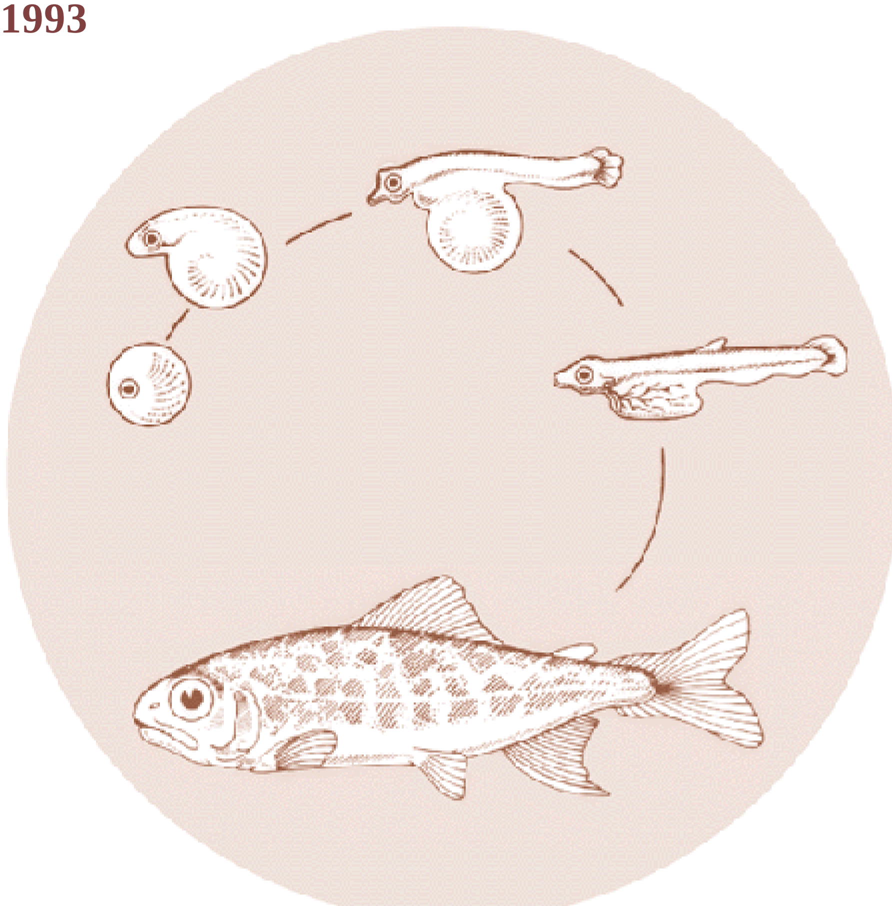
Hood River and Pelton Ladder Evaluation Studies

Annual Report
1993



DOE/BP-00631-3

April 1994

This Document should be cited as follows:

Olsen, Erik, Rod French, James Newton, ''Hood River and Pelton Ladder Evaluation Studies'', Project No. 1989-02900, 47 electronic pages, (BPA Report DOE/BP-00631-3)

Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208

This report was funded by the Bonneville Power Administration (BPA), U.S. Department of Energy, as part of BPA's program to protect, mitigate, and enhance fish and wildlife affected by the development and operation of hydroelectric facilities on the Columbia River and its tributaries. The views in this report are the author's and do not necessarily represent the views of BPA.

HOOD RIVER AND PELTON LADDER EVALUATION STUDIES

ANNUAL REPORT 1993

Prepared by:

Erik A. Olsen
Confederated Tribes of the Warm Springs Reservation
Warm Springs, OR 97761

and

Rod A. French
James A. Newton
Oregon Department of Fish and Wildlife
Portland, OR 97207

Prepared for:

U. S. Department of Energy
Bonneville Power Administration
Division of Fish and Wildlife
P.O. Box 3621
Portland, OR 97208362 1

Project Numbers:
89-29, 89-29-01, 89-053-03, 89-053-04, 93-019
Contract Numbers:
DE-BI79-89BP00631
DE-BI79-89BP00632
DE-BI79-93BP8 1756
DE-BI79-93BP81758
DE-BI79-93BP99921

APRIL 1994

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INTRODUCTION

The primary goals of the Hood River Production Project (HRPP) are 1) to increase production of wild summer and winter steelhead (Oncorhynchus mykiss) and 2) to reintroduce spring chinook salmon (Oncorhynchus tshawytscha) into the Hood River subbasin. Harvest and escapement goals are identified in the Hood River and Pelton Ladder master plans. Strategies for achieving the production goals were initially devised based on various assumptions about carrying capacity, survival rates, and escapement of stocks of anadromous salmonids in the Hood River subbasin. To obtain the information needed to more accurately estimate each parameter we operated an adult trap at Powerdale Dam to collect life history and escapement information on stocks of anadromous salmonids entering the Hood River subbasin. The Oregon Department of Fish and Wildlife (ODFW) funded the monitoring program at Powerdale Dam beginning in December 1991, and Bonneville Power Administration (BPA) took over the funding in August 1992.

The contract period for this project was 1 October 1992 through 30 September 1993. Objectives for FY 93 were 1) to develop a long term monitoring and evaluation plan for the Hood River and Pelton Ladder (Hood River/Pelton Ladder) projects, 2) to identify monitoring and evaluation needs for FY 94, 3) to prepare an annual report summarizing data collected at Powerdale Dam through 30 September 1993, and 4) to continue work on the various activities needed to construct hatchery facilities in the Hood River subbasin and for making the necessary modifications to Pelton Ladder. Objectives 1 and 2 were completed as the Hood River/Pelton Ladder Master Agreement. This report summarizes the life history and escapement data collected at the Powerdale Dam adult trap and the status of the engineering work. We will use the life history and escapement data 1) to test the assumptions on which harvest and escapement goals for the Hood River and Pelton Ladder master plans are based, and 2) to develop biologically based management recommendations for implementing HRPP. We will continue to collect life history and escapement data at the adult trap during both the development and execution of HRPP.

METHODS

An upstream migrant fish trap was installed at Powerdale Dam in December 1991. Powerdale Dam, which is owned and operated by Pacific Power and Light (PP&L), is located at river mile. (RM) 4.5 in the main stem of the Hood River (Figure 1). The trap was installed in the uppermost pool of an existing fish ladder located on the east bank of the river. The stop log water intake control of the fish ladder was modified to let water flow through a submerged opening in the ladder. A removable bar grate with one inch spaces between bars blocked the submerged opening to prevent fish from leaving the top pool of the ladder. A fyke, installed at the entrance to the uppermost pool, prevented fish from backing down the ladder after they entered the uppermost pool. A wood slat cover was put on the trap to prevent fish from jumping out of the trap and a lock on the cover prevented poaching. A false floor of wood slats was installed at the bottom of the trap to reduce the depth of the trap from about 4.5 feet to about 2 feet. This modification facilitated removal of the fish. In June 1992, we replaced the submerged fyke with a finger weir because it was observed that spring chinook salmon would avoid swimming through the submerged fyke and would often try to jump over it. We did not observe any migration delay or abnormal fish behavior with the new design.

The adult trap at Powerdale Dam has been operated daily since December 1991 except during the winter when low stream temperatures slow upstream migration. Generally, the trap is checked in the morning to minimize potential handling stress associated with sampling fish during the afternoon when, typically, water temperatures are higher.

We individually removed each jack and adult fish from the adult trap using a soft mesh landing net, then transferred them to a holding tank where we identified their species, examined them for injuries, and determined their sex. We distinguished spring and fall races of chinook salmon based on run timing, external coloration, and general appearance. We distinguished summer and winter races of steelhead based on fin marks, external coloration, degree of scale tightness and scale erosion, state of sexual maturity relative to the time of year, external parasite load, color of gill filaments, and general appearance. After examining each fish, we inserted it into a flexible rubber sleeve that covered the fishes eyes. This procedure reduced thrashing and eliminated the need for anaesthetizing the fish in order to measure its fork length and to attach uniquely numbered anchor tags. Fork lengths were measured to the nearest 0.5 cm. We entered field data on a computer form and entered it into a database.

We estimated fecundity of winter steelhead used as hatchery broodstock by air spawning females and estimating the number of eggs per female with a volumetric displacement technique.

We collected scale samples from almost all jack and adult fish sampled at the trap. Samples were collected from the key scale area on each side of the fish and placed into uniquely numbered scale envelopes which we sent to ODFW's research laboratory in Corvallis, OR. There, the scale samples were mounted on gummed cards and acetate impressions were made of them. The impressions were viewed by microfiche. We determined origin-wild or hatchery-and life history-freshwater and ocean ages-using scale analysis (Borgerson et al.. 1992).

We classified summer and winter races of steelhead as wild or hatchery fish based on fin mark and scale analysis. We assumed all unmarked summer and winter steelhead classified as wild were returns from production in the Hood River subbasin. We assumed that adipose clipped and unmarked summer steelhead classified as hatchery fish were returns from subbasin hatchery production releases. Adipose clipped summer steelhead were classified as Hood River subbasin hatchery fish because all subbasin hatchery production is adipose clipped prior to release as smolts (see **HATCHERY PRODUCTION).** Marked and unmarked winter steelhead were classified as Hood River subbasin hatchery fish based on fin mark and age.

Hatchery winter steelhead from the 1989 brood were the first fin marked fish released into the Hood River subbasin. We assumed returning unmarked hatchery winter steelhead from earlier broods were Hood River subbasin hatchery fish. Summer and winter steelhead that were not classified as wild or Hood River subbasin hatchery fish were classified as stray hatchery fish. Currently, all hatchery winter steelhead released in the Hood River subbasin are fin clipped prior to release and alternate brood releases are marked with a unique fin clip combination.

Fin clipped steelhead, classified as wild, were not used in estimating migration timing, sex ratio, or age structure to minimize the potential for misidentification of origin. This group of fish would include marked wild and natural strays and Hood River subbasin wild fish with deformed fins or whose fins were removed by sport fishers. Fin removal has been observed in the Hood River subbasin (personal communication on 11/17/93 with Jim Newton, Oregon Department of Fish and Wildlife, The Dalles, Oregon). To estimate escapements, we assumed that marked summer and winter steelhead, classified as wild fish, were returns from wild Hood River subbasin production. Generally, numbers of marked wild fish were very low. We also assumed that summer and winter steelhead with regenerated scales, or from which we took no scale samples, occurred as wild, Hood River subbasin hatchery, and stray hatchery fish in the same proportions as those in the sample population.

