Hood River and Pelton Ladder Evaluation Studies and Hood River Fish Habitat Project

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HOOD RIVER AND PELTON LADDER
EVALUATION STUDIES
AND
HOOD RIVER FISH HABITAT PROJECT

ANNUAL PROGRESS REPORT

1998

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INTRODUCTION

The Hood River subbasin is home to four species of anadromous salmonids: chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*Oncorhynchus kisutch*), steelhead (*Oncorhynchus mykiss*), and sea run cutthroat trout (*Salmo clarki*). Indigenous spring chinook salmon were extirpated during the late 1960's. The naturally spawning spring chinook salmon currently present in the subbasin are progeny of Deschutes stock. Historically, the Hood River subbasin hatchery steelhead program utilized out-of-basin stocks for many years. Indigenous stocks of summer and winter steelhead were listed in March 1998 by National Marine Fisheries Service (NMFS) under the Endangered Species Act (ESA) as a “Threatened” Species along with similar genetically similar steelhead in the Lower Columbia Basin.

Measure 703(f)(5) of the Northwest Power Planning Council’s (NPPC) 1987 Fish and Wildlife Program recommended Bonneville Power Administration (BPA) investigate the feasibility of developing artificial production facilities for chinook salmon and steelhead in the Hood, Umatilla, Walla Walla, Grande Ronde, and Imnaha rivers (Northeast Oregon Hatchery Project). The Confederated Tribes of the Warm Springs Reservation of Oregon (CTWS) and the Oregon Department of Fish and Wildlife (ODFW) began the Hood River Production Master Plan process in 1988 under the planning umbrella of the Northeast Oregon Hatchery Project (NEOH). However, in 1991 the NPPC separated out and linked the Hood River portion of the NEOH to the Pelton Ladder Project on the Deschutes River. The Pelton Ladder Project converted an unused section of the fish ladder into a rearing facility for spring chinook salmon destined for the Hood.

In 1992, the NPPC approved the Hood River and Pelton Ladder Master Plans (O’Toole P. and ODFW 1991a and 1991b, and Smith and the Confederated Tribes of the Warm Springs Reservation of Oregon 1991) within the framework of the Columbia River Basin Fish and Wildlife Program and recommended adoption of a phased approach (e.g., evaluation studies, project implementation, and follow-up monitoring and evaluation studies). A comprehensive monitoring and evaluation (M&E) program was implemented in the Hood River subbasin in late 1991, including information on the life history and production of stocks of anadromous salmonids returning to the Hood River subbasin (Olsen et al. 1994). Information collected for the Hood River Production Program (HRPP) was used to prepare an environmental impact statement evaluating the HRPP's impact on the human environment (DOE and BPA 1996a and b).

The HRPP is jointly implemented by the CTWS and the ODFW. The primary goals of the HRPP are to (1) re-establish naturally sustaining spring chinook salmon using Deschutes River stock in the Hood River subbasin, (2) rebuild naturally sustaining runs of summer and winter steelhead in the Hood River subbasin, (3) maintain the genetic characteristics of the populations, (4) restore degraded fish habitat, and (5) contribute to tribal and non-tribal fisheries, ocean fisheries, and the NPPC's interim goal of doubling salmon runs. Data collected by the HRPP has been summarized annually in the following progress reports: Olsen et al., 1994; Olsen et al., 1995; CTWS and ODFW 1996; CTWS and ODFW January 1998; Olsen et al., December 1998; Lambert et al., December 1998; and this report.

The contract period for FY 98 was 1 October, 1997 through 30 September, 1998. Work implemented during FY 98 included (1) acclimation of hatchery spring chinook salmon and winter steelhead smolts, (2) spring chinook salmon spawning ground surveys on the West Fork Hood River (3) genetic analysis of steelhead and cutthroat [contractual service with the ODFW], (4) Hood River water temperature studies, (5) Oak Springs Hatchery (OSH) coded-wire tagging and clipping evaluation, (6) preparation of a draft copy of the Hood River Watershed Assessment and the Tribal Habitat Protection, Restoration, and Monitoring Plan, (7) early action habitat protection and restoration (8) Pelton Ladder evaluation studies, (9) management advice and guidance to BPA and ODFW engineering on HRPP facilities, and (10) preparation of an annual report summarizing project objectives for FY 98.

HOOD RIVER

ACCLIMATION

Introduction

The Hood River Production Master Plan (1991) originally called for acclimating half of the hatchery spring chinook salmon (*Oncorhynchus tshawytscha*) and summer steelhead (*Oncorhynchus mykiss*) smolts and none of the winter steelhead smolts prior to release into the Hood River subbasin. The remaining smolts were to be directly released into the subbasin. This approach was designed to evaluate the benefits associated with acclimation prior to implementing full acclimation for all species (Department of Natural Resources (CTWS) 1993). When the NPPC accepted the Hood River Production Master Plan in 1992, they strongly encouraged development of “facilities to acclimate all smolts to be released into the Hood River subbasin where it is feasible to provide such facilities” (NPPC 1992). Furthermore, the NPPC encouraged fishery managers to “use temporary and/or portable facilities wherever possible to reduce costs and facilitate their removal if monitoring and evaluation show them not to be needed”. Therefore, all hatchery produced spring chinook salmon and winter steelhead smolts have been acclimated and volitionally released since 1996 (Lambert et al. January 1998). In 1998, one permanent raceway was used for winter steelhead acclimation on the East Fork Hood River (20.5 rivermiles [Rm] from the Columbia River) and two portable acclimation raceways (21 Rm from the Columbia River) and one circular tank (Rm 26.5) were used for acclimating spring chinook salmon on the West Fork. The circular tank was a new addition in 1998.

Prior to spring chinook salmon juveniles being transported to the Hood River for acclimation, they were reared for about six months at Pelton Ladder. Pelton Ladder is located in the Deschutes River subbasin, at Rm 100 (**See Pelton Ladder Section, Figures 26 & 27**). Spring chinook salmon juveniles, for release into the Hood River, have been reared at Pelton Ladder since 1995-96 (Lambert et al. January 1998).

HRPP tribal staff have four key objectives for the acclimation project on the Hood River (Department of Natural Resources (CTWS) 1993):

1. Determine if acclimation significantly influences homing of spring chinook salmon and winter steelhead.

2. Determine if smolt outmigration is significantly higher for acclimated smolts than directly released smolts.

3. Determine if acclimated smolts result in a higher smolt to adult survival rate than directly released smolts.

4. Determine if outmigration timing is similar between hatchery acclimated smolts and naturally produced smolts.

Therefore, winter steelhead and spring chinook salmon were acclimated near primary spawning habitat with the intent that they would imprint and home back to their primary spawning areas. In addition, smolts were acclimated a minimum of four days prior to release from the acclimation ponds to reduce stress and improve survival (Schreck et al. 1989; Whitesel et al. 1994). Finally, hatchery winter steelhead and spring chinook salmon smolts were allowed to emigrate volitionally when physiologically and morphologically ready.

History Of Hatchery Releases For The HRPP

Prior to the acclimated release in 1996, all hatchery winter steelhead and spring chinook salmon smolts were directly released into the Hood River subbasin. The target hatchery production goal for the HRPP, during phase one of the project, was 125,000 spring chinook salmon smolts. Juvenile hatchery spring chinook salmon have been reared at Round Butte Hatchery (RBH) since the 1993 brood. Prior to the 1993 brood, spring chinook salmon juveniles were reared at Bonneville Hatchery. The numbers of hatchery spring chinook salmon (Deschutes River broodstock) smolts released into the West Fork Hood River were 46,445 (1991 brood year) and 170,004 (1993 brood year). No spring chinook smolts were released into the Hood River subbasin from the 1992 brood (Olsen et al., December 1998).

The target hatchery production goal for the HRPP, during phase one of the project, was 50,000 winter steelhead smolts. The numbers of hatchery winter steelhead (Hood River broodstock) smolts released into the East Fork Hood River ranged from 38,034 to 48,985 smolts for the 1992-1994 broods (Olsen et al., December 1998). Juvenile hatchery winter steelhead (Hood River broodstock) were reared at OSH.

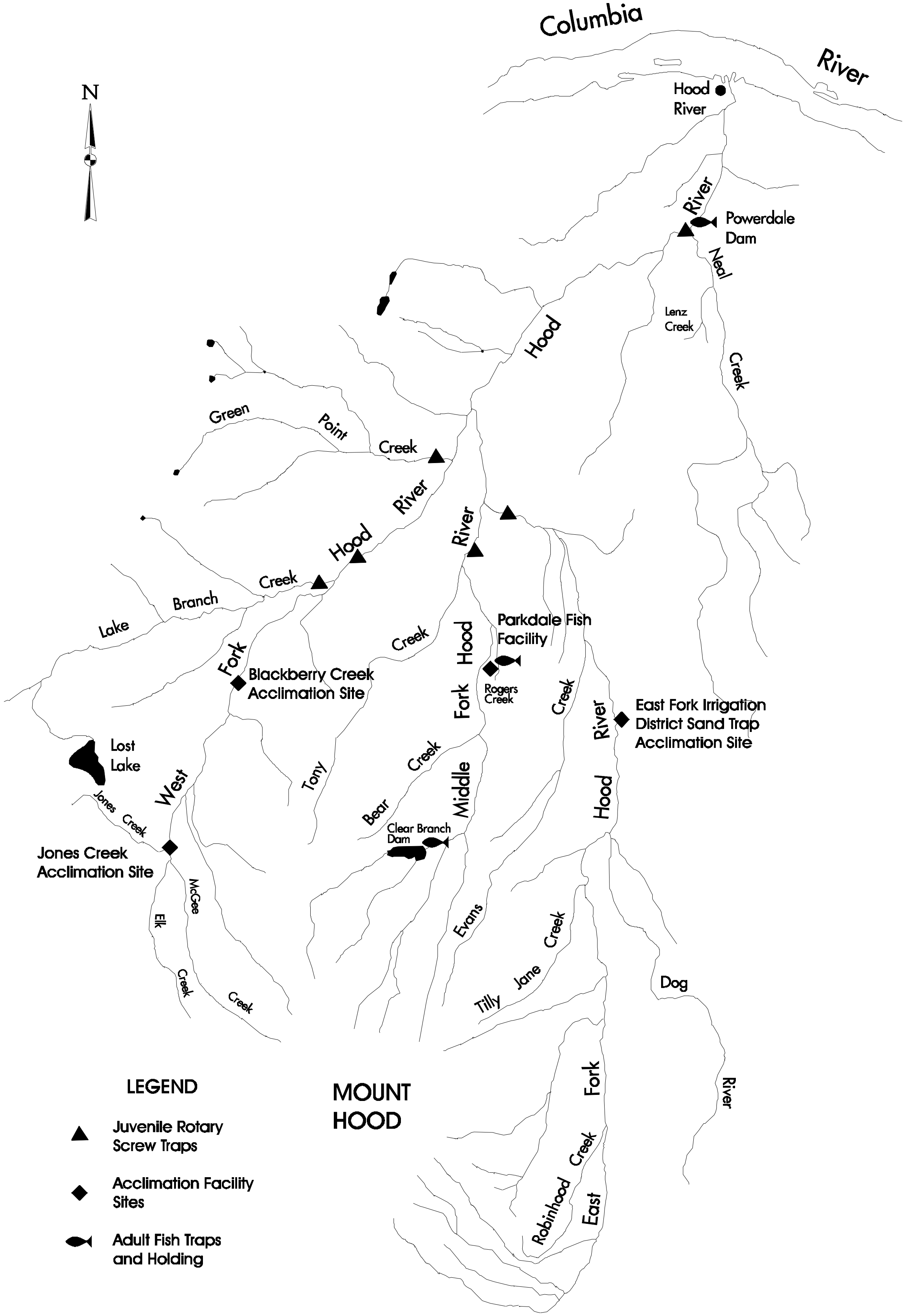


Figure 1. Project sites in the Hood River subbasin.

Methods

East Fork Acclimation Of Winter Steelhead

Hatchery winter steelhead smolts have been acclimated and volitionally released on the East Fork Hood River since 1996. In 1996, smolts were acclimated in a portable acclimation pond at Toll Bridge County Park (Lambert et al. January 1998). In 1997 and 1998 the East Fork Irrigation District's (EFID) sand trap (Rm 6.0) was used for acclimation (Figure 1). Permission was granted by the EFID to use the concrete raceway at no cost to this project. The CTWS modified the sand trap raceway for acclimation by inserting catwalks, channel irons and I-beams for screens and stop logs, and a baffle to disperse intake water (Figure 2).

Winter steelhead smolts were volitionally released from the concrete raceway using a stop log system. About 61,200 smolts at 6.9 fish/lb were released into the East Fork Hood River. The first group of 29,510 were transported from OSH on 7 April, to the acclimation site. They were released volitionally between 14-20 April. Group one non-migrants were left to acclimate with the second group. The second group of 31,707 arrived on 22 April and were held until their volitional release between 28 April-12 May and 1-4 June.

An acclimation caretaker was on site 24 hr/d. Dissolved oxygen, water temperature, and fish mortalities were recorded periodically during 1996-1998 acclimation (**Appendix Tables A-1, A-3 and A-5**). Winter steelhead smolts were fed minimally during the 1996 acclimation and taken off at least three days prior to release. During the 1997 and 1998 acclimation period, steelhead were not fed.

Winter steelhead smolts were weighed (g) and measured (mm) and condition factors calculated (weight [g] x 100/length^3 [mm]) prior to and after acclimation release. Smolts which remained in the acclimation raceway were enumerated by weighing total fish and figuring fish/lb, then hauled by truck in a portable liberation tank on 4 June and released at the mouth of the Hood River.

Post-acclimated smolts were sampled at a rotary screw trap by ODFW at Rm 4.5 on the mainstem Hood River (Figure 1). Outmigration timing was monitored

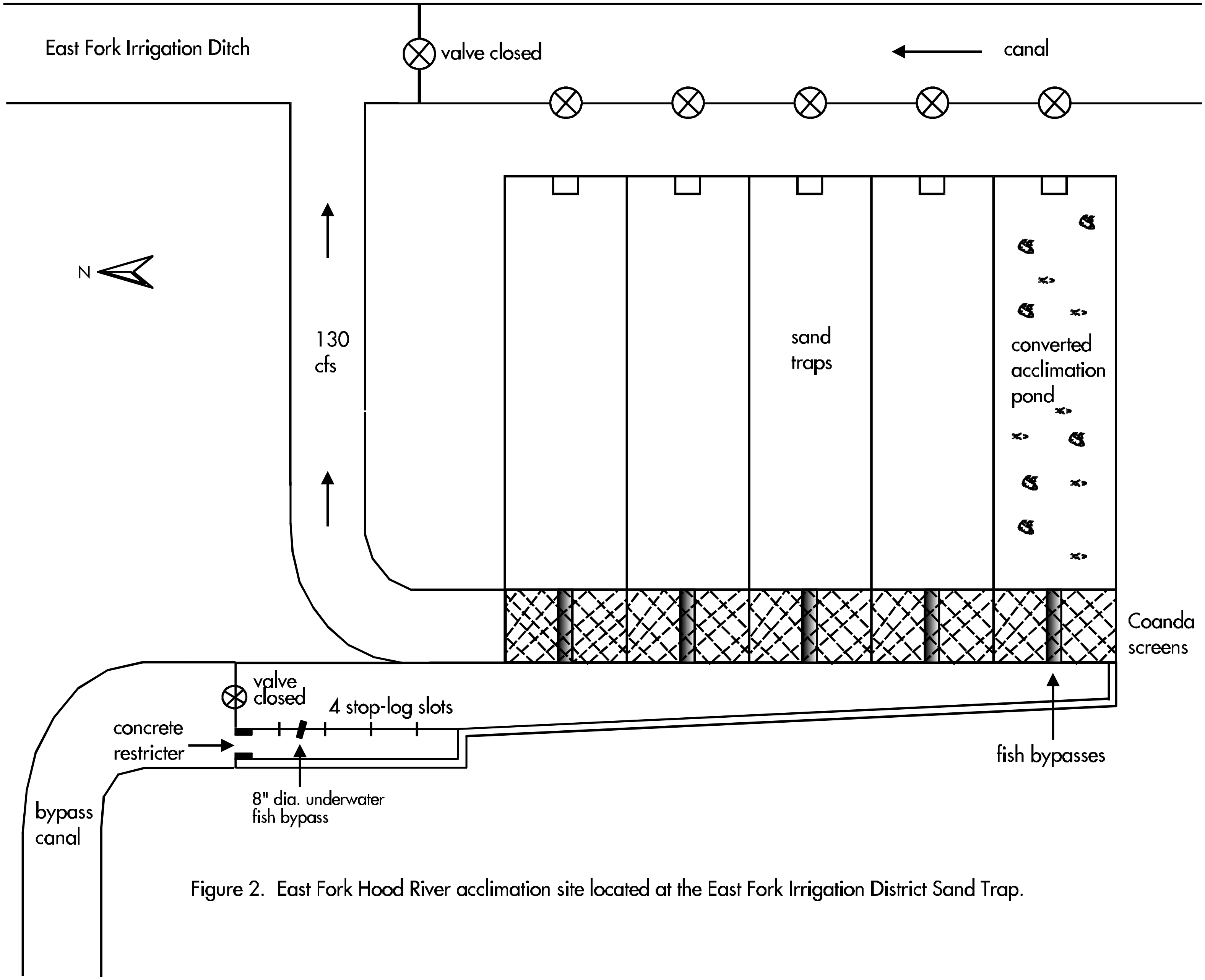


Figure 2. East Fork Hood River acclimation site located at the East Fork Irrigation District Sand Trap.

and smolt survival estimated. Comparisons were made between acclimated hatchery smolts and wild smolt migrants. All trapped fish were anesthetized, sorted by species, examined for fin marks, and counted. ODFW used mark and recapture methods to estimate the abundance of wild, natural, and hatchery produced anadromous salmonid smolts that migrated from the Hood River subbasin. A pooled Peterson estimate with Chapman's modification was used to estimate numbers of downstream migrants by species (Olsen et al., December 1998; Methods).

Outmigration timing was based on daily numbers at the migrant trap which were extrapolated using biweekly wild trapping efficiency numbers (**Appendix Table A-3**). In addition, smolt outmigration survival from the acclimated smolts were compared to non-acclimated smolts from previous releases.

Electrofishing surveys performed in the East Fork and nearby tributaries from 1996-1998 helped in evaluating residualism of hatchery winter steelhead releases. A three pass and two pass removal method was used to estimate population numbers (Olsen et al., December 1998; Methods). High flows and glacial turbidity within the Hood River subbasin have made it difficult to complete a thorough evaluation of steelhead residualism.

West Fork Acclimation Of Spring Chinook Salmon

Spring chinook salmon smolts were acclimated at two locations in the West Fork Hood River drainage: the Blackberry Creek (Rm 9.0) and Jones Creek (Rm 14.0) sites (Figure 1). Unlike the East Fork, water quality and quantity in the West Fork is considerably better because it is not as influenced by glacial runoff or irrigation withdrawal. However, the West Fork is in a remote canyon with no electricity, making acclimation set-up more difficult. At both acclimation sites, land ownership included both a private landowner and the US Forest Service (USFS) and required special use permits from both groups. A permit was also required from the Hood River County.

The Blackberry Creek location is an old rock quarry site near Dry Run Bridge and is within preferred spawning and rearing habitat. Two portable raceways were purchased from ModuTank, Inc in 1996 and have been used successfully at the Blackberry Creek site (Figure 3). The raceways have dimensions of 11'9" x 49'3" x 4'9" and a capacity of holding 19'500 gallons of water. Raceways were constructed of four foot galvanized steel panels bolted together, “L” braces and stainless steel cables for support, a 36 mil reinforced polypropylene liner and a six inch PVC bulkhead for draining the raceway. ODFW had also used this type of portable raceway successfully on the Siuslaw River (Lindsay et al. 1991-1994). Figure 4 shows a detailed diagram of the Blackberry Creek acclimation setup.

Assembly of the two ModuTank portable raceways and piping began each year in March and lasted 1-2 weeks to complete; ranging from 600-700 hrs of labor. Water for the raceways was diverted from Blackberry Creek, tributary of the West Fork, through a screened intake box and a 930 ft gravity flow pipeline of 8" pipe. The intake box dimensions were 2'6" x 2'5" x 1'9". There was about 38 ft of head differential between the intake box and the raceways. This provided approximately 348-378 gal/min of water into the east raceway (raceway one) and 374-390 gal/min into the west raceway (raceway two).

In addition, about 360 ft of 8" pipe was used for the return flow back to the West Fork Hood River. Control valves regulated water at the intake box, the junction of the two raceways, and at each raceway outlet. An elaborate bracing and support system for the pipeline took much of the assembly time. The base for the ponds required considerable filling with gravel and sand, leveling and compacting. Once the raceways were erected, a four foot high,

Figure 3. Acclimation raceways used for rearing spring chinook salmon smolts at the Blackberry Creek acclimation site.

six inch diameter PVC standpipe was connected to the outlet bulkhead of each raceway to control the water level. The standpipes were also used to release fish and to drain the raceways when needed. The raceways were covered with a fine mesh net to prevent fish from jumping out and to protect them from predators.

The Jones Creek acclimation site was new in 1998. This site was located at the upper end (elevation 2300 ft) of the West Fork Hood River (Figure 1). The West Fork reach of stream that Jones Creek flows into is a moderate terrace/hillslope confinement habitat type with a low stream gradient; and ideal spring chinook salmon habitat in the Hood River subbasin (**See Spring Chinook Salmon Spawning Ground Surveys**). At this location, a circular tank was used for acclimation (Figure 5). The tank was 10'0" diameter x 4'6" high and had a capacity of holding 2,344 gallons of water. Figure 6 shows a schematic of the Jones Creek acclimation site.

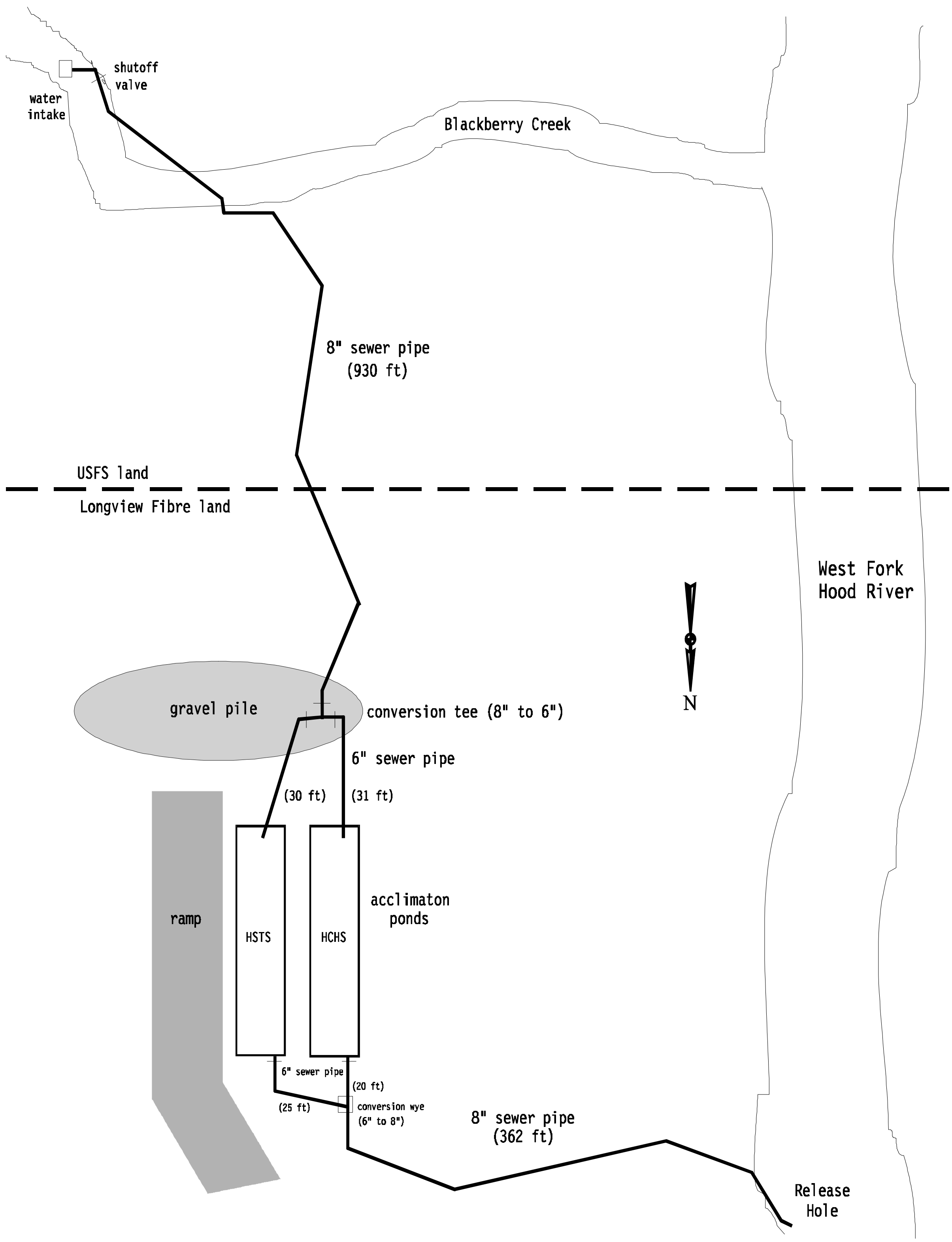


Figure 4. Schematic of the Blackberry Creek acclimation site (Rm 9.0) located near Dry Run Bridge.

Figure 5. Acclimation circular tank used for rearing spring chinook salmon smolts at the Jones Creek acclimation site.

Setup of the circular tank and piping lasted from 8 April to 11 April and took about 200 hours of labor. Water for the circular tank was diverted from Jones Creek through a screened intake box and a 680 ft gravity flow pipeline of 4" pipe. There was about 7 ft of head differential between the intake box and the top of the circular tank. This provided about 130 gal/min of water to the tank.

In addition, about 32 ft of 4" pipe was used for the return flow back to the West Fork Hood River. Control valves regulated water at the intake box and circular tank outlet. Once the circular tank was placed, a four ft high, diagonal, four inch diameter PVC standpipe was connected to the outlet hole to control the water level. The standpipe was also used to release fish and to drain the tank when needed. The tank was covered with a fine mesh net to prevent fish from jumping out and to protect them from predators.

At both locations, a battery operated flotation alarm system was attached to each raceway and circular tank. The alarm system sounded when the water level increased (i.e., plugged screen from fish mortalities or debris) or

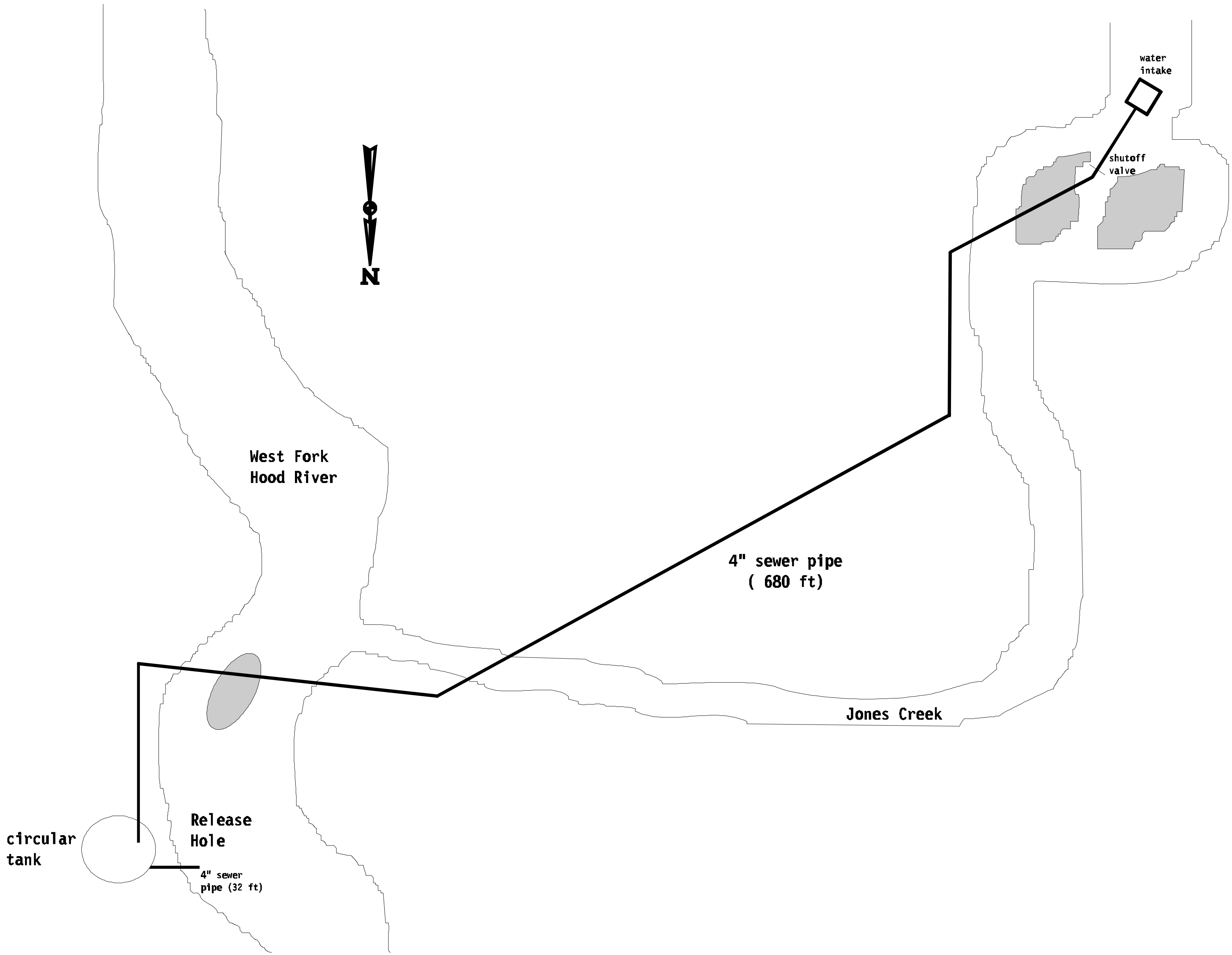


Figure 6. Schematic of the Jones Creek acclimation site, tributary to the West Fork (Rm 14.0).

decreased i.e., lack of water). The contact points of the alarm could be adjusted to trigger at various water depths. The float consisted of a 4'6" dowel with a Styrofoam float attached to the bottom. A rain gutter downspout encompassed the float, protecting it from waves in the raceway created by wind.

About 126,659 Deschutes River stock spring chinook salmon smolts averaging 9.7 fish/lb were acclimated in the West Fork Hood River. Spring chinook salmon smolts were acclimated in two separate groups to keep loading at acceptable levels. The first group of 62,929 smolts was transported from Pelton Ladder rearing cell four to the West Fork acclimation raceways between 1-2 April, 1998. These smolts were allowed to volitionally emigrate between 9-14 April, 1998. The second group of spring chinook smolts (63,730) was hauled from Pelton Ladder rearing cell five between 15-16 April, 1998. Of the 63,730 smolts, 8,245 were hauled to the Jones Creek site; acclimated until 22 April; then volitionally released. At the Blackberry Creek site, the second group (55,485), along with the remaining first group, were acclimated until 22 April, 1998; then volitionally released.

