Lyons Ferry Complex Hatchery Evaluation: Summer Steelhead and Trout Report 2001 and 2002 Run Years

by

Joseph D. Bumgarner
Maureen P. Small
Lance Ross
Jerry Dedloff

Washington Department of Fish and Wildlife
Fish Program / Science Division
Hatchery & Wild Interactions Sub-Unit
600 Capital Way North
Olympia, Washington 98501-1091

to

U.S. Fish and Wildlife Service
Lower Snake River Compensation Plan Office
1387 Vinnell Way, Suite 343
Boise, Idaho 83709
Cooperative Agreements #'s 14110-1-J042, 14110-2-J050,
and 14110-3-J051

December 2003

Acknowledgments

The ongoing success of the steelhead and trout program is the result of the coordinated and dedicated efforts of many WDFW employees, as well as employees from other State and Federal Agencies. We especially thank Butch Harty, Don Peterson, Doug Maxey, Dick Rogers, and the Lyons Ferry/Tucannon staff for their hard work, insight, and assistance of activities conducted at Lyons Ferry Complex for the last two years.

We thank Jon Hansen, Marsha White, and Larry Barrett, of Idaho Fish and Game for their assistance in conducting joint Snake River creel surveys and providing coded-wire tag recoveries from Idaho fisheries. We also thank Rich Carmichael's crew from Oregon Department of Fish and Wildlife, especially Mike Flesher, for their leadership in conducting the Grande Ronde River creel survey and providing the CWT recoveries. Jerry Harmon and the other NOAA Fisheries personnel at Lower Granite Dam provided valuable data on adult freeze-branded steelhead passage. The accuracy and timeliness of all the data provided by the above individuals is always appreciated.

We thank Glen Mendel and the WDFW Fish Management staff in southeast Washington for collecting summer steelhead genetic samples in the smaller tributaries of the Walla Walla River Basin. Bonneville Power Administration (BPA) provided the WDFW funding for collection and partial analysis of these samples.

We thank John Sneva, Jim Shaklee, Susan Markey, Charles Morrill and Lynn Anderson for their assistance with portions of the project.

We thank Mark Schuck, Glen Mendel, Debbie Milks, Michael Gallinat, Chris Star, Todd Pearsons, and Jim Scott for their critical review of the draft manuscript, and Colleen Desselle for preparing the final draft for printing.

Finally we thank the entire staff of the Lower Snake River Compensation Plan Office for their firm support in funding these studies.

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Abstract

As part of the Lower Snake River Compensation Plan (LSRCP) mitigation program, Lyons Ferry Complex (LFC) released summer steelhead into area rivers, and rainbow trout were stocked into local lakes during the springs of 2002 and 2003. Additionally, fry and fingerling rainbow trout were reared and provided to Idaho Fish and Game during those same years. Sub-groups of released juvenile steelhead were tagged with a combination of the following internal/external tags/marks (freeze brand, coded-wire tag (CWT), Visual Implant Elastomer (VIE) tag, adipose and ventral fin clip) and released into the Tucannon, Walla Walla, Touchet, Snake, and Grande Ronde rivers. In addition, Passive Integrated Transponder (PIT) tags were used to monitor migration timing and success through the Snake and Columbia River dams, and for determining smolt-to-adult survival in Tucannon River natural and endemic brood smolts captured and released from the Tucannon River smolt trap. Detection and survival rates varied among the groups but were likely related to bypass efficiency at each collector facility. All previous PIT tag releases (1994-2002) were summarized using the SURPH2 survival estimator, and compared to detection rates.

Natural and hatchery origin steelhead smolts were also captured/sampled/PIT tagged at the Tucannon River smolt trap (2001/2002 migration). A population estimate by age class was completed for the naturally produced population.

Residualism of endemic brood hatchery steelhead in the Tucannon and Touchet rivers was monitored through a combination of electrofishing estimates and smolt trapping (Tucannon River only). Endemic stock residualism rates based on these methods indicated relatively low residualism. However, our methods do not allow for an assessment of fish removed from the trout fishery, or from mortality immediately following release until the time of summer electrofishing sampling. The length frequency of residuals that were sampled during electrofishing surveys appeared to be spread uniformly across the release group.

Adult trapping occurred at Lyons Ferry Hatchery and Cottonwood trap for the collection of standard hatchery broodstock (Lyons Ferry and Wallowa stocks). In addition, endemic broodstock programs continue to be investigated on the Touchet and Tucannon rivers. These programs may eventually replace the Lyons Ferry and/or Wallowa stocks in each of the rivers. Efforts to date have only proven somewhat successful with apparent improved stock performance (survival) in the hatchery for both stocks. However, problems in rearing continue to limit program effectiveness. Adult traps have also allowed access to fish for natural stock characterization. We investigated the use of a resistivity counter on the Touchet River in 2003. Results of the counter were positive and we believe future use will provide accurate counts of returning steelhead into the upper Touchet River. Spawning and egg fertilization procedures on the LFH stock were examined in 2003 with higher egg survival documented in the test groups. Results prompted a change in fertilization procedures (not draining the ovarian fluid prior to fertilization) for both endemic programs and the Wallowa stock where success has generally been poor in the past, but were greatly improved using the new procedure.

National Marine Fisheries Service (new name "NOAA Fisheries" – 2003) provided freeze-brand data from adult steelhead captured at Lower Granite Dam for the 2001 and 2002 run years. The data

provided insight to the potential stray rates of Lyons Ferry stock steelhead into the upper Snake River Basin. Also, freeze-brand data on the Wallowa stock fish released from the Grande Ronde River at Cottonwood AP, were used to estimate adult returns to the project area. The Lower Granite Dam brand data have generally been more reliable than coded-wire tag estimates.

Creel surveys were conducted in the Washington portion of the Snake River, and it's tributaries, and in the Walla Walla and Touchet rivers in both run years. We surveyed between 6,600 and 10,200 steelhead anglers. Overall catch rates varied slightly between the years. Anglers interviewed, catch rates, and harvest rates were summarized. We conducted cooperative creel surveys on the Lower Grande Ronde River in Washington with Oregon Department of Fish and Wildlife (ODFW). Grande Ronde creel data (total catch, effort hours, etc.) were summarized by ODFW and provided to WDFW for inclusion in this report.

Spawning ground surveys were conducted in the Tucannon River, portions of the Touchet River, and portions of the Asotin Creek basin in 2002 and 2003. High stream flows in both 2002 and 2003 made surveys difficult, and did not allow a final estimate to be calculated. Electrofishing surveys on the Tucannon and Touchet rivers, and Asotin Creek were conducted during July and August each year. The numbers of naturally produced steelhead in LSRCP rivers were similar to previous years and appear to be generally stable. The juvenile estimates in 2002 from most of the sites sampled showed an increase in densities that was likely due to the very strong return in 2001/2002.

Preliminary genetic stock analysis of Tucannon and Touchet river natural origin steelhead, and LFH stock steelhead was completed. Results indicate that each of these natural stocks remain genetically distinct from the LFH stock despite years of supplementation in each basin. Tucannon and LFH stocks are more similar and indicate some introgression between the two. Further analysis of the Tucannon and LFH stocks needs to occur, and long-term monitoring of the genetic characteristics of the new endemic broodstock(s) should occur because of the small founding populations used.

In summary, the Lyons Ferry summer steelhead program continues to meet and/or exceed its original mitigation goals by supplying large returns for harvest within the Lower Snake River area. However, impacts to listed salmonid species and other non-target species may not be within acceptable limits. Further evaluation and monitoring must occur to fully assess these impacts (i.e. reproductive success of hatchery and native fish where they co-exist), and to implement changes in the future. In the interim, production of both LFH and Wallowa stocks were decreased as a precautionary measure. The degree and rate of straying of LFH and Wallowa stocks needs to be summarized for upcoming Subbasin Planning efforts. Genetic stock characterization needs to continue, especially with the new broodstock developments, and additional analysis is needed in the Tucannon River to determine the degree of stock introgression with the LFH stock.

Introduction

This annual report is one in a continuing series describing Washington Department of Fish and Wildlife's (WDFW) progress toward meeting trout (resident and anadromous) mitigation goals established in the Lower Snake River Compensation Plan (LSRCP). The reporting period covers between 1 July 2001 and 30 June 2003. Smolt trapping information for the 2002/2003 migration will be presented in a future report, as population estimates were not completed at time of report printing. In addition, coded-wire tag recoveries and expansions from the sport fishery will be presented in future reports.

The LSRCP program in Washington State began in 1981 with construction of Lyons Ferry Hatchery (LFH). Refurbishing of the Tucannon Fish Hatchery (TFH) followed in 1984-85. In addition to the hatchery construction and modifications, three remote acclimation ponds (AP) were built along the Tucannon, Touchet, and Grande Ronde rivers to acclimate juvenile summer steelhead[1] before release. All of these facilities make up WDFW's Lyons Ferry Complex (LFC) (Figure 1).

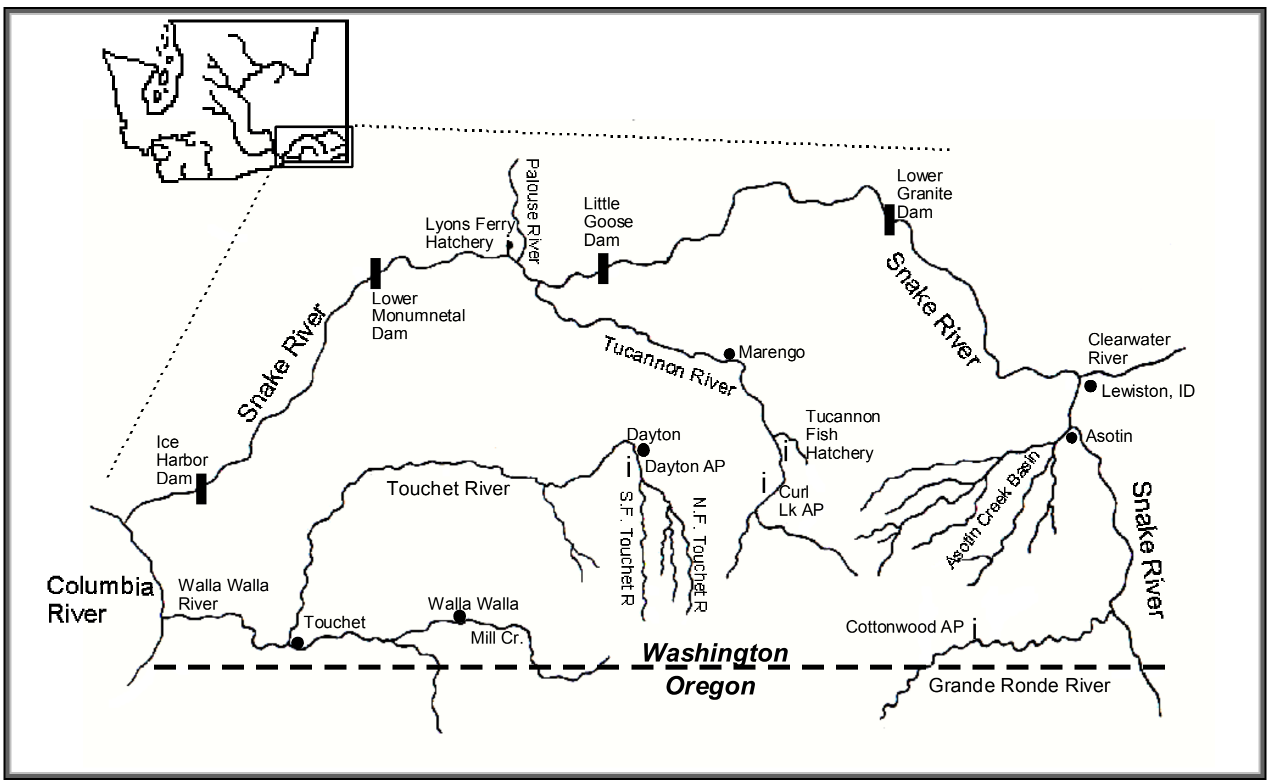

Figure 1. Map of major rivers and streams in Southeast Washington, and Lyons Ferry Complex facilities.

1 Throughout this report, the term "steelhead" refers to summer steelhead, unless otherwise noted in the text.

The LFC steelhead program began as “in kind, in place” replacement under the mitigation program, with goals to maintain genetic integrity of steelhead stocks. Unfortunately, non-endemic steelhead stocks were initially utilized for the program (Wells and Wallowa stocks). Broodstock trapping at Lyons Ferry (mainly Wells stock, but occasionally mixed with Wallowa stock) eventually made to what we now term the LFH stock. These non-endemic stocks were de-facto “supplementation” stocks to the natural populations within the basins where they were planted, since they were allowed to escape into natural spawning areas. However, that strategy is not the current goal, and supplementation of the natural populations with these stocks is considered undesirable. Actions have been taken where possible to reduce this impact (i.e., changing of release locations, reductions in the numbers released, fishery regulation changes, and development of new endemic broodstocks on the Tucannon and Touchet rivers).

Recent declines in adult natural[2] steelhead escapement, and the eventual listing by the National Oceanographic and Atmospheric Administration (NOAA) Fisheries (formally known as National Marine Fisheries Service) of Snake River and Mid-Columbia steelhead under the ESA in 1999 as “Threatened”, reinforces the need for continual monitoring of natural steelhead and salmon populations in rivers receiving LFC fish. Natural juvenile density and population estimates, and population estimates from smolt trapping (Tucannon River only) are used to assess the potential effects of hatchery fish on natural populations, as well as determine whether hatcheries can be used in recovering ESA listed populations. Further, because of federal rulings on the risks of the hatchery stocks (National Marine Fisheries Service 1999 Biological Opinion), the project has been tasked with deciding what course of action should be taken with our hatchery steelhead stocks to lessen effects on ESA listed fish (i.e. releases of LFH (non-local) stock of summer steelhead into the Touchet River).

The Lyons Ferry Evaluation assesses whether the LFC produces fish that meet the LSRCP mitigation goals (USACE 1975), as determined through estimated returns to the project area (Snake River) from trap counts, spawning escapement estimates, and the sport fishery. The evaluation program also attempts to determine what parts of the mitigation program may adversely affect listed salmonid populations protected under the Endangered Species Act (ESA), and recommends actions to improve the facilities' effectiveness.

[2] Throughout this report, the term “natural” steelhead refers to fish that were reared in the stream, but could have been produced by parents of either wild or hatchery origin.

Methods/Results/Discussion

Hatchery Operation Monitoring

Rainbow Trout Production

As part of the LSRCP mitigation program, WDFW has produced rainbow trout for release into rivers and lakes in southeast Washington for recreational fishing opportunities. Original goals of the LSRCP were to provide 93,000 lbs (3 fish/lb) to the area, of which 6,100 lbs were destined for Idaho waters (USFWS 1998). The original rainbow trout program goal was reduced by 13,100 lbs for instream habitat improvement projects on the Tucannon River and Asotin Creek (Schuck 1985). Currently, the LFC goal is to produce 237,500 trout (79,900 lbs) for release into southeast Washington. For the Idaho Fish and Game (IDFG) LSRCP program, LFC will produce 150,000 (3,000 lbs) fry (Spokane stock), and 50,000 (3,333 lbs) fingerlings (Kamloops stock). With ESA listings of chinook, steelhead, and bull trout in recent years, stocking of rainbow trout from LFC into Washington State area waters has been shifted exclusively to small lakes and ponds to reduce the potential negative affects to listed species that reside in rivers.

Rainbow trout (mainly Spokane stock) for the LSCRP program are reared at both LFH and TFH. Performance of the Spokane stock production from LFC has been monitored for many years (Table 1). Survivals by brood year (BY) have remained relatively constant from year to year. Number of fish planted (fry + catchable) represents total annual production of LSRCP rainbow trout. A State funded trout program (Production Goal = 4,000 fish) also contributes to overall production within the lower Snake River area. In 2002, LFC produced 203,880 (68,779 lbs) catchable size rainbow trout and released them into southeast Washington waters (Appendix A). Catchable trout presented in Appendix A represent both LSRCP and State funded trout programs. Catchable trout (LSRCP and State funded programs combined) averaged 2.96 fish/lb at release in spring 2002. In 2003, LFC produced 216,944 (72,417 lbs) catchable size rainbow trout and released them into southeast Washington waters. Catchable trout (LSRCP and State funded programs combined) averaged 3.3 fish/lb at release in spring 2003.

Between 2001 and 2003, WDFW provided fry and fingerling to Idaho Fish and Game for release into Idaho waters for recreational fishing opportunities. The number of fish provided satisfied the mitigation goals. In 2001, 152,791 rainbow trout fry (1,874 lbs) and 36,600 fingerlings (1,525 lbs) were reared and transferred to Idaho. In 2002, 160,615 rainbow trout fry (1,663 lbs), and 41,682 fingerlings (940.9lbs) were reared and transferred to Idaho.

Table 1. LSRCP produced rainbow trout (Spokane stock) and survival rates at LFC, brood years 1986-2002.

Stock (BY)	Eggs received	Fry produced	(Egg-to-fry survival)	Fish planted # of fry	Lbs of fry	# of catchable	Lbs of catchable	(Fry-to-outplant survival)
Spokane (86)	464,500	377,393	81.2%	100,289	973	136,045	41,570	62.6%
Spokane (87)	501,500	446,694	89.1%	147,993	5,903	266,360	92,225	92.8%
Spokane (88)	530,700	426,153	80.3%	207,186	18,792	226,690	91,829	100.0%
Spokane (89)	758,090	652,535	86.1%	272,164	7,589	264,974	97,088	82.3%
Spokane (90)	618,000	596,670	96.5%	257,780	6,162	218,917	97,264	79.9%
Spokane (91)	696,220	637,285	91.5%	269,387	8,639	271,052	108,956	84.8%
Spokane (92)	603,200	648,731	90.9%	242,366	6,981	286,604	106,325	96.4%
Spokane (93)	615,600	600,308	97.5%	276,602	7,867	263,521	85,013	89.9%
Spokane (94)	690,200	660,944	95.7%	319,125	10,111	216,837	72,088	81.1%
Spokane (95)	685,610	656,301	95.7%	209,905	7,144	291,028	87,570	76.3%
Spokane (96)	677,420	626,030	92.4%	266,626	7,748	248,254	79,920	82.4%
Spokane (97)	570,000	568,362	99.7%	189,961	3,735	393,776	116,373	100.0%
Spokane (98)	545,000	543,801	99.8%	160,900	2,726	239,767	81,440	73.7%
Spokane (99)	545,000	515,070	94.5%	189,788	2,725	191,065	76,553	73.9%
Spokane (00)	545,000	475,348	87.2%	205,091	2,011	209,156	69,682	87.4%
Spokane (01)	545,598	582,473	100.0%	251,517	2,230	216,944	72,417	65.6%

Note: The precision of hatchery methods at times measure survival between life stages as > 100%; 100% is reported as a maximum in these situations.

Steelhead Production

The LFC currently produces four stocks of steelhead that supply the smolts released into the Snake, Tucannon, Grande Ronde, Walla Walla, and Touchet rivers. All smolt releases into LSRCP area waters are planned for a release size of 4-5 fish/lb. Production goals (numbers of fish) have been reduced in recent years for both the LFH and Wallowa stocks produced at LFC due to jeopardy rulings by NOAA Fisheries, a rising from concerns about impacts to natural stocks and returns exceeding mitigation goals. The production cuts in both the LFH and Wallowa stocks, to reduce potentially negative impacts to ESA listed steelhead, was estimated by evaluating the average smolt-to-adult survival rates from this stock, and the ability to achieve the mitigation goal (1,500 adults annually) 80% of the time.

The Wallowa stock steelhead are collected by trapping fish in Cottonwood Creek (tributary to the Grande Ronde), with a 2003 release year production goal of 200,000. All Wallowa stock steelhead produced from LFC are released into the Grande Ronde from Cottonwood AP. The 2003 brood year smolt production was reduced to 160,000 based on smolt survivals.

The LFH stock steelhead is collected at the LFH trapping facility, with a 2003 release year smolt production goal of 420,000. The LFH stock are released into the Snake River at LFH (60,000 smolts), the lower Tucannon River at river kilometer (rkm) 27.2 (135,000 smolts), the Walla Walla River at rkm 36.8 (125,000 smolts), and the Touchet River at Dayton AP (100,000 smolts). For the 2003 brood year, production will be reduced from 420,000 to 345,000 smolts (60,000 @ LFH; 100,000 in the Tucannon; 85,000 for Touchet River at Dayton AP, and 100,000 in the Walla Walla River).

In 2000 we initiated the development and 5-year evaluation of two endemic stocks for the Tucannon and Touchet rivers. Interim smolt goals for each program during the development/evaluation stage have been set at 50,000. Natural (unmarked) fish collected from the Tucannon and Touchet rivers have been the broodstock.

Life stage survivals of steelhead at LFC remain highly variable among stocks and among years. Fish health problems (i.e., cold water disease), presence of pathogens such as Infectious Hematopoetic Necrosis virus (IHNV), and spawning conditions at LFC and at remote spawning sites (Cottonwood Creek adult trap), have all affected survival of the Wallowa and LFH stocks of steelhead (Tables 2 and 3). The newly developed endemic stocks in the Tucannon and Touchet rivers (Tables 4 and 5) have had slightly better survival in the hatchery than the LFH and Wallowa stocks.

Table 2. Number of spawners, average fecundity, and survival by life state of Wallowa stock steelhead spawned at Cottonwood Creek adult trap, 1992-2003.

BY	Spawned female	Spawned male	Average eggs/ female	Eggs taken	Eggs retained	Percent retained	Fry	Egg-fry survival[a]	Smolts	Fry-smolt survival
1992	113	225	4,942	558,437	198,747	25.6	186,656	93.9	160,017	85.7
1993	96	206	5,562	533,995	289,198	54.2	271,970	94.0	165,630	60.9
1994	118	204	5,465	644,886	366,115	56.8	302,397	82.6	144,503	47.8
1995	99	61	5,164	511,283	335,489	65.6	321,050	95.7	263,449	82.0
1996	124	109	4,855	601,979	430,394	71.5	447,569	100.0	274,886	64.1
1997	92	92	5,834	536,723	401,270	74.8	317,590	79.1	252,211	79.4
1998	173	164	5,023	868,973	479,606 [b]	55.2	475,181	99.1	268,803	56.6
1999	126	116	4,775	601,699	389,664	64.8	389,664	100.0	274,146	70.4
2000	105	116	4,981	523,011	322,238	61.6	322,238	100.0	215,584 [c]	66.9
2001	94	108	5,364	504,182	381,427	75.7	253,743	66.5	182,722	72.0
2002	82	87	5,152	422,441	319,479	75.6	261,335	81.8	236,627	90.5
2003	65	65	5,192	327,477	242,557	95.3	232,433	95.8		

[a] The imprecision of hatchery methods at times measures survival between life stages as >100% ; 100% is reported as a maximum in these situations.

[b] Destroyed 285,785 viable, disease free, eyed eggs that were in excess of program needs.

[c] Release goal was changed from 250K to 200K during rearing. Excess smolts (50,270) were planted as catchable trout into SE Washington area lakes.

Table 3. Number of spawners, average fecundity, and survival by life state of LFH stock steelhead spawned at LFH, 1987-2003.

BY	Spawned female	Spawned male	Average fecundity	Eggs taken	Eggs retained	Percent retained	Fry	Egg-fry survival[a]	Smolts	Fry-smolt survival
1987	250	NA	4,446	1,111,506	1,095,906	98.6	983,901	89.8	665,658	67.3 [b]
1988	267	NA	3,527	941,756	818,148	86.9	793,240	96.9	597,607	75.3
1989	243	576	5,198	1,263,237	957,074	75.8	941,000	98.3	0	0.0 [c]
1990	437	955	5,883	2,570,676	1,483,485	57.7	1002,320	67.6	635,635	63.4
1991	261	532	4,966	1,296,249	1,165,315	89.9	1115,368	95.7	357,497	32.1 [d]
1992	240	100	5,162	1,239,055	905,438	73.1	416,265	46.0	387,767	93.2 [e]
1993	234	100	5,175	1,211,053	940,022	77.6	860,983	91.6	611,417	71.0
1994	253	NA	5,345	1,352,296	899,350	66.5	845,316	94.0	558,130	66.0
1995	343	NA	5,168	1,772,477	929,597	52.4	895,882	96.4	610,545	68.2
1996	330	NA	4,893	1,614,636	1,151,363	71.3	1148,114	99.7	807,253	70.3 [f]
1997	217	246	5,025	1,090,638	962,705	88.3	809,845	84.1	569,264	70.3 [g]
1998	279	280	5,236	1,460,967	934,247 [h]	63.9	768,522	82.3	567,732	73.9
1999	227	253	5,025	1,140,813	807,374	70.8	807,374	100.0	495,864	61.4
2000	183	188	4,764	871,856	650,867	74.7	617,380	94.9	381,686	61.8
2001	151	242	5,300	800,350	636,727	79.6	505,451	79.4	423,065	83.7
2002	194	231	4,954	941,223	768,832	81.6	732,566	95.3	378,917[i]	60.4
2003	126	257	4,524	580,351	533,287	91.9	521,578	97.8		

a The imprecision of hatchery methods at times measures survival between life stages as >100% 100% is reported as a maximum.
b An additional 203,857 were outplanted as pre-smolts (fry-outplant survival was 88.4%)
c Losses to IHNV = 100%
d Includes 92,116 fish planted as sub-smolts: an estimate 172,000 fish lost to bird predation.
e Destroyed 378,257 fish infected with IHNV
f Includes 191,000 fry planted into Sprague Lake.
g Included 15,207 fry planted into Rock Lake.
h 308,666 eggs discarded from IHNV positive females.
i Does not include 105,502 fish that were planted as fry in to Sprague Lake.

Table 4. Number of spawners, average fecundity, and survival by life state of Tucannon Endemic stock steelhead spawned at LFH, 2000-2003.

BY	Spawned female	Spawned male	Average fecundity	Eggs taken	Live eggs	Percent survival	Fry	Egg-fry survival[a]	Smolts	Fry-smolt survival
2000	16	21	5,053	80,850	71,971	89.0	71,971	100.0	60,020	83.4
2001[b]	15	15	7,571	113,563	101,497	89.4	98,836	97.4	58,616	82.7
2002	13	16	5,708	74,204	66,969	90.3	51,713	77.2	43,688	84.5
2003	11	19	5,676	79,464	52,034	65.5	51,119	98.2		

a The imprecision of hatchery methods at times measures survival between life stages as >100% 100% is reported as a maximum.
b 24,948 fingerlings were released in October 2001. Fry to smolt survival is calculated from fry minus fingerling release minus 3,000 loss between fry and fingerling outplant.

Table 5. Number of spawners, average fecundity, and survival by life state of Touchet Endemic stock steelhead spawned at LFH, 2000-2003.

	Spawned									Fry-
BY	female	male	Average fecundity	Eggs taken	Live eggs	Percent survival	Fry	Egg-fry survival[a]	Smolts	smolt survival
2000	12	7	4,428	53,139	43,572	82.0	43,296	99.4	36,487	84.3
2001	14	11	4,847	67,861	52,116	76.8	52,116	100.0	45,501	87.3
2002	14	19	5,060	70,843	66,460	93.8	31,715	47.7	31,440	99.1
2003	16	17	5,762	92,184	84,641	91.8	81,247	95.9		

[a] The imprecision of hatchery methods at times measures survival between life stages as >100% 100% is reported as a maximum.

Fish Marking and Releases

All hatchery steelhead production from the LFH or Wallowa stocks produced at LFC were marked with an adipose (AD) fin clip prior to release for harvest management. Study groups within the LFH and Wallowa stocks of fish were marked with one or a combination of the following: CWT, left ventral (LV) fin clip, and freeze brands for specific contribution studies (Appendix B). Most of the groups were released for eventual documentation of survival and contribution to fisheries. Another objective of the marked released groups was to determine stray rates of LFC produced fish from their release locations.

The Tucannon and Touchet rivers endemic steelhead stocks are not currently managed for harvest; so adipose fins were not clipped prior to release. In 2002, the Tucannon and Touchet endemic stocks were coded-wire tagged (CWT) and given a red Visual Implant Elastomer (VIE) tag behind the eye for external identification (Appendix B, Table 1). In 2003, the Tucannon and Touchet endemic stocks were CWT and given a green VIE tag behind the eye for external identification. Visual Implant tag color will vary each year in the future for BY designation upon adult return and capture at adult traps.

Further, groups of endemic steelhead from the Touchet and Tucannon release sites were tagged with Passive Integrated Transponder (PIT) tags to monitor migration success (detection at downstream dams), and migration timing. Other groups were also tagged from the LFH and Wallowa stocks. Tag codes, freeze brands, and VIE tags were reported to the Pacific States Marine Fishery Commission (PSMFC) for publication. Evaluation staff collected pre-release samples for all LFC release locations in 2002 and 2003 to characterize each release population (Table 6). Release size goals for the Wallow and LFH stock were generally met, but endemic stocks have typically been smaller than desired. Later and extended spawn timing, and the inability to successfully feed the endemic fish has continued to be a problem. Both endemic programs have produced fish that are easily frightened during feeding, unlike the LFH or Wallowa stock fish that aggressively respond to feed hitting the surface of the pond. Demand feeders, timed automatic feeders, or visually blocking the fish culturist during feeding times need to be explored when feeding the endemic stock if we hope to make these programs successful.

Table 6. Mean fork lengths, weights, condition factor (K), co-efficient of variation (CV), fish per pound (FPP), and the percent of each release visually documented as a precocial male from LFC steelhead prior to release, 2002 and 2003.

Location (Stock)	Year	Date	N	Avg LN (mm)	Avg WT (g)	K	CV	FPP	Percent precocial
Cottonwood									
(Wallowa)	2002	4/02	279	193.8	83.9	1.10	12.4	5.4	0.4
	2002	4/09	252	201.4	89.2	1.06	10.6	5.1	1.2
	2003	3/25	213	182.7	69.7	1.10	11.6	6.5	0.0
	2003	4/01	247	202.8	93.2	1.08	10.1	4.9	0.0
	2003	4/08	276	196.1	86.1	1.10	11.1	5.3	0.0
Tucannon									
(LFH)	2002	4/12	328	213.1	103.0	1.02	11.6	4.4	1.8
(Endemic)	2002	4/03	276	195.1	82.3	1.03	15.5	5.5	2.5
(LFH)	2003	4/14	239	215.6	106.9	1.04	11.7	4.2	1.26
(Endemic)	2003	4/03	201	186.6	86.2	1.14	22.3	5.3	0.0
	2003	4/15	283	182.5	74.2	1.06	21.3	6.1	0.0
Touchet									
(LFH)	2002	4/05	299	207.6	102.6	1.12	9.7	4.4	0.0
	2002	4/12	281	214.9	113.9	1.11	10.4	4.0	0.7
	2002	4/19	201	219.5	115.9	1.08	9.9	3.9	0.5
(Endemic)	2002	4/30	828	185.3	71.5	0.98	15.8	6.4	2.7
(LFH)	2003	3/31	208	199.2	89.4	1.08	13.1	5.1	0.0
	2003	4/15	206	206.0	96.5	1.06	12.6	4.7	1.46
(Endemic)	2003	4/14	294	199.3	93.3	1.10	16.3	4.9	1.36
Walla Walla (LFH)	2002	4/12	313	218.0	113.3	1.05	11.4	4.0	0.0
	2003	4/14	221	213.4	102.2	1.02	9.8	4.4	0.9
Lyons Ferry									
(LFH)	2002	4/12	317	213.0	104.9	1.04	12.3	4.3	0.9
	2003	4/14	217	211.3	98.5	1.01	9.4	4.6	3.23
Lake #1 [a]									
(LFH)	2002	4/15	206	232.5	113.7	0.89	6.5	4.0	0.0
	2002	4/16	200	228.2	111.4	0.92	7.6	4.1	0.0
	2002	4/17	207	232.4	118.4	0.93	7.8	3.8	0.0
	2002	4/18	203	227.8	110.6	0.92	7.7	4.1	0.5
	2002	4/19	205	222.9	106.8	0.94	9.8	4.3	0.0
	2002	4/22	200	221.6	100.9	0.90	9.9	4.5	1.5
	2002	4/23	213	217.5	100.9	0.94	11.9	4.5	0.5
	2003	4/15	202	223.7	107.4	0.95	7.5	4.2	0.0
	2003	4/16	236	213.5	94.9	0.95	10.2	4.8	0.0
	2003	4/17	200	214.8	99.2	0.97	10.6	4.6	1.5

[a] Fish removed from Lake #1 were released in the Walla Walla, Tucannon and on-site at LFH.

Hatchery Smolt Emigration

Freeze Brands

We calculated relative smolt passage during down river migration in the Snake River (Cottonwood, Tucannon and Lyons Ferry releases) and the Columbia River (Dayton and Walla Walla River releases) from freeze brands sampled at the juvenile bypass facilities located at dams (Fish Passage Center unpublished data). A Passage Index[3], estimated median, and 95% passage time (days) for each freeze brand group released from the 1994 to 2002 release year was determined (Table 7). The 2003 release year data will be presented in a future report, as out-migration will continue past the reporting period. Passage index data for LFH and Tucannon River releases are for migration to Lower Monumental Dam. Lower Granite Dam was used for the passage index for fish released in the Grande Ronde River at Cottonwood AP. McNary Dam was used for the passage index for fish released from the Walla Walla Basin (Dayton and Walla Walla River). The percent of each release sampled based on the passage index can vary significantly from year to year (Table 7) because collection efficiency is dependent upon river flow and spill rates at the dams. The total number of fish entering the bypass facility, and the ability of the samplers working at the dam to handle these fish also likely influences the percentage sampled. For example, observations of brands from the 2002 release year was one of the lowest since 1994, while collection efficiency was very high in 1998 and 1999 for most release groups.

Table 7. Estimated passage of freeze branded LFC steelhead at the first downstream collector dam from site of release, 1994-2002 release year (FPC 2002, unpublished data)

Year Brand	Release site	Passage index	Number released [a]	Percent of release	Size (#/lb)	Passage days 50%	95%
1994							
LA/RA-7U-1,3	Tucannon River	7,074	50,008	14.1	4.3	33	58
LA/RA-IT-1,3	Walla Walla River	16,284	60,260	27.0	3.7	14	23
1995							
LA/RA-IC-1,3	Dayton AP	9,500	59,818	15.9	3.8	24	40
LA/RA-IJ-1,3	Tucannon River	5,514	52,929	10.4	5.3	26	44
LA-H-1	Lyons Ferry Hatchery	4,817	39,728	12.1	3.9	27	45
RA-H-1,2	Walla Walla River	11,539	49,515	23.3	3.7	12	23
1996							
LA-IV-1,3	Dayton AP	13,492	76,878	17.5	4.4	26	38
RA-IV-1,3	Tucannon River	5,597	56,813	9.9	5.0	17	41
LA/RA-IT-1,3	Lyons Ferry Hatchery	13,139	58,871	22.3	5.3	12	29
1997							
RA-IL-3	Cottonwood AP	13,931	38,032	36.6	6.8	14	31
LA-IC-1,3	Dayton AP	14,750	59,416	24.8	6.4	21	46
RA-IC-1,3	Tucannon River	8,920	57,286	15.6	5.7	22	39
LA/RA-S-1,2	Lyons Ferry Hatchery	14,712	78,872	18.7	4.5	20	44

[3] Passage Index is a relative indicator of group passage within a migration year and does not represent survival. A passage index is calculated by dividing daily fish collection by the proportion of flow passing through the sampled unit or powerhouse.

Table 7. continued

Year Brand	Release site	Passage Index	Number Released [a]	Percent of release	Size (#/lb)	Passage days 50%	95%
1999							
RA-IT-3	Cottonwood AP	39,524	85,365	46.3	4.3	27	43
RA-IT-1	Tucannon River	16,136	40,062	40.3	3.5	25	41
RA/LA-IV-1,3	Lyons Ferry Hatchery	38,016	78,537	54.8	3.5	16	39
2000							
RA-2-2	Cottonwood AP	22,915	74,036	30.9	5.5	29	39
LA-2-2	Dayton AP	4,713	37,077	12.7	3.6	36	58
LA-IC-1,3	Tucannon River	14,355	38,945	36.9	4.1	12	36
RA-IC-1	Lyons Ferry Hatchery	12,963	19,361	66.9	4.0	8	25
2001							
LA-IJ-1	Cottonwood AP	12,240	40,301	30.4	5.0	4	13
LA-S-1	Tucannon River	5,344	19,871	26.9	3.0	24	45
RA-S-1	Lyons Ferry Hatchery	6,805	19,837	34.3	3.2	16	40
2002							
LA-IT-1	Cottonwood AP	4,008	39,858	10.1	5.1	19	37
LA-IV-1	Tucannon River	1,221	20,942	5.8	4.2	19	40
RA-IV-3	Lyons Ferry Hatchery	1,751	19,524	9.0	4.6	20	37

[a] Adjusted for brand loss

Juvenile PIT Tag Results

During the spring of 2001, we PIT tagged several groups of hatchery origin steelhead and a few groups of natural origin steelhead (Tucannon River) to monitor downstream migration success and timing to each of the dams located on the Snake and Columbia rivers. In 2002, PIT tags were applied to natural and endemic brood fish at the Tucannon River smolt trap, and to endemic brood fish released on the Touchet River. Cumulative unique PIT tag detections from one of the Snake or Columbia river dams were summarized and provided a total detection history for each tag group (Table 8).

Detection rates from releases in 2001 at LFH, Dayton, and Cottonwood were similar to previous years (Bumgarner et al. 2002). The two endemic groups in the Touchet and Tucannon may not have migrated from the system to the degree as the other release groups based on detection rates we've observed in the past. Release size may be a factor in the detection rates as they were smaller than our standard release sizes of LFH or Wallowa stock fish.

During the spring of 2003, natural and endemic origin smolts were captured and PIT tagged at the Tucannon River smolt trap in 2003; tag information and survival estimates will be presented in future reports. PIT tags were not inserted into Touchet Endemic stock fish in 2003 due to the low detection rates from the Touchet River releases in the past.

Table 8. Unique detections of PIT tags from steelhead released from LFC facilities, 2001 and 2002.

Release year Release location/group	Number tagged	Detection facility [a] LGR	LGO	LMO	MCN	JDA	BONN	Total (%)
2001								
Lyons Ferry (LFH stock)	347	0	0	139	31	0	1	171 (49.3)
Touchet R. @ Dayton (LFH stock)	349	0	0	0	105	6	7	118 (33.8)
Touchet R. (Endemic stock)	507	0	0	0	9	0	0	9 (1.8)
Cottonwood AP (Wallowa stock)	349	219	11	4	2	0	1	237 (67.9)
Tucannon R. (Endemic stock)	497	0	0	102	17	1	0	120 (24.1)
Tucannon R. @smolt trap (Endemic)	320	0	0	112	17	0	1	130 (40.6)
Tucannon R. @smolt trap (LFH)	211	0	0	84	16	1	3	104 (49.3)
Tucannon R. @smolt trap (Natural)	333	0	0	166	27	0	0	193 (57.9)
2002								
Tucannon Endemic Stock Fingerlings								
Tucannon R. @ Lady Bug Flat C.G.	385	NA	NA	13	2	2	0	17 (4.4)
Tucannon R. @ Panjab Bridge	385	NA	NA	16	3	0	0	19 (4.9)
Tucannon R. @ Cow Camp Bridge	382	NA	NA	19	2	0	1	22 (5.8)
Tucannon R. @ Camp Wooten Br.	383	NA	NA	18	3	1	0	22 (5.7)
Endemic Stock Smolts								
Touchet R. (Endemic stock smolts)	800	NA	NA	NA	8	5	4	17 (2.1)
Tucannon R. @smolt trap (Endemic)	1,216	NA	NA	634	70	22	33	759 (62.4)
Tucannon R. @smolt trap (Natural)	1,506	NA	NA	768	119	38	43	968 (64.3)

[a] Detection Facilities: LGR - Lower Granite Dam, LGO - Little Goose Dam, LMO - Lower Monumental Dam, MCN - McNary Dam, JDA – John Day Dam, BONN - Bonneville Dam.