We classified spring chinook salmon as natural or hatchery fish based on fin mark and scale analysis. We assumed unmarked spring chinook salmon classified as natural were returns from subbasin production. We assumed all unmarked and adipose clipped spring chinook salmon classified as hatchery fish were returns from Hood River subbasin hatchery production releases because a large component of the Hood River subbasin hatchery production releases are unmarked, and because all marked hatchery fish are released with an adipose clip (see **HATCHERY PRODUCTION).** No marked spring chinook salmon in the 1993 run year were classified as wild. Hatchery spring chinook salmon that had a fin clip combination other than a single adipose clip were classified as a stray hatchery fish. To estimate escapements, we assumed that spring chinook salmon with regenerated scales, or from which we took no scale samples, occurred as wild, Hood River subbasin hatchery, and stray hatchery fish in the same proportions as those in the sample population.

Coho salmon (Oncorhynchus kisutch) were classified as wild or hatchery fish based on fin mark and scale analyses. We assumed wild coho salmon were returns from subbasin production. Marked and unmarked hatchery coho salmon were assumed to be strays because no hatchery coho salmon are currently released into the Hood River subbasin. We estimated migration timing, sex ratio, age structure, and escapements using the same methods described for summer and winter steelhead. Only one fin clipped coho salmon in the 1992 run year was classified as a wild fish.

RESULTS

Summer Steelhead

Wild and subbasin Foster stock hatchery summer steelhead began entering the adult trap at Powerdale Dam in the last 2 weeks of March (Table 1). The median migration date for wild summer steelhead occurred within the last 2 weeks of July 1992, and for Foster stock hatchery summer steelhead the median migration date was in the last 2 weeks of June 1992 (Table 1). Migration to Powerdale Dam was completed by early May 1993 for both wild and Foster stock hatchery components of the run (Table 1).

In the 1992-93 run year, summer steelhead escapement to Powerdale Dam was estimated at 484 wild, 1.682 Foster stock hatchery, and 56 stray hatchery fish (Table 2). Wild summer steelhead migrated mainly as freshwater age 2 and age 3 smolts and returned mainly as 2 salt adults (Table 3). Foster stock hatchery fish all migrated in the year of release (i.e. freshwater age 1 smolts) and returned mainly as 2 salt adults (Table 3). We estimated that 3.6% of the wild fish and 0.8% of the Foster stock hatchery fish were repeat spawners (Table 3). No repeat spawners had more than one spawning check (Table 4).

Mean fork length of wild summer steelhead without a spawning check ranged from 54-57 cm for 1 salt adults, 68-70 cm for 2 salt adults, and was 82 cm for 3 salt adults (Table 5). Mean fork length of Foster stock subbasin hatchery summer steelhead without a spawning check was 55 cm for 1 salt adults, 68 cm for 2 salt adults, and 78 cm for 3 salt adults (Table 5).

With the exception of age 2/3 fish. most wild summer steelhead returned as females (Table 6). Most returning Foster stock hatchery summer steelhead were males in age categories l/l and l/3 and females in age category l/2 (Table 6). Female repeat spawners made up 65% of the wild and 77% of the Foster stock hatchery returns (Table 6).

Winter Steelhead

Winter steelhead entered the adult trap at Powerdale Dam as early as the first 2 weeks of December (Tables 7 and 8). The median migration date for wild winter steelhead occurred in April and for Big Creek stock hatchery winter steelhead it occurred from early February to early March (Tables 7 and 8). Migration to Powerdale Dam was completed by early to late June for the wild run and by late April to early May for the Big Creek stock hatchery run (Tables 7 and 8). In both the

1991-92 and 1992-93 run years, the wild run of winter steelhead migrated into the Hood River subbasin later than the Big Creek stock hatchery run. Historically, the Big Creek stock was used as broodstock for the hatchery supplementation program in the Hood River subbasin.

Until the 1991 brood release, hatchery broodstock was taken exclusively from the Big Creek stock of winter steelhead. The 1991 brood was to have been the first in which all hatchery broodstock was collected from the wild Hood River stock. However, several Big Creek stock hatchery winter steelhead were incorporated into the hatchery broodstock in 1991 because of high pre-spawning mortality and the low numbers of adults collected as broodstock (see **HATCHERY PRODUCTION).** The 1992 brood is the first brood for which hatchery broodstock was collected entirely from the wild Hood River stock of winter steelhead. The first adults from the 1992 brood release will return as 1 salt adults in the 1993-94 run year.

For the 1991-92 and 1992-93 run years, estimates of winter steelhead escapement ranged from 408 to 693 wild, 213 to 289 subbasin hatchery, and 30 to 34 stray hatchery fish (Table 9). Currently, all hatchery fish caught at Powerdale Dam are hauled downriver and released at the mouth of the Hood River. This program was implemented to prevent Big Creek stock hatchery winter steelhead from spawning above Powerdale Dam. Adult returns from the 1993 brood release of Hood River stock hatchery winter steelhead will be the first hatchery fish that will be passed above Powerdale Dam. Adult hatchery returns from the 1991 brood release of winter steelhead will not be passed above Powerdale Dam because they are progeny of wild and Big Creek stock hatchery winter steelhead (see **HATCHERY PRODUCTION).** Adult hatchery returns from the 1992 brood release of winter steelhead will also not be passed above Powerdale Dam. Hatchery broodstock was not collected from throughout the entire run and for this reason returns from the 1992 brood release are not considered to be genetically similar to the wild stock. All stray hatchery fish are hauled downriver and released at the mouth of the Hood River.

Most wild winter steelhead migrated as freshwater age 2 and age 3 smolts and returned mainly as 2 and 3 salt adults (Table 10). Most subbasin hatchery fish migrated in the year of release (freshwater age 1 smolt) and returned mostly as 2 and 3 salt adults (Table 10). We estimated that 2.4% of the subbasin hatchery fish returning in the 1991-92 run year had a scale pattern indicating they remained in the Hood River subbasin for 1 year before migration as smolts. Repeat spawners comprised 7.4% to 7.9% of the wild winter steelhead run and 2.0% to 3.8% of the subbasin hatchery winter steelhead run sampled at Powerdale Dam (Table 10). Few repeat spawners had more than one spawning check (Tables 11 and 12).

Mean fork length of wild winter steelhead without a spawning check ranged from 59 to 66 cm for 2 salt adults and 76 to 80 cm for 3 salt adults (Tables 13 and 14). Mean fork length for subbasin hatchery winter steelhead without a spawning check was 57 cm for 1 salt adults and ranged from 62 to 73 cm for 2,salt adults and 75 to 77 cm for 3 salt adults (Tables 13 and 14).

Although sex ratio as a percentage of females varied markedly among age classes, wild winter steelhead returned mostly as females (Table 15). Subbasin hatchery winter steelhead mainly returned as males in age category l/2 and as females in age categories l/l and l/3 (Table 15). Both wild and subbasin hatchery repeat spawners returned mainly as females.

Fecundity estimates ranged from 1,930 to 4,950 eggs per female for 2 salt adults and from 2,502 to 6,398 eggs per female for 3 salt adults (Table 16).

Spring Chinook Salmon

Natural spring chinook salmon entered the adult trap at Powerdale Dam early in May and subbasin hatchery spring chinook salmon entered the adult trap late in April (Table 17). The median date of migration occurred within the last 2 weeks of June for the natural run, and within the last 2 weeks of May for the subbasin hatchery run (Table 17). The natural run completed its migration to Powerdale Dam by late July, and the subbasin hatchery run completed its migration by late September (Table 17).

In the 1992 run year, spring chinook escapement was estimated at 35 natural, 411 subbasin hatchery, and 1 stray hatchery fish (Table 18). Scale analysis indicated that natural spring chinook salmon migrated mainly as subyearling (age 0+) smolts and returned mainly as age 4 adults (Table 19). Subbasin hatchery spring chinook salmon all migrated as age l+ (freshwater age 2) smolts and returned mainly as age 4 adults (Table 19).

All jack and adult fish which migrated as subyearling smolts. and were unmarked, had a freshwater scale pattern that was not typical of natural or hatchery stocks located above Bonneville Dam. Scale analysis indicated that annuli were farther apart than those typically observed on scales taken from either group of fish. Spring chinook salmon with this unique scale pattern were classified as having an accelerated growth pattern before migration as smolts and were categorized as natural fish for purposes of estimating escapement. However, Oregon stocks of wild and natural spring chinook salmon above Bonneville Dam do not exhibit a subyearling life history pattern. Almost all spring chinook salmon in the Deschutes River subbasin migrate as yearling smolts (Lindsay et al., 1989). Fewer than one percent of the returning wild spring chinook salmon in the John Day River subbasin migrate as subyearling smolts (Lindsay et al., 1984). No returning wild spring chinook salmon in the Grande Ronde and Imnaha river subbasins have shown a subyearling smolt life history pattern (telephone communication on 11/16/93 with Rhine Messmer, Oregon Department of Fish and Wildlife, La Grande, Oregon). We proposed two hypotheses to explain the anomalous life history pattern: 1) these fish are summer or fall run chinook salmon that were mis-classified as spring chinook salmon and 2) these fish are unmarked stray hatchery produced fish released as fingerlings.

Fall chinook salmon migrate almost entirely as subyearling smolts, and upriver stocks of summer chinook migrate as either subyearling or yearling smolts depending on the stock (telephone communication on 10/15/93 with Don Swartz, Oregon Department of Fish and Wildlife, Clackamas, Oregon). Typically, returning jack and adult summer chinook salmon migrate past Bonneville Dam in June and July. Peak migration occurs in July (Oregon Department of Fish and Wildlife and Washington Department of Fisheries, 1991). Fall chinook salmon usually return to freshwater in August and September (Oregon Department of Fish and Wildlife and Washington Department of Fisheries, 1991). The run timing data on spring chinook salmon showing a subyearling smolt migration pattern indicates that migration timing may be too early to warrant classifying this group of chinook salmon as either summer or fall run fish. More than half of these fish were sampled before July and all were sampled before August.

