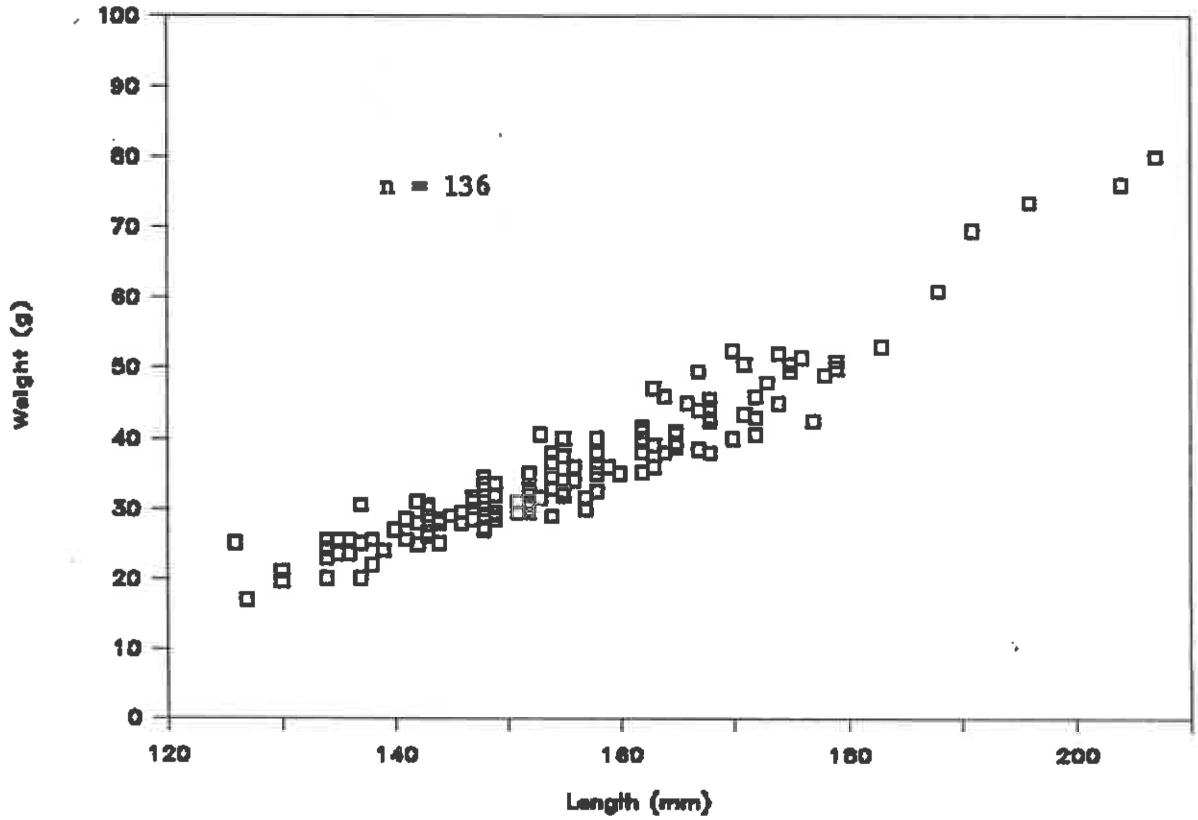
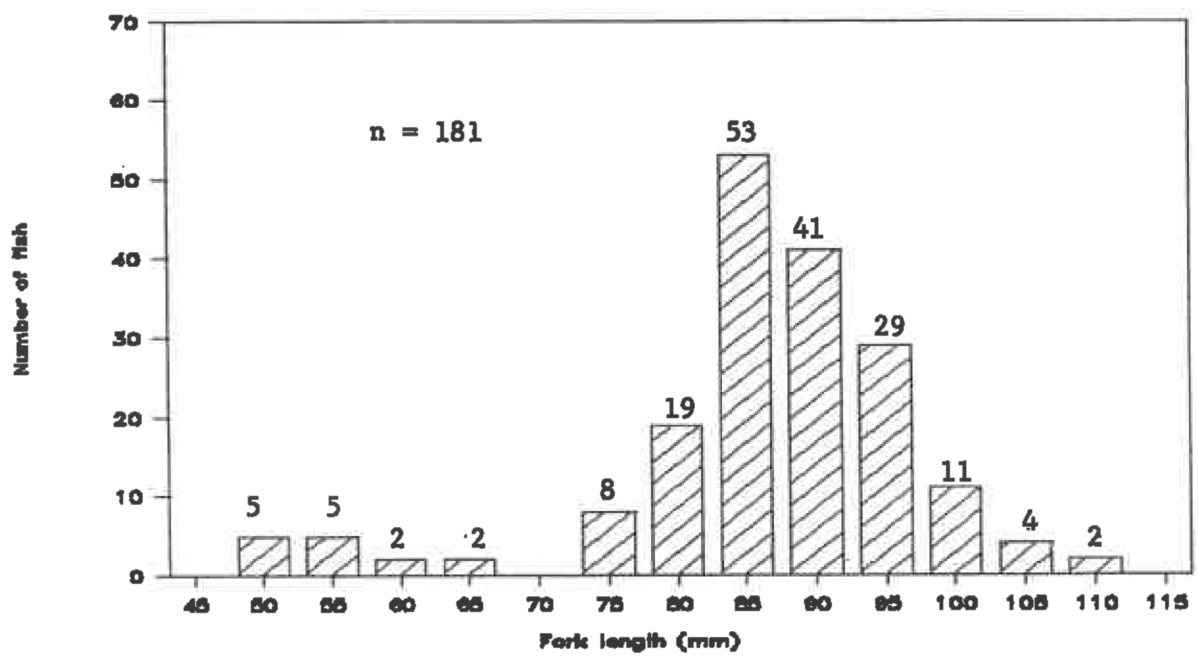


Figure 1. Length/weight relation for smolts and transitional migrants captured at the Charlie Creek weir, spring 1986.

Appendix L.



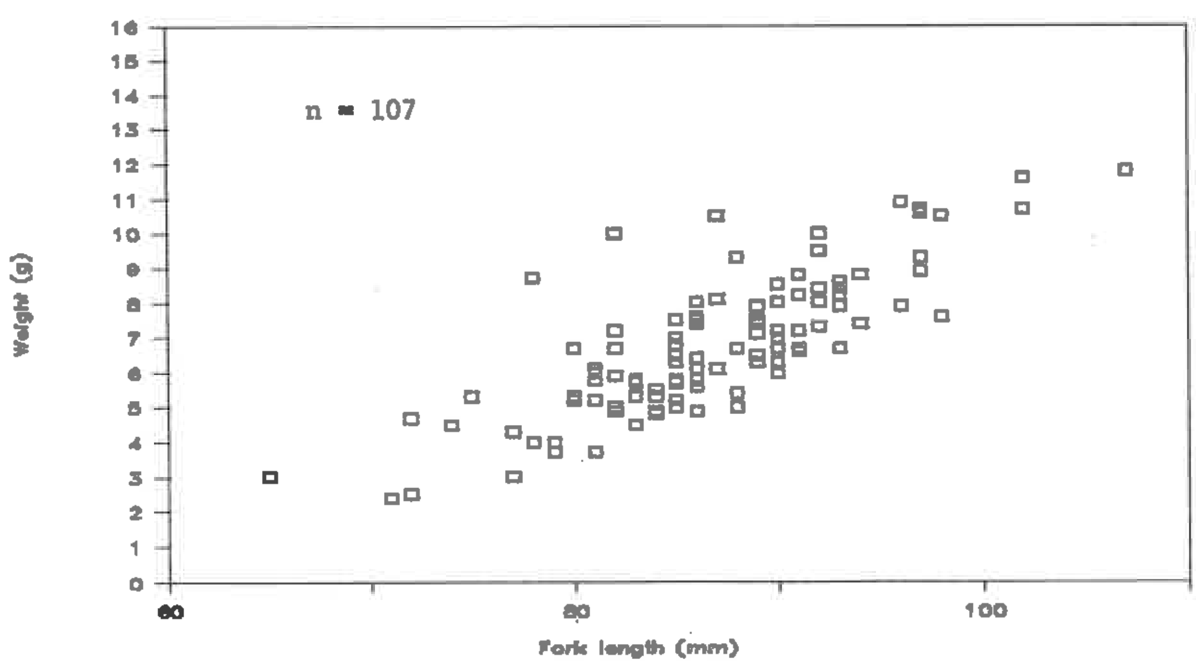


Figure 1. Length-frequency and length-weight distributions for chinook salmon out-migrants captured in a floating inclined plane trap operated by WDW in Asotin Creek, spring 1986.

Appendix M. Relative abundance of other species captured at the floating inclined plane trap in Asotin Creek, spring 1986.

Dace	Sucker	Sculpin	Bull trout	Other
732 [A]	55 [B]	21	1 [C]	11 [D]

A Only 5 Long-nosed dace identified as to species, others may have been Long-nosed or speckled dace.

B Mostly juveniles, unidentified species.

C 16.2 cm, captured in June.

D 6 toads and 5 salamanders.

Appendix N. A nonparametric Tukey's Multiple Range Test for comparisons of mean lengths for various age classes of juvenile steelhead captured at the Cottonwood Conditioning Pond intake screen, spring 1986 (Zar 1984, pg. 189).

$k = 4$, error df = 61,

$s^2 = 3.5664$ from ANOVA error MS

$SE = \sqrt{(s^2/2)(1/n_A + 1/n_B)}$

for uneven sample sizes

$H_o = \bar{X}_A = \bar{X}_B = \bar{X}_C = \bar{X}_D$

$q = (\bar{X}_A - \bar{X}_B) / SE$

rank of means	1	2	3	4
Scale age	2+	3+	hatchery	1 +
means lengths	15.53	18.93	19.04	19.64
n	29	23	8	5

	Comparison B vs A	Difference $\bar{X}_A - \bar{X}_B$	SE	q	Table q	Signif. level	Conclus.
**	4 vs 1	19.64 - 15.53	0.6466	6.356	5.65	0.001	reject H_o
	4 vs 2	19.64 - 18.93	0.6589	1.077	3.31	0.100	accept
	4 vs 3	19.64 - 19.04	0.7613	0.792	3.31	0.100	accept
*	3 vs 1	19.04 - 15.53	0.5333	4.607	4.59	0.010	reject H_o
	3 vs 2	19.04 - 18.93	0.5481	0.195	3.31	0.100	accept
**	2 vs 1	18.93 - 15.53	0.3728	9.120	5.65	0.001	reject H_o

* significant difference $p < 0.01$.

** significant difference $p < 0.001$.

Appendix O. Description of sites electrofished.