Smolts were volitionally released from the portable raceways and circular tank utilizing a new technique in acclimation. An aluminum hopper (or funnel) was constructed with a rectangular “V” shaped bottom, three vertical sides, one open side and the “V” bottom connected to a six inch diameter pipe. A V-shaped bottom allowed at least three inches of water to flow into the standpipe. The hopper dimensions were approximately two ft square by one ft high. During the volitional release, one section of standpipe was removed to lower the water level in the raceway to approximately a three ft depth. The hopper was placed on top of the remaining standpipe providing directional water flow and easier fish emigration.

A caretaker was on-site 24 hr/d. Dissolved oxygen, water temperatures, and fish mortalities were recorded periodically from 1996-1998 (**Appendix Tables A-2, A-4, and A-6**). Mean fork length (mm) and weight (g) were measured and condition factors (weight [g] x 100/length^3 [mm]) calculated for non-migrant spring chinook salmon smolts. Non-migrant smolts were forced out of the acclimation raceways and circular tank into the West Fork Hood River at the Jones Creek site on 27 April and 7 May at the Blackberry Creek site. Once hatchery spring chinook salmon smolts left the acclimation raceways, their temporal distribution was graphed and compared to smolts produced in the wild.

Downstream migrant anadromous salmonids were trapped by ODFW using a rotary screw trap located on the mainstem Hood River [Rm 4.5] (Figure 1). Outmigration timing was based on daily counts at the migrant trap and not adjusted for trapping efficiency. Low numbers of naturally produced spring chinook salmon smolts and poor survival of hatchery smolts from handling, resulted in no trapping efficiency for spring chinook salmon smolts.

Electrofishing surveys performed in the West Fork and nearby tributaries from 1996-1998 helped in evaluating residualism of hatchery spring chinook salmon releases (Olsen et al., December 1998 and ODFW, unpublished data, 1999). A three pass and two pass removal method was used to estimate population numbers (Olsen et al., December 1998; Methods). High flows and glacial turbidity within the Hood River subbasin has made it difficult to complete a thorough evaluation of spring chinook salmon residualism.

Results and Discussion

East Fork Acclimation Of Winter Steelhead

In 1998 a total of 62,136 Hood River stock hatchery winter steelhead smolts were acclimated and released between 7 April to 4 June. Of the 62,136 smolts, an estimated 61,217 emigrated volitionally, 919 non-migrants remained in the raceway and were hauled by truck and released into the mainstem Hood River. One mortality occurred during truck transport. Group one and two were acclimated seven days before release (Table 1).

ODFW estimated in 1996, 1997, and 1998 that 32,914 (73.3%), 48,661 (81.4%), and 47,530 (76,5%) acclimated and volitionally released smolts migrated passed the mainstem juvenile trap (Rm 4.5), respectively. Estimates of 1994 and 1995 trap catches of unacclimated smolts were 27.5% and 38.1% (Figure 7). Based on five years of data, acclimated and volitionally released smolts continue to migrate out of the subbasin at a higher rate than those which were directly released by hatchery truck (Figure 7).

Increased smolt outmigration of acclimated and volitional releases may be the result of fish having time to recover from stress after they were hauled in liberation trucks. Studies have shown with coho salmon (*O. kisutch*) (Schreck et al. 1989) and steelhead (*O. mykiss*) (Whitesel et al. 1994) that stress from transportation via hatchery truck can cause a marked physiological

Table 1. Hood River hatchery winter steelhead acclimated in the East Fork Hood River drainage, 1996-1998 releases. (Ad = adipose, LV = left ventral, RM = right maxillary, and LM = left maxillary)

Location, Release year, Release group	Fin mark	Date transferred to raceway	Number transferred to raceway	Fish/lb	Number of days acclimated	Mortalities[a]	Number[b] released
Toll Bridge Park,							
1996,							
Group 1	Ad-LV-RM	Apr 1-4	24,057	5.7	9-12	24 (2)	24,033
Group 2	Ad-LV-RM	Apr 22-24	26,965	5.0	8-10	94 (11)	26,871
EFID Sand Trap,							
1997,							
Group 1	Ad-LM	Apr 11-15	27,740	5.7	6-10	29 (15)	27,711
Group 2	Ad-LM	Apr 29	32,578	8.3	6	452 (5)	32,126
1998,							
Group 1	Ad-RM	Apr 7	29,510	5.2	7	0 (0)	29,510
Group 2	Ad-RM	Apr 21	32,626	7.5	7	0 (0)	32,626

[a] Mortalities from fish truck liberations are shown in parentheses. Of the total 481 mortalities in 1997, 442 were the result of sampling smolts which did not emigrate volitionally from the acclimation raceway.

[b] Of the total 50,904 released in 1996, 5,988 did not emigrate volitionally and were hauled and released into the lower mainstem Hood River. Of the total 59,837 released in 1997, 2,545 did not emigrate volitionally of which 2,103 were forced out into the East Fork Hood River. Of the total 32,626 released from group two in 1998, 919 (1 mort) did not emigrate volitionally and were hauled and released into the mainstem Hood River.

stress response. Schreck (1989) also found “fish not given adequate time to recover from the transport stress were less capable than unstressed fish of surviving in the wild”.

Hatchery winter steelhead smolt size at release has varied since the 1994 releases; ranging from 5.3 fish/lb to 6.9 fish/lb (Table 2). In addition, 1998 acclimated smolts varied between release groups. Group one averaged 5.2 fish/lb and group two was 7.5 fish/lb (Table 1). There is no correlation between size at release (Table 2) and percentage of smolts emigrating from the Hood River subbasin (Figure 7) for hatchery winter steelhead.

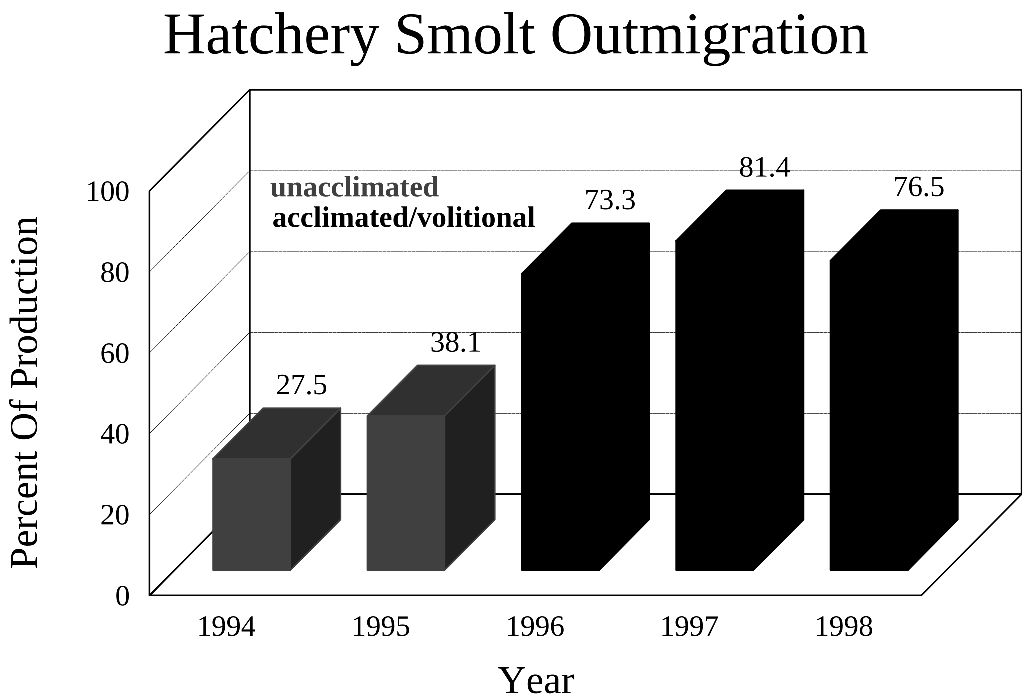


Figure 7. Percentage of the production released of hatchery winter steelhead smolts migrating past the mainstem Hood River juvenile migrant trap (Rm 4.5), 1994-1998 releases.

Hatchery winter steelhead at OSH were graded into two size groups, large (Group one) and medium (Group two). The two groups were reared in separate raceways at OSH. This allowed hatchery personnel to modify their feeding schedule and accelerate the growth of smaller juveniles so that the entire production group is more uniformly sized upon transfer to the Hood River subbasin. To keep the poundage at acceptable levels in the acclimation raceways, winter steelhead smolts were acclimated in two groups. The larger fish (Group one) were acclimated first, followed by the smaller fish (Group two). Group two remained at OSH on the modified feeding schedule for an additional three weeks. In 1996, group two was larger at size of release than group one, which differentiated from other release years.

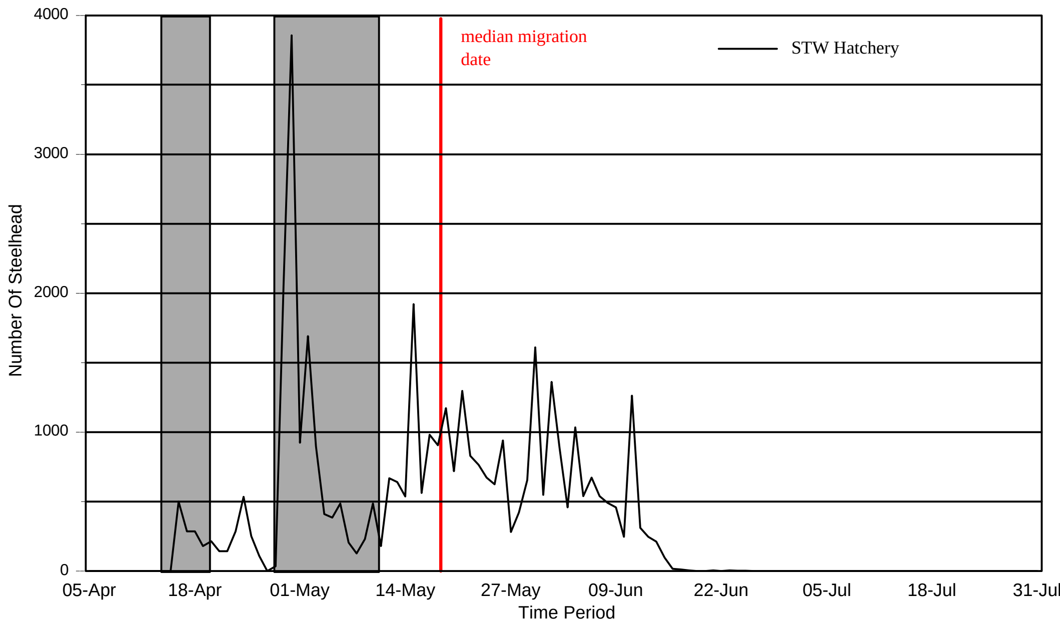
Table 2. Average size of release by year for hatchery winter steelhead smolts into the East Fork Hood River, 1994-1998.

Release Year	**Size (Fish/lb)**
1994	5.9
1995	5.4
1996	5.3
1997	6.9
1998	6.9

The mainstem Hood River rotary screw trap was operational by the 5th of April. Temporal distribution of hatchery winter steelhead and wild rainbow/steelhead smolts to the mainstem Hood River rotary screw trap (Rm 4.5) have been similar since acclimation began in 1996 (Figure 8; **See Appendix Figures A-1 and A-2**). In 1998, the median date of arrival of hatchery smolts, at the mainstem rotary screw trap, was 18 May compared to 2 May for wild rainbow/steelhead. The median migration dates since 1996 for hatchery and wild smolts have ranged from 9 May-18 May and 2 May-19 May respectively. The mainstem rotary screw trap for 1998 was not operated on 9-10 April and 12 April because of high numbers of hatchery steelhead and spring chinook salmon releases.

No hatchery winter steelhead smolts were recovered in the mainstem and East Fork Hood River tributaries during electro-fishing surveys from 1996 to 1998 (Olsen et al., December 1998 and ODFW, unpublished data, 1999). High flows and glacial flour in the East Fork Hood River from 1996 to 1998 did prevent electro-fishing surveys to assess the impact of hatchery steelhead on wild production. In 1994 and 1995 hatchery winter steelhead were found while electro-fishing Rm 0.5 and 5.5 on the East Fork Hood River. In addition, hatchery steelhead smolts were recovered in Neal Creek (tributary to the mainstem Hood River) in 1994 sampling (Olsen et al., January 1998).

The condition factor for volitional migrants averaged 0.96 versus 1.03 for smolts which did not volitionally migrate and remained in the acclimation raceway (Table 3).



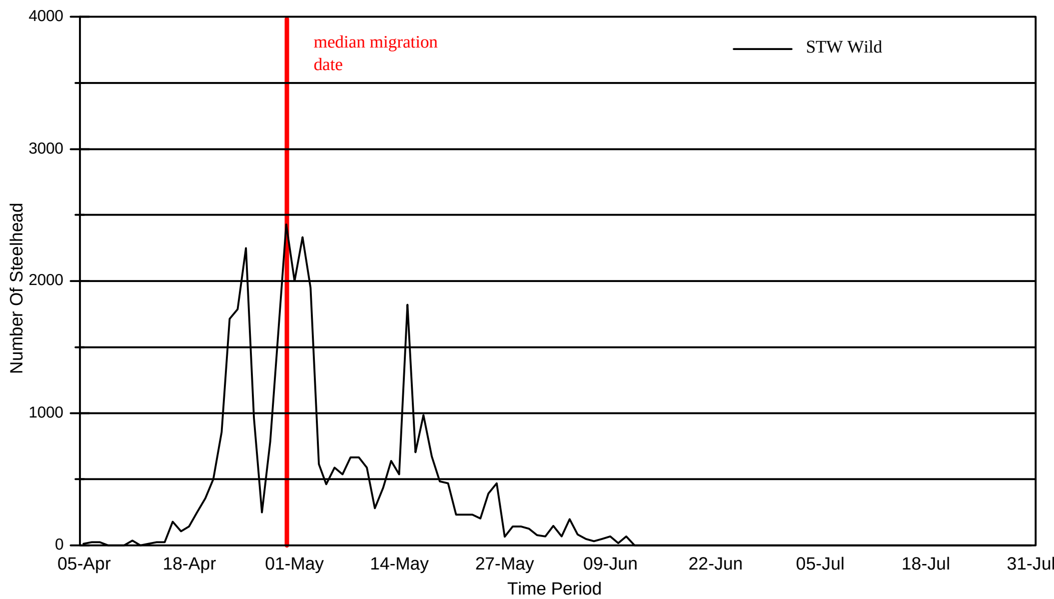


Figure 8. Migration timing of hatchery winter steelhead and wild rainbow/steelhead at the mainstem Hood River rotary screw trap, 1998 migration year. The trap was not operational on 9-10 April and 12 April. Numbers were adjusted for trapping efficiency. The shaded portion represents timing of volitional releases from the East Fork Hood River acclimation raceways.

Table 3. Mean condition factors for hatchery winter steelhead volitional migrants collected in the mainstem Hood River juvenile rotary screw trap and forced out migrants which remained in the acclimation raceway, 1996-1998.[a]

Location, release year, migrant group	N	Mean	Range	95% C.I.
Toll Bridge Park,				
1996,				
Volitional migrants	274	0.96	0.80 - 1.28	± 0.01
Forced migrants	207	1.00	0.84 - 1.15	± 0.01
EFID Sand Trap,				
1997,				
Volitional migrants	647	0.99	0.57 - 1.30	± 0.01
Forced migrants	212	0.99	0.65 - 1.33	± 0.06
1998,				
Volitional migrants	1537	0.96	0.65 - 1.47	± 0.01
Forced migrants	200	1.03	0.79 - 1.45	± 0.06

[a] Condition factor was estimated as (weight [g] * 100/length^3 [mm].

West Fork Acclimation Of Spring Chinook Salmon

A total of 126,860 Deschutes River stock hatchery spring chinook salmon smolts were transferred by truck to the West Fork Hood River in 1998 (Table 4). Of the 126,860 smolts, 124,783 were acclimated and allowed to leave volitionally; a small portion of smolts did not emigrate and were forced out of the raceways at the end of acclimation. An estimated 2,077 smolts died in the raceways, most showed outward signs of bacterial kidney disease. At the Blackberry Creek acclimation site, smolts in group one were acclimated 8-9 days and 7-8 days for group two prior to release. At the Jones Creek site, smolts were acclimated 6 days prior to release (Table 4).

At the Blackberry Creek acclimation site, group one loading in the east raceway (raceway one) and west raceway (raceway two) at time of transfer was 8.5 lbs/gpm (1.4 lbs/cu ft) [Table 5]. Considering the lack of information on non-migrants for group one, it was impossible to accurately calculate loading in the raceways for group two at Blackberry Creek. The loading for the circular pond at Jones Creek for group two was 6.5 lbs/gpm (2.7 lbs/cu ft).

Table 4. Deschutes River stock spring chinook salmon acclimated in the West Fork Hood River drainage, 1996-1998.

Location, Release year, Release group[a],	Fin mark	Date transferred to raceways	Number transferred to raceways	Fish/lb	Number of days acclimated	Mortalities[b]	Number released
Blackberry Creek,							
1996,							
Group 1	Ad-RV	Apr 8-10	85,080	10.1	6-8	180 (124)	84,900
Group 2	Ad-RV	Apr 22-23	44,838	9.5	7-8	527 (40)	44,311
1997,							
Group 1	Ad-LV	Apr 7-8	46,446	8.0	6-7	679 (77)	45,767
Group 2	Ad-LV	Apr 16-17	56,380	8.4	4-5	1054 (279)	55,326
1998,							
Group 1	Ad-RV	Apr 1-2	63,130	9.78	8-9	1073 (201)	62057
Group 2	Ad-RV	Apr 15-16	55,485	9.7	7-8	944	54541
Jones Creek,							
1998,							
Group 2	Ad-RV	Apr 16	8,245	9.7	6	60	8,185

[a] Group one was transferred from Pelton Ladder cell number four and group two was transferred from Pelton Ladder cell number five.

[b] In parentheses is mortalities from fish truck liberations.

Hatchery spring chinook salmon smolts were released starting 9 April for group one and 22 April for group two. Figure 8 shows the 1998 spring chinook salmon smolt outmigration timing at the mainstem Hood River rotary screw trap (Rm 4.5). During the 1998 hatchery smolt outmigration, very few acclimated group one fish moved out of the Hood River subbasin during the first release. Upon release of group two hatchery smolts along with leftover group one non-migrants, there was a large peak in outmigration on 24 April, with a more gradual outmigration through to 11 May (Figure 8). Typically, when hatchery spring chinook salmon smolts have been released in the West Fork Hood River, they have moved out of the system very quickly. For example, the 1996 outmigration figure shows three large peaks, one following each volitional release (**Appendix Figure A-3**). Although, in 1997 the hatchery spring chinook salmon outmigration was slightly more gradual (**Appendix Figure A-4**). In 1998, the rotary screw trap was not operated between the 9-10 April or 12 April. An outbreak of bacterial kidney disease weakened hatchery smolts, making it difficult to mark for trap efficiency. Therefore, no estimate was collected by ODFW for the number of spring chinook salmon smolts leaving the subbasin. Very few (32 total) wild spring chinook salmon smolts were captured in the mainstem screw trap during 1998. A total of 66 wild smolts were captured in 1997 and 22 in 1996.

Table 5. Raceway loading and water intake in the portable raceways and circular pond during spring chinook salmon smolt acclimation, West Fork Hood River tributaries, 1996-1998.

Location, Pond type, Release year, Release group[a]	Raceway loading	Raceway water intake (gpm)
Blackberry Creek,		
East raceway,		
1996,		
Group 1	10.6 lbs/gpm (1.6 lbs/cu ft)	351
Group 2	10.6 lbs/gpm (1.6 lbs/cu ft)	351
1997,		
Group 1	8.3 lbs/gpm (1.2 lbs/cu ft)	348
1998,		
Group 1	8.5 lbs/gpm (1.4 lbs/cu ft)	371
West raceway,		
1996,		
Group 1	11.9 lbs/gpm (2.1 lbs/cu ft)	401
Group 2	2.1 lbs/gpm (0.6 lbs/cu ft)	401
1997,		
Group 1	7.8 lbs/gpm (1.3 lbs/cu ft)	374
1998,		
Group 1	8.5 lbs/gpm (1.4 lbs/cu ft)	390
Jones Creek,		
Circular pond,		
1998,		
Group 2	6.5 lbs/gpm (2.7 lbs/cu ft)	130

[a] Group one was transferred from Pelton Ladder cell #4 and group two was transferred from Pelton Ladder cell #5.

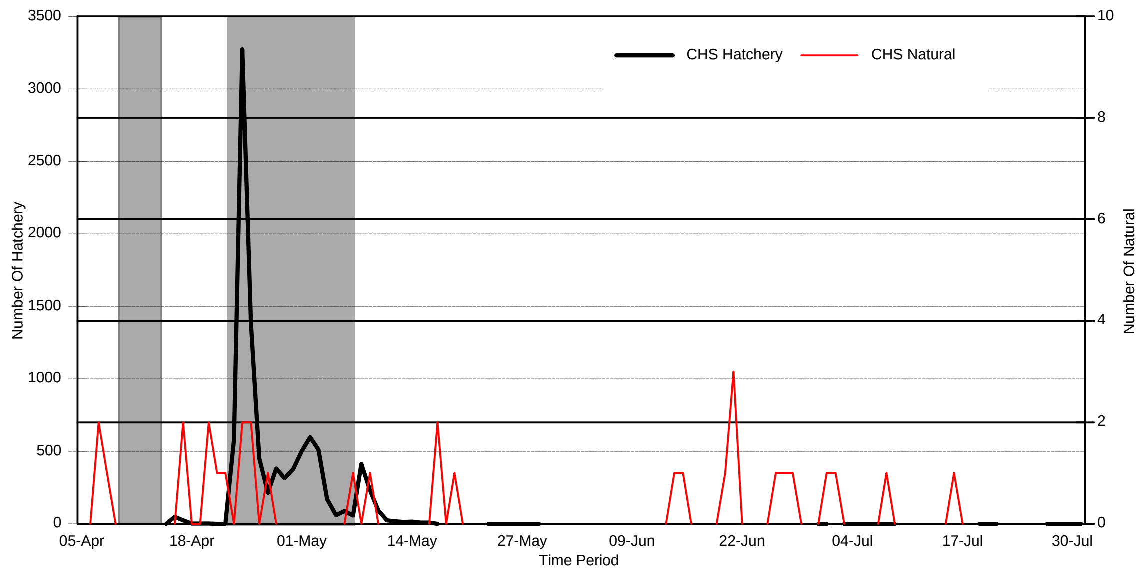


Figure 9. Migration timing of hatchery and naturally produced spring chinook salmon smolts at the mainstem Hood River rotary screw trap, 1998 migration year. The trap was not operational on 9-10 April and 12 April. Numbers were not adjusted for trapping efficiency. The shaded portion represents the timing of the volitional release from the West Fork Hood River acclimation raceways.

No hatchery spring chinook salmon smolts were recovered while electro-fishing the West Fork Hood River tributaries from 1996 to 1998 (Olsen et al., December 1998 and ODFW, unpublished data, 1999). High flows and glacial flour prevented HRPP staff from electro-fishing the West Fork Hood River mainstem in 1996-1998 to assess the impact of hatchery spring chinook salmon on wild and natural spawning production.

Recommendations

Hatchery steelhead and spring chinook salmon smolts which do not volitionally migrate should be transported and released below Powerdale Dam (Rm 4.5). Releasing non-volitional migrants below Powerdale Dam will eliminate potential competition with wild and naturally produced juveniles and resident trout in the Hood River subbasin.

Poor visibility and higher flows on the West Fork and East Fork Hood River have made it difficult to complete electrofishing and snorkeling surveys To assist in evaluating residualism of hatchery winter steelhead and spring chinook salmon smolts, surveys should be completed in late September or early October when glacial silt decreases from cooler air temperatures and flows are still minimum. Man-power and project time constraints have prevented this task from being completed.

SPRING CHINOOK SALMON SPAWNING GROUND SURVEYS

Introduction

The West Fork Hood River extends approximately twenty miles from the base of Mt. Hood to the mainstem Hood River. The native run of spring chinook salmon which utilized the West Fork has been extinct since the mid-1960's (O'Toole and ODFW 1991). In an effort to reestablish spring chinook salmon into the Hood River subbasin, the Oregon Department of Fish and Wildlife (ODFW) began direct releases of Carson stock spring chinook salmon into the West Fork in 1986 and later switched to Deschutes stock in 1991 (Olsen et al. 1995). In 1996, as part of the Hood River Production Program (HRPP), the Confederated Tribes of Warm Springs (CTWS) began acclimating and volitionally releasing Deschutes stock spring chinook salmon (CTWS and ODFW, December 1998).

The HRPP began extensive spring chinook salmon spawning surveys on the West Fork in 1997. The objective of these surveys is to develop baseline information for:

1. spawning distribution and abundance
2. spawn timing
3. prespawning mortality and fish health
4. spawner origins and sex ratios

Data gathered from these surveys, combined with upper West Fork spawning data gathered by the U.S. Forest Service (USFS) from 1992-95 (**Appendix Table B-1**) and telemetry data gathered by ODFW in 1994 and 1995 (Olsen et al. 1995; ODFW and CTWS 1996), will be used to evaluate supplementation and the effects of acclimating and volitionally releasing Deschutes stock spring chinook salmon into the Hood River subbasin; and to help determine how the West Fork can best be utilized for natural production of spring chinook salmon.

Methods

During 1998, the geographic distribution, timing, and magnitude of natural spawning was documented for the West Fork Hood River. Survey index areas and timing of surveys were developed based on prior spring chinook spawning surveys (USFS, unpublished data 1992-1995); ODFW radio telemetry distribution surveys (Olsen et al. 1995; ODFW and CTWS 1996); run timing and abundance data collected by ODFW at the Powerdale Dam fish trap (ODFW and CTWS 1998); and stream reconnaissance. As a result of this information, the West Fork Hood River was divided into nine index areas (Figure 10):

- #1 - Punchbowl Falls (Rm 0.0-Rm 0.25). From the confluence of the West Fork and the mainstem Hood River to Punchbowl Falls.
- #2 - Moving Falls (Rm 0.25-Rm 2.5). From immediately above Punchbowl Falls to immediately below the fish ladder at Moving Falls.
- #3 - Moving Falls/Dee Diversion (Rm 2.5-Rm 6.1). From immediately below the fish ladder at Moving Falls to the Dee Irrigation diversion head works.
- #4 - Lake Branch (Rm 0.0-Rm 0.8). From the confluence of Lake Branch Creek and the West Fork to Rm 0.8 of Lake Branch Creek.
- #5 - Dee diversion/Dry Run (Rm 6.1-Rm 8.2). From the rapids directly above the Dee Irrigation diversion headworks to Dry Run Bridge.
- #6 - Dry Run/Red Hill (Rm 8.2-Rm 11.3). From Dry Run Bridge to Red Hill Creek.
- #7 - Red Hill/Ladd (Rm 11.3-Rm 13.1). From Red Hill Creek to Ladd Creek.
- #8 - Ladd (Rm 13.1-Rm 14.0). From Ladd Creek to the confluence of Elk and McGee Creeks.
- #9 - McGee (Rm 0.0-Rm 1.0). From the mouth of McGee Creek to RM 1.0 of McGee Creek.

All index areas were surveyed, except index area seven, every two weeks from 3 August, 1998 to 26 October, 1998 with assistance from ODFW. Index area seven was excluded from bi-monthly surveys due to high turbidity. This area was later surveyed on 21 October when turbidity loads caused by glacial waters decreased from Ladd Creek. Surveys generally required a crew of two and were conducted downstream by foot. Narrow canyon walls provided poor access in indexes three through six and required dry suits for swimming portions of these areas. Surveys began prior to any evident spawning activity and continued until no spawning activity was apparent.

General daily field notes included date, survey crew initials, start/end time of survey, water temperature(EF), and visibility into water (high>6', 3'>moderate<6', low<3'). Redds, carcasses, and live fish were counted and recorded along with the accompanying rivermile. Rivermiles were initially mapped manually then later derived by map wheel using USGS and Water Resources maps.

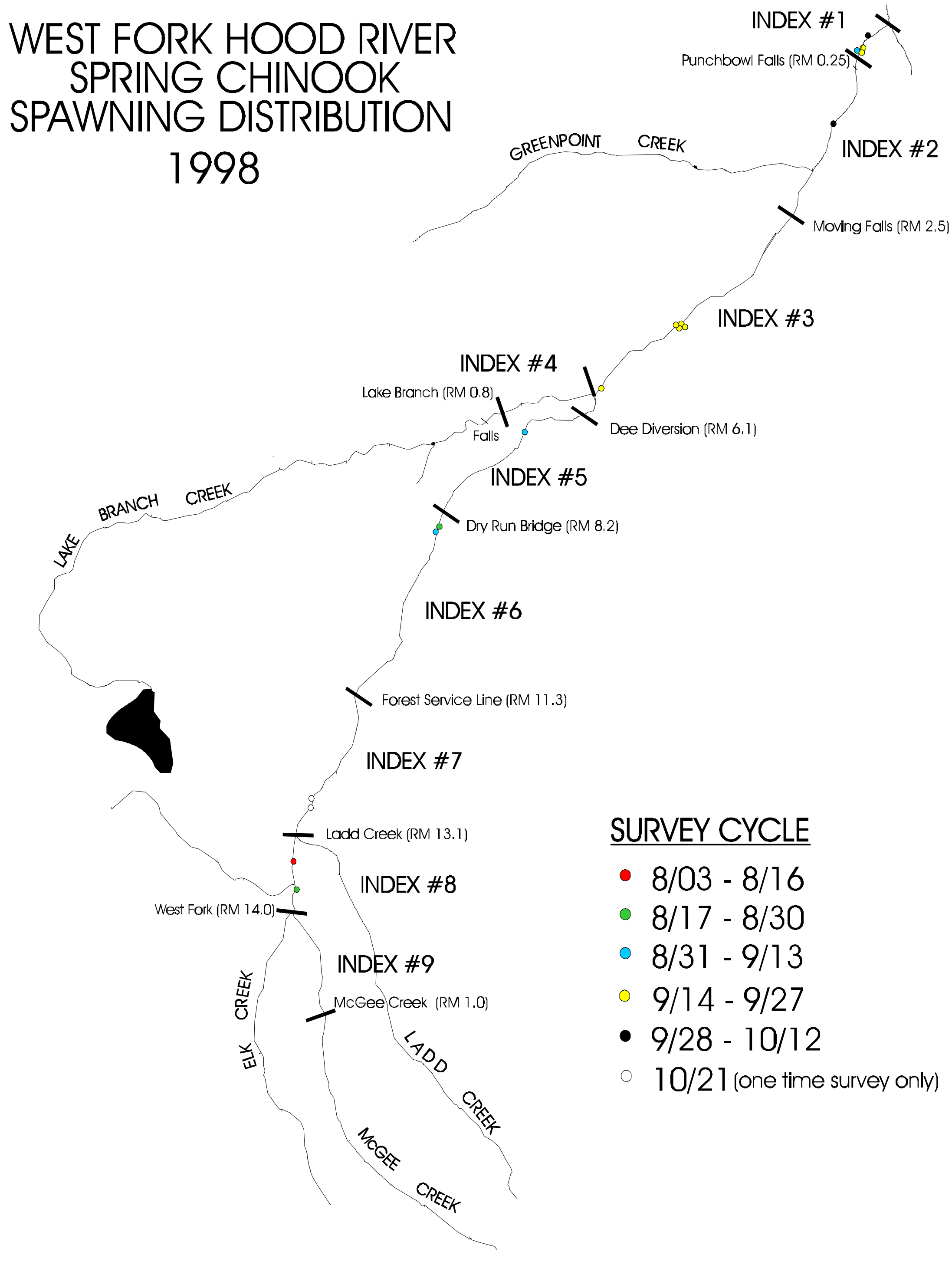


Figure 10. Survey index areas and redd locations by date, 1998.