Historically, several hatcheries released fingerling spring chinook salmon near the Hood River subbasin either annually or semiannually. These hatcheries include: Carson National Fish Hatchery (CNFH) in the Wind River subbasin. Little White Salmon National Fish Hatchery (LWSNFH) in the Little White Salmon River subbasin, Klickitat Hatchery in the Klickitat River subbasin. and Warm Springs National Fish Hatchery (WSNFH) in the Deschutes River subbasin. None of the unmarked spring chinook salmon sampled at Powerdale could have originated from WSNFH because all fingerling releases are adipose clipped and coded wire tagged before release. Generally, strays originating from CNFH can also be discounted based on age since the last release of fingerlings from CNFH was from the 1987 brood (telephone communication on 10/20/93 with Tim Roth, U.S. Fish and Wildlife Service, Hazel Dell, Washington). These fish would have returned as five year olds in 1992. Spring chinook salmon with a subyearling life history pattern returned mostly as 4 year old fish (Table 18) from the 1989 brood. Only one five year old spring chinook salmon with a subyearling life history pattern was sampled at Powerdale Dam.

If unmarked hatchery spring chinook salmon with a subyearling smolt migration pattern are straying into the Hood River subbasin, it is likely that a significant number would have originated from either LWSNFH or Klickitat Hatchery. Unmarked fingerling spring chinook salmon are currently released annually from LWSNFH into the Little White Salmon River subbasin and semiannually from Klickitat Hatchery into the Klickitat River subbasin. Fingerling releases from LWSNFH are reared in a hatchery program that was designed to accelerate growth so that June releases will weigh about 30 to 40 fish/pound. Fingerling releases from Klickitat Hatchery represent excess production and are not reared in any specialized hatchery program designed to accelerate growth. At this time we cannot determine if these production groups are straying into the Hood River subbasin. While our scale samples were being analyzed, no scale samples were available from jack and adult spring chinook salmon returning to the Little White Salmon and Klickitat river subbasins for comparison with the scale samples from the Hood River subbasin. In 1994, we will collect scale samples from jack and adult spring chinook salmon with a subyearling smolt life history pattern that return to the Little White Salmon and Klickitat river subbasins. These scale samples will be used to determine if returns from fingerling production releases from LWSNFH and Klickitat Hatchery stray into the Hood River subbasin.

Currently, no direct evidence is available to indicate whether unmarked spring chinook salmon with subyearling smolt life history patterns are returns from subbasin natural production or are unmarked stray hatchery fish. Survival rates for fingerling releases from LWSNFH indicate, however, that numbers of fish expected to stray into the Hood River subbasin are fairly low. Fingerling production releases from LWSNFH ranged from approximately 574,200 to 1.050,OO for the 1987-89 broods (telephone communication on 10/20/93 with Tim Roth, U.S. Fish and Wildlife Service, Hazel Dell, Washington). Tom Roth reported recovering a total of 22 fish in 1993 from Drane Lake, at the mouth of the Little White Salmon River, and the Little White Salmon River sport fishery (telephone communication on 10/20/93 with Tim Roth, U.S. Fish and Wildlife Service, Hazel Dell, Washington). This is less than the number of fish that were sampled at Powerdale Dam. Low survival rates from fingerling to returning jack and adult fish back to the Little White Salmon River subbasin indicate that it is unlikely that large numbers of fish would be straying into the Hood River subbasin. Currently, no information is available on juvenile and adult life history patterns for hatchery spring chinook salmon released as fingerlings from LWSNFH. It is possible that hatchery fish released as fingerlings may exhibit a much higher straying rate than hatchery fish released as smolts. A higher straying rate would reduce survival back to the Little White Salmon River subbasin while increasing the number of fish straying into other subbasins.

Additional information is needed to determine whether natural spring chinook salmon in the Hood River subbasin migrate as subyearling smolts. The question may be moot after HRPP is fully implemented. One of the main goals of HRPP is to re-establish a natural run of spring chinook salmon in the Hood River subbasin. Although natural production now occurs in the subbasin. we assume they are progeny of stray or Carson stock hatchery spring chinook salmon spawning in the wild. Upon full implementation of HRPP, neither the 1) naturally produced progeny of Carson stock spring chinook salmon, 2) marked Carson stock hatchery spring chinook salmon, nor 3) hatchery stray spring chinook salmon will be passed above Powerdale Dam. The hatchery program will use the Deschutes stock of spring chinook salmon to develop a natural run in the Hood River subbasin. Deschutes stock hatchery spring chinook salmon do not exhibit a subyearling smolt life history pattern in the Deschutes River subbasin and we do not anticipate that this life history pattern will occur in the natural run that becomes established in the Hood River subbasin.

Mean fork length of wild spring chinook salmon that migrated as yearling smolts was

72 cm for age 4 adults and 85 cm for age 5 adults (Table 20). Mean fork length for subbasin hatchery produced spring chinook salmon was 74 cm for age 4 adults and 88 cm for age 5 adults (Table 20).

Sex ratio as a percentage of females varied widely for age 4 and age 5 adult spring chinook salmon (Table 21). The sex ratio for the combined group of natural spring chinook salmon was 57% for age 4 adults and 75% for age 5 adults. The sex ratio of subbasin hatchery fish was 76% for age 4 adults and 71% for age 5 adults (Table 21)

Coho Salmon

In the 1992 run year, wild coho salmon entered the adult trap at Powerdale Dam in the first 2 weeks of September (Table 22). No wild coho salmon were recovered in the 1993 run year (Table 23). The median date of migration for wild coho salmon occurred in the last 2 weeks of September and migration was completed by early November (Table 221. The early entry time of wild coho salmon suggests these fish may be progeny of hatchery strays. Oregon's coastal stocks of wild coho salmon, as well as those in the Clackamas River subbasin, do not enter freshwater until about early to late October and their peak migration does not occur until around November through January (telephone communication on 11/18/93 with Al McGie, ODFW, Corvallis, Oregon).

For the 1992 through 1993 run years, estimates of coho salmon escapement ranged from 0 to 23 wild and from 32 to 80 stray hatchery fish (Table 24). All wild coho salmon returned as adults (Tables 24 and 25).

For wild adult coho salmon, mean fork length was 58 cm (Table 26) and the sex ratio as a percentage of females was 64% (Table 28). Mean fork length of stray hatchery adult coho salmon ranged from 58 to 64 cm (Tables 26 and 27).

HATCHERY PRODUCTION

Numbers of hatchery steelhead smolts released into the Hood River subbasin ranged from 70,928 to 99,973 summer steelhead and from 4.595 to 48,985 winter steelhead for the 1987-92 broods (Tables 29 and 30). Numbers of hatchery spring chinook salmon smolts released into the Hood River subbasin ranged from 75,205 to 197,988 smolts for the 1986-91 broods (Table 31). All hatchery summer and winter steelhead from the 1987-92 broods and hatchery spring chinook from the 1986-91 broods were released as full term smolts. The first hatchery production release of spring chinook salmon into the Hood River subbasin was the release of 92,680 fingerlings from the 1985 brood (Table 31). Earlier hatchery brood releases of summer and winter steelhead can be found in Olsen et al. (1992).

The 1991 brood of spring chinook salmon was the first brood from which hatchery broodstock was collected entirely from the Deschutes stock, The hatchery winter steelhead program was to have collected hatchery broodstock for the 1991 brood entirely from the wild Hood River stock, However, because of high pre-spawning mortality and the low numbers of adults collected for hatchery broodstock, several Big Creek stock hatchery winter steelhead were incorporated into the hatchery broodstock. Beginning with the 1992 brood, hatchery broodstock was collected entirely from the wild Hood River stock. There are no further plans to utilize either the Carson or Big Creek stocks as broodstock for the Hood River hatchery supplementation program.

The current hatchery production goal for winter steelhead is about 40,000 to 50,000 smolts. Volunteer anglers collected hatchery broodstock for the 1991 brood release, but pre-spawning mortality was high and fewer eggs were collected than the target goal. After 1991. the hatchery broodstock collection program at Powerdale Dam replaced the volunteer program.

ENGINEERING

Powerdale Dam

ODFW engineers completed the preliminary design on the proposed Powerdale Dam adult fish facility. The department distributed a memorandum and preliminary designs for review and comment to the affected agencies. Engineers also completed about 40% of the final design for the construction bid documents. Planning is nearly on schedule to advertise for construction bids in February 1994. Engineers are currently selecting a consultant to prepare the detailed mechanical and electrical design. ODFW engineers also asked PP&L to initiate a Federal Energy and Regulatory Commission (FERC) review of the preliminary fish facility design.

Engineers from ODFW. PP&L, and other resource and regulatory agencies coordinated in developing the design of the fish facility. ODFW also consulted with National Marine Fisheries Service (NMFS) fish passage experts who were concerned that the current and proposed fish passage facilities at Powerdale Dam may delay upstream migrant adults. All parties acknowledged that FERC relicensing, which will occur within the next 10 years, may result in directives that will require PP&L to modify the existing fishway. These changes might necessitate modifications to the proposed adult fish facility. The parties came to an agreement that potential ladder modifications at some undetermined future date should not preclude further design and construction of the new adult fish facilities.

An all-weather access road to Powerdale Dam is critical for construction and operation. Road development has been extremely challenging because of the general physical terrain near the mouth of the subbasin and the acquisition of easements for the road right-of-way. BPA right-of-way specialists identified the potential access routes to the east abutment of Powerdale Dam. In addition, ODFW engineers reviewed the access routes and eliminated all but one alternative after considering maximum allowable road grade and road construction difficulties. Surveys have been completed and the preliminary alignment has been established for the access road. ODFW engineers completed much of the final design work for this access route.

ODFW personnel and BPA right-of-way specialists contacted the three private landowners who will be affected by development of the access road. All three will have to agree to a road easement through their property before ODFW engineers can complete the final design and prepare bid documents for construction advertisement. All three landowners agreed to provide the easement but one property owner has indicated that he will provide an easement only on condition that hatchery winter steelhead are not passed above Powerdale Dam. Agreeing to this condition is unacceptable given the goals of HRPP. Negotiations between ODFW and the landowner have already modified his position, but further negotiation will be needed before this issue is resolved.

ODFW engineers and BPA right-of-way specialists conducted a cursory survey of a site for a smolt acclimation and adult holding facility near Parkdale, Oregon. Personnel from both agencies met with the landowner and the adjacent property owner to discuss building a hatchery facility on the property. Both parties reacted favorably to the proposal. ODFW engineers completed preliminary designs for the proposed hatchery facility.

Pelton Ladder

ODFW engineers completed the final design work for modification of Pelton Ladder. Pelton Ladder, which is located in the Deschutes River subbasin, will be used to rear spring chinook salmon to smolt size before they are released into the Hood River subbasin. Bid documents for construction of modifications to Pelton Ladder also have been completed. Copies of the final project design and technical construction specifications were distributed to all appropriate parties.