Site *	Stream	Date Surveyed	Site location	Reference Pt. Location.
CR1	Crooked Creek	9-5-86	400 ft. below First Creek	------
CR2	Crooked Creek	9-5-86	0.25 mi. below First Creek	------
SFW	S. Fork Wenaha	9-3-86	400 yds. above mouth	------
RA1	Rattlesnake Ck	8-11-86	0.15 mi above mouth & 0.1 mi above access bridge	orange flag near road at 0+00 and at upper net
RA2	Rattlesnake Ck	8-11-86	0.1 mi. downstream from hwy crossing, 1.5 mi. above G. Ronde R.	orange flag at site
------				
RA3	Rattlesnake Ck	8-13-86	above cattle chute and locked gate ,below 2nd road crossing of creek on East Fork,0.5 mi below RA4.	flag at upper net
RA4	Rattlesnake Ck	8-13-86	above 3rd crossing of the E. Fork, above cattle chute & locked gate, 0.8 miles above 1st crossing.	flag at lower net ------
PAN1	Panjab Creek	8-5-86	trail $3127, at small secondary trail on right	------
PAN2	Panjab Creek	8-6-86	0.9 miles upstream from Camp 13 bridge	section marker on tree near road
PAN3	Panjab Creek	8-7-86	1.5 miles upstream from Camp 13 bridge	------
CO1	Cougar Creek	8-13-86	just above mouth about 0.1 mi. (above road)	orange flag at 0+00
CO2	Cougar Creek	8-12-86	20 ft below cattle guard, 0.85 mi. above G. Rhonde road	orange flag at 0+00
WE1	Wenatchee Creek	8-14-86	0.9 mi. up from gate (near mouth)	flag at 1+06 lower net
SAC3	S. Fork Asotin	8-19-86	0.8 mi. up from Forks bridge	flag at upper net
SAC5	S. Fork Asotin	8-20-86	0.2 mi below upper bridge at barn	0+3 left bank
NA2	N. Fork Asotin	7-28-86	NA2 1985 site	------
NA3	N. Fork Asotin	7-28-86 +	------	------
NA4	N. Fork Asotin	7-28-86 +	------	------
NA5	N. Fork Asotin	7-28-86 +	------	------
NA6	N. Fork Asotin	7-28-86 +	------	------
NA7	N. Fork Asotin	7-29-86 +	------	------
NA8	N. Fork Asotin	7-29-86 +	------	------
NA9	N. Fork Asotin	7-29-86 +	------	------
NAS2	N. Fork Asotin	7-29-86 +	side channel	------
NAS3	N. Fork Asotin	7-29-86 +	side channel	------
PA2	Pataha Creek	7-17-86	2.8 mi. bel. PA1 & 0.5 miles above Columbia Center	------
PA1	Pataha Creek	7-17-86	above Col. Center at USFS line below Pataha camp	elk fence crossing stream
PA3	Pataha Creek	8-4-86	1 mi above USFS boundary & 150 yds above road crossing	1+38 is 136 yds above road culvert

* CR = Crooked Fork, SFW = S. Fork Wenaha, RA = Rattlesnake Ck., PAN = Panjab Ck., CO = Cottonwood Ck., WE = Wenatchee Ck. SAC = S. Fork Asotin Control site, NA = N. Fork Asotin, PA = Pataha Ck.

+ Sites are separated by 300 m, beginning at NA2 (measured along trail) (site NA2 - same as in Schuck & Mendel, 1987; 1 - 1.5 miles above end of road on USFS land).

Appendix P. Habitat measurements for sites electrofished, summer 1986.

SITE*	SITE LENGTH (ft)	MEAN WIDTH (ft)	SURFACE AREA (sq. ft)	MEAN DEPTH (ft)	POOL AREA (sq. ft)	% SITE IN POOLS	MEAN POOL DEPTH	MEAN POOL RATING	COVER AREA (sq. ft)	% SITE IN POOLS + COVER	% GRADIENT	DYE RATES (ft/sec)	MEAN THALWEG DEPTH (ft)	% SHADE
CR1	85.0	24.62	2092.70	0.9	---	---	---	---	---	---	0.7	---	---	90
CR2	72.5	37.25	2700.63	0.6	---	---	---	---	---	---	2.0	---	---	30
SFW	128.0	38.58	4938.67	1.3	---	---	---	---	---	---	2.6	---	---	---
RA1	115.0	8.39	965.04	0.2	132.8	13.75	0.70	1.3	15.0	15.3	5.4	0.26	0.45	80
RA2	135.0	8.12	1096.78	0.5	316.0	28.81	0.94	2.2	5.0	29.3	5.5	---	0.93	85
RA3	54.0	7.61	410.94	0.2	45.5	11.07	0.54	1.5	0.0	11.1	6.3	0.33	0.46	50
RA4	75.0	5.58	418.69	0.1	62.0	14.81	0.45	1.3	0.0	14.8	7.9	0.25	0.30	85
PAN1	100.0	8.82	882.00	0.5	123.8	14.03	0.82	1.8	10.3	15.2	2.3	0.91	0.66	75
PAN2	103.0	12.16	1252.48	0.5	141.0	11.25	1.06	2.3	10.3	12.1	1.8	1.14	0.91	65
PAN3	100.0	12.16	1216.00	0.6	301.0	24.75	0.92	3.1	4.5	25.1	1.7	0.77	1.10	65
CO1	93.0	5.80	539.40	0.4	73.5	13.63	0.59	1.4	0.0	13.6	7.0	0.13	0.66	85
CO2	128.0	5.63	720.00	0.2	119.0	16.53	0.54	1.5	0.0	16.5	8.0	0.22	0.40	90
WE1	106.0	19.10	2024.60	0.6	185.0	9.14	0.90	1.5	20.0	10.1	1.3	1.74	1.20	75
SAC3	104.0	8.93	946.58	0.4	54.8	5.78	0.83	2.0	24.0	8.3	2.9	---	0.83	40
SAC5	103.0	17.73	1879.59	0.2	41.5	2.21	0.50	1.0	0.0	2.2	3.5	1.03	0.46	5
NA2	30.0	11.80	354.19	0.3	---	---	---	---	---	---	---	---	---	---
NA3	35.0	20.08	702.90	1.3	---	---	---	---	---	---	---	---	---	---
NA4	48.0	22.22	1066.72	1.8	---	---	---	---	---	---	3.8	---	---	---
NA5	36.2	19.45	703.51	0.5	---	---	---	---	---	---	3.6	---	---	---
NA6	36.5	13.90	597.35	1.4	---	---	---	---	---	---	---	---	---	---
NA7	39.0	18.25	711.75	0.3	---	---	---	---	---	---	4.3	---	---	---
NA8	30.0	13.25	397.49	1.0	---	---	---	---	---	---	---	---	---	---
NA9	28.4	17.25	490.25	0.6	---	---	---	---	---	---	4.7	---	---	---
NAS2+	16.2	7.75	125.30	0.5	---	---	---	---	---	---	2.4	---	---	---
NAS3+	24.0	9.60	231.99	0.3	---	---	---	---	---	---	---	---	---	---
PA2	105.4	7.77	818.90	0.4	---	---	---	---	---	---	1.3	0.59	0.56	---
PA1	120.0	11.04	386.52	0.3	144.5	37.39	1.50	0.0	21.3	42.9	2.4	0.56	0.62	40
PA3	138.0	11.82	1246.06	0.4	227.8	18.27	0.79	1.9	58.0	22.9	3.4	0.31	0.77	75

* All sites listed in order from mouth - upstream. Site designations are: CR = Crooked Ck., SFW = South Fk. Wenaha, RA = Rattlesnake Ck., PAN = Panjab Ck., CO = Cottonwood Ck., WE = Wenatchee Ck., SAC = South Fk. Asotin Control site NA = North Fk. Asotin, PA = Pataha Ck.

\+ Side channel.

Appendix Q. Length frequencies of salmonids captured by electrofishing.

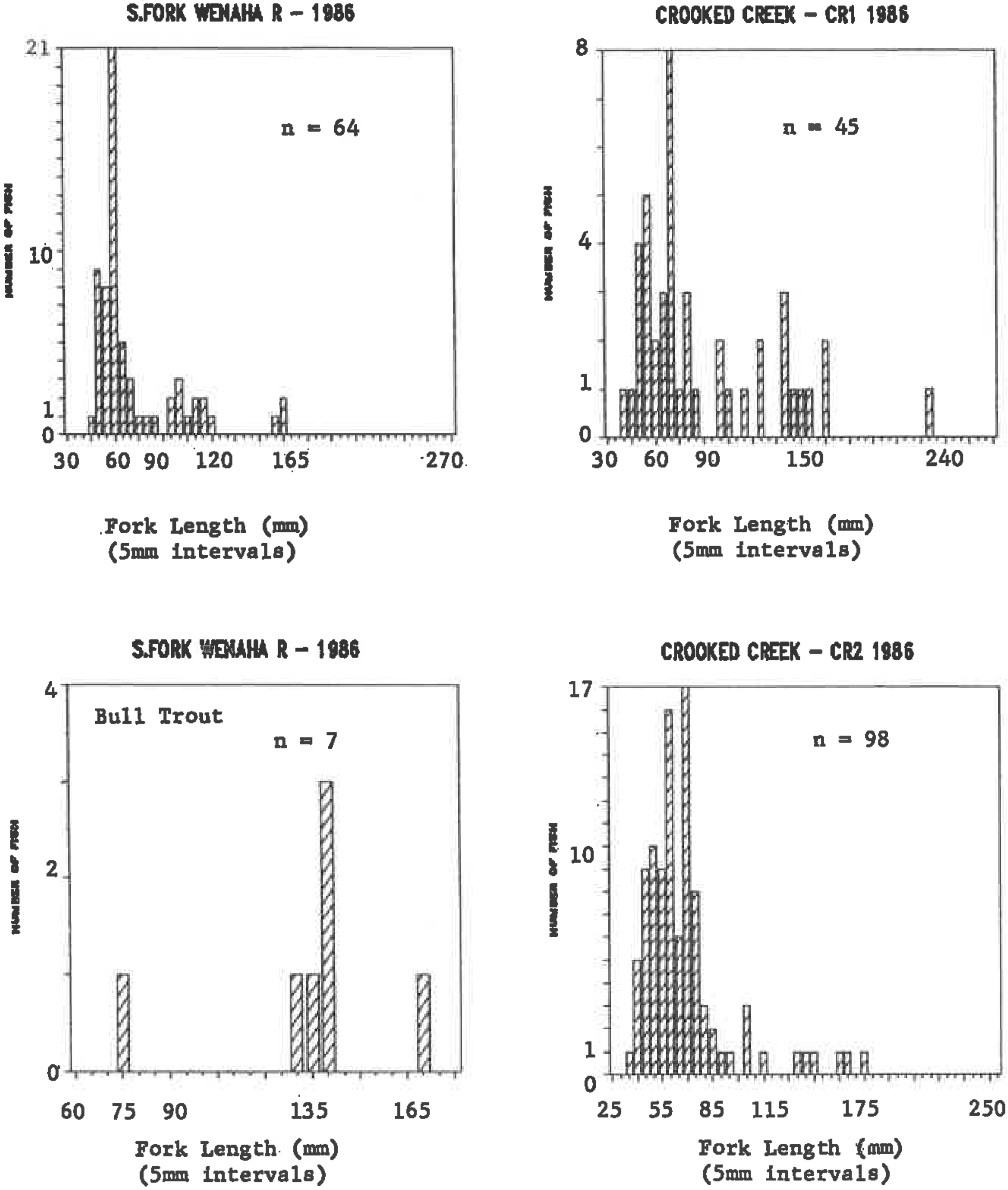


Figure 1. Length-frequencies for rainbow trout and bull trout captured at sites on Grande Ronde tributaries within the Wenaha-Tucannon Wilderness, September 1986.