SURPH Estimates

Since 1994, evaluation staff have PIT tagged various groups of steelhead for study purposes. Results were presented as unique detections among all the downstream dams, which equates to a total detection rate at the first collection facility (i.e. fish detected at McNary Dam must have passed Lower Monumental Dam). These detection rates were compared among groups as relative survival rates, and management decisions were influenced by some of the results (i.e. releasing steelhead smolts in the lower Tucannon River to reduce interactions between ESA listed chinook and hatchery steelhead). In 2003, we decided to calculate survival estimates from all previous release groups by utilizing the Survival under Proportional Hazards (SURPH version 2.1) model, developed by researchers at the University of Washington.

A limiting factor to our PIT tag studies in the past has been the relatively low number of PIT tags used in various groups. For the most part, studies were not intended to estimate survival to the first downstream collection site, but from the system as a whole. Rather, the PIT tags were used to characterize successful smolts from our release groups, with cumulative unique detections providing a relative survival rate. Hence, because of the limited number of PIT tags used each year, and in some cases low detection rates, the SURPH model could not produce reliable estimates to the first downstream collection site. Further, because of the small sample sizes, survival estimates to the second downstream collection site (generally McNary Dam) could not be made either.

Lyons Ferry Releases: Groups of PIT tagged fish were released on-station at LFH between 1995-2001. Unique detections varied greatly over the years (Figure 2), and these results were mainly used as a comparison of performance of fish released into the Tucannon River from Curl Lake or Marengo. The limited number of tags released in 1995 did not allow the SURPH model to run correctly as it produced a survival estimate of 223% to Lower Monumental Dam. In every year, the SURPH survival estimates were greater than the estimates produced by unique detections. Excluding the 1995 data, the average (geometric mean) survival rate to Lower Monumental Dam from LFH releases was 74.5%, compared to the unique detection method of 49.5%

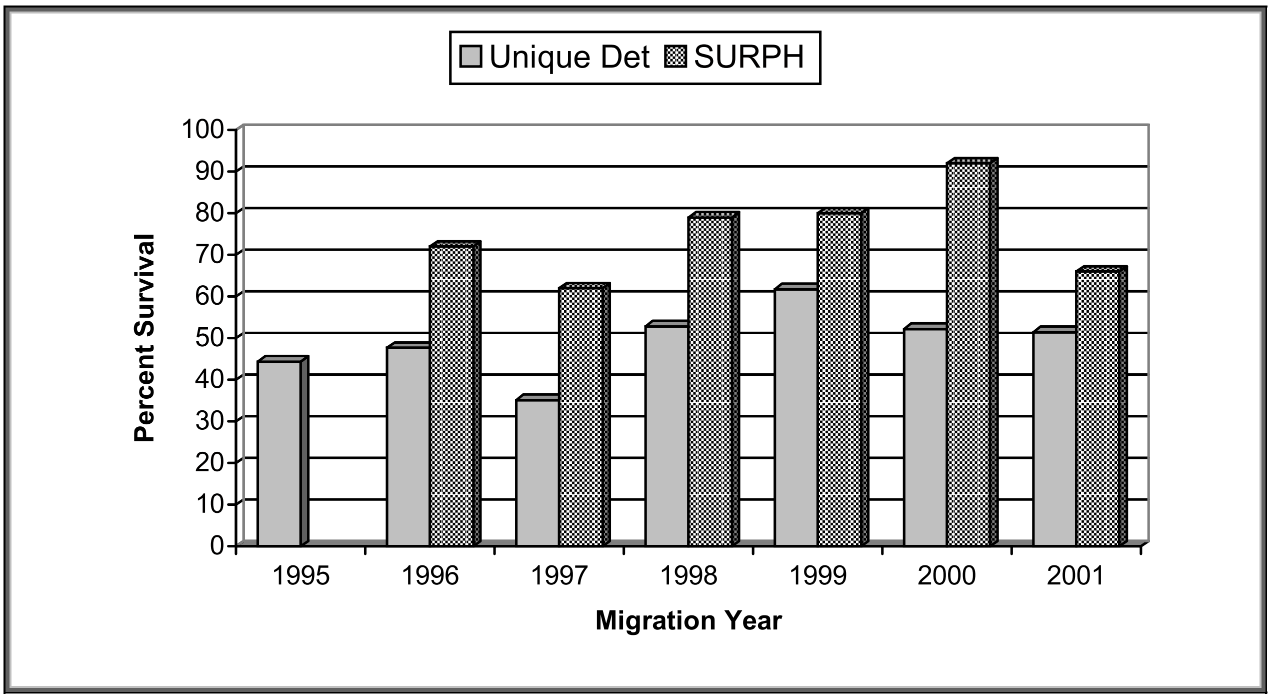

Figure 2. Estimated survival of PIT tagged summer steelhead (LFH stock) to Lower Monumental Dam released on-site from LFH based on cumulative unique detections or through the SURPH model estimation program.

Cottonwood AP Releases: Groups of PIT tagged fish were released from Cottonwood AP between 1998-2001. Unique detection rates varied greatly over the years. The SURPH survival estimates were greater than the estimates produced by unique detections, but were consistent (Figure 3). This is likely due to the high collection/detection efficiency at Lower Granite Dam. Average survival rate (geometric mean) estimated from the SURPH model was 70.6% compared to 64.4% from the unique detections.

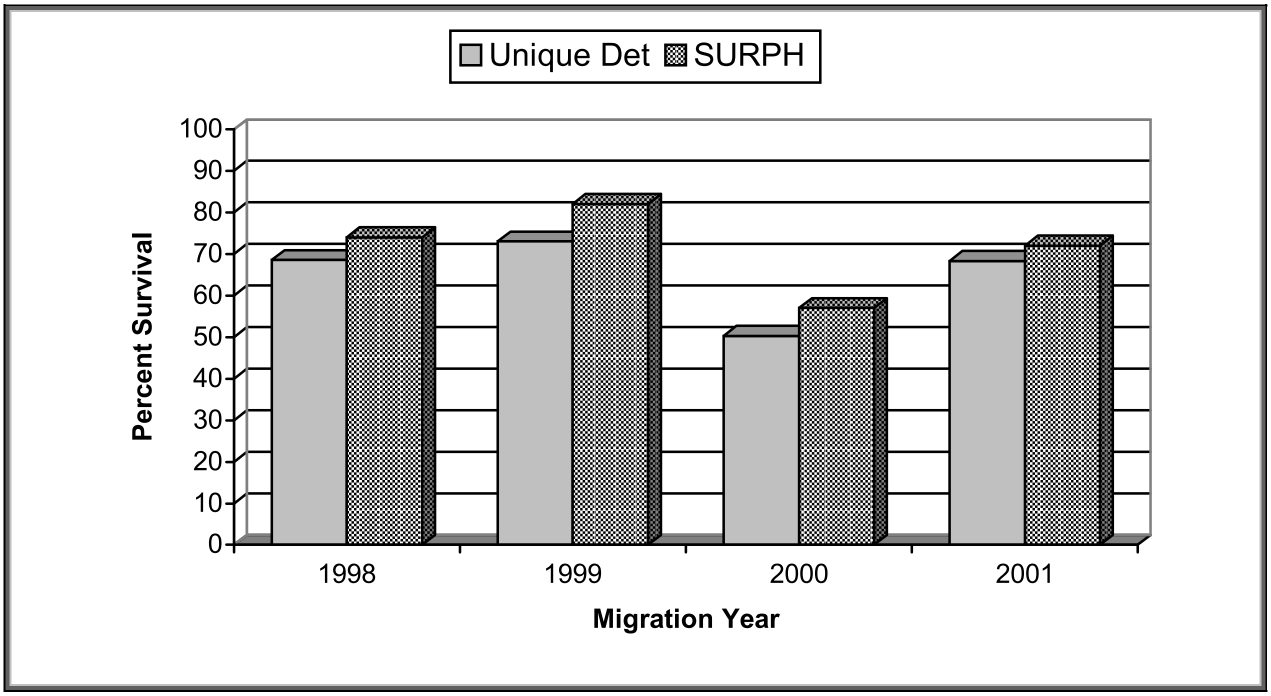

Figure 3. Estimated survival of PIT tagged summer steelhead (Wallowa stock) to Lower Granite Dam released from Cottonwood AP based on cumulative unique detections or through the SURPH model estimation program.

Touchet River/Dayton AP Releases: Groups of PIT tagged fish have been released in the Touchet River from Dayton AP or directly to the river from 1997-2002. Dayton AP releases occurred between 1997-2001, and direct river releases (Touchet endemic broodstock progeny) occurred in 2001 and 2002. Due to the low detection rates observed from our PIT tagged fish at McNary Dam, we have since abandoned the use of PIT tags in the Touchet River system. Consistent with previous results from LFH and Cottonwood releases, SURPH survival estimates were consistently higher as compared to the unique detection method (Figure 4). However, results were highly variable between and among years, demonstrating the lower detection rates observed at McNary Dam. Average survival rate (geometric mean) estimated from the SURPH model on Dayton AP releases was 37.2% compared to 19.5% from the unique detections. Average survival rate (geometric mean) estimated from the SURPH model on Touchet River direct stream releases was 3.5% compared to 1.9% from the unique detections. Direct stream release survival (Touchet endemic broodstock progeny) have been considerably lower than LFH stock releases from Dayton AP. Steelhead released from the endemic broodstock program have been undersized compared to LFH stock releases. We suspect that many of these fish never migrated from the stream after release.

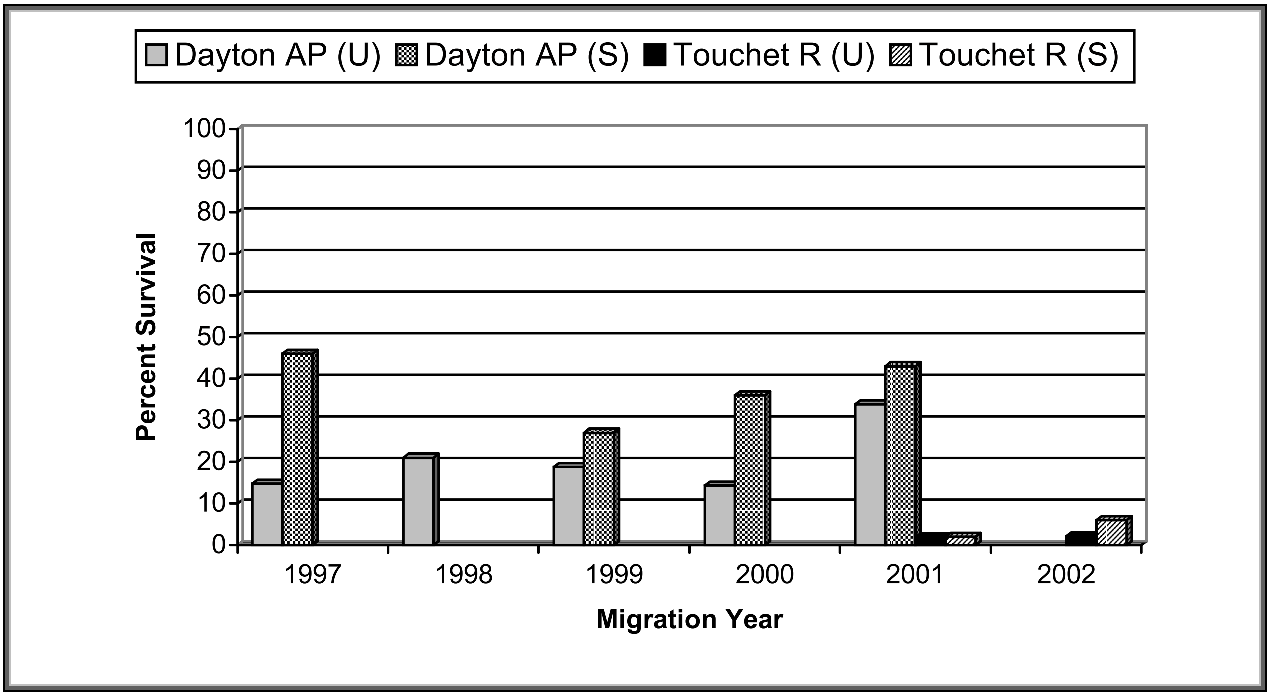

Figure 4. Estimated survival of PIT tagged summer steelhead (LFH stock) to McNary Dam released from Dayton AP based on cumulative unique detections (U) or through the SURPH model (S) estimation program.

Tucannon River Releases: Groups of PIT tagged fish have been released into the Tucannon River since 1994. Initial PIT tag studies revolved around the characterization of migrants and non-migrants from Curl Lake AP. In addition, PIT tags were put into groups of fish released directly into the Tucannon River at Marengo, or fish were PIT tagged after being captured at the smolt trap in the lower river. Each of these groups will be discussed in more detail below.

Curl Lake AP Releases: Migrants and non-migrants from Curl Lake AP were PIT tagged from 1994-1997. Results have varied over the years, but survival estimates produced from the SURPH model were generally consistent with the unique detection method. The number of migrants tagged in 1996 from volitional migrants did not allow for an accurate SURPH model estimate (Figure 5). Average survival rate (geometric mean) for volitional migrants estimated from the SURPH model was 49.5% compared to 13.4% from the non-migrants. Regardless, the results produced from the SURPH model were consistent to previous conclusions regarding migrant and non-migrant success from Curl Lake.

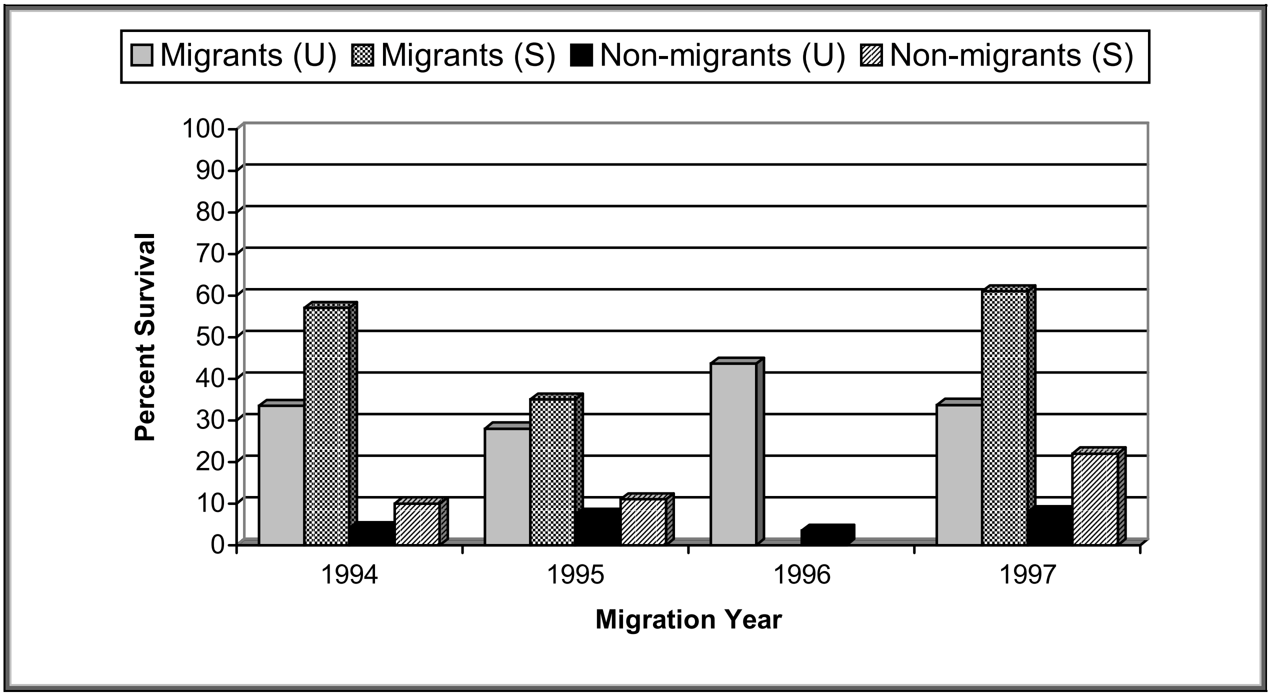

Figure 5. Estimated survival of PIT tagged summer steelhead (LFH stock) to Lower Monumental Dam released from Curl Lake AP in the Tucannon River based on cumulative unique detections (U) or through the SURPH model (S) estimation program.

Marengo Direct Stream Releases: Releases of PIT tagged fish occurred at Marengo between 1996-2000. Results have varied over the years, but survival estimates produced from the SURPH model were generally consistent with the unique detection method (Figure 6). Average survival rate (geometric mean) estimated from the SURPH model was 63.8% compared to 41.9% from the unique detection method. Average survival estimates from Marengo direct stream releases were consistently higher than survival estimates from Curl Lake AP volitional migrants (63.8% to 49.5%), but consistently lower than survival estimated from the LFH releases over the same years (63.8% at Marengo to 76.4% at LFH). However, an unknown percentage of the Marengo releases likely residualized or were mortalities immediately following release. These two factors likely account for the difference in survivals estimated.

LFH Stock at Smolt Trap: The LFH stock steelhead released into the Tucannon River are captured annually at the Tucannon River smolt trap. In 1999 and 2000, we PIT tagged a portion of those fish for comparisons of survival with natural origin fish captured and PIT tagged at the same site, and also to compare the survivals to those observed from the Marengo releases (as they were the same release group). Average survival rate estimated from the SURPH model was 87.9% compared to 52.2% from the unique detection method (Figure 7). Survival estimates from the SURPH model when compared to the Marengo direct stream releases for those two years were, as expected, higher because only fish that were actively migrating from the Marengo release groups were to be tagged (87.9% to 59.4%). Survival estimates from the SURPH model when compared to natural origin releases from the smolt trap for those two years were similar (87.9% to 84.4%), with hatchery origin fish having slightly greater survival.

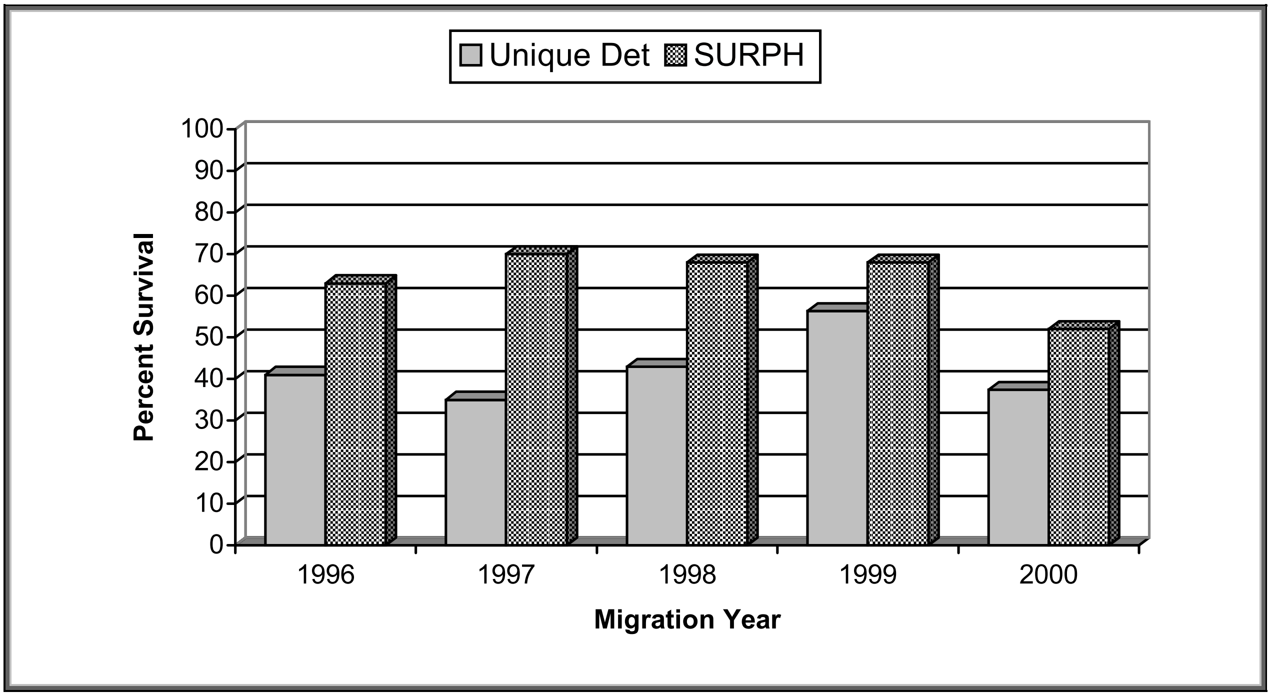

Figure 6. Estimated survival of PIT tagged summer steelhead (LFH stock) to Lower Monumental Dam released directly to the Tucannon River at Marengo Bridge based on cumulative unique detections or through the SURPH model estimation program.

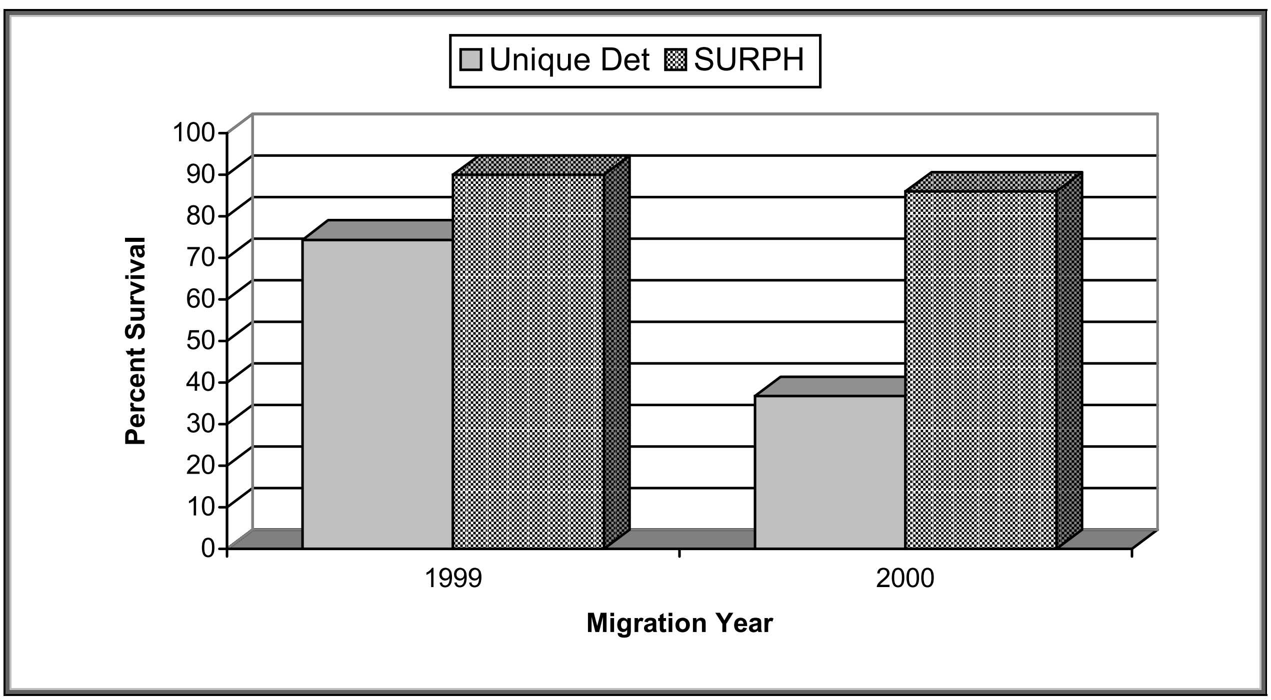

Figure 7. Estimated survival of PIT tagged summer steelhead (LFH stock) to Lower Monumental Dam tagged and released at the Tucannon River smolt trap based on cumulative unique detections or through the SURPH model estimation program.

Natural Origin Fish at Smolt Trap: Releases of PIT tagged fish from the Tucannon River smolt trap have occurred annually between 1997-2002. Results have varied over the years, but survival estimates produced from the SURPH model were generally consistent with the unique detection method, though is some cases substantially higher (Figure 8). Average survival rate (geometric mean) estimated from the SURPH model from all years was 86.3% compared to 58.5% from the unique detection method. Surprisingly, the survival rates are not that much different compared to hatchery fish (LFH stock or endemic stock tagged at the smolt trap (see next paragraph). We had generally assumed that natural origin fish survival would be greater because the condition of natural fish captured at the smolt trap was so much better than hatchery origin fish. Hatchery origin fish have comparatively more descaling and injuries to their fins.

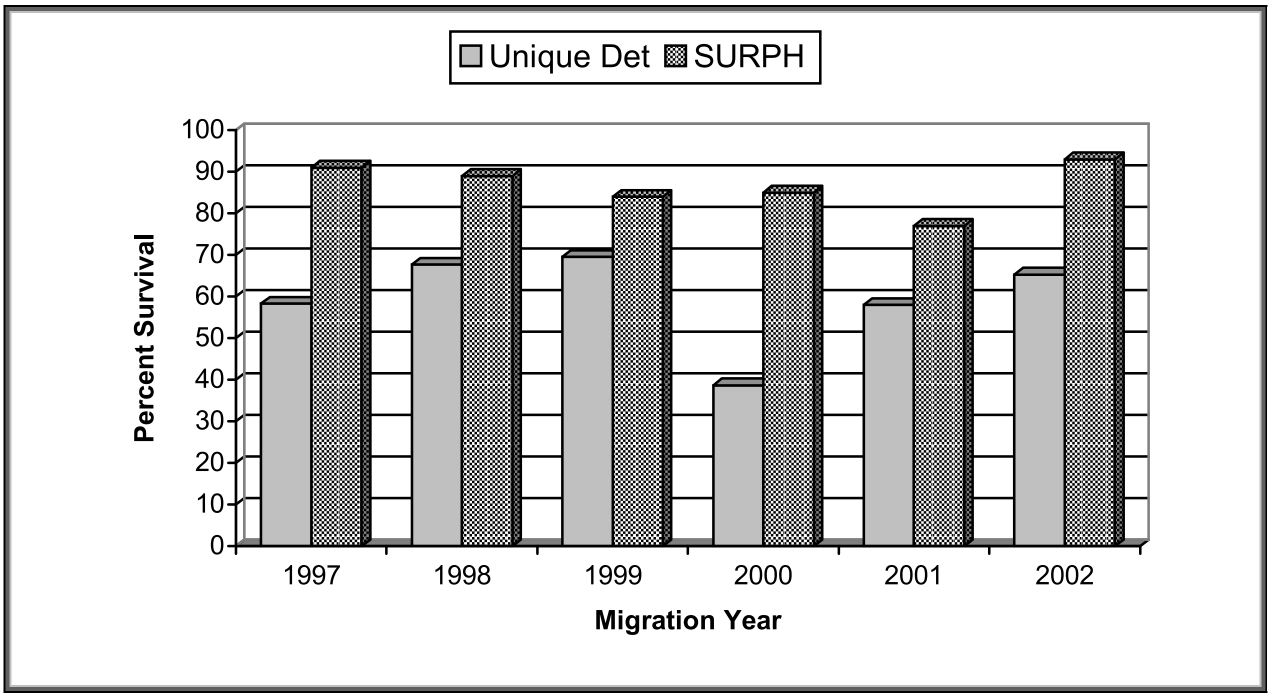

Figure 8. Estimated survival of PIT tagged summer steelhead (Tucannon River natural stock) to Lower Monumental Dam tagged and released at the Tucannon River smolt trap based on cumulative unique detections or through the SURPH model estimation program.

Tucannon Endemic Origin Fish Direct Stream Release and at Smolt Trap: In 2001, Tucannon River endemic stock smolts were PIT tagged and released at the Curl Lake AP intake structure. These fish were also captured and additional fish were PIT tagged at the Tucannon River smolt trap. We had hoped that results between these two release groups would give some indication to the amount of residualism following release. However, too many questions regarding mortality and fish that would not migrate until the second year, precluded a proper analysis using the data.

In 2002, because a limited number of PIT tags were available, and we got less than satisfactory results from 2001 in trying to determine the degree of residualism, we only implanted PIT tags in endemic origin fish at the Tucannon River smolt trap. Because of concerns about getting adult recoveries from these releases in the future, our PIT tagging efforts changed. Instead of obtaining just information on smolt migration, our ultimate goal was to PIT tag as many migrating smolts (evidenced by their passing the smolt trap) as possible. By tagging as many as we can, and with adult PIT tag detection capabilities increasing at the mainstem dams, we hope to estimate smolt-to-adult return rates for program evaluation in the future. Results were not consistent between the two years, but survival estimates produced from the SURPH model were higher than the unique detection method. It appears that fish released in 2001 had lower survival, which could be due to the low stream/river flows in 2001. Notably, other groups released in 2001 all showed lower estimated survival (Figure 9).

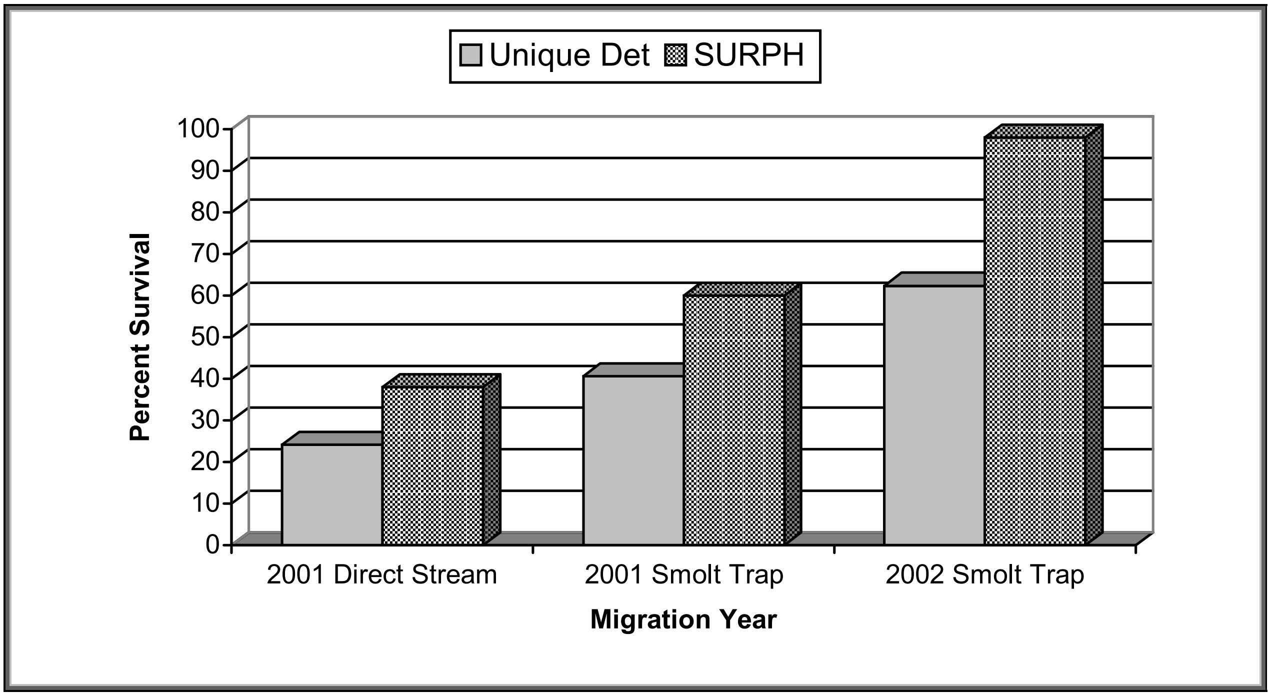

Figure 9. Estimated survival of PIT tagged summer steelhead (Tucannon River endemic stock) to Lower Monumental Dam from a direct stream release (2001) or tagged and released at the Tucannon River smolt trap (2001 and 2002) based on cumulative unique detections or through the SURPH model estimation program.

<u>Tucannon Endemic Origin Fingerling Release:</u> In the fall of 2001, a portion of the Tucannon River endemic stock fingerling/pre-smolts were PIT tagged and released at four locations in the upper Tucannon River watershed (Camp Wooten [rkm 68.1], Cow Camp [rkm 72.9], Panjab Br [rkm 74.5], and Lady Bug Flat Campground [rkm 77.7]. These fish exceeded the smolt production goal, and according to the Hatchery and Genetics Management Plan (HGMP) needed to be released as fingerlings into the upper basin (25,000). Based on their release size, we did not anticipate many of these would migrate the following spring. We estimated 1,510 (6%) of these fish emigrated from the upper river past our smolt trap. We PIT tagged 1,535 fish, 80 of which (5.2%) were uniquely detected at the downstream collection sites, demonstrating the smolt trap estimate was likely accurate. We anticipated additional migrants from these release groups in 2003; preliminary smolt trapping data from 2003 have confirmed our suspicions. Overall SURPH model survival based on the PIT tags detected from these groups indicate 8% parr-to-smolt survival from just the first year's data.

In addition to obtaining information on overall survival rate, PIT tags implanted at each release location were used to determine if one location showed greater survival should releases of this nature occur in the future. Previous PIT tag studies with spring chinook in the Tucannon River showed poorer survival the further upstream in the watershed fish were released (Bumgarner et al. 1997). We were curious to see if steelhead fingerlings would demonstrate the same differences in survival. Based on the first year's migrants, unique detection estimates seem to indicate slightly lower survival the further upstream fish were released (Figure 10). However, the SURPH model estimate indicates or suggests the opposite.

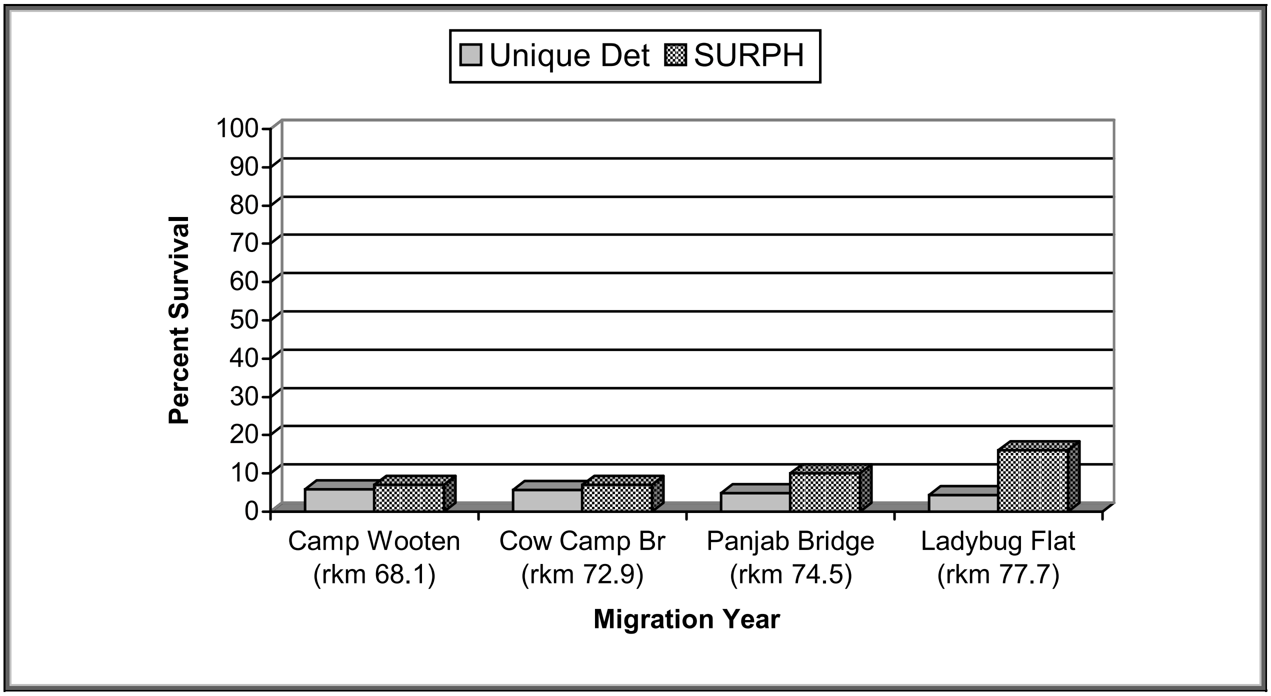

Figure 10. Estimated survival of PIT tagged summer steelhead (Tucannon endemic stock) to Lower Monumental Dam from upper river direct stream releases in the fall of 2001 based on unique detections or through the SURPH model estimation program.

Estimates of Residual Steelhead

The potential for residual hatchery steelhead to negatively affect natural salmonid populations through competition, displacement, or predation was identified as a concern by NOAA Fisheries after chinook salmon were listed as threatened under the ESA. In the early 1990's, WDFW began a series of experiments to examine methods to reduce residualism. Results from the Tucannon, Touchet, and Grande Ronde rivers have been provided in the past (Viola and Schuck 1995; Schuck et al. 1998; Martin et al. 2000). During 2001 and 2002, we estimated residual hatchery steelhead (LFH stock and Endemic stocks) in the Tucannon and Touchet rivers through the use of electrofishing surveys. Estimated residualism is therefore a minimum as mortality and harvest would have occurred before surveys were complete. Surveys in both rivers were completed approximately 3-4 months following release of smolts.

Tucannon River Residualism

In 2001, surveys were completed at 16 sites from rkm 22 (Hwy 12 Bridge) to rkm 78.5 (Winchester Cr). We estimated that 538 (0.4% of release) LFH stock, and 739 (0.1% of release) Tucannon endemic stock residuals were present in August. Residuals of each group in the Tucannon River were generally found near the release point. Rates of residualism documented from surveys in 2001 were low compared to previous estimates developed from an earlier time and different method (hook and line in early June).

In 2002, surveys were completed in nearly all of the same 16 sites as completed in 2001 from rkm 22 Hwy 12 Bridge to rkm76 (Lady Bug Flat Campground). We estimated that 4,029 (3.0% of release) LFH stock and 2,985 (3.6% of release) Tucannon endemic stock residuals (smolt and fingerling releases combined) were present. Residuals from the fingerling release were estimated at 1,066 (4.3% of release), with the smolt release making up the rest of the residuals.

In 2001, the residuals we found were roughly the same length distribution (no significant differences) as the release group (Figure 11), though the sample of residuals was small (N=9; t=0.27, P=0.78, α=0.05). In 2002, many of the residuals we found came from smaller size fish (Figure 12), though again our sample was small (N=12; t=0.91, P=0.34, α=0.05). With the exception of the small fish (<150 mm), we believe most of the residuals sampled would have likely been characterized as smolted or a transitional phase during pre-release sampling.

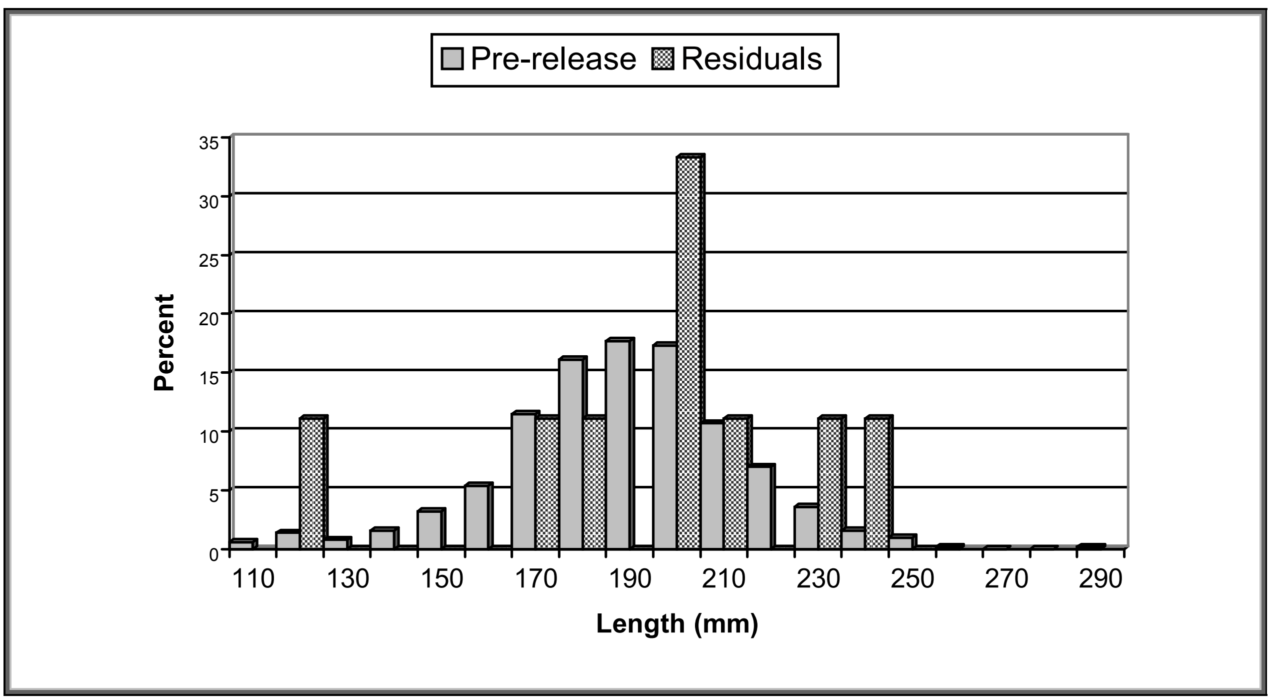

Figure 11. Length frequency distribution of Tucannon River endemic stock steelhead at pre-release sampling and captured by electrofishing surveys in 2001.