The drop-in rotary fish screens at the downstream end of each fish rearing cell will not be included in the general construction contract for FY 94. Additional design work remains to be completed on these units.

Inadequate funding has set back the completion of modifications to Pelton Ladder, but we are developing funding and scheduling proposals in anticipation that adequate funding will become available in FY 94. It is planned that construction work on Pelton Ladder will be completed by mid-October of FY 94 and that the ladder will be screened in FY 95. Currently, we are proposing to rear 1994 brood spring chinook salmon in Pelton Ladder for release in the Hood River subbasin in April 1996.

SCREENING EVALUATION

Irrigated orchards dominate agricultural use in the Hood River subbasin. A variety of surface sources provide irrigation water in the subbasin. Five irrigation districts provide most of the irrigation water. The irrigation districts, their water sources, and water rights are summarized in Table 32.

Only one irrigation diversion on an anadromous fish bearing stream is not now equipped with protective fish screening. The diversion is operated by the East Fork Irrigation District (EFID). It has its source in the East Fork Hood River (RM 6.3; Figure 1; Table 32). This diversion was screened from 1961-63 but the screens were later abandoned because of continual mechanical breakdowns.

Several screened irrigation diversions on anadromous fish bearing streams do not meet the current anadromous salmonid water approach velocities of 0.4 feet per second for juvenile fish under 60 mm fork length and 0.8 feet per second for juvenile fish over 60 mm fork length. These diversions are the Neal Creek screen, at RM 6.0 in Neal Creek, that has approach velocities of about 2 feet per second and the Farmers Irrigation District (FID) screen, at RM 11.6 in the main stem Hood River, that has approach velocities at more than 1 foot per second (Figure 1).

The Middle Fork Irrigation District outlet from Clear Branch Reservoir (Laurence Lake; Figure 1) is above the existing anadromous fish distribution. However, this outlet does not appear to have adequate screening to protect resident salmonids, including a remnant bull trout population.

The largest diversion in the Hood River subbasin is PP&L's hydroelectric intake located on the main stem of the Hood River at Powerdale Dam (RM 4.5: Figure 1). This intake can divert up to 500 cfs through a vertical traveling screen array. Water approach velocities at the screen surface probably exceed present criteria for juvenile salmon, but good bypass flows are likely to be effective for moving downstream migrants past this diversion.

Dee Forest Products maintains an unscreened diversion on Tony Creek (RM 0.75; Figure 1) that diverts up to 2.5 cfs for industrial uses and fire protection. This diversion does not prevent fish from entering the pipeline intake.

HABITAT

The intent of HRPP was to achieve subbasin production goals using hatchery supplementation, however, subbasin production is considered to be low as a result of relatively unproductive water, steep gradients, high turbidity and siltation, lack of in-stream structure, and relatively little spawning gravel (ODFW and CTWS, 1990).

Although many of these constraints result from natural occurrences, several have been aggravated by a long history of land management practices that include problems associated with timber harvest, water withdrawal, agricultural use, and hydroelectric development. Improved environmental laws and regulations helped slow the degradation of habitat, and various habitat improvement projects have alleviated some of the more critical habitat related problems. Although the combined effect has been to reduce juvenile mortality and to increase carrying capacity, several habitat improvement projects remain that can increase subbasin production capacity. These projects provide a mechanism for increasing the benefits associated with HRPP.

Public and private lands in the Hood River subbasin, managed for either timber harvest or agricultural use, have had a significant impact on anadromous salmonid habitat. Projects designed to rectify some of the more severe habitat problems have been initiated in the upper drainage where most of the public land is located. Mount Hood National Forest (MHNF) manages the largest block of public land. MHNF encompasses approximately 120,000 acres of land including 53 linear miles of stream considered suitable for anadromous salmonid habitat or about 27% of the linear mileage of stream on MHNF lands (ODFW and CTWS, 1990). In 1989, the MHNF began a variety of projects designed to improve habitat degraded as a result of past land management practices. These projects focused on increasing channel roughness and in-stream structure by introducing large woody material and boulders into the stream. These habitat improvements were in Clear Branch Creek, above and below Laurence Lake; Lake Branch Creek: West Fork Hood River: McGee Creek: Robinhood Creek, and the East Fork Hood River (telephone communication on 11/19/93 with Chuti Ridgley. United States Forest Service, Parkdale, Oregon). Other habitat improvement projects include work on private lands in Tony and Neal creeks, by ODFW, and on Green Point Creek, by FID. The FID improved habitat in Green Point Creek as mitigation for construction of a hydroelectric facility. ODFW continues to work with diversion operators to minimize the loss of downstream migrant juveniles. Currently, several habitat projects are in the planning stages for implementation on MHNF lands.

Although several habitat problems in the subbasin have been corrected, problem areas still remain that need to be addressed to fully realize the potential of HRPP. Past habitat improvement projects focused on improving passage for upstream migrant adults and downstream migrant juveniles. Currently, one major unscreened irrigation diversion needs to be screened and several screened diversions need improvement or major repairs (see **SCREENING EVALUATION).** The East Fork Irrigation District (EFID) operates and maintains the unscreened diversion. We believe this diversion has a major impact on fry-to-smolt survival. Projects that would improve passage for upstream migrant adults are limited to a few tributary streams. We believe all main stem passage problems have been rectified. Projects to improve adult passage include improvement of passage past the Middle Fork Irrigation District's (MFID) diversion ditch in Evans Creek: passage past a cataract at the mouth of Ode11 Creek: and passage through a road culvert in Bear Creek.

Several areas of the Hood River subbasin have been identified as sites that would benefit from habitat improvement projects. Riparian enhancement projects have been identified for Neal, Evans, and Baldwin Creeks. Additional stream structure projects have been identified for the West Fork Hood River, Wisehart Creek, Emil Creek, McGee Creek. Green Point Creek, and Ode11 Creek. Clear Branch Creek below Laurence Lake is a site for gravel supplementation. Habitat improvement in these areas provides an alternative for increasing the subbasins carrying capacity. Habitat inventory work to be completed as part of the Hood River/Pelton Ladder evaluation studies will increase the information about habitat deficiencies and will be used to develop priorities for habitat improvement projects in the subbasin. We will need to evaluate the effectiveness of various types of habitat projects to determine which would provide the greatest benefit in the Hood River subbasin. Habitat improvements demonstrating the greatest potential for improving egg-to-smelt survival and for increasing carrying capacity will have the highest priorities. Recommendations will be based in part on the life history and production information collected as part of the Hood River/Pelton Ladder evaluation studies.

SUMMARY

In December 1991, the monitoring and evaluation program in the Hood River subbasin began collecting life history and production information on stocks of anadromous salmonids returning to the subbasin. The program was implemented to provide the information needed to evaluate various management options for implementing HRPP. Information will also be used to prepare the environmental assessment (EA) needed to evaluate the programs impact on the human environment. Bonneville Power Administration (BPA) will prepare the EA in compliance with federal guidelines established in the National Environmental Policy Act.

This report summarizes the life history and production data collected at the Powerdale Dam trap on two complete run years of winter steelhead and coho salmon and one complete run year of summer steelhead and spring chinook salmon. The data will be used as baseline information 1) for evaluating HRPP, 2) for evaluating the program's impact on indigenous stocks of anadromous salmonids, and 3) for preparing the EA. We will continue to collect baseline information on indigenous stocks of anadromous salmonids for several years before implementation of HRPP. We will also begin collecting baseline life history and production information on stocks of resident salmonids in FY 94.

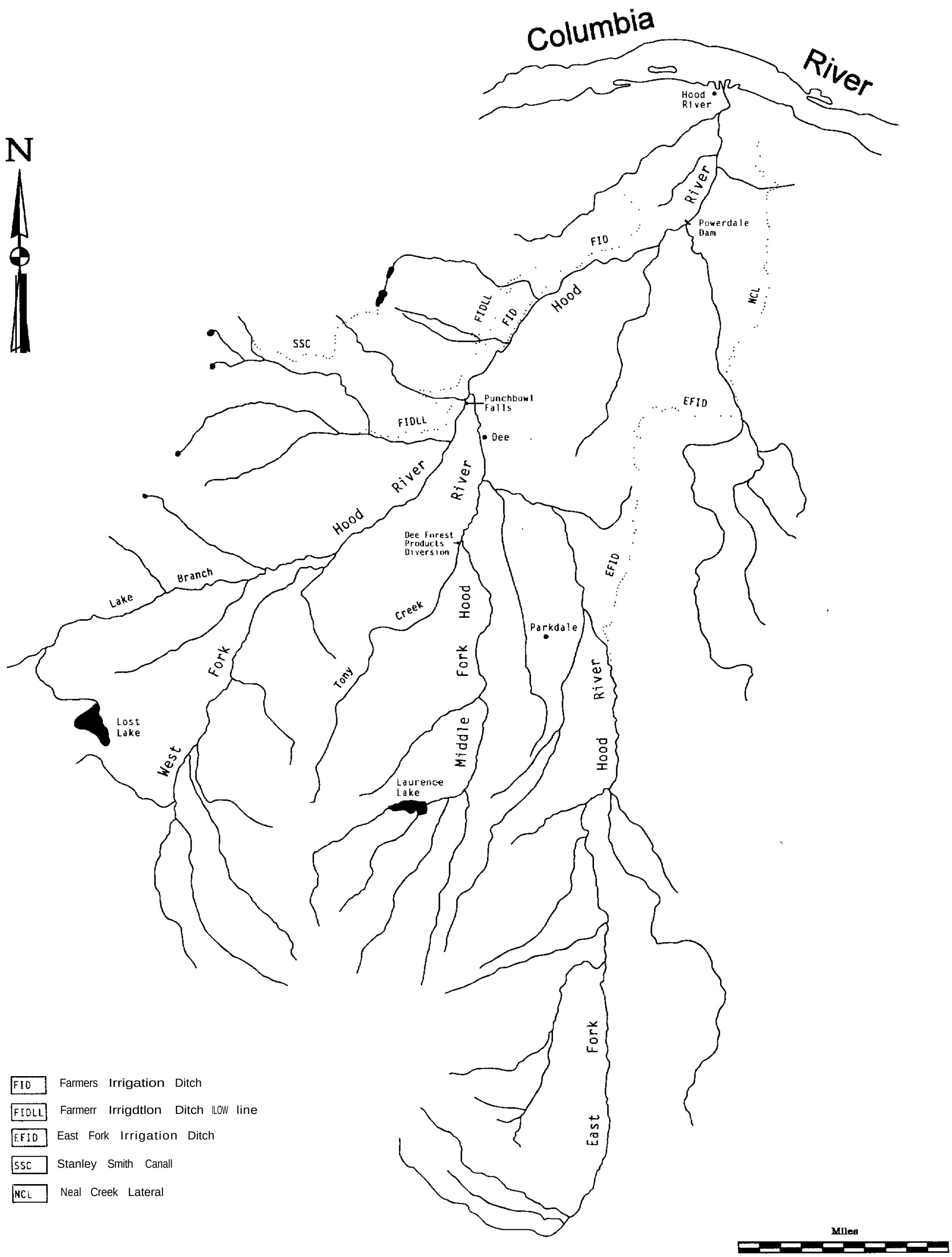

Figure 1. Map of the Hood River subbasin

Table 1. Migration timing of Summer steelhead captured at the Powerdale Dam trap in the 199293 run year