Appendix Q. (Cont.).

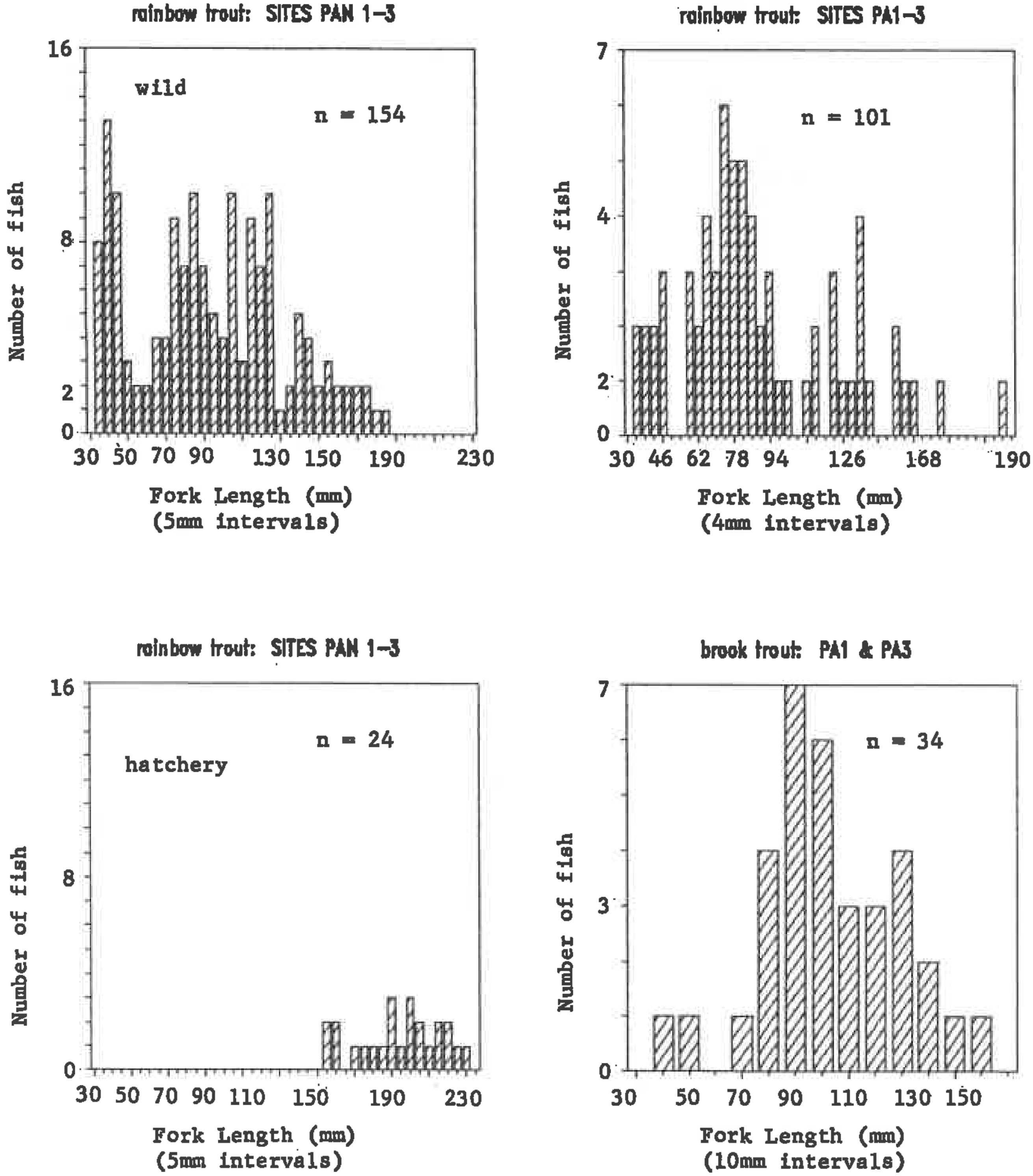


Figure 4. Length-frequencies of rainbow trout and brook trout captured at sites on tributaries of the Tucannon River, summer 1986, (Panjab Ck, Pataha Ck).

Appendix Q. (Cont.).

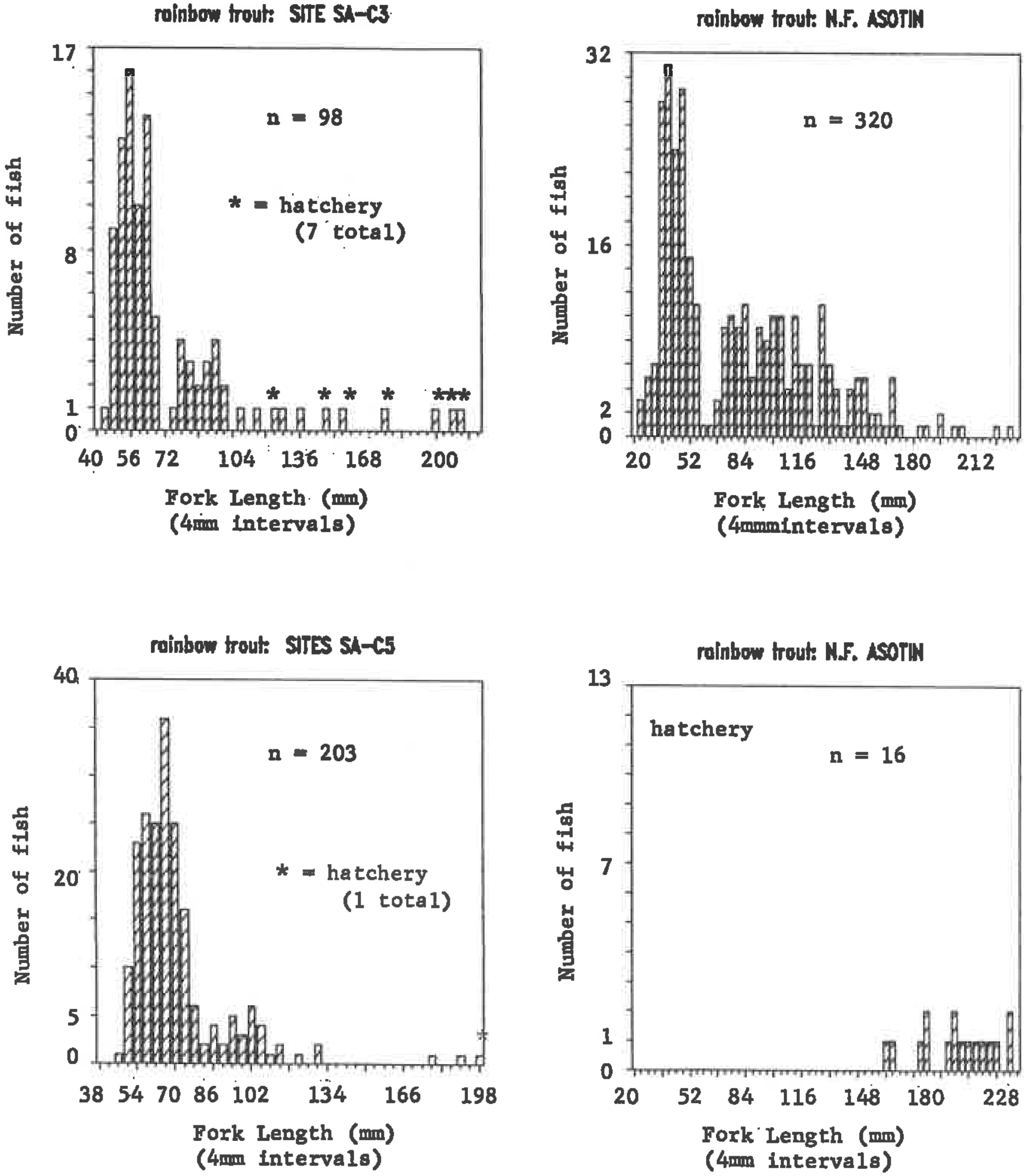
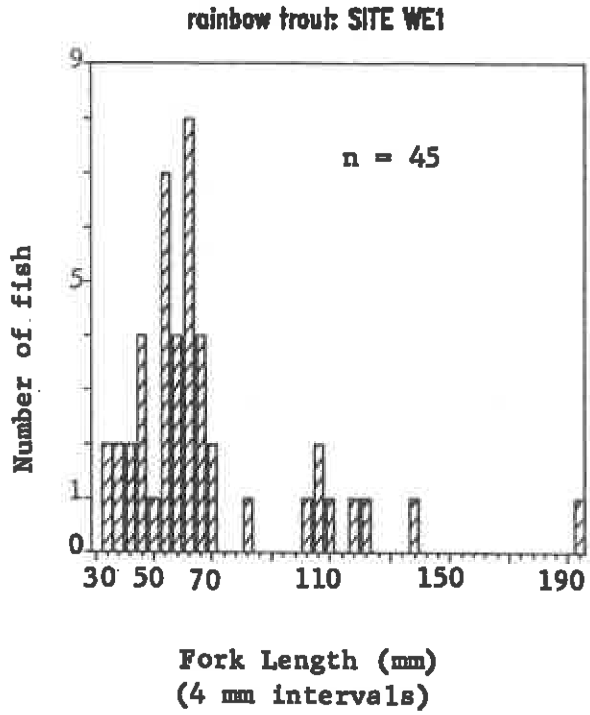
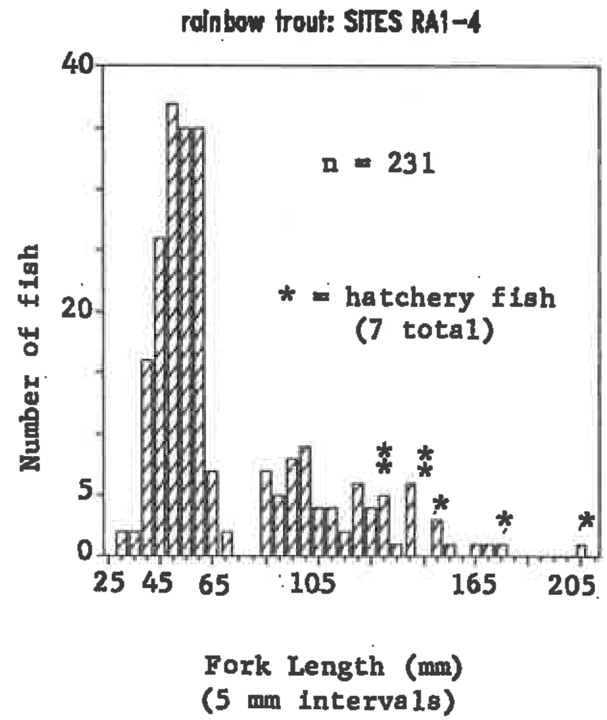


Figure 3. Length-frequencies for rainbow trout captured at sites on Asotin Creek tributaries (S. Fork, N. Fork), summer 1986.