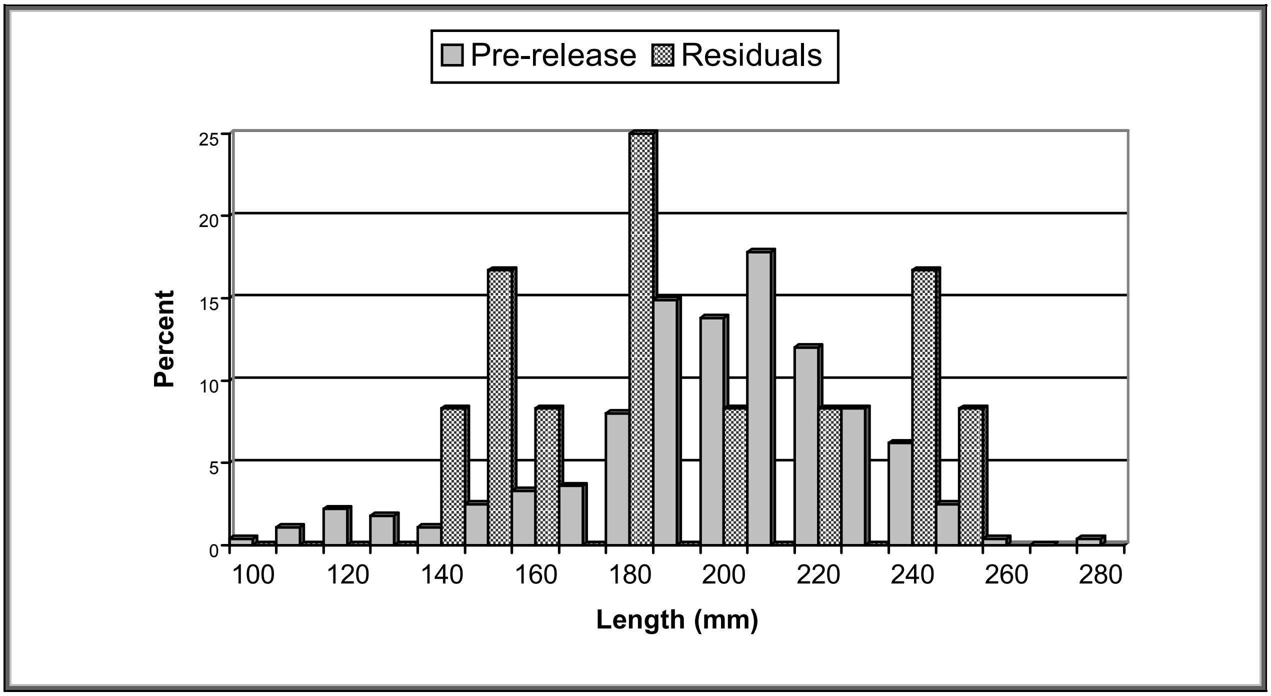

Figure 12. Length frequency distribution of Tucannon River endemic stock steelhead at pre-release sampling and captured by electrofishing surveys in 2002.

Touchet River Residualism

In 2001, surveys were completed at 43 sites scattered in the Touchet River upstream from the city of Waitsburg, and into the North, South, Wolf, and Robinson forks (See section on electrofishing surveys for more details). We estimated that 329 (0.3% of release) LFH stock, and 2,688 (7.4% of release) Touchet endemic stock residuals were present. The Touchet endemic stock number was calculated based on a capture of 44 residuals. The LFH stock fish were found in the mainstem Touchet River and the South Fork. During 2001, the Touchet endemic stock fish were found in the mainstem Touchet River and North Fork only.

In 2002, surveys were completed at 27 sites scattered in the mainstem upstream from the city of Waitsburg, and into the North, South, Wolf, and Robinson forks (See section on electrofishing surveys for more details). We estimated that 472 (0.3% of release) LFH stock, and 4,537 (9.9% of release) Touchet endemic stock residuals were present. The Touchet endemic stock number was calculated based on a capture of 80 residuals. The LFH stock fish were found in the mainstem Touchet River and the South Fork. During 2002, the Touchet endemic stock fish were more widely scattered compared to 2001, with fish found in the mainstem Touchet River, North Fork, Wolf Fork, and lower-most portion of the South Fork.

In both 2001 ($N=44$; $t=7.78$, $P<0.0001$, $\alpha=0.05$) and 2002 ($N=80$; $t=3.91$, $P=0.0001$, $\alpha=0.05$), the residuals were significantly greater in size compared to release (Figures 13 and 14). With the exception of the small fish (<150 mm), most of the residuals sampled would have likely been characterized as smolted or a transitional phase during pre-release sampling. Based on the shift in length distribution, it appears that these residuals have been actively eating. Similar changes in the length distribution of residuals in the Tucannon River (LFH stock) were also found previously (Martin et al. 1993).

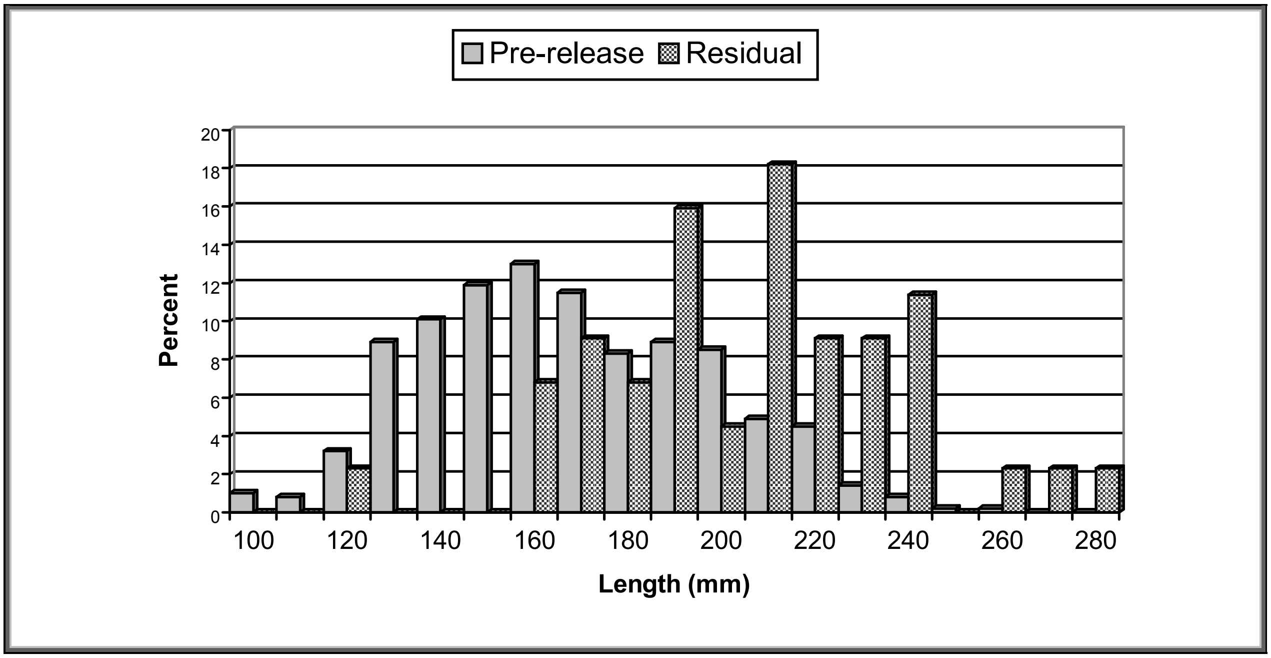

Figure 13. Length frequency distribution of Touchet River endemic stock steelhead at pre-release sampling and captured by electrofishing surveys in 2001.

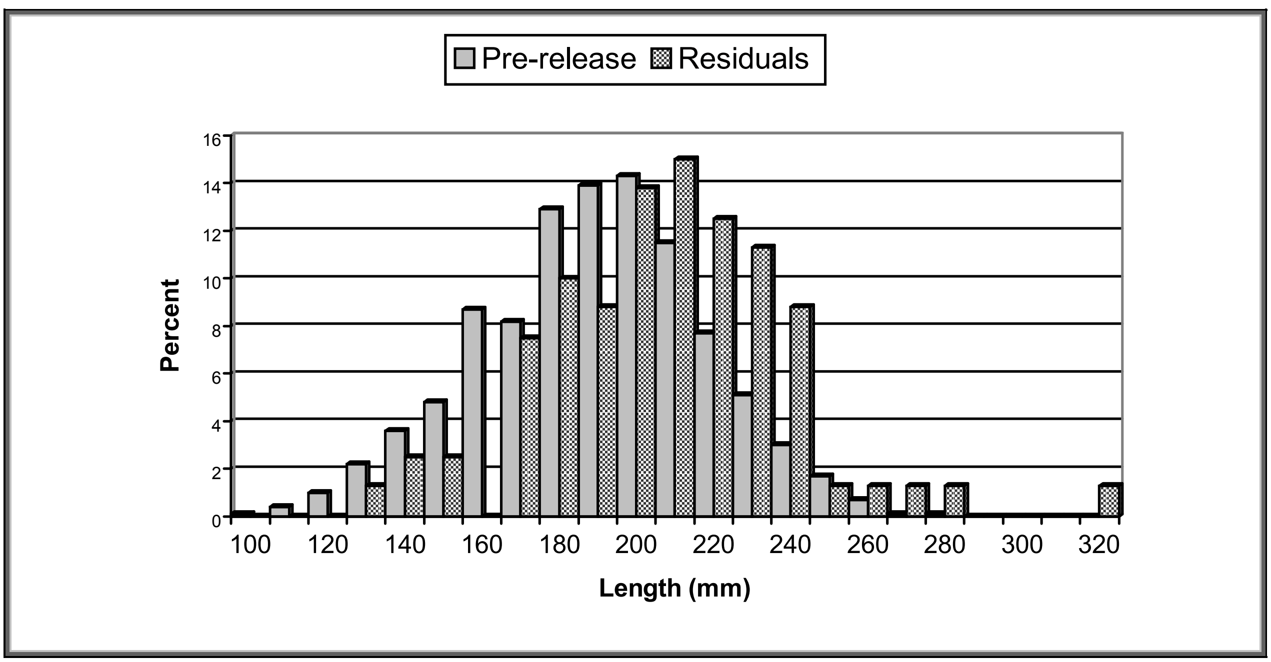

Figure 14. Length frequency distribution of Touchet River endemic stock steelhead at pre-release sampling and captured by electrofishing surveys in 2002.

Smolt Trapping on the Tucannon River

We operated a 5 ft rotary screw trap (Figure 11) at rkm 2.7 on the Tucannon River between fall of 2001 and spring 2003 to estimate the numbers of migrating natural steelhead smolts. The trap was operated intermittently during off-peak migration periods (fall and winter), but trapping was intensified (5-7 days/week) during the spring when the main out-migration occurs. Trapping during the summer (July-September) was not conducted due to the lack of fish migrating during that time of year. This lack of migration is due to extreme water temperatures that often exceed 27 ^{o}C during the summer.

Figure 15. Tucannon River smolt trap.

Each week during the main out-migration (March-May), we attempted to determine trap efficiency by clipping a portion of the caudal fin on captured migrants and releasing them about one rkm upstream of the trap. The percent of marked fish recaptured was used as an estimate of weekly trapping efficiency. When insufficient fish were captured for trap efficiency estimates, stream flow data (provided from United States Geological Survey gauge station) were used in a correlation analysis that relates outmigration to stream flow. To estimate potential juvenile migrants passing when the trap was not operated, we calculated the average number of fish trapped for three days before and three days after non-trapping periods. The mean number of fish trapped daily was then divided by the estimated trap efficiency to calculate fish passage. Total daily estimated steelhead (natural and hatchery endemic stock) outmigrating from the Tucannon River was calculated by expanding the daily catch by the corresponding weekly trap efficiency.

2001/2002 Trapping

During the 2001/2002 trapping season (trap operation: 14 October, 2001 to 15 July, 2002), we captured 2,116 natural steelhead smolts at the trap, for an estimated 19,472 total smolt out-migration. More than 92% of the migrant smolts were captured between 14 April and 8 June (Table 9). In addition to smolts captured in the trap, 1,099 newly emerged fry also were captured between late April and early July. We were not able to estimate the total number of fry passing the trap, nor are the fate of these fish known. Newly emerged fry were typically between 26 and 35 mm fork length and are not included in the smolt production estimates. Of the 2,116 steelhead smolts captured, scale samples were taken from 816, with 680 of those readable. Four different brood years were represented in the scale ages. Age composition based on the scale readings and expanded smolt estimate was 42.31% Age 1, 55.49% Age 2, 2.11% Age 3, and 0.09% Age 4. Bias in the age composition is not suspected due to the large overlap in length frequency distribution (Figure 12).

Table 9. Natural steelhead smolt estimates from the Tucannon River, 2001/2002 season.

	Age				
Month [a]	1	2	3	4	Total
October					
November	37	595	112		744
December					
January		35	18		53
February		26			34
March		53	12	8	74
April	586	2,569	141	9	3,296
May	6,282	7,099	212		13,593
June	1,127	447	3		1,577
July	18				18
Total	8,050	10,824	498	17	19,389

[a] The trap was not operated between 27 October and 20 January. Based on previous years data, we typically see a migration of steelhead passed the trap in November and early December. That estimated migration is shown for the month of November.

To estimate the number of migrants from each brood year (Table 10), weekly age compositions based on scale samples collected for that week were applied to each weeks' smolt estimate. Scales were collected from fish captured between late January and mid-June, covering 96% of the estimated out-migration, so the age composition is accurately reflected for the season.

During the 2001/2002 out-migration, during the main out-migration period (March-May) mean length, weight, and K-factor for natural fish captured was 178.2 mm, 52.3g and 1.02, respectively. Peak of migration for natural steelhead was 23 May, with an estimated 2,033 smolts migrating past the trap on that day.

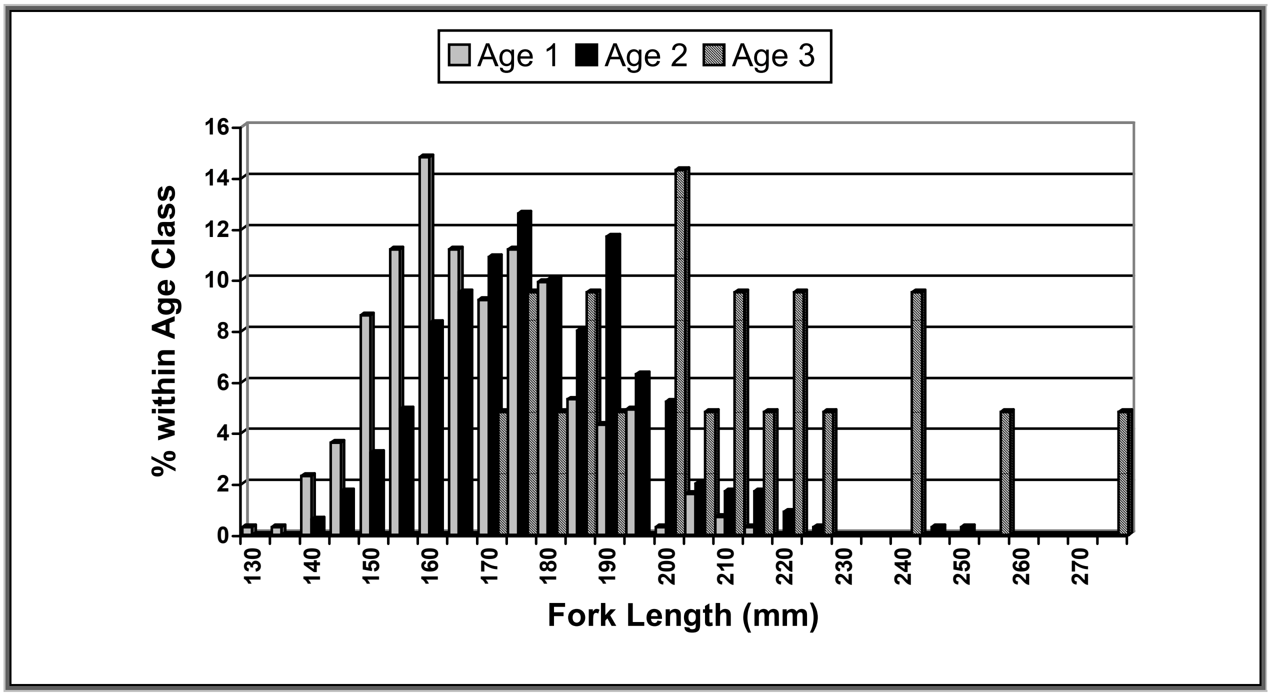

Figure 16. Percent length frequency distribution of natural origin steelhead trapped in the Tucannon River smolt trap during the 2001/2002 migration.

Table 10. Estimated production of natural-origin steelhead smolts from the Tucannon River by migration (1995-2002) and brood year (1993-2001).

Migration	Brood Year									Totals
year	1993	1994	1995	1996	1997	1998	1999	2000	2001	
1995/1996 [a]	835	8,249	5,583							14,667
1996/1997 [a]		908	8,967	6,069						15,944
1997/1998			834	11,584	16,684					29,096
1998/1999				1,133	14,095	9,000				24,229
1999/2000				37	3,279	25,069	14,897			43,282
2000/2001					8	945	13,747	11,912		26,612
2001/2002						17	498	10,824	8,050	19,389
Totals	NC	NC	15,384	18,823	34,066	35,031	29,142	NC		

[a] Scales were not collected during the 1995/1996 or 1996/1997 migration years. Age composition for those years are based on mean age composition from the 1998/1999 to 2000/2001 migration years. Age 4 fish were not included in the calculation based on their low frequency.

Adult Steelhead Traps and Spawning

As part of our annual broodstock collection and research interests, WDFW hatchery and evaluation staff operates a series of adult steelhead traps in SE Washington rivers. Lyons Ferry hatchery staff operated the LFH and Cottonwood Creek adult traps. Tucannon Fish Hatchery (TFH) staff operates the upper Tucannon adult trap, and evaluation staff operates an adult trap on the lower Tucannon River, and the Touchet River trap in Dayton. The purpose and results from each trapping location are described in the following sections.

Tucannon Hatchery Adult Trap (Upper)

A permanent adult steelhead and salmon trap was installed in 1998 at the TFH water intake diversion dam. The trap consists of a barrier (dam) and a fish ladder around the barrier, similar to those at mainstem Snake River dams that allow fish to ascend the river. The trap is a 12' x 12' x 5' section of the ladder which fish enter through a funnel. The trap is generally operated from February through September, and checked daily by hatchery personnel. Records are kept for captured steelhead, spring chinook, and bull trout. Steelhead and bull trout are enumerated, sampled, and passed upstream to spawn. Some spring chinook are collected for broodstock (Gallinat et al. 2001), and the rest are passed upstream to spawn naturally. No natural or hatchery-origin steelhead have been collected for broodstock from the TFH trap during this report period, although natural steelhead have been collected for broodstock in the past (Schuck et al. 1995). Samples collected from natural steelhead have included length, scales, DNA (fin clip or opercle punch), and sex determination. Steelhead trapping is reported by brood year at the TFH (1 June of the previous year to 31 May of the current year). Fish captured after June 1 are bright and appear fresh from the ocean.

2002 Trapping

In 2002, there were177 natural-origin and 29 hatchery-origin steelhead were trapped (Appendix C, Tables 1 and 2). All natural fish were released upstream to spawn in the upper Tucannon basin and all hatchery-origin fish were released downstream.

2003 Trapping

In 2003, there were 64 natural-origin and 12 hatchery-origin steelhead were trapped (Appendix C, Tables 1 and 3). All natural fish were released upstream to spawn in the upper Tucannon basin and all hatchery-origin fish were released downstream.

Tucannon River Adult Trap (Lower)

A temporary adult steelhead trap (weir with metal pickets) was erected at rkm 17.7 during the fall/winter of 2001/2002 and 2002/2003. The objective of this trap was to enumerate and describe the natural-origin steelhead in the Tucannon River, and to collect natural-origin fish for a new hatchery broodstock (Bumgarner et al. 2002). The current goal is to collect enough adults (~13 females, 23 males) to produce 50,000 smolts for release at Age 1.

2002 Brood Trapping and Spawning

On 1 October 2001, we installed the weir/trap at rkm 17.7, and began trapping the same day. In all, 74 natural fish (40 males and 34 females) and 130 hatchery fish were trapped (Appendix C, Tables 4 and 5), of which 36 natural fish (16 females and 20 males) were collected for broodstock. Fish that were not collected for broodstock were passed upstream after length and sex were determined, and scales and DNA samples collected. During 2001, pre-spawning loss at LFH (6 fish, 16.7%) was lower than the previous year because of more aggressive formalin treatments to control fungus.

During February and March of 2002, 13 adult females were spawned with 16 males at LFH. Total eggtake in 2002 was estimated at 74,204, slightly exceeding the goal for the program. Age composition of spawned females was 38.5% one-ocean age fish with a mean fecundity of 4,910, and 61.5% two-ocean age fish with a mean fecundity of 6,207. Mean fork lengths of one and two-ocean age female steelhead spawned at LFH in 2001 were 61.1 cm (N=5) and 71.2 cm (N=8), respectively. Age composition and mean length of spawned males was 93.7% one-ocean age fish [56.4 cm (N=15)], and 6.3% two-ocean age fish [70.0 cm (N=1)]. No three-ocean age males or females were collected in BY2002.

We obtained scales samples from 25 natural origin females and 32 natural origin males from the 2002 brood year (samples from the lower Tucannon trap and TFH trap). Five different age classes were documented in 2002 (Table 11).

2003 Brood Trapping and Spawning

On 12 September 2002, we installed the weir/trap at rkm 17.7, and began trapping the same day. In all, 86 natural fish (30 males and 56 females) and 228 hatchery fish were trapped Appendix C, Tables 4 and 6), of which 36 natural fish (18 females and 18 males) were collected for broodstock. Fish that were not collected for broodstock were passed upstream after length and sex were determined, and scales and DNA samples were collected. During 2002, pre-spawning loss (0 fish) was again lower than the previous year because of more aggressive formalin treatments to control fungus. High spring river flows in early February and again in March severely shifted/damaged the adult trap and limited its effectiveness to collect fish for broodstock and to collect biological samples for the remainder of the year.

During February, March, and April of 2003, 11 adult females were spawned with 19 males at LFH. Total eggtake in 2003 was estimated at 79,464, slightly exceeding the goal for the program. Age composition of spawned females was 26.7% one-ocean age fish with a mean fecundity of 4,657, and 73.3% two-ocean age fish with a mean fecundity of 8,630. Mean fork length of one and two-ocean age female steelhead spawned at LFH in 2003 were 58.3 cm (N=4) and 73.4 cm (N=11), respectively. Age composition and mean length of spawned males was 40.0% one-ocean age fish [60.7 cm (N=6)], and 60.0% two-ocean age fish [75.8 cm (N=9)]. No three-ocean age males or females were collected in BY2003.

In all, we obtained scales samples from 70 natural origin females and 35 natural origin males from the 2003 brood year (samples from the lower Tucannon trap and TFH trap). Six different age classes were documented in 2003 (Table 11). In addition, we were able to document repeat spawners in the Tucannon River for the first time (~3.6% of the run).

Table 11. Fresh and salt-water age composition [a] of natural origin adults from the Tucannon River, 2000-2003 brood years.

Year	Age 1.1		Age 1.2		Age 2.1		Age 2.2		Age 3.1		Age 3.2		Repeat spawners
	N	%	N	%	N	%	N	%	N	%	N	%	
2000	14	25.5	4	7.3	29	52.7	4	7.3	4	7.3	0	0.0	NONE
2001	0	0.0	8	27.6	8	27.6	11	37.9	0	0.0	2	6.9	NONE
2002	4	9.1	8	18.2	22	50.0	8	18.2	2	4.5	0	0.0	NONE
2003	0	0.0	3	3.6	22	26.2	47	55.9	4	4.8	5	6.0	YES [b]
Combined	18	8.5	23	10.9	81	38.2	70	33.0	10	4.7	7	3.3	- - -

[a] Age reporting protocol is F.S, where F=freshwater years and S=saltwater years of age.
[b] Three fish sampled in 2003 were repeat spawners, one fish was 1.1S, two were 2.1S for 3.6% of the run.

Touchet River Adult Trap

On the Touchet River near the town of Dayton, WDFW personnel had previously operated an adult trap at the water intake structure to the Dayton AP from 1993-1995 (Schuck et al. 1994-1996). The purposes of these trapping efforts were to determine the potential for developing a local steelhead broodstock for the Touchet River, and to assess adult/redd ratios to better estimate spawner abundance. Trapping efforts in the early years were successful, though trap efficiency needed improvement for a broodstock development program and to assess the adult/redd ratios. During the 1996 flood, portions of the intake structure that were used as part of the trap were destroyed, and further trapping efforts were temporarily halted. Following the listing of mid-Columbia River summer steelhead in 1999 (which includes the Touchet River natural stock), WDFW revisited the idea of developing an endemic broodstock for the Touchet River. Broodstock collection of natural-origin fish began in 2000.

In 2002 and 2003, we set up a broodstock collection schedule based on the previous years trapping data (relative past run timing). Because we have had problems with having mature males during spawning, we collected more heavily on males early in the trapping. We thought they would mature quicker when they would be held on the warm well water (11 ^{o}C) at LFH. In an attempt to lessen transport trips to LFH with broodstock and allow time for other pressing activities, we tried (if possible) to haul fish on Mondays or Tuesdays each week. If the weekly quota could not be met, fish were hauled on other days if necessary. Further, because of the extended spawn timing, we have proportionally collected fish from the earlier part of run (February and March – see Figures 17 and 18), but generally past the peak. Had we collected more fish in April and May, spawn timing would have been extended even further creating more problems with rearing fish at LFH. While this might not be the most desired action, it has been necessary to limit the number and distance between spawns. Should this program expand in the future, it will be easier to include a few fish from the latter part so the entire run is represented in the broodstock.

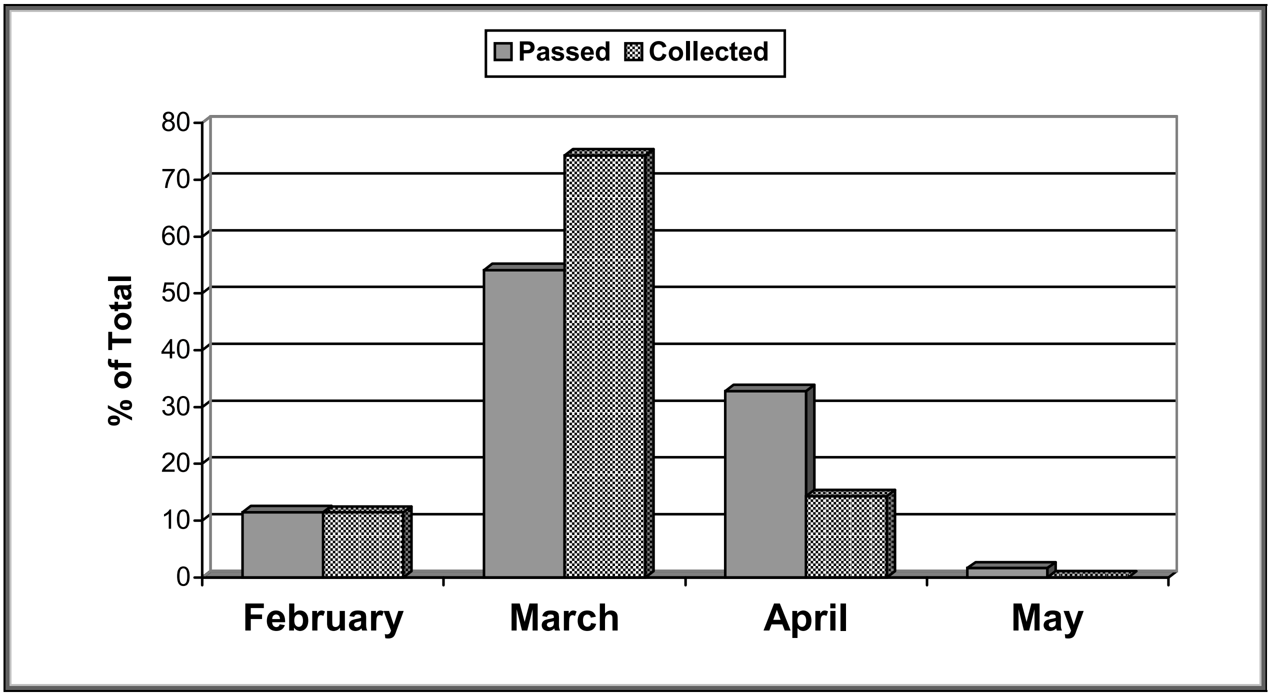

Figure 17. The percent of summer steelhead (Touchet River natural origin) passed or collected for broodstock by month for the 2001 run year.

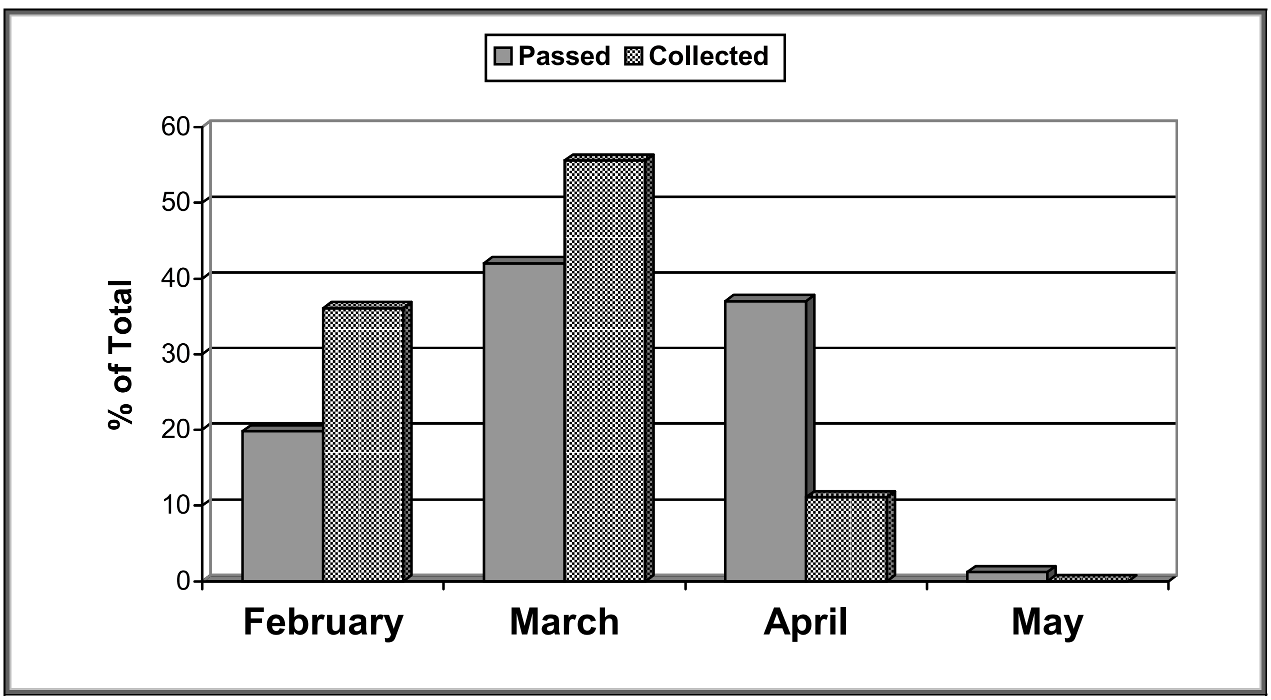

Figure 18. The percent of summer steelhead (Touchet River natural origin) passed or collected for broodstock by month for the 2002 run year.

2002 Brood Trapping and Spawning

The adult trap was operated from 18 February to 13 June in 2002. Trapping was successful as 172 natural (94.5%) and 10 hatchery origin (5.5%) steelhead were captured (Appendix C, Tables 7 and 9). Trapping efficiency in 2002 could not be calculated due to our inability to conduct spawning ground surveys because of high, turbid stream flows.

From the 2002 brood natural fish trapped between 20 February and 13 June, we collected 35 (16 females and 19 males) for broodstock. Pre-spawning loss at Lyons Ferry in 2002 was considerably higher than in 2000 (5%), but lower than 2001 (28%), with 5 (14%) fish dying prior to spawning. In the end 19 males were spawned with 14 females yielding 70,843 eggs for the program. Age composition of spawned females was 42.9% one-ocean age fish with a mean fecundity of 4,499 and 57.1% two-ocean age fish with a mean fecundity of 5,481. Mean lengths of one and two-ocean age female steelhead spawned at LFH in 2002 were 60.8 cm (N=6) and 72.1 cm (N=8), respectively. Age composition and mean length of spawned males was 86.7% one-ocean age fish [63.8 cm (N=13)], and 13.3% two-ocean age fish [70.8 cm (N=2)]. No three-ocean age males or females were collected in the 2002 brood year.

2003 Brood Trapping and Spawning

The adult trap was operated from 03 February to 27 June in 2003. We trapped 120 (90.9%) natural and 12 hatchery origin (9.1%) steelhead (Appendix C, Tables 8 and 9). Once again trapping efficiency in 2003 could not be calculated due to our inability to conduct spawning ground surveys because of high, turbid stream flows. Sex ratio of natural steelhead was highly skewed toward females (76.2%); 66% of the hatchery fish trapped were females.

From the 2003 brood natural fish trapped between 06 February and 20 May, we collected 34 (18 females and 16 males) for broodstock. Pre-spawning mortality was low in 2003 with two fish (1 male, 1 female) dying. For the season, 17 males were spawned (2 additional males were live spawned at the trap and released) with 16 females yielding 92,184 eggs for the program. One female was determined to have bad eggs following gamete extraction. These females were never fertilized with semen. Age composition of spawned females was 18.8% one-ocean age fish with a mean fecundity of 4,455 and 81.2% two-ocean age fish with a mean fecundity of 6,063. Mean lengths of one and two-ocean age female steelhead spawned at LFH in 2003 were 62.2 cm (N=3) and 72.5 cm (N=13), respectively. Seven of the spawned males were one-ocean fish with a mean length of 59 cm and the remaining 11 spawned males were two-ocean fish with a mean length of 79.8 cm. No three-ocean age females or males were captured in the 2003 brood year.

Age Composition of Touchet River Steelhead (1993-1995, 1999-2003)

During nearly all years the Touchet River adult trap has been operated, scales have been collected from natural-origin fish to describe the freshwater and ocean age composition. Samples were limited in early years because of limited trapping due to stream flows and overall poor trapping efficiency. From the samples collected, a variety of life history patterns have been documented over the years (Table 12).

Table 12. Age composition (Freshwater.Saltwater) of natural origin adults from the Touchet River, 1994-1995 and 1999-2003 brood years.

BY	Age 1.1		Age 1.2		Age 2.1		Age 2.2		Age 3.1		Age 3.2		Age 4.1		Age 4.2		Repeat spawners
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	
1994	0	0.0	0	0.0	6	28.6	8	38.1	3	14.3	3	14.3	0	0.0	0	0.0	YES [a]
1995	0	0.0	0	0.0	0	0.0	5	85.7	0	0.0	0	0.0	0	0.0	1	14.3	NONE
1999	0	0.0	1	3.2	18	58.1	9	29.0	2	6.5	0	0.0	0	0.0	0	0.0	YES [b]
2000	1	3.2	1	3.2	17	54.8	8	25.8	3	9.7	1	3.2	0	0.0	0	0.0	NONE
2001	1	0.6	14	8.0	84	48.3	40	23.0	15	8.6	9	5.2	1	0.6	0	0.0	YES [c]
2002	6	4.8	3	2.4	84	67.7	20	16.1	6	4.8	3	2.4	0	0.0	0	0.0	YES [d]
2003	0	0.0	8	6.7	20	16.7	73	60.8	2	1.7	10	8.3	0	0.0	0	0.0	YES [e]
Totals	**8**	**1.6**	**27**	**5.3**	**229**	**45.1**	**164**	**32.3**	**31**	**6.1**	**26**	**5.1**	**1**	**0.2**	**1**	**0.2**	

[a] One fish sampled in 1994 was a repeat spawner, 2.1S for 4.8% of the run.
[b] One fish sampled in 1999 was a repeat spawner, 2.1S for 3.2% of the run.
[c] Ten fish sampled in 2001 were repeat spawners, eight fish were 2.1S, two was 2.1S1 for a total of 5.7% of the run.
[d] Two fish sampled in 2002 were repeat spawners, one fish was 2.1S, one was 2.1S for a total of 1.6% of the run.
[e] Six fish sampled in 2003 were repeat spawners, one fish was 1.1S, four were 2.1S, and one was 3.1S for a total of 5.8% of the run.

While geographically similar to the Tucannon River, age composition for natural steelhead in the Touchet River is different. A larger proportion of juveniles rearing in the Touchet River spend two years in the stream before migrating, compared to the Tucannon River that has a strong age-1 smolt component. Ocean age at return is similar to the Tucannon though, with the one-salt age class being dominant. On average, about 4% of the returning fish are repeat spawners in the Touchet River. In 2003, the repeat spawner rate was estimated at 5.8%.

Touchet River Resistivity Counter

Bumgarner et al. (2002) previously described the Touchet River adult trap and barrier dam. Pickets have been installed between 1993-1995, and 1999-present to collect natural origin summer steelhead for biological samples and in more recent years to collect fish for a new hatchery broodstock endemic to the Touchet River. Managers have raised concerns in the last few years that the PVC pickets used to discourage fish from jumping barrier dam may be displacing natural origin steelhead (and other sensitive species such as bull trout and whitefish) from the upper Touchet River basin. Further, forcing all fish into the adult trapping area was not desired, and has also likely contributed to displacing fish to below the trap. Unfortunately, design of the PVC pickets and spring time flow conditions do not allow for easy removal of the pickets, so unrestricted passage has not been possible. In addition, if pickets could be removed it does not allow for an accurate count of passage above the dam. To solve this problem, we needed to allow a location in the barrier dam for unrestricted passage, yet use cameras or other technology to count passing fish.

In 2003, we installed an Aquantic ® Logie 2100c resistivity fish counter at the Touchet River adult trap to enumerate fish passage into the upper basin when our adult trap was not operated. The fish counter uses changes in the electrical resistance between electrode pairs caused by fish passage to provide counts. The date, time, conductivity, channel, direction of movement (up or down) and peak signal size, together with samples of coded values of electrical resistance (trace data) are recorded by the counter when a change in electrical resistance above a threshold setting is encountered. When a change in resistance occurs, data is recorded either as an event (E), down count (D), or up count (U). Events (E) are given when the counters computer algorithm does not recognize it as a fish movement. Such events may be fish that behaved oddly over the counter electrodes, debris, turbulence, or air entrainment noise. The counter consisted of the computer hardware unit where all data was stored and interpreted, and the counter ramp (Figure 14) that was placed in a slot of the barrier dam. The counter ramp was set between a 1:6 and 1:8 slope (depending on water conditions) that provided enough water depth for fish to swim over, but with velocities fast enough that fish could not easily remain on the ramp. If fish were able to remain on the ramp, they would potentially produce multiple counts (U, D, or E) that would be difficult to interpret and could inflate the overall counts.

<u>Results:</u> The fish counter unit and ramp was not received from the manufacturer until mid-March 2003. Flow conditions, early spawning, and difficulties installing pickets due to flow conditions limited the overall use of the fish counter in 2003. By the time the unit was installed, it was apparent that the first year was going to be testing/adjusting of the unit for future use. We typically ran the counter from Friday though Monday or Tuesday each week, with trapping occurring during the middle of week to obtain biological samples or broodstock for the hatchery.