Period	Wild		Subbasin hatchery		Stray hatchery		Unknown	
	Number	Cumulative %	Number	Cumulative %	Number	Cumulative %	Number	Cumulative %
Mar 01-15	0	0	0	0	0	0	1	5.3
Mar 16-31	1	0.2	8	0.5	0	0	2	15.8
Apr 01-15	12	2.7	48	3.4	0	0	1	21.1
Apr 16-30	6	4.0	82	8.3	0	0	0	21.1
May 01-15	7	5.5	131	16.1	2	3.6	1	26.3
May 16-31	21	9.9	191	27.5	3	8.9	0	26.3
Jun 01-15	31	16.4	136	35.7	0	8.9	1	31.6
Jun 16-30	68	30.6	279	52.4	2	12.5	1	36.8
Jul 01-15	49	40.9	253	67.5	6	23.2	2	47.4
Jul 16-31	48	50.9	220	80.7	4	30.4	2	57.9
Aug 01-15	37	58.7	136	88.9	3	35.7	1	63.2
Aug 16-31	18	62.5	28	90.5	0	35.7	1	68.4
Sep 01-15	17	66.0	26	92.1	4	42.9	0	68.4
Sep 16-30	55	77.6	55	95.4	16	71.4	1	73.7
Oct 01-15	25	82.8	24	96.8	0	71.4	2	64.2
Oct 16-31	24	87.8	10	97.4	4	78.6	0	84.2
Nov 01-15	38	95.8	15	98.3	5	87.5	2	94.7
Nov 16-30	12	98.3	4	98.6	0	87.5	0	94.7
Oec 01-15	2	98.7	1	98.6	0	87.5	0	94.7
Dec 16-31	1	99.0	4	98.9	0	87.5	1	100
Jan 01-15	0	99.0	0	98.9	0	87.5	0	100
Jan 16-31	1	99.2	0	98.9	1	89.3	0	100
Feb 01-15	0	99.2	0	98.9	1	91.1	0	100
Feb 16-29	0	99.2	0	98.9	0	91.1	0	100
Mar 01-15	1	99.4	0	98.9	1	92.9	0	100
Mar 16-31	1	99.6	3	99.0	1	94.6	0	100
Apr 01-15	0	99.6	11	99.7	3	100	0	100
Apr 16-30	0	99.6	4	99.9	0	100	0	100
May 01-15	2	100	1	100	0	100	0	100
May 16-31	0	100	0	100	0	100	0	100
Jun 01-15	0	100	0	100	0	100	0	100
Totals	477		1,670		56		19	

Table 2. Summer steelhead escapements to the Powerdale Dam trap by origin, run year. and age category. fish of unknown origin were allocated to origin categories based on scale analysis and the ratio of fish of known origin (see **METHODS).**

Origin, Run Year	Total escapement	Freshwater/Ocean aqe										Repeat spawners
		1/1	1/2	1/3	1/4	2/1	2/2	2/3	3/1	3/Z	4/2	
Wild.												
1992-93	**484**		**5**	--	--	**25**	**305**	**48**	**6**	**77**		17
Subbasin hatchery.												
1992-93	1.682	**48**	**1.477**	**143**	1	--	--	--		--		13
Stray hatchery.												
1992-93	**56**	**4**	**43**	**a**	--	--	--	**1**		--		--

Table 3. Age composition[a] (percent) of adult summer steelhead sampled at the Powerdale Dam trap by origin and run year

Origin. Run Year	N	Freshwater/Ocean age										Repeat spawners
		1/1	1/2	1/3	1/4	2/1	2/2	2/3	3/1	3/2	4/2	
Wild,												
1992-93	477	--	1.0	--		5.2	62.9	9.9	1.3	15.9	0.2	3.6
Subbasin hatchery,												
1992-93	1.669	2.8	87.8	8.5	0.06	--		--	--			0.8
Stray hatchery,												
1992-93	56	7.1	76.8	14.3	--		--	1.8	--	--		

a Estimates in a given run year may not add to 100% due to rounding error.

Table 4. Mean fork length (cm) of summer steelhead with spawning checks in the 1992-93 run year by origin. sex. and age category. Fish were sampled at the Powerdale Dam trap.

Origin. Sample pop.. Statistic	Freshwater/Ocean age						
	1/1s.2	l/2s.3	2/1s.2	2/2s.3	2/2s.4.	3/1s.2	3J2s.3
Wild.							
Female.							
N	--	--	2	7	1	--	1
Mean	--	--	72.00	74.07	77.5	--	73.5
STD	--	--	4.95	3.68	--	--	--
Range	--	--	68.5-75.5	69.0-78.0	77.5	--	73.5
Hale.							
N	--	--	1	3	--	1	--
Mean	--	--	64.5	74.33	--	58.0	--
STD	--	--	--	1.89	--	--	--
Range	--	--	64.5	73.0-76.5	--	58.0	--
Total.							
N	--	--	3	10	1	1	1
Mean	--	--	69.50	74.15	77.50	58.0	73.5
STD	--	--	5.57	3.14	--	--	--
Range	--	--	64.5-75.5	69.0-78.0	77.50	58.0	73.5
Subbasin hatchery.							
Female.							
N	1	9	--	--	--	--	--
Mean	62.0	72.56	--	--	--	--	--
STD	--	2.84	--	--	--	--	--
Range	62.0	68.0-77.0	--	--	--	--	--
Hale.							
N	1	2	--	--	--	--	--
Mean	60.0	73.50			--	--	--
STD	--	3.54			--	--	--
Range	60.0	71-0-76.0	--	--	--	--	--
Total.							
N	2	11	--	--	--	--	--
Mean	61.00	72.73	--	--	--	--	--
STD	1.41	2.81	--	--	--	--	--
Range	60.0-62.0	68.0-77.0	--	--	--	--	--

Table 5. Mean fork length (cm) of **summer** steelhead without spawning checks in the 1992-93 run year by orlgln. +sex. and age category. Flsh were sampled at the Powerdale Dam trap.

Origln. Sample pop., Statlstlc	Freshwater/Ocean age 1/1	1/2	1/3	1/4	2/1	2/2	2/3	3/1	3/2	4/2	Samplea mean
Wild,											
Female.											
N	--	3	--	--	**18**	237		**5**	61	**1**	350
Mean	--	69.33	--	--	**58.44**	69.19	78.::	**52.90**	68.24	**63.5**	68.74
STD	--	2.75	--	. .	3.41	4.44	2.92	9.41	3.70	--	5.64
Range	--	66.5-72.O	--	. .	51.5-63. 5	59.0-80.5	71.0-82.5	36.5-59.0	59.5-76.5	63.5	36.5-82.5
Male,											
N	--	**2**	--	--		63	**33**		**15**	--	127
Mean	--	**67.50**	--	--	52.1:	71.37	**83.97**	62.:	**69.43**	--	73.29
STD	--	3.54	--	--	4.26	5.47	5.53	--	4.84	--	9.53
Range	--	65.0-70.0	--	--	46.0-58.5	58.0-82.5	74.0-97.5	**62.5**	59.5-77.0	--	46.0-97.5
Total.											
N	--	**5**	--	--	**25**	300	**47**	**6**	**76**		477
Mean	--	**68.60**	--	--	**56.68**	69.64	82.**29**	**54.50**.	**68.47**	63.:	69.95
STD	--	2.82	--	--	4.59	4.75	5.52	9.28	3.94	--	7.18
Range	--	65.0-72.0	--	--	46.0-63.5	58.0-82.5	71-o-97.5	36.5-62.5	59.5-77.0	**63.5**	36.5-97.5
Subbasin hatchery,											
Female											
N	**22**	1.074	**48**	. .	--	--	me	--	--	--	1.155
Mean	**55.36**	67.44	**76.03**	--	--	. .	.-	--	--	--	67.60
STD	4.97	3.45	4.32	--	--	.-	--	--	--	--	4.29
Range	42.0-61.5,	51.0-77.0	64.0-84.5	--	--	.-	--	--	--	--	42.0-84.5
Male.											
N		392	**94**		--			--	--	--	515
Mean	54.:	70.81	**79.70**	90.:	--	--	--	--	--	--	71.69
STD	3.08	3.94	4.89	--	--	--	--	--	--	--	6.61
Range	50.0-62.0	51.5-87.5	69.0.92;5	**90.5**	--	--	--	--	--	--	50.0-92.5
Total.											
N	4 7	1.466	142	**1**	--	--	--	--	--	--	1.670
Mean	.55.11	68.34	78.46	**90.5**	--	--	--	--	--	--	68.86
STD.	4.04	3.89	5.00	--	--	--	--	--	--	--	5.45
Range	42.0-62.0	51.0-87.5	64.0-92.5	**90.5**	--	--	--	--	--	--	42.0-92.5.

a Mean estlmate Includes steelhead with spawning checks and steelhead in which the origin but not the age of the fish could be determined from the scale sample.