Appendix Q. (Cont.)





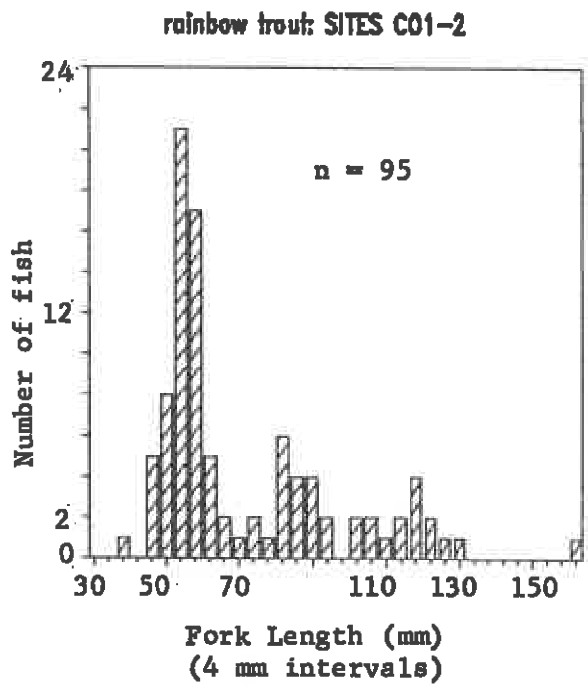


Figure 2. Length-frequencies for rainbow trout captured at sites on Tributaries of the Grande Ronde River, summer 1986. (Wenatchee Ck, Cougar Ck, Rattlesnake Ck.).

Appendix R. Population and density calculation information for sites electrofished during summer 1986 in SE Washington.

Site	Fork Length (mm) of Rainbows (or species as defined)[a]	Pass 1	Pass 2	Estimated Population (N)	95 % CL	% Capture Probability	Site Area (m2)
CR1	36-81	22	7	31	5.7	72.5	194.46
	99-226	7	8	15 *	--	--	
	TOTAL	29	15	56 *	22.1	53.0	
	DV	1	0	1 *	--	--	
CR2	39-90	52	34	86 *	--	37.7	251.16
	94-178	7	5	12 *	--	--	
	TOTAL	59	39	98 *	--	36.7	
SFW	41-83	39	11	50	6.4	74.6	487.56
	91-164	10	4	14	4.8	70.0	
	TOTAL	49	15	69	8.6	71.9	
	CH	2	6	8 *	--	--	
	DV	4	3	7 *	--	--	
RA1	30-68	82	15	99	4.5	83.6	89.75
	81-174	18	3	21	1.5	87.5	
	TOTAL	100	18	121	5.2	83.1	
	CH	1	0	1 *	--	--	
	hatchery	2	0	2 *	--	--	
RA2	30-64	40	15	62	11.9	65.5	101.34
	82-164	30	4	34	1.5	89.5	
	TOTAL	70	19	95	8.8	74.2	
	hatchery	3	2	5 *	--	--	
RA3	0-70	0	0	0	--	--	38.22
	89-119	8	1	9	0.8	90.0	
	TOTAL	8	1	9	0.8	90.0	
RA4	46-59	9	0	9	0.0	100.0	38.94
	100-168	5	1	6	1.2	85.7	
	TOTAL	14	1	15	0.6	93.8	
CO1	45-70	15	5	21	4.4	74.1	50.16
	71-168	9	1	10	0.7	90.7	
	TOTAL	24	6	31	3.7	78.9	
CO2	55-66	27	10	41	8.8	67.3	66.96
	80-135	25	3	28	1.3	90.3	
	TOTAL	52	13	68	6.1	77.4	
WE1	33-68	28	8	38	5.4	75.0	188.29
	80-191	4	5	9 *	--	--	
	TOTAL	32	13	51	11.6	64.3	

Appendix R. (Cont).

Site	Fork Length of Rainbows (or species as defined)[a]	Pass 1	Pass 2	Estimated Population (N)	95 % CL	% Capture Probability	Site Area (m2)
PAN1	32-55	10	4	15	4.8	70.7	81.37
	77-220	17	1	18	0.5	94.7	
	TOTAL	27	5	32	2.1	86.5	
	hatchery	3	1	4 *	--	--	
	DV +	2	0	2 *	--	--	
PAN2	34-58	19	0	19	0	100.00	179.64
	63-181	26	8	36	5.6	73.9	
	TOTAL	45	8	54	3.3	84.1	
PAN3	31-58	3	2	5 *	--	--	113.93
	64-486	62	26	88 *	--	60.3	
■	TOTAL	65	28	93 *	--	59.2	
	hatchery	11	9	20 *	--	--	
SAC3	42-68	56	12	70	4.8	81.0	86.37
	75-212	28	2	30	0.8	93.8	
	TOTAL	84	14	100	4.3	84.5	
	hatchery	7	0	7 *	--	--	
SAC5	44-81	140	30	177	8.4	79.4	169.85
	84-196	26	7	34	4.0	78.6	
	TOTAL	166	37	212	9.6	78.7	
	hatchery	1	0	1 *	--	--	
NA2	34-46	4	0	4	0.0	100.0	32.94
pool	67-107	4	1	5	1.5	83.3	
	TOTAL	8	1	9	0.8	90.0	
	CH	3	0	3	0.0	100.0	
NA3	34-55	16	6	24	6.4	68.8	65.37
run	76-217	31	3	34	1.1	91.9	
	TOTAL	47	9	57	3.5	83.6	
	hatchery	3	0	3 *	--	--	
	CH	6	5	11 *	--	--	
NA4	23-53	15	4	19	2.3	82.6	99.20
riffle	76-124	10	4	15	4.9	70.0	
	TOTAL	25	8	35	5.7	73.3	
NA5	24-59	16	9	32 *	17.9	52.1	65.43
run	71-235	26	10	40	9.0	66.7	
	TOTAL	42	19	73 *	18.6	58.7	
	hatchery	2	3	5 *	--	--	
	CH	3	0	3	0.0	100.0	

Appendix R. (Cont).

Site	Fork Length of Rainbows (or species as defined)[a]	Pass 1	Pass 2	Estimated Population (N)	95 % CL	% Capture Probability	Site Area (m2)
NA6	33-52	9	2	11	1.6	84.6	47.24
pool	67-205	23	1	24	0.4	96.0	
	TOTAL	32	3	35	1.1	92.1	
	hatchery	1	0	1 *	--	--	
NA7	32-56	19	2	21	1.0	91.3	66.19
riffle	72-160	5	0	5	0.0	100.0	
	TOTAL	24	2	26	0.9	92.9	
NA8	28-54	12	3	15	2.0	83.3	44.17
run	70-195	27	4	31	1.6	88.6	
	TOTAL	39	7	47	3.2	83.6	
	CH	1	1	2 *	--	--	
NA9	30-53	22	1	23	0.5	95.8	45.59
pool	67-233	21	3	24	1.4	88.9	
	TOTAL	43	4	47	1.3	92.2	
	hatchery	6	0	6	0.0	100.0	
	CH	2	1	3 *	--	--	
NAS2	33-56	7	0	7	0.0	100.0	14.31
	75-165	2	2	4 *	--	--	
	TOTAL	9	2	11	1.6	84.6	
	hatchery	0	1	1 *	--	--	
NAS3	36-42	4	2	6 *	0.0	100.0	21.57
	71-96	6	0	6	0.0	100.0	
	TOTAL	10	2	12	1.5	85.7	
PA2	33-98	12	4	16	2.6	80.0	76.16
	111-151	5	1	6	1.2	85.7	
	TOTAL	17	5	23	4.0	75.9	
PA1	55-99	17	2	19	1.1	90.5	123.68
	114-196	8	3	11	2.5	78.6	
	TOTAL	25	5	30	2.2	85.7	
	BROOK						
	76-94	4	0	4	0.0	100.0	
	117	1	0	1	0.0	100.0	
	TOTAL	5	0	5	0.0	100.0	
PA3	35-87	10	3	13	2.2	81.3	152.02
	109-133	2	0	2	0.0	100.0	
	TOTAL	12	3	15	2.0	83.3	
	BROOK						
	35-106	15	4	19	2.3	82.6	
	116-153	6	4	10 *	--	--	
	TOTAL	21	8	32	7.8	67.4	

Appendix R. (Cont.)

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[a] Age 0+ is first length group for rainbows and 1+ is below it in table: hatchery fish (ad, LV, & branded) are included in total and 1+ population estimates, CH=Chinook, DV = Bull Trout, Brook = Brook trout.

* <=60 % reduction between pass 1 and 2, use estimate with caution, some estimates are sums of passes so they should be considered a MINIMUM ESTIMATE ONLY.

+ DV = 17.8mm & 59.8 g and 8.6mm fork length & 7.1 g.

[b] Qualitative electrofishing site above 1st tributary produced 7 wild RB, 5 DV, 4 ad clipped RB, 1 LA-IT-1 brand. Qualitative electrofishing site above second tributary produced 3 wild RB and 1 DV.

Appendix S. Biomass estimates (g/100 m²) for salmonids captured by electrofishing at sites in Southeast Washington, Fall 1986.