During the time the trap was running, the counter recorded 55 total events (21 E, 30 U, 4 D). Two of the down counts were from fish also counted as up counts within a second or two before the down count. Two of the down counts occurred much later on and were likely bull trout or bridge lip suckers which had a tendency to fall back after being passed upstream of the trap. Of the "U" events, we were able to capture six on video (Figure 15), and one "D" count on video as well. Unfortunately, none of the "E" events were captured on video, so we don't know what was causing those events. We suspect that some events may have been from fish trying to pass, but the slope of the ramp was too steep. This was likely the case for smaller size fish such as hatchery steelhead residuals, bull trout, or brown trout. We also suspect that plastic floor mats located at the upper end of the ramp may have spooked the fish from passing all the way over the electrodes to trigger a "U" count. The floor mats had a tendency to wave in the water. They were removed after the first few weeks of operation. In addition, the conductivity meter apparently malfunctioned for a short period of time during operation. Conductivity readings were 4-5 times the actual conductivity as measured by a hand held meter. The counter unit algorithm uses the conductivity reading and the threshold setting determined by the operator to distinguish fish counts. Since the conductivity readings were high, false signals were received and logged as "E" events.

Overall, we were pleased with results obtained during 2003. The manufacturer has promised a new conductivity meter, and we should be able to get the counter into place long before the first adult returns next year. We anticipate that with the use of the resisitivity counter, we should be able to more accurately estimate the adult steelhead passage into the upper Touchet River Basin in 2004.

Miscellaneous Species Trapped – Touchet River

In addition to summer steelhead, we capture, measure, and pass upstream bull trout (*Salvelinum confluentus*), mountain whitefish (*Prosopium williamsoni*), and brown trout (*Salmo trutta*). Sex determination, scale samples, DNA clips, weights, and PIT tags are sometimes collected/inserted as well from each of these. Data from bull trout, whitefish and brown trout captured for all years are presented in Appendix D. Numerous adult bridgelip suckers (*Catostomus columbianus*) area also captured, but have not been enumerated until spring 2003. In 2003, we captured and released 636 adult bridgelip suckers upstream of the trap.

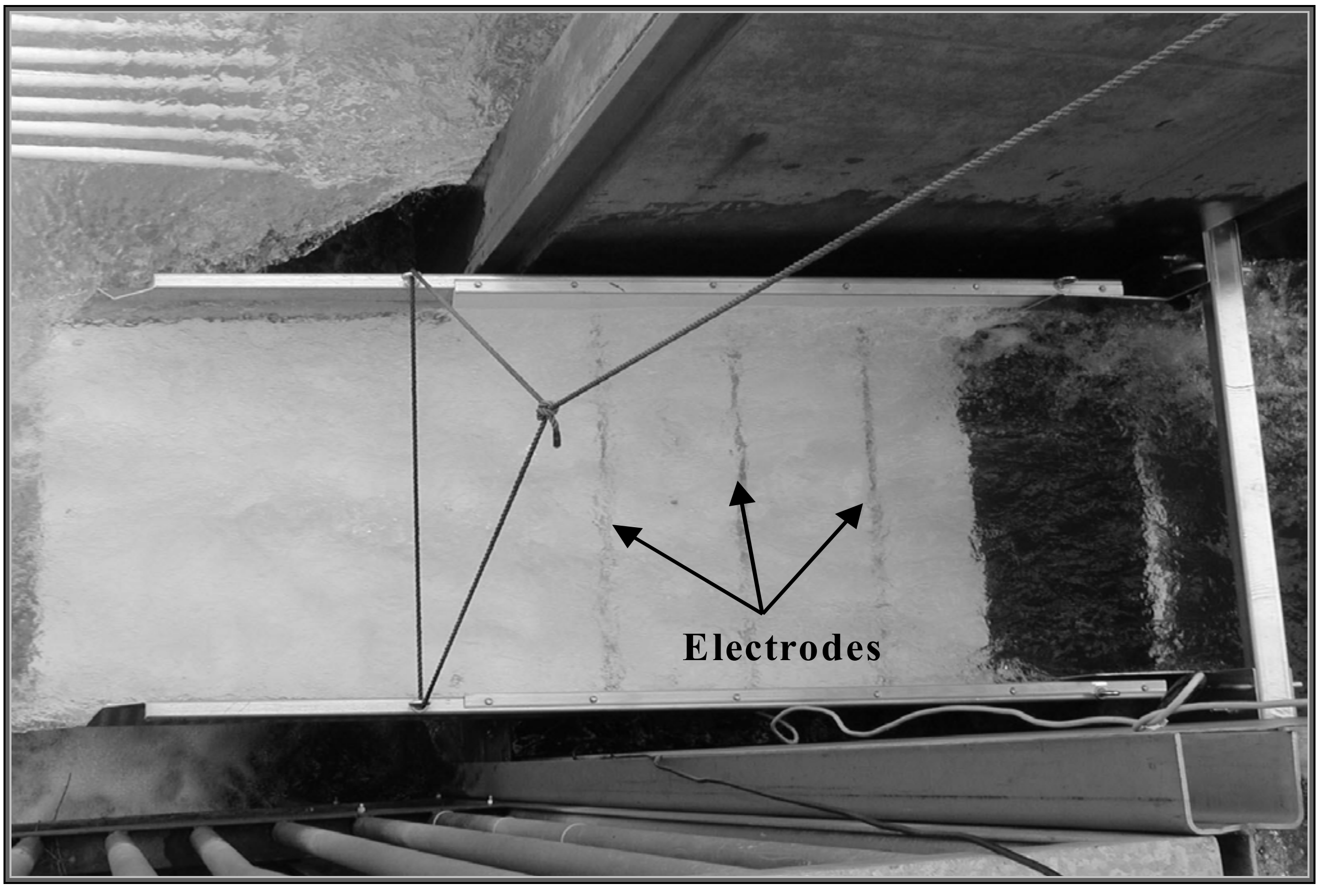

Figure 19. Overhead view of resistivity counter ramp with visable electrodes.

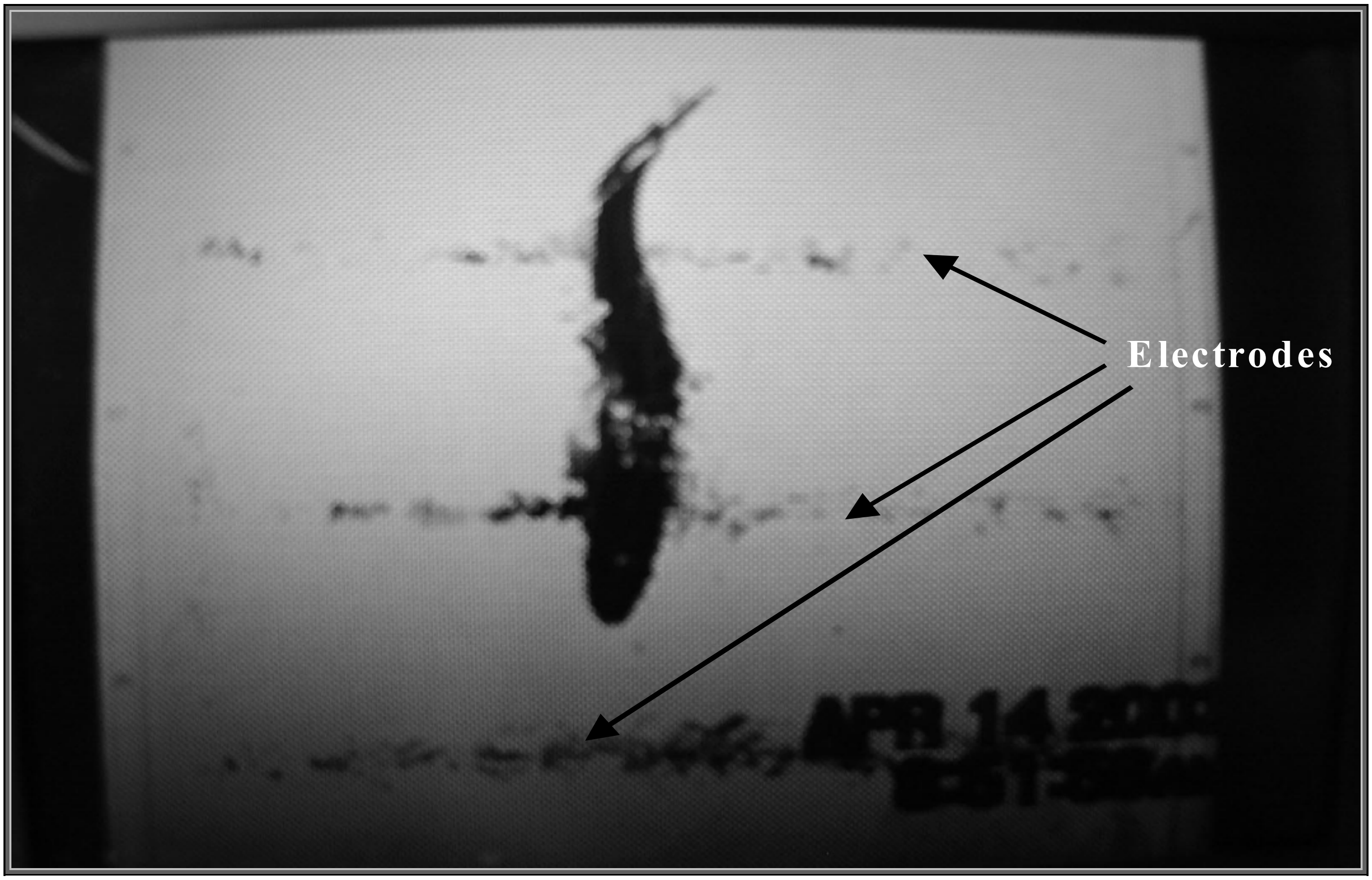

Figure 20. Touchet River adult summer steelhead captured on video crossing the electrodes as it passed upstream on 14 April, 2003.

Lyons Ferry Hatchery Trap

Lyons Ferry Hatchery staff operates an on-station adult trap to collect steelhead (LFH stock) from the Snake River for broodstock and for evaluation purposes. Steelhead entering the Snake River during the summer are subject to high river temperatures, hence many fish find refuge in the cool water exiting LFH. Many of the LFC tagged fish return to the hatchery (regardless of their release location), so it allows us to collect many fish from our different tag/release groups to determine adult contributions to the mitigation goal.

Broodstock goals for 2002 were 175 females and 175 males. Most of the fish retained for broodstock during 2002 consisted of coded-wire tagged fish to obtain recoveries from the tag study being conducted at LFH. Additional survival analysis conducted during 2002 showed that further reductions in the LFH stock steelhead production (down to 345,000 smolts) could still meet mitigation goals. The 2003 broodstock goals were lowered to 120 females and 240 males. Doubling the number of males used was an attempt to maintain a higher effective population size for genetic management.

2002 Brood Trapping, Sorting, and Spawning

Adult steelhead were trapped at LFH from 4 July through 14 November 2001. We trapped a total of 7,596 adult steelhead (4,254 female (56%) and 3,342 male (44%)). This total number includes 1,136 adults that were trapped and then accidentally killed when the water to the fish trap shut off during a power outage. Fish to be retained for broodstock were sorted on 8, 9, and 11 October, and 20 November. All fish not needed for broodstock or retained for the CWT study were returned to the Snake River to contribute to the sport fishery (4,627). Of the fish trapped, 66 were wild (2.3%). We recovered 853 fish with CWT's (Appendix E, Table 1). Mortality during trapping (excluding the fish kill), holding, and spawning was 666 fish (10.3% of all fish trapped). During January and February of 2002, 191 females were spawned with 231 males, producing 941,223 fertilized eggs. Eggs in excess of program needs were destroyed. Fecundities of one-ocean and two-ocean females were 4,825 and 5,905 eggs, respectively. Mean length of one-ocean male and female steelhead were 60.4 (N=393, SD=3.5) and 58.0 (N=449, SD=3.2), respectively. Mean length of two-ocean male and female steelhead were 69.4 (N=43, SD=5.3) and 67.7 (N=115, SD=4.2), respectively.

2003 Brood Trapping, Sorting, and Spawning

Adult steelhead were trapped at LFH from 1 September through 15 November 2002. We trapped 1,483 female (58.5%) and 1,052 male (41.5%) adult steelhead. Fish to be retained for broodstock were sorted on 21 and 22 November. All fish not needed for broodstock or retained for CWT recoveries were returned to the Snake River to contribute to the sport fishery (1,779). Of all the fish trapped, none were wild origin (unmarked). We recovered 371 fish with CWT's (Appendix E, Table 2). Mortality during trapping, holding, and spawning was 257 fish (10.1% of all fish trapped). During January and February of 2003, 126 females were spawned with 257 males, producing 575,617 fertilized eggs. Eggs in excess of program needs were destroyed. Fecundities of one-ocean and two-ocean females were 4,275 and 6,265 eggs, respectively. Mean length of one-ocean male and female steelhead were 59.9 (N=135, SD=3.6) and 58.2 (N=148, SD=3.4), respectively. Mean length of two-ocean male and female steelhead were 74.0 (N=15, SD=5.2) and 68.0 (N=72, SD=4.9), respectively.

Egg Fertilization Method Test

We tried some new fertilization and egg handling methods in 2003. New hatchery managers at LFH had noticed that green egg to fry mortality seemed exceptionally high over the years. New techniques were tried during spawning and compared with the old method. Spawning procedure groups tested were; 1) draining the ovarian fluid, add semen and stir, and add ½ cup water after 30 seconds (Standard Method, Test Group #1, N=40), originally adopted to reduce the potential of IHNV transmission to eggs from infected females, 2) do not drain ovarian fluid, and add semen and stir allowing longer time (4-5 minutes) for semen to sit on the eggs before rinsing, no water added (Test Group #2, N=40), and 3) same as Test Group #2 but with the addition of ½ cup water after 4-5 minutes (Test Group #3, N=41). All groups were water hardened in 100ppm Iodophore in buckets with at least two times the volume of eggs. Fish were spawned over a five-week period, with each experimental group consisting of about 1/3 of fish spawned each week.

To be a true controlled experiment, eggs from each female should have been split into the appropriate experiments to reduce any bias that bad eggs from a female could produce in the results. However, excess handling of the unfertilized eggs was one of the concerns raised by the hatchery managers, so this was not done. Therefore, we examined the results at a variety of fertilization success levels so females with bad eggs would be eliminated from the results. Fish determined to have high levels of IHNV were removed from the experiment and destroyed before eggs were counted.

At eye-up, each female's eggs were counted/estimated to determine total eggs collected from each female. The number of dead eggs were counted by hand count (unless the majority of eggs were dead), and the number of live eggs were generally estimated by weight (unless there were very few live eggs). Weight estimates were determined by counting out 100 live or dead eggs and weighing them to the nearest 0.1g. The remaining live or dead eggs were then placed in a colander, gently shaken to remove excess water, and weighed to the nearest 0.1g. Complete hand counts were conducted on a sub-sample of the egg lots in 2003. From those, it was determined that a 6% correction factor was needed to adjust the weight count to actual number of eggs (excess water remaining in the eggs was causing an overestimate). Percent survival for each egg lot was calculated. The percent survival data was then transformed using the arcsine function to normalize the data. The data from each experimental group over the five weeks was combined and means were calculated from the transformed data and tested using ANOVA and Tukey's test. We established survival criteria for each analysis as follows: 1) 100% of the samples used, 2), samples with >90% mortality removed, 3) samples with >50% mortality removed, and 4) samples with >25% mortality removed. Depending on the survival criteria tested, we found significant differences among the experimental groups (Table 13).

Table 13. Summary of statistical tests for egg fertilization experiment at LFH on summer steelhead.

Samples used	Group #	N	Mean survival (SD)	ANOVA	Tukey
	Group 1	40	78.7 (26.3)	F=2.58,	$\mu_1 = \mu_2 = \mu_3$
All Samples	Group 2	40	87.1 (22.7)	P=0.0802	
	Group 3	41	88.7 (19.8)		
	Group 1	38	82.8 (19.5)	F=4.23,	$\mu_1 < \mu_2 = \mu_3$
>90% mortality removed	Group 2	38	91.5 (12.2)	P=0.0169 ***	
	Group 3	40	90.8 (14.3)		
	Group 1	34	88.1 (11.5)	F=2.89,	$\mu_1 = \mu_2 = \mu_3$
>50% mortality removed	Group 2	37	93.0 (7.9)	P=0.0600	
	Group 3	39	92.5 (9.9)		
	Group 1	29	92.0 (6.7)	F=3.12,	$\mu_1 < \mu_3$, $\mu_1 = \mu_2,$
>25% mortality removed	Group 2	35	94.4 (5.5)	P=0.0487 ***	$\mu_2 = \mu_3$
	Group 3	35	95.5 (3.6)		

**** Indicates a significant test at a 95% confidence level.

From the results we determined that either of the modified techniques (Groups 2 or 3), had greater survival to the eye-up stage over the standard method used in the past. The exact cause of the increase survival could not be directly determined from these experiments because of the multiple factors that were changed. The combination of not draining the ovarian fluid from the eggs, and letting the semen mix with the eggs for a longer period of time before rinsing appears to increase survival. The addition of water as a last step to increase fertilization success did not appear to matter. Based on these results, we have recommended that spawning/fertilization procedures for summer steelhead be changed for all steelhead stocks. From this point forward, the ovarian fluid will not be drained until after the semen has been mixed with the eggs, and the semen will be allowed to mix with the eggs for a longer period of time before rinsing.

Cottonwood Creek Trap

The adult trap at Cottonwood Creek, a tributary of the Grande Ronde River, has been operated since 1992. This trap provides steelhead broodstock (Wallowa stock) to produce smolts that will be released from the Cottonwood AP. These releases support a large steelhead sport fishery on the lower Grande Ronde River. Generally, 80-100 females were needed to provide adequate eggs for the program. New smolt production goals were set that required the spawning of only 65 2003BY females. The number of males used will be doubled to maintain a large effective population size for genetic management. Trapped fish in excess of broodstock needs during 2002 and 2003 were 1) released above the trap for natural spawning, or 2), killed for CWT recoveries and distributed to the upper Cottonwood Creek for nutrient enhancement.

2002 Brood Trapping and Spawning

During March and April, 1,712 adult steelhead (1,084 female, 628 male) were trapped at Cottonwood Creek adult trap. Age composition based on CWT recoveries and fork lengths was 75.2% one-ocean and 24.8% two-ocean. A total of 82 females were spawned with 87 males in 2002, producing 422,441 fertilized eggs. Eggs in excess of program needs were destroyed. Individual female egg data was lost, so mean fecundities are not available. During 2002, fish that were not spawned were allowed to go above the trap to spawn. All carcasses from spawning, or fish that were killed outright to retrieve the CWT's were distributed in upper Cottonwood Creek for nutrient enhancement. We recovered 350 fish with CWT's (Appendix E, Table 3); all were originally released on-site at Cottonwood AP.

2003 Brood Trapping and Spawning

During March and April, 480 adult steelhead (322 female, 158 male) were trapped at Cottonwood Creek adult trap. Age composition based on CWT recoveries and fork lengths was 39.5% one-ocean and 60.5% two-ocean. A total of 65 females were spawned with 65 males in 2003, producing 254,418 fertilized eggs. Average fecundity of one and two-ocean age females was 4,166 and 6,352 eggs/female, respectively. The total eggs cited does not include eggs from 14 females that were destroyed after they tested positive with high titer of IHN virus, and two bad females. Eggs in excess of program needs (70,455) were planted as fry/fingerlings in SE Washington area lakes. During 2003, fish that did not contain CWT's or were not spawned, were allowed to go above the trap to spawn naturally. All carcasses from spawning and fish that were killed outright to retrieve the CWT's were distributed in upper Cottonwood Creek for nutrient enhancement. We recovered 56 fish with CWT's (Appendix E, Table 4); all were originally released on-site at Cottonwood AP.

As stated earlier, we had determined through an experiment at LFH that not draining the ovarian fluid from the eggs, and letting the semen remain longer on the eggs appeared to increase fertilization success. Fertilization success to eye-up from fish spawned at Cottonwood Creek has always been relatively poor. We suspected that because the ovarian fluid was drained off at Cottonwood, perhaps eggs were drying out and thus compromised while in transport back to LFH. While this was not specifically tested, we used the new transport and fertilization method on the Cottonwood fish in 2003. Mortality to eye-up was 4.7%, compared to an average of 25% loss documented between 1995-2001.

Passage at Dams

At Lower Granite Dam (LGD), NOAA Fisheries operates the adult trapping facility to monitor the migration and passage of salmon and steelhead throughout the year (Jerry Harmon, NOAA Fisheries 2003 pers comm.). All coded-wire tagged fish are diverted to a holding area where they are sampled. During the 2001 and 2002 run years, large returns of both summer steelhead and fall chinook salmon required intermittent operation of the adult trap during the peak of the run. Dates and times of when the adult trap was operated were provided to WDFW. We expanded the observed number of freeze brands based on the daily sample rate to calculate total of each freeze brand that would have potentially been trapped. All CWT tagged adult steelhead entering the LGD trap were sampled for fin clips and freeze brands and then released. Returns of branded fish to LGD (Table 14) can be used to estimate minimum return rates of WDFW steelhead release groups back to the Snake River at LGD.

PIT Tagged Adult Recoveries

The use of PIT tags has been beneficial in describing characteristics of successful migrants from steelhead releases in Southeast Washington (Schuck et al. 1996, 1997, 1998, Martin et al. 2000), and providing information on timing to each detection facility (Bumgarner et al. 2002). All of our studies with PIT tags were designed for juvenile evaluation purposes only. Adult evaluation was not considered, or expected to be, an integral portion of those studies due to the low number of expected adult returns and adult detections expected at the two historic detection facilities (Bonneville and Lower Granite Dam), and in more recent years at McNary Dam. While small samples sizes from adult detections would not be valid on their own to describe smolt-to-adult survival rates, we have presented them here to be used in conjunction with coded-wire tag recoveries to describe performance of particular release groups. Survival from coded wire tag recoveries that will match PIT tag data will be presented in future reports.

The number of PIT tags detected in adult steelhead has been low (Table 15) as expected. However, smolt-to-adult survival rates are similar to rates estimated by coded-wire tag recoveries for the different release groups prior to 2000. Further, since natural-origin smolts are not coded-wire tagged for survival estimates, results from PIT tagged releases provided some insight regarding smolt-to-adult survival rates of natural origin smolts from the Tucannon River. Based on the PIT tag data, survivals among the 1997-2000 release years have varied considerably, with the 1997 release year having very poor survival within all release groups (many were not detected when they returned), when compared to the 1999 and 2000 release years.

Table 14. Adult returns of LFH freeze branded or VIE tagged steelhead to Lower Granite Dam in run years 1999-2002, from smolts released in 1998-2001.

Release Year Brand/VIE	Release site	Adults by run year 1999	2000	2001	2002	Total adults	Branded smolts released [a]	Percent survival
1998								
RA-IJ-1	Cottonwood - Grande R.	101	84			185	22,760	0.813
RA-IJ-3	Cottonwood - Grande R.	129	127			256	24,588	1.041
LA-7U-1	Dayton AP - Touchet R.	115	23			138	19,285	0.716
RA-7U-1	Dayton AP - Touchet R.	80	26			106	17,496	0.606
LA-IJ-1	Tucannon @ Marengo	213	100			313	24,196	1.294
LA-IJ-3	Tucannon @ Enrich	230	96	1		327	24,492	1.335
LA-H-1	Snake River @ LFH	98	47			145	19,679	0.737
LA-H-2	Snake River @ LFH	92	35			127	20,559	0.618
RA-H-1	Snake River @ LFH	103	45			148	19,450	0.761
RA-H-2	Snake River @ LFH	70	52			122	19,651	0.621
1999								
RA-IT-1	Tucannon @ Marengo		253	113	1	367	19,473	1.884
RA-IT-3	Cottonwood - Grande R.		1,062	594		1,656	85,365	1.940
RA-IV-1	Snake River @ LFH		96	40	1	137	19,641	0.698
RA-IV-3	Snake River @ LFH [b]		209	77		286	19,658	1.455
LA-IV-1	Snake River @ LFH		95	32	1	128	19,646	0.651
LA-IV-3	Snake River @ LFH		76	27		103	19,592	0.526
2000								
RA-2-2	Cottonwood - Grande R.			2,514	442	2,956	74,026	3.993
RA-IC-1	Snake River @ LFH			290	24	314	19,361	1.622
LA-2-2	Dayton AP - Touchet R.			209	47	256	37,077	0.690
LA-IC-3	Tucannon @ Marengo			256	17	273	19,807	1.378
LA-IC-1	Tucannon @ Enrich			296	21	317	19,143	1.656
2001								
LA-IJ-1	Cottonwood - Grande R.				696	696	40,301	1.727
RA-S-1	Snake River @ LFH				39	39	19,837	0.196
LA-S-1	Tucannon River				60	60	19,871	0.302
LY-VIE	Tucannon River @Curl				3	3	51,977	0.006
RY-VIE	Touchet River @ NF				0	0	33,750	0.000

[a] Observed brands or VI adjusted for brand/VI loss as measured at release.
[b] We suspect that some of these brands were heard or read incorrectly, and likely belonged to the Cottonwood AP releases.

The 2002/2003 run was the first return from our endemic broodstock releases into the Tucannon and Touchet rivers. From the 2001 release year, we PIT tagged over 800 smolts in the Tucannon River release, and about 500 smolts in the Touchet River release. To date, none of these PIT tagged fish have been detected as returning adults. However, given the release size of these fish (both under program goals), and the poor outmigration conditions in 2001 (low water), we expect that survival will be below normal.

Table 15. PIT tag detections of adult summer steelhead at Bonneville (BON), McNary (MCN), and Lower Granite (LGR) dams from various WDFW LFC release locations, and estimated smolt-to-adult (SAR) survival rates.

Release year [a]	Origin	Release location	Number PIT tagged	Detection facility [b] BON	MCN	LGR	SAR to BON (%)	SAR to MCN (%)	SAR to LGR (%)
1998	Hatchery	Cottonwood AP	343	2	NA	2	0.583	NA	0.583
1999	Hatchery	Cottonwood AP	345	7	NA	7	2.029	NA	2.029
2000	Hatchery	Cottonwood AP	354	4	3	3	1.130	0.847	0.847
2001	Hatchery	Cottonwood AP	347	1	0	0	0.288	0.000	0.000
1995	Hatchery	Lyons Ferry	191	5	NA	5	2.618	NA	2.618
1996	Hatchery	Lyons Ferry	350	0	NA	0	0.000	NA	0.000
1997	Hatchery	Lyons Ferry	361	1	NA	1	0.277	NA	0.277
1998	Hatchery	Lyons Ferry	350	6	NA	5	1.714	NA	1.428
1999	Hatchery	Lyons Ferry	348	3	NA	1	0.862	NA	0.287
2000	Hatchery	Lyons Ferry	345	12	10	10	3.478	2.899	2.899
2001	Hatchery	Lyons Ferry	344	1	1	0	0.291	0.291	0.000
1994	Hatchery	Curl Lake AP	130	1	NA	1	0.769	NA	0.769
1995	Hatchery	Curl Lake AP	130	3	NA	3	2.308	NA	2.308
1996	Hatchery	Tucannon R. @Marengo	350	1	NA	1	0.286	NA	0.286
1997	Hatchery	Tucannon R. @Marengo	349	0	NA	0	0.000	NA	0.000
1998	Hatchery	Tucannon R. @Marengo	700	9	NA	8	1.286	NA	1.143
1999	Hatchery	Tucannon R. @Marengo	300	6	NA	5	2.000	NA	1.667
2000	Hatchery	Tucannon R. @Marengo	345	9	6	6	2.609	1.739	1.739
1999	Hatchery	Tucannon R. @Smolt Trap	503	9	NA	8	1.789	NA	1.590
2000	Hatchery	Tucannon R. @Smolt Trap	514	10	7	7	1.945	1.362	1.362
2001	Hatchery	Tucannon R. @Smolt Trap	211	1	1	1	0.474	0.474	0.474
1997	Natural	Tucannon R. @Smolt Trap	254	0	NA	0	0.000	NA	0.000
1998	Natural	Tucannon R. @Smolt Trap	486	2	NA	2	0.412	NA	0.412
1999	Natural	Tucannon R. @Smolt Trap	367	7	NA	6	1.907	NA	1.635
2000	Natural	Tucannon R. @Smolt Trap	555	20	15	14	3.604	2.702	2.523
2001	Natural	Tucannon R. @Smolt Trap	333	0	0	0	0.000	0.000	0.000
1997	Hatchery	Dayton AP	701	1	NA	1	0.143	NA	0.143
1998	Hatchery	Dayton AP	347	3	NA	2	0.864	NA	0.576
1999	Hatchery	Dayton AP	353	2	NA	1	0.566	NA	0.283
2000	Hatchery	Dayton AP	350	15	9	8	4.285	2.571	2.286
2001	Hatchery	Dayton AP	349	5	5	1	1.433	1.433	0.287

[a] Complete returns of fish released in 2001 (two-ocean age) were not complete at time of data extraction from PITTAGIS.

[b] Detection numbers at Bonneville and McNary include fish detected at LGR since they would have had to pass Bonneville and McNary to get to Lower Granite Dam. Detection capabilities at Bonneville began in 1998, McNary Dam was operation in 2002, and Lower Granite Dam has been operational since 1995.

Steelhead Angler Surveys

WDFW personnel survey steelhead sport anglers within the LSRCP area of Washington (see Schuck et al. 1990 for methods). Sport fishing for steelhead trout is open yearly on the Snake and Columbia rivers from 1 September through 31 March, and on tributaries to the Snake River from 1 September through 15 April. Anglers can keep only AD clipped fish, some of which are also LV clipped indicating the presence of a CWT. Data from each week's surveys are summarized during the season and provided to the local news media to assist anglers.

The creel surveys allow us to recover CWT fish, which we then attempt to estimate the number of LFC steelhead in the Washington sport catch in SE Washington. Estimates of harvest are obtained by expanding our recoveries from a sample rate based on total estimated harvest obtained from statewide steelhead catch record card estimates. In the past, we've calculated these estimates, and these were reported in the annual reports. Obtaining the final harvest estimates generally takes one-two years after the run year is complete, and has resulted in the delay of reporting. In the future, we will provide a harvest update as a separate report every 2-3 years. For this report, we will report catch information that was recorded by creel personnel, and provide information of the catch from the ODFW/WDFW creel census on the lower Grande Ronde River.

Fishery Catch Rates

Catch rates reported in the table below for each of the three years contain some biases in the Tucannon, Touchet and Walla Walla rivers. During each of these years we have collected catch/harvest rate information from trusted, select anglers in each of these rivers. These select anglers are skilled, and likely have higher catch/harvest rates than the average person typically checked during angler surveys. Catch rates estimates from those rivers should be used with caution. Use of these select anglers has allowed us to spend additional time in other river sections to obtain adequate samples for CWT expansions.

During the 2000/2001 steelhead season, we surveyed 7,519 anglers that fished over 26,000 hours and caught 2,452 fish within the LSRCP area of Washington (Table 16). A total of 535 natural origin fish (21.8% of the total catch documented from angler surveys alone) were caught and released during the 2000/2001 season.

During the 2001/2002 steelhead season, fewer anglers were surveyed, but they fished more hours than the previous year and caught over 1,700 more fish within the LSRCP area of Washington (Table 16). A total of 1,008 natural origin fish (23.9% of the total catch documented from creel surveys alone) were caught and released during the 2001/2002 season. Overall catch rate improved during the 2001/2002 season, mainly due to the very large run of steelhead.

During the 2002/2003 steelhead season, we surveyed more anglers than either the 2000/2001 or 2001/2002 surveys. Anglers interviewed fished almost 39,000 hours and caught 3,628 fish within the LSRCP area of Washington (Table 16). A total of 1,283 natural origin fish (35.4% of the total catch documented from creel surveys alone) were caught and released during the 2002/2003 season.

Table 16. Steelhead angler interview results for fall/winter/spring of 2000/2001, 2001/2002, and 2002/2003 run years from Washington State licensed anglers.

Year River section description [a]	Section number	Anglers surveyed	Total hours fished	Natural fish caught	Hatchery fish kept	Hatchery fish released	Catch rate (hr/fish)
2000/2001 Run Year							
Columbia River							
McNary Dam to Pasco	533	1,024	7,267.5	53	116	0	43.0
Walla Walla River	659	272	601.5	23	59	22	7.3
Mill Creek	655	4	2.8	2	1	1	0.9
Touchet River	657	261	583.5	32	75	31	5.5
Tucannon River	653	279	637.0	59	116	239	3.6
Snake River							
Mouth to IHR	640	23	91.0	0	1	0	91.0
IHR to LMD	642	2,181	6,394.8	48	140	4	34.0
LMD to LGD	644	2,087	5,047.3	49	170	5	23.0
LGD to LGR	646	479	1,429.0	18	39	0	25.1
LGR to Hwy 12 Br	648	73	319.5	3	18	0	15.2
Hwy 12 Br upstream	650	836	4,285.5	248	706	174	4.5
Totals		**7,519**	**26,659.4**	**535**	**1441**	**476**	**10.9**
2001/2002 Run Year							
Columbia River							
McNary Dam to Pasco	533	1,225	7,837.5	71	141	4	37.0
Walla Walla River	659	431	976	32	82	27	8.6
Mill Creek	655	2	2.0	1	1	1	1.0
Touchet River	657	217	447.5	70	68	21	3.2
Tucannon River	653	332	885.0	182	497	334	1.3
Snake River							
Mouth to IHR	640	34	108.8	3	3	0	18.1
IHR to LMD	642	2,332	6,832.3	87	204	4	23.5
LMD to LGD	644	1,802	8,949.0	106	661	92	11.7
LGD to LGR	646	228	757.5	7	28	0	21.6
LGR to Hwy 12 Br	648	36	173.5	4	15	6	9.1
Hwy 12 Br upstream	650	1,030	5,465.5	445	911	103	4.0
Totals		**6,603**	**32,434.6**	**1,008**	**2,611**	**592**	**7.7**
2002/2003Run Year							
Columbia River							
McNary Dam to Pasco	533	1,796	5,327.5	101	209	2	17.2
Walla Walla River	659	399	862.5	18	37	1	15.7
Mill Creek	655	4	6.5	2	0	0	3.3
Touchet River	657	189	417.5	62	45	11	3.9
Tucannon River	653	288	1,063.0	75	195	63	3.9
Snake River							
Mouth to IHR	640	0	0.0	0	0	0	0.0
IHR to LMD	642	3,654	11,296.5	144	271	7	27.2
LMD to LGD	644	2,427	12,494.0	349	723	39	11.7
LGD to LGR	646	625	2,456.8	50	95	0	16.9
LGR to Hwy 12 Br	648	11	68.3	4	3	0	9.8
Hwy 12 Br upstream	650	809	4,954.0	478	597	47	4.6
Totals		**10,202**	**38,946.6**	**1,283**	**2,175**	**170**	**10.7**

[a] Abbreviations as follows: IHR=Ice Harbor Dam, LMD=Lower Monumental Dam, LGD=Little Goose Dam, LGR=Lower Granite Dam, Hwy=Interstate Highway

Grande Ronde River

We cooperated with ODFW by conducting a joint survey of anglers on the lower Grande Ronde River (in both Washington and Oregon). Angler effort, catch rates, and harvest were calculated by ODFW as described in Carmichael et al. (1988). Total sample of fish, estimated harvest, and CWT's recovered by ODFW from the Grande Ronde fishery in Washington were supplied by ODFW (Mike Flesher; pers. communication 2002 and 2003). We then added additional samples/tag recoveries from the mouth of the Grande Ronde, and from the Shoemaker Access (rkm 25.6). All samples were combined and sent to Olympia for CWT expansion once statewide harvest estimates from punch cards were complete.

2000/2001 Season

During the 2000/2001 steelhead season, anglers fished an estimated 27,764 hours on the Grande Ronde River from Bogan's Oasis (rkm 41.9) upstream to the Oregon State line (rkm 61.9). Total estimated catch, harvest, and effort by month are provided (Table 17).

2001/2002 Season

During the 2001/2002 steelhead season, anglers fished an estimated 29,173 hours on the Grande Ronde River from Bogan's Oasis (rkm 41.9) upstream to the Oregon State line (rkm 61.9). Total estimated catch, harvest, and effort by month are provided (Table 17). Slightly more effort was put forth in 2001/2002, but the total catch was substantially greater. Overall catch rate was 33% higher in 2001/2002. This was likely due to the record return of steelhead during the year, and excellent water conditions available during the fishing season. Considerably more natural-origin fish were captured/released in 2001/2002 as well.

Table 17. Estimated angler effort, catch rates, and harvest for steelhead anglers on a portion of the Grande Ronde River in Washington, 2000/2001 and 2001/2002 (Mike Flesher, ODFW unpublished data, 2003).

Run Year		2000				2001			
2000/2001	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Total
Effort Hours	493.3	4359.4	1674.2	1561.3	1450.4	6052.2	9677.6	2496.4	27764.8
Catch Rate	0.0364	0.0932	0.1395	0.1271	0.1954	0.2297	0.2238	0.3388	0.1996
Total Catch [a]	18	406	234	199	284	1390	2166	846	5542
Fish Kept	5	154	98	118	106	717	1074	367	2639
Hatchery Released	0	153	60	36	71	366	830	467	1982
Natural Released	13	100	76	45	107	307	263	12	921

Run Year		2001				2002			
2001/2002	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Total
Effort Hours	636.2	5322.8	4135.1	1908.9	1952.6	4765.5	8458.3	1994.0	29173.4
Catch Rate	0.0296	0.0902	0.1137	0.1181	0.2276	0.2337	0.4124	0.7696	0.2666
Total Catch [a]	19	480	470	225	445	1114	3489	1535	7776
Fish Kept	4	216	164	90	270	551	1406	427	3127
Hatchery Released	4	89	125	29	46	188	1601	1059	3142
Natural Released	11	175	182	106	128	375	482	49	1508

[a] Estimated fish captured have been rounded to whole numbers, so total of fish kept and released may not always add up to total catch.

Steelhead Spawning Ground Surveys

During the spring of 2002 and 2003, WDFW attempted to determine the number of adult steelhead spawning in select reaches of southeast Washington streams. For a greater description of survey methods, see Bumgarner et al. (2002) or Schuck et al. (1993).

During 2002, staff conducted surveys in sections of the Touchet River, Tucannon River and Asotin Creek. Additional surveys were conducted in adjacent or nearby areas by WDFW Fish Management Staff and reported in other documents (Mendel et al. 2003; Mendel et al. 2002). Surveys were conducted at index sections (Appendix F) on a weekly or bi-monthly basis when possible. Unfortunately, a high spring flow event occurred on 14 April 2002. Surveys conducted before that were made two weeks earlier, and it was another two weeks before the rivers could be surveyed again. Nearly all previous redds documented were not visible, and it was likely many redds constructed during the month when surveys were not conducted were not visible as well. Based on that observation, we stopped surveys and could not make a final estimate for any of the rivers

During 2003, we made only one attempt to conduct surveys. High, muddy, spring flows in February and March made the rivers unfit for surveys for both of those months. In addition, seasonal weather was unusually warm, and apparently prompted early spawning in nearly all rivers, with much of the spawning occurring in the lower part of the watersheds. Our one attempt on surveys was in Asotin Creek on 17 April. We surveyed the lowest two miles of the South Fork (0 redds), the upper most 2.5 miles of the mainstem (3 redds), and the lowest three miles of Charley Creek (6 redds). In all locations, the gravels were clean from the earlier high steam flows making redd observation marginal. Based on this result, spawning ground surveys on the Tucannon and Touchet rivers were not attempted.

Trends in Naturally Produced Juvenile Steelhead, 1983-2002

As in previous years, WDFW electrofished (multiple pass removal method (Zippin 1958) established or new index sites (Appendix G) to estimate juvenile steelhead densities and derive population estimates for specific river reaches (Mendel 1984; Hallock and Mendel 1985; Schuck and Mendel 1987; Schuck et al. 1990-1998). Additional juvenile surveys were conducted in the Touchet River and Asotin Creek basins by WDFW Fish Management Staff and reported in other documents (Mendel et al. 2003; Mendel et al. 2002). Survey sections in 2000 were expanded to cover more extensive river reaches than in previous years (Bumgarner et al. 2002). This was an attempt to coordinate juvenile production sampling areas with spawning ground surveys. Estimates for additional river reach sections were not added to the following graphs so long-term trends within historical reach sections could be presented. Expanded sections will be presented in future reports when additional data are available. Population time series graphs of estimated juvenile steelhead densities are calculated for portions of the Tucannon Basin (Tucannon River and Cummings Creek), Touchet River (North, South, and Wolf forks), and Asotin Creek (North and South forks, and mainstem). Densities of juvenile steelhead for all survey areas are provided in Appendix H. The following survey section reaches of Asotin Creek and the Touchet and Tucannon rivers were sampled in 2002 and 2003. Some sites in the Tucannon, Cummings

Creek, South Touchet, and Charley Creek were changed in 2002 because of miscommunications, or because of decreasing/increasing the number of sites for estimation purposes.