Table 9 Winter steelhead escapements to the Powerdale Dam trap by origin. run year, and age category Fish of unknown origin were allocated to origin categories based on scale analysis and the ratio of fish of known origin (see METHODS)

Origin, Stock, Run Year	Total escapement	Freshwater/Ocean aoe											Repeat spawners
		1/1	1/2	1/3	2/1	2/2	2/3	2/4	3/1	3/2	3/3	4/2	
Wild.													
Hood River.													
1991-92	693		3	4	9	421	75	0	1	111	17	1	51
1992-93	408		2	6	35	173	122	1	1	20	16	0	32
Subbasin hatchery,													
Big Creek,													
1991-92	289		269	7		6	1	--		--		--	6
1992-93	206		65	133		0	0	_.		--		--	a
Mixed.[a]													
1992-93	7	7	--		--		--						
Stray hatchery,													
1991-92	34		19	14			--						1
1992-93	30		18	9						—			3

a Returns from the 1991 brood are progeny of wild x Big Creek stock hatchery crosses

Table 10 Age composition[a] (percent) of winter steelhead sampled at the Powerdale Dam trap by origin and run year

Origin, Stock, Run year	N	Freshwater/Ocean age 1/1	1/2	1/3	2/1	2/2	2/3	2/4	3/1	3/2	3/3	4/2	Repeat spawners
Wild,													
Hood River,													
1991-92	662	--	05	06	1.4	60.7	10 7	0	02	16 0	2.4	02	74
1992-93	392	--	0.5	15		42.3	29 a	0.3	0.3	4.8	38	0	79
Subbasln hatchery,													
Big Creek,													
1991-92	245		93 1	24		20	,0 4	--	--	--	_	--	2.0
1992-93	185	--	31 4	64 9	--	0	0	--					3.8
Mixed[b]													
1992-93	6	100				--	--	--	--	--	--		
Stray hatchery,													
1991-92	32		56.2	40 6		--		--					31
1992-93	29	--	58.6	310	--		—	--		—	—		10.3

a Estimates In a given run year may not add to 100% due to rounding error.
b Returns from the 1991 brood are progeny of wild x Big Creek stock hatchery crosses.

Table 11 Mean fork length (cm) of winter steelhead with spawning checks ln the 1991-92 run year by orlgln. sex, and age category Fish were sampled at the Powerdale Dam trap

Origin. Sample pop Statistic	Freshwater/Ocean Age 1/2 3	1/3 4	1/2s 3s 4	2/1s 2	2/2s 3	2/2s.4	2/3s 4	3/2s 3	3/3s 4	2/2s 3s 4	2/3s 4s 5
Wild.											
Female,											
N	--	--	--		13	2	4	4	1	5	1
Mean	--				70 27	76.75	84 38	67 12	81 5	75 20	82 0
STD			--		5 23	0 35	4 01	3 28	—	4 62	—
Range	--				64 O-81 0	76 5-77.0	78 5-87 5	65 O-72 0	81 5	69.0-80 0	82 0
Male.											
N	--	--	--	3	12	1	1				
Mean	--			63 50	67 08	79 0	85 0	--			
STD	--	--	--	5 63	4 14	--					
Range	--	--	--	60.0-70.0	60 5-78 0	79 0	85.0	--	--		
Total.											
N	--			3	2 5	3	5	4	1	5	1
Mean	--	--		63.50	68.74	77 50	84.50	67 12	81 5	75 20	82 0
STD	--			5.63	4 92	1.32	3 48	3 28	—	4 62	--
Range	--	--	--	60 O-70 0	60 5-81.0	76 5-79 0	78 5-87 5	65 O-72 0	81.5	69 0	82 0
Subbasin Hatchery.											
Female.											
N	2	1	1	--	--	--		--	--		
Mean	72 5	83 0	73 0	--	--	--				--	--
STD	2 83			--	--	--		--	--		
Range	70 5-74 5	83 0	73 0	--	--	--		--	--		
Male.											
N	1	--	--	--	--	--					
Mean	68.0	--	--	--	--	--				--	--
STD	--	--	--	--	--	--					
Range	68 0	--	--	--	--	--					--
Total.											
N	3	1	1	--	--	--					
Mean	71.00	83 0	73 0	--	--	--				--	--
STD	3.28	--	--	--	--	--					
Range	68 o-74 5	83.0	73.0	--	--	--			--		

Table 12 Mean fork length (cm) of winter steelhead with spawning checks in the 1992-93 run year by origin. sex, and age category. Fish were sampled at the Powerdale Dam trap

Origin. Sample pop Statistic	Freshwater/Ocean age 1/2s 3	2/1s.2	2/2s 3	2/3s.4	3/2s.3	2/2s 3s 4
Wild.						
Female.						
N	1		15	5	4	2
Mean	84 5		69 77	83 80	70 62	81.00
STD	—		4 60	4 25	3 94	1 41
Range	84 5	--	63 0-78 0	78 5-89 0	66 5-74 0	80 0-82 0
Male,						
N		3	1		—	
Mean		63 67	70 00	--		
STD		9 82			--	
Range		58 0-75 0	70.00	—	--	
Total,						
N	1	3	16	5	4	2
Mean	84 5	63 67	69 78	83 80	70.62	81 00
STD		9 82	4 45	4 25	3.94	1 41
Range	84.5	58.0-75 0	63.0-78.0	78 5-89 0	66.5-74.0	80 0-82.0
Subbasin hatchery.						
Female,						
N	5	--	--	--	--	
Mean	75.50	--	--		--	
STD	5.50	--	--			
Range	68 0-82 0	--				
Male,						
N	2	--			--	
Mean	68.00	--	—			—
STD	7.78	--				
Range	62.5-73 5	--				
Total,						
N	7					
Mean	73.36					
STD	6 61	—				
Range	62.5-82 0					

Table 13 Mean fork length (cm) of winter steelhead without spawning checks in the 1991-92 run year by origin, sex. and age category. Fish were sampled at the Powerdale Dam trap

Origin. Sample pop.. Statistic	Freshwater/Ocean age 1/2	1/3	2/1	2/2	2/3	3/1	3/2	3/3	4/2	Sample[a] mean
Wild.										
Female,										
N	2	3		235	45		68	14	1	407
Mean	63 50	76.50		65 45	74.34		64 60	76 54	59 5	67 40
STD	6 36	1 32		4 28	4.37		3 52	5 79		6 04
Range	59 0-68 0	75 5-78 0		54 5-80 0	64 5-86 5	—	56.0-71 0	68 5-88.5	59.5	54.5-88 5
Male,										
N	1	1	9	167	26	1	38	2		270
Mean	60.5	77 5	48 56	67 16	79 10	51 5	66 01	86 00		67 68
STD			2 10	4 76	4 11		5 29	6 36	—	7 31
Range	60.5	77 5	44 0-51 0	56.5-82.5	72 0-87 5	51 5	55 0-76.0	81 5-90 5		44.0-90 5
Total.										
N	3	4	9	402	71	1	106	16	1	677
Medn	62 50	76 75	48 56	66 16	76 06	51 5	65 10	77.72	59 5	67 51
STD	4 82	1.19	2 10	4 56	4 82		4 27	6 50		6 57
Range	59 0-68 0	75 5-78 0	44 0-51 0	54 5-82 5	64 5-87 5	51.5	55 0-76 0	68.5-90 5	59 5	44.0-90 5
Subbasln hatchery										
Female,										
N	81	6	—	3				—		109
Mean	63 51	74 67		71 00	76 i	-				64 67
STO	2 83	4.81		1 32			—	—		4 79
Range	56 0-70 0	70 5-83 0	--	70 0-72 5	76.5		-		—	56 0-83.0
Male,										
N	147			2		—	--	--		175
Mean	63 97			75 00		-	--	--		64.16
STD	3 22			9 19			--	--		3.46
Range	55 5-73 0		—	68 5-81 5	--		--	--		55 5-81 5
Total,										
N	228	6	—	5	1		--	--	-	284
Mean	63 81	74 67	—	72 60	76 5		--	--	-	64 36
STD	3 09	4 81		5 18		—	--	--		4 02
Range	55.5-73 0	70 5-83 0		68.5-81.5	76 5		--	--		55.5-83.0

a Mean estimates include steelhead with spawning checks and steelhead In which the origin but not the age of the fish could be determined from the scale sample

Table 14 Mean fork length (cm) of winter steelhead without spawning checks in the 1992.93 run year by origin, sex, and age category. Fish were sampled at the Powerdale Dam trap

Origin. Sample pop Statistic	Freshwater/Ocean age 1/1	1/2	1/3	2/1	2/2	2/3	2/4	3/1	3/2	3/3	Sample[a] mean
Wild,											
Female,											
N		1	4	9	104	84	—	1	8	9	247
Mean		64.5	73.88	55 28	64 67	76.12		55.0	64 81	77 28	69.80
STD			2.84	2 15	4.03	4.53	--	--	5.26	5 90	7.75
Range		6415	71.5-78 0	52 5-59.0	54 O-76 5	65.5-87.0	--	55 0	60 O-73 0	71 5-88 5	52 5-89 0
Male,											
N		1	2	25	62	33			1.	6	148
Mean		54 0	82 75	51 26	67 14	80 89	95 i	--	65 iii	85.17	68.56
STD			3 18	2.99	4 95	6 47	_-	--	3 72	5.87	11.51
Range		5470	80 5-85 0	46 O-58 0	56 O-80.0	70.5-95 0	95 a		61.5-75.0	77.5-92 0	46 O-95 0
Total,											
N		2	6	34	166	117	1	1	19	15	395
Mean		59.25	76 83	52 32	65 59	77.47	95.0	55 0	65 29	80.43	69 33
STD		7.42	5.28	3 30	4 54	5 56			4.32	6.94	9.34
Range		54 O-64.5	71.5-85 0	46 O-59 0	54 O-80 0	65.5-95.0	95Ti	55 0	60 O-75.0	71.5-92.0	46 O-95 0
Subbasin hatchery.[b]											
Female.											
N	4	12	89				--	--	_-	—	119
Mean	57 38	60.71	75 74				--		—		73.45
STD	2.36	2 51	3.64						—	_-	6.64
Range	54 o-59 5	57.0-64.5	67 O-86.5				--	--	—		54 O-86 5
Male.											
N	2	46	31	--	--				—	-_	88
Mean	55 75	62 33	81 85	--	--				—	_-	70.26
STD	2 47	2.67	4 82							—	10.37
Range	54 o-57 5	57 O-67 0	67 O-93.0		--		--	--	—	_-	54 O-93.0
Total.											
N	6	58	120						--	--	207
Mean	56.83	61.99	77 32						--	--	72.09
STD	2.29	2 70	4 79			--			--	--	8.55
Range	54.0-59 5	57.0-67.0	67 O-93 0			--			--	--	54 O-93.0

a Mean estimates include steelhead with spawning checks and steelhead in which the origin but not the age of the fish could be determined from the scale sample

b Age l/l winter steelhead are returns from the 1991 brood release. These fish are progeny of wild x Big Creek stock hatchery crosses

Table 15. Winter steelhead sex ratios as a percentage of females by origin. run year, and age category Fish were sampled at the Powerdale Dam trap. (Sample size in parentheses)

Origin. Stock, Run year	Freshwater/Ocean age											Repeat spawners
	l/l	l/2	1/3	2/1	2/2	2/3	2/4	3/l	3/2	313	4/2	
Wild.												
Hood River,												
1991-92		67 (3)	75 (4)	0 (9)	58 (402)	63 (71)	--	0 (1)	64 (106)	88 (16)	100 (1)	65 (49)
1992-93		50 (2)	67 (6)	26 (34)	63 (166)	72 (117)	0 (1)	100 (1)	42 (19)	60 (15)	--	a7 (31)
Subbasin hatchery.												
Big Creek,												
1991-92		36 (228)	100 (6)	--	60 (5)	100 (1)					__	80 (5)
1992-93		21 (58)	74 (120)	--			__					71 (7)
Mixed.a												
1992-93	67 (6)	--	__									

a Returns from the 1991 brood are progeny of wild x Big Creek stock hatchery crosses

Table 16 Mean fecundity of wild winter steelhead by ocean age Fish were sampled at the Power-dale Dam trap.