Redds were flagged on the adjacent streambank with the date and surveyors initials which allowed the identification of old and new redds. Carcasses were examined for fin marks, sexed, measured to the nearest fork and MEPS (middle eye-posterior scale) length, and checked for Bacterial Kidney Disease and spawning success. Snouts were removed from carcasses with missing fins for the purposes of coded wire tag recovery. Scales were collected from non-Floy-tagged carcasses and were archived for later use. Finally, the caudal peduncle was severed from carcasses to indicate which fish had been sampled.

Results And Discussion

Spring chinook salmon spawning occurred throughout the West Fork Hood River from 13 August to 29 September. Peak spawning occurred in 1998 between 14 September and 27 September (Table 6), compared to 19 August through 15 September in 1997 (Table 7). In 1998, seventeen spring chinook salmon redds were documented in the surveyed index areas (Table 6). Similar to 1997, in 1998 the greatest spawning activity occured in index area one (16 redds and 4 carcasses/mile) and index area eight (2.2 redds and 4.4 carcasses/mile)[Table 8]. No redds were documented in index area four (Figure 10), down from six redds in 1997 (**Appendix Figure B-1**).

Table 6. Spring chinook salmon redd counts by index area and dates surveyed on the West Fork Hood River. 1998.

DATE	INDEX AREAS									
	Index 1[a]	Index 2	Index 3	Index 4	Index 5	Index 6	Index 7[b]	Index 8[c]	Index 9	**TOTAL**
8/03-8/16	0	0	0	0	0	0	-	1	0	**1**
8/17-8/30	0	0	0	0	0	1	-	1	0	**2**
8/31-9/13	1	0	0	0	1	1	-	0	0	**3**
9/14-9/27	2	0	5	0	0	0	-	0	0	**7**
9/28-10/12	1	1	0	0	0	0	-	0	0	**2**
10/13-10/26	0	0	0	0	0	0	2	0	0	**2**
TOTAL	**4**	**1**	**5**	**0**	**1**	**2**	**2**	**2**	**0**	**17**

[a] Last redds surveyed on 9/29/98 in index areas one and two.
[b] Redd count survey on 10/21/98 only.
[c] First redd surveyed on 8/13/98 in index area eight.

Table 7. Spring chinook salmon redd counts by index area and dates surveyed on the West Fork Hood River. 1997.

DATE	INDEX AREAS									
REDDS	Index 1	Index 2[a]	Index 3	Index 4	Index 5	Index 6	Index 7[b]	Index 8	Index 9	**TOTAL**
8/05-8/18	0	-	0	0	0	0	-	0	0	**0**
8/19-9/01	1	-	3	6	0	1	-	7	0	**18**
9/02-9/15	3	-	2	0	1	3	-	4	1	**14**
9/16-9/29	1	-	1	0	0	1	-	2	0	**5**
9/30-10/15	0	-	0	0	0	0	-	0	0	**0**
TOTAL	**5**	**-**	**6**	**6**	**1**	**5**	**3**	**13**	**1**	**40**

[a] Surveys not conducted in 1997 for index area two.
[b] Redd count surveys on 8/7/97 and 10/23/97 only.

Table 8. Spring chinook salmon redds and carcasses per mile and percentage of total redds and carcasses by index area in the West Fork Hood River. 1998.

Statistic	INDEX AREA									
	Index 1	Index 2	Index 3	Index 4	Index 5	Index 6	Index 7[a]	Index 8	Index 9	**West Fork**
redds/ mile	16	4	1.4	0	.5	.6	1.1	2.2	0	**1.1**
%of redds	23.5%	5.8%	29.4%	0%	5.8%	11.7%	11.7%	11.7%	0%	
carcasses /mile	4	0	0	0	0	.3	0	4.4	0	**.37**
%of carcasses	16.6%	0%	0%	0%	0%	16.6%	0%	66.6%	0%	

[a] Surveyed on 10/21/98 only.

The 1998 adult spring chinook salmon count at Powerdale Dam was 101 fish, including 50 females and 51 males. Forty-two spring chinook salmon were taken for broodstock, one hatchery fish was recycled to the mouth of Hood River and one mortality was recorded at the fish ladder. The remaining 25 females and 32 males were passed upstream to spawn naturally. Of these 57 fish, 47 were naturally reproduced and 10 were of hatchery origin (Table 9).

Table 9. Disposition, sex, and origin of spring chinook salmon adult return to Powerdale dam. 1998.

DISPOSITION	ORIGIN				TOTAL
	NATURALLY REPRODUCED		HATCHERY		
	Male	Female	Male	Female	
Passed above dam	29	18	3	7	**57**
Broodstock	15	19	3	5	**42**
Mortality			1		**1**
Recycled to mouth				1	**1**
TOTAL	**44**	**37**	7	**13**	**101**

All spring chinook salmon jacks and adults (except mini-jacks) passed over Powerdale Dam were inserted with a visible Floy-tag at the base of the dorsal fin. Two Floy-tags were retrieved from carcasses during our surveys. Information derived from 1997 & 1998 tags shows no correlation between run timing at Powerdale Dam and spawner distribution on the West Fork (Figure 11). In Figure 11, Lake Branch fish recoveries were all designated as West Fork Hood River (Rm 5.5) and the West Fork was extended beyond rivermile 14 to include McGee Creek. Furthermore, floy tag information for 1998 showed a median of 109 days to spawn, with 87 and 131 days to spawn (Figure 12). Floy tag data, from the 1992 and 1993 USFS spawning ground surveys, are included in Figure 12 with median days to spawn at 94.3 and 87.8, respectively.

Six carcasses were recovered throughout the West Fork Hood River and its tributaries of which two were unmarked and four were unknown. Two of the carcasses were female, one was male, and three were unknown (skin only) for a female to male ratio of 2:1 (Table 10). Four of the carcasses were recovered within index area eight, one in index area six, and one in index area one (Table 11). No coded wire tags were recovered for 1998. No bacterial kidney disease was found and all fish appeared to have spawned completely.

Figure 11. Correlation between date spring chinook salmon were Floy-tagged at Powerdale Dam and the recovery location by rivermile of these fish in the West Fork Hood River. 1997-98.

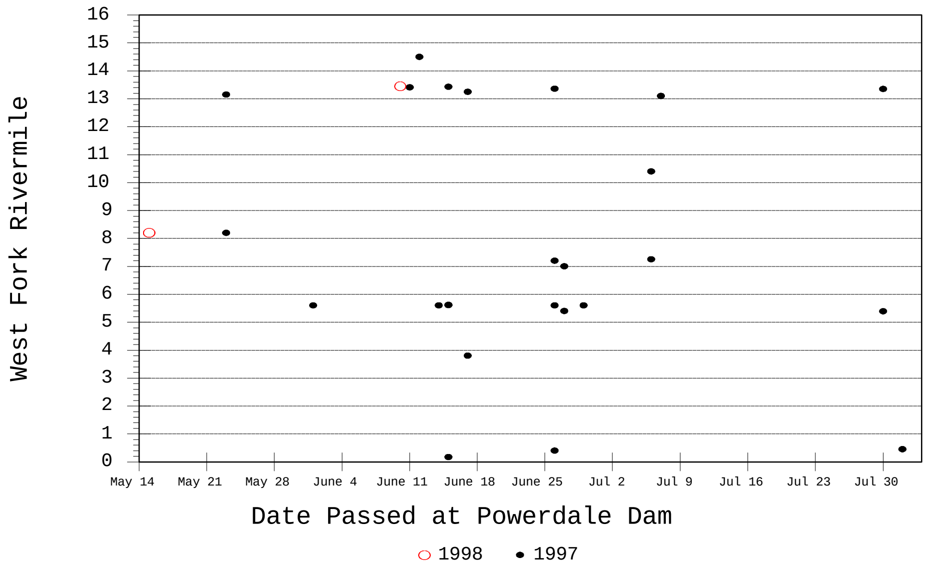


Figure 12. Number of days between the date spring chinook were Floy-tagged at Powerdale Dam and the date recovered. 1997-98.

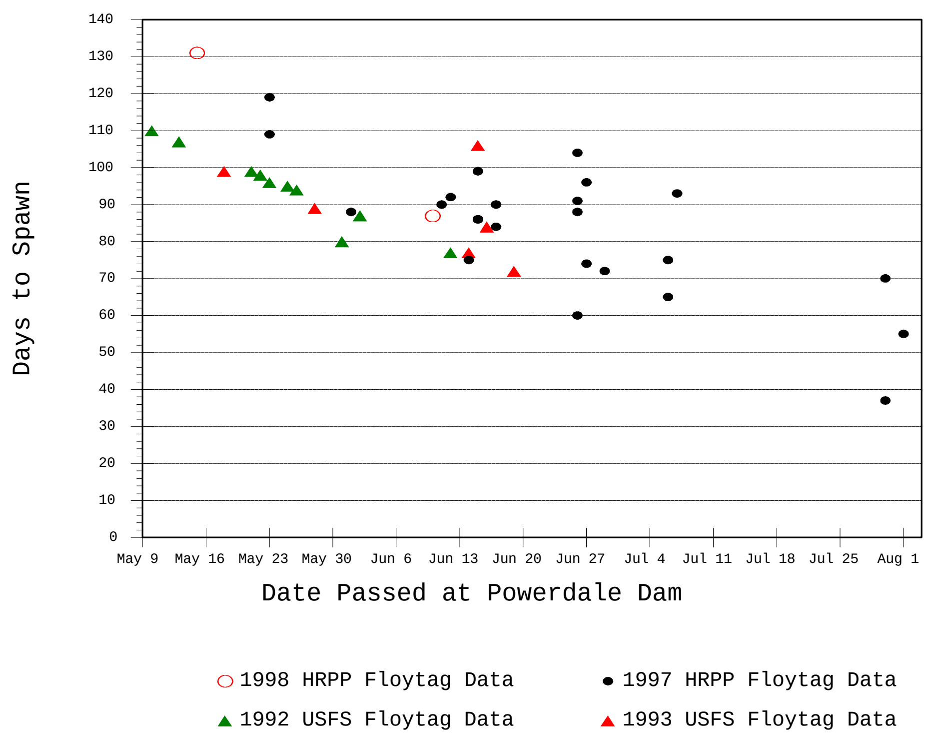


Table 10. Number of spring chinook carcasses collected during spawning surveys by sex and origin. 1998.

PRODUCTION ORIGIN	SEX			TOTAL
	Male	Female	Unknown	
Natural	1	1		**2**
Hatchery				**0**
Unknown		1	3	**4**
TOTAL	**1**	**2**	**3**	**6**

Table 11. Spring chinook salmon carcass counts by index area and dates surveyed on the West Fork Hood River. 1998.

DATE	INDEX AREAS									
	Index 1	Index 2	Index 3	Index 4	Index 5	Index 6	Index 7[a]	Index 8	Index 9	**TOTAL**
8/03-8/16	0	0	0	0	0	0	-	0	0	0
8/17-8/30	0	0	0	0	0	0	-	4	0	4
8/31-9/13	0	0	0	0	0	0	-	0	0	0
9/14-9/27	0	0	5	0	0	1	-	0	0	1
9/28-10/12	1	0	0	0	0	0	-	0	0	1
10/13-10/26	0	0	0	0	0	0	0	0	0	0
TOTAL	1	0	0	0	0	1	0	4	0	6

[a] Carcass count survey on 10/21/98 only.

Recommendations

Two passage problem areas exist on the West Fork and need to be monitored. Punchbowl Falls fish ladder (Rm 0.25) should be cleaned of sand and gravel each spring prior to the arrival of spring chinook salmon, and subsequently inspected throughout the summer. The Dee Irrigation District diversion should be monitored as a potential barrier to spring chinook salmon, especially during low water years.

Hood River Water Temperature Study

Introduction

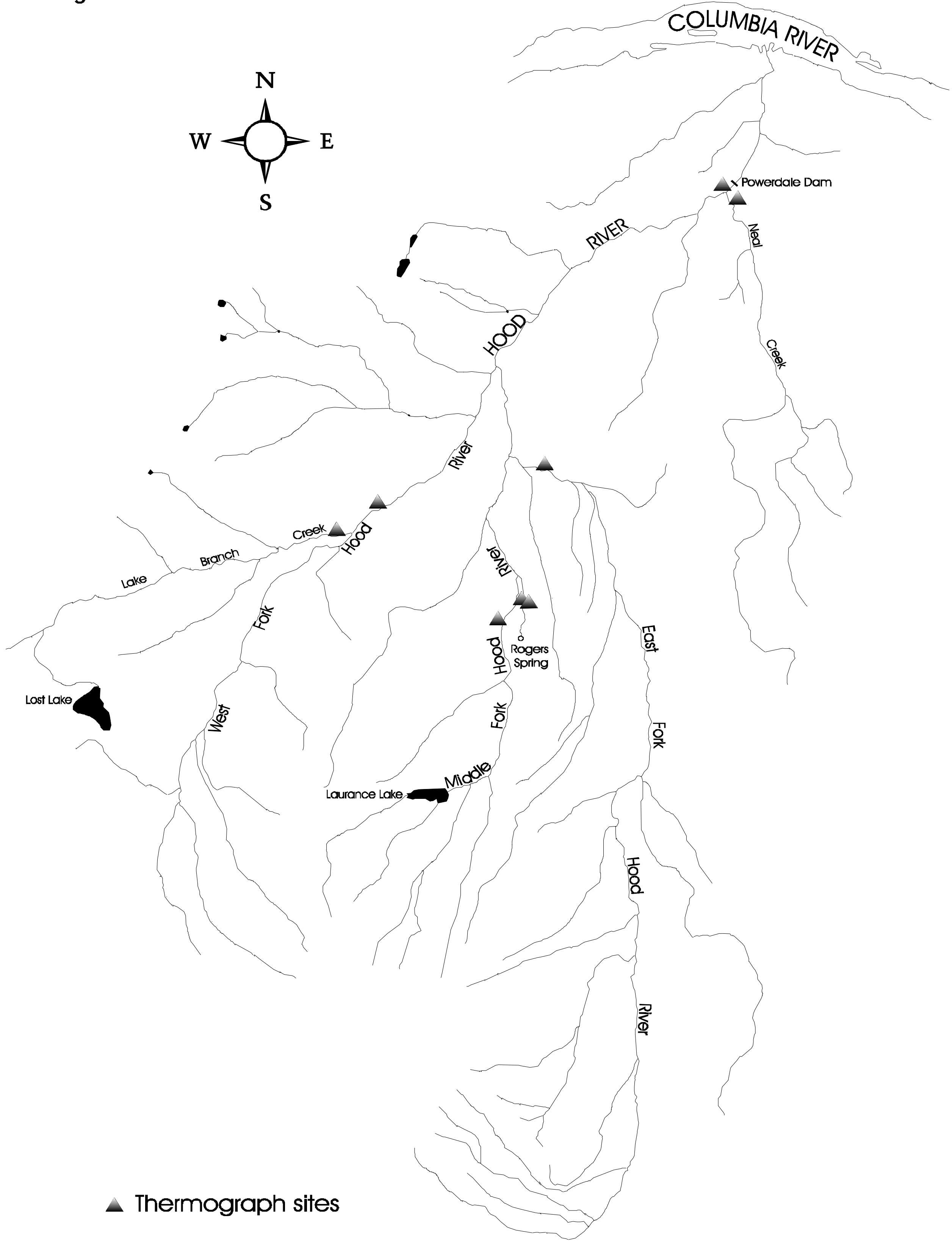
Water temperatures have been collected in the Hood River subbasin during the past eight years to develop a baseline data base for the Hood River Production Program (HRPP). Baseline data has been collected in the mainstem (Rm 3.9), West Fork (Rm 16.0), and East Fork (Rm 15.0) since 1990 and the Middle Fork (Rm 19.0) since 1994 (Figure 13). In addition, water temperatures have been collected from Rogers Spring and a zone of mixed water consisting of Middle Fork and Rogers Spring waters (Rm 19.0) since May, 1995. This study was conducted to evaluate the use of mixed Middle Fork and Rogers Spring Creek in holding broodstock and for acclimation at the Parkdale Adult Holding Pond and Egg Collection Facility. Two more sites were added in 1998 as part of the Oregon Department of Environmental Quality (ODEQ) Total Maximum Daily Load (TMDL) Plan to meet Clean Water Act requirements. The additional sites in 1998 were at the mouth of Neal Creek and Lake Branch Creek (Figure 13). Site descriptions and years of monitoring are included in Table 12.

Methods

Ryan Tempmentor thermographs were used to collect the baseline water temperature data through July of 1998, at which time these units were replaced with Onset Hobo Stowaways. Temperatures were recorded every two hours through May of 1998 and every hour thereafter. Stowaways were also used to record water temperatures every hour for Neal Creek, Lake Branch, and the Parkdale Facility water study. All thermographs have been calibrated since May, 1998, in accordance with the “Stream Temperature Protocol” developed for the Oregon Coastal Salmon Restoration Initiative (ODEQ, Draft Revised Version, May 1997).

Data was downloaded into a computer every few months and reviewed for anomalies. Extreme high and low temperature anomalies, presumably caused by dewatering or freezing, were excluded. A computer program (ERVB 95.7) was used to summarize the data into daily maximum, minimum, and average temperatures and identify the number of days in which water temperatures exceeded ODEQ maximum daily and maximum 7-day moving average water temperature standards (Figures 14-18). ODEQ maximum daily and maximum 7-day moving average standards for salmonids are 17.9 EC, salmonid spawning and fry emergence 12.8 EC, and bulltrout 10.0 EC (Tables 13-17).

Figure 13


N
W
E
S
COLUMBIA RIVER
Powerdale Dam
RIVER
HOOD
Neal
Creek
River
Hood
Creek
Branch
Lake
Fork
West
Lost Lake
River
Hood
Rogers
Spring
Fork
Middle
Laurance Lake
East
Fork
Hood
River
Thermograph sites

Results and Discussion

During 1998, water temperatures in the mainstem, West Fork, and Middle Fork were at or below ODEQ maximum 7-day moving average water temperature standards for salmonids (17.9 EC), with the maximum of 17.9, 13.3, and 13.5, respectively (Tables 13-15 and Figures 14-16). The East Fork exceeded these same standards on 31 days with a maximum of 19.2 EC, and Neal Creek exceeded these standards on 46 days with a maximum of 20.7 EC. The Lake Branch Creek thermograph was stolen and no data was available from this site.

Water temperature recording for the Parkdale study was interrupted due to construction of the Parkdale Fish Facility. The following analysis is based on available data. Summer steelhead brood stock could be held at the Parkdale Facility throughout the entire year and spawned from mid-February through mid-May. Average daily temperatures in 1998 at Parkdale ranged from 3.9 EC-5.2 EC for Rogers Spring and 1.0 EC-11.6 EC for the Middle Fork and Rogers Spring mixed waters (Figure 19). Winter steelhead broodstock will be held and spawned at the Parkdale facility from January through mid-June. During this time the average daily temperatures for Rogers Spring ranged from 3.9 EC - 5.0 EC and 1.0 EC-8.9 EC for the mixed waters. Spring chinook broodstock will be held and spawned at Parkdale from mid-May through September. During this time the average daily temperatures for Rogers Spring ranged from 4.8 EC-5.2 EC and 5.9 EC-11.6 EC for the mixed waters.

Meehan (1991) recommended temperatures of 3.9 EC-9.4 EC for ripening and spawning of steelhead and 5.6 EC-13.9 EC for chinook salmon. Rogers Spring meets the recommended temperatures for steelhead throughout the year, but remained below the recommendations for chinook salmon for the period they are held and spawned. The Middle Fork and Rogers Spring mixed waters meet the recommended temperatures for chinook salmon for the period they are held and spawned, but only achieved the recommendations for steelhead from 20 March to 21 June and from 27 September to 27 November (Figure 19).

Acclimation of salmonids at Parkdale will occur in April and May. Average daily temperatures for these two months ranged from 4.6 EC-5.0 EC for Rogers Spring and 4.1 EC-7.7 EC for the mixed waters. Temperature preferences for rearing and incubating anadromous salmonids fall between 7.8 EC and 15.0 EC with danger zones at <0.6 EC or >20.0 EC (Bottom et al. 1985). Rogers Spring and the mixed waters remained below the lowest preferred temperature (7.8 EC), but above the danger zone (<0.6 EC) during the acclimation period.

It appears that the recommended water temperatures for spawning and rearing can be obtained by manipulating water sources and temperatures during the time steelhead and chinook are held at the Parkdale Fish Facility. However, it will require close scrutiny and periodic adjustments of facility water temperatures in order to fall in the range of recommendations in the literature.

Table 12. Hood River subbasin water temperature monitoring site locations and years of data gathered.

Stream	Longitude	Latitude	Altitude	Years of data
Mainstem Hood River (Rm 3.9)	W121 31.464	N45 39.931	300'	1990-98
West Fork Hood River (Rm 16)	W121 41.233	N45 33.447	1500'	1990-98
Middle Fork Hood River (Rm 19)	W121 37.557	N45 31.410	1500'	1994-98
East Fork Hood River (Rm 15)	W121 37.049	N45 34.350	1400'	1990-98
Neal Creek (Rm 0.1) tributary to the Hood River @ Rm 4.2	W121 31.576	N45 39.796	300'	1998
Lake Branch Creek (Rm 0.1) tributary to the West Fork Hood River @ Rm 17	W121 41.904	N45 32.647	1700'	1998
Rogers Spring Creek (Rm 19)	W121 37.240	N45 31.425	1400'	1995-98
Mixture of Rogers Spring and Middle Fork (Rm 19)	W121 37.240	N45 31.425	300'	1995-98

Figure 14. Mainstem Hood River daily average, maximum, and minimum water temperature, 1998.

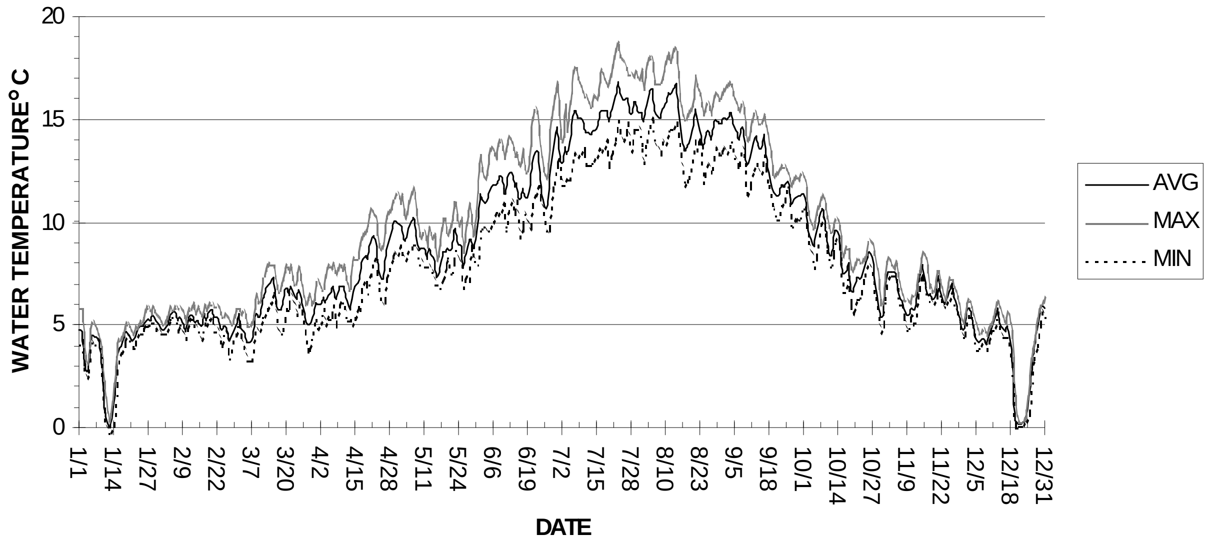


Table 13. Mainstem Hood River monthly and seven-day moving average water temperatures, and number of days above Daily and Seven-Day Moving Average Water Temperature Standards, 1990-1998.

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
START DATE	7/5/90	1/1/91	1/1/92	1/1/93	1/1/94	1/1/95	1/1/96	1/1/97	1/1/98
END DATE	12/31/	12/31/	12/30/	12/30/	12/31/	12/31/	12/31/	12/31/	12/31/
DATA DAYS	180	365	199	364	365	365	362	365	362
7 Day Avg Max > 10	69	173	45	163	179	172	159	147	139
7 Day Avg Max > 12.8	57	113	23	94	133	110	106	78	103
7 Day Avg Max > 17.9	0	3	0	0	28	0	0	0	0
Daily Maximum > 10	72	172	49	163	175	167	157	144	151
Daily Maximum > 12.8	60	111	23	96	127	115	99	72	102
Daily Maximum > 17.9	3	3	0	1	25	1	2	0	7
MONTHLY MAX									
January		5.9	7.1	5.1	6.4	6.8	7.0	5.7	5.9
February		8.1	8.5	6.1	6.4	8.1	8.9	6.0	6.0
March		10	11.3	8.1	10.0	9.2	9.2	7.8	7.9
April		11.8	13.1	9.8	12.3	11.3	11.4	8.8	11.1
May		13.4	17.1	13.4	15.9	15.4	12.9	11.1	12.0
June		16.0	16.8	16.3	17.3	16.7	15.3	14.0	16.7
July	18.2	17.6		16.3	19.6	17.9	18.0	15.5	18.6
August	17.9	18.8		18.0	19.0	18.3	17.3	16.4	18.3
September	13.2	15.9		16.1	15.9	16.4	14.7	14.9	16.7
October	13.2	13.4		13.0	13.6	11.8	12.0	11.8	12.2
November	9.6	9.4	7.4	8.6	8.0	9.4	8.2	8.9	8.5
December	6.4	7.5	5.1	6.0	6.4	8.5	5.6	6.0	6.1
MAXIMUM 7-DAY AVG MAX	17.6	18.0	15.9	17.4	18.7	17.4	17.6	15.6	17.9

Figure 15. West Fork Hood River daily average, maximum, and minimum water temperatures, 1998.

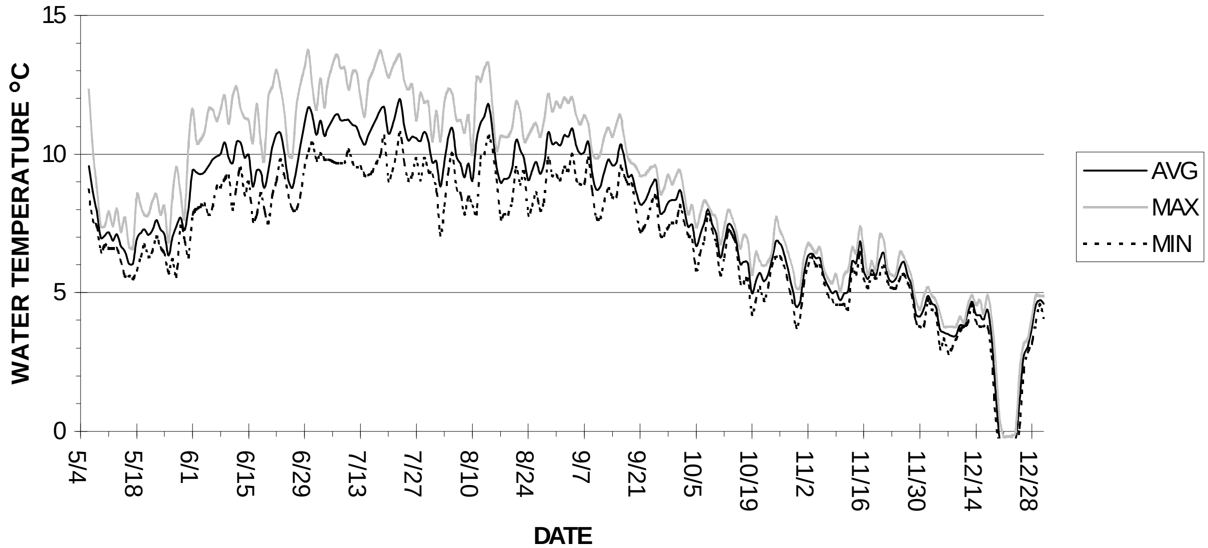


Table 14. West Fork Hood River monthly and seven-day moving average water temperatures, and number of days above Daily and Seven-Day Moving Average Water Temperature Standards, 1990-1998.

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
START DATE	7/5/90	1/1/91	1/1/92	1/1/93	1/1/94	1/1/95	1/1/96	1/1/97	
END DATE	12/31/	12/31/	12/30/	12/31/	12/31/	12/31/	12/30/	10/1/9	12/31/
DATA DAYS	180	365	365	334	365	365	365	274	332
7 Day Avg Max > 10	87	120	156	91	146	129	109	85	102
7 Day Avg Max > 12.8	44	50	87	4	57	35	30	30	8
7 Day Avg Max > 17.9	0	0	0	0	0	0	0	0	0
Daily Maximum > 10	91	115	149	88	135	126	106	85	104
Daily Maximum > 12.8	42	52	83	14	64	42	34	31	17
Daily Maximum > 17.9	0	0	0	0	0	0	0	0	0
MONTHLY MAX									
January		5.3	6.0	4.2	5.6	4.7	5.8	4.5	
February		6.4	6.7	5.1	5.0	6.5	5.1	4.5	
March		8.0	9.7	7.4	7.6	7.4	6.1	4.2	
April		9.8	10.7	7.7	10.0	9.5	8.5	5.7	
May		11.1	14.3	11.6	13.4	13.1	10.0	6.9	12.3
June		13.6	17.1	13.4	14.1	13.9	12.8	9.9	13.7
July	15.4	15.0	16.8	13.4	16.7	15.3	15.0	11.9	13.7
August	15.6	15.5	16.6		15.6	15.2	14.3	13.4	13.2
September	13.6	13.1	13.6	13.2	13.3	13.3	12.2	12.6	12.0
October	11.5	11.3	11.3	11.0	11.6	10.3	10.5		9.4
November	8.6	8.5	8.9	7.6	6.7	8.5	6.4		7.4
December	5.7	6.6	4.8	5.3	5.3	7.5	5.1		5.2
MAXIMUM 7-DAY AVG MAX	15.1	14.8	16.2	13.0	15.8	14.6	14.2	13.4	13.3

Figure 16. Middle Fork Hood River daily average, maximum, and minimum water temperatures, 1998.