Asotin Creek: _Main Asotin Creek:_ From the Cloverland road turnoff bridge (4.8 km upstream from the mouth) upstream to the North and South Forks confluence. _North Fork Asotin Creek:_ From the confluence with the South Fork upstream 10.4 rkm to the U.S. Forest Service boundary (second fence). _South Fork Asotin Creek:_ From the confluence with the North Fork upstream 9.6 rkm to the old chimney (homestead) site. _Charley Creek:_ From the mouth upstream 11.8 rkm to the old Corral.

Touchet River: _Mainstem Touchet River:_ From the city of Waitsburg city park to the confluence of the North and South fork of the Touchet River (16.3 rkm). _North Fork Touchet River:_ From the confluence with the South Touchet upstream to the bridge at mile post 13. _South Fork Touchet River:_ From the mouth upstream 25.1 rkm to the mouth of the Burnt Fork. _Wolf Fork of North Fork Touchet River:_ From the mouth upstream 16.5 rkm (Newby's Cabin). _Robinson Fork of Touchet River:_ From the mouth upstream 8.0 rkm.

Tucannon River: _Main Tucannon River:_ From the Interstate HWY 12 Bridge upstream to Sheep Creek. _Cummings Creek:_ From mouth upstream 10.4 rkm.

Asotin Creek

In both 2001 and 2002, we electrofished five sites each in the Asotin Creek mainstem, North Fork, South Fork, and Charley Creek. Populations have remained relatively stable in the North Fork (Figure 16). Populations in the South Fork have been slightly more variable (Figure 17), with Age 0 production almost non-existent in some years. The 2002 population estimate in the South Fork was the highest that has been estimated since sampling began under the LSRCP. Populations estimated in the mainstem (Figure 18) have remained relatively stable, similar to the North Fork. During 2001 in Charley Creek, we estimated 12,935 (+/- 4,721) Age 0, and 8,181 (+/- 2,333) Age 1+ steelhead. In Charley Creek during 2002, we estimated 23,161 (+/- 11,756) Age 0, and 7,012 (+/- 2,897) Age 1+ steelhead.

In both the North and South forks, low estimated production of Age 0 has not always corresponded to a decrease in Age 1+ fish the following year. We suspect that low sample size and area surveyed has influenced the results. We've begun the process of re-analyzing all electrofishing data for possible errors and these will be updated in future reports. In addition, we are investigating ways (increased sampling) to increase the confidence of our estimates.

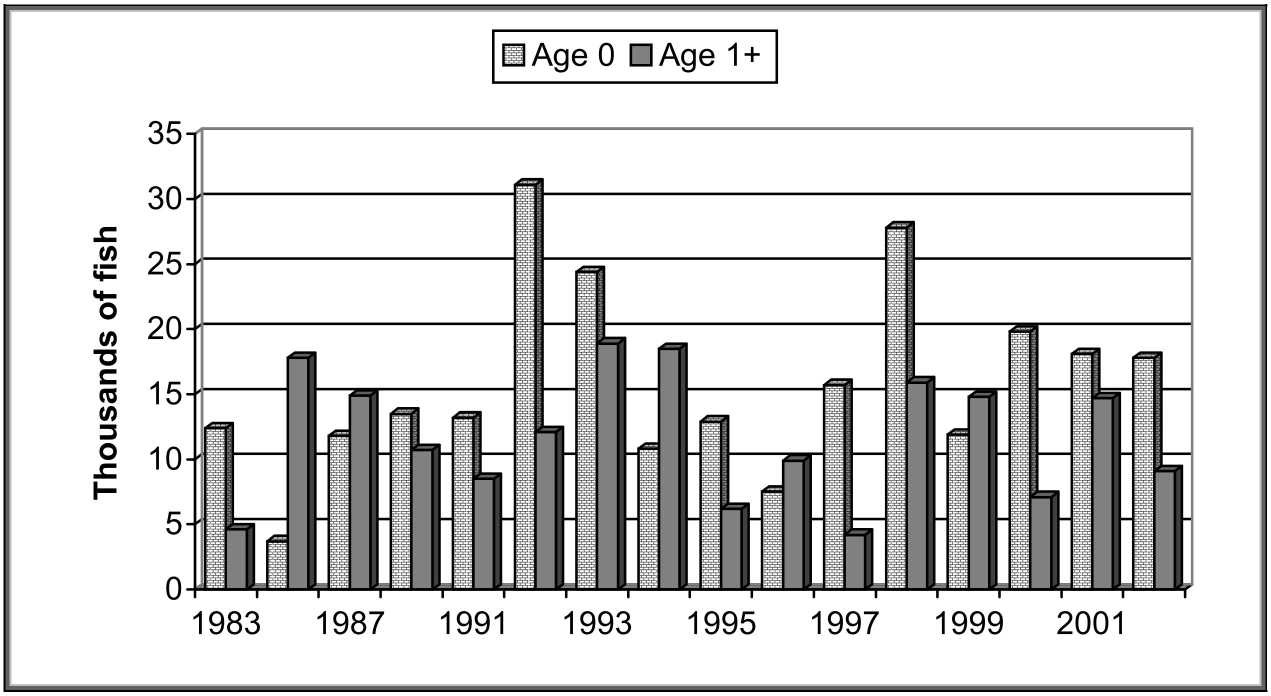

Figure 21. Estimates of natural juvenile steelhead abundance on the North Fork of Asotin Creek from the confluence with the South Fork upstream 7.4 rkm to U. S. Forest Service Boundary, 1983-2002.

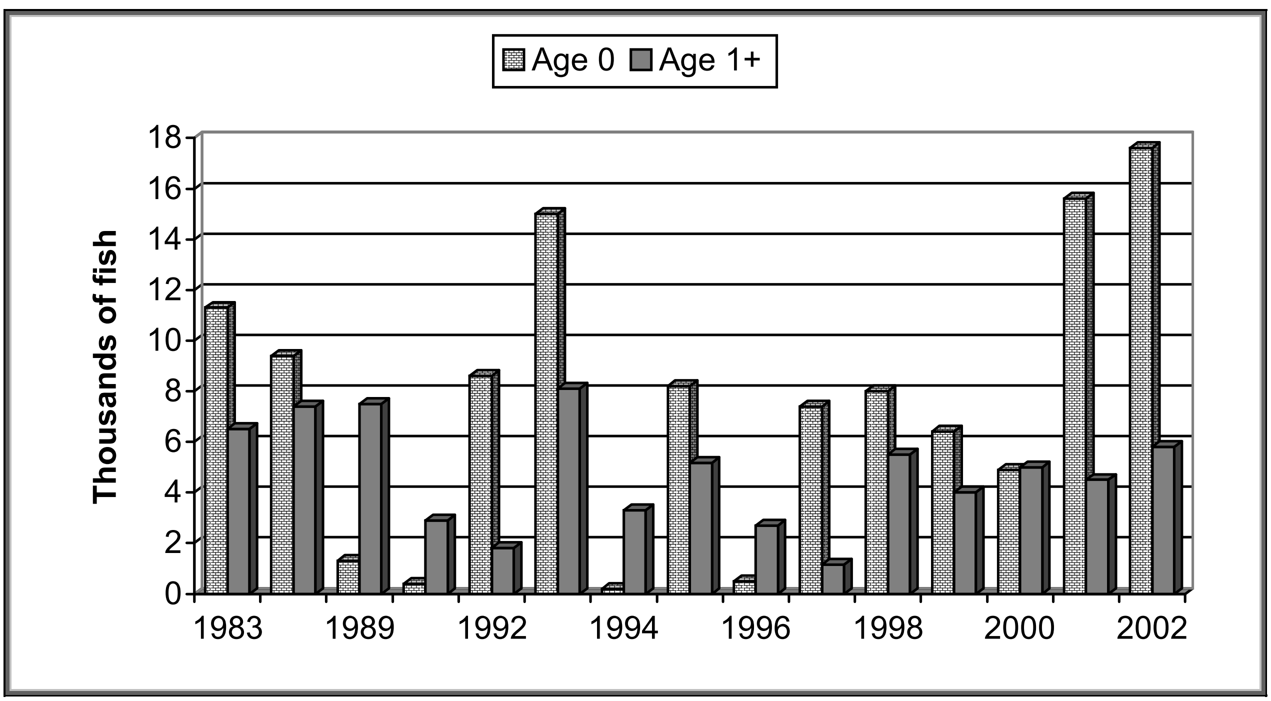

Figure 22. Estimates of natural juvenile steelhead abundance on the South Fork of Asotin Creek from the confluence with the North Fork upstream 5.6 rkm to first bridge crossing, 1983-2002.

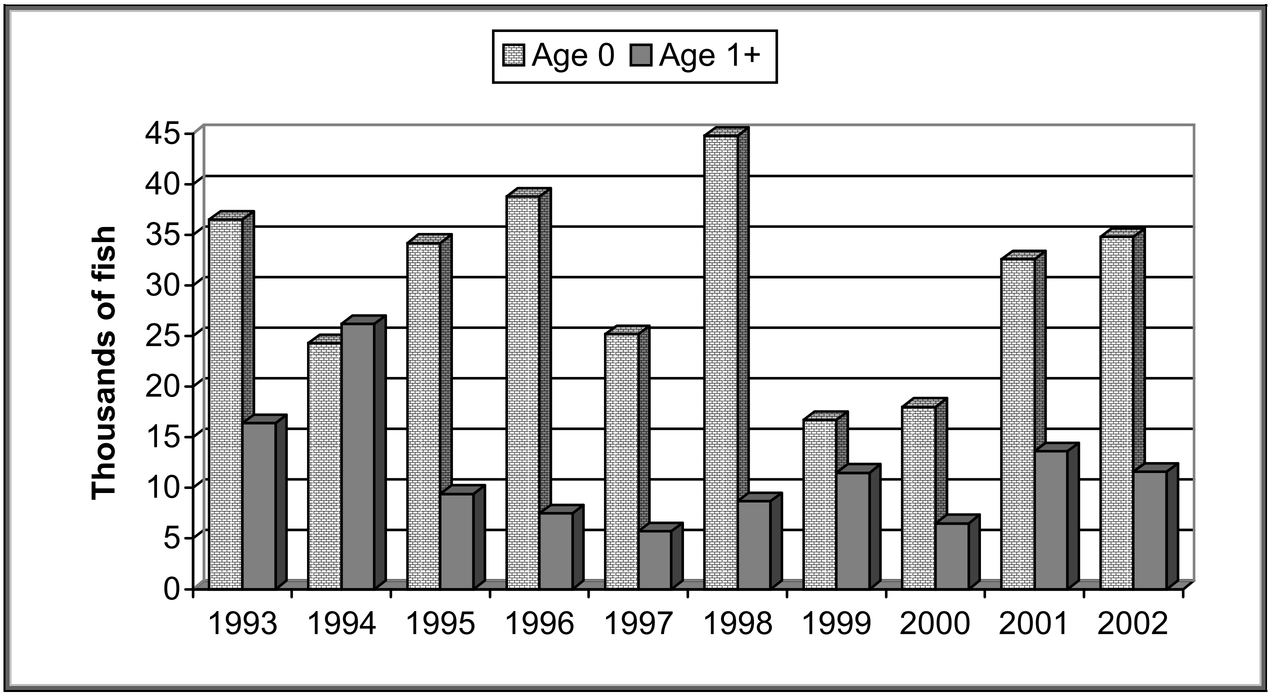

Figure 23. Estimates of natural juvenile steelhead abundance on the mainstem of Asotin Creek from Headgate Park to the confluence of the North and South forks (8.0 rkm), 1993-2002.

Touchet River

In both 2001 and 2002, multiple sites were sampled in the mainstem Touchet River and the North, South, Wolf, and Robinson forks. In 2001, additional information from two electrofishing sites on the upper Wolf Fork were obtained from the WDFW Fish Management crew (Mendel pers comm., 2001). These data were incorporated with ours to make the population estimates within the reach. Long-term trends in the Touchet River have varied considerably over the years. Age 1+ production in the North Fork declined rapidly in the late 1990's, but appeared to rebound in 2000 (Figure 19). This is interesting considering that Age 0 production for some years (i.e., 1997 and 1998) was relatively high. Abundance trends for both the South Fork and Wolf Fork have also been variable over the years documented (Figures 20 and 21). However, in all of these years, sample sizes prior to 2000 were small (3 sites/stream) each year, and population estimates may not be accurate.

Population estimates in the mainstem Touchet River, and in the Robinson Fork in 2001 and 2002 were as follows. In the mainstem Touchet River in 2001 we estimated Age 0 = 41,390 (+/- 21,351) and Age 1+ = 1,005 (+/- 934). In 2002 we estimated Age 0 = 35,513 (+/- 14,579) and Age 1+ = 1,682 (+/- 1,741). In the Robinson Fork in 2001 we estimated Age 0 = 7,707 (+/- 3,373) and Age 1+ = 4,231 (+/- 3,440). In 2002 we estimated Age 0 = 14,468 (+/- 6,521) and Age 1+ = 4,970 (+/- 2,273). The number of Age 1+ steelhead in the mainstem Touchet River compared to the previous year Age 0 is very small. This is likely from mortality due to high water temperature conditions causing considerable mortality, or that fish migrate from the system after one year of rearing. This factor is unknown and should be considered for further investigation.

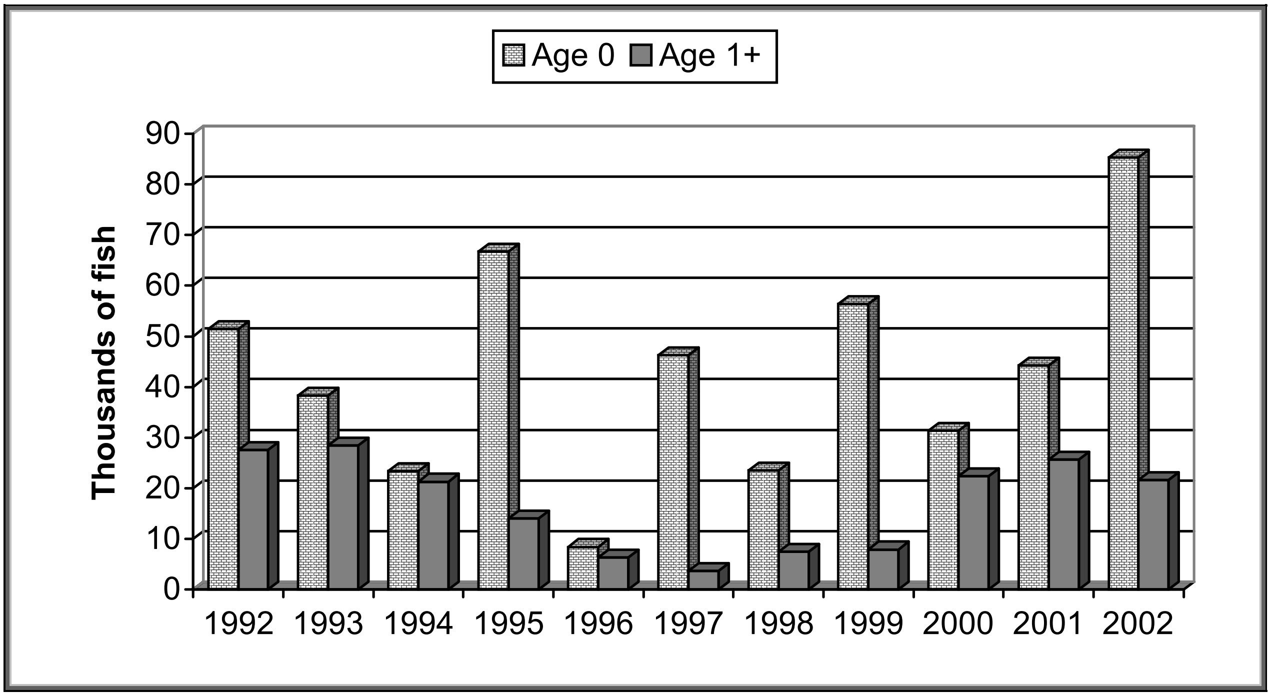

Figure 24. Estimates of natural juvenile steelhead abundance in the North Fork of the Touchet River, from confluence with the South Fork upstream 17.8 rkm, 1992-2002.

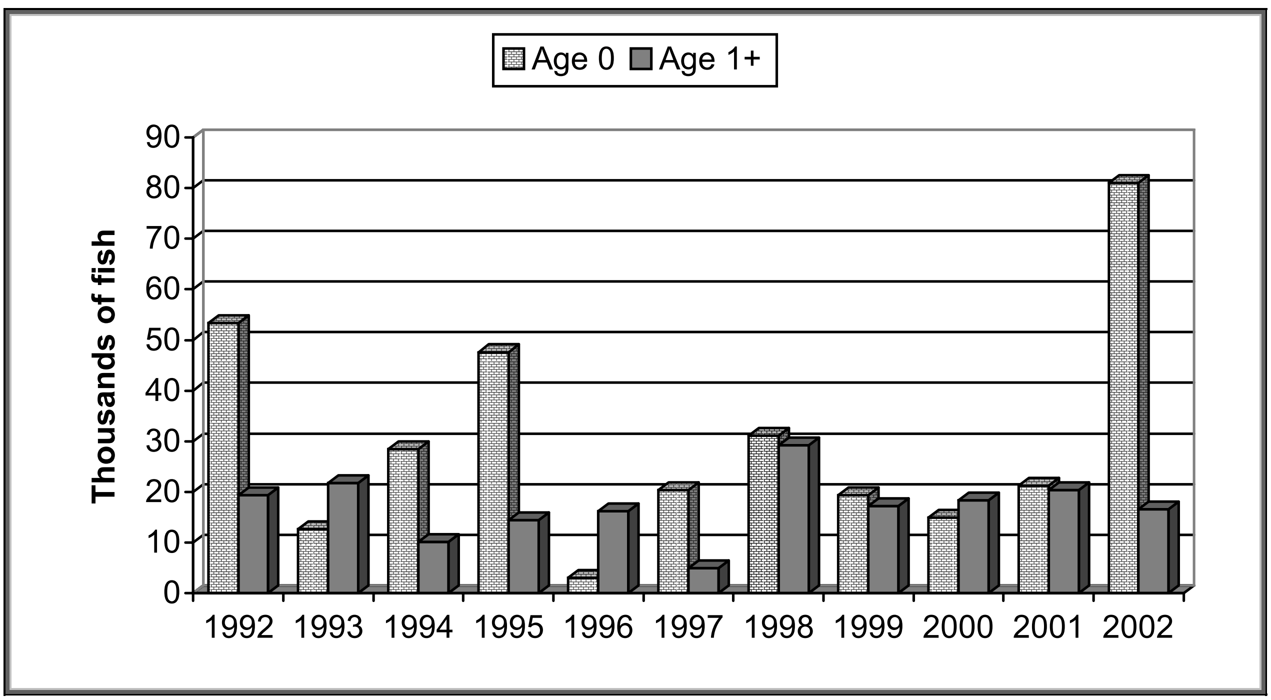

Figure 25. Estimates of natural juvenile steelhead abundance in the South Fork of the Touchet River, from confluence with the North Fork upstream 25.1 rkm, 1992-2002.

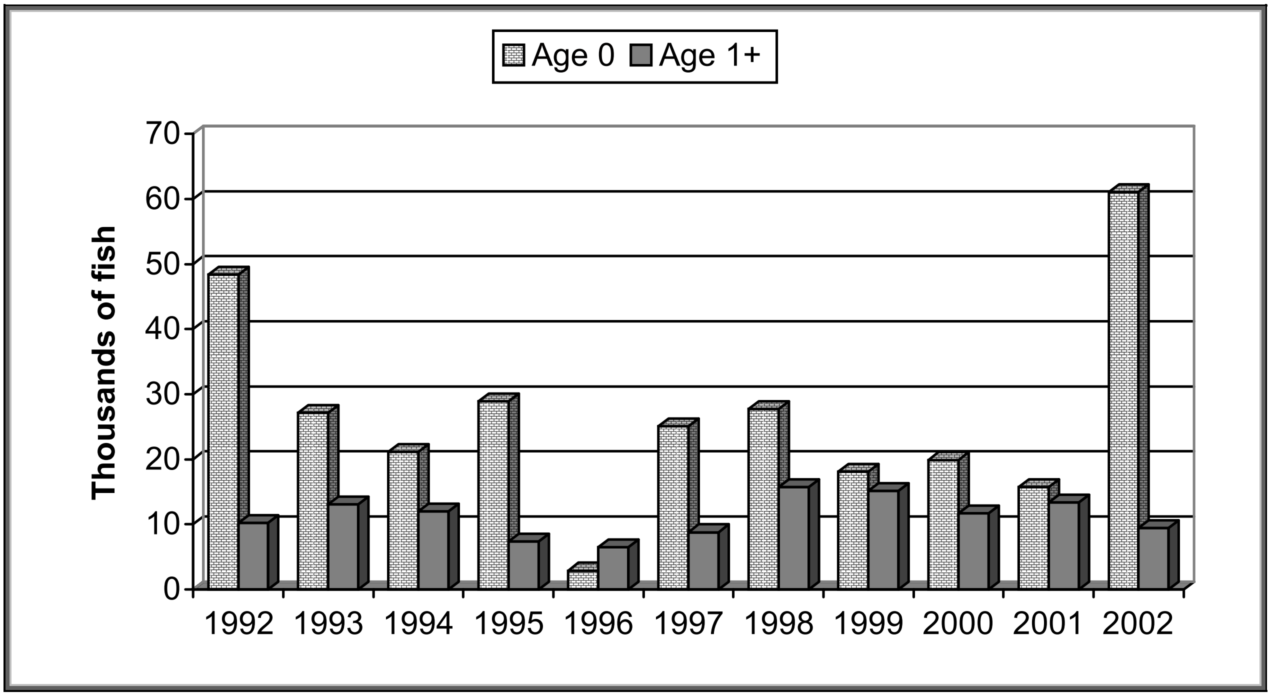

Figure 26. Estimates of natural juvenile steelhead abundance in the Wolf Fork of the Touchet River, from confluence with the North Fork upstream 16.5 rkm, 1992-2002.

Tucannon River

Populations of Age 0 steelhead have remained relatively stable over time, possibly with a slight downward trend. Conversely, long-term trends in the Age 1+ steelhead within the reach described have generally declined over time. We believe that this trend can largely be attributed to an overall decrease in the number of adults spawning in the upper reaches of the Tucannon River (Figure 22). It was discovered in the early 1990's that the Tucannon River adult trap (built primarily for spring chinook trapping) was impeding steelhead escapement into the upper Tucannon River. At this time we speculate that no downward trend is visible in Age 0 steelhead because sample sites were skewed in distribution throughout the reach, with relatively high densities of Age 0 fish in two sites located below the adult trap. Densities of Age 1+ juveniles are generally less, and perhaps better indicate the overall status of the population between 1986 and 2001. In 2002, we documented a large number (175) of adult steelhead that were passed above the Tucannon Fish Hatchery adult trap. This large escapement resulted in a large number of Age 0 steelhead in the reach described. The 2002 population estimate in the reach was the largest that has been documented since 1984 when the project began. We are hopeful the number of Age 1+ fish will increase in 2003 as well, indicating the upper basin was reseeded with juvenile steelhead. Population estimates in Cummings Creek have remained stable since the early 1990's (Figure 23). The estimate in 2002 was also the highest on record.

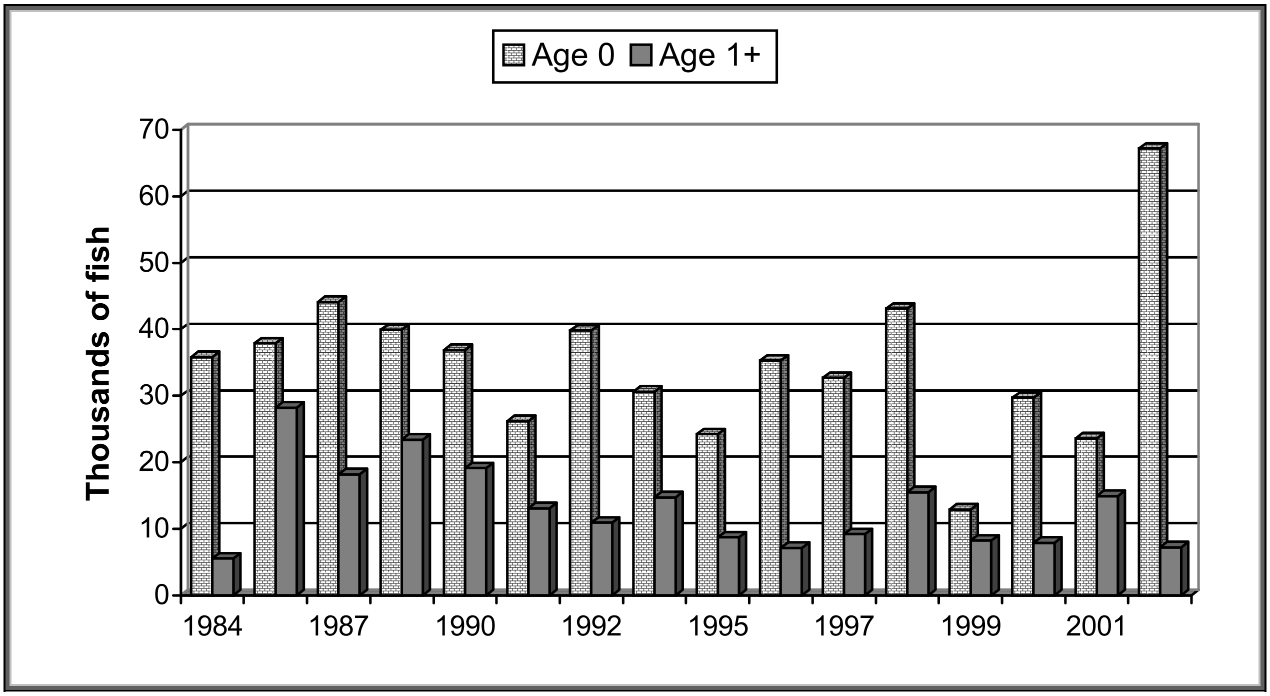

Figure 27. Estimates of natural juvenile steelhead abundance in the Tucannon River from Campground 1 (rkm 55.4) upstream 19.1 rkm to Panjab Bridge, from most years between 1984-2002.

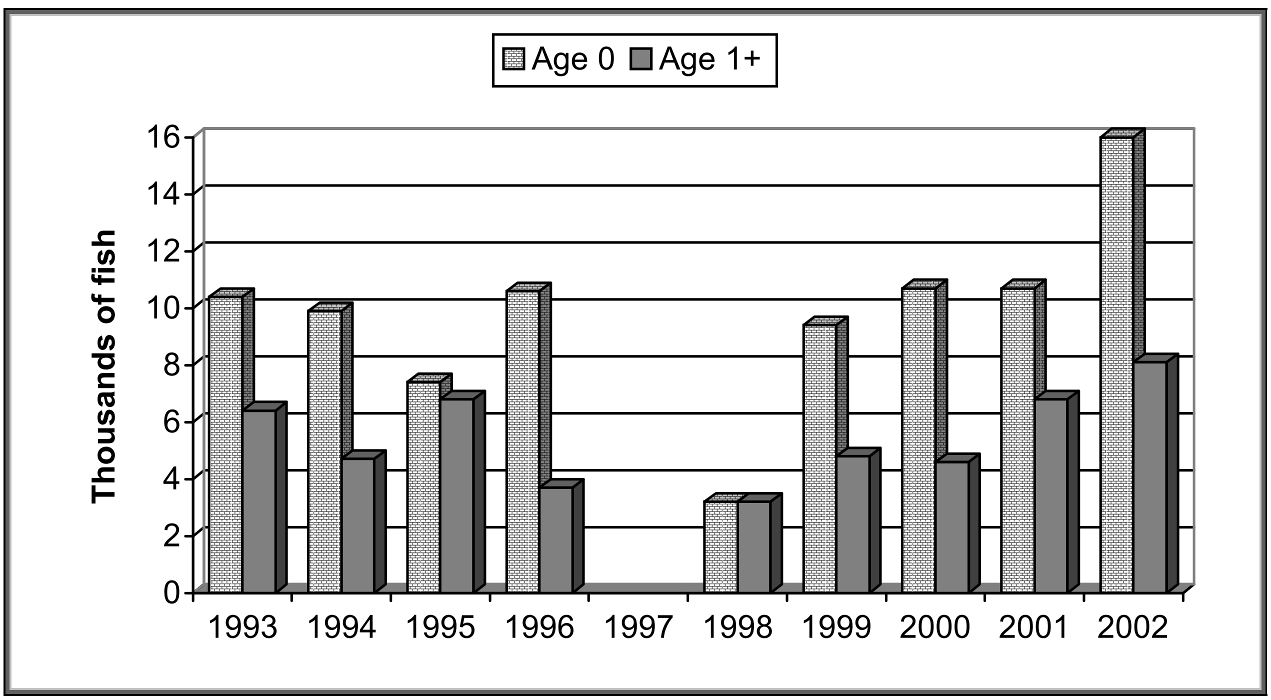

Figure 28. Estimates of natural juvenile steelhead abundance in Cummings Creek from the mouth upstream 8.0 rkm for most years between 1993-2002.

Genetic Comparison of Steelhead in SE Washington

Background: In 1999, the National Marine Fisheries Service concluded that continued releases of LFH stock steelhead in the Snake River constituted jeopardy to ESA listed populations of natural summer steelhead. With that ruling, WDFW, with support from the Nez Perce Tribe (NPT) and the Umatilla Tribe (CTUIR), began the development of locally adapted summer steelhead broodstocks by trapping natural origin fish from the Tucannon and Touchet rivers. This decision was based on the belief that genetic differences still existed between the natural stocks and hatchery fish being released in each of these rivers, even though hatchery releases had occurred for the past 20 years. Limited genetic (allozyme) data from Tucannon River wild-stock steelhead in the early 1990's suggested that little introgression of the LFH stock had occurred. However, the steady decline of natural fish in each of the rivers may have allowed more introgression of the LFH stock in recent years. For example, in the Tucannon River we are fairly certain that hatchery origin fish actively spawn and produce smolts in the lower Tucannon River, and likely mix with natural spawners on the spawning ground. Therefore, unmarked adults coming back and currently being trapped and collected for the new endemic broodstock could have mixed origin or full hatchery-origin parents. Also, by trapping in the lower river, we may be capturing unmarked steelhead from other river systems that just "dip in" the Tucannon River.

From 1998-2002 on the Tucannon River, and 1999-2002 on the Touchet River, evaluation and hatchery staff have collected fin clip or opercle punches from natural origin steelhead captured in traps on each of the rivers. These and other tissue samples collected from both evaluation and Fish Management staff from the basins were collected to genetically determine, through DNA microsatellite analysis, the summer steelhead stock structure in SE Washington, and potentially determine if distinct stocks of natural origin fish remain. Specific questions that were posed to the genetics lab were: 1) Are there significant genetic differences among summer steelhead from LFH and endemic Tucannon and Touchet rivers summer steelhead?, 2) Are there significant genetic differences between Tucannon and Touchet river endemic stock steelhead?, and 3) How do the Tucannon and Touchet river endemic stocks compare to other steelhead stocks in the Snake or Columbia River basins?

Methods and Results: Genotypes were assessed at 14 microsatellite loci (Appendix H, Table 1) for 1,246 summer steelhead collected from 1998 through 2002 from 11 locations in the Tucannon, Touchet and Walla Walla drainages (Appendix H, Table 2). Tucannon River natural stock collections include wild-origin (unclipped) adult summer steelhead collected at river kilometer (rkm) 17.7 and at the Tucannon Fish Hatchery adult trap (rkm 59) in the Tucannon River. Lyons Ferry Hatchery stock summer steelhead (finclipped) were collected at the LFH, and a few were collected at the Tucannon Fish Hatchery adult trap. With the exception of the 99CN LFH stock collection, all Tucannon natural origin stock and LFH stock collections were adult fish (Appendix H, Table 2). (The 99Lyon's Ferry adult collection, 99NX, was omitted from the study: samples were degraded and failed to produce DNA.) Touchet River collections include wild-origin summer steelhead sampled at the Touchet River trap at Dayton (rkm 87.4), Coppei Creek, Robinson Creek, Wolf Fork, North Fork Touchet River, and South Fork Touchet River. Several of the Touchet River collections were juveniles (Appendix H, Table 2). Walla Walla River collections included adult wild-origin summer steelhead sampled from the Upper

Walla Walla River (provided to WDFW from ODFW). Samples from Yellowhawk Creek and upper Mill Creek (a few Yellowhawk Creek fish were included in the 1998 Mill Creek collection) were collected by the Tri-State Steelheaders and the U.S. Forest Service and provided to WDFW for these analyses.

Statistical tests were applied to determine characteristics of individual collections, to estimate relatedness among collections from different locations, and to assess relationships between wild-origin summer steelhead and hatchery-origin summer steelhead. To estimate inbreeding and population mixing, Hardy-Weinberg equilibrium (HWE) values (departure from heterozygosity expected when collection is a set of randomly mating individuals) were tested in collections for each locus and globally across loci using GENEPOP (Raymond and Rousset 1995).

Eight loci (Appendix H - Table 1) and fifteen collections (Appendix H - Table 2) were out of HWE for homozygote excess suggesting that collections have either experienced inbreeding or that the collections were admixtures (more than one population sampled). Inbreeding occurs when effective population size is small for several years. Loci were tested for linkage (are alleles at different loci associated?) in pairwise genotypic disequilibrium tests across all collections using GENEPOP. After corrections for multiple tests (sequential Bonferroni correction, Rice 1989), 30/91 loci pairs were in disequilibrium when summed over all populations. This non-independence could arise from several sources: through close proximity on the same chromosome so that alleles at different loci are transmitted as a set rather than independently, through non-random mating so that individuals with particular genotypes are mating with each other, through a recent bottleneck or small effective population size so that related individuals are mating with each other, or if there is an admixture of populations or sibling groups in the collections.

Since different loci pairs were out of equilibrium in different collections (and other steelhead collections in our database show no disequilibrium), physical linkage is unlikely. The trend towards homozygote excess in several collections could suggest population admixture where collections included individuals from two (or more) populations, or in juvenile collections two (or more) sibling groups or a mix of rainbow and steelhead juveniles. Since juvenile collections displayed most of the genotypic disequilibrium (Appendix H - Table 2), and juveniles move throughout drainages, all three possibilities are likely. 98Mill Cr. also showed linkage disequilibrium. This could reflect population admixture through the inclusion of some Yellowhawk Creek fish. Small effective population sizes and consequent mating among relatives also likely influenced disequilibrium. This hypothesis is supported by HWE tested at the collection level and Fis values. Fis values (a measure of individual heterozygosity) were calculated using FSTAT (Goudet 2001, Appendix H - Table 2). Positive Fis values in all collections and significant values in most collections and overall suggested that collections have experienced significant inbreeding (Appendix H - Table 2), a result of depressed population size sustained for multiple generations.

Since loci appear to be non-independent (much linkage disequilibrium) and several populations were out of Hardy-Weinberg equilibrium, tests investigating relationships among collections should be interpreted cautiously. In pairwise genotypic tests using GENEPOP, 180/210 comparisons indicated significant differences in genotypic distributions (Appendix H - Table 3).

Some of the tests indicating non-differentiation were likely the result of small sample size: 98TucannonWild (N = 13) was undifferentiated from most other Tucannon River and Lyon's Ferry collections and some Touchet River collections. The 98Tucannon hatchery-origin (N=22) collection was also undifferentiated from the wild-origin Tucannon collections. However, the 99Dayton collection was undifferentiated from several Touchet, Walla Walla and Tucannon River collections and there was no obvious reason for this result. The sample size was adequate (N = 33), and the collection was obtained several river miles upstream from the confluence of the Snake and Columbia rivers. In addition, the 20000, 2001 and 2002 year classes from Dayton trap were differentiated from most of the other Tucannon and Touchet River collections. It is possible that the 1999 collection included some mixture from different breeding groups so that it shared genotypes with a wider variety of collections than the other collections. Pairwise tests using Lyon's Ferry Hatchery collections with robust sample sizes (1999 and 2002) indicated a distinction between hatchery-origin and wild-origin steelhead: both collections had significantly different genotypic distributions from all collections from the Touchet, Tucannon and Walla-Walla drainages. With the exception of tests involving 99Touchet, the Touchet and Tucannon rivers collections were significantly different from each other.

In a dendrogram analysis (PHYLIP, Felsenstein 1993), collections were plotted in a neighbor-joining tree according to Cavalli-Sforza and Edwards (1967) pairwise geometric distances (Figure 29). Distances were based upon allele frequencies at 14 loci. The analysis was bootstrapped 1,000 times to give an indication of confidence for groupings in the dendrogram: to simulate variability in the data set encountered if populations were resampled 1,000 times, the allele frequency matrix was resampled 1,000 times, a distance matrix was calculated for each data set, and a neighbor-joining dendrogram was constructed from each distance matrix. The 1,000 dendrograms were combined in a consensus tree and values at the nodes of the tree indicate the percentage of 1,000 trees in which the collections beyond the node occurred together. The consensus tree shows some geographic structure in distinctions between the three drainages: the Tucannon-Lyon's Ferry group, the Walla Walla group and the Touchet group. The wild-origin Tucannon collections from 2001 and 2002 and Lyons' Ferry Hatchery collections formed a branch with 77% bootstrap support, with hatchery collections at the terminus of the branch. The 1998 and 1999 wild Tucannon collections formed their own separate branch (no bootstrap support). Since these were small collections (13 and 22 individuals respectively), genetic characterizations of these collections were probably distorted. The upper Walla Walla collections formed a group with 98% bootstrap support and they were joined by 98Mill Cr. from the Walla Walla drainage, with 76% bootstrap support. Collections from the Touchet drainage formed an unsupported branch that also included the 00Yellowhawk collection from the Walla Walla drainage. The 00Yellowhawk collection consisted of 11 individuals and was also poorly characterized genetically. The 2001 and 2002 Touchet collections at the Dayton trap formed their own branch with 99% bootstrap support.

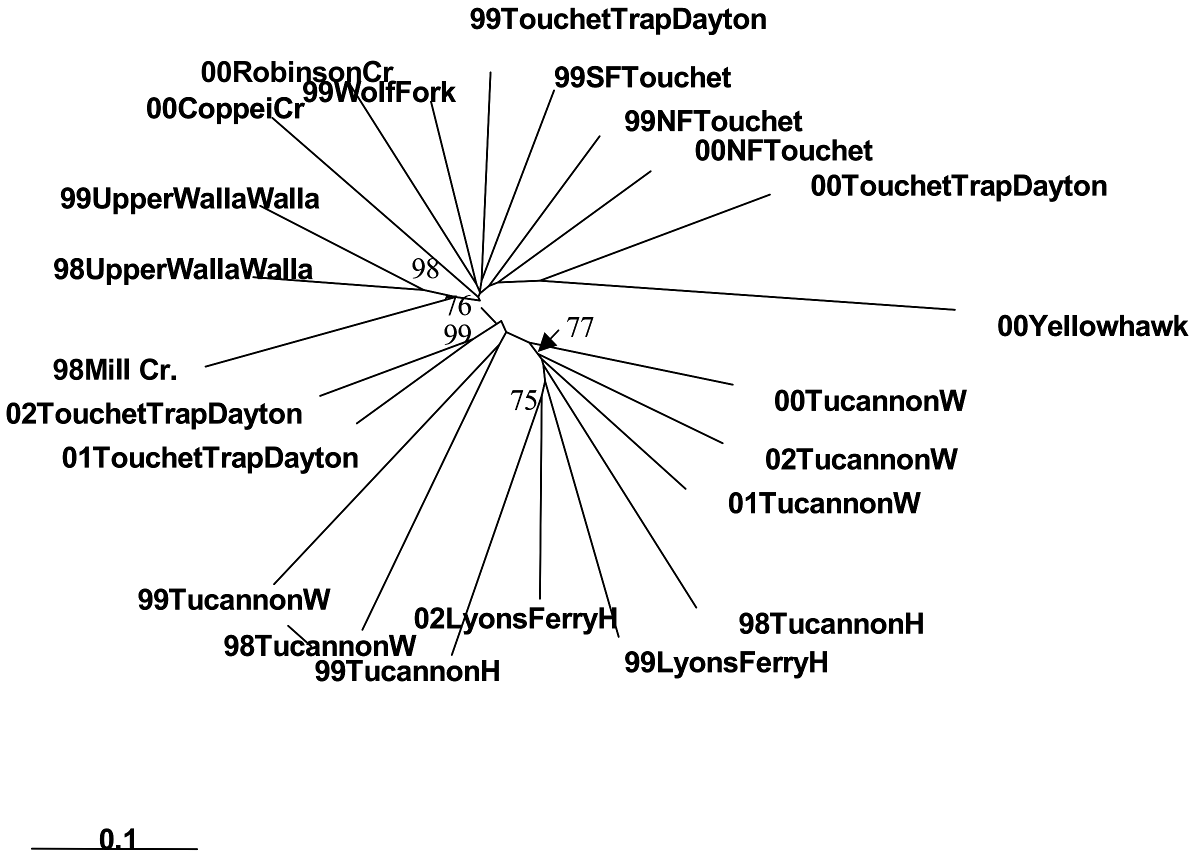

Figure 29. Neighbor-joining dendrogram showing genetic relationships among Tucannon, Touchet and Walla Walla summer steelhead collections. Numbers at the nodes indicate the percentage of 1000 trees in which the collections beyond the node grouped together.