Ocean age, Run year	Mean fork len.gth (cm)	Fecundity			
		N	Mean	Range	95% CI
2 Salt,					
1991-92	62 7	11	2.940	1,930 · 4.950	f 624
1992-93	66 4a	8	3.620	3,036 · 4.117	f 317
3 Salt,					
1991-92	74 8	6	3,032	2,502 · 4.080	± 572
1992-93	78 8	a	4,286	2.916 · 6,398	± 1.341

a Fork length was not recorded for one fish

Table 17 Migration timing of spring chinook salmon captured at the Powerdale Dam trap in the 1992 run year

Period	Wild		Subbasin hatchery		Stray hatchery		Unknown	
	Number	Cumulative %	Number	Cumulative %	Number	Cumulative %	Number	Cumulative %
Apr 01-15	0	0	0	0	0	0	0	0
Apr 16-30	0	0	9	29	0	0	3	29
May 01-15	1	30	70	25 6	0	0	12	14 4
May 16-31	8	27 3	107	60 2	0	0	46	58 7
Jun 01-15	5	42 4	53	77 3	0	0	25	82 7
Jun 16-30	11	75 8	50	93 5	0	0	13	95.2
Jul 01-15	4	87 9	13	97 7	0	0	2	97 1
Jul 16-31	4	100	4	99 0	0	0	0	97 1
Aug 01-15	0	100	2	99 7	1	100	2	99 0
Aug 16-31	0	100	0	99.7	0	100	0	99.0
Sep 01-15	0	100	0	99.7	0	100	0	99.0
Sep 16-30	0	100	1	100	0	100	1	100
Oct 01-15	0	100	0	100	0	100	0	100
Totals	33		309		1		104	

Table 18 Spring chinook salmon escapements to the Powerdale Dam trap by origin. run year, and age category Fish of unknown origin were allocated to origin categories based on scale analysis and the ratio of fish of known origin (see METHODS).

Origin. Run year	Total escapement	Freshwater Total age					
		13	14	1.5	2.3	2.4	2.5
Natural, 1992	35	1	21	1		9	3
Subbasin hatchery, 1992	411	--		--	1	391	19
Stray hatchery. 1992	1		1		--		

Table 19. Age composition[a] (percent) of spring chinook salmon sampled at the Powerdale Dam trap by origin and run year

Origin. Run year	N	Freshwater Total age 13	14	1.5	23	2.4	25
Natural,							
1992	33	30	60 6	30		24 2	91
Subbasin hatchery,							
1992	302				03	95 0	46

a Estimates in a given run year may not add to 100% due to rounding error

Table 20 Mean fork length (cm) of spring chinook salmon in the 1992 run year by origin. sex. and age category Fish were sampled at the Powerdale Dam trap

Origin. Sample pop Statistic	Freshwater Total age						Sample[a] mean
	13	14	15	2.3	24	2.5	
Natural,							
Female,							
N		14	1	--	2	2	19
Mean		80 04	86 0		69 75	85.25	79 82
STD		7 19		--	8 13	10 96	8 03
Range		62 0-91 0	85.0	--	64 0-75 5	77 5-93.0	62.0-93 0
Male,							
N	1	6			6	1	14
Mean	71 0	84 00			73 17	84 0	78 43
STD		6 18			9 31		9 04
Range	71 0	79 0-95 0		--	57 5-82 0	84 0	57 5-95 0
Total,							
N	1	20	1		8	3	33
Mean	71 0	81 22	86 0		72 31	84 83	79.23
STO		7 00			8 59	7 78	8 36
Range	71 0	62 0-95 0	86 0	--	57 5-82 0	77 5-93 0	57 5-95 0
Subbasln hatchery,							
Jacks,							
N	--	--	--	1		--	1
Mean	--		--	54 5		--	54.5
STD	--	--	--	--		--	--
Range	--	--	--	54 5		--	54.5
Female,							
N	--		--		218	10	228
Mean	--	--	--		73 34	84.85	73 84
STD		--	--	--	4 18	8 21	5.00
Range	--	--	--	--	53 5-93 0	72.0-99.0	53.5-99.0
Male,							
N			--	--	69	4	73
Mean			--	--	75.07	96 75	76 25
STD			--	--	5 91	5 12	7.67
Range				--	56 0-89.0	91 0-102 0	56 0-102 0
Total,							
N	--	--	--	1	287	14	309
Mean		--	--	54 5	73 75	88 25	74.32
STD	--	--			4.71	9 16	5.92
Range			--	54 5	53 5-93 0	72 0-102 0	53 5102.0

a Mean estimates include spring chlnook salmon in which the origin but not the age of the fish could be determined from the scale sample

Table 21 Spring chinook salmon sex ratios as a percentage of females by origin, run year, and age category Fish were sampled at the Powerdale Dam trap (Sample size in parentheses)

Origin. Run year	Freshwater Total age					
	1.3	14	15	23	24	25
Natural, 1992	0 (1)	70 (20)	100 (1)		25 (8)	67 (3)
Subbasln hatchery, 1992				0 (1)	76 (287)	71 (14)

Table 22 Migration timing of coho salmon captured at the Powerdale Dam trap in the 1992 run year

Period	Wild		Stray hatchery		Unknown	
	Number	Cumulative %	Number	Cumulative %	Number	Cumulative %
Aug 01-15	0	0	0	0	0	0
Aug 16-31	0	0	1	13	0	0
Sep 01-15	1	45	6	89	0	0
Sep 16-30	11	54 5	37	55 7	1	50.0
Oct 01-15	5	72 3	12	70 9	0	0
Oct 16-31	4	95 5	12	86 1	1	100
Nov 01-15	1	100	11	100	0	0
Nov 16-30	0	100	0	100	0	0
Totals	22		79		2	

Table 23 Migration timing of coho salmon captured at the Powerdale Dam trap ln the 1993 run year

Period	Stray hatchery		Unknown	
	Number	Cumulative %	Number	Cumulative %
Aug 01-15	0	0	0	0
Aug 16-31	0	0	1	25 0
Sep 01-15	1	36	1	50 0
Sep 16-30	3	14 3	1	75 0
Oct 01-15	9	46 4	0	75 0
Oct 16-31	10	82 1	0	75 0
Nov 01-15	0	82 1	0	75 0
Nov 16-30	3	92 9	0	75 0
Dec l-15	2	100	1	100
Totals	28		4	

Table 24 Coho salmon escapements to the Powerdale Dam trap by origin. run year. and age category Fish of unknown origin were allocated to origin categories based on scale analysis and the ratlo of fish of known origin (see METHODS).

Origin. Run year	Total escapement	Freshwater Total age 2.2	23
Wild.			
1992	23		23
1993	0	--	
Stray hatchery,			
1992	80	13	67
1993	32	0	32

Table 25 Age composition (percent) of coho salmon sampled at the Powerdale Dam trap by orlgln and run year

Origin. Run year	N	Freshwater Total age 22	23
Wild.			
1992	22		100
1993	0		
Stray hatchery,			
1992	79	16 5	83 5
1993	28	a	100

Table 26 Mean fork length (cm) of coho salmon in the 1992 run year by origin, sex. and age category Fish were sampled at the Powerdale Dam trap

Origin, Sample pop, Statistic	Freshwater.Total age 2.2	2.3	Sample[a] mean
Wild.			
Female,			
N	--	14	14
Mean	--	60.86	60.85
STD	--	4.29	4.28
Range	--	52 5-66 0	52 5-66 0
Male,			
N	--	8	8
Mean	--	53 62	53 62
STD	--	8 25	8 24
Range	--	43 5-67.5	43 5-67 5
Total,			
N	--	22	22
Mean	--	58.23	58 23
STD		6.83	6 83
Range		43 5-67 5	43 5-67 5
Stray hatchery,			
Jacks,			
N	13		13
Mean	37 85		37 85
STD	2.90		2.90
Range	31.0-44 5		31.0-44.5
Female,			
N	--	24	24
Mean		59.62	59.62
STD		6 71	6 71
Range	--	40 0-68 5	40.0-68.5
Male,			
N	--	42	42
Mean	--	57 44	57.44
STD		7 15	7.15
Range	--	41 5-72.5	41.5-72 5
Total,			
N	13	66	79
Mean	37 a5	58.23	54 88
STD	2.90	7 03	10 02
Range	31 0-44 5	40 0-72 5	31 0-72 5

a Mean estimate includes coho salmon in which the orlg>n but not the age of the fish could be determined from the scale sample

Table 27 Mean fork length (cm) of adult coho salmon (Freshwater.Total age) in the 1993 run year by origin and sex Fish were sampled at the Powerdale Dam trap

Origin. Sample pop Statistic	Age 2-3
Stray hatchery,	
Female,	
N	5
Mean	66 20
STD	5 57
Range	59.0-73 0
Male,	
N	23
Mean	63.72
STD	6 21
Range	50.5-74 0
Total.	
N	28
Mean	64 16
STD	6 08
Range	50 5-74 0

a Mean estimate includes coho salmon in which the origin but not the age of the fish could be determined from the scale sample