Rainbow Trout	Age 0+				Age 1+				
Site [A]	Size Range (mm)	# Fish Measured [B]	Mean Weight (g)	Estimated Total Weight [C] (g/100m2)	Size Range (mm)	# Fish Measured [B]	Mean Weight (g)	Estimated Total Weight [C] (g/100m2)	Sum Total Biomass (g/100m2)
SFW	41-83	0	--	--	91-164	0	--	--	--
CR1	36-81	0	--	--	99-226	0	--	--	--
CR2	39-90	0	--	--	94-178	0	--	--	--
WE1	33-68	36	1.96	39.6	80-191	9	22.40	107.5	147.1
CO1	45-70	20	2.67	111.9	71-168	10	19.26	383.3	495.2
CO2	55-66	37	2.61	159.7	80-135	28	11.61	485.3	645.0
RA1	30-68	97	1.27	140.1	81-174	21	16.04	375.3 [D]	515.4
RA2	30-64	55	1.71	104.7	82-164	34	14.40	482.4 [D]	587.1
RA3	0-70	0	--	--	89-119	9	10.16	239.8	239.8
RA4	46-59	9	1.90	43.9	100-168	6	26.58	409.3	453.2
PA2	33-98	16	5.93	119.2	111-151	6	25.62	199.8	319.0
PA1	55-99	19	4.37	67.3	114-196	11	32.68	290.9	358.2
PA3	35-87	13	2.48	21.3	109-133	2	16.20	21.1	42.4
PAN1	32-55	14	1.06	19.5	77-220	18	38.69	855.0 [D]	874.6
PAN2	34-58	19	0.84	8.9	63-181	34	12.09	241.8	250.7
PAN3	31-58	5	0.68	3.0	64-486	88	26.61	2,054.3 [D]	2,057.3
SAC3	42-68	68	1.85	149.8	75-212	30	19.36	671.8 [D]	821.6
SAC5 [E]	44-81	170	2.63	274.0	84-196	33	15.43	308.6 [D]	582.6
NA2	34-46	4	1.85	22.4	67-107	5	8.20	124.6	147.0
NA3	34-55	22	0.94	34.5	76-217	34	25.50	1,326.0 [D]	1,360.5
NA4	23-53	19	0.84	16.0	76-124	14	9.22	139.2	155.2
NA5 [G]	24-59	25	2.02	98.8	71-235	36	33.92	2,072.5 [D]	2,171.3
NA6	33-52	11	0.87	20.3	67-205	24	19.23	976.9 [D]	997.2
NA7	32-56	21	0.70	22.2	72-160	5	12.36	93.9	116.1
NA8	28-54	15	0.66	22.4	70-195	31	22.11	1,552.1	1,574.5
NA9 [G]	30-53	23	0.41	20.7	67-233	24	38.82	2,041.9 [D]	2,062.6
NAS2	33-56	7	0.86	41.3	75-165	4	22.30	611.0 [D]	652.3
NAS3	36-42	6	0.70	19.5	71-96	6	5.03	139.8	159.3
Other Salmonids [F]									
RA1 CH	66	1	3.00	3.3					
PA1 BK	76-94	4	7.02	22.5	117	1	16.8	13.4	35.9
PA3 BK	35-106	19	7.21	90.1	116-153	10	23.75	156.7	246.8
NA2 CH	55-63	3	3.96	36.0					
NA3 CH	49-75	11	2.85	47.9					
NA5 CH	65-103	3	8.60	39.6					
NA8 CH	59-73	2	3.70	16.7					
NA9 CH	60-71	3	3.20	21.1					
PAN1 DV	76-117	5	8.98	22.5					

A See Appendix O for site designations.
B # of fish measured, plus fish with weights estimated from length/weight curve for that stream.
C Mean weight x estimated densities.
D Hatchery fish included.
E No weights measured so used weights for fish of same size category from other site.
F Listed with site designations is species code: CH = chinook salmon, WF = white fish, DV = bull trout, BK = brook trout.
G Weights estimated by extrapolation.

Appendix T. Length/weight of trout captured on N.F. Asotin Creek, 1986.

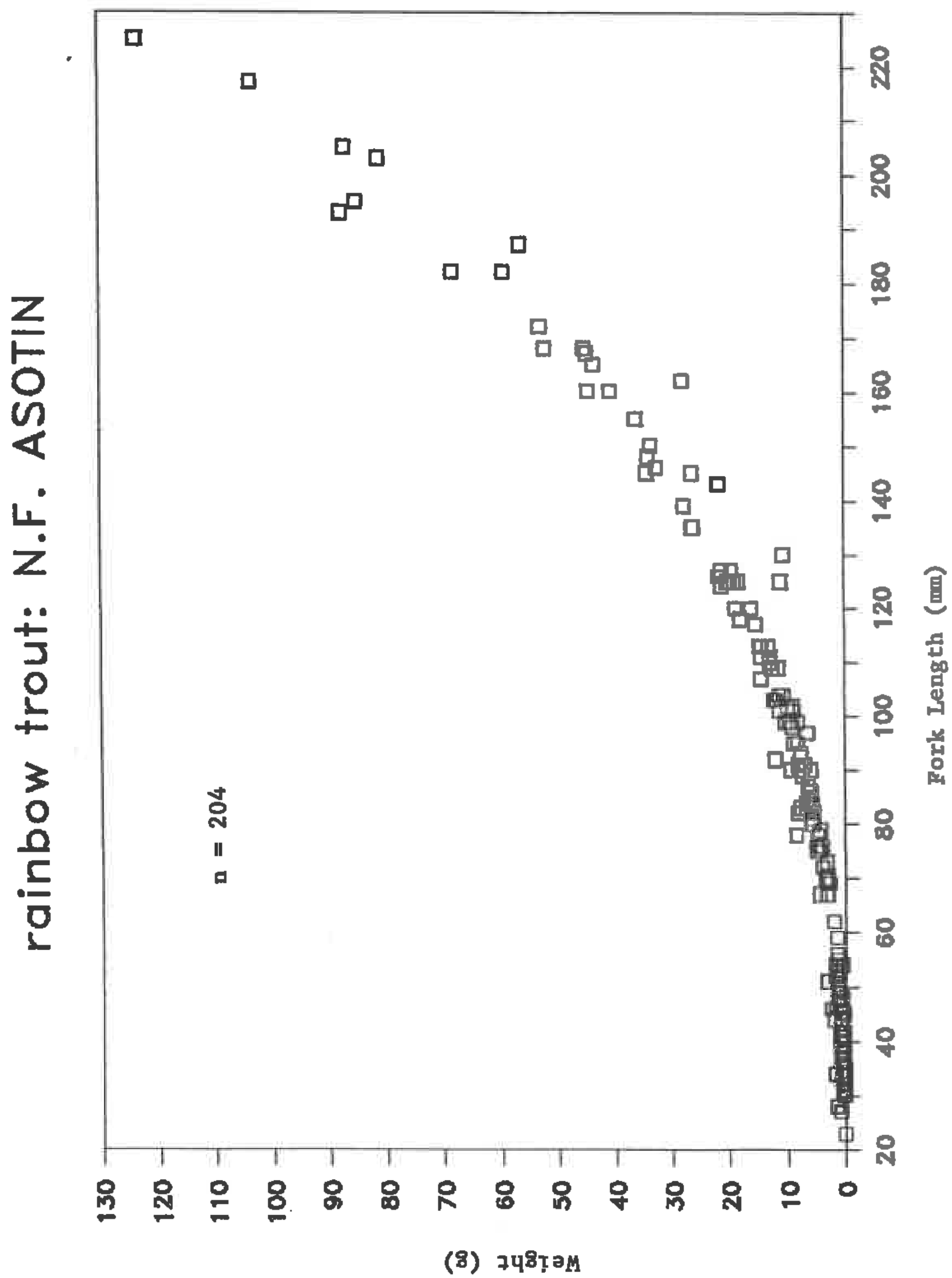


Figure 1. Length/weight for rainbow trout up to 225 mm fork length.

Appendix T. (Cont.).

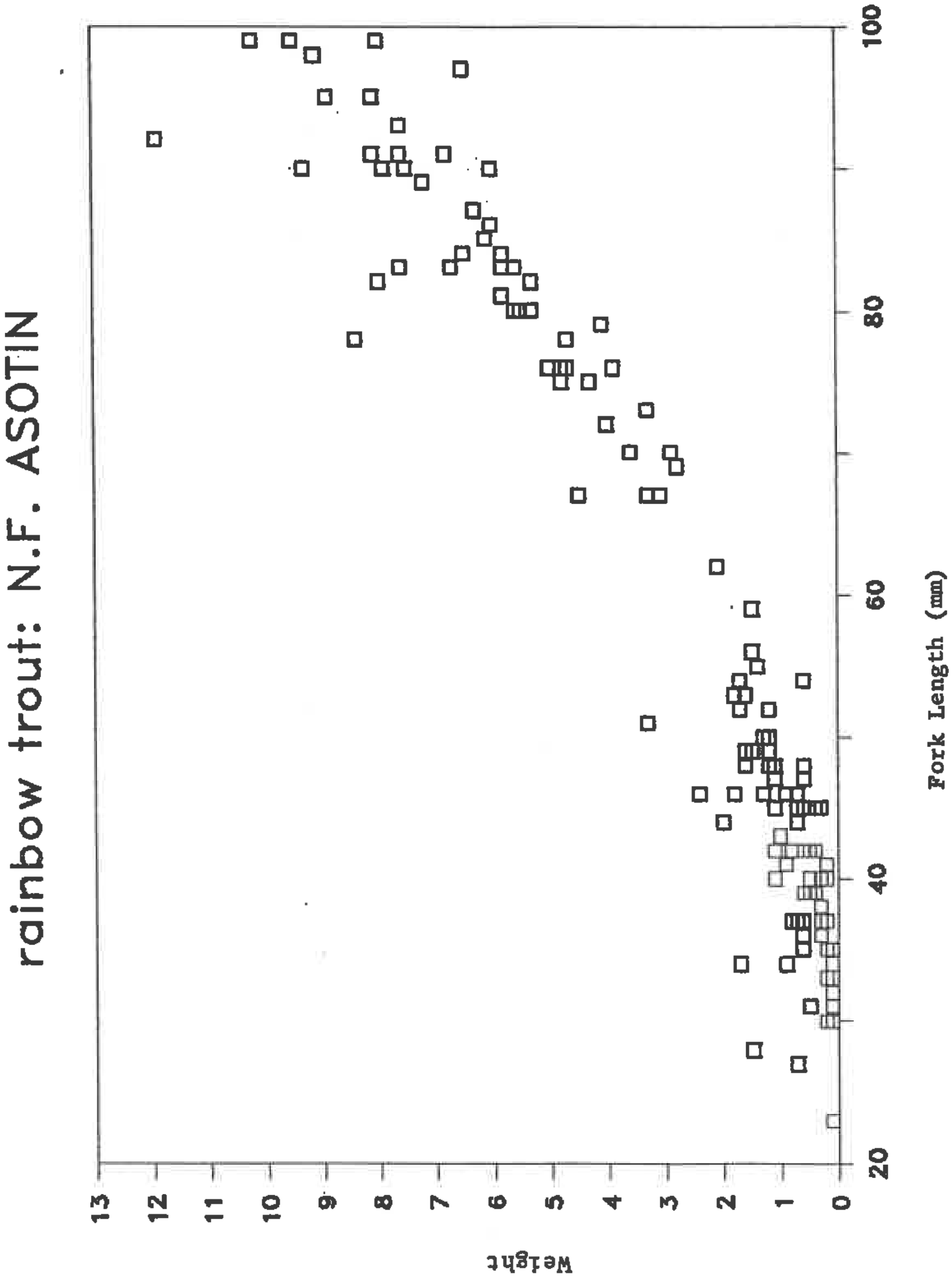


Figure 2. Length/weight for rainbow trout 100 mm fork length.

Appendix U. Relative abundance of non-salmonid fish species present at sites electrofished by WDG during fall 1986.