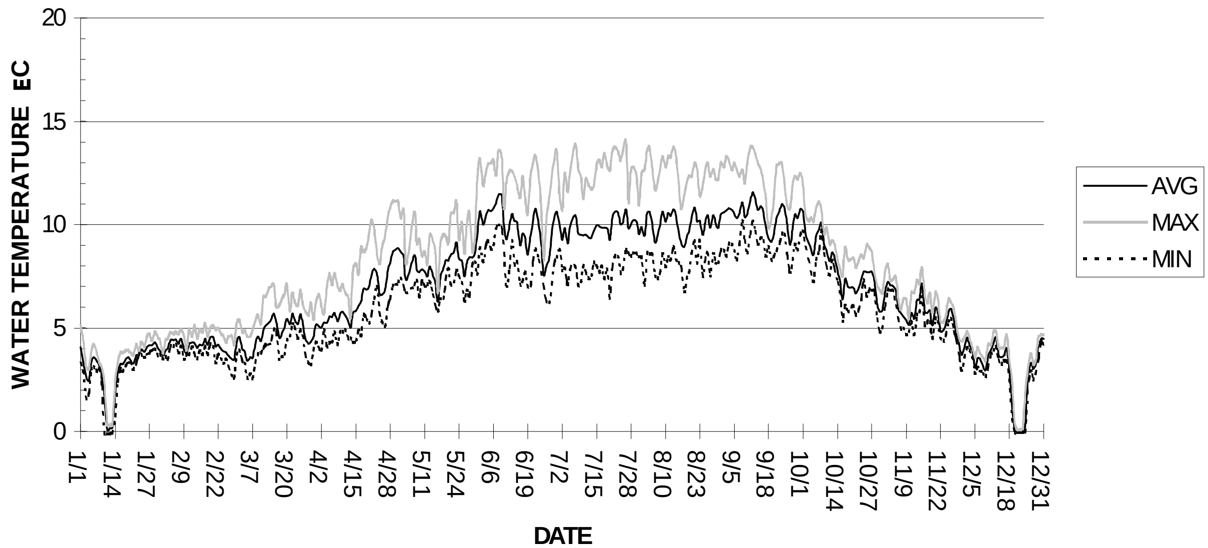


Table 15. Middle Fork Hood River monthly and seven-day moving average water temperatures, and number of days above Daily and Seven-Day Moving Average Water Temperature Standards, 1990-1998.

	1994	**1995**	**1996**	**1997**	**1998**
START DATE	1/27/94	1/1/95	1/1/96	1/1/97	1/1/98
END DATE	12/31/9	12/31/95	12/31/96	12/31/97	12/31/98
DATA DAYS	339	223	364	365	361
7 Day Avg Max > 10	165	41	135	124	134
7 Day Avg Max > 12.8	62	5	2	0	23
7 Day Avg Max > 17.9	0	0	0	0	0
Daily Maximum > 10	157	45	120	118	142
Daily Maximum > 12.8	62	11	11	10	40
Daily Maximum > 17.9	0	0	0	0	0
MONTHLY MAX TEMPERATURES					
January	4.3	4.6	5.0	4.6	5.1
February	5.7	6.1	5.6	5.3	5.2
March	8.9	7.8	6.4	6.3	7.1
April	11.3	8.8	9.0	8.1	11.1
May	13.8		11.2	11.0	12.3
June	14.7		12.7	12.7	13.6
July	14.6		13.4	13.7	14.0
August	14.1	12.9	13.3	13.5	13.7
September	14.0	13.8	12.8	12.3	13.7
October	12.3	12.0	11.3	10.0	11.9
November	5.7	7.6	7.1	8.1	8.0
December	5.2	6.4	4.6	4.8	4.8
MAXIMUM 7-DAY AVG MAX	13.7	13.2	13.0	12.8	13.5

Figure 17. East Fork Hood River daily average, maximum, and minimum water temperatures, 1998.

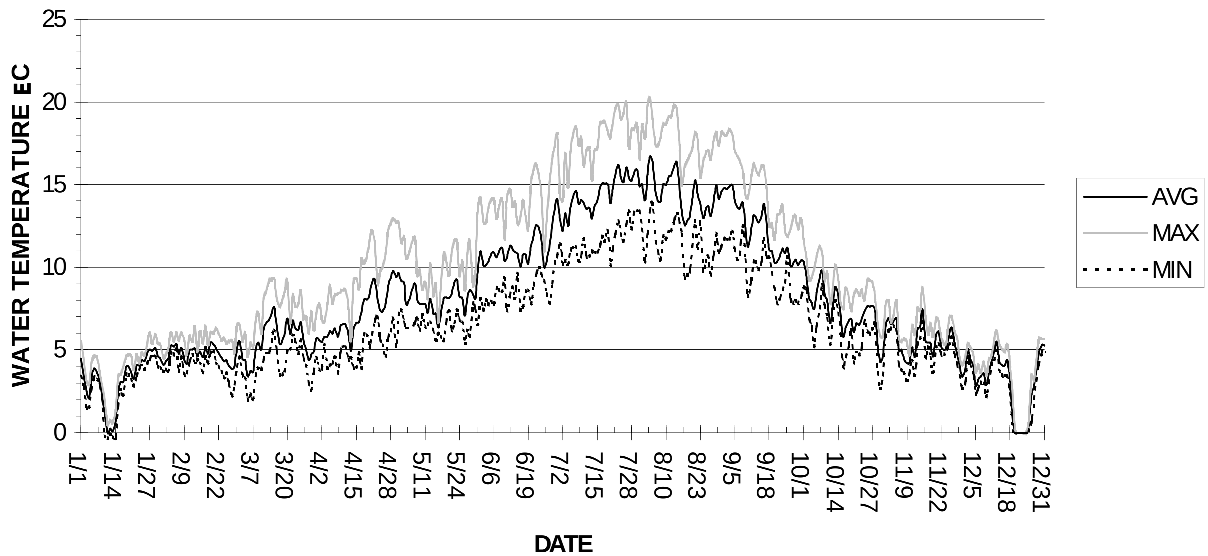


Table 16. East Fork Hood River monthly and seven-day moving average water temperatures, and number of days above Daily and Seven-Day Moving Average Water Temperature Standards, 1990-1998.

	1990	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
START DATE	7/5/90	3/26/92	1/1/93	1/1/94	1/1/95	1/1/96	1/1/97	1/1/98
END DATE	9/28/90	12/31/92	12/31/93	12/31/94	12/31/95	12/31/96	12/31/97	12/31/98
DATA DAYS	86	281	365	365	223	366	365	362
7 Day Avg Max > 10 degrees C	80	185	83	169	39	149	153	148
7 Day Avg Max > 12.8 degrees C	80	139	45	120	24	96	85	104
7 Day Avg Max > 17.9 degrees C	30	65	0	43	0	1	0	31
Daily Maximum > 10 degrees C	86	185	139	171	44	146	147	153
Daily Maximum > 12.8 degrees C	86	132	68	124	26	95	85	109
Daily Maximum > 17.9 degrees C	34	63	0	46	0	13	1	32
MONTHLY MAX								
January			4.6	6.1	6.2	6.0	5.7	6.0
February			6.0	5.9	7.7	6.2	6.2	6.4
March		11.8	8.3	10.3	9.0	8.1	9.0	9.3
April		13.4	10.7	12.8	10.3	11.6	10.0	12.9
May		18.7	13.4	15.3		12.8	12.0	13.6
June		22.0	17.1	18.3		15.4	14.6	18.0
July	20.4	22.8	17.3	21.6		19.0	17.2	19.9
August	21.1	22.8		20.6	15.6	18.4	18.0	20.2
September	18.0	18.7		17.1	16.7	15.6	16.2	18.3
October		12.4		14.3	11.5	12.6	11.1	11.7
November		8.4		6.4	8.5	7.5	8.9	8.7
December		4.8		5.9	6.8	5.0	5.0	6.1
MAXIMUM 7-DAY AVG MAX	20.5	21.8	15.8	20.7	15.8	18.1	17.0	19.2

Figure 18. Neal Creek daily average, maximum, and minimum water temperatures, 1998.

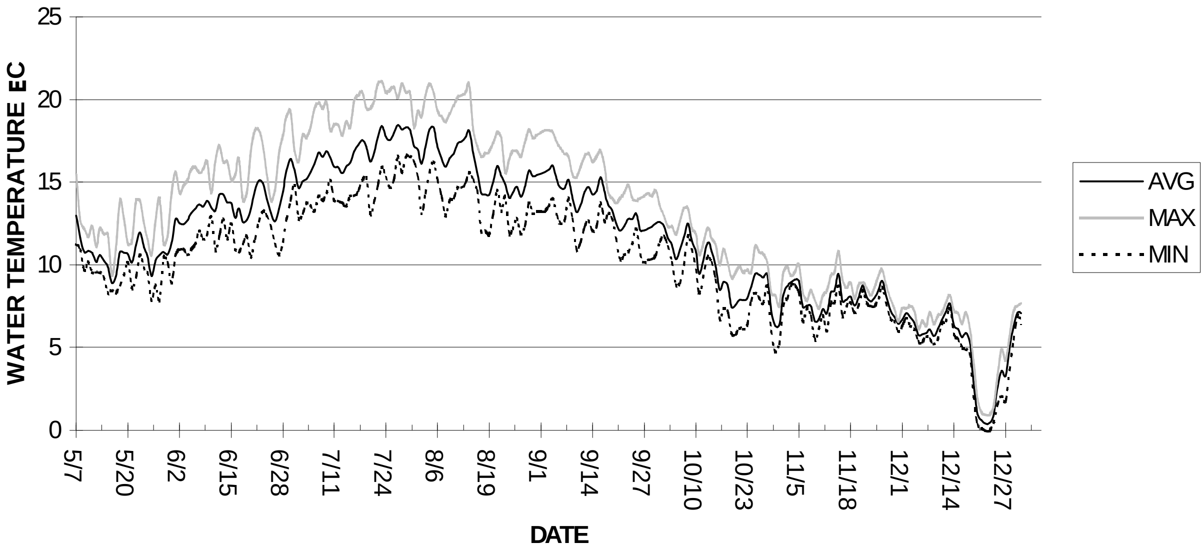
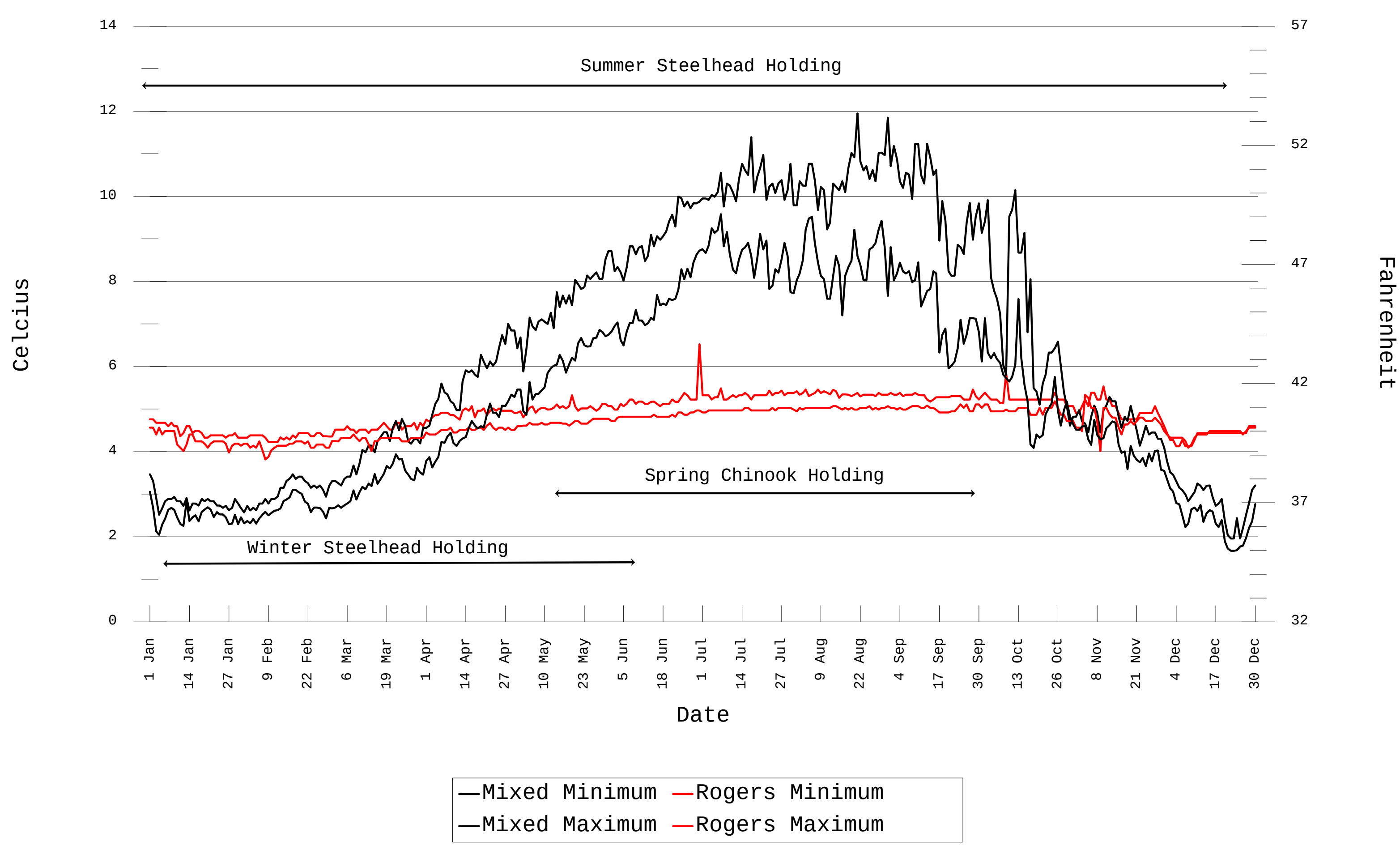


Table 17. Neal Creek average monthly and seven-day moving average water temperatures, and number of days above Daily and Seven-Day Moving Average Water Temperature Standards, 1990-1998.

	1998	**MONTHLY MAX TEMPERATURES**	
START DATE	5/7/98	January	
END DATE	12/31/98	February	
DATA DAYS	238	March	
7 Day Avg Max > 10 degrees C, 1/1 to 12/30	158	April	
7 Day Avg Max > 12.8 degrees C, 1/1 to 12/30	128	May	15.4
7 Day Avg Max > 17.9 degrees C, 1/1 to 12/30	46	June	19.3
Daily Maximum > 10 degrees C, 1/1 to 12/30	167	July	21.1
Daily Maximum > 12.8 degrees C, 1/1 to 12/30	132	August	20.9
Daily Maximum > 17.9 degrees C, 1/1 to 12/30	51	September	18.1
		October	13.5
		November	10.8
		December	8.1
		MAXIMUM 7-DAY AVG MAX	20.7

Figure 19

Average Maximum and Minimum Temperatures for Rogers Spring and Mixed (Rogers Spring and Middle Fork) Waters, 1995-1998.



OAK SPRINGS HATCHERY EVALUATION

Introduction

The percent coded-wire tag retention and clipping results on Hood River stock hatchery winter steelhead have been evaluated by HRPP personnel since the 1993 brood year. These fish are reared at OSH where coded-wire tagging and clipping takes place. All tagging is contracted through the ODFW tagging and clipping program. Hatchery winter steelhead production at OSH was graded into two size groups (small and large) prior to tagging in late October. Each size group was reared in a separate raceway at OSH.

Methods

Coded-wire tag retention is evaluated using a coded-wire tag detector. A subsample of fish were sampled and the tag was either present or absent. For clipping evaluations, a random sample of marked fish were sampled from ponds M-1 and M-2 to evaluate the quality of mark combinations used on hatchery winter steelhead. Hatchery juveniles were examined and classified as 1) not clipped (>75% remains), 2) poor clips (25-75%) or 3) clipped (less than 25% remains) based on a subjective evaluation of each mark group present in the ponds.

Results and Discussion

Coded-wire tag retention and clipping results for winter steelhead (brood years 1993-1996) are summarized in Appendix Tables C-1, C-2, and C-3. Discussion of these results can be found in Lambert et al., January 1998 and December 1998. The 1997 brood winter steelhead were not coded-wire tagged and were clipped with an adipose and right maxillary fin clip. Results for the 1996 brood showed a high number of no- and poor- adipose clips and the right maxillary clips were slightly higher in number than the 1996 brood left maxillary clips (Table 18).

Table 18. Clipping results for winter steelhead at Oak Springs Hatchery, 1997 brood. (Percent of total number sampled is in parentheses. Ad = adipose, RM = right maxillary.)

Broodstock, hatchery, brood year	Pond	Fin clip	Date sampled	Number sampled	No Ad	Poor Ad	No RM	Poor RM
Hood River, Oak Springs,								
1997	M-1	Ad-RM	6-Apr-98	210	1 (0.5)	23 (11.0)	1 (0.5)	1 (0.5)
1997	M-2	Ad-RM	20-Apr-98	205	10 (4.9)	19 (9.3)	7 (3.4)	4 (2.0)

Continued monitoring of tag retention and clipping at OSH is necessary. Poor tag retention and clipping results for the 1994 brood winter steelhead resulted in a more careful evaluation of tagging and clipping procedures at OSH. Although coded-wire tag retention problems were eliminated in the 1995 brood, poor quality fin clipping continued to be a problem. Clipping results for the 1996 brood were better, however no- and poor- clips increased again for adipose and right maxillary clips for the 1997 brood. HRPP personnel will continue to work with OSH to improve fin mark quality.

GENETICS

Resident and anadromous salmonids were sampled by CTWS and ODFW at selected sites in the Hood River and surrounding subbasins; and hatcheries from 1994 through 1996 (Table 19). Samples were collected to characterize and identify populations of rainbow-steelhead and cutthroat trout by allozyme electrophoresis and morphology to determine 1) the natural biodiversity of the Hood River Basin, including the subspecies present, the population and metapopulation structure, and the presence of any exceptionally unique populations; 2) if and where hybridization was occurring; and 3) the impacts of historic hatchery programs on the biodiversity of the subbasin, including contributions to hybrid zones. Funding for the survey and analysis is provided by ODFW, USFS, and BPA. The analysis is contracted to staff at the University of Montana through the genetics program at ODFW, who are coordinating the effort.

A preliminary report in December 1995 by Ron Gregg and Fred Allendorf (University of Montana) to ODFW, outlined mostly genetic analysis methods with some early results (Lambert et al. 1996). Early results of Hood River samples showed (1) the North Fork Greenpoint resident trout population appeared to be pure rainbow trout, (2) the Pinnacle Creek resident trout population is largely cutthroat with some evidence of rainbow trout hybridization, and (3) Dog River, Emile Creek, Robinhood Creek, Pocket, and Bucket Creek all show morphology and electrophoretic evidence consistent with pure cutthroat trout.

Another progress report was completed on 2/6/97 by Paul Spruell (University of Montana) to ODFW, outlining the focus of the work in FY 97 (Lambert et al. December 1998). The University of Montana completed DNA extractions from the bulk of the samples; and continued the development of microsatellite multiplexes and identification of species specific DNA markers, which will be used in the project analysis. In FY 98, the University of Montana staff continued to analyze samples and will submit another progress report in FY 99 and a final report in the summer of FY 2000.

Table 19. Whole juvenile fish collected in the Hood River and surrounding subbasins, and hatcheries for genetic inventory and analysis. 1994 - 1996.

Collection site	Date sampled	River mile	Species	Number	Map location
Oak Springs Hatchery	03/29/94	----	Winter Steelhead-Hood River Stock 50	50	----
Oak Springs Hatchery	03/29/94	----	Summer Steelhead-Foster/Skamania Stock 40	50	----
mainstem Hood River	05/26/94	4.5	Rainbow-Steelhead	20	R10E/T2N SECT 12
West Fork Hood River	05/26/94	4.5	Rainbow-Steelhead	9	R9E/T1N SECT 22
West Fork Hood River	06/10/94	4.5	Rainbow-Steelhead	12	R9E/T1N SECT 22
mainstem Hood River	06/10/94	4.5	Rainbow-Steelhead	18	R10E/T2N SECT 12
East Fork Hood River	06/10/94	1.0	Rainbow-Steelhead	3	R10E/T1N SECT 22
Bear Creek	07/20/94	0.5	Cutthroat	a	R9E/T1S SECT 11
Tony Creek	07/20/94	0.5	Rainbow-Steelhead	45	R9E/T1N SECT 25
Elk Creek	07/20/94	0.25	Rainbow-Steelhead	b	R8E/T1S SECT 26
McGee Creek	07/20/94	0.25	Rainbow-Steelhead	25	R8E/T1S SECT 25
Rimrock Creek	07/28/94	0.25	Cutthroat	25	R10E/T1S SECT 9
Dog River	07/28/94	0.25	Rainbow-Cutthroat	64	R10E/T1S SECT 20
Robinhood Creek	08/09/94	0.5	Rainbow-Cutthroat	23	R10E/T2S SECT 32
Greenpoint Creek	08/09/94	1.0	Rainbow-Steelhead	35	R9E/T1N SECT 11
Oak Springs Hatchery	06/27/95	----	Summer Steelhead-Foster/Skamania Stock 40	31	----
Oak Springs Hatchery	06/27/95	----	Rainbow-Stock 53	30	----
Oak Springs Hatchery	10/05/95	----	Winter Steelhead-Hood River Stock 50	35	----
Roaring River Hatchery	06/27/95	----	Rainbow-Stock 13	30	----
Big Creek Hatchery	08/01/95	----	Winter Steelhead-Big Creek Stock 13	32	----
Fifteenmile Creek	06/15/95	33.5	Rainbow-Steelhead	31	R13E/T1S SECT 33
Eightmile Creek	06/15/95	30.0	Rainbow	30	R11E/T2S SECT 9
West Fork Hood River	06/15/95	4.5	Rainbow-Steelhead	7	R9E/T1N SECT 22
South Fork Mill Creek	07/13/95	10.0	Cutthroat	26	R11E/T1S SECT 16
South Fork Mill Creek	07/13/95	2.0	Rainbow-Steelhead-Cutthroat	30	R12E/T1N SECT 33
Fivemile Creek	07/13/95	19.0	Cutthroat	30	R11E/T1S SECT 24
Warm Springs River	05/23/96	1.0	Summer Steelhead	29	R14E/T8S SECT 20

[a] Sample was pooled with the sample from Tony Creek for a total of 45 fish.
[b] Sample was pooled with the sample from McGee Creek for a total of 25 fish.

HABITAT

Project Work In Fiscal Year 1998

The CTWS staff were involved in implementing early action habitat projects and writing the Habitat Protection, Restoration, and Monitoring Plan in FY 1998. Project staff also spent time evaluating habitat opportunities in the Hood River subbasin. Details of individual projects are described below.

Watershed Assessment and Habitat Protection, Restoration, and Monitoring Plan

In conjunction with early action habitat projects, a Watershed Assessment by the Hood River Watershed Group (HRWG) and a Habitat Protection, Restoration, and Monitoring Plan by the CTWS are being prepared. The Hood River Watershed Assessment follows the Oregon Watershed Assessment Manual prepared for the Governors Watershed Enhancement Board (GWEB)[Watershed Professionals Network, 1999]. The Oregon assessment procedure uses the geomorphic structure of a stream as the basis for determining habitat potential and evaluation of land use practices and natural processes. In departure from the GWEB manual, a chapter about wildlife and vegetation in the Hood River subbasin was added with the help of the U.S. Forest Service. The completion date of the Watershed Assessment will be January, 2000.

Following completion of the Watershed Assessment, a draft copy of the Hood River Fish Habitat Protection, Restoration, and Monitoring Plan will be completed by CTWS; and will be finalized following review by co-managers and participants in the HRPP. The Habitat Plan will incorporate components of the watershed assessments, completed by the USFS (USDA Forest Service, Mt Hood National Forest Service 1996a and 1996b) and the HRWG and is essentially a detailed list of potential fish habitat projects and actions that most directly support the Hood River Production Program. It will be a working document and will be updated year-to-year as projects are identified and prioritized by a Hood River Subbasin Habitat Work Group consisting of the CTWS, HRWG, and ODFW.

A Watershed/Habitat Coordinator position was contracted in FY 98 by CTWS to complete the Watershed Assessment and assist in writing the Habitat Plan. This position was funded equally ($20,000) by the Hood River Soil and Water Conservation District (HRSWCD) and CTWS.

Habitat improvement projects will be assessed and incorporated in the Hood River habitat plan. The draft habitat plan will be finalized in February 2000.

Neal Creek Canal Diversion And Screen - Preliminary Feasibility Evaluation

The East Fork Irrigation District (EFID) diverts 45 cfs from Neal Creek, tributary to the mainstem Hood River, into an irrigation ditch to serve orchardists in the lower valley (Figure 20). The low head diversion dam is a partial barrier to adults and the 32 inch diameter by 100 inch long rotary fish screen located in the ditch 1/4 mile downstream is inadequate to handle the volume of water in the ditch. At full operation, irrigation water tops the screen allowing fish access into the irrigation canal system. Past salvage fish salvage operations have found steelhead/rainbow trout and cutthroat trout throughout the Neal Creek ditch and lateral canals. Approach velocities were estimated at two ft/s, approximately five times the National Marine Fisheries Service (NMFS) standard (0.4 ft/s). Also, the mesh size of the rotary screen (1/8 inch) does not meet NMFS criteria of 3/32 inch.

A preliminary feasibility evaluation was completed in FY 98 by SJO Engineering, to look at three options to improve the EFID Neal Creek diversion: 1) construct a direct pipeline to convey the Neal Creek diversion flow of 50 cfs to the current diversion point out of Neal Creek. This pipe line would bypass Neal Creek's natural drainage channel entirely and would be routed along the existing old road bed on the west side of the stream. There would be several stream crossings involved to reach the current diversion site; 2) upgrade the existing central canal along the east side of the valley to increase the capacity to handle the additional Neal Creek flow of 50 cfs. This would involve approximately three miles of canal upgrades as well as 1,000 ft of piping at the end of the canal to directly convey the flow down the slope and across the stream to the current diversion site; and 3) continue to divert irrigation water into Neal Creek and operate the diversion in its current configuration. This option would include a new fish screen at the current diversion site and would satisfy ODFW and NMFS criteria.

The cost estimates presented by SJO Engineering for each option were
1) $2,700,000,
2) $2,000,000, and
3) $ 400,000.

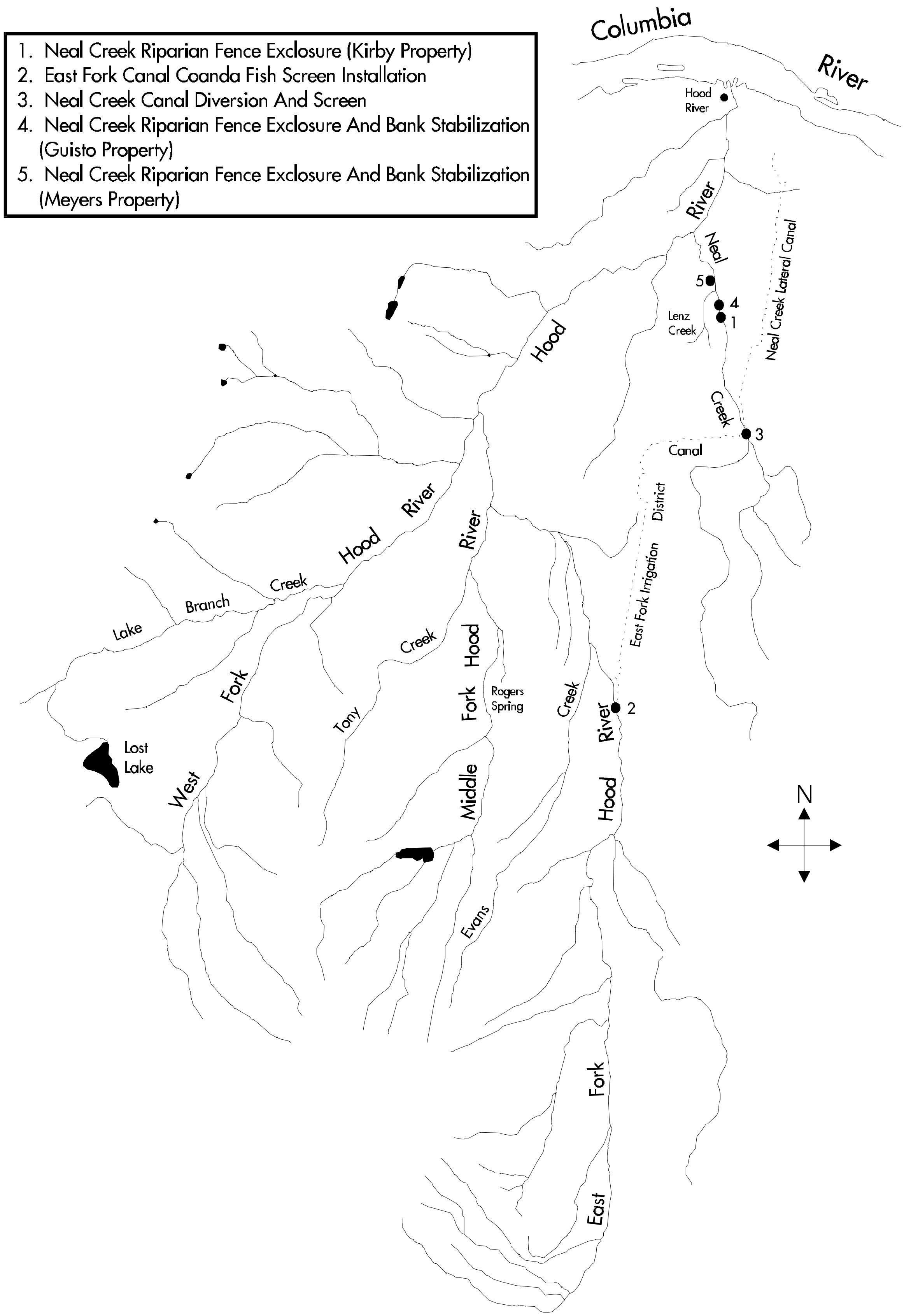


Figure 20. The location of completed HRPP early action fish habitat projects within the Hood River subbasin.

Upon review by the EFID, CTWS, and ODFW it was determined option three was the most practical solution in the near-term for the Eastside Lateral diversion of water from Neal Creek. The long range plan of EFID is to pipe the irrigation water under Neal Creek and connect to the existing Neal Creek ditch. However, it will take several years to find financial resources to complete this plan. SJO Engineering will be contracted in FY 99 to:

1) confirm a precise screening and cleaning scheme with ODFW and NMFS,
2) confirm hydraulics and topography at the Neal Creek screen site,
3) verify costs and lead times for screens and cleaning equipment,
4) determine impacts to existing property owners,
5) verify adequate access to the screen site permanently and during construction, and
6) complete a screen design for the chosen screening system.

Neal Creek Riparian Fence Exclosure And Bank Stabilization (Guisto Property - Rm 2.5)

About one-half mile of riparian area of Neal Creek, tributary to the mainstem Hood River, and one-quarter mile of Lambert Creek was fenced in October 1998 with a four strand barbed-wire fence to exclude livestock (Figure 21). The barbed-wire fence was setback 10-15 feet from the creeks. A single stream crossing was constructed to allow livestock watering and access to a second pasture area across Neal Creek on the West side of the property. Fencing of each creek, will decrease the level of disturbance by livestock on this portion of the channel; allowing vegetation growth, reducing erosion and sedimentation impacts, and stabilizing channels and banks.