Table 28 Coho salmon sex ratios as a percentage of females by origin. run year, and age category. Fish were sampled at the Powerdale Dam trap (Sample size in parentheses)

Origin. Run year	Freshwater Total age 22	23
Wild,		
1992		64 (22)
1993		
Stray hatchery,		
1992	62 (13)[a]	36 (66)
1993		18 (28)

a Eight Jacks were classified as females based on visual observation

Table 29 Hatchery juvenile summer steelhead releases In the Hood River subbasln for the 1987-92 broodsa

Broodstock. Hatchery, Brood year	Fin clip[b] or coded wire tag	Survival rate (%)	Date(s) released	Fish/lb	Number released	Release location
Foster,[c]						
Oak Springs.						
1987	AD		04/08/88	44	5,830	Hood River
1987	AD		04/11/88	46	5.026	Hood River
1987	AD		04/04-05/88	47	17.249	Hood River
1987	AD		04/08/88	44	5.500	West Fork Hood River
1987	AD		04/04/88	45	5,400	West Fork Hood River
1987	AD		04/06/88	4.6	10,324	West Fork Hood River
1987	AD		04/04-05/88	47	17,188	West Fork Hood River
1987	AD		04/07/88	50	12.350	West Fork Hood River
1988	AD		04/07/89	53	12.826	Hood River
1988	AD		04/11/89	55	13,630	Hood River
1988	AD		05/02-03/89	43	10.213	West Fork Hood River
1988	AD		04/10/89	53	19,504	West Fork Hood River
1988	AD		04/06.12/89	55	32,853	West Fork Hood River
1989	AD	--	04/04/90	53	4,876	Hood River
1989	AD	--	04/11/90	65	10.660	Hood River
1989	AD	--	04/04.05/90	5.3	25,422	West Fork Hood River
1989	AD	--	04/03/90	5.4	5.940	West Fork Hood River
1989	AD	--	04/03.09/90	55	20.306	West Fork Hood River
1989	AD		04/06/90	57	14,591	West Fork Hood River
1990	AD		04/29/91	5.4	7.020	Hood River
1990	AD		04/30/91	55	14.743	Hood River
1990	AD	--	04/24/91	58	7.013	Hood River
1990	AD	--	04/22/9i	52	12,787	West Fork Hood River
1990	AD	--	04/23/91	53	6,943	West Fork Hood River
1990	AD	--	04/24/91	55	6,869	West Fork Hood River
1990	AD	--	04/23/91	56	6.776	West Fork Hood River
1990	AD		04/23/91	58	14.981	West Fork Hood River
1991	AD		04/08/92	48	5.880	Hood River
1991	AD		04/07/92	5.2	12.870	Hood River
1991	AD		04/06/92	54	13.365	Hood River
1991	AD		04/08/92	55	6,958	Hood River
1991	AD		04/07/92	47	15.082	West Fork Hood River
1991	AD		04/07/92	52	15,023	West Fork Hood River
1991	AD		04/06/92	54	13.750	West Fork Hood River
1991	AD		04/08/92	5.5	17,045	West Fork Hood River
1992	AD		04/07-08/93	60	33.570	West Fork Hood River
1992	AD		05/04/93	6.3	17,955	West Fork Hood River
1992	AD		05/05/93	65	19.403	West Fork Hood River

[a] Estimates of production releases prior to the 1987 brood are in Olsen et al. (1992)
[b] Ad = Adipose.
[c] The Foster stock was developed from the Skamanla stock of summer steelhead

Table 30 Hatchery juvenile winter steelhead releases in the Hood River subbasin for the 1987-92 broods[a]

Broodstock. Hatchery, Brood year	Fin clip[b] or coded wire tag	Survival rate (%)	Date(s) released	Fish/lb	Number released	Release location
Big Creek,						
Trojan Ponds						
1988	No mark		04/17/89	42	4,890	East Fork Hood River
1989	Ad		04/12/90	4.7	4,253	Middle Fork Hood River
1989	Ad		04/12/90	47	7,755	East Fork Hood River
Gnat Creek,						
1987	No mark		04/22/88	56	28.000	MFk Hood River
1989	Ad		05/09/90	54	12.015	Middle Fork Hood River
1989	Ad		05/09/90	54	12,015	East Fork Hood River
1990	Ad-LM	--	04/23/91	5.2	5,356	Middle Fork Hood River
1990	Ad-LM	--	04/23/91	52	15.078	East Fork Hood River
Mixed,[c]						
Oak Springs.						
1991	Ad		03/31/92	46	4,595	East Fork Hood River
Hood River.						
Oak Springs,						
1992	Ad-LP		04/06/93	5.8	15,225	Middle Fork Hood River
1992	Ad-LP		04/06/93	60	15.420	East Fork Hood River
1992	Ad-LP		04/06/93	56	18,340	East Fork Hood River

[a] Estimates of production releases prior to the 1987 brood are in Olsen et al. (1992)

[b] Ad = Adipose, LP = Left Pectoral; LM = Left Maxillary.

[c] The 1991 brood are progeny of wild x Big Creek stock hatchery crosses.

Table 31 Hatchery Juvenile spring chinook salmon releases in the Hood River subbasin for the 1985-91 broods[a].

Life history stage, Broodstock. Hatchery, Brood year	Fin clip or coded wire tag	Survival rate (%)	Date(s) released	Fish/lb	Number released	Release location
Fingerling.						
Carson,						
Irrigon.						
1985	No mark		06/18/86	23 0	92.680	West Fork Hood River
Smolt.						
Carson.						
Bonneville.						
1986	No mark	--	03/14/88	9.4	11.724	West Fork Hood River
1986	No mark	--	03/ 14/88	97	30.895	West Fork Hood River
1986	No mark	--	03/ 14/88	10.1	11.644	West Fork Hood River
1986	No mark	--	03/14/88	10 2	12,288	West Fork Hood River
1986	No mark	--	03/14/88	10 5	4,988	West Fork Hood River
1986	No mark	--	03/14/88	10 8	9,150	West Fork Hood River
1986	No mark	--	03/14/88	11.1	14,570	West Fork Hood River
1986	07-42-57	--	03/14/88	11 2	34,548	West Fork Hood River
1986	07-42-57	--	03/14/88	11 4	14,443	West Fork Hood River
1986	07-42-57	--	03/14/88	11 6	5,689	West Fork Hood River
1987	No mark	--	03/09/89	10 0	33,013	West Fork Hood River
1987	No mark	--	03/09/89	10.8	31,828	West Fork Hood River
1987	No mark	--	03/09/89	11 0	7.419	West Fork Hood River
1987	07-42-58	--	03/09/89	11 0	24,698	West Fork Hood River
1987	No mark	--	03109189	11 1	8,568	West Fork Hood River
1987	07-42-58	--	03/09/89	11 1	28,521	West Fork Hood River
1988	07-52-23	--	03/13/90	94	23.970	West Fork Hood River
1988	No mark	--	03/12-13/90	99	42,565	West Fork Hood River
1988	No mark	--	03/13/90	10.0	20,799	West Fork Hood River
1988	07-52-23	--	03/13/90	10 0	10.650	West Fork Hood River
1988	No mark	--	03/12/90	10 1	11.209	West Fork Hood River
1988	No mark	--	03/12/90	10 2	13,973	West Fork Hood River
1988	07-52-23	--	03/14/90	10 2	10,761	West Fork Hood River
1988	No mark	--	03/12-13/90	10 3	30,483	West Fork Hood River
1988	07-52-23	--	03/14/90	10.4	14,144	West Fork Hood River
1988	No mark	--	03/12/90	10 5	7.770	West Fork Hood River
1988	No mark	--	03/12/90	10.8	11.664	West Fork Hood River
1989	07-55-30	--	03/25/91	94	53.614	West Fork Hood River
1989	No mark	--	03/25/91	98	29,399	West Fork Hood River
1989	No mark	--	03/25/91	11 2	42.419	West Fork Hood River
1990	No mark	--	04102192	97	41,647	West Fork Hood River
1990	No mark	--	04/02/92	99	62.954	West Fork Hood River
1990	07-56-59		04/02/92	10 2	58,694	West Fork Hood River

Table 31 Continued

Life history stage, Broodstock, Hatchery, Brood year	Fin clip or coded wire tag	Survival rate (%)	Date(s) released	Fish/lb	Number released	Release location
Smolt. (cant 1						
Deschutes.						
Bonneville.						
1991	07-33-35		04/01/93	11 2	11,760	West Fork Hood River
1991	07-33-35		04/01/93	11.3	34,685	West Fork Hood River
Round Butte,						
1991	07-50-22 R2	--	04/08.09/93	6.7	28.760	West Fork Hood River

[a] The 1986 brood release is the first production release of hatchery spring chinook smolts into the Hood River subbasin

Table 32 Primary irrigation diversions in the Hood River subbasln and their water source and water right

Irrigation district	Water source	Water right
East Fork Irrigation District	E Fk Hood River	113 cfs
Mount Hood Irrigation District	E Fk Hood River	15 cfs
Middle Fork Irrigation District	Clear Branch Reservoir	127 cfs
Middle Fork Irrigation District	Clear Branch tributaries	40 cfs
Middle Fork Irrigation District	Trout Creek	6 cfs
Middle Fork Irrigation District	Wishart Creek	1 cfs
Dee Irrigation District	W Fk Hood River	22 cfs
Dee Irrigation District	W Fk Hood River	57 cfs
Farmers Irrigation District	Hood River	75 cfs
Farmers Irrigation District	W Fk Hood River	58 5 cfs
Farmers Irrigation District	Hood River tributaries	73 cfs

ACKNOWLEDGEMENTS

We sincerely appreciate the many persons who helped complete this report. Special thanks to Jim Newton and Steve Pribyl of the ODFW, mid-Columbia fisheries district, for both the construction and operation of the Powerdale trap and for supervision of field personnel. We thank them for their insight and guidance throughout the study. We also thank trap operators Jim Burgett, Brian Arrington, and Rod Linnell without whom we would know much less about the abundance and life history of anadromous salmonids in the Hood River subbasln. We gratefully appreciate the contributions of scale readers Lisa Borgerson and Ken Kenaston, and of Mary Ann Davis who entered all scale and trap data'into a database. We would also like to thank Pacific Power and Light (PP&L) for allowing us to operate an adult trapping facility at Powerdale Dam and both Steve Pribyl and Patty O'Toole for editing drafts of the report.

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