SITE	SCULPINS[a]	DACE[b]	LAMPREY[c]	SUCKERS[d]	RED-SIDED SHINERS	N. SQUAWFISH	PEAMOUTH/ CHISELMOUTH[e]
RA1	C [f]	N	N	N	N	N	N
RA2	C	N	N	N	N	N	N
RA3	N	N	N	N	N	N	N
RA4	N	N	N	N	N	N	N
CR1	Y-T,M?	Y-LN	N	N	N	N	N
CO1	N	N	N	N	N	N	N
CO2	N	N	N	N	N	N	N
WE1	O	O-LN	N	N	N	N	N
SAC3	O	O	N	N	N	N	N
SAC5	O	N	N	N	N	N	N
NA2	?	?	N	N	N	N	N
NA3	?	?	N	N	N	N	N
NA4	?	?	N	N	N	N	N
NA5	?	?	N	N	N	N	N
NA6	?	?	N	N	N	N	N
NA7	?	?	N	N	N	N	N
NA8	?	?	N	N	N	N	N
NA9	?	?	N	N	N	N	N
NAS2	Y	R-LN	N	N	N	N	N
NAS3	?	?	N	N	N	N	N
PAN1	?	?	N	N	N	N	N
PAN2	?	?	N	N	N	N	N
PAN3	?	?	N	N	N	N	N
PA2	C	N	N	N	N	N	N
PA1	C	N	N	N	N	N	N
PA3	?	?	N	N	N	N	N

[a] Sculpins may include Piute or Margined.
[b] Dace may include Long-nosed (LN) and speckled (S).
[c] Lamprey are River lamprey (Bugert WDF, pers. commun.).
[d] Suckers may include bridgelip (BL) and large scale (LS).
[e] some fish classified as peamouth at TU1 and TU3 may be chiselmouth.
[f] Relative abundance is:

N = none present
Y = present (amount not recorded)
R = 0-4 fish captured
O = 5-10 "
C >10 fish captured

[g] letters after the hyphen are the species identification (see footnotes above).

Appendix V. Trout data from WDF electrofishing, summer 1986.

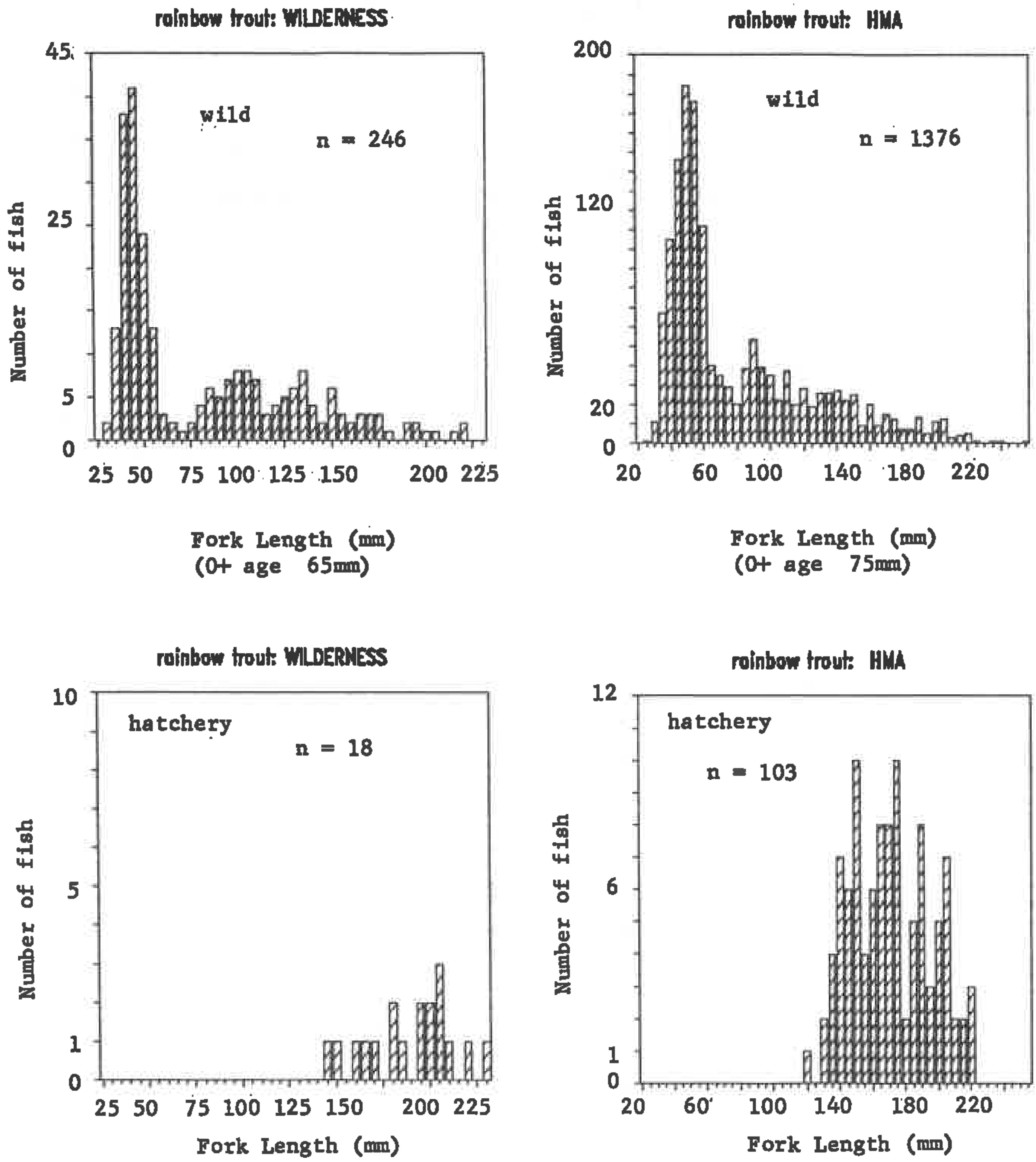
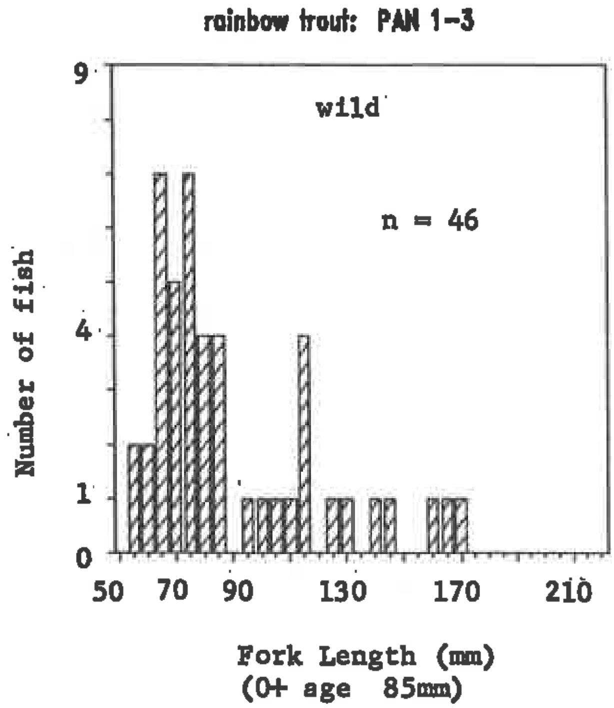


Figure 1. Length-frequencies for rainbow trout captured by WDF on portions of the Tucannon River during electrofishing, summer 1986.

Appendix V. (Cont.).



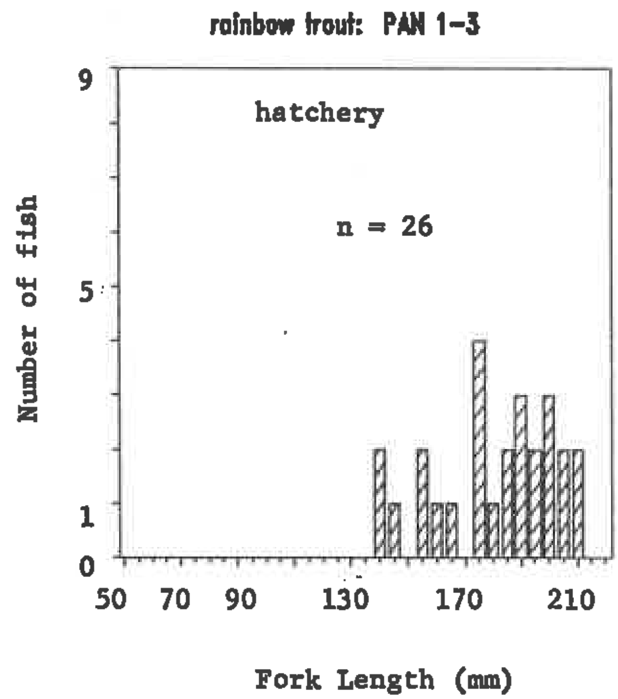
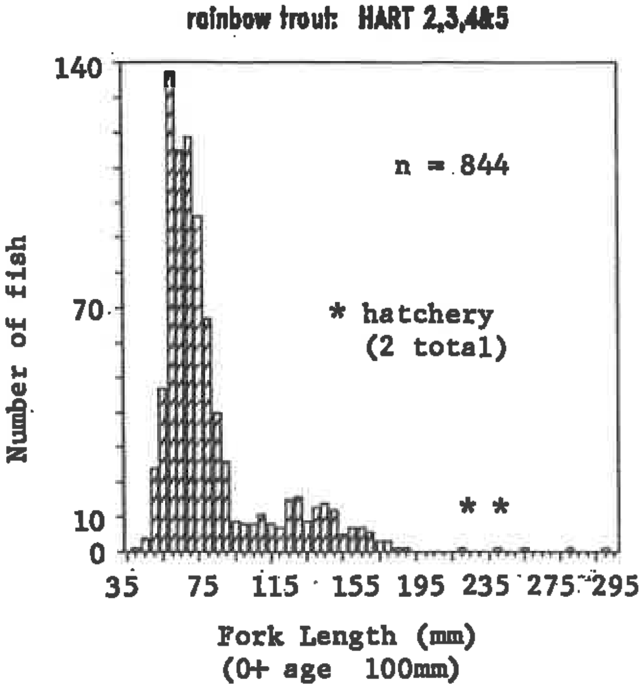
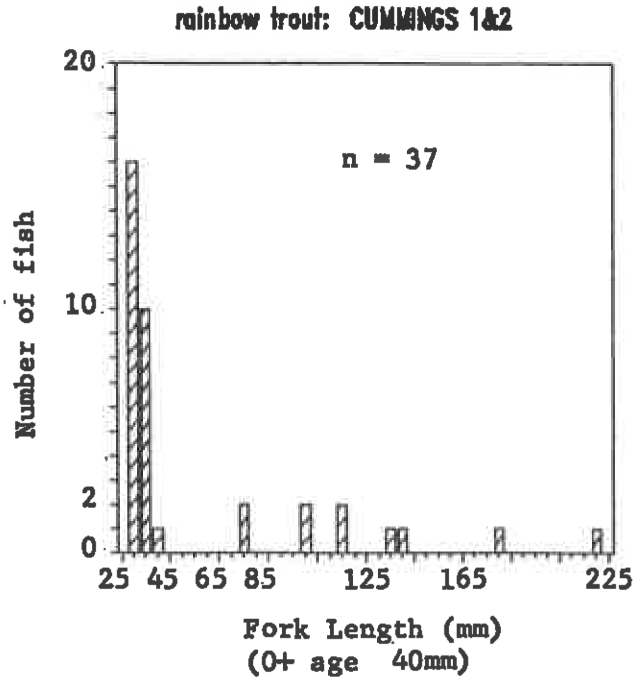


Figure 2. Length-frequencies for rainbow trout captured by WDF on Panjab Creek during electrofishing, summer 1986.