The Cavalli-Sforza and Edwards distances were also employed in a multidimensional scaling analysis (MDS) using NTSYS-PC (Rohlf 1993). This shows genetic relationships similar to the NJ analysis but without the confines of the hierarchical structure of the dendrogram, and with the addition of a third dimension. Here the distortion in genetic distances caused by small collection sizes in 00Yellowhawk became apparent: 00Yellowhawk separated from all collections along the first axis (Figure 30.). The 1998 and 1999 Tucannon wild collections separated from all other collections along the third axis. While these Tucannon collections were small, this could indicate some changes over time in the genetic profile of the wild collections: more recent wild Tucannon collections (2000 – 2002) clustered with hatchery collections. The upper Walla Walla collections clustered below but near the Touchet River collections. The MDS analysis suggested that the Tucannon River and Lyon's Ferry collections formed subgroups within a larger group, and that the Touchet and Walla Walla rivers collections formed a second large group. Although genetic distances were large between the 1998 and 1999 wild Tucannon collections and the other Tucannon collections, in the pairwise genotypic test they were not significantly different from many collections. This indicates that genetic distances were distorted by small sample sizes.

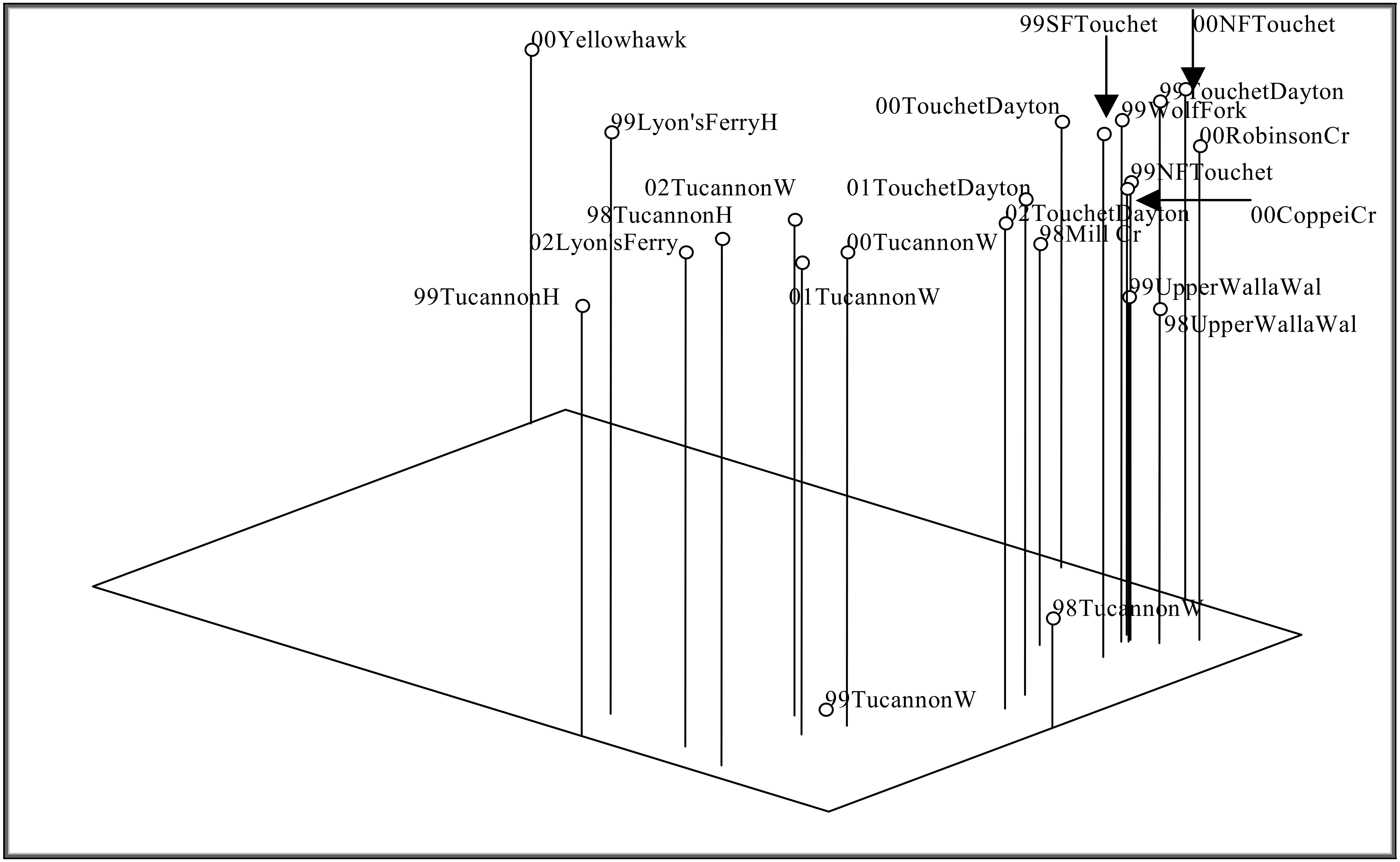

Figure 30. Multidimensional scaling plot showing genetic relationships among Tucannon, Touchet, and Walla Walla steelhead collections (all collections included in analysis).

When collections were analyzed in a dendrogram including collections from the Grande Ronde drainage (00Wallowa Hatchery, 00Cougar, 00Menatchee, 00Rattlesnake and 00Crooked, Figure 31), regional distinction was seen in four branches: a Grande Ronde branch with 72% bootstrap support, a Tucannon-Lyon's Ferry Hatchery branch with 71% bootstrap support, a Walla Walla branch with 99% bootstrap support and a Touchet branch.

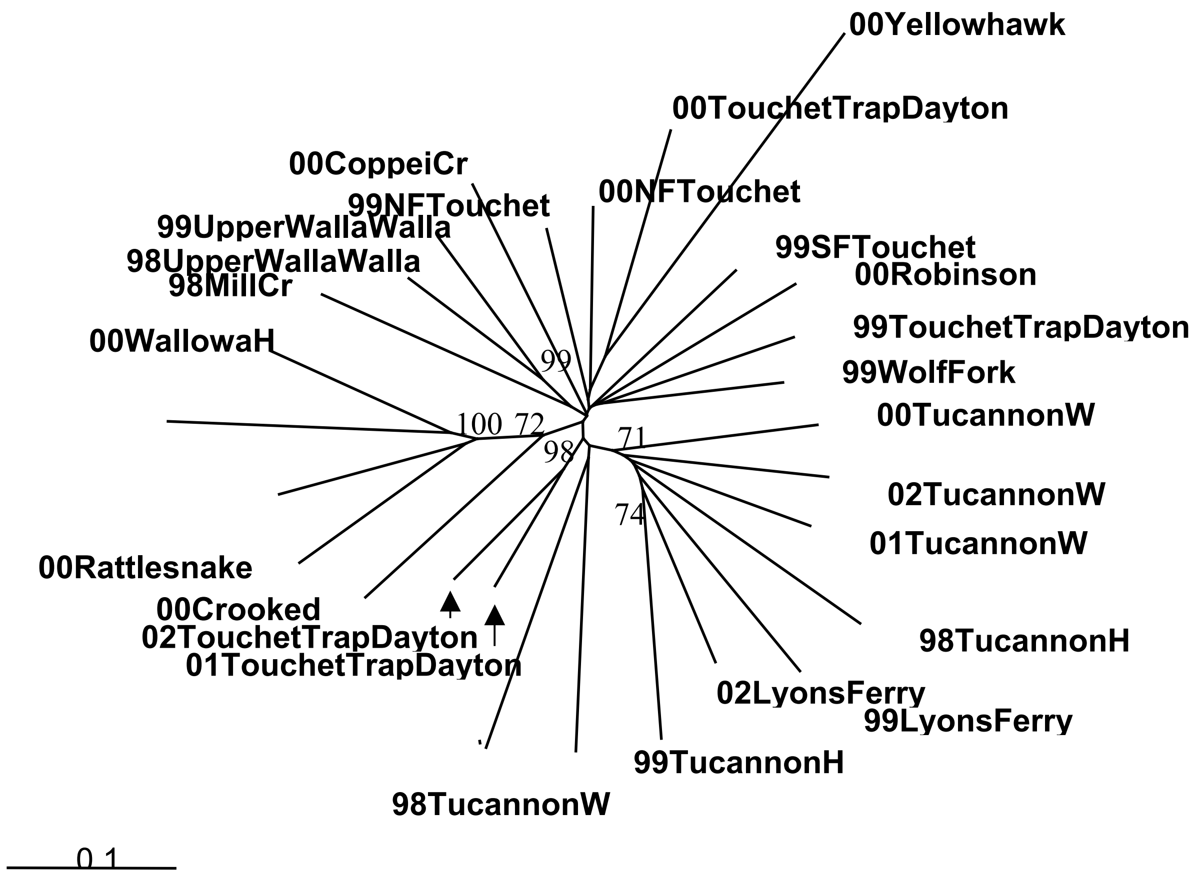

Figure 31. Dendrogram showing genetic relationships among Tucannon, Touchet and Walla Walla summer steelhead collections and Grande Ronde steelhead collections.

Discussion: The overall pattern of this data set indicated genetic distinction between wild-origin and hatchery-origin summer steelhead in both the Tucannon and Touchet rivers. The LFH hatchery stock is primarily a Wells stock, with some Wallowa stock influence. Wells Hatchery stock was originally used for releases at LFH, but in years of low production, the Wallowa stock was also incorporated. The Wallowa stock is a Snake River composite stock that was derived by Oregon Department of Fish and Wildlife from adult steelhead trapped at the Lower Snake River dams. It was termed Wallowa stock because it was reared at Wallowa Hatchery, Oregon, and releases occurred in the Wallowa River (Grande Ronde). Total contributions from each of these stocks were Wells (~85%) and Wallowa (~15%).

Despite several years of supplementation with LFH stock smolts in the Tucannon River, wild-origin Tucannon River summer steelhead remain genetically distinct from the LFH stock. The LFH stock does show a closer genetic relationship with the Tucannon River wild-stock collections than with the Touchet River wild-stock collections. This may reflect the origin of the hatchery stock since the Wallowa and Tucannon rivers are within the same Snake River ESU and may thus share more alleles than either population shares with the Touchet River collections from the Lower Columbia River ESU. Further, we believe there has been more introgression of the LFH stock fish because of the distribution of hatchery and natural origin spawners in the Tucannon River compared to the Touchet River. Adult trap data from the Tucannon suggests that in many years, natural origin fish were outnumbered by the LFH stock on the spawning grounds.

Lyons Ferry Hatchery summer steelhead smolts have also been released into the Touchet River at Dayton acclimation pond. In spite of this infusion, the Touchet River wild-stock collections remain genetically distinct from the LFH hatchery stock and from the Tucannon River wild stock. Some of this distinction indicates that LFH summer steelhead stock have failed to introgress into the wild-stock population in the Touchet drainage. This conclusion has also been supported from the Dayton adult trap data that suggests that very few hatchery origin fish return to the natural spawning areas in the Touchet River, but remain well below them near the smolt release location. Some of this distinction may also be due to low population numbers experienced by Touchet River populations - genetic drift may have enhanced differentiation. Since drift is a random process, sampling should be continued for multiple years to develop a more comprehensive genetic portrait of these populations. Further, if future hatchery supplementation is planned for the Touchet River, these endemic populations should be monitored to ensure that they retain their genetic integrity.

Summary:

- Wild-origin summer steelhead from the Tucannon, Touchet, and Walla Walla rivers are significantly different genetically from Lyons Ferry hatchery summer steelhead
- Wild-origin summer steelhead from the Tucannon River are significantly different genetically from wild-origin summer steelhead from the Touchet and Walla Walla rivers

Conclusions and Recommendations

While attempting to develop hatchery management procedures (acclimation, size and time of release, location of release, etc.) to maximize fish survival (SARs) and minimize the effects of a large hatchery program on ESA listed populations of salmonids, considerable insights to the biology of steelhead have been gained. A better understanding of the physical attributes of successful hatchery smolts, and conversely of residual steelhead, has significantly improved program success while decreasing negative effects on all wild salmonid populations. Further, WDFW has committed to testing the development of new broodstocks from natural origin fish where needed to reduce impacts (genetic, straying) to the natural populations. Beginning with the 1998 release year, we released tagged groups from the Tucannon, Grande Ronde and Walla Walla systems, and from LFH. Returns of straying tagged fish will be closely monitored, and an upcoming LSRCP report from WDFW releases will document stray rates for the program.

Washington's LSRCP steelhead and trout program has consistently returned adult steelhead and provided recreational opportunity for put/take trout fisheries from catchable rainbow, in excess of the LSRCP goals. In an effort to maintain successful mitigation in an ESA environment, we offer the following conclusions/recommendations from our studies, and offer additional areas of interest that should be pursued in the future to answer critical questions:

1. The NOAA Fisheries ruled that LSRCP hatchery steelhead jeopardized listed steelhead populations within the Snake and Columbia river basins (NMFS 1999), and called for the development of new endemic broodstocks for the hatchery steelhead program. Initial efforts in the Tucannon and Touchet rivers appear to be somewhat successful, but more data are needed before a final conclusion is reached, and we expand the use of these local broodstocks.

   For example, the current adult traps we use for capturing broodstock are not adequate for adult return evaluation. Moderate to high river flows disable both traps. In addition, since none of the fish released are marked for harvest, we have no other way of accounting for these fish upon return. Further, to be truly successful, hatchery rearing of these endemic stocks needs to be improved (growth during rearing and size at release – see #4 below). Decisions will also have to be made regarding Wallowa stock releases into the Grande Ronde Basin.

   Adult traps have been utilized to collect the standard hatchery steelhead stocks, develop new endemic stocks, or to assess stock/population potential in other areas. In addition, they provide an opportunity to collect tagged (ADLV+CWT) hatchery steelhead that may come from the LRSCP program to assist in determining success, or from other programs throughout the region.

   Recommendation: Continue with development/evaluation of endemic broodstocks in the Tucannon and Touchet rivers on a trial basis. We recommend that a large number of the endemic steelhead be PIT tagged prior to release. Adult PIT tag detection capabilities should be able to provide answers on adult return rates where current adult traps fall short.

Recommendation: Modify/improve existing adult traps to evaluate each endemic program and provide recommendations for each broodstock. Continue to investigate barrier types that can be used at the Dayton Adult Trap and Tucannon Fish Hatchery adult trap to improve trapping efficiency at each trap.

Recommendation: Continue to investigate adult returns to tributaries in the Washington portion of the Grande Ronde River. Continue to coordinate with ODFW for efforts regarding future development of new endemic broodstocks for releases into the Grande Ronde Basin.

Recommendation: At all trapping locations, sacrifice all tagged (ADLV+CWT) adult steelhead to determine release points and assess straying of stocks.

2. In conjunction with #1, the LFH and Wallowa stock program returns have nearly always exceeded Washington's LSRCP mitigation goals. The LFH and Wallowa stock fish therefore have likely caused some impacts to the listed populations because of straying into non-target waters and genetic introgressions. During 2002, return data from CWT groups were analyzed during the HGMP development process. Evaluation of the data concluded that production releases could be lowered, while continuing to meet mitigation goals. Reductions in program releases from each of these stocks would lessen any potential negative impacts they may have on listed populations. Based on the evaluations, we have recommended and implemented the following production cuts in the LFH and Wallowa stock programs.

   Recommendation: The LFH stock will be reduced from 420,000 to 345,000 smolts beginning with the 2004 release (60,000 @LFH; 135,000 reduced to 100,000 in Tucannon River @ Enrich Bridge, 100,000 reduced to 85,000 in the Dayton AP – Touchet River; 125,000 reduced to 100,000 in the Walla Walla River). The Wallowa stock will be reduced from 200,000 to 160,000 beginning with the 2004 release. In the Tucannon River, we recommend that all LFH stock release points be at or below Enrich Bridge (rkm 27) to lessen the potential effects of returning adults on natural populations in the upper basin.

3. The release of Wallowa stock juvenile steelhead from Cottonwood Creek AP is a successful portion of Washington's mitigation program. In addition to the Cottonwood AP releases, the ODFW also releases large numbers (up to 1.2 million) of Wallowa stock steelhead into the upper Grande Ronde River. However, CWT recoveries from fisheries and traps have raised concerns about Wallowa stock stray rates into other river systems (mainly the Deschutes River in Oregon). Beginning in 1997, we started releasing tagged smolts (ADLV+CWT+Freeze Brand) from Cottonwood AP to re-evaluate this potential straying issue. Within the next few months, the ODFW will produce a report describing the stray rates of Wallowa stock and other Snake River basin steelhead stocks into the Deschutes River. However, due to their analysis method (need of a good terminal trapping location to obtain CWT's), data from the Cottonwood AP releases were not included because it lacks a good adult trap. Therefore, the ODFW report will describe the stray rates of Wallowa stock fish released from the ODFW facilities in the upper Grande Ronde only. Therefore, the Wallowa stock released from Cottonwood will be associated with their findings based solely on stock name. As such, WDFW will conduct another analysis using data from our Cottonwood release groups, but using Lower Granite Dam as the final observation point in the Snake River (use of freeze brand

recoveries observed at the dam). Preliminary data analysis suggests that straying of Cottonwood fish into the Deschutes River is minimal (i.e. <5%). Therefore, abandoning the use of this stock based on the stray issue into the Deschutes River may be unfounded.

Freeze brands have played a critical role in determining relative returns to Lower Granite Dam. There continues to be discussion that sampling of fish for brands, etc. may be discontinued as run sizes increase making it difficult to sample all the fish. PIT tags could be used in place of brands, with the adult detector at Lower Granite then providing adult return data. However, PIT tags are expensive relative to freeze branding.

Recommendation: Continue the use of Wallowa stock steelhead (at a reduced smolt production level) trapped at Cottonwood AP for use in the Grande Ronde River and marking (ADLV+CWT+Brand) test groups to determine if Cottonwood AP released fish stray into down-river and local tributaries. Provide a summary report documenting the amount of straying into the Deschutes River from Cottonwood AP fish. Investigate the cost benefits involved with PIT tagging fish from Cottonwood in the future to determine adult return rates and straying.

4. Natural origin steelhead return in the Tucannon and Touchet rivers over an extended period during the run. Collections for broodstock have become difficult given the relatively small number needed, and the time frame needed to hold fish prior to spawning. As such, we have typically collected fish in the earlier portion of each run. In addition, spawn timing is affected due to the holding facility temperature. Extended spawn timings and juvenile fish that avoid hatchery workers and feed are creating problems in the hatchery rearing phase by having populations with large size variation, and failure to meet size goals upon release; likely decreasing survival following release.

   Recommendation: Continue to document run timing and spawn timing (when and how long) of natural fish collected for endemic broodstocks.

   Recommendation: Continue to develop/update broodstock collection protocols appropriate for each stock.

   Recommendation: Discuss rearing protocols with hatchery personnel to best meet production goals for each endemic program (i.e. inside rearing tanks, covers on ponds, automatic feeders, underwater feeders, etc…).

5. Each year, considerable time and effort is placed on our juvenile electrofishing surveys. Densities and population estimates have been derived, but large variance within and between sites (caused by single habitat types being sampled and spatial patchiness of the species within the watershed) have led to very large confidence limits around the estimates. To decrease these and provide more confidence in our estimates we must either 1) sample more sites, or 2) survey larger sites to sample more varied habitat. Each of the options is limited because staff and time currently allocated are maximized.

Recommendation: Investigate the use of sampling longer sites, but do not conduct the multiple pass method. An option would be to use a single pass method (sampling perhaps 4x the area with multiple habitat types included), and using past capture efficiencies (by age class) to derive a density/population estimate for each site. We suspect this will reduce the variance between sites. The combination of reduced variance, larger area sampled, and more representative habitat types sampled, should increase estimate accuracy and decrease confidence limits. Continue to conduct multiple pass surveys at selected sites for each tributary to check capture efficiency between and within.

6. Genetic stock analysis between Tucannon and Touchet river natural origin steelhead, and LFH stock steelhead was completed. Results indicate that each of these groups remain genetically distinct from each other despite years of supplementation in each basin. Tucannon and LFH stock are more similar and indicate some introgression between the two stocks may have occurred. The Touchet River stock appears to be more intact.

   We also suspect there may be some differences in the Tucannon River natural origin fish within the watershed. Large numbers of hatchery origin fish have been documented spawning in the lower Tucannon River (Marengo and downstream), and we've documented a large number of Age 1 smolts leaving the system. We suspect that these Age 1 smolts maybe offspring of mixed or hatchery origin parents. However, upon adult return and possible collection for the new endemic broodstock program, they are indistinguishable from fish that may have reared in the upper Tucannon River (more likely natural origin parents).

   Recommendation: Long-term monitoring of the genetic characteristics of the new endemic broodstock should occur because of the small founding populations used for the hatchery broodstock.

   Recommendation: Further analysis of the Tucannon and LFH stock needs to occur. Additional samples from both the LFH and natural stock should be collected. Genetic comparisons should be made between natural origin fish captured from the lower Tucannon Trap and the Tucannon FH adult trap, and by freshwater age class determined from scales (Age 1 versus Age 2,3 smolts).

7. The reconditioning of post-spawned steelhead ("kelts") in aquaculture/hatchery facilities may bolster depleted populations of steelhead by increasing the number of repeat spawners. In this fashion, reconditioning may constitute a novel approach to hatchery reforms. For many populations in the upper Columbia and Snake rivers, kelt reconditioning could also maintain the iteroparous life history strategy, a trait that sets steelhead apart from the Pacific salmon species. Reconditioning has the additional advantage of allowing fisheries managers to select which fish (e.g., hatchery or wild) are reconditioned, providing the means to intentionally supplement with the most appropriate stocks or components of the run.

   During the first year of development for the endemic broodstock programs in 2000, WDFW initiated reconditioning of kelts. Kelts were placed in a 20' circular rearing tank at LFH following spawning. However, our attempts at reconditioning failed, as the fish failed to eat any of the foods offered. WDFW was aware at that time that other organizations (Columbia

River Inter-Tribal Fish Commission, Oregon Dept of Fish and Wildlife) were spending much more effort and research in developing techniques for reconditioning kelts. Given our poor success, reconditioning efforts were discontinued until others published successful results. Since then, considerable knowledge has been gained in the process of reconditioning kelts (Columbia River Inter-Tribal Fish Commission 2002), which can now be used to better our success.

Recommendation: For upcoming brood years, we will potentially live spawn all endemic broodstock from the Tucannon and Touchet rivers. Live spawned fish (PIT tagged for unique identification) will be kept in 20' circular tanks at LFH for reconditioning. Kelts will be reconditioned for one year, with all or a portion of the survivors spawned again in the hatchery. Survival of the reconditioned kelts gametes will be compared to newly trapped fish for the broodstock program, and previous success. Results will be evaluated in context of the funds required for reconditioning. Funds to complete this project have not been identified or secured at this point.

8. Ecological interactions between hatchery steelhead and natural chinook are relatively unknown. Data on disease transference, competition (residuals vs natural production), and predation in the streams are relatively scarce. The bulk of the hatchery origin steelhead resides in the stream for only a very short time, so documentation of impacts are difficult to assess. Effects from residuals, (while residing longer in the stream), are also difficult to assess given their relative low numbers to natural production.

   Recommendation: Over the next 1-2 years, coordinate with others in the WDFW Science Division to design some controlled studies to examine some of these factors in the streams. In the short term, design a study to examine predation on fall chinook from hatchery steelhead smolts on the Tucannon River.

9. Natural steelhead smolt production, and smolt-to-adult survival from SE Washington streams (with the exception of the Tucannon River – see this report) are unknown. Beginning in 2004, a BPA funded assessment project will begin on Asotin Creek. Smolt production and smolt-to-adult survivals from natural steelhead produced in Asotin Creek will follow in a few years. The unique aspect of the Asotin Creek Project will be the ability to relate natural smolt production to the number of spawners through the utilization of an adult trap. This is not the case with the Tucannon River, so our ability to assess watershed health based on smolt production/spawer is not possible.

   In the Touchet River, a proposal has been submitted through Fisheries Restoration and Irrigation Mitigation Program (FRIMA) to modify the existing water intake system to the Dayton AP. This modification includes plans to provide improved fish passage. Management and research entities are also going to include an adult trap as part of the modification to assess natural fish (steelhead, bull trout, whitefish and spring chinook) production from the upper Touchet River Basin.

   Recommendation: Provide recommendations to design engineers on the adult trap portion of the project. Continue to investigate ways for limiting the number of adult steelhead that can bypass the current adult trap, or at least use methods that can provide an accurate count (resistivity counter). If possible, incorporate into the design to allow for smolt sampling. If that option is not possible, secure funding to purchase a rotary screw trap for the Touchet River to estimate natural smolt production from the basin.

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Appendix A

Rainbow Trout Plants from Lyons Ferry Complex: 2002 and 2003

Appendix A, Table 1. Catachable size rainbow trout plants from Lyons Ferry Complex, 2002. Represents both LSRCP and State funded programs.

County	Location	Number of Plants	LSRCP lbs of fish planted	LSRCP # of fish planted	State lbs of fish planted	State # of fish planted
Adams	Adams Lake	2	1,918	5,262		
	Total	*2*	*1,918*	*5,262*		
Asotin	Golf course Pond	6	6,089	17,910	258	150
	Headgate Pond	1	533	2,046		
	Silcott Pond	2	1,333	4,012		
	West Evans Pond	8	5,928	17,749	344	200
	Total	*17*	*13,903*	*41,717*	*602*	*350*
Columbia	Beaver Lake	2	356	1,007		
	Big Four Lake	2	715	2,002	546	300
	Blue Lake	12	5,717	16,824	513	250
	Curl Lake	5	3,015	10,081	680	300
	Dam Pond	2	684	2,004		
	Dayton Jv. Pond	6	983	3,016	214	100
	Deer Lake	2	577	2,088		
	Donnie Lake	1	182	400		
	Orchard Pond	2	716	2,003		
	Rainbow Lake	9	4,060	13,566	711	300
	Spring Lake	6	1,699	5,077	685	284
	Watson Lake	8	2,713	8,950	630	260
	Total	*57*	*21,417*	*67,018*	*3,979*	*1,794*
Franklin	Dalton Lake	5	6,009	18,114	516	300
	Marmes Pond	2	684	2,004		
	Total	*7*	*6,693*	*20,118*	*516*	*300*
Garfield	Baker's Pond	2	458	1,208		
	Casey Pond	1	136	503		
	Total	*3*	*594*	*1,711*		
Walla Walla	Bennington Lake	8	7,004	19,958	328	200
	Fishhook Park Pond	3	1,505	4,999	312	100
	Jefferson Park Pond	3	688	2,002	172	100
	Lions Park Pond	5	1,020	3,354	227	100
	Quarry Pond	3	5,765	18,001	516	300
	Union Flat Creek	1	580	1,508		
	Total	*23*	*16,562*	*49,822*	*1,555*	*800*
Whitman	Garfield Pond	1	910	2,002		
	Gilcrest Pond	1	100	2,000		
	Pampa Pond	3	1,587	5,001	624	200
	Riparia Pond	1	751	1,953		
	Total	*6*	*4,248*	*10,956*	*624*	*200*
Total Rainbows		**118**	**65,335**	**196,604**	**3,444**	**7,276**

Appendix A, Table 2. Rainbow trout plants from Lyons Ferry Complex, 2003. Represents both LSRCP and State funded programs.

County	Location	Number of Plants	LSRCP lbs of fish planted	LSRCP # of fish planted	State lbs of fish planted	State # of fish planted
Adams	Sprague Lake	1	782	2,502		
	Total		*782*	*2,502*		
Asotin	Golf course Pond	10	6,029	18,064	690	400
	Headgate Pond	1	435	2,001		
	Silcott Pond	2	1,235	4,002		
	West Evans Pond	9	6,136	19,195	702	400
	Total	*22*	*13,835*	*43,262*	*1,392*	*800*
Columbia	Beaver Lake	3	417	1,511		
	Big Four Lake	2	645	2,000	447	300
	Blue Lake	12	5,387	17,459	556	301
	Curl Lake	8	2,612	11,596	355	172
	Dam Pond	2	679	2,003		
	Dayton Jv. Pond	6	982	3,189	150	75
	Deer Lake	3	832	3,031		
	Donnie Lake	1	99	436		
	Orchard Pond	2	668	2,004		
	Rainbow Lake	10	4,583	15,977	585	300
	Spring Lake	7	2,290	8,022	556	300
	Watson Lake	8	3,918	13,120	585	300
	Total	*64*	*23,112*	*80,348*	*3,234*	*1,748*
Franklin	Dalton Lake	6	6,678	20,068	612	300
	Marmes Pond	3	690	2,004		
	Total	*9*	*7,368*	*22,072*	*612*	*300*
Garfield	Baker's Pond	2	493	1,503		
	Casey Pond	1	115	506		
	Total	*3*	*608*	*2,009*		
Walla Walla	Bennington Lake	6	6,714	19,562		
	Fishhook Pk. Pond	3	1,580	5,045	118	60
	Jerrerson Park Pond	2	455	2,002	213	100
	Lions Park Pond	5	1,340	4,026	213	100
	Quarry Pond	6	6,350	19,992	612	300
	Total	*22*	*16,439*	*50,627*	*1,156*	*560*
Whitman	Garfield Pond	1	465	2,000		
	Gilcrest Pond	1	435	2,001		
	Pampa Pond	3	1,423	5,003	408	200
	Riparia Pond	1	693	2,010		
	Union Flat Creek	1	455	1,502		
	Total	*7*	*3,471*	*12,516*	*408*	*200*
Total Rainbows		**128**	**65,615**	**213,336**	**6,802**	**3,608**

Appendix B

Summer Steelhead Releases from Lyons Ferry Complex, 2002 and 2003

Appendix B, Table 1. Summer steelhead smolt releases from Lyons Ferry Complex, 2002 and 2003, and fingerling releases in 2001. Note: All WDFW CWT codes begin with "63".

Year Location (Stock)	Rkm	Date	Total release	Marked release	CWT code	Marks/ Brand/ VIE	Lbs	Size #/lb	CWT %Loss	Brand/VI %Loss
2001										
Tucannon River (upper)	67.7 70.4 74.1 75.2	10/5	24,948	24,640	Agency	CWT ONLY RA VIE	876	28.5	1.2362	7.5472
2002										
Grande Ronde @ Cottonwood AP (Wallowa)	45.9	4/01	182,722	40,520	11/78	ADLV LA-IT-1	34,805	5.25	1.7391	0.2484
Snake River @LFH (LFH)	92.8	4/16	62,612	19,236	12/70	ADLV RA-IV-3	15,176	4.13	4.8230	0.1221
Tucannon River @ Marengo or Enrich Br (LFH)	39.7, 31.3	4/16-4/17	135,203	20,468	12/78	ADLV LA-IV-1	31,469	4.30	3.1847	0.0000
Touchet River @ Dayton AP (LFH)	86.4	4/01	125,391	20,610	12/79	ADLV	30,583	4.10	1.2500	
Walla Walla River (LFH)	56.0	4/16	99,859	18,938	12/69	ADLV	25,002	3.99	6.2882	
Tucannon River @ Curl Lake Intake (Tucannon)	64.0	4/02	58,616	56,770	09/70	CWT ONLY RR VIE	10,658	5.49	3.1487	4.6846
Touchet River @ NF Touchet Bridge (Touchet)	91.5	5/02	45,501	36,565	11/77	CWT ONLY LR VIE	7,153	6.36	19.639	9.3240
2003										
Grande Ronde @ Cottonwood AP (Wallowa)	45.9	4/15	236,627	41,255	15/23	ADLV LA-IC-1	44,641	5.30	2.1561	7.3606
Snake River @LFH (LFH)	92.8	4/15	60,001	21,384	15/16	ADLV LA-2-2	12,850	4.67	1.6061	9.7210
Tucannon River @ Enrich Br (LFH)	31.3	4/15-4/18	115,496	21,004	15/79	ADLV RA-2-2	24,887	4.64	1.2810	7.8565
Touchet River @ Dayton AP (LFH)	86.4	4/15	100,445	20,817	15/80	ADLV	21,371	4.70	0.9136	
Walla Walla River (LFH)	56.0	4/15-4/17	102,975	21,165	15/81	ADLV	22,110	4.66	7.5548	
Tucannon River @ Curl Lake Intake (Tucannon)	64.0	4/15	43,688	38,154	14/82	CWT ONLY RG VIE	8,243	5.30	12.6678	6.7114
Touchet River @ NF Touchet Bridge (Touchet)	91.5	4/21	31,440	27,716	15/30	CWT ONLY LG VIE	6,416	4.90	11.8441	13.1184

Appendix C

Natural and Hatchery Origin Adult Summer Steelhead Trapping Data: Tucannon FH Trap, Lower Tucannon River Trap, and the Dayton Trap, 2002 and 2003 Run Years

Appendix C, Table 1. Natural origin summer steelhead trapped at the TFH trap during the 2001 run year.

Date	Length (cm)	Sex	Date	Length (cm)	Sex	Date	Length (cm)	Sex	Date	Length (cm)	Sex
2/25	66	F	4/09	63	F	4/13	61	M	4/18	61	M
2/25	64	M	4/09	63	F	4/13	61	M	4/18	66	M
2/25	64	M	4/09	69	F	4/13	64	M	4/18	66	M
3/15	53	F	4/09	69	F	4/13	64	M	4/18	66	M
3/15	56	F	4/09	71	F	4/13	64	M	4/18	66	M
3/15	58	F	4/09	74	F	4/13	66	M	4/18	66	M
3/15	61	F	4/09	77	F	4/13	69	M	4/18	69	M
3/15	61	F	4/09	82	F	4/13	69	M	4/18	71	M
3/15	61	F	4/09	82	F	4/13	71	M	4/19	58	F
3/15	66	F	4/09	61	M	4/14	61	F	4/19	64	F
3/15	74	F	4/09	63	M	4/14	61	F	4/19	64	F
3/15	61	M	4/09	66	M	4/14	64	F	4/19	66	F
3/15	64	M	4/09	69	M	4/14	66	F	4/19	66	F
3/15	66	M	4/09	69	M	4/14	58	M	4/19	71	F
3/15	71	M	4/09	69	M	4/14	64	M	4/19	74	F
3/15	76	M	4/09	71	M	4/15	66	M	4/19	76	F
3/15	76	M	4/09	74	M	4/15	58	F	4/19	79	F
3/15	79	M	4/09	74	M	4/15	58	F	4/19	61	M
3/15	84	M	4/09	84	M	4/15	61	F	4/19	69	M
3/16	61	M	4/10	66	F	4/15	61	F	4/19	76	M
3/16	62	M	4/10	69	F	4/15	71	F	4/21	56	F
3/16	62	M	4/10	71	F	4/18	69	M	4/21	61	F
3/25	66	F	4/10	71	F	4/18	61	F	4/21	71	F
3/25	69	F	4/10	74	F	4/18	61	F	4/21	76	F
3/25	56	M	4/10	79	F	4/18	61	F	4/21	64	M
3/25	56	M	4/10	61	M	4/18	61	F	4/22	64	F
3/25	61	M	4/10	64	M	4/18	61	F	4/22	64	M
3/25	64	M	4/10	66	M	4/18	61	F	4/22	74	M
3/25	64	M	4/13	56	F	4/18	61	F	4/28	58	F
3/25	66	M	4/13	58	F	4/18	64	F	4/28	61	F
3/25	71	M	4/13	58	F	4/18	64	F	4/28	71	F
3/25	75	M	4/13	58	F	4/18	64	F	4/28	66	M
3/30	60	F	4/13	58	F	4/18	64	F	4/30	61	F
3/30	61	F	4/13	58	F	4/18	66	F	5/04	56	F
3/30	74	F	4/13	61	F	4/18	66	F	5/08	64	F
3/30	52	M	4/13	61	F	4/18	71	F	5/08	66	M
3/30	60	M	4/13	61	F	4/18	71	F	5/11	66	F
3/30	60	M	4/13	64	F	4/18	71	F	5/22	64	F
3/30	66	M	4/13	64	F	4/18	71	F	5/29	58	F
3/30	68	M	4/13	64	F	4/18	74	F			
3/30	79	M	4/13	64	F	4/18	74	F			
3/31	59	F	4/13	64	F	4/18	76	F			
4/05	65	F	4/13	71	F	4/18	76	F			
4/05	65	F	4/13	74	F	4/18	61	M			
4/05	64	M	4/13	74	F	4/18	61	M			
4/05	64	M	4/13	61	M	4/18	61	M			

Appendix C, Table 2. Natural origin summer steelhead trapped at the TFH trap during the 2002 run year.

Date	Length (cm)	Sex	Date	Length (cm)	Sex	Date	Length (cm)	Sex	Date	Length (cm)	Sex
1/30	73.5	F	3/17	70	F	3/24	68	F	4/05	70	F
2/11	66	F	3/17	57	M	3/24	70	F	4/05	71	F
2/16	74	F	3/17	68	M	3/24	50	F	4/08	81	M
2/16	54	M	3/18	64	M	3/25	76	F	4/11	58	M
2/18	62	M	3/18	65	M	3/25	60	M	4/11	60	M
2/19	68	M	3/18	75	M	3/26	64	M	4/21	---	F
3/10	74	M	3/18	74	F	3/26	71	F	4/21	---	F
3/10	60	M	3/18	67	F	3/26	60	F	4/21	---	F
3/10	53	M	3/18	59	M	3/27	68	F	4/21	---	F
3/11	78	M	3/18	74	F	4/01	73	F	4/21	---	M
3/11	55	M	3/18	73	F	4/01	69	F	4/23	---	M
3/14	71	F	3/24	72	F	4/01	70	M	4/23	---	M
3/14	57	M	3/24	67	M	4/01	66	M	4/23	---	M
3/14	60	F	3/24	73	F	4/01	66	F			
3/14	83	M	3/24	75	M	4/01	65	M			
3/14	57	M	3/24	69	F	4/05	79	F			
3/14	72	F	3/24	68	F	4/05	73	F			

Appendix C, Table 3. Hatchery origin summer steelhead trapped at the TFH trap during the 2001 and 2002 run years.

2001 Run Year						**2002 Run Year**					
Date	Length (cm)	Sex	Date	Length (cm)	Sex	Date	Length (cm)	Sex	Date	Length (cm)	Sex
7/04	- - -	F	4/09	74	M	3/11	56	F			
3/15	64	M	4/10	64	M	3/18	63	M			
3/30	60	M	4/13	64	M	3/18	60	M			
3/30	62	M	4/13	66	M	3/24	57	M			
3/30	62	M	4/14	58	M	3/24	58	F			
3/30	63	M	4/14	61	M	3/26	73	M			
4/05	60	M	4/14	64	M	3/27	62	M			
4/05	61	M	4/18	61	F	3/27	59	M			
4/05	64	M	4/18	64	M	3/28	57	M			
4/09	61	M	4/18	64	M	4/01	57	F			
4/09	61	M	4/19	64	F	4/05	70	F			
4/09	63	M	4/28	61	F	4/17	57	F			
4/09	66	M	4/30	61	M						
4/09	66	M	5/28	- - -	F						
4/09	71	M									

Appendix C, Table 4. Natural origin summer steelhead trapped at the Lower Tucannon Trap during the 2001 and 2002 run years.