Along a portion of the fence was an area where flooding in 1996 eroded a portion of the streambank into the pasture on the property. The flood scouring had formed the initial stages of a backwater or side-channel, with nearly vertical banks devoid of vegetation. Approximately 120 cubic yards of bioengineered rip-rap was placed in September 1998 across the eroded area and filled behind with river rock and dirt (Figure 22). The approximate dimensions of the berm are: 125 feet long, by 4 feet wide, and 6 feet deep. The bottom of the berm was keyed into the bed of the stream and the vertical bank was taken back to a 1.5/1 slope prior to rock placement (Figure 23). Angular rock from an upland source was used for the bioengineered rip-rap with a minimum piece size of 18 inches. The berm also contained bundles of willow at or near the toe of the rip-rap blanket and live-staked hardwoods planted or

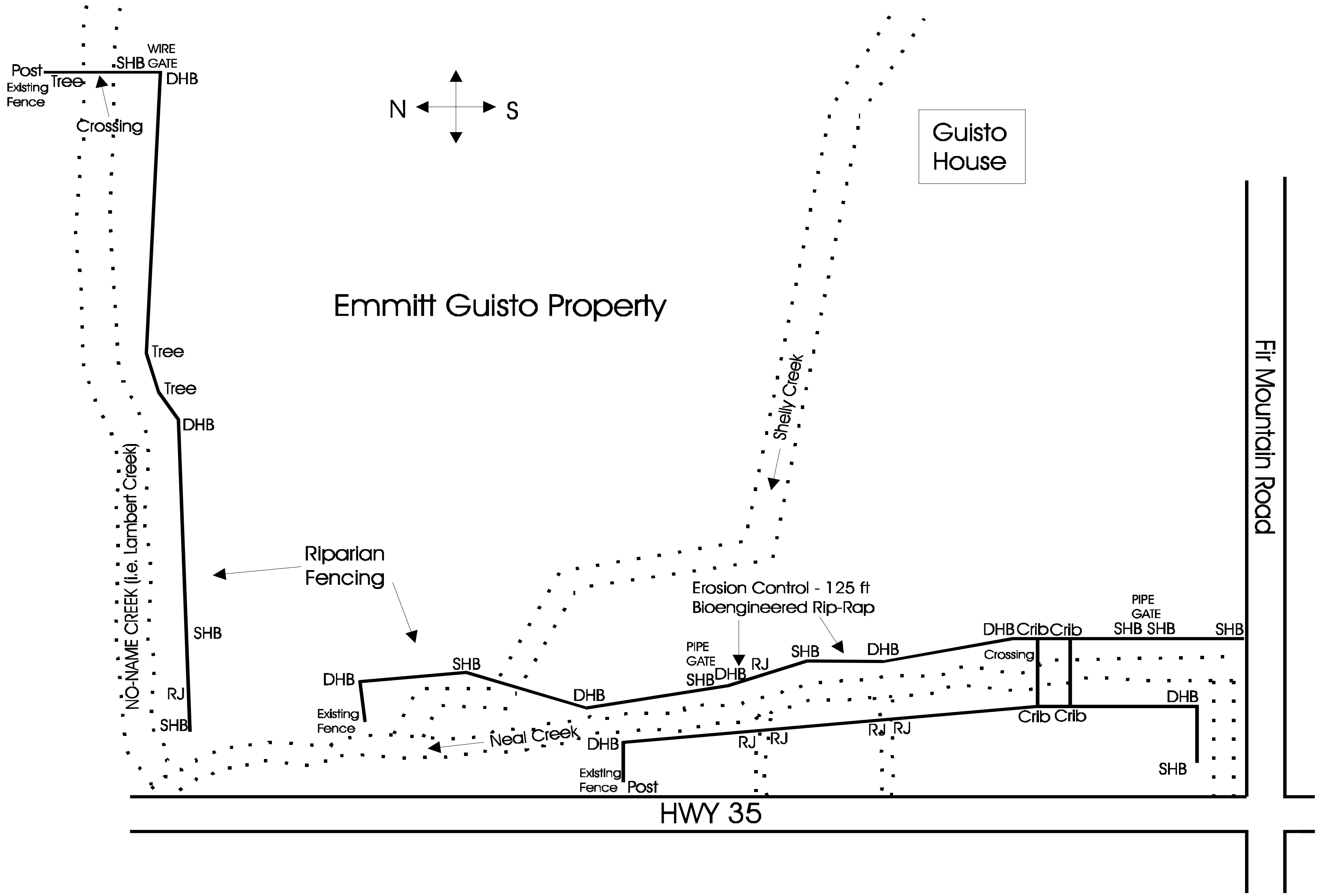


Figure 21. Diagram of the Guisto property riparian fence exclosure and bank stabilization project location on Neal Creek, 1998.

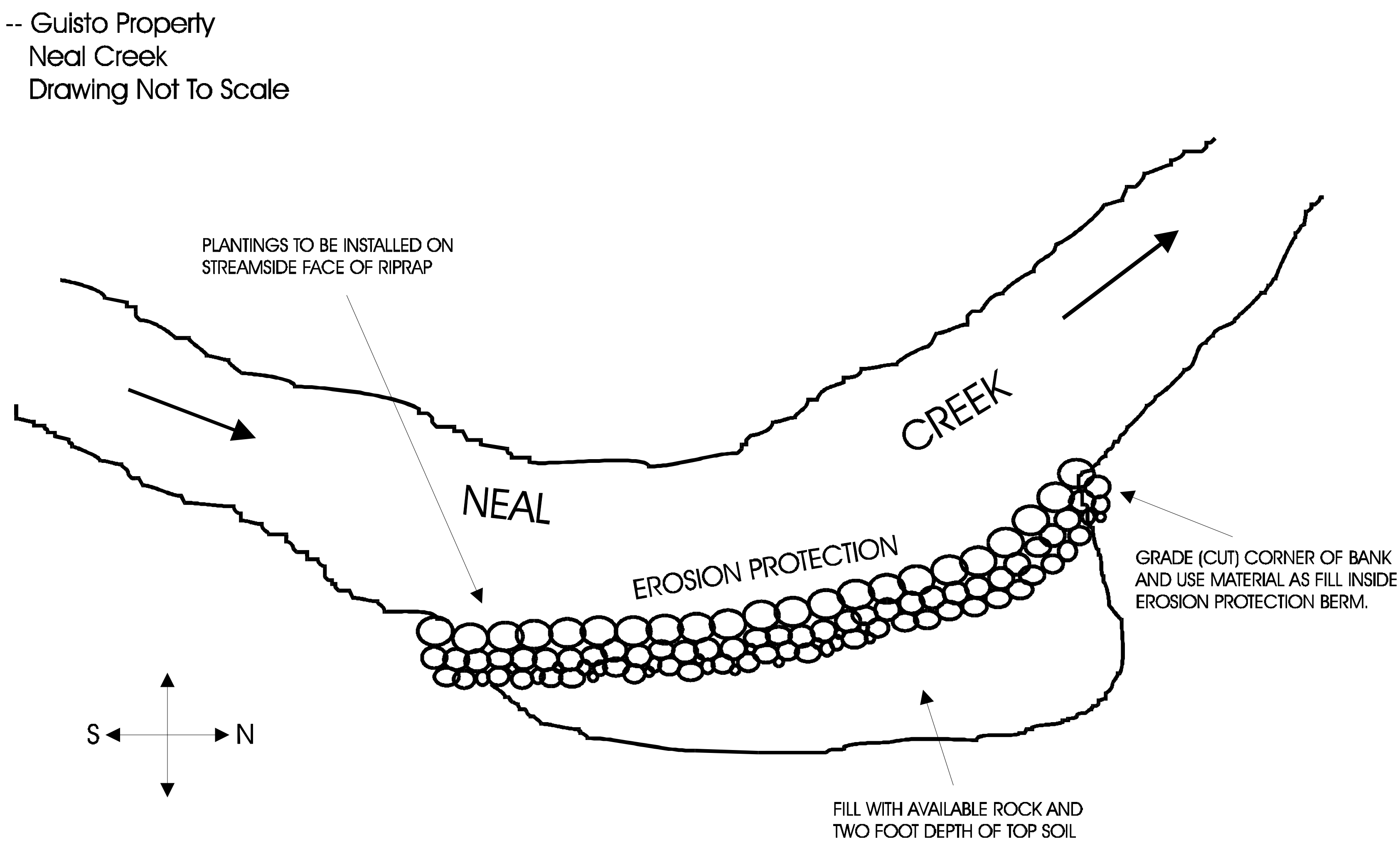


Figure 22. Diagram of the Guisto property bioengineered rip-rap berm on Neal Creek (Rm 2.5), 1998.

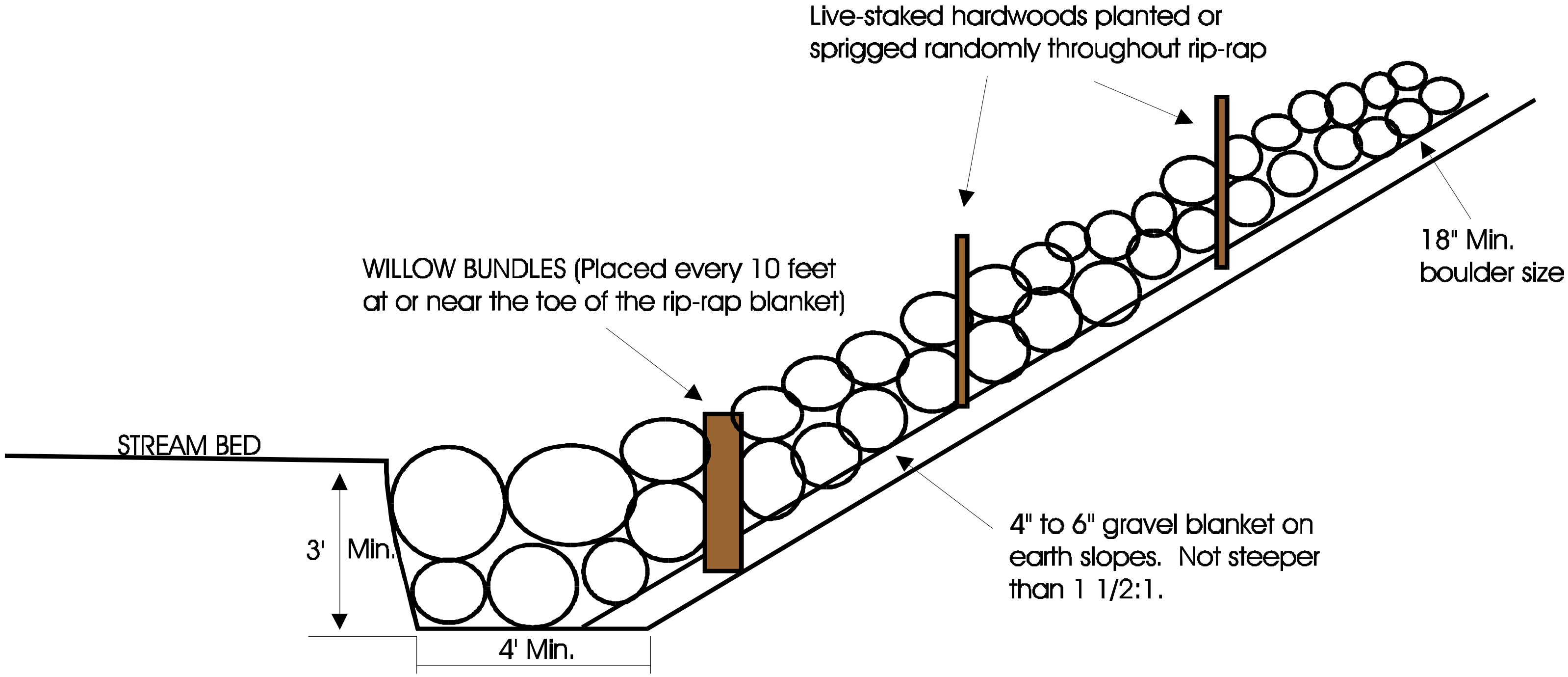


Figure 23. Cross section of the bioengineered rip-rap used on Neal Creek (Rm 2.5), 1998.

sprigged randomly throughout the rip-rap to provide vegetation and increase berm stability (Figure 23). All disturbed areas were seeded with an appropriate upland seed mix. Figure 24 shows photographs of the bioengineered rip-rap project with riparian fencing on Neal Creek.

The bioengineered rip-rap will reduce the dynamic nature of Neal Creek by protecting the bank and fencing project. Willow staking of the armored area and planting hardwoods randomly throughout the rip-rap will provide for some vegetation cover along the bank and assist in stabilizing of the bank.

The short-term effects of a riparian fence exclosure are to remove sources of erosion and reduce disturbance levels within the riparian corridor. The long-term effect is to restore a portion of the riparian corridor to a more natural and higher functioning state. The ultimate goal is to increase salmonid habitat and increase egg and juvenile survival.

Neal Creek Riparian Fence Exclosure And Bank Stabilization (Meyers Property - Rm 2.0)

Around one-quarter mile of riparian area of Neal Creek, tributary to the mainstem Hood River, and a small portion of Meyers Creek was fenced in November 1998 with a four strand barbed-wire fence to exclude livestock (Figure 25). The fence was setback 10-15 feet from the creek. A single stream crossing was constructed to allow livestock access to an additional pasture and barn area on the North side of the propery.

The short-term effects of a riparian fence exclosure are to remove sources of erosion and reduce disturbance levels within the riparian corridor. The long-term effect is to restore a portion of the riparian corridor to a more natural and higher functioning state. The ultimate goal is to increase salmonid habitat and increase egg and juvenile survival.

The owner of the property (Meyers) agreed to allow the fencing in exchange for having a portion of the streambank stabilized with bioengineered rip-rap. The flood of 1996, completely changed the location of the channel on the southern end of the property and because the property line in the deed is based on stream location, the landowner lost about an acre of land. A high flow event in 1997 continued to erode the streambank further. Currently there is an existing rock berm constructed with old refrigerators filled with rock

Figure 24. Photos of the completed bioengineered rip-rap project with riparian fencing on Neal Creek (Rm 2.0), July 1999.

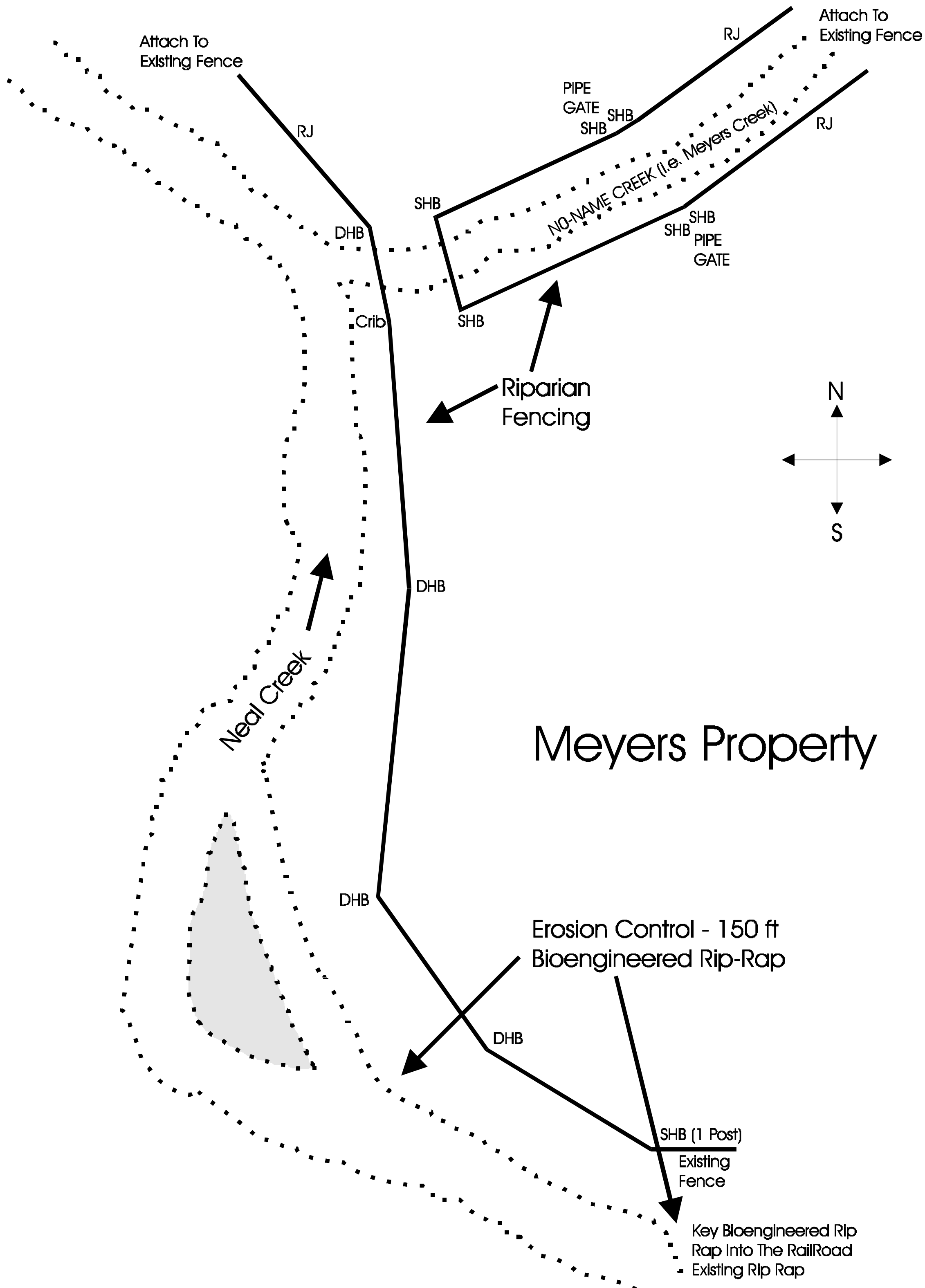


Figure 25. Diagram of the Meyers property riparian fence exclosure (1998) and future bank stabilization project location on Neal Creek.

and placed to prevent further bank erosion. CTWS, in FY 1999, proposes to remove the berm, grade the west bank to a less steep slope and place approximately 256 cubic yards of bioengineered rip-rap on the bank for protection. Bioengineered rip-rap will be placed using the same technique as described previously on the Guisto property project (Figure 23).

Past Project Work

East Fork Canal Coanda Fish Screen Installation

Another major success in FY 97 and FY 98 was the screening of the East Fork Irrigation District's (EFID) diversion on the East Fork Hood River. The diversion, which had been unscreened for nearly 25 years, diverts a significant portion (130 cfs) of the East Fork Hood River from 1 March to 1 November (including fry, fingerlings, smolts, and adults). Based on fish salvage in the Fall of each year by ODFW, CTWS, and the USFS, it is believed that a portion of the East Fork salmonid production is lost each year in this irrigation canal. The CTWSRO staff was involved in consultation and screen evaluation; no dollars were contributed directly to this project.

In February, 1996 a flood in the East Fork Hood River drainage washed out the original East Fork sand trap. A new sand trap and Coanda fish screen was designed by SJO Engineering for the EFID (**See East Fork Acclimation Of Winter Steelhead, Figure 2**). The Coanda screen is a stationary wedge-wire screen that is highly efficient at passing water through it. The sand trap and Coanda screens are designed to settle out glacial sediment from the East Fork Hood River, while providing fish passage back to the East Fork Hood River. The Coanda screen was chosen over conventional screens with moving parts because of its ability to operate effectively in streams with high sediment loads. In consultation with CTWS and ODFW, the fish screen design was approved with an understanding that mortality would need to be below five percent (including losses due to descaling). To test the fish mortality criteria a Coanda screen prototype was constructed and evaluated with fall chinook salmon smolts and rainbow trout fingerlings. Results of the biological performance tests were excellent. Although some minor, diffuse scale loss was observed for both experimental and control groups, no "descaling" according to the criteria or other significant injury was detected for any fish, whether experimental or control (Buell & Associates, Inc., October 1996). The EFID proceeded with using the Coanda screening system knowing they would be required to evaluate the full sized version for minimum performance criteria. Construction was completed in the Fall of 1996.

Logistical problems were found during the 1997 irrigation season. The EFID found they could not divert the full 130 cfs through the sand trap facility during the peak irrigation. To meet irrigation needs (130 cfs) the EFID opened the canal valve and diverted water directly into the ditch bypassing the screens (**See East Fork Acclimation Of Winter Steelhead, Figure 2**). Modifications were subsequently made to the facility allowing the EFID to divert the necessary 130 cfs through the sand trap. The 1998 irrigation season was the first full season that the fish screens were in full operation.

In March 1998 steelhead were listed by the National Marine Fisheries Service (NMFS) in the lower Columbia River ESU, which includes the Hood River and tributaries. Since the listing, NMFS is working with the EFID to develop an operational plan for the facility and coordinate testing procedures to evaluate whether or not the facility and screens meet NMFS criteria for fish passage.

Neal Creek Riparian Fence Exclosure (Kirby Property - Rm 3.0)

Another example of landowner cooperation was a riparian fencing project completed on Neal Creek in 1996 as part of the Tribal Early Action Projects funded by BPA (Lambert et al., January 1998). As a cost share to this project, volunteers from the HRWG (along with CTWS staff) in May 1998 planted 125 Ponderosa Pine seedlings throughout the project reach. The Ponderosa Pine seedlings were donated from the Lava Nursery near Parkdale.

Future Project Work

A habitat project proposal was submitted to BPA for FY 1999 funding ($117,088). The habitat proposal was approved and five additional projects will be completed in FY 1999 along with three projects extended from the FY 1998 statement of works for BPA: (1) construction of 0.5 miles of riparian livestock exclosure fence on Lenz Creek (VanKoten Property - Rm 0.1), tributary to Neal Creek; (2) placement of bio-engineered rip rap on an eroded bank area to protect riparian fencing and allow bank stabilization on Neal Creek (Meyers Property - Rm 2.0), tributary to the mainstem Hood River; (3) restore three miles of access to winter steelhead, spring chinook salmon, and resident trout habitat by eliminating a concrete apron and stop logs and constructing a jump pool at the Tony Creek diversion (Rm 0.5). Tony Creek is a tributary to the Middle Fork Hood River; (4) assist Middle Fork Irrigation District in developing an alternative irrigation water source at three sites on Evans Creek (Higgins pond - Rm 2.5, Hutson pond - Rm 4.0, Evans Creek diversion - Rm 5.5), tributary to the East Fork Hood River, eliminating the need for the irrigation diversion dam fish barriers. Upon completion, these projects will restore access to 4.5 miles of winter steelhead, coho salmon, and resident trout habitat; (5) Assist East Fork Irrigation District in developing an alternative federally approved screen design for the irrigation water diversion on Neal Creek (Rm 6.0). Project completion will allow safe downstream passage to winter steelhead and resident fish back into Neal Creek; and (6) continue to cost-share with the HRSWCD to fund the Watershed/Habitat Coordinator position to complete the Hood River Watershed Assessment and assist CTWS in writing the Habitat Plan.

PELTON LADDER

INTRODUCTION

The NPPC's Columbia River Basin Fish and Wildlife Program set a goal to double the runs of Columbia River salmon and steelhead. This increase is designed to offset losses resulting from the development and operation of the Columbia River hydropower system.

In its amended (1987) Fish and Wildlife Program, the NPPC included a goal to increase fish production at Pelton Ladder as a low-capital means of contributing to additional adult returns in the Columbia Basin and Deschutes River subbasin. The NPPC further specified that the ODFW and CTWS prepare a Master Plan prior to any design and construction. The Master Plan was completed in July, 1991 (Smith, M. 1991). Additional background information on the Deschutes River subbasin can be found in Lindsay et al., 1987 and 1989.

Pelton Ladder is an adult fishway extending from below Pelton Regulating Dam to the Pelton Dam (Rm 100), which impounds Lake Simtustus (Figure 26). The ladder is 10 feet wide, 6 feet deep, and 2.8 miles long. It was originally designed and constructed to allow passage of adult spring chinook salmon and summer steelhead around the re-regulating dam to Lake Simtustus. However, the ladder was abandoned for adult passage after the facilities at Round Butte Dam (located above Pelton Dam) failed to effectively pass juvenile salmonids downstream.

In the early 1980's, Pelton Ladder was modified and used as a rearing site for some of the juvenile spring chinook salmon produced at RBH. RBH, funded by Portland General Electric (PGE), was developed to mitigate for losses of spring chinook salmon and summer steelhead caused by the Pelton-Round Butte hydroelectric projects. The aim of the program is to achieve the mitigation level of 1,200 adults returning to Pelton trap each year. Prior to the 1994 brood year, RBH produced 270,000 spring chinook smolts as part of this mitigation effort.

In 1995, as part of the HRPP, the ladder was modified to create three new cells for rearing Deschutes stock hatchery spring chinook salmon (Figure 27). The three new cells were modified to replicate the existing rearing strategy in each section. These modifications allow the capability to rear 187,000.

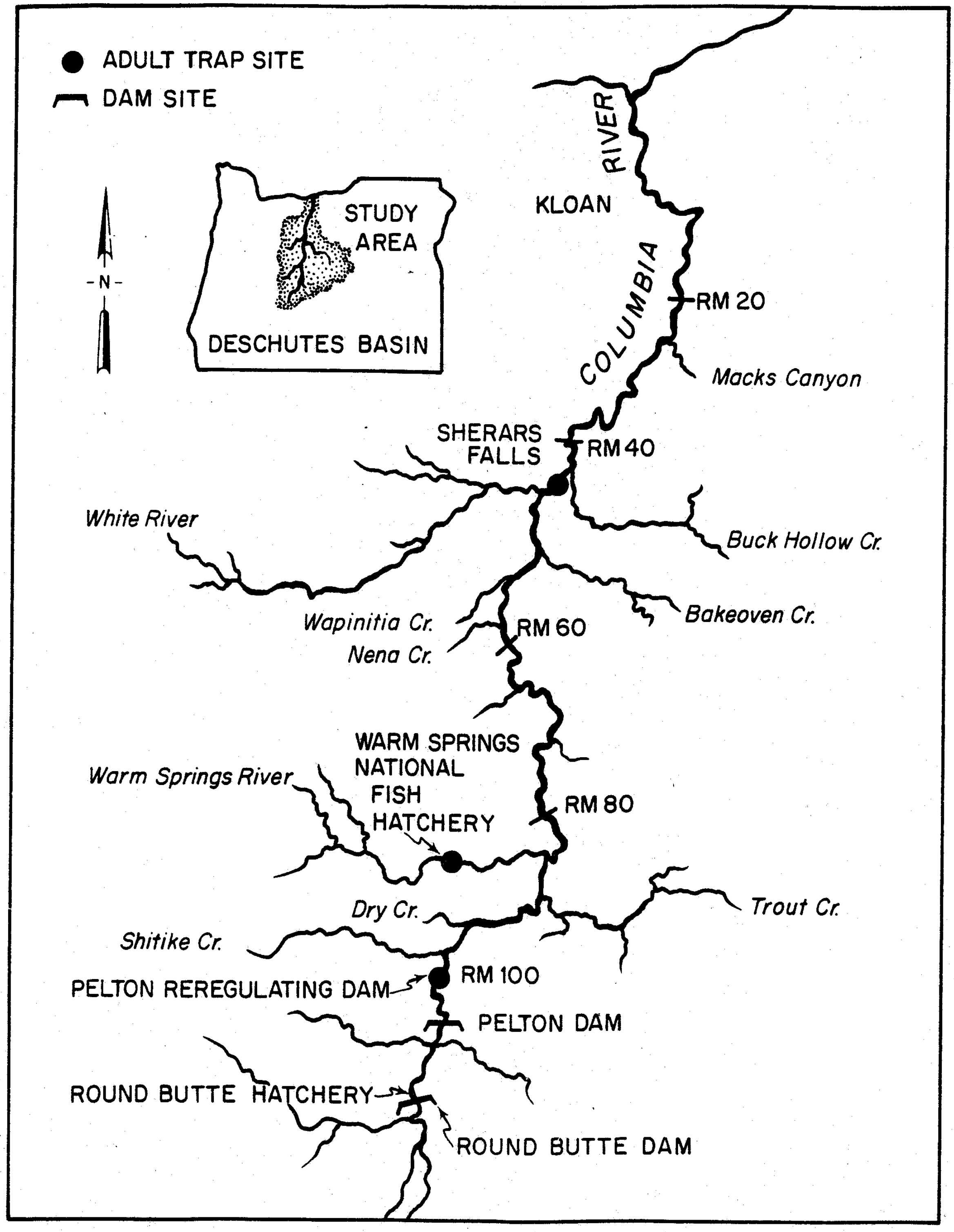


Figure 26. Lower 100 miles of the Deschutes River.

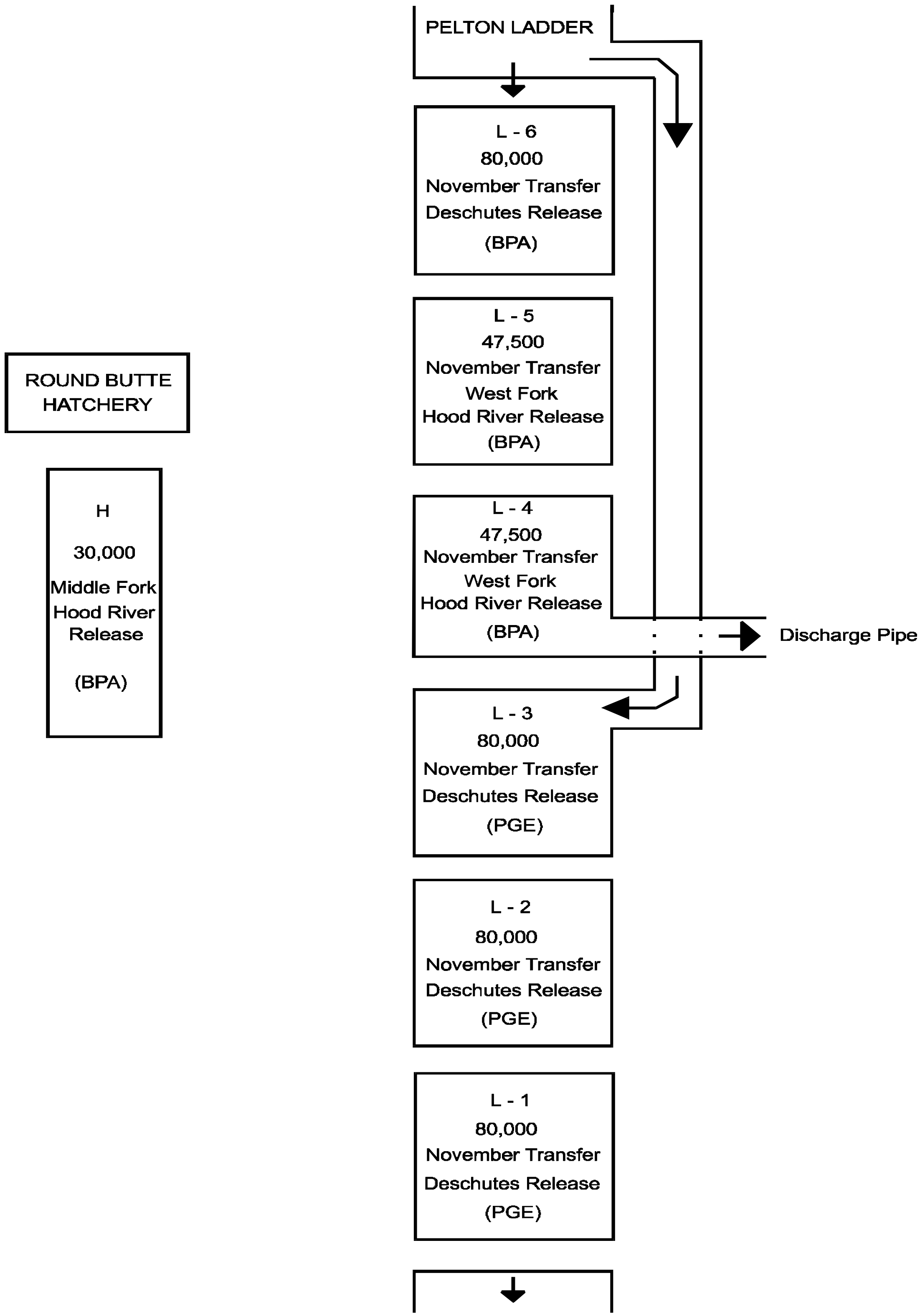


Figure 27. Rearing strategy for Round Butte Hatchery and Pelton Ladder to accommodate production of spring chinook salmon study fish, release year 1999 and 2,000.

additional spring chinook salmon smolts. Fish reared in the new cells, L-4 and L-5, have been released into the Hood River since 1996. New cell L-6 (uppermost cell), is used as an experimental study group for release into the Deschutes River. Upon completion of the Pelton Ladder studies, juvenile spring chinook salmon reared in the new cell (L-6) will be used for increasing production in the Hood River.