Appendix V. (Cont.).





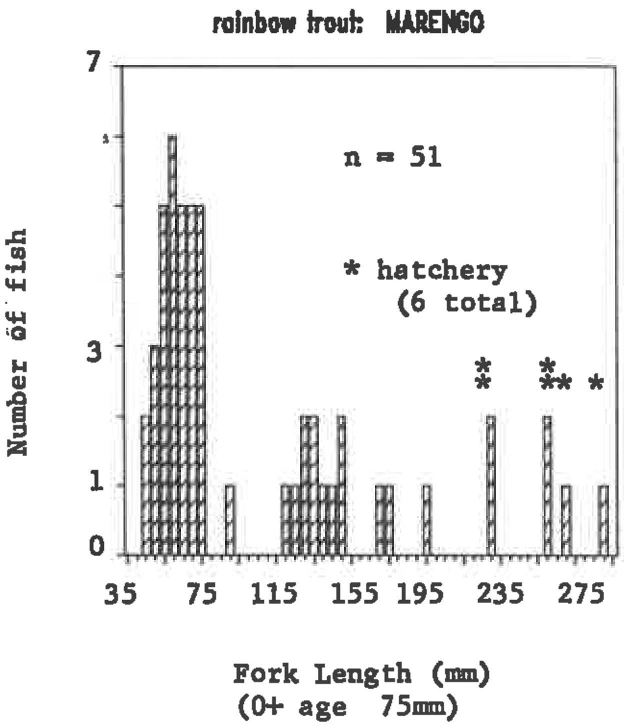


Figure 3. Length-frequencies for rainbow trout captured by WDF on portions of the Tucannon River during electrofishing, summer 1986.

Appendix V. (Cont.).

Table V-1. Gamefish population and density information from sites electroshocked by WDF personnel, summer and fall 1986 (pers. comm. with Bob Bugert, WDF).

SITE [a] TYPE (Date)	AGE [b]	PASS 1	2	3	POPULATION (N)	95 % CL	AREA (m2)	DENSITY (FISH/100m2)	95 % CL
WILDERNESS (above Panjab Ck)									
10 RUN	0+	23	0		23	0.0	118.53	19.4	0.0
(8-22)	1+	20	6		27	4.2		22.8	3.5
	Tot	43	6		49	1.9		41.3	1.6
	AD	4	1		5 *	--		4.2	--
19 POOL	0+	8	4		12 *	--	114.14	10.5	--
(8-21)	1+	9	2		11	1.6		9.6	1.4
	Tot	17	6		24	4.6		21.0	4.0
	AD	2	0		2	--		1.8	--
21 POOL	0+	4	0		4	0.0	62.51	6.4	0.0
(8-21)	1+	12	2		14	1.3		22.4	2.1
	ToT	16	2		18	1.1		28.8	1.8
	AD	2	0		2	--		3.2	--
14 RIFFLE	0+	19	3		22	1.5	165.81	13.3	0.9
(8-21)	1+	17	5		23	4.0		13.9	2.4
	Tot	36	8		45	3.7		27.1	2.2
	AD	1	0		1	--		0.6	--
5 POOL	0+	4	0		4	0.0	70.31	5.7	0.0
(8-20)	1+	10	3		13	2.2		18.5	3.1
	Tot	14	3		17	1.8		24.2	2.6
	AD	2	0		2	--		2.8	--
11 POOL	0+	36	3		39	1.0	159.22	24.5	0.6
(8-19)	1+	19	4		23	2.0		14.4	1.3
	Tot	55	7		62	2.0		38.9	1.3
	AD	2	0		2	--		1.3	--
3 RUN	0+	13	1		14	0.9	42.37	33.0	2.1
(8-22)	1+	5	2		7	2.3		16.5	5.4
	Tot	18	3		21	1.6		49.6	3.8
	AD	0	1		1 *	--		2.4	--
16.1 POOL	0+	6	1		7	1.0	45.43	15.4	2.2
(8-25)	1+	8	0		8	0.0		17.6	0.0
	Tot	14	1		15	0.6		33.0	1.3
	AD	3	0		3	--		6.6	--
16.2 RIFFLE	0+	7	4		11 *	--	64.68	17.0	--
(8-25)	1+	3	0		3	0.0		4.6	0.0
	Tot	10	4		15	4.9		23.2	7.6

Table V-1. (Cont.)

SITE ^ TYPE (Date)	AGE *	PASS 1	2	3	POPULATION (N)	95 % CL	AREA (m2)	DENSITY (FISH/100m2)	95 % CL
HMA (Habitat Mgmt. Area Headquarters to Panjab Creek)									
1 RIFFLE	0+	85	19		108	6.6	218.49	49.4	3.0
(8-14)	1+	4	5		9 *	--		4.1	--
	Tot	89	24		120	9.4		54.9	4.3
2 BOULDER	0+	55	21		87	15.3	581.12	15.0	2.6
(8-13)	1+	28	6		35	3.4		6.0	0.6
	Tot	83	27		121	13.3		20.8	2.3
3 RUN	0+	26	7		34	4.0	161.43	21.1	2.5
(8-12)	1+	8	3		11	2.5		6.7	1.5
	Tot	34	10		47	6.6		29.1	4.1
4 POOL	0+	7	1		8	0.9	123.56	6.5	0.7
(8-11)	1+	4	0		4	0.0		3.2	0.0
	Tot	11	1		12	0.7		9.7	0.6
5 RIFFLE	0+	57	12		71	4.7	195.08	36.4	2.4
(8-11)	1+	14	8		28	16.6		14.4	8.5
	Tot	71	20		97	9.0		49.7	4.6
6 RUN	0+	20	2		22	0.9	115.39	19.1	0.8
(8-11)	1+	17	4		21	2.1		18.2	1.8
	Tot	37	6		43	2.1		37.3	1.8
	AD	1	0		1	--		0.9	--
7 BOULDER	0+	29	4		33	1.6	204.94	16.1	0.8
(8-8)	1+	18	4		22	2.1		10.7	1.0
	Tot	47	8		56	3.2		27.3	1.6
	AD	0	1		1	--		0.5	--
8 POOL	0+	9	0		9	0.0	142.66	6.3	0.0
(8-7)	1+	8	3		11	2.5		7.7	1.8
	Tot	17	3		20	1.6		14.0	1.1
	AD	2	1		3 *	--		2.1	--
9 RIFFLE	0+	30	4		34	1.6	246.65	13.8	0.6
(8-7)	1+	4	5		9	--		3.6	--
	Tot	34	9		45	5.2		18.2	2.1
	AD	1	0		1	--		0.4	--
10 RUN	0+	17	3		20	1.6	144.86	13.8	1.1
(8-6)	1+	8	1		9	1.8		6.2	1.2
	Tot	25	4		29	1.7		20.0	1.1
	AD	4	1		5	--		3.5	--
11 BOULDER	0+	8	2		10	1.7	69.24	14.4	2.5
(8-7)	1+	21	3		24	1.4		34.7	2.0
	Tot	29	5		34	2.0		49.1	2.9
	AD	9	0		9	--		13.0	0.0

Table V-1. (Cont.)

SITE ^a^ TYPE (Date)	AGE ^b^	PASS 1	PASS 2	PASS 3	POPULATION (N)	95 % CL	AREA (m2)	DENSITY (FISH/100m2)	95 % CL
12 POOL (8-12)	0+	12	5		18	5.0	154.95	11.6	3.2
	1+	29	9		40	5.7		25.8	3.7
	Tot	41	14		60	9.3		38.7	6.0
	AD	13	2		15	1.3		9.7	0.8
13 RIFFLE (8-6)	0+	27	5		32	2.1	178.88	17.9	1.1
	1+	10	4		15	4.8		8.4	2.7
	Tot	37	9		48	4.9		26.8	2.7
14 RUN (8-6)	0+	11	0		11	0.0	92.27	11.9	0.0
	1+	19	1		20	0.5		21.7	0.5
	Tot	30	1		31	0.4		33.6	0.4
	AD	5	0		5	0.0		5.4	0.0
15 BOULDER (8-5)	0+	24	2		26	0.9	180.10	14.4	0.5
	1+	25	1		26	0.4		14.4	0.2
	Tot	49	3		52	0.9		28.9	0.5
	AD	2	1		3 *	--		1.7	--
16 POOL (8-5)	0+	26	2		28	0.8	191.32	14.6	0.4
	1+	33	14		55 *	--		28.7	--
	Tot	59	16		79	7.3		30.8	3.8
	AD	10	8		18 *	--		9.4	--
17 RIFFLE (8-4)	0+	23	3		26	1.3	180.21	14.4	0.7
	1+	10	10		20	--		11.1	--
	Tot	34	13		53	11.2		29.4	6.2
	AD	2	2		4 *	--		2.2	--
18 RUN (8-1)	0+	33	10		46	6.7	175.74	26.6	3.9
	1+	4	5		9	--		5.1	--
	Tot	37	15		60	13.7		34.1	7.8
	AD	0	2		2 *	--		1.1	--
19 POOL (9-18)	0+	6	1		7	1.0	74.06	9.5	1.3
	1+	11	3		14	2.1		18.9	2.8
	Tot	17	4		21	2.1		28.4	2.8
	AD	3	0		3	--		4.0	--
20 POOL (7-31)	0+	27	12	2	42	3.2	110.23	38.1	2.9
	1+	9	4	3	17	4.8		15.4	4.4
	Tot	36	16	5	60	5.6		54.4	5.1
	AD	4	3	2	9 *	--		8.2	--
21 BOULDER (8-1)	0+	15	0		15	0.0	129.71	11.6	0.0
	1+	29	5		34	2.0		26.2	1.5
	Tot	44	5		49	1.6		37.8	1.2
	AD	2	2		4 *	--		3.1	--

Table V-1. (Cont.)