2001 Run Year								2002 Run Year							
Date	Ln (cm)	Sex	DNA	Date	Ln (cm)	Sex	DNA	Date	Ln (cm)	Sex	DNA	Date	Ln (cm)	Sex	DNA
10/10	74.5	F	---	3/10	58.5	M	IE-51	9/16	69	F	GQ-1	1/29	---	M	---
10/12	77.0	F	IE-1	3/11	60.0	F	IE-47	9/17	70	M	GQ-2	1/29	70	F	GQ-19
10/12	64.5	M	IE-2	3/11	60.0	M	IE-52	9/22	57	F	GQ-3	1/29	70	F	GQ-20
10/14	66.5	M	---	3/11	63.0	F	IE-46	10/04	74	M	---	1/29	---	M	---
10/14	57.0	M	---	3/11	74.5	F	IE-45	10/08	---	M	GQ-4	1/30	---	F	---
10/14	74.0	F	IE-3	3/11	61.5	F	IE-44	10/10	68	F	GQ-5	1/31	---	F	---
10/15	61.0	M	IE-4	3/11	61.5	M	IE-53	10/10	71.5	F	GQ-6	1/31	---	F	---
10/15	64.0	F	IE-5	3/11	62.0	M	IE-54	10/16	75	M	GQ-7	1/31	---	F	---
10/16	60.0	M	IE-6	3/11	71.0	M	---	10/16	71.5	F	GQ-8	1/31	---	F	---
10/17	70.5	F	IE-7	3/12	64.0	M	IE-55	10/19	66	M	GQ-9	1/31	---	F	---
10/17	67.5	M	IE-8	3/12	72.0	F	IE-42	10/20	75	M	GQ-10	1/31	---	F	---
10/18	69.5	F	IE-9	3/12	56.5	F	IE-43	10/20	71	F	GQ-11	1/31	65	F	GQ-21
10/20	66.0	M	IE-10	3/12	59.0	M	IE-56	10/20	73	F	GQ-12	2/01	60	F	GQ-23
10/22	65.0	M	IE-11	3/12	62.5	M	IE-57	10/23	68.5	F	GQ-13	2/01	70	F	GQ-22
10/23	57.0	F	---	3/12	61.0	F	IE-25	11/12	---	F	---	2/17	70	F	GQ-24
10/25	74.0	F	IE-12	3/12	64.5	M	IE-58	11/13	---	M	---	2/17	73	F	GQ-25
10/26	71.0	M	IE-13	3/12	64.0	M	IE-59	11/13	---	M	---	2/17	60	F	GQ-26
10/29	60.0	M	IE-14	3/12	56.5	M	IE-36	11/14	---	M	---	2/20	---	M	---
10/30	68.0	F	IE-15	3/12	64.5	F	IE-26	11/19	---	M	---	2/21	---	F	---
11/02	60.0	F	IE-16	3/12	58.0	M	IE-27	11/20	---	F	---	2/22	---	M	---
11/04	64.0	F	IE-17	3/12	60.0	M	IE-28	11/20	---	F	---	2/26	---	M	---
11/05	73.0	M	IE-18	3/12	59.5	M	IE-29	11/21	---	F	---	2/28	75.5	F	GQ-32
11/15	80.0	M	IE-19	3/12	68.0	M	IE-30	11/23	---	M	---	3/02	75.5	F	GQ-33
11/17	66.0	M	IE-20	3/13	---	M	---	12/09	---	F	---	3/02	72	F	GQ-34
11/17	73.0	F	IE-21	3/13	---	M	---	12/13	---	F	---	3/02	71	F	GQ-35
11/17	69.0	F	IE-22	3/13	---	F	---	12/13	---	M	---	3/02	80.5	F	GQ-36
11/17	62.0	M	IE-23	3/13	---	M	---	12/14	68	F	---	3/02	73	F	GQ-37
11/21	80.0	M	IE-24	3/13	---	F	---	12/14	60	M	---	3/03	---	M	---
2/12	69.0	F	IE-37	3/13	---	F	---	12/14	60	F	---	3/03	---	M	---
2/17	55.0	M	IE-35	3/13	---	F	---	12/17	---	M	---	3/04	76.5	F	GQ-38
2/22	57.5	M	IE-48	3/13	---	M	---	12/17	62.5	F	---	3/04	---	M	---
2/23	68.0	F	IE-38	3/13	---	F	---	12/17	62	M	GQ-14	3/05	61.5	M	GQ-41
2/23	64.5	F	IE-39	3/13	---	M	---	12/17	---	M	---	3/05	70.5	F	GQ-42
2/23	70.0	F	IE-33	3/13	---	M	---	1/03	---	F	---	3/05	---	M	---
2/23	57.5	M	IE-50	3/13	---	F	---	1/04	74.5	F	GQ-15	3/05	77.5	F	GQ-43
2/24	68.0	F	IE-34	3/13	---	M	---	1/05	66.5	F	GQ-16	3/05	---	M	---
2/25	70.0	M	IE-49	3/14	66.0	F	IE-31	1/14	74	F	GQ-17	3/05	57	F	GQ-44
				3/14	60.0	F	IE-32	1/28	74.5	F	GQ-18	3/06	56.5	F	GQ-45
												3/06	58	F	GQ-46
												3/06	78	F	GQ-47
												3/06	---	M	---
												3/06	68.5	F	GQ-48
												3/06	68	F	GQ-49
												3/06	---	M	---

Appendix C, Table 5. Hatchery origin summer steelhead trapped at the Lower Tucannon Trap during the 2001 run year.

Date	Length (cm)	Sex	Date	Length (cm)	Sex	Date	Length (cm)	Sex	Date	Length (cm)	Sex
10/03	60.5	F	10/20	59.0	F	11/21	67.5	M	3/11	65.0	F
10/03	66.5	F	10/20	62.5	M	2/07	58.5	F	3/11	55.0	M
10/09	58.5	F	10/20	60.0	F	2/17	61.0	F	3/11	66.0	M
10/11	60.0	M	10/21	63.0	M	2/18	65.0	M	3/11	57.5	M
10/12	57.0	M	10/26	63.5	M	2/18	70.0	M	3/12	62.0	M
10/12	62.0	M	10/27	74.5	M	2/18	72.0	M	3/12	67.5	F
10/14	58.0	F	10/27	58.5	F	2/20	61.0	M	3/12	60.0	M
10/14	61.5	F	10/28	69.0	F	2/21	65.0	M	3/12	59.0	M
10/14	65.5	M	10/29	65.5	M	2/21	61.0	M	3/12	63.0	M
10/14	73.5	M	10/30	60.0	M	2/21	54.5	M	3/12	63.5	M
10/14	71.5	M	10/30	61.5	M	2/22	74.5	F	3/12	60.5	F
10/14	61.0	M	10/30	61.0	F	2/22	63.0	M	3/12	60.0	M
10/14	61.0	F	10/30	61.5	F	2/23	60.0	M	3/12	61.5	M
10/14	59.0	F	10/30	56.0	F	2/23	68.5	F	3/12	72.0	F
10/14	67.0	F	11/02	60.5	F	2/23	63.0	M	3/12	59.5	M
10/15	70.0	F	11/02	63.0	M	2/24	60.0	F	3/12	58.0	F
10/16	66.0	M	11/02	74.5	F	2/24	58.0	M	3/12	58.0	M
10/16	67.5	F	11/02	57.0	F	2/24	61.5	M	3/12	57.0	M
10/16	61.0	F	11/04	65.0	F	2/24	57.5	F	3/12	69.0	F
10/17	72.5	F	11/15	---	M	3/05	60.0	M	3/12	60.0	M
10/17	77.0	M	11/15	70.0	F	3/05	66.0	F	3/12	57.5	F
10/19	55.5	F	11/15	54.5	F	3/06	63.0	M	3/13	---	F
10/19	61.5	F	11/16	---	---	3/09	61.0	M	3/13	---	F
10/20	61.5	M	11/16	---	---	3/10	57.0	M	3/13	---	F
10/20	55.0	F	11/16	---	---	3/10	---	F	3/13	---	M
10/20	59.0	F	11/16	---	---	3/10	61.0	M	3/13	---	M
10/20	61.5	M	11/17	559.0	M	3/10	65.0	M	3/13	---	F
10/20	54.0	F	11/17	61.0	M	3/11	57.0	F	3/13	---	F
10/20	59.0	M	11/17	57.0	F	3/11	61.0	M	3/13	---	M
10/20	62.0	M	11/17	60.0	F	3/11	54.0	M	3/14	60.5	M
10/20	57.5	F	11/17	58.0	F	3/11	58.0	F	3/14	69.0	F
10/20	61.0	M	11/17	62.0	F	3/11	61.5	F	3/14	58.0	M
10/20	57.5	F	11/21	54.5	F	3/11	68.0	F			
10/20	58.0	F	11/21	58.5	F	3/11	54.0	M			

Appendix C, Table 6. Hatchery origin summer steelhead trapped at the Lower Tucannon Trap during the 2002 run year.

Date	Length (cm)	Sex	Date	Length (cm)	Sex	Date	Length (cm)	Sex	Date	Length (cm)	Sex
9/13	58.5	F	10/08	- - -	M	12/14	59.5	F	2/01	- - -	F
6/13	60.0	M	10/08	- - -	M	12/14	57.0	F	2/06	56.5	F
9/14	- - -	F	10/08	- - -	M	12/14	64.0	M	2/07	56.0	F
9/14	- - -	F	10/09	62.5	F	12/14	62.0	F	2/17	51.0	F
9/16	63.0	F	10/09	63.0	F	12/14	61.5	M	2/17	55.0	F
9/16	57.0	M	10/09	74.5	F	12/14	63.0	M	2/17	69.0	M
9/16	61.0	F	10/09	56.0	F	12/14	65.0	F	2/17	66.0	M
9/16	61.0	M	10/11	62.0	F	12/14	60.0	F	2/18	61.0	M
9/17	58.5	F	10/11	63.0	F	12/14	63.0	M	2/18	72.0	F
9/17	53.0	F	10/11	74.5	F	12/14	63.0	F	2/19	55.0	M
9/17	60.0	M	10/15	55.0	M	12/14	58.0	F	2/20	59.0	M
9/18	61.5	F	10/17	70.0	F	12/15	62.5	F	2/21	74.0	F
9/18	55.0	F	10/17	58.5	M	12/15	55.0	F	2/21	61.5	F
9/18	57.0	F	10/18	57.0	F	12/15	57.0	M	2/21	67.5	F
9/19	55.0	F	10/19	63.0	F	12/15	59.0	M	2/22	71.5	F
9/19	52.0	F	10/19	62.0	M	12/15	57.0	F	2/22	60.0	F
9/19	61.5	F	10/19	60.0	F	12/15	72.0	F	2/23	62.0	M
9/19	65.0	M	10/19	55.0	F	12/15	61.5	F	3/02	61.5	M
9/20	64.5	F	10/21	69.5	F	12/15	74.5	M	3/02	73.0	M
9/20	55.0	F	10/21	59.0	F	12/15	62.0	M	3/02	57.0	M
9/21	60.0	F	10/21	62.5	M	12/15	61.0	M	3/02	59.0	F
9/21	58.0	M	10/21	56.0	F	12/15	61.0	F	3/03	58.0	M
9/22	57.0	M	10/21	68.5	F	12/17	63.5	F	3/03	61.0	M
9/22	61.0	F	10/22	62.0	F	12/17	58.0	F	3/03	57.5	M
9/23	54.0	M	10/22	65.0	M	12/17	60.5	M	3/03	59.5	F
9/23	58.0	F	10/31	60.0	M	12/17	63.0	F	3/03	75.5	F
9/23	62.0	M	11/08	58.0	M	12/17	61.0	M	3/04	52.0	F
9/25	78.0	F	11/08	58.0	F	12/23	58	F	3/04	61.0	F
9/25	56.0	F	11/08	54.5	M	12/29	63.0	M	3/04	61.0	F
9/26	60.0	F	11/08	57.0	M	1/03	63.5	F	3/04	61.0	M
9/26	61.0	F	11/08	62.5	M	1/03	61.0	F	3/05	73.5	M
9/26	74.0	F	11/08	63.5	M	1/03	57.5	M	3/05	73.0	M
9/26	61.0	M	11/08	56.0	F	1/14	63.0	M	3/05	56.0	M
9/26	79.5	M	11/12	61.0	F	1/14	66.0	M	3/05	80.0	F
9/27	52.0	M	11/12	60.0	F	1/28	56.0	F	3/05	85.0	M
9/29	55.0	F	11/13	56.0	F	1/29	67.0	M	3/05	63.0	F
9/29	64.5	M	11/14	52.5	M	1/30	55.0	M	3/05	60.0	M
9/30	55.5	M	11/14	58.5	F	1/30	56.5	F	3/05	61.0	M
9/30	60.0	F	11/14	55.0	F	1/30	61.0	M	3/05	61.5	F
10/01	58.0	F	11/18	69.5	F	1/31	57.0	F	3/05	59.5	F
10/01	72.0	F	11/20	59.0	F	1/31	59.0	F	3/05	62.0	M
10/02	62.0	F	11/20	60.0	F	1/31	59.0	M	3/05	57.0	M
10/02	- - -	M	11/20	72.0	F	1/31	61.5	F	3/05	74.0	M
10/04	61.0	F	11/20	57.0	F	1/31	61.0	M	3/06	69.0	F
10/04	64.0	M	11/20	58.5	F	1/31	---	F	3/06	57.5	F
10/04	74.0	M	11/21	70.0	F	1/31	56.5	F	3/06	82.0	M
10/04	60.0	M	11/21	60.0	M	1/31	68.0	F	3/06	64.5	M
10/04	62.0	M	11/22	72.5	F	1/31	63.0	F			
10/04	64.5	M	12/06	57.0	M	1/31	58.0	M			
10/08		F	12/06	65.0	M	1/31	61.0	M			
10/08		M	12/13	65.0	M	1/31	56.5	F			
10/08		M	12/13	65.0	M	2/01	---	F			
10/08		F	12/13	61.0	M	2/01	---	F			
10/08		F	12/13	51.5	F	2/01	---	F			
10/08		M	12/13	55.0	M	2/01	---	F			
10/08		M	12/13	64.0	M	2/01	---	F			

Appendix C, Table 7. Natural origin summer steelhead trapped at the Dayton Trap during the 2001 run year, and DNA samples collected.

Date	Ln (cm)	Sex	DNA	Date	Ln (cm)	Sex	DNA	Date	Ln (cm)	Sex	DNA	Date	Ln (cm)	Sex	DNA
2/20	66.0	M	IF01	3/07	56.0	M		3/21	61.0	F	IF37	4/03	58.0	F	
2/20	65.5	M	IF02	3/07	73.5	M		3/24	62.0	F		4/03	66.5	F	
2/20	64.0	F	IF03	3/09	71.0	M		3/24	64.5	F		4/03	66.0	F	
2/20	56.0	F	IF29	3/10	73.0	F		3/24	65.0	M		4/03	67.0	F	IF77
2/20	61.5	M	IF93	3/10	61.5	F		3/25	67.5	M	IF34	4/03	64.0	M	IF90
2/21	64.0	F	IF04	3/10	61.0	M		3/25	62.0	F	IF35	4/04	63.5	F	IF58
2/21	63.0	F	IF05	3/10	62.0	M		3/25	58.0	M	IF36	4/04	64.0	F	IF59
2/21	71.0	F	IF06	3/10	57.0	M		3/25	58.0	F	IF38	4/05	56.5	F	
2/21	65.5	M	IF07	3/10	62.0	M		3/25	58.5	F	IF39	4/05	60.5	M	
2/21	61.0	M	IF08	3/10	62.5	M		3/25	58.0	F	IF40	4/05	60.0	M	
2/21	64.0	M	IF09	3/11	75.5	F	IF24	3/25	63.0	F	IF43	4/05	65.0	M	
2/21	62.0	F	IF10	3/11	57.0	F	IF25	3/25	61.0	M	IF57	4/05	66.0	M	IF53
2/22	63.0	F		3/11	58.0	F	IF26	3/25	60.0	F	IF71	4/05	64.0	M	IF60
2/22	71.0	F		3/11	64.0	F	IF27	3/26	- - -	M		4/05	57.0	F	IF61
2/22	63.0	M		3/11	60.0	F	IF32	3/26	71.0	F	IF42	4/05	59.0	M	IF62
2/22	70.5	M		3/11	67.5	F	IF33	3/27	59.0	F		4/05	73.5	F	IF63
2/27	62.0	F	IF11	3/11	67.5	F	IF41	3/27	60.0	F		4/05	69.0	F	IF64
2/28	76.5	F	IF30	3/11	66.5	M	IF94	3/27	58.0	F		4/05	63.0	F	IF65
2/28	69.0	M	IF83	3/11	61.5	M	IF95	3/27	62.0	F	IF44	4/05	69.0	F	IF66
3/01	63.0	M	IF12	3/12	59.0	F	IF28	3/27	72.5	F	IF45	4/05	52.0	M	IF67
3/01	68.0	M	IF13	3/15	57.5	F		3/27	62.0	F	IF46	4/05	61.0	F	IF68
3/01	65.0	M	IF85	3/15	59.0	F		3/27	60.0	F	IF47	4/07	53.0	F	
3/03	70.0	M		3/15	60.0	F		3/27	63.0	F	IF48	4/07	57.0	F	
3/05	72.5	F	IF14	3/15	60.0	F		3/27	60.0	F	IF49	4/07	60.0	F	
3/05	58.5	M	IF15	3/15	68.0	F		3/28	63.0	M	IF50	4/07	73.5	F	
3/05	66.5	F	IF16	3/15	61.0	F		4/01	55.0	F		4/07	65.5	M	
3/05	68.0	F	IF17	3/15	63.0	F		4/01	56.0	F		4/08	65.5	M	IF69
3/05	67.5	F	IF18	3/15	77.0	F		4/01	56.0	F		4/11	56.0	F	IF72
3/05	62.5	F	IF19	3/15	65.0	F		4/01	58.0	F		4/12	76.5	F	IF73
3/05	58.0	F	IF20	3/15	58.0	M		4/01	58.0	F		4/12	59.0	M	IF74
3/05	58.0	F	IF31	3/15	64.0	M		4/01	56.0	F		4/2	55.5	F	IF75
3/05	72.5	M	IF82	3/15	69.0	M		4/01	59.0	F		4/12	63.0	M	IF76
3/05	63.0	M	IF84	3/15	64.0	M	IF86	4/01	60.0	F		4/23	55.0	F	
3/05	67.5	M	IF91	3/15	63.0	M	IF88	4/01	63.0	F		4/23	61.0	F	
3/05	63.5	M	IF92	3/16	60.0	F		4/01	63.0	F		4/23	74.5	F	IF79
3/06	66.0	F		3/17	53.0	F		4/01	69.0	F		4/23	63.0	M	IF80
3/06	62.0	M		3/18	72.0	F	IF54	4/01	71.0	F		4/24	72.0	F	
3/06	61.0	M		3/18	64.0	M	IF81	4/01	56.0	M		4/24	69.5	F	
3/06	62.0	M		3/20	64.0	F	IF55	4/01	62.0	M		4/24	68.0	M	
3/06	64.5	M		3/20	69.5	F	IF56	4/01	61.0	M		4/25	61.0	F	
3/06	61.0	F	IF21	3/20	70.0	F	IF70	4/01	69.0	F	IF87	5/03	61.0	F	
3/06	62.0	M	IF22	3/20	66.0	M	IF89	4/02	79.5	F	IF51	5/09	59.0	M	
3/06	72.0	M	IF23	3/20	63.0	M	IF96	4/02	57.0	F	IF52	5/13	58.0	M	
												5/25	60.0	M	

Appendix C, Table 8. Natural origin summer steelhead trapped at the Dayton Trap during the 2002 run year, and DNA samples collected.

Date	Ln (cm)	Sex	DNA	Date	Ln (cm)	Sex	DNA	Date	Ln (cm)	Sex	DNA	Date	Ln (cm)	Sex	DNA
2/06	77	F	GP11	3/05	83.5	M	GP73	3/12	59	M	GP50	4/03	72.5	F	---
2/07	71.5	F	GP31	3/05	56	M	---	3/12	59.5	F	---	4/08	68	F	GP78
2/07	64.5	F	GP33	3/07	67	F	GP46	3/12	69.5	F	---	4/08	74.5	F	---
2/07	59	M	GP76	3/10	77	F	GP12	3/13	78	F	GP67	4/09	73	F	GP79
2/11	64	F	GP35	3/10	71	F	GP13	3/13	---	M	---	4/09	73	F	---
2/16	62	M	GP1	3/10	71	F	GP47	3/19	---	M	---	4/09	78	M	GP80
2/16	72	F	GP2	3/10	68.5	F	GP48	3/19	---	F	---	4/09	75.5	F	GP81
2/16	86	M	GP3	3/10	70	F	GP14	3/19	---	F	---	4/09	60	F	GP82
2/16	58	M	GP4	3/10	72	F	GP15	3/19	---	F	---	4/10	60	M	---
2/17	72	F	GP5	3/10	71	F	GP16	3/19	78	F	GP40	4/10	70	F	---
2/18	65.5	F	GP6	3/10	64.5	F	GP17	3/20	68	F	GP41	4/10	67.5	F	---
2/19	67	F	GP7	3/10	68	F	GP18	3/20	65.5	F	GP42	4/10	57	F	---
2/19	65	F	GP8	3/10	69.5	F	GP19	3/20	75.5	F	GP43	4/11	65.5	F	---
2/19	76.5	F	GP9	3/10	71	F	GP20	3/21	61	F	GP44	4/11	55.5	M	---
2/19	62.5	M	---	3/11	70	F	GP21	3/26	---	F	---	4/11	60	F	---
2/21	58	M	GP71	3/11	69.5	F	GP22	3/26	---	M	---	4/11	69.5	F	---
2/21	75	F	GP36	3/11	61.5	F	GP23	3/27	68.5	F	GP51	4/11	67	F	---
2/21	66.5	F	GP10	3/11	72.5	F	GP24	3/27	---	F	---	4/11	75	M	---
2/21	75	M	---	3/11	72	F	GP25	3/28	69.5	F	GP52	4/11	70	F	---
2/22	77	M	---	3/11	73	F	GP26	4/01	66	F	GP53	4/16	71.5	F	GP84
2/22	75	M	---	3/11	66	F	GP27	4/01	70	F	GP54	4/18	74	F	GP85
2/23	72	F	---	3/11	68.5	F	GP28	4/01	70	F	GP55	4/18	68	F	GP86
2/23	77.5	F	---	3/11	66	F	GP29	4/01	73.5	M	GP56	4/22	76	M	GP87
2/23	62.5	F	---	3/11	76.5	F	GP30	4/01	68	F	---	4/22	72	F	GP88
2/23	67.5	F	---	3/11	78	M	GP72	4/01	71	F	GP57	4/23	76	F	GP89
2/23	74	F	---	3/11	78	M	GP75	4/01	57	F	GP58	4/29	71.5	F	GP90
2/24	70	M	GP49	3/11	76.5	M	GP65	4/01	72	F	GP59	5/02	71.5	F	---
2/27	70	F	GP37	3/11	70	F	---	4/01	71	F	GP60				
2/27	74	F	GP38	3/11	65.5	F	---	4/01	71	F	GP61				
2/27	80	M	GP34	3/11	78	F	---	4/01	69	M	GP62				
3/03	74	F	GP39	3/11	69	F	---	4/02	78	M	GP63				
3/03	58	M	GP74	3/11	67	F	---	4/02	74	M	GP64				
3/05	74	F	GP45	3/12	75.5	M	GP77	4/02	73	F	---				

Appendix C, Table 9. Hatchery origin summer steelhead trapped at the Dayton Trap during the 2001 and 2002 run years.

2001 Run Year			**2002 Run Year**		
Date	Length (cm)	Sex	Date	Length (cm)	Sex
2/22	59.0	F	2/11	---	M
2/28		M	2/15	---	M
3/26	60.0	F	2/21	60.5	M
3/27	61.5	F	2/21	68	F
4/01	76.0	M	3/10	71	F
4/01	57.0	M	3/10	60	M
4/07	65.0	M	3/10	58.5	F
4/08	65.0	M	3/11	78	F
4/09	65.0	F	4/02	57	F
5/25	66.0	F	4/23	57.5	F
			5/29	61.5	F
			6/11	64.5	F

Appendix D

Bull Trout, Whitefish, and Brown Trout Capture Data from the Touchet River Adult Trap, 1999-2002

Appendix D: Table 1. Whitefish captured at the Dayton Adult Trap on the Touchet River, 1999-2003.

Year	Date	LN (cm)	WT (g)	Age	Year	Date	LN (cm)	WT (g)	Age
1999	13-Apr	36.5			2003	1-May	29.2	271.7	4
1999	5-May	36.0			2003	20-May	24.7	163.6	2
1999	5-May	41.0			2003	20-May	25.5		2
1999	7-May	33.0			2003	20-May	27.3		3
1999	20-May	19.0			2003	20-May	28.0	218.6	3
					2003	22-May	25.6	158.7	3
2000	23-May	30.0			2003	23-May	26.0	215.6	3
2000	5-Jun	27.0			2003	23-May	29.0	233.6	5
2000	7-Jun	33.0			2003	28-May	23.7	150.2	3
2000	11-Jun	28.0			2003	29-May	25.6	189.9	3
2000	13-Jun	24.5			2003	29-May	26.4	222.6	3
2000	13-Jun	27.0			2003	30-May	24.0	152.3	2
2000	15-Jun	27.0			2003	30-May	25.0	194.0	3
2000	15-Jun	28.0			2003	30-May	27.0	242.3	3
2000	15-Jun	28.0			2003	30-May	29.0	299.0	3
2000	15-Jun	28.5			2003	30-May	26.5	213.4	4
2000	15-Jun	29.0			2003	30-May	27.0	198.1	4
2000	15-Jun	30.0			2003	30-May	25.0	173.2	
2000	16-Jun	25.0			2003	3-Jun	23.3	129.0	2
2000	16-Jun	27.5			2003	3-Jun	25.5	180.1	2
2000	23-Jun	28.0			2003	3-Jun	26.8	192.0	2
2000	29-Jun	NA			2003	3-Jun	24.6	159.0	3
					2003	3-Jun	25.1	181.4	3
2001	12-May	30.0			2003	3-Jun	25.2	185.3	3
2001	25-May	28.0			2003	3-Jun	25.3	190.0	3
2001	25-May	30.5			2003	3-Jun	26.7	222.2	3
2001	8-Jun	30.5			2003	3-Jun	24.5	145.4	4
					2003	3-Jun	26.6	205.1	4
					2003	3-Jun	27.2	185.5	4
					2003	3-Jun	28.2	238.1	4
					2003	5-Jun	26.5	184.3	3
					2003	5-Jun	27.1	220.7	3
					2003	10-Jun	32.0	305.0	3
					2003	10-Jun	27.5	205.1	4
					2003	10-Jun	45.0	152.6	4
					2003	11-Jun	25.6	158.4	3
					2003	11-Jun	27.4	220.7	3
					2003	12-Jun	25.2	179.6	
					2003	19-Jun	25.5		3
					2003	24-Jun	30.0		5

Appendix D: Table 2. Brown trout captured at the Dayton Adult Trap on the Touchet River, 1999-2003.

Year	Date	LN (cm)	WT (g)	Age	Year	Date	LN (cm)	WT (g)	Age
1999	3/25	35.5			2002	4/23	28		
1999	5/20	NA			2002	4/23	33.5		
1999	6/14	43.0							
1999	6/20	25.5			2003	3/19	51.0		
					2003	4/22	33.0	465.8	
2000	5/1	NA			2003	5/14	58.5		
2000	6/10	60.0			2003	5/14	30.0		
2000	6/13	35.0			2003	5/23	36.0	546.7	3
2000	6/15	NA			2003	5/28	47.0		
2000	6/15	NA			2003	5/28	55.0		
2000	6/20	NA			2003	5/29	62.0		
2000	6/24	NA			2003	6/3	37.5	745.1	4
2000	6/26	45.0			2003	6/4	41.5	901.8	3
2000	6/27	42.0			2003	6/6	37.0	699.4	3
2000	6/29	34.0			2003	6/10	36.5	603.2	
2000	6/29	53.0			2003	6/10	50.0	1500.1	4
2000	6/29	35.0			2003	6/10	37.0	699.5	4
2000	6/30	43.0			2003	6/10	42.0	1027.5	5
					2003	6/12	47.0	1259.6	3
2001	4/1	37.0			2003	6/12	55.5		
2001	4/26	28.5			2003	6/13	36.0	616.6	4
2001	4/27	48.0			2003	6/19	35.0		
2001	5/10	34.5		4					
2001	5/30	53.0							
2001	6/4	45.0							
2001	6/7	47.0		2					
2001	6/7	58.0							
2001	6/8	45.0							
2001	6/8	45.0							
2001	6/8	47.0							
2001	6/18	27.5							
2001	6/19	29.5		2					
2001	6/19	36.0							

Appendix D: Table 3. Bull trout captured at the Dayton Adult Trap on the Touchet River, 1999-2003.

Year	Date	LN (cm)	WT (g)	Age	PIT Tag Code	Year	Date	LN (cm)	WT (g)	Age	PIT Tag Code
1999	4/5	41.0				2001	4/17	41.0			
1999	4/8	30.5				2001	4/18	34.0			
1999	4/18	36.5				2001	4/18	44.0			
1999	4/21	34.0				2001	4/20	31.0	250.0		
1999	4/26	37.0				2001	4/20	31.0	250.0		
1999	5/1	39.0				2001	4/20	33.0	360.0		
1999	5/7	33.0				2001	4/25	28.0	238.6		
1999	5/17	37.5				2001	4/25	30.0	302.0		
1999	5/17	51.0				2001	4/25	33.5	436.0		
1999	5/18	39.0				2001	4/26	28.5	208.2		
1999	5/18	43.0				2001	4/27	50.0	1250.0		
1999	5/18	57.0				2001	4/27	50.0	1540.0		
1999	5/19	35.0				2001	5/2	33.0	340.0		3D9.1BF0F5F7FB
1999	5/19	37.0				2001	5/2	47.0	1060.0		3D9.1BF11B9CAC
1999	5/20	12.0				2001	5/2	47.0	1290.0		3D9.1BF11E94B4
1999	5/22	37.0				2001	5/8	42.5		4	3D9.1BF0ED5E5F
1999	5/22	58.0				2001	5/10	41.0	700.0		3D9.1BF11EC702
1999	5/23	31.0				2001	5/12	45.0	880.0		3D9.1BF11B9E12
1999	6/17	18.6				2001	5/14	32.5	360.0		3D9.1BF1107490
1999	6/21	34.5				2001	5/14	33.0	345.0		3D9.1BF11135F6
						2001	5/14	35.5	390.0		3D9.1BF0EDD0F2
2000	4/12	40.0				2001	5/14	36.0	515.0		3D9.1BF0EDB5BB
2000	4/12	45.0				2001	5/14	59.0			3D9.1BF11B89CA
2000	4/14	38.0				2001	5/15	27.0			
2000	4/14	59.0				2001	5/23	27.0			3D9.1BF11BF98E
2000	4/15	41.5				2001	5/23	44.0	930.0		3D9.1BF0EDBD4C
2000	4/21	44.0				2001	5/24	30.0			3D9.1BF0ED5003
2000	4/22	32.0				2001	5/24	34.0			3D9.1BF0E99D83
2000	4/28	52.0				2001	5/25	30.5			3D9.1BF0F8CA8D
2000	5/1	45.0				2001	5/29	28.5			3D9.1BF0EDA19D
2000	5/2	30.0				2001	5/29	29.5			3D9.1BF0EDD5A7
2000	5/3	61.0				2001	5/29	31.5			3D9.1BF0ED6885
2000	5/5	NONE				2001	5/29	33.0			3D9.1BF0ED02B2
2000	5/8	NONE				2001	5/29	33.0			3D9.1BF0EC5D70
2000	5/9	NONE				2001	5/29	35.5			3D9.1BF0EDCE80
2000	5/22	30.5				2001	5/30	33.0			3D9.1BF0E7E271
2000	5/22	34.5				2001	6/11	33.5		3	3D9.1BF0EDB198
2000	5/22	36.0				2001	6/18	33.0		4	3D9.1BF0EDA754
2000	5/23	28.0									
2000	6/13	34.0				2002	4/2	32.0			
2000	6/18	34.0				2002	4/9	34.0			
2000	6/22	49.5				2002	4/9	35.0			
2000	6/30	18.0				2002	5/1	34.0	350.0		3D9.1BF0F634AC
2001	4/1	36.0				2002	5/9	33.0	380.0		3D9.1BF0EDC5F6
2001	4/6	31.0				2002	5/10	50.0	1225.0		3D9.1BF11B9E12
2001	4/15	NONE				2002	5/10	37.0	560.0		NA
2001	4/17	29.0				2002	5/13	38.0	550.0		3D9.1BE11E9FFD
2001	4/17	34.0				2002	5/14	36.0	540.0		3D9.1BF0ED614A

Appendix D: Table 4. Continued

2002	5/17	38.0	600.0		3D9.1BF11ABB66	2003	5/2	28.0	239.7	4	3D9.1BF11E9D0E
2002	5/17	51.0	1400.0		3D9.1BF0ED5E5F	2003	5/6	30.5	310.9	4	3D9.1BF115B943
2002	5/20	34.8	470.0		3D9.1BF123980C	2003	5/6	34.5	434.9	4	3D9.1BF11AC2DB
2002	5/22	32.0	400.0		3D9.1BF11EA809	2003	5/6	35.0	460.8	4	3D9.1BF110542E
2002	5/25	24.0	130.0		NA	2003	5/7	33.5	364.6	4	3D9.1BF123A24F
2002	5/30	35.0	480.0		3D9.1BF11ABCO4	2003	5/15	35.5		5	3D9.1BF11ACEA4
2002	5/31	27.0	340.0		3D9.1BF11EBE01	2003	5/15	36.0	523.5	5	3D9.1BF11EA580
2002	5/31	37.2	540.0		3D9.1BF11AC1B6	2003	5/16	38.5			3D9.1BF12399D9
2002	6/2	27.0	180.0		NA	2003	5/16	34.5		4	3D9.1BF11AC215
2002	6/2	34.0	440.0		NA	2003	5/16	30.5		4	3D9.1BF11ABE28
2002	6/5	33.5	420.0		NA	2003	5/22	36.0	461.7	4	3D9.1BF11ABFDD
2002	6/12	38.0			3D9.1BF11E9DC4	2003	5/22	35.0	446.3	4	3D9.1BF11ABFDF
2002	6/13	31.0			3D9.1BF123A317	2003	5/22	34.0	418.2	3	3D9.1BF11EA71A
						2003	5/23	32.0	340.4	3	3D9.1BF11EB0B7
2003	3/12	32.0				2003	5/28	34.5	437.5	4	3D9.1BF11E9A03
2003	4/9	34.0	439.4	4	3D9.1BF11F01F4	2003	5/28	34.0	457.9		3D9.1BF11EC3FF
2003	4/10	42.0	812.5	5	3D9.1BF11EC0BB	2003	5/28	31.5	327.1	3	3D9.1BF1239508
2003	4/17	33.0	440.7		3D9.1BF11ABD87	2003	5/28	37.5	578.7		3D9.1BF11ACA45
2003	4/22	32.0	307.5	4	3D9.1BF1166956	2003	5/29	27.1	236.2	3	3D9.1BF11E939D
2003	4/22	40.5	831.0	5	3D9.1BF115F7B3	2003	5/29	32.5	330.7	4	
2003	4/23	41.5	886.5	5	3D9.1BF11EB12C	2003	5/30	33.0	376.5	3	3D9.1BF11EA05A
2003	4/23	36.5	506.2	4	3D9.1BF11EAD1A	2003	5/30	33.0	336.5	3	3D9.1BF1239C77
2003	4/23	33.5	440.5	4	3D9.1BF11ABC91	2003	6/10	26.5	198.4	2	3D9.1BF113A9E5
2003	4/29	36.5	536.2	5	3D9.1BF1167058	2003	6/12	30.5	295.4	3	3D9.1BF11EC309
2003	4/29	29.7	294.1	4	3D9.1BF11E984A	2003	6/27	25.2	169.7	2	3D9.1BF11E99D3
2003	5/2	35.5	489.6	4	3D9.1BF11EBA26						
2003	5/2	33.0	441.9	5	3D9.1BF1159E5E						

Appendix E

Summary of Coded-Wire Tagged Summer Steelhead Trapped at LFH and Cottonwood Trap for the 2001 and 2002 Run Years

Appendix E, Table 1. Summary of tagged adult summer steelhead trapped at LFH for the 2001 run year.

Brood year	Freeze brand	CWT code	Stock	Release site		Number of tags
1997	RA-H-1	630108	Lyons Ferry	Lyons Ferry Hatchery		1
	RA-7U-1	630423	Lyons Ferry	Touchet River @ Dayton AP		1
					Total	**2**
1998	RA-IT-3	630460	Wallowa	Cottonwood AP (Grande Ronde R.)		2
	RA-IT-1	631001	Lyons Ferry	Tucannon River		32
	LA-IV-1	631002	Lyons Ferry	Lyons Ferry Hatchery		34
	RA-IV-1	631003	Lyons Ferry	Lyons Ferry Hatchery		27
	LA-IV-3	631004	Lyons Ferry	Lyons Ferry Hatchery		25
	RA-IV-3	631005	Lyons Ferry	Lyons Ferry Hatchery		38
		092634	Imnaha	Little Sheep Creek		1
		105245	Pahsimeroi	Pahsimeroi Ponds		2
		105406	Pahsimeroi	Salmon River (Red Rock)		1
					Total	**162**
1999	LA-IC-3	631305	Lyons Ferry	Tucannon River @ Enrich Br		116
	LA-IC-1	631306	Lyons Ferry	Tucannon River @ Marengo		88
	RA-IC-1	631307	Lyons Ferry	Lyons Ferry Hatchery		273
	LA-2-2	631308	Lyons Ferry	Touchet River @ Dayton AP		366
	RA-2-2	631309	Wallowa	Cottonwood AP (Grande Ronde R.)		6
		092935	Wallowa	Big Canyon (Grande Ronde R.)		1
		105425	Hells Canyon	Hells Canyon Dam		1
		105515	Hells Canyon	Little Salmon R. (Stinky Springs)		1
		105513	?????????	Idaho Fish and Game		1
					Total	**853**
			Lost tags, Unreadable tags, No Wire			27
					Grand Total	**880**

Appendix E, Table 2. Summary of tagged adult summer steelhead trapped at LFH for the 2002 run year.

Brood year	Freeze brand	CWT code	Stock	Release site		Number of tags
2000	NONE	630115	Lyons Ferry	Touchet River @ Dayton AP		45
2000	LA-IJ-1	630281	Wallowa	Cottonwood AP (Grande Ronde R)		1
2000	LA-S-1	631053	Lyons Ferry	Tucannon		34
2000	RA-S-1	631139	Lyons Ferry	Lyons Ferry		119
2000	NONE	631140	Lyons Ferry	Walla Walla		85
1999	LA-IC-3	631305	Lyons Ferry	Tucannon River @ Enrich Br		4
1999	LA-IC-1	631306	Lyons Ferry	Tucannon River @ Marengo		3
1999	RA-IC-1	631307	Lyons Ferry	Lyons Ferry		22
1999	LA-2-2	631308	Lyons Ferry	Touchet River		57
1999	RA2-2	631309	Wallowa	Cottonwood AP (Grande Ronde R)		1
					Total	**371**
				Lost tags, Unreadable tags		6
					Grand Total	**377**

Appendix E, Table 3. Summary of tagged adult summer steelhead trapped at Cottonwood Trap for the 2001 run year / 2002 brood year.