METHODS

Study Design

The objective of experimental releases of spring chinook salmon from Pelton Ladder and RBH is to determine if modifying Pelton Ladder to rear more fish will reduce effectiveness of the existing production program. Furthermore, the study will evaluate how size at time of release effects post-release survival and provide basic information about rearing conditions in the ladder. Comparisons of the modified Pelton Ladder cells will be made against post-release survival rates of fish reared in the lower three cells of Pelton Ladder and hatchery ponds at RBH (Figures 28 and 29). Releases at RBH and Pelton Ladder were of two targeted size groups: mediums (8 fish/lb) and smalls (12 fish/lb).

A Hobo temperature logger was used to collect water temperatures for Pelton Ladder throughout the rearing of spring chinook salmon smolts. Temperature data was recorded every hour and was downloaded at the end of rearing. Downloaded data for each site is reviewed for anomalies and is summarized into daily mean temperatures.

Rearing Procedures

Spring chinook salmon broodstock was collected randomly at Pelton Trap throughout the run between early May and mid June. Prior to the 1997 run year, 500 adults were collected and held at the hatchery. In 1998, 800 was collected for broodstock. Spring chinook salmon adults not needed for broodstock were given to the CTWSRO after snouts were removed from coded-wire tagged fish.

During the 1995-96 and 1996-97 finish rearing at Pelton Ladder, an

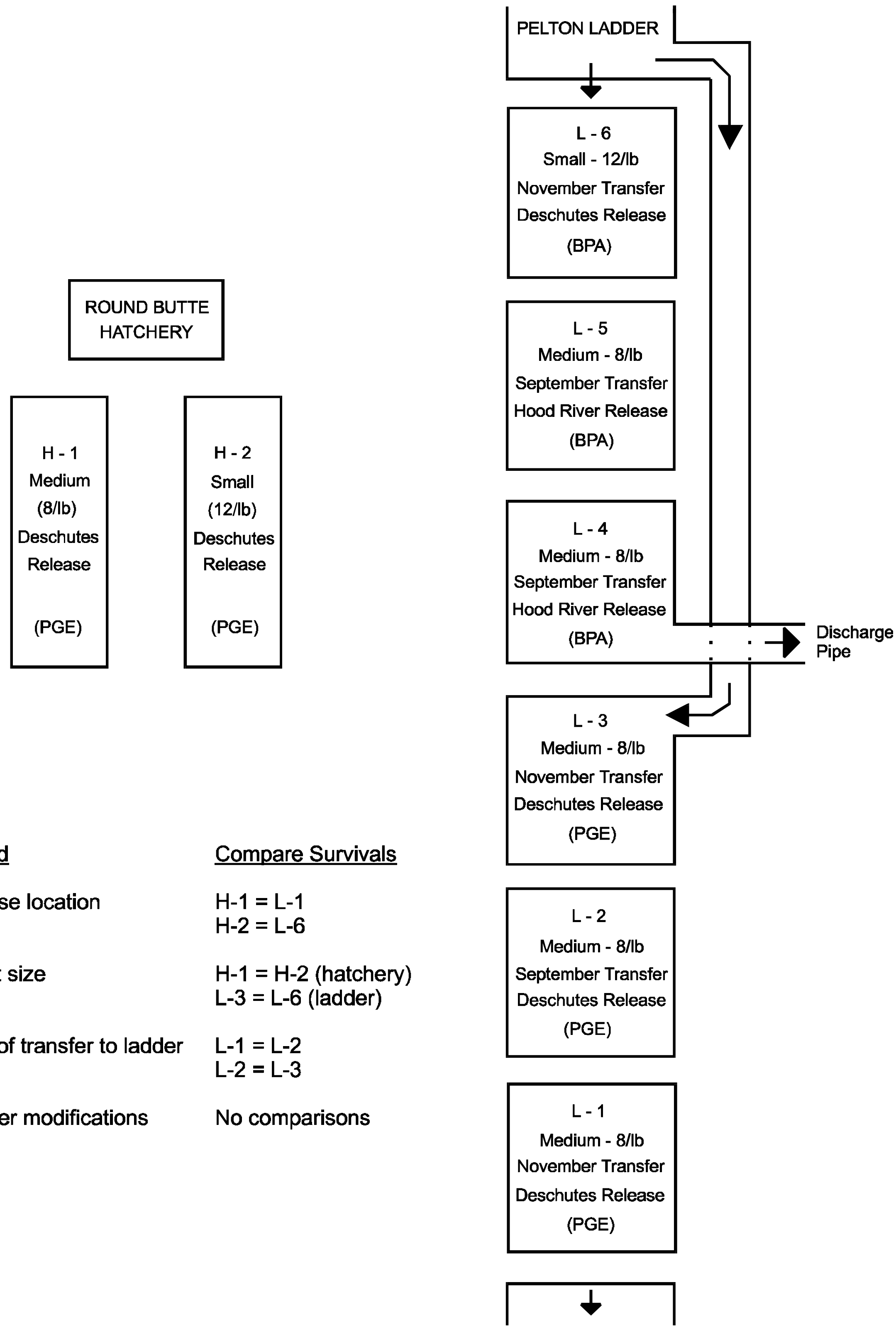
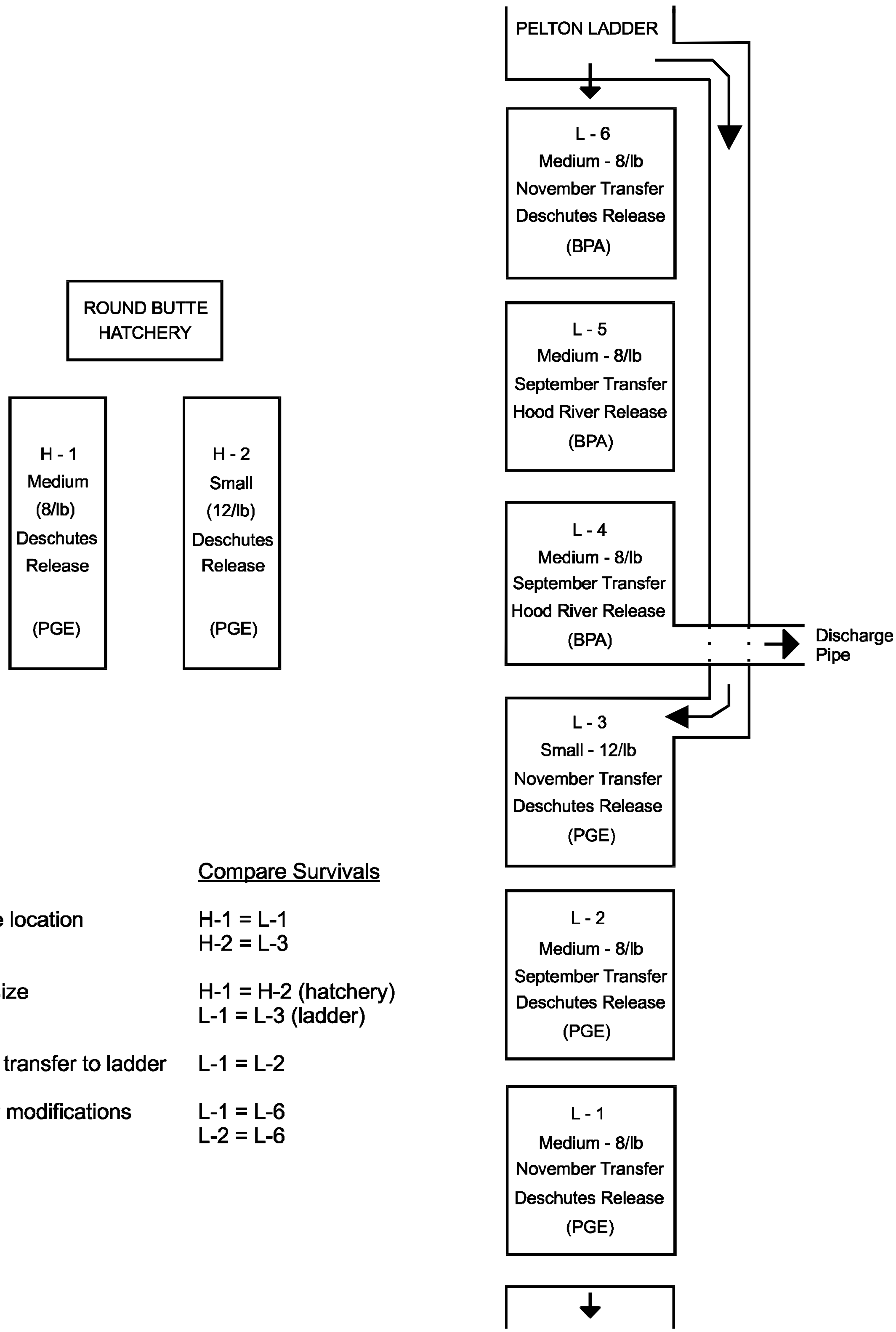


Figure 28. Ponding plan for RBH/Pelton Ladder to accommodate production of the 1994 brood spring chinook salmon study fish. Release year 1996.



Variable Tested	Compare Survivals
Effective release location	H-1 = L-1 H-2 = L-3
Effective smolt size	H-1 = H-2 (hatchery) L-1 = L-3 (ladder)
Effective time of transfer to ladder	L-1 = L-2
Effects of ladder modifications	L-1 = L-6 L-2 = L-6

Figure 29. Ponding plan for RBH/Pelton Ladder to accommodate production of the 1995-1996 brood spring chinook salmon study fish. Release years 1997-1998.

extremely high level of hatchery spring chinook salmon smolt loss occurred as a result of Bacteria Kidney Disease (BKD). The parents of these smolts were highly infected with the disease and was most likely the cause of the fish loss. In 1997, following the fish loss event, a decision was made to cull eggs from adult females that carry high levels of BKD. Reducing the vertical transmission from parent to offspring is believed to be the most effective means of controlling the disease in fish hatcheries (Nyara, memo, 1997).

During the 1997 spring chinook salmon run year, 39% of the fish captured at Pelton Trap were strays. Prior to the 1997 run year, approximately 2% was normal (Bill Nyara, personal communication June 25, 1998). The need to exclude eggs and milt from stray spring chinook salmon and to cull eggs from adult females with BKD after spawning has required RBH to hold 400 females and 400 males when available. If stray rates return to a more manageable level (approximately 2% or less), only 300 females and 300 males are necessary.

Spawning of spring chinook salmon at RBH occurred in late August and in early September. One male was used to fertilize the eggs of one female. Approximately 750,000 eggs were taken to produce 454,000 smolts needed for release. The eggs were moved to Heath incubators and placed on chilled water (5.5EC). Chilled water slowed the incubation period down and allowed smolts to be released as spring yearlings (fish reared from egg-take until spring of the second year). In the incubator eggs were water hardened for one hour and disinfected in a 10ppm iodopher solution for 10 minutes.

After the eggs had eyed, they were shocked and sorted to remove dead and blank eggs. The chiller was turned off in late December. Fry were reared in ambient 10.5EC water in 6 ft diameter circular tanks until they reached a size of at least 300 fish/lb. Fry targeted as mediums (8 fish/lb) were then transferred in March to a single Burrows pond. Fry targeted as smalls (12 fish/lb) were transferred in April. Larges were then split again in early May from one to two ponds. All ponds of spring chinook fingerlings were split again in July and August after being marked. Fish reared in Pelton Ladder were transferred there either in September, October, or November (**Appendix Tables E-1, E-2, E-3, and E-4**) and allowed to migrate volitionally the following April. **Appendix Table E-5** shows spring chinook salmon juvenile releases from RBH into the Deschutes River (1978-1997 broods).

In 1996, a high shortage occurred between what went in Pelton Ladder cells four and five from RBH (**Appendix Table E-2**) and disposition to the Hood River acclimation site (**See Acclimation, Table 4**). This was the first year an inventory was completed on fish coming out of the Pelton Ladder cells and raised concerns about the actual numbers released over the years from Pelton Ladder. Many ideas were shared to explain count inaccuracy by program staff, but most agreed mortality from BKD was likely the main factor. During 1997-98 Pelton Ladder finish rearing, ODFW, PGE, and CTWS evaluated spring chinook salmon smolt mortality in Pelton Ladder and at RBH. RBH (ODFW) staff picked morts daily off fish screens and PGE and CTWS staff snorkeled bi-weekly to account for mortality in the cells themselves. RBH staff collected non-migrant mortalities from Pelton Ladder on 12 May.

All spring chinook salmon targeted for release into the Deschutes River were marked with an adipose fin clip, while those smolts destined to the Hood River were marked with an adipose and left ventral, right ventral, or right maxillary clip combination. All Deschutes and Hood River subbasin releases were differentially marked with a coded-wire tag (**See Appendix Tables E-1, E-2, E-3, and E-4**). Tag retention was determined just before release by crowding the fish in a pond or raceway and evaluating a random sample of fish. The presence of a coded-wire tag was assessed with a field detector. Each fish in the sample was examined for a fin clip. Spring chinook salmon juveniles were weighed (g) and measured (mm) and condition factors (weight [g] * 100/length^3 [mm]) were calculated prior to release in the spring.

Coded-wire tags from returning adults were recovered from snouts of fish collected at the Pelton Trap, Warm Springs National Fish Hatchery, and tribal and non-tribal fisheries at Sherars Falls. Return rate was calculated as the percentage of juveniles released with coded-wire tags that returned as adults.

RESULTS AND DISCUSSION

Comparisons Of Pre-Modification vs Post-Modification Adult Production

Release of spring chinook salmon smolts for this study were in 1996 (1994 brood). Study results, based on post-release survival rate, between the newly modified and old cells of Pelton Ladder and ponds at RBH will be analyzed upon a completed brood year (Table 20). The first complete brood year (1994) for Pelton Ladder studies will be 1999.

Mean length, weight, and condition factors were estimated for Deschutes spring chinook salmon smolts reared at RBH and Pelton Ladder prior to release (Table 21). Mean condition factors for brood years 1994-1997 ranged from 1.05 to 1.28.

Measured Smolt Mortality At Pelton Ladder And Round Butte Hatchery

Mortality rates were high for Pelton Ladder reared hatchery spring chinook salmon smolts (Table 22). Mortality at Pelton Ladder and RBH from 1 October, 1997 to 12 May, 1998 ranged from 156-5,461 morts per cell, not counting non-migrant mortality collected in May. A total of 15,235 mortalities were collected. Mortality at the ladder was confirmed by ODFW Pathology to be outbreaks of BKD. Interestingly in cell three, which had the least mortality of all Pelton Ladder cells, and RBH ponds one and two were the only groups that did not have infectious hematopoietic necrosis (IHN). All other groups, prior to transfer to Pelton Ladder, were treated for outbreaks of IHN at RBH. The percentage of morts collected on the screen versus those collected by snorkeling was 31% (Table 22).

RECOMMENDATIONS

The purchase and installation of emergency pumps at Pelton Ladder need to be considered in future budgets. Emergency pumps would be necessary if there was a loss of water supply to the fish rearing cells. Loss of water could result in fish mortality or an early release of spring chinook salmon fingerlings. An early release could result in an indirect mortality. When considering emergency pumps, project staff should consider needs for future additional cells.

Continue to evaluate hatchery spring chinook salmon smolt mortality loss at Pelton Ladder and RBH during 1998-1999 Pelton Ladder and RBH finish rearing. Accounting for mortality in the ladder provides a more accurate count of smolts released into the Deschutes River subbasin as part of the Pelton Ladder study; provides RBH staff knowledge of potential outbreaks of disease in Pelton Ladder; and mort samples collected can be sent to ODFW Pathology for determination of cause.

Table 20. Return by age of Pelton Ladder and Round Butte Hatchery (RBH) reared spring chinook salmon back to the Deschutes River subbasin, 1994-97 broods. Returns include tribal and sport harvest, and Pelton Trap. Harvest data expanded. Coded-wire tag data not expanded for no snout/no tag/lost tag. No brood year specific estimates of adult returns are complete. (Percent return is in parentheses).

Brood year, location reared, pond or cell	Release date	Number released	Size (fish/lb)	Total age			
				Age 3	Age 4	Age 5	Total
1994,							
RBH,							
H-1	04-25-96	19239	8.0	1(0.01)	5(0.03)		6(0.03)
H-2	04-25-96	25654	10.7	1(0.01)	8(0.03)		9(0.04)
Pelton Ladder,							
L-1	04-22-96	65625	7.3	8(0.01)	62(0.09)		70(0.11)
L-2	04-23-96	63445	7.8	10(0.02)	50(0.08)		60(0.09)
L-3	04-24-96	63551	8.3	8(0.01)	74(0.12)		82(0.13)
L-4,5	04-25-96	7282	9.9	0(0.00)	3(0.04)		3(0.04)
L-6	04-25-96	85151	10.9	5(0.01)	45(0.05)		50(0.06)
1995,							
RBH,							
H-1	04-15-97	14910	6.5	2(0.01)			2(0.01)
H-2	04-15-97	25938	11.0	17(0.07)			17(0.07)
Pelton Ladder,							
L-1	04-16-97	61102	7.3	5(0.01)			5(0.01)
L-2	04-17-97	61232	7.3	8(0.01)			8(0.01)
L-3	04-18-97	90474	11.0	13(0.01)			13(0.01)
L-6	04-21-97	62530	8.0	3(0.01)			3(0.01)
1996,							
RBH,							
H-1	04-13-98	16397	8.6				
H-2	04-13-98	31699	12.0				
Pelton Ladder,							
L-1	04-13-98	60145	9.0				
L-2	04-14-98	63213	8.1				
L-3	04-15-98	96633	11.0				
L-6	04-16-98	64149	10.0				

Table 20. Continued.

Brood year, location reared, pond or cell	Release date	Number released	Size (fish/lb)	Total age Age 3	Age 4	Age 5	Total
1997,							
Pelton Ladder,							
L-1	04-12-99	71395	7.8				
L-2	04-13-99	72375	7.52				
L-3	04-14-99	79611	7.74				
L-6	04-15-99	80940	7.12				

Table 21. Estimates of mean fork length (FL; mm), weight (g), and condition factor (CF) for Deschutes stock hatchery spring chinook salmon smolts sampled at Pelton Ladder (C = cell) and Round Butte Hatchery (H = pond) prior to release into the Deschutes and Hood River subbasins[a], 1994-1997 broods.

Statistic, pond or cell, brood year	N	Mean	Range	95% C.I.
FL (mm),[b]				
H-1,				
1994	152	178.1	135 - 260	± 10.6
1995	177	175.7	145 - 240	± 9.9
1996	201	158.6	126 - 283	± 8.6
H-2,				
1994	209	158.9	135 - 195	± 9.4
1995	157	158.0	125 - 190	± 10.6
1996	203	153.6	130 - 236	± 8.9
H-10,				
1997	275	172.8	133 - 250	± 7.9
C-1,				
1994	226	174.7	120 - 245	± 8.2
1995	197	175.0	136 - 229	± 9.3
1996	198	155.3	118 - 230	± 9.1
1997	265	170.0	127 - 245	± 7.4
C-2,				
1994	210	170.3	130 - 260	± 8.7
1995	199	176.1	137 - 224	± 9.6
1996	200	162.1	130 - 263	± 9.0
1997	207	168.9	130 - 238	± 8.4
C-3,				
1994	204	165.1	130 - 245	± 8.7
1995	195	153.6	125 - 213	± 9.0
1996	199	152.5	129 - 239	± 9.1
1997	207	168.7	130 - 235	± 8.8
C-4,				
1994	226	158.6	125 - 265	± 8.4
1995	208	167.5	115 - 250	± 8.4
1996	203	146.3	103 - 208	± 8.3
1997	530	168.4	106 - 233	± 5.6
C-5,				
1994	229	160.9	125 - 240	± 8.8
1995	213	174.0	109 - 235	± 8.8
1996	199	156.2	103 - 216	± 9.1
1997	297	173.6	91 - 236	± 7.8

Table 21. Continued.

Statistic, pond or cell, brood year	N	Mean	Range	95% C.I.
FL (mm),[b]				
C-6,				
1994	200	148.9	125 - 210	± 8.8
1995	212	166.0	130 - 250	± 8.1
1996	202	152.9	122 - 222	± 8.6
1997	208	170.8	135 - 239	± 8.8
Weight (g),[c]				
H-1,				
1994	152	69.5	26.2 - 188.1	± 0.9
1995	177	69.6		
1996	200	49.8	22.6 - 300.0	± 0.29
H-2,				
1994	209	46.4	25.8 - 97.0	± 1.5
1995	157	44.4		
1996	203	42.4	23.0 - 152.0	± 1.02
H-10,				
1997	275	67.7	28.5 - 197.6	± 0.43
C-1,				
1994	226	66.0	22.6 - 178.1	± 0.1
1995	197	60.8	24.3 - 124.3	± 0.8
1996	198	46.3	19.3 - 177.2	± 0.77
1997	265	62.8	22.2 - 179.9	± 0.05
C-2,				
1994	210	59.8	23.4 - 199.4	± 0.08
1995	198	65.3	28.9 - 134.1	± 1.19
1996	200	53.8	24.8 - 300.0	± 0.20
1997	207	61.4	26.6 - 162.3	± 0.30
C-3,				
1994	204	54.5	24.6 - 164.1	± 0.3
1995	195	41.7	19.8 - 106.5	± 1.04
1996	199	40.5	23.4 - 153.6	± 1.1
1997	207	59.4	23.6 - 149.7	± 0.76
C-4,				
1994				
1995	208	58.4	18.6 - 174.1	± 0.3
1996	203	38.9	11.9 - 119.9	± 0.75
1997	530	61.6	15.2 - 171.8	± 0.59

Table 21. Continued.

Statistic, pond or cell, brood year	N	Mean	Range	95% C.I.
C-5,				
1994				
1995	213	63.7	10.0 - 159.8	± 0.51
1996	199	46.1	9.3 - 124.5	± 1.15
1997	297	66.8	6.7 - 175.8	± 0.80
C-6,				
1994	200	39.8	22.8 - 117.8	± 1.3
1995	212	55.3	23.7 - 167.6	± 0.08
1996	202	41.7	20.6 - 137.6	± 0.5
1997	208	62.8	26.2 - 161.4	± 0.54
CF,[d]				
H-1,				
1994	152	1.17	0.90 - 1.63	± 0.08
1995	177	1.28		
1996	200	1.17	0.90 - 1.44	± 0.07
H-2,				
1994	209	1.13	0.85 - 1.60	± 0.06
1995	157	1.05		
1996	203	1.14	0.96 - 1.70	± 0.07
H-10,				
1997	275	1.24	0.96 - 1.53	± 0.06
C-1,				
1994	226	1.15	0.78 - 1.53	± 0.07
1995	197	1.07	0.80 - 1.26	± 0.07
1996	198	1.19	1.04 - 1.49	± 0.07
1997	265	1.18	0.68 - 1.49	± 0.06
C-2,				
1994	210	1.13	0.84 - 1.40	± 0.07
1995	198	1.15	0.94 - 1.32	± 0.07
1996	200	1.19	1.06 - 1.65	± 0.07
1997	207	1.19	1.02 - 1.40	± 0.07
C-3,				
1994	204	1.15	0.90 - 1.42	± 0.07
1995	195	1.11	0.94 - 1.28	± 0.07
1996	199	1.12	0.91 - 1.38	± 0.07
1997	207	1.17	1.01 - 1.35	± 0.07
C-4,				
1994				
1995	208	1.17	1.03 - 1.42	± 0.07
1996	203	1.20	0.87 - 1.57	± 0.07

Table 21. Continued.

Statistic, pond or cell, brood year	N	Mean	Range	95% C.I.
CF,[d]				
C-5,				
1994				
1995	213	1.13	0.77 - 1.72	± 0.06
1996	199	1.17	0.85 - 1.39	± 0.07
1997	297	1.22	0.89 - 1.63	± 0.06
C-6,				
1994	200	1.19	0.95 - 1.51	± 0.07
1995	212	1.12	0.75 - 1.40	± 0.07
1996	202	1.12	0.93 - 1.39	± 0.07
1997	208	1.19	0.91 - 1.56	± 0.07

[a] Juveniles were sampled within one week of release.

[b] Lengths were rounded to the nearest 5 mm for the 1994 brood year and hatchery ponds one and two for the 1995 brood year.

[c] Fish scale maximum weight is 300 g.

[d] Condition factor was calculated as (weight [g] * 100/length^3 [mm]).

Table 22. Monthly mortality at Pelton Ladder cells (L) and Round Butte Hatchery ponds (P) for spring chinook salmon juveniles from October 1, 1997, through May 12, 1998. (In parentheses is the number of mortalities recovered on the drum screen of each Pelton Ladder cell.)

Pond or cell location	P 8 - L 1	P 10 - L 2	P 6 - L 3	P 2 - L 4	P 5 - L 5	P 9 - L 6	P 1a - P 1	P 1b - P 2	TOTAL
Date transferred	4,5-Nov-97	30-Sept-97	04-Nov-97	30-Sept-97	29-Sept-97	05-Nov-97	30-Sept-97	30-Sept-97	
October[a]	53	54	11	90 (2)	57 (4)	54	6	26	351 (6)
November[b]	76	20	53	106	63	48	13	16	395 (--)
December	33 (1)	33 (5)	21 (1)	47 (8)	79 (5)	34 (6)	21	6	274 (26)
January	110 (4)	212 (5)	8 (2)	146 (28)	318 (25)	70 (10)	9	6	879 (74)
February	169 (25)	507 (62)	4 (3)	332 (34)	639 (76)	87 (27)	4	5	1747 (227)
March	2369 (981)	535 (235)	28 (9)	514 (140)	656 (138)	361 (64)	9	6	4478 (1567)
April[c]	2651 (1340)	191 (96)	31 (3)	250	288 (38)	222 (60)	--	8	3641 (1537)
May[d]	867	867	869	--	--	867	--	--	3470 (--)
Total	**6328 (2351)**	**2419 (403)**	**1025 (18)**	**1485 (212)**	**2100 (286)**	**1743 (167)**	**62**	**73**	**15235 (3437)**

[a] Mortalities includes those collected at RBH. The following list is mortalities collected for each RBH pond in October:

P8-L1 - 53
P6-L3 - 11
P9-L6 - 54

[b] Mortalities includes those collected at RBH. The following list is mortalities collected for each RBH pond in November:

P8-L1 - 19
P6-L3 - 2
P9-L6 - 8

[c] All Pelton Ladder cell four mortalities and 118 of cell five mortalities in April were from loading the fish truck for transport to the Hood River.

[d] Non-migrant smolts recovered in Pelton Ladder on 12 May, 1998 by RBH staff.

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APPENDIX A

Acclimation Supportive Data

Appendix Table A-1. Temperature, dissolved oxygen, and mortality in the portable acclimation raceway for hatchery winter steelhead at Toll Bridge County Park, East Fork Hood River, 1996.

Date	Time	Temperature EC	Dissolved oxygen (ppm)	Mortalities
1-Apr	1700	7.7	9.73	3(2 transp)
2-Apr	0630	4.3	7.93	4
	1530	6.5	9.49	
	1815	5.8	8.11	
3-Apr	0830	4.1	10.69	7
	1415	7.7	9.86	
4-Apr	0745	3.8	10.03	5
	1200	6.5	7.25	
	1600	8.3	7.45	
	1900	7.4	9.13	
5-Apr	0700	4.3	8.95	2
6-Apr	1315	9.4	6.40	1
	1830	9.7	7.50	
7-Apr	0900	5.9	8.70	1
	1400	9.4	9.69	
	1900	10.7	8.68	
8-Apr	1930	6.2	7.24	0
9-Apr	1630	8.2	7.71	0
10-Apr	0730	5.3	8.24	1
11-Apr	0845	5.0	10.02	0
	1830	6.1	9.30	
12-Apr	0815	5.3	9.75	0
	1840	5.4	8.95	
13-Apr	0700	3.5	9.55	1
	1300	6.2	8.85	
	1830	8.0	8.35	
14-Apr	0800	4.2	9.67	0
	1330	7.6	9.08	
	1900	8.2	8.17	
15-Apr	0700	5.1	9.43	0
	1530	8.5	8.50	
	1930	8.1	8.66	

Appendix Table A-1. Continued.

Date	Time	Temperature EC	Dissolved oxygen (ppm)	Mortalities
16-Apr	0800	5.8	9.54	0
	1315	7.6	9.23	
	1900	7.1	9.15	
17-Apr	1100	5.2	9.16	0
	1800	6.2	8.67	
18-Apr	0700	4.1	9.71	0
	1430	5.9	9.14	
	1845	6.3	8.83	
19-Apr	0730	3.8	9.60	0
	1300	4.8	9.48	
	1945	5.4	9.32	
20-Apr	0715	3.6	9.80	0
21-Apr				0
22-Apr				2(2 transp)
23-Apr	0815	5.9	7.91	5(2 transp)
	1310	7.3	7.38	
	1750	7.0	8.24	
24-Apr	0705	4.8	8.25	3(1 transp)
	1315	5.3	7.60	
	1715	6.9	6.59	
25-Apr	0715	5.1	8.50	8
	1415	6.9	6.81	
26-Apr	0700	4.4	8.30	7
	1330	6.7	6.95	
	1720	8.0	6.30	
27-Apr	0750	4.2	8.60	9
	1425	7.6	7.0	
	1930	7.0	7.15	
28-Apr	0800	3.8	8.25	13
	1430	8.0	6.85	
	1900	8.1	6.98	
29-Apr	0735	5.9	7.68	11
	1500	9.2	7.32	
	1900	8.6	7.10	

Appendix Table A-1. Continued.

Date	Time	Temperature EC	Dissolved oxygen (ppm)	Mortalities
30-Apr	0800	5.1	8.45	12
	1430	8.5	8.15	
	1930	8.3	8.03	
1-May	0730	6.1	8.16	7
	1215	7.4	6.68	
	1400	8.2	6.47	
2-May	0710	5.4	8.20	0
	1330	6.7	8.15	
	1930	5.7	8.25	
3-May	0800	5.4	8.20	0
	1300	6.5	8.35	
	1930	6.4	8.30	
4-May	0800	4.1	8.20	1
	1330	7.4	7.65	
	1900	7.6	7.69	
5-May	0730	4.7	9.18	2
	1230	6.4	8.38	
	1900	7.8	7.56	
6-May	0800	4.2	9.03	0
	1330	8.2	8.32	
	1900	8.5	8.41	
7-May	0730	4.7	9.35	0
	1200	5.6	9.12	
	1900	6.3	9.09	
8-May				13(6 transp)

Appendix Table A-2. Temperature, dissolved oxygen, and mortality in the portable acclimation raceways for hatchery spring chinook salmon at Blackberry Creek, West Fork Hood River, 1996.