SITE ^ TYPE (Date)	AGE	PASS 1	PASS 2	PASS 3	POPULATION (N)	95 % CL	AREA (m2)	DENSITY (FISH/100m2)	95 % CL
22 RUN	0+	8	3		11	--	76.78	14.3	--
(7-31)	1+	10	2		12	1.5		15.6	2.0
	Tot	18	5		24	3.9		31.3	5.1
18.5 RIFFLE	0+	37	2		39	0.7	168.60	23.1	0.4
(8-14)	1+	10	8		18 *	--		10.7	--
	Tot	47	10		59	4.6		35.0	2.7
	AD	1	1		2 *	--		1.2	--
16.5 BOULDER	0+	39	10		51	5.1	230.99	22.1	2.2
(8-19)	1+	42	8		51	3.4		22.1	1.5
	Tot	[illegible]	18		103	6.5		44.6	2.8
	AD	4	0		4	--		[illegible]	[illegible]
HMAS (side channels within the HMA)									
1 POOL	0+	19	0		19	0	106.16	17.9	0.0
(8-27)	1+	19	6		26	4.3		24.5	4.1
	Tot	38	6		44	2.1		41.5	2.0
	AD	2	0		2	--		1.9	--
2 RUN	0+	15	0		15	0	63.03	23.8	0.0
(8-27)	1+	3	3		6	--		9.5	--
	Tot	18	3		21	1.6		33.3	2.5
	AD	2	0		2	--		3.2	--
3 POOL	0+	7	0		7	0	89.86	7.8	0.0
(8-28)	1+	6	2		8	2.0		8.9	2.2
	Tot	13	2		15	1.2		17.7	1.3
	AD	2	1		3 *	--		3.3	--
4 RUN	0+	8	4		12	--	62.51	19.2	--
(8-28)	1+	3	0		3	0.0		4.8	0.0
	Tot	11	4		15	2.7		24.0	4.3
	AD	1	0		1	--		1.6	--
5 POOL	0+	38	5		43	1.7	109.85	39.1	1.5
(7-30)	1+	12	3		15	2.0		13.7	1.8
	Tot	50	8		59	3.1		53.7	2.8
	AD	4	0		4	0.0		3.6	0.0
6 RUN	0+	10	1		11	0.7	65.78	16.7	1.1
(8-28)	1+	8	3		11	2.5		16.7	3.8
	Tot	18	4		22	2.1		33.4	3.2
	AD	5	2		7 *	--		10.6	--
Hartsock (HMA headquarters to Hartsock Grade)									
2 RUN	0+	148	47		215	17.7	414.34	51.9	4.3
(9-22)	1+	59	32		91 *	--		22.0	--
	Tot	207	79		332	31.8		80.1	7.7
	AD	1	0		1	--		0.2	--

Table V-1. (Cont.)

SITE [a] TYPE (Date)	AGE	PASS 1	PASS 2	PASS 3	POPULATION (N)	95 % CL	AREA (m2)	DENSITY (FISH/100m2)	95 % CL
3 RUN (9-26)	0+	154	33		195	8.9	405.00	48.1	2.2
	1+	20	3		23	1.5		5.7	0.4
	Tot	174	36		218	8.8		53.8	2.2
4 RIFFLE (9-11)	0+	173	44		231	12.8	450.03	51.3	2.8
	1+	13	3		16	1.9		3.6	0.4
	Tot	186	47		248	13.2		55.1	2.9
	AD	1	0		1	--		0.2	--
5 RIFFLE (9-15)	0+	69	27		111	18.3	301.72	36.8	6.1
	1+	14	5		20	4.6		6.6	1.5
	Tot	83	32		133	19.9		44.1	6.6
Marengo (Hartsock Grade to Marengo)									
POOL (8-8)	0+	22	9		35	9.6	108.72	32.2	8.8
	1+	13	7		24 *	12.0		22.1	11.0
	Tot	35	16		61 *	17.1		56.1	--
	Hatch	3	3		6 *	--		5.5	--
SHEEP CREEK [c]									
1 RIFFLE (6-11)	0+	3	0		3	0.0	169.29	1.8	0.0
	1+	5	0		5	0.0		3.0	0.0
	Tot	8	0		8	0.0		4.7	0.0
3 RIFFLE (6-16)	0+	0	1		1 *	--	88.21	1.1	--
	1+	3	0		3	0.0		3.4	0.0
	Tot	3	1		4 *	--		4.5	--
CUMMINGS CREEK									
1 RUN (6-18)	0+	11	3		14	2.1	35.09	39.9	6.0
	1+	3	0		3	0.0		8.5	0.0
	Tot	14	3		17	1.8		48.5	5.1
2 RUN (6-18)	0+	9	4		14	5.2	35.80	39.1	14.5
	1+	7	0		7	0.0		19.6	0.0
	Tot	16	4		20	2.2		55.9	6.1
PANJAB CREEK									
1 RUN (6-9)	0+	15	1		16	0.6	81.37	19.7	0.7
	1+	17	0		17	0.0		20.9	0.0
	Tot	32	1		33	0.4		40.6	0.5
	AD	11	0		11	0.0		13.5	0.0
2 RUN (6-9)	0+	10	0		10	0.0	179.64	5.6	0.0
	1+	13	1		14	0.6		7.8	0.3
	Tot	23	1		24	0.4		13.4	0.2
	AD	9	0		9	0.0		5.0	0.0
3 RIFFLE (6-9)	0+	4	1		5	1.5	113.93	4.4	1.3
	1+	7	3		10	2.7		8.8	2.4
	Tot	11	4		15	2.7		13.2	2.4
	AD	4	2		6 *	--		5.3	--

Table V-2.

SITE [a]	Species [b]	PASS 1	PASS 2	PASS 3	Lengths (mm)
OTHER GAME FISH [d]					
WILD 3	DV	1	0		166
5	DV	1	1		156,145
10	DV	5	0		205,125,114,109,122
11	DV	3	0		152,182,111
14	DV	2	0		131,201
14	WF	2	1		360,415,343
16.1	DV	1	0		151
19	DV	6	0		120,52,122,108,89,127
21	DV	5	3		102,132,124,116,133,127,120,124
PANJAB					
3	DV	1	0		131
SHEEP					
1	DV	2	0		203,140
3	DV	1	0		179
HMA					
5	WF	1	0		215
6	WF	2	0		201,191
8	DV	1	0		189
12	WF	2	0		380.385
12	DV	3	1		203,211,261,310
14	DV	4	0		155,213,146,302
16	DV	1	0		306
16.5	DV	1	0		160
17	DV	1	0		178
18.5	DV	1	0		151
20	WF	1	0	0	30
21	DV	1	0		230
22	DV	1	0		233
HMAS					
2	DV	1	0		192
HART					
3	WF	2	0		232,295
5	WF	1	0		238

[a] Sites within the Wilderness start at the Panjab confluence and are at 1000 ft intervals, with Site 21 about 300 m below Ruchert's Camp. 1985 sites 2.2, 2.4, 3.3, 3.4, 4.2, 7, and 10 were renamed 3, 5, 10, 11, 14, 19, and 21, respectively, for 1986. HMA sites begin near the HMA HQ then at approx. 1000 m intervals in a systematic manner by habitat type. Hartsock sites begin at Hartsock Grade (Sites 2 and 3 were TU7 and 8, respectively, in 1985). Hart 4 & 5 are new for 1986 - contact Bob Bugert, WDF, for specific locations. Panjab sites were at 240 ft intervals with the first site 150 ft upstream of the confluence. Sheep and Cumming Creeks are similar to Panjab.

[b] Age based on length-frequency histograms. 1+ and Total includes hatchery fish. AD = Adipose or ventral fin clips or brands.

* <= 60% reduction between passes, used sum to estimate population.

[c] Data for Sheep Ck sites 2 and 4 are unavailable from WDF.

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

Appendix W.

Rainbow and Brown Trout Plants, Lyon's Ferry/Tucannon, 1986.

COUNTY	LOCATION	No. of Plants	Pounds of Fish	No. Fish Planted
ASOTIN	Alpowa Ck.	1	840	2604
	Asotin Ck.	1	2125	6588
	Golf Course Pd.	2	250	4215
	Headgate Pd.	2	710	2345
	Silcott Pd.	1	430	1505
	W.Evans Pd.	2	610	2063
	TOTAL		5,965	19,320
COLUMBIA	Beaver Lk.	3	1200	3755
	Big Four	1	1005	2512
	Blue Lk.	4	4382	13883
	Curl Lk.	3	4035	12293
	Dam Pd.	2	736	1668
	Dayton Jv.Pd.	2	595	1989
	Deer Lk.	4	2587	7432
	Orchard Pd.	2	435	1017
	Rainbow Lk.	8	10002	29899
	Spring Lk.	4	5213	14920
	Touchet R.(RB)	1	1588	5306
	Touchet R.(GB)*	1	4302	12906
	Tucannon R.	5	8335	25134
	Watson Lk.(RB)	8	8665	29795
	Watson Lk.(GB)*	1	630	1575
	TOTAL	Rainbow Tr.	48,108	143,577
		Brown Tr.	4,932	14,481
FRANKLIN	Dalton Lk.	1	1680	5040
	TOTAL		1,680	5,040
GARFIELD	Bakers Pd.	1	290	1044
	Casey Pd.	1	290	1015
	Coles Pd.	2	440	1509
	Pataha Ck.	3	1390	4641
	TOTAL		2,410	8,209
WALLA WALLA	Blue Ck.	1	180	648
	College Pl. Pd.	2	480	1575
	Coppei Ck.	1	400	1440
	Dry Ck.	1	400	1440
	Fishhook Pk. Pd.	2	1775	6043
	Jefferson Pk. Pd.	2	480	1575
	Mill Ck.	3	3350	9913
	Mill Ck. Resv.	1	9000	22950
	Quary Pd.	2	6490	15628
	TOTAL		22,555	84,162
WHITMAN	Alkali Ck.	1	130	468
	Garfield Pd.	1	415	1494
	Gilcrest Pd.	1	415	1494
	Pampa Pd.	3	4082	10883
	Riparia Pd.	1	468	1076
	Union Flat Ck.	1	320	1152
	TOTAL		5,830	16,567
	GRAND TOTAL	Rainbow Tr.	86,548	253,951
		Brown Tr.	4,932	14,481

* State program, not LSRCP funded.

Appendix X. Corrected Adult returns to Columbia River Basin, 1985.

Table 1. Adult Returns of Lyons Ferry Steelhead to Locations and Fisheries within the Columbia River Basin, 1985. @

Estimated recovery or harvest (% of release)							
Tag Code Brand	63/28/38 (LA-S-1)	63/28/39 (RA-S-1)	63/28/40 (RA-S-2)	63/32/12 (RA-IJ-1)	63/32/13 (RA-IJ-2)	63/32/14 (RA-IV-1)	63/32/15 (RA-IV-3)
Location							
L.Col. Sport	17(.035)					9(.030)	
Zone 6 Net	142(.289)	51(.153)	84(.269)	24(.082)	36(.123)	29(.097)	69(.235)
Deschutes R. caught escaped		7(.021)*	5(.016)*				
L.Ferry Ladder	43(.087)*	3(.009)*	2(.006)*	2(.007)*	3(.010)*	2(.006)*	2(.007)*
Upper Snake R. Sport	51(.113)	29(.087)	9(.029)[1]	20(.068)[1]	57(.194)[1]	49(.166)[1]	43(.146)
Idaho Sport[2]	25(.055)			14(.048)	13(.044)	6(.020)	13(.044)
Wallowa Hatch.		19(.057)	15(.048)				
Totals	275(.616)	109(.329)	115(.368)	60(.205)	109(.371)	94(.318)	127(.432)

@ tag recoveries are based on sample data collected by several agencies and forwarded to WDG through each states' tag coordinator.

* Indicates that no sample rate could be obtained and the number listed is for fish collected.

[1] No in-sample sport recoveries. Number listed here is jaw tags returned to NMFS at L. Granite dam for a $5.00 reward.

[2] IDFG data for rivers other than the Snake R.