Brood year	Freeze brand	CWT Code	Stock	Release site		Number of tags
1998	RA-IT-3	630460	Wallowa	Cottonwood AP (Grande Ronde R.)		81
					Total	**81**
1999	RA-2-2	631309	Wallowa	Cottonwood AP (Grande Ronde R.)		260
					Total	**260**
				Lost tag (9) , No tag (33)		42
				Grand Total for Year		**383**

Appendix E, Table 4. Summary of tagged adult summer steelhead trapped at Cottonwood Trap for the 2002 run year / 2003 brood year.

Brood year	Freeze brand	CWT code	Stock	Release site		Number of tags
1999	RA-2-2	631309	Wallowa	Cottonwood AP (Grande Ronde R.)		48
					Total	**48**
2000	LA-IJ-1	630281	Wallowa	Cottonwood AP (Grande Ronde R.)		21
					Total	**21**
				Lost tag, No tag (1)		3
				Grand Total for Year		**72**

Appendix F

Summary of Summer Steelhead Spawning Surveys in the Tucannon and Touchet Rivers, and Asotin Creek in 2002

Appendix F, Table 1. Results of summer steelhead redd surveys in the Tucannon River and Cummings Creek, 2002

Stream Section surveyed	Est. Rkm	Dates surveyed	Redds counted	Total redds	Exp. # of redds	% of total reach	Total est. redds for reach
Tucannon (totals)	**62.2**			**164**	**NA**	**NA**	**NA**
Camp Wooten to Deer Lake	7.9	3/25, 4/03	3, 11	14	NA	NA	NA
Hatchery Br. to Br. 14	6.7	3/25, 4/03	8, 13	21	NA	NA	NA
Bridge 11 to Hovrud's Silt Basin	7.6	3/22, 3/27, 4/04, 4/26	18, 5, 42, 13	78	NA	NA	NA
King Grade Br. To Enrich Br.	7.2	3/21, 4/03, 4/26	15, 33, 3	51	NA	NA	NA
Cummings Creek (totals)	**8.0**				**NA**	**NA**	**NA**
Upstream 3.8 road miles to mouth	6.1	4/22	12	12	NA	NA	NA

Appendix F, Table 2. Results of summer steelhead redd surveys in the Touchet River, 2002

Stream Section surveyed	Est. Rkm	Dates surveyed	Redds counted	Total redds	Exp. # of redds	% of total reach	Total est. redds for reach
Mainstem (totals)				**59**	**NA**	**NA**	**NA**
None conducted in 2002							
North Fork (totals)	**23.0**						
LE of Frames to Wolf Fork Br.	5.1	4/05	10	10	NA	NA	NA
Marll Br to South Touchet Mouth	1.9	4/05	0	0	NA	NA	NA
South Fork (totals)	**25.3**						
Camp Nancy Lee to Bridge 2	7.8	3/28, 4/04, 4/23	3, 20, 7	30	NA	NA	NA
Wolf Fork (totals)	**17.5**						
Coates Cr to Robinson Fork	7.6	4/04, 4/24	8, 11	19	NA	NA	NA
Robinson Fork (totals)							
None conducted in 2002							

Appendix F, Table 3. Results of summer steelhead redd surveys in Asotin Creek, 2002.

Stream Section surveyed	Est. Rkm	Dates surveyed	Redds counted	Total redds	Exp. # of redds	% of total reach	Total est. redds for reach
Mainstem (totals)				**180**	**NA**	**NA**	**NA**
NF/SF confluence ↓ 2.6 road miles	15.5	3/20, 4/01, 4/25	20, 28, 5	53	NA	NA	NA
2 miles ↑ Heagate, ↓ 1.0 miles		3/20, 4/01, 4/25	5, 35, 7	47	NA	NA	NA
North Fork (totals)							
3 miles ↑ Lick Creek to Lick Creek	11.8	4/01, 4/25	41, 5	46	NA	NA	NA
South Fork (totals)							
2 miles ↑ mouth to mouth	10.6	3/20, 4/01, 4/25	1, 6, 3	10	NA	NA	NA
Charley Creek (totals)							
State land fence to Asotin Rd Br.	10.3	4/01, 4/25	17, 7	24	NA	NA	NA

Appendix G

Estimates of Juvenile Summer Steelhead Densities in SE Washington Rivers that are part of the LSRCP Program

Appendix G, Table 1. Mean juvenile summer steelhead / rainbow trout densities (fish/100 m^2) by age class for SE Washington rivers that are a part of the LSRCP Program.

Stream Name	Asotin Creek				Touchet River			Tucannon River	Cummings Creek
Year	Main	North Fork	South Fork	Charley Creek	North Fork	South Fork	Wolf Fork	Main	Main
Age 0 Steelhead / Rainbow Trout									
1983	- - -	23.7	44.3	- - -	- - -	- - -	- - -	- - -	- - -
1984	- - -	6.6	39.0	- - -	- - -	- - -	- - -	16.0	- - -
1985	- - -	- - -	- - -	73.0	- - -	- - -	- - -	- - -	- - -
1986	- - -	29.7	- - -	- - -	- - -	- - -	- - -	18.4	- - -
1987	- - -	- - -	- - -	- - -	- - -	- - -	- - -	20.6	- - -
1988	- - -	45.8	- - -	- - -	- - -	- - -	- - -	- - -	- - -
1989	- - -	22.8	6.0	- - -	- - -	- - -	- - -	18.1	- - -
1990	- - -	- - -	- - -	- - -	- - -	- - -	- - -	19.1	- - -
1991	- - -	22.1	1.8	- - -	- - -	- - -	- - -	13.0	- - -
1992	- - -	56.9	50.0	- - -	35.5	42.8	41.1	17.4	- - -
1993	49.1	36.8	78.7	- - -	26.0	8.7	21.8	14.6	43.2
1994	36.8	20.4	0.8	19.0	20.8	16.2	20.2	- - -	42.9
1995	47.7	23.4	34.5	- - -	42.5	31.1	25.0	11.0	32.4
1996	62.8	13.0	2.0	64.4	4.9	1.9	2.3	15.8	47.8
1997	33.4	24.0	32.5	- - -	28.5	11.6	21.1	16.5	- - -
1998	52.2	44.6	32.9	18.3	15.4	16.7	23.6	17.2	12.5
1999	20.9	11.0	27.4	12.7	24.5	9.4	15.6	5.2	31.3
2000	26.6	41.9	21.8	43.0	15.6	10.9	15.3	19.3	40.3
2001	35.6	33.9	68.8	38.5	23.6	13.8	13.6	17.8	14.8
2002	37.1	40.4	84.7	65.8	48.0	52.1	43.4	27.2	54.9
Age 1+ Steelhead / Rainbow Trout									
1983	- - -	8.7	25.3	- - -	- - -	- - -	- - -	- - -	- - -
1984	- - -	7.5	30.6	- - -	- - -	- - -	- - -	2.5	- - -
1985	- - -	- - -	- - -	37.6	- - -	- - -	- - -	- - -	- - -
1986	- - -	37.6	- - -	- - -	- - -	- - -	- - -	13.7	- - -
1987	- - -	- - -	- - -	- - -	- - -	- - -	- - -	8.5	- - -
1988	- - -	8.1	- - -	- - -	- - -	- - -	- - -	- - -	- - -
1989	- - -	18.1	34.0	- - -	- - -	- - -	- - -	10.6	- - -
1990	- - -	- - -	- - -	- - -	- - -	- - -	- - -	9.8	- - -
1991	- - -	14.2	13.9	- - -	- - -	- - -	- - -	6.5	- - -
1992	- - -	22.2	10.4	- - -	19.0	15.5	8.7	4.8	- - -
1993	22.1	28.1	42.5	- - -	19.3	15.0	10.5	7.0	26.3
1994	39.6	34.9	16.4	20.0	18.9	5.8	11.5	- - -	20.4
1995	13.1	11.2	21.7		8.9	9.5	6.4	4.0	29.6
1996	12.2	17.4	11.2	15.3	3.6	10.2	5.3	3.2	16.6
1997	6.9	6.7	4.6		2.3	2.8	7.4	4.6	- - -
1998	10.2	25.5	22.8	49.0	4.9	16.2	13.4	6.4	12.7
1999	14.4	13.9	17.3	22.9	3.4	8.4	13.0	4.2	16.1
2000	9.7	16.6	22.3	17.9	11.2	13.3	8.9	4.9	17.3
2001	19.7	30.4	29.8	23.6	13.7	13.6	11.6	6.9	8.6
2002	12.0	19.7	24.7	19.4	12.1	10.7	6.6	4.3	27.4

Appendix G, Table 2. Densities of juvenile steelhead/rainbow trout (fish/100 m2) from electrofishing sites in the Tucannon River basin, 2001 and 2002.

Year	Stream Site Name	Est. rkm	Site length (m)	Mean width (m)	Area (m^2)	Fish/100m^2 Age 0	Fish/100m^2 Age 1+
2001	**Tucannon River (Main)**						
	TUC1-00	22.0	40.0	7.5	300.0	12.67	0.67
	TUC2-00	28.0	40.0	11.5	458.0	15.05	0.87
	TUC3-00	31.9	40.0	9.9	396.0	25.25	5.81
	TUC4-00	34.1	40.0	9.3	372.7	37.56	4.83
	TUC5-00	36.7	40.0	9.6	384.8	24.95	1.30
	TUC6-00	41.8	40.0	7.0	281.6	12.43	4.97
	TUC7-00	46.3	40.0	12.1	484.0	9.92	8.06
	TUC8-00	49.1	40.0	8.4	335.2	21.48	2.68
	TUC9-00	52.7	40.0	10.1	402.4	57.65	26.34
	TUC10-00	57.1	40.0	11.9	477.6	27.22	7.12
	TUC11-00	61.2	40.0	9.8	393.6	8.38	5.34
	TUC12-00	64.4	40.0	9.8	392.8	8.15	6.11
	TUC13-00	68.4	40.0	12.9	515.2	7.76	9.32
	TUC14-00	73.2	40.0	8.5	338.4	6.80	9.16
	TUC15-00	75.8	45.0	8.3	372.6	8.32	6.71
	TUC16-00	78.5	62.8	6.8	423.9	0.94	11.32
	Cummings Creek						
	CC-1-01	0.0	41.0	3.6	147.6	49.46	8.13
	CC-2-01	1.8	40.0	3.6	144.0	38.89	24.30
	CC-3-01	3.8	44.0	3.5	154.0	33.12	34.42
	CC-4-01	5.8	40.0	3.0	120.0	30.00	29.17
2002	**Tucannon River (Main)**						
	TUC1-00	22.0	40.0	10.0	399.2	17.54	0.25
	TUC2-00	28.0	40.0	12.1	482.4	35.24	1.24
	TUC3-00	31.9	40.0	13.3	530.4	25.45	5.47
	TUC4-00	34.1	40.0	15.4	616.8	21.24	2.11
	TUC5-00	36.7	40.0	11.5	459.2	5.66	0.22
	TUC6-00	41.8	40.0	9.5	380.8	23.90	5.51
	TUC7-00	46.3	40.0	14.4	575.2	17.04	5.91
	TUC8-00	49.1	50.0	12.9	645.0	19.53	5.43
	TUC9-00	52.7	37.0	12.0	444.7	24.28	4.05
	TUC10-00	57.1	40.0	11.9	477.6	16.75	4.19
	TUC11-00	61.2	40.0	10.6	423.2	40.64	1.18
	TUC12-00	64.4	40.0	9.7	386.4	30.80	3.88
	TUC13-00	68.4	40.0	8.9	256.8	61.66	3.36
	TUC14-00	73.2	40.0	10.6	424.0	20.28	5.66
	TUC15-02		40.0	9.8	391.2	40.64	3.58
	TUC16-02		40.0	8.0	319.2	35.40	16.92
	Cummings Creek						
	CC-1-01	0.0	50.0	4.1	206.3	56.73	8.73
	CC-2-01	1.8	50.0	3.0	149.0	31.54	36.24
	CC-3-01	3.8	50.0	4.3	214.0	77.10	43.93
	CC-4-01	5.8	50.0	3.2	161.0	54.04	21.74
	CC-5-02	7.7	50.0	2.9	146.0	91.10	36.99

Appendix G, Table 3. Densities of juvenile steelhead/rainbow trout (fish/100 m2) from electrofishing sites in the Touchet River basin, 2001.

Stream Site Name	Est. rkm	Site length (m)	Mean width (m)	Area (m^2)	Fish/100m^2 Age 0	Fish/100m^2 Age 1+
Touchet River (Main)						
MT-1-01	70.5	50.0	12.8	640.0	22.19	0.16
MT-2-01	72.9	50.0	11.6	581.7	3.09	0.00
MT-3-01	76.1	50.0	10.0	500.0	15.20	0.00
MT-4-01	79.2	50.0	11.1	556.0	6.83	0.18
MT-5-01	81.6	50.0	12.4	618.3	29.76	0.16
MT-6-01	84.0	50.0	10.0	499.0	49.10	0.80
MT-7-01	87.0	50.0	11.3	564.2	43.42	1.60
MT-8-01	90.3	50.0	11.8	591.7	12.34	1.52
North Fork						
NFT-1-01	0.1	50.0	10.8	540.0	21.85	3.33
NFT-2-01	2.0	50.0	12.0	598.0	26.59	16.22
NFT-3-01	6.8	50.0	7.0	350.0	35.71	17.71
NFT-4-01	9.1	50.0	5.5	277.0	22.38	9.03
NFT-5-01	12.4	50.0	9.0	452.0	17.92	13.50
NFT-6-01	14.8	50.0	6.3	314.0	14.33	22.93
NFT-7-01	17.7	50.0	6.4	319.0	26.33	13.48
South Fork						
SFT-1-01	0.1	50.0	5.1	253.0	30.43	3.56
SFT-2-01	2.2	50.0	6.5	325.8	11.66	0.31
SFT-3-01	3.8	50.0	7.7	386.0	9.59	8.03
SFT-4-01	5.6	50.0	7.2	259.2	20.32	4.73
SFT-5-01	7.2	50.0	7.7	386.0	13.47	2.59
SFT-6-01	8.8	50.0	6.3	316.0	22.78	8.86
SFT-7-01	10.4	50.0	6.6	330.0	10.61	9.70
SFT-8-01	12.0	50.0	8.2	409.0	4.89	12.71
SFT-9-01	13.6	50.0	5.4	268.0	11.94	23.13
SFT-10-01	15.2	50.0	5.1	254.0	11.02	37.01
SFT-11-01	16.9	50.0	3.1	154.0	12.99	27.92
SFT-12-01	18.5	50.0	4.7	236.0	6.36	11.02
SFT-13-01	20.1	50.0	5.3	267.0	13.48	28.09
Wolf Fork						
WFT-1-01	0.2	50.0	10.9	547.0	31.63	6.03
WFT-2-01	2.1	54.0	8.4	455.8	16.89	10.75
WFT-3-01	4.3	50.0	9.0	450.0	17.56	8.44
WFT-4-01	6.6	50.0	8.8	439.0	26.20	14.12
WFT-5-01	8.6	50.0	7.5	373.0	20.91	13.14
WFT-6-01	10.6	50.0	6.2	312.0	5.77	11.54
WFT-7-01	12.6	50.0	6.3	315.0	12.06	11.75
WFT-8-01	14.6	50.0	5.4	269.0	0.00	18.59
WFT-9-01	15.2	30.0	4.8	145.2	0.69	8.95
WFT-10-01	16.3	30.0	3.6	108.6	4.60	12.89
Robinson Fork						
RFT-1-01	0.8	50.0	3.9	196.0	12.24	1.02
RFT-2-01	2.4	50.0	3.7	183.0	45.36	7.65
RFT-3-01	3.8	50.0	3.9	196.0	21.43	12.24
RFT-4-01	5.6	50.0	3.5	176.0	19.89	34.66
RFT-5-01	7.2	60.0	4.3	255.0	25.88	12.94

Appendix G, Table 4. Densities of juvenile steelhead/rainbow trout (fish/100 m2) from electrofishing sites in the Touchet River basin, 2002.

Stream Site Name	Est. rkm	Site length (m)	Mean width (m)	Area (m^2)	Fish/100m^2 Age 0	Fish/100m^2 Age 1+
Touchet River (Main)						
MT-1-01	70.5	50.0	14.2	712.0	16.29	0.28
MT-2-01	72.9	50.0	13.1	654.0	6.88	0.31
MT-3-01	76.1	50.0	15.8	790.0	10.00	0.00
MT-4-01	79.2	50.0	11.8	589.0	32.60	0.34
MT-5-01	81.6	50.0	14.9	745.0	8.46	0.13
MT-6-01	84.0	50.0	8.9	447.0	17.00	3.58
MT-7-01	87.0	50.0	17.1	856.0	11.68	0.93
MT-8-01	90.3	50.0	10.9	546.0	30.22	0.73
North Fork						
NFT-1-01	0.1	50.0	10.0	499.0	34.47	2.40
NFT-2-01	2.0	50.0	8.7	436.0	19.72	9.17
NFT-3-01	6.8	50.0	8.2	410.0	88.78	13.90
NFT-4-01	9.1	50.0	6.0	301.0	45.51	12.29
NFT-5-01	12.4	50.0	8.4	418.0	56.70	12.20
NFT-6-01	14.8	50.0	6.8	341.0	53.08	19.35
NFT-7-01	17.7	50.0	6.0	302.0	37.75	15.89
South Fork						
SFT-1-02	0.1	50.0	6.4	318.0	35.22	6.29
SFT-2-02	3.9	50.0	8.3	413.0	37.77	1.94
SFT-3-02	7.1	50.0	6.7	335.0	48.39	1.79
SFT-4-02	10.4	50.0	6.2	309.0	40.78	0.65
SFT-5-02	13.5	50.0	6.1	305.0	51.48	3.28
SFT-6-02	16.7	50.0	5.7	284.0	75.35	16.55
SFT-7-02	19.6	50.0	5.5	274.0	66.79	10.22
SFT-8-02	25.3	50.0	4.3	214.0	60.75	47.20
Wolf Fork						
WFT-1-01	0.2	50.0	10.7	537.0	48.23	2.79
WFT-2-01	2.1	50.0	11.2	560.0	30.71	2.50
WFT-3-01	4.3	50.0	8.0	402.0	44.53	6.72
WFT-4-01	6.6	50.0	7.8	392.0	42.96	7.65
WFT-5-01	8.6	50.0	8.6	431.0	47.33	9.28
WFT-6-01	10.6	50.0	7.3	367.0	35.42	5.99
WFT-7-01	12.6	50.0	6.9	345.0	54.49	11.59
Robinson Fork						
RFT-1-01	0.8	65.0	4.8	313.3	76.60	14.04
RFT-2-01	2.4	50.0	4.3	214.0	28.50	7.94
RFT-3-01	3.8	50.0	4.3	215.0	22.79	16.28
RFT-4-01	5.6	50.0	4.1	207.0	34.60	25.60
RFT-5-01	7.2	50.0	4.2	208.0	46.15	7.69

Appendix G, Table 5. Densities of juvenile steelhead/rainbow trout (fish/100 m2) from electrofishing sites in the Asotin Creek basin, 2001 and 2002.

Year	Stream Site Name	Est. rkm	Site length (m)	Mean width (m)	Area (m^2)	Fish/100m^2 Age 0	Fish/100m^2 Age 1+
2001	**Asotin Creek (Main)**						
	MA-1-01	4.4	50.0	12.0	598.0	33.95	9.20
	MA-2-01	7.8	50.0	10.1	503.0	29.42	27.83
	MA-3-01	11.5	53.0	8.1	427.2	22.00	22.94
	MA-4-01	15.2	50.0	9.6	478.0	52.72	15.48
	MA-5-00	19.0	50.0	8.0	399.0	39.85	23.06
	North Fork						
	NFA-1-00	1.6	50.0	7.3	366.0	33.06	19.95
	NFA-2-00	3.8	50.0	7.4	369.0	34.69	39.02
	NFA-3-00	7.0	50.0	6.1	307.0	54.72	40.72
	NFA-4-00	9.6	50.0	5.6	279.0	27.60	31.18
	NFA-5-00	11.8	50.0	7.7	385.0	19.48	21.04
	South Fork						
	SFA-1-00	0.6	50.0	3.2	161.0	63.35	20.50
	SFA-2-00	3.0	50.0	3.3	165.0	102.42	38.18
	SFA-3-00	5.4	50.0	3.6	181.0	82.32	13.81
	SFA-4-00	8.2	50.0	3.1	154.0	62.34	42.21
	SFA-5-00	10.9	50.0	3.9	193.0	33.68	34.20
	Charley Creek						
	CC-1-00	1.0	44.0	3.4	151.4	60.11	35.01
	CC-2-00	3.7	50.0	2.6	131.0	40.46	23.66
	CC-3-00	6.4	50.0	3.5	177.0	6.21	28.81
	CC-4-00	9.1	50.0	3.4	171.0	45.61	12.28
	CC-5-00	11.8	50.0	3.1	153.0	39.87	18.30
	CC-6-00	13.0	50.0	3.2	162.0	43.21	30.86
2002	**Asotin Creek (Main)**						
	MA-1-01	4.4	57.0	7.8	444.6	40.71	9.45
	MA-2-01	7.8	50.0	9.9	494.0	32.19	8.91
	MA-3-01	11.5	50.0	8.9	445.0	24.49	12.36
	MA-4-01	15.2	50.0	10.2	511.0	52.84	9.39
	MA-5-00	19.0	50.0	9.6	478.0	35.15	19.87
	North Fork						
	NFA-1-0	1.6	50.0	8.1	407.0	38.08	17.69
	NFA-2-0	3.8	50.0	7.9	397.0	45.09	21.91
	NFA-3-0	7.0	50.0	6.9	344.0	26.16	16.57
	NFA-4-0	9.6	50.0	6.5	326.0	52.45	20.55
	NFA-5-0	11.8	50.0	8.2	409.0	40.34	21.52
	South Fork						
	SFA-1-0	0.6	50.0	5.3	265.0	90.57	15.85
	SFA-2-0	3.0	50.0	4.2	212.0	50.94	21.70
	SFA-3-0	5.4	50.0	4.4	218.0	61.93	29.82
	SFA-4-0	8.2	50.0	4.5	224.0	81.25	31.25
	SFA-5-0	10.9	50.0	3.3	165.0	138.79	25.45
	Charley Creek						
	CC-1-00	1.0	50.0	3.5	173.0	31.21	15.03
	CC-2-00	3.7	50.0	3.6	179.0	37.43	9.50
	CC-3-00	6.4	50.0	3.2	162.0	91.36	29.01
	CC-4-00	9.1	50.0	3.3	166.0	50.0	16.87
	CC-5-00	11.8	50.0	3.5	176.0	118.75	27.27

Appendix G, Table 6. Electofishing site locations during 2001 and 2002 for the Tucannon River and Cummings Creek.

Site name 2001	Site name 2002	Approximate site location/description
TUC1-00	TUC1-00	100’ below Highway 12 Bridge (Road Mile 13.5)
TUC2-00	TUC2-00	100 m above Enrich Bridge (Road Mile 17.1)
TUC3-00	TUC3-00	milepost 6 on Tucannon Road (Road Mile 19.5)
TUC4-00	TUC4-00	100 m below King Grade Bridge (Road Mile 20.9)
TUC5-00	TUC5-00	Hovrud’s Silt Basin, Part of site includes some bad habitat restoration (RM 23.2)
TUC6-00	TUC6-00	Across from MP 12, above Marengo Bridge (Road Mile 25.7)
TUC7-00	TUC7-00	½ way between Br 11 and Br 12, near Donohue’s Hay Barn (Road Mile 28.3)
TUC8-00	TUC8-00	100 m above Bridge 13 (Road Mile 30.6)
TUC9-00	TUC9-00	Across from Last Resort RV Park, Byers Habitat Site (Road Mile 32.9)
TUC10-00	TUC10-00	Across from Campground 2, Rock Cliff below site (Road Mile 35.3)
TUC11-00	TUC11-00	Across from Campground 5, USFS Info Board (Road Mile 37.8)
TUC12-00	TUC12-00	Across from Big 4 Lake, top is at the overflow from lake (Road Mile 40.0)
TUC13-00	TUC13-00	Across from Camp Wooten, old HMA 15 (Road Mile 42.3)
TUC14-00	TUC14-00	100’ above Cow Camp Bridge (Road Mile 44.5)
TUC15-00		Upper End of Wild Campground 2 (Road Mile 46.7) FS Blocked road to CG.
TUC16-00		Above Winchester Creek (Road Mile 48.2)
	TUC15-02	100 m above Wild Campground 1 (Road Mile 46.0)
	TUC16-02	Lower End of Lady Bug Flat Campground (Road Mile 47.7)
CC1-01	CC1-01	~50 m above mouth of Cummings Creek
CC2-01		1.4 miles above the Gate along the Cummings Creek Trail Road
CC3-01		2.6 miles above the Gate along the Cummings Creek Trail Road
CC4-01		~200 m above USFS Boundary
	CC2-02	1.2 miles above the Gate along the Cummings Creek Trail Road
	CC3-02	2.4 miles above the Gate along the Cummings Creek Trail Road
	CC4-02	3.6 miles above the Gate along the Cummings Creek Trail Road
	CC5-02	4.8 miles above the Gate along the Cummings Creek Trail Road

Appendix G, Table 7. Electofishing site locations during 2001 and 2002 for the Touchet River.

Site name 2001	Site name 2002	Approximate site location/description
MainStem		
MT1-01	MT1-01	Upstream from Waitsburg City Park Bridge (Road Mile 44.3)
MT2-01	MT2-01	Billy Carter's property, ¼ mile below Lower Hogeye Rd. (Road Mile 46.1)
MT3-01	MT3-01	Behind Bickelhaupt's pond, ½ mile below State Park Bridge (Road Mile 47.7)
MT4-01	MT4-01	Behind Lewis and Clark State Park (Road Mile 48.5)
MT5-01	MT5-01	~100m above Rose Gulch Bridge (Road Mile 49.9)
MT6-01	MT6-01	~50m below Ward Road Bridge (Road Mile 51.4)
MT7-01	MT7-01	½ mile below mouth of Patit Creek (Road Mile 53.5)
MT8-01	MT8-01	~50m below mouth of South Touchet (Road Mile 56.1)
North Fork		
NFT1-01	NFT1-01	~50m above the mouth of the South Touchet (Road Mile 0.1)
NFT2-01	NFT2-01	~100m above Vernon Marll's Bridge (Road Mile 1.2)
NFT3-01	NFT3-01	~50m above Wolf Fork Bridge (Road Mile 4.2)
NFT4-01	NFT4-01	~100m above MP 7 on North Touchet Road (Road Mile 5.7)
NFT5-01	NFT5-01	Behind Jerry Dedloff's House (Road Mile 7.6)
NFT6-01	NFT6-01	~50m above Bridge at MP 11 (Road Mile 9.2)
NFT7-01	NFT7-01	~20m above last bridge on North Touchet Rd. at MP 13 (Road Mile 11.0)
South Fork		
SFT1-01	SFT1-01	~20m up from mouth (Road Mile 0.0)
SFT2-01		~150m downstream from Harting Grade Bridge (Road Mile 1.3)
SFT3-01		~150m downstream from Pettyjohn Bridge (Road Mile 2.4)
SFT4-01		~100m above MP 3 on South Touchet Rd (Road Mile 3.4)
SFT5-01		MP 4 on South Touchet Rd (Road Mile 4.4)
SFT6-01		MP 5 on South Touchet Rd (Road Mile 5.4)
SFT7-01		MP 6 on South Touchet Rd (Road Mile 6.4)
SFT8-01		MP 7 on South Touchet Rd (Road Mile 7.4)
SFT9-01		Mouth of second canyon on left side of rd above Camp Nancy Lee (Road Mile 8.4)
SFT10-01		MP 9 on South Touchet Rd (Road Mile 9.4)
SFT11-01		Across from Rainwater locked gate (Road Mile 10.4)
SFT12-01		½ mile above private cabins above locked gate
SFT13-01		1.5 miles above private cabins above locked gate
	SFT2-02	downstream of Pettyjohn Bridge (Road Mile 2.4)
	SFT3-02	2 miles above Pettyjohn Bridge (Road Mile 4.4)
	SFT4-02	4 miles above Pettyjohn Bridge (Road Mile 6.4)
	SFT5-02	~100m above Camp Nancy Lee Bridge (Road Mile 8.4)
	SFT6-02	2 miles above Camp Nancy Lee Bridge (Road Mile 10.4)
	SFT7-02	4 miles above Camp Nancy Lee Bridge (Road Mile 12.4)
	SFT8-02	Belwo Mouth of Griffen Fork Creek (Road Mile 14.4)
Wolf Fork		
WF1-01	WF1-01	~100m above mouth of the Wolf Fork, behind Fairchild's house
WF2-01	WF2-01	1.2 miles above Wolf Fork Bridge
WF3-01	WF3-01	2.4 miles above Wolf Fork Bridge
WF4-01	WF4-01	Gibbon's Bridge (Road Mile 3.7)
WF5-01	WF5-01	Donnelly's Bridge (Road Mile 5.2)
WF6-01	WF6-01	½ mile below Martin's Bridge (Road Mile 6.7)
WF7-01	WF7-01	Mouth of Coates Creek (Road Mile 7.8)
WF8-01		1.2 miles above private yellow gate (Road Mile 9.1)
Robinson		
RF1-01	RF1-01	½ Mile upstream from bridge at mouth
RF2-01	RF2-01	1.5 miles upstream from bridge at mouth
RF3-01	RF3-01	2.4 miles upstream from bridge at mouth
RF4-01	RF4-01	3.5 miles upstream from bridge at mouth
RF5-01	RF5-01	4.5 miles upstream from bridge at mouth

Appendix G, Table 8. Electofishing site locations during 2001 and 2002 for Asotin Creek.

Site name 2001	Site name 2002	Approximate site location/description
Mainstem		
AC1-01	AC1-01	~200m above bridge at George Creek mouth, behind Joe Curl's house
AC2-01	AC2-01	½ way between George Creek and Headgate Park
AC3-01	AC3-01	~100m upstream of Headgate Park Dam
AC4-01	AC4-01	~2.5 miles below confluence bridge, public fishing access area
AC5-01	AC5-01	Upper end of 1998 meander reconstruction (Frank Koch's property)
North Fork		
NF1-00	NF1-00	~20m above mouth of Lick Creek
NF2-00	NF2-00	1.4 miles above Lick Creek Crossing
NF3-00	NF3-00	3.0 miles below upper USFS fence line (where Pinkham Trail enters)
NF4-00	NF4-00	1.4 miles below upper USFS fence line
NF5-00	NF5-00	6.4 miles above Lick Creek Crossing, upper USFS fence line at Pinkham Trail
South Fork		
SF1-00	SF1-00	~300m above South Fork mouth, where Campbell Grade Rd comes off of hillside
SF2-00	SF2-00	2 miles above mouth of South Fork
SF3-00	SF3-00	~50 m downstream from Schlee Bridge
SF4-00	SF4-00	1.7 miles above Schlee Bridge
SF5-00	SF5-00	3.4 miles above Schlee Bridge
Charley Creek		
CC1-01	CC1-02	Frank Koch's water diversion ditch, ¼ mile up from main Gate at Koch's house
CC2-01		1.5 miles upstream from main Gate at Koch's house
CC3-01		2.8 miles upstream from main Gate at Koch's house
CC4-01		3.9 miles upstream from main Gate at Koch's house
CC5-01		End of road, ~7/10 of a mile above State Land fence
CC6-01		Old corrals, 6.5 miles above main Gate at Koch's house
	CC2-02	1.7 miles above main Gate at Koch's house
	CC3-02	2.9 miles above main Gate at Koch's house
	CC4-02	4.4 miles above main Gate at Koch's house
	CC5-02	5.9 miles above main Gate at Koch's house

Appendix H

Summer Steelhead Genetic Data

Appendix H, Table 1. Microsatellite loci used to construct genotypes for Touchet, Tucannon and Walla Walla summer steelhead. Hardy Weinberg equilibrium (HWE) *P*-values are the probability of a random union of gametes in a test for homozygote excess across all populations. Loci out of Hardy-Weinberg equilibrium in global tests across all populations are in bold type. Fis measures heterozygotes deficit, Ho is the observed proportion of heterozygotes, Ht is the overall gene diversity (expected heterozygosity), Dst is the gene diversity among samples and Gst is an estimate of Fst, a measure a population subdivision. Values were estimated using FSTAT.

	# alleles	HWE *P*-value	Fis	Ho	Ht	Dst	Gst
One102	26	**0.0012**	0.03	0.878	0.919	0.007	0.008
Ots-100	23	0.005	0.015	0.817	0.845	0.006	0.007
One-114	26	0.0997	0.02	0.899	0.922	0.007	0.008
One-101	26	**0**	0.136	0.406	0.538	0.056	0.105
One-108	27	**0**	0.074	0.829	0.912	0.013	0.014
Ots-103	9	0.2883	-0.036	0.25	0.244	0.001	0.005
Ots-1	22	**0**	0.097	0.745	0.858	0.038	0.044
Omy-77	23	**0**	0.095	0.815	0.9	0.007	0.008
Ots-3M	10	0.0252	0.038	0.657	0.703	0.004	0.006
Omy-1001	27	0.126	0	0.903	0.92	0.01	0.011
Omm-1128	39	**0**	0.044	0.862	0.954	0.038	0.04
Omm-1130	57	**0**	0.027	0.929	0.959	0.009	0.01
Omm-1070	46	**0**	0.13	0.847	0.95	0.008	0.008
Omy-1011	21	0.423	-0.004	0.884	0.895	0.008	0.009
Overall		**0**	0.049	0.766	0.823	0.015	0.019

Appendix H, Table 2. Summer steelhead collections from Touchet and Tucannon drainages. Collection name and year of collection (99 for 1999, etc.) are under "Collection", and code assigned to collection is under "code". Collection type, adult (A) or juvenile (J) is indicated under A/J column. The number of loci pairs in disequilibrium is indicated under "# dis". Multi-locus tests for Hardy-Weinberg equilibrium (both homozygote and heterozygote excess) were conducted using GENEPOP. *P*-values for collections out of equilibrium for homozygote excess are in bold type. Global values across all loci are in the bottom row. Fis values, allelic richness and gene diversity were calculated using FSTAT. Significant Fis values are in bold type, totals and mean values are in the bottom row.

Collection	Code	N	A/J	# dis	HWE *P*-value	Fis	Fis *P*-value	Gene diversity	Allelic richness
99Touchet trap @ Dayton	99AH	33	A		0	**0.068**	0.0001	0.8212	9.6141
00Touchet trap @ Dayton	00AA	30	A		0.0002	0.051	0.0031	0.8129	9.5534
01Touchet trap @ Dayton	01AT	94	A		0	**0.051**	0	0.8101	9.2643
02Touchet trap @ Dayton	01IF	84	A	1	0.0068	0.04	0.0003	0.8111	9.2768
00Coppei Cr. (Touchet)	00EB	60	J	7	0	**0.056**	0	0.7951	8.7079
00Robinson Cr. (Touchet)	00EC	57	J	2	0.0086	0.026	0.0409	0.7913	8.4224
00NF Touchet	00ED	77	J	3	0	**0.056**	0	0.8023	9.1600
99NF Touchet	99EY	99	J	5	0.0054	0.035	0.0007	0.8161	9.2153
99Wolf Fork (Touchet)	99EZ	98	J	11	0	0.031	0.0017	0.8160	9.0276
99SF Touchet	99FA	89	J	1	0	0.032	0.0015	0.8114	9.0353
99Upper Walla Walla	99AI	49	A		0	**0.057**	0	0.7954	9.2584
98Upper Walla Walla	98AK	77	A	1	0	**0.076**	0	0.7955	9.1049
00Yellowhawk	00AR	11	A		0.0215	0.061	0.0246	0.8194	9.4661
98Mill Cr.	98AL	43	A	4	0	**0.06**	0.0001	0.8366	9.7143
98Tucannon (Wild)	98AJ	13	A		0.0583	0.034	0.1386	0.8163	9.5654
99Tucannon (Wild)	99AG	22	A		0.0255	0.031	0.0015	0.816	9.0353
00Tucannon (Wild)	00AX	44	A		0	**0.073**	0	0.8258	9.7489
01Tucannon (Wild)	01AA	51	A		0	0.044	0.0006	0.8032	9.7279
02Tucannon (Wild)	01IE	37	A	1	0	0.044	0.0028	0.8164	9.8899
98Tucannon Hatch-origin	98AJ	22	A	1	0.0174	0.059	0.0028	0.8031	9.0636
99Tucannon Hatch-origin	99AG	24	A		0.1223	0.032	0.0014	0.8114	9.7679
99Lyon's Ferry Hatchery	99CN	47	J	2	0	**0.069**	0	0.7525	8.2949
Overall		1246				**0.063**		0.8076	9.7679

Appendix H, Table 3. Pairwise genotypic test result *P*-values from GENEPOP. The pairwise Chi square test estimated the probability that the two populations had significantly different distributions in genotypes. If *P*-value is above 0.0002 (*P*-value corrected for multiple simultaneous tests), genotypic distributions were not significantly different. Cells containing a dash had highly significant *P*-values: their Chi square value exceeded 100 (*P*-value = 0.0000). Hatchery is abbreviated H and Hatchery-origin is abbreviated HO.

Sample	00Dayton	99Dayton	00Coppei Cr.	00Robinson Cr.	00NF Touchet	99NF Touchet	99Wolf Fork	99SF Touchet	01Dayton	02Dayton	99Upper WW	98Upper WW
00Dayton (Touchet)												
99Dayton (Touchet)	-											
00Coppei Cr.	-	-										
00Robinson Cr.	-	0.00001	-									
00NF Touchet	0.0001	0.0021	-	-								
99NF Touchet	-	0.0037	-	-	-							
99Wolf Fork	-	0.257	-	-	-	-						
99SF Touchet	-	0.0217	-	-	-	-	-					
01Dayton (Touchet)	-	-	-	-	-	-	-	-				
02Dayton (Touchet)	-	-	-	-	-	-	-	-	0.005			
99Upper Wall Walla	-	0.0092	-	-	-	-	-	-	-	-		
98Upper Wall Walla	-	0.0005	-	-	-	-	-	-	-	-	0.202	
00Yellowhawk	0.042	-	-	-	-	-	-	-	-	-	-	-
98Mill Cr.	-	0.0063	-	-	-	-	-	-	-	-	-	-
98Tucannon (Wild)	0.00125	0.332	-	-	0.00005	0.00036	0.0002	-	0.107	0.241	0.0135	0.016
99Tucannon (Wild)	-	-	-	-	-	-	-	-	-	-	-	-
98Tucannon (HO)	-	-	-	-	-	-	-	-	-	-	-	-
99Tucannon (HO)	-	-	-	-	-	-	-	-	-	-	-	-
00Tucannon (Wild)	-	0.0004	-	-	-	-	-	-	-	-	-	-
01Tucannon (Wild)	-	-	-	-	-	-	-	-	-	-	-	-
02Tucannon (Wild)	-	0.0003	-	-	-	-	-	-	-	-	-	-
99Lyon's Ferry (H)	-	-	-	-	-	-	-	-	-	-	-	-
02Lyon's Ferry (H)	-	-	-	-	-	-	-	-	-	-	-	-

Table 3. continued

	00Yellow	98Mill Cr	98Tuc(W)	99Tuc(W)	98Tuc(HO)	99Tuc(HO)	00Tuc(W)	01Tuc(W)	02Tuc(W)	99LFH	02LFH
00Dayton (Touchet)											
99Dayton (Touchet)											
00Coppei Cr.											
00Robinson Cr.											
00NF Touchet											
99NF Touchet											
99Wolf Fork											
99SF Touchet											
01Dayton (Touchet)											
02Dayton (Touchet)											
99Upper Walla Walla											
98Upper Walla Walla											
00Yellowhawk											
98Mill Cr.	-										
98Tucannon (Wild)	0.00003	0.019									
99Tucannon (Wild)	-	-	-								
98Tucannon (HO)	-	-	0.0244	-							
99Tucannon (HO)	-	-	0.01589	-	0.00434						
00Tucannon (Wild)	-	-	0.710	-	0.121	-					
01Tucannon (Wild)	-	-	0.32	-	0.259	-	0.229				
02Tucannon (Wild)	-	-	0.369	-	0.062	-	0.724	0.726			
99Lyon's Ferry (H)	-	-	-	-	-	-	-	-	-		
02Lyon's Ferry (H)	-	-	-	-	-	-	-	-	-	-	

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Fish Program
Science Division

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U.S. Fish and Wildlife Service
Office of External Programs
4040 N. Fairfax Drive, Suite 130
Arlington, VA 22203