Date	Time		Temperature EC		Dissolved oxygen (ppm)		Mortalities[a]	
	Pond 1	Pond 2	Pond 1	Pond 2	Pond 1	Pond 2	Pond 1	Pond 2
8-Apr							38	0(38)
9-Apr	1400		6.6				9	42(43)
10-Apr		1500		6.5		6.34	6	16(22)
11-Apr	1000	1040	5.9	5.9	9.53	9.47	24	6(21)
12-Apr	0650	0715	5.0	4.9	9.56	9.64	4	7
	1830	1830	5.0	4.9	9.67	9.43		
13-Apr	0745	0745	4.9	4.9	10.42	9.80	2	6
	1200	1200	5.4	5.5	9.97	9.97		
	1800	1800	6.1	5.9	9.61	9.51		
14-Apr	0700	0725	4.7	4.8	9.57	9.94	1	16
	1200	1216	5.5	5.6	9.84	10.02		
	1800	1838	5.5	5.3	6.72	6.51		
15-Apr	0655	0712	4.6	4.6	9.96	9.45	2	1
	1200	1400	4.5	4.5	9.83	9.79		
	1800	1820	5.6	5.6	10.01	9.98		
16-Apr	0609	0631	4.6	4.6	9.65	9.89	0	0
	1157	1210	5.2	5.2	10.25	8.45		
	1800	1800	5.0	5.0	9.50	6.31		
17-Apr	0700	0700	4.5	4.4	9.38	9.36	0	0
	1248	1258	5.4	5.4	9.79	9.50		
	1800	1815	4.9	4.9	9.53	9.55		
18-Apr	0830	0832	4.5	4.5	10.10	10.21	0	0
	1200	1200	4.6	4.6	9.51	10.10		
	1810	1812	4.7	4.7	9.82	9.83		
19-Apr	0730	0732	4.3	4.3	9.98	9.73	0	0
	1200	1202	4.6	4.6	9.80	9.68		
	1650	1650	5.2	5.2	8.44	8.75		
20-Apr	0810	0812	4.4	4.5	9.43	9.10	0	0
	1200	1223	5.2	5.5	9.80	9.78		
	1800	1813	5.5	5.7	9.93	9.91		
21-Apr	0700	0700	4.4	4.4	9.50	9.53	1	0
	1200	1208	5.4	5.5	9.84	9.85		
	1800	1818	4.9	4.9	9.45	9.45		

Appendix Table A-2. Continued.

Date	Time		Temperature EC		Dissolved oxygen (ppm)		Mortalities[a]	
	Pond 1	Pond 2	Pond 1	Pond 2	Pond 1	Pond 2	Pond 1	Pond 2
22-Apr	0700	0711	4.5	4.5	9.37	9.40	108	0(19)
	1428	1435	5.1	5.1	8.55	8.36		
	1800	1813	5.8	5.8	9.54	9.54		
23-Apr	0632	0645	4.8	4.8	9.68	9.66	55	91(21)
	1155	1207	5.7	5.7	9.60	9.60		
	1800	1822	5.6	5.6	9.77	9.79		
24-Apr	0700	0709	4.4	4.4	9.38	9.38	31	64
	1200	1215	4.9	4.9	9.98	9.50		
	1800	1808	5.4	5.4	9.73	9.84		
25-Apr	0545	0602	4.4	4.4	9.98	9.96	20	36
	1200	1203	5.9	5.9	8.48	8.56		
	1800	1815	6.0	6.0	8.39	8.39		
26-Apr	0700	0715	5.0	5.0	8.39	8.27	13	31
	1300	1230	5.7	5.7	8.42	8.57		
	1815	1800	5.9	5.9	7.58	7.42		
27-Apr	1715	0700	4.8	4.8	7.85	8.03	5	17
	1213	1200	5.5	5.5	9.84	9.85		
	1858	1812	5.8	5.8	9.75	9.75		
28-Apr	0700	0710	4.1	4.1	9.95	9.95	9	24
	1201	1225	4.3	4.3	9.98	9.99		
	1800	1813	4.5	4.5	10.02	10.01		
29-Apr	0700	0715	4.4	4.4	9.87	9.84	2	7
	1200	1221	5.9	5.9	8.99	8.93		
	1800	1819	4.7	4.7	9.50	9.58		
30-Apr	0630	0645	4.3	4.3	9.45	9.45	0	1
	1200	1210	4.5	4.5	9.93	9.93		
	1800	1800	5.6	5.6	8.83	8.70		
1-May	1800	1830	4.4	4.4	9.85	9.85	0	0
2-May	0700	0711	4.1	4.1	7.53	7.53	0	8
3-May	1230	1242	4.2	4.2	8.82	8.82	0	0
4-May	1900	1918	4.5	4.5	9.28	9.27	0	4

Appendix Table A-2. Continued.

Date	Time		Temperature EC		Dissolved oxygen (ppm)		Mortalities[a]	
	Pond 1	Pond 2	Pond 1	Pond 2	Pond 1	Pond 2	Pond 1	Pond 2
5-May	0700	0710	4.1	4.1	7.45	7.45	0	0
	1200	1207	4.3	4.3	6.99	6.95		
	1800	1813	4.2	4.2	9.35	9.35		
6-May	0700	0714	4.0	4.0	8.77	8.77	0	0
	1307	1314	4.4	4.4	8.89	8.94		
	1900	1919	4.3	4.3	8.54	8.54		

[a] In parentheses is mortalities from fish truck liberations.

Appendix Table A-3. Temperature, dissolved oxygen, and mortality in the concrete acclimation raceway for hatchery winter steelhead at the East Fork Irrigation District Sand Trap, East Fork Hood River, 1997.

Date	Time	Temperature EC	Dissolved oxygen (ppm)	Mortalities
11-Apr			12.5	5
12-Apr	1430	6.8		6
13-Apr				5
14-Apr	0950	5.6		0
15-Apr	0900	5.8		3
	1200	5.6		
	1600	6.7		
16-Apr	0800	5.0		0
17-Apr				6
18-Apr				1
19-Apr				1
20-Apr				2
21-Apr				0
22-Apr				0
23-Apr				0
24-Apr				0
25-Apr	1040	5.0		0
	1328	5.2		
	1920	6.2		
26-Apr	0730	4.9		0
	1240	7.2		
	1845	8.3		
27-Apr	0715	5.0		0
	1300	7.3		
	1930	7.9		
28-Apr	0700	4.8		0
	1330	6.1		
	1730	6.7		
29-Apr	0800	4.9		6
	1130	6.3		
	1700	8.0		
30-Apr	0800	4.9		1
	1330	6.0		
	1800	7.0		

Appendix Table A-3. Continued.

Date	Time	Temperature EC	Dissolved oxygen (ppm)	Mortalities
1-May	0800	3.9		0
	1300	7.0		
	1948	6.6		
2-May	0744	3.7		0
	1340	6.8		
	1930	7.3		
3-May	0815	5.4		0
	1306	6.8		
	1900	7.5		
4-May	0745	5.4		1
	1252	7.4		
	1930	7.7		
5-May	0753	5.5		2
6-May				0
7-May				0
8-May	1000	5.3		0
	1304	8.3		
	1916	9.4		
9-May	0730	5.4		0
	1340	9.3		
	1900	10.0		
10-May	0740	5.3		0
11-May	0810	5.7		0
	1400	9.9		
	2030	10.3		
12-May	0600	5.2		0
13-May				0
14-May				0
15-May				442

Appendix Table A-4. Temperature, dissolved oxygen, and mortality in the portable acclimation raceways for hatchery spring chinook salmon at Blackberry Creek, West Fork Hood River, 1997.

	Time		Temperature EC		Dissolved oxygen (ppm)		Mortalities[a]	
Date	Pond 1	Pond 2	Pond 1	Pond 2	Pond 1	Pond 2	Pond 1	Pond 2
7-Apr	1800	1130	5.0	5.0			107	82
8-Apr	0800	0800	4.3	4.3			156	34
	1030	1030	4.3	4.3	11.3	11.7		
	1400	1400	4.6	4.6	10.7	11.2		
	1645	1645	4.7	4.7	10.6	11.5		
9-Apr	0800	0800	3.8	3.8	11.2	11.8	32	36
	1200	1200	4.1	4.1	11.2	11.7		
	1600	1600	4.1	4.1	11.1	11.4		
10-Apr	0800	0800	3.8	3.8	10.9	11.4	33	27
	1300	1300	4.1	4.1	10.6	11.0		
	1600	1600	4.4	4.4	10.8	10.9		
11-Apr	0800	0800	3.1	3.1	11.4	11.6	27	21
	1300	1300	4.1	4.2	11.0	11.2		
	1800	1800	4.1	3.9	10.7	10.6		
12-Apr	0800	0800	2.8	2.8	11.2	11.1	24	14
	1300	1300	3.7	3.8	11.4	11.1		
	1800	1800	4.2	4.2	10.8	10.9		
13-Apr	0800	0800	4.1	4.1	10.6	11.1	14	11
	1300	1300	4.5	4.4	10.9	11.0		
	1800	1800	4.6	4.5	11.1	11.2		
14-Apr	0800	0800	4.6	4.2	11.3	11.5	27	16
	1300	1300	4.6	4.6	11.1	11.3		
	1800	1800	4.8	4.7	11.2	11.5		
15-Apr	0800	0800	4.0	3.9	11.2	11.8	7	11
	1300	1300	5.2	4.9	11.6	11.9		
	1830	1830	5.4	5.3	11.5	11.6		
16-Apr	0800	0800	4.4	4.4	11.3	11.6	0	300
		1400		5.9		11.1		
		1830		5.2		10.1		
17-Apr	0800	0800	4.3	4.3	11.7	10.8	133	197
	1400	1400	5.4	5.5	9.5	10.0		
	1700	1700	5.4	5.3	9.3	9.5		

Appendix Table A-4. Continued.

Date	Time		Temperature EC		Dissolved oxygen (ppm)		Mortalities[a]	
	Pond 1	Pond 2	Pond 1	Pond 2	Pond 1	Pond 2	Pond 1	Pond 2
18-Apr	0800	0800	4.4	4.4	10.5	10.1	31	111
	1300	1300	4.8	4.8	9.9	9.3		
	1800	1800	4.9	4.8	9.9	9.5		
19-Apr	0800	0800	4.7	4.7	10.1	9.7	37	50
	1300	1300	4.9	4.9	10.1	9.7		
	1800	1800	5.1	5.1	10.1	9.6		
20-Apr	0800	0800	4.5	4.5	10.2	9.8	58	40
	1300	1300	4.9	4.9	10.1	9.5		
	1800	1800	5.0	5.0	9.4	8.6		
21-Apr	0800	0800	4.0	4.0	10.1	9.6	0	0
	1300	1300	4.4	4.4	10.4	9.5		
	1800	1800	5.1	5.1	9.5	8.8		
22-Apr	0800	0800	4.5	4.5	10.1	9.5	20	13
	1300	1300	4.9	4.9	10.1	9.7		
	1800	1800	4.9	4.9	10.0	9.5		
23-Apr	0800	0800	4.6	4.6	9.9	4.6	0	0
	1300	1300	5.3	5.3	10.2	9.7		
	1710	1710	5.1	5.1	10.3	10.0		
24-Apr	0800	0800	4.3	4.3	10.8	10.5	26	12
	1300	1300	4.9	4.9	10.5	10.1		
	1800	1800	5.3	5.3	10.3	9.8		
25-Apr	0800	0800	4.2	4.2	11.0	10.7	0	0
	1300	1300	5.5	5.5	10.3	9.3		
	1800	1800	6.2	6.1	10.3	9.4		
26-Apr	0800	0800	4.8	4.8	11.1	10.5	0	0
	1300	1300	6.2	6.2	11.2	10.2		
	1800	1800	6.6	6.4	10.8	10.5		
27-Apr	0800	0800	5.3	5.0	11.4	11.6	2	3
	1300	1300	5.4	5.4	11.6	11.4		
	1800	1800	5.7	5.5	11.3	11.3		

Appendix Table A-4. Continued.

Date	Time		Temperature EC		Dissolved oxygen (ppm)		Mortalities[a]	
	Pond 1	Pond 2	Pond 1	Pond 2	Pond 1	Pond 2	Pond 1	Pond 2
28-Apr	0800	0800	4.6	4.7	11.6	11.5	5	3
	1300	1300	5.3	5.3	11.1	10.8		
	1800	1800	5.9	5.9	11.3	11.2		
29-Apr	0800	0800	5.0	5.0	11.7	11.5	0	2
	1300	1300	5.7	5.8	11.8	11.4		
30-Apr	0800	0800	5.0	5.0	12.3	11.6	0	0
	1330	1330	5.4	5.4	12.2	11.4		
	1800	1800	4.7	4.7	12.4	12.3		
1-May	0800	0800	4.0	4.0	12.9	12.3	0	11
	1300	1300	5.4	5.4	12.3	11.8		
	1800	1800	5.2	5.2	12.3	11.9		
2-May	0800	0800	3.8	3.8	13.1	12.4	0	0
	1300	1300	5.2	5.1	12.1	11.6		
	1800	1800	5.6	5.6	12.1	11.6		
3-May	0800	0800	4.1	4.0	12.9	12.4	0	0
	1300	1300	5.9	5.9	12.1	11.6		
	1800	1800	6.2	6.0	11.9	11.9		
4-May	0800	0800	5.6	5.4	12.1	12.0	0	0
	1300	1300	6.5	6.2	12.2	11.1		
	1800	1800	6.6	6.6	11.9	11.5		
5-May	0800	0800	5.8	5.5	12.3	11.9	0	0
	1300	1300	7.1	6.8	12.1	11.6		
	1800	1800	7.0	7.1	12.5	11.1		
6-May	0800	0800	6.0	5.8	12.1	11.8	0	0
	1300	1300	6.8	6.6	12.3	12.0		
	1800	1800	6.2	6.3	12.3	12.0		
7-May	0800	0800	4.8	4.8	12.6	12.5	0	0
	1300	1300	6.2	6.2	12.4	12.1		
	1800	1800	6.7	6.7	12.3	12.0		
8-May	0900	0900	5.3	5.3	12.8	12.6	0	0
	1300	1300	6.8	6.8	12.5	11.8		
	1800	1800	7.2	7.2	12.0	11.7		
9-May	0730	0730	5.8	5.8	12.5	12.3	0	0

[a] In parentheses is mortalities from fish truck liberations.

Appendix Table A-5. Temperature, dissolved oxygen, and mortality in the concrete acclimation raceway for hatchery winter steelhead at the East Fork Irrigation District Sand Trap, East Fork Hood River, 1998.

Date	Time	Temperature EC	Dissolved oxygen (ppm)	Mortalities
10-Apr	0700	4.1		0
	1430	6.4		
	2000	6.7		
11-Apr	0900	4.4		0
	1500	11.0		
	2000	6.0		
12-Apr	0830	3.3		0
	1230	5.3		
	1945	6.0		
13-Apr	1300	4.2	10.5	0
	1800	5.3	10.4	
14-Apr	0745	3.2	10.4	0
15-Apr				0
16-Apr				0
17-Apr				0
18-Apr				0
19-Apr				0
20-Apr				0
21-Apr	1230	11.8	13.4	0
22-Apr				0
23-Apr				0
24-Apr	0800	4.6		0
	1320	8.3		
	1930	8.6		
25-Apr	0730	4.0		0
	1225	7.6		
	1930	7.7		
26-Apr	0800	4.0		0
	1340	7.7		
	2000	8.7		
27-Apr	0605	4.9		0
	1200	7.3	9.9	
	1800	6.0	11.3	
28-Apr	0830	10.3	10.0	0

Appendix Table A-6. Temperature, dissolved oxygen, and mortality in the portable acclimation raceways for hatchery spring chinook salmon at Blackberry Creek, West Fork Hood River, 1998.

Date	Time		Temperature EC		Dissolved oxygen (ppm)		Mortalities[a]	
	Pond 1	Pond 2	Pond 1	Pond 2	Pond 1	Pond 2	Pond 1	Pond 2
1-Apr	1430	1430	5.2	5.2	10.9	10.9	32(101)	24(100)
2-Apr	0830	0830	4.6	4.6	11.9	11.5	273	83
	1700	1700	5.5	5.5	10.8	11.0		
3-Apr	1825	1818	5.3	5.3	11.0	11.4	100	115
4-Apr	0903	0848	4.8	4.7	11.3	11.3	19	18
	1607	1614	5.3	5.3	11.1	11.3		
	1906	1858	5.1	5.1	10.9	11.3		
5-Apr	0916	0924	4.8	4.8	11.7	11.6	35	40
	1409	1416	5.4	5.4	11.1	11.0		
	1906	1912	5.5	5.5	10.6	10.9		
6-Apr	0913	0920	4.9	4.9	11.4	11.5	21	52
	1333	1339	5.4	5.4	11.1	11.2		
	1906	1911	5.6	5.6	11.1	11.2		
7-Apr	0821	0827	4.8	4.8	11.5	11.7	0	0
	1900	1930	5.1	5.4	11.3	10.8		
8-Apr	0830	0845	3.9	3.9	12.1	12.1	19	15
	1200	1210	4.6	4.6	11.1	12.0		
9-Apr	0830	0900	4.6	4.6	11.6	11.7	1	0
	1300	1320	5.3	5.3	10.5	9.5		
10-Apr	0800	0820	4.6	4.6	11.4	11.4	8	9
	1224	1231	4.9	4.9	10.9	11.1		
	1853	1902	5.5	5.4	10.8	11.1		
11-Apr	0809	0816	4.5	4.5	11.2	11.6	2	6
	1319	1325	5.0	4.9	11.1	11.4		
	1906	1911	4.9	4.8	11.1	11.5		
12-Apr	0829	0835	4.1	4.1	11.7	11.7	0	0
	1249	1255	4.8	4.7	11.4	11.7		
	1904	1910	5.0	4.9	11.1	11.4		
13-Apr	0826	0832	4.2	4.2	11.5	11.9	0	0
	1214	1220	4.3	4.2	11.5	11.8		
	1908	1914	4.5	4.5	11.3	11.7		

Appendix Table A-6. Continued.

Date	Time		Temperature EC		Dissolved oxygen (ppm)		Mortalities[a]	
	Pond 1	Pond 2	Pond 1	Pond 2	Pond 1	Pond 2	Pond 1	Pond 2
14-Apr	0814	0820	4.3	4.3	11.6	11.8	0	0
	1400	1410	5.1	5.1	11.4	11.2		
	1900	1910	5.2	5.2	11.1	11.4		
15-Apr	0800	0745	4.5	4.5	11.4	12.1	94	51
	1300	1325	5.1	5.8	11.3	11.6		
16-Apr	1000	1020	5.2	5.1	10.6	11.1	123	178
17-Apr							69	42
18-Apr							68	62
19-Apr							63	24
20-Apr							55	36
21-Apr							15	5
22-Apr							15	13
23-Apr							0	0
24-Apr							5	2
25-Apr							1	1
26-Apr							0	1
27-Apr							0	0
28-Apr							2	1
29-Apr							1	1
30-Apr							1	1
1-May							0	1
2-May							1	1
3-May							2	0
4-May							0	0
5-May							1	0
6-May							0	0
7-May							6	2

[a] In parentheses is mortalities from fish truck liberations.

Appendix Table A-7. Temperature, dissolved oxygen, and mortality in the portable acclimation circular for hatchery spring chinook salmon at Jones Creek, West Fork Hood River, 1998.

Date	Time	Temperature EC	Dissolved oxygen (ppm)	Mortalities
16-Apr	1500	4.2	10.83	16
17-Apr	0730	2.8	12.11	20
	1200	4.2	11.63	
	1800	5.0	11.92	
18-Apr	0645	3.4	12.02	6
	1900	4.9	11.81	
19-Apr	0715	3.7	11.69	6
	1500	5.1	11.86	
	1919	4.5	11.97	
20-Apr	0741	2.9	12.54	4
	1415	5.6	11.35	
	1950	4.8	11.83	
21-Apr	0937	3.7	12.11	2
	1615	6.1	11.04	
	2045	4.8	11.50	
22-Apr	0920	3.9	11.84	3
	1600	5.6	11.05	
	1905	5.1	11.45	
23-Apr	0948	4.0	12.25	0
	1505	4.1	11.81	
	1946	3.9	12.19	
24-Apr	0615	2.7	12.6	0
	1230	3.5	12.40	
	1930	3.1	12.61	
25-Apr	0630	2.8	12.63	3
	0950	3.1	12.65	
	1500	4.3	12.16	
	1920	4.1	12.30	
26-Apr	0815	2.9	12.67	0

Appendix Table A-8. Biweekly counts of migrant wild rb-st (STW) and hatchery winter steelhead (HSTW) marked (M) and recaptured (R) at the mainstem migrant trap, 1996. (percent recapture = %).

Location,	April 1-15			April 16-30			May 1-15			May 16-31			June 1-15			June 16-30			July 1-15		
Species	M	R	%	M	R	%	M	R	%	M	R	%	M	R	%	M	R	%	M	R	%
Mainstem,																					
STW	14	1	7.1	5	3	60[a]	178	12	6.7	296	20	6.8	76	5	6.6	1	1	100	2	0	0
HSTW	50	3	6.0	95	8	8.4	409	19	4.6	343	19	5.5	246	3	1.2	10	0	0	2	0	0

[a] The formula for calculating STW trapping efficiency for 16-30 April was using a ratio comparison of hatchery and wild trapping efficiency numbers between 1-15 April and 1-15 May and comparing them to the time period 16-30 April. The formula was

$$\frac{13.8}{10.6} = \frac{X}{8.4}$$

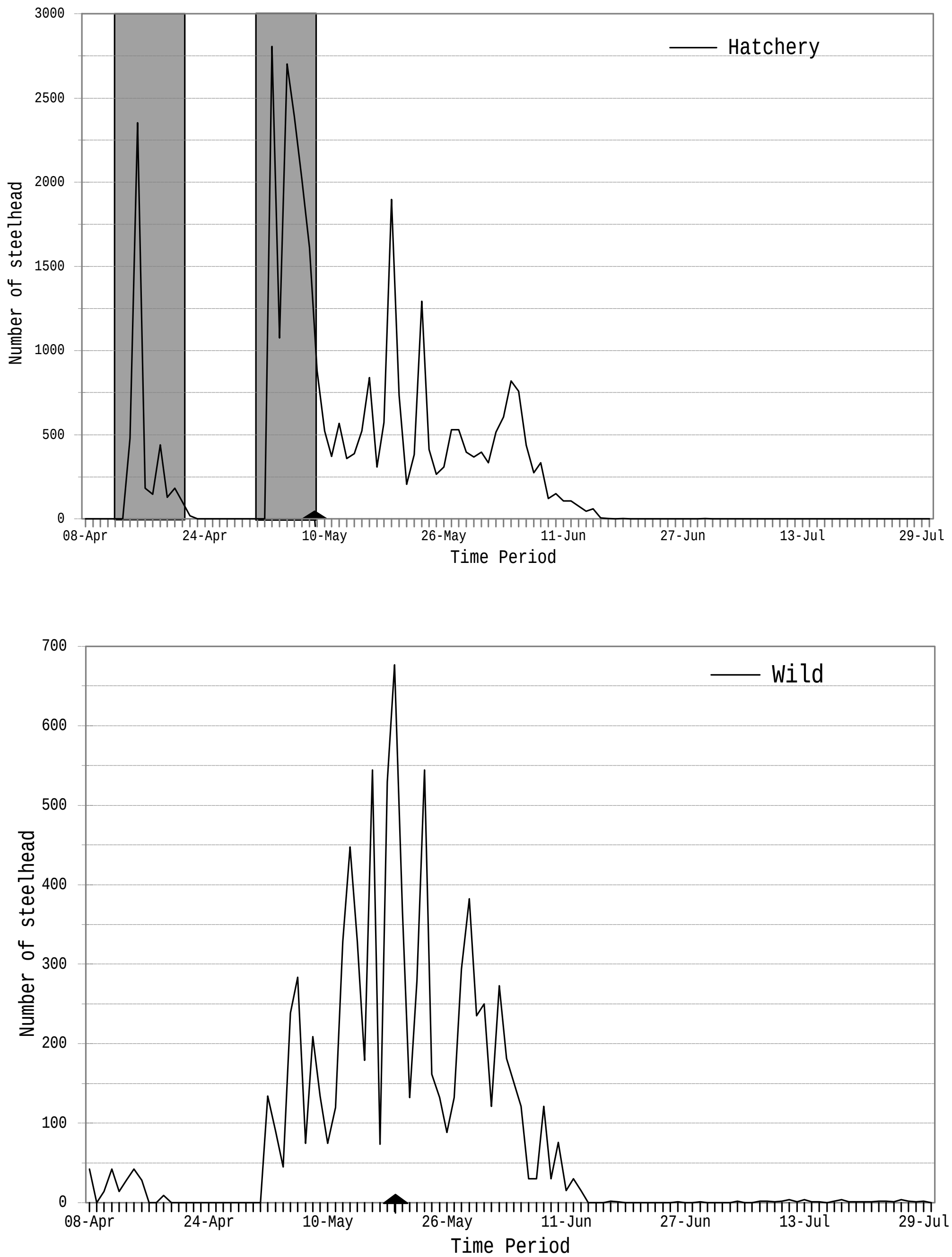
$$X = 10.9$$

Appendix Table A-9. Biweekly counts of migrant wild rb-st (STW) and hatchery winter steelhead (HSTW) marked (M) and recaptured (R) at the mainstem migrant trap, 1997. (percent recapture = %).

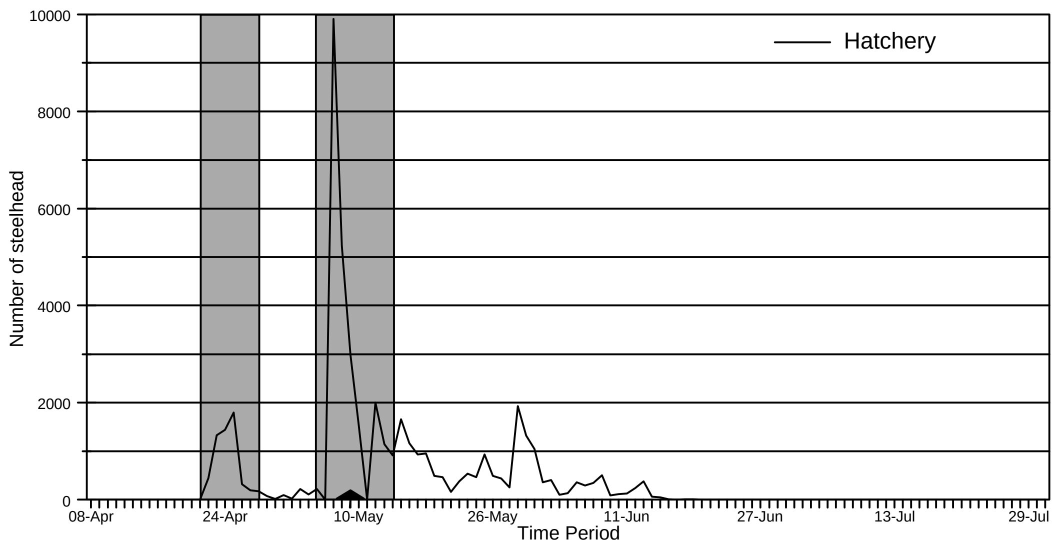
Location,	April 1-15			April 16-30			May 1-15			May 16-31			June 1-15			June 16-30			July 1-15		
Species	M	R	%	M	R	%	M	R	%	M	R	%	M	R	%	M	R	%	M	R	%
Mainstem,																					
STW	8	0	0	64	4	6.3	364	20	5.5	207	9	4.3	75	6	8.0	9	0	0	0	0	0
HSTW	0	0	0	306	3	1.0	202	3	1.5	340	13	3.8	276	10	3.6	29	0	0	1	0	0

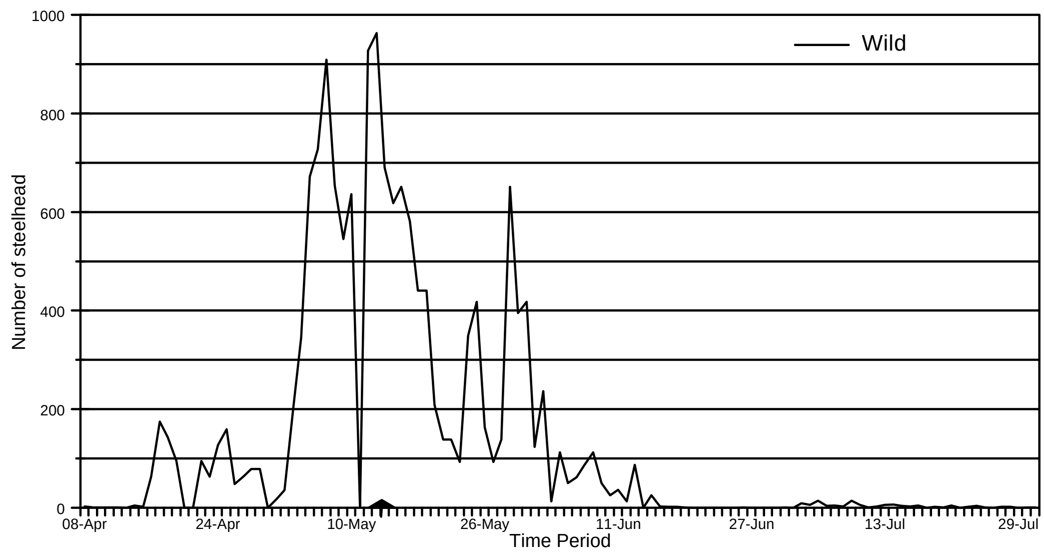
Appendix Table A-10. Biweekly counts of migrant wild rb-st (STW) and hatchery winter steelhead (HSTW) marked (M) and recaptured (R) at the mainstem migrant trap, 1998. (percent recapture = %).

Location,	April 1-15			April 16-30			May 1-15			May 16-31			June 1-15			June 16-30			July 1-15		
Species	M	R	%	M	R	%	M	R	%	M	R	%	M	R	%	M	R	%	M	R	%
Mainstem,																					
STW	12	1	8.3	358	10	2.8	458	18	3.9	345	22	6.4	49	3	6.1	4	0	0	5	0	0
HSTW	14	0	0	156	10	6.4	324	11	3.4	751	31	4.1	472	18	3.8	52	1	1.9	0	0	0

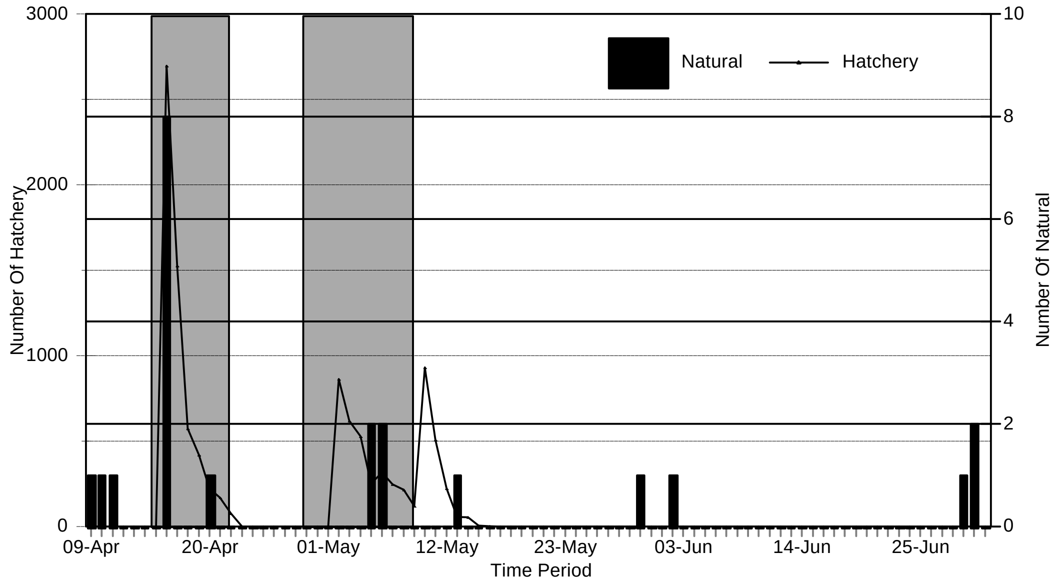


Appendix Figure A-1. Migration timing of hatchery winter steelhead and wild rainbow/steelhead at the mainstem Hood River rotary screw trap, 1996 migration year. The trap was not operational between 23 April-1 May. Numbers were adjusted for trapping efficiency. • = median migration date. The shaded portion represents timing of volitional releases from the East Fork Hood River acclimation raceways.

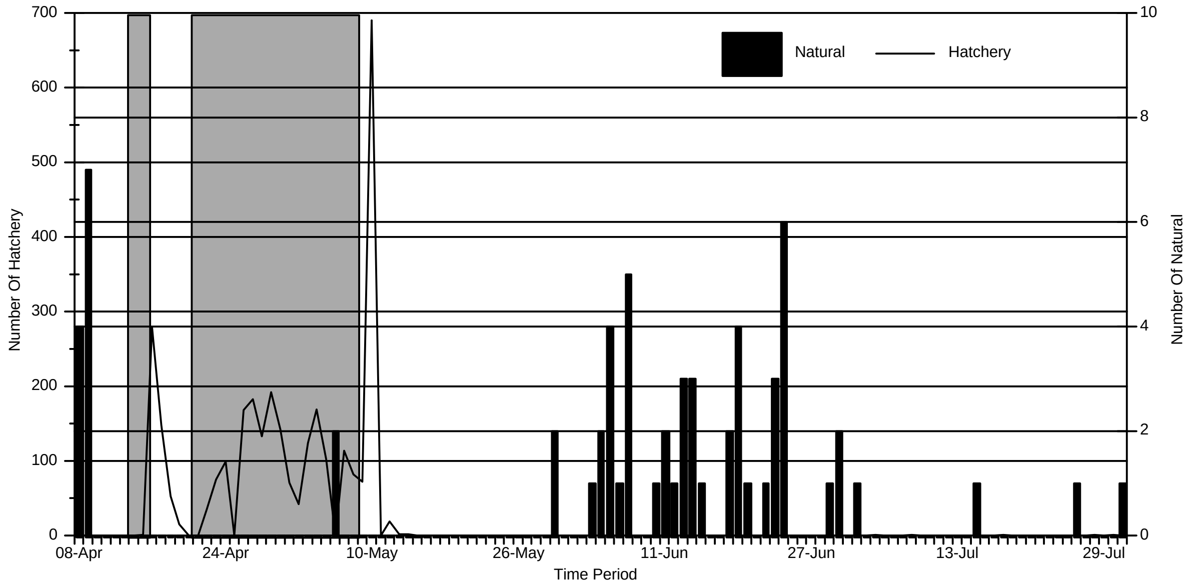




Appendix Figure A-2. Migration timing of hatchery winter steelhead and wild rainbow/steelhead at the mainstem Hood River rotary screw trap, 1997 migration year. The trap was not operational on 20-21 April and 11 May. Numbers were adjusted for trapping efficiency. • = median migration date. The shaded portion represents timing of volitional releases from the East Fork Hood River acclimation raceways.



Appendix Figure A-3. Migration timing of hatchery and naturally produced spring chinook salmon smolts at the mainstem Hood River rotary screw trap, 1996 migration year. Trap was not operational between 23 April-1 May. Numbers were not adjusted for trapping efficiency. The shaded portion represents the timing of the volitional release from the West Fork Hood River acclimation raceways.



Appendix Figure A-4. Migration timing of hatchery and naturally produced spring chinook salmon smolts at the mainstem Hood River rotary screw trap, 1997 migration year. Trap was not operational on 20-21 April and 11 May. Numbers were not adjusted for trapping efficiency. The shaded portion represents the timing of the volitional release from the West Fork Hood River acclimation raceways.

APPENDIX B

Spring Chinook Salmon Spawning Ground Survey Supportive Data

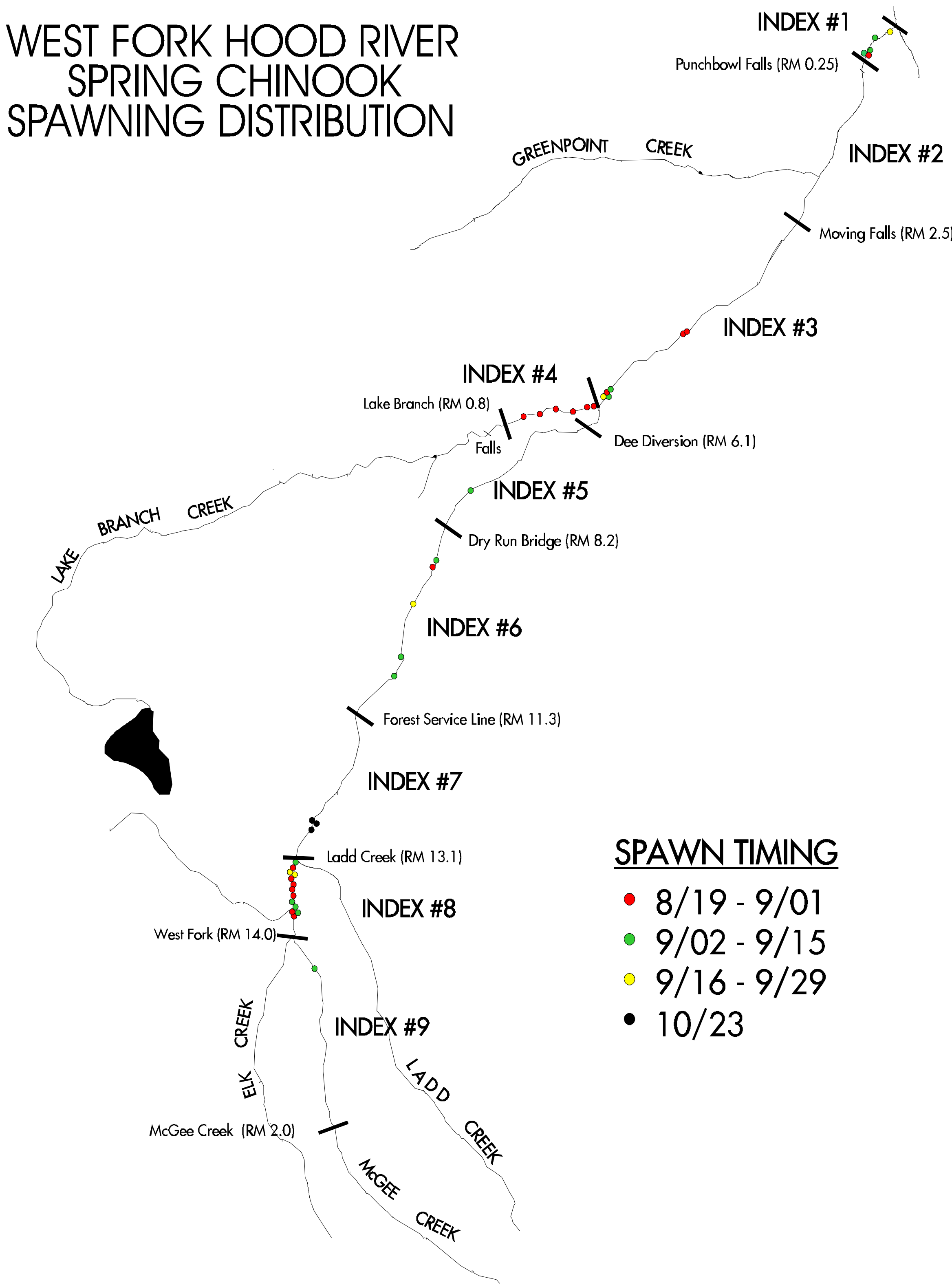
Appendix Table B-1. Summary of the USFS (Hood River Ranger District) unpublished data of the upper West Fork Hood River and McGee Creek spring chinook salmon spawning ground surveys. 1992-1995.

Year, Date	Location	Redds	Carcasses female	Carcasses male	Floytag Numbers
1992, 8/19	Ladd to lower 100' of McGee.	0	1	1	5682
	McGee (100'-500' upstream from confluence with W.F. Hood River.	9	0	0	
8/27	West Fork only.	0	5	2	5460
8/28	West Fork road access to the confluence of McGee.	11	11	5	5247, 5920, 5412, 5744, 5500, 5406, 5192, 5555
	Ladd to road access.	16	2	1	
	McGee (300 yds upstream from the confluence with the West Fork.	2	0	0	
8/31	West Fork just above Ladd Creek.	0	2	0	
1993[a], 8/25	Below Ladd only (Rm 13.0).	N/A	2	1	2232, 2465 2685, 2694, 2771
8/30	Below Ladd to the confluence of the West Fork (Rm 13 - 14).	N/A	2	1	
9/08	West Fork (Rm 13 - 13.8).	N/A	1	0	2742
1994, 8/24	Ladd to the top of the ‘93 project (Rm 13.1 - 13.7).	0	0	1	
9/17	Ladd to McGee (Rm 13.1 - 14.0)	4	2	1	4669
	McGee up 1/4 mile.	0	0	0	
1995, 9/11	West Fork (Rm 13).	0	0	0	
9/22	Ladd to McGee (Rm 13.1 - 14.0).	0	0	0	
	100' upstream from the mouth of Elk and 0.5 miles up McGee.	0	0	0	

[a] Formal redd counts were not conducted in 1993.

Appendix Table B-2. West Fork Hood River spring chinook salmon spawning ground survey coded wire tag recovery data, 1997. (Ad=adipose, LV=left ventral, RV=right ventral).

Coded Wire Tag Code	Date recovered	Recovery location (Rm)	Mark	Sex	MEPS Length (cm)	Floy tag number	Spawned out? (Yes/No)	Comments
7/5/49	8-19-97	5.0	AdLV/RV	F	71.0	None	Yes	U. Idaho radio tag CH 22, Code 83
7/5/49	9-5-97	5.4	Ad	F	70.5	11167	Yes	
7/5/49	9-9-97	7.1	Ad	M	61.0	None	Yes	
7/5/49	9-22-97	7.2	Ad	F	61.4	8839	Yes	
7/5/49	10-8-97	13.4	Ad	F	78.0	8853	Yes	



Appendix Figure B-1. Survey index areas and redd locations by date, 1997.

APPENDIX C

Oak Springs Hatchery Evaluation Supportive Data

Appendix Table C-1. Percent tag retention and clipping results for the 1993 brood year winter steelhead. (Ad = adipose, LV = left ventral)

Broodstock, hatchery, brood year,	**Tag code**	**Fin clip**	**Date**	**Percent tag retention**	**Percent fin clip**
Hood River,					
Oak Springs,					
1993	07-05-36	Ad-LV	14-Oct-93	99.7	99.4
1993	07-05-37	Ad-LV	14-Oct-93	100.0	99.7
1993	07-05-38	Ad-LV	19-Oct-93	89.2	99.7
1993	07-05-39	Ad-LV	19-Oct-93	99.4	99.2

Appendix Table C-2. Percent coded-wire tag retention, tag code, and clipping information for winter steelhead, 1994-1995 broods. (adipose = Ad, left ventral = LV, right maxillary = RM)

Broodstock, hatchery, brood year	**Pond**	**Tag code**	**Fin clip**	**Date sampled**	**Percent tag retention**
Hood River,					
Oak Springs,					
1994	L-3	07-08-63	Ad-LV	28-Nov-94	95.8
		07-09-16			
1994	L-4	07-09-17	Ad-LV	28-Nov-94	88.9
		07-09-18			
1994	L-4	07-09-17	Ad-LV	05-Apr-95	86.6
		07-19-18			
1995	L-3	07-11-31	Ad-LV-RM	12-Jan-96	100.0
1995	L-4	07-11-32	Ad-LV-RM	12-Jan-96	97.1

Appendix Table C-3. Clipping results for winter steelhead at Oak Springs Hatchery, 1994-1996 broods. (Percent of total number sampled is in parentheses. Ad = adipose, LV = left ventral, RM = right maxillary, LM = left maxillary.)

Broodstock, hatchery, brood year	Pond	Fin clip	Date sampled	Number sampled	No Ad	Poor Ad	No LV	Poor LV	No RM	Poor RM	No LM	Poor LM
Hood River,												
Oak Springs,												
1994	L-3	Ad-LV	28-Nov-94	378	7(2)	38(10)	0(0)	10(3)				
1994	L-4	Ad-LV	28-Nov-94	350	4(1)	15(4)	0(0)	6(2)				
1994	L-4	Ad-LV	05-Apr-95	322	3(1)	28(9)	0(0)	8(2)				
1995	L-3	Ad-LV-RM	12-Jan-96	104	0(0)	0(0)	2(2)	26(25)	0(0)	0(0)		
1995	L-4	Ad-LV-RM	12-Jan-96	102	0(0)	0(0)	0(0)	19(19)	0(0)	0(0)		
1996	M-2	Ad-LM	10-Apr-97	128	0(0)	3(2)					1(1)	2(2)
1996	M-1	Ad-LM	28-Apr-97	216	3(1)	7(3)					2(1)	0(0)

APPENDIX D

Investigation of the Biodiversity of Oncorhynchus mykiss and O.clarki in the Vicinity of Mt. Hood and the Columbia Gorge

Progress Report 2/6/97

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Report

We initiated work on June 1, 1996. We have completed DNA extractions form the bulk of the samples. Our work is currently focused on two aspects of the project, development of microsatellite multiplexes and identification of species-specific DNA markers.

In accord with the 1996 Study Plan we initiated microsatellite analysis of samples from the study area. We have identified at least 10 microsatellite primer pairs that produce informative DNA fragments. We are currently in the process of combining these primers into “multiplex” sets to allow the amplification of three or four loci simultaneously. Wenburg et al. 1996 have previously developed four multiplex sets for these species. We are using their work to compensate for various thermocyclers and detection techniques, that work should proceed quickly.

Our initial microsate screening occasionally detected individuals that contain alleles well beyond the size range normally observed in the population from which they were sampled. This observation has been reported in microsatellite data and may simply be a result of a major mutation within the microsatellite locus in a few individuals. However, microsatellite allele size distributions frequently vary between species and thus these aberrant alleles may in fact be the result of hybridization. This raised some concern that some of our samples might be hybrids that were not visually identified as such and prompted us to focus on the development of species identification techniques in concert with our microsatellite screening.

We are utilizing two techniques to identify rainbow trout (Oncorhynchus mykiss), cutthroat trout (O.clarki), and their hybrids. The first technique, intron screening, is based on fixed restriction enzyme recognition site differences between the species in non coding DNA. John Baker, a University of Washington graduate student, is working with Paul Moran at the NMFS Montlake Lab to identify species specific markers using this technique. We are cooperating with them to generate these markers in the most efficient manner possible.

We are also using paired interspersed element PCR(PINE-PCR) to identify rainbow, cutthroat and their hybrids. This technique utilizes dispersed repetitive elements as PCR priming sites and amplifies DNA fragments flanked by two such elements. We have successfully used this technique to identify bull trout (Salvelinus confluentus), brook trout (S.fontinalis), and their hybrids. Our initial screening indicates that it will also be successful in Oncorhynchus. We have currently identified nine putative diagnostic PINE markers and are continuing to screen other primer pairs.

APPENDIX E

Pelton Ladder Supportive Data

Appendix Table E-1. Cell and pond location of 1994 brood spring chinook salmon juveniles at Pelton Ladder and Round Butte Hatchery, 1995. (Ad = adipose, RV = right ventral, L = ladder, H = hatchery.)

Pond	Ship to ladder or pond	Pond or cell number	Size (fish/lb)	Number	Tag code-clip
H-1A	Oct.1	H-1	18.1	22,100	07-09-37-Ad
H-1B	Oct.1	H-2	34.5	33,118	07-09-36-Ad
H-7	Nov.13	L-1	13.6	66,181	07-09-35-Ad
H-2	Sept.25	L-2	21.4	63,916	07-09-33-Ad
H-3	Nov.15	L-3	14.2	63,782	07-09-34-Ad
H-10	Sept.28	L-4	29.7	63,784	07-11-30-AdRV
H-8	Sept.27	L-5	29.4	63,885	07-11-30-AdRV
H-4	Nov.14	L-6	24.3	95,885	07-09-38-Ad

Appendix Table E-2. Cell and pond location of the 1995 brood spring chinook salmon juveniles at Pelton Ladder and Round Butte Hatchery, 1996. (Ad = adipose, LV = left ventral, L = ladder, H = hatchery.)

Pond	Ship to ladder or pond	Pond or cell number	Size (fish/lb)	Number	Tag code-clip
H-1A	Oct.17	H-1	16.4	21,016	09-17-44-Ad
H-1B	Oct.17	H-2	26.0	31,552	09-17-45-Ad
H-5	Nov.13	L-1	14.3	64,848	09-17-42-Ad
H-6	Oct.15	L-2	14.1	64,809	09-17-41-Ad
H-8	Nov.13	L-3	22.0	96,643	09-17-46-Ad
H-2	Oct.15	L-4	14.6	64,752	09-17-47-AdLV
H-7	Oct.15	L-5	14.1	64,794	09-18-06-AdLV
H-10	Nov.13	L-6	11.9	64,750	09-17-43-Ad

Appendix Table E-3. Cell and pond location of the 1996 brood spring chinook salmon juveniles at Pelton Ladder and Round Butte Hatchery, 1997. (Ad = adipose, RV = right ventral, L = ladder, H = hatchery.)

Pond	Ship to ladder or pond	Pond or cell number	Size (fish/lb)	Number	Tag code-clip
H-1A	Sept.30	H-1	20.4	21,693	09-22-23-Ad
H-1B	Sept.30	H-2	18.9	32,123	09-22-24-Ad
H-8	Nov.4,5	L-1	13.1	66,206	09-22-20-Ad
H-10	Sept.30	L-2	12.9	65,421	09-22-21-Ad
H-6	Nov.4,5	L-3	19.6	97,944	09-22-25-Ad
H-2	Sept.30	L-4	12.3	64,436	09-22-26-AdRV
H-5	Sept.30	L-5	11.7	65,631	09-22-27-AdRV
H-9	Nov.4,5	L-6	15.8	65,654	09-22-22-Ad

Appendix Table E-4. Cell and pond location of the 1997 brood spring chinook salmon juveniles at Pelton Ladder and Round Butte Hatchery, 1998. (Ad = adipose, RV = right ventral, L = ladder, H = hatchery.)

Pond	Ship to ladder or pond	Pond or cell number	Size (fish/lb)	Number	Tag code-clip
H-10	Nov.16	H-10	13.4	30,487	09-25-57-AdRM
H-1	Nov.20	L-1	14.7	82,248	09-25-51-Ad
H-2	Nov.20	L-2	15.5	82,286	09-25-52-Ad
H-3	Nov.19	L-3	14.5	82,282	09-25-53-Ad
H-4	Nov.18	L-4	13.7	48,669	09-25-56-AdLV
H-9	Nov.17	L-5	14.8	48,761	09-25-55-AdLV
H-8	Nov.18	L-6	15.9	82,336	09-25-54-Ad

Appendix Table E-5. Releases of juvenile spring chinook salmon from Round Butte Hatchery into the Deschutes River, 1978-1997 broods. LP = left pectoral; RP = right pectoral; LM = left maxillary; RM = right maxillary. [a]

Brood year, release date	Release site	Number released	Size at release (fish/lb)	Fin clip or coded-wire tag code
1978:				
05/10/79	Pelton Ladder [b]	14579	19.7	07-18-24
05/30/79	Pelton Reregulating Dam	54300	22.0	07-18-25
04/14/80	Pelton Reregulating Dam	32865	8.0	07-19-49
04/14/80	Pelton Reregulating Dam	30758	8.8	07-19-50
04/14/80	Pelton Ladder [b]	29993	8.0	07-19-51
1979:				
05/12/80	Pelton Ladder [b]	22280	20.0	07-21-53
10/06/80	Pelton Reregulating Dam	29264	5.9	07-21-54
03/10/81	Pelton Reregulating Dam	30450	7.3	07-23-10
04/24/81	Pelton Reregulating Dam	29200	4.9	07-23-09
03/02/81	Pelton Ladder [c]	25446	8.8	07-23-11
1980:				
10/05/81	Pelton Reregulating Dam	46578	5.7	07-23-47
10/05/81	Pelton Reregulating Dam	29430	11.4	07-23-49
03/02/82	Pelton Ladder [c]	28656	5.9	07-23-48
03/23/82	Pelton Reregulating Dam	25010	4.8	07-23-50
1981:				
10/11/82	Pelton Reregulating Dam	28538	6.4	07-25-20
10/11/82	Pelton Reregulating Dam	59118	23.6	07-27-15
03/21/83	Pelton Reregulating Dam	57340	9.3	07-27-14
03/02/83	Pelton Ladder (Upper) [c]	48495	12.2	07-27-16
03/21/83	Pelton Ladder (Lower) [c]	28847	12.2	07-27-17

[a] Production releases prior to the 1978 brood are in Lindsay et al. (1987). Experimental releases totaling 70,013 were made into Pelton Ladder from 1975 to 1979 (1974-77 broods) to determine migration timing but were not included in this table.

Appendix Table E-5. Continued.

Brood year, release date	Release site	Number released	Size at release (fish/lb)	Fin clip or coded-wire tag code
1982:				
05/24/83	Pelton Reregulating Dam	28920	19.2	07-28-36
10/05/83	Pelton Reregulating Dam	53550	16.3	07-28-43
10/06/83	Pelton Reregulating Dam	28200	5.6	07-28-37
04/16/84	Pelton Reregulating Dam	28790	5.2	07-28-39
04/16/84	Pelton Reregulating Dam	28991	5.2	07-28-40
03/05/84	Pelton Ladder (Lower) [c]	53941	9.5	07-28-42
04/15/84	Pelton Ladder (Upper) [c]	50946	8.4	07-28-41
1983:				
10/08/84	Pelton Reregulating Dam	60797	12.4	07-31-31
10/09/84	Pelton Reregulating Dam	30394	6.5	07-31-32
04/02/85	Pelton Reregulating Dam	57748	5.8	07-31-28
03/09/85	Pelton Ladder (Lower) [c]	60712	7.6	07-31-29
04/01/85	Pelton Ladder (Upper) [c]	60759	7.6	07-31-30
1984:				
03/12/86	Pelton Reregulating Dam	32000	5.7	07-33-20
03/13/86	Pelton Reregulating Dam	30952	5.7	07-33-20
06/03/86	Pelton Ladder (Mix) [c]	62994	7.7	07-33-21
06/05/86	Pelton Ladder (Mix) [c]	74744	7.7	LV LM
06/05/86	Pelton Ladder (Mix) [c]	75160	7.7	LP
1985:				
04/13/87	Pelton Reregulating Dam	54863	5.5	07-39-28
05/27/87	Pelton Ladder (Mix) [c]	62000	7.5	07-39-29
05/27/87	Pelton Ladder (Mix) [c]	74000	7.5	RV RM
05/27/87	Pelton Ladder (Mix) [c]	75000	7.5	RP

Appendix Table E-5. Continued.

Brood year, release date	Release site	Number released	Size at release (fish/lb)	Fin clip or coded-wire tag code
1986:				
04/11/88	Pelton Reregulating Dam	54221	6.9	07-44-61
04/11/88	Pelton Ladder (Mix) [c]	55147	8.5	07-44-62
04/22/88	Pelton Ladder (Mix) [c]	66593	8.5	LV LM
04/22/88	Pelton Ladder (Mix) [c]	66594	8.5	LP
05/25/88	Pelton Ladder (Mix) [c]	6123	8.2	07-44-62
05/25/88	Pelton Ladder (Mix) [c]	7771	8.5	LV LM
05/25/88	Pelton Ladder (Mix) [c]	7770	8.5	LP
1987:				
04/17/89	Pelton Reregulating Dam	28186	7.3	07-46-22
04/17/89	Pelton Reregulating Dam	29528	6.4	07-46-23
04/18/89	Pelton Ladder (Cell 1) [c]	20473	9.5	07-46-24
04/18/89	Pelton Ladder (Cell 2) [c]	20408	9.3	07-46-25
04/18/89	Pelton Ladder (Cell 3) [c]	20458	10.6	07-46-26
04/18/89	Pelton Ladder (Mix) [c]	153865	9.8	RM
1988:				
04/20/90	Pelton Reregulating Dam	29590	6.5	07-50-61
04/19/90	Pelton Reregulating Dam	28608	6.0	07-50-62
05/17/90	Pelton Ladder (Cell 3) [c]	24107	10.7	07-50-58
05/17/90	Pelton Ladder (Cell 2) [c]	20967	9.7	07-50-59
05/17/90	Pelton Ladder (Cell 1) [c]	21328	8.8	07-50-60
05/17/90	Pelton Ladder (Mix) [c]	134847	9.7	LM
1989:				
04/22/91	Pelton Reregulating Dam	29959	6.1	07-53-61
04/23/91	Pelton Reregulating Dam	29959	6.1	07-53-62
05/14/91	Pelton Ladder (Cell 1) [c]	21236	9.5	07-53-63
05/14/91	Pelton Ladder (Cell 2) [c]	21232	9.5	07-54-01
05/14/91	Pelton Ladder (Cell 3) [c]	21521	10.5	07-54-02
05/14/91	Pelton Ladder (Mix) [c]	146895	9.8	RM

Appendix Table E-5. Continued.

Brood year, release date	Release site	Number released	Size at release (fish/lb)	Fin clip or coded-wire tag code
1990:				
04/28/92	Pelton Reregulating Dam	28575	6.5	07-56-48
04/28/92	Pelton Reregulating Dam	28575	6.5	07-56-49
05/21/92	Pelton Ladder (Cell 1) [c]	21148	9.8	07-56-45
05/20/92	Pelton Ladder (Cell 2) [c]	21540	9.8	07-56-46
05/21/92	Pelton Ladder (Cell 3) [c]	21393	9.8	07-56-47
05/21/92	Pelton Ladder (Mix) [c]	149548	9.8	LM
1991:				
04/07/93	Pelton Reregulating Dam	24735	6.1	07-50-08
04/05/93	Pelton Ladder (Cell 1) [c]	21122	8.7	07-59-40
04/05/93	Pelton Ladder (Cell 1) [c]	47713	8.7	07-59-49
04/06/93	Pelton Ladder (Cell 2) [c]	22020	10.0	07-59-39
04/06/93	Pelton Ladder (Cell 2) [c]	49600	10.0	07-59-48
04/07/93	Pelton Ladder (Cell 3) [c]	49127	9.8	07-59-47
04/07/93	Pelton Ladder (Cell 3) [c]	21589	9.8	07-59-38
1992:				
04/18/94	Pelton Reregulating Dam	26580	6.0	07-02-30
05/06/94	Pelton Ladder (Cell 3) [c]	70995	8.6	07-02-27
05/06/94	Pelton Ladder (Cell 2) [c]	70996	9.3	07-02-28
05/06/94	Pelton Ladder (Cell 1) [c]	68998	8.9	07-02-29
1993:				
04/17/95	Pelton Reregulating Dam	29318	5.8	08-05-29
04/17/95	Pelton Ladder (Cell 3) [c]	69446	8.7	07-05-26
04/19/95	Pelton Ladder (Cell 2) [c]	70042	8.7	07-05-27
04/18/95	Pelton Ladder (Cell 1) [c]	70413	8.1	07-05-28

Appendix Table E-5. Continued.

Brood year, release date	Release site	Number released	Size at release (fish/lb)	Fin clip or coded-wire tag code
1994:				
04/23/96	Pelton Ladder (Cell 2) [d]	63445	7.8	07-09-33
04/24/96	Pelton Ladder (Cell 3) [e]	63551	8.3	07-09-34
04/22/96	Pelton Ladder (Cell 1) [e]	65625	7.3	07-09-35
04/25/96	Pelton Reregulating Dam	25654	10.7	07-09-36
04/25/96	Pelton Reregulating Dam	19239	8.0	07-09-37
04/25/96	Pelton Ladder (Cell 6) [e]	85151	10.9	07-09-38
04/25/96	Pelton Ladder (Cell 4,5) [f]	7282	9.9	07-11-30
1995:				
04/17/97	Pelton Ladder (Cell 2) [g]	61232	7.3	09-17-41
04/16/97	Pelton Ladder (Cell 1) [e]	61102	7.3	09-17-42
04/21/97	Pelton Ladder (Cell 6) [e]	62530	8.0	09-17-43
04/15/97	Pelton Reregulating Dam	14910	6.5	09-17-44
04/15/97	Pelton Reregulating Dam	25938	11.0	09-17-45
04/18/97	Pelton Ladder (Cell 3) [e]	90474	11.0	09-17-46
1996:				
04/13/98	Pelton Reregulating Dam	16397	8.6	09-22-23
04/14/98	Pelton Reregulating Dam	31699	12.0	09-22-24
04/20/98	Pelton Ladder (Cell 1) [e]	60145	9.0	09-22-20
04/21/98	Pelton Ladder (Cell 2) [d]	63213	8.1	09-22-21
04/22/98	Pelton Ladder (Cell 3) [e]	96633	11.0	09-22-25
04/23/98	Pelton Ladder (Cell 6) [e]	64149	10.0	09-22-22
1997:				
04/12/99	Pelton Ladder (Cell 1) [e]	71395	7.8	09-25-51
04/13/99	Pelton Ladder (Cell 2) [e]	72375	7.5	09-25-52
04/14/99	Pelton Ladder (Cell 3) [e]	79611	7.7	09-25-53
04/15/99	Pelton Ladder (Cell 6) [e]	80940	7.1	09-25-54

[b] Fish were transported from the hatchery to Pelton Ladder in March and allowed to migrate on their own volition beginning on the release date.

[c] Fish were transferred from the hatchery to Pelton Ladder in late October or early November and allowed to migrate on their own volition beginning on the release date.

[d] Fish were transferred from the hatchery to Pelton Ladder in September and allowed to migrate on their own volition beginning on the release date.

[e] Fish were transferred from the hatchery to Pelton Ladder in November and allowed to migrate on their own volition beginning on the release date.

[f] Hood River destined spring chinook salmon smolts leaked through the rotary screen seals from Pelton Ladder cells four and five into the Deschutes River release cells. Fish were transferred from the hatchery to Pelton Ladder in September and allowed to migrate on their own volition beginning on the release date.

[g] Fish were transferred from the hatchery to Pelton Ladder in October and allowed to migrate on their own volition beginning on the release date.